

# MC5

Force and Torque Transducer



## APPLICATIONS

The MC5 force and torque transducer is particularly suitable for applications requiring simultaneous measurement of several forces and moments, or measurement of forces that change direction and position over time. Applications for this transducer include research and development in machining, robotics, ocean engineering and aerospace. It is commonly used in test frames and orthopedic simulators.

## DESCRIPTION

The MC5 force and torque transducer measures loads in the range between the capacities of AMTI's popular MC3 and MC8 transducers. It is available with vertical force capacities of 5,600 to 45,000 N (1,250 to 10,000 lbs) and corresponding horizontal force and moment capacities (see table on reverse side). These sensors are available with one to six outputs corresponding to  $F_x$ ,  $F_y$ ,  $F_z$ ,  $M_x$ ,  $M_y$ , and  $M_z$ . Models with custom capacities and layouts are available for special applications.

The MC5 has five-inch diameter circular top and bottom surfaces manufactured from high strength aluminum with an anodized finish. An elastomeric O-ring seal protects the strain gages and wiring, and internal sealing of the strain gages further ensures long life and consistent, reliable performance.

## CALIBRATION

Each sensor is inspected and tested in AMTI's calibration facility. The calibration procedure involves loading the transducer with ten point uniaxial loads at eight precise locations. These load sets are used by our calibration software to provide the six main sensitivity terms along with calibration matrices for crosstalk compensation.

## AMPLIFICATION

The MC5 force and torque sensor incorporates strain gages and a precision element to isolate and measure applied forces and moments. As with most conventional strain gage transducers, bridge excitation and signal amplification are required. AMTI's amplifiers are stable high gain devices which provide excitation and amplification for multiple channels in one convenient package. AMTI's amplifiers process the signals from the transducer and provide outputs suitable for an A/D converter and digital computer or other recording instrument.

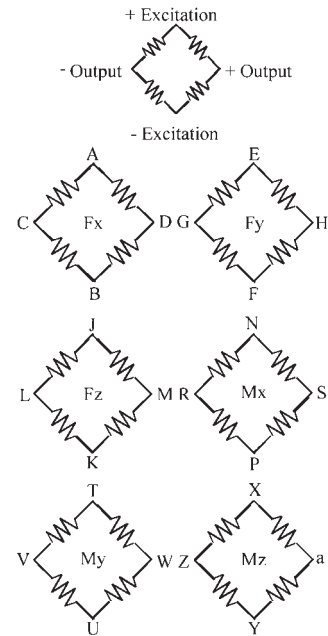
## CUSTOM

AMTI also offers many other multi-axis transducers to meet your specific needs. Units smaller than 1 inch (2.54 cm) in diameter and large transducers with 200,000 pound vertical capacities are available as standard products. Many of our sensors are waterproof and custom transducers are routinely designed and manufactured. Contact AMTI for additional information.

The following specifications are for estimating purposes. Actual precision calibrations are furnished with each instrument. The manufacturer reserves the right to alter the specifications without notice.

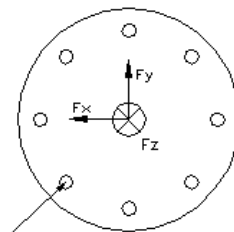
MC5 Series Specifications	1250	2500	5000	10000
Fz Capacity <sup>1</sup> , lb (N)	1250 (5560)	2500 (11125)	5000 (22250)	10000 (44500)
Fx, Fy Capacity <sup>1</sup> , lb (N)	625 (2780)	1250 (5340)	2500 (11125)	5000 (22250)
Mz Capacity, in-lb (Nm)	1250 (140)	2500 (283)	5000 (565)	10000 (1130)
Mx, My Capacity <sup>2</sup> , in-lb (Nm)	1800 (203)	3700 (418)	7500 (8480)	15000 (1695)
Fz Sensitivity, $\mu\text{V}/[\text{V}\cdot\text{lb}]$ ( $\mu\text{V}/[\text{V}\cdot\text{N}]$ )	1.0 (0.23)	0.5 (0.11)	0.24 (0.05)	0.12 (0.03)
Fx, Fy Sensitivity $\mu\text{V}/[\text{V}\cdot\text{lb}]$ ( $\mu\text{V}/[\text{V}\cdot\text{N}]$ )	4.0 (0.91)	2.0 (0.45)	1.0 (0.23)	0.5 (0.11)
Mz Sensitivity $\mu\text{V}/[\text{V}\cdot\text{in}\cdot\text{lb}]$ ( $\mu\text{V}/[\text{V}\cdot\text{N}\cdot\text{m}]$ )	1.4 (12.4)	0.7 (6.2)	0.4 (3.54)	0.2 (1.77)
Mx, My Sensitivity $\mu\text{V}/[\text{V}\cdot\text{in}\cdot\text{lb}]$ ( $\mu\text{V}/[\text{V}\cdot\text{N}\cdot\text{m}]$ )	2.3 (20.3)	1.15 (10.18)	0.6 (5.31)	0.3 (2.65)
Fz Stiffness $\times 10^6$ lb/in ( $\times 10^7$ N/m)	0.6 (10.5)	1.2 (21.0)	2.5 (43.8)	5.0 (87.6)
Fx, Fy Stiffness <sup>2</sup> $\times 10^6$ lb/in ( $\times 10^7$ N/m)	0.12 (2.1)	0.25 (4.4)	0.5 (8.8)	1.0 (17.5)
Mz Stiffness $\times 10^6$ in-lb/rad ( $\times 10^6$ Nm/rad)	0.5 (0.06)	1.0 (0.11)	2.0 (0.23)	4.0 (0.45)
Mx, My Stiffness $\times 10^6$ in-lb/rad ( $\times 10^6$ Nm/rad)	0.75 (0.09)	1.5 (0.17)	2.9 (0.33)	5.5 (0.62)
Lowest Resonant Frequency, Hz; Mx and My	440	625	880	1250

### WIRING FOR MC5 SENSOR

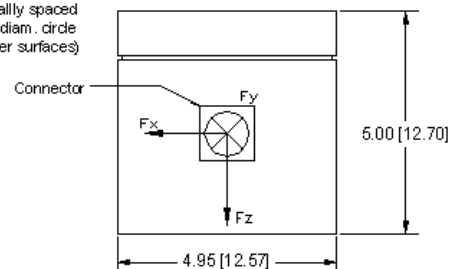


Bridge Fz = 700 ohms  
Bridges Fx; Fy; Mx; My; Mz = 350 ohms

Dimensions in inches (cm).



Eight 5/16"-18 threaded inserts equally spaced on 4.000 (10.16) diam. circle (upper and lower surfaces)



### CONNECTOR TYPE

Souriau 851-02E16-26P50-44

<sup>1</sup> The Fx, Fy and Fz capacities can be exceeded by a factor of 3 as long as the Mx, My and Mz capacities are not exceeded.

<sup>2</sup> Referenced to transducer origin located 2.37 in (6 cm) below top surface.

### GENERAL SPECIFICATIONS

**Safety Factor:** Minimum 50% above capacity

**Total Weight:** 7 lb (3 kg)

**Sensor Top Weight:** 3 lb (1.4kg)

**Excitation, Recommended :** 10V or less

**Temperature Range:** 0 to 125°F (-17 to 52°C)

**Fx, Fy, Fz hysteresis:**  $\pm 0.2\%$  Full Scale Output

**Fx, Fy, Fz non-linearity:**  $\pm 0.2\%$  Full Scale Output

**Crosstalk:** Less than 2% on all channels

The normalizing factor for force to moment crosstalk calculations is 40:1 (N to Nm), or 1:1 (lb to in-lb). For example, a 1 Nm moment is equivalent to a 40 N force and produces less than 0.8 N output on a force channel due to crosstalk.

ISO 9001:2000 CERTIFIED



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