

**PART I - DESCRIPTION**

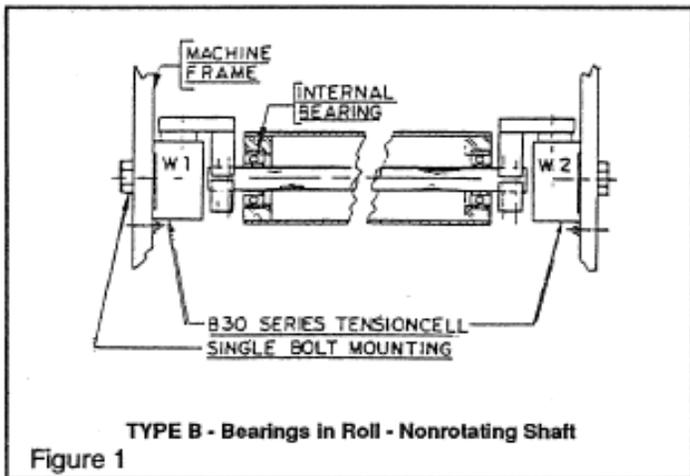
**I-A GENERAL INFORMATION**

Comptrol Series 30 Type "B" and "C" Tensioncells are force transducers especially designed to measure and control web tension on continuous strip processing lines. They are normally installed in matched pairs at each end of a measuring roll. (See Figure 1 & 2)

A Tensioncell consists of a unique combination of two integral systems {one mechanical, the other electrical} for converting the mechanical force of strip tension into an electrical signal which is directly proportional to the strip tension.

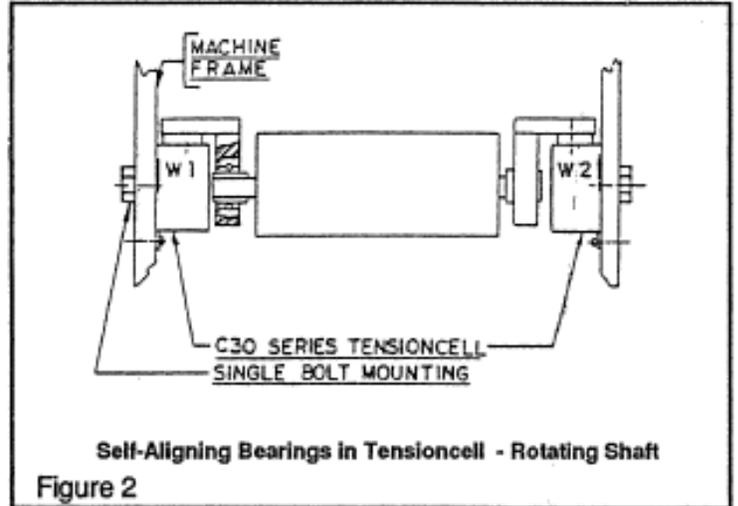
**Type "B"**

Type "B" Tensioncells are designed for use in NON-ROTATING shaft installations. A self-aligning shaft clamp assures proper alignment of the measuring roll when the Tensioncells are bolted to the frame of the machine. Type "B" cells are supplied in matched pairs, one to be mounted at each end of the measuring roll. Note that the cell marked "W2" is a mirror image of "W1". "W2" allows for thermal expansion of the shaft. (See Figure 1)



**Type "C"**

Type "C" Tensioncells are intended for ROTATING shaft installations. They are supplied with self-aligning ball bearings to assure positive alignment of the measuring roll. Type "C" Tensioncells are supplied in matched pairs, one to be mounted at each end of the tension measuring roll. Note that the cell marked "W2" is a mirror image of "W1". The "W2" cell allows for thermal expansion of the rotating shaft. (See Figure 2)



**I-B THE MECHANICAL SYSTEM**

The mechanical system consists of a Patented "C-Flexure Pivot Assembly" which incorporates amounting Base Block, frictionless elastic pivot (or hinge), and Load Plate. (See Figure 3) When a mechanical force is applied to the Load Plate the pivot permits its deflection toward or away from the Base Block.

(Continued on next page)

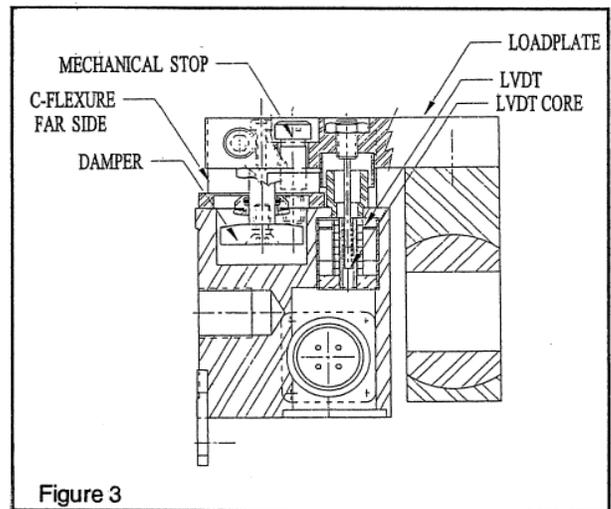


Figure 3

**Table of Contents**

General Information.....	1
Installation and Operation.....	4
Adjustments.....	5
Troubleshooting.....	6
Recalibration.....	7
Dimension Drawing.....	8 & 9
How To Order.....	10
Application Review.....	11

For our discussion here, deflection of the Load Plate toward the Base Block is defined as the "Compression Mode", while the opposite is defined as the "Tension Mode". Tensioncells are designed to operate equally well in either mode.

The Base Block contains an integral Mechanical Stop to limit the amount of deflection in either direction, and a Viscous Damper to allow control of the Tensioncell response to rapid changes in apparent tension loads. (See Page 1, Figure 3)

**I-C THE ELECTRICAL SYSTEM**

The electrical system consists of a Linear Variable Differential Transformer (LVDT) which converts the mechanical deflection of the Load Plate into a useful electrical output signal. (See Figure 4) The movable core of the LVDT is mechanically coupled to the Load Plate by means of the Core Adjust Assembly. (See Figure 4) This adjustment is factory set and is not accessible.

**I-D TYPE "K" DC LVDT**

As illustrated in Figure 4, a DC LVDT consists of the following components:

- An oscillator network, which converts the DC input voltage into a high frequency alternating current for exciting the Primary Coil (P<sub>1</sub>).
- A Primary Coil (P<sub>1</sub>).
- A movable, permeable metallic core.
- Two Secondary Coils (S<sub>1</sub> and S<sub>2</sub>).
- A demodulator and summing network to rectify and integrate the currents from the Secondary coils.

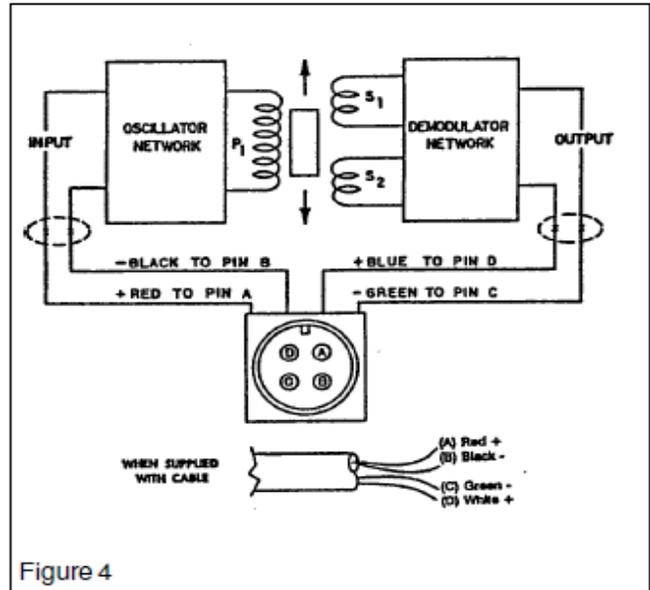


Figure 4

With Comptrol LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the Tensioncells. Thus, they may be used in "floating ground" or "ground return" systems. This eliminates the need for extra circuit boards which are required for most strain gage loadcells.

Tensioncells are factory adjusted to provide an offset voltage with no load applied (no deflection). Using an input of 24 volts DC, the LVDT is set to provide an output of 3.5 volts into a resistive load of not less than 100,000 ohms. The voltage resulting from the maximum rated deflection then adds to or subtracts from the 3.5 volt offset. This results in an output voltage of 3.5 to 6.5 volts in the Compression Mode and 3.5 to 0.5 volts in the Tension Mode. (See Figure 5)

While acceptable performance may be obtained over an input voltage range of 6.0 to 30.0 volts DC, the output voltage will vary in direct proportion to the input voltage. Because of this, the use of a "well regulated" constant voltage power supply is essential for accurate and repeatable tension measurement.

In standard applications, where two Tensioncells are used, the inputs may be connected in parallel allowing the Tensioncells to be excited from the same power supply. The LVDT outputs are then summed to obtain a signal representing the strip tension and tare loads distributed across the roll.

Comptrol Tension Indicators supply 24-volt DC and integrate the output signals in a summing amplifier. This permits incorporation of additional circuitry for offset and gain. (See Indicator Manual for more information).

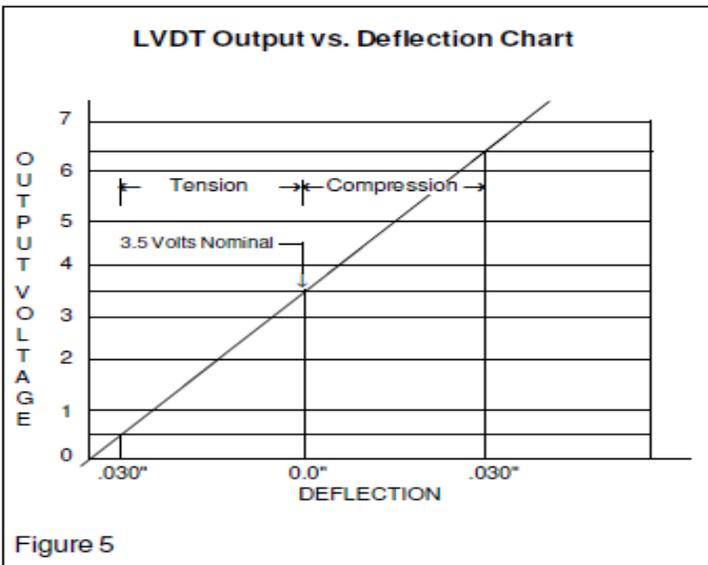


Figure 5

**I-E DESCRIPTION OF OPERATION**

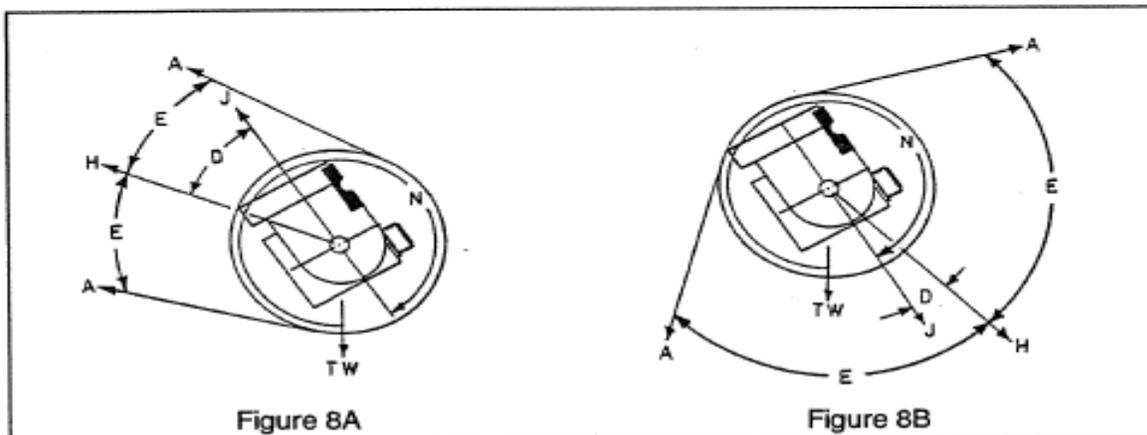
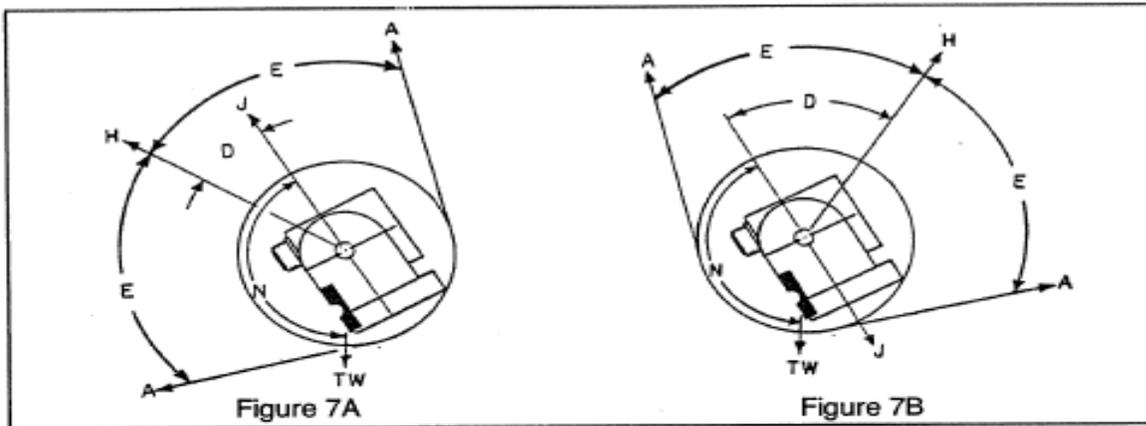
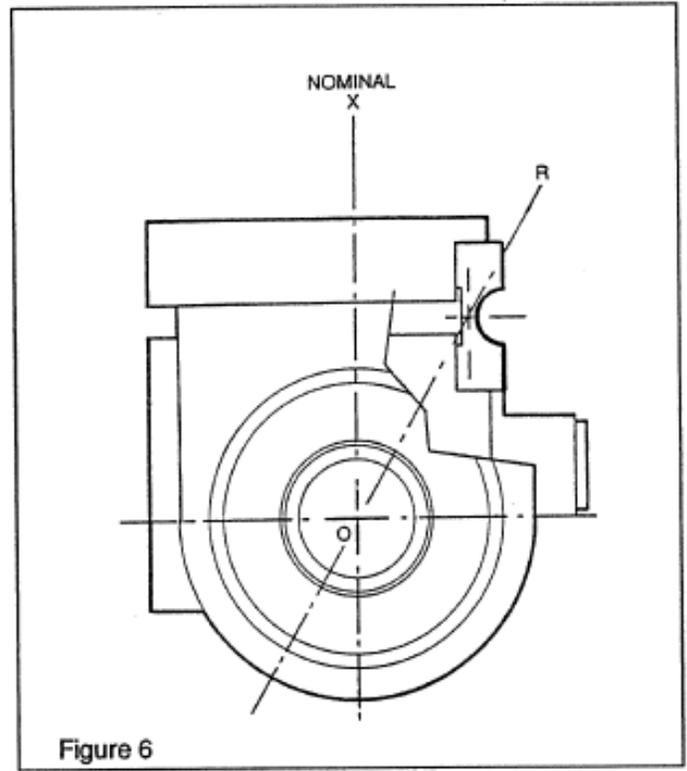
The total resultant load per cell (JT) is calculated by resolving web force vectors acting upon the Tensioncells, with respect to the Loading Line (OX). (JT) is the resultant of both TENSION and TARE loads, PER CELL! (See Figure 6)

The intrinsic design of Comptrol Tensioncells allows the location of the Resultant Load of Web Tension (H) on any angle with respect to the Load Line (OX). Note, however, that the Total Force vector (JT) must always be calculated on the line (OX).

Any force vector falling on the line (OR) (through the pivot point of the C-Flexure) will produce no deflection, and thus no change in electrical output.

Rotating the Tensioncell on its mounting bolt changes the force vectors on the cell. This feature makes it possible to minimize the tare component and maximize the load signal output.

The resultant tare is minimized by mounting the Tensioncell so that (N) is 149° (See Figure 7A and 7B) or so that (N) is 329° (See Figure 8A and 8B).



**PART II - INSTALLATION AND OPERATION**

**II-A INSPECTION UPON DELIVERY**

Comptrol Tensioncells are carefully packaged in sturdy reinforced cartons or wooden boxes and are securely blocked or bolted in place.

1. Upon receipt, examine the exterior of the container for obvious damage or tampering.
2. Check the contents against the packing list.
3. Promptly report any damage or shortage to both the carrier and Comptrol.

**II-B HANDLING**

Tensioncells can be handled manually.

**II-C LONG TERM STORAGE**

While Comptrol loadcells are plated, exposure to weather, dirt, or moisture should be avoided when they are stored.

**II-D MECHANICAL INSTALLATION**

NOTE: Refer to the Dimension Drawing Pages 8 and 9 of this manual for detailed identification of all parts.

Tensioncells are designated as "W1" and "W2", one being the mirror image of the other to provide for mounting between two fixed walls. (See Figure 9)

Comptrol Wall Mounted Tensioncells are mounted to the machine frame by a 5/8-11 UNC bolt which is in line with the centerline of the measuring roll shaft. This allows the Tensioncell to be rotated around the centers of the measuring roll and mounting bolt to achieve the proper mounting angle. (Description of Operation on Page 3)

The locating tab prevents the Tensioncell from rotating and secures it in a permanent location. It also provides a means of repeating rotatory position when the Tensioncell needs replacement.

Note: Remove the 1/4" locking screw and the 5/8" mounting bolt. This permits the roll assembly with Tensioncells to be lifted out of the machine.

**To Install Tensioncells:**

1. Make sure a 5/8" diameter hole is drilled through the machine frame in line with the centerline of the measuring roll shaft for the 5/8-11 UNC mounting bolt.
2. Fasten the Tensioncell to the machine frame with the mounting bolt.
3. Rotate the Tensioncell to the proper mounting angle and tighten the mounting bolt. (Refer to N on the calibration sheet for the proper mounting angle)
4. Drill a #6 (.204) hole concentric with the 1/4" hole in the locating tab.
5. Remove the Tensioncell and tap the hole for a 1/4-20 thread.
6. Repeat steps 1 through 5 for the Tensioncell to be mounted at the other end of the measuring roll.
7. Assemble the Tensioncells onto the ends of the measuring roll shaft. -
8. Position the roll with the Tensioncells on the machine and fasten with the mounting bolts.
9. Rotate the Tensioncells to the proper mounting angle and tighten the mounting bolts.
10. Lock the locating pad for each Tensioncell against the machine frame using the 1/4-20 x 1/2 socket head cap screw.

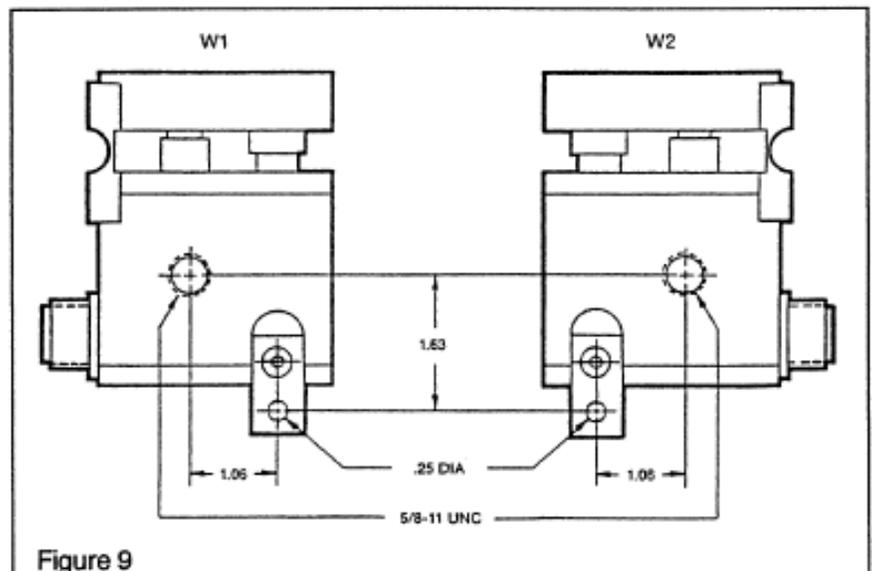


Figure 9

11. Tighten the shaft in the mounting block on the "W1" unit. (The shaft end at "W2" is left free to allow it to move as the shaft expands with temperature changes)

**II-E MECHANICAL ALIGNMENT**

Align the measuring roll to avoid any mechanical binding or friction. The measuring roll must be level and perpendicular to the path of the strip material for accurate measurement.

The Mechanical Stops are fixed for the required travel of the Load Table.

**II-F ELECTRICAL INSTALLATION**

(Read the entire electrical wiring procedure before proceeding.)

1. Turn off all electrical power to the loadcell.
2. Use twisted four conductor signal cable, Belden 9402 or equivalent, in grounded steel conduit from the LVDTs to the control panel.
3. Observing correct polarity, connect the positive (+) input lead to Pin A and the negative (-) input lead to Pin B. (See Figure 10)
4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 10.)
5. Repeat Steps 1 through 4 of the electrical wiring procedure for the Tensioncells mounted on the other end of the measuring roll.

TYPE 'K' 24 VOLT DC LVDT SPECIFICATIONS	
Input .....	6-30volts DC
Output .....	0.5 - 6.5 volts DC (nominal, open circuit)
Output impedance.....	2.5K ohms
Current Consumption.....	40mA
Recommended Load.....	100K ohms or greater
Maximum Temperature: .....	250°F

Note: Comptrol loadcells are calibrated for 24-volt DC input voltage to provide a 0.5 to 6.5 volts DC output signal. Output voltage will vary proportionally to input voltage.

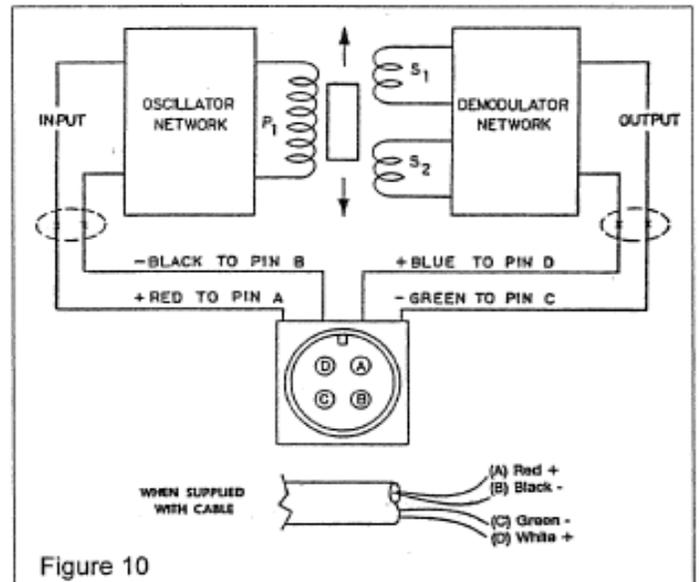


Figure 10

**II-G ELECTRICAL ZERO ADJUSTMENT**

(Read the complete Electrical Zero Adjustment procedure before proceeding with the adjustment.)

1. Disengage strip from the measuring roll so that no tension force is applied to the loadcell.
2. Connect a voltmeter to Pins C and D (See Figure 10)
3. Apply 24-volt DC electrical power to the loadcell observing the correct polarity. [Plus (+) to Pin A and minus (-) to Pin B]. Do not exceed the maximum rated input voltage.

NOTE: Allow 20 minutes for the loadcell to warmup before taking first readings to insure accurate readings.

4. Measure the output voltage of the LVDT between the Green and Blue leads for each Tensioncell with a voltmeter with a sensitivity of at least 100,000 ohms per volt. The output voltage should be between 0.5 and 6.5 volts.
5. Since Comptrol Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

### II-H FULL LOAD ADJUSTMENT

After the loadcell has been zeroed, a pull test can be made to check the output voltage of the loadcell at full load. (See calibration sheet for voltage output.)

1. Run a non-stretchable rope over the center of the tension roll simulating the web path. (NOTE: the rolls should be free to turn)
2. With one end of the rope secured, hang a known weight, equally over the roll so that the total tension is equal to the maximum strip tension specified on the calibration sheet, at the other end. (See Figure 11)
3. With a voltmeter connected to Pins C and D of the connector, an output voltage will be observed.
4. Repeat Step 3 for the Tensioncell mounted on the opposite end of the measuring roll.

Comptrol loadcells instrumentation provides the required signal conditioning and a reliable high level output signal for use as feedback control of a tension drive system. The feedback signal is directly proportional to the strip tension applied. If a Comptrol control is used, refer to the control manual for further calibration.

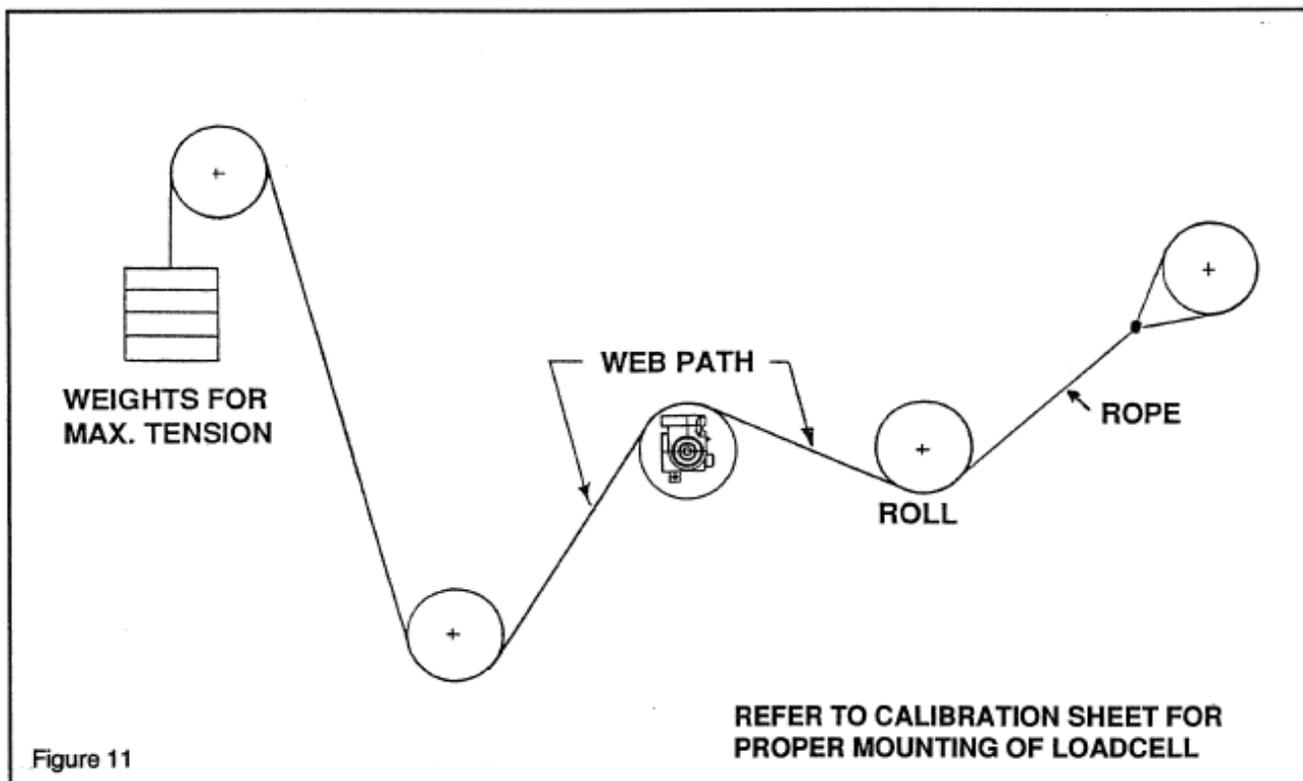
Although the electrical output of Comptrol Tensioncells are sufficient to drive most electrical indicators, substantial signal conditioning is normally required for effective tension instrumentation system control. Refer to the documentation available from the instrumentation supplier for more information.

### PART III - TROUBLE SHOOTING

When properly installed in accordance with the original design specifications, Comptrol Tensioncells should require little or no regular maintenance or service.

Certain conditions, however, can impair their inherently accurate and reliable performance. Therefore, if trouble should arise, the following conditions should be checked.

(Continued on next page)



**III-A MECHANICAL**

1. Has the tension measuring system been changed?
  - a. An increase or decrease in web tension (Refer to A on the calibration sheet for specified web tension).
  - b. An increase or decrease in the wrap angle. (Refer to B on the calibration sheet for the specified wrap angle)

If the above parameters have been changed enough to prevent the unit from operating within the limits of the fixed Mechanical Stops, replacement of the Flexure will be required. For this modification, the Tensioncell should be returned to the factory with complete specifications.

2. Are the loadcells mounted securely?
3. Is tension measuring roll in proper alignment and does it turn freely?
4. Are bearings and seals free of all binding and stickiness? Are they worn?

**III-B ELECTRICAL**

1. Are LVDTs receiving correct input voltage?

Check line voltage, fuses or circuit breakers, and power switches. Check power supply output and voltage to LVDTs.

2. Are all connections secure?

Check for continuity. Retighten all connections. Recheck operation.

3. Are LVDTs open or shorted.

To check, turn off power and disconnect the input and output leads. Check coil continuity and resistance. (Refer to Figure 12)

- a. Pin A to Pin B (Primary Coil) should be in excess of 2 megohms.
- b. Pin A or Pin B to LVDT shell should be in excess of 5 megohms.
- c. Pin C to Pin D (Secondary Coil) should be approximately 20,000 ohms.
- d. Pin C or Pin D to LVDT shell should be in excess of 5 megohms.

If LVDT circuits are open or shorted, replace LVDT. Contact Comptrol with Tensioncell model number and serial number.

**PART IV - RECALIBRATION PROCEDURES**

All Comptrol Tensioncells are factory calibrated before shipment as specified in the purchase order. However, if any of the following parameters vary from the original design specifications, recalibration will become necessary.

1. Strip Tension (Refer to A on the calibration sheet for the specified strip tension)
2. Wrap Angle (Refer to B on the calibration sheet for the specified wrap angle)
3. Inclination of the Passline (Refer to C on the calibration sheet for the specified Passline)
4. Mounting Angle (Refer to N on calibration sheet for the specified mounting angle)

**IV-A RECALIBRATION AFTER INSTALLATION**

Wall Mounted Tensioncells can be relocated around the center of the measuring roll. The theory of this operation is explained in the Description of Operation on Page 3. If this procedure cannot accomplish the necessary changes because the tension requirements are extremely different than the original application, it will be necessary to return the Tensioncells to the factory for new flexures and a new nominal rating.

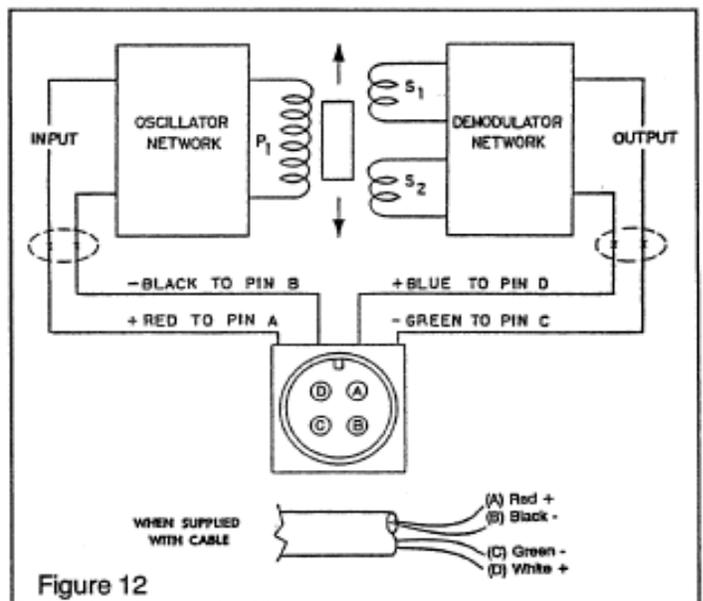
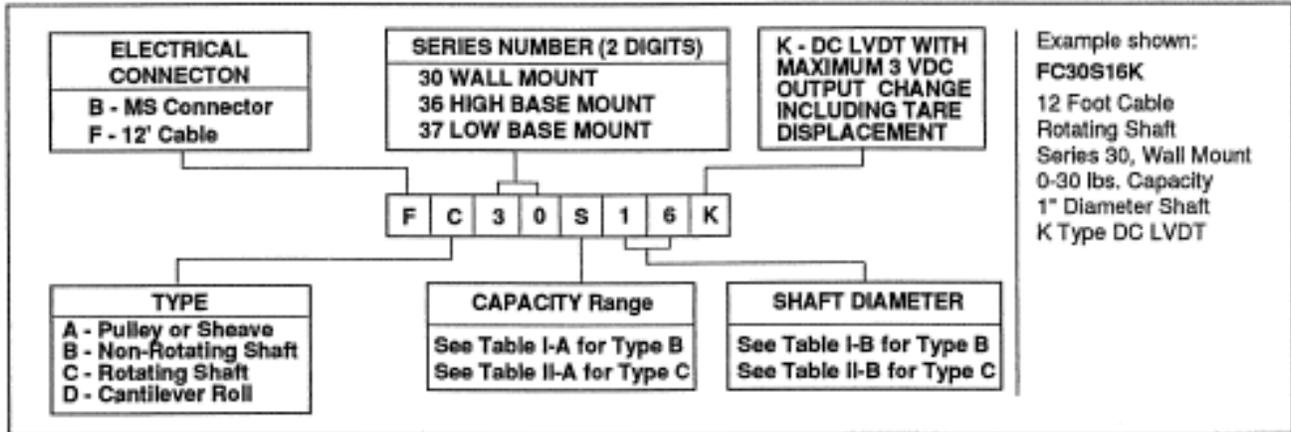


Figure 12

**MODEL NUMBER NOMENCLATURE EXAMPLE**

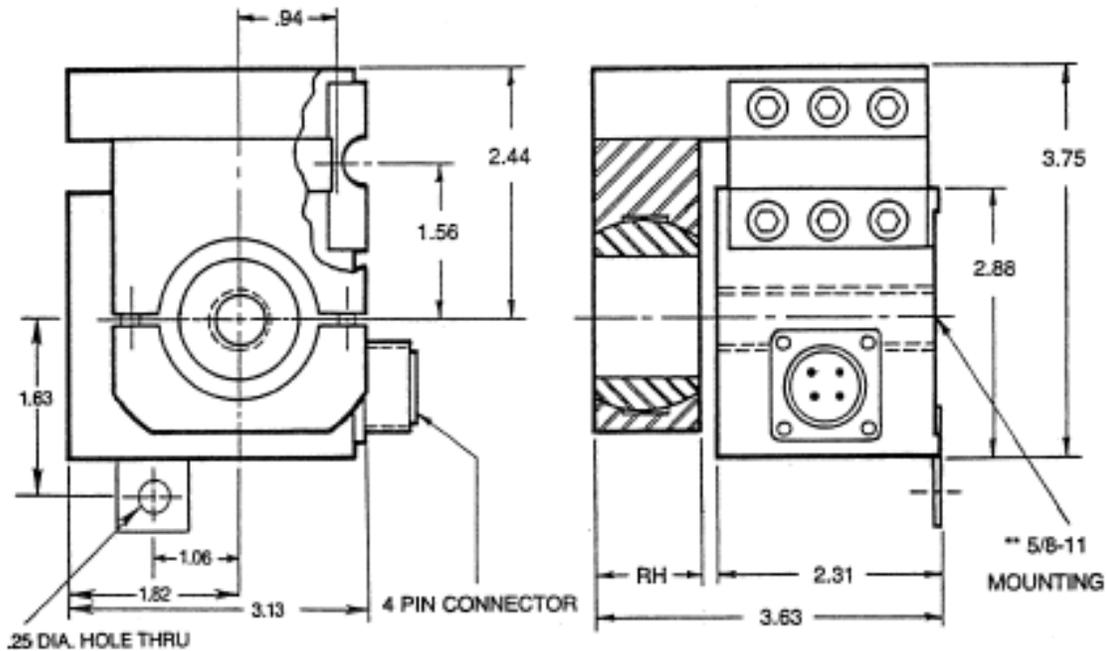


**SERIES 30, TYPE B SPECIFICATIONS - NON-ROTATING SHAFT MOUNTING**

**TABLE I-A SERIES 30, TYPE B - NOMINAL CAPACITY RANGES**

CODE	L*	M*	N	P	S	T	U	W	X	Y	Z
POUNDS	0-4	0-8	0-13	0-20	0-30	0-50	0-90	0-140	0-200	0-300	0-500

\* Tensioncells in this range supplied for shaft sizes up to maximum 3/4" diameter unless approved by factory.  
\*\* Comptrol wall mounted tensioncells are located by a 5/8-11 bolt at the roll centerline and locating tab which maintains rotational position of the tensioncell. (See Page 4.)



**Notes:**  
W1 unit shown here.  
W2 unit is applied at the opposite end of the roll.  
W1 unit clamps the shaft while W2 allows for temperature expansion of the roll.  
Both units have self-aligning feature.

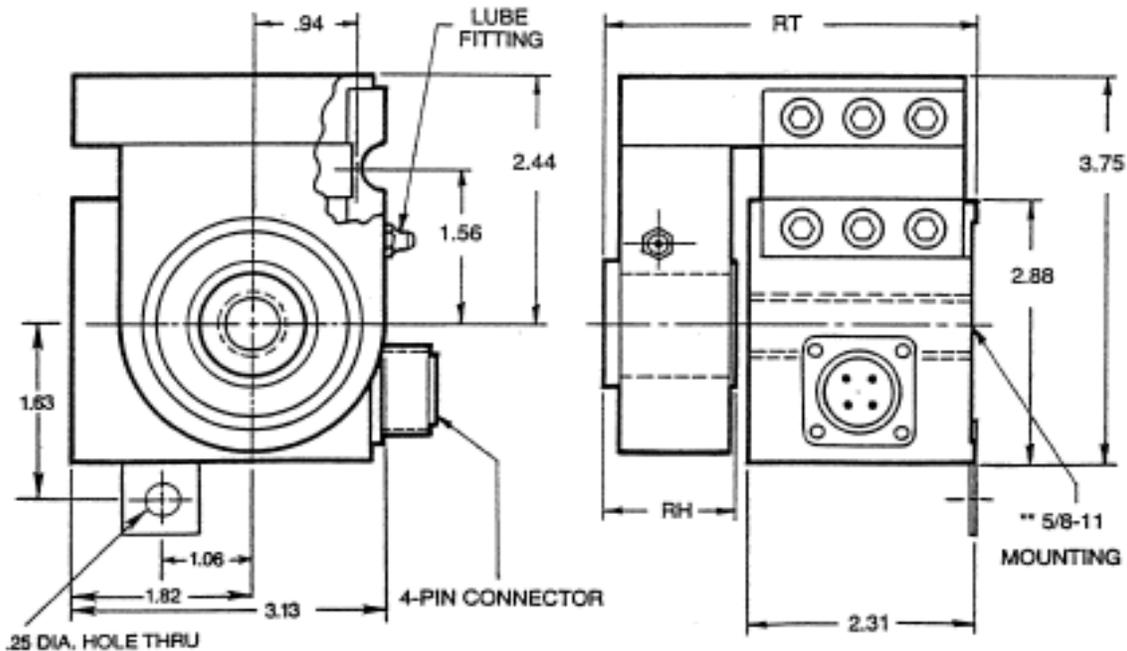
**TABLE I-B - SERIES 30, TYPE B SHAFT DIAMETER CODE**

CODE	08	10	12	14	16	18	20	22	24
INCHES	1/2	5/8	3/4	7/8	1.0	1-1/8	1-1/4	1-3/8	1-1/2
RH	1.00			1.13					

**SERIES 30, TYPE C SPECIFICATIONS - ROTATING SHAFT MOUNTING**

CODE	L*	M*	N	P	S	T	U	W	X	Y	Z
POUNDS	0-4	0-8	0-13	0-20	0-30	0-50	0-90	0-140	0-200	0-300	0-500

- \* Tensioncells in this range supplied for shaft sizes up to maximum 3/4" diameter unless approved by factory.
- \*\* Comptrol wall mounted tensioncells are located by a 5/8-11 bolt at the roll centerline and locating tab which maintains rotational position of the tensioncell. (See Page 4.)



**Notes:**

Fifteen standard shaft diameters. See Table II-B  
 W1 unit shown here.  
 W2 unit is applied at the opposite end of the roll.  
 W1 unit clamps the shaft while W2 allows for temperature expansion of the roll.  
 Both units have self-aligning feature.

CODE	08	09	10	11	12	14	15	16	17	18	19	20	21	22	23
INCHES	1/2	9/16	5/8	11/16	3/4	7/8	15/16	1.0	1-1/16	1-1/8	1-3/16	1-1/4	1-5/16	1-3/8	1-7/16
RH	1.31			1.38			1.53			1.69					
RT	3.81						4.03			4.13					

### HOW TO ORDER TENSIONCELLS AND CONTROLS

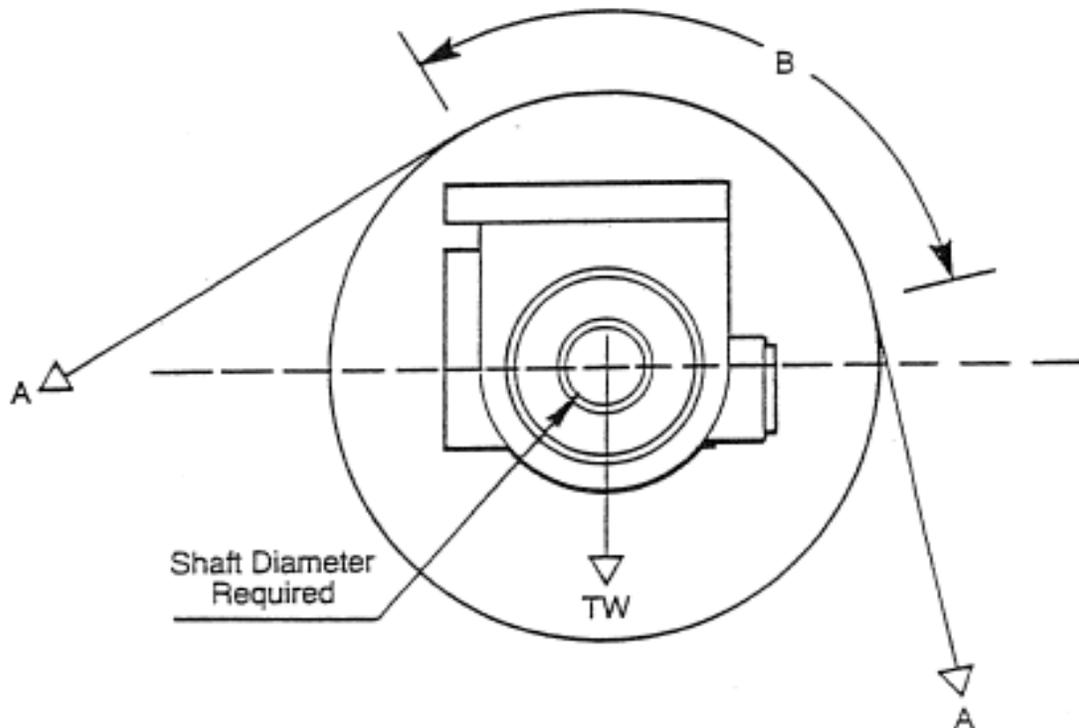
Our Application Engineering Department will make all calculations and offer installation suggestions as part of our formal quotation. To help us provide these services, we request that you furnish us with complete information about your requirements. If possible include a drawing or sketch of your application, noting the preferred position of the electrical conduit box. The information listed below is the MINIMUM we require: (Refer to illustration below.)

- Maximum Strip, Web, or Strand Tension (A)
- Total Wrap Angle (B)
- Inclination of the Passline with respect to horizontal (C)
- Total Weight of the roll and bearings (or sheave and bearing) (TW)
- Shaft Diameter
- Rotating or Non-Rotating Shaft
- Measuring Roll Diameter (in inches)
- Maximum Machine Speed (FPM)

Include the Model Number of the Loadcell Control Required.

When placing your order, please include instructions as to how the equipment and/or shipping containers are to be marked. Loadcells are assembled from stock parts for fast delivery.

When ordering spare, or replacement parts, please reference the Model and Serial Number of the original equipment. Comptrol maintains complete files and documentation on all loadcell equipment.



## APPLICATION REVIEW

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Name \_\_\_\_\_

Phone \_\_\_\_\_ Email \_\_\_\_\_

### APPLICATION DATA

Wrap No. \_\_\_\_\_ C = \_\_\_\_\_ deg. C' = \_\_\_\_\_ deg.

Strip Tension: Max \_\_\_\_\_ lbs. Min. \_\_\_\_\_ lbs.

Line Speed: Max \_\_\_\_\_ fpm Min \_\_\_\_\_ fpm Roll Diameter \_\_\_\_\_ in.

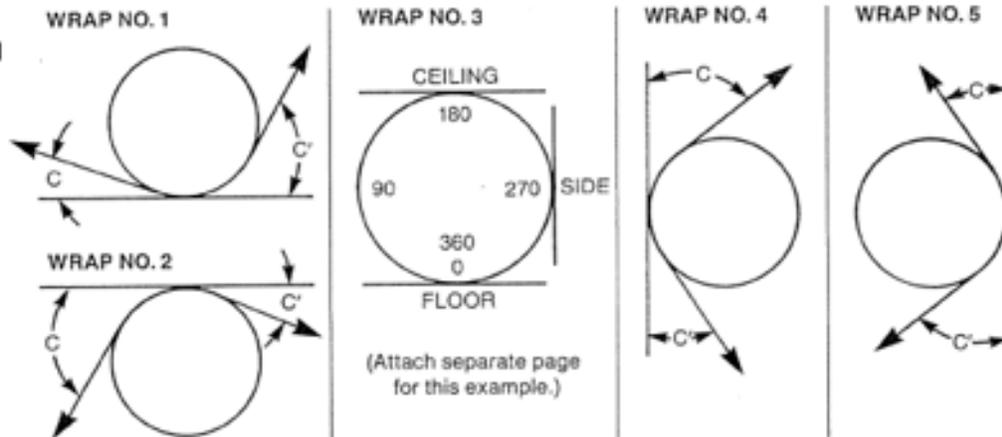
Mounting:  Side  Under Pillow Block Bearing (specify manufacturer & model)

Bearing Mfr. \_\_\_\_\_ Model No. \_\_\_\_\_

Roll and bearing weight: \_\_\_\_\_ lbs. Shaft diameter: \_\_\_\_\_ in.

Controller:  Analog  Digital Installation:  New  Existing

COMPTROL  
STRIP TENSION  
TRANSDUCER  
DATA



Special Considerations (Environment, temperature, etc.): \_\_\_\_\_

The information contained in this document is subject to change without notice. Comptrol has made effort to ensure the accuracy and completeness of the descriptions and procedures discussed in this document. Failure to comply with these procedures may result in personal injury, or damage to the Comptrol product or the equipment used in conjunction with it.

Comptrol assumes no liability for incidental or consequential personal or equipment damages arising from the use of this document, the software and hardware described, or failure to comply with the procedures contained in this document.

Note that protective covers or guarding may not be shown in some illustrations to provide a clearer view of specific components or assemblies. All protective covers and guarding must be installed before operating the unit.

Reproduction, copying, or the disclosure to any third party for any unauthorized purpose of the contents or software contained or described in this document is prohibited with written authorization from Comptrol. Violators will be prosecuted.