



Features

- Single or Dual axis measurement
- Measuring range $\pm 90^\circ$
- Solid state MEMS sensor
- 0-10V analogue output for each channel
- Frequency response 1Hz (to suit solar tracking)
- Small size, 46 x 39 x 10.5mm
- Sealed to IP67
- 5 core 2m PUR cable with 5 pin M12 Connector rated for continuous outdoor use.



Applications

- Single and dual axis PV Solar Trackers
- Security systems
- Platform levelling and monitoring
- GPS compensation
- Platform scales and weigh bridge levelling
- Agricultural and industrial vehicle tilt monitoring
- Telescopic and scissor lift platform monitoring
- Can be readily customised for most applications

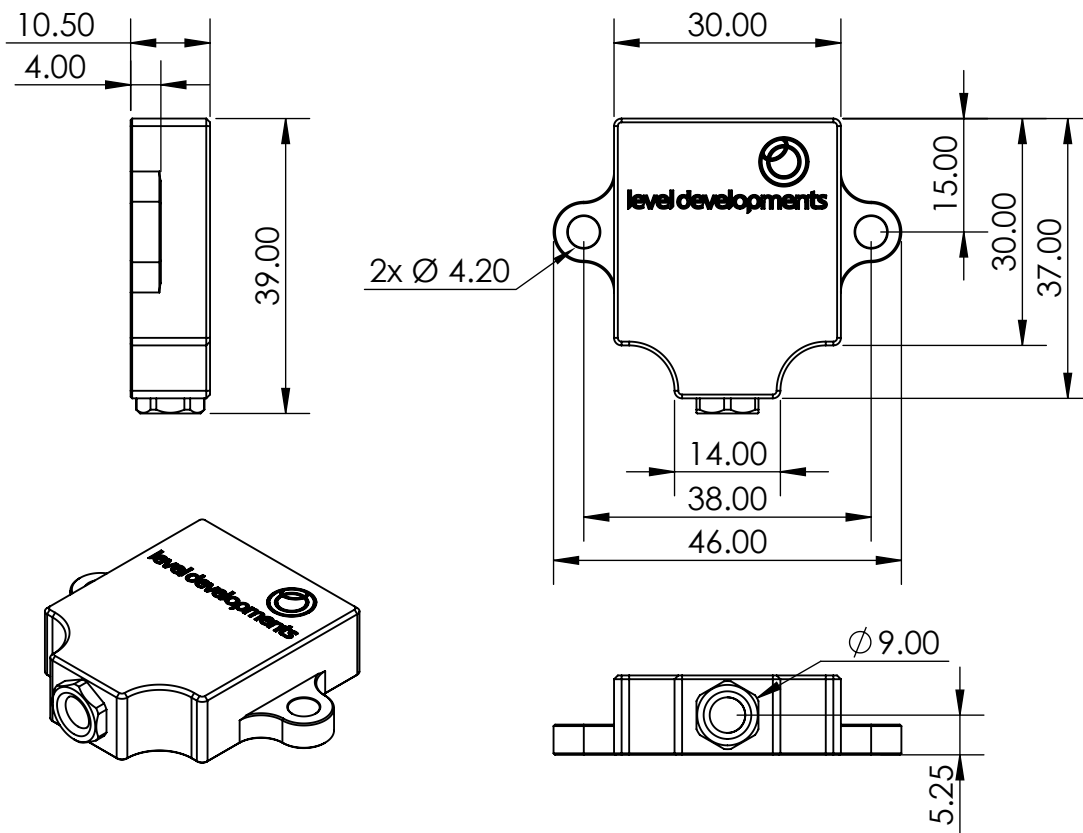
Description

The LCH-90-A is a low cost dual axis inclinometer sensor supplied in a sealed machined Aluminium housing. It has a 0-10V analogue interface for each of the X and Y measurement axis. A PCB only version is also available (part number LCP-90-A). These devices are manufactured and calibrated in our UK factory to guarantee performance to the stated specification.

Specifications

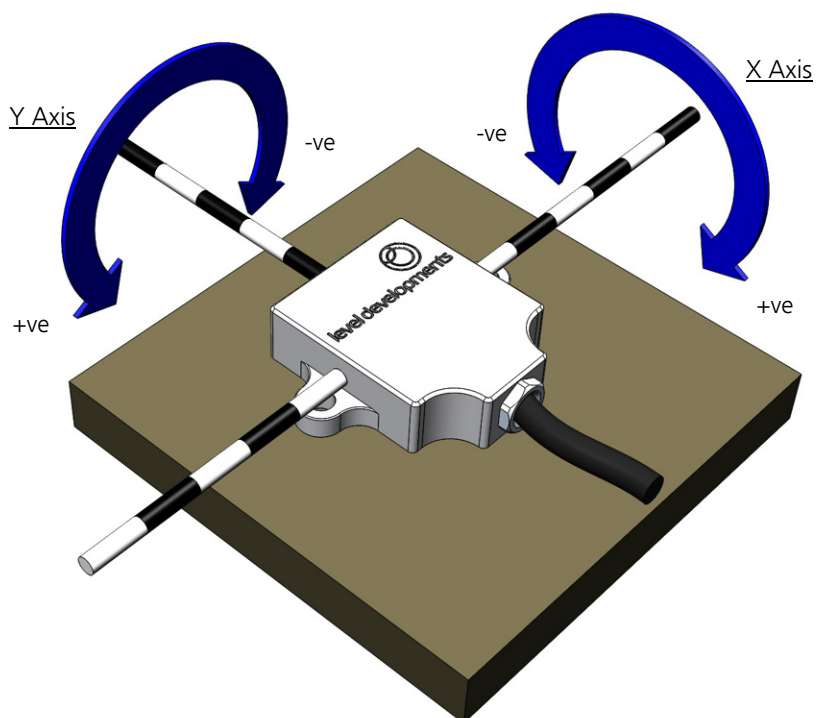
Parameter	Value	Unit	Notes
Supply Voltage	13-30	V dc	Internal circuit protects from transients and reverse polarity, however use of a low noise DC supply is recommended to ensure the best performance.
Operating Current	13	mA	Maximum value
Output Impedance	100	Ω	
Operating Temperature	-40 to 85	$^\circ\text{C}$	
Size: Width Length Height	46.0 39 10.5	mm	
Measuring range	± 90	$^\circ$	
Zero Output Voltage	5	V dc	Nominal output voltage when device is placed on a level surface
Zero Bias Error	± 0.1	$^\circ$	Maximum zero offset angle when unit is placed on a level surface. For optimum zero point accuracy, the mounting angle of the part can be adjusted.
Zero Bias Temperature Error	0.02	$^\circ/\text{C}$	The maximum change in zero position output per $^\circ\text{C}$ of temperature change
Sensitivity	4.5 79	V / g mV/ $^\circ$	Output voltage is proportional to the sine of the angle Sensitivity for the first 1° (when the device is tilted between 0 and 1°)
Sensitivity Temperature Error	0.01	$\%/\text{C}$	% Change in sensitivity per $^\circ\text{C}$ of temperature change
Accuracy (20$^\circ\text{C}$)	± 0.3	$^\circ$	The maximum error between the measured and displayed value at any point in the measurement range (up to $\pm 45^\circ$) at room temperature (20 $^\circ\text{C}$)
Accuracy (-10 to 60$^\circ\text{C}$)	± 1	$^\circ$	The maximum error between the measured and displayed value at any point in the measurement range over the specified temperature range
Long Term Stability	0.1	$^\circ$	1 year stability when device is powered continuously at 20 $^\circ\text{C}$
Resolution (@1Hz BW)	0.05	$^\circ$	Smallest measurable change in output
Low Pass Filter Freq.	1	Hz	Includes a second order low pass filter on the output with a 1Hz -3dB cut-off. The filter can be factory set to different values on request.
Mechanical shock	3000 (0.5ms) 10000 (0.1ms)	g	Shock survival limit for MEMS sensor.
Cable Length	2	m	With 5 pin M12 Connector, Other lengths available on request.
Weight	24	g	Not including cable

Dimension Drawing



Axis Direction and Mounting Orientation For Dual Axis Use

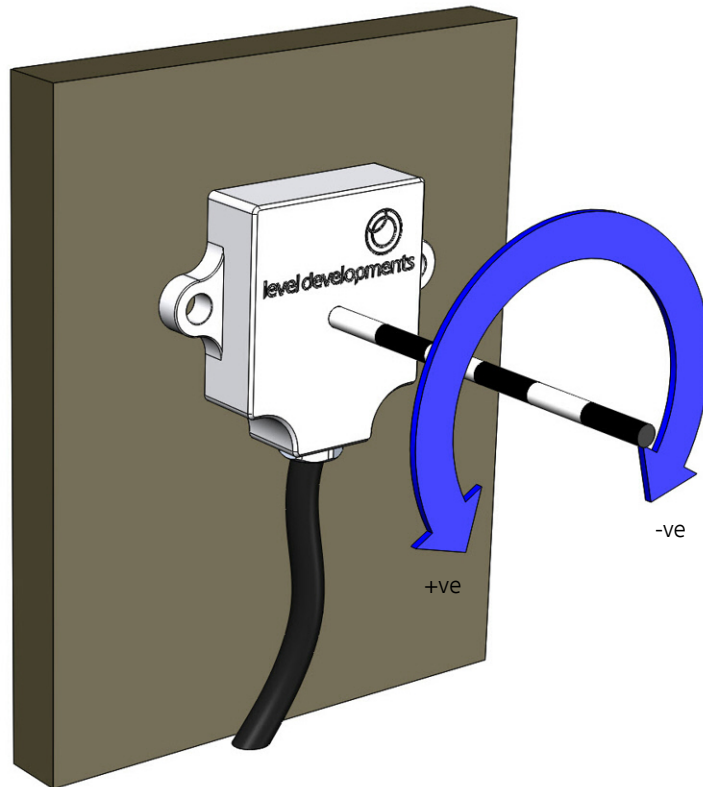
Mounted on Horizontal Surface



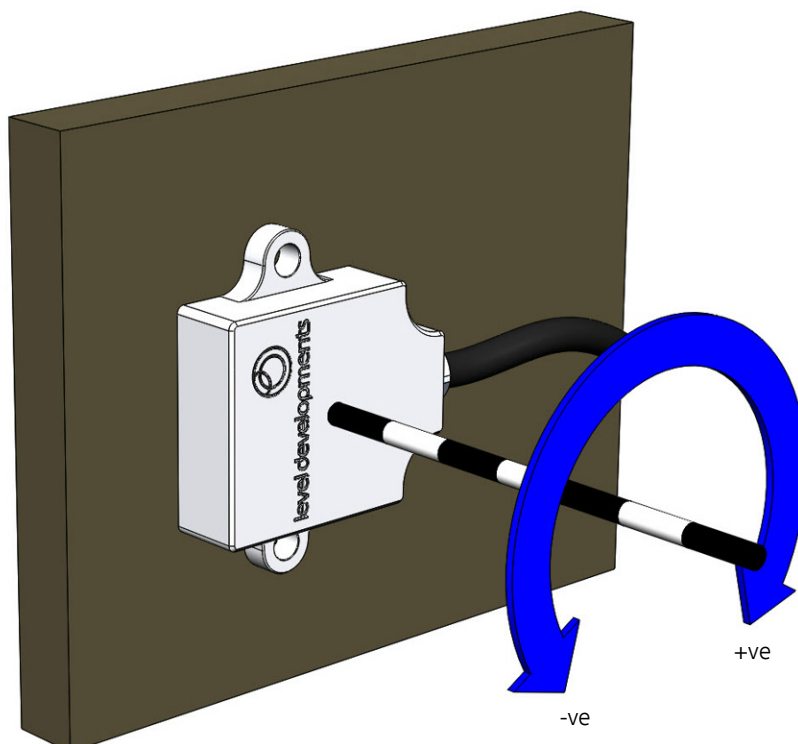


Axis Direction and Mounting Orientation For Single Axis Use

Mounted on Vertical Surface - Y Axis In Use



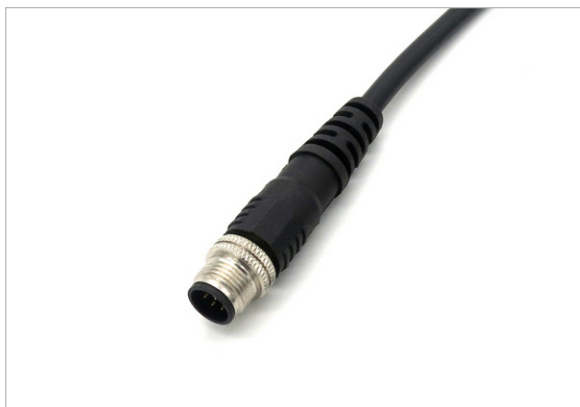
Mounted on Vertical Surface - X Axis In Use





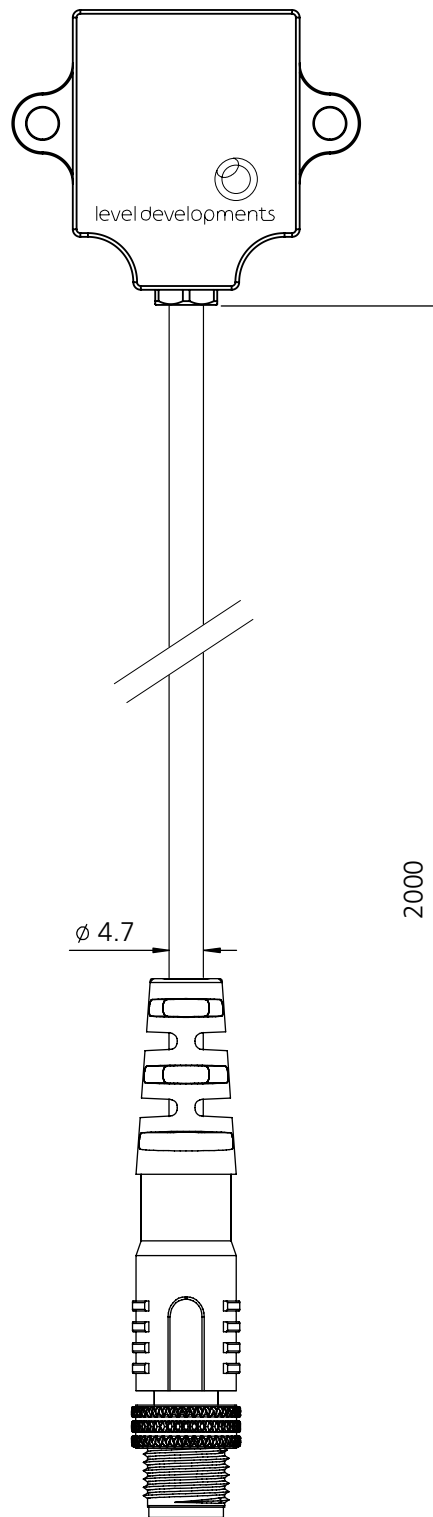
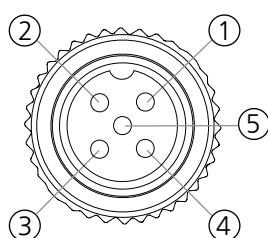
Cable and Connector Details

Parameter	Value
Connector description	M12 5-pin male
Connector make-up	Over-moulded
Coding	A-coded
Overall length	2 meters
Connector seal rating	IP67
Braided	Yes
Braid type	Tin plated Copper
Jacket material	PUR
Jacket diameter	4.7mm (max)
Wire Gauge	24 AWG
Conductor strands	41x0.08mm



Pin Number	Internal Wire Colour	Function
1	Brown	+ve Supply
2	White	Y Axis Output
3	Blue	Gnd (0v)
4	Black	X Axis Output
5	Grey	Signal Gnd Analogue Output

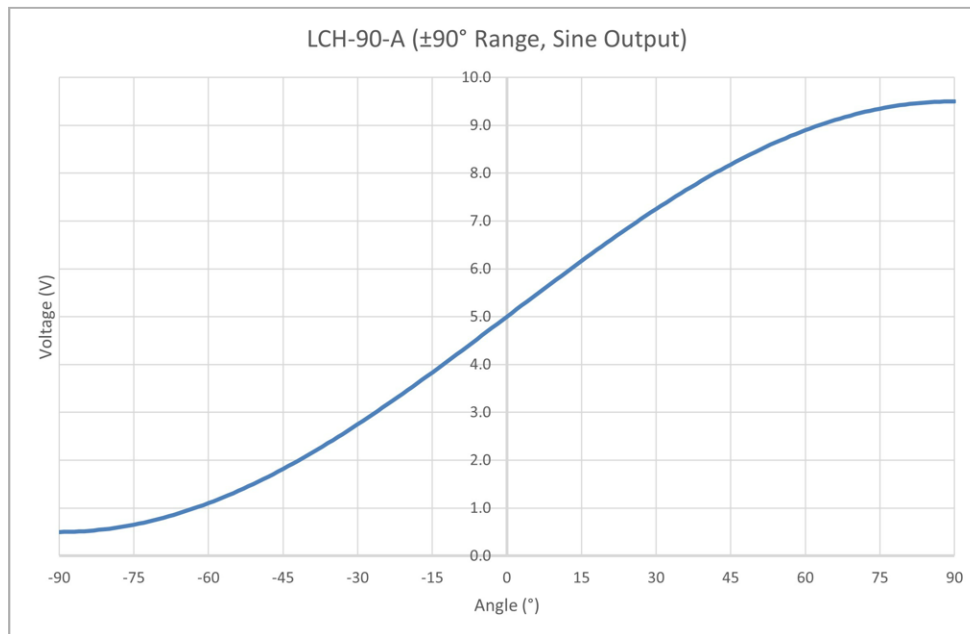
M12 male connector
View from front:





Voltage Output Change With Angle

All inclinometers measure a change in the effect of the gravitational field on a proof mass to derive angle. As the inclinometer sensor is rotated, the sensing element is subject to gravitational forces which move the proof mass, and this movement is detected and converted to a voltage. In this sensor the output is linear with the change in acceleration (g), which means that the output is a Sine function of the change in angle. Due to the flexible design of this product, it can also be configured to give a linear output with change in angle. For the Sine output configuration the graph below shows the output voltage vs. angle.



$$\text{Angle} = \sin^{-1} \left(\frac{(V_{\text{out}} - V_{\text{offset}})}{\text{Sensitivity}} \right)$$

Where:

V_{out} is the measured voltage from the sensor

V_{offset} is the voltage at 0° (which is 5V)

Sensitivity for this product is 4.5V/g

The output is very linear around the zero position, for example at $\pm 10^\circ$ the sine non linearity would only introduce an error of 0.05° . As the angle approaches 90° the sensitivity of the sensor drops significantly making measurements up to the full 90° range much less accurate. As such, the accuracy figures quoted in the specifications on page 1 are only valid for the first 45° of the measurement range

Product Options

1. Output Voltage range can be factory modified to suit most requirements (e.g. 0 to 5V or 0.5 to 4.5V).
2. Full scale measurement range can be anywhere between $\pm 10^\circ$ to $\pm 90^\circ$.
3. Output Voltage can be factory modified to be Sine output or linear function proportional to angle.
4. Standard cable length is 2m, fitted with 5 pin M12 connector, others are available on request.
5. Low Pass Filter can be factory adjusted between 0.125 and 32Hz.
6. Axis Orientation and mounting orientation can be factory modified.

Special order versions are generally only available for volume orders or ongoing requirements.



Certification

The products are type approved to in accordance with the following directive(s):

EMC Directive 2004/108/EC

And it has been designed, manufactured and tested to the following specifications:

BS EN61326-1:2006

Electrical equipment for measurement, control and laboratory use – EMC Requirements

BS EN55011:2007, Group 1
Class B



Certification is available on request.