



MCRT® 80001V

LOW CAPACITY BEARINGLESS TORQUEMETERS WITH HIGH PRECISION ANALOG, DIGITAL AND FM OUTPUTS

Torque Ranges: 5 to 50 N-m (44.3 to 443 lbf-in)

Best\* Real World Accuracy Of Any Similar Rotary Torquemeter, Torque Sensor Or Torque Transducer

Wide Installed Measurement Bandwidth and Fast Installed Response

Simple to Install, Tolerant of Wide Rotor-Stator Misalignment

Low Sensitivity to Clamping Loads

High Overrange

0.02% Combined Nonlinearity & Hysteresis

Noise Tolerant Carrier Amplification

Bi-Directional Rotor Shunt Calibration

No Hoop or Caliper Antennae



- Digital Output of Torque & Temperature
- Analog and FM Torque Outputs
- 3 kHz Signal Bandwidth
- Torque Max/Min's Updated @ 20 kHz
- 200% Overload, 150% Overrange
- 0.00054%/°C Compensation
- 0.036% Accuracy Class
- 13 Selectable Bessel Data Filters
- Interface Software Furnished
- Select from 10 Units of Measure Without Recalibration

\*NIST traceable calibration performed in our accredited laboratory (NVLAP Lab Code 200487-0). For details visit www.himmelstein.com or follow the accreditation link at www.nist.gov.

Low capacity MCRT® 80001V Rotary Torque Sensors have very high accuracy in real-world applications, not just in the cal lab. That's due to very high stiffness which yields wider installed bandwidth and faster response than competitive devices<sup>1</sup>. Furthermore, industries highest Overrange avoids errors<sup>2</sup> which occur when torque peaks are clipped. Two performance grades are offered.

A Carrier Amplifier, immune to dc and low frequency noise, handles the torque bridge output. Hardening against electromagnetic interference (EMI) generated by Variable Frequency Drives, ISM transmitters and other Industrial noise sources further enhances performance.

Bi-directional rotor shunt cal verifies calibration and operation of the entire data chain in CW and CCW modes.

It is invoked via stator switches, I/O line or from your computer. Multiple bridges and elegant design provide exceptional immunity to clamping and other extraneous loads. These devices have very high stiffness, low deflection and provide unsurpassed static and dynamic system response. The Torquemeter is installed without an additional coupling resulting in a torsionally stiff driveline with low overhung moment and a short overall length.

The torque signal is digitized on the rotor and sent to the stator where analog, frequency and Com Port outputs are created. Choose RS232/RS422/RS485 or USB (option) communication. Included software interfaces with your Windows-based PC. It displays Real-time, Max/Min and Spread Torque, Rotor Temperature, does limit checks, Torque versus Time plots and stores test results. Password protection may be invoked.

1. See Application Note 2211010 2. See Application Note 208058

## EXCEPTIONAL IMMUNITY TO NOISE AND INTERFERENCE FROM ISM TRANSMITTERS

Bearingless Torquemeters necessarily use unshielded antennae. As a result, any device (including a like Torquemeter) operating at or near their carrier frequency, can cause interference. FCC rules allow Industrial, Scientific and Medical (ISM) devices to generate unlimited energy. Most Bearingless Torquemeters use

an ISM frequency for power and/or data transfer. As a result, they are susceptible to interference from other ISM devices. Since FCC rules only allow narrow band (typically  $\pm 7$  kHz) transmission for unlicensed use, wideband ISM frequency Torquemeters risk violation of FCC regulations. Himmelstein Bearingless Torquemeters use non-ISM frequency for power and data, have field strengths within FCC rules, powerful 12 pole signal filters and near field (not radiated field) signal transfer.

Common Specifications*	Performance Grade	
	Code N	Code C
<b>Torque Range<sup>1</sup></b>	Factory Set @ Transducer Full Scale Torque Range; see Note 1.	
<b>Torque Units of Measure</b>	Select From: N-m, kN-m, N-cm, kgf-m, gf-cm, lbf-in, lbf-ft, ozf-in, ozf-ft without re-calibration	
<b>Temperature Units of Measure</b>	Select °F or °C without re-calibration	
<b>Combined Nonlinearity and Hysteresis</b> (0 to $\pm 100\%$ of full scale) <small>(Best Fit Line Basis - see Tech Memo 230104)</small>	$\leq \pm 0.04\%$	$\leq \pm 0.02\%$ (not available on 5 N-m range)
<b>Overload</b> (% of Range)	$\pm 200$	
<b>Overrange<sup>2</sup></b> (% of Range)	150. Applies to all outputs except limited to $\pm 15V$ on Analog Outputs and 200% on CCW FM output.	
<b>Repeatability</b>	$\leq \pm 0.02\%$ of Range	$\leq \pm 0.01\%$ of Range
<b>Accuracy Class<sup>3</sup></b>	0.04%	0.036%
<b>Calibration Signal<sup>4</sup></b>	100% of full scale for clockwise and counterclockwise directions	
<b>Zero Drift</b> (% of Range per °C/ per °F)	$\leq \pm 0.0018/0.001$	$\leq \pm 0.00054/0.0003$
<b>Span Drift</b> (% of Reading per °C/ per °F)	$\leq \pm 0.0036/0.002$	$\leq \pm 0.0036/0.002$
<b>24 Hour Drift</b> (% of Range - applies to all outputs)	$\leq \pm 0.02$	
<b>Temperature Ranges</b> (°C/°F)	Compensated Range: +24 to +79.4/+75 to +175; Usable Range: -32 to +85/-25 to +185; Storage Range: -54 to +107/-65 to +225	
<b>Permissible Rotor to Stator Gap</b> (mm/inch)	Axial: $\pm 10.2/\pm 0.4$ . Radial: 7.6/0.3 with or without Optical (Code O) Speed Pickup Option	
<b>Analog Output Signals<sup>5</sup>, Auto Scaled</b>	Allowable Load: 10k resistive, minimum; 0.05 $\mu$ F capacitive, maximum.	
<b>Full Scale Torque</b>	$\pm 10V$ with $\pm 15V$ overrange. User may select $\pm 5V$ with $\pm 15$ overrange.	
<b>Signal Filter Cutoff Frequency<sup>1</sup></b>	From 0.1 Hz to 1 kHz in thirteen 1-2-5 steps plus 3 kHz. Filters have Bessel Response; and are free from delay distortion and overshoot errors.	
<b>Frequency Modulated Output<sup>5</sup></b>	Frequency: 10 $\pm 5/20\pm 10/40\pm 20$ kHz; field changeable (Default = 10 $\pm 5$ kHz); TTL square wave	
<b>Peak-Peak Digital Output<sup>5</sup> Noise vs Filter Cutoff Frequency</b>	<0.0001 @ 0.1 Hz, 0.002 @ 1 Hz, 0.004 @ 10 Hz, 0.01 @ 100 Hz, 0.0372 @ 1 kHz, 0.06 @ 3 KHz	
<b>Peak-Peak Digital Output<sup>5,6</sup> Noise vs Filter Cutoff Frequency</b> (millivolt)	On 10V setting: 6 @ 0.1 to 100 Hz, 8 @ 1 kHz and 12 @ 3 kHz. On 5V setting: 6 @ 0.1 to 100 kHz, 7 @ 1 kHz and 8 @ 3 kHz.	
<b>Torque Sampling Rate and Bandwidth</b>	Sampled @ 20 kHz. Torque 3 dB bandwidth is 3 kHz reducible by filters (see Note 6 & above).	
<b>Rotor-to-Stator Transfer Rate</b>	1.25 Mbaud	
<b>RS232/RS422/RS485/USB Communication<sup>7</sup></b>	Com port outputs Torque and Temperature with units of measure. Inputs torque range if other than sensor full scale, selects units of measure, selects filter cutoff, etc. and permits remote computer control of the test. For USB interface specify Option U.	
<b>BAUD Rate</b>	115,200; Drivers are protected for short circuit (current limit) and $\pm 15$ kV ESD protected.	
<b>Maximum Cable Length</b>	RS232 = 15 m, RS422/485 = 1,220 m; 120 $\Omega$ termination may be accessed via software.	
<b>Interface Software With Torque Limits</b>	Provided to interface with Windows-based PC. Includes 6 m interconnect cable <sup>8</sup> for a PC. Flags on PC screen classify user-set High and Low Limits for Current, or Max/Min of Speed (Max-Min)	
<b>I/O Lines and FM Output<sup>5</sup></b>	Input lines are +Cal, -Cal, Tare, Clear Tare, Reset Max/Min. Output lines are Data OK & FM.	
<b>Status LEDs</b> (on Stator Keypad)	3 LEDs: <b>Power</b> (Yellow = Power-up, Green = OK, Red = Fault); <b>Data</b> (Green = OK, Red = Data Error); <b>Rotor Temperature</b> (Green = In Operating Range, Red = Out of Operating Range).	
<b>Keypad Control Switches</b>	+CAL invokes CW Rotor Shunt Cal, -CAL invokes CCW Rotor Shunt Cal, Both held simultaneously for 5 seconds invokes Tare.	
<b>Rotor Temperature</b>	Rotor temperature is output via Com Port. Range is -18 to 85 °C; Accuracy is $\pm 1^\circ$ C.	
<b>Optional Zero Velocity Speed Pickups</b>	Outputs Pulse Train: 30 ppr for Optical Type	
<b>Supply Voltage/Power<sup>5</sup></b>	10 to 26 VDC @ 6 to 11 watt nominal, varies with rotor misalignment	

**Specification Notes:**

1. Outputs may be set at any value equal to or less than the Torquemeter Full Scale Rating. For example: If the Full Scale Rating is 50 N-m, the user may re-scale to 20 N-m. Then the analog output would be 5 or 10 volt at 20 N-m and the digital output, at the Com Port, would be 20. However, the above specification still defines measurement resolution. See Application Note 20804 for further details on Torquemeters operated with extended measuring range.
  2. **In the overrange region** all outputs are guaranteed to have combined nonlinearity and hysteresis less than 0.1% of full scale. This avoids large average and peak torque errors that driveline resonance and pulsating driver and load devices can cause near the high end of the sensor range. See Application Note 20805B for more complete information. Torquemeters have infinite fatigue life for full reversals up to half their overload rating. Above that, you risk a fatigue failure. An MCRT® 80001V will provide accurate data, without yielding, when torque peaks are 200% of its full scale rating. However, its fatigue life will be reduced and, therefore, **it should not be used continuously of for long periods above half its overload rating.** Additionally, if you are using the analog output, it is linear up to 15 volt. That corresponds to 150% of full scale on the 10 volt output setting and 300% on the 5 volt output setting. Accordingly, if you expect torque peaks greater than 150% of full scale, you should switch to the 5 volt setting.
  3. The greatest of Combined Error, Repeatability, Zero Drift and Span Drift over 10°C (18°F). It is expressed as a percent of full scale.
  4. CW torque causes CW rotation if viewed from the driving end. CCW torque causes the opposite rotation.
  5. Power Input and all outputs are protected. Digital inputs are reverse polarity and overvoltage protected.
  6. Torque signal bandwidth upper limit is 3 kHz determined by the integral anti-aliasing filter. Realizable, installed measurement bandwidth is limited by driveline components. A Torquemeters principal contribution is determined by its torsional stiffness; see Application Note 221101D for further information.
  7. Analog noise is measured by an Agilent U1520A Scope with bandwidth set to 10 kHz.
  8. A 20 foot long Torquemeter to RS485 Com Port cable is shipped with each Torquemeter. That communication protocol provides for long, robust connection in a noisy industrial environment, and permits connection of multiple Torquemeters to a single host computer. An optional USB to RS422/585 adapter is available, if needed; specify option U.
  9. Fused and reverse polarity protected.
- Specifications are subject to change without notice.

## MCRT® 80001V Bearingless Torquemeters

MCRT® Model	Torque Rating		Speed Rating	Torsional Stiffness	Maximum Angular Deflection	Rotating Inertia	Maximum Extraneous Loads <sup>1</sup>			Max Rotor Weight
	Range	Overload					Thrust	Bending	Shear	
<b>SI Units</b>	<b>[N-m]</b>		<b>[rpm]</b>	<b>[N-m/rad]</b>	<b>[degree]</b>	<b>[kg-m<sup>2</sup>]</b>	<b>[N]</b>	<b>[N-m]</b>	<b>[N]</b>	<b>[kg]</b>
80001V(5-0 Nm)	5	10	0 to ±15,000 Suffix H or, 0 to ±8,500 Suffix B	2,330	0.123	0.00196	222	2.8	58	0.835
80001V(1-1 Nm)	10	20		6,670	0.087	0.00197	445	5.7	111	0.837
80001V(2-1 Nm)	20	40		18,110	0.063	0.00197	890	11.3	222	0.840
80001V(5-1 Nm)	50	100		70,040	0.041	0.00197	2,224	28.3	556	0.847
<b>English Units</b>	<b>[lbf-in]</b>			<b>[lbf-in/rad]</b>	<b>[degree]</b>	<b>[ozf-in s<sup>2</sup>]</b>	<b>[lbf]</b>	<b>[lbf-in]</b>	<b>[lbf]</b>	<b>[lbs]</b>
80001V(5-0 Nm)	44.3	88.5		20,620	0.123	0.278	50	25.0	13	1.84
80001V(1-1 Nm)	88.5	177		58,140	0.087	0.279	100	50.0	25	1.85
80001V(2-1 Nm)	177	354		160,300	0.063	0.279	200	100	50	1.85
80001V(5-1 Nm)	443	886		619,900	0.041	0.279	500	250	125	1.87

**Note 1.** Maximum extraneous loads and rated torque may be applied simultaneously without damage.

### Order Number Format ➔ MCRT® A B C D E F

**A** = Model Number; 80001V.

**B** = Range from tables above; (5-0 Nm) or (2-1 Nm), etc.

**C** = Performance Code; N for Standard or C for Enhanced Performance.

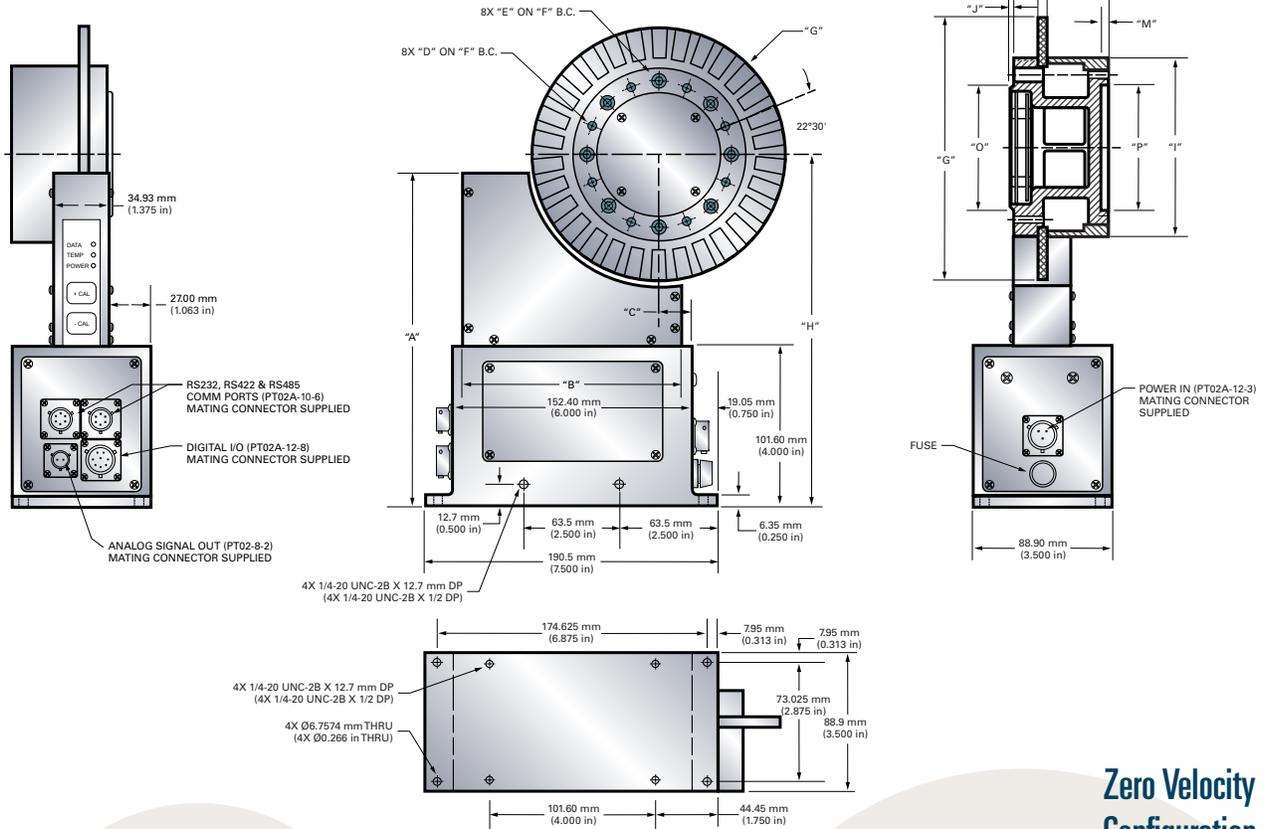
**D** = Optional Zero Velocity Speed Pickup; N for None or O for Optical Type.

**E** = Maximum Speed Rating Suffix; H designates 15,000 rpm, B designates 8,500 rpm.

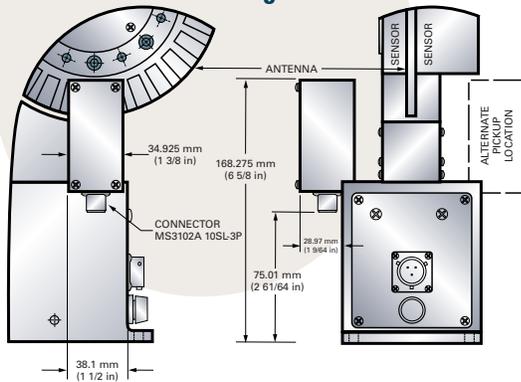
**F** = USB Interface; U when RS422/485 adapter is furnished, N when omitted.

**Order Number Example ➔ MCRT® 80001V(1-1 N-m)COHU** is a Bearingless Torquemeter with a 10 N-m (88.5 lbf-in) Torque Rating, a 20 N-m (177 lbf-in) Torque Overload Rating, Enhanced Performance, an Optical Speed Pickup, a 15,000 rpm Maximum Speed Rating and USB Adapter.

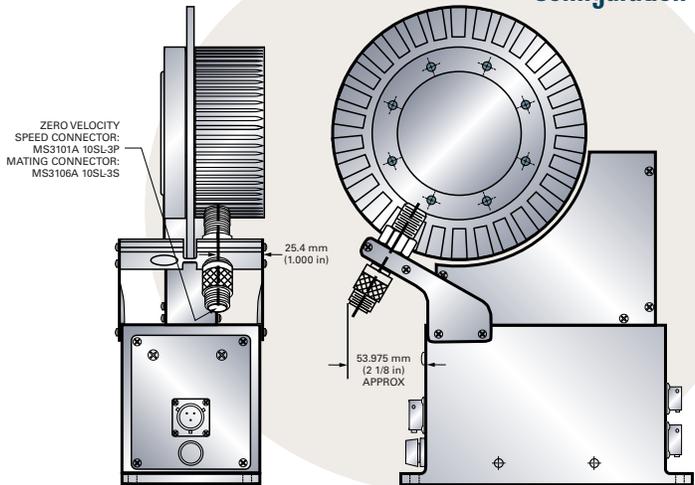
# Outline Dimensions\*



## Optical Encoder Configuration



## Zero Velocity Configuration



## Zero Velocity Configuration

Units	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P
SI	215.49	139.70	20.85	M4 X 17.4	Ø4.62 THRU Ø8.30 X 47.63 DP C'BORE	89.00	Ø161.93	227.03	Ø111.13	3.18	63.50	41.275	4.78	79.365 79.352	79.393 79.375
English	8.484	5.500	0.813	M4 X 0.685	Ø0.182 THRU Ø0.328 X 1.875 DP C'BORE	Ø3.504	Ø6.375	8.938	Ø4.375	0.125	2.500	1.625	0.188	3.1246 3.1241	3.1257 3.1250

\* Please note, dimensions are subject to change without notice. Please contact factory for certified drawings.

# S. Himmelstein and Company

Designing and Making the World's Best Torque Instruments since 1960

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