BULLETIN 7300B

MCRT®3900X ***Non-Contact***
2-Wire, 4-20 mA
TORQUE TRANSMITTERS

Torque Ranges: 25 to 2,000,000 lb-in
2.8 to 226,000 n-m





- *High Accuracy*
- *High (4X) Overload*
- *Switchable to 12 ±8 mA Mode*
- *Bidirectional Operation Includes Stall*
- *NIST Traceable, Dead Weight Calibrated*
- *Switch Selected Direction (CW/CCW) and Bandwidth*
- *Traceable Field Calibration/Setup Free of Cable Effects*
- *15-5PH Stainless Shaft, Splashproof & Corrosion Resistant*
- *Exceptional Immunity to Electric Machine Magnetic Fields*

For Reliable Measurement & Control of Machines & Machine Driven Processes

S. HIMMELSTEIN AND COMPANY
Measurement And Control Products Since 1960

Features

- **High Accuracy**
- **Infinite Fatigue Life**
- **High Overload Capacity**
- **Full Bidirectional Operation**
- **Two-Wire, 4-20 mA Output**
- **Switchable to 12 ±8 mA Mode**
- **Switch Selected Direction (CW/CCW) and Filter Bandwidth**
- **Reverse Polarity Protection**
- **NIST Traceable, Dead Weight Calibrated**
- **Static and Dynamic Response**
- **Long, Maintenance-Free Life**
- **Immune to Vibration & Lubricants**
- **One Piece 15-5PH Stainless Steel Shaft**
- **Splashproof, Corrosion Resistant Construction**
- **Ferrite-free Rotary Transformer Coupled Foil Strain Gage Torque Sensing**
- **NIST Traceable Field Setup Free of Cable Effects**
- **Proven World-Wide on The Toughest Jobs**
- **No Slip Rings, Brushes, LVDT's, Optical Paths, Ferrites, or Radio Transmitters**
- **Exceptional Immunity to Electric Machine Fields**

Applications

Control, Monitoring and Testing Of:

- **Mixers, Extruders, Reactors**
- **Clarifier Drives, Emulsifiers**
- **Crushers, Pelletizers, Conveyers**
- **Rolling and Grain Mills, Grinders**
- **Gear, Belt, and Fluid Transmissions**
- **Winders, Paper Machines, Drill Rigs**
- **Fluid Viscosity, Pumps, Fans, Blowers,**
- **Machine Tools, Vehicle and Marine Drives**
- **Electric, Air and Hydraulic Motors**
- **Gasoline, Diesel and Turbine Engines**
- **Or Virtually any Rotating Machinery**

Benefits

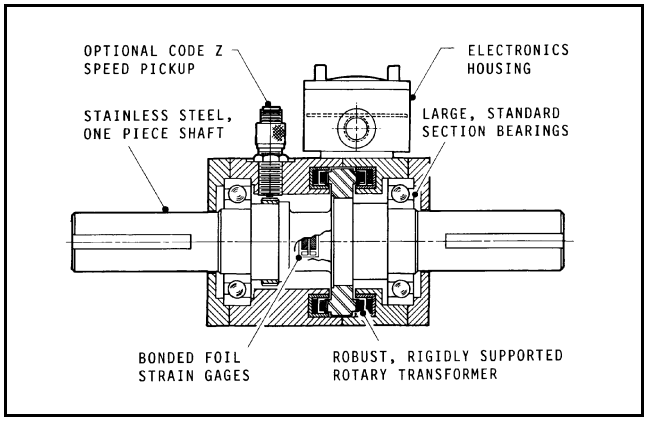
MCRT® devices provide the fastest, easiest, most dependable way to measure torque. *The use of actual rather than inferred torque, mechanical power and energy makes possible otherwise unusable* processes and machine control strategies. Very fast measurement response enhances those capabilities.

The control and verification of machine performance, efficiency, load, and load sharing are common uses. Display and logging of operating data permits you to optimize maintenance scheduling and thus minimize costly downtime. Early detection of dangerous and wasteful conditions are valuable benefits. Examples are process and machine degradation, overload, load loss, and destructive torsionals.

Transmitter Description

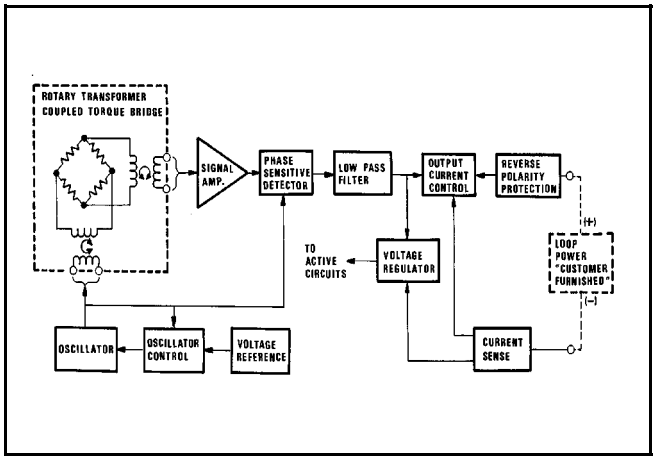
When installed between a driver and its load, MCRT® 3900X torque transmitters *measure bidirectional static (stall) and dynamic shaft torque and speed* (an option). These devices use patented Himmelstein technology field-proven in three decades of use. A one piece stainless shaft carries bonded, foil strain gages. They measure torque and, in combination with element design, cancel bending and thrust loads.

Rotary transformers connect the rotating gages to stationary, 4-20 mA transmitter circuitry. The transformers provide high quality non-contact signal coupling to the rotating gages. Rotary transformers don't wear or generate noise. They are immune to ambient noise, vibration, lubricants and other hostile environments.



Torque Transmitter Construction

RFI shielded circuitry and the current loop output, provide high noise immunity. A simple, 2-wire loop yields *NIST traceable field adjustments free of cable effects*. There are no slip rings, brushes, radio transmitters and other limited-life, noise-generating elements. Their elimination further increases performance and reliability. Moreover, the *robust, non-ferrite design* suits these transmitters for diesel and other hostile environments.

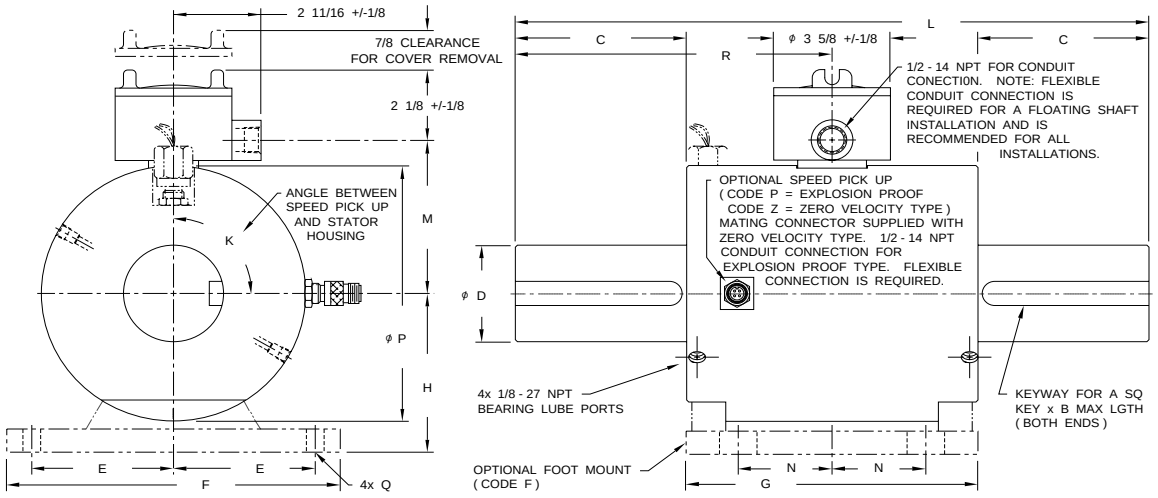


Simplified Block Diagram

Standard Ratings, Shaft End Transmitter Models

*(*Code N denotes Standard Performance, Code C denotes Enhanced Performance.)*

MCRT® MODEL	TORQUE RANGE		TORQUE OVERLOAD		SPEED RATING [rpm]		SHAFT STIFFNESS		ROTATING INERTIA		MAX WT.
	[lb-in]	[n-m]	[lb-in]	[n-m]	Code N*	Code C*	[lb-in/rad]	[n-m/rad]	[oz-in sec^2]	[n-m sec^2]	[lbs]
3901X(25-0)	25	2.82	100	11.3	0 to ± 6,000	0 to ±15,000	$5.59X10^3$	$6.32X10^2$	0.035	$2.5X10^{-4}$	11
3901X(5-1)	50	5.65	200	22.6	0 to ± 6,000	0 to ±15,000	$1.17X10^4$	$1.32X10^3$	0.035	$2.5X10^{-4}$	11
3901X(1-2)	100	11.3	400	45.2	0 to ± 6,000	0 to ±15,000	$2.14X10^4$	$2.42X10^3$	0.035	$2.5X10^{-4}$	11
3902X(25-1)	250	28.2	1,000	113	0 to ±5,000	0 to ±15,000	$5.02X10^4$	$5.67X10^3$	0.036	$2.5X10^{-4}$	11
3902X(5-2)	500	56.5	2,000	226	0 to ±5,000	0 to ±15,000	$5.60X10^4$	$6.33X10^3$	0.036	$2.5X10^{-4}$	12
3903X(5-2)	500	56.5	2,000	226	0 to ±5,000	0 to ±10,000	$1.54X10^5$	$1.74X10^4$	0.11	$7.8X10^{-4}$	23
3903X(1-3)	1,000	113	4,000	452	0 to ±5,000	0 to ±10,000	$2.14X10^5$	$2.42X10^4$	0.11	$7.8X10^{-4}$	23
3904X(2-3)	2,000	226	8,000	904	0 to ±3,800	0 to ±10,000	$4.21X10^5$	$4.76X10^4$	0.16	$1.1X10^{-3}$	26
3904X(5-3)	5,000	565	20,000	2,260	0 to ±3,800	0 to ±10,000	$5.93X10^5$	$6.70X10^4$	0.16	$1.1X10^{-3}$	26
3906X(1-4)	10,000	1,130	40,000	4,520	0 to ±3,600	0 to ±8,000	$1.80X10^6$	$2.03X10^5$	2.3	$1.6X10^{-2}$	105
3906X(2-4)	20,000	2,260	80,000	9,040	0 to ±3,600	0 to ±8,000	$2.70X10^6$	$3.05X10^5$	2.4	$1.7X10^{-2}$	105
3907X(25-3)	25,000	2,820	100,000	11,300	0 to ±3,600	0 to ±6,000	$5.70X10^6$	$6.44X10^5$	2.8	$2.0X10^{-2}$	115
3907X(5-4)	50,000	5,650	200,000	22,600	0 to ±3,600	0 to ±6,000	$7.10X10^6$	$8.02X10^5$	3.0	$2.1X10^{-2}$	115
3908X(1-5)	100,000	11,300	400,000	45,200	0 to ±2,400	0 to ±3,600	$2.90X10^7$	$3.28X10^6$	11.0	$7.8X10^{-2}$	150
3908X(25-4)	250,000	28,200	750,000	84,700	0 to ± 2,400	0 to ±3,600	$3.95X10^7$	$4.46X10^6$	11.7	$8.3X10^{-2}$	150
3909X(5-5)	500,000	56,500	2,000,000	226,000	0 to ± 1,200	0 to ± 1,800	$1.25X10^8$	$1.41X10^7$	207	1.46	780
3909X(1-6)	1,000,000	113,000	4,000,000	452,000	0 to ± 1,200	0 to ± 1,800	$1.42X10^8$	$1.60X10^7$	218	1.54	800
3910X(15-5)	1,500,000	170,000	6,000,000	678,000	0 to ±1,000	0 to ±1,200	$2.21X10^8$	$2.50X10^7$	567	4.00	1455
3910X(2-6)	2,000,000	226,000	7,350,000	830,000	0 to ± 1,000	0 to ± 1,200	$2.27X10^8$	$2.56X10^7$	582	4.11	1475



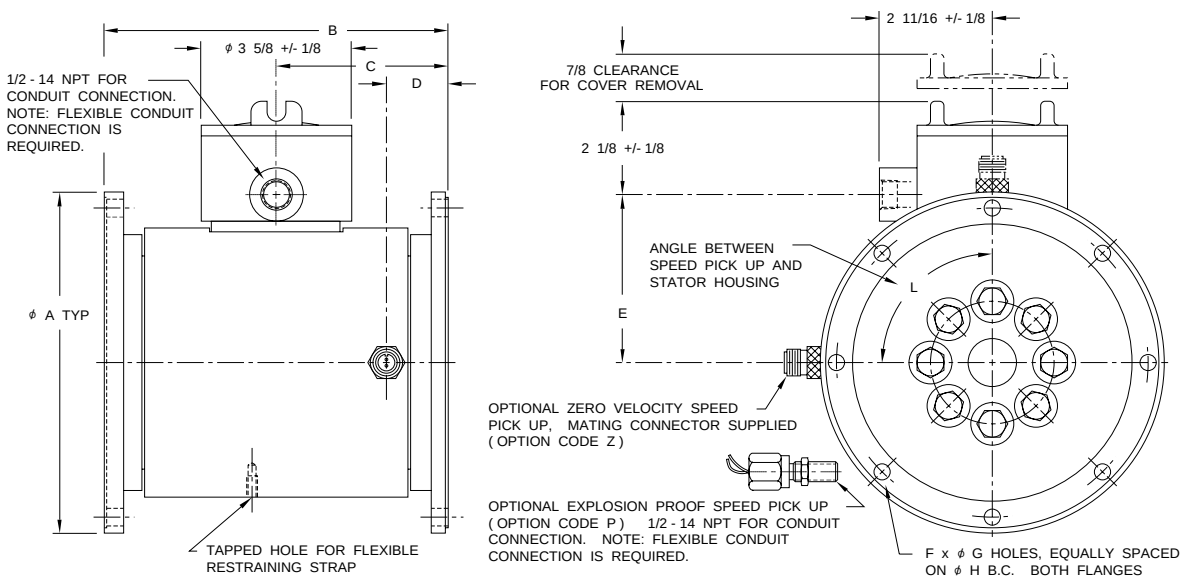
MCRT® MODEL	DIMENSIONS [inches]														
	A	B	C	D[1]	E	F	G	H	L	M	N	P	K	Q	R
3901X	0.187	1.125	1.50	0.625	2.25	5.50	5.50	2.250	8.50	2 11/16	1 ½	3 15/32	90°	0.406D	4 1/4
3902X	0.187	1.625	2.00	0.750	2.25	5.50	5.50	2.250	9.50	2 11/16	1 ½	3 15/32	90°	0.406D	4 3/4
3903X	0.250	1.750	2.00	1.000	2.625	6.25	7.00	2.500	10.00	3 1/8	1 ½	4 7/32	90°	0.406D	5
3904X	0.375	2.750	3.38	1.500	2.625	6.25	7.00	2.500	12.75	3 1/8	1 ½	4 7/32	90°	0.406D	6 3/8
3906X	0.625	3.500	4.13	2.500	4.25	10.00	8.75	5.000	17.00	4 7/8	2 13/16	7 15/16	0°	Note 2	8 ½
3907X	0.750	4.500	5.13	3.000	4.25	10.00	8.75	5.000	19.00	4 7/8	2 13/16	7 15/16	0°	Note 2	9 ½
3908X	1.000	6.500	7.56	4.500	4.25	10.00	7.75	5.000	23.00	5 1/4	2 13/16	8 ½	0°	Note 2	12 27/32
3909X	Note 3	8.000	9.00	7.750	7.00	15.50	18.00	8.000	36.00	7 7/8	7 7/8	13 7/8	0°	Note 2	18
3910X	Note 4	12	13.50	9.375	8.50	18.50	20.00	9.750	47.00	9 ½	8 7/8	17	0°	Note 2	23 ½

1. Tolerance on D diameter is +0.0000/-0.0005 for diameters – < 2.5" and +0.000/-0.001 for diameters > 2.5". 2. Slotted 0.531 wide by 1-1/8 long.
3. Dual rectangular keyways at each end are 2" wide by 1.50" high. 4. Dual rectangular keyways at each end are 2.50" wide by 1.75"high.

Standard Ratings, Compact Flanged Transmitter Models

MCRT® MODEL	TORQUE RANGE		TORQUE OVERLOAD		SPEED RATING [rpm]		SHAFT STIFFNESS		ROTATING INERTIA		MAX WT.
	[lb-in]	[n-m]	[lb-in]	[n-m]	Code N*	Code C*	[lb-in/rad]	[n-m/rad]	[oz-in sec^2]	[n-m sec^2]	[lbs]
3960X(5-2)	500	56.5	2000	226	0 to ±4,000	0 to ±8,000	$6.02X10^5$	$6.80X10^4$	0.6	0.0042	12½
3960X(1-3)	1,000	113	4000	452	0 to ±4,000	0 to ±8,000	$1.38X10^6$	$1.56X10^5$	0.6	0.0042	12½
3960X(2-3)	2,000	226	8000	904	0 to ±4,000	0 to ±8,000	$2.64X10^6$	$2.98X10^5$	0.6	0.0042	12½
3961X(3-3)	3,000	339	12,000	1,360	0 to ±4,000	0 to ±8,000	$2.43X10^6$	$2.75X10^5$	0.9	0.0064	15½
3961X(5-3)	5,000	565	20,000	2,260	0 to ±4,000	0 to ±8,000	$2.93X10^6$	$3.31X10^5$	0.9	0.0064	15½
3961X(12-3)	12,000	1,360	36,000	4,070	0 to ±4,000	0 to ±8,000	$3.53X10^6$	$3.99X10^5$	0.9	0.0064	15½
3970X(12-3)	12,000	1,360	48,000	5,420	0 to ±3,600	0 to ±5,500	$6.80X10^6$	$7.68X10^5$	8.24	0.058	51
3970X(24-3)	24,000	2,710	96,000	10,800	0 to ±3,600	0 to ±5,500	$1.22X10^7$	$1.38X10^6$	8.27	0.058	51½
3970X(48-3)	48,000	5,420	192,000	21,700	0 to ±3,600	0 to ±5,500	$1.79X10^7$	$2.02X10^6$	8.33	0.059	52
3980X(1-5)	100,000	11,300	400,000	45,200	0 to±2,400	0 to ±3,600	$3.92X10^7$	$4.43X10^6$	54.5	0.38	153
3980X(25-4)	250,000	28,200	750,000	84,700	0 to ±2,400	0 to ±3,600	$5.95X10^7$	$6.74X10^6$	54.9	0.39	155
3990X(5-5)	500,000	56,500	2,000,000	226,000	0 to ±1,200	0 to ±1,800	$1.52X10^8$	$1.72X10^7$	482	3.40	979
3990X(1-6)	1,000,000	113,000	4,000,000	452,000	0 to ±1,200	0 to ±1,800	$1.77X10^8$	$2.00X10^7$	493	3.48	998
3991X(15-5)	1,500,000	170,000	6,000,000	678,000	0 to ±1,000	0 to ±1,200	$2.82X10^8$	$3.19X10^7$	1,838	12.98	1,502
3991X(2-6)	2,000,000	226,000	7,350,000	830,000	0 to ±1,000	0 to ±1,200	$2.92X10^8$	$3.30X10^7$	1,852	13.08	1,516

*Code N denotes Standard Performance, Code C denotes Enhanced Performance.



MCRT® MODEL	DIMENSIONS [inches]								
	A	B	C	D	E	F	G	H	L
3960X	4.250 ±0.001 *(Flange faces are pilotless)*	5 3/16	2 19/32	1 3/32	2 27/32	8	3/8-24UNF-2B	3.625	90°
3961X	4.250 ±0.001 *(Flange faces are pilotless)*	5 15/16	2 31/32	1 15/32	2 27/32	8	3/8-24UNF-2B	3.625	90°
3970X	8 *(Flange faces have male and female pilots*)*	8	4 1/32	1 7/16	4 1/16	8	0.377 +0.002/-0.000	7.250	0°
3980X	12 *(Flange faces have female pilots*)*	15 1/4	8 13/16	5 5/8	5 1/4	16	0.630 +0.002/-0.000	10.375	0°
3990X	23 *(Flange faces have female pilots*)*	31	15 ½	7 1/8	7 7/8	32	0.755 +0.002/-0.000	20.625	0°
3991X	30 *(Flange faces have female pilots*)*	37	18 ½	9 1/8	9 ½	32	1.005 +0.002/-0.000	27	0°

**Contact the factory for a print of flange details.*

Shaft End and Flanged Models

Shaft end transmitters are the choice for most applications. They cost less than flanged models and, they can either be floated or foot mounted. Flanged transmitters are much shorter than the shaft end types. Therefore, flanged models are often used when axial space is insufficient to accommodate a longer, shaft end model.

Flanged models also handle large* axial or thrust loads *without special mounting considerations or hardware*. As a result, they are frequently used in marine or vehicular drives, to support the weight and thrust of a mixers' impeller, and in other similar circumstances. *A flanged transmitter must be installed as a floating shaft.*

* generally a thrust in pounds equal to the transmitters' full scale rating in pound-inches.

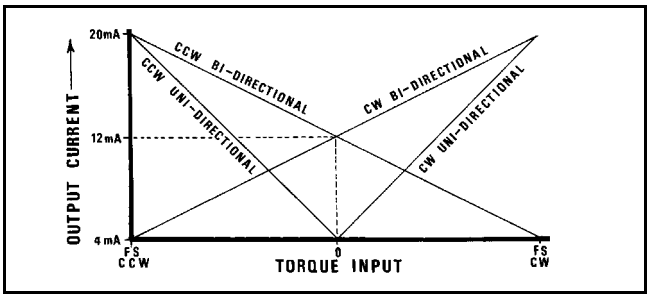
General Specifications

	Code N Standard Performance	Code C Enhanced Performance
Nonlinearity (end point method, % of F.S.):	≤ ±0.20	≤ ±0.10
Hysteresis (% of F.S.):	≤ ±0.20	≤ ±0.10
Nonrepeatability (% of F.S.):	≤ ±0.10	≤ ±0.05
Combined Errors (combined non-linearity, hysteresis and non-repeatability, % of F.S.):	≤ ±0.3	≤ ±0.15
Stability, 6 Months (% of F.S.):	≤ ±0.3	≤ ±0.15
Rotational Effect on Zero (% of F.S.):	≤ ±0.15	≤ ±0.05
Calibration Accuracy (% of F.S. @ 75 deg. F., traceable to NIST):	≤ ±0.05	≤ ±0.02
Temperature Effects:		
Zero (% of F.S./deg. F.):	≤ ±0.005	≤ ±0.002
Span (% of Rdg./deg. F.):	≤ ±0.005	≤ ±0.002
Compensated Range:	+75 to +175 deg. F.	
Minimum Usable Range:	-25 to +185 deg. F.	
Storage Range:	-65 to +225 deg. F.	
Outputs: 4 switch selected modes, as follows (see curves below)		
Clockwise[1] (CW) Unidirectional Torque:	4-20 mA	
Counterclockwise[1] (CCW) Unidirectional Torque:	4-20 mA	
CW Bidirectional:	12±8 mA	
CCW Bidirectional:	12±8 mA	
Measurement Bandwidth*:	dc to 200 Hz or, dc to 1.5 Hz, switch selected.	
Zero Control Range:	5% of F.S., nominal.	
Span Control Range:	5% of F.S., nominal.	
Supply Voltage (see curve below):	10 to 32 Volts dc, fused and reverse polarity protected.	
Maximum Load Resistance (see curve below):	1100 ohms @ 32 V, or [(50)(Supply Volts) - 500] ohms.	
Power Supply Effects:	output changes < 1.5 uA per volt.	

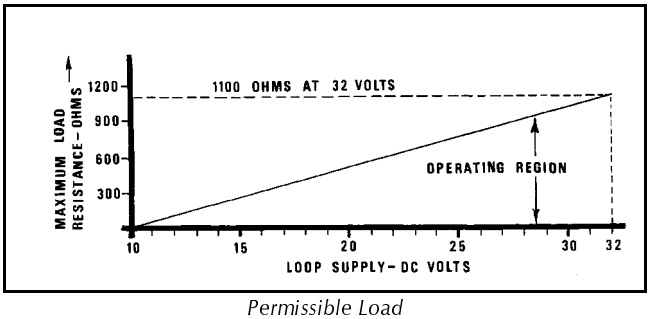
Notes

* Bandwidth upper limit is determined by the transmitter filter(s). The self resonant frequency of its mechanical element is greater than 1 kHz.

1. CW torque causes the transmitter shaft to turn CW when viewed from its driven end. CCW torque causes the opposite rotation.
2. "F.S." denotes "full scale". "rdg." denotes "reading". "deg. F." denotes "degree Fahrenheit".
3. Speed ratings are for continuous, bidirectional operation *without external lubrication.*
4. These transmitters will operate in a condensing atmosphere, and if wetted with non-corrosive fluids and mud. When used under contaminated conditions, clean regularly or *cover to deflect contaminants*. These devices are not submersible.
5. Transmitters operated in hazardous locations must be purged with air or another inert gas. Provision is made for porting purge air via the standard conduit fitting. When measuring speed in a hazardous atmosphere, *specify an explosion proof speed pick-up (Code P).*
6. Construction materials are: Shaft and end bells – *15-5PH stainless steel,* body – *low copper aluminum,* electronic housing – *cast iron,* paint – *epoxy polyester,* bolts – *316 stainless steel or black oxide alloy steel.*
7. Electrical connections are: *screw terminals for loop connections via ½" internally threaded conduit fitting.* Optional zero velocity pick-up *uses an MS connector.* Optional explosion proof speed pick-up has *wire leads and a ½" internally threaded fitting.*
8. *Specifications and dimensions are subject to change without notice.*



Switch Selected Operating Modes



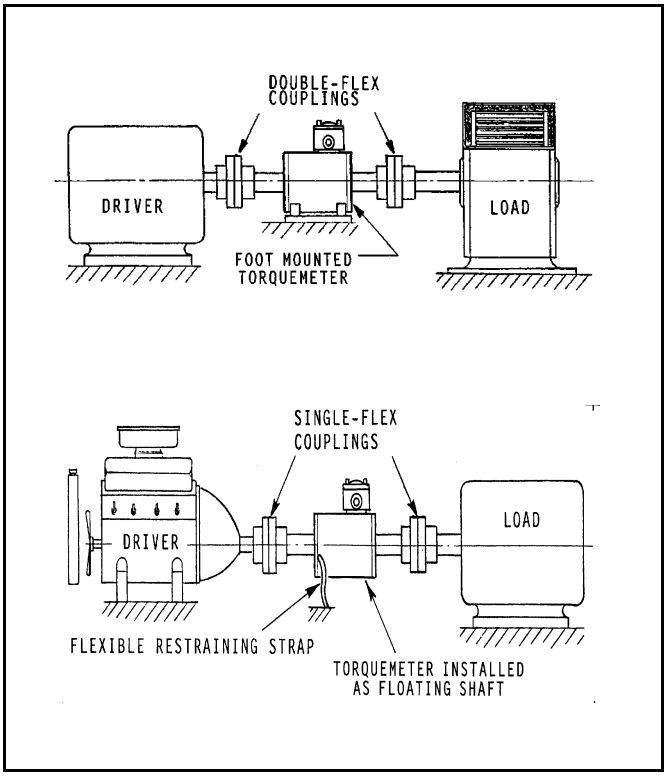
Permissible Load

Patent Notice: Himmelstein torque measurement products are manufactured under one or more of the following U.S. Patents:

RE26,501 3,441,886 3,531,748 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

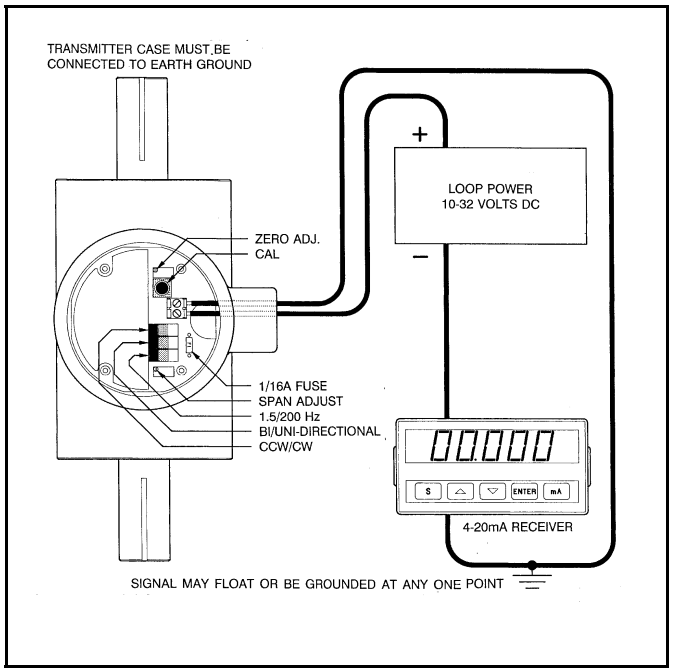
Installation

When it's installed between a driver and its load, a transmitter measures shaft torque. A shaft end transmitter may be floated or, foot mounted as shown in the upper sketch. Both shaft end and flanged end types may be operated as floating shafts; see the lower illustration. A floating transmitter handles the greatest axial loads, a foot mounted transmitter operates at the highest speeds.



Mechanical Installation

Just connect loop power as shown. A voltage between 10 and 32 volts dc is required. Switches select the desired operating mode, i.e., CW or CCW, unidirectional or bidirectional. A switch also selects a 1.5 or 200 hertz frequency response. The 1.5 hertz cutoff is useful for eliminating vibratory signals, if present. The 200 hertz response may be used to drive a fast controller or for wideband data acquisition. Internal, NIST traceable, calibration circuitry verifies transmitter operation and simplifies scaling of the customers' recording/control system.



Electrical Connections

Available Options: Available options are listed. Consult the factory should you have special requirements.

Enhanced Performance - Code C, or N if Standard
This option reduces measurement errors by a factor of two or more and increases maximum shaft speed. See specifications for full details.

Foot Mount - Code F, or N if None
Foot mounts provide a rigid stator mounting. They are only available on shaft end transmitters. Refer to outline drawing for dimensions.

Zero Velocity Speed Pick-up - Code Z, or N if None
Outputs 60 voltage pulses/revolution, not *4-20 mA*. Its amplitude is constant with speed. It requires 5 to 15V dc power. Output pulse amplitude is approximately the input supply voltage less 0.5 volts.

Explosion-Proof Speed Pick-up - Code P, or N if None
Outputs 60 voltage pulses/revolution, not *4-20 mA*. Its amplitude is proportional to speed. ***Use Code Z pick-ups for speeds below 500 rpm.***

Order Number: MCRT® 3961X (5-3) - C - N - Z - 8000

Model No. and Range — MCRT® 3961X (5-3)
Performance — C
Foot Mount — N
Speed Pick-up — Z
Maximum RPM — 8000

S. HIMMELSTEIN AND COMPANY
2490 Pembroke Avenue, Hoffman Estates, IL 60195, USA • Tel: 847/843-3300 • Fax: 847/843-8488

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