GM ELECTRONICS®

ULTRASONIC SENSORS FOR LEVEL AND DISTANCE MEASUREMENT

GMULM01-EX / GMULM02-EX

GMULM03-EX

GMULM01-EX/GMULM02-EX

The µP probes, GMULM01-EX - GMULM02-EX - GMULM03-EX are devices for measuring levels, which use an ultrasonic wave beam to calculate, with extreme precision and, without contact, distances up to 10 m.
These probes feature high-output sound power, combined with a variable gain system, real-time automatic calibration, automatic compensation for ambient temperature changes, and the use of noise rejection algorithms to deliver virtually zero readings. of noise.
This is also true in the presence of many of the various sources of acoustic, electrical and thermal noise present on the systems.
In the basic versions, the probes are equipped with two independently adjustable thresholds, an analogue 4/20 mA output and an RS485 serial output.
The ultrasonic sensor emits high frequency pulses in the direction of the product to be measured; the product reflects a part of these impulses towards the sensor that emitted them.
The time it takes for the pulses to travel the distance between the sensor and the product is called the time of flight.
A simple algebraic formula links the measured distance, time of flight and temperature; this calculation is performed automatically by the microprocessor placed on the ultrasound probe.

Ultrasonic sensors for level and distance measurement

Fields of application:

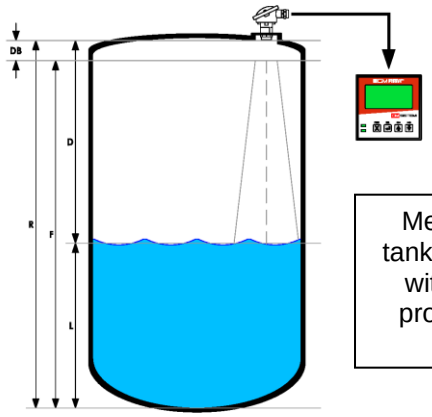
1. Continuous non-contact level measurement for fluids and solid materials placed in silos, crushers and deposits.
2. Measurement of the flow of fluids in open channels and / or rivers.
3. Maximum measuring range: 10 m for measurements on fluids and 5 m for measurements on solids (GMULM01-EX)
4. Maximum measuring range: 5 m for measurements on fluids and 2.5 m for measurements on solids (GMULM02-EX)

Advantages of the ultrasonic measuring system.

1. Compensation of temperature variation for Time of Flight correction; the ultrasonic measurement remains accurate even in the presence of significant variations in the ambient temperature.
2. Hermetic container in PVC, able to resist chemical aggression.
3. The measurement, without contact, allows to operate in environments (eg corrosive) where no other system is able to operate.

Examples of applications:

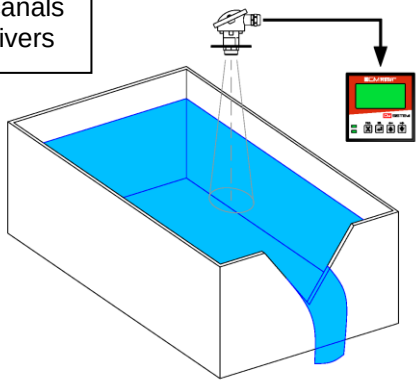
Fig. 1



Measurement in tanks and / or silos, with any type of product, liquid or solid

Fig. 2

Flow measurement for open canals and / or rivers



R= distance with empty tank
F= useful distance (distance with empty tank - blocking distance)
D= distance between sensor and fluid
L= fluid level
DB= blocking distance

Fig. 3

Continuous measurement in tanks with the presence of agitators

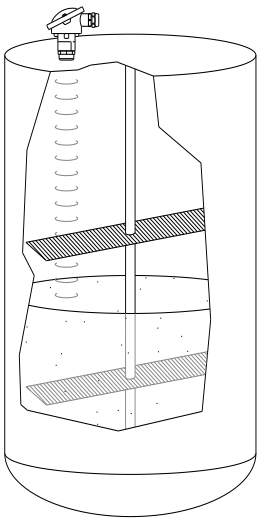
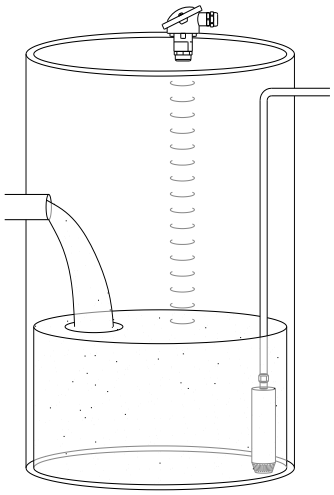


Fig. 4



Pump control for emptying and / or filling

Operation of the time-of-flight principle.

The ultrasonic sensor emits high frequency pulses in the direction of the product to be measured.
The product reflects a part of these impulses towards the sensor that emitted them.
The time it takes the pulses to travel the distance between the sensor and the product is called the time of flight.
A simple algebraic formula links the measured distance, time of flight and temperature; this calculation is performed automatically by the microprocessor placed on the ultrasound probe.

Flight time correction.

A thermal sensor, placed in the probe, communicates to the processor the value of the temperature to be compensated

Block Distance.

The measured distance cannot be less than the blocking distance, because the probe is not able to measure it correctly.
All measurements must be between the block distance and the maximum range of the probe.
Care must be taken that the distance of the product to be measured is never, for any reason, even unexpected, less than the blocking distance.

Installation conditions for level measurement.

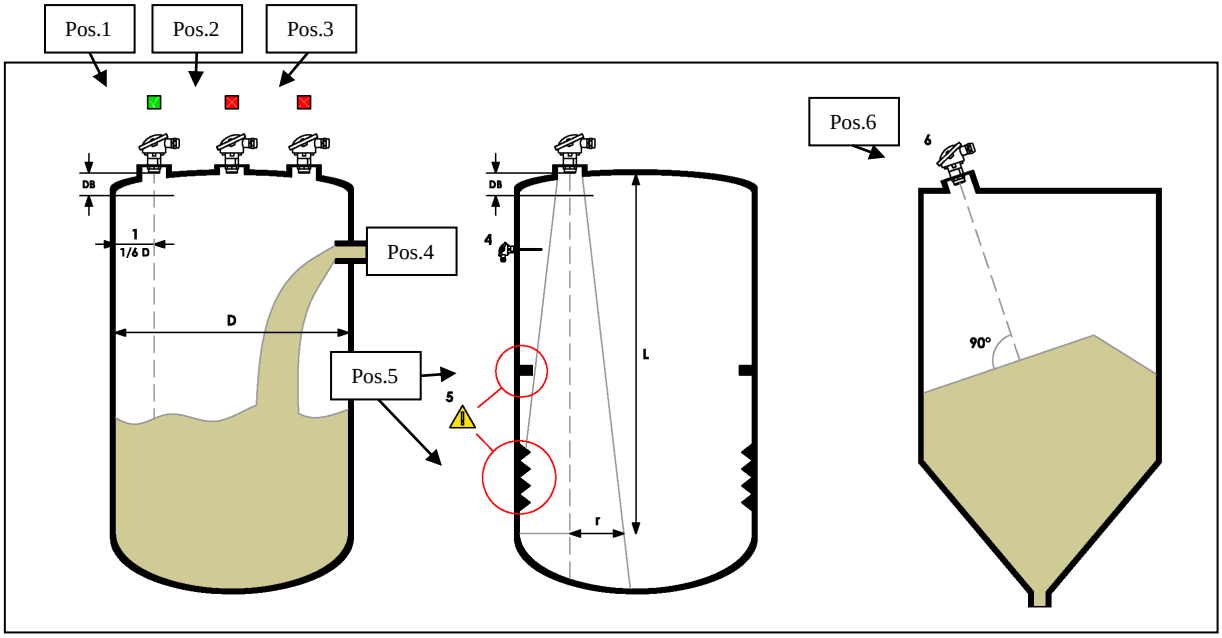


Fig. 5 Fig. 6 Fig. 7

1. If possible, install the sensor so that its bottom edge protrudes into the container.

2. Make sure that the maximum level does not reach the DB blocking distance. (Fig. 5 and Fig. 6)

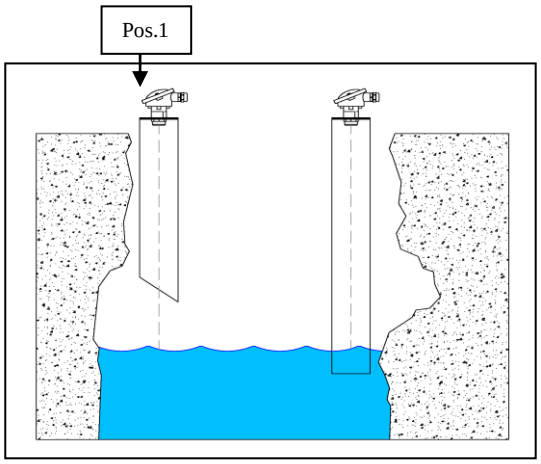
3. Do not install the sensor in the center of the silo (Position 2, Fig. 5). However, it is recommended to maintain a distance of 1/6 of the diameter of the silo (1 / 6D), between the sensor and the silo itself (Position 1, Fig. 5).

4. Avoid installations above the load socket (Position 3, Fig. 5) or, in any case, in areas disturbed by liquid jets or strong air currents.

5. Avoid installing the sensor in areas where the emission angle intercepts other equipment already installed, such as: temperature sensors, level switches etc. (Position 4, Fig. 6), or where there are obstacles such as: welds, protrusions, pipes, etc. (Position 5, Fig. 6).

6. Position the sensor vertically, for measurements on liquids and at different angles for measurements on solids (Position 6, Fig. 7), taking care to always maintain a reflection angle of 90 °.

Guide tubes for ultrasound



In confined areas with strong interference, we recommend the use of an ultrasound guide tube.
(E.g. PE or PVC wastewater pipe) with a minimum diameter of DN60
Make sure that the tube is not blocked, even partially by dirt. If necessary, clean the tube at regular intervals.
If the guide tube ends in the air, cut at 45 ° as in Pos.1, Fig. 8.

Mechanical Dimensions

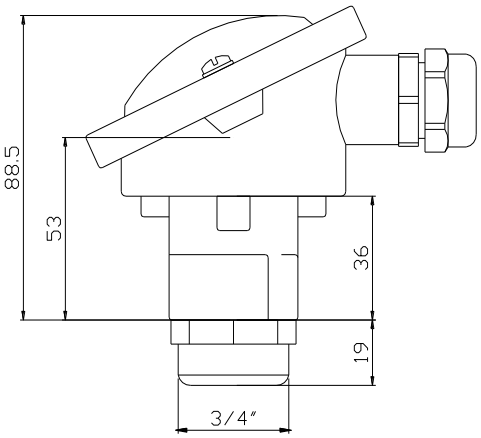


Fig. 9

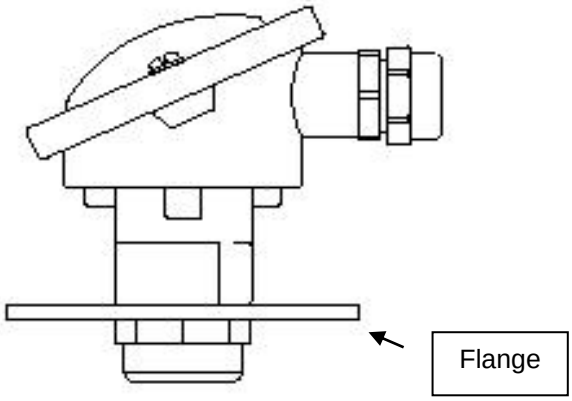
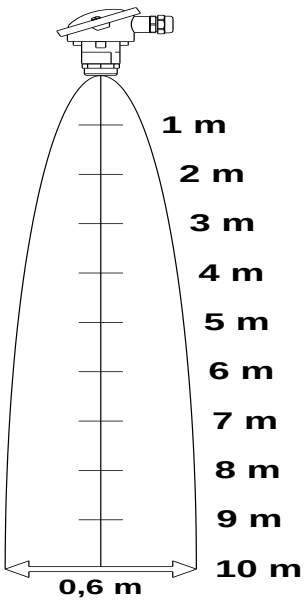


Fig. 10



Trend of the emission lobe, in the range 0-10 m

Fig. 11

LED, JUMPER, BUTTON, TERMINAL BLOCK, CONNECTION BOARD LAYOUT

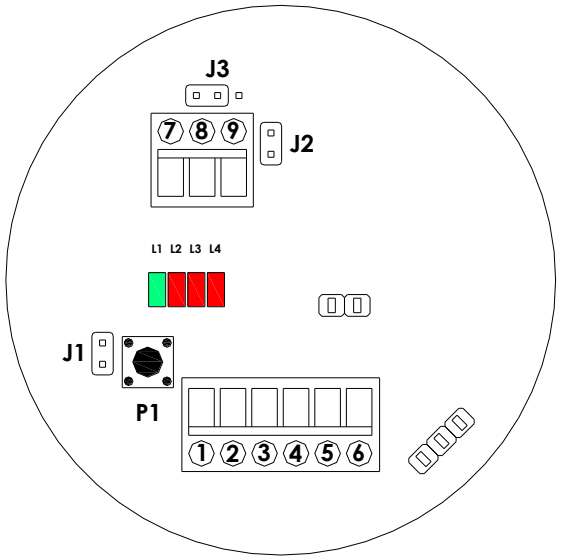


Fig. 12

TERMINAL BLOCK DESCRIPTION: (Fig. 12**)**

1 = POSITIVE POWER
2 = NEGATIVE POWER SUPPLY
3 = TEST INPUT
4 = RS485 SERIAL (A)
5 = RS485 SERIAL (B)
6 = 4/20 mA PWM OUTPUT
7 = U1 THRESHOLD OUTPUT
8 = U2 THRESHOLD OUTPUT
9 = FAULT OUTPUT U3

Description of LED with jumper J1 disconnected: normal operation: (Fig. 12)

LED 1: steady on = power supply voltage + V (terminals 1 and 2) present.
LED 2 : on slow flashing = stable acquired value
LED 2: on fast flashing = value being acquired
LED 3 : on = output U1 active (pin 7); exceeding the threshold 1.
LED 4 : on = output U2 active (pin 8); exceeding the threshold 2

DESCRIPTION OF JUMPERS and BUTTON: (Fig. 12)

J1 : probe calibration.
With J1 off, probe in normal operation.
With J1 inserted, calibration of the start of scale, end of scale, threshold 1 and threshold 2 values (see following procedure)

J2 : logical inversion of the outputs.
With J2 off, the output contacts (solid state relay) are normally open,
With J2 inserted, the output contacts (solid state relays) are normally closed.

J3 : setting the common to positive / negative.

P1 : Calibration button.

PROBE IGNITION, SIGNALS, AUTOMATIC CHECKS AT START-UP

Note. the analogue output function selection must be performed at this point, during initialization,
4-20mA output mode: Current or Centimeters
This mode is described below in the Calibrations chapter.

Start probe:

SOFTWARE VERSION:

LED 1 ON -> + 24V power supply present
LED 2 FLASHES -> the number of flashes indicates the software version
LED 4 ON -> static

MEMORY TEST:

LED 1 ON -> power supply present
LED 2 ON
LED 3 ON
LED 4 ON

The probe performs a 4 second memory test on the components.
If the test fails, the ignition cycle will start again.
At the end of the test, the LEDs turn off for 3 seconds.

4-20mA output mode selection: Current or Centimeters

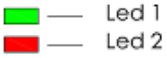
LED 1 ON -> power supply present
LED 2 **OFF -> channel 1** LED 2 **ON -> channel 2**
LED 3 -> Fast Flashing
LED 4 -> Fast Flashing

By pressing button P1 you can set the probe mode (1 or 2) within 8 seconds from the start of the flashing of LEDs 3 and 4.
At the end of the time all the LEDs will flash slowly 3 times to confirm.

Note: To check the setting, the probe must be disconnected and the ignition procedure described here again.

CALIBRATION OF START AND END POINTS OF 4-20mA OUTPUT and OUTPUTS THRESHOLD 1, THRESHOLD 2

1) Position the probe at the desired distance for the calibration of 4 / 20mA and / or thresholds 1 and 2.
2) Insert the J1 jumper, located next to the P1 button
3) IL led L2



It will flash quickly for a few seconds "setting selection time",
- during this time, pressing the P1 button will change and therefore select the outputs that are wish to calibrate, see point 4 below) .

4) Using the P1 button, select the parameter to be calibrated, as per the following table:

LED 3 e LED 4 turned off	=	Threshold calibration 1
LED 3 turned on LED 4 turned off	=	Threshold calibration 2
LED 3 turned off LED 4 turned on	=	Calibration 4 mA
LED 3 e LED 4 turned on	=	Calibration 20 mA

5) Wait for Led 2 to stop flashing and stay on steady,
Note. in this case (programming), led L2 has a double function, both to signal the time for selecting the channel to be calibrated (fast flashing), and for checking the stability of the measured signal (slow flashing - fixed),
it will light up steadily when the measurement is stable..
6) Then wait for LED 2 to stay on steady.
7) Press and hold the P1 button.
8) Wait for LED 1, LED 2 and LED 3 to flash simultaneously.
9) Release button P1.
10) The value of the current distance will be associated with the parameter chosen at point 4);
Eg. if the probe is placed at a distance of 1000 mm and we want to calibrate the 4 mA, the value 1000 will come stored in the 4 mA calibration parameter.
11) Repeat the procedure from point 1) to point 8), for all the parameters to be calibrated.
12) Remove jumper J1 to exit programming.

Verification of the calibrations, using a multimeter.

If a multimeter, configured as a milliammeter (20mA), is connected to the 4/20 mA output, during the calibration phase (see previous calibration procedure) it is possible to verify the correct acquisition of the set values: eg. during the calibration of the distance / level value corresponding to 4 mA, this current value will be generated and will be readable on the multimeter; when calibrating the distance / level value corresponding to 20 mA, this current value will be generated and will be readable on the multimeter.
Alternatively, it is possible to transmit the value converted into mm on the 4/20 mA output.

***** **Es.1** reading the value 11.76 mA on the milliammeter it is sufficient to divide this value by two (without comma) obtaining the value 588 (1176/2) which represents the distance in cm from the probe.
Es.2 if the value displayed on the milliammeter is 3.00 mA, the distance measured by the probe is 150 cm (300/2).
The procedure for obtaining this operating mode involves switching the probe off and on again.
After the initial phase, which foresees the display of the software version and the memory test, it is necessary to perform the "selection of the 4-20mA output mode: Current or centimeters", as indicated below :

***** example display on multimeter:

= 1479 mm = 951 mm

GENERAL CHARACTERISTICS

GMULM01:

DESCRIPTION: Microprocessor technology.
POWER SUPPLY: 24 VDC (18-36VDC) 30 mA.
OUTPUT 2: 1 analogue output in 4/20 mA current.
ULTRASONIC FREQUENCY: 42 KHz.
MINIMUM MEASURING DISTANCE : 0.5 m .
EMISSION ANGLE: 10 ° typical
OPERATING ENVIRONMENT TEMPERATURE RANGE: -40 ° C / + 65 ° C.
MATERIAL: Die-cast aluminum (UNI EN 1706)
IP CLASSIFICATION: IP65

LEDS: 4 led per segnalazioni.
OUTPUT 1: n.2 rele a stato solido max 48V 120 mA.
OUTPUT 3: n.1 uscita digitale seriale RS485.
READING FREQUENCY: 7,5 Hz
MAXIMUM DISTANCE OF MEASUREMENT : 10 m
RESOLUTION: 1 mm.
CONTAINER: DIN A
EMITTER MATERIAL: Alluminio/PVC
CERTIFICATION: ATEX II 3D EEx IP65 T85 ° C

GMULM02:

DESCRIPTION: Microprocessor technology.
POWER SUPPLY: 24 VDC (18-36VDC) 30 mA.
OUTPUT 2: 1 analogue output in 4/20 mA current.
ULTRASONIC FREQUENCY: 42 KHz.
MINIMUM MEASURING DISTANCE : 0.3 m.
EMISSION ANGLE: 10 ° typical
OPERATING ENVIRONMENT TEMPERATURE RANGE: -40 ° C / + 65 ° C.
MATERIAL: Die-cast aluminum (UNI EN 1706)
IP CLASSIFICATION: IP65

LEDS: 4 led per segnalazioni.
OUTPUT 1: n.2 rele a stato solido max 48V 120 mA.
OUTPUT 3: n.1 uscita digitale seriale RS485.
READING FREQUENCY: 7,5 Hz
MAXIMUM DISTANCE OF MEASUREMENT : 5 m
RESOLUTION: 1 mm.
CONTAINER: DIN A
EMITTER MATERIAL: Alluminio/PVC
CERTIFICATION: ATEX II 3D EEx IP65 T85 ° C

GMULM03:

DESCRIPTION: Microprocessor technology.
POWER SUPPLY: 24 VDC (18-36VDC) 30 mA.
OUTPUT 2: 1 analogue output in 4/20 mA current.
ULTRASONIC FREQUENCY: 42 KHz.
MINIMUM MEASURING DISTANCE : 0.2 m.
EMISSION ANGLE: 10 ° typical
OPERATING ENVIRONMENT TEMPERATURE RANGE: -40 ° C / + 65 ° C.
MATERIAL: Die-cast aluminum (UNI EN 1706)
IP CLASSIFICATION: IP65

LEDS: 4 led per segnalazioni.
OUTPUT 1: n.2 rele a stato solido max 48V 120 mA.
OUTPUT 3: n.1 uscita digitale seriale RS485.
READING FREQUENCY: 7,5 Hz
MAXIMUM DISTANCE OF MEASUREMENT : 3,5 m
RESOLUTION: 1 mm.
CONTAINER: DIN A
EMITTER MATERIAL: Alluminio/PVC
CERTIFICATION: ATEX II 3D EEx IP65 T85 ° C

Warnings and Maintenance.

The installation of the probes must be performed in a workmanlike manner, by qualified and appropriately trained personnel to operate on ultrasonic probes.
The probes are designed for the measurement of levels in the industrial sector. Medical applications are excluded.
At maximum intervals of 3 months, and in any case even less, if there are fine and / or adhesive powders, it is advisable to carry out an external check and cleaning of the probe; debris and / or dirt accumulated on the emitting part of the probe can prevent it from functioning correctly.
At the end of their life, the probes must be disposed of in compliance with the regulations in force (do not throw away in common waste).

DECLARATION OF CONFORMITY

GM SISTEMI
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DECLARES:

UNDER OUR LIABILITY THAT THE PRODUCT:

GMULM01-EX - GMULM02-EX - GMULM03-EX
ULTRASONIC LEVEL METERS

To which this declaration refers
IS COMPLIANT
and therefore meets the essential requirements of the directives :
EC Electromagnetic Compatibility Directive 2014/30/EU
EC Low Voltage Directive 2014/35/EU

Salizzole (VR) 09/2019

GM SISTEMI
Legal Representative
Guarnieri Massimo

DECLARATION OF CONFORMITY ATEX

This product complies with the directive **ATEX 2014/34/UE** (ex 94/4/CE)

II 3D EEx IP65 T85 °C

GM ELECTRONICS is a trademark by

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