The Penny & Giles dual redundant output, no-contact rotary position sensor has a slim, low profile rectangular housing (36 x 35mm), and uses a factory programmable 12 bit Hall effect sensor system.

**NRH275DR** has a fully encapsulated sensor system that can withstand high shock and vibration as well as operate up to 140°C, with environmental protection to IP67 (dust protection and water immersion to 1m depth for 24 hours). The sensor is activated by a separate magnet with a choice of three mounting styles.

**NRH275DR** is designed for applications in extreme environments where space is limited. It also allows up to ±2mm radial magnet offset, with a permissible air gap of 2-7mm between the sensor and magnet.

**NRH275DR** operates from a 5Vdc regulated supply and is factory programmed to allow a wide range of output configurations which include CH1 angle; CH2 angle; Output type; Output direction; Electrical connections.

**NRH275DR** is ideally suited to operate in hostile environmental conditions on a range of applications with specialty vehicles - such as articulated dump trucks (tip control), garbage collection vehicles (bin lift control), road sweeping vehicles (4-wheel steering), and racing cars (throttle pedal position).

### Key Features
- NO CONTACT – Hall effect technology
- Unlimited mechanical lifetime – WEAR FREE
- Simple mounting, low profile design
- Dual redundant outputs
- Analog (Vdc) outputs – 0.1-4.9 or 0.5-4.5Vdc
- Optional Digital (PWM) outputs
- Environmental protection to IP67
- 18 AWG wires suitable for AMP or Deutsch connectors
- Optional NC10 conduit tube protection
## PERFORMANCE

### ELECTRICAL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>° 20 to 360 in 1° increments</td>
</tr>
<tr>
<td>Supply voltage Vdc</td>
<td>5 ±0.5 (regulated) to each independent sensor channel</td>
</tr>
<tr>
<td>Over voltage protection Vdc</td>
<td>Up to 12 (-40 to +60°C)</td>
</tr>
<tr>
<td>Maximum supply current mA</td>
<td>&lt;12.5 each independent supply (&lt;25 total)</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Short circuit protection</td>
<td></td>
</tr>
<tr>
<td>Output to GND</td>
<td>Yes</td>
</tr>
<tr>
<td>Output to supply</td>
<td>Yes (up to 10Vdc)</td>
</tr>
<tr>
<td>Power-on settlement time S</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Resolution %</td>
<td>0.025 of measurement range (12bit)</td>
</tr>
<tr>
<td>Non-linearity*</td>
<td>&lt; ±0.4</td>
</tr>
<tr>
<td>Temperature coefficient ppm/°C</td>
<td>&lt; ±30</td>
</tr>
</tbody>
</table>

* Non-linearity is measured using the Least-Squares method on a computerised calibration system

### Analog Output (order code A1, A4, A6 or A7)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output range Vdc</td>
<td>Ratiometric output voltage – 10 to 90% (A1, A6) or 2 to 98% (A4, A7) of Vsupply over measurement range (±1%)</td>
</tr>
<tr>
<td>Monotonic range Vdc</td>
<td>0.25 (5%) and 4.75 (95%) nominal (A1, A6)</td>
</tr>
<tr>
<td></td>
<td>0.05 (1%) and 4.95 (99%) nominal (A4, A7)</td>
</tr>
<tr>
<td>Load resistance Ω</td>
<td>10k minimum (resistive to GND)</td>
</tr>
<tr>
<td>Output noise mVrms</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Input/output delay mS</td>
<td>&lt;2 (A1, A4) (&lt;0.6 is optional for this parameter- A6, A7)</td>
</tr>
</tbody>
</table>

### PWM Output (order code Pn)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWM frequency Hz</td>
<td>244 ±20% over temperature range (P1) with options for 500 (P2) or 1000 (P3)</td>
</tr>
<tr>
<td>PWM levels Vdc</td>
<td>0 and Vsupply (±1%)</td>
</tr>
<tr>
<td>Duty cycle %</td>
<td>10 to 90 over measurement range</td>
</tr>
<tr>
<td>Monotonic range %</td>
<td>5 and 95 nominal</td>
</tr>
<tr>
<td>Load resistance Ω</td>
<td>10k minimum (resistive to GND)</td>
</tr>
<tr>
<td>Rise/fall time μS</td>
<td>&lt;15</td>
</tr>
</tbody>
</table>

### MECHANICAL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical angle °</td>
<td>360, continuous</td>
</tr>
<tr>
<td>Maximum rotational speed °/sec</td>
<td>3600</td>
</tr>
<tr>
<td>Weight G</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Mounting</td>
<td>Use 4 x M3 CSK head screws.</td>
</tr>
<tr>
<td></td>
<td>Bolt (B) or Plug (P) or Magnet only (M) options are available for the customer to assemble to their equipment or integrate into their design</td>
</tr>
<tr>
<td>Phasing</td>
<td>When magnet/carrier ident feature is facing toward the sensor and cable exit, sensor output is at mid travel. Sensor and magnet are supplied as a matched pair.</td>
</tr>
</tbody>
</table>

### ENVIRONMENTAL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>IP67</td>
</tr>
<tr>
<td>Life</td>
<td>This product has no contacting mechanical parts</td>
</tr>
<tr>
<td>Dither life</td>
<td>Contactless – no degradation due to mechanism dither</td>
</tr>
<tr>
<td>Operational temperature °C</td>
<td>-40 to +140</td>
</tr>
<tr>
<td>Storage temperature °C</td>
<td>-55 to +140</td>
</tr>
<tr>
<td>Vibration</td>
<td>BS EN 60068-2-64: 1995 Sec 8.4 (31.4gn rms) 20 to 2000Hz Random</td>
</tr>
<tr>
<td>Shock</td>
<td>3m drop onto concrete and 2500g</td>
</tr>
<tr>
<td>EMC immunity level</td>
<td>BS EN 61000-4-3:1999 to 100V/m. 80MHz to 1GHz and 1.4GHz to 2.7GHz (2004/108/EC)</td>
</tr>
</tbody>
</table>

### DIMENSIONS and ORDERING CODES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual wires</td>
<td>Spec 44A wire x 6; 18 AWG, 1.65mm diameter</td>
</tr>
<tr>
<td>Connectors</td>
<td>Deutsch 6 way (DTM04 6P) or AMP Superseal 1.5</td>
</tr>
<tr>
<td>Conduit</td>
<td>NC10 conduit tube can be fitted as an option</td>
</tr>
</tbody>
</table>

### ELECTRICAL CONNECTIONS [options]

<table>
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<tr>
<th>Parameter</th>
<th>Value</th>
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<td>Conduit</td>
<td>NC10 conduit tube can be fitted as an option</td>
</tr>
</tbody>
</table>
NRH275D R Performance

Electrical Data

- Measurement range: 20°C ± 35°C (11°F ± 95°F) Input range: 5Vdc ± 0.5Vdc @ regulated +0.0mA to +1.5mA (1.5mA for Channel)
- Temperature coefficient: <±0.4% (See Fig 1)
- Duty cycle: 10% to 90% over measurement range
- Monotonic range: 0.25V (5%) and 4.75V (95%) nominal
- Load resistance: 10KΩ minimum (resistive to GND)
- Output noise: ≤1 mVrms
- PWM frequency: 244Hz (STD) ±20% over temperature range. For 500Hz & 1000Hz see ordering code
- Rise/Fall time (244Hz, 500Hz & 1000Hz): <15µs typical
- Input/Output Delay: <0.6 ms (See Ordering Code)
- Short circuit protection output to GND: Yes
- Short circuit protection output to supply: Yes
- Over voltage protection: Up to 60V DC (40 to +20V)
- Power on settlement: <1s
- Resolution: 12 bit (See Fig 1)
- Non linearity: <±0.4% (See Fig 1)
- Temperature coefficient: <±30ppm/°C
- Over voltage protection: Up to 12V (−40 to +60°C)
- Supply reverse polarity protection: Yes
- Short circuit protection: Yes
- Power: 12.5mA ( privileating range of measurement range)
- Supply range: 25mA (12.5mA Per Channel)
- Short circuit protection: Yes

Analog Outputs Options

- Analog output options: 0.1V – 4.9V
- Voltage output range: Monotonic range 0.05V (1%) and 4.95V (99%) nominal
- Voltage output range: Ratiometric output voltage from 2% to 98% (±1%)
- Load resistance: 10KΩ minimum (resistive to GND)
- Output noise: ≤1 mVrms

Digital Outputs Options

- Digital output options: 0V and VSupply (±1%)
- Duty cycle: 10% to 90% over measurement range
- Monotonic range: 5% 95% nominal
- Load resistance: 10KΩ minimum (resistive to GND)
- Output noise: ≤1 mVrms

Environmental Data

- Tested to: Temperature: −55 to +125°C, Humidity: 3% to 93% RH non-condensing
- Storage temperature: 0°C to +40°C, Relative Humidity: ≤95% (non-condensing)
- Shock: 3m drop onto concrete and 250g
- Vibration: 5g 5 to 150Hz
- Electronic Interference: 5g 5 to 500Hz
- Salt spray: BS EN 60068-2-11: 1987 Seven Day 48 Hours

Specifications

- CL10 Conduit Tube
- 2.7mm (2 Axis)
- Magnet Carrier Options
- BOLT TYPE CARRIER
- PLUG TYPE CARRIER
- Air Gap: 2-7mm (2 axis)
- Rotary Hall Sensor
- Magnets ONLY
- Magnet Holder Code: 3. = Both Clockwise 4. = Both Anticlockwise 5. = CH1 Clockwise, CH2 AntiClockwise

Ordering Codes

- Connection Code: P: PWM – 244Hz P: PWM – 500Hz P: PWM – 1KHz
- Cable Code: P2C. = 0.2M Fitted with Conduit Tube P2N. = 0.2M No Conduit P5C. = 0.5M Fitted with Conduit Tube P5N. = 0.5M No Conduit 02C. = 2M Fitted with Conduit Tube 02N. = 2M No Conduit
- Magnet Holder Code: 3. = Both Clockwise 4. = Both Anticlockwise 5. = CH1 Clockwise, CH2 AntiClockwise
- Magnet Type Code: NC = Non Contact

Note 1: Target specification is based on a nominal air gap of 3.5mm

Sensor and magnet to be maintained as a matched pair

Non Linear Law Switch Outputs

- Mixed PWM/Analog Outputs
- Alternative PWM Frequencies

Phasing Sensor is at null electrical angle when the indent feature on the magnet carrier and cable exit are aligned shown in Fig3

Encapsulant Visible

8 Pos: 11.9 x 90°

Individual Cores Spec 44A 1.65mm OD – (See Connector Options)

DEUTSCH CONNECTOR

amp connector

penny + giles

Part Number: NRH275DR

Non Contact Rotary Hall Sensor

Cross Reference

REF: A1 – Analogue 0.5V – 4.5V A4 – Analogue 0.1V – 4.9V A6 – Analogue 0.5V – 4.5V With 0.6ms Input/Output Delay
A7 – Analogue 0.1V – 4.9V With 0.6ms Input/Output Delay

Ordering Codes: NRH275D R /--- /--- /-- /- /-/--/--
**CONNECTOR OPTIONS C2 SENSOR FITTED WITH AMP 1.5 SUPERSEAL 282108-1 PIN OUT**

1. GND (1)         
2. V+(1)              
3. VOUT(1)         
4. GND(2)   
5. V+(2)            
6. VOUT(2)

**MAGNET CARRIERS**

- **OFFSET**
  - X Variable Offset, Y Fixed @ 0mm, Z 7mm
  - X Variable Offset, Y Fixed @ 0.25mm, Z 2mm
  - X Variable Offset, Y Fixed @ 0.5mm, Z 2mm
  - X Variable Offset, Y Fixed @ 2mm, Z 2mm

**MID POINT OF ELECTRICAL ANGLE**

- **Output Increases for ACW Unit When Viewed As Shown**
- **Output Increases for CW Unit When Viewed As Shown**

**MAGNET IDENT**

- **DOM**

**LINEARITY**

- X Variable Offset, Y Axis Fixed @ 0mm, Z 2mm

**Output law for 3 different angles**

- **Angle of rotation, \( \theta \) (°)**
- **Output Voltage (V)**
- **Output Voltage (%)**

**NRH275DR Magnet Misalignment Vs Linearity**

- X Variable Offset, Y Axis Fixed @ 0mm, Z 2mm
- X Variable Offset, Y Axis Fixed @ 0.25mm, Z 2mm
- X Variable Offset, Y Axis Fixed @ 0.5mm, Z 2mm
- X Variable Offset, Y Axis Fixed @ 2mm, Z 7mm

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**FIG 1.**

**FIG 2.**

**FIG 3.**

**FIG 4.**

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**MAGNET CARRIERS IDENT FEATURE**

**NRH275DR Magnet Misalignment Vs Linearity**

- **D No.**
- **Material:** BODY / CARRIER POLYMER WITH METAL INSERTS
- **Title:** NON CONTACT ROTARY HALL SENSOR
- **Part Number:** NRH275DR
- **MID POINT OF ELECTRICAL ANGLE**

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