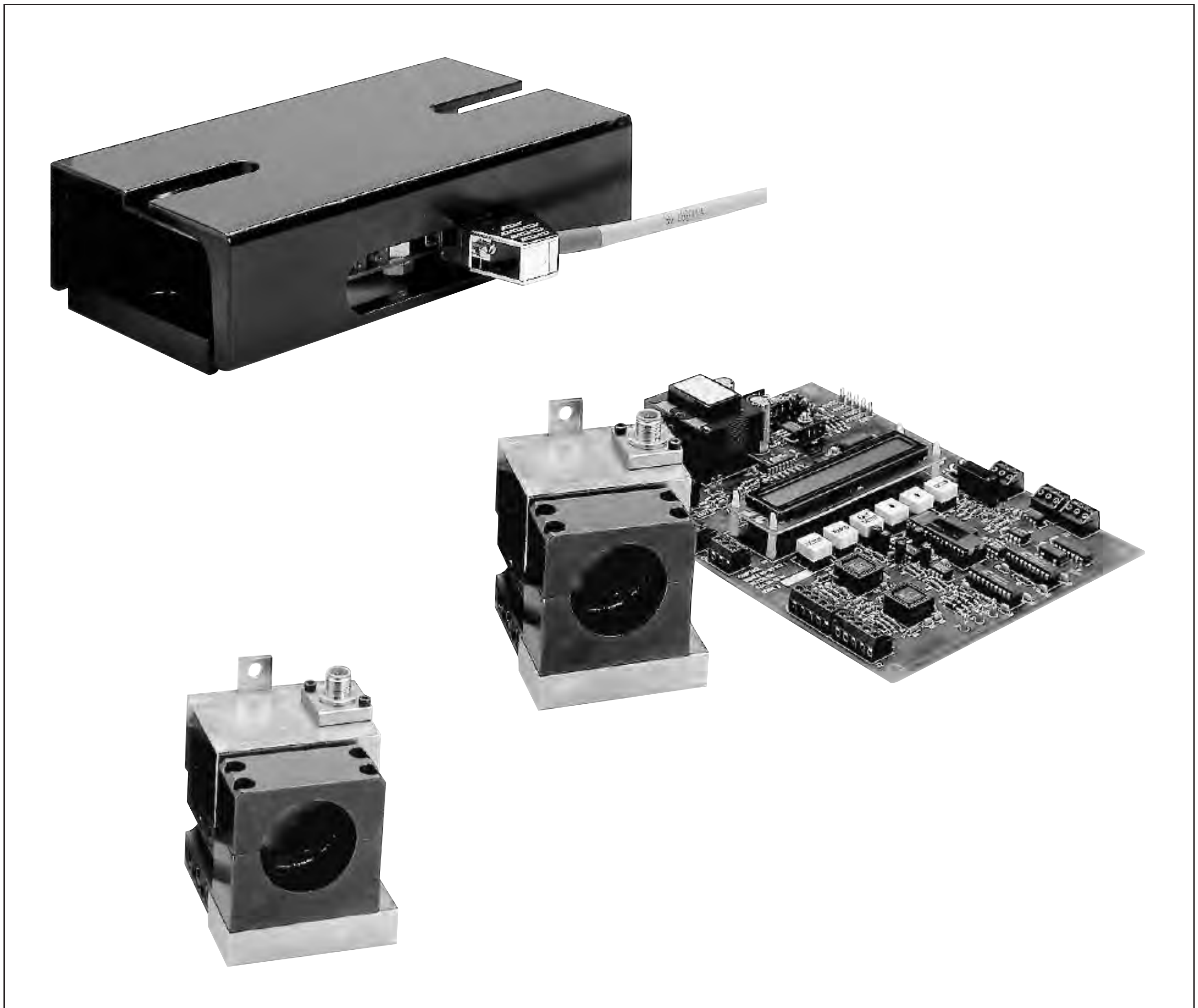
FM Series Foot Mounted Load Cells
AC10 Measuring System
A30 Single Range Tensioncells
B30 Single Range Tensioncells
C30 Single Range tensioncells

P-2012

Installation Instructions



Warner Electric

Contents

⚠WARNING Failure to follow these instructions may result in product damage, equipment damage, and serious or fatal injury to personnel.

FM Series Foot Mounted Load Cells

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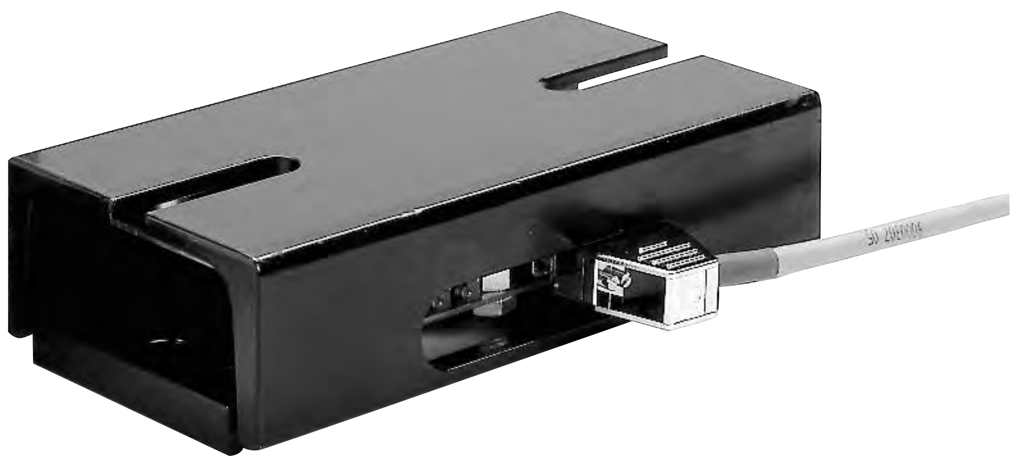
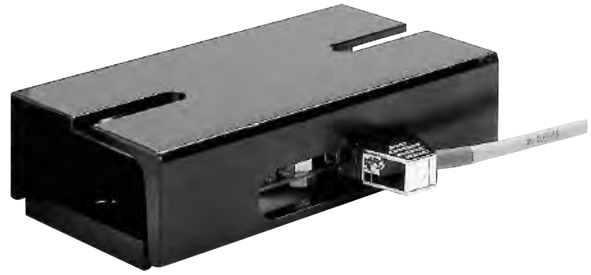


The FM style load cell provides easy and convenient mounting to the roll that is being measured (used with pillow blocks). The load cell is a strain gauge style unit that is ideal for heavy tension applications. It can be mounted regardless of orientation, but has to work in compression. Only the perpendicular force (resultant) is measured by the load cell. The perpendicular force can be at a maximum permitted angle of +/- 30 degrees. Correct load cell sizing must be adhered to so potential overload forces do not damage cells.



FM Series Part Numbers

FM	01	-	1000	-	AC
Model	Size		Load in N		Amplifier built in

Specifications:

Load Ratings	N	100	250	500	1000	2500	5000	10000
	(Lbs.)	(22)	(56)	(112)	(225)	(562)	(1124)	(2248)
Size		01	01	01	01	01	01	02

Input Power
±12 to ±15 VDC
@ 45 MA ±5%

Output Signal
5VDC output at rated load

Temperature Range
0-70 degrees C
(32 -158 degree F)

Temperature drift
0.1 % of rating per degree C

Non-linearity and Repeatability
< 0.5%

Power Consumption
1 Watt

Cable
16 ft. provided with load cell

Maximum Load Ratings (See Figure 6)

Overload
120% of rated load

Compression Overload
150% of rated load

Horizontal Load
50% of rated load

Model Numbers/Part Numbers

FM01-100	6910-840-100
FM01-250	6910-840-102
FM01-500	6910-840-104
FM01-1000	6910-840-106
FM01-2500	6910-840-108
FM01-5000	6910-840-110
FM01-10K	6910-840-112

Alignment

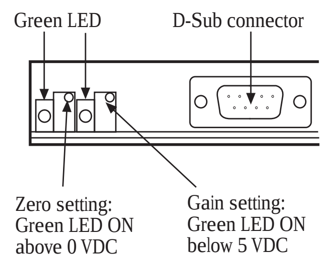


Figure 1

The sensor has been factory calibrated:
0VDC (No load)
5VDC (Rated load)
Two potentiometers and LED's are located near the "D" connector (See Figure 1) for visual indication. When used in the nominal range, both LED's are "ON". Although the load cell has been factory calibrated. The unit may be rescaled if necessary. It is recommended that a qualified technician do this procedure.

Attach a digital volt meter between the signal lead (yellow) and 0VDC (ground). With no load on the cell adjust the zero potentiometer for a 0VDC output. The zero setting LED should be "OFF". Any voltage above 0VDC, the zero LED will turn "ON".

Apply the mazimum load to the cell. Adjust the gain potentiometer for a 5VDC output reading. The gain LED should be "OFF" at a 5VDC output level. Remove the load and insure the gain LED is "ON".

The zero and gain adjustments may need to be repeated a couple of times to insure proper setting.

Wiring Hookup:

The load cell requires a +15VDC and a -15VDC power supply. The 5V/15V switch inside the MCS2000-CTLC must set to +/-15VDC. Terminate all unused wires from cable.

Wiring example using One Load Cell with the MCS2000-CTLC control

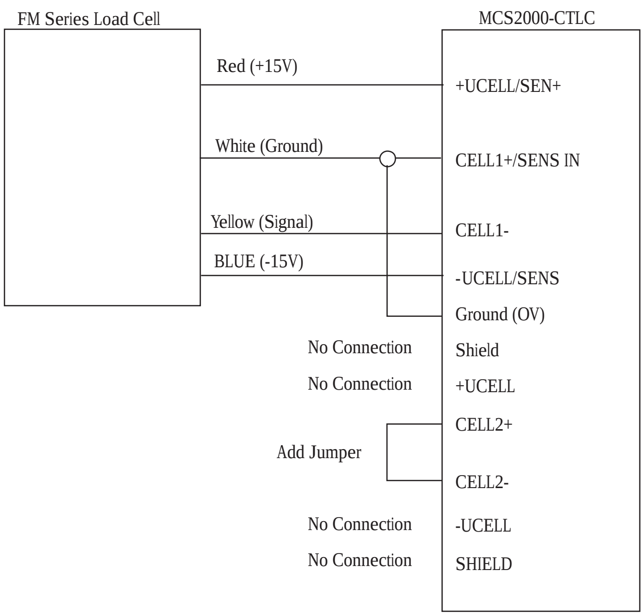


Figure 2

Wiring example using 2 load cells with the MCS2000-CTLC control

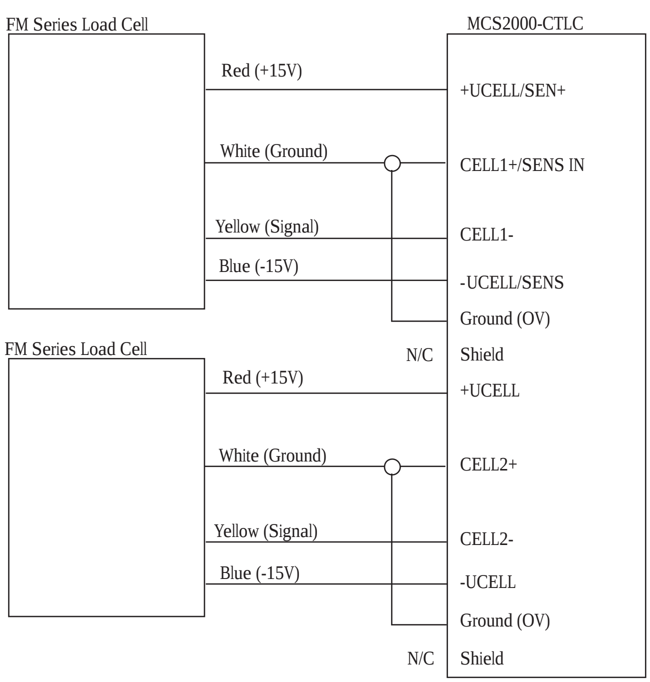


Figure 3

Notes: It is recommended to use the load cell in a compression application. It must be fitted on a flat surface in order to avoid original sensitive plate stress. Do not load the sensor before mounting it with screws on the mounting surface.

System Example:

FM Load Cell with an Electric Brake

This is a typical load cell unwind application example. The electric brake varies the tension on the web depending on the feedback from the load cell. The load cell signal is amplified and interpreted in the controller (MCS2000-CTLC). The controller then puts out a corresponding 0-10 VDC signal to the power supply and drive (MCS2000-PSDRV). The PSDRV then amplifies and interprets the signal from the controller and puts out a corresponding 0-24 VDC signal to the brake to apply either more or less braking.

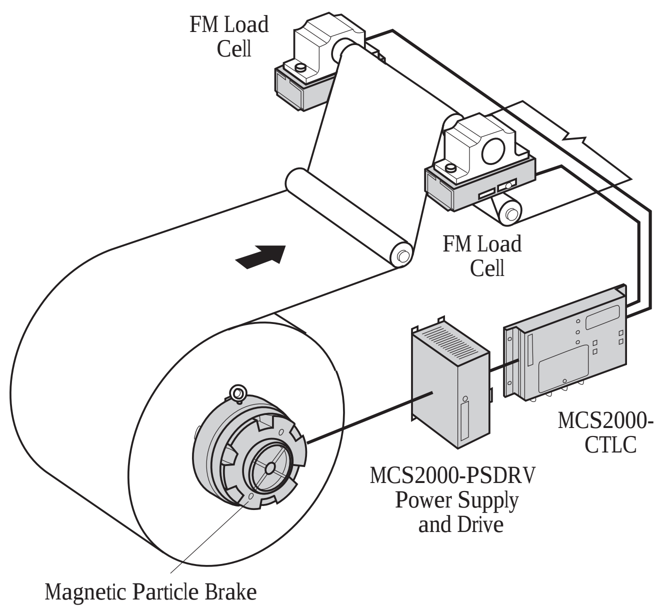
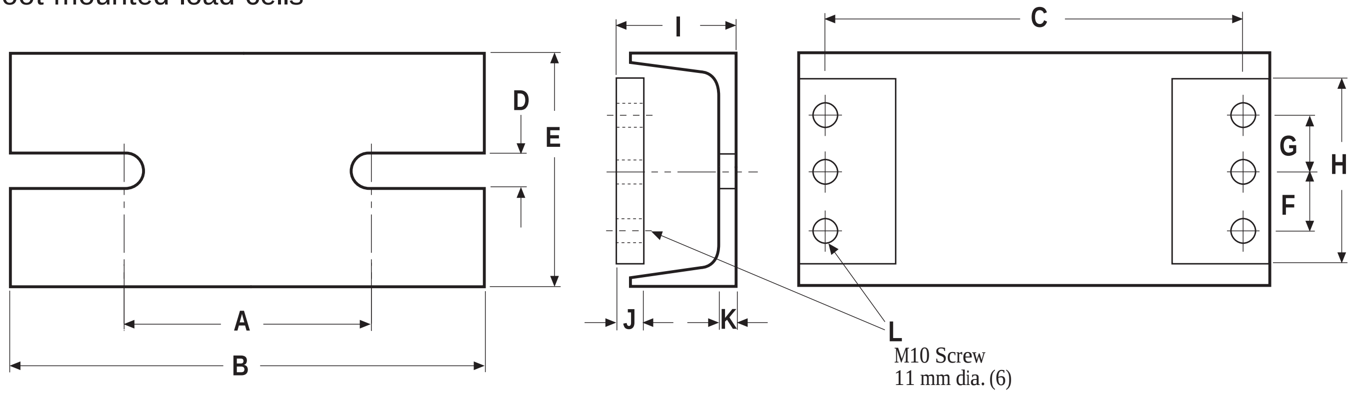


Figure 4

Dimensions

FM Series

Foot mounted load cells



(–) Denotes millimeters

Size	Load Ratings N (lbs.)	A	B	C	D	E	F	G	H	I	J	K	L
01	**100 (22)** **250 (56)** **500 (112)** **1000 (225)** **2500 (562)** **5000 (1124)**	4.055 (103)	7.874 (200)	6.890 (175)	.512 (13)	4.016 (102)	.984 (25)	.984 (25)	3.150 (80)	2.047 (52)	.472 (12)	.236 (6)	.433 (11)
02	**10000 (2248)**	5.591 (142)	8.858 (225)	7.677 (195)	.669 (17)	5.00 (127)	.984 (25)	.984 (25)	3.937 (100)	2.165 (55)	.709 (18)	.236 (6)	.433 (11)

Figure 5

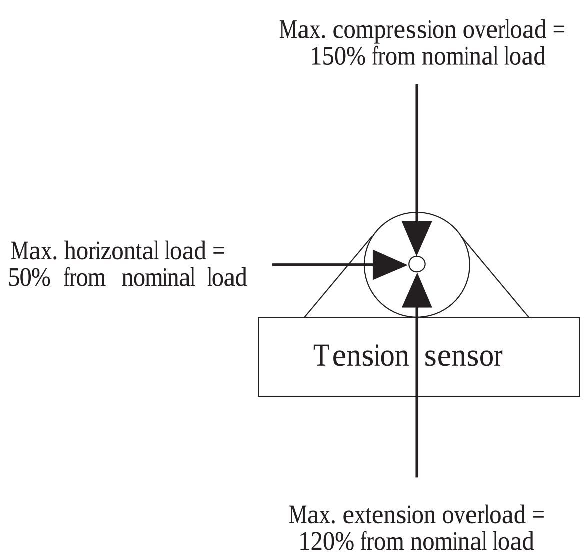


Figure 6

AC10 Measuring System

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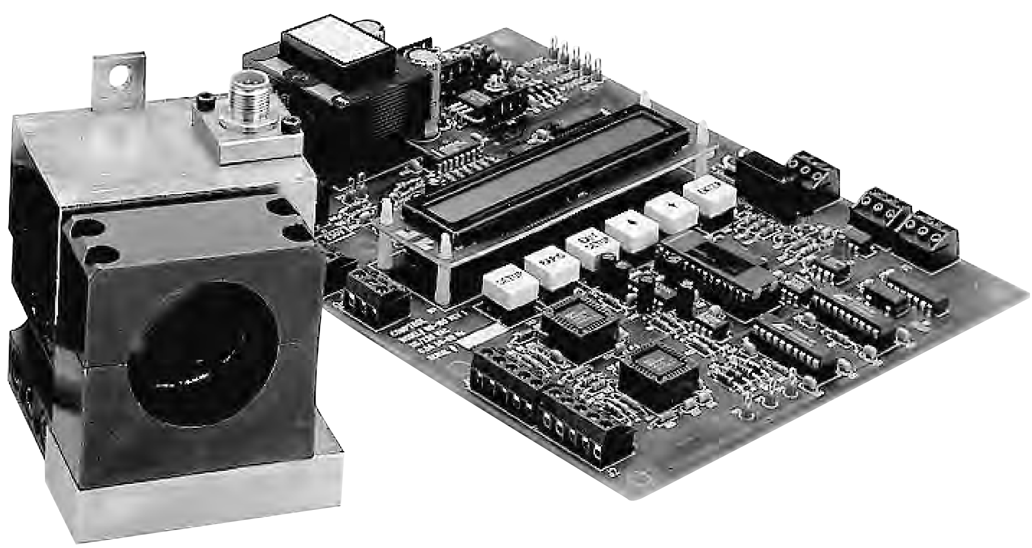


Introduction

This manual is intended for use by qualified personnel to assist them in the safe setup and operation of the Warner Electric AC10 Tension Measuring System. Warner Electric has made every effort to insure the accuracy and completeness of the information and recommends that all procedures be read and understood before performing them. Please contact Warner Electric with any questions regarding any information contained in this manual.

System Overview

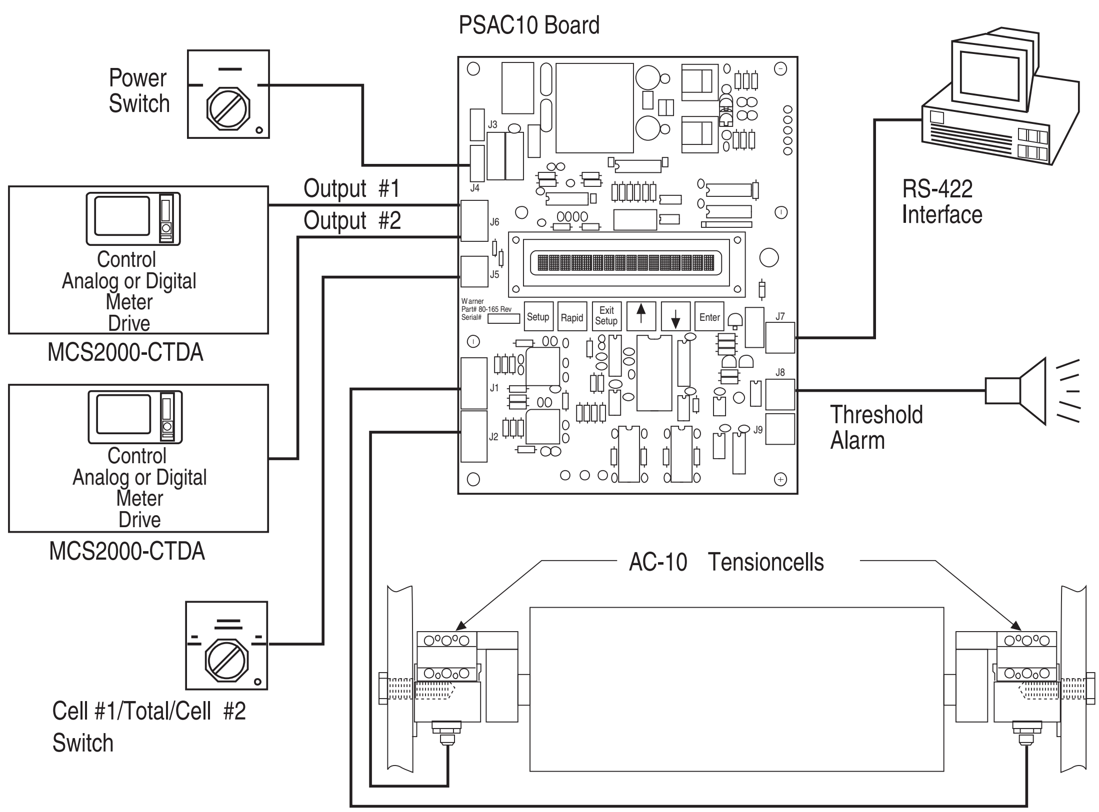
The AC10 Tension Measuring System is designed to measure tension on continuous strip processing lines and equipment. The system consists of two AC10 Tensioncells, the PSAC10 power supply amplifier board, and two cables for connecting the Tensioncells to the board.

AC10 Tensioncells are mounted in pairs, one at each end of the measuring roll. During operation the Tensioncells continuously measure the mechanical tension force applied to the measuring roll. When the force is applied, the load plate deflects toward or away from the base block depending on the resultant force acting upon the Tensioncell. Deflection toward the base block is defined as the "Compression Mode." Deflection away from the base block is defined as the "Tension Mode." AC10 Tensioncells work equally well in either mode.

The mechanical deflection of the load plate is converted into an electrical output signal by the AC Linear Variable Differential Transformer (LVDT). Displacement of the LVDT core caused by variations in web tension results in an output signal to the PSAC10 board directly proportional to the applied tension.

The analog outputs from the Tensioncells are converted into digital signals by the microprocessor-based electronics. The signals are conditioned, processed, and summed to produce two individually scaleable, -10 to +10 volt DC analog outputs to a tension indicator, drive or a MCS2000 CTDA control which can be used to monitor or control tension. The percent tension applied to each Tensioncell and the total tension are displayed on the board mounted 16-character liquid crystal display (LCD).

Terminals are also provided for connecting a user supplied On/Off power switch, 1-only 2-only switch, and RS-422 PC interface. A threshold alarm relay connection is also provided.



Note: When using the PSAC10 board, connect the outputs to the MCS2000 CTDA. There is no need to use the MCS2000 CTLC, because the signal is amplified and summed in the PSAC10.

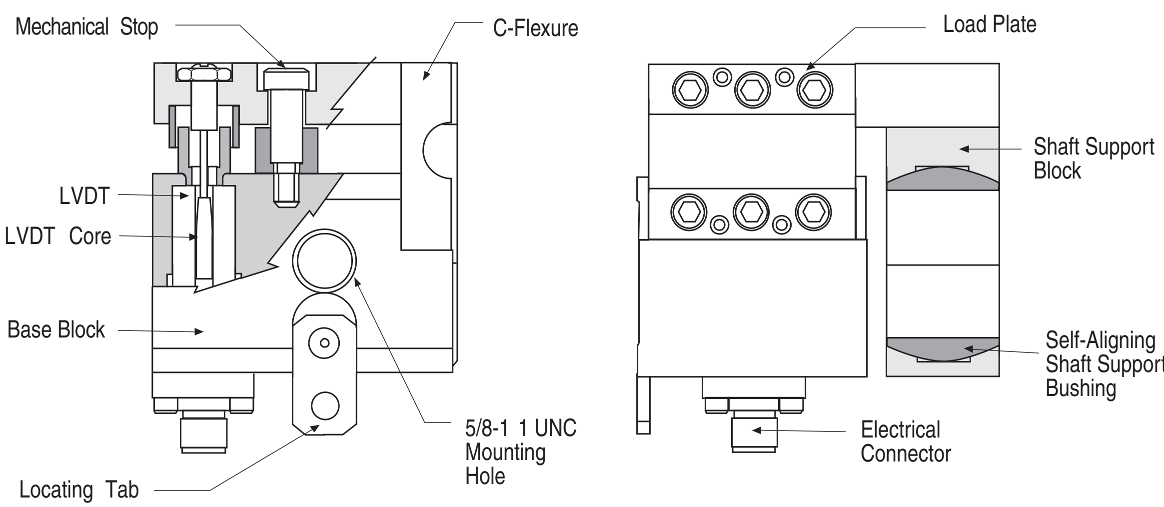
AC10 Tensioncells

AC10 Tensioncells are available in three capacity ranges for non-rotating shaft applications with maximum resultant force plus tare load of 60, 170, or 500 pounds respectively.

The rugged, all-steel construction of the AC10 Tensioncell includes four basic components: the one-piece base block, the patented C-Flexure, the load plate, and the shaft support block. The factory-set mechanical stop provides overload protection up to ten times the maximum rated load capacity of the unit.

Each unit is wall mounted by means of a single bolt located in line with the integral self-aligning, stainless steel shaft support bushing and the centerline of the roll shaft. This permits the Tensioncell to be rotated and mounted at the required angle around the axis of the measuring roll. The locating tab at the bottom of the unit locks it in position.

The primary conversion element between the mechanical tension force and the electrical output signal is an AC Linear Variable Differential Transformer (LVDT). The LVDT electrical elements are encapsulated and sealed against shock, vibration, or tampering. Input and output circuits are isolated from each other and from the Tensioncell body. This permits the Tensioncells to be used in floating ground electrical systems.



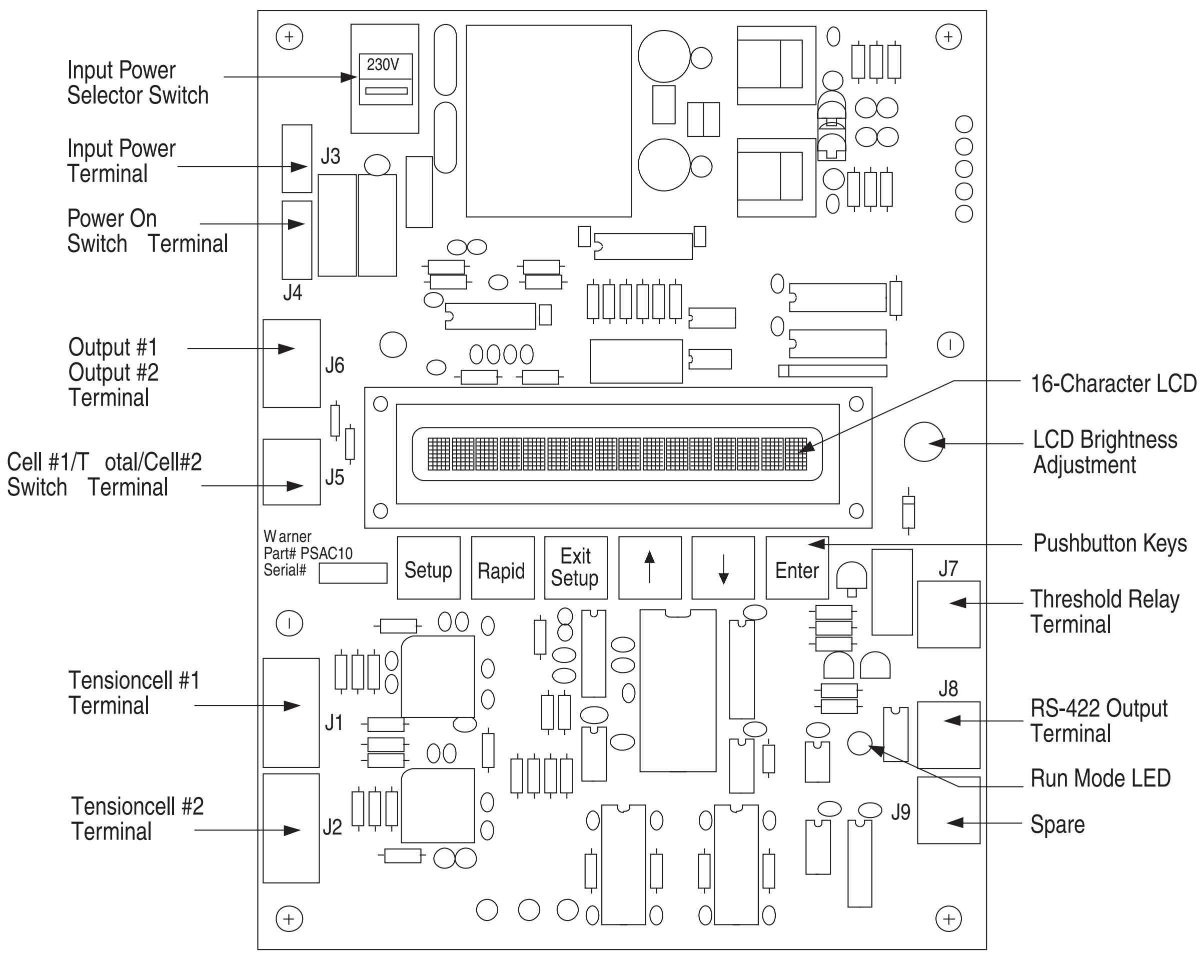
AC10 Electronics

The AC10 microprocessor-based electronics adds ease of setup, versatility, and accuracy of the overall system by eliminating the need for potentiometers to adjust or setup the system. All adjustments and system settings are performed by using the pushbutton keys on the board. During setup, alphanumeric prompts are displayed on the 16-character LCD to guide the user through the setup procedure.

Other features of the PSAC10 board include:

- Two individually scaleable -10 to +10 volt DC outputs
- Run Mode LED
- Programmable threshold relay
- Cell#1/Total/Cell#2 switch connection
- LCD Brightness Adjustment
- Switch selectable 115/230 volt AC input power

An RS422 Serial Output terminal is also provided for interfacing the AC10 system with a PC to monitor and/or record the percent tension applied to each Tensioncell. Data is transferred in ASCII text format. The RS422 output can be converted to RS-232.



Specifications

AC10 Tensioncells

Dimensions (l x w x h) . . . . .3.00" x 3.44" x 3.90"

Maximum Load Capacity (tension plus tare)

AC10A . . . . .60 pounds

AC10B . . . . .170 pounds

AC10C . . . . .500 pounds

Minimum Tension Load Required for Setup

AC10A . . . . .4 pounds

AC10B . . . . .10 pounds

AC10C . . . . .30 pounds

Standard Shaft Diameters (1/16" increments) . . . . .1/2" to 1-1/2"

Overload Protection . . . . .10 times maximum rated load of unit

Maximum Deflection at Full Load . . . . .0.010"

LVDT

Operating Temperature . . . . .250°F maximum

Excitation Voltage . . . . .15 Vrms @5KHz

Output . . . . .3.2 volts AC/inch displacement / volt excitation

Excitation Resistance . . . . .335 Ohms ±5%

Output Signal Resistance . . . . .100 Ohms ±5%

Linearity . . . . .0.1% of full scale

Hysteresis . . . . .0.1% of full scale

Repeatability . . . . .0.1% of full scale

Temperature Drift . . . . .0.02% per °C

PSAC10 Power Supply/Amplifier Board

Dimension (l x w) . . . . .8.75" x 6.88"

Maximum height of components above board . . . . .1.5"

Operating Temperature Range . . . . .32°F to +160°F (0°C to +70°C)

Input Voltage (switch selectable) . . . . .115/230 VAC, 50-60 Hz, <1.0 Ampere

Output Voltage (two individually scaleable) . . . .-10 to +10 VDC

Maximum cable distance between Tensioncell and board . . . . .100 feet

(The output load to the board must be 2 kΩ or greater)

Threshold Relay Contact .1A @ 24 VDC, 500mA@ 120 VAC, 250 mA @ 220 VAC

RS-422 Data Rate . . . . .300bps, NP, 8, 1 stop bit

Pushbutton Key Functions

The six pushbutton keys on the PSAC10 board are used to enter and exit the Setup Mode and to make adjustments during the procedure. This section describes the various key functions and combinations that are used while setting up the system.

Keys	Function
↑ RAPID	The UP arrow key is used to toggle between selections. It is also used to incrementally increase the output voltage each time the key is pressed. When the UP arrow and RAPID keys are pressed simultaneously, the voltage value will change continuously until the keys are released or the upper limit is reached. (See note below.)
↓ RAPID	The DOWN arrow key is used to toggle between selections and to incrementally decrease the output voltage each time the key is pressed. When the DOWN arrow and RAPID keys are pressed simultaneously, the voltage value will change continuously until the keys are released or the lower limit is reached. (See note below.)
ENTER	The ENTER key is used to make selections and store values before proceeding to the next Setup step.
SETUP ↑	Pressing and releasing these keys simultaneously accesses the Setup Mode. An asterisk (*) will display next to the right tension value.
SETUP ENTER	Press and release these keys simultaneously to start the Setup procedure when in the Setup Mode.
EXIT	Press and release this key to exit the Setup Mode at any time. The system will return the settings entered during the last completed setup procedure.
SETUP RAPID	Press and release these keys simultaneously to enter the settings for the Programmable Alarm Output.
SETUP EXIT	Press and release these keys simultaneously to zero the system.

Note: During setup, the output voltage value will change approximately 5 millivolts each time the Up or Down arrow key is pressed and released. Pressing and releasing the RAPID key and the Up or Down arrow key simultaneously will change the value approximately 200 millivolts. Holding the Rapid key and an arrow key in, will continuously change the value until the keys are released.

Installation

Pre-Installation Inspection

Before installing the AC10 system:

☐1. Insure all components are present. A typical system consists of two AC10 Tensioncells, one PSAC10 board, and two 30 foot lengths of cable for connecting the Tensioncells to the board. Refer to Model Number Designation (Chart 1) below to verify load capacity and shaft diameter.

☐2. Inspect all electrical and mechanical components for physical damage.

☐3. Promptly report any damage to the carrier and Warner Electric.

The maximum rated load capacity must be greater than or equal to (RF + TW) where W = Tare Weight. The Web Resultant Force (RF) and Tare Weight are always summed. Refer to the Model Number Designation (Chart 1) below to verify the shaft diameter, and that the maximum rated load capacity of each unit.

Warner Electric also recommends the Resultant Force (RF) be greater than 1/3 the maximum load capacity of the Tensioncells.

Warner Electric side mount AC10 Tensioncells are shipped in pairs designated W1 and W2. The W1 unit has a split stainless steel, self-aligning bushing for clamping the measuring roll. The bushing in the W2 unit is not split to allow for shaft expansion.

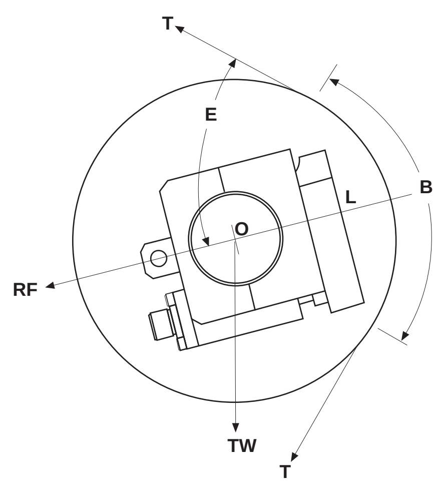
Mechanical Installation – Tensioncells

AC10 Tensioncells are available in three capacity ranges. The rated load capacity should always be larger than the maximum calculated Tare Weight (W) plus the Resultant Force (RF).

To calculate the Resultant Force:

1. E = (180°- $^{B}/_{2}$) where B = Wrap Angle

2. RF = T x CosineE where T = Web Tension



Tensioncell Model Number Designation

AC10B 18 W1

Code	Max. Load Capacity (pounds)	Min. Tension Load for Setup (pounds)
A	60	4
B	170	10
C	500	30

Support Bushing (AC10 only)
W1 = Split bushing for clamping
W2 = Solid bushing for expansion

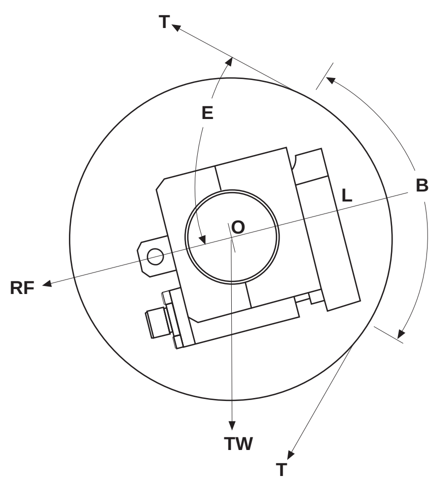
Shaft Diameter							
08	1/2	13	13/16	18	1-1/8	23	1-7/16
09	9/16	14	7/8	19	1-3/16	24	1-1/2
10	5/8	15	15/16	20	1-1/4		
11	11/16	16	1	21	1-5/16		
12	3/4	17	1-1/16	22	1-3/8		

Example: AC10B18W1
AC10 = Side Mount Tensioncell
B = 170 pound capacity
18 = 1-1/8 inch shaft diameter
W1 = AC10 with split brushing

Chart 1

Before installing the Tensioncells, refer to machine drawings, or other documentation to determine the mounting angle. If the mounting angle is not specified, mount the Tensioncells so that the Tensioncell load line (OL) bisects the wrap angle and aligns with the Resultant Force (RF).

The Tensioncells are mounted to the machine frame with a 5/8-11 UNC bolt. The bolt is in line with the centerline of the shaft support bushing. This allows the Tensioncells to be rotated around the centerline of the roll so that the Tensioncell load line (OX) aligns with the Resultant Force (RF).



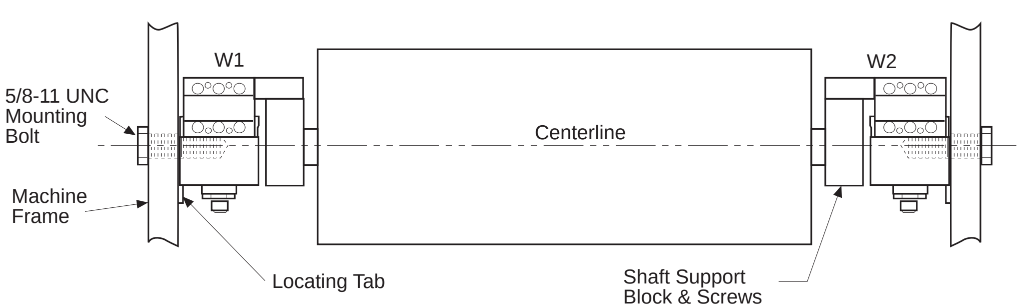
To install the Tensioncells:

- ☐ 1. Drill a 5/8" diameter hole through each side of the machine frame at the measuring roll location. The holes must be in line with each other and roll centerline to insure that the roll is level.
- ☐ 2. Fasten the Tensioncell to the machine frame with the 5/8-11 UNC mounting bolt.
- ☐ 3. Rotate the Tensioncell to the proper mounting angle and tighten the mounting bolt.
- ☐ 4. Drill a #6 (.204) hole concentric with the 1/4" hole in the locating tab.
- ☐ 5. Remove the Tensioncell to provide clearance to tap the hole for a 1/4-20 thread.
- ☐ 6. Repeat steps 2 through 5 for the Tensioncell for the other end of measuring roll shaft.
- ☐ 7. Loosen, but do not remove, the four screws in the bottom of the shaft support block enough to slide the Tensioncells on the roll shaft.

Note: The mounting angle must be the same for both Tensioncells and the Load Plate for both units must face in the same direction.

- ☐ 8. Position the roll with the Tensioncells in the machine and fasten them to the machine frame with the mounting bolts. Tighten the bolts enough to allow the Tensioncells to be rotated to the desired mounting angle.
- ☐ 9. Rotate the Tensioncells to align the locating tab with the 1/4-20 threaded hole. Lock the Tensioncells in position against the machine frame using a 1/4-20 x 1/2 socket head cap screw.
- ☐ 10. Tighten the mounting bolt on each unit.
- ☐ 11. Align the measuring roll so that there is no mechanical binding or friction.
- ☐ 12. Tighten the four screws in the bottom of each shaft support block.

Note: The mechanical stops are factory set to provide 1000% overload protection.



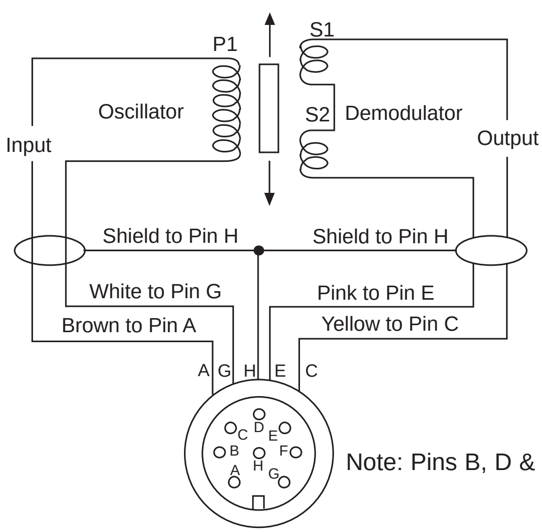
Electrical Installation

(Read the entire electrical installation procedure before proceeding.)

The PSAC10 Power Supply/Amplifier board should be securely mounted in a cabinet or enclosure using the mounting holes and standoffs INPUT provided. Refer to the dimension drawing on Page 19 for mounting hole locations.

Two 30 foot cables are provided for connecting the AC10 Tensioncells with the PSAC10 board. A screw-on connector is provided at one end of each cable for connecting to the AC10 Tensioncells.

Note: If the board must be located more than 30 feet away from the Tensioncells, the cable can be extended up to a total of 100 feet using Belden #8723 (or equivalent) in a grounded steel conduit.



Note: Pins B, D & F are not used

Electrical Connections

Although either Tensioncell in the system can be designated as Tensioncell #1 or #2, the following electrical connections assume the AC10 Tensioncell marked W1 is Tensioncell #1 and the Tensioncell marked W2 is Tensioncell #2.

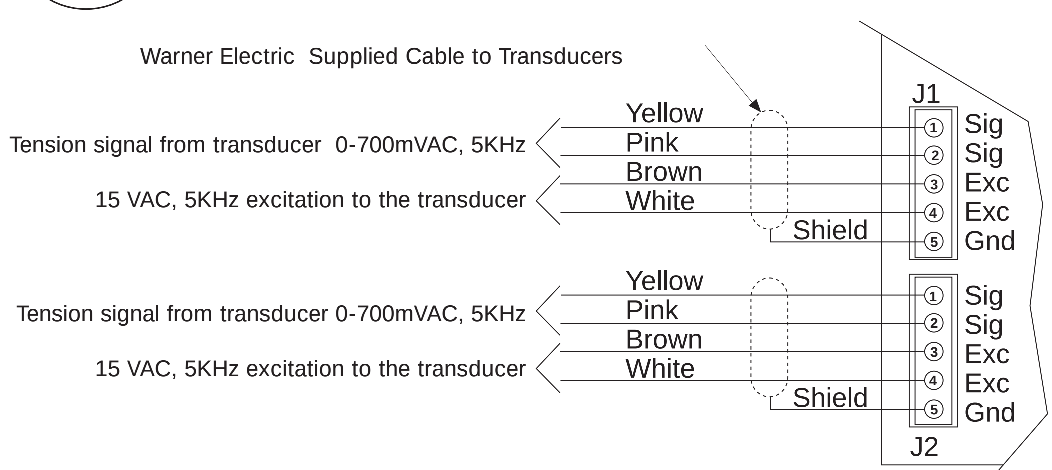
Notes:

1. The wire color connections listed for J1 and J2 will differ if Belden #8723 (or equivalent) cable is required. Insure the correct wiring connections are made with respect to the connection made with the Warner Electric supplied cable.

2. The Warner Electric supplied cable/connector assembly is an eight conductor cable. However, only the yellow, pink, brown, and white and shield wires used.

J1 to W1 Tensioncell Terminal Connection with Warner Electric supplied cable

Terminal	Label	Description	Wire Color
J1-1	Sig	AC signal from LVDT	Yellow
J1-2	Sig	AC signal from LVDT	Pink
J1-3	Exc	Excitation to LVDT	Brown
J1-4	Exc	Excitation to LVDT	White
J1-5	Gnd	Shield	Shield

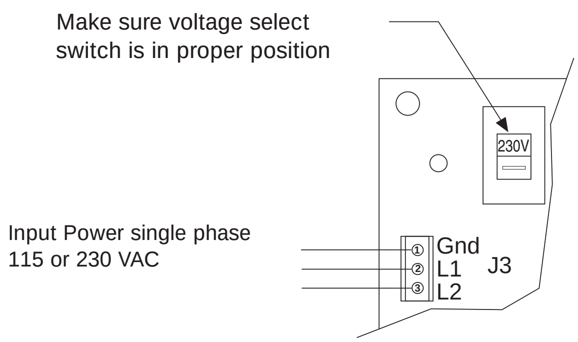


J2 to W2 Tensioncell Connection with Warner Electric supplied cable

Terminal	Label	Description	Wire Color
J2-1	Sig	AC signal from LVDT	Yellow
J2-2	Sig	AC signal from LVDT	Pink
J2-3	Exc	Excitation to LVDT	Brown
J2-4	Exc	Excitation to LVDT	White
J2-5	Gnd	Shield	Shield

J3 Input Power (115/230 VAC, 1-PH, 50/60 Hz)

Terminal	Label	Description	Wire Color
J3-1	Gnd	Ground	Green
J3-2	L1	L1 (230V) or Hot (115V)	Black
J3-3	L2	L2 (230V) or Neutral (115V)	White



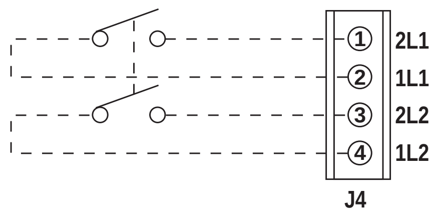
The input voltage selector switch must correspond to the voltage of the input power source.

J4 AC Power Switch and/or Power Indicator Terminal

J4 provides the terminal connection for an external AC Power Switch and/or power indicator. The indicator should not draw more than 40 milliamps of current. J4 may also be used to supply AC power to a digital voltmeter by connecting the meter between J4-2L1 and J4-2L2.

> **Note:** If an ON-OFF switch is not used, jumpers must be installed from J4-2L1 to J4-1L1 and from J4-2L2 to J4-1L2 for proper operation.

Terminal	Label	Description
J4-1	2L1	(Switched) Line 1
J4-2	1L1	(Hot) Line 1
J4-3	2L2	(Switched) Line 2
J4-4	1L2	(Hot) Line 2

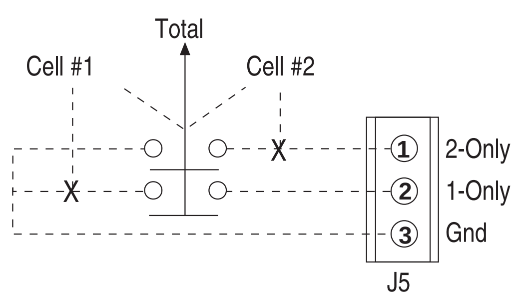


J5 Cell#1/Total/Cell#2 Switch Terminal (For Output #2 only)

J5 provides the connections for an external three-position switch with two normally open contacts. When used in conjunction with a remote meter, the switch allows the user to monitor total tension or the tension applied to either Tensioncell. The meter should be connected to Output #2 at J6, terminals Out2 and Gnd.

With the switch in the normally closed position, Output #2 will indicate the total tension. In the Cell#1 position, Output #2 switches to indicate the tension measured by the W1 Tensioncell. Changing to the Cell#2 position switches Output #2 to indicate the tension applied to the W2 Tensioncell.

Terminal	Label	Description
J5-1	2-Only	(Switched) tension W1
J5-2	1-Only	(Switched) tension W2
J5-3	Gnd	Ground

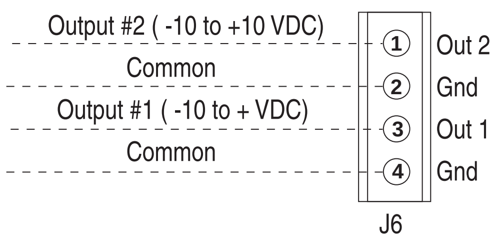


J6 Analog Outputs Terminal

The J6 terminal provides the connections for the two 10 volt DC outputs. Each output can provide up to 30 milliamp current.

During setup, each output is individually scaleable to meet the requirements needed to calibrate the indicator, drive, or control connected to the board. The board circuitry is designed to allow a switch to be connected at Terminal J5. This switch allows the user to monitor the Output #2 signal with respect to total tension, or the tension applied to either Tensioncell.

Terminal	Label	Description
J6-1	Out2	Scaleable -10 to +10 VDC Output
J6-2	Gnd	Common
J6-3	Out1	Scaleable -10 to +10 VDC Output
J64	Gnd	Common

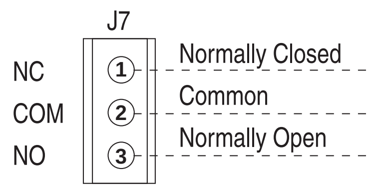


J7 Threshold Relay Terminal

J7 provides the connections for utilizing the AC10 Threshold Relay which is a form "C" dry relay contact, rated at 1 Amp. During setup, the threshold (percentage of total tension) is programmed to operate when the total tension is either above or below the threshold value.

The contact may be wired to function in either the normally open or normally closed state.

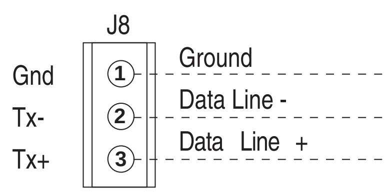
Terminal	Label	Description
J7-1	NC	Normally Closed Contact
J7-2	COM	Common
J7-3	NO	Normally Open Contact



J8 RS232 Output Terminal

J8 provides the cable connections for interfacing the PSAC 10 board with a PC to monitor total tension and tension applied to each Tensioncell. Data is transferred in ASCII text format.

Terminal	Label	Description
J8-1	Gnd	Ground
J8-2	Tx-	Data Line +
J8-3	Tx+	Data Line-



J9 (Spare)

Initial Electrical Checks

Before applying power:

Note: Make sure that the Input Power Selector Switch matches the available input voltage. Verify that the 8-position dip switch is set as follows:

Switch	1	2	3	4	5	6	7	8
Position	ON	ON	ON	ON	OFF	ON	ON	ON

Apply power.

The red Run Mode LED in the lower right hand corner of the board should be flashing.

AC10 Setup Procedure

Important: The input to any external device wired to J6-3 Out1 or J6-1 Out 2 must be 10 VDC or less.

The following procedure assumes a digital voltmeter will be used when measuring and setting the desired output voltages. If the outputs are connected to a digital or analog indicating device, which will be used during normal operation, these devices may be used during the setup procedure.

Note: The voltage setting for Output #1 at 100% load must be more positive than the voltage setting at 0% load. The same applies to the voltage settings for Output #2.

With power applied to the PSAC10 board, allow the system to "warmup" for 20 minutes or longer before proceeding with the setup procedure.

☐1. Press and release the SETUP and UP-ARROW keys simultaneously. An asterisk (*) will display next to the right tension value.

0%	**0%**	***0%**

☐2. Press and release SETUP & ENTER simultaneously to start the SETUP procedure.

Note: The Run Mode LED should stop flashing.

Compression Mode

☐3. Select either the COMPRESSION MODE or TENSION MODE using the UP or DOWN arrow key to toggle between the two choices.

a. Select the COMPRESSION MODE if the direction of the tension force is toward the base block.

b. Select TENSION MODE the direction on the tension force is away from the base block.

☐4. Press ENTER when the desired mode is displayed.

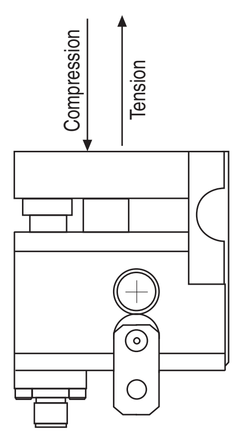
Steps 5 through 8 are performed with only the tare load applied on the Tensioncells.

Note: To exit the SETUP mode at anytime during the following procedure, press and release the EXIT key. The system will return to the settings entered during the last completed setup.

☐5. **Apply Load 0%**

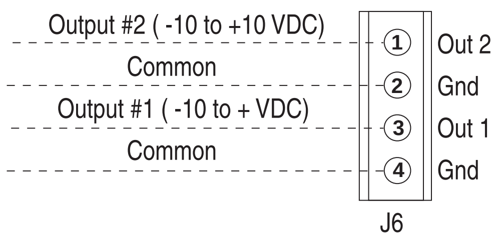
Insure that the Tensioncells are properly installed and the material is removed from the measuring roll.

☐6. Press ENTER.



☐ 7. **Adjust Out 1 0%**

a. Connect a digital voltmeter between J6-3 Out 1 and J6-4 Gnd.
b. Press the UP or DOWN arrow key (and RAPID key if necessary) until the desired no load output voltage is attained.
c. Press ENTER.



☐ 8. **Adjust Out 2 0%**

a. Connect a digital voltmeter between J6-1 Out 2 and J6-2 Gnd.
b. Press the UP or DOWN arrow key (and RAPID key if necessary) until the desired no load output voltage is attained.
c. Press ENTER.

Note: Steps 9 through 12 can be performed with 50% or 100% load applied when setting Output #1 and Output #2 voltage. Refer to the table at the right for minimum resultant load required for setup before proceeding.

☐ 9. **Apply Load 100%**

a. Press the UP or DOWN arrow key to toggle between 50% or 100%. When desired percentage is displayed.

The illustrations at the right show two pull test methods. These tests are used to apply a load representative of the web tension. The load should be equal to the percentage of the full load selected (50% or 100%).

b. Thread a non-stretchable rope over the center of the tension measuring roll simulating the web path.

Note: All rolls used in the pull test should be free running rolls.

c. With one end of the rope secured, hang a weight equal to the full load tension. (50% if selected)

A crane scale may be used to apply the required load.

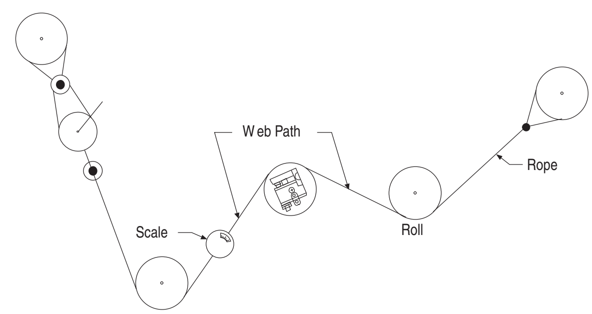
d. Press ENTER.

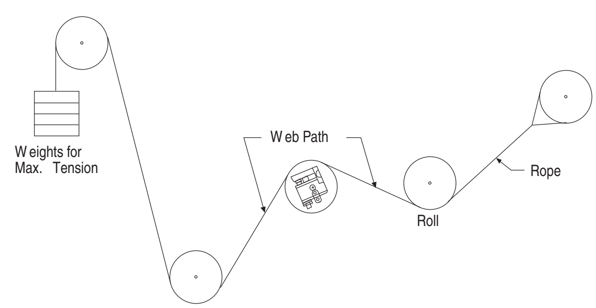
☐ 10. **Adjust Out 1 100%**

a. Connect a digital voltmeter between J6-3 Out 1 and J6-4 Gnd.

b. Press the UP or DOWN arrow key (and RAPID key if necessary) until the desired full load output voltage is attained.

c. Press ENTER.





Model	Max Load Capacity (Pounds)	Min. Tension Load for Setup (Pounds)
ACIDA	60	4
ACIDB	170	10
ACIDC	500	30

Table 2

☐11. **Adjust Out 2 100%**

a. Connect a digital voltmeter between J6-1 Out 2 and J6-2 Gnd.

b. Press the UP or DOWN arrow key (and RAPID key if necessary) until the desired output voltage is attained.

c. Press ENTER.

☐12. **Setup Complete**

a. Press ENTER.

Programmable Threshold Relay

The Threshold Relay can be programmed to Close on Higher (if the total tension goes above) or Close on Lower (if the total tension goes below) a preset programmable threshold between 0% and 102% of the total tension. The dry relay contact is rated at 1 amp @ 24VDC, 250mA @ 220 VAC, or 500 mA @ 120 VAC.

A lamp may be connected between J7-3 NO (or J7-1 NC) and J7-3 COM during setup, start up, and/or normal operation to verify the relay is operating properly.

To set the threshold value:

☐1. Press the SETUP & RAPID keys simultaneously. The display will show a message indicating the current value of the threshold. The Run Mode LED will continue to flash.

Threshold 000%

☐2. Press the UP or DOWN arrow key until the desired threshold value is displayed.

☐3. Press ENTER to select the value.

☐4. Press the UP or DOWN arrow key to toggle between the CLOSE ON LOWER or CLOSE ON HIGHER prompt.

Close on Lower

☐5. Press ENTER to select the desired mode.

Note: The threshold may be set while the web machinery is in operation. Although the LCD will not be showing the tension, Output #1, Output #2, and the serial output will still be responding to tension changes.

If the threshold value or mode is reset with the equipment operating, the new value will take effect immediately.

Reset Tare to Zero

The tare value may be zeroed to compensate for any offsets accumulated during normal operation. Press the SETUP and EXIT keys simultaneously to reset the tare to zero.

Note: Resetting tare to zero must be done with no tension load applied.

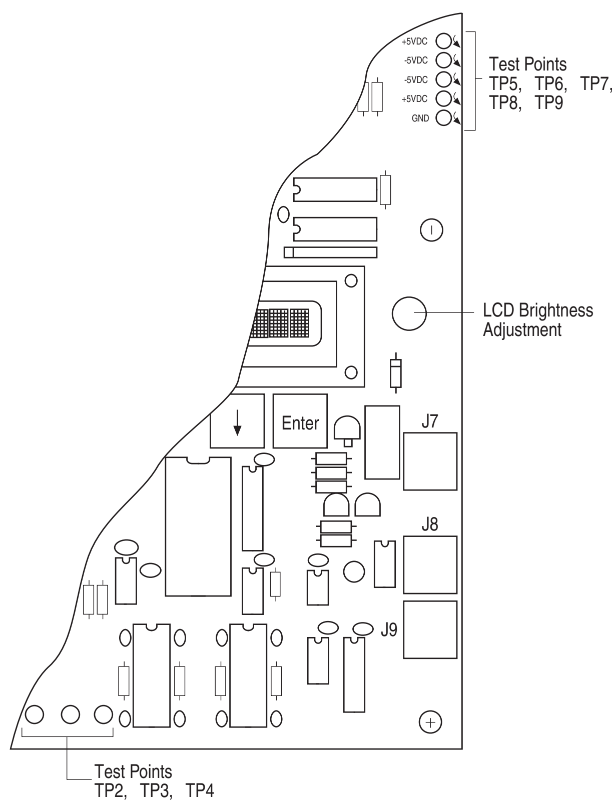
Troubleshooting

When properly installed in accordance with the design specification and procedures outlined in this manual, the AC10 Tension Measuring System should require little or no regular maintenance or service. Certain conditions, however, can impair the accuracy, reliability, and performance of the system. The following are some conditions to consider which may effect the mechanical and/or electrical components of the system.

1. Have the system operating parameters changed?
    a. Has the web tension changed?
    b. Does the tension plus tare load exceed the maximum rated load capacity of the unit?
    c. Has the Wrap Angle changed?
2. Are the Tensioncells mounted correctly and securely?
3. Is the tension measuring roll properly aligned and does it turn freely?
4. Is the line voltage present and the on-board Input Power Selector Switch in the correct position?
5. Is an external power switch connected and operating correctly? If an external switch is not used, are the jumpers properly installed at J4? See page 11.
6. Are all fuses and/or circuit breakers installed and functional? There are two 250V, 500mA fuses on the board.
7. Is the Run Mode Indicator LED flashing? If not, check if the system is in Setup mode.
8. Is the on-board display lit? Check LCD Brightness Adjustment.
9. Verify the following voltages.

TP3 to TP7	+10 volts DC
TP4 to TP7	+2.5 volts DC
TP5 to TP7	+15 volts DC
TP6 to TP7	+5volts DC
TP8 to TP7	-5 volts DC
TP9 to TP7	-15 volts DC

10. Are outputs responding to tension changes? Check connections and voltages at J1, J2, and J6.
11. Does the output signal(s) from the board meet the voltage requirements for the device(s) connected to it?
12. Is the Excitation Voltage to the LVDTs correct?



a. Using an AC volt meter with at least 5Khz band width, measure the voltage between J1-3 Exc and J1-4 Exc. The meter should read 15Vrms ~ 5Khz ± 5%. If excitation voltage is low, turn off power to the board and remove the J1 connector. Turn power back on and recheck. If voltage is correct, check for a short in Tensioncell cable assembly. Repeat test for Cell #2 at J2.

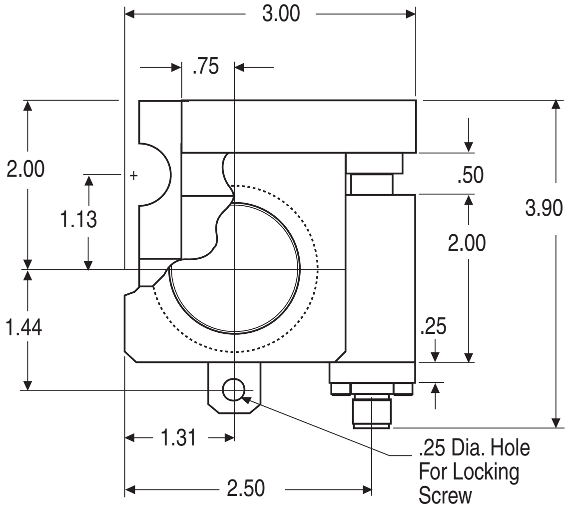
b. With board power off, remove the J1 connector and measure the resistance between the Yellow (J1-1 Sig) and Pink (J1-2 Sig) wire terminals. The resistance reading should be 335 ohms ± 5%. The resistance between White (J1-3 Exc) and Brown (J1-4 Exc) wire terminals should be 100 ohms ± 5%. If readings are incorrect, disconnect cable at the Tensioncell designated as Cell #1, and check resistance between pins C and E, and A and G. Repeat test for Cell #2 at J2.

13. Does the system zero? Press the SETUP and EXIT keys simultaneously.

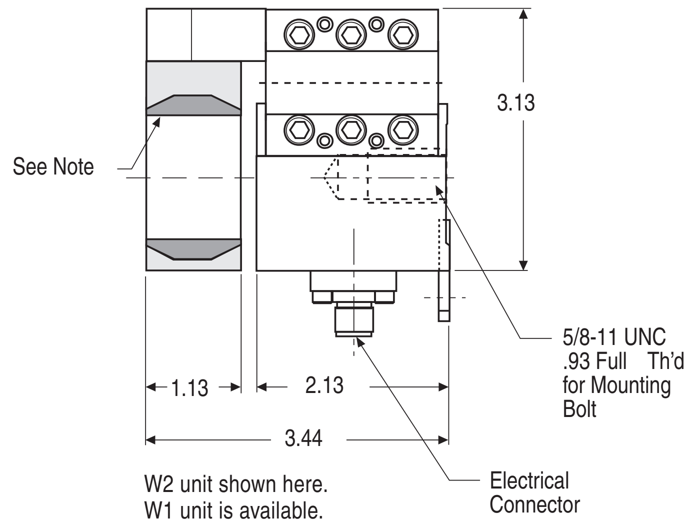
14. Does repeating Setup procedure help?

15. If problem(s) persists, contact your local Warner Electric Representative or the factory.

AC10 Tensioncell Dimensional Drawings



Note: Stainless steel self-aligning bushing provided for 1/2" to 1-1/2" diameter shafts in 1/16" increments.



W2 unit shown here.
W1 unit is available.

(Specifications and dimensions subject to change without notice.)

Tensioncell Model Number Designation

A C 1 0 B 1 6 W 1

Code	Max.Load Capacity (pounds)	Min.Tension Load for Setup (pounds)
A	60	4
B	170	10
C	500	30

Support Bushing (AC10 only)

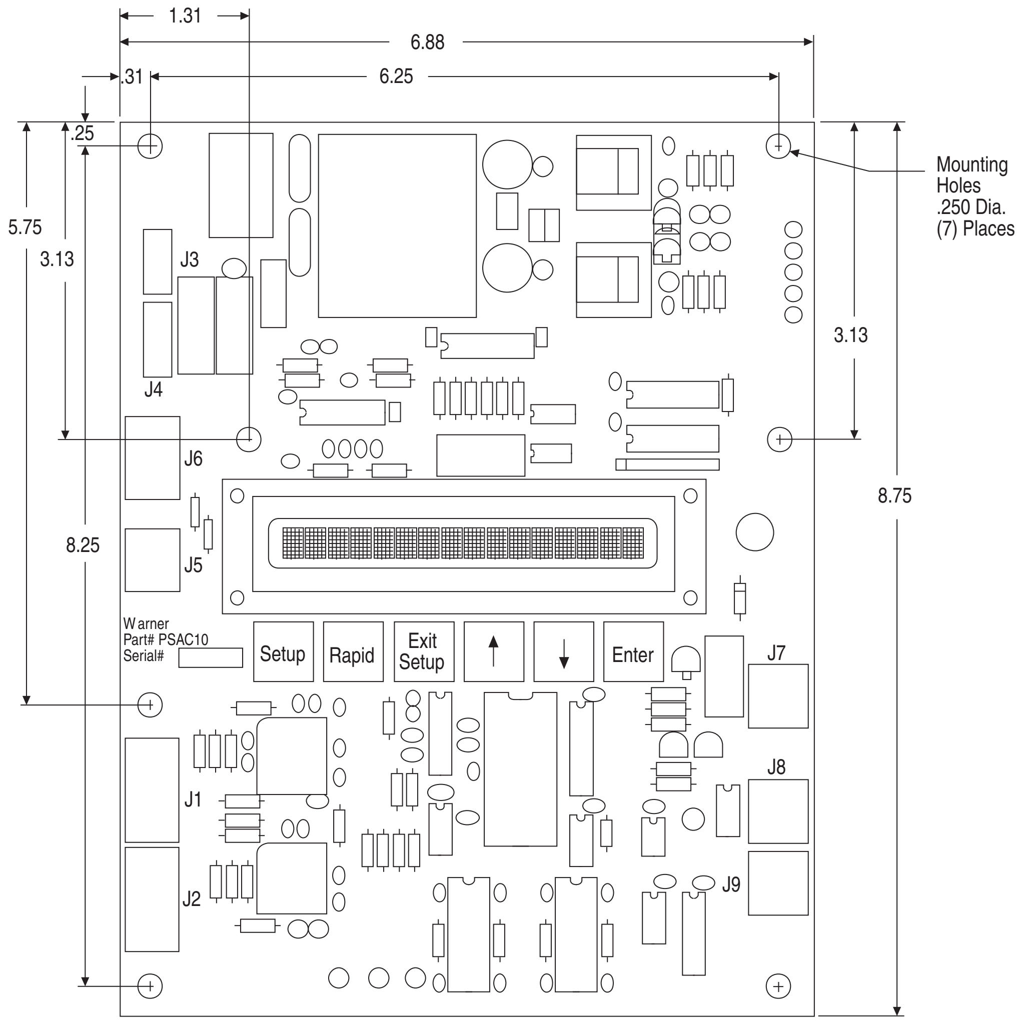
W1 = Split bushing for clamping
W2 = Solid bushing for expansion
S = System, which includes one "W1" cell, one "W2" cell, two 30 ft cables and a PSAC10 board.

Shaft Diameter	
12	3/4
16	1
20	1-1/4
23	1-7/16

Examine: AC10B16W1
AC10 = Side Mount Tensioncell
B = 170 pound capacity
16 = 1 inch shaft diameter
W1 = AC10 with split bushing

Note: Other shaft diameters are available.

PSAC10 Board Dimensions



Specifications and dimensions subject to change without notice.

A30 Single Range Tensioncells

P-2012-3
819-0403

Description

A. General Information

Warner Electric Series 30 Type A Tensioncells are force transducers, specially designed to measure and control tension on single strand wire, cable or filaments, on continuous strip processing lines. They convert the mechanical force of strand tension into an electrical signal, which is directly proportional to the strand tension.

Type "A" Tensioncells are installed as single units with a pulley or sheave (See Figures 1a and Figure 1b). They are intended for NON-ROTATING shaft installations. Tensioncells can be provided to accept shaft sizes from 3/4 inch to 1-7/16 inch. (See Table 1-B, Page 11)

B. The Mechanical System

The mechanical system consists of a Patented "C-Flexure Pivot Assembly" which incorporates a mounting Base Block, frictionless elastic pivot (or hinge), and Load Plate. (See Figure 2) When a mechanical force is applied to the Load Plate, the pivot permits its deflection toward or away from the Base Block.

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 Figure 2)

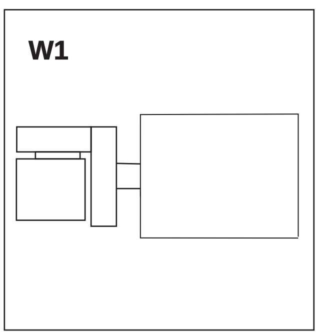


Figure 1a

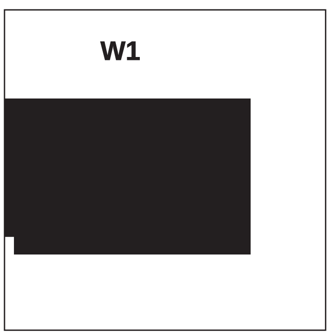


Figure 1b

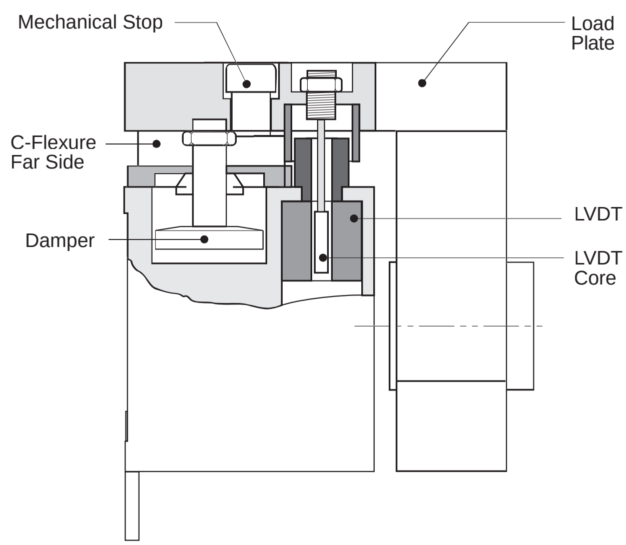


Figure 2

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 3) The moveable core of the LVDT is mechanically coupled to the Load Plate. This core assemble is factory set and is not accessible.

D. Type "K" DC LVDT

As illustrated in Figure 3, 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 (P1)
- A Primary Coil (P1)
- A movable, permeable metallic core
- Two Secondary Coils (S1 and S2)
- A demodulator and summing network to rectify and integrate the currents from the Secondary Coils

With Warner Electric LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the tensioncell. 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 straingage 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 4)

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.

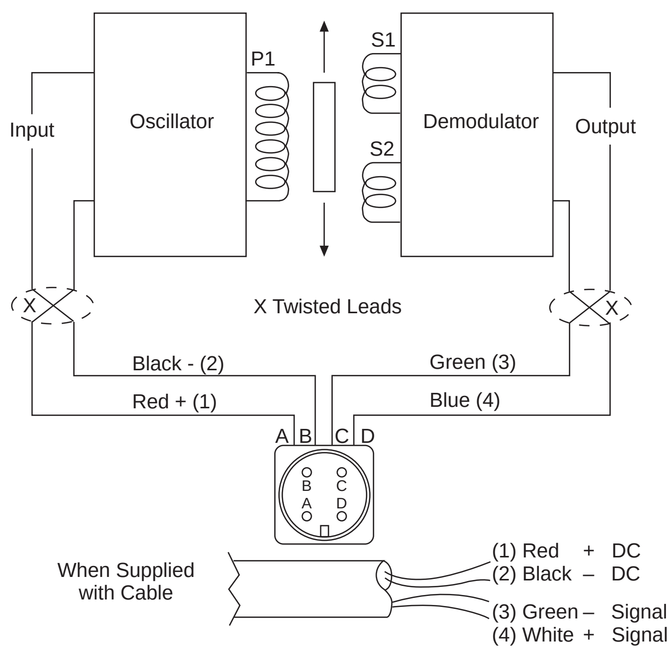


Figure 3

LVDT Output vs. Deflection Chart

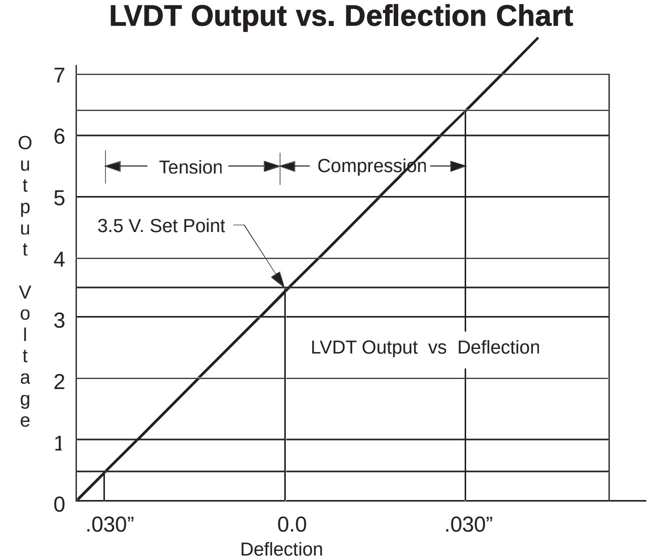


Figure 4

E. Description of Operation

The total resultant load per cell (RF) is calculated by resolving all force vectors acting upon the Tensioncell, with respect to the Loading Line (OL). (RF) is the resultant of both TENSION and TARE loads, PER CELL!! (See Figure 5)

The intrinsic design of Warner Electric Tensioncells allows the location of the Resultant Load of Strip Tension (H) on any angle with respect to the Load Line (OL). Note, however, that the Total Force vector (RF) must always be calculated on the line (OL).

Any force vector falling on the line (OR) (through the pivot point of the C-Flexure) will produce no deflection, and thus no 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 31°. (See Figure 6)

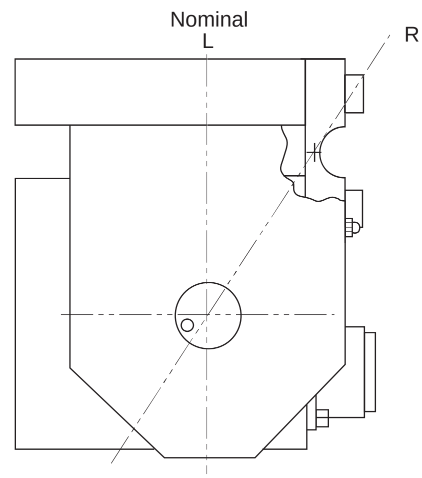


Figure 5

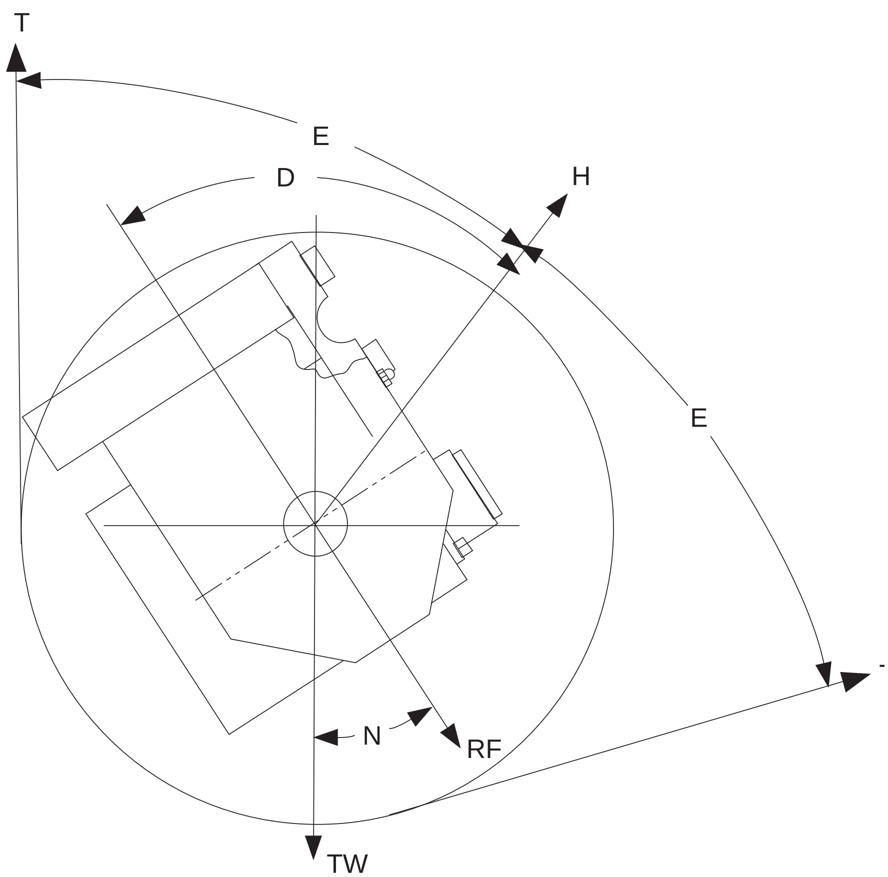


Figure 6

Installation and Operation

A. Inspection Upon Delivery

Warner Electric 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 Warner Electric.

B. Handling

Tensioncells can be handled manually.

C. Long Term Storage

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

D. Mechanical Installation

Note: Refer to the Dimension Drawing Pages 10 and 11 of this manual for detailed identification of all parts.

Tensioncells are designated as W1 and W2, one being the mirror image of the other. (See Figure 7)

Warner Electric 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 5)

The locating tab prevents the Tensioncell from rotating and secures it in a permanent location. It also provides a means of repeating rotary 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.

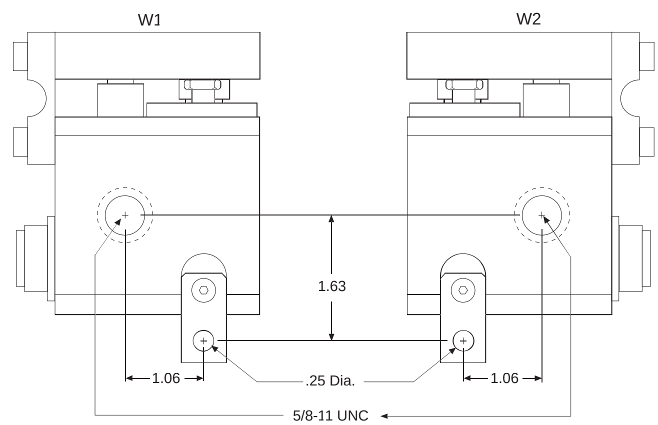


Figure 7

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 Y 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. Assemble the Tensioncells onto the ends of the measuring roll shaft.

☐7. Position the roll with the Tensioncells on the machine and fasten with the mounting bolts.

☐8. Rotate the Tensioncells to the proper mounting angle and tighten the mounting bolts.

☐9. Lock the locating pad for each Tensioncell against the machine frame using the 1/4-20 x 1/2 socket head cap screw.

☐10. Tighten the shaft in the mounting block on the W1 unit.

E. Mechanical Alignment

Align the sectional 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.

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 8)

☐4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 8)

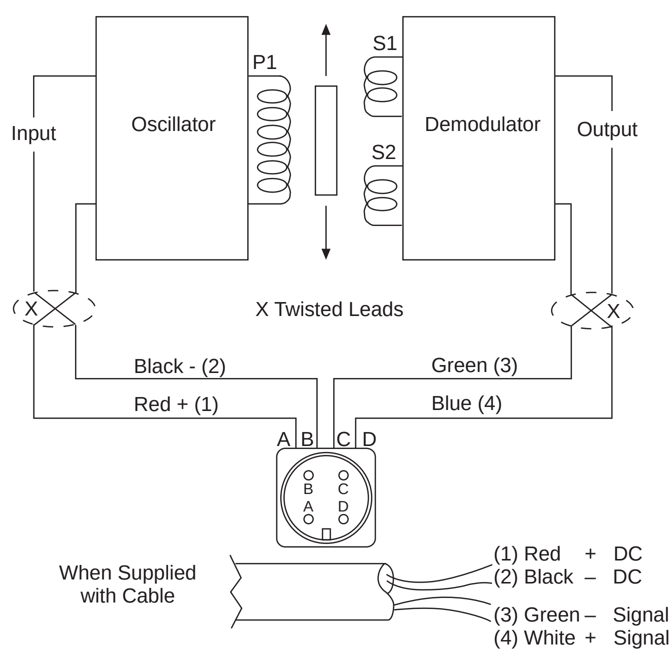


Figure 8

Set up and Adjustments Specifications

Type "K" 24 volt DC LVDT Specifications	
Input	6-30 volts DC
Output	0.5-6.5 volts DC (nominal, open circuit)
Output Impedence	2.5K ohms
Current Consumption	40 mA
Recommended Load	100K ohms or greater
Max. Operating Temp	250°F

Note: Warner Electric loadcells are calibrated for 24 volt DC input voltage to provide a 0.5 to 6.5 volts DC output signal.

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 8)

☐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 volt meter 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 Warner Electric Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

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.

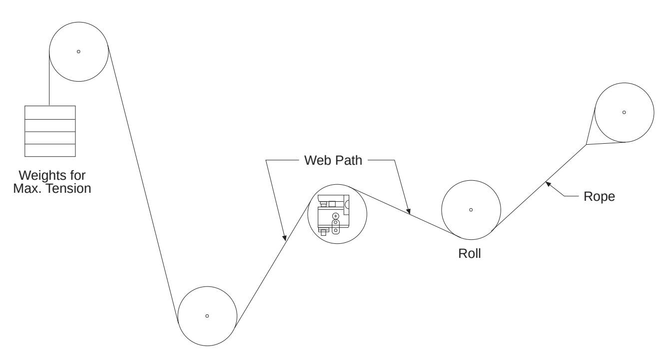
☐1. Run a non-stretchable rope over the center of the tension roll simulating the web path. (**Note:** The rolls should be free to turn.)

☐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 9)

☐3. With a voltmeter connected to Pins C and D of the connector, an output voltage will be observed.

Warner Electric 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 Warner Electric control is used, refer to the control manual for further calibration.

Although the electrical output of Warner Electric 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.



(Figure 9)

Trouble Shooting

When properly installed in accordance with the original design specifications Warner Electric 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.

1. Has the tension measuring system been changed?

   a. An increase or decrease in strip tension.

   b. An increase or decrease in the wrap angle.

   If the above parameters have been changed enough to prevent the unit from operating within the limits of the fixed Mechanical Stop, restore parameters to previous condition or consult factory.

2. Is the loadcell 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?

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 10)

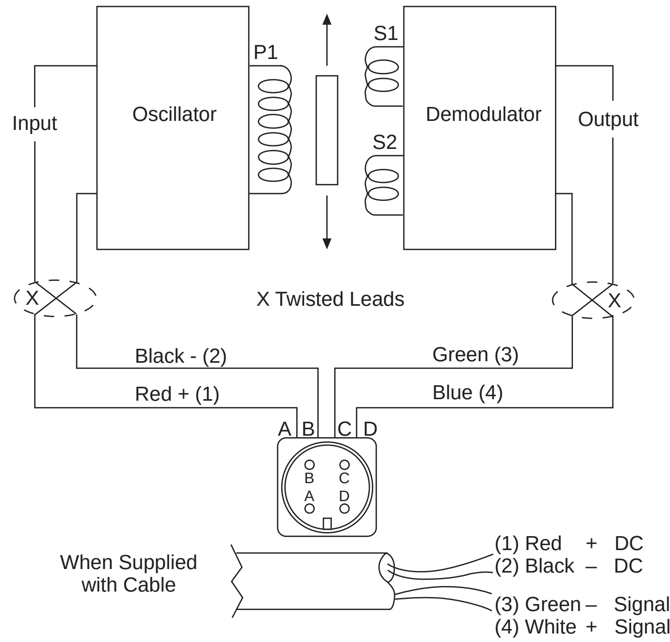


Figure 10

   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 Warner Electric with tensioncell model number and serial number.

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 5. 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 cells.

Model Number Nomenclature Example

Electrical Connection
B - MS Connector

Series Number (2 Digits)
30 Wall Mount

K - DC LVDT with Maximum 3 VDC Output Change Including Tare Displacement

B	A	3	0	T	1	6	K	W1

Type
A - Pulley or Sheave

Capacity Range
See Table 1-A

Shaft Diameter
See Table I-B for Type A

Shaft Mounting Configuration
W1 Split bushing
W2 Solid bushing

Example Shown:
BA30T16KW1
B = MS Connector
A = Pulley Mount
30 = Series 30, Wall Mount
T = 0-50 lbs. Capacity
16 = 1” Diameter Shaft
K = K Type DC LVDT
W = Split Bushing

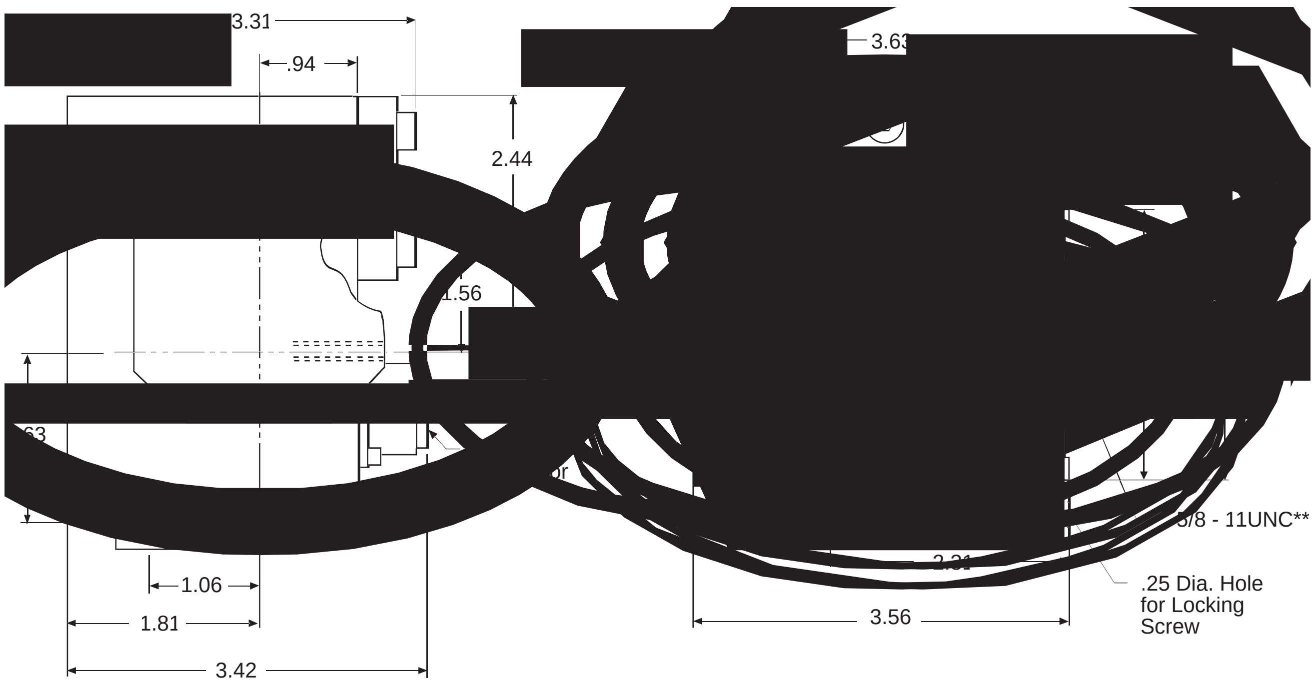
Note: For dual load cell applications “W1” and “W2” cell are required.

Series 30, Type A Specifications – Non-Rotating Shaft Mounting

Series 30, Type A – Nominal Capacity Ranges			
Code	P	T	U
Pounds	0-20	0-50	0-90

Table I-A

Note: Other load ratings are available as special order. Contact Warner Electric for other load ranges available.



** Warner Electric wall mounted tensioncells are located by a 5/8-11 bolt at the roll centerline and locating tab which maintains rotational position to the tensioncell. (See Page 5.)

Shaft Specifications			
Code	3/4	1.0	1-1/4
Inches	12	16	20

Table I-B

Note: Other shaft diameters are available as special order. Contact Warner Electric for other shaft diameter availiblilty.

B30 Single Range Tensioncells

P-2012-4
819-0404

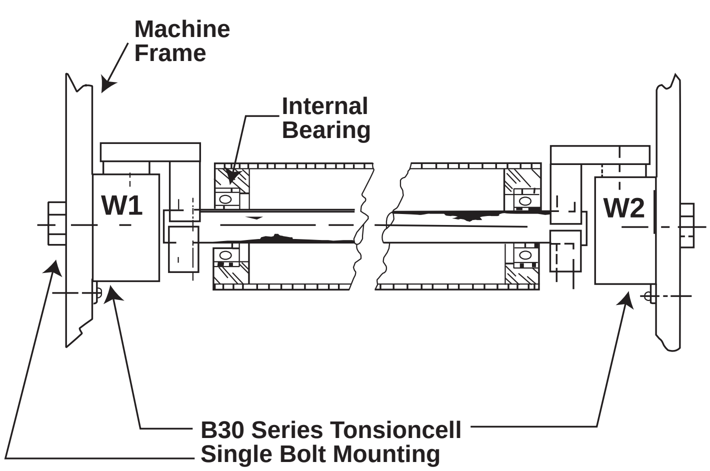
Description

General Information

Warner Electric Series 30 Type B 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)

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" Tensioncells are intended for NON-ROTATING shaft installations. A self-aligning shaft clamp assures proper alignment of the measureing roll when the tension cells are bolted to the machine frame. Type "B" 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 shaft. (See Figure 1)



Type B - Bearings in Roll - Non-Rotating Shaft

Figure 1

The Mechanical System

The mechanical system consists of a Patented "C-Flexure Pivot Assembly" which incorporates a mounting Base Block, frictionless elastic pivot (or hinge), and Load Plate. (See Figure 2) When a mechanical force is applied to the Load Plate, the pivot permits its deflection toward or away from the Base Block.

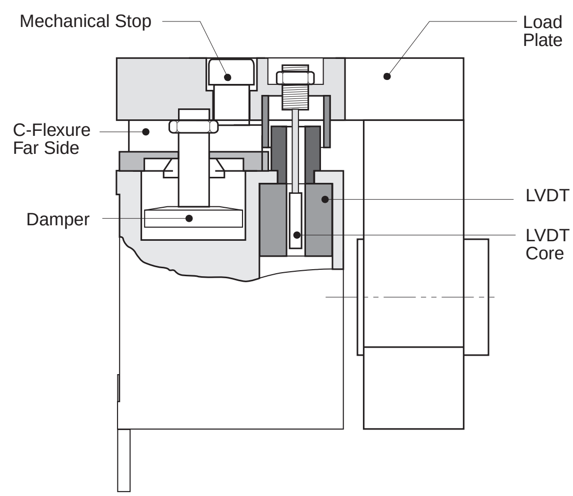


Figure 2

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 3, Figure 2)

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 3.) The movable core of the LVDT is mechanically coupled to the Load Plate by means of the Core Adjust Assembly. (See Figure 3) This adjustment is factory set and is not accessible.

Type "K" DC LVDT

As illustrated in Figure 3, a DC LVDT consists of the following components:

- An oscillator, which converts the DC input voltage into a high frequency alternating current for exciting the primary coil (P1)
- A Primary Coil (P1)
- A movable, permeable metallic core
- Two Secondary Coils (S1 and S2)
- A demodulator and summing network to rectify and integrate the currents from the Secondary Coils

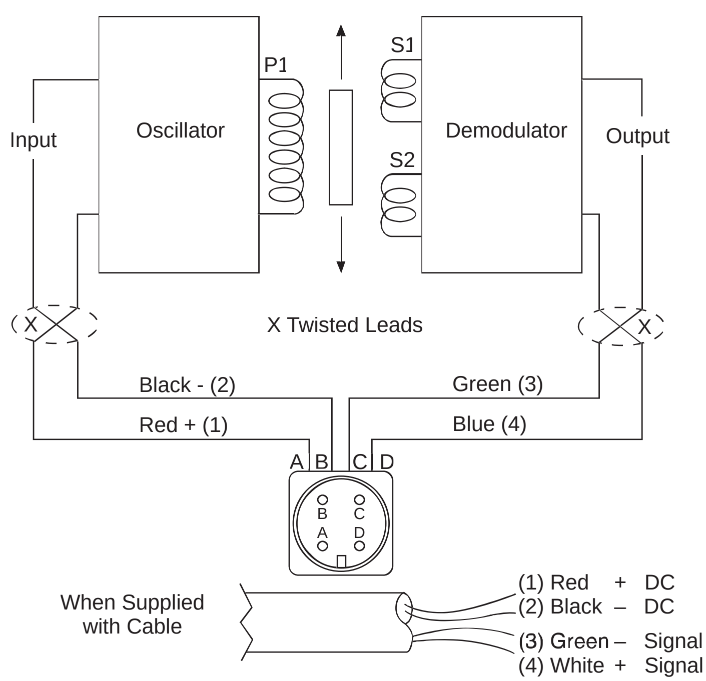


Figure 3

With Warner Electric LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the tensioncell. 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 straingage 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 4)

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.

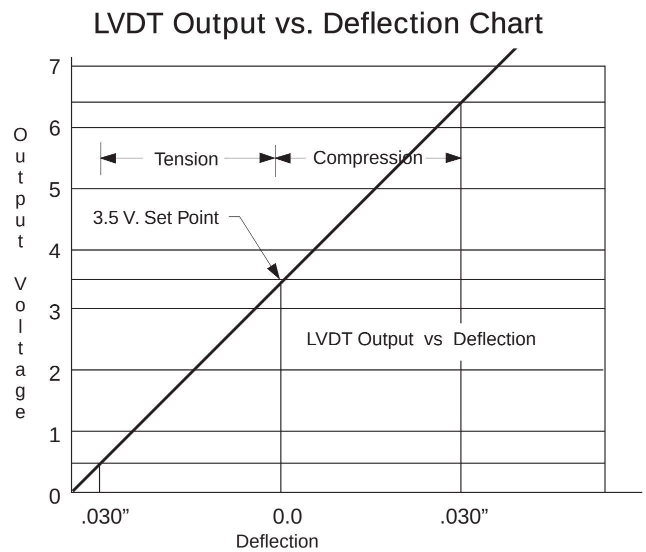
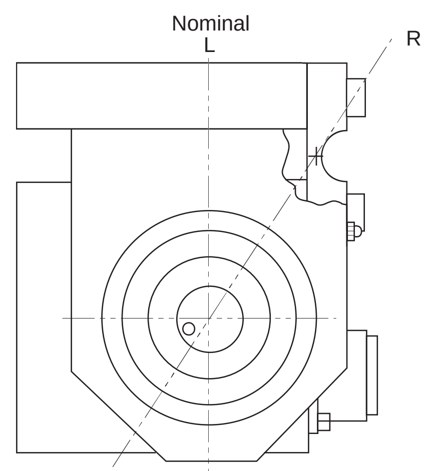


Figure 4

Description of Operation

The total resultant load per cell (RF) is calculated by resolving all force vectors acting upon the Tensioncell, with respect to the Loading Line (OL). (RF) is the resultant of both TENSION and TARE loads, PER CELL!! (See Figure 5)



(Figure 5)

The intrinsic design of Warner Electric Tensioncells allows the location of the Resultant Load of Strip Tension (H) on any angle with respect to the Load Line (OL). Note, however, that the Total Force vector (RF) must always be calculated on the line (OL).

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 Figures 6A and 6B) or so that (N) is 329° (See Figures 7A and 7B).

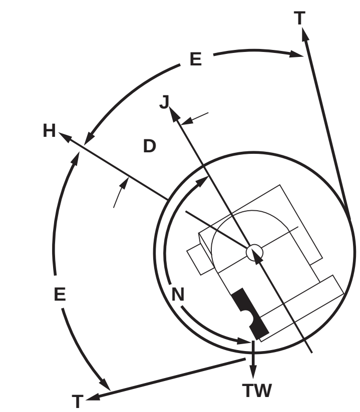


Figure 6A

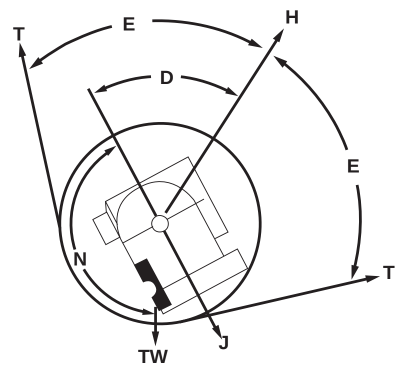


Figure 6B

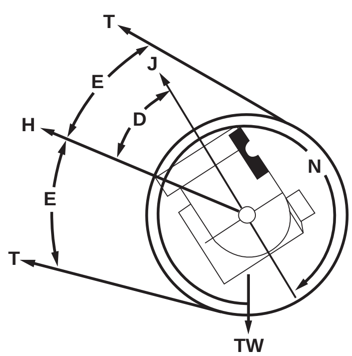


Figure 7A

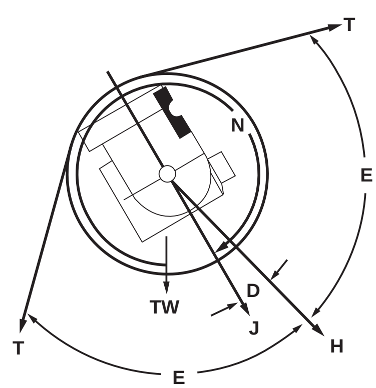


Figure 7B

Installation and Operation

Inspection Upon Delivery

Warner Electric 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 Warner Electric.

Handling

Tensioncells can be handled manually.

Long Term Storage

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

Mechanical Installation

Note: Refer to the Dimension Drawing Pages 11 and 12 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 8)

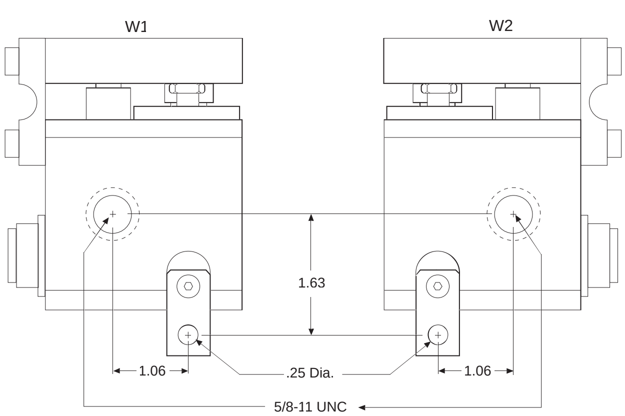


Figure 8

Warner Electric 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 5).

The locating tab prevents the Tensioncell from rotating and secures it in a permanent location. It also provides a means of repeating rotary 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 capscrew.

☐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).

Mechanical Alignment

Align the sectional 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.

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 9)

☐4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 9)

☐5. Repeat Steps 1 through 4 of the electrical wiring procedure for the Tensioncells mounted on the other end of the measuring roll.

Specifications

Type "K" 24 volt DC LVDT Specifications	
Input	6-30 volts DC
Output	0.5-6.5 volts DC (nominal, open circuit)
Output Impedence	2.5K ohms
Current Consumption	40 mA
Recommended Load	100K ohms or greater
Max. Operating Temp	250°F

Note: Warner Electric loadcells are calibrated for 24 volt DC input voltage to provide a 0.5 to 6.5 volts DC output signal.

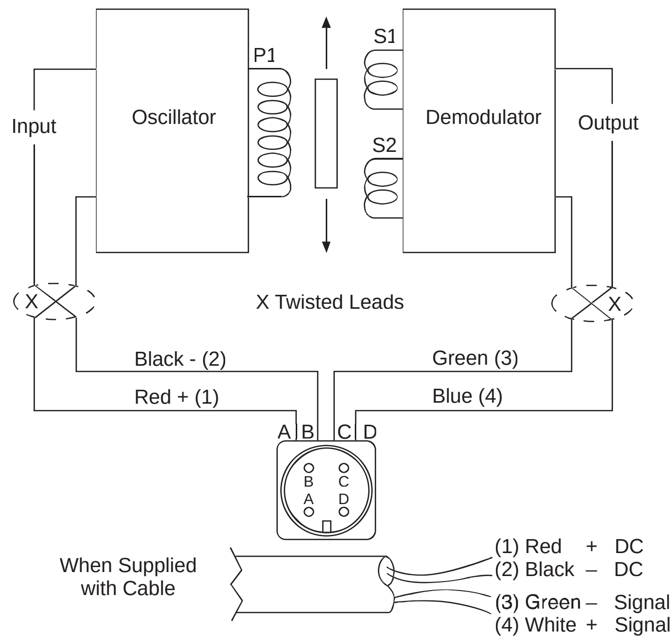


Figure 9

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 9)

☐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 White leads for each tensioncell with a volt meter 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 Warner Electric Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

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 10)

☐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.

Warner Electric 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 Warner Electric control is used, refer to the control manual for further calibration.

Although the electrical output of Warner Electric 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.

Trouble Shooting

When properly installed in accordance with the original design specifications Warner Electric 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)

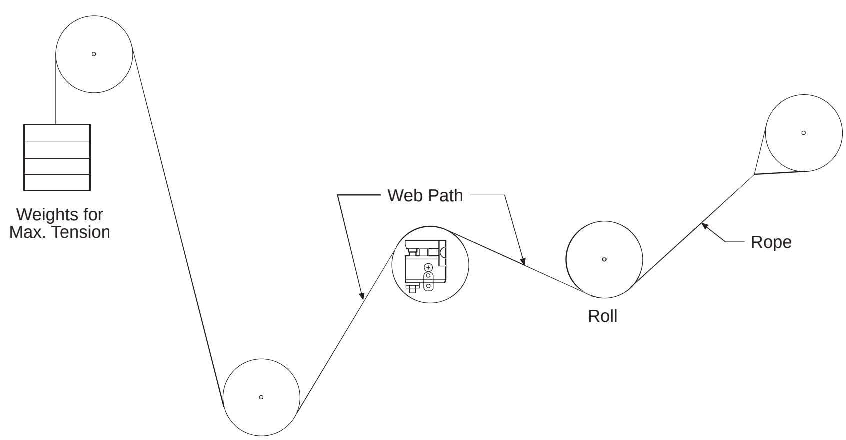


Figure 10

Mechanical

1. Has the tension measuring system been changed?

   a. An increase or decrease in strip tension (Refer to A on the calibration sheet for specified strip 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 tensioncells 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?

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 11)

   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 the Tensioncell LVDT. Contact Warner Electric with Tensioncell model number and serial number.

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 5. 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 a different Tensioncell.

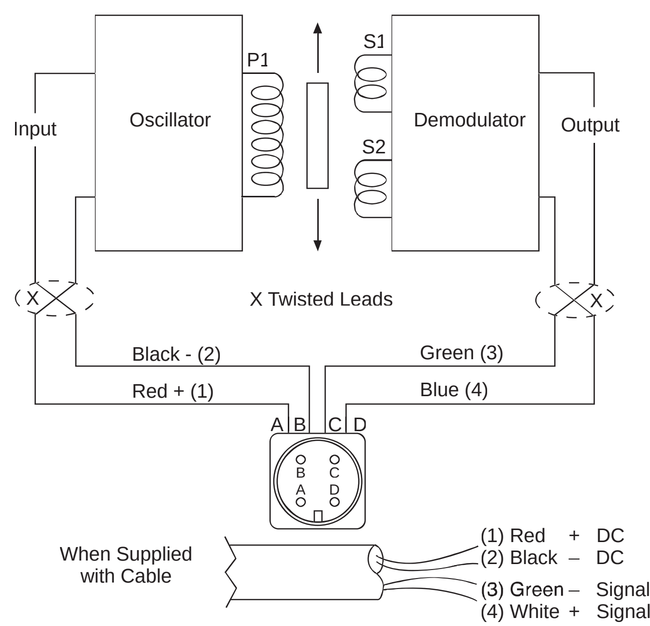


Figure 11

Model Number Nomenclature Example

Electrical
Connection
B - MS Connector

Series Number (2 Digits)
30 Wall Mount

K - DC LVDT with
Maximum 3 VDC Output Change Including Tare Displacement

B	B	3	0	P	1	6	K	W1

Type
B - Non-Rotating Shaft

Capacity Range
See Table II-A

Shaft Diameter
See Table II-B

Shaft Mounting Configuration
W1-Split bushing
W2-Solid bushing

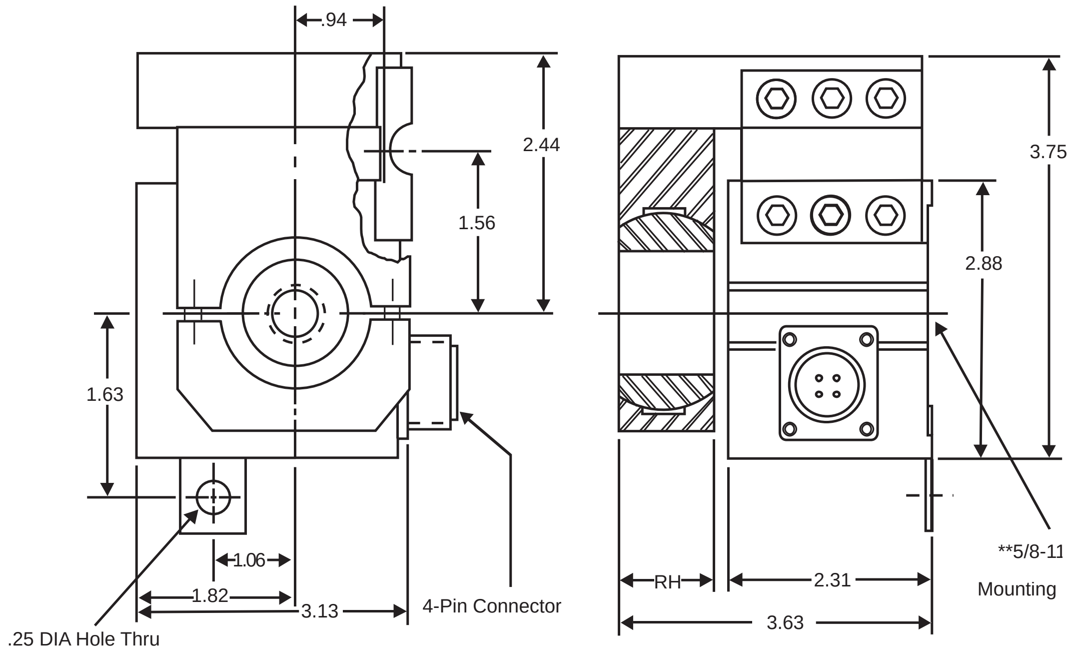
Example Shown:
BC30P16KW1
N = MS Connector
C = Rotating Shaft
30 = Series 30, Wall Mount
P = 0-20 lbs. Capacity
16 = 1” Diameter Shaft
K = K Type DC LVDT
W1 = Split Bushing

Series 30, Type B Specifications – Non-Rotating Shaft Mounting

Series 30, Type B – Nominal Capacity Ranges					
Code	P	T	U	X	Z
Pounds	0-20	0-50	0-90	0-200	0-500

Table II-A

Note: Other Load ranges are available on special order. Contact Warner Electric for ratings & abalability.



**Warner Electric 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 6.)

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.

Series 30, Type B Shaft Diameter Code				
Code	12	16	20	23
Inches	3/4	1.0	1-1/4	1-7/16
RH	1.00	1.13		

Table II-B

Note: Other shaft diameters are availible in special order. Contact Warner Electric for other shaft diameter avalibility.

C30 Single Range Tensioncells

P-2012-5
819-0405

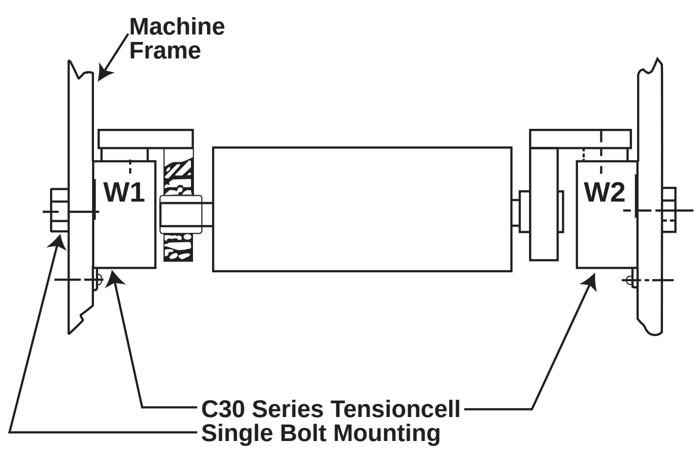
Description

General Information

Warner Electric Series 30 Type 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)

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 "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 1)



Self-Aligning Bearings in Tensioncell - Rotating Shaft

Figure 1

The Mechanical System

The mechanical system consists of a Patented "C-Flexure Pivot Assembly" which incorporates a mounting Base Block, frictionless elastic pivot (or hinge), and Load Plate. (See Figure 2) When a mechanical force is applied to the Load Plate, the pivot permits its deflection toward or away from the Base Block.

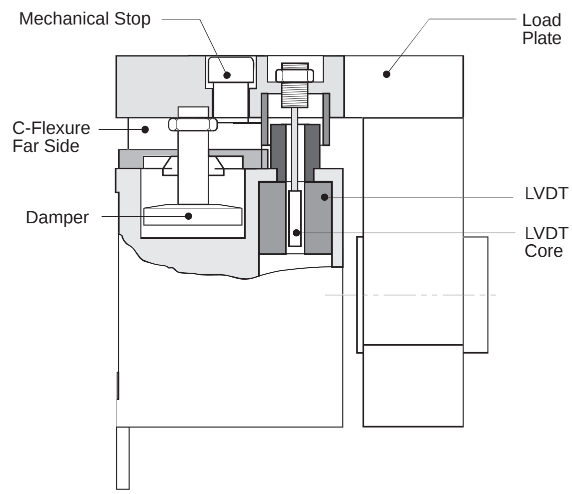


Figure 2

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 3, Figure 2)

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 2) The movable core of the LVDT is mechanically coupled to the Load Plate by means of the Core Adjust Assembly. (See Figure 3) This adjustment is factory set and is not accessible.

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 (P1).
- A Primary Coil (P1)
- A movable, permeable metallic core
- Two Secondary Coils (S1 and S2)
- A demodulator and summing network to rectify and integrate the currents from the Secondary Coils

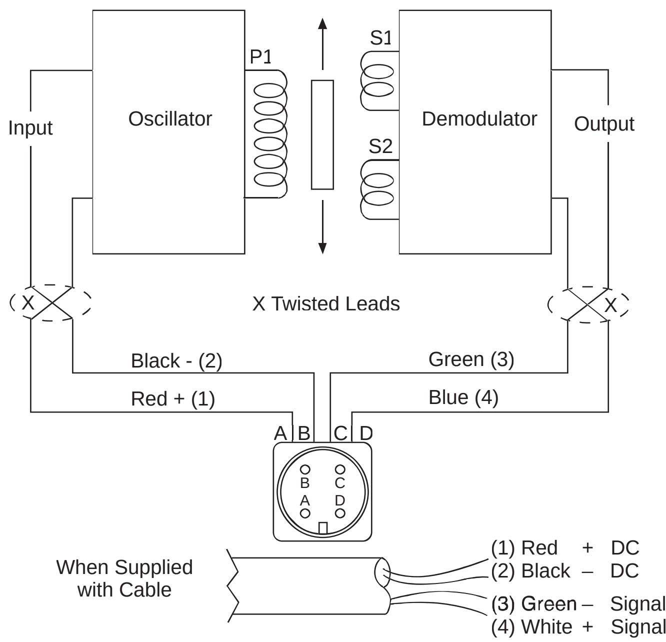


Figure 3

With Warner Electric LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the tensioncell. 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 straingage 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 4)

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.

LVDT Output vs. Deflection Chart

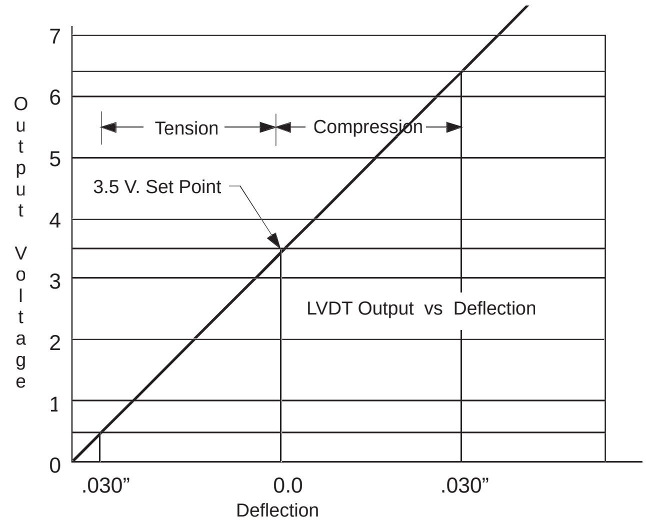
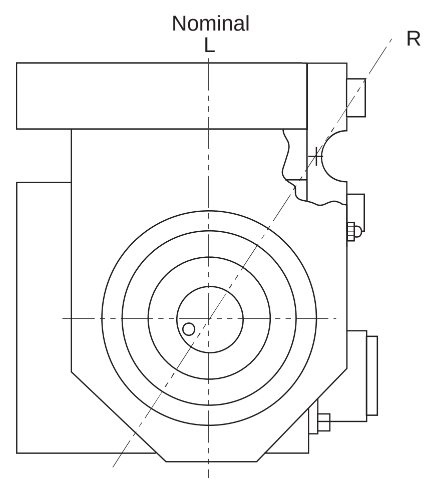


Figure 4

Description of Operation

The total resultant load per cell (RF) is calculated by resolving all force vectors acting upon the Tensioncell, with respect to the Loading Line (OL). (RF) is the resultant of both TENSION and TARE loads, PER CELL!! (See Figure 5)



(Figure 5)

The intrinsic design of Warner Electric Tensioncells allows the location of the Resultant Load of Strip Tension (H) on any angle with respect to the Load Line (OL). Note, however, that the Total Force vector (RF) must always be calculated on the line (OL).

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 Figures 6A and 6B) or so that (N) is 329° (See Figures 7A and 7B).

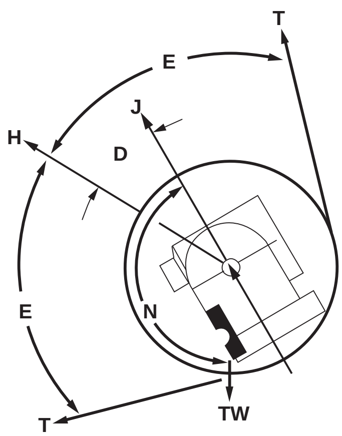


Figure 6A

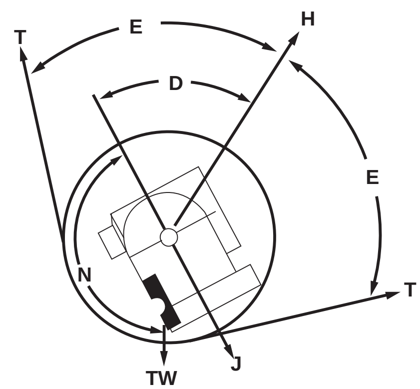


Figure 6B

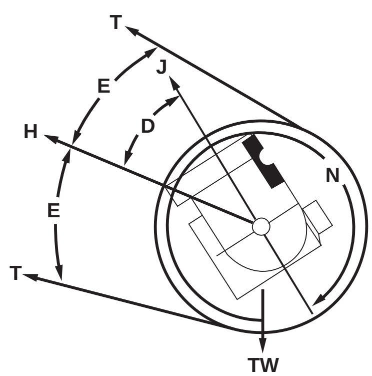


Figure 7A

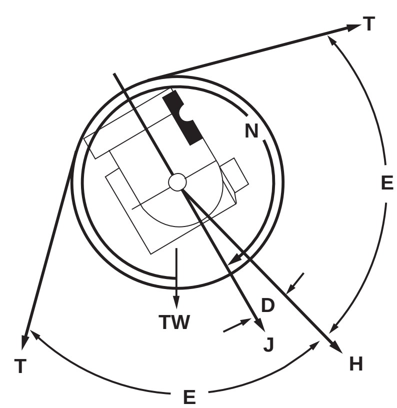


Figure 7B

Installation and Operation

Inspection Upon Delivery

Warner Electric 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 Warner Electric.

Handling

Tensioncells can be handled manually.

Long Term Storage

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

Mechanical Installation

Note: Refer to the Dimension Drawing Pages 11 and 12 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 8)

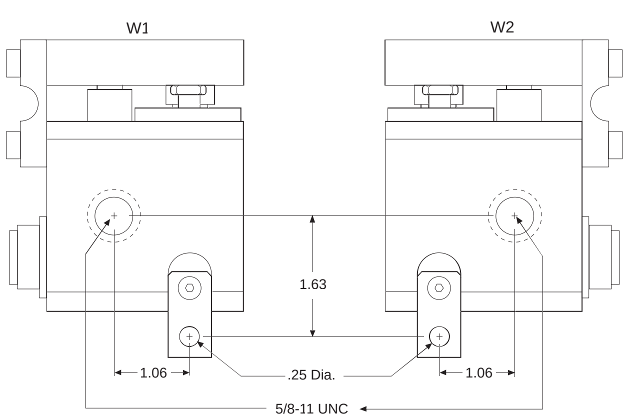


Figure 8

Warner Electric 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 6).

The locating tab prevents the Tensioncell from rotating and secures it in a permanent location. It also provides a means of repeating rotary 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 capscrew.

☐ 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).

Mechanical Alignment

Align the sectional 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.

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 9)

☐ 4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 9)

☐ 5. Repeat Steps 1 through 4 of the electrical wiring procedure for the Tensioncells mounted on the other end of the measuring roll.

Specifications

Type "K" 24 volt DC LVDT Specifications

Input	6-30 volts DC
Output	0.5-6.5 volts DC (nominal, open circuit)
Output Impedence	2.5K ohms
Current Consumption	40 mA
Recommended Load	100K ohms or greater
Max. Operating Temp	250°F

Note: Warner Electric loadcells are calibrated for 24 volt DC input voltage to provide a 0.5 to 6.5 volts DC output signal.

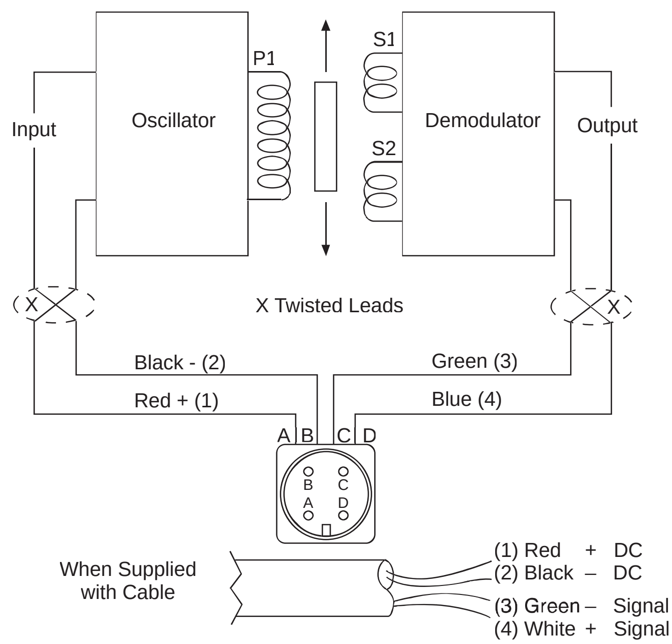


Figure 9

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 9)

☐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 volt meter 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 Warner Electric Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

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 10)

☐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.

Warner Electric 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 Warner Electric control is used, refer to the control manual for further calibration.

Although the electrical output of Warner Electric 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.

Trouble Shooting

When properly installed in accordance with the original design specifications Warner Electric 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)

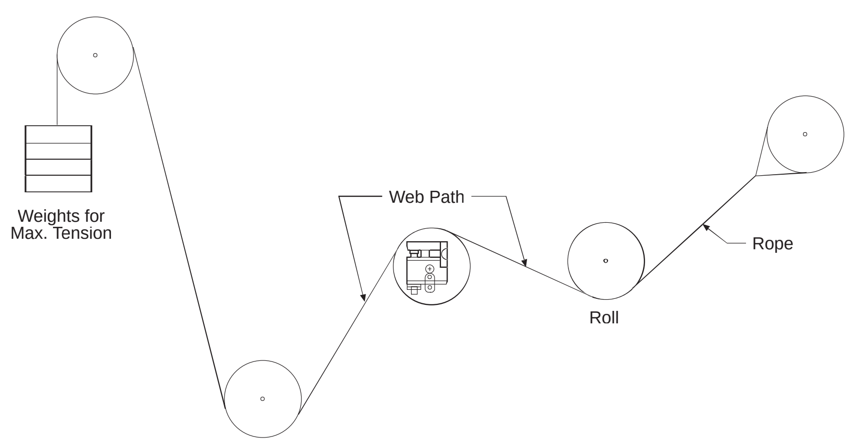


Figure 10

Mechanical

1. Has the tension measuring system been changed?

   a. An increase or decrease in strip tension (Refer to A on the calibration sheet for specified strip 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 tensioncells 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?

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 11)

   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 the Tensioncell LVDT. Contact Warner Electric with Tensioncell model number and serial number.

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 5. 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 a different Tensioncell.

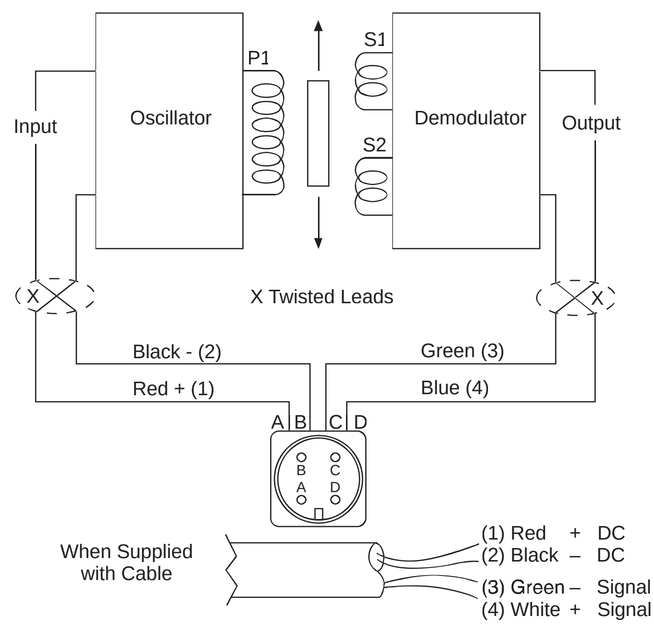


Figure 11

Model Number Nomenclature Example

Electrical
Connection
B - MS Connector

Series Number (2 Digits)
30 Wall Mount

K - DC LVDT with
Maximum 3 VDC Output
Change Including Tare
Displacement

B	C	3	0	P	1	6	K	W1

Type
C - Rotating Shaft

Capacity Range
See Table II-A

Shaft Diameter
See Table II-B

Shaft Mounting Configuration
W1-Split bushing
W2-Solid bushing

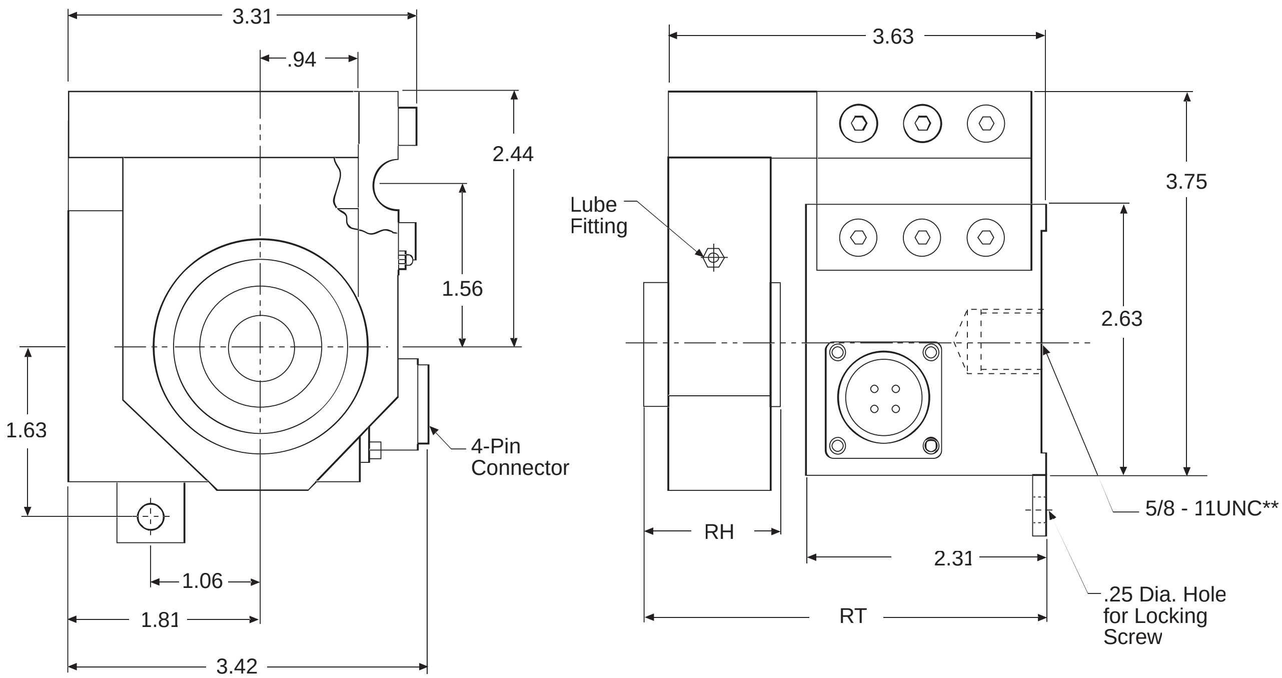
Example Shown:
BC30P16KW1
N = MS Connector
C = Rotating Shaft
30 = Series 30, Wall Mount
P = 0-20 lbs. Capacity
16 = 1” Diameter Shaft
K = K Type DC LVDT
W1 = Split Bushing

Series 30, Type C Specifications – Rotating Shaft Mounting

Series 30, Type C – Nominal Capacity Ranges					
Code	P	T	U	X	Z
Pounds	0-20	0-50	0-90	0-200	0-500

Table II-A

Note: Other load ratings are available as special order.
Contact Warner Electric for ratings and availability.



**Warner 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 6.)

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.

Series 30, Type C Shaft Diameter Code				
Code	12	16	20	23
Inches	3/4	1.0	1-1/4	1-7/16
RH	1.31	1.38	1.69	
RT	3.81		4.131.00	1.13

Table II-B

Note: Other shaft diamters are available as special order. Contact Warner Electric for ratings and availability.

Warranty

Warner Electric LLC warrants that it will repair or replace (whichever it deems advisable) any product manufactured and sold by it which proves to be defective in material or workmanship within a period of one (1) year from the date of original purchase for consumer, commercial or industrial use.

This warranty extends only to the original purchaser and is not transferable or assignable without Warner Electric LLC's prior consent.

Warranty service can be obtained in the U.S.A. by returning any defective product, transportation charges prepaid, to the appropriate Warner Electric LLC factory. Additional warranty information may be obtained by writing the Customer Satisfaction Department, Warner Electric LLC, 449 Gardner Street, South Beloit, Illinois 61080, or by calling 815-389-3771.

A purchase receipt or other proof of original purchase will be required before warranty service is rendered. If found defective under the terms of this warranty, repair or replacement will be made, without charge, together with a refund for transportation costs. If found not to be defective, you will be notified and, with your consent, the item will be repaired or replaced and returned to you at your expense.

This warranty covers normal use and does not cover damage or defect which results from alteration, accident, neglect, or improper installation, operation, or maintenance.

Some states do not allow limitation on how long an implied warranty lasts, so the above limitation may not apply to you.

Warner Electric LLC's obligation under this warranty is limited to the repair or replacement of the defective product and in no event shall Warner Electric LLC be liable for consequential, indirect, or incidental damages of any kind incurred by reason of the manufacture, sale or use of any defective product. Warner Electric LLC neither assumes nor authorizes any other person to give any other warranty or to assume any other obligation or liability on its behalf.

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