

ULTRASONIC LEVEL METERS ULM-53L

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USED SYMBOLS

To ensure maximum safety of control processes, we have defined the following safety instructions and information. Each instruction is labeled with the appropriate pictogram.



Alert, warning, danger

This symbol informs you about particularly important instructions for installation and operation of equipment or dangerous situations that may occur during the installation and operation. Not observing these instructions may cause disturbance, damage or destruction of equipment or may cause injury.



Information

This symbol indicates particularly important characteristics of the device.

1. SAFETY



All operations described in this instruction manual have to be carried out by trained personnel or by an accredited person only. Installation, commissioning, operation and maintenance of the capacitive level sensors has to be carried out in accordance with this instruction manual; the provisions of regulations in force regarding the installation of electrical equipment have to be adhered to.

Improper use, installation or set-up of the sensor can lead to crashes in the application, (overfilling of the tank or damage of system components).

The manufacturer is not responsible for improper use, loss of work caused by either direct or indirect damage, and for expenses incurred at the time of installation or during the period of use of the level sensors.

2. PACKING, TRANSPORTATION AND STORAGE

Equipment ULM-53L is packed in a cardboard wrap and the whole consignment is placed in a cardboard box. The cardboard box is suitably filled to prevent mechanical damage during transport. Let the device packed up till the use to prevent possible damage.

Transport to the customer is realized by forwarding company. Upon receipt, please check whether the shipment is complete and corresponds to the extent of the order, or whether during the transport did not occurred the damage of the packaging or the equipment. The device apparently damaged during transport do not use and contact the manufacturer to resolve the situation.

If the device is transported further, then only wrapped in the original packaging and protected against shocks and weather. Store the device in its original packaging in a dry place, sheltered from the weather, with humidity up to 85% without the effects of chemically active substances. Storage temperature range is from -20°C to +60°C.



Level meters variants ULM-53_-02, 06, 10 are fitted with protective caps at the ultrasonic transducer to prevent damage. Before commissioning, remove the caps!

3. MEASURING PRINCIPLE

The ULM® ultrasonic level meters are compact measurement devices containing an ultrasonic transmitter and an electronic module. Using an transmitter, level meters transmit the series of ultrasonic pulses that spread towards the level surface. The transmitter recuperates reflected acoustic waves that are subsequently processed in the electronic module. Based on the period during which the individual pulses spread towards the level and back, this period is averaged by the electronics that performs temperature compensation and subsequently a conversion to an output current (voltage) or Modbus communication.

4. RANGE OF APPLICATION

The level meters are suited to continuous non-contact level measurement of liquids (water solutions, sewerage water, etc.), mash and paste materials (sediments, sticks, resins etc.) in closed or open vessels, sumps, reservoirs and open channels. In case the level of bulk-solid materials is measured, the measurement range is reduced.

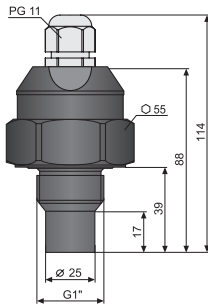
ULM-53L-__-I and ULM-53L-__-U level meters has no customer accessible adjusting elements. Customer choice of the maximum measurement range (factory settings), The outputs can be current (4 ... 20 mA) or voltage (0 ... 10 V). ULM-53L-__-M level meters has no customer accessible adjusting elements. Two-way communication (parameterization) by RS-485 Modbus RTU protocol.

5. FEATURES OF VARIANTS

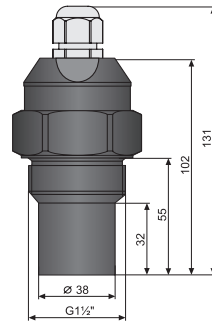
ULM-53L-02	Measuring range from 0.25 m to 2 m (customer configurable), plastic PVDF (Polyvinylidene Fluoride) transmitter and plastic body, process connection with thread G 1".
ULM-53L-06	Measuring range from 0.25 m to 2 m (customer configurable), plastic PVDF (Polyvinylidene Fluoride) transmitter and plastic body, process connection with thread G 1½".
ULM-53L-10	Measuring range from 0.5 m to 10 m (customer configurable), plastic PVDF transmitter and plastic body, process connection with PP (Polypropylene) flange.
ULM-53L-20	Measuring range from 0.5 m to 20 m (customer configurable), plastic PVDF transmitter and plastic body, process connection with aluminium flange.

6. DIMENSIONAL DRAWINGS

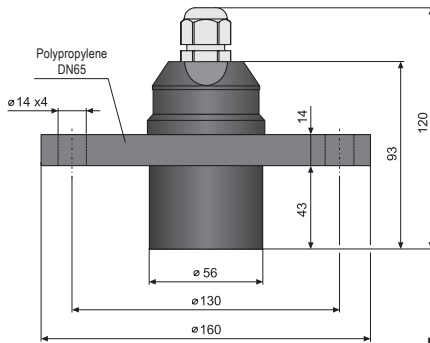
ULM-53L-02-



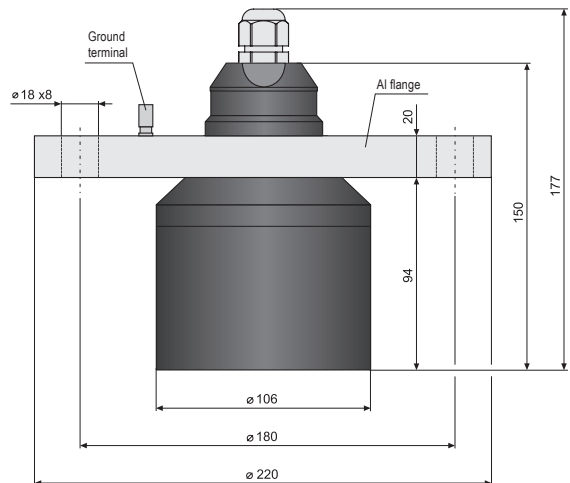
ULM-53L-06-



ULM-53L-10-



ULM-53L-20-



7. INSTALLATION INSTRUCTIONS

- a) Install the level meter in a **vertical position** into the upper lid of the tank (vessel) or reservoir using a lug, a fastening nut or a flange in such a way that the ULM axis is perpendicular to the level of the measured liquid (Fig. 1).
- b) **Minimum** dimension parameters when installing into a lid or a ceiling of a tank are listed in Fig. 3.
- c) When installing in an **open channel** (reservoir, drain and the like), install the level meter onto a console to the expected maximum level as close as possible.
- d) In compliance with the measurement principle, no signals reflected in the area directly below the level meter (the so-called dead zone) can be evaluated. The dead zone (Fig. 2) determines the minimum distance possible between the level meter and the highest surface level. Medium minimum distance parameters are listed in chapter on „Technical specifications“.
- e) It is **necessary** to install the level meter in such a way that the bin level does not interfere with the dead zone when filled up to the maximum. If measured level interferes with the dead zone, the level meter will not work properly.

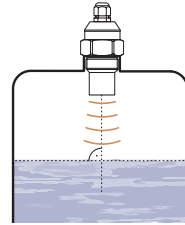


Fig. 1: Recommended installation in the tank

ULM-53L-02; 10	$d > 1/12 c$ (Min. 200 mm)
ULM-53L-06	$d > 1/8 c$ (Min. 200 mm)
ULM-53L-20	$d > 1/10 c$ (Min. 200 mm)

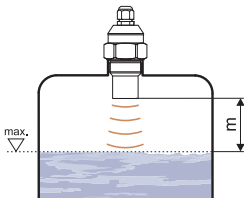


Fig. 2: Level meter dead zone

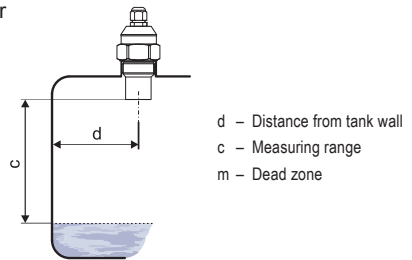


Fig. 3: Installation distance from the tank wall

- f) In case the maximum surface level in the tank interferes with the dead zone, the level meter has to be mounted into a higher installation neck. Subsequently, the tank can be filled nearly up to the maximum volume. The neck's inner surface has to be even and smooth (without edges and welded joints), the inner edge should be rounded in the position point where the ultrasonic waves leave the pipe. Choose the largest possible neck's diameter, but keep the neck's height as low as possible. Recommended dimensions of the neck are listed in Fig. 4.

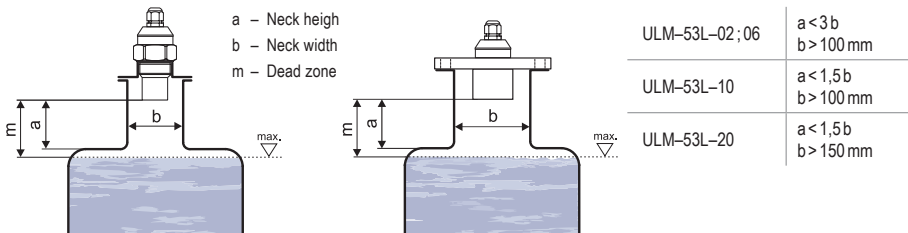


Fig. 4: Possible installation of the installation neck

- g) Foam on the level absorbs the acoustic wave reflection which might cause malfunction of the level meter. For mounting find the location where the foaming is as low as possible (Fig. 5).
- h) Emitted acoustic signal must not be affected by near objects (ladders, mixers, propellers, etc.), stream of filling, air flow, etc. (Fig. 6).

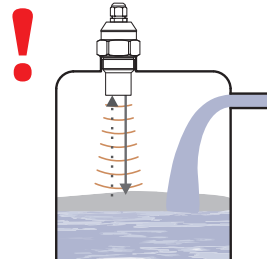


Fig. 5: Thick foam on the surface

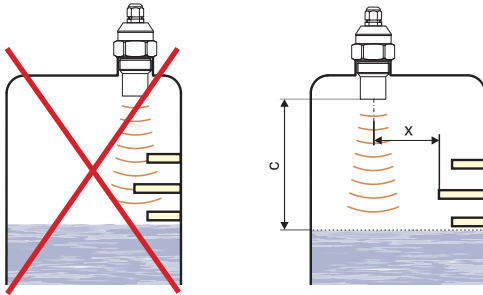


Fig. 6: Minimum distance of the level meter to nearby objects in the tank

ULM-53L-02 ; 10	$x > 1/12 c$ (min. 200 mm)
ULM-53L-06	$x > 1/8 c$ (min. 200 mm)
ULM-53L-20	$x > 1/10 c$ (min. 200 mm)

x – Distance to the edge of the longest object
c – Measurement range of the level meter

- i) Do not install the level meter in or above the **filling point** (Fig. 7).

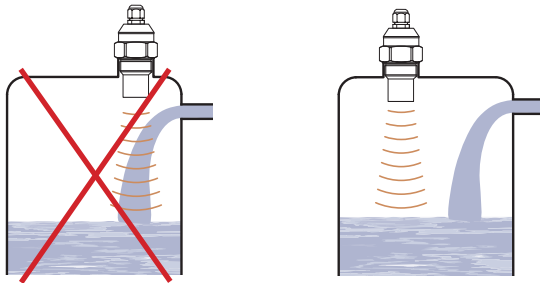


Fig. 7: Level meter installation outside the influence of filling circulation

- j) In case the level of bulk-solid materials is measured, the measurement range is **reduced**. We recommend to consult the use with the manufacturer.

- k) The level meter must **not be installed** in places with direct solar radiation and must be protected against weather conditions.
- l) In case the installation at places with direct solar radiation is inevitable, it is necessary to mount a **shielding cover** above the level meter (Fig. 8).
- m) To lower the minimum distance to the medium measured, a **reflection board** made from solid, even and smooth material can be installed together with the level meter (Fig. 10). Subsequently, the tank can be filled nearly up to the maximum volume. The solution is suitable for open tanks and reservoirs.
- n) Scattering or attenuation of the ultrasonic signal can result if the surface level has been moderately stirred or rippled as a consequence of a stirrer's operation, inflow of liquid and the like. Consequently, measuring range or unreliable level meter's functioning **might follow** (Fig. 11).
- o) False surface reflections of the ultrasonic signal might result as a consequence of **rotating mixer's blades** that ripple the surface level and thus cause unreliable level meter's functioning (Fig. 12).
- p) The level meter should not be installed at places where ultrasonic signal **false reflections** caused by stirrer blades might occur (Fig. 13).

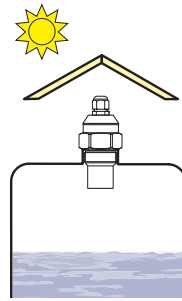


Fig. 8: Direct solar radiation shielding cover

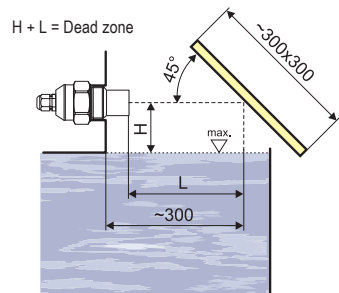


Fig. 9: Reflection board

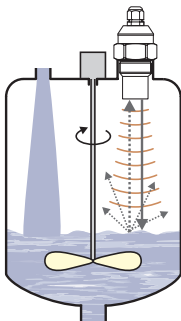


Fig. 10: Moderately stirred surface

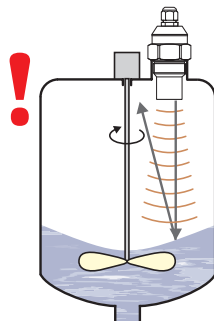


Fig. 11: Intensely stirred surface

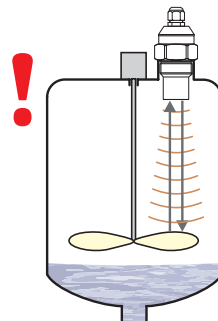


Fig. 12: False reflection caused by mixer blade

- q) Horn adapter ST-G1 (ULM-53L-02) and ST-G1,5 (ULM-53L-06) for improved transmitted signal reception can be used in open channels, sumps, tanks, etc.
- r) Horn adapter increases the radiation directivity of acoustic waves, improves reception of weak echoes (unstable level surfaces, solid materials, etc.) and reduces the risk of false reflections.
- s) The horn adapter is installed to level meters via process connection G1" (ST-G1) or G1½" (ST-G1,5).

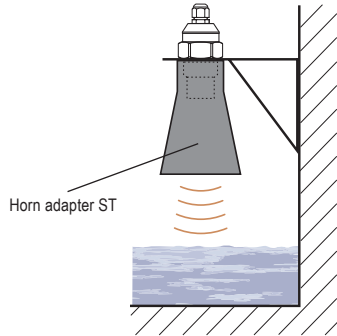


Fig. 13: Horn adapter installation

8. ELECTRICAL CONNECTION

ULM-53L-__-I and ULM-53L-__-U

The ultrasonic level meter is designed to be connected to supply unit or to controller through two or three-wire 5 m long cable. Connection diagram as shown in Fig. 14 and 15.

„ULM-53L-__-M“

The connection is done by means of shielded four wires cable directly into a binary input of control system (RS-485). Connection diagram as shown in Fig. 16. Shielded cable length is 5 m.

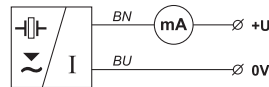


Fig. 14: Level meter connection diagram (Variant – I)

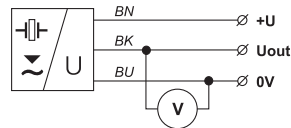


Fig. 15: Level meter connection diagram (Variant – U)

Legend:

BK – Black	WH – White
BU – Blue	YE – Yellow
BN – Brown	GN – Green

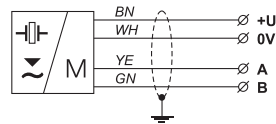


Fig. 16: Level meter connection diagram (Variant – M)



Make the electric connection in voltage-free state!



In case of strong electromagnetic interferences (EMI), parallel cable ducting with power lines, or when cable length exceeds 30m we recommended to use shielded cable (for "I" and "U" variants only).

9. LEVEL METER SETTING

There are no setting elements on the level meters. ULM-53L-__-M type adjusting (parameterization) by RS-485 Modbus RTU protocol.

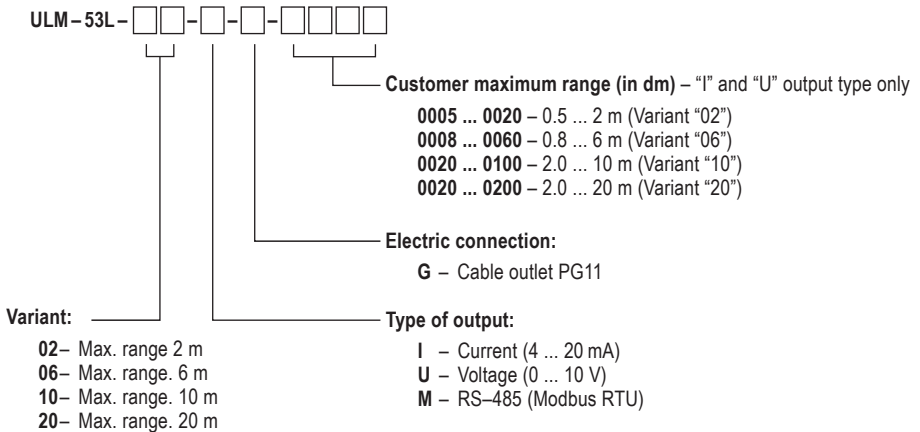
Modbus RTU commands are shown in separate appendix.

10. STATUS SIGNALIZATION

ULM-53L-__-I and ULM-53L-__-U type are produced without optical LED indication. No echo reflection or dead zone indication via current or voltage change in output. See "Technical data" table.

ULM-53L-__-M type are produced without optical LED indication. No echo reflection or dead zone indication via RS-485 Modbus RTU protocol.

11. ORDER CODE



12. ACCESSORIES

Standard

(included in the level meter price)

- 1pc of seal (for ULM-53L-02; -06)
- 5 m of cable

Optional

(for extra charge)

- Fixing nut G1" and G1 ½"
- Horn adapter ST-G1 and ST-G1,5

13. SAFETY, PROTECTION AND COMPATIBILITY

The level meter ULM–53L is equipped with protection against reverse polarity and output current overload.

Protection against dangerous contact is secured by low safety voltage that complies with EN 33 2000-4-41. EMC according to EN 55022/B, EN 61326/Z1 and EN 61000-4-2 to 6.

Supplied electrical equipment matches the requirements of valid European directives for safety and electromagnetic compatibility. The declaration of Conformity for the above mentioned product was issued.



The device must be installed in such a way, to prevent mechanical damage of sensor face.

14. USE, MANIPULATION AND MAINTENANCE

The level meter does not require any personnel for its operation. Follow-up displaying device is used to inform the technological entity operating personnel on the measured substance level height during the operation. Maintenance of this equipment consists in verification of integrity of the level meter and of the supply cable. Depending on the character of the substance measured, we recommend to verify at least once per year the clarity of the ultrasound transducer emitting field and to clean it, respectively. In case any visible defects are discovered, the manufacturer or reseller of this equipment must be contacted immediately.



It is forbidden to perform any modifications or interventions into the ULM–53L level meter without manufacturer's approval. Potential repairs must be carried out by the manufacturer or by a manufacturer authorized service organization only.

Installation, commissioning, operation and maintenance of the ULM–53L level meter has to be carried out in accordance with this instruction manual; the provisions of regulations in force regarding the installation of electrical equipment have to be adhered to.

15. GENERAL CONDITIONS AND WARRANTY

Dinel, s.r.o. guarantees for the period of three (3) years that the product has the characteristic as in technical specification is mentioned. The guarantee can be invoked only when the product is completed by original invoice and guarantee list. This guarantee does not cover the damages resulting from misuse, improper installation or incorrect maintenance.

This guarantee cease when user or the other person makes any changes on the product or the product is mechanically or chemically damaged, or the serial number is not readable.

In the case of rightful complaint we replace the product or its defective part.

16. SPECIFICATIONS

TECHNICAL DATA		
Measuring range ¹⁾	ULM-53L-02-__	0.25 ... 2 m
	ULM-53L-06-__	0.25 ... 6 m
	ULM-53L-10-__	0.5 ... 10 m
	ULM-53L-20-__	0.5 ... 20 m
Supply voltage		18 ... 36 V DC
Current supply	ULM-53L-__-U	12 mA
	ULM-53L-__-M	25 mA
Current output	ULM-53L-__-I	4 ... 20 mA (Limit values 3.9 ... 20.5 mA)
Voltage output	ULM-53L-__-U	0 ... 10 V (Limit values 0 ... 10.2 V)
Communication protocol	ULM-53L-__-M	Galvanic separation RS-485 without 120 Ω termination resistor
Resolution		< 1 mm
Accuracy (Within the total range)	ULM-53L-06-__ ; 10-__ ; 20-__	0.2 %
	ULM-53L-02-__	0.25 %
Temperature error		Max. 0.04% / K
Beamwidth (-3 dB)	ULM-53L-02-__ ; 10-__	10°
	ULM-53L-06-__	14°
	ULM-53L-20-__	12°
Ambient temperature range	ULM-53L-02-__ ; 06-__	-30 ... +70°C
	ULM-53L-10-__ ; 20-__	-30 ... +60°C
Measuring period	ULM-53L-02-I ; -U	0.6 s
	ULM-53L-06-I ; -U	1.0 s
	ULM-53L-10-I ; -U	1.8 s
	ULM-53L-20-I ; -U	5.0 s
	ULM-53L-__-M	Setting by Modbus RTU
Averaging	ULM-53L-__-I ; -U	4 Measuring
	ULM-53L-__-M	Setting by Modbus RTU
Short time temperature stress resistance		+90°C / 1 hod.
Max. operation overpressure (on transmission surface)		0.1 MPa
Failure indication	Echo failure	3.75 mA / 0 V / Modbus RTU
	Level in dead zone	22 mA / 10.5 V / Modbus RTU
Protection class		IP68
Cable	ULM-53L-__-I	PVC 2 x 0.75 mm ²
	ULM-53L-__-U	PVC 3 x 0.5 mm ²
	ULM-53L-__-M	PVC 2 x 2 x 0.25 mm ² (twisted pair, shielded)
Maximal current output load resistance (at U = 24 V DC)		R _{max} = 270 Ω
Minimal voltage output load resistance		R > 1 kΩ
Delay between supply power rise time and first measurement		Max. 5 s (by type)
Delay between power supply rise time and full emission		Max. 45 s (by type)
Weight	ULM-53L-02-__	0.55 kg
	ULM-53L-06-__	0.65 kg
	ULM-53L-10-__	0.95 kg
	ULM-53L-20-__	3.15 kg

1) In case the level of bulk-solid materials is measured, the measurement range is reduced.

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QMS
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