ENCODER SPECIFICATION

Model GCC40-14G3

FEATURES

• Multi-turn absolute
• Meets ballistic shock
• Fully qualified for tanks
• Large quantity delivered
• Radiation Hardened
• LED illuminators
• Single input voltage

SPECIFICATION SUMMARY

• Resolution 14 bits
• No. of turns for 14 bits 30
• Output Code Gray
• Format Serial
• Interface RS 485
• Input +5 volts
• Accuracy ± 1 LSB
• Diameter 4 inches
• Temperature
  Operating -25° to +140°F
  Storage -60° to +160°F
General Description:
Model GCC40-14G3 Shaft Position Encoder is a photo-optical device utilizing solid-state illumination sources and photodiode detectors. Inherently due to the electro-optical devices used, this unit is rad-hard as outlined herein. The code format is CW and CCW 14 bit cyclic binary gray code via RS-485 (NRX-L) encoded serial data. This unit will deliver aforementioned 14 bit gray code (16,384 counts) over 30 turns of the input shaft.

Mechanical Specifications:
- Encoder Outline Dimensions: See Sheet 5
- Weight: 10 lbs. max.
- Code: 14 bit cyclic gray code, serial format (Via RS-485 NRZ-L format)
- Function: Parallel gray code with RS-485 serial throughput
- Resolution: 0.022 degrees (1 count) over 30 turns of input shaft
- Shaft Loading
  - Axial: 8 lbs. rev. load max.
  - Radial: 30 lbs max applied to shaft in any direction perpendicular to the axis of rotation about the shaft circumference
- Shaft Backlash: \( \leq 0.33^\circ \)
- Shaft Runout: \( \leq 0.002 \) TIR
- Starting Torque
  - \( \leq 5.1 \) in-oz at > +55°F (+12.8°C)
  - \( \leq 15.0 \) in-oz at -25°F (-31.78°C)
- Moment of Inertia: \( \leq 0.34 \text{ gm/cm/sec}^2 \)
- Operating Speed: 1 RPS nominal

Electrical Specifications:
- Input:
  - Input Power: +5.0 VDC \( \pm 0.5 \) VDC
  - Power Consumption: \( \leq 3.75 \) Watts (W)
  - Insulation Resistance: 10 Megohms min. @ 100 ± 10 VDC
  - Chassis Isolation: The input power return of the encoder and the assembly chassis shall be isolated from one another such that the direct current resistance between them is not less than 10 Megohms.
Logic States/Code:

- **Code (Ref)**
  14 bit cyclic binary gray format 0.022° per gray code word (of shaft rotation) over 30 turns of input shaft

- **Direction of Rotation**
  Clockwise (CW) rotation of shaft (as viewed from the shaft end) shall produce an increasing count. Counterclockwise (CCW) rotation shall produce a decreasing count.

- **Logic**
  - **RS-485 Performance**
    The assembly shall comply with EIA Standard RS-485 including waveform characteristics, and shall be capable of transmitting NonReturn-to-Zero-L (NRZ-L) encoded serial data as shown on sheets 5 and 6 of this specification. The output shall consist of 1 MHz 14-pulse data produced at a maximum rate of 200 Hz.
  
  - **RS-485 Transmitter/Receiver**
    SN95176B (TI) or equivalent
  
  - **Logic States**
    - **High**
      1.5 VDC minimum
    - **Low**
      0.5 VDC maximum
    - **Sinking Current**
      ≥ 16 milliamperes (mA)
  
  - **Presentation of Output Data**
    The output shall be NRZ-L in gray code with the most significant bit (MSB) transmitted first. This will be in response to a 15-bit 1 MHz clock input. The 14-bit output will be synchronized with the last 14 bits.

  - **Accuracy (Serial Output)**
    Accuracy of the serial output signal shall be the theoretical serial output signal ± one bit in the least significant bit (LSB).

  - **Accuracy (Dynamic Motion)**
    A plus or minus two bits shall be allowed for dynamic motion.

- **Zero Position Definition**
  A zero position is the position of the inout shaft which corresponds to an output data word of all lows.

- **Illumination Source**
  GaAlAs Emitter. Useful life 100,000 hours minimum. (Radiation Hardened)

- **Photodetector**
  Photodiode (Radiation Hardened)
Environmental Characteristics:

- **Temperature**
  - Operating Temperature: -25°F to +140°F (-31.78°C to +60.0°C)
  - Storage Temperature: -60°F to +160°F (-51.0°C to +71.1°C)

- **Humidity**
  - Relative to 100%

- **Salt Fog**
  - Atmosphere shall consist of salt solution, 5% by weight Sodium Chloride (NaCl) and 95% by weight distilled water.
  - Salt Fog Exposure: +90°F to +95°F
  - Temperature Range: (+32.2°C to +35.0°C)

- **Vibration**
  - The vibration shall consist of a logarithmic sweep rate of 15 minutes per sweep cycle from 5 to 500 to 5 Hz.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Frequency (Hz)</th>
<th>Amplitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>5 to 25</td>
<td>± 1.0 g</td>
</tr>
<tr>
<td></td>
<td>25 to 35</td>
<td>0.030 inch</td>
</tr>
<tr>
<td></td>
<td>35 to 500</td>
<td>± 2.0 g</td>
</tr>
<tr>
<td>Longitudinal and Latitudinal</td>
<td>5 to 500</td>
<td>± 1.0 g</td>
</tr>
</tbody>
</table>

- **Shock**
  - **Basic Shock**
    - 30 ± 3 g for 11.0 ± 1.1 milliseconds (ms) duration half sine wave applied in each direction of three mutually perpendicular axes
  - **Gun Firing Shock**
    - 100 ± 10 g for 1.0 ± 0.1 milliseconds (ms) duration half sine wave applied in each direction of three mutually perpendicular axes
  - **Ballistic Shock**
    - 1000 ± 10 g for 1.0 ± 0.1 milliseconds (ms) duration half sine wave applied in each direction of three mutually perpendicular axes