



## 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
- PUR cable rated for continuous outdoor use in solar applications



## 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

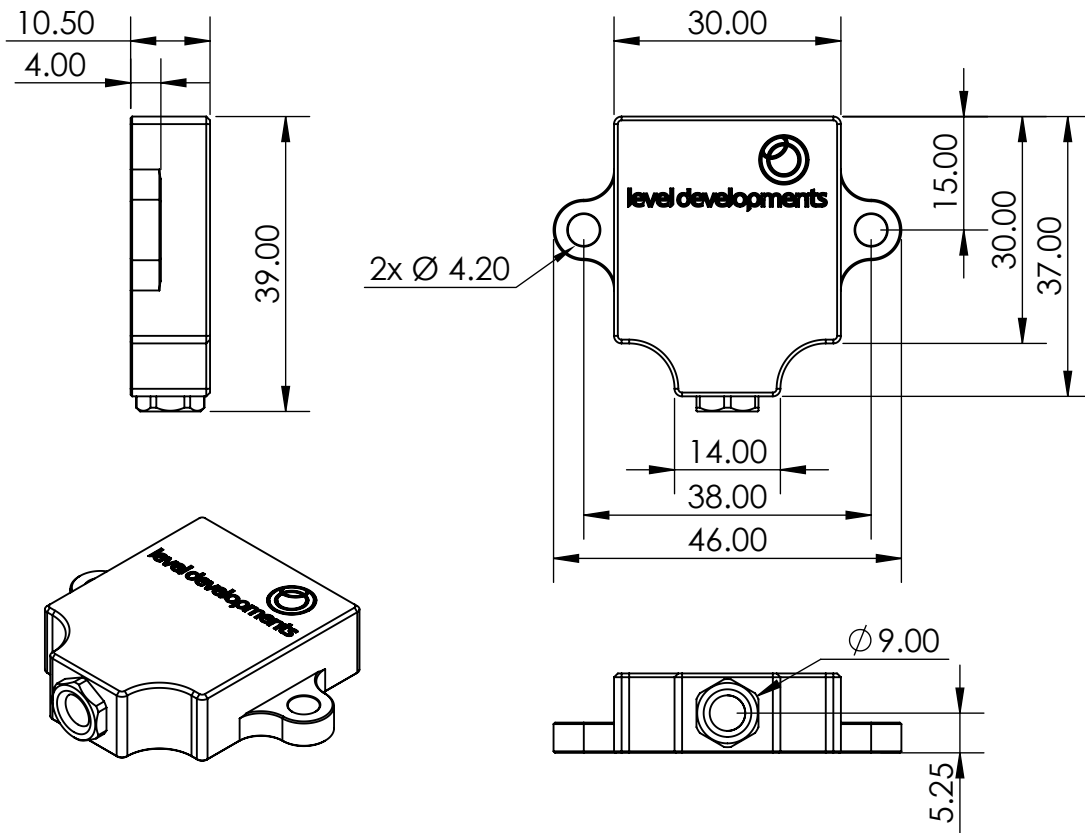
The LCH-90-A is a low cost dual axis inclinometer sensor supplied in a sealed machined Aluminium housing. It has a 0-10V analogue interface for each of the X and Y measurement axis. A PCB only version is also available (part number LCP-90-A). These devices are manufactured and calibrated in our UK factory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

## Specifications

Parameter	Value	Unit	Notes
<b>Supply Voltage</b>	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.
<b>Operating Current</b>	13	mA	Maximum value
<b>Output Impedance</b>	100	$\Omega$	
<b>Operating Temperature</b>	-40 to 85	$^\circ\text{C}$	
<b>Size:</b> Width Length Height	46.0 39 10.5	mm	
<b>Measuring range</b>	$\pm 90$	$^\circ$	
<b>Zero Output Voltage</b>	5	V dc	Nominal output voltage when device is placed on a level surface
<b>Zero Bias Error</b>	$\pm 0.1$	$^\circ$	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.
<b>Zero Bias Temperature Error</b>	0.02	$^\circ/\text{C}$	The maximum change in zero position output per $^\circ\text{C}$ of temperature change
<b>Sensitivity</b>	4.5 79	V / g mV/ $^\circ$	Output voltage is proportional to the sine of the angle Sensitivity for the first $1^\circ$ (when the device is tilted between 0 and $1^\circ$ )
<b>Sensitivity Temperature Error</b>	0.01	$\%/\text{C}$	% Change in sensitivity per $^\circ\text{C}$ of temperature change
<b>Accuracy (20<math>^\circ\text{C}</math>)</b>	$\pm 0.3$	$^\circ$	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 $^\circ\text{C}$ )
<b>Accuracy (-10 to 60<math>^\circ\text{C}</math>)</b>	$\pm 1$	$^\circ$	The maximum error between the measured and displayed value at any point in the measurement range over the specified temperature range
<b>Long Term Stability</b>	0.1	$^\circ$	1 year stability when device is powered continuously at 20 $^\circ\text{C}$
<b>Resolution (@1Hz BW)</b>	0.05	$^\circ$	Smallest measurable change in output
<b>Frequency Response</b>	1	Hz	Frequency at which the output is -3dB from input. Filter is 2 pole, and can be factory set to different values on request.
<b>Mechanical shock</b>	3000 (0.5ms) 10000 (0.1ms)	g	Shock survival limit for MEMS sensor.
<b>Cable Length</b>	2	m	Other lengths available on request
<b>Weight</b>	24	g	Not including cable

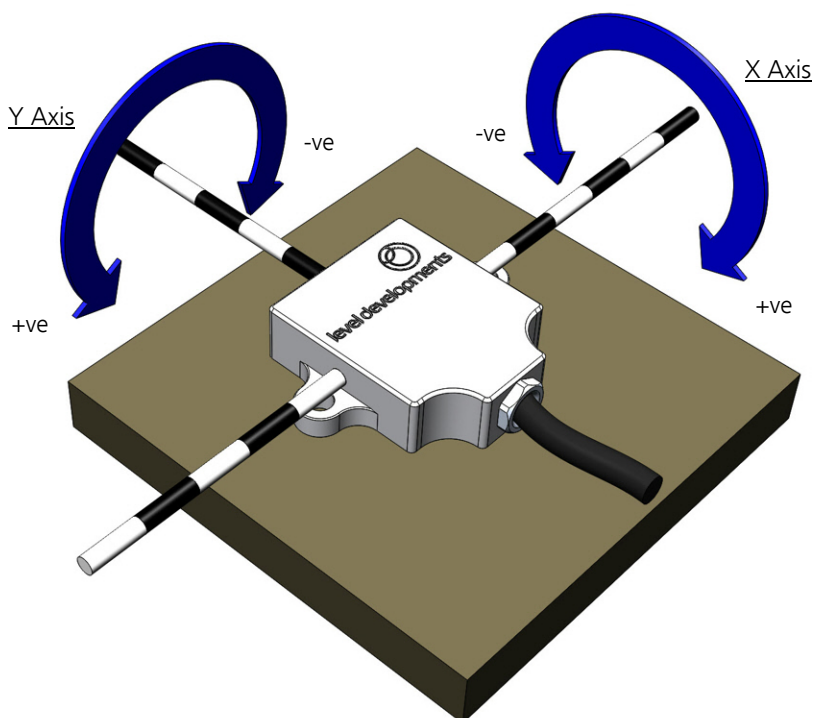


Dimension Drawing



Axis Direction and Mounting Orientation For Dual Axis Use

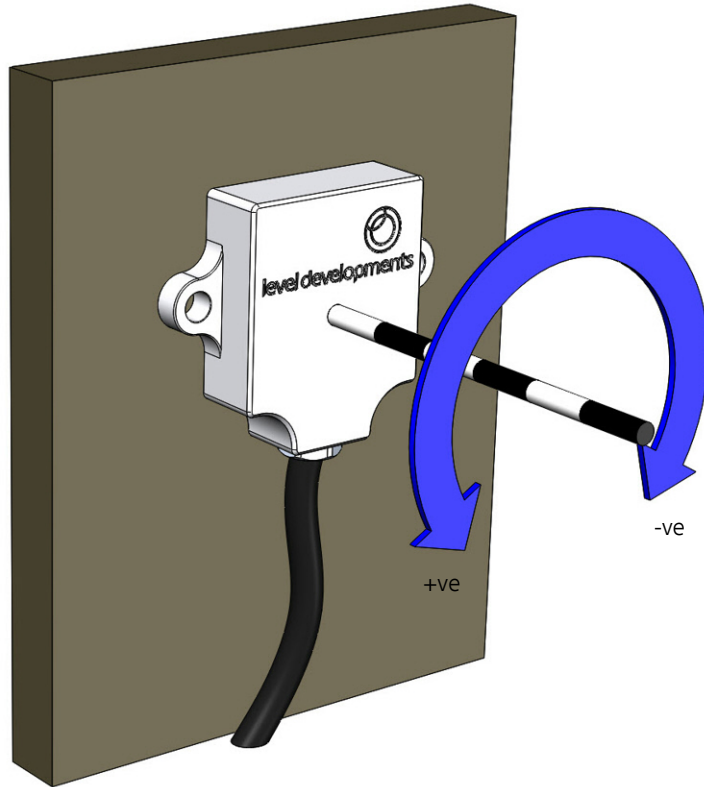
Mounted on Horizontal Surface



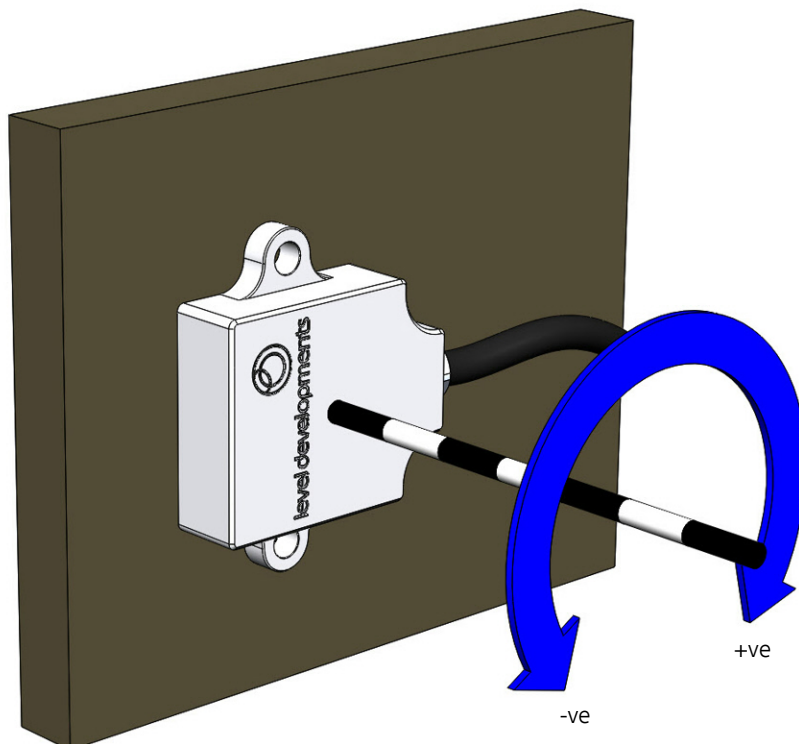


Axis Direction and Mounting Orientation For Single Axis Use

Mounted on Vertical Surface - Y Axis In Use



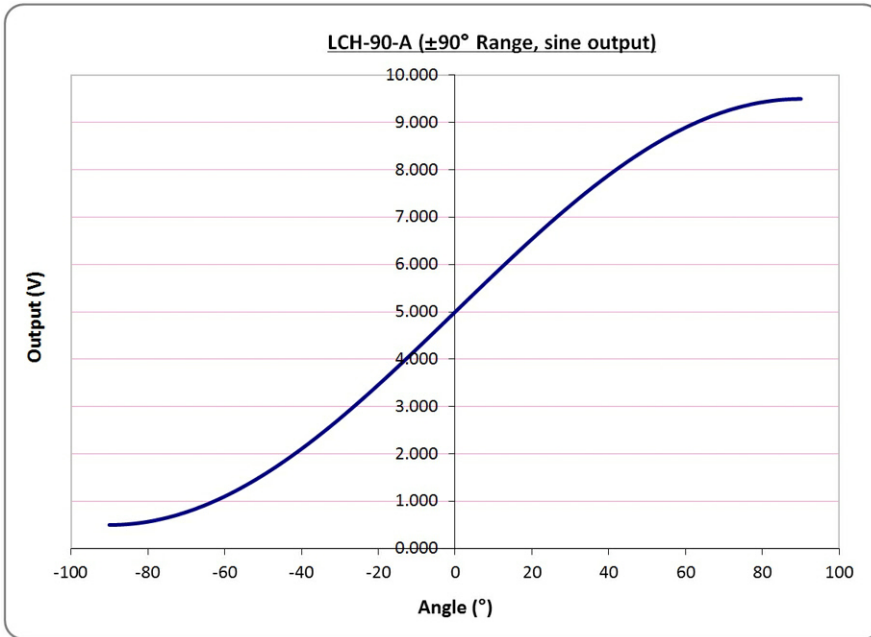
Mounted on Vertical Surface - X Axis In Use





### 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.



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

Where:

Vout is the measured voltage from the sensor

Voffset 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 ±10° 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 degree range much less accurate. As such, the accuracy figures quoted in the specifications on page 1 are only valid for 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 ±10 to ±90°.
3. Output Voltage can be factory modified to be Sine output or linear function proportional to angle.
4. Standard cable length is 2m, others are available on request.
5. Frequency response can be factory adjusted between 0.125 and 32Hz.
6. Axis Orientation and mounting orientation can be factory modified.

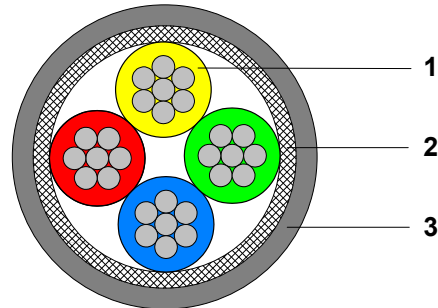
Special order versions are generally only available for volume orders or ongoing requirements.



### Connection Details

Standard cable is 2m long. Cables can be supplied in any length up to 100m.

1. Core wires, tin plated copper, 18x0.1mm strands per conductor (26 AWG). 4 conductors, colours red, blue, yellow and green with PVC core insulation.
2. Braided screen of tin copper wire with minimum 85% coverage.
3. Black PUR (Polyurethane) Solar jacket. Flame retardant, reduced smoke generation, zero halogen, excellent for use in water and oil, good for use in acids and fuels, radiation tolerance: 10E6 Gy, UV stable, suitable for continuous outdoor use.



Parameter	Value	Unit	Notes
Approximate Weight	35	g/m	
Operating Temperature	-20 to 70	°C	
Conductor Resistance	100	Ω/Km	Maximum resistance
Insulation Resistance	1500	MΩ/Km	Minimum resistance
Test Voltage	1.5	KV DC	
Voltage Rating	440	V	
Core Current Rating	1	A	At 40°C air temperature
Individual Core Diameter	1.1	mm	
Overall Diameter	4.6	mm	

Internal Wire Colour	Function
Red	+ve Supply
Blue	Ground
Green	Y Axis Vout
Yellow	X Axis Vout

### 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.

