

MODEL 633 SIX-DEGREE OF FREEDOM SENSOR

SPECIFICATIONS

- Silicon MEMS Gyro, DC Response
- $\pm 500^\circ/\text{sec}$ to $\pm 24,000^\circ/\text{sec}$ Rate Ranges
- Silicon PR MEMS Accels, DC Response
- $\pm 50\text{g}$ to $\pm 6000\text{g}$ Acceleration Ranges
- SAE J211 & ISO 6487 Compliant
- NHTSA FMVSS 202a Compliant

The Model 633 6-DOF Sensor is an analog sensor that includes outputs of three gyroscope/rate sensors and three DC accelerometers in one small package. The rate sensors and accelerometers are aligned orthogonally to each other which allow the user to measure motions in all 6 degrees of freedom (6-DOF).

Designed specifically for product research and development testing in harsh environments, the Model 633 maintains its precision under high shock conditions. The sensor utilizes silicon MEMS Gyro sensing elements with custom electronics and packaging to produce an angular rate sensor that is highly reliable even under excessive shock and vibration environments. The piezo-resistive MEMS acceleration sensors feature a full bridge output configuration with ideal gas damping tailored for outstanding shock survivability and a flat frequency response to $>6\text{kHz}$

For a similar sensor with lower acceleration and angular rate ranges, TE Connectivity also offers the model 634 6-DOF Sensor.

FEATURES

- Low Noise Jacketed Cables
- Rugged Integral Strain Relief
- Reliable Silicon MEMS Sensors
- -40 to $+105^\circ\text{C}$ Temperature Range
- Compact, Shock Resistant Package
- Low Cross-Axis Sensitivity

APPLICATIONS

- Auto Safety Crash Testing
- Dummy Instrumentation
- Pedestrian Impact
- Rollover Testing
- Motorsports Applications
- Biomechanics Testing
- Shock & Impact Testing

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PERFORMANCE SPECIFICATIONS

All values are typical at +24°C and 10Vdc excitation unless otherwise stated. TE Connectivity reserves the right to update and change these specifications without notice.

Parameters

DYNAMIC (ACCELERATION SENSORS)

| | -050 | -100 | -200 | -500 | -2K | -6K | Notes |
|----------------------------|--------|--------|--------|--------|--------|--------|--------------------------|
| Dash Number | -050 | -100 | -200 | -500 | -2K | -6K | See Ordering Info |
| Range (g) | ±50 | ±100 | ±200 | ±500 | ±2000 | ±6000 | |
| Sensitivity (mV/g) | 2.0 | 1.1 | 0.8 | 0.4 | 0.15 | 0.10 | Ratiometric ¹ |
| Frequency Response (Hz) | 0-1000 | 0-1200 | 0-1500 | 0-2500 | 0-5000 | 0-6000 | ±1/2dB |
| Natural Frequency (Hz) | 4000 | 6000 | 8000 | 10000 | 23000 | 26000 | |
| Non-Linearity (%FSO) | ±1.0 | ±1.0 | ±1.0 | ±1.0 | ±1.0 | ±1.0 | BFSL |
| Transverse Sensitivity (%) | <3 | <3 | <3 | <3 | <3 | <3 | <1% Typical |
| Shock Limit (g) | 5000 | 5000 | 5000 | 5000 | 10000 | 10000 | |
| Damping Ratio | 0.5 | 0.5 | 0.5 | 0.3 | 0.15 | 0.05 | Typical |

DYNAMIC (RATE SENSORS)

| | -500 | -1K5 | -6K | -12K | -18K | -24K | Notes |
|----------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| Dash Number | -500 | -1K5 | -6K | -12K | -18K | -24K | See Ordering Info |
| Range (deg/sec) | ±500 | ±1500 | ±6000 | ±12K | ±18K | ±24K | |
| Sensitivity (mV/deg/sec) | 4.00 | 1.33 | 0.333 | 0.167 | 0.111 | 0.083 | ±15% |
| Frequency Response (Hz) | 0-1000 | 0-1000 | 0-1000 | 0-2000 | 0-2000 | 0-2000 | +1dB/-3dB |
| Non-Linearity (%FSO) | ±0.5 | ±0.5 | ±0.5 | ±0.5 | ±0.5 | ±0.5 | BFSL |
| Cross-Axis Sensitivity (%) | <1 | <1 | <1 | <1 | <1 | <1 | |
| Shock Limit (g) | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | |
| Residual Noise (mV RMS) | 3.66 | 1.20 | 3.30 | 1.22 | 1.50 | 1.20 | Passband |

ELECTRICAL

| | | | | | | | |
|---|--------------------------------|--|--|--|--|--|------------------|
| Zero Acceleration Output (mV), Rate Sensors | ±100 | | | | | | Differential |
| Zero Acceleration Output (mV), Accel Sensors | ±25 | | | | | | |
| Excitation Voltage (Vdc), Rate Sensors | 4.9 to 16.0 | | | | | | Per channel |
| Excitation Voltage (Vdc), Accel Sensors | 2 to 10 | | | | | | Per channel |
| Excitation Current (mA), Rate Sensors | <8 | | | | | | Per channel |
| Influence of Linear Acceleration (deg/sec/g) | 0.1 | | | | | | For rate sensors |
| Common Mode Voltage (Vdc), Rate Sensors | 2.5 | | | | | | ±5% |
| Full Scale Output Voltage (Vpk), Rate Sensors | ±2 | | | | | | |
| Output Resistance (Ω), Rate Sensors | 400 | | | | | | |
| Input Resistance (Ω), Accel Sensors | 3000 to 5000 | | | | | | |
| Output Resistance (Ω), Accel Sensors | 3000 to 5000 | | | | | | |
| Insulation Resistance (MΩ) | >100 | | | | | | @100Vdc |
| Turn On Time (msec), Rate Sensors | <100 | | | | | | |
| Ground Isolation | Isolated from Mounting Surface | | | | | | |

ENVIRONMENTAL

| | | | | | | | |
|---|--------------------------|--|--|--|--|--|---------------|
| Thermal Zero Shift, Rate Sensors (%FSO) | ±2.5 | | | | | | -40 to +105°C |
| Thermal Sensitivity Shift, Rate Sensors (%) | ±2.0 | | | | | | -40 to +105°C |
| Thermal Zero Shift, Accel Sensors (mV/°C) | -0.11 ±0.11 | | | | | | -40 to +105°C |
| Thermal Sensitivity Shift, Accel Sensors (%/°C) | -0.25 ±0.25 | | | | | | -40 to +105°C |
| Operating Temperature (°C) | -40 to +105 | | | | | | |
| Humidity (Active Element & Electronics) | Hermetically Solder Seal | | | | | | |
| Humidity (Housing) | Epoxy Sealed, IP65 | | | | | | |

PHYSICAL

| | |
|-----------------------------|---|
| Case Material | Stainless Steel |
| Cable | 2x Cables; 12x #30AWG Cond PFA Insulated, Braided Shield, PU Jacket |
| Weight (cable not included) | 35 grams |
| Mounting | 2x #2.56 or M2 Mounting Screw |
| Mounting Torque | 4 lb-in (0.45 N-m) |

¹ Output is ratiometric to excitation voltage

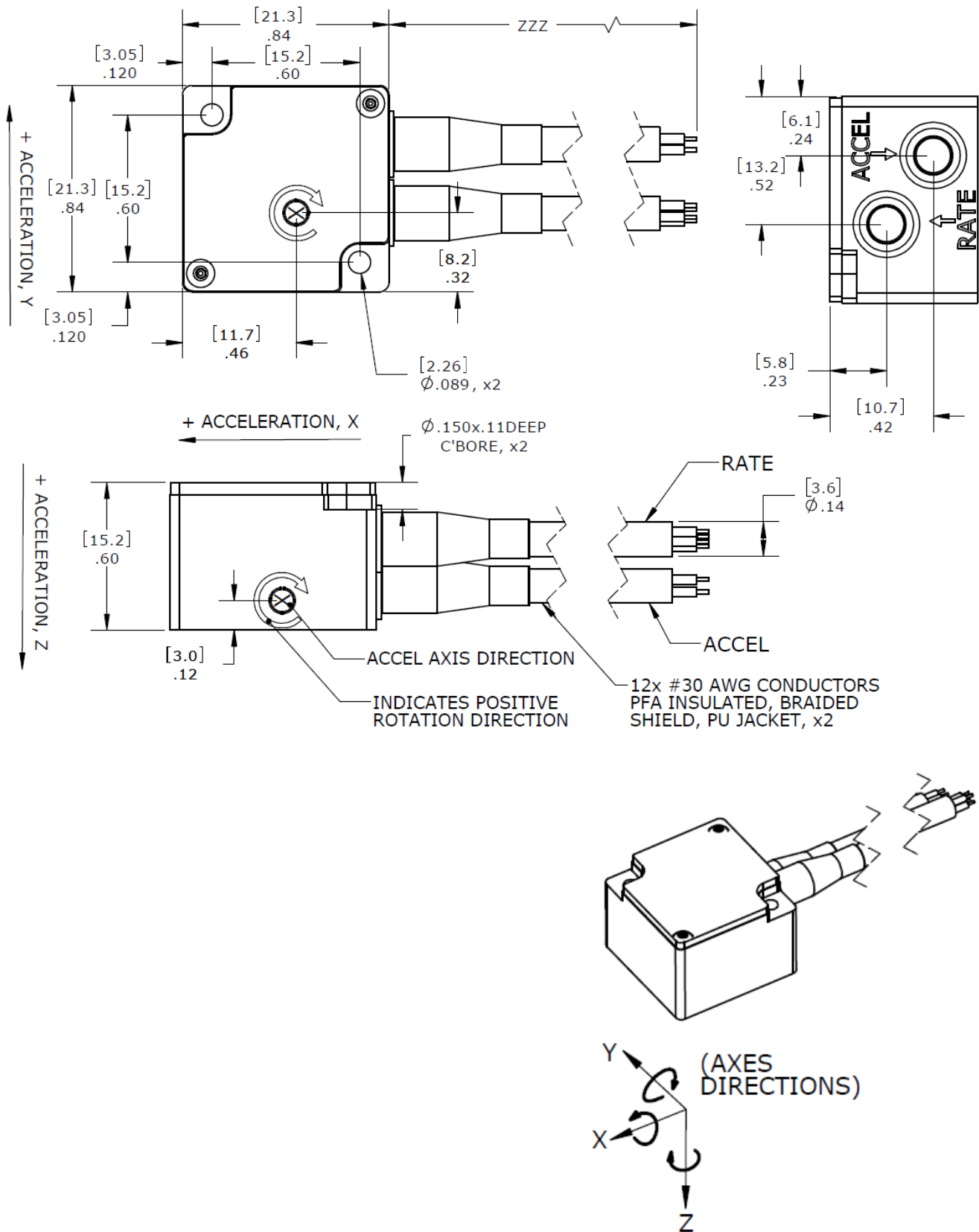
Calibration Supplied: CS-FREQ-0100 NIST Traceable Amplitude Calibration to FR Limit
CS-ARLIN NIST Traceable Linearity Calibration to FS Range

Supplied Accessories: AC-D03548 2x #2-56 (3/4" length) Socket Head Cap Screw

Optional Accessories: 121 3-Channel Precision Low Noise DC Amplifier

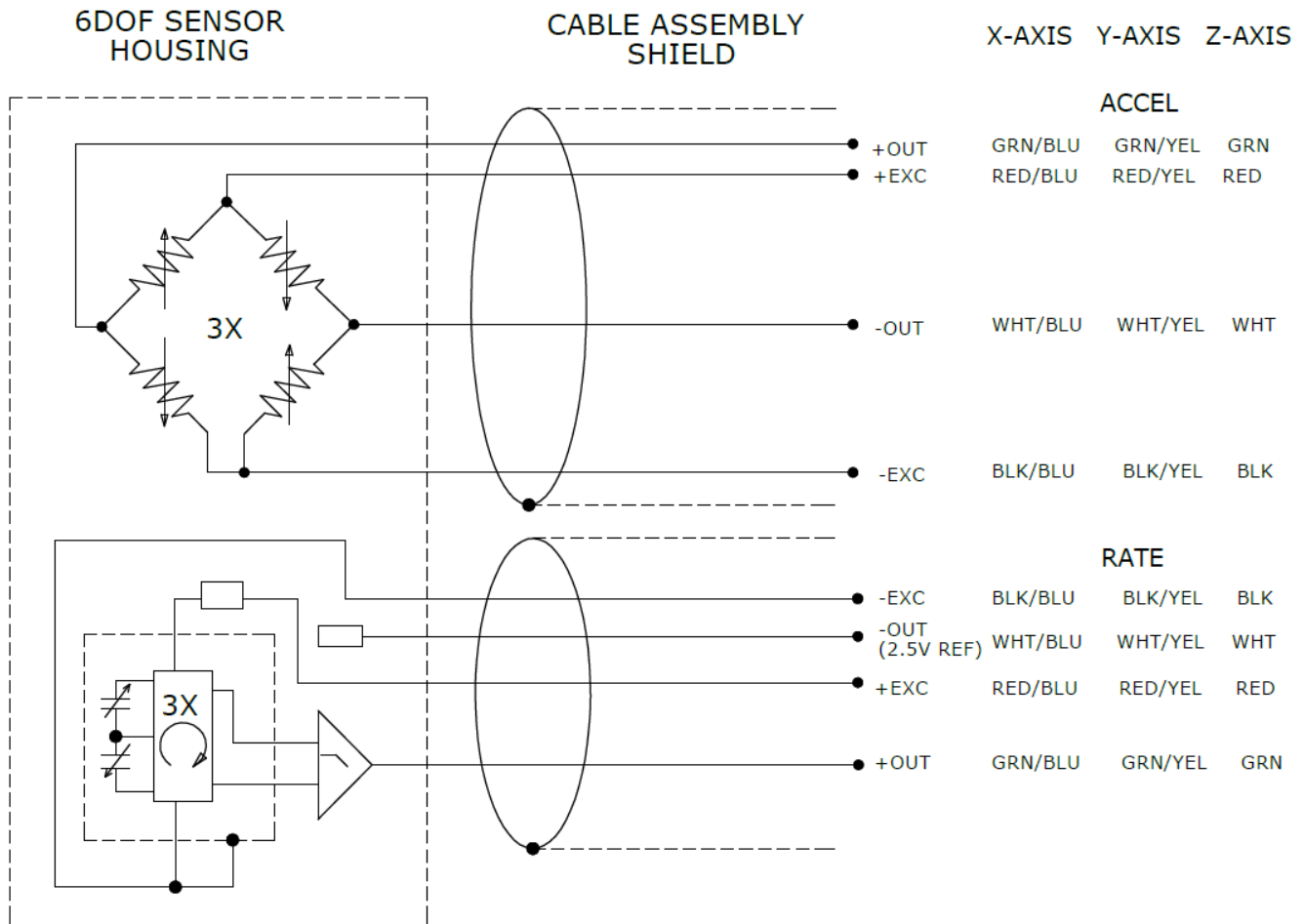
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DIMENSIONS



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SCHEMATIC



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ORDERING INFORMATION

| | | | | |
|---|------------|------------|------------|-----------|
| 633 | GGG | RRR | ZZZ | XX |
| Range (Accelerometer) | | | | |
| 050 = 50g | | | | |
| 100 = 100g | | | | |
| 200 = 200g | | | | |
| 500 = 500g | | | | |
| 2K = 2000g | | | | |
| 6K = 6000g | | | | |
| Range (Rate Sensor) | | | | |
| 500 = 500deg/sec | | | | |
| 1K5 = 1500deg/sec | | | | |
| 6K = 6000deg/sec | | | | |
| 12K = 12,000deg/sec | | | | |
| 18K = 18,000deg/sec | | | | |
| 24K = 24,000deg/sec | | | | |
| Cable Length | | | | |
| 120 = 120 inches, 10 feet | | | | |
| 240 = 240 inches, 20 feet | | | | |
| 360 = 360 inches, 30 feet | | | | |
| 600 = 600 inches, 50 feet | | | | |
| 197 = 197 inches, 5 meters | | | | |
| 276 = 276 inches, 7 meters | | | | |
| Reserved for custom designs. Leave blank for standard options listed above. | | | | |

Example; 633-500-6K-120
Model 633, 500g accel range, 6000deg/sec rate range, 120inch (10ft) cable length