

# INSTRUCTION MANUAL

Ultrasonic Tank Level Sensor **Amplifier built-in**

**UA-11**



This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

## 1 OUTLINE

This sensor detects the liquid level in the tank, without contact, by sensing through the tank wall using ultrasonic waves

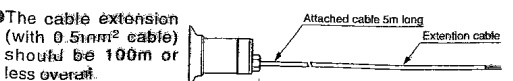
## 2 SPECIFICATIONS

Item	Model No.	UA-11
Applicable tank (*)	Tank diameter (2) Wall thickness (2) Material (3)	φ300 to φ3,000mm 6mm or less Metal (stainless steel, iron steel etc.)
Contents		Water or the same viscous liquid (excluding bubble)
Supply voltage		12 to 24V DC ± 10% Ripple P-P 10% or less
Current consumption		60mA or less
Repeatability		± 3mm (with water)
Output (OUT1 OUT2)		NPN open-collector transistor • Maximum sink current : 100mA • Applied voltage : 30V DC or less • Residual voltage : 1.5V or less (at 100mA sink current) 1V or less (at 40mA sink current)
Output operation		OUT1 : ON when detecting liquid, OUT2 : OFF when detecting liquid
Short-circuit protection		Incorporated
Response time (*4)		Approx. 5ms on condition with the tank 3,000mm diameter with water inside
Operation indicator		Red LED (lights up when OUT1 is activated)
Stability indicator		Green LED (lights up under the stably detecting and undetecting)
Sound emission lock function		Incorporated
Crosstalk prevention function		Incorporated
Protection		IP67 (IEC)
Ambient temperature		-10 to +80°C (No dew condensation nor icing allowed), Storage : -20 to +90°C
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH
Case earthing		Capacitor earth
Material		Enclosure : SUS304, Tail : PFA, Skirt : EPR, Adjuster : PPS
Cable		Cable type cable 5m long with six 0.2mm <sup>2</sup> conductors
Accessories		MS-UA11-2 (Sensor mounting bracket) : 1pc. UA-G1 (Paste) : 1pc., Adjusting screw-driver : 1pc.

- \*1) : It can not be used for multi-layered tanks having thermal insulating jackets for refrigeration, heat retaining, etc.  
 \*2) : Since the permitted tank diameter and the wall thickness differs with the type of liquid in the tank and the tank shape, please contact the company for details.  
 \*3) : It can not be used for tanks made of resin.  
 \*4) : Since it differs with the tank diameter or the type of liquid please contact the company for details.

## 3 CAUTIONS

- Do not supply power while wiring
- Verify that supply voltage ripple is within the rating
- With a commercial switching regulator, ground the F.G. terminal
- Where some device generating noise such as a switching regulator or an inverter motor is placed near the sensor, ground the F.G. terminal
- Make sure to ground the metal tank on which UA-11 is mounted.
- Do not use any auto-transformer (single-wound) to supply power
- The transient time duration is 50ms after power-up
- Do not run the sensor cable along any high-voltage or power cable in parallel or in a same raceway. It may cause a malfunction by induction.

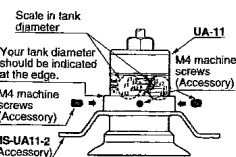


Thank you very much for using SUNX sensors. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of the sensor. Kindly keep this manual in a convenient place for quick reference.

## 4 MOUNTING

### Mounting

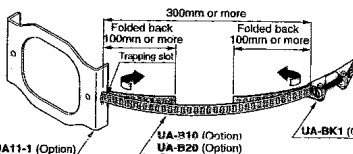
- Insert the UA-11 through the sensor mounting bracket (MS-UA11-2). Position the bracket where your tank diameter is exactly pointed at the edge of it on the left side scale of the sensor body. This adjusts the mounting depth to correctly seat the sensor to the tank wall. Fix the sensor in the bracket with three attached M4 x 6mm screws. The tightening torque should be 0.59N·m (5kgf·cm) or less.  
 Note : The left side scale is used for belt mounting, but the right side scale for weld mounting on the above figure.



- Fix the mounting bracket (MS-UA11-1) on your tank by belt mounting or weld mounting as follows

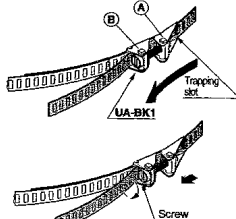
### Belt mounting

- Prepare two belts of different lengths by cutting the UA-B□ with nippers. One should be over 500mm long. The second belt approximates your tank circumference minus 200mm. Round the cut ends of belts not to be injured.
- Insert the one end of the 500mm belt through the trapping slot on the side of the MS-UA11-1 and fold it back inside 100mm or more. Insert the other end through the slit on the UA-BK1 buckle and fold it back inside 100mm or more. The distance between the MS-UA11-1 and the UA-BK1 should be 300mm or more.



- Insert the one end of the circumference belt through the trapping slot on the other side of the MS-UA11-1 and fold it back inside 100mm or more.

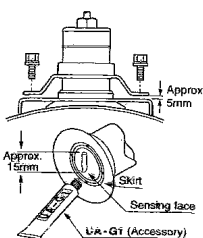
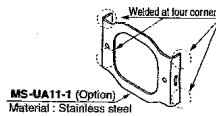
- Route it around the tank and insert the end of it through the UA-BK1 buckle over the former belt as shown. Pull it tight and hang it on the hook of the buckle. Make sure that the belts retain perfect roundness on a horizontal plane.
- Tighten the belts by screwing at the buckle with a minus screw-driver. The tightening torque should be approx. 0.74N·m (7kgf·cm), but do not deform the tank by tightening.



- Note : - Use two or more UA-BK1 buckles around a large tank 2m or more in diameter.  
 - The belts (UA-B□) should be laid in a circle concentric to the lateral section of the tank. If not, as the belt becomes loose, the detectability will deteriorate.  
 - Do not belt the UA-11 on a cubic tank because of inadequate thrust. Mount it on the cubic tank by welding.

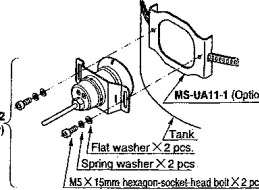
### Weld mounting

- Weld MS-UA11-1 on the tank wall at the four corners.
- Note : Welding may yield a gap between mounting bracket (MS-UA11-1) and the tank's outer wall. In this case, since the tank scale cannot be used as it is, if the sensor is fixed on the sensor mounting bracket (MS-UA11-2), set the sensor at a position which is shifted, with respect to the position indicated by the tank scale, towards the cable side by an amount equal to the gap. The following procedure may also be used to set the sensor:
- The sensor is pressed tightly against the tank's outer wall.
  - Under the condition of (i), fix the sensor and the sensor mounting bracket (MS-UA11-2) with M4 x 6mm screws at such a position that there is a gap of 5mm approx. between the mounting bracket (MS-UA11-1) and the sensor mounting bracket (MS-UA11-2).



- Squeeze out a bead of the UA-G1 paste approx. 15mm long on the sensing face. Flatten it smoothly over the sensing face and the skirt. Keep it not to contain air bubbles.

- Affix the mounting bracket (MS-UA11-2) holding the sensor to the mounting bracket (MS-UA11-1) with two hexagon-socket-head bolts (M5 x 15mm). Each bolt must be applied with the spring and the flat washer.



- Tighten the bolts alternately so that the sensing face contacts the tank surface evenly. The tightening torque MS-UA11-2 should be 2.94N·m (Accessory) (30kgf·cm) or less. Do not deform the tank by tightening.
- Note : If the tightening is unsecured, unbalanced, or incorrect it weakens or biases thrusting the sensing face against the tank wall. Uneven surface contact makes the sensor inoperable.

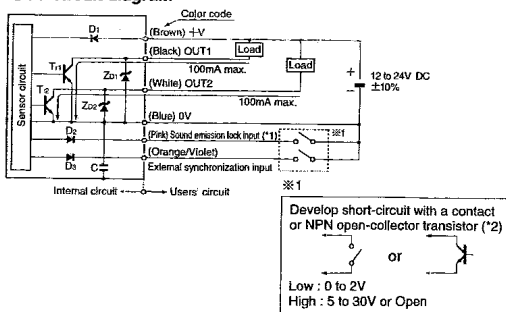
### Caution on mounting

- Always handle the edges of the belts (UA-B□) carefully to avoid possible injury.
  - Any paste put into the eye should be washed off with water. Consult an eye doctor immediately.
  - Any paste dropped on the skin should be washed off with water.
  - Make sure to test for compatibility with your tank before actual use.
- The UA-11 can not be used with the following tank constructions:
- A multi-layered tank such as with a thermal insulating jacket for refrigeration heat-retaining, etc.
  - A cone-shaped tank
  - A tank with a pipe, a fin, a stirrer, an agitator, or a shaker inside, which obstructs the sound propagation
  - A tank made of a resin
  - A tank storing liquid that is highly viscous, or including grains, bubbles, or layers of some different ingredients

- Keep air out of the contact section between the sensing face and the tank wall. An uneven surface contact or a weak thrust makes the sensor inoperable.
- Wipe rust, moisture, dirt, and dust off the mounting surface of the tank with sand paper and a cloth dampened with ethyl alcohol.
- To change the position, remove the sensor from the tank, wipe the paste off the sensor head with a cloth dampened with ethyl alcohol, and apply fresh paste.
- Keep the UA-G1 paste not to be exposed to the sun or moisture.
- The scale on the sensor body is calibrated only for a cylindrical tank when using the MS-UA11-1 or the MS-UA11-2.
- Waves on the liquid surface may flicker the output and the operation indicator.
- The stream of contents may affect the detectability.
- If the paste flows out from the contact section between the sensing face and the tank wall, the detectability may deteriorate. Keep the contact section away from chemical agents, or heavy splashes of water.
- If the tank wall is much thicker than the specified range or the sensitivity is too high for the tank size, the derivative sound returned around the tank wall may cause the sensor to generate the output with no liquid. In this case, reduce the sensitivity, and check that the output is ON when the liquid level is higher than the sensing point and OFF when the level is lower than it, up to the empty state.
- Please contact the company for the sensor's chemical withstandability.

## 5 CONNECTING

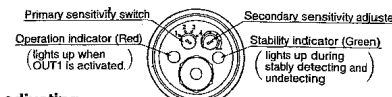
### I/O circuit diagram



- Symbol : D1 : Reverse polarity protection diode  
 D2, D3 : Reverse current protection diode  
 Zn : Surge absorption zener diode  
 Tr1, Tr2 : NPN output transistor  
 C : Capacitor
- (\*1) : It stops emitting the sound if connected to 0V.  
 (\*2) : If the external synchronization input is connected with a contact, make notice of the response time.

## 6 CALIBRATION

### Back face



### Sensitivity adjusting

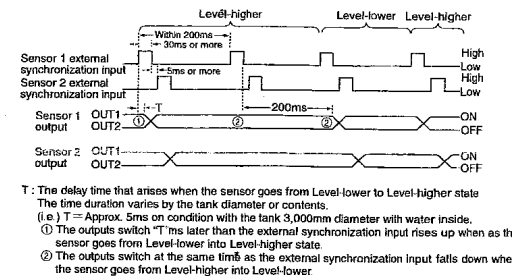
Procedure	Operation	Adjuster										
①	Set the primary sensitivity switch for your tank as shown below.	<table border="1"> <thead> <tr> <th>Primary sensitivity switch</th> <th>Tank diameter (mm)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>φ300 to φ500</td> </tr> <tr> <td>2</td> <td>φ500 to φ1,000</td> </tr> <tr> <td>3</td> <td>φ1,000 to φ2,000</td> </tr> <tr> <td>4</td> <td>φ2,000 to φ3,000</td> </tr> </tbody> </table>	Primary sensitivity switch	Tank diameter (mm)	1	φ300 to φ500	2	φ500 to φ1,000	3	φ1,000 to φ2,000	4	φ2,000 to φ3,000
Primary sensitivity switch	Tank diameter (mm)											
1	φ300 to φ500											
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3	φ1,000 to φ2,000											
4	φ2,000 to φ3,000											
	Note : The relationship between the set value and the tank diameter differs in the viscosity of the contents, the thickness of the wall, etc.	Primary sensitivity switch										
②	Turn the secondary sensitivity adjuster counterclockwise fully to the minimum.	Secondary sensitivity adjuster										
③	Fill the tank until the level is higher than the sensor mounted position. Turn the adjuster gradually clockwise up to a point (A) where both the operation indicator and the stability indicator light up. If no operation indicator lights up, even the operation indicator is fully turned, shift the primary sensitivity switch up one segment of the scale and do the step (2) and (3) again.	Secondary sensitivity adjuster										
④	Drain the contents from the tank until the level is lower than the sensor-mounted position. Make sure that the operation indicator lights off and the stability indicator lights up. Turn the adjuster clockwise until the operation indicator lights up again. After its lighting, turn the adjuster slightly counterclockwise to a point (B) where the indicator goes off.	Secondary sensitivity adjuster										
⑤	Set the adjuster at the center between the point (A) and (B) which obtains the optimum sensitivity.	Optimum point Secondary sensitivity adjuster										

## 7 SOUND EMISSION LOCK FUNCTION

The emission of sound is suspended when the sound emission lock input is connected to 0V. This can be used to check the sensor operability while the level is higher than the sensor-mounted position, and to prevent the crosstalk by the emission control.

## 8 CROSSTALK PREVENTION FUNCTION

If two or more sensors are mounted on a tank together, crosstalk may occur. The sound emitted from one sensor may return into the other sensors. It saturates the sensitivity and trips the output. However, it can be prevented by pulse input regularly oscillating to each sensor with the distinct phase.



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