Revision A

Document Number: 20190208-SEN001

Approval Sheet

Water level Sensor – 1Channel, 2Channels, 3Channels

Part Number: SE-10020-XX
Item Number1: AWC-LVSS1CH (1 Channel)
Item Number2: AWC-LVSS2CH (2 Channels)
Item Number3: AWC-LVSS3CH (3 Channels)

- XX: 01-1ch, 02-2ch, 03-3ch

Supplier Signature:

Customer Name:
Customer Part Number:
Customer Approval Signature:

08-Feb-19

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Water Level Sensor
1 channel, 2 channels and 3 channels

LINK TO RELATED SPECIFICATIONS	
Document Name	**Document Number**

REVISION HISTORY

Rev	Changes	Rev/Date	Written By	Approver	ECO No.
0	Initial for review	08 Feb 19	JS Ma	SE Jeong	N/A

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1 Scope

This specification provides the mechanical, electrical and physical requirements of capacitive touch sensor for use in water level detecting sensor products. The sensors included are 1 channel, 2 channels and 3 channels with a wire harness and the touch sensing wire. The sensor must be suitable for operating at -40°C to +85°C with the supply voltage 2.5Vdc to 5.0 Vdc.

The product components layout is to comprise a parallel capacitor, resistors and AWS01 touch sensor IC arrangement of a PC Board arranged in a plastic housing. Electrical connections must be located as specified in this document to ensure compatibility with specific SENTROL package styles. The output voltage must be proportional to both the physical touch on O type terminal and also to the power excitation (voltage or current supply).

Equipment, equipment settings, tooling and process flow required to achieve the requirements described below are not in the scope of this document but must be included in Suppliers Process Flow, FMEA and Control Plan and any changes are subject to Supplier Change Request which must be approved by SENTROL.

2 Basic Requirements

2.1.1 Mechanical Stucture

- Sensor is to consist of wires for power supply, ground, touch sensing, Housing and PC Board
- PC Board and Wire must be RoHS compliant.
- The Sensor feature is shown in Figure 2, dimension and tolerances of all external Sensor features (height, width, length, location etc) are relevant to packaging fit and must be specified on the Part Drawing.
- Mounting dimension of sensor housing and touch sensing O type terminal diameter relative to the water tank must also be shown on the Part Drawing.
- Wire grade, number, color and its order must be specified on the Part Drawing

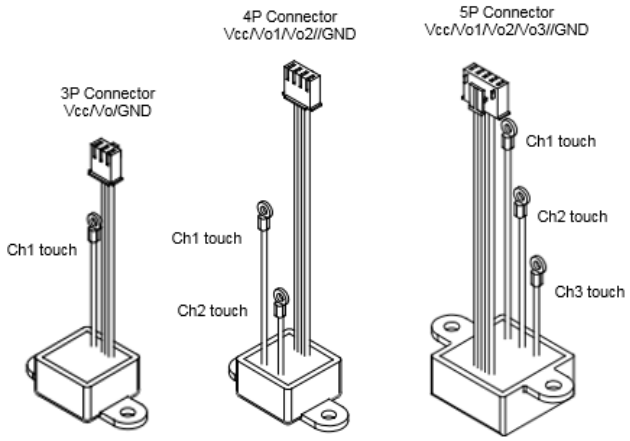


Figure 1 Feature of the sensor. This feature shows one, two & three channel water level sensor.

2.1.2 Electrical Connections

- The electrical circuit diagram is shown in Figure 2, the exact value of components is important and must be shown on Part Drawing.
- The wire layout of the Sensor is shown in Figure 1, the exact connection of each wire and colour order must be specified on the Part Drawing.
- Electrical function is defined in Section 3.1.

2.1.3 Environmental Durability

- The sensor must be designed to include all necessary electrical isolation required to minimize the effects of any contamination which may be present due to processing/materials of the PCB, components, part itself or which may become present on the sensor from manufacturing and application environments.
- The sensor must also withstand exposure to the high and low temperature environment and to the water.

3 Water Level Sensor Characteristics

3.1 General Definitions

This Section defines the parameters which are used in the Sections 0 and 0 to specify the water level Sensor.

3.1.1 Electrical Circuit

Equivalent circuit layout for Sensor is shown in Section 2.1.

This circuit defines the connections for the Supply (V_{DD}), Ground (GND), Output (Vo) for one channel sensor. Channel 2 and channel 3 sensors are able to be arrayed with this circuit.

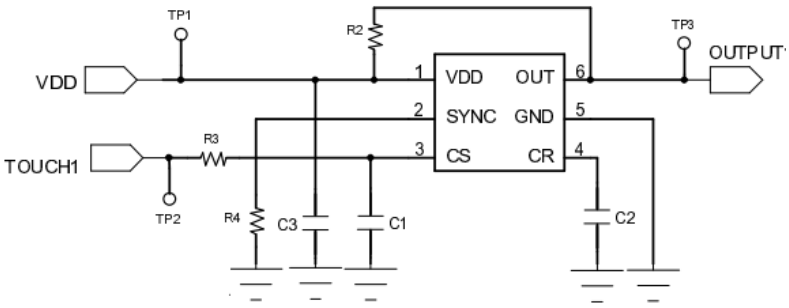


Figure 2 Circuit schematic diagram of the sensor. This diagram shows one channel water level sensor's circuit. 2 and 3 channels water level sensors have two or three arrays of this circuit in the PC Board.

3.1.2 Output Voltage Characteristic

The Output Voltage (V_{OUT}) is open drain structure and an internal pull-up resistor is in the circuit. The output is high in normal state and the output signal drops when the touch point detect an object such as hand touch or water. See the test procedure in 5.2.

Output Signal

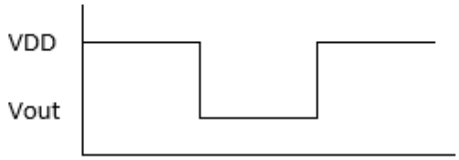


Figure 3 Output diagram of the sensor

3.2 Maximum Ratings

Unless otherwise stated values are specified at **5±0.1Vdc** at **25±3°C**

Item	PARAMETER	SYMB	CONDITIONS	MIN	TYP	MAX	UNIT
	ELECTRICAL EXCITATION						
3.2.1	Maximum Supply Voltage	V_{DD}				**5.5**	V
3.2.2	Maximum Supply Current	Is				**100**	mA
3.2.3	Power Dissipation					**200**	mW
	TEMPERATURE RANGE						
3.2.4	Operating Temperature Range			**-20**	**25**	**75**	°C
3.2.5	Storage Temperature Range			**-40**	**25**	**85**	°C

This parameter can be verified for each part on process monitor structures if necessary

3.3 Performance Characteristics

Unless otherwise stated values are specified at **5±0. 1Vdc** at **25±3°C**

Item	PARAMETER	SYMB	CONDITIONS	MIN	TYP	MAX	UNITS
SUPPLY VOLTAGE AND BRIDGE RESISTANCE							
3.2.6	Operating Supply Voltage	V_{DD}		**3.5**	-	**5.5**	V
3.2.7	Supply Current	Is		-	**750**	-	uA
3.2.8	Output Current			-	-	**4.0**	mA
OUTPUT SIGNAL							
3.2.9	Output High	V_{High}	No contact to sensing rug terminal	**Vs-0.3**		**Vs+0.**	Vdc
3.2.10	Output Low	V_{Low}	Contact to sensing rug terminal	-	**0**	**0.5**	Vdc
.2.11	Time for power reset			-	**100**	-	m sec
.2.12	Sensing Life Time		Vsupply = 5.0 Vdc	**300K**	-	-	times

4 Design and Production Validation Requirements

This Section defines the minimum test data which must be collected to verify that the requirements specified in Sections 3.1.2 are met. General requirement is for a minimum process capability Cpk of 1.67 at start of production and an ongoing (long-term) Cpk of 1.33. Corresponding test conditions and procedures are in Section 5.

Test Parameter (with reference to Specification)	Test Conditions	Design Validation		Production Validation		In-Process Testing	
		Minimum Sample	Acceptance Criteria	Minimum Sample	Acceptance Criteria	Minimum Sample	Acceptance Criteria
Function Test (3.1.2)	3.1.2	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	100%[1]	Cpk>1.33
Insulation Resistance Test (>50 MΩ)	500VDC	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Each Lot * 3 units	Cpk>1.33
High Temp. Test	70℃ for 48hrs	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Every 6* months	Cpk>1.33
Low Temp. Test	-20℃ for 48hrs	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Every 6* months	Cpk>1.33
Leak Test	1min water for 3 min	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Every 6* *months	Cpk>1.33
Vibration Test	75cm	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Every* Year	Cpk>1.33
Drop Test	-	1 lot 3 units	No failures	1 lot 3 units	No failures Cpk>1.67	Every* Year	Cpk>1.33

[1] This data must be collected for each lot and archived to be made available at SENTROL request for three (3) years after date of manufacture.

* To be determined with SENTROL if periodic/volume based audit is still required after a process capability Cpk>1.67 is demonstrated at Production Validation or if long-term capability of Cpk>1.33 is demonstrated.

5 Test Conditions and Procedures

5.1 Test Package Requirements

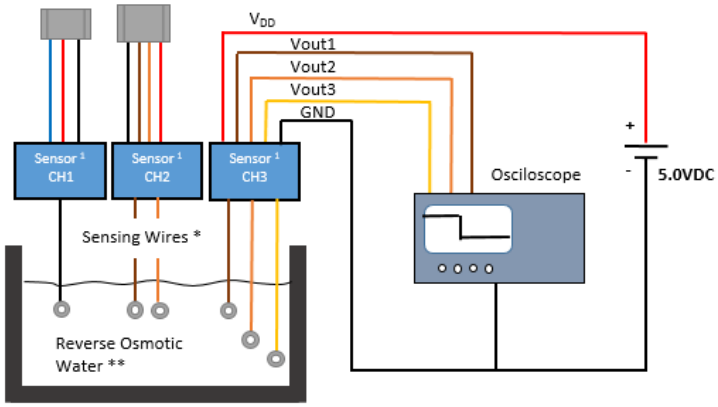
- The test must be reviewed and approved by SENTROL prior to the start of validation testing.
- Unless otherwise stated below, during tests the temperature is to be maintained with **± 5°C**.
- Unless otherwise stated below, the Sensor must be powered for these tests with **Vs = 5±0.5Vdc**.

5.2 Basic Function Tests

5.2.1 Function test Procedure

Output Voltage measured as a function of touch in water:

- Step 1: Connect the sensor wires (V_{DD}, V_{out1}, V_{out2}, V_{out3} & Ground) to power supply & Oscilloscope
- Step 2: Power on the Oscilloscope & power supply and check if the output signal is on High
- Step 3: Immerse the sensing wire in the water tank and then check if the output signal is on Low
- Step 4: Remove the sensing wire from the water tank and then check if the output signal is on High
- If the output signal shows as described, the sensor passes the test



[1] The sensor has 3 channels; the figure shows 1,2,3 channels sensor. Feature of the sensor shows in figure 1 and the wire diagram for the test is varied by the channels of the sensor.

* The sensor has the sensing wire which is immersed in the water, one channel sensor has one wire for sensing which is for detection the water height, two & three channels sensor have two & three wires to detect the different water height.

** Water in the diagram is TDS 10~20ppm Reverse Osmotic Water, which is the 9:1 mix between distilled water (TDS 0ppm) and tap water (TDS 100ppm).

Figure 4 Output Function test diagram of the sensor

5.2.2 Insulation Resistance Test

This is a kind of electrical safety test of the sensor, Connect the Power DC500V between terminal of the connector and sensor body, and then check if the resistance value is over 50 MΩ.

5.3 Environment Test

5.3.1 High Temperature Test in Air

To determine behaviour during and after high temperature stress, samples are to be exposed to the following conditions:

- Temperature: **70°C ± 5°C**
- Dwell Time at Temp: **1 hour**
- Cooling Time: **< 1 hour**

5.3.2 Low Temperature Test in Air

To determine behaviour during and after low temperature stress, samples are to be exposed to the following conditions:

- Temperature: **-20°C ± 5°C**
- Dwell Time at Temp: **1 hour**
- Dry Time: **< 1 hour**

5.3.3 Water Insulation test

To determine behaviour during and after water test, samples are to be exposed to the following conditions:

- Water Temperature in tank: **25°C ± 5°C**
- Dwell Time at Temp: **3 minutes**
- Dry Time: **< 1 hour**

5.4 Vibration Test

To determine behaviour during and after vibration test, samples are to be exposed to the following conditions:

- Frequency: 1000 Hz
- Amplitude: 2mm
- Mounting face of sensor: X, Y & Z direction
- Duration: 20 minutes at each direction

5.5 Drop Test

To determine behaviour during and after vibration test, samples are to be exposed to the following conditions:

- Height from ground: 75 cm
- Drop direction: X, Y & Z direction of the sensor

The functional tests of Section 3.1 & 5,2 must be repeated before and after these environment tests to verify performance. The function as a result of these test must meet requirement specified in Section 3.3

5.6 Shipping and Handling Conditions

5.6.1 Cleanliness

The Sensor must be supplied free from all forms of contamination such as dust water or oil liquid residues.

5.6.2 Shipping Conditions

- The sensor must be shipped on a carton box - the dimensions and mechanical details of this packaging must be specified on the Part Drawing.
- Sensor must be bundled by 25 sensors and packed the 2 bundles in a plastic pack.
- The packing quantity in the carton box must be defined by sensor channel and it size
- Shipping Identification information must be supplied with each box shipment as follows: -
  - Purchase Order Number (Date of order may be substituted)
  - SENTROL Part Number
  - Lot Number
  - Number of Good