

# MCRT<sup>®</sup> 88700V High Capacity, Bearingless Dual Range Digital Torquemeters

High Ranges: 300,000 to 4,000,000 lbf-in (33.9 to 452 kN-m); Low Ranges 60,000 to 800,000 lbf-in (0.678 to 90.4 kN-m)

**BEST REAL-WORLD ACCURACY OF ANY HIGH CAPACITY DUAL RANGE TORQUEMETER, TORQUE SENSOR OR TORQUE TRANSDUCER**

**WIDEST INSTALLED MEASUREMENT BANDWIDTH AND FASTEST INSTALLED RESPONSE**

**SIMPLE TO INSTALL, TOLERANT OF WIDE ROTOR-STATOR MISALIGNMENT**

**LOWEST SENSITIVITY TO CLAMPING LOADS**

**HIGHEST OVERRANGE AND OVERLOAD**

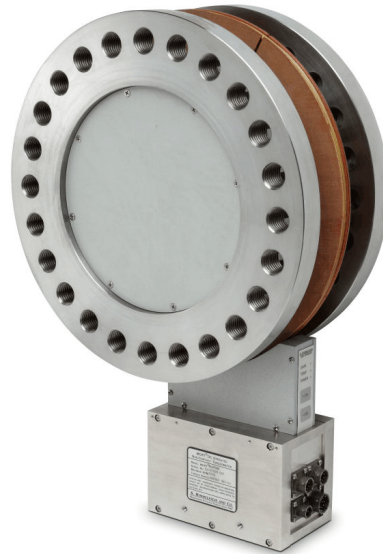
**WORLD CLASS TEMPERATURE PERFORMANCE**

**GREATEST IMMUNITY TO EXTERNAL NOISE**

**BI-DIRECTIONAL ROTOR SHUNT CALIBRATION**

**NO HOOP OR CALIPER ANTENNAE**

- **0.05% Combined Nonlinearity & Hysteresis**
- **200% & 1,000% Overload**
- **300% Overrange**
- **0.0006%/°F Compensation**
- **3 kHz Signal Bandwidth**
- **Analog and FM Outputs**
- **Digital Torque & Temperature Output**
- **13 Bessel Data Filters**
- **Max/Min's Updated @ 20 kHz**
- **Interface Software Furnished**
- **Select From 12 Units of Measure Without Re-calibration**



\*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>88700V High Capacity Dual Range Torquemeters measure high and low torques with high accuracy and without the cost and inconvenience of swapping two conventional sensors. They correctly measure torque if the peak to average ratio is high. Their use avoids the accuracy loss that occurs if an oversized sensor is used to prevent damage.

Accuracy is high in real-world applications, not just in the cal lab. That's due, in part, to very high stiffness which yields wider installed bandwidth and faster response than competitive<sup>1</sup> devices. Industries highest overrange avoids errors from clipped torque peaks. World class temperature performance reduces drive heating and gradient errors. Also enhancing real world performance is noise hardening against EMI from VFD's, ISM transmitters and other noise sources.

1. See Application Note 221101D 2. See Application Note 20805B

Each range is calibrated to full scale with 10 CW and CCW steps (20 total) and documented by a NVLAP approved Certificate certifying NIST traceability and that our laboratory operation and quality management system meet ISO/IEC 17025:2005. A 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**. 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 communications. Included software interfaces with your Windows-based PC. It displays Real-time, Max/Min and Spread Torque, Rotor Temperature, checks limits, does torque time plots and stores test results.

## **S. HIMMELSTEIN AND COMPANY**

*Designing and Making the World's Best Torque Instruments Since 1960*

## Exceptional Immunity To Noise And Interference From ISM Transmitters

Bearingless Torquemeters 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 ISM devices to generate unlimited energy. Because most Bearingless Torquemeters use an ISM frequency for data transfer, 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*	Standard, Code N Performance		Enhanced, Code C Performance	
	High Range	Low Range	High Range	Low Range
High or Low Range **				
Torque Range <sup>1</sup>	Factory Set @ Transducer Full Scale Torque; see Note 1.			
Units of Measure (select one without re-calibration)	Select lbf-in, lbf-ft, ozf-in, ozf-ft, N-m, kN-m, N-cm, kgf-m, kgf-cm, gf-cm			
Temperature Units of Measure	Select °F or °C without re-calibration.			
Combined Nonlinearity & Hysteresis <sup>2</sup> (% of Range, Best Fit Line Basis - see Tech Memo 230104)	$\leq \pm 0.1\%$		$\leq \pm 0.05\%$	
Overload (% of Range)	200	1,000	200	1,000
Repeatability (% of Range)	$\leq \pm 0.02$	$\leq \pm 0.03\%$	$\leq \pm 0.02$	$\leq \pm 0.03\%$
Accuracy <sup>3</sup> (nonlinearity, hysteresis & repeatability)	$\leq \pm 0.1\%$ of Range		$\leq \pm 0.05\%$ of Range	$\leq \pm 0.06\%$ of Range
Calibration Signal <sup>4</sup>	100.00% of full scale for clockwise and counterclockwise directions			
Zero Drift (% of Range per °F/per °C)	$\leq \pm 0.001/0.0018$	$\leq \pm 0.005/0.009$	$\leq \pm 0.0006/0.001$	$\leq \pm 0.003/0.0054$
Span Drift (% of Reading per °F/per °C)	$\leq \pm 0.002/0.0036$		$\leq \pm 0.002/0.0036$	
48 Hour Drift (% of Range - applies to all outputs)	$\leq \pm 0.02$	$\leq \pm 0.05$	$\leq \pm 0.02$	$\leq \pm 0.05$
Temperature Ranges (°F/ °C.)	Compensated Range: +75 to +175/+24 to +79.4; Usable Range: -25 to +185/-32 to +85 Storage Range: -65 to +225/-54 to +107			
Rotor to Stator Maximum Misalignment (Inches/mm)	MCRT® 88708V - Axial: $\pm 0.25/\pm 6.4$ , Radial: 0.3/7.6 MCRT® 88709/10V - Axial: $\pm 0.2/0/\pm 5.1$ , Radial: 0.3/7.6 If Magnetic (Code Z) Speed Pickup is installed, then both maximums become 0.04/1.0.			
Effect of Clamping Loads (% of Range)	$\leq \pm 0.06$		$\leq \pm 0.03$	
Analog Output Signals <sup>5</sup> , Auto-Scaled	Allowable Load: 10k resistive, minimum; 0.05µF capacitive, maximum.			
Full Scale Torque, Both Ranges	$\pm 10V$ with $\pm 15V$ overrange. User may select $\pm 5V$ with $\pm 7.5V$ overrange. Caution: see Note 2.			
	$\pm 5V$ with $\pm 15V$ overrange. User may select $\pm 10V$ with $\pm 15V$ overrange. Caution: see Note 2.			
Signal Filter Cutoff Frequency <sup>6</sup>	From 0.1 Hz to 1 kHz in thirteen 1-2-5 steps plus 3 kHz. Selected from a remote PC. Filters have Bessel Response; and are free from delay distortion and overshoot errors.			
Frequency Modulated Output <sup>5</sup>	Frequency: $10 \pm 5/20 \pm 10/40 \pm 20$ kHz; field changeable (Default = $10 \pm 5$ kHz); TTL square wave			
Peak-Peak Digital Output <sup>5</sup> Noise vs Filter Cutoff Frequency (% of Range)	High Range: 0.0002 @ 0.1-1 Hz, 0.004 @ 10 Hz, 0.01 @ 100 Hz, 0.04 @ 1 kHz, 0.06 @ 3 kHz Low Range: 0.001 @ 0.1 & 1 Hz, 0.02 @ 10 Hz, 0.055 @ 100 Hz, 0.2 @ 1 kHz, 0.3 @ 3 kHz			
Peak-Peak Analog Output <sup>5,6</sup> Noise vs Filter Cutoff Frequency (millivolt peak-peak)	4 @ 0.1 Hz and 1Hz, 5 @ 10 Hz, 8 @ 100 Hz, 18 @ 1 kHz and 33 @ 3 kHz.			
Torque Sampling Rate and Bandwidth	20 kHz. The 3 dB bandwidth is 3 kHz reducible by filters (see Note 6 & above).			
Rotor-to-Stator Transfer Rate	1.25 Mbaud			
RS232/RS422/RS485/USB Communications <sup>7</sup>	Outputs Torque and Temperature with units of measure. Inputs torque range if other than sensor full scale, selects units of measure, filter cutoff, etc. and permits remote test control.			
Baud Rate	115,200; Drivers are protected for short circuit (current limit) and $\pm 15$ kV ESD protected.			
Maximum Cable Length	RS232 = 50 feet, RS422/485 = 4,000 feet; 120 ohm termination may be accessed via			
Interface Software With Torque Limits	Provided to interface with Windows-based PC. Includes 20 foot interconnect cable <sup>7</sup> for a PC.			
I/O Lines and FM Output <sup>5</sup>	Input lines are +Cal, -Cal, Tare, Clear Tare, Toggle Range. Output lines are Data OK & FM Out.			
Range Select	Accomplished via Com Port and via Toggle Range I/O Line.			
Status LED's (on Stator Keypad)	3 LED's: Power (Yellow = Power-up, Green = OK, Red = Fault); Data (Green = OK, Red = Error); Rotor Temperature (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	Rotor temperature is output via Com Port. Range is 0 to 185 °F.; Accuracy is $\pm 2$ °F.			
Optional Zero Velocity Speed Pickups	Optical and Magnetic pickups output pulse train. Magnetic type restricts misalignment; see			
Supply Voltage/Power <sup>8</sup>	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 1,000,000 lbf-in, the user may re-scale to 500,000 lbf-in. Then the analog output would be 5 or 10 Volts at 500,000 lbf-in and the digital output, at the Com Port, would be 500,000. However, the above specification still defines measurement accuracy. 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.
2. *In the overrange region* all outputs are guaranteed to have combined nonlinearity and hysteresis lower 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.  
If you are using the analog output, it is linear up to 15 volts. That corresponds to 150% of full scale on the 10 volt output setting and 300% on the 5 volts output setting. Accordingly, when using the analog output and if you expect torque peaks greater than 150% of full scale, you should switch to the 5 volt setting.
3. Assumes torque range is set to the device full scale torque rating.
4. CW torque causes CW rotation if viewed from the driving end. CCW torque causes the opposite rotation.
5. Input power is fused 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.
6. Analog noise is measured with an Agilent U1520A Scope with bandwidth set to 10 kHz.
7. A 20 foot long Torquemeter to RS422/485 PC port 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 RS422/485 adapter is (P/N 330-0003) if your PC has only USB ports.

Should you prefer to use the RS232 interface and your computer has an integral RS232 port, you may order a Torquemeter to PC cable; P/N 224-8359-20 is 20 feet long, P/N 224-8350-50 is 50 feet long.

8. Fused and reverse polarity protected

\* Specifications are subject to change without notice.


## ORDER NUMBER FORMAT MCRT® A B C D

A = Model from tables; 88708V, or 88709V, etc.

B = Range from tables; (3-5) or (5-5), etc.

C = Performance Code; N if Standard or C if Enhanced.

D = Optional Zero Velocity Speed Pickup; N for None, Z for Magnetic Type, O for Optical Type

ORDER NUMBER EXAMPLE  MCRT® 88709V(1-6)NO specifies a dual range Bearingless Torquemeter with a 1,000,000 lbf-in High Range, a 200,000 lbf-in Low Range, a 2,000,000 lbf-in Overload Rating, Standard Performance and an installed Optical Speed Pickup.

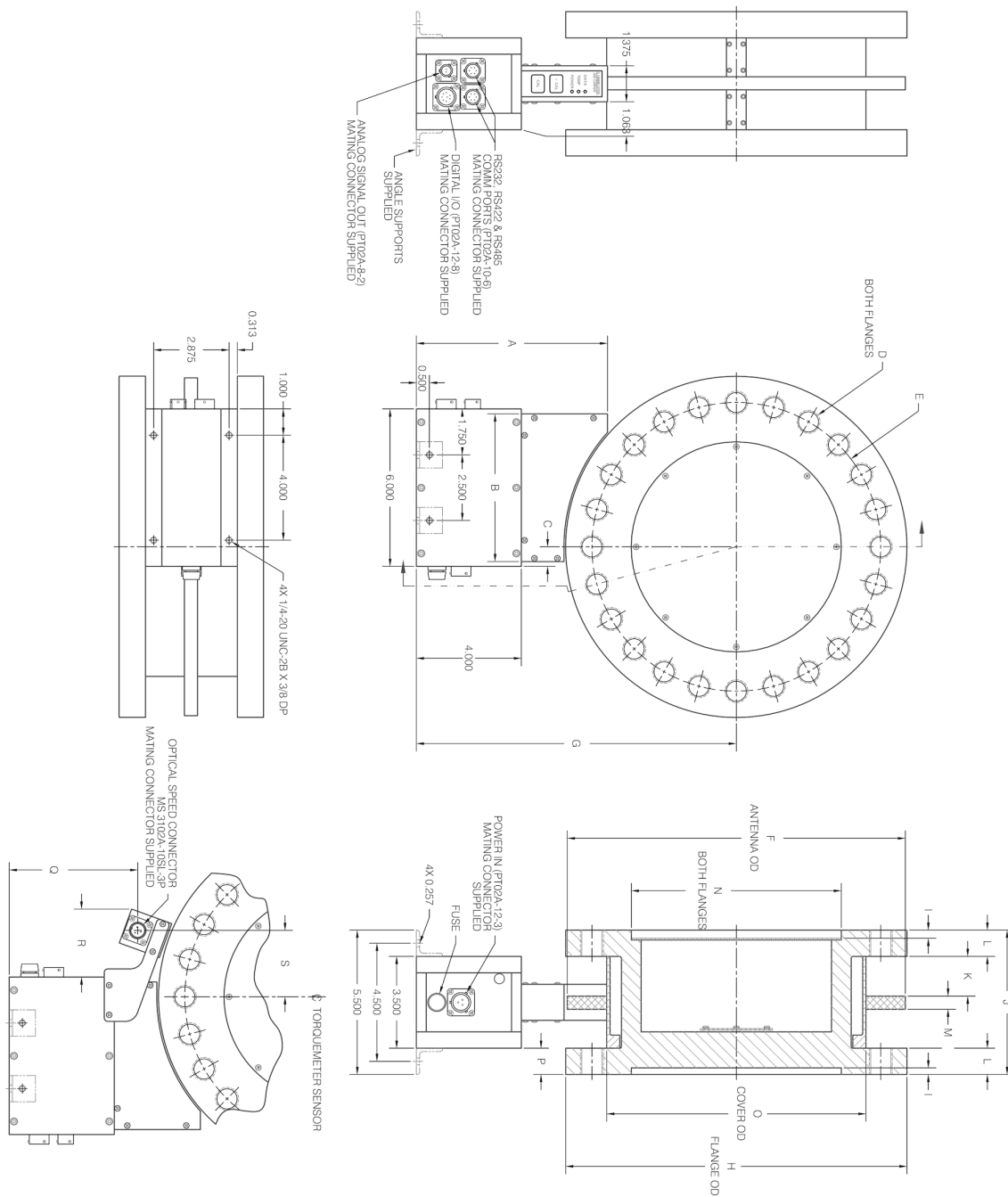
## MCRT® 88700V High Capacity, Dual Range Bearingless Digital Torquemeters

MCRT® MODEL	High Range			Low Range			Maximum Speed  (rpm)
	Full Scale Torque		Maximum Deflection	Full Scale Torque		Maximum Deflection	
	(lbf-in)	(kN-m)	(degree)	(lbf-in)	(kN-m)	(degree)	
88708V(3-5)	300,000	33.9	0.038	60,000	6.78	0.008	5,000
88708V(5-5)	500,000	56.5	0.047	100,000	11.3	0.009	
88708V(75-4)	750,000	84.8	0.056	150,000	17.0	0.011	
88709V(1-6)	1,000,000	113	0.034	200,000	22.6	0.007	3,000
88709V(175-4)	1,750,000	198	0.040	350,000	39.6	0.008	
88709V(25-5)	2,500,000	283	0.042	500,000	56.5	0.008	
88710V(325-4)	3,250,000	367	0.040	650,000	73.5	0.008	2,200
88710V(4-6)	4,000,000	452	0.040	800,000	90.4	0.008	

MCRT® MODEL	All Models. (Torque Overload is 200% of the High Range Torque Rating)					Rotor Weight
	Torsional Stiffness	Rotating Inertia	Maximum Thrust*	Maximum Bending*	Maximum Shear*	
English Units <sup>EN</sup>	(lbf-in/rad)	(ozf-in s <sup>2</sup> )	(lbf)	(lbf-in)	(lbf)	(lb)
88708V(3-5)	451,000,000	63.0	15,000	100,000	15,000	62.2
88708V(5-5)	615,500,000	64.8	25,000	150,000	25,000	64.2
88708V(75-4)	763,200,000	66.2	37,500	250,000	37,500	66.2
88709V(1-6)	1,680,000,000	620	200,000	150,000	50,000	260
88709V(175-4)	2,520,000,000	640	350,000	262,500	87,000	275
88709V(25-5)	3,330,000,000	662	500,000	375,000	125,000	280
88710V(325-4)	4,680,000,000	1,337	650,000	487,000	160,000	425
88710V(4-6)	5,670,000,000	1,375	800,000.0	600,000	200,000	440
SI Units <sup>SI</sup>	(N-m/rad)	(kg-m <sup>2</sup> )	(N)	(N-m)	(N)	(kg)
88708V(3-5)	50,950,000	0.445	67,200	11,300	67,200	35.4
88708V(5-5)	69,550,000	0.458	112,000	16,900	112,000	36.3
88708V(75-4)	86,242,000	0.467	168,000	28,200	168,000	37.2
88709V(1-6)	190,000,000	4.38	896,000	16,900	224,000	118
88709V(175-4)	285,000,000	4.52	1,570,000	29,700	390,000	125
88709V(25-5)	376,000,000	4.67	2,240,000	42,400	560,000	127
88710V(325-4)	529,000,000	9.44	2,910,000	55,000	717,000	193
88710V(4-6)	641,000,000	9.71	3,590,000	67,800	896,000	196

\* Maximum extraneous loads and rated torque may be applied simultaneously without damage

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



MCHT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
8_008V	7.281	5.625	0.750	24 X 7/8-9UNC-2B	11.000	12.875	12.187	13.000	0.250	5.500	1.516	1.000	0.500	Ø 8.00018	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 11.7500	16.552	0.535	5-1/16 ± 1/16	2-13/16 ± 5/32	2-21/32 ± 5/32
8_010V	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 13.2622	20.000	0.660	5-1/16 ± 1/16	2-13/16 ± 5/32	2-21/32 ± 5/32

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