

INSTRUCTION MANUAL

(AO-70263)

FOR CLEVELAND-KIDDER[®] ULTRA SERIES SLIM CELL TRANSDUCER



REVISION

AA

Industrial Products Division

REVISION HISTORY

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WARRANTY

Cleveland Motion Controls warrants the goods against defects in design, materials and workmanship for the period of 12 months from the date of delivery on the terms detailed in the Cleveland Motion Controls, Inc. Terms and Conditions of Sale, document number AO-90131.

Cleveland Motion Controls, Inc. reserves the right to change the content and product specification without notice.

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INTENDED USERS

This Instruction Manual is to be made available to all persons who are required to configure, install or service the amplifier equipment described in this manual or any other related activity.

ADDITIONAL INFORMATION

For the latest product information, technical literature etc., visit our website at www.cmcontrols.com

ATTENTION: The following information is provided merely as a guide for proper installation. Cleveland Motion Controls cannot assume responsibility for the compliance (or failure to comply) to any code (national, local or other) that prescribes the proper installation of this electro-mechanical device or associated equipment. A hazard of personal injury and/or property damage can exist if applicable codes are not adhered to.

CE EMC RESPONSIBILITY

Cleveland Motion Controls Ultra Slim Cell Transducer when used in conjunction with the Ultra Series Amplifier can be considered a component performing a direct function and therefore is subject to the provisions of the EMC Directive.

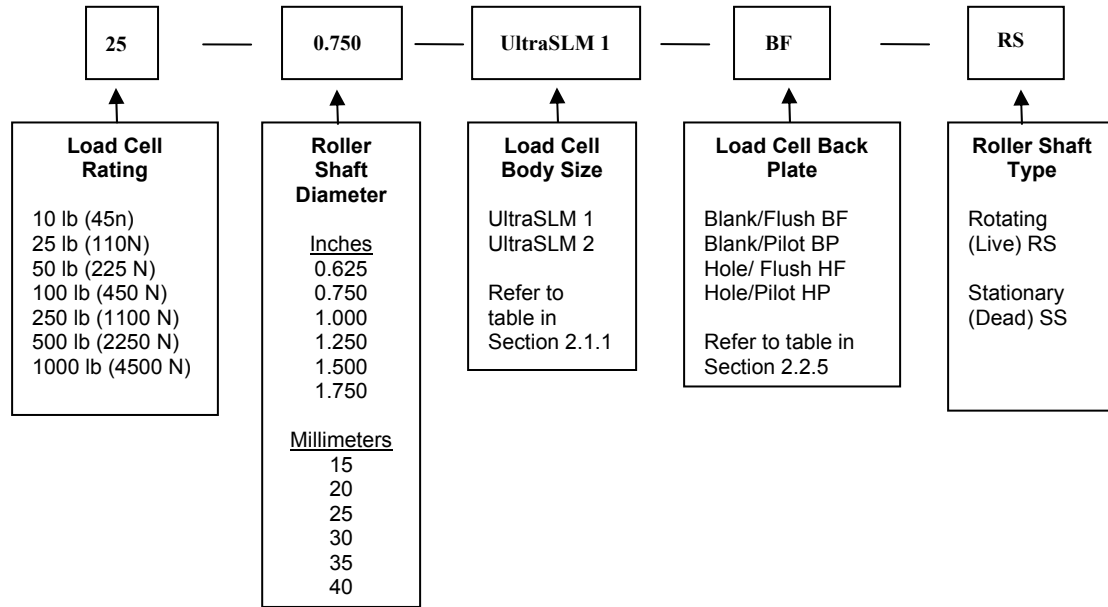
The Cleveland-Kidder Ultra Transducer may be used by a manufacturer as a component of a larger system, along with other components, which may or may not bear the CE mark. The system assembler is responsible for the compliance of the system as a whole with the EMC Directive.

Before installing the Transducer you must clearly understand who is legally responsible for conformance with the EMC Directive. Misappropriation of the CE mark is a criminal offense.

1 IMPORTANT INFORMATION

1.1 ORDER NUMBERS

Use the following illustration to configure an ordering number when purchasing a Slim Cell Ultra Series Load Cell:



To order the optional mounting bracket, use the part numbers listed in the table below:

If you need a mounting bracket for:	Then order part number:
Slim Cell Size 1 (UltraSLM 1)	SLM BR 1
Slim Cell Size 2 (UltraSLM 2)	SLC BR2

1.2 CONTACT INFORMATION AND SERVICE ASSISTANCE

For service assistance, have the following information available:

- Type of Slim Cell Transducer
- Maximum Working Force
- Purchase Order Number

To contact us, visit our website at www.cmcccontrols.com or use the following numbers:

Phone: 216.524.8800

Fax: 216.642.5155



Disassembly by improperly trained personnel may result in additional damage to these units. Should repairs be required or for warranty repairs, contact the Customer Service Department for a return authorization number before returning the units.

1.3 RECEIVING AND UNPACKING

After receiving the Ultra Slim Cell Transducer you should:

- Carefully unpack and handle the equipment
- Compare the received shipment with the packing list
- Report any damage to the carrier and your CMC representative
- Store equipment that will not be used in a clean, dry location
- Take appropriate precautions to prevent moisture, dust and dirt from accumulating in storage and installation areas

1.4 PRE-INSTALLATION PRECAUTIONS

1.4.1.1 SHIPPING

Shock and vibration transmitted to the transducers by the sensing roll during transportation can damage the transducers. It is essential that you remove the sensing roll when the machine is shipped with the transducers mounted.

1.4.1.2 ROLL BALANCE

The sensing roll should be adequately balanced. Understand that the balance of the sensing roll will be more demanding than that typically needed in general rotating machinery. The goal goes beyond just limiting the force to which bearings will be subjected, but rather to minimize the generation of an unintended noise component in the transducer tension signal. The centrifugal force caused by imbalance can be estimated using the following formula:

$$F = (1.77 \times 10^{-6}) \times W \times R \times (\text{RPM})^2$$

Where:

F = centrifugal force (in units of lb-f)

W = weight imbalance (in units of ounces)

R = radius of displacement, distance of imbalance weight from roll axis of rotation (in inches)

RPM = Revolution per minute

Note that the force goes up as the square of the RPM or in other words, doubling the RPM causes four times the force. Because rolls tend to have a high length-to-diameter ratio, two-plane (dynamic) balancing is recommended. Balancing is particularly needed where higher RPMs and lower web forces are involved.

To illustrate how much imbalance induced “noise” could be generated, the following table shows the force disturbance for various ISO balance grades for an illustrative case of a 20 pound roll (4” diameter x 36” long, aluminum) rotating at 1500 RPM.

Balance Grade (ISO 1940/1):	Residual Imbalance:	Resultant Force due to Residual Imbalance:
G16	1.25 oz-in	+/- 5 lb-f at 25 Hz
G6.3	0.5 oz-in	+/- 2 lb-f at 25 Hz
G2.5	0.2 oz-in	+/- 0.8 lb-f at 25 Hz
G1	0.08 oz-in	+/- 0.3 lb-f at 25 Hz

1.4.1.3 CRITICAL ROLL SPEED

Even with a balanced roll, a vibration can be set up in a stationary shaft. If this vibration (in cycles per minute) occurs at the harmonic frequency of the shaft, the transducers can be damaged. To determine the critical roll speed, use the following formula:

$$\text{Critical roll speed in RPM} = \frac{4.8 \times 106 \times \text{Shaft O.D.}}{(\text{Shaft Length})^2}$$

(Dimensions are in inches)

To assure that this issue is avoided, the critical roll speed should be at least 20% above the roll speed attained at maximum web speed.

1.4.1.4 AVOIDING DAMAGE TO THE TRANSDUCERS

To avoid damaging the transducers, refrain from repetitive overloading above the maximum working force or severe overloading.

1.4.1.5 EXCITATION VOLTAGE



Maximum Excitation Voltage for the Ultra Series Slim Cell transducers must be limited to 5.6 VDC or 5.6 VRMS. Do not use 10 Volt excitation or possible damage to the semiconductor strain gage elements can occur. Before applying power to the amplifier, verify that the amplifier excitation voltage has been set to 5.0 VDC.

2 GENERAL DESCRIPTION

The Ultra Series Slim Cell Transducer utilizes a twin sensing beam. Conversion from mechanical strain to an electrical signal is accomplished using semiconductor-based, piezoresistive strain gage elements. The Full Wheatstone Bridge configuration provides an electrically balanced output yielding twice the amount of signal swing as half-bridged transducers operated at the same excitation voltage. Integral span compensation is used to correct for temperature induced gain changes.

Slim Cell Transducers can be used with either rotating (live) shaft rolls (RS type) or stationary (dead) shaft rolls (SS type) that incorporate their own low friction bearings. For more information on transducer type selection refer to Section 1.1.

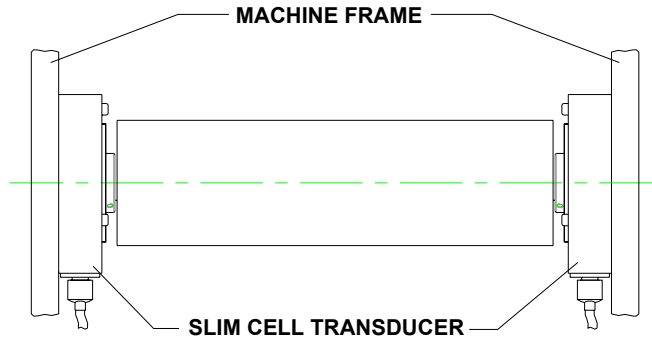


Figure 1- Slim Cell Transducer Incorporating Shaft Bearing Function

2.1 SPECIFICATIONS

Item:	Specification:	
Transducer Weight	Slim Cell 1	Slim Cell 2
	2.8 lbs. 1.3 kg	6.6 lb. 3.0 kg.
Weight + Bracket	Slim Cell 1	Slim Cell 2
	5.5 lbs. 2.5 kg.	11.6 lb. 5.3 kg.
Material	Body and Side Plates – Stainless Steel 410	
Bridge Resistance	135-147 Ohms @ 20 °C	
Gage Type	Semi-conductor strain gage, gage factor equals 95 (nominal)	
Connector Type	M12 Quick-disconnect, 4 conductor, DC keyed	
Excitation Voltage	5.6 VDC or VAC (RMS) maximum (Excess voltage can cause permanent damage)	
Nominal Output Signal at Rated MWF	+/- 100 mV per Transducer (with 5 VDC or VAC rms excitation voltage)	
Output Impedance	Approximately 64 Ohms per Bridge leg	
Maximum Voltage, Gage to Beam or Base (Ground)	50 Volts peak	
Operating Temperature Range	0° F to +200° F	
Maximum RPM	2500 (without derating)	
Alignment	+/- 2 degrees angular displacement	
Break-away torque	0.6 lb-in	

2.1.1 SLIM CELL FORCE RATINGS

Size	MWF (lb.)	Linear Overload (%)*	Ultimate Overload (%) **
UltraSlim 1	10	400	800
	25	400	800
	50	400	1000
	100	300	1000
	250	300	1000
	500	150	500
UltraSlim 2	500	200	1000
	1000	150	500

*Linear overload: Maximum force applied on the transducer before hitting the safety stop (the output is linear up to that point).

** Ultimate Overload: Maximum force applied on the transducer with out risking permanent deformation.

2.2 BEFORE INSTALLING THE TRANSDUCER

Before you install the Slim Cell Transducer you should perform the following steps:

1. Review the safety considerations (Section 2.2.1)
2. Assemble the mounting hardware and review the torque fastener information (Section 2.2.2)
3. Reference the mounting dimensions (Section 2.2.3)
4. Determine a mounting location (Section 2.2.4)
5. Determine an appropriate mounting style (Section 2.2.5)

2.2.1 SAFETY CONSIDERATIONS



Safety should not be an afterthought. Before installing, servicing or calibrating review and follow applicable policies and procedures to ensure worker safety. Machinery must be in a safe state and be aware of any additional hazards that can arise when installing and calibrating higher force transducers.

The following points are important to remember:

- Check that all hardware is mounted with appropriate fasteners (thread size and pitch, fastener grade, length of thread engagement).
- When “dead-weights” are used to produce calibration forces, always wear steel-toed shoes.
- When manually handling calibration weights and rolls, use safe lifting practices to avoid injury.
- Size cordage or straps with ample safety factors to reduce the chances of failure and falling weights.
- Consider where the cords and weights will travel to should a failure occur.

2.2.2 MOUNTING HARDWARE AND RECOMMENDED FASTENER TORQUE

UltraSlim 1:	Torque:
¼ - 20 x 1-3/8 (typical) SAE grade 8	10 lb-ft
M6 - 1.0 x 35 mm L, Property Class 10.9	8 N-m
Setscrews	
10 - 32 (Inch Hub)	24 lb-in
M5 - 0.8 (Metric Hub)	4.7 N-m

UltraSlim 2:	Torque:
3/8-16 x 2 (typical) SAE grade 8	32 lb-ft
M10 - 1.5 x 50 mm L, Property Class 10.9	45 N-m
Setscrews	
¼ - 20 (Inch Hub)	7.5 lb-ft
M6 - 1.0 (Metric Hub)	6 N-m



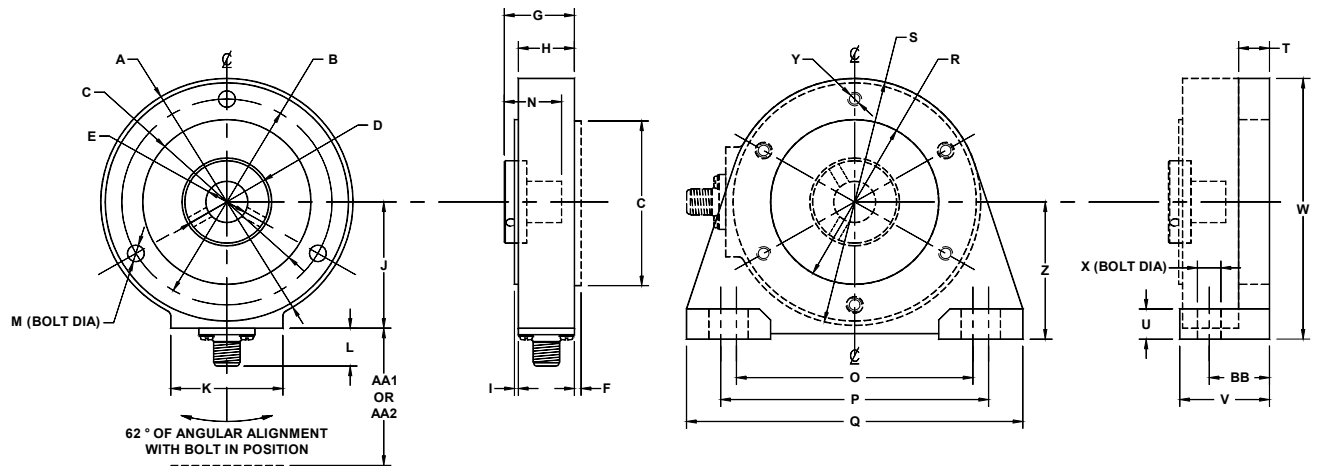
Mechanisms used for industrial automation can tax even the best threaded fasteners. You can improve the likelihood that bolts and shafts remain secure by using suitable anaerobic “thread lockers” during the final assembly.

Trademark Information

Loctite is a registered trademark of Henkel Loctite Corp.

Kidder is a registered trademark of Cleveland Motion Controls

2.2.3 MOUNTING DIMENSIONS



Dimensions in Inches:

Designator:	Dimension in Slim Cell Transducer 1:	Dimension in Slim Cell Transducer 2:
A	4.50	5.80
AA1 (mating conn. at right angle)	1.3	1.3
AA2 (mating conn. straight)	2.5	2.5
B	3.75	4.75
BB	1.08	1.33
C	2.996 - 3.000	4.196 - 4.200
D	1.50	2.46
E	Refer to Section 1.1 for roll shaft diameters	
F	0.12	0.14
G	1.31	1.70
H	1.02	1.32
I	0.07	0.10
J	2.30	3.05
K	2.00	2.50
L	0.65	0.65
M	.28 (3)	.40 (3)
N	1.02	1.36
O	4.22	5.50
P	4.78	6.5
Q	6.00	8.00
R	3.000 - 3.006	4.200 - 4.206
S	4.50	5.80
T	0.55	0.65
U	0.55	0.65
V	1.60	2.1
W	4.75	6.2
X	3/8 (2)	1/2 (2)
Y	1/4 - 20 NC (3)	3/8-16 NC (3)
Z	2.50	3.30

Dimensions in Millimeters:

Designator:	Dimension in Slim Cell Transducer 1:	Dimension in Slim Cell Transducer 2:
A	114.3	174.3
AA1 (mating conn. at right angle)	33	33
AA2 (mating conn. straight)	64	64
B	95.3	120.7
BB	27.4	33.8
C	76.10 - 76.20	106.58 - 106.68
D	38.1	62.5
E	Refer to Section 1.1 for roll shaft diameters	
F	3.0	3.6
G	33.3	43.2
H	25.9	33.5
I	1.8	2.5
J	58.4	77.5
K	50.8	63.5
L	16.5	16.5
M	6 (3)	8 (3)
N	25.9	34.5
O	107.2	139.7
P	121.4	165.1
Q	152.4	203.2
R	76.20 - 76.35	106.68 - 106.83
S	114.3	174.3
T	14.0	16.5
U	14.0	16.5
V	40.6	50.8
W	120.6	157.5
X	10 (2)	12 (2)
Y	1/4-20 NC (6)	3/8-16 NC (6)
Z	63.5	83.8

Figure 2 – Transducer and Mounting Bracket Dimensions

2.2.4 SELECTING A MOUNTING LOCATION

Select the mounting location for the transducer keeping the following points in mind:

- The transducer can be mounted to either inside or outside of the machine frame.
- The tension-sensing roll *must not* be mounted where the web wrap angle can vary, or the transducer will not interpret the tension properly. If a variance in the wrap angle occurs, it is sensed by the transducer as a tension change and the change is indicated on the tension indicator. In cases where it is impossible to mount the transducer where the wrap angle does not vary, the change in indicated tension that results should be calculated and if small, can be disregarded.

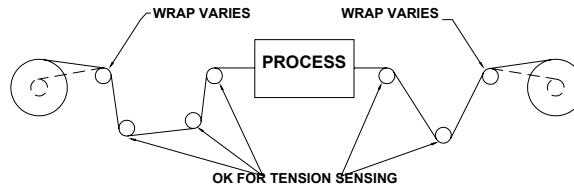


Figure 3 – Example of Varying Wrap Angles

2.2.5 DETERMINE A MOUNTING STYLE

The Ultra Slim Cell Transducer can be mounted in several different ways (Figure 4). When choosing a mounting style, evaluate your options by taking the following points into consideration:

- Safety
- Machine Frame orientation
- Ease of Assembly

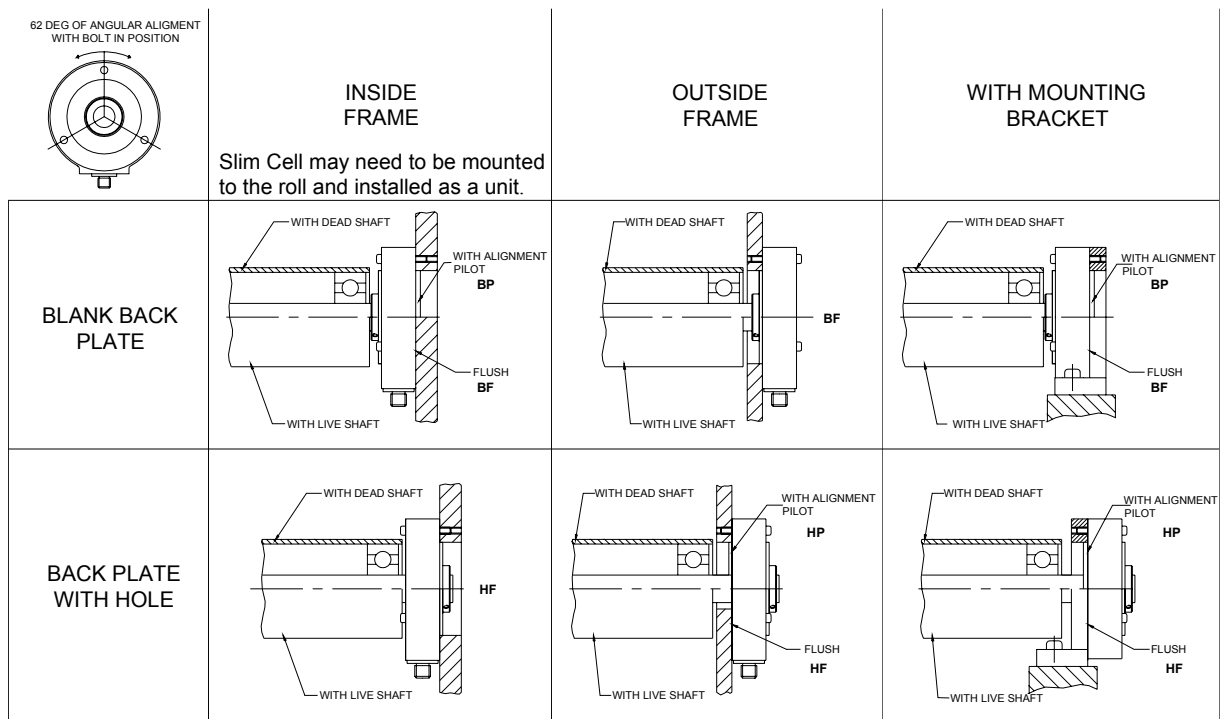


Figure 4- Slim Cell Transducer Mounting Styles

3 INSTALLING THE SLIM CELL TRANSDUCER

3.1 INSTALLATION PRECAUTIONS

To ensure proper installation and operation of the system, keep the following points in mind:

- Do not apply shock loads to the Slim Cell bearing assembly when mounting or dismounting rolls.
- Exercise care to avoid overstressing the transducer when handling partially mounted rolls. Even relatively short rolls can afford an impressive mechanical advantage over the transducer.
- Bolting the transducer to a non-flat surface can cause deformation of the transducer body and degrade the quality of the tension signal.



Failure to follow these precautions can result in serious damage to the Slim Cell Transducers and possibly void the warranty!

3.2 MOUNTING THE SLIM CELL TRANSDUCER TO THE MACHINE FRAME

The Slim Cell Transducer can be mounted directly to the machine frame or mounted using the optional mounting bracket.

The mounting surfaces for the Slim Cell Transducer should be flat and parallel to each other. Remove any loose paint, rust or scale from the machine frame before mounting.

When Mounting the Slim Cell Transducer Directly to the Machine Frame:	When Mounting the Bracket to the Machine Frame:
<ul style="list-style-type: none"> • The Slim Cell can be mounted on either the inside or outside of the machine frame. Refer to Figure 4 to help determine the arrangement that best suits your application. • Before drilling and tapping the mounting holes in the machine frame, refer to section 3.3 to ensure proper alignment of the Slim Cell. • Mount the Slim Cell Transducer into place with three bolts. For properly positioned bolt hole centers and sizes, refer to the dimensions listed for letters B and M in Figure 2. The bolt hole centers are evenly spaced on a circle and 120 degrees from each other. 	<ul style="list-style-type: none"> • The transducers can be mounted on either side of the bracket. Refer to Figure 4 to help determine the arrangement that best suits your application. • Drill and tap two mounting holes in the machine frame for each bracket. Refer to dimension X, O and P in Figure 2 for correct dimensions for the bolt holes.

3.3 POSITIONING THE SLIM CELL TRANSDUCER

Use the following step when positioning the transducers for mounting:

1. Before bolting the transducer in place, be sure that it is generally aligned with the tension force (load direction). The transducer is properly aligned when the load direction (bisector of the wrap angle) is pointing along a line connecting the “+” and “-“ signs located on the sides of the load cell
2. Insert and finger-tighten the bolts.
3. Rotate the Slim Cell outer ring so that the load direction is precisely aligned with the “+/-“ axis. The outer ring can be rotated 60 degrees in either direction to achieve the proper alignment position.
4. Tighten the mounting bolts to the recommended torque (Refer to section 2.2.2). It is a good practice to tighten each bolt incrementally, and in succession.
5. Note the alignment of the force. If the force points to the “+” sign, the output signal of the transducer is positive. If the force points to the “-“ sign, the output is negative. This information is important to know when wiring the transducer to the amplifier, indicator or controller terminals. Interchanging the black wire and white wire at the amplifier terminals (connections) may be required to provide the proper signal polarity for the device.

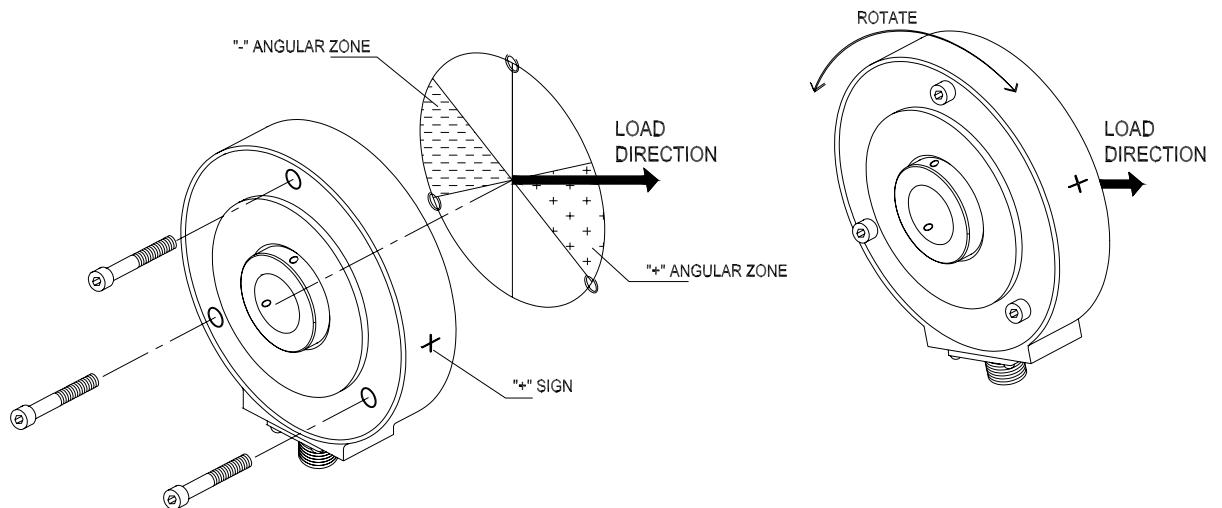


Figure 5 – Positioning the Slim Cell Transducers for Mounting

3.4 MOUNTING THE ROLL

Be sure to exercise care during this portion of the installation, as it is easy to produce excessive force on the transducer sensing beams. To mount the roll, use the following steps:

1. Loosely fit the roll into the transducer to verify that the shaft and the adapter fit without excessive interference or clearance. For reference, the bore diameter of the hub is +0.0007 and +0.0017 in. (+0.018 and +0.043 mm) from the nominal diameters listed in Section 1.1.
2. Check to see if the transducer has a blank back plate (without a hole). If it is a blank plate, be sure that the roll shaft does not extend too deep inside of the Load Cell and rub against the back plate. Refer to letter N in Figure 2 of this document.
3. Secure one end of the roll shaft into either of the Slim Cell Transducer shaft hubs by tightening the two set screws.
4. Tighten the set screws while preloading the hub.

Preloading of the adapter shaft hub allows for expansion and contraction of the roll shaft. Because of the effects of thermal gradients and differing material, both expansion and contraction must be accommodated. To preload the hub:

Push the hub inward against the resistance of the internal spring prior to tightening the set screw on the remaining shaft hub.



During final assembly, you can use Loctite® #609 retaining compound on the roll journal to transducer hub interface, and Loctite's #242 (removable strength) thread locker on the set screws.

3.5 CHECKING THE TRANSDUCER MOUNTING

Before preparing to apply force to the transducer(s) and calibrating the amplifier, inspect the load cell to confirm that it is oriented and mounted in accordance to the installation instructions. Common problems include:

- Failure to mount transducers on flat (machined) surface.
- Poor shaft alignment that exceeds allowable limits.
- Fastener torque either excessive or insufficient.
- Transducer mis-oriented so that the axis of sensing is not true to the applied force vector (bisector of the wrap angle).
- Roll is mounted without allowance for shaft expansion/contraction at transducer hub.
- The transducer is positioned in the web path so that the wrap angle is not constant.

3.6 ELECTRICAL CONNECTIONS AND WIRING

Refer to the installation wiring diagrams supplied with the Cleveland-Kidder tension indicator or controller for making the transducer to amplifier connections. Make certain that:

- The cables do not interfere with the web path, and that they are away from gearing or other moving parts.
- You exercise care when routing the cables to avoid pick-up from noise-radiating power cabling (motor armature leads, AC main wiring, etc).
- In environments with severe electromagnetic noise, it may be necessary to route the cables inside metallic conduit.
- You accommodate polarity changes by reversing the orientation of the Slim Cell or by interchanging the black and white output wires.

Figure 6 illustrates a typical full-bridge transducer configuration.

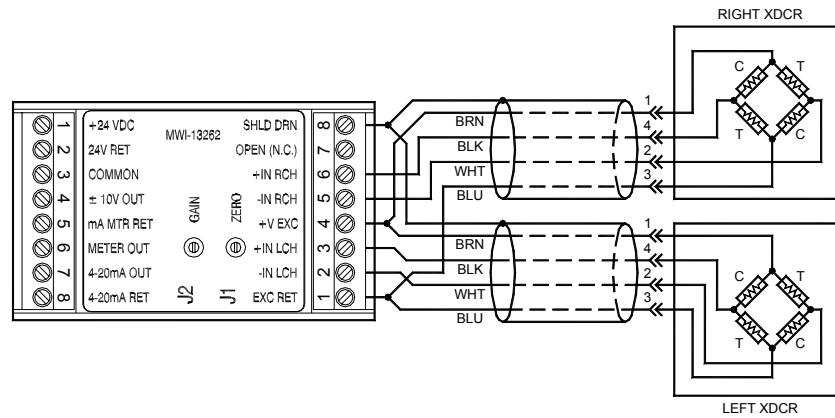


Figure 6 – Full-Bridge Transducer Wiring

3.7 MATING CONNECTORS

The M12 connector used on the Ultra Series Slim Cell transducer is a four-pin, DC keyed, male connector that mates directly with the molded corsets offered by Cleveland Motion Controls. The following table lists the pin numbers and cable colors that apply:

Pin Number	Wire Color	Signal
1	brown	Excitation Voltage
2	white	Output – (low going)
3	blue	Excitation Return
4	black	Output + (high going)

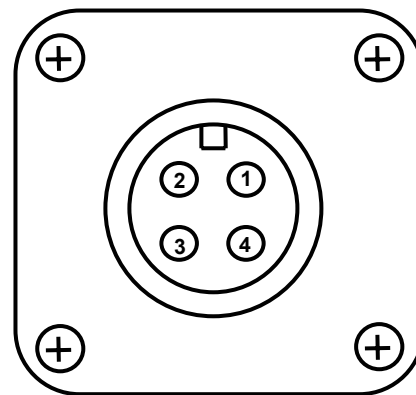


Figure 7 - Front View of M12 Connector

When mating the connector, align the keying mechanism and pins so that they enter the socket without you having to apply excessive force. Use your fingers to sufficiently tighten the coupling nut enough to ensure an adequate seal and to discourage accidental loosening.



A separate mating connector is available from Cleveland Motion Controls as a convenient field attachable (insulation displacement) solution if you elect to make your own cables or need to repair damaged connectors. To order, use CMC part number, X44-34338.

3.8 CALIBRATION

For the proper calibration procedure, refer to the Instruction Manual that accompanied your amplifier or tension controller.

4 TROUBLE SHOOTING



Safety should not be an afterthought. Before installing, servicing or calibrating review and follow applicable policies and procedures to ensure worker safety. Machinery must be in a safe state and be aware of any additional hazards that can arise when installing and calibrating higher force transducers.

The following table provides you with a list of typical issues that you may encounter and possible solutions:

If you are having this issue:	Then:
Low Output Signal	<p>The transducer may have too large a maximum working force (MWF) in relation to the force to be sensed, or the wrap angle may be insufficient and is not able to generate an optimum resultant force on the transducer.</p> <p>Or</p> <p>The transducer may be improperly orientated such that the transducer's axis of sensitivity is not aligned with the bisector of the wrap angle.</p> <p>Or,</p> <p>Check the amplifier to confirm that the signals from each transducer will combine additively. Otherwise, the two signals will work against each other, and only minute differences between signals appear.</p>
Wrong Polarity of Output Signal	<p>Transducers may have been incorrectly oriented. Refer to section 3.3 for proper load direction. Alternately, change the signal sense by interchanging the white and black transducer leads into the amplifier.</p>
No Output Signal	<p>Check to be sure that all connections have been made completely and properly.</p> <p>Inspect the connecting cables for crimps or cuts.</p> <p>Verify that the appropriate excitation voltage is being issued by the amplifier with the load cells connected.</p> <p>Disconnect the transducer output wires from the amplifier's input terminals (to eliminate any potential for accidental loading) and check the output signal using a voltage meter.</p> <p>Check the transducer (refer to Section 4.1.1 - DC Resistance Check in this document).</p>
Excessive Output Signal with Minimal or No Load	<p>There may be a high degree of misalignment of the transducers causing a severe pre-load.</p> <p>Or</p> <p>The sensing guide roll assembly may be excessively heavy. The sensing guide roll should not weigh more than ½ the maximum working force of the transducers in most cases.</p> <p>Or</p> <p>The transducer may have too small a maximum working force for the application. Replace with a higher maximum working force transducer or decrease the web wrap angle.</p> <p>Also,</p> <p>Check cables and connectors for intended connections using an ohm-meter or continuity checker. Inspect not only for continuity where expected, but also disconnect pluggable connectors and check for unintended resistances (shorts) between conductors.</p> <p>Inspect the transducers for mechanical reasons why there is a reported overload. Possibilities include, debris wedged in the transducer's shaft seal area, or a roll shaft bottoming inside the transducer body.</p>
Poor Linearity	<p>Check for mechanical reasons such as rubbing or binding that interferes with the force being properly transmitted to the load cell.</p> <p>Or</p> <p>Your calibration efforts may have been conducted while either the transducer or the amplifier was in a non-linear mode (i.e. under the effects clipping or saturation). Try and recalibrate the amplifier using a lower force.</p> <p>To determine whether the clipping is being caused by the transducer or the amplifier, apply a series of intermediate forces and record the unamplified tension signal. If the data demonstrates that the transducer is linear then, investigate the amplifier.</p>

4.1.1 DC RESISTANCE CHECK

If you have attempted to resolve your issue using the table above and have been unsuccessful, use the following checks to determine the viability of the transducer.

The following nominal DC resistances table indicates a normal load cell, with no load applied at room temperature. The resistances are cited using both the wire color and the M12 connector pin numbers (Figure 7). Often, it is best to begin by measuring the resistances at the amplifier end of the cable. Then, if a problem is indicated, un-mate the transducer end of the connector and check the resistances. Following this procedure, allows you to readily and initially check the resistances without disturbing the transducer or M12 connections and inadvertently disturbing the interconnect condition.

Measurements taken between the following wires:	Corresponding M12 Connector Pins:	Target Resistance:
WHT - BLK	2-4	118 Ohm
BRN - BLU	1-3	140 Ohm Varies slightly based on load cell temperature
WHT - BLU	2-3	112 Ohm
WHT - BRN	2-1	88 Ohm
BLK - BRN	4-1	88 Ohm

Resistance should **NOT** be indicated (> 10 M-ohm) between any of the transducer connections and the metal body of the transducer when the M12 transducer connector is un-mated. A low resistance indicates a possible breakdown of an insulation component, and could be caused by excessive voltage between the body and electrical connections of the transducer.

4.1.2 DC VOLTAGE AND CURRENT CHECKS

When 5VDC excitation is applied to a correctly wired transducer, the output to ground voltage for each of the bridge outputs should be approximately 2.8 VDC. The difference in voltage between the two output leads (BLK and WHT) is the un-amplified tension signal. It should be only tens of mill volts with little applied force, increasing to approximately 100 mV at the transducers MWF.

The current flow through the bridge Excitation connections (into BRN and out the BLU wire) should be approximately 35 mA and equal in each wire. Non-equal currents indicate that the current is being diverted, indicating a potential wiring error, short circuit, or ground loop.

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