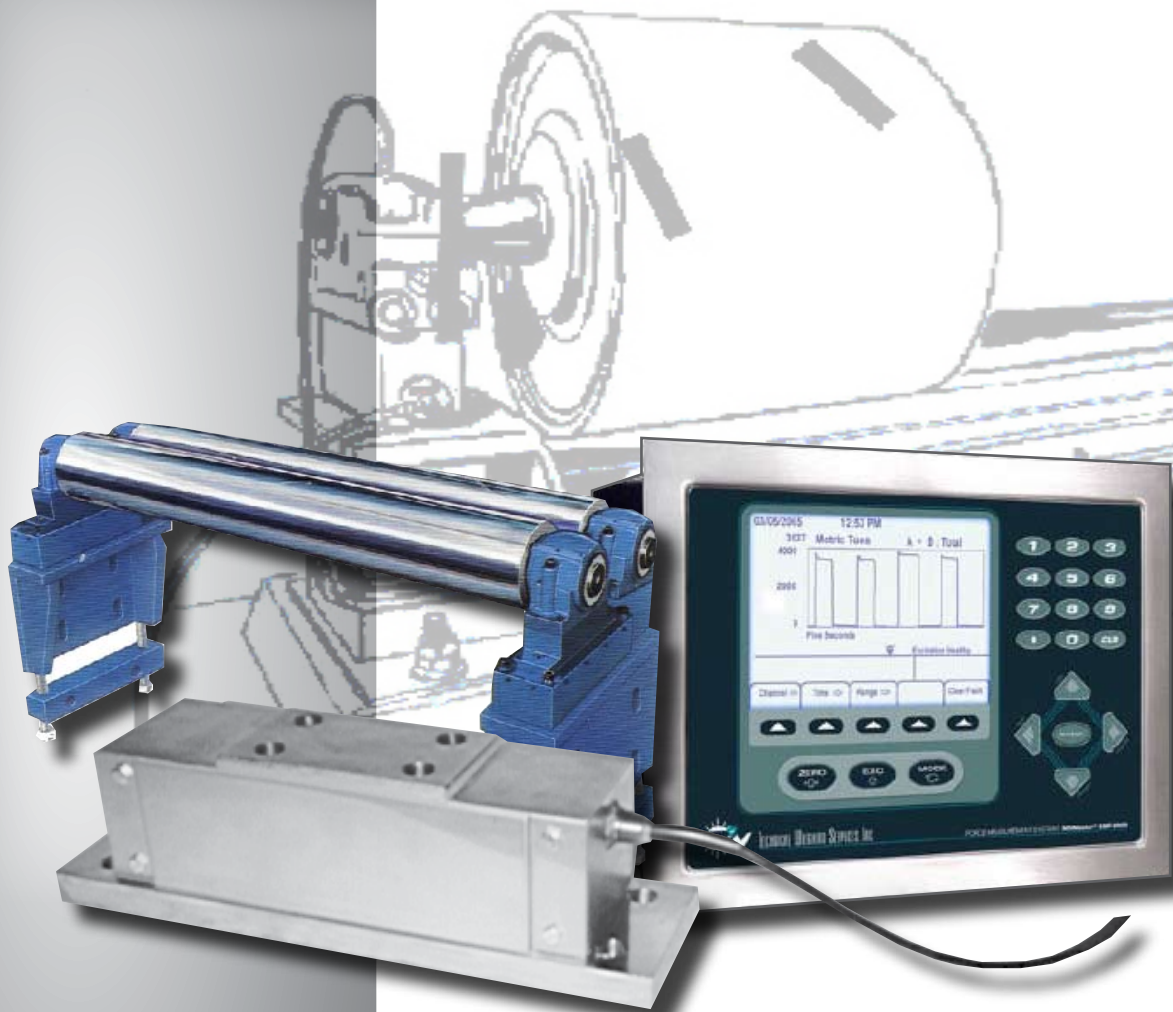


# Rolling Mill Sensors

Tension Measuring Systems

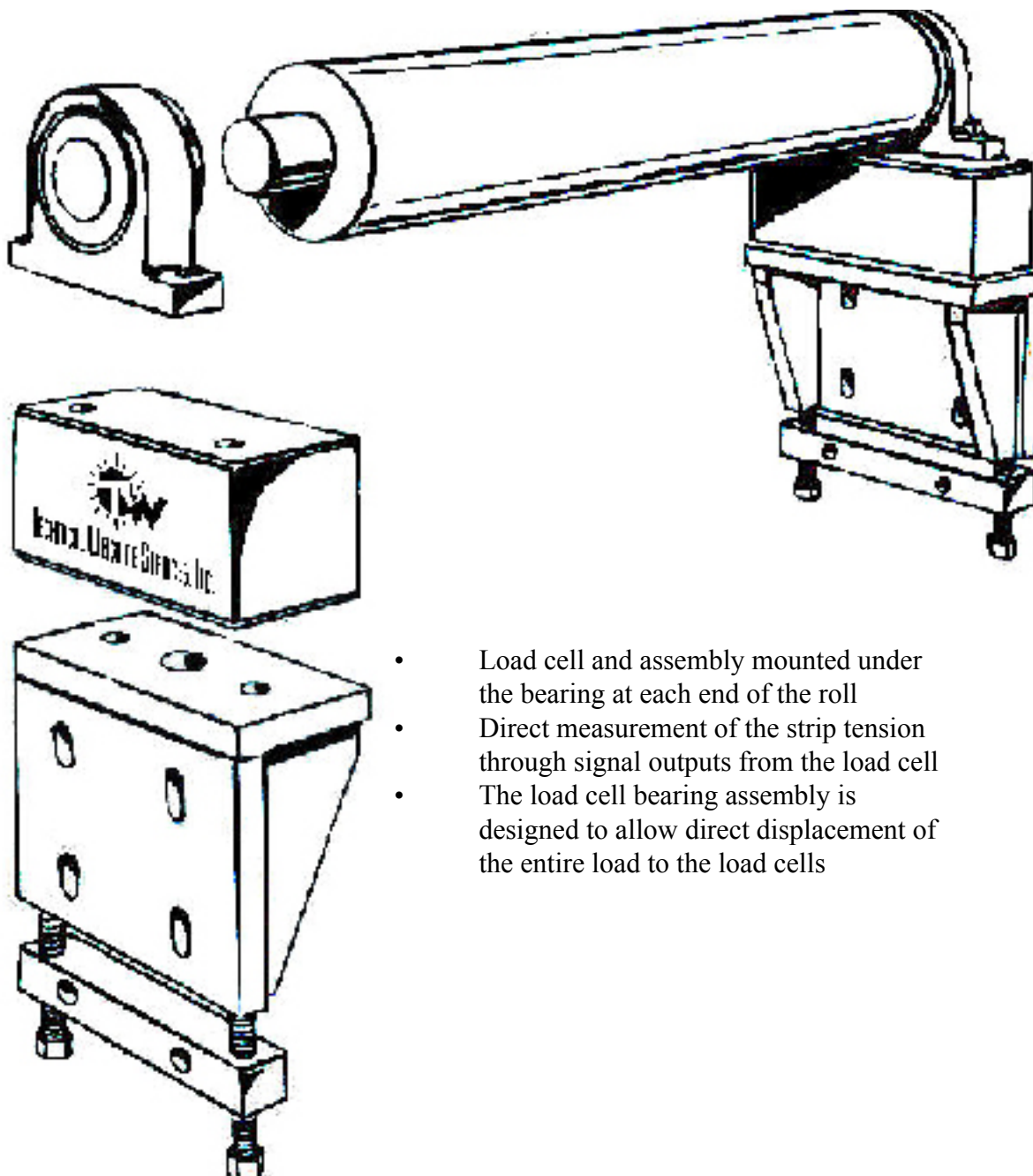


**TECHWEIGH**

# STRIP MILL TENSIONMETER

The dependability and the accuracy of the TWS Tensiometer is a requirement in the heavy applications and harsh environment of the rolling mills. Full systems engineering applications are included with all TWS systems. The system consists of high performance strain gage load cells constructed to withstand the extreme conditions along with TWS bearing assemblies that have been engineered and designed to assure 100% of the load to be load cell bearing.

To complement all of our systems, TWS offers a large variety of PLC/PC choices as well as complete software packages that best fit your application.



- Load cell and assembly mounted under the bearing at each end of the roll
- Direct measurement of the strip tension through signal outputs from the load cell
- The load cell bearing assembly is designed to allow direct displacement of the entire load to the load cells

# TENSION MEASUREMENT SYSTEMS

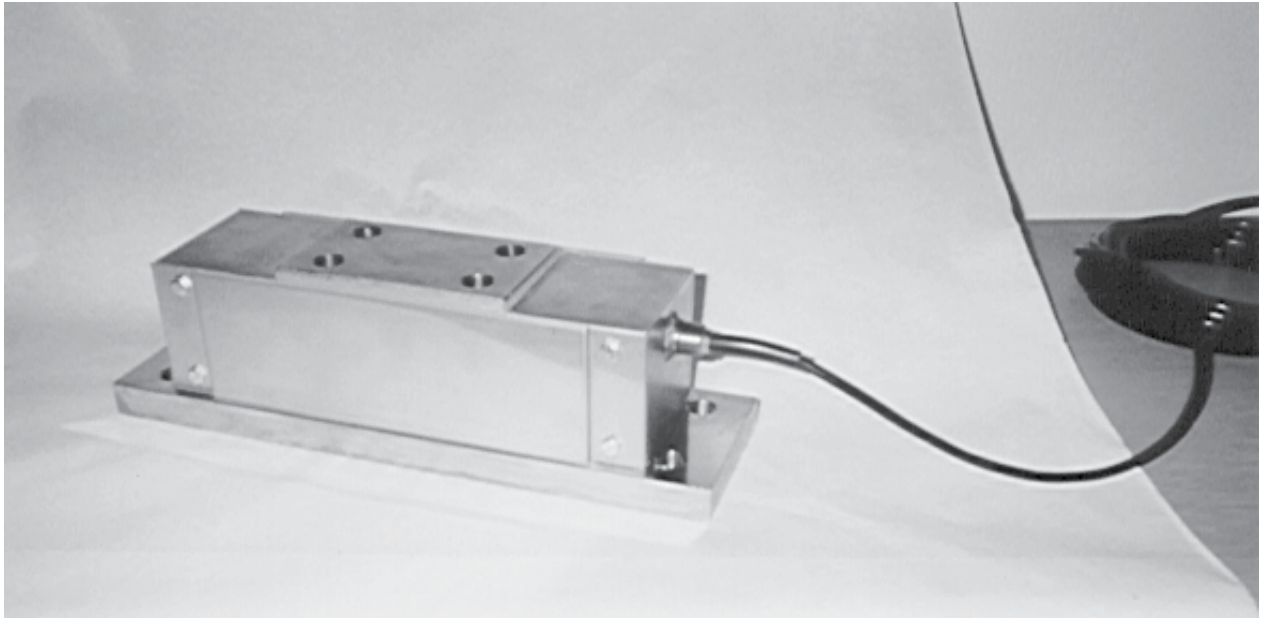
## Strip Tension Load Cell Sensors

### DESCRIPTION

The Tensiometer Load Cell Sensors are electromechanical sensors used in metals processing lines, paper machines and other hostile industrial applications to accurately and reliably measure strip tension. TWS offers applications for both new installations and the retrofitting and/or upgrading of existing systems.

The tension generated by the deflection of the strip over a sensing roll is measured by sensing that force with the load cell sensors. The load cells are designed to mount directly under the roll bearing pillow blocks. Two load cells are used (one on each end of the roll) to measure force parallel to the long axis of its mounting surface.

To complete the strip tension system one of the TWS signal processors or a complete PLC/PC control system can be added.



### FEATURES

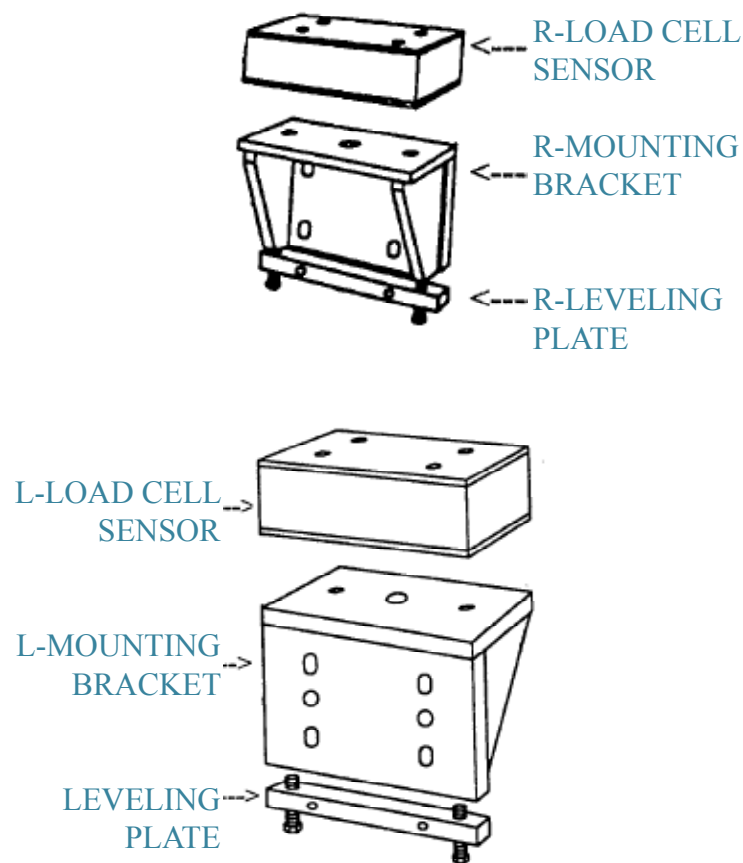
- > Environmentally or Hermetically sealed
- > Single piece high strength alloy steel Nickel Plated or Stainless Steel construction
- > Less than .1% Full Scale Combined Error
- > Structural overload capability of 500% of rated capacity
- > 30 ft., 4 conductor, shielded attached cable
- > Attached threaded fitting to accommodate seal tight

# TENSION MEASUREMENT SYSTEMS

## Strip Tension Load Cell Sensors

### DESCRIPTION

TWS can design the mounting brackets for all tensiometer applications to fit in the frame utilizing the minimum amount of space. The load cell can be mounted so as to not interfere with other mechanical equipment. The brackets and surrounding hardware can be custom designed to provide quick, and ease of installation. Leveling is accomplished with adjustable bolts mounted that allow for ease of load cell leveling after installation.



Load Cell Mounting Brackets / Load Cell Sensors / Right & Left For Single Roll Tensiometer

### FEATURES

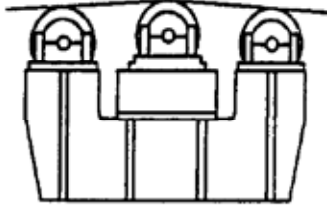
- > Tension Load Cell Brackets are specifically designed for quick installations in new applications
- > Custom brackets can be designed to match existing mill housing boltholes for ease of replacement on existing mill equipment.
- > All welds are completed by certified welders and stressed relieved.
- > All finished product is painted blue unless specified different by customer.

# TENSION MEASUREMENT SYSTEMS

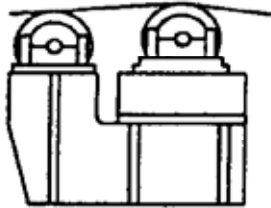
## Strip Tension Load Cell Sensors

### DESCRIPTION

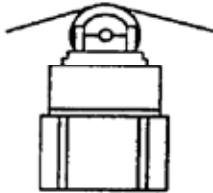
Included in each complete tensiometer system are a roll assembly, a pair of support brackets, and a pair of load cell sensors. The system is completed with one of several TWS instrumentation options from single amplifiers, to a simple control unit, to a complete PLC control system.



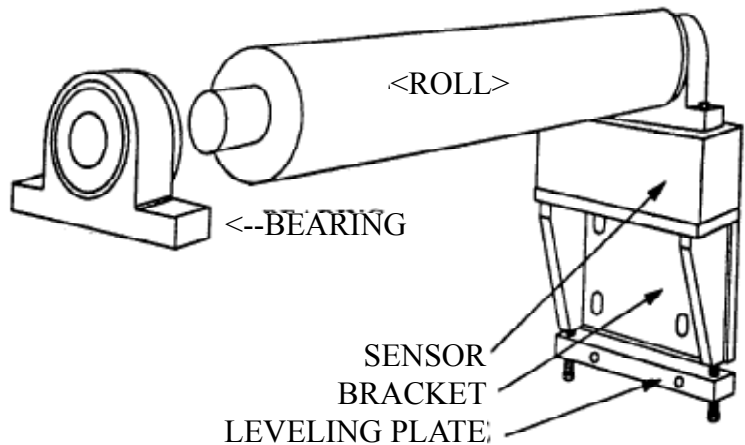
THREE ROLL SYSTEM



TWO ROLL SYSTEM



SINGLE ROLL SYSTEM



### Strip Tensiometer Assembly

- > Designed to handle shock loading
- > One, two and three roll applications
- > Specifically designed per application installation
- > Mill duty self aligning bearing
- > Hardened chrome plated rugged roll
- > Designed with rugged construction for long life and reliability.

**SINGLE ROLL:** (Most Common) compact and utilizing minimum amount of space.

**TWO ROLL:** (2 different designs) strip configuration and movement determines design

**THREE ROLL:** used when down pass wrap angle is always variable

# TENSION MEASUREMENT SYSTEMS

## Choosing the Proper System

In any industry where materials are handled in continuous strip form it is typically beneficial to know the tension in that strip.

In most strip processing lines there may be several locations where measurement of the strip tension is valuable not only from a safety viewpoint, but possibly for the sake of process quality.

The data can be used to feed back to the tension control system, to identify potential equipment or bearing failures, to sound warnings and/or to shut down a system when strip breakage has occurred, to identify a few potential uses for measuring strip tension.

This can be done with accuracy utilizing load cell sensors to support selected rolls in the system.

The accuracy of each system is dependent on many variables and each system will require evaluation by TWS engineers.

### LOAD CELL SENSOR SELECTION

A primary variable is the amount of wrap of the strip around the selected roll. Ideally the wrap angle is fixed because the adjacent rolls in the entry and exit directions are fixed.

Other variables include the maximum and minimum strip tension values, the dead weight of the roll and bearings, relationship to the mounting surface, fixed shaft or live and the bolt pattern for mounting the roll.

TWS engineers will take all these variables into consideration in analyzing the range of load on each end of the shaft, and the orthogonal vectors of that load at maximum strip tension.

From this data they will compute the cell capacity and they will recommend a cell configuration.

TWS offers various load cell sensors for measuring vertical loads, such as our MBK, QSB, QBB, LP1 and other style sensors.

That selection depends on the loads and bearing styles.

For horizontal force measurement we would typically use our MBK style load cell sensor.

Envelope drawings will be provided with each TWS proposal showing the configuration of the selected load cell sensors.

One of the most critical variables in these systems is the convention by which entry and exit angles are expressed.

The TWS data sheet questionnaire and chart is intended to clarify these variables.

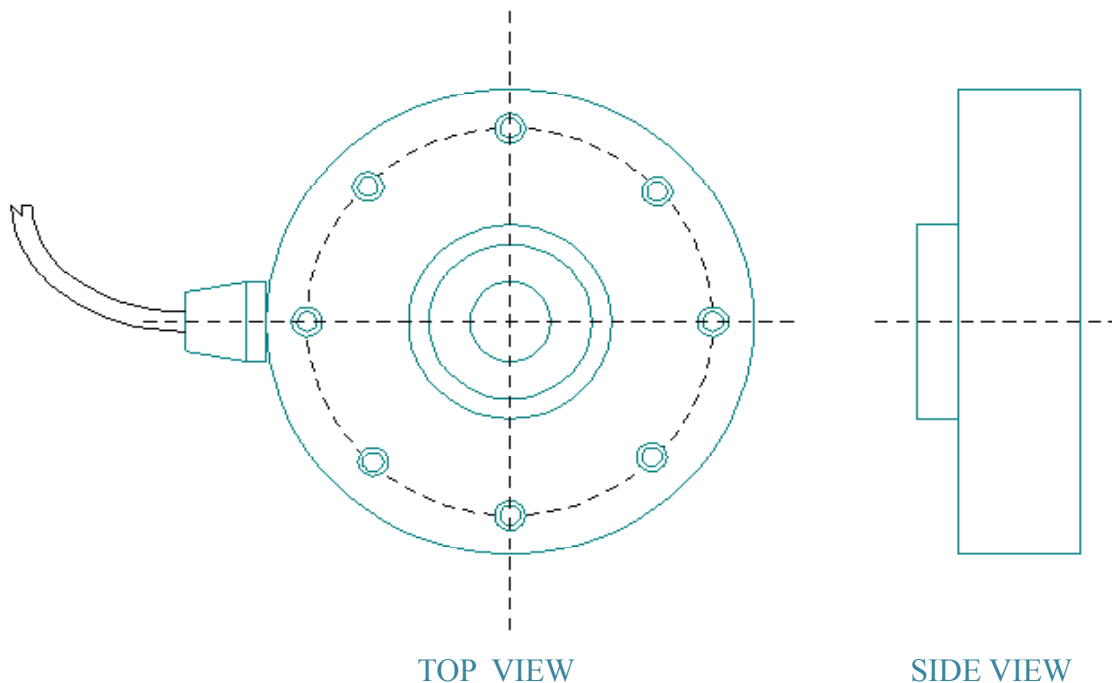
This can be completed by the customer with the assistance of a TWS representative.

# TENSION MEASUREMENT SYSTEMS

## Strip Tension Load Cell Sensors: Specifications

### LP-1 LOAD CELL SENSOR

- > 2.0 mV/V Full Scale Output
- > 350 Ohms Bridge Resistance
- > 17-4PH Stainless Steel Material
- > Temperature Compensation Range  
15 deg. F to 130 deg. F ( 450 deg. F optional)
- > Environmentally Sealed
- > 500 % Safe Overload
- > 25 ft. 4 Conductor Cable
- > 1/2 in. NPT Cable Fitting / Sealtight Connector
- > Less than .1% Full Scale Combined Error



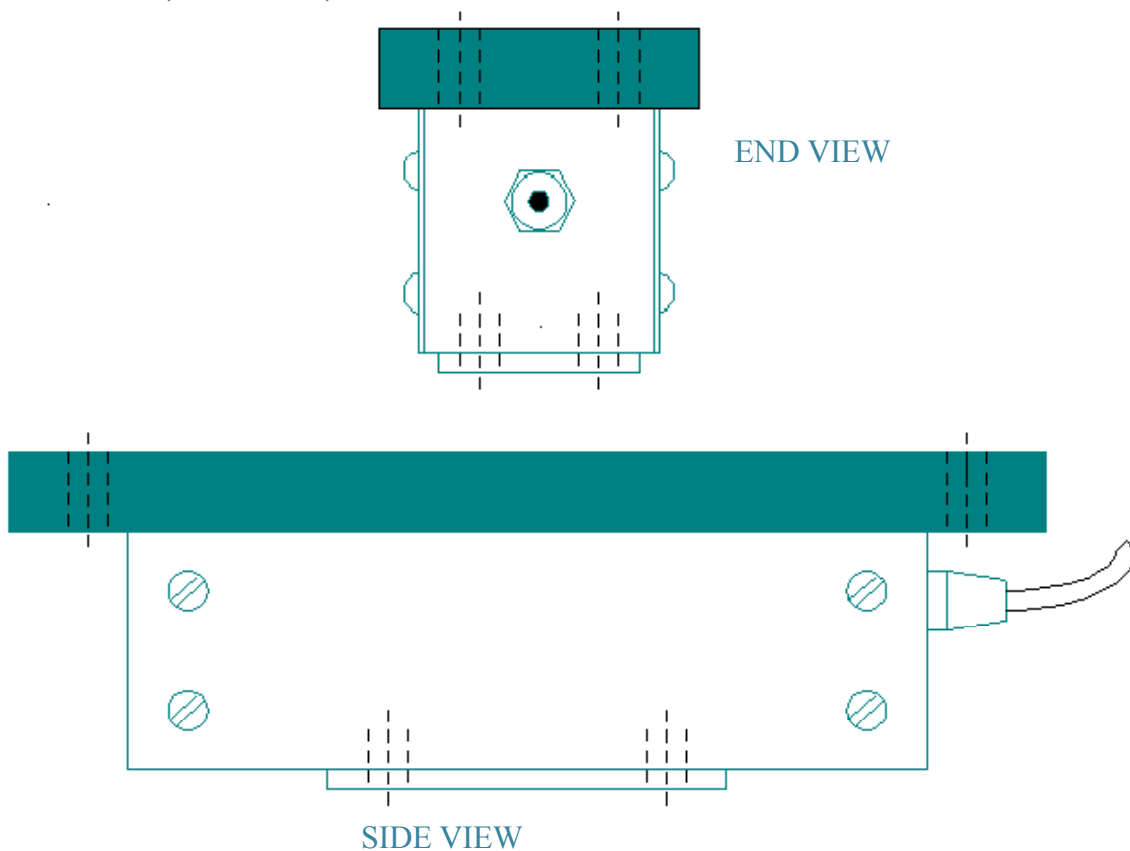
**NOTE:** All Load Cell Sensors are specifically designed in mounting and in capacity to fit each application. TWS engineers will engineer and design each sensor to fit your specific requirements.

# TENSION MEASUREMENT SYSTEMS

## Strip Tension Load Cell Sensors: Specifications

### MBK LOAD CELL SENSOR

- > 2.0 mV/V Full Scale Output
- > Custom Mounting Plate Attached
- > Less than .1% Full Scale Combined Error
- > 350 Ohms Bridge Resistance
- > 4340 Material, Nickel Plated
- > Temperature Compensation Range  
15 deg. F to 130 deg. F (450 deg. F optional)
- > ½ in. NPT Cable Fitting/Sealtight Connector
- > 25 ft. 4 Conductor Cable
- > 300% Safe Overload
- > Hermetically Sealed, IP67



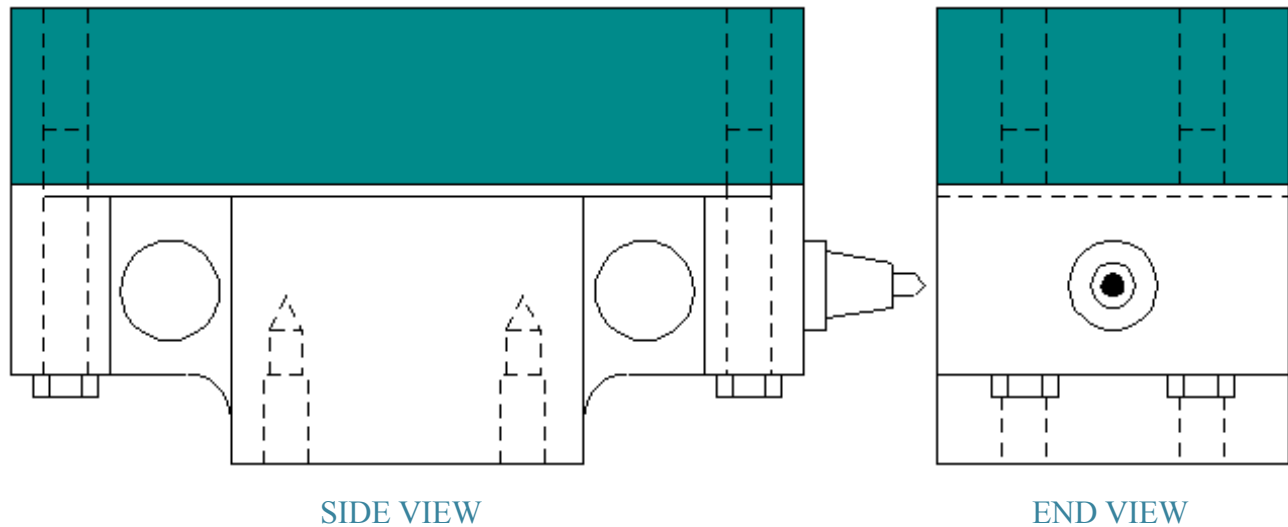
**NOTE:** All Load Cell Sensors are specifically designed in mounting and in capacity to fit each application. TWS engineers will engineer and design each sensor to fit your specific requirements

# TENSION MEASUREMENT SYSTEMS

## Strip Tension Load Cell Sensors: Specifications

### QSB Load Cell Sensor

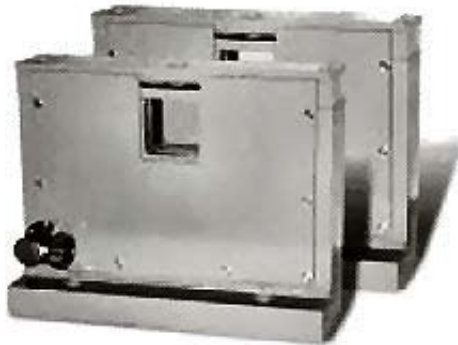
- > 2.0 mV/V Full Scale Output
- > 350 Ohms Bridge Resistance
- > 4340 Material, Nickel Plated
- > Temperature Compensation Range  
15 deg. F to 130 deg. F (450 deg. F optional)
- > Hermetically Sealed, IP67
- > 300% Safe Overload
- > 25 ft. 4 Conductor Cable
- > ½ in. NPT Cable Fitting/Sealtight Connector
- > Custom Mounting Plate Attached
- > Less than .1% Full Scale Combined Error



**NOTE:** All Load Cell Sensors are specifically designed in mounting and in capacity to fit each application. TWS engineers will engineer and design each sensor to fit your specific requirements.

# TENSION MEASUREMENT SYSTEMS

## TWS Pillowblock Tensiometer Load Cells



STANDARD DESIGN  
TWFBL 101B



CUSTOM DESIGN TWO-ROLL  
TWFBL 101C



VERTICALLY MEASURING  
PILLOWBLOCK  
TWFCL 101 A

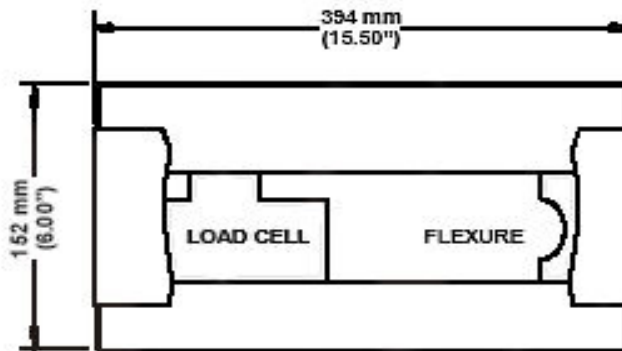


HORIZONTALLY MEASURING  
PILLOWBLOCK  
TWFTL 201 CE

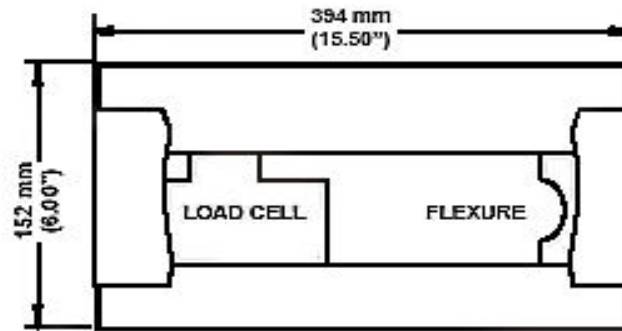
# TENSION MEASUREMENT SYSTEMS

## Load Cell Model LP-1

### TYPICAL DIMENSIONS

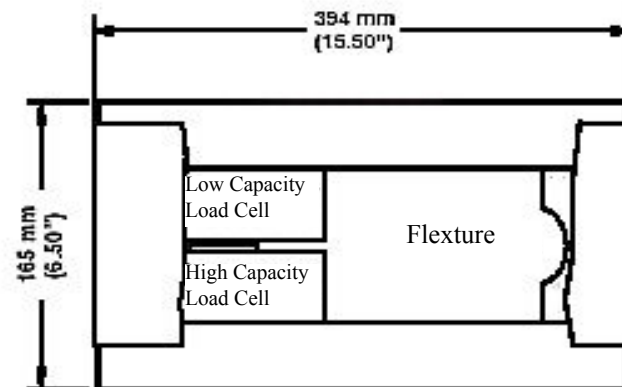
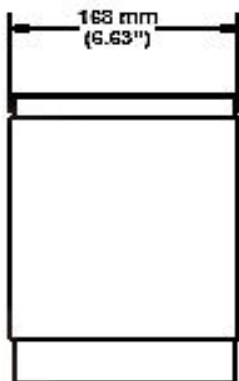


Tensiometer Load Cell Assembly  
Single Range



Narrow Type  
Tensiometer Load Cell Assembly  
Single Range

Note: Also available in dual  
Range: 146mm (5.75") x 165mm  
(6.50")



Tensiometer Load Cell Assembly  
Dual Range

Note:

- Tensiometer Load Cell Assembly can be custom designed to suit applications.
- Size and location of top and bottom plate mounting holes drilled and tapped to suit application.

# TENSION MEASUREMENT SYSTEMS

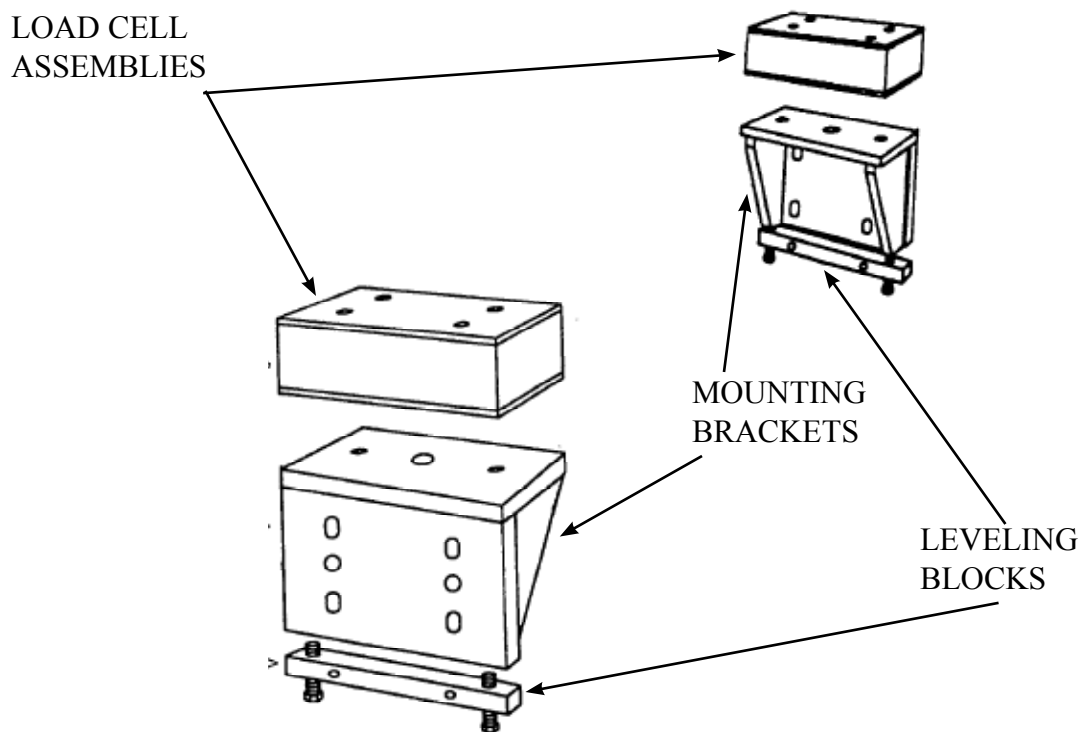
## Load Cell Model LP-1

### SPECIFICATIONS:

Capacity:	Related to installation geometry. Single and dual range load cell assemblies available to suit any tension and wrap angle compensation.
Bridge Resistance:	700 ohms
Excitation voltage:	15 VDC or VAC maximum
Output:	1.0 to 1.5 mV per volt of excitation at rated load
Response time:	Less than 1.0 mS (at amplifier output)
Linearity:	Within 0.25% of full scale output through rated load range
Hysteresis:	Less than 0.1% of full scale output
Repeatability:	Within 0.05% of full scale output
Thermal zero shift:	+/- 0.005% ( 50 parts per million) of full scale output per deg. C over the compensated range of 20 deg. C to 100 deg. C (68 deg. F to 212 deg. F)
Load limits:	Overload stop inside and integral with the load cell allows at least 20 times overload without mechanical damage
Operating temperature range:	0 to 150 deg. C (32 to 302 deg. F)
Storage temperature range:	-40 to 180 deg. C (-40 to 356 deg. F)
Accuracy of calibration:	+/- 0.1% of full scale output at rated load traceable to the National Institute of Standards and Technology (formerly the U.S. National Bureau of Standards)
Deflection:	0.11 mm (0.005 inches) maximum

# TENSION MEASUREMENT SYSTEMS

## Load Cell Model LP-1



MOUNTING BRACKETS WITH LEVELING BLOCKS  
FOR A SINGLE ROLL TENSIO METER

### DESCRIPTION:

Mounting brackets for one, two, or three roll tensiometer assemblies are designed to fit within the mill frame window using a minimum amount of space. They allow the tensiometer to be mounted out of the way of other interstand mechanical equipment. The fabricated steel brackets are custom designed to minimize installation time on mills being modernized and use as many of the existing mill housing bolts as practical. The bracket-shave the mounting surfaces machined and all necessary bolt holes drilled to facilitate a quick installation. A leveling device complete with jacking bolts provides a convenient means of leveling the tensiometer during installation.

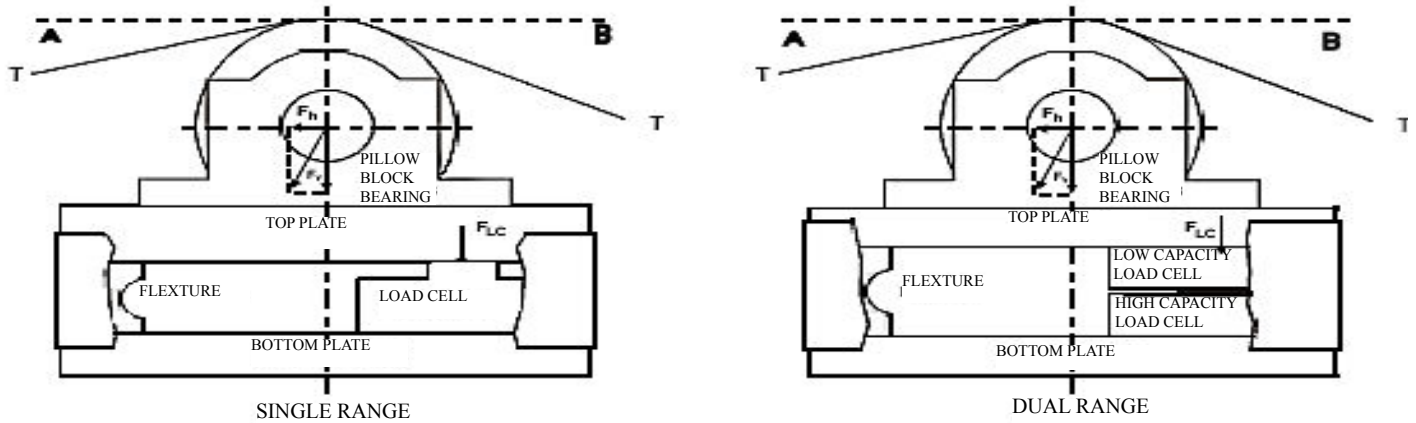
### FEATURES:

- Tensiometers can be installed on existing mills quickly and with minimum cost by using as many of any existing mill housing bolt holes as practical.
- Custom engineering assures that tensiometer installation can be accomplished with a minimum amount of downtime since the design takes into consideration all the particular circumstances and factors that can reduce installation time.

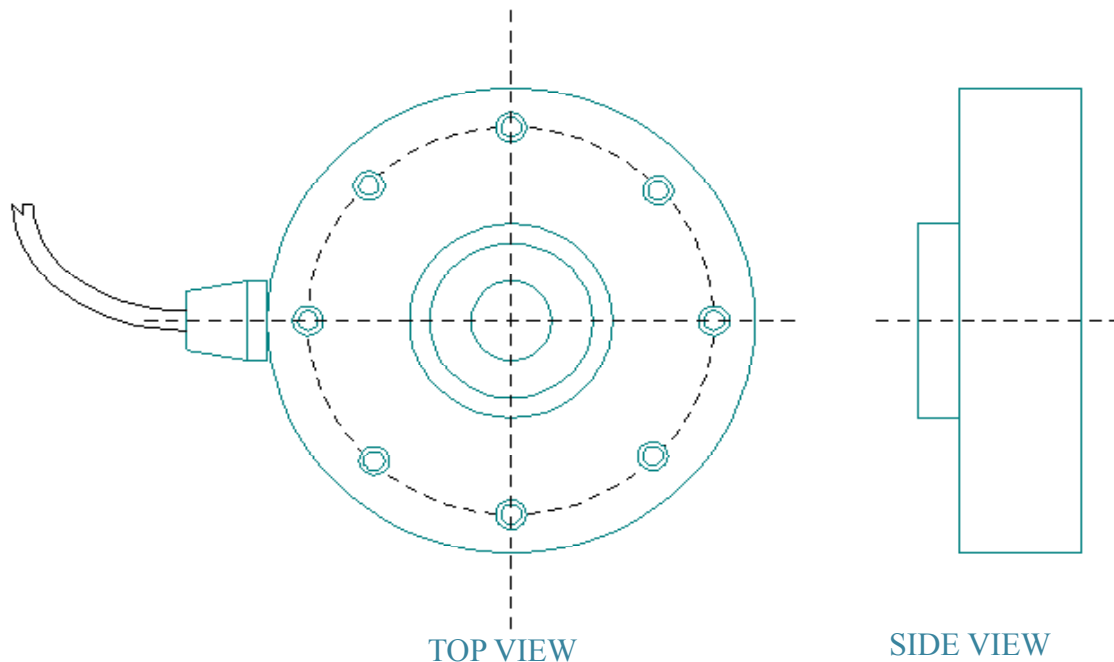
# TENSION MEASUREMENT SYSTEMS

## Load Cell Model LP-1

Tension in the strip exerts force on a dynamically balanced sensing roll over which the strip is drawn. A Load Cell Assembly, mounted under the roll bearings at each end of this roll, senses the component of force normal to the base (Figure 1). The signal outputs, together with parameters for strip deflection or wrap-angles A and B and installation geometry, provide a direct indication of the strip tension.



By measuring the force normal to the Load Cell ( $F_{Lc}$ ) and knowing the geometry dependent constant ( $k$ ), strip tension ( $T$ ) can be calculated.



**NOTE:** All Load Cell Sensors are specifically designed in mounting and in capacity to fit each application. TWS engineers will engineer and design each sensor to fit your specific requirements.

# MILLMASTER® DSP2000

## Digital Signal Processor



### MillMaster® DSP-2000... High Speed Force Measurement Systems Suitable for Inner Loop Process Control

Designed specifically to meet the demands of the Modern Rolling Mill, the MillMaster DSP-2000 delivers accurate measurement and communication at the high speed required by today's technology, and other applications that require continuous measurements.

The MillMaster DSP-2000 processes two input analog signals and supplies four analog output signals at a rate of 10,000 updates per second. Real time histograms representing up to 20 minutes of operation are displayed on the MillMaster's large graphical screen. The user friendly interface also makes setup and calibration easy.

Simple key presses navigate the operator through on screen diagnostics allowing you to monitor the information critical to your process. View operator side, drive side, total, or differential values.

The MillMaster DSP-2000 can interface with high-capacity magnetic transducers or strain gauge load cells, and is capable of single cell operation.

The MillMaster DSP-2000 can be integrated with any roll force and/or strip tension system to provide the high accuracy and reliability required by today's modern rolling mill.

### Standard Features

- Large 4.6" W x 3.4" H
- 320 x 240 pixel back-lit LCD graphical display
- Five displayed soft keys
- Front panel or serial configuration/calibration
- Operator prompts
- 24 on-board digital I/O
- Multiple screens
- Time domain up to 20 minutes
- High-speed; up to 10,000 counts per second
- Designed for simplicity and ease of use
- Capable of single cell operation
- User password protection
- Factory calibrated prior to shipping
- On screen level detection I/O and rate of rise (metal in mill) detect

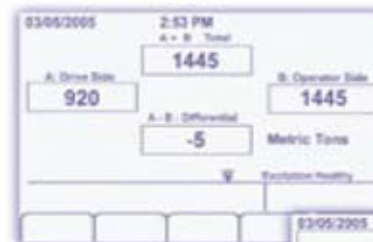
### Approvals



### MillMaster® DSP-2000 Universal System can be integrated with the following load cells:

- 1st Generation ABB Load Cells
- 2nd Generation ABB Load Cells
- ABB MillMate Load Cells
- All Kelk Load Cells
- MillMaster® Load Cells

*The DSP-2000's user friendly interface allows operators to monitor process in real time. A simple key press allows navigation through various screen modes.*



*An example of a full system view is shown above. The screen at right displays a single channel, operator side view.*



Technical Weighing Services, Inc (TWS) was formed in 1986 to provide the steel industry with custom scales, electronic weighing packages, and control systems. Our Process Control Systems Group was formed to compliment the mechanical weighing aspects of our business.

The combination of weighing and material handling capability along with computer based process control products and expertise allows us to offer clients the unique advantage of "One Stop Shopping". As a company we can offer solutions ranging from the load cells and scales, to complete, integrated control and material handling solutions.

The effective application of weighing science technology demands more than a piece-meal approach. TWS can provide tightly coordinated services such as mechanical design, fabrication, installation, controls design and build, and turnkey project management, thus assuring a successful project.

### TWS Strip Tension Measurement System

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