Non-contact Rotary Hall Effect Sensors

Applications Note

Issue 1

January 2019

Introduction

The purpose of this document is to provide information relating to ***axial displacement***, ***ferrous interference*** and ***magnet interchangeability*** for the Penny & Giles range of **NRH** no-contact rotary sensors.

If there are any questions or doubt, with any of the information contained herein, then please consult with Curtiss-Wright for further assistance. Contact: appsupport@curtisswright.com

Revision History

Issue 1	Initial release	January 2019

Background

The following sections collate test results and feedback to address commonly asked questions relating to the NRH sensors.

The results in the document mainly refer to the NRH280, but these results can also be used as a guideline for other products in the NRH family

The final section details some real life frequently asked questions.

Magnet Interchangeability

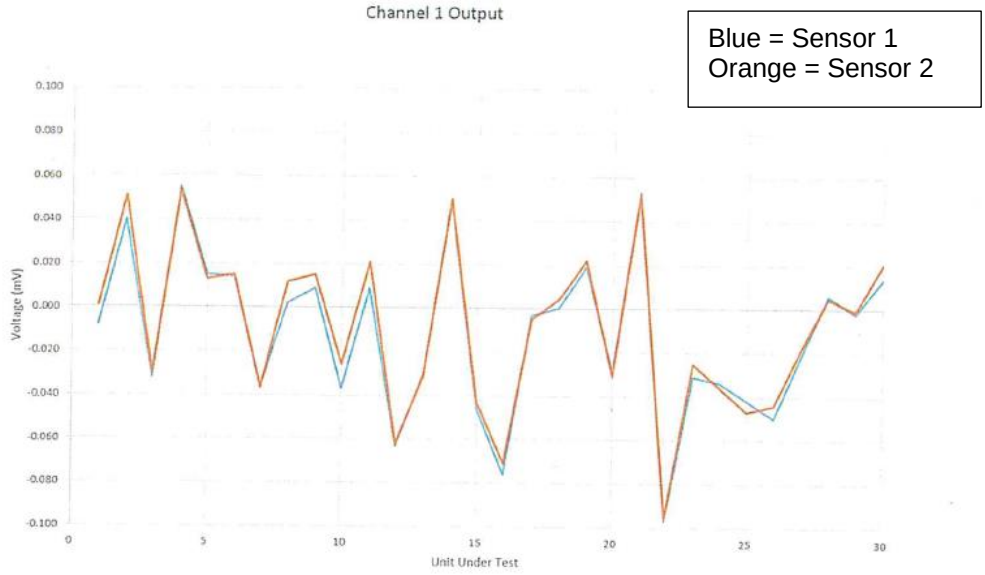
It's often the case that a batch of sensors are delivered to the customer and the paired magnets become mixed up and separated from the original sensor.

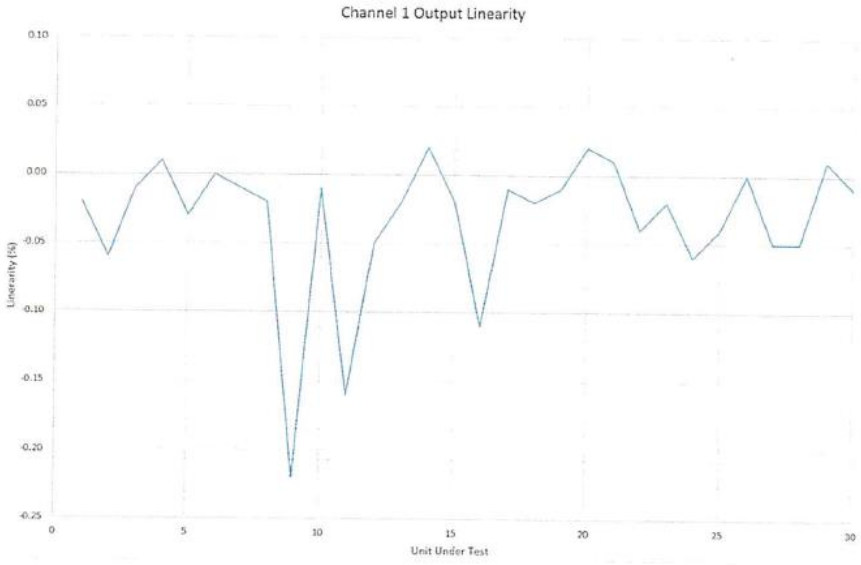
Sensors that have been factory programmed using a paired magnet and using a different magnet for which it has been programmed, can differ from the stated specification on the sensor data sheet.

For example, a sensor that is used with another magnet could result in the start or end output voltage being 100mV different from the required start or end voltage. This is also true for the linearity, which could be effected by up to 0.25%.

The following graphs show the effects of swapping the sensor, but not the magnet:-

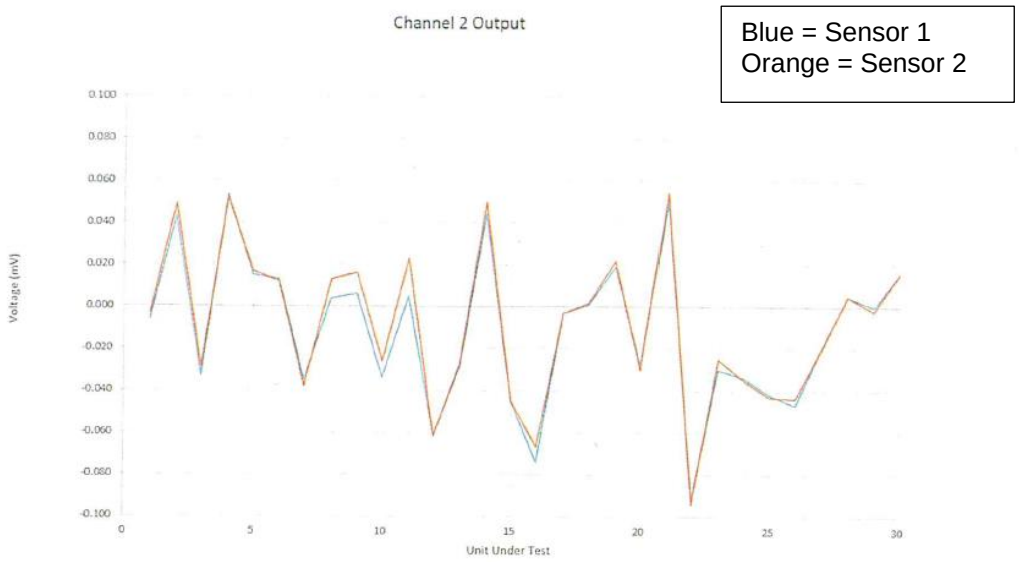
Results for Channel 1

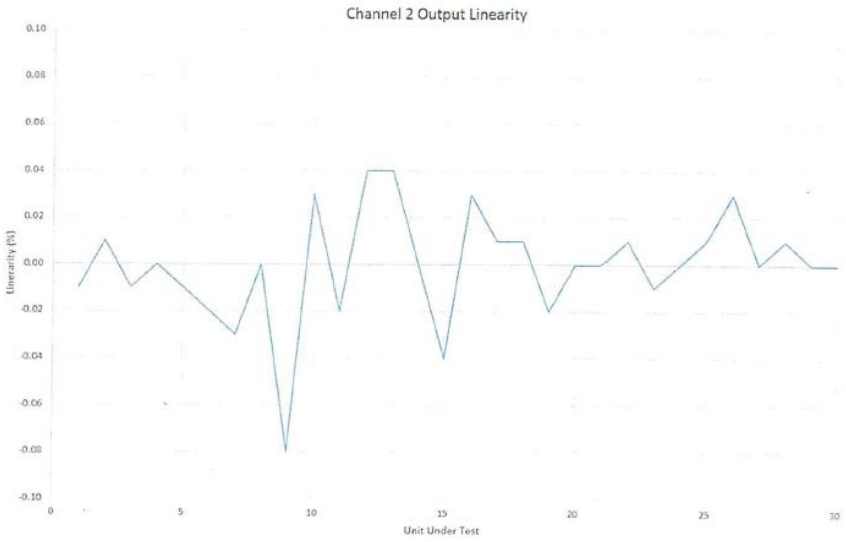




Magnet Interchangeability

Results for Channel 2





Test results have shown that the inter-changeability of the magnet to NRH280DP will result in a typical start or end voltage variation of ±100mV and typical variation in linearity of ±0.25%.

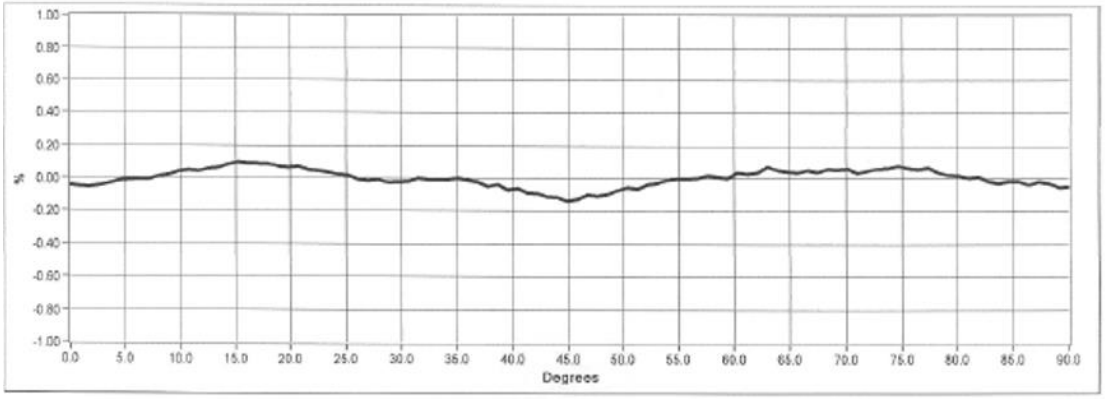
This information is based on a suitable fixture environment.

Axial Displacement

The following tests were performed using a NRH280DP to test the off axis capability.

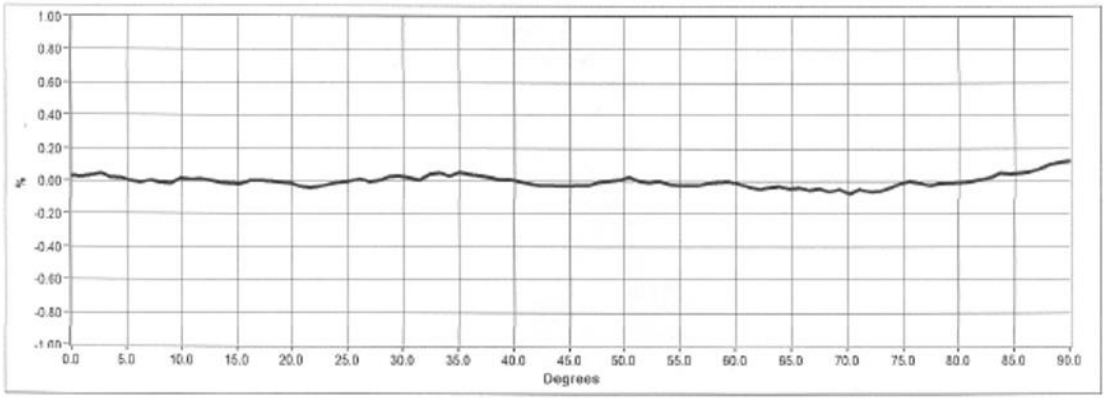
The NRH280DP was programmed in the normal way at an angle of 90° with both outputs set to the clockwise direction (NRH280DP/90/90/A1/3/P5) and the linearity recorded:-

ch1



Voltage Level ch1	0.495	4.487	Pass	Accuracy ch1 +/- %	0.12 Pass
Direction Status ch1	CW		Pass	Angle ch1	90.0

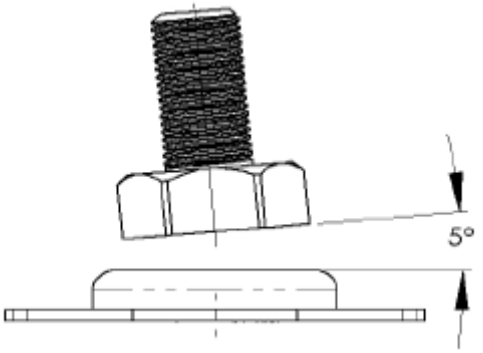
ch2



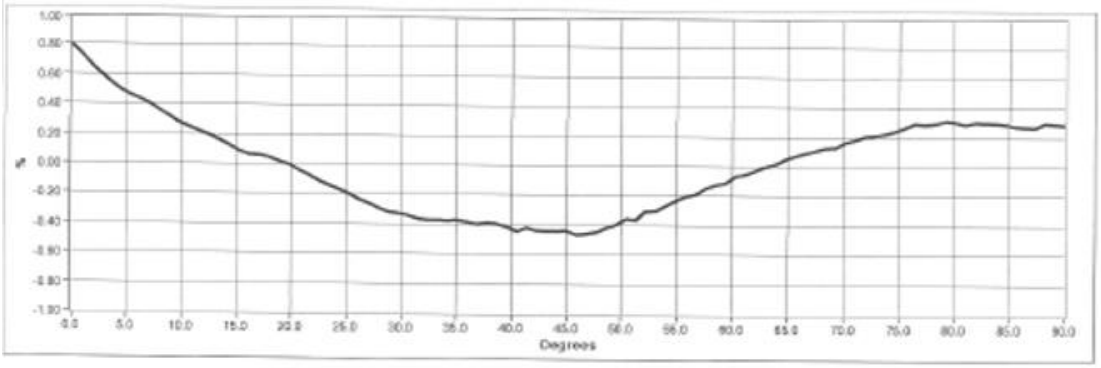
Voltage Level ch2	0.498	4.512	Pass	Accuracy ch2 +/- %	0.10 Pass
Direction ch2	CW		Pass	Angle ch2	90.0

Axial Displacement

NRH280DP Output with Offset Magnet
Testing carried out with magnet offset, as shown below. The sensor was not reprogrammed from the previous set of test results.

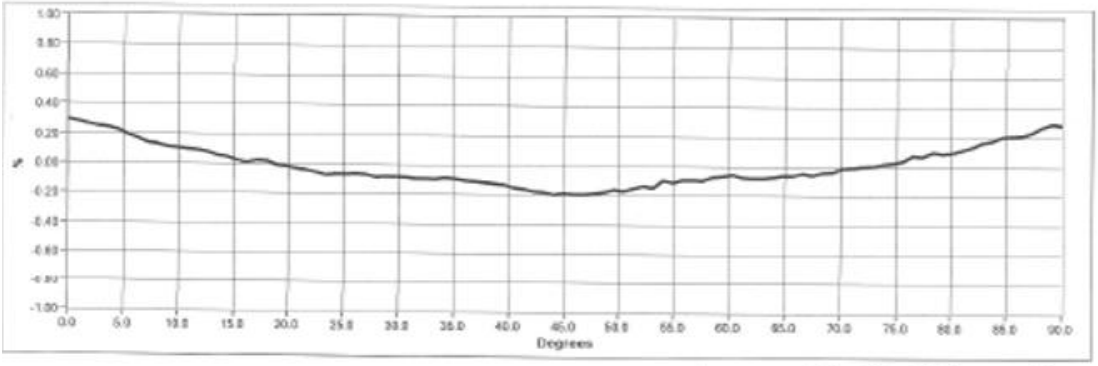


ch1



Voltage Level ch1	0.387	4.455	Fail	Accuracy ch1 +/- %	0.63	Fail
Direction Status ch1	CW		Pass	Angle ch1	90.0	

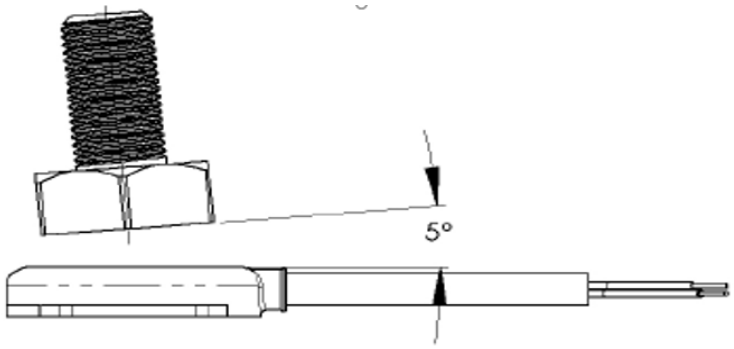
ch2



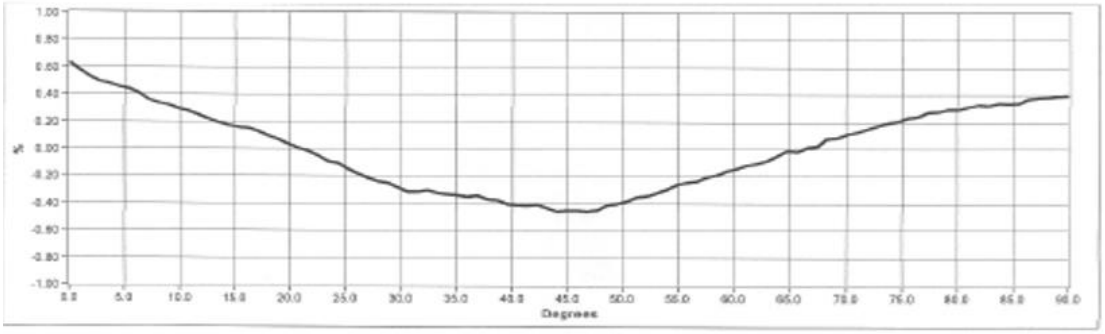
Voltage Level ch2	0.465	4.488	Pass	Accuracy ch2 +/- %	0.24	Pass
Direction ch2	CW		Pass	Angle ch2	90.0	

Axial Displacement

NRH280DP Output with Offset Magnet
Testing carried out with magnet offset, as per the previous test, but the sensor was rotated by 90°, as shown below. The sensor was not reprogrammed from the previous set of test results.

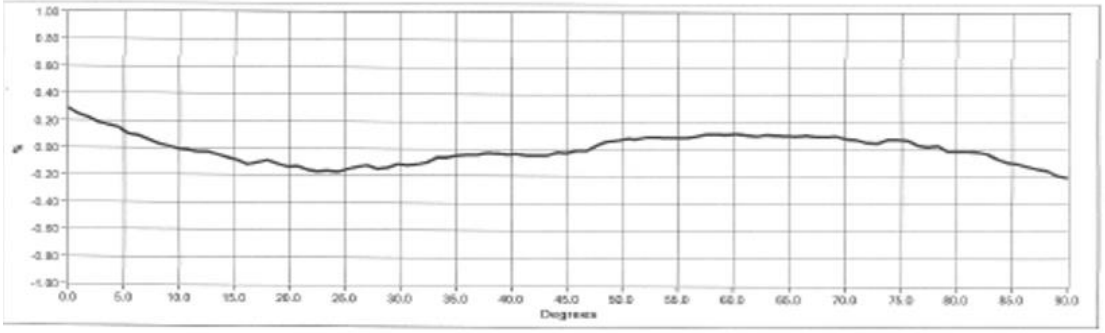


ch1



Voltage Level ch1	0.469	4.465	Pass	Accuracy ch1 +/- %	0.55	Fail
Direction Status ch1	CW		Pass	Angle ch1	90.0	

ch2



Voltage Level ch2	0.445	4.527	Fail	Accuracy ch2 +/- %	0.25	Pass
Direction ch2	CW		Pass	Angle ch2	90.0	

To conclude, the start and end voltages are similar to the original output trace, but the linearity does increase.

Ferrous Interference

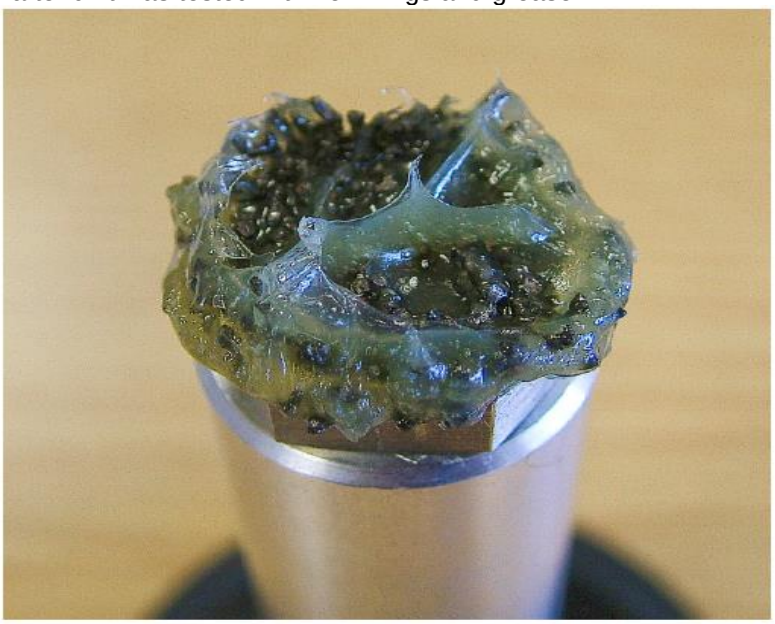
NRH280DP Tested with Iron Filings

The NRH280DP was programmed in the normal way at an angle of 90° with one output set clockwise, the other output set to anticlockwise (NRH280DP/90/90/A/5/B/A) and the linearity recorded.

One gram of coarse iron metal filings was mixed with a small amount of LM grease and wiped over the surface of the NRH:-

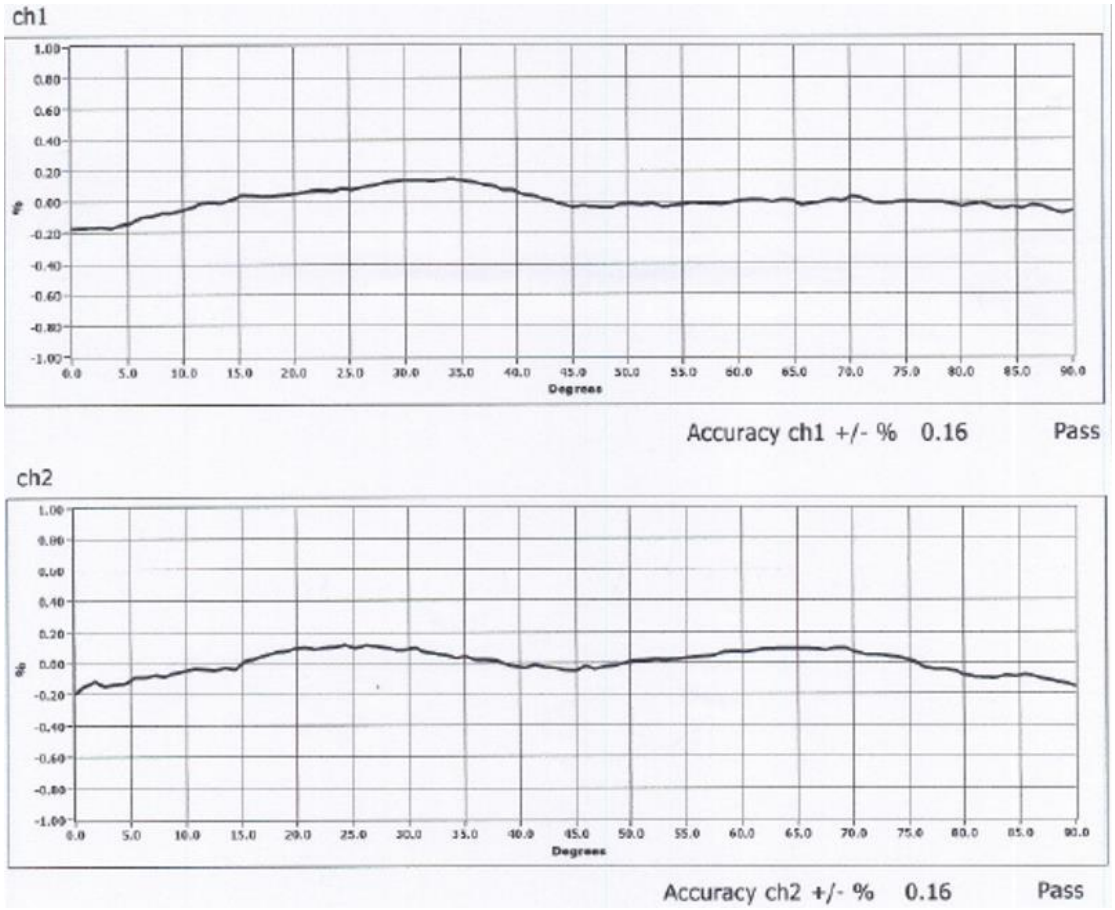
The sensor was retested over the same angle (90°) and the linearity recorded.

Magnet holder after unit was tested with iron filings and grease:-



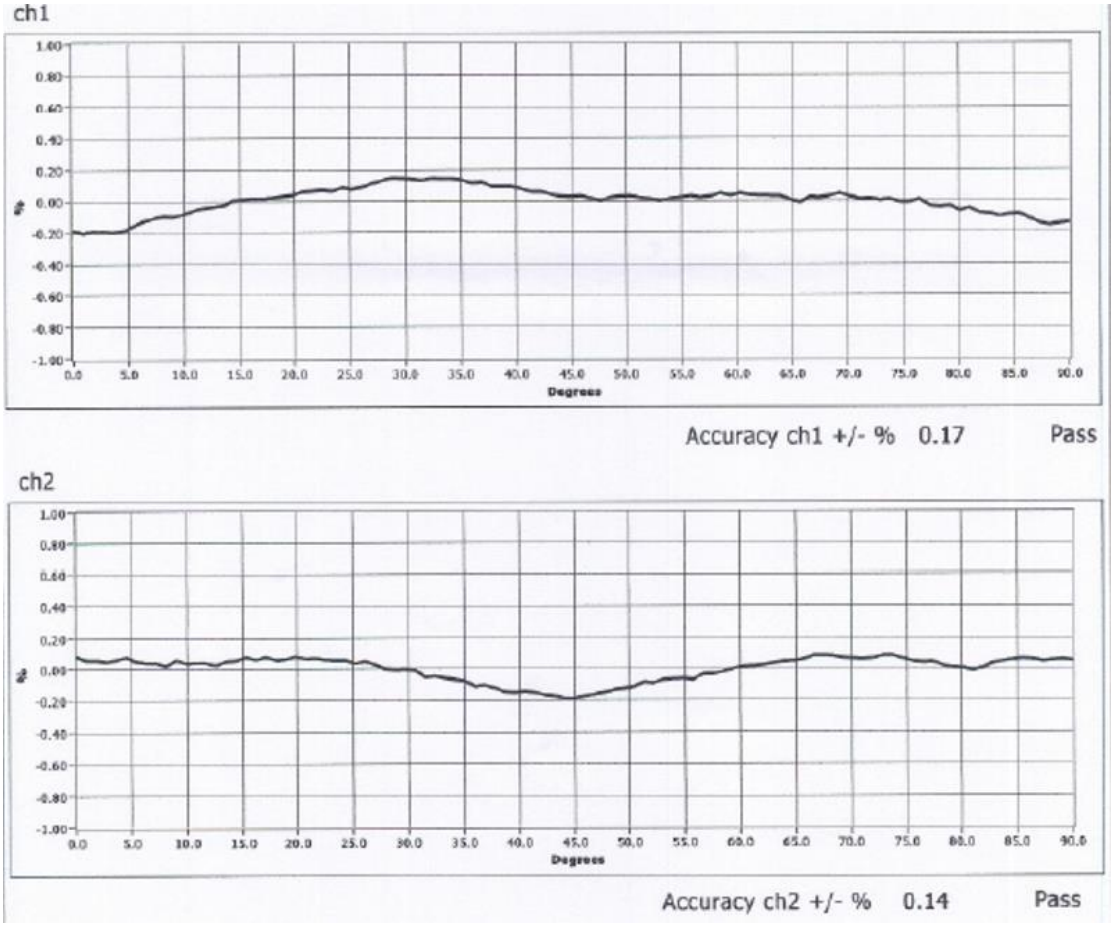
Ferrous Interference

Pre Iron Filings Test Results



Ferrous Interference

Post Iron Filings Test Results



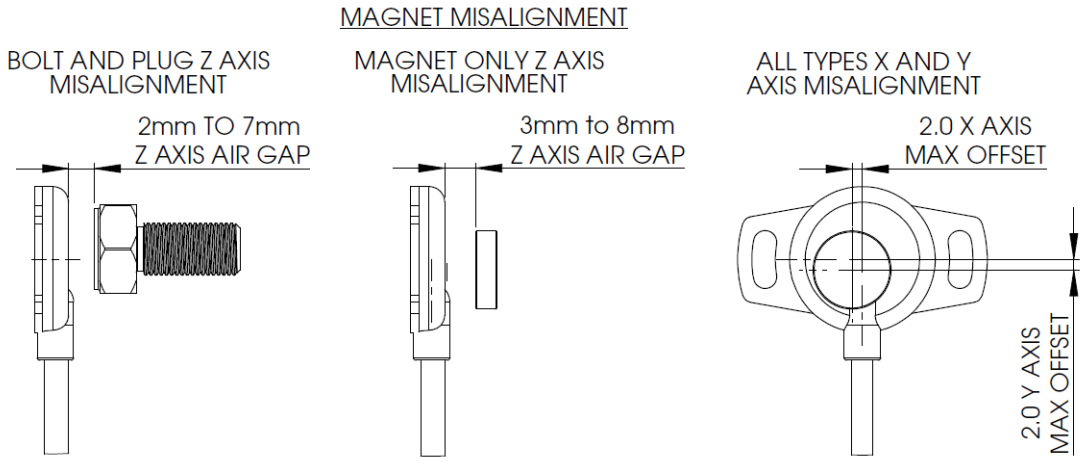
In conclusion, there is minimal effect on the linearity for the NRH if the magnet becomes contaminated by iron filings.

Frequently Asked Questions

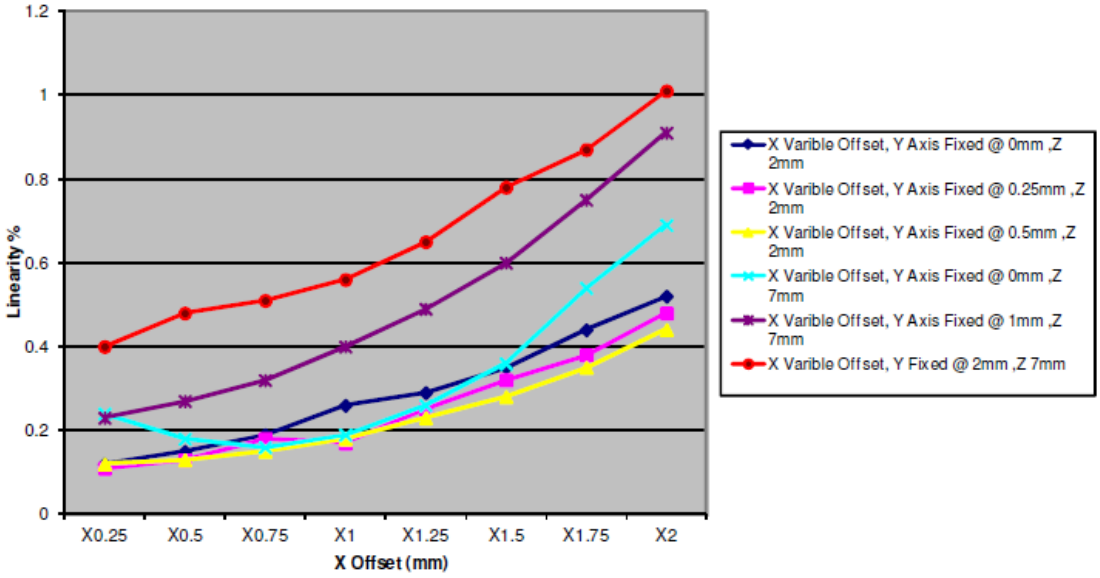
The follow questions and answers have been collated from real life customer enquiries:-

Q. *What is the biggest air gap I can have?*

A. The nominal air gap is 3.5mm. Increasing this distance will result in an increase to the linearity. See further details below:-



Magnet Misalignment Vs Linearity



If the air gap is exceeded then the sensor will trigger a diagnostic flag to indicate an error.

Q. *Will it be affected by electromagnetic radiation?*

A. The sensor has been designed and tested to: BS EN 61000-4-3 (1999) to (100V/Metre), 80MHz to 1GHz and 1.4GHz and 1.4GHz to 2.7GHz.

Frequently Asked Questions

Q. *Can I put the magnet in a mounting that is magnetised*?

A. No, this is not recommended. It will have a detrimental effect on the linearity.

Q. *Can I use an 8mm magnet?*

A. Yes, but only if it is perfectly aligned. A smaller magnet has more potential for creating larger offsets and off axis alignment.

Q. *Can I put the magnet on the opposite side of the sensor?*

A. It is not recommended, as the sensor and magnet have been calibrated for their intended orientation.

Q. *Will it be affected by oil between the sensor and the magnet?*

A. No.

For further information on the Penny & Giles NRH sensors, please visit:

http://www.cw-industrialgroup.com/Products/Sensors/Rotary-Position-Sensors