

# MCRT<sup>®</sup> 86000V & MCRT<sup>®</sup> 87000V

## Bearingless Digital Torquemeters

Torque Ranges: 500 to 750,000 lbf-in. (56.5 N-m to 84.8 kN-m)

### HIGH ACCURACY UNDER REAL - WORLD CONDITIONS

**HIGHEST OVERRANGE AND OVERLOAD**  
**WORLD CLASS TEMPERATURE PERFORMANCE**  
**BEST DYNAMIC RESPONSE**  
**BI-DIRECTIONAL ROTOR SHUNT CALIBRATION**  
**SIMPLE, NON-CRITICAL INSTALLATION**

- 0.05% Accuracy\*
- 200% & 400% Overload
- 300% Overrange
- 0.0006%/°F Compensation
- 3 kHz Data Bandwidth
- Analog and FM Outputs
- Digital Output with Temperature
- 10 Units of Measure
- 11 Bessel Data Filters
- Max/Min's Updated @ 21 kHz
- Interface Software Furnished
- Zero Velocity Speed Pickup Options



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

MCRT<sup>®</sup>86000V and 87000V Torquemeters have **high accuracy in real-world applications, not just in the cal lab**. That's due, in part, to **industries highest Overrange**. High Overrange avoids clipping real-world torque peaks and driveline torsionals. **Without high Overrange, clipped peaks produce large measurement errors<sup>1</sup>**.

World class temperature performance greatly reduces drive heating and gradient errors. Also enhancing real world performance is noise hardening against electromagnetic interference (EMI) generated by Variable Frequency Drives, ISM transmitters and other industrial noise sources.

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

1. See Application Note 20805B

invoked via stator switches, I/O line or from your computer. Multiple bridges provide immunity to extraneous loads. The short torque path yields high stiffness, low deflection and provides exceptional static and dynamic system response. The torque-meter is installed without an additional coupling resulting in a torsionally stiff driveline, with low overhung moment and a short overall length.

The sensors' output is digitized on the rotor and sent to the stator where analog, frequency and Com Port outputs are created. Choose RS232, RS422, or RS485 communications. Included software interfaces with your Windows-based PC. It displays Real-time, Max/Min and Spread Torque, does limit checks, torque versus time plots and stores test results. Password protection may be invoked when needed.

# **S. HIMMELSTEIN AND COMPANY**

*Designing and Making the Worlds Best Torque Instruments Since 1960*

## Exceptional Immunity To Noise And Interference From ISM Transmitters

To achieve short length, high stiffness and wide signal bandwidth, bearingless sensors use unshielded antennae. As a result, any device (including a like torquemeter) operating at or near its carrier frequency, can cause interference.

FCC rules allow Industrial, Scientific and Medical (ISM) devices to generate unlimited energy. Such ISM devices are commonplace in industry where they are used for inventory control, parts tracking, controlling personnel access, induction heating, etc.

Most Bearingless Torquemeters use a **single ISM frequency**. 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 frequencies 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*	Code N Performance	Code C Performance
<b>Torque Range</b>	Factory Set @ Transducer Full Scale Torque; see Note 1.	
<b>Units of Measure</b>	User may select from lbf-in, lbf-ft, ozf-in, ozf-ft, N-m, kN-m, N-cm, kgf-m, kgf-cm, gf-cm without re-calibration	
<b>Accuracy</b> <sup>2</sup> (nonlinearity, hysteresis & repeatability)	$\leq \pm 0.1$ (End Point, % of Range)	$\leq \pm 0.05$ (End Point, % of Range)
<b>Bi-polar Shunt Calibration Enable</b>	From Stator Switches (one CW, one CCW), via TTL I/O, or PC Com Port using furnished software.	
<b>Zero Drift</b> (% of Range/deg. F.)	$\leq \pm 0.001$	$\leq \pm 0.0006$
<b>Span Drift</b> (% of Reading/deg. F.)	$\leq \pm 0.002$	$\leq \pm 0.002$
<b>Temperature Ranges</b> (deg. F.)	Compensated Range: +75 to +175; Usable Range: -25 to +185; Storage Range: -65 to +225	
<b>Rotor to Stator Maximum Misalignment</b> (inches)	Axial: $\pm 0.4$ , except 86/87008V Series are $\pm 0.25$ , Radial: 0.3 except it is 0.04 $\pm 0.01$ with Magnetic (Code Z) Speed Pickup.	
<b>Rotational Effects</b> (% of Range)	$\leq \pm 0.01$	
<b>Analog Output Signals<sup>6</sup>, Auto-Scaled</b>	Allowable Load: 10k resistive, minimum; 0.05 $\mu$ F capacitive, maximum.	
<b>MCRT<sup>®</sup> 86000V Full Scale Torque<sup>3</sup></b>	Default is $\pm 10V$ with $\pm 15V$ overrange. User may select $\pm 5V$ with $\pm 7.5V$ overrange. Caution: see Note 7.	
<b>MCRT<sup>®</sup> 87000V Full Scale Torque<sup>3</sup></b>	Default is $\pm 5V$ with $\pm 15V$ overrange. User may select $\pm 10V$ with $\pm 15V$ overrange. Caution: see Note 7.	
<b>Signal Filter Cutoff Frequency<sup>4</sup></b>	Field selectable from 1 Hz to 1 kHz in ten 1-2-5 steps plus 3 kHz selected from a remote PC using furnished software. Filters have Bessel Response; and are free from delay distortion or overshoot errors.	
<b>Frequency Modulated Output, Auto-Scaled</b>	Frequency: 10 $\pm 5$ kHz or 20 $\pm 10$ kHz or 40 $\pm 20$ kHz; field changeable (Default = 10 $\pm 5$ kHz); TTL square wave output.	
<b>Overrange</b> (% of Range, see Application Note 20805)	150 to 300; model/user selection dependent - see above. Applies to analog, Digital and FM (except for CCW side) Outputs.	
<b>System Resolution<sup>2</sup></b> (% of Range)	0.01	
<b>Output Noise, All Outputs</b> (% of Range)	<0.01 at 1Hz, <0.01 at 10 Hz, < 0.015 at 100 Hz, <0.028 at 1 kHz and <0.041 at 3 kHz.	
<b>Torque Sampling Rate and Bandwidth</b>	Torque is sampled @ 21 kHz. Its' 3db bandwidth is 3 kHz but can be reduced by filters (see above).	
<b>Rotor-to-Stator Transfer Rate</b>	1.25 MBaud	
<b>RS232, RS422, RS485 Communications Port</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 BAUD Rate, and permits remote computer control of the test.	
<b>BAUD Rate</b>	115,200; Drivers are protected for short circuit (current limit) and $\pm 15kV$ ESD protected.	
<b>Maximum Cable Length</b>	RS232 = 50 feet, RS422/485 = 4,000 feet; 120 Ohm termination may be accessed via software.	
<b>Interface Software With Torque Limits</b>	Provided to interface with Windows-based PC. Includes 20 foot interconnect cable for a PC. Flags on PC screen classify user-set High and Low Limits for Current, or Max/Min or Spread (Max - Min) Torque data.	
<b>I/O Lines and FM Output</b>	5 input and 2 output lines. Input lines are +CAL, -CAL, TARE, CLEAR TARE, and RESET MAX/MIN. Output lines are Data OK and FM Torque Signal.	
<b>Status LED's</b> (on Stator Keypad)	Three Color Coded LED's: <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, Auxiliary Measurement</b>	Rotor temperature is output via Com Port. Range is 0 to 185 degrees F.; Accuracy is $\pm 2$ degrees nominal. See above for status LED's.	
<b>Optional Zero Velocity Speed Pickups</b>	Optical (Code O) and Magnetic (Code Z) pickups outputs 30 to 60 pulses/revolution, model dependent.	
<b>Supply Voltage/Power<sup>5</sup></b>	10 to 26 VDC @ 6 Watts with Antenna aligned to 10 Watts with maximum specified misalignments.	

### Notes:

- Outputs may be set at any value  $\leq$  Torquemeter Full Scale Rating. *For example:* If the Full Scale Rating is 10,000 lbf-in, the user may re-scale to 5,000 lbf-in. Then the analog output would be 5 or 10 Volts at 5,000 lbf-in and the digital output, at the Com Port, would be 5,000. However, the specification still defines measurement accuracy, i.e., 0.1% (for code N) or 0.05% (for code C) of the sensor full scale range— a possible error of 10 lbf-in (code N) or 5 lbf-in (code C). In other words, you can use this capability to change the scaling but it will not change measurement accuracy; see Application Note 20804 for further details on Torquemeters operated with extended measuring range.
  - Assumes torque range is set to the device full scale torque rating.
  - CW torque causes CW rotation if viewed from its driven end. CCW torque causes the opposite rotation.
  - Torque signal bandwidth upper limit is 3 kHz determined by the integral anti-aliasing filter. Realizable measurement bandwidth is limited by driveline components; see Technical Memorandum 8150.
  - Fused and reverse polarity protected.
  - All outputs are fused. Digital inputs are reverse polarity and overvoltage protected.
  - Torquemeters have infinite fatigue life for full reversals up to half their overload rating. Above that, you risk a fatigue failure. Outputs are linear to the overrange rating which, for the 87000V, exceeds the infinite fatigue life threshold (50% of the overload rating). Do not knowingly operate in this region.
- \* Specifications are subject to change without notice.

**Standard Ratings,  
MCRT® 86000V Bearingless Torquemeters With 200% Overload (Call for Other Capacities)**

MCRT® Model	Torque Rating		Speed Rating	Torsional Stiffness	Maximum Angular Deflection	Rotating Inertia	Maximum Extraneous Loads <sup>2</sup>			Max Rotor Wt.
	Range	Overload					Thrust	Bending	Shear	
	[lbf-in]*						[rpm]	[lbf-in/rad]	[degree]	
86002V(5-2)	500	1,000	0 to ±15,000	2.77 X 10 <sup>6</sup>	0.010	0.67	500	250	125	6
86002V(1-3)	1,000	2,000	0 to ±15,000	2.77 X 10 <sup>6</sup>	0.021	0.67	1,000	500	250	6
86004V(2-3)	2,000	4,000	0 to ±13,500	1.61 X 10 <sup>7</sup>	0.007	7.2	2,000	1,000	400	28
86004V(5-3)	5,000	10,000	0 to ±13,500	2.04 X 10 <sup>7</sup>	0.014	7.2	4,000	2,000	800	28
86004V(1-4)	10,000	20,000	0 to ±13,500	2.73 X 10 <sup>7</sup>	0.021	7.2	7,000	3,500	1,000	28
86007V(2-4)	20,000	40,000	0 to ±10,000	2.87 X 10 <sup>8</sup>	0.004	59	10,000	5,000	2,000	94
86007V(5-4)	50,000	100,000	0 to ±10,000	3.09 X 10 <sup>8</sup>	0.009	59	20,000	10,000	4,000	94
86007V(1-5)	100,000	200,000	0 to ±10,000	3.20 X 10 <sup>8</sup>	0.018	59	30,000	15,000	5,000	94
86008V(3-5)	300,000	600,000	0 to ±5,000	3.60 X 10 <sup>8</sup>	0.047	72.2	15,000	100,000	15,000	78
86008V(5-5)	500,000	1,000,000	0 to ±5,000	4.90 X 10 <sup>8</sup>	0.058	73.8	25,000	150,000	25,000	80
86008V(75-4)	750,000	1,500,000	0 to ±5,000	5.80 X 10 <sup>8</sup>	0.075	75.3	37,500	250,000	37,500	82


**Standard Ratings,  
MCRT® 87000V Bearingless Torquemeters With 400% Overload (Call for Higher Capacities)**

MCRT® Model	Torque Rating		Speed Rating	Torsional Stiffness	Maximum Angular Deflection	Rotating Inertia	Maximum Extraneous Loads <sup>2</sup>			Max Rotor Wt.
	Range	Overload					Thrust	Bending	Shear	
	[lbf-in]*						[rpm]	[lbf-in/rad]	[degree]	
87002V(5-2)	500	2,000	0 to ±15,000	2.77 X 10 <sup>6</sup>	0.010	0.67	1,000	500	250	6
87004V(1-3)	1,000	4,000	0 to ±13,500	1.61 X 10 <sup>7</sup>	0.003	7.2	2,000	1,000	400	28
87004(25-2)	2,500	10,000	0 to ±13,500	2.04 X 10 <sup>7</sup>	0.007	7.2	4,000	2,000	800	28
87004V(5-3)	5,000	20,000	0 to ±13,500	2.73 X 10 <sup>7</sup>	0.010	7.2	7,000	3,500	1,000	28
87007V(1-4)	10,000	40,000	0 to ±10,000	2.87 X 10 <sup>8</sup>	0.002	59	10,000	5,000	2,000	94
87007V(25-3)	25,000	100,000	0 to ±10,000	3.09 X 10 <sup>8</sup>	0.005	59	20,000	10,000	4,000	94
87007V(5-4)	50,000	200,000	0 to ±10,000	3.20 X 10 <sup>8</sup>	0.009	59	30,000	15,000	5,000	94
87008V(15-4)	150,000	600,000	0 to ±5,000	3.60 X 10 <sup>8</sup>	0.024	72.2	15,000	100,000	15,000	78
87008V(25-4)	250,000	1,000,000	0 to ±5,000	4.90 X 10 <sup>8</sup>	0.029	73.8	25,000	150,000	25,000	80
87008V(375-3)	375,000	1,500,000	0 to ±5,000	5.80 X 10 <sup>8</sup>	0.037	75.3	37,500	250,000	37,500	82

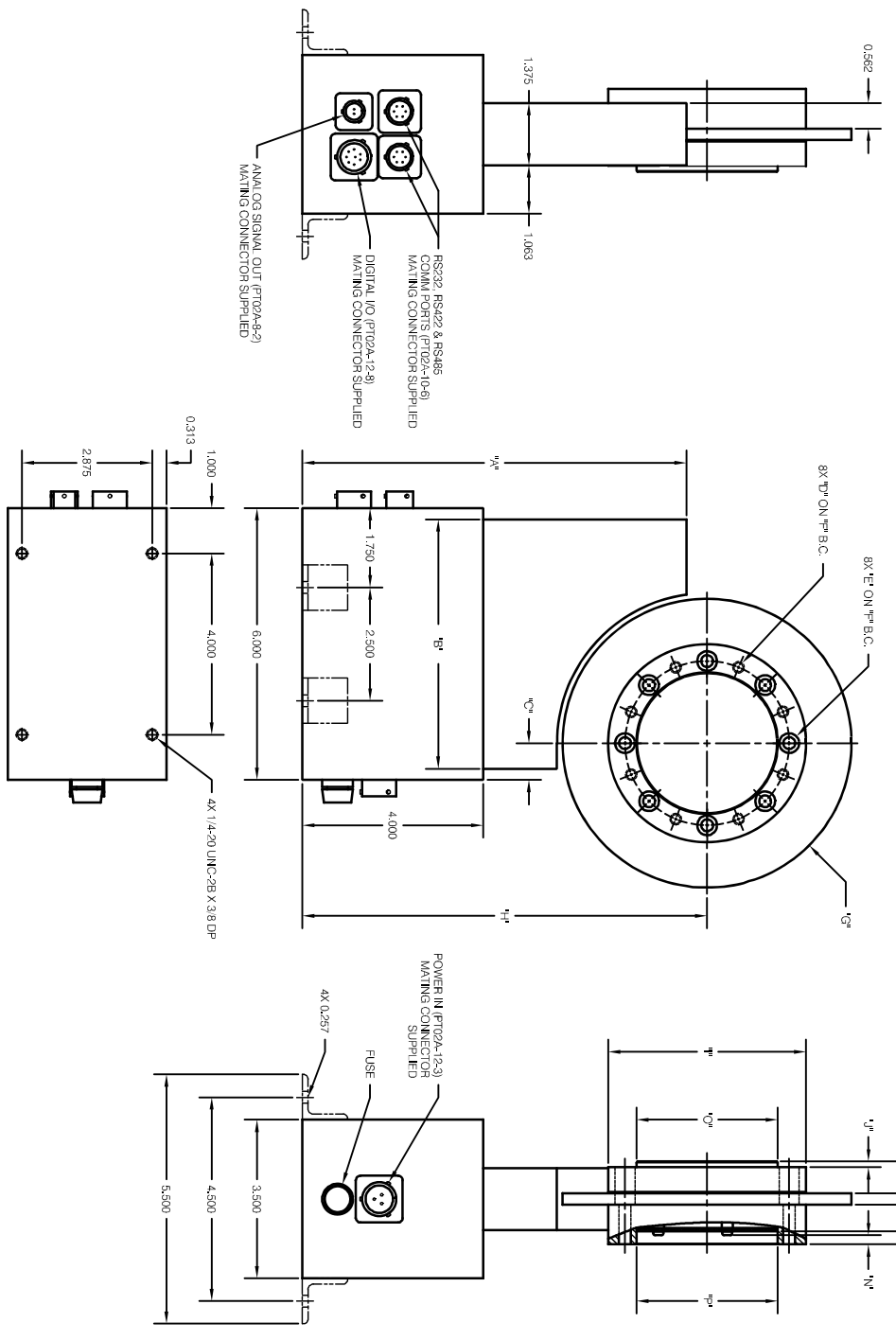
Notes: 1. \* To convert lbf-in to N-m multiply by 0.112985. 2. Maximum extraneous loads and rated torque may be applied simultaneously without damage

**ORDER NUMBER FORMAT  MCRT® A B C D**

- A = Model Number from tables; 86002V, 86004V, etc.
- B = Range from tables above; (3-5) or (5-5), etc.
- C = Performance Code; N for Standard Performance or C for Enhanced Performance
- D = Optional Zero Velocity Speed Pickup; N for None, Z for Magnetic Type, O for Optical Type

**ORDER NUMBER EXAMPLE  MCRT® 86008V(5-5)CO** specifies a Torquemeter with a 500,000 lbf-in Torque Rating, a 200% Torque Overload rating, Enhanced Performance and an Optical Speed Pickup.

MCHRT	V <sub>1</sub>	V <sub>2</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>	C <sub>10</sub>	C <sub>11</sub>	C <sub>12</sub>	C <sub>13</sub>	C <sub>14</sub>	C <sub>15</sub>	C <sub>16</sub>	C <sub>17</sub>	C <sub>18</sub>	C <sub>19</sub>	C <sub>20</sub>	
8.002V	8.464	5.500	0.813	1/4-20 X 1/2 DP	Ø0.266 THRU Ø0.488 X 0.828 DP C93ORE	Ø3.625	Ø6.375	8.938	Ø14.375	0.125	1.828	0.875	0.297	0.201	Ø 3.1246	Ø 3.1241	Ø 3.1250						
8.004V	7.891	5.500	0.813	7/16-14 X 7/8 DP	Ø0.453 THRU Ø0.793 X 1.250 DP C93ORE	Ø5.625	Ø8.875	10.188	Ø6.875	0.250	3.500	1.813	0.409	0.314	Ø 4.8744	Ø 4.8737	Ø 4.8750						
8.007V	7.251	5.625	0.750	3/4-10 X 1-1/2 DP	Ø0.766 THRU Ø1.188 X 2.016 DP C93ORE	Ø9.000	Ø12.875	12.188	Ø10.875	0.250	4.578	2.125	0.422	0.266	Ø 7.4894	Ø 7.5012	Ø 7.5000						



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