PART I - DESCRIPTION

I-A GENERAL INFORMATION

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

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

Type B

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

Type C

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

Figure 2

Self-Aligning Bearings in Tensioncell - Rotating Shaft

I-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 3.) When a mechanical force is applied to the Load Plate, the pivot permits its deflection toward or away from the Base Block.

(Continued on next page)

Figure 3

MECHANICAL STOP
C-FLEXURE
PAR SIDE

DAMPER

LOADPLATE
LVDT
LVDT CORE

Table of Contents

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FAXALOG .................................................. 11
For our discussion here, deflection of the Load Plate toward the Base Block is defined as the "Compression Mode", while the opposite is defined as the "Tension Mode". Tension cells 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 tension cell response to rapid changes in apparent tension loads. (See Page 1, Figure 3)

I-C THE ELECTRICAL SYSTEM

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

I-D TYPE “K” DcLVDT

As illustrated in Figure 4, a DcLVDT 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 (Pp).
- A Primary Coil (Pp).
- 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 Comptrol LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the tension cell. Thus, they may be used in "floating ground" or "ground return" systems. This eliminates the need for extra circuit boards which are required for most strain gage loadcells.

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

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

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

Comptrol Tension cell Controls supply 24 volt Dc and integrate the output signals in a summing amplifier. This permits incorporation of additional circuitry for offset and tare adjustments, as well as adjustments for balance and gain. (See Control Manual for more information.)

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I-E DESCRIPTION OF OPERATION

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

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

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

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

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

1. Make sure a 5/8" diameter hole is drilled through the machine frame in line with the centerline of the measuring roll shaft for the 5/8-11 UNC mounting bolt.

2. Fasten the Tensioncell to the machine frame with the mounting bolt.

3. Rotate the Tensioncell to the proper mounting angle and tighten the mounting bolt. (Refer to N on the calibration sheet for the proper mounting angle.)

4. Drill a #6 (.204) hole concentric with the 1/4" hole in the locating tab.

5. Remove the Tensioncell and tap the hole for a 1/4-20 thread.

6. Repeat steps 1 through 5 for the Tensioncell to be mounted at the other end of the measuring roll.

7. Assemble the tensioncells onto the ends of the measuring roll shaft.

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

9. Rotate the Tensioncells to the proper mounting angle and tighten the mounting bolts.

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

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

II-E MECHANICAL ALIGNMENT

Align the 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.

II-F ELECTRICAL INSTALLATION

(Read the entire electrical wiring procedure before proceeding.)

1. Turn off all electrical power to the loadcell.

2. Use twisted four conductor signal cable, Belden 9402 or equivalent, in grounded steel conduit from the LVDTs to the control panel.

3. Observing correct polarity, connect the positive (+) input lead to Pin A and the negative (-) input lead to Pin B. (See Figure 10.)

4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 10.)

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

II-G ELECTRICAL ZERO ADJUSTMENT

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

1. Disengage strip from the measuring roll so that no tension force is applied to the loadcell.

2. Connect a voltmeter to Pins C and D (See Figure 10.)

3. Apply 24 volt Dc electrical power to the loadcell observing the correct polarity. [Plus (+) to Pin A and minus (-) to Pin B.] Do not exceed the maximum rated input voltage.

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

4. Measure the output voltage of the LVDT between the Green and Blue leads for each tensioncell with a voltmeter with a sensitivity of at least 100,000 ohms per volt. The output voltage should be between 0.5 and 6.5 volts.

5. Since Comptrol Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

Type "K" 24 volt DcLVDT Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>6-30 volts Dc</td>
</tr>
<tr>
<td>Output</td>
<td>0.5-6.5 volts Dc (nominal, open circuit)</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>2.5K ohms</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>40 mA</td>
</tr>
<tr>
<td>Recommended Load</td>
<td>100K ohms or greater</td>
</tr>
<tr>
<td>Max. Operating Temp.</td>
<td>250°F</td>
</tr>
</tbody>
</table>

Note: Comptrol loadcells are calibrated for 24 volt Dc input voltage to provide a 0.5 to 6.5 volts Dc output signal.
II-H FULL LOAD ADJUSTMENT

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

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

2. With one end of the rope secured, hang a known weight, equally over the roll so that the total tension is equal to the maximum strip tension specified on the calibration sheet, at the other end. (See Figure 11.)

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

4. Repeat Step 3 for the Tensioncell mounted on the opposite end of the measuring roll.

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

PART III - TROUBLE SHOOTING

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

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

(Continued on next page)
III-A MECHANICAL

1. Has the tension measuring system been changed?
   a. An increase or decrease in 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 Flexure will be required. For this modification, the Tensioncell should be returned to the factory with complete specifications.

2. Are the loadcells mounted securely?

3. Is tension measuring roll in proper alignment and does it turn freely?

4. Are bearings and seals free of all binding and stickiness? Are they worn?

III-B ELECTRICAL

1. Are LVDTs receiving correct input voltage?
   Check line voltage, fuses or circuit breakers, and power switches. Check power supply output and voltage to LVDTs.

2. Are all connections secure?
   Check for continuity. Retighten all connections. Recheck operation.

3. Are LVDTs open or shorted.
   To check, turn off power and disconnect the input and output leads. Check coil continuity and resistance. (Refer to Figure 12.)
   a. Pin A to Pin B (Primary Coil) should be in excess of 2 megohms.
   b. Pin A or Pin B to LVDT shell should be in excess of 5 megohms.
   c. Pin C to Pin D (Secondary Coil) should be approximately 20,000 ohms.
   d. Pin C or Pin D to LVDT shell should be in excess of 5 megohms.

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

PART IV - RECALIBRATION PROCEDURES

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

1. Strip Tension (Refer to A on the calibration sheet for the specified strip tension.)

2. Wrap Angle (Refer to B on the calibration sheet for the specified wrap angle.)

3. Inclination of the Passline (Refer to C on the calibration sheet for the specified passline.)

4. Mounting Angle (Refer to N on calibration sheet for the specified mounting angle.)

IV-A RECALIBRATION AFTER INSTALLATION

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

Figure 12
MODEL NUMBER NOMENCLATURE EXAMPLE

<table>
<thead>
<tr>
<th>ELECTRICAL CONNECTION</th>
<th>SERIES NUMBER (2 DIGITS)</th>
<th>K - DC LVDT WITH MAXIMUM 3 VDC OUTPUT CHANGE INCLUDING TARE DISPLACEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>B - MS Connector</td>
<td>30 WALL MOUNT</td>
<td></td>
</tr>
<tr>
<td>F - 12' Cable</td>
<td>36 HIGH BASE MOUNT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37 LOW BASE MOUNT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F C 30 S 16 K</td>
<td></td>
</tr>
</tbody>
</table>

Example shown:
FC30S16K
12 Foot Cable
Rotating Shaft
Series 30, Wall Mount
0-30 lbs. Capacity
1" Diameter Shaft
K Type DC LVDT

<table>
<thead>
<tr>
<th>TYPE</th>
<th>CAPACITY Range</th>
<th>SHAFT DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pulley or Sheave</td>
<td>See Table I-A for Type B</td>
</tr>
<tr>
<td>B</td>
<td>Non-Rotating Shaft</td>
<td>See Table II-A for Type C</td>
</tr>
<tr>
<td>C</td>
<td>Rotating Shaft</td>
<td>See Table I-B for Type B</td>
</tr>
<tr>
<td>D</td>
<td>Cantilever Roll</td>
<td>See Table II-B for Type C</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>CODE</th>
<th>L*</th>
<th>M*</th>
<th>N</th>
<th>P</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>POUNDS</td>
<td>0-4</td>
<td>0-8</td>
<td>0-13</td>
<td>0-20</td>
<td>0-30</td>
<td>0-50</td>
<td>0-90</td>
<td>0-140</td>
<td>0-200</td>
<td>0-300</td>
<td>0-500</td>
</tr>
</tbody>
</table>

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

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

![](image)

** 5/8-11 MOUNTING

### TABLE I-B: SERIES 30, TYPE B SHAFT DIAMETER CODE

<table>
<thead>
<tr>
<th>CODE</th>
<th>08</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCHES</td>
<td>1/2</td>
<td>5/8</td>
<td>3/4</td>
<td>7/8</td>
<td>1.0</td>
<td>1-1/8</td>
<td>1-1/4</td>
<td>1-3/8</td>
<td>1-1/2</td>
</tr>
<tr>
<td>RH</td>
<td>1.00</td>
<td>1.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SERIES 30, TYPE C SPECIFICATIONS - ROTATING SHAFT MOUNTING

TABLE II-A

<table>
<thead>
<tr>
<th>CODE</th>
<th>SERIES 30, TYPE B - NOMINAL CAPACITY RANGES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L*</td>
</tr>
<tr>
<td>POUNDS</td>
<td>0-4</td>
</tr>
</tbody>
</table>

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

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

TABLE II-B

<table>
<thead>
<tr>
<th>CODE</th>
<th>SERIES 30, TYPE C SHAFT DIAMETER CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>08</td>
</tr>
<tr>
<td>RH</td>
<td>1.31</td>
</tr>
<tr>
<td>RT</td>
<td>3.81</td>
</tr>
</tbody>
</table>
HOW TO ORDER TENSIONCELLS AND CONTROLS

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

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

Include the Model Number of the Loadcell Control Required.

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

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

Basic application data

- Wrap No. _____
- C=_______°  C’=_______°
- Strip Tension? _______ Lbs.
- □ Base Mounted Transducer (Pages 1, 4, 8, and 13)
- Centerline Height, Pillow Block Bearing? _______ in.
- Mounting: □ Floor □ Ceiling □ Side □ Angle (as shown)
- □ Wall Mounted Transducer (Pages 11 to 13)
- Total Units Required __________
- Installation: □ New □ Existing

Request

- □ Send Data per Basic Application Data.
- □ Send Complete Tension Monitoring Catalog
  - □ UPS □ Air
- Comments: __________________________
  __________________________
  __________________________
  __________________________

COMPtrol Incorporated
9505 Midwest Avenue
Cleveland, Ohio 44125
Phone: (216) 587-5200
COMPTROL MANUFACTURED PRODUCTS

BALLSCREW PRODUCTS
- Inch and metric rolled thread ball screws
- Precision ground ball screws
- Single and preloaded ballnuts for base, flange, cut-off flange, or trunnion mounting
- Base, flange, or cut-off flange mounted end bearing supports
- Custom and modified units also available

COMPLETE BALLSCREW PACKAGES
Comptrol complete ball screw packages feature standard pre-engineered Comptrol products to provide ready-to-install ball screw "package" consisting of the ball screw, ballnut, and end mounting bearing supports. Custom and modified standard assemblies are also available.

HIGH SPEED LINEAR POSITIONERS
Comptrol industrial linear positioners for applications requiring stroke lengths up to 36 inches, load capacities up to 5,000 pounds, and speeds up to 50 inches per second.

QUALITY VERIFICATION SYSTEMS

Comptrol Rod and Piston Systems
An industry standard for over 20 years in reciprocating engine plants around the world, Comptrol Connecting Rod and Piston Balancing Systems provide an accurate, high speed method of weighing and balancing connecting rods and pistons on automatic engine transfer lines.

Comptrol Weighcells Systems
Ideal for automatic assembly and packaging systems, Comptrol weighcells provide a high speed, continuous method of monitoring of process quality. These systems can detect weight deviations within 0.1 gram of the ideal weight in 0.8 seconds.

TENSION MONITORING SYSTEMS
Comptrol tension monitoring systems are designed to measure and control strip or web tension of continuous process lines. Available in over 30 models with capacity ranges from 4 to 20,000 pounds, these units are ideal for new, replacement and retrofit applications.

COMPTROL TECHNICAL SUPPORT

ENGINEERING
- Application Assistance
- Mechanical Design
- Electrical Design
- Software Design

CUSTOMER SUPPORT
- Field Service Support
- Project Planning
- Installation Supervision and Assistance
- Installation Inspection
- Documentation

MANUFACTURING
- Electrical and Mechanical Assembly
- In-house Machining

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