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## Tank-Spion Digital LX-2

Measuring an monitoring device for tank contents.  
Type option: LX-2-R - with 2 relays additionally.

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### Mounting and Instructions



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#### **IN GENERAL**

The tank content display device LX-2 or LX-2-R is to be used for monitoring of tank levels in pressureless liquid tanks. Additional functions to liter displaying are e.g. temperature measuring, data transmission or linking to facility management systems.

The LX-2-R type additionally provides two output relays, e.g. for controlling an alert unit, for switching magnetic valve or dry protection of pump.

The displayed liter values are not to be used for billing purpose.

For the intended use and to abide the rules for warranty do strictly follow the Mounting and Instructions, which have to be handed out to the owner.

## STRUCTURE

The LX-2 (-R) has an eight characters LCD display and a measuring input for a level probe. The LX-2-R type additionally provides 2 programable relays, with opening and closing contacts. The measuring probe can be mounted with a screw joint of R1 " or R1½ ". A reduction for 2" is not included in scope of delivery.

## LIQUIDS

Liquid		Liquid	
<b>Heating oil</b>	<i>DIN EN 51603-1</i>	<b>Motor oil</b>	<i>No used oil !</i>
<b>Diesel oil</b>	<i>DIN EN 590</i>	<b>Hydraulic oil</b>	
<b>Bio Diesel oil</b>	<i>DIN EN 14214</i>	<b>Glycerin</b>	
<b>Plant oil</b>	<i>* after consulting</i>	<b>Glycol</b>	
<b>Petroleum</b>	<i>Flash point &gt; 55 °C</i>	<b>Water</b>	
<b>Carbamide dissolution</b>	<i>e.g. AdBlue</i>	<b>Gasoline with flash point &lt; 55 °C</b>	<i>Only with EEx-probe and Zener barrier</i>

## LABELING



Confirming to EN 50081-1 , EN 50082-1 and EN 61010-1 / A2

## MOUNTING INSTRUCTIONS

Only qualified persons are allowed to install the measuring probe and to connect the display device. Follow the regulation for each liquid, especially for the risk of water pollution and for flammable liquids.

Condition for proper operation of measuring device is a professional installation. Follow the technical rules for planning, construction and operation of the entire facility. Additionally follow the rules for tank mounting and operation.

- Condition for proper operation is a pressureless storage tank. The tank must have proper ventilation. Oil tanks and gasoline tanks must be equipped with a level limiter.
- The cable entry in the tank has to be made watertight and vapor tight by using PTFE sealing tape.
- The measuring probe and display device are not safety devices. They do not replace the level limiter of a tank.
- Installation of the display device in explosive zones is not permitted.  
In that case ask for an EEx-probe with Zener barrier. The tank probe must be mounted inside the tank with a cable protection pipe.
- The display device is connected to 230V AC. Operating is only permitted with closed box lid.

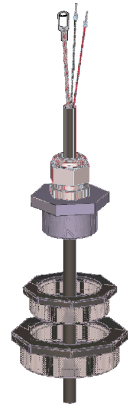
In case of inappropriate installation you lose any warranty.

## MOUNTING OF MEASURING PROBE

- In case of cellar steal tanks or subgrounded tanks use the included screwing joint for mounting the measuring probe.
- If an old fuel gauge was used dismount it and use the tank screwing port.
- Subgrounded tanks normally provide an idle screwing port. In that case dismount the dummy plug.

### Mounting:

- In case of a heating oil tank switch off the oil burner and lock the suction pipe if necessary.
- Clear the tank's screwing port.
- Put the cable of the probe through the screwing joint. Put the measuring probe into the tank.
- Mount the screwing joint with PTFE sealing tape.
- Sink the measuring probe down to the ground of the tank. Fix the cable with the PG screwing. The measuring probe may optionally lay or stand on the ground of the tank.
- Zero-point calibration is not required in normal case.
- If nessecary unlock the suction pipe, switch on the oil burner and check the functions.



## ELECTRIC INSTALLATION

### Interconnection of measuring probe to display device

Probe supply: DC 15 – 24 V

Connection: Connect the 2-wire probe cable in the way:  
Red(+) => clamp 1 , Black (-) => clamp 2.

Air capillary: The air capillary must have ventilation to atmosphere.  
The end of the probe's cable and the air capillary must be protected against humidity.

Extension: The cable of the probe can be extended up to 100 m,  
e.g. with NYM or YR or NYY.  
Line diameter at least 2 x 0,4 mm<sup>2</sup>.  
In case of cable extension in a manhole or outdoors  
it is recommended to use a waterproof clamp box with  
special air pressure ventilation (accessories).

Shielding: Near by power current cables it is recommended to use  
a shielded probe signal line. (Cable shielding has to be  
grounded.)

### Supply voltage:

Voltage: AC 230 V 50 Hz

Clamps: PE (protective conductor), N (neutral conductor),  
L (phase).  
Power line is not included in accessories.

*Refer to last page.*

*The capillary in the  
probe's cable must  
have ventilation.  
The capillary filter  
stays attached !*

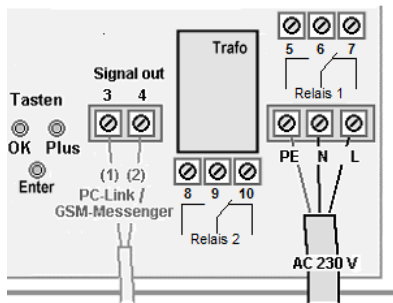
*Refer to probe  
instructions.*

## LX-2-R :

### Relay connection

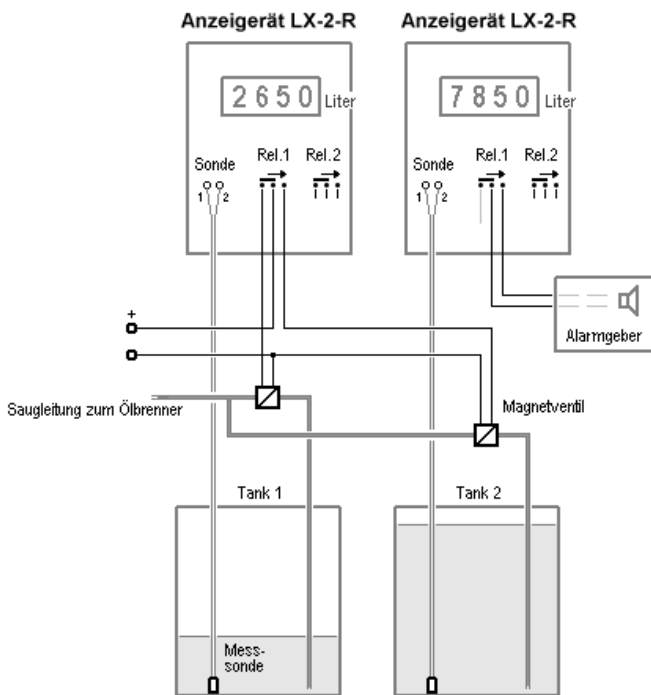
The LX-2-R type has two relays for controlling external electric circuits or for alert signaling.

In case of failure or minimum level (or temperature limit) the relay outputs 6-7 and 9-10 are linked and the relay outputs 5-6 and 8-9 are opened; refer to PCB print.



	<u>Normal state</u>	<u>/ Event state</u>	<u>Normal state</u>	<u>/ Event state</u>
Relay 1	Clamp 5 - 6 opened	/ Contact links	Clamp 6 - 7 linked	/ Contact opens
Relay 2	Clamp 8 - 9 opened	/ Contact links	Clamp 9 -10 linked	/ Contact opens
Voltage	Max. 250 V AC			
Current	Max. 3,5 A			

### AUTOM. CHANGEOVER OF TANKS



Example  
LX-2-R

## INITIAL SETUP

Determine the tank data and enter them into the mode:

You find the **push buttons** (blue) on the PCB positioned between the connection clamps.

- Press ENTER => Device enters the setup mode (Step „1.Sonde“).
- You can step through the input menu items by pressing PLUS or MINUS.
- Press ENTER to step into a sub-menu.
- Press PLUS or MINUS for selection; press ENTER for confirming.
- In step 8 you reach „8.Exit“. Press ENTER for returning to display mode.

For particular parameter setup refer to P.7.

### Setup / Programming

<i>Function</i>	<i>Description</i>	<i>Values</i>
<b>1. Probe „Sonde“</b>	Select the probe range (refer to probe label) – default is 250 mbar	250mbar
<b>2. Liquid „Fluid“</b>	Liquid selection (refer to P. 8) e.g. : - Heating oil (preselection):           Heat.oil - Diesel:                                        Diesel - select other predefined liquids by + / - - otherwise enter the specific weight . . . .kg/l In case of unknown weight go to <u>step 10.Set h</u>	Heat.oil
<b>3. Tank shape „Tank“</b>	Tank shape selection (refer to P. 8) e.g. : - linear (preselection):                 Linear - horz. cylinder:                         Cyl. - horz. cylinder 50 to 100 m <sup>3</sup> :       Cyl.>50m3	Linear
<b>4. Tank volume „Volume“</b>	Enter the tank volume (100% of capacity): <u>Attention:</u> If a bearing chart is available it is recommended to take the largest value pair out of the chart. E.g. in case of a 100 m <sup>3</sup> subgrounded tank the exact value could be of 100 600 liters.	40.000L
<b>5. Tank height (100% value) „Height“</b>	Enter the interior tank height in mm: E.g. 2.500 mm (Max. value = 9.999 mm) (Height without manhole) <u>Attention:</u> If a bearing chart is available it is recommended to take the largest value pair out of the chart. E.g. in case of a 100 m <sup>3</sup> subgrounded tank the exact value could be 288 cm = 2880 mm.	2.500 mm

<b>Step 6 + 7</b> set up only in case of relays	EXIT or RELAY. Relay parameters for LX-2-R type	
<b>6. Relay 1</b> „Relay1“	Enter relay switchpoint as %-value 01 – 99 (or as °C-value of -99 - +99 , <u>only in case of temperature measuring probes</u> ) Deactive => Use +/- , press ENTER Active => Use +/- , press ENTER On 10% => Use +/- to set up the switch-on point. Off 12% => Use +/- to set up the switch-off point On +15°C => ditto for temp. switch-on point Off+17°C => ditto for temp. switch-off point deactive sets the relay out of order. Values of 0% or 0°C for switch-on/-off points deactivate the relay, too.	active On 10% Off 12% On +15°C Off +17°C
<b>7. Relay 2</b> „Relay2“	Inputs for relay 2 are analog to 6. Relay 1	
<b>8. Exit</b> „Exit“	Press ENTER for returning to display mode	16.500L
<b>Steps 9 – 24</b>	In steps 10 – 25 you will find additional settings	

Standard setup ends at step 8 by confirming EXIT.

Then the display shows the current tank content.

After setup close the box lid.

## Programming Examples

<b>Example 1</b>	Cellar tank for 6000 L heating oil. Liter displaying. Linear steel tank. Interior height 165 cm (Current level: 125 cm). Probe 0 - 250 mbar
<u>Step</u>	<u>Input</u>
1.	Probe: 250 mbar 250mbar
2.	Liquid: Heating oil Heat.oil
3.	Tank shape: linear Linear
4.	Tank volume: 6000 Liter 6000L (select by +/-)
5.	Interior tank height: 165 cm 1650mm (select by +/-)
6.	Relay1 – no function deactive
7.	Relay2 – no function deactive
8.	Exit => press ENTER for display mode => 4550L

### Tank with interior mantle

In case of tank with interior mantle (e.g. horz. cyl. or cellar steel tank) correct the input values.

Example: Mantle thickness 2 cm => reduce interior height by ca. 4 cm

Volume 10 m<sup>3</sup> => reduce volume by 5%

Volume 20 m<sup>3</sup> => reduce volume by 4%

Volume 50 m<sup>3</sup> => reduce volume by 3%

Volume 100 m<sup>3</sup> => reduce volume by 2.5%

**Example 2** Subgrounded tank for 100,600 L Diesel. Probe 0 - 250 mbar.  
Interior height 2.88 m (Current level: 54 cm)

<u>Step</u>	<u>Input</u>
1. Probe: 250 mbar	250mbar
2. Liquid: Diesel	Diesel
3. Tank shape: horz. cylindric	Cyl.>50m <sup>3</sup>
4. Tank volume: 100,600 liter	100600L (refer to bearing chart)
5. Interior tank height: 288 cm	2880mm (refer to bearing chart)
6. Relay1 – no function	deactive
7. Relay2 – no function	deactive
8. Exit => press ENTER for display mode =>	12800L

**Beispiel 3** Font, 7,50 m max. water level from ground (current level 4,20 m).  
Probe TDS-6029 (0-1000 mbar). Displaying in m:

<u>Step</u>	<u>Input</u>
1. Probe: 1000 mbar	1000mbar
2. Liquid: Water	H2O
3. Shape: linear	linear
4. Volume: 7,500 liter (or m)	7500L (select by +/-)
5. Height: 7.50 m	7500mm (select by +/-)
6. Relay1 – ON at 0.5% - OFF at 10%	active => On: 05% => Off:10%
7. Relay2 – No function	deactive
8. Exit => Step forward by pressing PLUS	
12. Unit – m	Unit: m
13. Rounding auto	auto (press ENTER to confirm)
14. Exit => press ENTER for display mode =>	e.g. 4.20m









### SETUP MENU, COMPL.

<i>Step</i>	<i>Function</i>	<i>Description</i>
<b>0. Exit</b>		Go back to display mode
<b>1. Probe</b>	100mbar 150mbar 250mbar 500mbar 1000mbar 2000mbar 3000mbar 5000mbar ...mbar Cal-Mode	<p><u>Tank height:</u> Heating oil up to 1,2 m / Water up to 1 m Heating oil up to 1,8 m / Water up to 1,5 m</p> <p>Default range: Up to 3 m of heating oil / Water up to 2,5 m Heating oil up to 6 m / Water up to 5 m Heating oil up to 12 m / water up to 10 m Heating oil up to 24 m / Water up to 20 m Heating oil up to 36 m / Water up to 30 m Heating oil up to 60 m / Water up to 50 m</p> <p>Enter the specific probe range value.</p> <p>Is displayed in case of calibration via '10.Set H' or '11.Set V'.</p>

<b>2. Fluid</b> Liquid	Heat.oil	0,845 - default
	H2O	0,999
	Diesel	0,830
	BioD	0,880
	RME,FAME	0,880 (Raps Methyl Esther, Fatty Acid Methyl Esther)
	Rapsoil	0,915
	Palmoil	0,910
	Motoroil	0,865
	AdBlue	1,090
	Normal-B	0,743
Super-B	0,750	
...kg / liter	Enter a density value	
Cal-Mode	Is displayed in case of calibration via '10.Set H' or '11.Set V'.	

If the density of the liquid is unknown the reference height can be entered in step 10 Set h. Therefore determine the current fill level in mm and subtract 10 mm from it. Enter this value and confirm with YES.

In case the current fill level is less than 75% it is recommended to correct the value to the updated value after the next filling for getting a good measuring accuracy.

<b>3.Tank</b> Tank shape / type	Linear	Default: <u>Linear</u> tank. Rectangular tank; vertical cylinder; steel cellar tank.	
	Cyl.	<u>Cylindric</u> tank ( <u>alternative</u> : Cyl.>50m <sup>3</sup> ). Horizontal cylindric tank, up to 45 m <sup>3</sup> . Typical tank shape for outdoor tanks and subgrounded steel tanks.	
	Ball	<u>Spherical</u> tank. Ball-shaped subgrounded tank; common subgrounded plastic tanks (GRP).	
	Oval	<u>Oval</u> cellar tank. Typical shape of GRP tanks and single-walled tank	
	Konvex	<u>Convex</u> plastic tank. Slightly bellied tank shape	
	Konkav	<u>Concave</u> plastic tank battery. Cave-bellied tank shape.	
	Plastic	Plastic tank with large <u>cavity</u> . Hollow in the middle of the tank's body. (No ring bandages)	
	Cyl. > 50m <sup>3</sup>	<u>Large cylindric</u> outdoor tank of 50.000 Ltr up to 100.000 Liter of volume ( <u>alternative</u> : 'Cyl.' - see above ).	
	Table (for input)	<u>Reference table</u> to be entered; by up to 15 pairs of values ( cm => Liter ).	Unsymmetrical or other tank shape.



<b>4.Volume (capacity)</b>	xxx xxx L	Tank capacity (total 100%). Presetting is 0 L . The value setup is required in any case.
<b>5.Height (interior)</b>	x xxx mm	Interior tank height. Presetting is 2.000 mm
		<u>LX-2</u> : Step 6 + 7 => EXIT. <u>LX-2-R</u> : Step 6 + 7 => RELAY 1+2
<b>6.Relay1 or Exit</b>	deactive active	Selecting by (+). ENTER for saving and forwarding to On value.
	On: 10%	Presetting is 10%, range is 0...99 . Relay switches On when under-running e.g. 10% level.
	Off:12%	Presetting is 12% (Hysteresis). Relay switches Off again when when level exceeds e.g. 12% again.
	On: +15C	<u>Only in case of temperature measuring adaptor is inserted:</u> Range is -99C ... +99C. If On=0 and Off=0 the temperature alerting is diabled. Presetting is 15 °C. Relay switches On when under-running e.g. 15°C temperature.
	Off: +17C	Temperature presetting is 17 °C (Hysteresis). Relay switches Off again when temp. exceeds e.g. 17°C again.
<b>7.Relay2</b>		Input for 7.Relay2 refer to 6.Relay1
<b>8. Exit</b>		Return to displaying mode.
<b>9.Offset</b>	ESC/Calibrat	Zero-point offset calibration for the measuring probe.
<b>10.Set h</b>	x xxx mm Cal: No Cal: Yes	Input option for a reference height (2-points calibration), usefull in case of unknown specific weight of the fluid. Subtract* 10 mm from the beared liquid level, and enter that value. After confirming with 'Cal: Yes', then in step 1+2 'Cal-Mode' will be displayed instead of a value. If this is done at a low tank filling level it is recommend to repeat this later on at a higher filling level. Also refer to 11.Set V
<b>11.Set V</b>	xxx xxx L	Fine trimming of current liter value. Use +/- buttons and confirm with 'Cal: Yes'
<b>12. Unit</b>	Unit: L Unit: % Unit: m Unit: kg	Presetting is L (liter) ( max. value: 999,900L ) ( max. value: 100.00% ) ( max. value: 999.99 m ) ( max. value: 999,900kg )
<b>13.Round Rounding</b>	auto off or 2, 5, 10... 100	Rounding of displaying value: Presetting is 'auto'. off = highest resolution without rounding; wobbling values. A certain rounding is recommended => sedation.
<b>14. Show</b>	Show %- Symbol Y/N	Displaying option: A grafical %-symbol corresponding to the current content appears in 2 s alternation to the liter displaying.
<b>15-19. Exit</b>		Return to displaying mode.
<b>20. LCD</b>	Contr 60	Trimming the contrast of the LCD display.
<b>21. Info</b>	Displaying of:	Software version V3.00 Serial no. SN1234 Offset xxxx Gain xxxx

<b>22. Test I</b>		Displaying current measuring value in mA and displaying the hex. value of the A/D converter.
<b>23. Test R</b>	Rel1 ON Rel1 OFF Rel2 ON Rel2 OFF	At LX-2-R type => Testing functions of both relays. ( At LX-2 type => without function )
<b>24. Init</b>		- Reset - ESC = Exit without resetting (Escape). Reset = Restart of the internal micro program. Defaults = Re-initializing (clearing) of all parameters back to the delivery default setting.
<b>26. Exit</b>		Return to displaying mode

## ERROR CODES

<i>Message</i>	<i>Meaning</i>
Error E 1	Invalid input value.
Error E 2	Measuring value of the probe is too small ! - E002 at zero-point calibration: If current is less than 3,5 mA => Probe error. - E002 at input step 4: Make sure the probe is plunged. Or current fluid level is under the calibration minimum level.
Error E 3	Measuring value is too high for zero-point calibration. - The probe must not be plunged ! A probe's current higher than 4,5 mA indicates a problem with the probe.
Error E 4	Setup is possible only if zero-point calibration is done. Execute the zero-point calibration again (=> 9. Offset).
Error E 5	Height input is larger than tank height. (Wrong input.)
Error E 6	The measuring value is too small for reference. Make sure the probe is plunged. Settled height is too large (or means the measuring value is too small for setting). Execute the zero-point calibration again (=> 9. Offset). If it does not work check the probe current (mA) !
Error E 7	The current measuring value is too small for the corresponding tank height or the volume input value. Make sure the probe is plunged.
Error E 8	The current measuring value (or mA) is too high. Check electrical connection and check the measuring range of the probe. Switch the 230V supply voltage off and on. Check input steps 3 and 4. Execute the zero-point calibration again. (=> 9. Offset). Otherwise the measuring probe has to be checked.
Error E 9	The current value is 0 mA. The probe's connection could be broken. Check the probe connection (polarity) and extension. Measure the voltage at the probe (red to black).
Error E10	Calbration error. Switch off an on the 230V supply voltage and retry. Otherwise the probe is working not properly.
Error E11	Warning – The liquid level in the tank is too low for an exact calibration. (Press OK to continue anyway.)
Error E12	Yet no measurement data is received from the external tanks 2 ... 4.

## FUNCTION CHECK

It is recommend to check if the displayed liters are correct after a complete fueling or once year.

Two practical options are: - Lift the probe and check the 0 Liter displaying  
- Check the mm value displayed in Step '11. Set H' (without trimming!)

## TECHNICAL DATA

### Display device

Supply voltage:	AC 230 V 50 Hz	Protection class:	IP 30 or IP65 (by EN 60529)
Power consumption:	max. 2 VA		
Measuring input:	4 - 20mA ; $U_0 = 20V$ ;	Resolution:	10 bit
		Accuracy:	$\pm 1 \%$
Relay output:	LX-2-R has 2 relays		
Voltage strength (U):	max. 250 V AC	Analog output:	Adaptor 0-5 V DC
Current strength (I):	max. 3,5 A	Analog output:	Adaptor 4-20 mA
Dimensions [mm]	120 x 120 x 49 (IP30) or 130 x 130 x 60 (IP65)	Box material:	Polystyrol (IP30) or Polycarbonat (IP65)

### Measuring probe

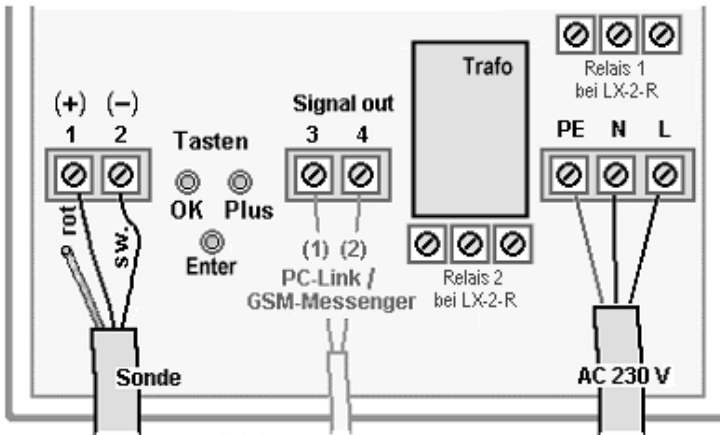
Supply voltage:	24 V DC	Protection class:	IP 68 (by IEC 529)
Materials:	V4A ; POM; FPM; HD-PE	Probe length (without cable): Cable length: 150 / 250 mbar type	107 mm 5 m / 6 m
Mounting orientation:		Vertically or horizontally with contact to tank ground.	
Temperature range:		Liquid temperature	0 °C - +45 °C

## ACCESSORIES

Order no.	Component	Application
12080	Clamp box IP 65, special, waterproof and ventilated	For extension of the probe's cable (outdoors) or in the tank's manhole.
12064	Output adaptor 0 - 5 V	Pluggable module. Provides an analogue voltage ( linearized ).
12065	Output adaptor 4-20 mA	Pluggable module. Provides an analog signal of 4-20mA (passive), 2-wire principle ( linearized current signal ).
12036 12037	PC-Link Lite PC-Link Extended	Add-on set for data transmission to a PC. Data logging, Charting functions, automatic email generating.

## CONNECTION PLAN

for Tank-Spion Digital LX-2 and LX-2-R (with relays)



Complete set : **LX-2** : Art-Nr. 12032

Complete set : **LX-2-R** : Art-Nr. 12033

**Maintenance:** Check if the displayed liters are correct:

Two practical options are:

- Lift the probe above the liquid level. Then check if ~ 0 L is displayed
- Check the mm value displayed in Step '11. Set H' (without trimming!).

In case of deviation it is recommended to recalibrate the measuring probe via step '9. Offset'.

**Manufacturer:**

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