7014
Liquid Level Sensor

User Manual

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7014-30-055 Iss 6

IMPORTANT NOTICES:

1. Gill Sensors & Controls Limited can take no responsibility for installation and/or use of its equipment if this is not done in accordance with the appropriate issue and/or amendment of the manual.
2. The user of this manual should ensure that it is appropriate in all details to the exact equipment to be installed and/or operated. If in doubt, the user should contact Gill Sensors & Controls Limited for advice.
3. If further details are required which do not appear in this manual, contact Gill Sensors & Controls Limited or one of their agents.
4. Install and use the 7014 Liquid Level Sensor in accordance with local regulations.
5. Gill Sensors & Controls Limited reserve the right to change or revise the information supplied in this document without notice and without obligation to notify any person or organisation of such revision or change.

HELP US TO HELP YOU:

Every effort has been made to ensure the accuracy in the contents of our documents, however, Gill Sensors & Controls Limited can assume no responsibility for any errors or omissions in our documents or their consequences. Gill Sensors & Controls Limited would greatly appreciate being informed of any errors or omissions that may be found in the contents of any of our documents.

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1. FOREWORD

Thank you for purchasing a 7014 liquid level sensor manufactured by Gill Sensors & Controls Limited. The unit has no customer serviceable parts. To achieve optimum performance we recommend that you read the whole of this manual before proceeding with installation and use.

Gill Sensors & Controls Limited are continually mproving their products and specifications may be subject to change without prior notice.

2. INTRODUCTION

The 7014 sensor provides continuous real-time monitoring of the level of any water based liquid. Having no moving parts, no floats and no holes the sensor will continue to report accurate liquid levels even if there is particulate matter suspended in the liquid. There are three analogue output options to allow integration into a variety of measurement systems.

3. PRINCIPLE OF OPERATION

Using conductive sensor elements over the length of the probe, the 7014 sensor can measure the extent that the probe part is immersed in a liquid and hence determine the liquid level. This is done without direct contact between the sensor elements and the liquid and without any moving parts.

Note that the 7014 sensor can operate in any water based liquid, with or without suspended particle matter. However, it will not work with liquids that are based on non-conductive materials, such as oil and fuel.

The measured liquid level is reported via a choice of 3 analogue outputs:

- Industry standard 4 – 20 mA current loop
- Voltage output scalable anywhere in the range 0 – 10 volts
- Resistive, for direct drive of resistive gauges

Using GSlevel, the graphical user interface supplied, the output from the 7014 sensor can be adjusted to meet any required measurement range.

All 7014 probe variants have a second output. This consists of a zero-volt switch that can be configured as either a maximum or minimum level warning switch.

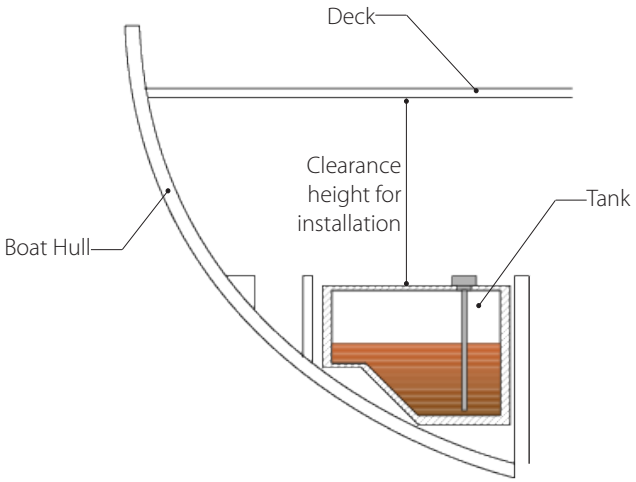
4. INSTALLATION

Please check the sensor for any signs of transit damage prior to installation. Do not remove the packaging until you are ready to install the sensor.

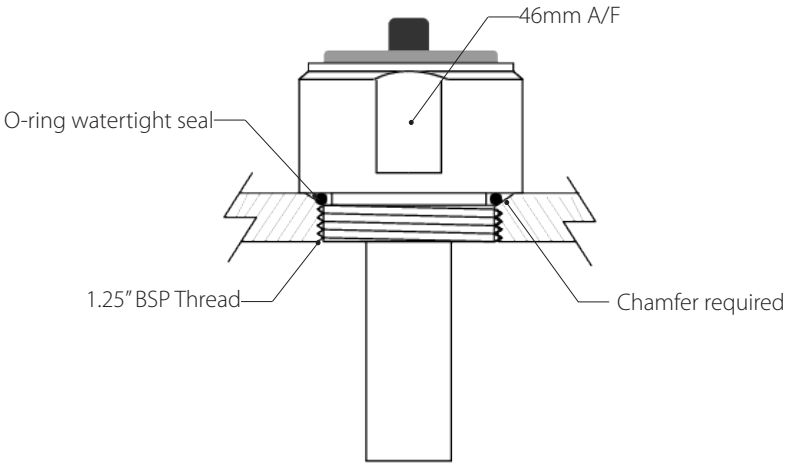
DO NOT attempt to cut the sensor to length or bend the sensor probe. Both actions will result in the sensor failing and will invalidate the warranty.

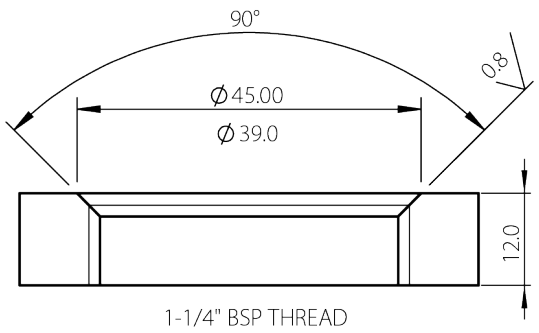
The sensor must be installed in the deepest part of the tank to be measured on a flat surface. The sensor is supplied as standard with a 1.25" BSP thread. However, if it is preferable to install the sensor using a five bolt SAE patten, an adaptor is available as an optional extra.

Bear in mind this is a rigid sensor. Your first step should be to ensure that you have sufficient clearance access above the tank to get the sensor in. Sideways clearance may also be needed so this needs to be taken into account as well. An example of a marine installation is shown below.



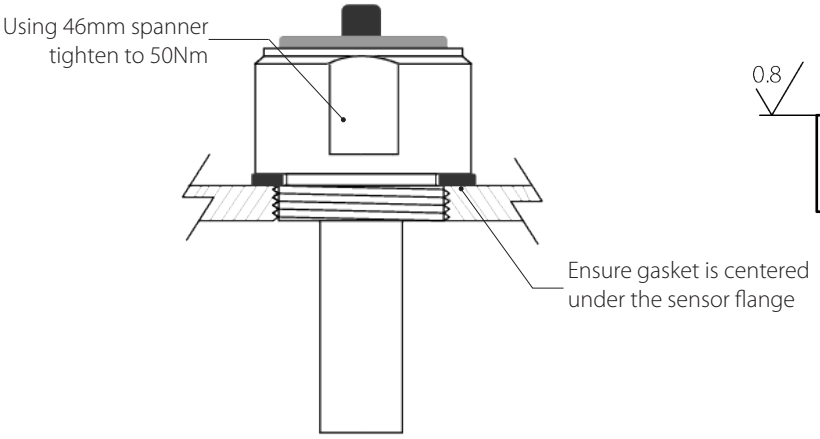
Install the sensor into a 1.25" BSP threaded hole, and tighten the sensor using a 46mm A/F spanner. The sensor is supplied with an O-ring and gasket for sealing. To use the O-ring, the mounting hole requires a chamfer to be machined around the upper edge. Tighten to a torque of 50Nm +/-10%, when the sensor face 'bottoms out' on the top of the tank.

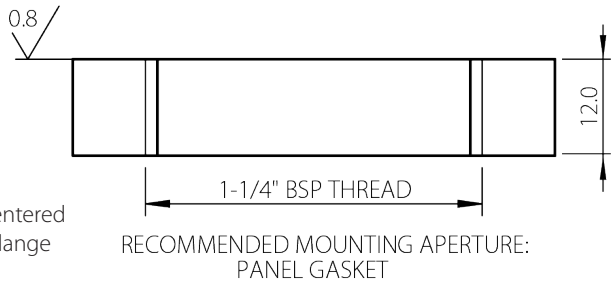




RECOMMENDED MOUNTING APERTURE:
O-RING SEAL

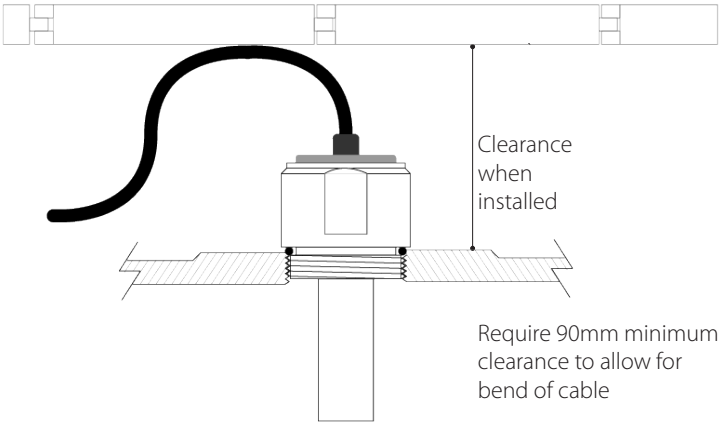
If it is not possible to create a chamfer, then the gasket should be used. Remove the O-ring and fit the gasket over the thread mount, black face up. Ensure the gasket is centered under the sensor and tighten to a torque of 50Nm +/-10%, approximately 4.5 turns.





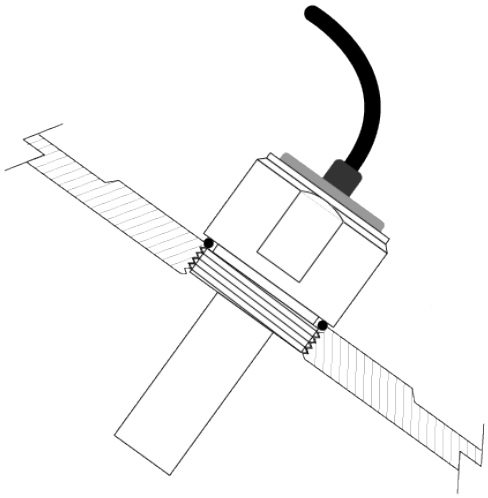
RECOMMENDED MOUNTING APERTURE:
PANEL GASKET

Once installed the sensor requires a minimum of 90mm from the top of the tank to the underside of a housing to allow for cable bend.



The sensor can be installed at any angle from vertical to a maximum recommended angle of 45°. The sensor does not require any support inside the tank.

However, you must ensure that the mounting hole in the tank is strong enough to withstand the forces imposed by the sensor from weight and vibrations.



Important: The 7014 sensor must not be used in a tank that is not adequately vented.

5. ELECTRICAL CONNECTION

The sensor cable has four wires:

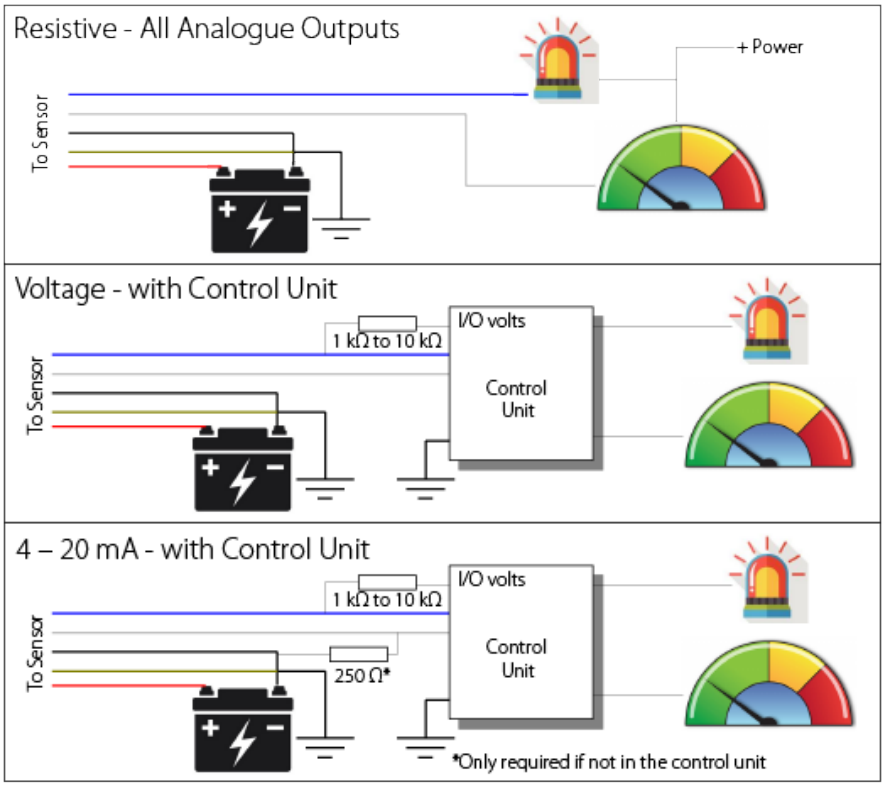
Red = d.c. power supply
Black = ground
White = measurement output
Blue = switch output

The installation of the sensor has different requirements, depending on the analogue output:

Voltage: The power supply must be at least 0.5V greater than the maximum output voltage required. The switch output requires a pull-up resistor of 1 to 10 kOhms

Current: The measurement output requires a 250 Ohm load resistor across the output. The switch output requires a pull-up resistor of 1 to 10 kOhms

Resistive: The resistive meter requires its own d.c. power supply.



6. COMMISSIONING & SETUP

To setup and commission the sensor you will require a standard USB lead - Type A to Mini B.

On the top of the sensor flange, remove the retaining screw and cover using a 1.5mm Allen key. This enables access the USB connection. Note that there is an 'O' ring seal around the cover which makes it hard to remove.

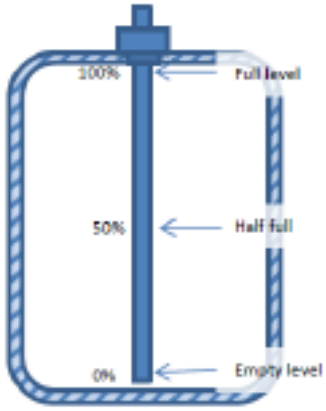
When replacing the cover please ensure that a good seal is re-established.

7. GRAPHICAL USER INTERFACE

The 7014 sensor is configured via GSlevel installed on a local PC. Connect the USB cable to the PC, supply power to the sensor and follow the instructions in the GSlevel User Manual.

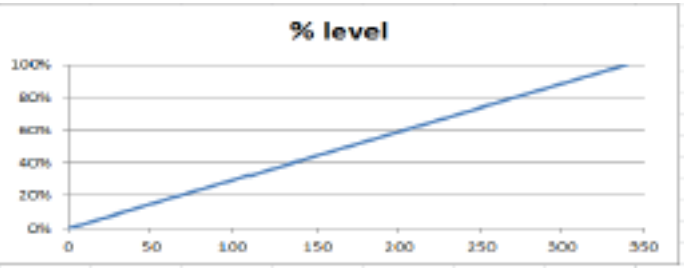
8. WHAT IS TANK PROFILING?

If you consider a regular tank profile as below

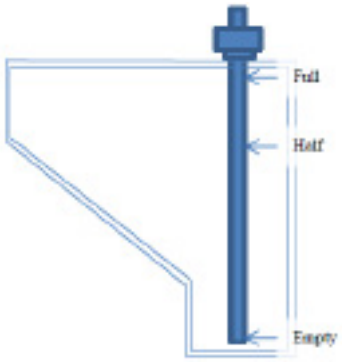


The sensor is supplied so that it reports the level in a linear path as the level rises. For a regular shaped tank this is correct. For example, a 340 litre tank would show an output as;

litres	% level
0	0%
34	10%
68	20%
102	30%
136	40%
170	50%
204	60%
238	70%
272	80%
306	90%
340	100%

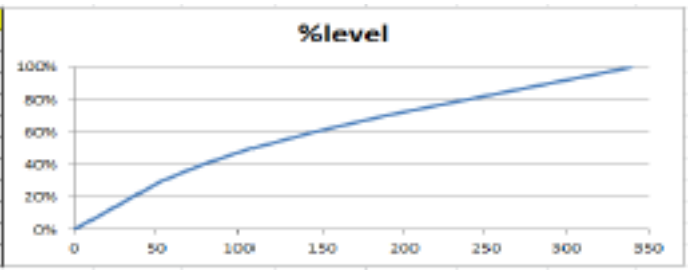


However if you look at an irregular shaped tank instead



It is clear that a 50% tank level is not 50% of the way up the probe. Looking at a 340 litre tank again the output would be as follows;

litres	%level
0	0%
18	10%
35	20%
54	30%
78	40%
109	50%
146	60%
190	70%
239	80%
290	90%
340	100%



Without using tank profiling a 50% reported level would only be 109 litres.

9. FAULT INDICATIONS AND RETURNS

LED Status indications

LED	Status
Green (Solid)	Normal operation
Yellow (Flashing)	Bad configuration data
Red (Flashing)	Sensor failure
Red (Solid)	Firmware not running

If any of these faults arise, please contact Gill Sensors and Controls. Contact details can be found on the front of this document.

The 7014 sensor has no moving parts and requires inimal maintenance in use. Faults in operation are most likely to occur if the sensor is incorrectly configured during installaton. Configuring the measurement output and the tank or the tank profiling incorrectly will cause the reported output to be incorrect. A very bad configuration will prevent any output being reported at all.

Important: Due to potential health risks from contamination, we cannot accept 7014 sensors back from a customer or installer if the sensor has been used in a waste liquid environment (either full or empty tank or pipes) or if the sensor(s) may have been contaminated by handling.

7014 sensors returned without authorization will be rejected back to the carrier or held, package unopened, at Good Inwards pending pick-up by customer.

If a 7014 waste liquid sensor fails within the warranty period Gill Sensors and Controls will send a replacement sensor.

10. SENSOR SPECIFICATIONS

Feature	007 Variant 4-20 mA	008 Variant 0-10 V	010 Variant Resistive
Wiring: Outer diameter: 6.9 mm Power pair: Red & Black 22 AWG 1.4 mm diameter PVC insulation Output pair: Blue & White 24 AWG 2.0 mm diameter PVC insulation Drain: 22 AWG: 19 strands	Red: +ve power supply Black -ve power supply Blue: Switch output White: 4-20 mA output Screen: Bare drain wire	Red: +ve power supply Black: -ve power supply Blue: Switch output White: 0 to 10 volt output Screen: Bare drain wire	Red: +ve power supply Black: -ve power supply Blue: Switch output White: Resistive output Screen: Bare drain wire
Power Supply: Reverse voltage protected. Overvoltage protected: +/-50 V	6V to 32V (Assuming 25 ohm resistor) 30mA at 6V 20mA at 12V 14mA at 16 to 32V + up to 20mA output current	6V to 32V 30mA at 6V 20mA at 12V 15mA at 16 to 32V Note: Supply voltage must be greater than the configured output voltage	6V to 32V 40mA at 6V 30mA at 12V 26mA at 16 to 32V
Temperature Range:	Storage: -40°C to +85°C Operation: -40°C to +85°C		
Configuration:	An App. is available from https://www.gillsc.com/ which may be used to configure the tank profile, the output measurement range and calibration information. The App. is PC based and connection to the Black water probe is via a micro-USB type B connection under a cover in the cap of the sensor.		

Feature	007 Variant 4 – 20 mA	008 Variant 0 – 10 V	010 Variant Resistive
Outputs: Measurement output	Industrial standard current-loop in the nominal range 4 mA to 20 mA. Normally this will linearly represent the measured liquid level, but may be reconfigured to match non-linear tank profiles and to be any range within the 4 to 20 mA range. The power supply –ve is the return path for the output current.	Voltage output representing measured liquid level. Normally this will linearly represent the measured liquid level, but may be reconfigured to match non-linear tank profiles and to be any range within the 0.5 V to 10 V range. Note: output voltage must be configured to be less than the supply voltage. Output impedance: 500 ohms Recommended load resistor >=10 kΩ.	The resistive output is designed for direction connection to a level gauge. The output is configured as a nominal 10 Ω to 180 Ω but should be re-configured to suit the fitted gauge and the installation arrangement. Note: The default settings may vary between gauge manufacturers. In this instance, use the custom configuration option in GSlevel to set empty, mid and full scale outputs.
Output Resolution: Measurement output	Step size < 0.1 mA. Note: The measurement resolution is less than this.	Step size < 10 mV Note: The measurement resolution is less than this.	Step size < 0.2 Ω Note: The measurement resolution is less than this.
Tolerance:	+/-10% of the full scale value.		
Output Rate: Measurement output	>= 10 Hz		
Outputs: Error	Error is reported as a 2.5 mA output current.	Error is reported as a 0.25 V output voltage.	Not applicable.
Outputs: Switch output	Zero-volt switch output that is connected to the –ve power supply when the switch is turned on. Maximum 'off' voltage : 32 V Maximum 'on' current: 150 mA The switch output may be configured to measure any liquid level threshold and may switch "on" when the level is either greater or less than the threshold level.		
Configuration Interface:	USB micro-B connector under a cover in the cap of the sensor. See the section "Configuringthe sensor" for detailed information.		
Mounting:	Standard 1.25" BSP thread. 5-bolt SAE adaptor available as an optional extra.		

Feature	007 Variant 4-20 mA	008 Variant 0-10 V	010 Variant Resistive
Size:	Body: 46 mm diameter x 41mm height. Body height above mounting flange: 29 mm. Clearance above mounting flange (once installed) 90 mm (to allow for cable bend radius). Probe : 22 mm diameter x requested probe length.		
Weight:	0.33 Kg + 0.042g /10 cm probe length. E.g. 500mm length probe will weigh 0.54 kg		
Materials:	Cable: PVC sheathing + Tinned copper cores. Cap: ULTEM 1000 Body: Stainless steel-316 EPDM-70 Probe outer: FEP Probe : Copper + Glass reinforced Polyester		
LED Status Indicator: (In cap of body of sensor)	Green (solid): Powered and fully operational Yellow (flashing) : Configuration data invalid or corrupt Red (flashing): Sensor failure, measurement beyond calibrated range Red (solid): Firmware upgrade expected / in progress		

11. ENVIRONMENTAL SPECIFICATIONS

Feature	007 Variant 4-20 mA	008 Variant 0-10 V	010 Variant Resistive
Operational Temperature:	Minimum: EN60945:2002 (8.4) Low Temperature, extended to - 40 °C Maximum: EN60945:2002 (8.2) Dry heat, extended to +85 °C EN60945:2002 (8.5) Thermal Shock		
Shock:	EN60068-2-27:2009		
Vibration :	EN60945:2002 (8.7) Vibration		
Ingress:	BS EN 60529:1992 +A2:2013 IP6X Cat 1 BS EN 60529:1992 +A2:2013 IPX6 BS EN 60529:1992 +A2:2013 IPX8 BS EN 60529:1992 +A2:2013 IPX9K		
Drop: Within packaging	1 m – 3 sides		
External Pressure	> 5 bar absolute > 10 bar differential (across mounting flange)		
Damp Heat:	EN60945:2002 (8.3) Damp Heat 95% RH +55 °C		
Chemical compatibility:	Fuels: Diesel, Gasoline Oils: Hydraulic, Gear, Motor, Vegetable, Synthetic ester, Polyalphaolefin, Polyglycol Coolants: Ethylene Glycol, water Fluids: Salt water		
Cable pull:	50 N all 3 axis, in both directions		
EMC: Categories: Protected & Exposed	EN 60945:2002 (7.1) Extreme power supply EN 60945:2002 (9) Electromagnetic Emissions (all sub-sections) EN 60945:2002 (10) Immunity to Electromagnetic Environment (all sub-sections) EN 61000-6-2:2005 (residential, commercial and light industrial) EN 61000-6-3:200& + A1:2011 (residential, commercial and light industrial) EN 61326-2-1:2013 (measurement, control and laboratory) EN 61326-1:2013		
Compass Safe Distance:	Recommendation : not to be sited within 0.5 m of magnetic compass measuring equipment		

12. PART NUMBER CONFIGURATOR

Exact Length (mm)

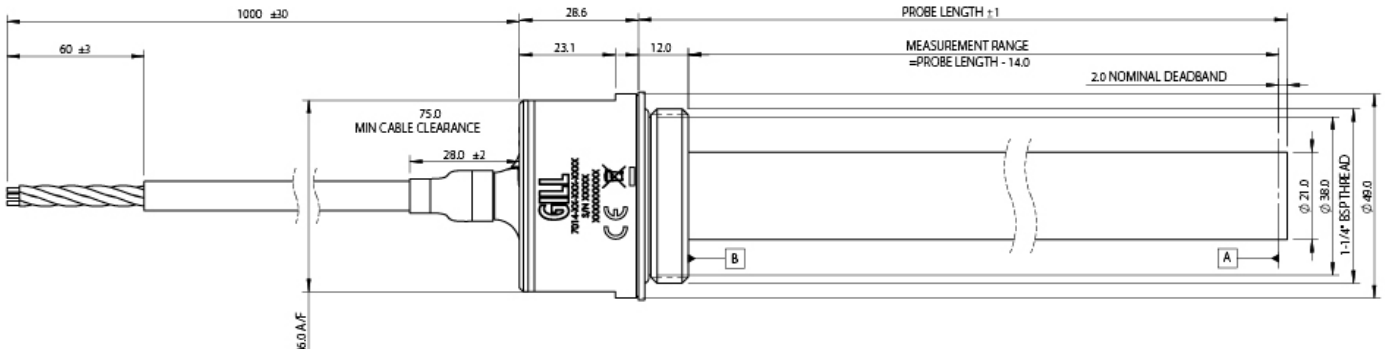
7	0	1	4	-	0	0	-	x	x	x	-	

Length Range
1 = 50 - 500mm
2 = 510 - 1000mm
3 = 1010 - 1500mm
4 = 1510 - 2000mm

Output Type
K = Voltage
L = Current
M = Resistive

Thread Size
A = 1.25"

13. SENSOR DRAWING



14. PARTS SUPPLIED

7014 Liquid Level Sensor
O-ring and gasket
GSlevel User Interface (incorporates user manuals)
Quick Start Guide

15. CE Declaration

Gill Sensors & Controls

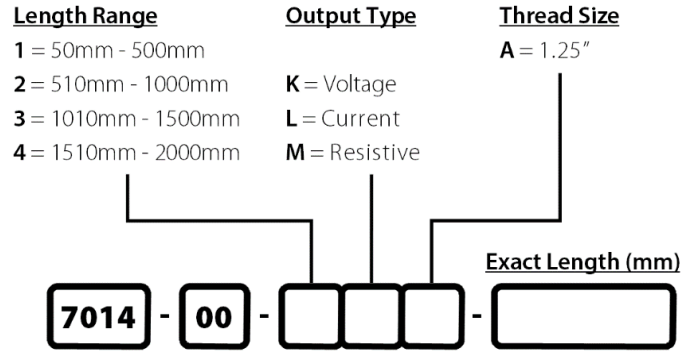
EU Declaration of Conformity

In accordance with the following CE Directives:

2014/30/EU (Electromagnetic Compatibility – EMC)
2011/65/EU (Restriction of Hazardous Substances – RoHS)

We, Gill Sensors & Controls Ltd., declare under our sole responsibility that the products:

GS Level 7014 – Blackwater Liquid Level Sensor (all variants as detailed below):



Manufactured by: Gill Sensors & Controls Ltd.
Unit 600 Ampress Park
Lymington,
Hampshire, UK
SO41 8LW

To which this declaration relates, are in conformity with the protection requirements of Council Directive 2014/30/EU on the approximation of the laws relating to electromagnetic compatibility. This Declaration of Conformity is based upon compliance of the product with the following harmonised standards:

Marine	EN 60945: 2002
	EN 61326-1: 2013
Light Industrial	EN 61000-6-3: 2007 + A1: 2011
	EN 61000-6-4: 2007 + A1: 2011
Measurement Control	EN 61326-2-1: 2013
	EN 61000-6-1:2007
Heavy Industrial	EN 61000-6-2: 2005

Gill Sensors & Controls Limited certifies that the 7014 Liquid Level Sensor is compliant with the European Union's Restriction on the Use of Hazardous Substances in Electrical and Electronic Equipment ("RoHS II") Directive 2011/65/EC by absence of hazardous materials specified herein.

Restriction of Hazardous Substances	EN 50581:2012

Signed by:

Print Name: *C. Wright – Director of Group Operations*

Date of issue: 15/06/2017
Place of issue: Gill Sensors & Controls Ltd. Unit 600 Ampress Park, Lymington, Hampshire. UK SO41 8LW