



## Features

- Dual axis measurement
- Full scale range from  $\pm 10^\circ$  to  $\pm 60^\circ$
- Solid state MEMS sensor
- 0-5V or 0-10V analogue output for each channel
- Frequency response 1Hz
- Small size, 46 x 39 x 10.5mm
- Sealed to IP67
- PUR cable rated for continuous outdoor use
- Factory configurable to suit most 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

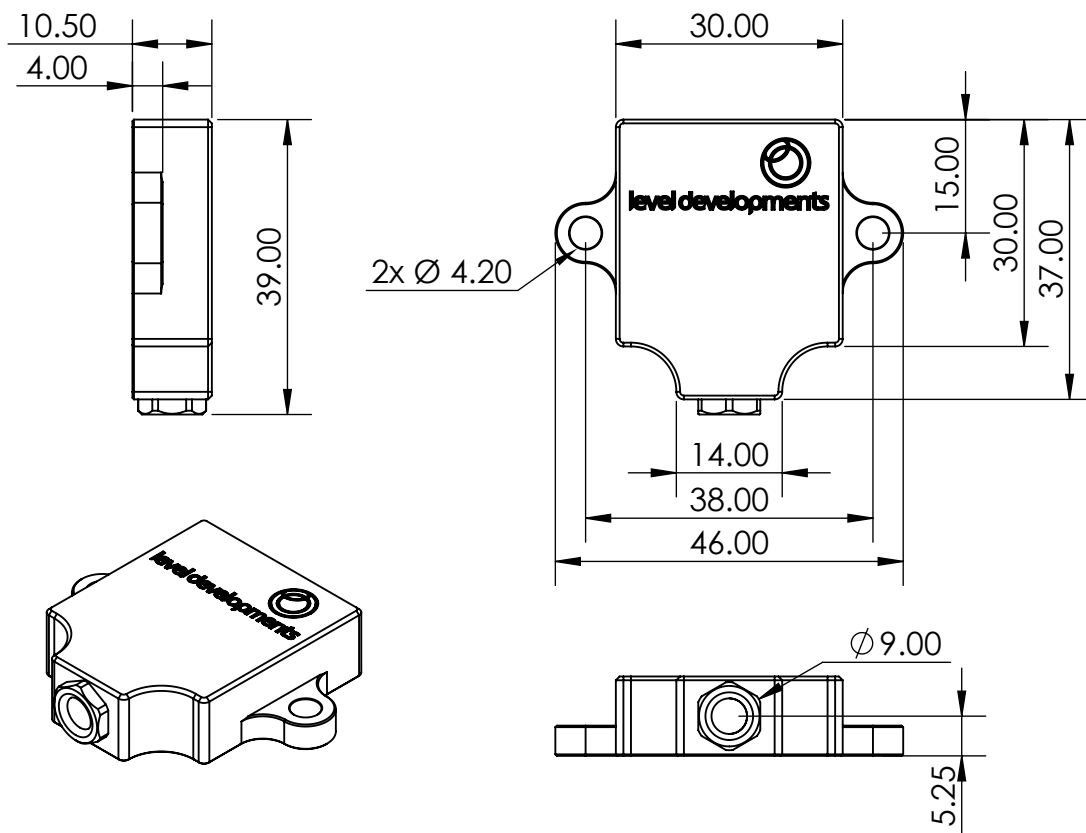
The LCH-A-D is a low cost dual axis inclinometer sensor supplied in a sealed machined Aluminium housing. It has an analogue interface for each of the X and Y measurement axis. A PCB only version is also available (part number LCP-A-D). These devices are manufactured and calibrated in our UK factory to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

## Specifications

Parameter	Value	Unit	Notes
<b>Supply Voltage</b>	7-30	V	For 0.5-4.5V analogue output range devices
	12-30	V	For 0.5-9.5V analogue output range devices 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>	15	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>	$\pm 10$ to $\pm 60$	$^\circ$	Full scale measuring range is selected by part numbering (see page 4)
<b>Zero Output Voltage</b>	2.5	V	For 0.5-4.5V analogue output range devices
	5	V	For 0.5-9.5V analogue output range devices 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 Temperature Error</b>	0.01	$\%/^\circ\text{C}$	% 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)	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

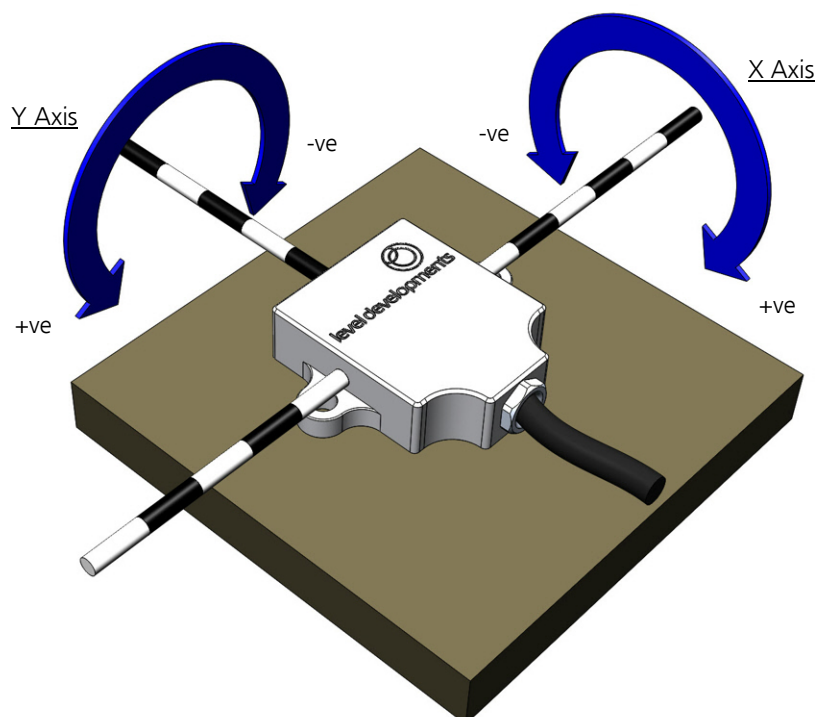


### Dimension Drawing



### Axis Direction and Mounting Orientation For Dual Axis Use

#### Mounted on Horizontal Surface





### 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 measured. In this inclinometer there are two sensing elements mounted perpendicular to one another so that the device can measure both the X and Y axis simultaneously. Internally these two sensors are measured and a processor derives the angular position. This angle is then converted to a voltage which is linear with the change in angle. In this device there are two output voltage stages, one for each of the measurement axis. As the angle is varied over the full scale range the output voltage changes between 0.5 to 4.5V or 0.5 to 9.5V depending on the product option (see page 5).

$$\text{Angle} = \frac{(V_{\text{out}} - V_{\text{offset}}) \times 1000}{SF}$$

Where

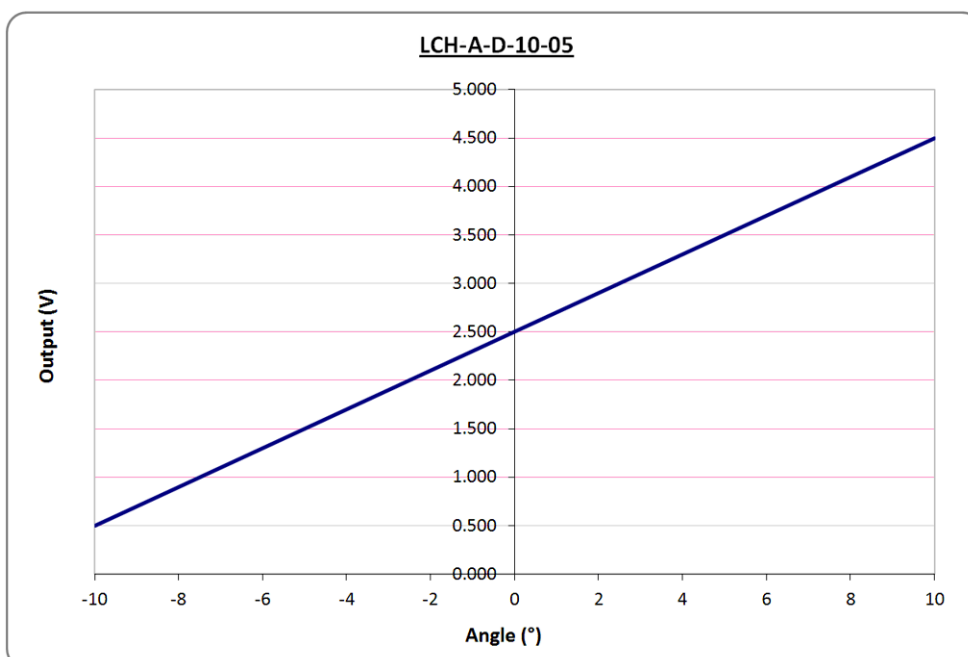
$V_{\text{out}}$  is the measured voltage from the X or Y axis inclinometer output.

$V_{\text{offset}}$  is the voltage at a 0° which is 2.5V (see table)

$SF$  is the Scale Factor in mV per degree (see table)

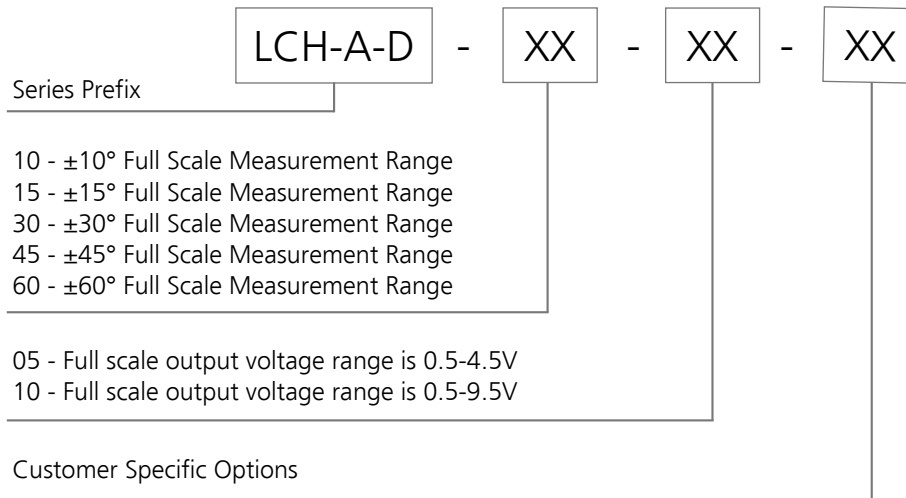
Part Number	Description	Scale Factor (SF)	Zero Output ( $V_{\text{offset}}$ )
LCH-A-D-10-05	±10° Full scale range, 0.5 to 4.5V output	200mV/°	2.5V
LCH-A-D-15-05	±15° Full scale range, 0.5 to 4.5V output	133.3mV/°	2.5V
LCH-A-D-30-05	±30° Full scale range, 0.5 to 4.5V output	66.67mV/°	2.5V
LCH-A-D-45-05	±45° Full scale range, 0.5 to 4.5V output	44.44mV/°	2.5V
LCH-A-D-60-05	±60° Full scale range, 0.5 to 4.5V output	33.33mV/°	2.5V
LCH-A-D-10-10	±10° Full scale range, 0.5 to 9.5V output	450mV/°	5V
LCH-A-D-15-10	±15° Full scale range, 0.5 to 9.5V output	300mV/°	5V
LCH-A-D-30-10	±30° Full scale range, 0.5 to 9.5V output	150mV/°	5V
LCH-A-D-45-10	±45° Full scale range, 0.5 to 9.5V output	100mV/°	5V
LCH-A-D-60-10	±60° Full scale range, 0.5 to 9.5V output	75mV/°	5V

Example Graph Of Output (±10° Full Scale Range with 0.5 to 4.5V Output Range)





## Part Numbering



### Example:

#### **LCH-A-D-30-10**

LCH-A-D Series Inclinometer  
 $\pm 30^\circ$  Full Scale Measurement Range  
0.5 to 9.5V full scale output

## Product Options

1. Output Voltage range can be factory modified to suit most requirements
2. Output Voltage can be factory modified to be a Sine function of angle.
3. Standard cable length is 2m, others are available on request.
4. Frequency response can be factory adjusted between 0.125 and 32Hz
5. Axis Orientation and directions can be factory modified.
6. Cable can be pre-assembled with mating connector for customers application.

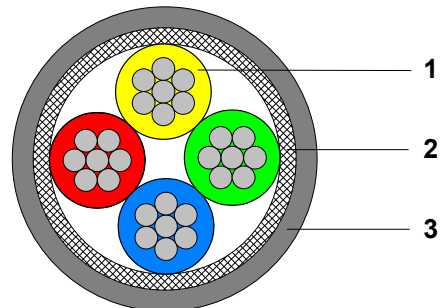
Special order versions are generally only available for volume orders or ongoing requirements.



## 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	-40 to 85	°C	Static operation
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
Yellow	X Axis Vout
Green	Y 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

BS EN55011:2007, Group 1  
Class B

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

