**Motion Type:** Rotary

**Usage Grade:** Light Industrial

**Output:** Incremental

**Max Resolution:**
- 7,200 counts/rev
- 144,000 counts/rev w/ ext. electronics

---

**Small Package - Big Performance**

The Series 9x11S is a family of optical incremental encoders designed specifically for light industrial applications that require high resolution in a small package. These features make the 911S superior to competitive encoders:

- Resolutions up to 1800 cycles/rev (7,200 counts/rev, or 0.05°/count)
- Standard zero index signal
- LED illumination for long life (>100,000 hours)
- Differential photo-detectors for signal stability
- RS-422 differential line driver output for noise immunity
- Single-board, surface-mount electronics (9111S)
- Sealed ABEC 7 bearings for contamination resistance
- Grease lubrication for long trouble-free service

Two models available:

**Model 9111S:** suitable for most applications

**Model 9211S:** provides higher accuracy and with external customer electronics, generates up to 144,000 counts/rev
**Input Power (excluding customer load)**

+5 VDC at 75 mA (150 mA for 9211S)  
+12 or +15 VDC at 75 mA max. (9111S only)

**Output Device Options**

**Square Waves (output code 'L')**

EIA/RS-422 balanced differential line driver on all channels, protected to survive an extended-duration short circuit across its output. May be used single-ended for TTL-compatible inputs. The encoder's complementary output voltages will typically swing to within two volts of the applied power supply input voltage rail. The high-voltage-capable line driver can sink or source up to 70 mA, and can readily interface to controllers requiring 12 or 15 volt "open collector" type signals.

As part of our continuing improvement program, these specifications are subject to change without notice.

**Buffered Sinusoids (output code 'B')**

9211 only  
The output device is an op amp referenced to (50% ±3%) x Vcc. Typical signal roll-off at 100 kHz ≤ 3dB. Signal values at 1 kHz with 4.7 Ω load to ground (20°C):

- P-P signal amplitude, data channels: 1.0±0.1 V  
- Amplitude ratio, min chan to max chan: 0.90 to 1.00  
- P-P signal amplitude, index channel: 0.7±0.3V

**Index**

Index is standard and it is ungated with a width of 360° ±180° electrical.

**Extended Resolution**

The series 911S offers resolution up to 7,200 counts/rev (3 arcmin/count) after 4X quadrature-edge detection. If finer resolution is required (up to 144,000 counts/rev, or 9 arcsec/count), the HR2A external electronics package can be used with the 9211S. This provides a wide range of options that ensures compatibility with virtually all commercially available counter circuits, dedicated encoder interface cards and programmable logic controllers:

- Any number of quadrature square waves from 1 to 20 times the line count on the disc  
- Fixed-duration pulses at 1, 2 or 4 times any integer from 1 to 20.  
- A choice of CW/CCW or PULSE/DIRECTION output pulse format.  
- A zero-index (reference) signal in either gated ½ cycle, gated ¼ cycle, or fixed-duration pulse format.  
- EIA/RS-422 or open-collector line drivers.  
- On-board low-dropout voltage regulator.

Refer to the HR2A data sheet for full details.

Gurley Precision Instruments  
514 Fulton Street  
Troy, NY 12180 U.S.A.  
(800) 759-1844, (518) 272-6300, fax (518) 274-0336,  
Online at www.gurley.com, e-mail: info@gurley.com
Sinusoidal Output

Square Wave Output

Wiring Colors

<table>
<thead>
<tr>
<th>Conn Code</th>
<th>Square Wave Output</th>
<th>Buffered Sinusoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>A</td>
<td>SIN</td>
</tr>
<tr>
<td>Brown</td>
<td>/A</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>B</td>
<td>COS</td>
</tr>
<tr>
<td>Orange</td>
<td>/B</td>
<td>INDEX</td>
</tr>
<tr>
<td>Blue</td>
<td>INDEX</td>
<td>INDEX</td>
</tr>
<tr>
<td>White</td>
<td>/INDEX</td>
<td></td>
</tr>
<tr>
<td>Gray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>+V</td>
<td>+V</td>
</tr>
<tr>
<td>Black</td>
<td>Common</td>
<td>Common</td>
</tr>
<tr>
<td>Bare</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

Channel B (COS) leads Channel A (SIN) for CW shaft rotation, viewed from the shaft end

* Connector Code S is not available with Buffered Sinusoid output

Pinouts

<table>
<thead>
<tr>
<th>DA-15P Connector Code Q</th>
<th>Square Wave Output</th>
<th>*Buffered Sinusoid Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>/INDEX</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>INDEX</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>/B</td>
<td>+V</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>INDEX</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>/A</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>Case</td>
</tr>
<tr>
<td>9</td>
<td>Case</td>
<td>SIN</td>
</tr>
<tr>
<td>10</td>
<td>+V</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DA-9P Connector Code S</th>
<th>Square Wave Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>/INDEX</td>
</tr>
<tr>
<td>2</td>
<td>INDEX</td>
</tr>
<tr>
<td>7</td>
<td>/B</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
</tr>
<tr>
<td>8</td>
<td>/A</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>Case</td>
</tr>
<tr>
<td>5</td>
<td>+V</td>
</tr>
<tr>
<td>9</td>
<td>Common</td>
</tr>
</tbody>
</table>

Gurley Precision Instruments
514 Fulton Street
Troy, NY 12180 U.S.A.
(800) 759-1844, (518) 272-6300, fax (518) 274-0336,
Online at www.gurley.com, e-mail: info@gurley.com
MODEL -

9111S  Standard
9211S  High accuracy

LINES - Disc line count
00360   00500   00512   00600   00720   00900
01000   01024   01250   01800
Consult factory for other line counts.

INDEX

F  Full cycle
V  - Input voltage
   5 5 volts dc
   C 12 volts dc (9111S only)
   F 15 volts dc (9111S only)

OUT - Output format

L  RS-422 line driver
   B Buffered sinusoids (9211S only)

INTERPOLATION

01  Standard

BASE

A  Standard

CABLE - Cable length, inches (04-99)
   18  Standard

CABLE EXIT

T  Standard

CONN - Connector

P  Pigtails (no connector)
   Q  DA-15P
   S  DE-9P

DIA - Shaft diameter

02E  0.1250* dia (standard)
   AAE  0.1200* dia

SPEC - Special code

X  To define non-standard features
   N  No special features

ACCESSORIES (order separately)

M01  Mating connector for DA-15P
M06  Mating connector for DE-9P
AX06399  Synchro mounting cleats
ISC3N  Interface card for PC

SPECIAL CAPABILITIES
For special situations, we can optimize catalog encoders to provide higher frequency response, greater accuracy, wider temperature range, reduced torque, non-standard line counts, or other modified characteristics. In addition, we regularly design and manufacture custom encoders for user-specific requirements. These range from high-volume, low-cost, limited-performance commercial applications to encoders for military, aerospace and similar high-performance, high-reliability conditions. We would welcome the opportunity to help you with your encoder needs.

WARRANTY
Gurley Precision Instruments offers a limited warranty against defects in material and workmanship for a period of one year from the date of shipment.

Gurley Precision Instruments
514 Fulton Street
Troy, NY 12180 U.S.A.
(800) 759-1844, (518) 272-6300, fax (518) 274-0336,
Online at www.gurley.com, e-mail: info@gurley.com