The HS45 is a large bore, heavy duty, rugged encoder designed to operate in very demanding environments. It is available in both single and dual output versions as shown. These encoders use a preloaded bearing set for mechanical stability and a long service life.

The dual output version has redundant electronics internal to the encoder simplifying signal distribution to multiple controllers.

Special Models of the HS45 Incremental Encoder are available with one or more of the following certifications. Consult factory for details.

- **Canadian Standards:**
  - Class I, Zone 0, Group IIC
- **U.S. Standards:**
  - Class I, Group A,B,C & D;
  - Class II Group E,F & G
- **CENELEC**:
  - II 1 G  Ex ia IIB/IIC T4 Ga
  - II 3 G  Ex nA IIB T3 Gc
- **EN 55011** and **EN 61000-6-2**
- **UL 12.0035X** and **UL 13.0071X**
- **Canadian Standards**:
  - Class I, Zone 0, Group IIC
  - Class I, Div 2, Group A,B,C & D;
  - Class II, Div 2, Group F & G

**Special Features:**
- **S** = Special features specified on purchase order (consult factory)

**Hazardous Area Ratings:**
- **EX** = Intrinsically Safe
- **NI** = Non-Incendive
- **Contact factory for voltage options**

**Notes & Tables:** All notes and tables referred to in the text can be found on the back page.

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**HS45 Incremental Ordering Options**

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: **HS45F-175-R2-SS-8192-ABZC-28V/V-SM18**).

All notes and tables referred to can be found on the back of this page.
**Dimensions**

**MS Connector Termination**

**R1 Tether Block and Pin**

**R2 Tether Arm (Fits Ø 7.25 [184] B.C.)**

**Table 1 Incremental Output Terminations**

The connector style will determine pinouts. For example, an encoder with ABC channels and an M18 connector uses the table to the right.

<table>
<thead>
<tr>
<th>Wire Color (Z2AWG)</th>
<th>DA VSP Connector</th>
<th>Channels Designated in Model No.</th>
<th>M18 Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEL</td>
<td>13</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>BLUE</td>
<td>14</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>GRN</td>
<td>15</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>RED</td>
<td>6</td>
<td>V (Supply Voltage)</td>
<td></td>
</tr>
<tr>
<td>BLK</td>
<td>1</td>
<td>G (Circuit Common)</td>
<td></td>
</tr>
<tr>
<td>GRN</td>
<td>9</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td></td>
<td>J</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1 Output Waveform**

**Notes**

1. The typical hollow shaft product is supported by, and clamped to, the driving shaft. A flexible tether is used to keep the housing from rotating.
2. The rubber seal is recommended in virtually all installations. The most common exceptions are applications requiring a very low starting torque or those requiring operation at both high temperature and high speed. For these exceptions, a felt seal is recommended. Felt seals require very low starting torque and can virtually eliminate frictional heat. Encoders ordered with felt seal will have an enclosure rating of IP50 and will have less than 1/10th the starting Torque specified under Mechanical Configurations.
3. Non-standard index widths and multiples are available by special order. Consult factory.
4. Complementary outputs are recommended for use with line driver type (source/sink) outputs. When used with differential receivers, this combination provides a high degree of noise immunity.
5. Output IC's: Output IC's are available as either Line Driver (LD) or NPN Open Collector (OC) types. Open Collectors require pull-up resistors, resulting in higher output source impedance (sink impedance is similar to that of line drivers). In general, use of a Line Driver type output is recommended. Line Drivers source or sink current and their lower impedance mean better noise immunity and faster switching times. Warning: Do not connect any line driver outputs directly to circuit common/OV, which may damage the driver. Unused outputs should be isolated and left floating. Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs.

**28V/W:** Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard (48V). This is the recommended replacement for 3904 and 7406R open collector outputs with internal pullup resistors. It is also a direct replacement for any 4469, 8830, 8830 or 26LS1 line driver.

**28V/S:** Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard, internally regulated with 5V (TTL compatible) logic out. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 120 mA typical (plus load current). This is the recommended replacement for 3904AR and 7406R open collector outputs with internal pullup resistors.

**28V/OC:** NPN Open Collector (3904*, 7272*). Current sink of 80 mA max. Current sourced by external pull-up resistor. Output can be pulled up to voltage other than supply voltage (33 V max). Input voltage 5 to 28 VDC +/- 5% standard. Supply current is 120 mA typical. This replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689. 5V/OCR, 15V/OCR, 24V/OCR: Open Collector (3904*, 7406*, 7272*). Current sink of 20 mA max. Current sourced by external pull-up resistor sized at approximately 100 ohms/volt. Max current source is 10 mA. Supply current is 100 mA typical, 120 mA with internal pull-ups. The 5V/OCR, 15V/OCR and 24V/OCR are often replaced by the 296F in system upgrades.

3904, 3904R, 4469, 5V/V, 5V/OC, 5V/OVR: Intrinsicly safe line driver and open collector outputs. These drivers are specific to intrinsically safe encoders and are installed per the appropriate control drawings listed in Table 2.1 on page 48.

6. Special –S at the end of the model number is used to define a variety of non-standard features such as special shaft lengths, voltage options, or special testing. Please consult the factory to discuss your special requirements.

7. Higher frequency response may be available. Please consult with the factory.

8. Extended temperature ratings are available in the following ranges:
-40 to 70°C, -40 to 85°C, -20 to 100°C and -40 to 100°C depending on the particular model. All models can operate down to -55°C. Extended temperature ranges can affect other performance factors. Consult with factory for more specific information.

9. Making straight plug receptacles may be ordered from the factory.

For M12 use MS3116F12-1S, For M14 use MS3116F14S-S3S
For M14/19 use MS3116H14-1S5, For M16 use MS3106F16S-1S5
For M18 use MS3106F18S-1S5, For M20 use MS3106F20S-2S5

* Products manufactured prior to April 2007 used the line driver IC number instead of voltage output in model number.