Cherry sensors deliver unmatched performance and reliability to a broad range of OEM products. At ZF Friedrichshafen AG, the owner of the Cherry brand, we specialize in economical sensors that are suitable for the most rigorous environments, including extremes of temperature, humidity, thermal shock and vibration. Choose a standard product, or partner with our design engineers as they help you to develop a custom solution. Customers in the heavy truck, off highway, recreational vehicle, appliance, automotive and medical markets all rely on Cherry sensors for practical designs and durable products.

High-Performance Sensors for Demanding Environments

Cherry offers seven standard sensor product series:

- MP — Magnetic Position Sensors
- GS — Geartooth Speed Sensors
- SD — Geartooth Speed and Direction Sensors
- VN — Ferrous Vane Sensors
- AN — Angular Position Sensors
- AS — Magnetic Actuators and Mating Connectors
Your Total Design Partner

When you need a custom sensor, Cherry provides the design expertise and development tools needed to bring your product to market quickly. We focus on innovation within our core competencies of magnetics, packaging, electronic design, and sealing technologies to assure our customers reliable sensing solutions.

Consider a few of the capabilities Cherry can deliver to your next custom sensor project:

- Using a solid model design concept developed by the customer, Cherry design engineers apply 3D magnetic modeling to ensure appropriate airgaps and magnetic fields are designed in at the start of the project.

- When harsh environments are involved, Cherry recommends appropriate packaging and sealing technology. Our packaging innovations have resulted in sensors that perform under extreme conditions: temperatures up to 150°C, immersion in solvents to IP68, and exposure to salt spray, dust, gravel and repeated thermal shock.

- With Cherry’s in-house stereolithography and prototype line, we can quickly provide a highly engineered design.

- We match the latest solid state magnetic sensor technologies to proprietary circuits capable of providing EMI, ESD, EMC and Conducted Immunity resistance tough enough to exceed automotive standards.

- To simulate the wide range of environments that our products experience in the field, Cherry’s testing facilities provide concept evaluation, design and product validation, and continuous conformance testing to international standards.

- In-house high-density circuit board assembly assures the quality of our electronics.

- TS-16949 certified factories on multiple continents provide you with advantages in speed, cost and flexibility.

Put Cherry’s broad capabilities to work for you in your most demanding applications.

For more information on Cherry products contact ZF Electronic Systems today.

Phone: +49 9643 180
Web: www.cherry.de
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VN Series
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AN Series
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AS Series
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Compendium 24
Digital Hall-effect position sensor in low-profile flange-mount housing.

Features

- Capable of millions of operations
- Reverse Battery Protection to -24 VDC
- MP101401 south pole activated unipolar switching
- RoHS Compliant
- Latching versions available on special order basis

Applications

- Door position sensing
- Flow sensing
- Pedal switch

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Function</th>
<th>Operate Point Gauss (max.)</th>
<th>Release Point Gauss (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP101401</td>
<td>4.5 – 18</td>
<td>5.2</td>
<td>3-wire sink</td>
<td>400</td>
<td>20</td>
<td>–40 to 85</td>
<td>Unipolar Switch</td>
<td>139 (south)</td>
<td>47 (south)</td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations.
Pull-up resistor should be connected between output (Green) and Vcc (Red).
Unipolar switch output turns low in presence of magnetic south pole. Bipolar latch output latches high in presence of magnetic south poles and latches low in presence of magnetic north pole.

Specifications subject to change without notice.

Dimensions inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

Open Collector

Sinking Block Diagram

Leads = 24 AWG, PVC, UL1569, pre-tinned.
All tolerances ±0.007 (0.18) unless otherwise noted.
Solid state, magnetic position sensors in adjustable, threaded housing.

Features

- Excellent output stability over operating temperature range
- Regulated power supply not required
- Reverse battery protection to -24 VDC
- Wire: 20 AWG, tin plated, polyolefin insulation
- Anodized aluminum housing
- South pole activated
- RoHS Compliant
- Open Collector (NPN) output can be used with bipolar or cmos logic circuits with suitable pull up resistor
- Output switches low (off) when the magnetic field at the sensor exceeds the operate point threshold
- Output switches high (on) when the magnetic field is reduced to below the release point threshold

Applications

- Limit switch
- Home security
- Door position

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Operate Point Gauss (max.)</th>
<th>Release Point Gauss (min.)</th>
<th>Housing Color</th>
<th>Wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP100701</td>
<td>3.8 – 24</td>
<td>7.5</td>
<td>3-wire sink</td>
<td>400</td>
<td>25</td>
<td>-40 to 150</td>
<td>-40 to 150</td>
<td>245</td>
<td>60</td>
<td>Black</td>
<td>20 AWG x 1 m B BB</td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations. Pull-up resistor should be connected between output (Black) and Vcc (Brown).

Dimensions inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

Open Collector Sinking Block Diagram

Specifications subject to change without notice.
Hall-effect position sensor with convenient snap-fit mounting.

**Features**
- Solid state reliability
- Excellent output stability over operating temperature range
- Open Collector (NPN) output can be used with bipolar switch or cmos logic circuits with suitable pull up resistor
- MP101301 – unipolar switch
  - Output switches low (off) when the magnetic field at the sensor exceeds the operate point threshold.
  - Output switches high (on) when the magnetic field is reduced to below the release point threshold
- RoHS Compliant
- Latching version available on special order basis

**Applications**
- Speed sensing
- Door interlock sensing
- Water flow sensing

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Operate Point Gauss (max.)</th>
<th>Release Point Gauss (min.)</th>
<th>Leads</th>
<th>Reverse Battery Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP101301</td>
<td>3.8 – 24</td>
<td>7.5</td>
<td>3-wire sink</td>
<td>400</td>
<td>25</td>
<td>-40 to 85</td>
<td>-40 to 85</td>
<td>245</td>
<td>60</td>
<td>24 AWG x 150 mm</td>
<td></td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations. Pull-up resistor should be connected between output (Green) and Vcc (Red).

**Dimensions**

All tolerances ±0.005 (0.13) unless otherwise noted.

**Open Collector Sinking Block Diagram**

**Sensor Pocket**
Digital Hall-effect position sensor in plastic flange-mount housing.

**Features**

- Three sensing orientations available in a convenient flange mount housing
- Excellent output stability over operating temperature range
- Compatible with unregulated power supply
- Reverse battery protection to -24 VDC
- Open Collector (NPN) output can be used with bipolar switch or CMOS logic circuits with suitable pull up resistor
- MP102103 – north pole activated unipolar switch
  - Output switches low (off) when the magnetic field at the sensor exceeds the operate point threshold.
  - Output switches high (on) when the magnetic field is reduced to below the release point threshold
- RoHS Compliant

**Applications**

- Interrupt switch
- Limit switch
- Door position

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Function</th>
<th>Operate Point Gauss (max.)</th>
<th>Release Point Gauss (min.)</th>
<th>Sensing Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP102103</td>
<td>4.5 – 24</td>
<td>12</td>
<td>3-wire sink</td>
<td>500</td>
<td>20</td>
<td>-40 to 85</td>
<td>Switch</td>
<td>400 (north)</td>
<td>195 (north)</td>
<td>C</td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations. Pull-up resistor should be connected between output (Green) and Vcc (Red).

**Dimensions** inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

**Open Collector Sinking Block Diagram**
Reed-based magnetic position sensor in aluminum threaded housing.

**Features**
- Zero power consumption
- Suitable for DC and AC circuits
- Contacts hermetically sealed for long life
- RoHS Compliant

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Contact Form</th>
<th>Power Rating (W max.)</th>
<th>Switching Voltage (AC/DC max.)</th>
<th>Breakdown Voltage (VDC min.)</th>
<th>Switching Current (Amps max.)</th>
<th>Contact Resistance (Ohms max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Operate Time (msec typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP200701</td>
<td>SPST-NO Form A</td>
<td>10</td>
<td>AC 175</td>
<td>DC 175</td>
<td>200</td>
<td>0.5</td>
<td>0.200</td>
<td>– 40 to 105</td>
</tr>
<tr>
<td>MP200702</td>
<td>SPST-NC Form B</td>
<td>3</td>
<td>AC 30</td>
<td>DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>– 40 to 105</td>
</tr>
<tr>
<td>MP200703</td>
<td>SPDT-CO Form C</td>
<td>3</td>
<td>AC 30</td>
<td>DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>– 40 to 105</td>
</tr>
</tbody>
</table>

Dimensions inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

Operate Distance with AS101001 Magnetic Actuator

- Operate Distance: 0.150 (3.81) Min.
- Release Distance: 0.500 (12.7) Max.

Barrel: Black Anodized Aluminum.
24AWG PVC UL 1569 Black, Pre-Tinned.
Form C is a Three-Wire Device: Black = N/O, Blue = N/C, Brown = Common

Specifications subject to change without notice.
Reed-based magnetic sensor encapsulated in smooth plastic barrel.

Features
- Hermetically sealed contacts for long life
- Zero power consumption
- Available in a variety of standard contact configurations
- Resistant to moisture and dirt
- A standard magnetic actuator is available in the same housing (Cherry part number AS201701)
- RoHS Compliant

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Contact Form</th>
<th>Power Rating (W max.)</th>
<th>Switching Voltage (AC/DC max.)</th>
<th>Breakdown Voltage (VDC min.)</th>
<th>Switching Current (Amps max.)</th>
<th>Contact Resistance (Ohms max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Operate Time (msec typical)</th>
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</thead>
<tbody>
<tr>
<td>MP201701</td>
<td>SPST-NO Form A</td>
<td>10</td>
<td>AC 175 DC 175</td>
<td>200</td>
<td>0.5</td>
<td>0.200</td>
<td>–40 to 105</td>
<td>1.0</td>
</tr>
<tr>
<td>MP201702</td>
<td>SPST-NC Form B</td>
<td>3</td>
<td>AC 30 DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>–40 to 105</td>
<td>1.0</td>
</tr>
<tr>
<td>MP201703</td>
<td>SPDT-CO Form C</td>
<td>3</td>
<td>AC 30 DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>–40 to 105</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Dimensions inches (mm)
All tolerances ±0.005 (0.13) unless otherwise noted.

**Dimensions Diagram**

Operating Distance with AS201701 Magnetic Actuator

Operate Distance: 0.150 (3.81) Min.
Release Distance: 0.500 (12.7) Max.
Reed-based magnetic position sensor in plastic flange-mount package.

Features

- Contacts hermetically sealed for long life
- Zero power consumption
- Resistant to moisture and dirt
- A standard magnetic actuator is available in the same housing (Cherry part number AS201801)
- RoHS Compliant

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Contact Form</th>
<th>Power Rating (W max.)</th>
<th>Switching Voltage (AC/DC max.)</th>
<th>Breakdown Voltage (VDC min.)</th>
<th>Switching Current (Amps max.)</th>
<th>Contact Resistance (Ohms max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Operate Time (msec typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP201801</td>
<td>SPST-NO</td>
<td>10</td>
<td>AC 175 DC 175</td>
<td>200</td>
<td>0.5</td>
<td>0.200</td>
<td>–40 to 105</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Form A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MP201802</td>
<td>SPST-NC</td>
<td>3</td>
<td>AC 30 DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>–40 to 105</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Form B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifications subject to change without notice.
Reed-based magnetic position sensor in plastic flange-mount package.

**Features**

- Immune to hostile environments
- Contacts hermetically sealed for long life
- Suitable for DC and AC circuits
- Zero power consumption
- A standard magnetic actuator is available in the same housing (Cherry part number AS201901)
- RoHS Compliant

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Contact Form</th>
<th>Power Rating (W max.)</th>
<th>Switching Voltage (AC/DC max.)</th>
<th>Breakdown Voltage (VDC min.)</th>
<th>Switching Current (Amps max.)</th>
<th>Contact Resistance (Ohms max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Operate Time (msec typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP201901</td>
<td>SPST-NO</td>
<td>10</td>
<td>AC 175</td>
<td>DC 175</td>
<td>200</td>
<td>0.5</td>
<td>0.200</td>
<td>–40 to 105</td>
</tr>
<tr>
<td></td>
<td>Form A</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>MP201902</td>
<td>SPST-NC</td>
<td>3</td>
<td>AC 30</td>
<td>DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>–40 to 105</td>
</tr>
<tr>
<td></td>
<td>Form B</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP201903</td>
<td>SPDT-CO</td>
<td>3</td>
<td>AC 30</td>
<td>DC 30</td>
<td>200</td>
<td>0.2</td>
<td>0.100</td>
<td>–40 to 105</td>
</tr>
<tr>
<td></td>
<td>Form C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifications subject to change without notice.

**Dimensions**

| 0.200 (5.08) | 12.00 0.300 (304.8 7.62) | 0.125 (28.58) |
| 0.562 (14.27) | 0.375 (9.53) | 0.125 (3.18) |
| 0.375 (9.53) | 0.125 (3.18) |

Capsule: 30% Glass-Filled Polyester.
Leads: 24 AWG PVC UL 1569, Pre-Tinned.
Magnetically activated digital vane sensor in a rugged, overmolded plastic housing with three pins or 3-wire flying leads.

**Features**

- Immune to moisture and dust
- Reliable and repeatable
- No mechanical contacts to wear out
- Operates from 4.5 to 24 VDC
- Reverse battery protection to -24 VDC
- RoHS Compliant

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Termination</th>
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<tbody>
<tr>
<td>VN101501</td>
<td>3.8 – 24</td>
<td>7.5</td>
<td>3-pin sink</td>
<td>400</td>
<td>25</td>
<td>-40 to 85</td>
<td>-40 to 85</td>
<td>pins</td>
</tr>
<tr>
<td>VN101503</td>
<td>3.8 – 24</td>
<td>7.5</td>
<td>3-wire sink</td>
<td>400</td>
<td>25</td>
<td>-40 to 85</td>
<td>-40 to 85</td>
<td>24 AWG x 150 mm leads</td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations. Pull-up resistor should be connected between output (Green) and Vcc (Red).

**Dimensions** inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

**Open Collector Sinking Block Diagram**
Circuit-protected, Hall-effect geartooth speed sensor with adjustable stainless steel housing.

**Features**

- Senses motion of ferrous geartooth targets
- Near zero speed sensing capability
- Immune to rotational alignment
- 10 bit dynamic threshold detection offers
  - Automatically adjusting magnetic range
  - Self compensating to target geometry
  - Immune to target run out
- Compatible with unregulated power supply
- Reverse battery protected to -24 VDC
- Internal circuit protection to IEC 1000
  - EMI resistant to 10 V/m, 26 MHz to 1 GHz
  - ESD resistant to 4 kV (contact discharge)
  - Fast transient resistant to 2 kV
  - Conducted immunity resistant to 10VRMS@1kHz from 150kHz to 80MHz
- Stainless steel housing

**Applications**

- CNC machine tools
- Transmission speed
- Industrial feedback control

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Thread</th>
<th>Barrel Length</th>
<th>Cable</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS100101</td>
<td>5.0 – 24</td>
<td>6</td>
<td>sink</td>
<td>400</td>
<td>20</td>
<td>-40 to 125</td>
<td>-40 to 125</td>
<td>M12-1</td>
<td>65mm</td>
<td>22 AWG</td>
<td>12 mm circular</td>
</tr>
<tr>
<td>GS100102</td>
<td>5.0 – 24</td>
<td>6</td>
<td>sink</td>
<td>400</td>
<td>20</td>
<td>-40 to 125</td>
<td>-40 to 125</td>
<td>M12-1</td>
<td>65mm</td>
<td>x1m BBB</td>
<td></td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations.

Pull-up resistor should be connected between output and Vcc.

**Dimensions** inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

**Open Collector Sinking Block Diagram**

Specifications subject to change without notice.
GEARTOOTH SPEED SENSOR

GS1005-GS1007 Series

Hall-effect geartooth speed sensor with adjustable aluminum housing.

Features

- Senses motion of ferrous geartooth targets
- Near zero speed sensing capability
- Immune to rotational alignment
- 10 bit dynamic threshold detection offers
  - Automatically adjusting magnetic range
  - Self compensating to target geometry
  - Immune to target run out
- Compatible with unregulated power supply
- Reverse battery protected to -24VDC
- Discrete wire version: 20 AWG, tin plated, polyolefin insulation
- Hard coat anodized aluminum housing

Applications

- Exercise equipment
- Food processing equipment
- Speedometer

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Thread</th>
<th>Barrel Length</th>
<th>Leads</th>
<th>Connector</th>
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</thead>
<tbody>
<tr>
<td>GS100502</td>
<td>5.0 – 24</td>
<td>6</td>
<td>sink</td>
<td>400</td>
<td>20</td>
<td>-40 to 125</td>
<td>-40 to 125</td>
<td>M12-1</td>
<td>65mm</td>
<td>20 AWG</td>
<td>x1 m BBB</td>
</tr>
<tr>
<td>GS100701</td>
<td>5.0 – 24</td>
<td>6</td>
<td>sink</td>
<td>400</td>
<td>20</td>
<td>-40 to 125</td>
<td>-40 to 125</td>
<td>15/32˝ – 32 1.00˝</td>
<td>20 AWG</td>
<td>x1 m BBB</td>
<td></td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations. Pull-up resistor should be connected between output (Black) and Vcc (Brown).

Specifications subject to change without notice.

Dimensions  inches (mm)
All tolerances ±0.005 (0.13) unless otherwise noted.

16
Flange mount gear sensor rated to 140°C.

**Features**
- Capable of operating up to 150°C
- Designed to meet IEC60529 IP67 standard for immersion
- Resistant to fuels, solvents, and lubricants associated with engines, transmissions, brakes and chassis systems
- Customizable connector orientation
- ESD resistant to 15kV (contact discharge)
- Operates at arbitrarily low speeds
- Mating connector Delphi 12162280

**Applications**
- Transmission speed
- Wheel speed
- Engine speed
- Anti-lock braking systems

**Specifications**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Leads</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS101205</td>
<td>5.0 – 24</td>
<td>6</td>
<td>sink</td>
<td>600</td>
<td>25</td>
<td>–40 to 140</td>
<td>–55 to 150</td>
<td>Delphi*</td>
<td></td>
</tr>
</tbody>
</table>

Notes: These sensors require the use of an external pull-up resistor, the value of which is dependent on the supply voltage. See page 27 for recommendations.
Pull-up resistor should be connected between output and Vcc.

* Delphi 12162280

**Dimensions** inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

**Open Collector Sinking Block Diagram**

Specifications subject to change without notice.
GEARTOOTH SPEED AND DIRECTION SENSOR

SD1012 Series

Hall-effect geartooth speed and direction sensor with adjustable aluminum or flange-mount plastic housing.

Features

- Sense speed and direction of ferrous geartooth targets
- Plastic flange mount sensor rated to 125 °C
- Near zero speed sensing capability
- 10-bit dynamic threshold detection offers:
  - Automatically adjusting magnetic range
  - Self compensating to target geometry
  - Immune to target run out
- Compatible with unregulated power supply
- Reverse battery protected to -30 VDC
- Internal circuit protection to IEC 1000
  - EMI resistant to 10 V/m, 26 MHz to 1 GHz
  - ESD resistant to 4 kV (Contact discharge)
  - Fast transient resistant to 2 kV
  - Conducted immunity resistant to 10 VRMS from 150 kHz to 80 MHz
  - EMC compatible 30 A/m @ 50 Hz

Applications

- Wheel speed and direction
- Transmission speed and direction
- Hoist speed and direction

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operating Voltage Range (VDC)</th>
<th>Supply Current (mA max.)</th>
<th>Output</th>
<th>Output Saturation Voltage (mV max.)</th>
<th>Output Current (mA max.)</th>
<th>Operating Temp Range (°C)</th>
<th>Storage Temp Range (°C)</th>
<th>Housing Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD101201</td>
<td>4.75 – 24</td>
<td>20</td>
<td>sink</td>
<td>1000</td>
<td>20</td>
<td>–40 to 125</td>
<td>–40 to 125</td>
<td>Plastic</td>
</tr>
</tbody>
</table>

Notes: SD101201 uses Delphi Metri-Pack 150.2 Series Part No. 12162833. Mating terminal: Delphi Part No. 12124075.
A pull up resistor is required between power and each output. Resistor value is dependent upon input voltage. See page 27 for recommendations.

Specifications subject to change without notice.
### AN1 Series

**Intrinsically Linear Angular Position Sensor**

**Features**
- Patented non-contact angular position sensor
- Magnet/sensor orientation provides intrinsically linear output up to 85 degrees of electrical rotation (120 degrees mechanical rotation) without need for electrical compensation
- Return spring provides resistance to CCW motion
- Provided with EMI/ESD protection
- Fully encapsulated electronics

**Applications**
- Throttle and valve position sensing
- User interface controls (vehicles, gaming)
- Pedal position sensing
- Implement position sensing
- Gear Selection
- Joystick position

**Environmental Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>8G's nominal, 20 Hz to 2,000 Hz</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +125°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C to +135°C</td>
</tr>
</tbody>
</table>

**Electrical Specifications**

- **Effective Rotational Sensing Range**: Maximum 85° electrical output
- **Input Voltage**: 5.0 V ± 0.5%
- **Input Current**: 8 mA, max. @ 5 VDC
- **Output Shorted to Ground**: 12 mA, max.
- **Max Overvoltage**: 16 VDC
- **Sensor Output @ 5 VDC (Ratiometric to Input Voltage)**: 0.5 V to 4.5 V max.
- **Output Linearity @ 5 VDC**: ± 2%
- **Resolution**: Analog
- **Bulk Current Injection**: SAE J1113-4, 250 kHz to 500 MHz
- **Conduction and Coupling**: SAE J1113-12; ± 200 V
- **Electronic Discharge**: SAE J1113-13; ± 8 kV contact, ± 15 kV air
- **Radiated Immunity**: SAE J1113-21; 10 kHz to 18 GHz, 100 V/m
- **Immunity to Magnetic Fields**: SAE J1113-22; 200 uT AC Field, 45 Hz to 2 kHz, 10 Gauss, 800 A/m DC Field
- **Immunity to AC Fields**: SAE J1113-26; 15,000 V/m
- **Radiated Emissions**: SAE J1113-41; Class 4

**Mechanical Specifications**

- **Mechanical Travel**: 120° CCW maximum rotational travel
- **Rotation Torque**: 30 inch ounce (0.21 Nm) max with return spring
- **Mass**: 24 grams
- **Life**: + 10 million full cycles
- **Mating Connection**: Connector: Packard metri-pack 150 12124075, Terminal: 12124075, Housing: 12162185

**AN101101**

85° Sensor Output

(Typically Based on 5V Supply)
Programmable, non-contact magnetic position sensors capable of continuous rotation

**Features and Benefits**
- Angular position with high tolerance for misalignment
- Provides non-contact angular position sensing and full 360° rotation
- 5 VDC at tri-axis device.
- Sealed design exceeds IEC 60529 IP67 standard for immersion
- Performs with AS500106 standard magnetic carrier
- PWM output option available for custom applications
- Provided with EMI/ESD protection to SAE J1113 standards
- No mechanical interface means no parts to wear out
- Available with wire leads 12" (305 mm)

**Description**
The sensor operates by rotating a magnetic actuator close to the face of the sensor. Output voltage varies with angular position of the magnet relative to the sensor.

Optimal performance is achieved with Cherry’s AS500106 magnetic actuator. Sensor kits including this standard magnet are available.

**Applications**
- Throttle position sensor
- Replacement for smart bearings
- PRNDL switch for harsh environments
- Steer wheel position for drive by wire systems
- Pedal position sensor

**Mechanical Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Travel</td>
<td>0 to 360 degrees (no stops)</td>
</tr>
<tr>
<td>Dither</td>
<td>No mechanical contact</td>
</tr>
<tr>
<td>Mating Connector</td>
<td>Connector: Delphi Metri-pak 150.2 12162185 Terminal: 12124075</td>
</tr>
<tr>
<td>Maximum Air Gap</td>
<td>5 mm</td>
</tr>
<tr>
<td>Maximum Center-to-Center Offset</td>
<td>2 mm diameter (magnet to sensor)</td>
</tr>
</tbody>
</table>

**Dimensions mm**

20 Note: See page 21 for dimensions on the AS500106 Mating Magnet Carrier. Specifications subject to change without notice.
Electrical Specifications

Effective rotational sensing range 0 to 360 degrees of rotation
Input Voltage 5.0 V DC ± 10%
Max Overvoltage 14 V DC reversed voltage -10 V DC
Output Current Range 8 mA
Resolution Analog
Conduction and Coupling SAE J1113-12; ± Level 3
Electronic Discharge SAE J1113-13; ± 15kV
Immunity to Magnetic Fields SAE J1113-21
Conducted Transient Emmissions SAE J1113-42
Radiated Emmissions SAE J1113-41; Class 4
Output Linearity (with supplied magnet) ± 2.5% Full Scale
Analog Output Slew Rate 200 V.ms
Accuracy ± 2%
Operating Temperature –40 to 125°C

Sensor Output Signal

Rotation Angle (Percent of Sensing Range: 45°; 90°; 180°; or 360°)
Output Voltage (Vs = 5 VDC. Output is ratiometric for Vs = 4.5 to 5.5 VDC.)

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Sensing Range</th>
<th>Sensor/Magnet Assembly Kit #</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN820001</td>
<td>180°</td>
<td>CU103601*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820002</td>
<td>360°</td>
<td>CU103602*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820003</td>
<td>45°</td>
<td>CU103603*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820031</td>
<td>180°</td>
<td>Leads 12” (305mm)</td>
<td></td>
</tr>
<tr>
<td>AN820032</td>
<td>360°</td>
<td>Leads 12” (305mm)</td>
<td></td>
</tr>
</tbody>
</table>

*Includes AN8 sensor and AS500106 magnetic actuator

Magnets

Actuator Magnet
AS101001
Easy to install actuator magnet with threaded aluminum holder.
- South pole facing Alnico magnet
- Also available in the same package:
  - AS101002 with north pole facing Alnico magnet
  - AS101003 with south pole facing samarium cobalt magnet

Magnet Carrier
AS500106
- PPS Housing
- SmCo28 Magnet
- Recommended fastener: M4 Cap Screw
- Recommended torque: 3 Nm (26.5 in lbs.)

Dimensions inches (mm)
All tolerances ±0.005 (0.13) unless otherwise noted.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Sensing Range</th>
<th>Sensor/Magnet Assembly Kit #</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN820001</td>
<td>180°</td>
<td>CU103601*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820002</td>
<td>360°</td>
<td>CU103602*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820003</td>
<td>45°</td>
<td>CU103603*</td>
<td>Connector</td>
</tr>
<tr>
<td>AN820031</td>
<td>180°</td>
<td>Leads 12” (305mm)</td>
<td></td>
</tr>
<tr>
<td>AN820032</td>
<td>360°</td>
<td>Leads 12” (305mm)</td>
<td></td>
</tr>
</tbody>
</table>

*Includes AN8 sensor and AS500106 magnetic actuator
### Magnetic Reed Sensor

**Features**
- Hermetically sealed contacts for long life
- Available in SPST-NO/NC & SPDT versions
- Choice of higher electrical rating, magnet, termination, different cable types & cable lengths
- Moisture and dirt resistant
- Magnet available with same housing
- Zero power consumption

**Application**
- Door sensing

### Infrared Vane Sensor

**Features**
- High-speed capability (> 2.5 m/sec.)
- EMI/EMC compliant
- Encapsulated to meet IP65
- Available in NPN open collector, Opto transistor output
- Wide range of input voltages
- Separate LED indication for power & output
- Choice of different termination & cable lengths
- Highly immune to environmental factors (dust, temperature)

**Application**
- Floor Level Sensing in High Speed Elevators

### Door Information Sensor

**Feature**
- Ferrite magnet (40 x 25 x 10 mm) or ring magnet separately available
- Latch type

**Application**
- Door sensing

### Cylindrical Proximity Sensor

**Features**
- NO/NC type contacts available
- Customized wire length
- Available with ferrite magnet (40 x 25 x 10 mm)

**Application**
- Floor level sensing in elevators
Level Sensor

Features
- External mount
- Fast fitting
- Compact size
- Easily serviceable
- Customized wire length
- Operating temperature - 10°C to + 60°C

Application
- Float and level sensing (water/oil)

Bistable Latch Sensor

Features
- Latch type
- Lifetime: 100,000 operations min.
- Zero power consumption

Application
- Door sensing

ATEX approved Sensor

Features
- Hermatically sealed contacts
- Available in SPST NO/NC version
- Customized cable length and termination
- Resistance to moisture and dirt
- CE & ATEX approvals

Application
- Fuel Dispensing pumps

Speed Sensor

Features
- Operating voltage: 4.5 to 8 V
- Idle current of unit: < 10 mA
- Operating Temperature: -40°C, +120°C
- Output waveform shape: Square
- Duty cycle: 40% - 60%
- Pulses per revolution: 8
- Sensing Speed: 1 – 2000 rpm
- Output mode: Internal pull-up with VCC/Open collector available upon request
In General

**Airgap**
The switching distance of a sensor to a magnet or any other target to be detected depends on several factors, including:

- Sensing characteristics of the sensor
- Magnet material
- Magnet dimensions
- Relative motion of the magnet with respect to the sensor
- Presence of nearby magnetic or ferrous materials

**ESD Sensitivity**

- Cherry Reed sensors are not solid-state devices and thus immune to ESD
- Several of our solid-state series sensors, among them GS1001-1004, GS1012 and SD1012, are equipped with additional circuitry to enhance ESD immunity. They have been tested for ESD immunity in accordance with IEC publication 1000-4-2 using testing standard EN50082-2.

Other sensors, including MP1013, MP1021, GS1005-1009 and VN1015, should be treated as ESD sensitive and handled like other ESD-sensitive devices.

**Connection**
Depending on the type and version, Cherry sensors are equipped either with a defined standard connector or with wires for individual connection.

**Housing**
Cherry sensors are delivered in ready-for-assembly housings for the indicated protection class.

Vane Sensors

These sensors are actuated by vanes passing by the airgap. The ferromagnetic vane thereby changes the magnetic field between the sensor and the magnet in the two arms of the fork.

**Vane Material**
In general, all ferrous materials should have suitable vanes. We recommend iron or steel.

**Vane Dimensions**
We recommend a minimum vane material thickness of at least 1 millimeter and minimum width of at least 6.35 millimeters. The vane should penetrate a depth of less than 3 millimeters from the bottom of the sensor slot.

Vane Dimensions mm

![Vane Dimensions Diagram]

Specifications subject to change without notice.
Magnetic Proximity Sensors

Hall and Reed sensors, two types of magnetic proximity sensors, are most commonly used for long-life position and presence sensing. Cherry offers a wide range of Hall and Reed sensors.

Different Designs
Hall and Reed sensors differ greatly in the way they function. A Hall sensor is a solid-state device whose output changes when exposed to a magnetic field. A Reed sensor, on the other hand, is electrically switched with tiny contacts that open or close in the absence or presence of a magnetic field.

Different Applications
Both types of sensors can be used for many similar applications, but there also cases where one is clearly better than the other.

Unlimited Lifespan
Thanks to its almost unlimited lifespan, Hall sensors are ideal for gear tooth speed and rotary position sensing. Reed sensors cannot match the virtually infinite life of a Hall sensor.

Energy Efficiency
Reed Sensors have zero power consumption in standby mode and are, thus, very energy efficient. In addition, they are immune to ESD. Reed sensors are also frequently used for applications with supply voltages outside the typical 5VDC to 24VDC range of Hall sensors. They can effectively switch 110VAC at low current.

Reed Sensors
Cherry offers Reed sensors in different contact configurations:

<table>
<thead>
<tr>
<th>Contact Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normally open (Form A)</td>
<td>This sensor is normally open in the absence of a magnetic field, and closed near a magnetic field</td>
</tr>
<tr>
<td>Normally closed (Form B)</td>
<td>This sensor is closed in the absence of a magnetic field, and open near a magnetic field</td>
</tr>
<tr>
<td>Changeover (Form C)</td>
<td>This sensor has three leads representing the normally open, normally closed and common contacts. It is a “changeover” device because the common contact changes from the normally closed to the normally open position when a magnetic field is nearby</td>
</tr>
</tbody>
</table>

Magnetic Poles
Most solid-state sensors of our standard product line are south-pole sensitive. Exceptions: the bipolar latching sensors MP101303 and MP101304, which are latched with a south pole and unlatched with a north pole. The MP1021 series includes both north pole-sensitive devices and latching devices. All of our Reed sensors (MP2007 through MP2019) are omnipolar.

Airgap (Distance Sensor – Magnet)
The field strength at various points around a permanent magnet is dependent on several factors, including the shape, size and material of the magnet. Our bipolar latching sensors MP101303 and MP102104 have relatively low gauss thresholds, allowing for somewhat wider airgaps.

Switching Hysteresis
The switching hysteresis is determined by the difference between the sensing face and magnet detection distance as well as the sensing face and magnet release distance.

Sensor Operation

A Reed Sensor is an omnipolar, magnetically activated switch. It can be approached by a magnet from any angle and with either pole. Several possible operating methods are shown below.
Geartooth Sensors

The category geartooth sensors comprises speed sensors as well as combined speed and direction sensors.

Speed and Direction Measurement
The Cherry SD series speed & direction sensors provide both speed and direction output. The SD series sensor incorporates two Hall effect ICs that are slightly offset from one another. Internal conditioning logic analyzes the phase difference between the two sensors to determine the direction of the target rotation.

The standard SD series sensor has two separate digital outputs. It uses an open collector (sinking) output. The speed output switches from high (Vcc) to low (close to zero) when it detects a transition from "no-tooth" to "tooth present." The separate direction output is high when gear rotation is clockwise, and low when gear rotation is counter-clockwise.

Operating a Speed Sensor
Although commonly called a geartooth sensor, a solid-state speed sensor can detect the motion of various ferrous objects with some type of discontinuous surface.

Examples of appropriate targets include:
- Sprockets
- Bolt heads
- Roller chains
- Cavities in smooth surfaces

For best results, we recommend targets made from low carbon cold-rolled steel. Other factors that influence sensor performance include geartooth height and width, space between teeth, shape of the teeth and target thickness. As a general guideline, consider a target with the following minimum parameters:

<table>
<thead>
<tr>
<th>Tooth height</th>
<th>Tooth width</th>
<th>Distance between teeth</th>
<th>Target thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mm (0.200&quot;)</td>
<td>2.5 mm (.100&quot;)</td>
<td>10 mm (.400&quot;)</td>
<td>6.25 mm (.250&quot;)</td>
</tr>
</tbody>
</table>

Orientation
Cherry GS series geartooth sensors are not orientation-sensitive. Cherry SD series speed & direction sensors do have an orientation requirement, and the appropriate orientation is noted on the part itself.

Operating Life
As a solid-state device with no moving parts, a Cherry geartooth sensor’s operational life is virtually unlimited.

Frequency
The measuring range is somewhat dependent on the target and particular sensor, but maximum frequency is generally >10 kHz. Care must be taken in calculating the frequency depending on the target geometry. With asymmetrical targets, for example, ones with narrow tooth widths compared to tooth gaps, the time between the leading and trailing edge of the tooth is generally the governing factor. Our sensors have maximum response times from approximately 10 µS (MP series) to 50 µS (GS series) due to internal Hall cell processing schemes. If your response time is close to these numbers, unexpected results, such as lost counts, can occur.

As opposed to a variable reluctance sensor, a Cherry GS series geartooth sensor has an output amplitude that is independent of input frequency. It does not require a minimum speed. However, it does require some initial movement of the target in order to locate the tooth edge. We therefore call it a “near-zero-speed” sensor, whereas others refer to similar products as “zero-speed” sensors.

Position Sensor with Ring Magnet
Cherry’s solid-state magnetic position sensors also make excellent speed sensors when coupled with a rotating ring magnet. Advantages of this approach include:
- lower sensor cost
- larger airgaps and
- absolute zero-speed sensing.

Airgap (Distance Sensor – Target)
The required distance between sensor and target depends on the installation situation. In general, smaller gearteeths require smaller airgaps while larger gearteeths allow for larger airgaps. Consider starting with an airgap of 1 to 2 millimeters (.040” to .080”).

Specifications subject to change without notice.
**Current Sink Interfacing**

**3-Wire Sinking Interface**

Sinking outputs are often used in negative logic applications, where a low signal is required for an active state. There, sinking outputs normally have current flowing into the device output lead when the device is active. Also called “open collector outputs,” sinking outputs are compatible with any logic family since a wide voltage range may be used for Vcc. Furthermore, the voltage level used to power the Hall effect assembly may differ from the pull-up resistor to which it is attached. The external pull-up resistor connected between the output and Vcc is required for proper operation. With the resistor connected as shown, the output will be “pulled up” to Vcc when off and (approximately) to ground when on.

<table>
<thead>
<tr>
<th>Sensor Series</th>
<th>Connector Type</th>
<th>Vcc</th>
<th>Output</th>
<th>Connection Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>12mm circular Wire Lead</td>
<td>1</td>
<td>Brown</td>
<td>3 Black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Red</td>
<td>4 Black</td>
</tr>
<tr>
<td>GS</td>
<td>12mm circular Wire Lead Delphi</td>
<td>1</td>
<td>Brown</td>
<td>4 Black</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Red</td>
<td>3 Blue</td>
</tr>
<tr>
<td>VN</td>
<td>Pin Wire Lead</td>
<td>1</td>
<td>Red</td>
<td>2 Black</td>
</tr>
<tr>
<td>SD</td>
<td>Delphi</td>
<td>C</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

**Recommended pull-up resistor values are as follows:**

<table>
<thead>
<tr>
<th>Volts dc</th>
<th>Ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1 k</td>
</tr>
<tr>
<td>9</td>
<td>1.8 k</td>
</tr>
<tr>
<td>12</td>
<td>2.4 k</td>
</tr>
<tr>
<td>15</td>
<td>3 k</td>
</tr>
<tr>
<td>24</td>
<td>3 k</td>
</tr>
</tbody>
</table>

**Dimensions** inches (mm)

All tolerances ±0.005 (0.13) unless otherwise noted.

Specifications subject to change without notice.
Errors, technical changes, and delivery possibilities subject to change. Technical data is based on the specifications of the products only. Features are not guaranteed herewith. Binding data can be found only in drawings in conjunction with product specifications.