HRPG Series
Miniature Panel Mount Optical Encoders

Data Sheet

Description
The HRPG series is a family of miniature panel mount optical encoders, also known as Rotary Pulse Generators (RPG) and digital potentiometers. The HRPG is designed to be mounted on a front panel and used as a rotary, data-entry device. The HRPG is very flexible for numerous applications due to the many configuration options available. These options include detents or smooth, multiple terminations, versatile mounting capabilities, and different shaft configurations.

The HRPG uses optical reflective technology providing accuracy and reliability to the encoder. An LED emits a beam of light onto the specular codewheel surface. When the light strikes the surface, it projects the image of the codewheel back on the photodetector, causing the output to change. The entire detector circuit is on one IC, thus the part is less sensitive to temperature and other environmental variations.

Applications
Typical applications for the Rotary Pulse Generator include front panel instruments, audio/visual boards, and other devices requiring digital output from a turning knob.

Note: Avago Technologies encoders are not recommended for use in safety critical applications. Eg. ABS braking systems, power steering, life support systems and critical care medical equipment. Please contact sales representative if more clarification is needed.

Features
- Miniature size
- Smooth turning and detented options
- Multiple mounting bracket options
- Uses optical reflective technology
- Quadrature digital output
- Small footprint for versatile mounting
- TTL compatible
## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Storage Temperature</td>
<td>$T_S$</td>
<td>-40</td>
<td>+85</td>
<td>°C</td>
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<tr>
<td>Operating Temperature</td>
<td>$T_A$</td>
<td>0</td>
<td>+70</td>
<td>°C</td>
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<tr>
<td>Vibration</td>
<td></td>
<td>20</td>
<td>g</td>
<td></td>
<td>20 Hz to 2 kHz</td>
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<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>-0.5</td>
<td>7</td>
<td>V</td>
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<tr>
<td>Output Voltage</td>
<td>$V_O$</td>
<td>-0.5</td>
<td>$V_{CC}$</td>
<td>V</td>
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<tr>
<td>Output Current Per Channel</td>
<td>$I_O$</td>
<td>-1</td>
<td>5</td>
<td>mA</td>
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<tr>
<td>Shaft Load – Axial</td>
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<td>4.0</td>
<td>N</td>
<td>$10^6$</td>
<td>Revolutions</td>
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<tr>
<td>Shaft Load – Radial</td>
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<td>0.1</td>
<td>Nm</td>
<td>$10^6$</td>
<td>Revolutions</td>
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<tr>
<td>Revolution Life</td>
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<td>$10^6$</td>
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<td>Rev</td>
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## Recommended Operating Conditions

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<th>Parameter</th>
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<tr>
<td>Temperature</td>
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<td>Supply Voltage</td>
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<td>4.5</td>
<td>5.5</td>
<td>V</td>
<td>Ripple &lt; 100 mV_p-p</td>
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<td>Rotation Speed – Detented</td>
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<td>200</td>
<td>RPM</td>
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<tr>
<td>– Smooth</td>
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<td>300</td>
<td>RPM</td>
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<tr>
<td>Rotation Speed – Smooth</td>
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## Electrical Characteristics

### Over Recommended Operating Range

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<tr>
<td>Supply Current</td>
<td>$I_{CC}$</td>
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<td>High Level Output Voltage</td>
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<td>$I_{OH} = -40 \mu A$ Max.</td>
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<td>V</td>
<td>$I_{OL} = 3.2 mA$</td>
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</table>

### Output Waveforms

![Output Waveforms Diagram](image)

**NOTES:**

- **360° = 360° MECH. CPR**
- **1.** For HRPG-ADXX #XXX the nominal detent position is centered around low-low state (CHA = 0, CHB = 0).
- **2.** Detent position will lie within these boundaries, never in high-high state (CHA = 1, CHB = 1).
Mechanical Configurations

Termination Options
Option R – Pins Rear with Bracket
HRPG-AXXX#XXR

SUGGESTED CONFIGURATION

NUT AND WASHER MUST BE USED TO SECURE MOUNTING PLATE TO THE HOUSING.

MAX PANEL THICKNESS

3/8"-32 UNEF THREAD

5.8
0.23
MIN. TO LAST COMPLETE THREAD

TABS
0.79
0.031' 4 PLACES

15.11
0.595

9.96
0.392

3.6
0.14

STAR WASHER

HEX NUT 7/16"
11.1
0.44
FLAT TO FLAT

11.4
0.45
PINS 0.64 mm/0.025" SQ. 5 PLACES ON 2.54 mm/0.100" CENTERs

NOTES:
DIMENSIONS ARE: mm INCHES
TOLERANCES ARE: X ± 0.25 mm .XX ± 0.01"
XX ± 0.13 mm .XXXX ± 0.005"

SHIELD IS FOR HOUSING ESD PATH ONLY

1. GROUND 2 CHANNEL 8 CHANNEL 9 SHIELD (HOUSING GROUND)
Option F – Pins Front with Bracket

HRPG-Axxx#XXF

SUGGESTED CONFIGURATION

PCB MOUNTING DIMENSIONS

NO TRACES WITHIN
DOTTED LINES.

9.66
0.392

2.54
0.100 TYP.

1.214
0.08

9 PLACES

8.31
0.327

3/8"-32 UNEF THREAD

5.8
0.23
MIN. TO LAST COMPLETE THREAD

2.6
0.10 MAX. PANEL THICKNESS

PINS 0.64 mm/0.025" SOR. 5 PLACES
ON 2.54 mm/0.100" CENTERS

TABS 0.81
0.032
4 PLACES

STARS WASHER

HEX NUT 7/16" (11.1 mm)
FLAT TO FLAT

16.1
0.63

10.9
0.43

9.96
0.392

15.11
0.595

7.56
0.297

0.38
0.015 FLATS
0.030 OPTIONAL

R
4.89
0.193

3
0.12

NOTES:

DIMENSIONS ARE: mm

INCHES

TOLERANCES ARE: X ± 0.26 mm

0.01"

XX ± 0.13 mm

XXX ± 0.006"

SHIELD IS FOR HOUSING ESD PATH ONLY

1. GROUND (GOT ON BOTTOM)

2. CHANNEL B

3. CHANNEL C

4. CHANNEL A

5. CHANNEL D

6. SHIELD HOUSING GROUND

Pins of 0.64 mm/0.025" SOR. 5 PLACES
ON 2.54 mm/0.100" CENTERS
Option C – Cable Connector with Strain Relief

HRPG-AXXX#XXC

SUGGESTED CONFIGURATION

PANEL HOLE DIMENSIONS

CONNECTION
AMP 641225-5 MTA-100 CLOSED END HOUSING WITH DUST COVER,
FEMALE CONNECTOR ON 0.100"/2.54 mm CENTERS TO MATE WITH
MALE 0.025" (0.54 mm) SQR. POSTS, 0.28" ± 0.04 (7.11 ± 1.00 mm) LONG.

0.100" (2.54 mm) CENTERS, ROUND CONDUCTOR FLAT CABLE
GRAY PVC INSULATION

NOTES:

DIMENSIONS ARE

INCHES

TOLERANCES ARE

± 0.005"

SHIELD IS FOR HOUSING ESD PATH ONLY
Shaft Configurations

Shaft Dimensions (D-cut shown also)

- Flange Dia.: 8.03 mm (0.316 inches)
- Flange Flats: 0.40 mm (0.262 inches)
- D-cut Thickness: 0.13 mm ± 0.005
- Flange Flat Depth: 0.76 mm ± 0.030
- Flange Thickness: 1.27 mm ± 0.050
- D-cut Length: b ± 0.13 mm ± 0.005
- Shaft Length: l ± 0.13 mm ± 0.005
- Shaft Dia.: d ± 0.025 mm ± 0.001
- Chamfer: 0.76 mm (0.030) x 45°
<table>
<thead>
<tr>
<th>Option #</th>
<th>Shaft Length (l)</th>
<th>Shaft Diameter (d)</th>
<th>D-Cut Thickness (c)</th>
<th>D-Cut Length (b)</th>
<th>Sketch (not to scale)</th>
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<td>0.251”</td>
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<tr>
<td>13</td>
<td>0.30”</td>
<td>0.250”</td>
<td>0.225”</td>
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<td>19</td>
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<td>56</td>
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<td>6.00 mm</td>
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<td>10.16 mm</td>
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<tr>
<td>57</td>
<td>20.32 mm</td>
<td>6.02 mm</td>
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<td>59</td>
<td>20.32 mm</td>
<td>6.00 mm</td>
<td>5.33 mm</td>
<td>17.78 mm</td>
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Typical Interface

HRPG Series  CH A  CH B  HCTL-2016/2020 QUADRATURE DECODER/COUNTER  HOST PROCESSOR

Ordering Information

HRPG - A  #  

Shaft / Resolution
- S16 – Smooth 16CPR
- D16 – Detented 16CPR*
- S32 – Smooth 32CPR
- D32 – Detented 32CPR*
- SCA – Smooth 120CPR

Mechanical Configuration
- 11 – 0.3" long, 0.25" dia.
- 13 – 0.3" long, 0.25" dia. D-cut
- 14 – 0.5" long, 0.25" dia.
- 16 – 0.5" long, 0.25" dia. D-cut
- 17 – 0.8" long, 0.25" dia.
- 19 – 0.8" long, 0.25" dia. D-cut
- 51 – 7.6 mm long, 6 mm dia.
- 53 – 7.6 mm long, 6 mm dia. D-cut
- 54 – 12.7 mm long, 6 mm dia.
- 56 – 12.7 mm long, 6 mm dia. D-cut

Termination
- F – Pins Front with Bracket
- R – Pins Rear with Bracket
- C – Cable Connector with Strain Relief

*Note: When ordering detented versions, a D-cut shaft is recommended.

<table>
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<tr>
<th>HRPG Series</th>
<th>11</th>
<th>13</th>
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