

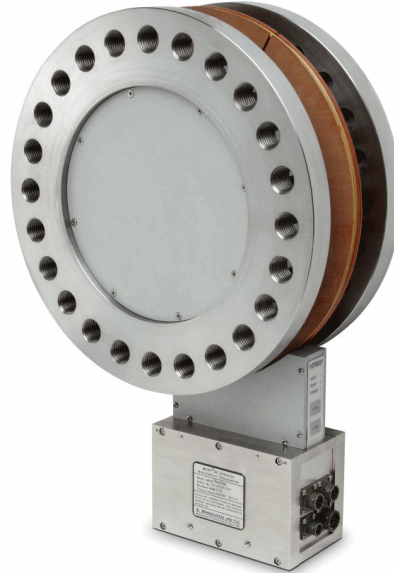
# MCRT<sup>®</sup> 86000V & 87000V High Capacity Bearingless Digital Torquemeters

Torque Ranges: 150,000 to 4,000,000 lbf-in (17.0 to 452 kNm)

## Best Performance Under Real-World Conditions

Industries Highest Overrange and Overload  
World Class Temperature Performance  
Greatest Immunity to External Noise  
Very High Stiffness and Low Deflection  
Bipolar Rotor Shunt Cal  
Accredited\*, CW and CCW Dead Weight Cal  
Simple, Non-critical Installation

- 0.05% Accuracy\*, 21,000 Samples/Sec
- 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
- 14 Bessel Data Filters
- 48  $\mu$ S Max/Min Update
- Interface Software Furnished
- Zero Velocity Speed Pickup Options



\*NIST traceable CW & CCW, full load calibration performed in our accredited laboratory (NVLAP Lab Code 200487-0). Details at our website or 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) from Variable Frequency Drives, ISM devices and other industrial noise sources - see overleaf.

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

1. See Application Note 20805B.

*modes*. It is 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 excellent *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 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 operating at or near their operating frequency, can cause interference.

FCC rules allow Industrial, Scientific and Medical (ISM) devices to generate unlimited energy. High-power ISM devices are commonplace and are used for inventory control, parts tracking, controlling personnel access, etc.

Most bearingless Torquemeters use an ISM frequency and are susceptible to Interference from other ISM devices. Those Torquemeters risk violation of FCC regulations since unlicensed use is only allowed in a narrow band.

Himmelstein Bearingless Torquemeters use non-ISM frequencies and have field strengths within FCC rules. If interference is encountered, they automatically switch to a clear channel.

| Common Specifications*                                           |                                                                | Code N Performance                                                                                                                                                                                                                        | Code C Performance              |
|------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Torque Range                                                     |                                                                | Factory Set @ Transducer Full Scale Torque; see Note 1.                                                                                                                                                                                   |                                 |
| Units of Measure                                                 |                                                                | 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.                                                                                                                        |                                 |
| Accuracy <sup>2</sup> (Nonlinearity, Hysteresis & Repeatability) |                                                                | ≤ ±0.1 (End Point, % of Range)                                                                                                                                                                                                            | ≤ ±0.05 (End Point, % of Range) |
| Bipolar Shunt Calibration Enable                                 |                                                                | From Stator Switches (one CW, one CCW), via TTL I/O, or PC Com Port using furnished software.                                                                                                                                             |                                 |
| Zero Drift (% of Range/deg. F.)                                  |                                                                | ≤ ±0.001                                                                                                                                                                                                                                  | ≤ ±0.0006                       |
| Span Drift (% of Reading./deg. F.)                               |                                                                | ≤ ±0.002                                                                                                                                                                                                                                  | ≤ ±0.002                        |
| Temperature Ranges (deg. F.)                                     |                                                                | Compensated Range: +75 to +175; Usable Range: -25 to +185; Storage Range: -65 to +225                                                                                                                                                     |                                 |
| Rotor to Stator Maximum Misalignment (inches)                    |                                                                | For MCRT <sup>®</sup> 86/87008V Series: ±0.25 Axial, 0.3 Radial. For MCRT <sup>®</sup> 86/87009V & 86/87010V Series: ±0.2 Axial, 0.2 Radial. If Magnetic (Code Z) Speed Pickup Option is installed then maximums are reduced - see below. |                                 |
| Analog Output Signals <sup>6</sup> , Auto-Scaled                 |                                                                | Allowable Load: 10k resistive, minimum; 0.05 uF capacitive, maximum.                                                                                                                                                                      |                                 |
|                                                                  | MCRT <sup>®</sup> 86000V Series Full Scale Torque <sup>3</sup> | Default is ±10 V with ±15 V overrange. User may select ±5 V with ±7.5 V overrange. Caution: see Note 7.                                                                                                                                   |                                 |
|                                                                  | MCRT <sup>®</sup> 87000V Series Full Scale Torque <sup>3</sup> | Default is ±5 V with ±15 V overrange. User may select ±10 V with ±15 V overrange. Caution: see Note 7.                                                                                                                                    |                                 |
| Signal Filter Cutoff Frequency <sup>4</sup>                      |                                                                | Field selectable from 0.1 Hz to 1 kHz in thirteen 1-2-5 steps plus 3 kHz selected from a remote PC using furnished software. Filters have Bessel Response; they are free of delay distortion and overshoot errors.                        |                                 |
| Frequency Modulated Output, Auto-Scaled                          |                                                                | Frequency: 10±5 kHz or 20±10 kHz or 40±20 kHz; field changeable (Default = 10±5 kHz); TTL square wave output.                                                                                                                             |                                 |
| Overrange (% 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.                                                                                                                  |                                 |
| System Resolution <sup>2</sup> (% of Range)                      |                                                                | 0.01                                                                                                                                                                                                                                      |                                 |
| Output Noise, All Outputs (% of Range)                           |                                                                | <0.01 at 1 Hz, <0.01 at 10 Hz, <0.015 at 100 Hz, <0.028 at 1 kHz and <0.041 at 3 kHz.                                                                                                                                                     |                                 |
| Torque Sampling Rate and Bandwidth                               |                                                                | Torque is sampled @ 21kHz. Its 3dB bandwidth is 3 kHz but can be reduced by filters (see above).                                                                                                                                          |                                 |
| Rotor-to-Stator Data Transfer Rate                               |                                                                | 1.25 MBaud                                                                                                                                                                                                                                |                                 |
| RS232, RS422, RS485 Communications Port                          |                                                                | 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.                |                                 |
| BAUD Rate                                                        |                                                                | 115,200; Drivers are protected for short circuit (current limit) and ±15kV ESD protected.                                                                                                                                                 |                                 |
| Maximum Cable Length                                             |                                                                | RS232 = 50 feet, RS422/485 = 4,000 feet; 120 ohm termination may be accessed via software.                                                                                                                                                |                                 |
| Interface Software With Torque Limits                            |                                                                | Provided to interface with Windows-based PC. Includes 20 foot RS232 interconnect cable for PC. Flags on PC screen classify user-set High and Low Limits for Current, or Max/Min or Spread (Max - Min) Torque data.                        |                                 |
| I/O Lines and FM Output                                          |                                                                | 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.                                                                                               |                                 |
| Status LEDs (on Stator Keypad)                                   |                                                                | Three Color Coded 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),                       |                                 |
| Keypad Control Switches                                          |                                                                | + CAL invokes CW Rotor Shunt Cal, - CAL invokes CCW Rotor Shunt Cal, Both held simultaneously for 5 seconds invokes TARE.                                                                                                                 |                                 |
| Rotor Temperature, Auxiliary Measurement                         |                                                                | Rotor temperature is output via Com Port. Range is 0 to 185 deg. F.; Accuracy is ±2 degrees, nominal. See above for status LEDs.                                                                                                          |                                 |
| Optional Zero Velocity Speed Pickups                             |                                                                | Optical (Code O) and Magnetic (Code Z) pickups output 30 ppr. Magnetic type restricts radial alignment to 40 ±10 mils.                                                                                                                    |                                 |
| Supply Voltage/Power <sup>5</sup>                                |                                                                | 10 to 26 VDC @ 9 watts with Antenna aligned to 12 watts with maximum specified misalignments.                                                                                                                                             |                                 |

### Notes:

- Outputs may be set at any value ≤ 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.

### ORDER NUMBER FORMAT **MCRT<sup>®</sup> A B C D**

- A = Model Number from tables; either 86008V or 87008V.
- 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<sup>®</sup> 86008V(5-5)CO** specifies a Bearingless Torquemeter with a 500,000 lbf-in Torque Rating, a 200% Torque Overload Rating, Enhanced Performance and an Optical Speed Pickup.

Standard Ratings, High Capacity MCRT® 86000V Bearingless Digital Torquemeters With 200% Overload

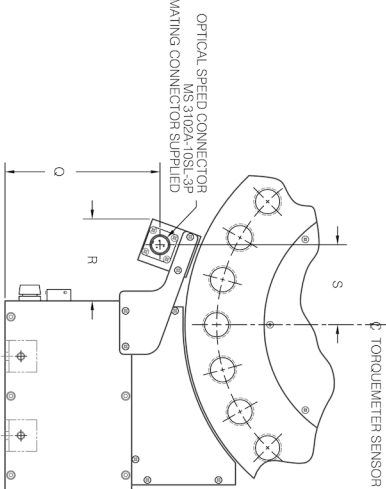
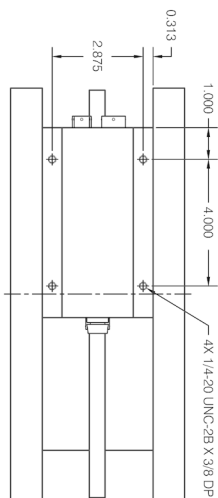
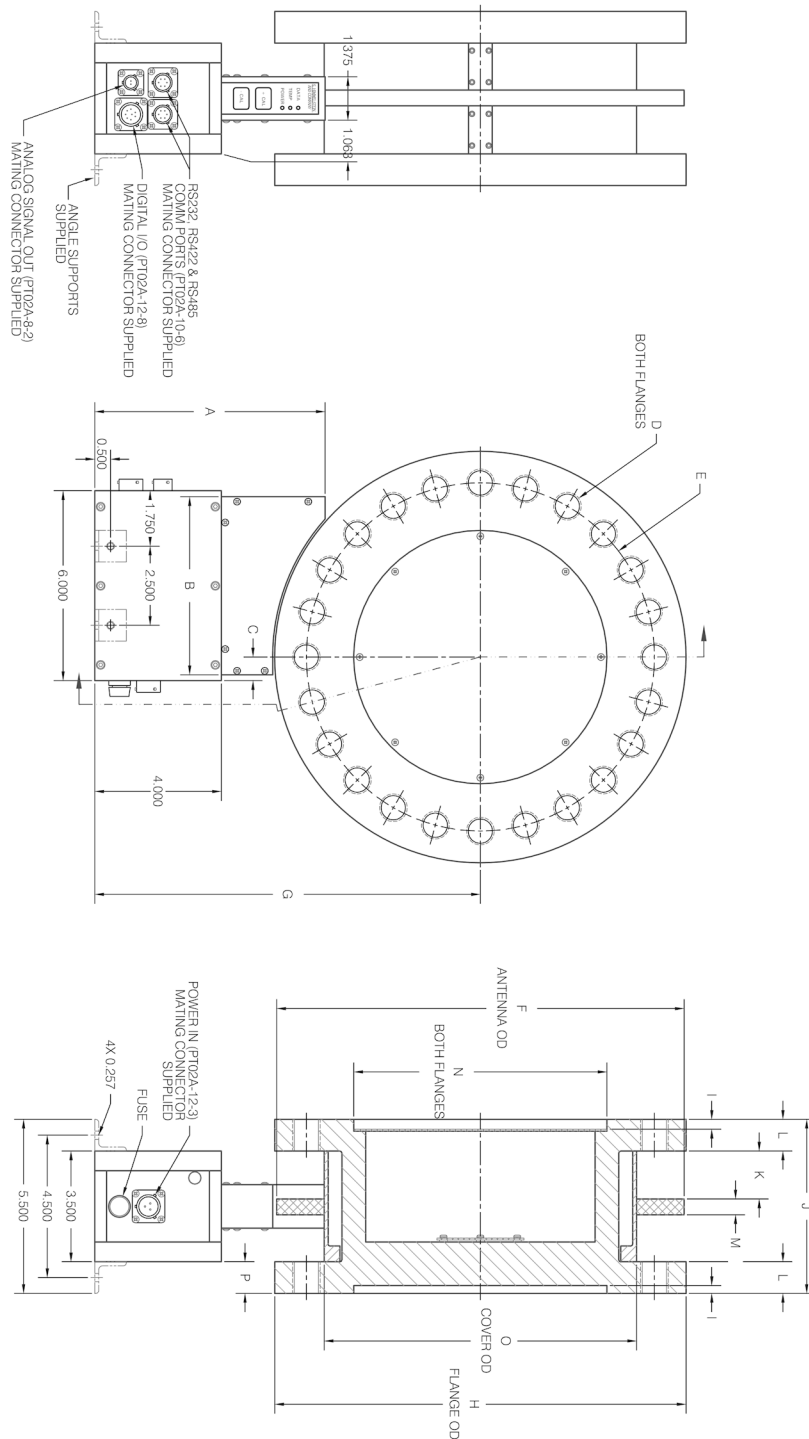
| MCRT <sup>®</sup><br>Model | Torque Ratings        |           | Speed<br>Rating | Torsional<br>Stiffness | Maximum<br>Angular<br>Deflection | Rotating<br>Inertia | Maximum<br>Extraneous Loads <sup>2</sup> |              |          | Max<br>Rotor Wt. |
|----------------------------|-----------------------|-----------|-----------------|------------------------|----------------------------------|---------------------|------------------------------------------|--------------|----------|------------------|
|                            | Range                 | Overload  |                 |                        |                                  |                     | Thrust                                   | Bending      | Shear    |                  |
|                            | [lbf-in] <sup>1</sup> |           |                 |                        |                                  |                     | [rpm]                                    | [lbf-in/rad] | [degree] |                  |
| 86008V(3-5)                | 300,000               | 600,000   | 0 to ±5,000     | 530,000,000            | 0.032                            | 4.0                 | 15,000                                   | 100,000      | 15,000   | 78               |
| 86008V(5-5)                | 500,000               | 1,000,000 | 0 to ±5,000     | 717,500,000            | 0.040                            | 4.0                 | 25,000                                   | 150,000      | 25,000   | 80               |
| 86008V(75-4)               | 750,000               | 1,500,000 | 0 to ±5,000     | 872,400,000            | 0.049                            | 4.1                 | 37,500                                   | 250,000      | 37,500   | 82               |
| 86009V(1-6)                | 1,000,000             | 2,000,000 | 0 to ±3,000     | 1,681,000,000          | 0.034                            | 39                  | 200,000                                  | 150,000      | 50,000   | 260              |
| 86009V(175-4)              | 1,750,000             | 3,500,000 | 0 to ±3,000     | 2,522,000,000          | 0.040                            | 40                  | 350,000                                  | 262,500      | 87,000   | 275              |
| 86009V(25-5)               | 2,500,000             | 5,000,000 | 0 to ±3,000     | 3,336,000,000          | 0.042                            | 41                  | 500,000                                  | 375,000      | 125,000  | 280              |
| 86010V(325-4)              | 3,250,000             | 6,500,000 | 0 to ±2,200     | 4,683,000,000          | 0.040                            | 84                  | 650,000                                  | 487,000      | 160,000  | 425              |
| 86010V(4-6)                | 4,000,000             | 8,000,000 | 0 to ±2,200     | 5,777,000,000          | 0.040                            | 86                  | 800,000                                  | 600,000      | 200,000  | 440              |

Standard Ratings, High Capacity MCRT® 87000V Bearingless Digital Torquemeters With 400% Overload

| MCRT <sup>®</sup><br>Model | Torque Ratings        |           | Speed<br>Rating | Torsional<br>Stiffness | Maximum<br>Angular<br>Deflection | Rotating<br>Inertia | Maximum<br>Extraneous Loads <sup>2</sup> |              |          | Max<br>Rotor Wt. |
|----------------------------|-----------------------|-----------|-----------------|------------------------|----------------------------------|---------------------|------------------------------------------|--------------|----------|------------------|
|                            | Range                 | Overload  |                 |                        |                                  |                     | Thrust                                   | Bending      | Shear    |                  |
|                            | [lbf-in] <sup>1</sup> |           |                 |                        |                                  |                     | [rpm]                                    | [lbf-in/rad] | [degree] |                  |
| 87008V(15-4)               | 150,000               | 600,000   | 0 to ±5,000     | 530,000,000            | 0.016                            | 4.0                 | 15,000                                   | 100,000      | 15,000   | 78               |
| 87008V(25-4)               | 250,000               | 1,000,000 | 0 to ±5,000     | 717,500,000            | 0.020                            | 4.0                 | 25,000                                   | 150,000      | 25,000   | 80               |
| 87008V(375-3)              | 375,000               | 1,500,000 | 0 to ±5,000     | 872,400,000            | 0.025                            | 4.1                 | 37,500                                   | 250,000      | 37,500   | 82               |
| 87009V(5-5)                | 500,000               | 2,000,000 | 0 to ±3,000     | 1,681,000,000          | 0.017                            | 39                  | 200,000                                  | 150,000      | 50,000   | 260              |
| 87009V(875-3)              | 875,000               | 3,500,000 | 0 to ±3,000     | 2,522,000,000          | 0.020                            | 40                  | 350,000                                  | 262,500      | 87,000   | 275              |
| 87009V(125-4)              | 1,250,000             | 5,000,000 | 0 to ± 3,000    | 3,336,000,000          | 0.021                            | 41                  | 500,000                                  | 375,000      | 125,000  | 280              |
| 87010V(1625-3)             | 1,625,000             | 6,500,000 | 0 to ±2,200     | 4,683,000,000          | 0.020                            | 84                  | 650,000                                  | 487,000      | 160,000  | 425              |
| 87010V(2-6)                | 2,000,000             | 8,000,000 | 0 to ±2,200     | 5,777,000,000          | 0.020                            | 86                  | 800,000                                  | 600,000      | 200,000  | 440              |

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

|        | "A"   | "B"   | "C"   | "D"                | "E"   | "F"    | "G"    | "H"    | "I"   | "J"   | "K"   | "L"   | "M"   | "N"       | "O"    | "P"   | "Q"           | "R"            | "S"            |
|--------|-------|-------|-------|--------------------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-----------|--------|-------|---------------|----------------|----------------|
| MCRT   | 7.281 | 5.625 | 0.750 | 24 X 7/8-9UNC-2B   | 11.00 | 12.875 | 12.187 | 13.000 | 0.250 | 5.500 | 1.516 | 1.000 | 0.500 | Ø 8.0018  | 9.875  | 1.000 | 4-7/8 ± 1/16  | 2-10/32 ± 5/32 | 5-7/32 ± 5/32  |
| 8_008V | 7.071 | 5.875 | 0.625 | 24 X 1-1/4-7UNC-2B | 18.50 | 21.000 | 16.571 | 21.000 | 0.375 | 8.000 | 0.000 | 1.500 | 1.000 | Ø 11.7520 | 16.552 | 0.535 | 5-1/16 ± 1/16 | 2-13/16 ± 5/32 | 2-21/32 ± 5/32 |
| 8_009V | 7.071 | 5.875 | 0.625 | 20 X 1-1/2-6UNC-2B | 21.50 | 24.000 | 18.071 | 24.000 | 0.406 | 9.000 | 0.000 | 1.875 | 1.000 | Ø 13.2522 | 20.000 | 0.660 | 5-1/16 ± 1/16 | 2-13/16 ± 5/32 | 2-21/32 ± 5/32 |
| 8_010V | 7.071 | 5.875 | 0.625 |                    |       |        |        |        |       |       |       |       |       |           |        |       |               |                |                |



Please note, dimensions subject to change without notice. Contact factory for certified drawings.

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