The series M136 magnetic rotary encoders are designed for light industrial applications that require up to twelve bits of resolution (4096 words or counts/turn) in a very small package. The four models share these features:

- Non-contact; frictionless; bi-directional rotation
- Maximum rotating speed: 30,000 RPM
- Protection: IP64 standard (IP 68 optional)
- Shock: 1000 m/s²; 6 ms (non-operating)
- Vibration: 100 m/s² @ 55 to 2000 Hz
- 36-mm body; blind hollow-shaft
- Weight: Encoder with 1m cable (no connector) 85 grams, magnet carrier 12 grams

**Models Available:**

- **M136-P** Parallel binary 12 bit
- **M136-S** Synchro-serial interface (SSI) 12 bit
- **M136-I** Incremental, 4096 counts/rev. (after quadrature decode)
- **M136-A** Analog (Voltage or Current)
### M136P Binary Parallel Interface

**Timing diagram:**

![Timing diagram](image)

- **Power Supply:** 8V to 26V DC
- **Power Consumption:** 20 mA
- **Output Voltage:** 
  - $V_{in} \geq V_{supply} - I \times l \leq 10$ mA
  - $V_i \leq 1$ V at $I_i \leq 10$ mA
- **Resolution:** max. 9 bits (512 words/turn)
- **Hysteresis:** 0.5 bit
- **Accuracy:** ± 1 bit
- **Repeatability:** ≤ 0.1 bit
- **Output signals:** D0 (LSB) - D8 (MSB) - natural binary
- **Output Type:** Push-pull @ 40mA, open collector NPN@25mA
- **Data inputs:** LE - latch enable input signal, active high
- **Max. Cable length:** 10m
- **Connector:** DA-15P or pigtails
- **Temp. Range:** -25°C to 125°C

Output increases with CW rotation

Maximum sampling rate is 500 kHz

### M136S Binary Synchro-Serial Interface (SSI)

256 to 4096 words per revolution

**Timing diagram:**

![Timing diagram](image)

- **Power Supply:** 5V DC
- **Power Consumption:** 35 mA
- **Resolution:** max. 12 bits (4096 words/turn)
- **Hysteresis:** 0.2°
- **Accuracy:** ± 0.3°
- **Repeatability:** ≤ 0.1 bit
- **Output signals:** Serial data (RS 422) - natural binary
- **Data inputs:** Clock (RS422)
- **Max. Cable length:** 100m (at 1 MHz)
- **Connector:** DE-9P or pigtails
- **Temp. Range:** -25°C to 85°C
- **Max Speed:** 18000 rpm @ 4096, otherwise 20000 rpm

Clock = 50 kHz to 1MHz

$t_m = 13 \mu s$ to 20 μs

Output increases with CW rotation

### M136I Incremental Output

**Output diagram:**

![Output diagram](image)

- **Power Supply:** 5V DC
- **Power Consumption:** 35 mA
- **Output TTL signals:** A, B, I, /A, /B, /I (RS 422)
- **Resolution (max):** 4096 counts/rev. (after quadrature decode)
- **Accuracy:** +/- 0.3 deg.
- **Max. cable length:** 20m
- **Connector:** DE-9P
- **Temp. Range:** -25°C to 85°C
- **Edge separation time:** 1/μsec minimum
- **Max. Speed:** 10000 rpm @ 4096, otherwise 20000 rpm

A leads B for CW rotation

Counts per rev = 1 cycle

360° x 4 = 1 cycle
M136A Analog - Voltage Output

VA  0 to 10 Vdc, CW
VE  0 to 10 Vdc, CCW
VM -10 to +10 Vdc, CW
VR -10 to +10 Vdc, CCW

Power Supply: VA & VE, +20 to 30 Vdc
Power Consumption: 40 mA (typical)
Output Voltage: VA, VE 0-10 Vdc
VM, VR -10 to +10 Vdc
Output Loading: Max. 10 mA
Linearity: 1%
Max. Cable Length: 20m (65 feet)
Connector: DE-9P or pigtails
Temp. Range: -25 C to +70 C (operating)
-25 C to 125 C (storage)

M136A Analog - Current Output

CA  4 to 20 mA, CW
CE  4 to 20 mA, CCW
CM  0 to 20mA, CW
CR  0 to 20 mA, CCW

Power Supply: +20 to 30 Vdc
Power Consumption: 50 mA plus output current
Output Current: CA, CE 4 TO 20 mA
CM, CR 0 to 20 mA
Output Loading: $R_i = 0 to V_o/I_{out max}$
Linearity: 1%
Max. Cable Length: 20m (65 feet)
Connector: DE-9P or pigtails
Temp. Range: -25 C to +70 C (operating)
-25 C to 125 C (storage)
### M136 Electrical Connections

#### SC (SSI) vs. IC (Incremental)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire Color (a,b)</th>
<th>Function</th>
<th>Wire Color (a,b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shield</td>
<td>White</td>
<td>Shield</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Clock</td>
<td>White</td>
<td>Index</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>Clock</td>
<td>Brown</td>
<td>B</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>-</td>
<td>A</td>
<td>Gray</td>
</tr>
<tr>
<td>5</td>
<td>+V</td>
<td>Red</td>
<td>+V</td>
<td>Red</td>
</tr>
<tr>
<td>6</td>
<td>Data</td>
<td>Green</td>
<td>Index</td>
<td>Brown</td>
</tr>
<tr>
<td>7</td>
<td>Data</td>
<td>Yellow</td>
<td>B</td>
<td>Yellow</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>-</td>
<td>A</td>
<td>Pink</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Blue</td>
<td>GND</td>
<td>Blue</td>
</tr>
</tbody>
</table>

#### VA, VE, VM, VR (Analog - Voltage) vs. CA, CE, CM, CR (Analog - Current)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire Color (a)</th>
<th>Wire Color (b)</th>
<th>Function</th>
<th>Wire Color (a)</th>
<th>Wire Color (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shield</td>
<td>White</td>
<td>Brown</td>
<td>Shield</td>
<td>White</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>-</td>
<td>-</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>V_ay</td>
<td>Black</td>
<td>Green</td>
<td>I_ay</td>
<td>Black</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>-</td>
<td>-</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>+V_ay</td>
<td>Red</td>
<td>Red</td>
<td>V_ay</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>6</td>
<td>-V_ay</td>
<td>Brown</td>
<td>Brown</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>-</td>
<td>-</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>-</td>
<td>-</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Orange</td>
<td>Blue</td>
<td>GND</td>
<td>Orange</td>
<td>Blue</td>
</tr>
</tbody>
</table>

#### PA, PB (Parallel)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire Color (a)</th>
<th>Wire Color (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shield</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>D8</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>D7</td>
<td>Brown</td>
<td>Brown</td>
</tr>
<tr>
<td>4</td>
<td>D6</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>5</td>
<td>D5</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>6</td>
<td>D4</td>
<td>Gray</td>
<td>Gray</td>
</tr>
<tr>
<td>7</td>
<td>D3</td>
<td>Pink</td>
<td>Pink</td>
</tr>
<tr>
<td>8</td>
<td>+V_dd</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>9</td>
<td>D2</td>
<td>Black</td>
<td>Black</td>
</tr>
<tr>
<td>10</td>
<td>D1</td>
<td>Violet</td>
<td>Violet</td>
</tr>
<tr>
<td>11</td>
<td>D0</td>
<td>Gray/Pink</td>
<td>Orange</td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>NC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>LE</td>
<td>Red/Blue</td>
<td>Clear</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>Blue</td>
<td>Blue</td>
</tr>
</tbody>
</table>

(a) standard EMC grade; shield and case connect to pin 1.
(b) high EMC grade; inner shield connects to pin 1, outer shield connects to encoder case.
(c) VM & VR only
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.