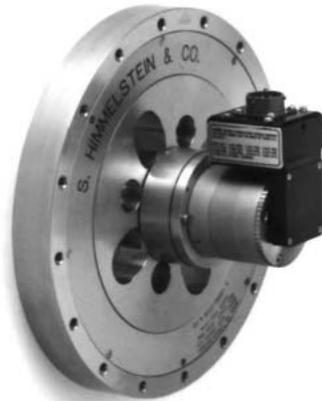


# MCRT<sup>®</sup> 27000T *Non-Contact* **WHEEL TORQUEMETERS** **(TORQUE WHEELS)**

For DC Operated Versions with  $\pm 5$  Volt DC Analog Outputs, See Bulletin 7801

## Unprecedented Immunity to Contamination & Vibration

- Waterproof, Corrosion Resistant Construction
- Extraordinary Immunity to Extraneous Loads and Temperature Gradients
- 4 mV/V Output or,  $\pm 5$  Volt Output (Option V)



To excite and display Torque only, use Models 701 or 711. For Torque, Speed and HP, use Model 721. See Bulletins 371 & 370.

- Measure Road Load, Braking Effort and Wheel Speed
- Installs Simply Without Vehicle Rework
- No Slip Rings, Ferrite's, or Semiconductor Gages
- NIST Traceable Dead Weight Calibration\*
- Torque Ranges: 250 to 100,000 lbf-in (28 to 11,300 N-m)

\*Calibration performed in our accredited metrology laboratory (NVLAP Lab Code 200487-0). For details see [www.himmelstein.com](http://www.himmelstein.com) or accreditation link at [www.nist.gov](http://www.nist.gov)

# **S. HIMMELSTEIN AND COMPANY**

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

## Description

Himmelstein torque wheels are non-contact, rotary transformer coupled wheel torque meters. They accurately measure wheel torque and speed during driving, braking, and coastdown. Standard units are available for front wheel, rear wheel, and all wheel drive applications. Uses include characterization of actual driving conditions, and coastdown, emissions correlation, braking and chassis dynamometer tests.

Installation is made without vehicle rework. Mounting the torque meter on a standard wheel produces a small offset. The offset can be eliminated with a modified wheel; either customer or Himmelstein furnished. Torquemeter weight and inertia emulate a conventional wheel.

Excellent temperature compensation and a unique sensor design provides intrinsic immunity to temperature gradients and radial and cornering loads. That design

also achieves clamping load cancellation. Superb, rotary transformers provide non-contact signal coupling to the rotating strain gage bridge. These advanced devices contain no ferrite's thus eliminating vulnerability to impact damage. Reduced frontal area models are available when aerodynamic drag is critical. Standard and optional zero velocity speed sensors provide 60 pulses/revolution (ppr). Optional encoder provides 3600 ppr (512 ppr for MCRT<sup>®</sup> 27830/27835).

Himmelstein readouts are available with NIST traceable system dead weight calibration. These computer compatible instruments measure torque, speed and compute wheel power(s). Computer based test systems with real time storage, computation, and plotting are also available. Wheel Torquemeters with Option V operate from a single unregulated dc supply and provide dual  $\pm 5V$  outputs with built-in filtering; see Bulletin 7801 for details.

## Unprecedented Immunity to Cable and Connector Contamination

MCRT<sup>®</sup> 27000T Series Torque Wheels are constructed of corrosion resistant materials and water-proofed to permit operation in shallow water. Nonetheless, during real-world field tests, connections must be opened to change tires, adjust brakes, etc. Those acts expose the measurement circuit to shunting errors from salt and other contaminants. Even though cables and connectors are sealed, testing in sub-zero temperature makes cable insulation brittle which, when subjected to vibration, can fatigue and expose the circuit to contamination.

These new torque meters exhibit *unprecedented tolerance to inevitable cable shunts*. When compared to a directly wired strain gage sensor, the effect of external cable shunts has been reduced by 1000\* times. And, you get these results with standard carrier amplifiers. Furthermore, you receive *the added benefits of Himmelstein rotary transformer technology, including elimination of internally generated shunting errors and noise from slip-ring/brush debris*. All this plus 4 mV/V output and newly enhanced impunity to electrical noise.

\* When expressed as a percentage of sensor full scale, the error signal generated by a shunt between any signal and excitation (or sense) line will be 1/1000th of that generated by the same shunt on a directly wired (or slip ring coupled) 700 ohm, 1.5 mV/V strain gage torque meter.

## General Specifications

**Non-Linearity:** ..... =  $\leq \pm 0.1\%$  of full scale.

**Hysteresis:** ..... =  $\leq \pm 0.1\%$  of full scale.

**Non-Repeatability** ..... =  $\leq \pm 0.05\%$  of full scale.

**Accuracy** (combined non-linearity, hysteresis, and non-repeatability)... =  $\leq \pm 0.1\%$  of full scale.

**Stability, 6 months** .....  $\leq \pm 0.15\%$  of full scale.

**Effect of Rotation on Zero:**..... =  $\leq \pm 0.025\%$  of F.S.

### Typical Radial

**Loading Crosstalk** (% F.S.) .....  $\frac{(0.8)(\text{Radial Load in LBS})}{\text{Full Scale Rating in LB-IN}}$

### Typical Bending (Cornering)

**Load Crosstalk** (% F.S.) .....  $\frac{(0.8)(\text{Bending Moment in LB-IN})}{\text{Full Scale Rating in LB-IN}}$

### Effect of Clamping Loads:

**Zero:** ..... =  $\leq 0.3\%$  of full scale.

**Span:** ..... =  $\leq 0.1\%$  of full scale.

### Notes:

1. When ordered with amplifier and cable, the system is dead weight calibrated traceable to the NIST.
2. Torquemeters only are dead weight calibrated with factory cable and amplifier. Calibration transfer is guaranteed only when used with a Himmelstein amplifier and cable with like part numbers.
3. "F.S." denotes "Full Scale".

### Temperature Effects

**Zero:** ..... =  $\leq \pm 0.002\%$  of full scale per deg. F.

**Span:** ..... =  $\leq \pm 0.002\%$  of reading per deg F.

**Compensated Range:** ..... + 75 to + 175 deg F.

**Maximum Useable Range:** ..... -65 to + 220 deg F.

**Nominal Output:**..... 4 millivolt/volt.

**Zero Balance:**.....  $\leq \pm 1\%$  of full scale.

**Excitation Voltage:**..... 3 to 6 volt rms, 3 kHz  $\pm 10\%$  sine wave capable of exciting a 90 ohm bridge.

**Readout:**..... Any carrier amplifier suitable for strain gage service meeting the stated excitation requirements. Use Himmelstein Models 701, 711, or 721 Instruments, for optimum performance.

**Shaft Speed:** ..... 0 to  $\pm 2,000$  RPM not including tire and wheel unbalance effects.

**Speed Pickup:**..... 60 ppr furnished on all units. 3600 ppr optical encoder available as an option. (512 ppr for MCRT<sup>®</sup> 27830/27835).

4. "deg F." denotes "degree Fahrenheit".
5. Speed ratings are for continuous, bi-directional operation.
6. All wheel torque meter models are waterproof and may be operated in shallow water. Please contact factory with your specific requirements.
7. Specifications are subject to change without notice.

## Installation Alternatives

Himmelstein wheel torqueometers can be installed using the standard vehicle wheel, or with a modified wheel. A standard wheels' centerline is offset from its' normal location. Use a modified wheel to eliminate this offset and thus maintain normal steering geometry and handling. Modified wheels should be used for coastdown and over the road testing to reduce drag and interference with road obstructions. Reduced frontal area model MCRT® 27830T/27835T torque wheels are recommended for these critical applications.

When axle and wheel adapters are purchased they will be furnished with standard dimensions, unless specified differently. Request certified prints for torqueometers, axle adapters, and wheel adapters. Variations in the size and location of wheels, brake assemblies, spindles, tie rods, chassis geometry and possible part motions; make it imperative that the user thoroughly analyze his installation and assure himself the mounted torqueometer will clear other vehicle components under his expected driving conditions. If a special torqueometer configuration or range is needed, please contact the factory.

### Using a Modified Wheel Assembly

Maintains original wheel position

Required installation for:

MCRT® 27830T	MCRT® 27835T
MCRT® 27920T	MCRT® 27930TU
MCRT® 27860T	MCRT® 27960T

Optional installation for:

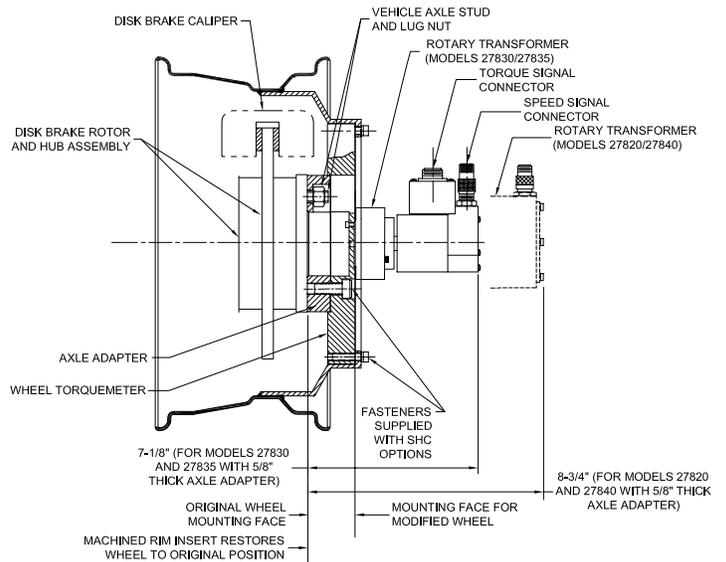
MCRT® 27820T	MCRT® 27840T
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**This installation requires the following items:**

1. **Axle Adapter**<sup>(2)</sup> - See Figure 3 if wheel torqueometer has a 4, 5, 6 or 8 bolt pattern. For universal bolt patterns, see Figure 1.
2. **Wheel Torqueometer** - See Page 6 for outline dimensions.
3. **Modified Wheel**<sup>(2)</sup> - See Figure 2.

#### NOTES:

- (1) Certified prints for all items are available on request.
- (2) Available as S. Himmelstein & Co. options.
- (3) See following pages for additional details.



### Using a Standard Wheel and a Wheel Adapter

Positions original wheel outboard by:

MCRT® 27820T .....approx. 2-1/4"

MCRT® 27840T .....approx. 3-5/8"

Installation only available for:

MCRT® 27820T	MCRT® 27840T
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**This installation requires the following items:**

1. **Axle Adapter**<sup>(2)</sup> - See Figure 3 if wheel torqueometer has a 4, 5, 6 or 8 bolt pattern. For universal bolt patterns, see Figure 1.
2. **Wheel Torqueometer** - See Page 6 for outline dimensions.
3. **Wheel Adapter**<sup>(2)</sup> - See Figure 4, based upon wheel bolt pattern.

#### NOTES:

- (1) Certified prints for all items are available on request.
- (2) Available as S. Himmelstein & Co. options.
- (3) See following pages for additional details.

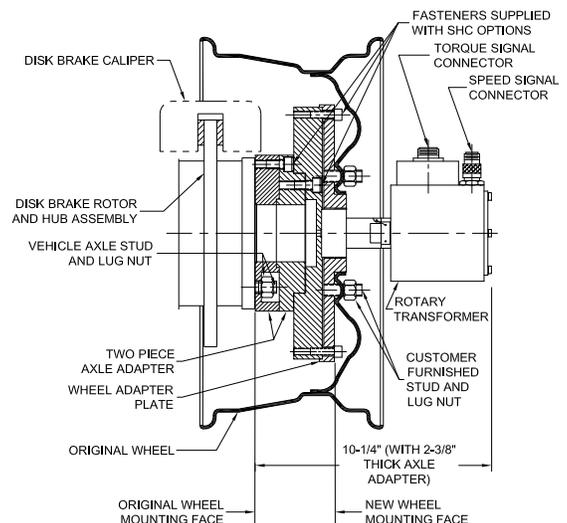
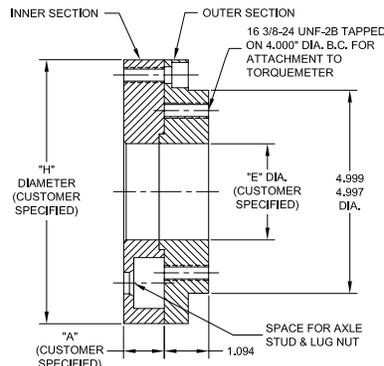
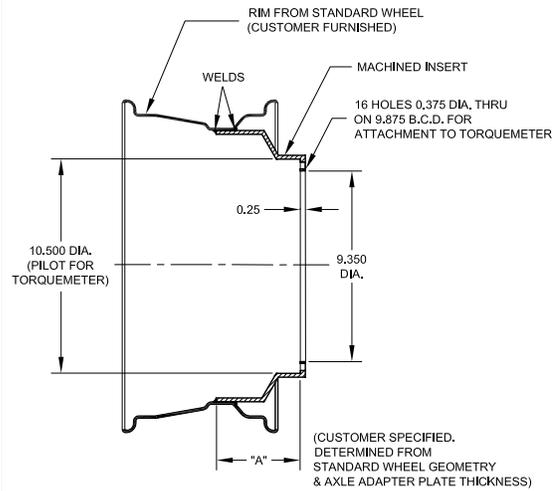


Figure 1.  
**Axle Adapter Kit**  
 Two Piece



- NOTES:**  
 (1) FOR UNIVERSAL BOLT PATTERNS  
 (2) 'A' DIMENSION MUST BE LONGER THAN LUG & NUT. IF OVERALL PART THICKNESS IS  $< 1.094 + 'A'$ , CONSULT THE FACTORY.  
 (3) 'H' DIMENSION  $< 6.500$  MUST BE REVIEWED BY FACTORY  
 (4) ADAPTER PLATE MATERIAL IS STEEL.

Figure 2.  
**Modified Wheel**



- NOTES:**  
 (1) MACHINED INSERT MATERIAL IS STEEL.

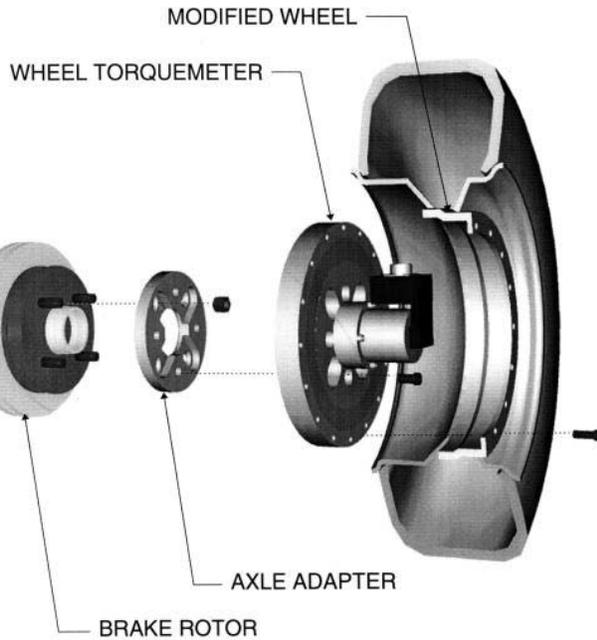
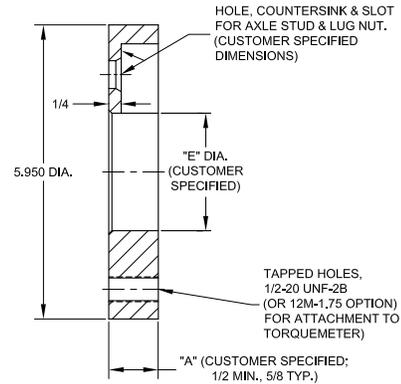


Figure 3.  
**Axle Adapter Kit – One Piece**



- NOTES:**  
 (1) FOR 4, 5, 6, & 8 BOLT PATTERNS.  
 (2) ADAPTER PLATE MATERIAL IS STEEL.

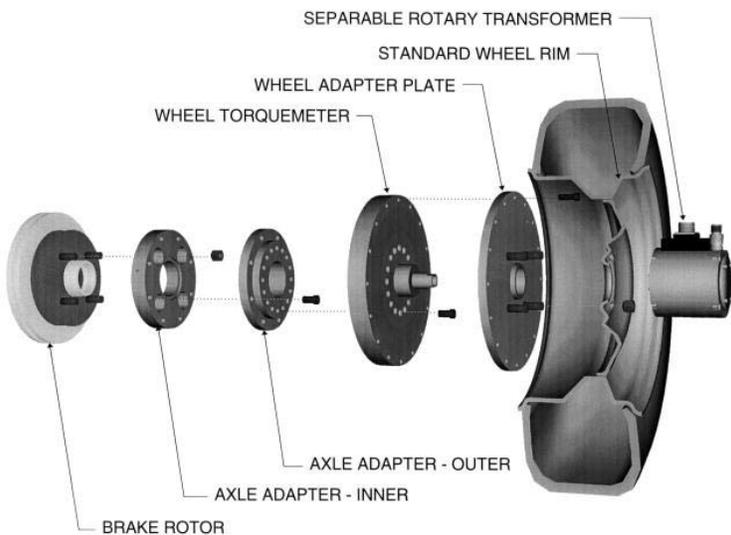
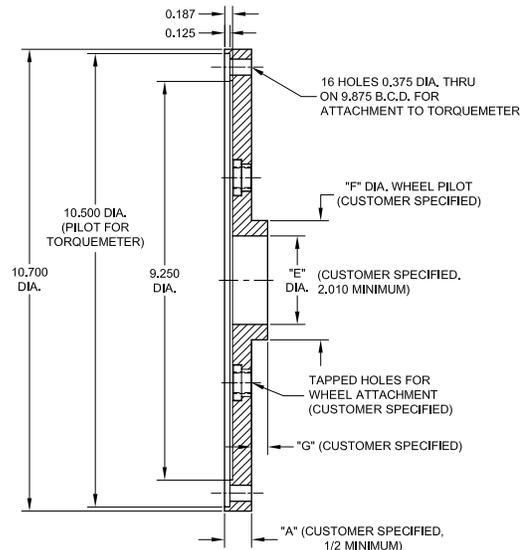


Figure 4.  
**Wheel Adapter Kit**



- NOTES:**  
 (1) MODELS MCRT® 27820T & MCRT® 27840T ONLY.  
 (2) ADAPTER PLATE MATERIAL IS ALUMINUM.

- GENERAL NOTES:**  
 (1) TORQUEMETER ATTACHMENT FASTENERS INCLUDED WITH ALL KITS.  
 (2) ALL DIMENSIONS ARE IN INCHES.

## Detailed Specifications, MCRT® 27000T Series Wheel Torquemeters

MCRT® MODEL	TORQUE RANGE		TORQUE OVERLOAD		TORSIONAL STIFFNESS	MAXIMUM RADIAL LOAD	MAXIMUM BENDING MOMENT	ROTATING INERTIA	MAX. WT.
	(lbf-in)	(N-m)	(lbf-in)	(N-m)	(lbf-in/rad)	(lbs)	(lbf-in)	(in-ozf sec <sup>2</sup> )	(lbs)
<b>2X Overload Models; Available in Universal, 4, 5, 6, or 8 Bolt Patterns</b>									
27820T(5-3)	5,000	565	10,000	5,650	12,800,000	2,000	3,400	4.6	13.9
27820T(1-4)	10,000	1,130	20,000	2,260	33,000,000	2,800	4,800	4.6	13.9
27820T(2-4)	20,000	2,260	40,000	4,520	75,200,000	3,900	6,800	4.6	13.9
27820T(5-4)	50,000	5,650	100,000	11,300	157,000,000	6,000	10,000	4.6	13.9
<b>10X Overload Models; Available in Universal, 4, 5, 6, or 8 Bolt Patterns</b>									
27840T(5-2)	500	56.5	5,000	565	2,600,000	1,150	1,950	4.6	13.9
27840T(1-3)	1,000	113	10,000	1,130	7,200,000	1,600	2,750	4.6	13.9
27840T(2-3)	2,000	226	20,000	2,260	21,000,000	2,300	3,900	4.6	13.9
<b>Reduced Frontal Area Rotary Transformer Models with 2X Overload; Available in 4 or 5 Bolt Patterns</b>									
27830T(5-3)	5,000	565	10,000	5,650	12,800,000	2,000	3,400	4.5	10.1
27830T(1-4)	10,000	1,130	20,000	2,260	33,000,000	2,800	4,800	4.5	10.1
27830T(2-4)	20,000	2,260	40,000	4,520	75,200,000	3,900	6,800	4.5	10.1
27830T(5-4)	50,000	5,650	100,000	11,300	157,000,000	6,000	10,000	4.5	10.1
<b>Reduced Frontal Area Rotary Transformer Models with 10X Overload; Available in 4 or 5 Bolt Patterns</b>									
27835T(5-2)	500	56.5	5,000	565	2,600,000	1,150	1,950	4.5	10.1
27835T(1-3)	1,000	113	10,000	1,130	7,200,000	1,600	2,750	4.5	10.1
27835T(2-3)	2,000	226	20,000	2,260	21,000,000	2,300	3,900	4.5	10.1
<b>Large Thru-Bore Rotary Transformer Models for 4WD; 2X Overload; Available in Universal Bolt Pattern Only</b>									
27930TU(5-3)	5,000	565	10,000	5,650	12,800,000	2,000	3,400	6.0	27.3
27930TU(1-4)	10,000	1,130	20,000	2,260	33,000,000	2,800	4,800	6.0	27.3
27930TU(2-4)	20,000	2,260	40,000	4,520	75,200,000	3,900	6,800	6.0	27.3
27930TU(5-4)	50,000	5,650	100,000	11,300	157,000,000	6,000	10,000	6.0	27.3
<b>Large Thru-Bore Rotary Transformer Models for 4WD; 10X Overload; Available in Universal Bolt Pattern Only</b>									
27920TU(5-2)	500	56.5	5,000	565	2,600,000	1,150	1,950	6.0	27.3
27920TU(1-3)	1,000	113	10,000	1,130	7,200,000	1,600	2,750	6.0	27.3
27920TU(2-3)	2,000	226	20,000	2,260	21,000,000	2,300	3,900	6.0	27.3

Notes: 1. Maximum radial loads and bending moments may be applied simultaneously with full scale torque.

2. Inertia and weight values do not include the axle adapter or rotary transformer; see note 3.

3. A typical, Himmelstein furnished axle adapter has an inertia of 1.1 in-ozf sec<sup>2</sup> and weighs 5.2 lbs.

4. All specifications are subject to change without notice.

5. For light truck applications, use the following Models (consult factory for details):

MCRT® 27860TE 1,000 to 2,000 lbf-in, with 10X overload, eight bolt pattern and 5 inch through bore for hub clearance

MCRT® 27960TE 5,000 to 100,000 lbf-in with 2X overload, eight bolt pattern and 5 inch through bore for hub clearance

MCRT® 27940TB,E 1,000 lbf-in with 10X overload, spider mounted transformer for 4WD applications

### Order Numbers:

MCRT® 27820T A (5-4) Z

Model No.\*

Bolt Pattern

Option Codes:

Code A - 4 Bolt Pattern

Code B - 5 Bolt Pattern

Code X - 6 Bolt Pattern

Code E - 8 Bolt Pattern

Code U - Universal Pattern

Torque Range

Speed Pickup

### Option Codes:

**Code A - Standard Speed Pickup**, outputs 60 voltage pulses per revolution, amplitude proportional to speed.

**Code Z - Optional Zero Velocity Speed Pickup**, outputs 60 voltage pulses per revolution. Requires 5 to 15 volt DC power, pulse amplitude is approximately 0.5 volts less than supply voltage.

**Code O - Optional Encoder**, 3600 ppr (512 ppr for MCRT® 27830/27835) encoder for enhanced speed measurement resolution. Outputs TTL pulses, requires 5 volt DC power supply.

\* The T suffix denotes a mV/V output torquemeter. Replacing with a V suffix, i.e., MCRT® 27820VA(5-4)Z specifies a DC Operated Torquemeter. That is one powered by a single, unregulated dc supply and which outputs dual ±5V signals. See Bulletin 7801 for details.

**Patent Notice:** S. Himmelstein and Company torquemeters are manufactured under one or more of the following U.S. Patents: RE 26,501; 3,441,886; 3,531,749; 3,717,029; 3,800,591; 3,961,526; 4,412,198; 4,555,956; 4,563,905; 4,616,512; 4,651,573; 4,790,175

