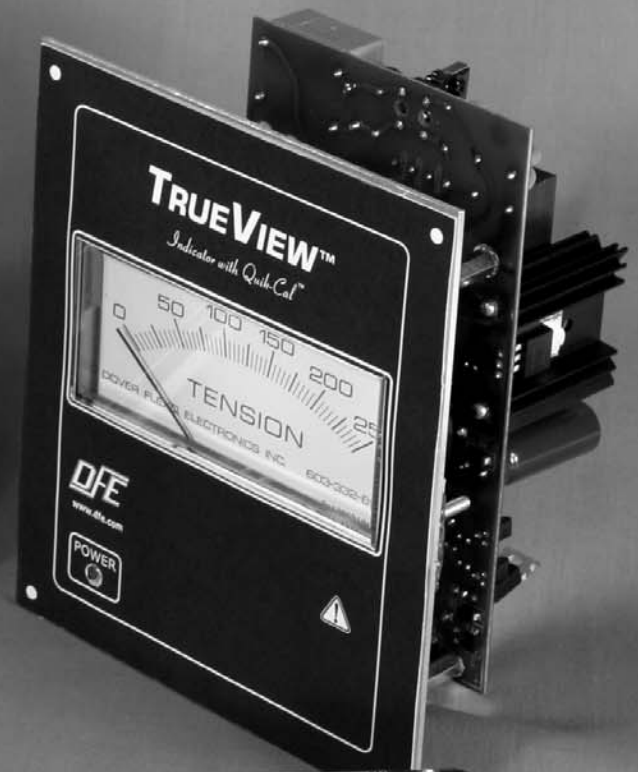


# INSTRUCTION MANUAL

## TRUEVIEW™

### TENSION INDICATOR

Models TI23 and TI24  
with Quik-Cal™



**5 YEAR WARRANTY**



**307 Pickering Road**

**Rochester, NH 03867-4630 U.S.A.**

For assistance, please call:

**TECHNICAL SERVICE** - Installations, Start-Up, Troubleshooting, Repairs, Field Service, Returns. **[techsupport@dfc.com](mailto:techsupport@dfc.com)**

**CUSTOMER SERVICE** - Replacement Parts, Individual Products, Questions about Orders, Manuals. **[customerservice@dfc.com](mailto:customerservice@dfc.com)**

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# NEW!

## QUIK-CAL™ PUSHBUTTON ZERO-SET AND CALIBRATION-SET

The new TI23 and TI24 tension indicators/transducer interfaces are built with a new labor-saving technology called Quik-Cal! **They do not have potentiometers for zero and calibration settings.** Instead, they have pushbuttons. Push each button once, for one second, and you are done!

Tension display is built in. No screwdriver is needed. No second-person is needed.

### ZERO SET

The weight of the transducer roll produces an output that is not caused by web tension. This is not desirable because it is not a tension measurement. To set the output of the indicator to zero when there is no tension, just press the ZERO button for one second.

You can even eliminate the need to press the ZERO button! The indicator can automatically set the output to zero when power is turned on. Just change a jumper setting on the circuit board.

### CAL SET

The weight you select for calibration determines the full-scale tension signal output. The indicator automatically multiplies the weight by the built-in calibration ratio to calculate full output.

The calibration ratio is the ratio of the calibration weight to the tension at full output.

The standard calibration ratio is 1:10, or 10%. So if you hang a 15 lb. weight and push the CAL button, the indicator will produce full output at 150 lbs. tension.

A calibration ratio of 25% is available for low tensions. (This is selected by a jumper on the circuit board). Use of a 15 lb. calibration weight will produce full output at 60 lbs. tension.

**STABILITY** is another benefit of this technology. The zero and calibration settings are stored digitally, so there is no drift over time and temperature variations as there can be with potentiometers.

Read Section 3.3 for details.



# TABLE OF CONTENTS

---

<b>SECTION ONE</b>	<b>PRODUCT DESCRIPTION</b>	
1.1	General Description . . . . .	1
1.2	Exploded View of TI23 and TI24 . . . . .	1
1.3	Specifications . . . . .	2
1.4	Environmental Conditions . . . . .	3
1.5	Standard Features . . . . .	3
1.6	Options . . . . .	3
<b>SECTION TWO</b>	<b>INSTALLATION</b>	
2.1	Dimensions . . . . .	5
2.2	Selection of Mounting Location . . . . .	6
2.3	Safety & EMC Requirements. . . . .	6
2.4	Installation Instructions . . . . .	7
2.5	Transducer Voltage Selection . . . . .	7
2.6	Tension Output Selection . . . . .	8
2.7	Standard Electrical Connections . . . . .	9
2.8	Tension Limit Switch External Relay Connections . . . . .	10
<b>SECTION THREE</b>	<b>CALIBRATION AND SETUP</b>	
3.1	Preparation . . . . .	11
3.2	Mechanically Zero the Tension Meter . . . . .	11
3.3	Calibrate the Output for Accuracy . . . . .	11
3.4	Calibration and Adjustment of Tension Limit Switch . . . . .	13
<b>SECTION FOUR</b>	<b>OPERATING INSTRUCTIONS</b> . . . . .	15
<b>SECTION FIVE</b>	<b>CARE AND MAINTENANCE</b> . . . . .	16
<b>SECTION SIX</b>	<b>TROUBLESHOOTING GUIDE</b> . . . . .	17
<b>SECTION SEVEN</b>	<b>REPLACEMENT PARTS</b> . . . . .	18

## APPENDICES

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<b>APPENDIX: A</b>	Location of Jumpers and Adjustments (Figures 15, 16) . . . . .	19
<b>B</b>	Electrical connections (Figures 17, 18) . . . . .	20
<b>C</b>	Transducer Electrical Connections (Figures 19-22) . . . . .	22
<b>D</b>	Typical Tensions of Various Materials . . . . .	26
<b>E</b>	Environmental Terms . . . . .	27
	Terms and Conditions of Sale and Shipment . . . . .	28
	Index . . . . .	29

# LIST OF ILLUSTRATIONS

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FIGURE		PAGE
1	Exploded View of Enclosure Mounting Style . . . . .	1
2	Exploded View of Panel Mounting Style . . . . .	2
3	Enclosure Mounting Dimensions . . . . .	5
4	Panel Mounting Dimensions . . . . .	5
5	Transducer Voltage Jumpers . . . . .	7
6	Tension Output Jumpers . . . . .	8
7	Standard Electrical Connections . . . . .	9
8	Tension Limit Switch External Relay Connections . . . . .	10
9	TI23 / TI24 PC Board . . . . .	11
10	Web Path . . . . .	12
11	Tension Limit Switch Board Adjustments . . . . .	13
12	Tension Limit Switch Test Point Values . . . . .	14
13	Replacement Part Numbers . . . . .	18
14	TI23 / TI24 PC Board . . . . .	19
15	Optional Tension Limit Switch Board . . . . .	19
16	Standard Electrical Connections . . . . .	20
17	Optional TLS External Relay Electrical Connections . . . . .	21
18	Models C, RS, & UPB Transducer Wiring . . . . .	22
19	RFA Transducer Wiring . . . . .	23
20	TR & NW Transducer Wiring . . . . .	24
21	LT Transducer Wiring . . . . .	25

## 1.1 GENERAL DESCRIPTION

The TrueView™ TI23 and TI24 Tension Indicators are designed to provide an indicator with an isolated interface between any type of DFE tension transducer and a variable speed drive system, computer, tension recorder, or other devices for tension control and display purposes. They have an analog meter to indicate operating tension. A Digital Meter is available as an Option. A single terminal block plugs into the circuit card, to which customer connections are made. This plug-in feature allows for easy field installation and servicing.

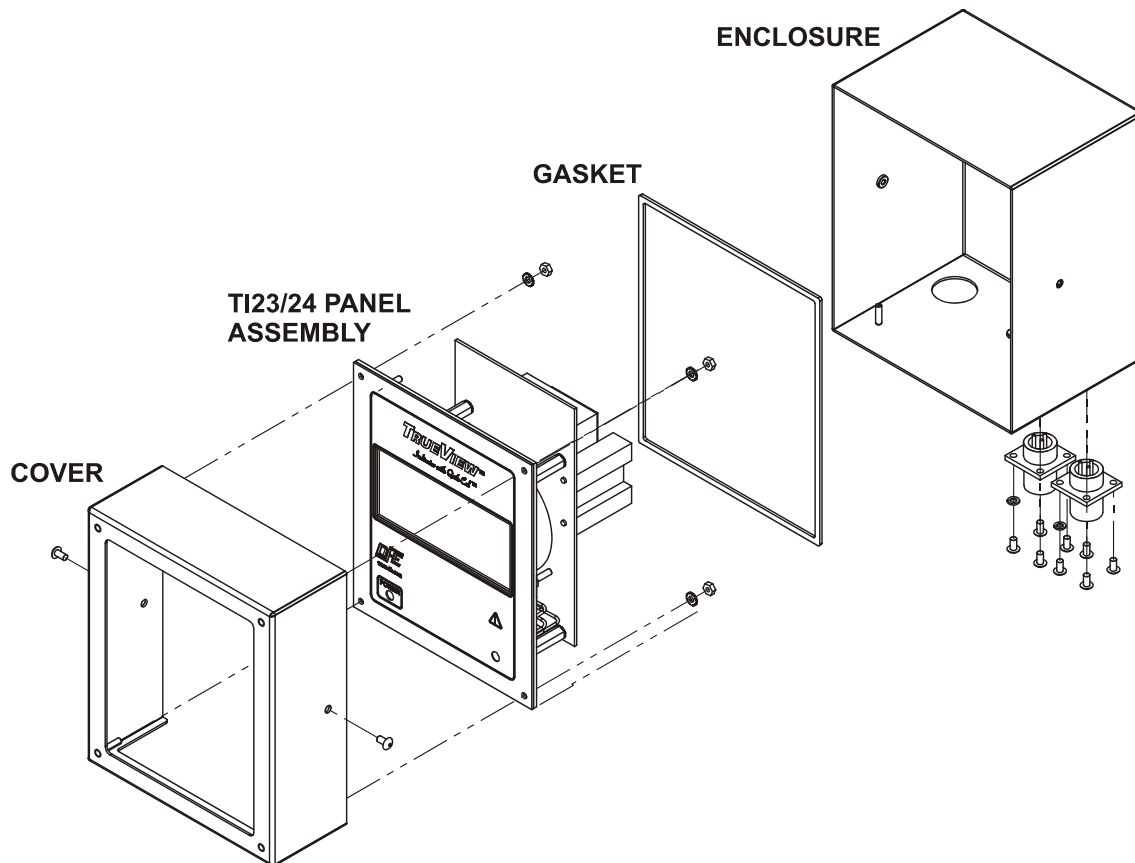
Models TI23 and TI24 are available with two mounting configurations and a choice of 0-10 Vdc or 4-20mA isolated outputs. Quik-Cal™ pushbutton zero and calibration comes standard. Dual calibration is available as a factory installed option.

The only difference between the TI23 and the TI24 indicators is their power input requirements. The TI23 operates on 115Vac 60Hz (230Vac 50Hz optional) and the TI24 operates on 24Vdc, power supplied separately.

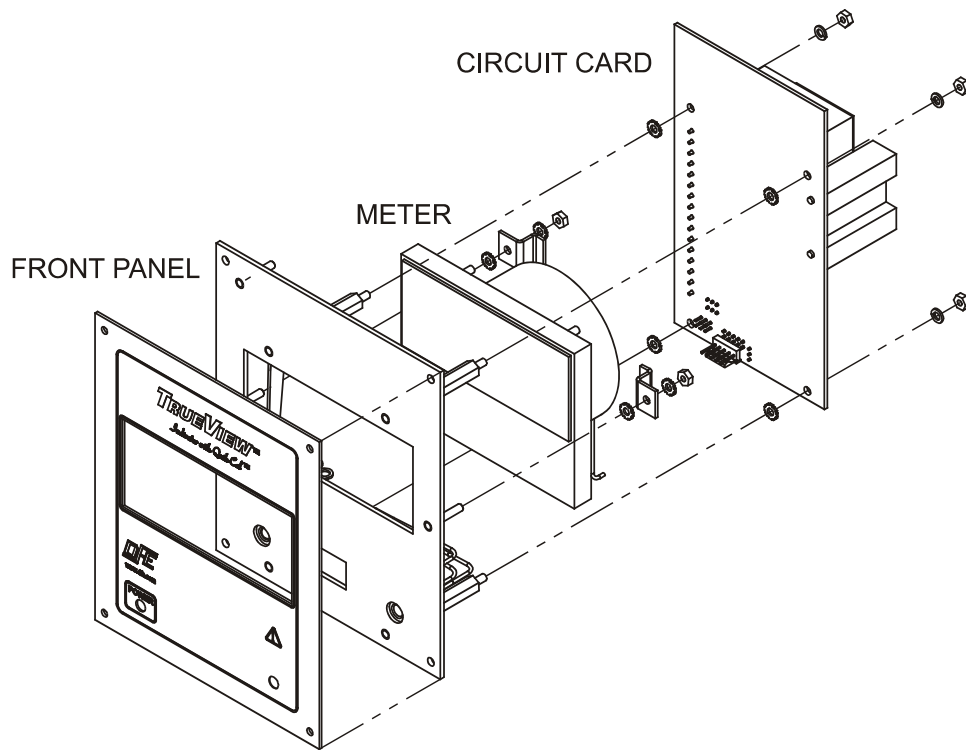
**▲ WARNING:** The isolated output is designed to prevent ground loops and noise. It is not intended or approved for safety isolation of hazardous voltages. Do not install unit where the isolated circuit and chassis ground are more than 40V peak differential.

**▲ WARNING:** TI23 models are designed for single phase AC operation only. Do not connect them across three phase lines or to three phase circuits to prevent product damage and potential hazard.

## 1.2 EXPLODED VIEWS OF TI23 and TI24



**Figure 1 - EXPLODED VIEW OF ENCLOSURE MOUNTING STYLE**



**Figure 2 - EXPLODED VIEW OF PANEL MOUNTING STYLE**

### 1.3 SPECIFICATIONS

Power Input:	Voltage	.....	<b>TI23</b> = 115/230Vac +/- 10%, 50/60Hz, Single Phase AC operation only for TI23.
		.....	<b>TI24</b> = 24 Vdc +/- 10%.
	Current	.....	<b>TI23</b> = 115V/60Hz = 0.047A, 230VAC/50Hz = 0.053A , 230VAC/60Hz = 0.025A.
		.....	<b>TI24</b> = 0.1 Amp DC.
Tension Signal Outputs:		.....	0 to +10Vdc OR 4 to 20mA (jumper selectable), both isolated from input power and transducer circuit.
			<ul style="list-style-type: none"> <li>• 0 to +10Vdc capable of over-range, -15% to 120% of full scale (-1.5Vdc to 12Vdc), to indicate over-range or error conditions</li> <li>• 0 to +10Vdc max loading is 5mA. This requires a 2000 Ohm or greater input resistance for equipment connected to this output.</li> <li>• 4-20mA capable of over-range, -15% to 120% of full scale (1.6mA to 23mA), to indicate over-range or error conditions.</li> <li>• 4-20mA max loop resistance is 500 Ohms.</li> </ul>
		.....	Tension meter with scale, non standard scale is optional.
Standard tension meter scales:		.....	0 to: 1, 5, 10, 25, 50, 100, 150, 250, 500, 1000.
Weight:		.....	1.5 lbs (0.23 kg) to 2.0 lbs (0.91 kg), depending on version.
Transducer Signal Input:		.....	0.5Vdc at rated load per pair (1.00Vdc for XRE option).
Transducer Excitation:		.....	5Vdc (10Vdc for the XRE option) jumper selectable.
Accuracy:		.....	Max error of 1% over temperature range. 0.1% Typical.
Zero (Tare) Range:		.....	Minimum 95% of transducer rating.
Calibration Range:		.....	Minimum 50 : 1.
Ambient Temperature Range:		.....	32°F to 104°F (0°C to 40°C).



## 1.4 ENVIRONMENTAL CONDITIONS (Ref. Appendix E for further information)

This section applies to equipment designed to be safe at least under the following conditions:

- Indoor use.
- Altitude up to 6500 ft (2000 meters).
- Temperature range: 32° F to 104° F (0° C to 40° C).
- Maximum relative humidity 80% for temperatures up to 87°F (31°C) decreasing linearly to 50% relative humidity at 104°F (40°C).
- Main supply voltage fluctuations not to exceed +/-10% of the nominal voltage.
- Main supply transient overvoltages according to overvoltage category II of IEC 60364-4-443.
- Pollution Degree 2 in accordance with EN61010-1:2001.

## 1.5 STANDARD FEATURES

SOME OF THESE FEATURES REQUIRE CONFIGURATION OR EXTERNAL WIRING. REFER TO SECTION 2.4 FOR INSTALLATION INSTRUCTIONS AND SECTION 2.7 FOR WIRING.

- **Quik-Cal™** push-button zero and calibration eliminates pot adjustments to make calibrating simple and fast.
- **0 to +10V Tension Output OR 4 to 20mA Tension Output.** Proportional to tension. Used as an input to a controller or instrumentation system. Both are isolated outputs standard. See Section 3.1 for installation and adjustment. Unit should be ordered with Output specified as 0-10V or 4-20mA for factory Zeroing.

**▲ WARNING:** The isolated output is designed to prevent ground loops and noise. It is not intended or approved for safety isolation of hazardous voltages. Do not install unit where isolated circuit and chassis ground are more than 40V peak differential.

- **Adjustable Meter Damping.** Used to adjust the responsiveness of the analog tension meter. Does not affect the 0-10V/4-20mA output.
- **Power Voltage Selection.** The TI23 Interface / Indicator is designed to operate at either 115Vac (standard) or 230Vac (optional factory modification). The TI24 operates on 24Vdc.
- **Easily serviceable.** The unit can easily be removed after unplugging the mating connector.
- **Small size.** Fits where many other products cannot.
- **Flexible Options.** Options and features can be tailored for each application.
- **Economical.** Provides many important features at a reasonable price.
- **Output Isolated from Earth Ground.** Isolation is provided between the output circuit and transducer ground, simplifying installations.
- **Screw Clamp Mating Terminal Block Connector.** Allows easy connection of external wiring.
- **Status LED.** Green LED flashes to verify ZERO and CALIBRATION, and indicates presence of power and proper circuit operation. If power is on and no faults are detected, LED will be on solid. LED will flash momentarily to indicate acceptance of a ZERO or CALIBRATION button push.
- **Short Circuit Protection.** Unit automatically protects transducer excitation and tension output from short circuits or excessive loading. If a short circuit is detected, the unit will safely shut that portion of the circuit off until the fault is cleared. Unit automatically recovers when the fault is removed.

## 1.6 OPTIONS

SOME OF THESE OPTIONAL FEATURES REQUIRE CONFIGURATION OR EXTERNAL WIRING. REFER TO SECTION 2.4 FOR INSTALLATION INSTRUCTIONS AND SECTION 2.7 FOR WIRING.

- **230 Volt Input (230).** 230Volt, 50 Hz AC power input. TI23 only.
- **25% Calibration Weight (25CW).** Used when 25% of full scale calibration weight is desired instead of the standard 10% calibration weight. Jumper selected between 10% and 25%.

▲ **WARNING:** TI23 models are designed for single phase AC operation only. Do not connect them across three phase lines or to three phase circuits to prevent product damage and potential hazard.

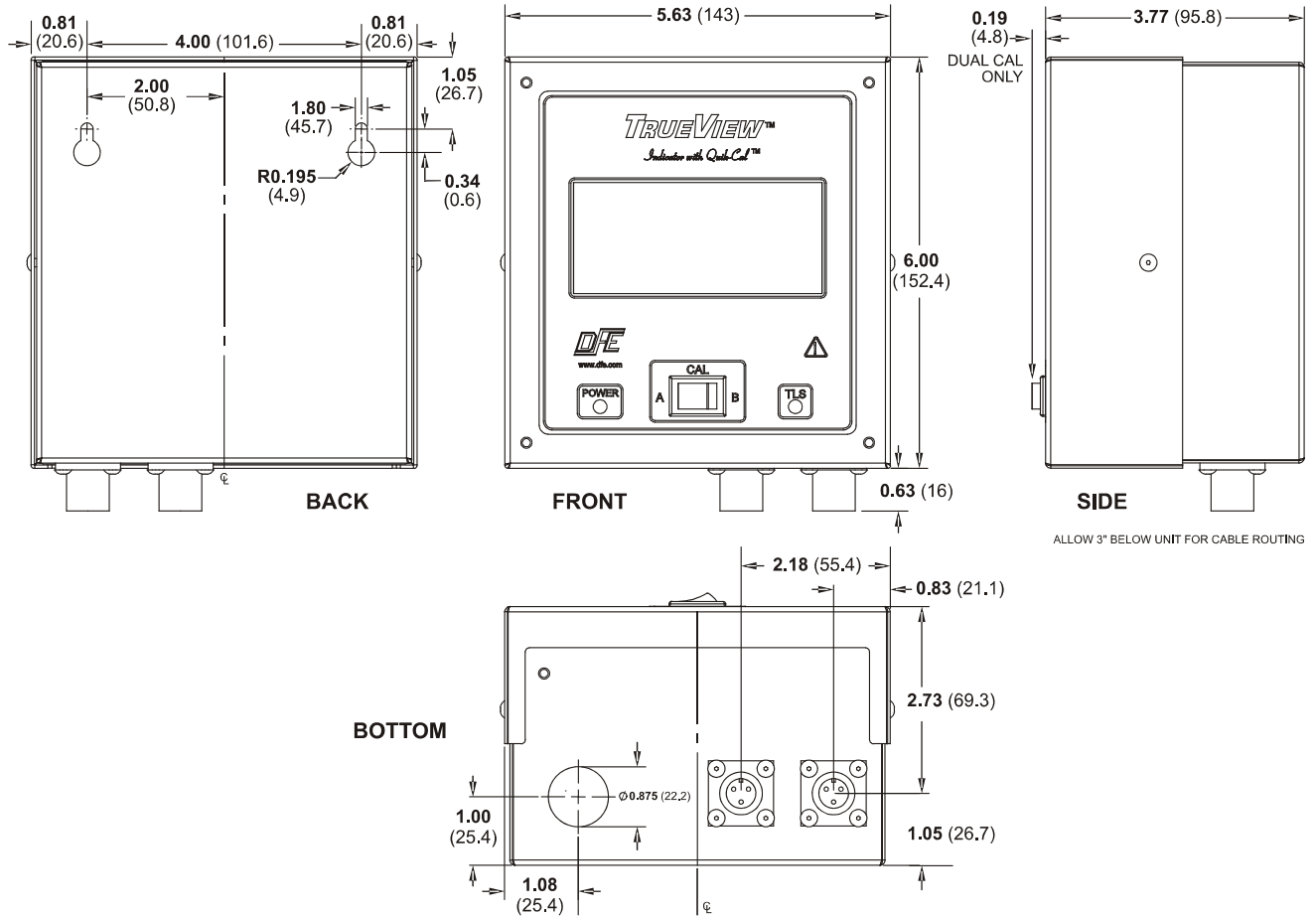
- **4 to 20mA Output (I420).** Isolated 4-20 mA current output, used in place of isolated 0 to +10V output. Jumper selected between 0 to +10V and 4-20mA.
- **Auto Zero (AZ).** Unit will auto zero the output on each power up. Jumper selected on or off.
- **Digital Tension Meter (DM).** Red LED 0.56" high, 4 digits. DFE Part# 723-2287.
- **Dual Calibration (DC).** Allows two calibration settings. Dual calibration example applications:
  - a. One set of transducers operating in a wide tension range. Dual calibration and dual meter scale is used to enhance the resolution of indicated tension.
  - b. One set of transducers that may be subject to two different wrap angles or web paths. In this case a dual meter scale may, or may not, be required
- **Extended Range (XRE).** 10 Vdc excitation for Extended Range transducers. Allows measurement of much lower tension than usual. Transducers must also have the XR option. Jumper selected between 5Vdc and 10Vdc.
- **Nonstandard Meter Scale.** Any other meter scale than standard ones offered by DFE. See Specifications for standard scales.
- **Tension Limit Switch (TLS).** An open collector output actuates at a pre-set adjustable trip point. Can be used as a web break detector, or high tension warning. A red LED activates on the front panel when TLS is triggered. Low and high trip points are independently adjustable. Trigger delay is adjustable.

▲ **WARNING:** TLS must not be used to switch hazardous voltages. It is rated for 24Vdc Maximum. Maximum current is 250mA. Ensure a proper dropping resistor is used to limit current to 250mA or less. Excess current or voltage can permanently damage the product and may pose a shock or fire hazard.

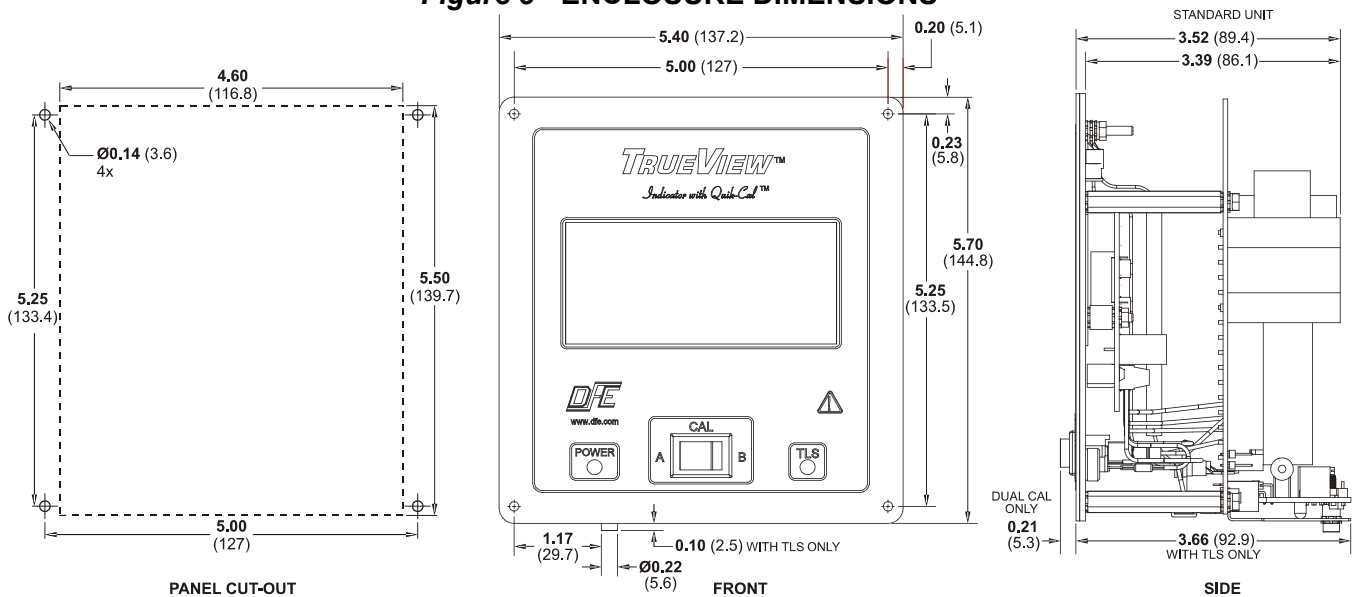
# SECTION 2

# INSTALLATION

## 2.1 DIMENSIONS inches (mm)



**Figure 3 - ENCLOSURE DIMENSIONS**



**Figure 4 - PANEL MOUNT DIMENSIONS**

## 2.2 SELECTION OF MOUNTING LOCATION

To ensure safety and proper operation, the TI23 or TI24 must be located away from dusty or wet environments. The TI23 or TI24 Panel configuration should be installed into a cabinet or enclosure. The Wall mount configuration should be mounted to a secure wall or surface that can support in excess of 35 lbs. (15.9 kg).

## 2.3 SAFETY AND EMC REQUIREMENTS

**▲ WARNING** If this equipment is not connected or operated in the manner specified, the operating safety of this unit or of connected equipment cannot be guaranteed.

**▲ WARNING:** The isolated output is designed to prevent ground loops and noise. It is not intended or approved for safety isolation of hazardous voltages. Do not install unit where isolated circuit and chassis ground are more than **40V** peak differential.

**▲ WARNING:** Operating without a properly installed cover may pose a shock hazard.

**! IMPORTANT:** For safety reasons, it is necessary to use appropriate wiring for your line voltage connections and for safety grounding. Make your ground connection between a reliable earth ground and the safety ground of your indicator using a wire with a gauge of at least 16 AWG (or a cross-sectional area of at least 1mm<sup>2</sup>) and insulation rating of at least 600V. Make your AC line voltage connections with wire gauge of at least 16 AWG (or a cross-sectional area of at least 1mm<sup>2</sup>) and insulation rating of at least 600V for each conductor. Secure this wiring to prevent inadvertent removal or strain on the input terminal.

**! IMPORTANT:** Proper transducer installation must include using shielded cables. The following is a list of cables available from DFE which meet this requirement:

CN 3-conductor cable for type C, RS, THN, and UPB transducers. Use 2 cables, 1 cable per transducer.

721-1554, 721-1539, 721-1540, 721-1541, 721-0085 (depending on desired length)

CN 6-conductor cable for type RFA, LT, VNW, and TR0, TR1, TR2, NW0, NW1 and NW2 transducers.

721-1558, 721-1551, 721-1552, 721-1553, 721-0984 (depending on desired length)

CN 6-conductor cable for NWI.

721-1610, 721-1611, 721-0984 (depending on desired length)

Other cables manufactured by DFE also meet this requirement. Contact DFE for more information.

For those desiring to run the transducer cables in conduit; Cables are available to bypass the amphenol type connectors and wire directly into the terminal block. Contact DFE for Cable information.

If you wire directly to the Terminal Block: Cable shielding must be attached to the SHIELD connection on the terminal block, or to an appropriately grounded enclosure. If you wish to assemble your own cables, contact DFE for assembly instructions.

## 2.4 INSTALLATION INSTRUCTIONS

Drill your mounting holes for the mounting style you will be using. Be sure to allow ample clearance below the unit for tool access and for wiring.

If you are using the Wall mount style; drill and tap 2 holes 4.00" (57.4 mm) apart horizontally. Insert your M4 or #8 screws and tighten but at the end reverse them out 3 turns. Place the enclosure keyholes over the screw heads and lower unit into place. Tighten the screws. If you are using the panel mounting style, mount the front plate of the indicator to your panel. Drill mounting holes per dimensions in Figure 4.

### If you are using a Panel Mount Style;

1. Drill your M3 clearance (0.140") holes in a 5.0" horizontal by 5.250" Vertical rectangle.
2. Cut an opening centered in the holes measuring 4.6" across by 5.5" tall.
3. Mount your Panel style indicator in the hole using 4 each M3 or #4 nuts and screws.

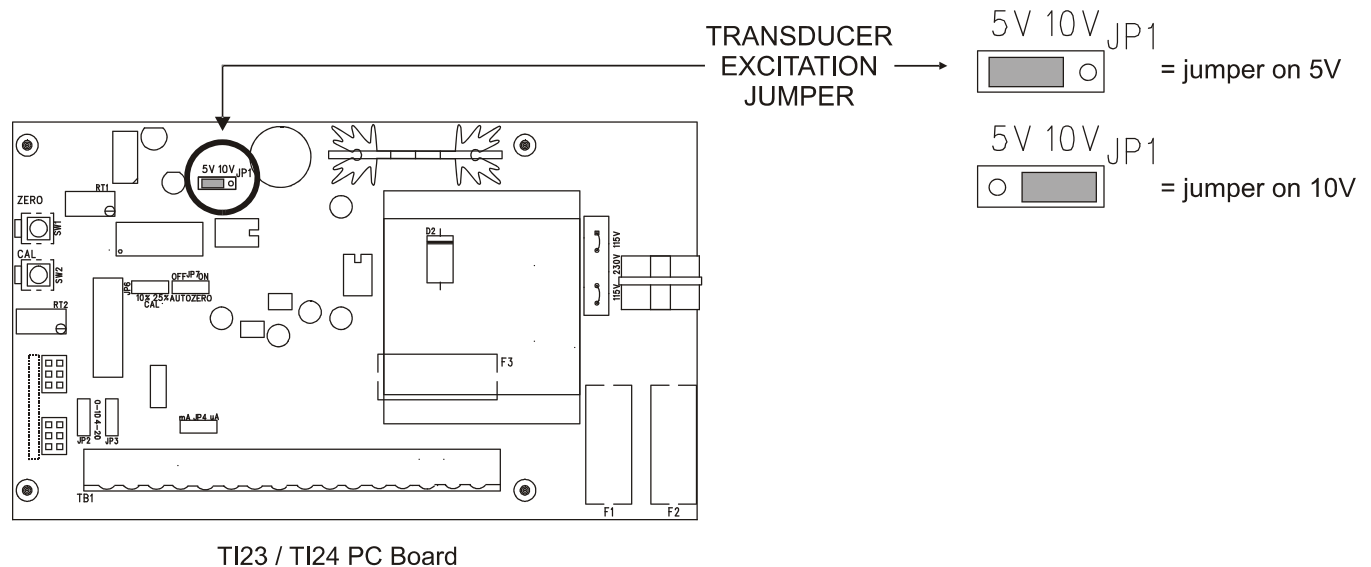
## 2.5 TRANSDUCER VOLTAGE SELECTION (Refer to Figure 5)

The tension transducers are excited by either the standard 5 Vdc or, 10 Vdc with the Extended Range option or LT (low tension) transducer.

**!!CAUTION Do NOT use the 10 Vdc excitation unless the transducers are LT type transducers or have the extended range option! The transducers MAY be DAMAGED!**

Set the transducer excitation jumpers as follows:

5 Vdc - Jumper on JP1, pins 1-2.      10 Vdc (XRE) - Jumper on JP1, pins 2-3.



**Figure 5 - TRANSDUCER VOLTAGE JUMPERS**

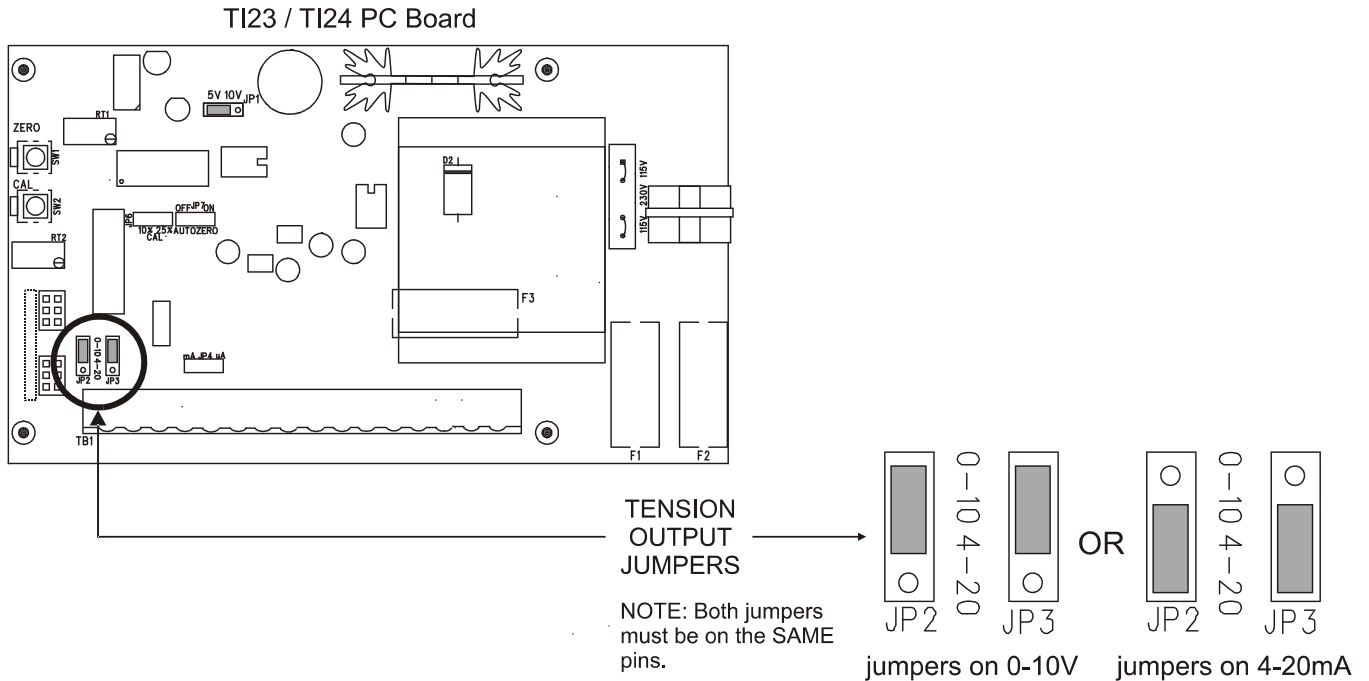
## 2.6 TENSION OUTPUT SELECTION

Verify that your TI23 or TI24 is set-up with the correct tension output. There will be a set of jumpers JP2 and JP3 on the main board. Refer to Figure 6.

If 0-10V is required, place jumpers on pins 1 to 2 on both JP2 and JP3.

If 4-20mA is required, place jumpers on pins 2 to 3 on both JP2 and JP3.

**NOTE:** Both jumpers must be in the same position or incorrect operation will result.



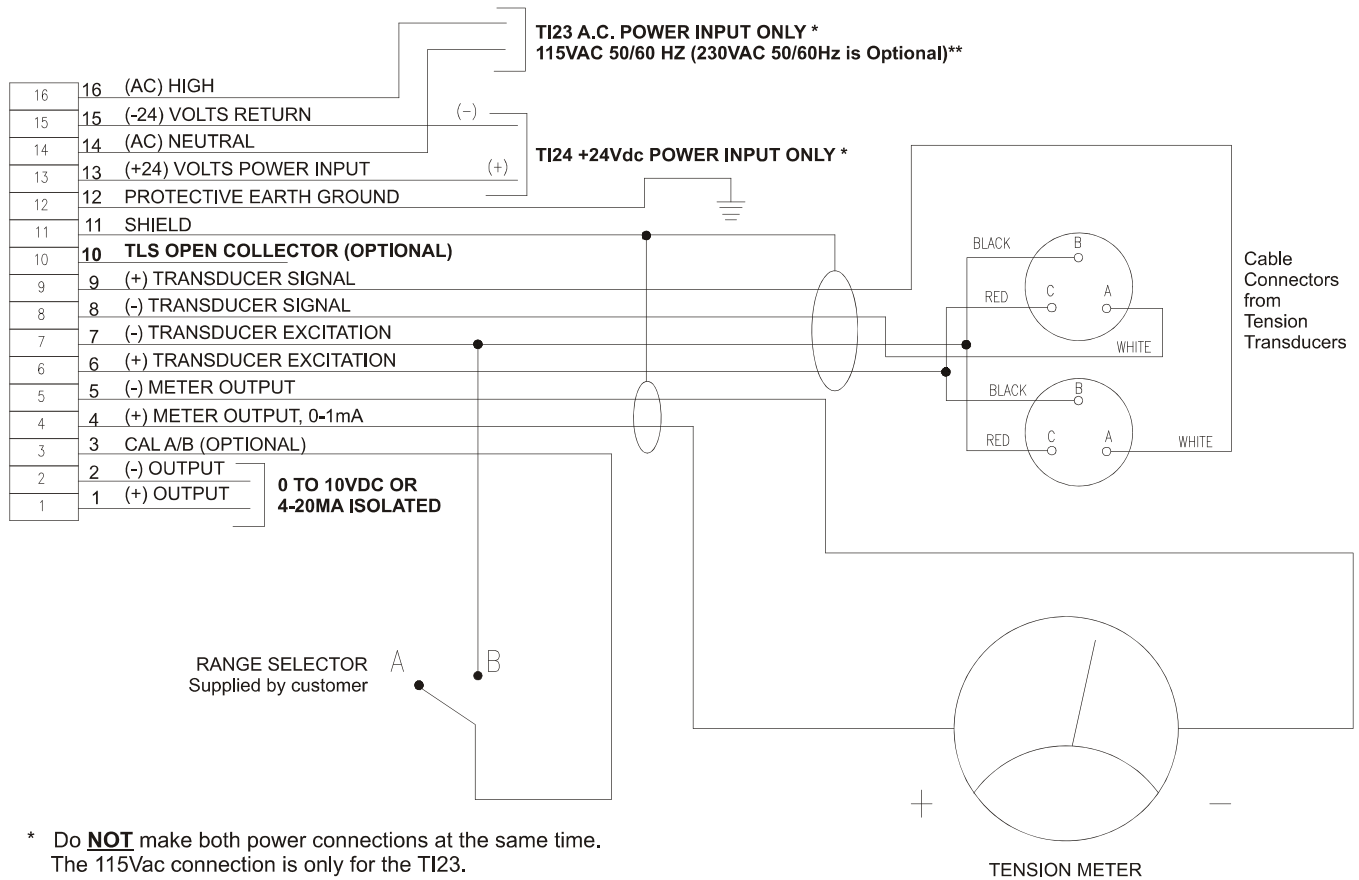
**Figure 6 - TENSION OUTPUT JUMPERS**

## 2.7 ELECTRICAL CONNECTIONS - STANDARD

Keep in mind that the indicator is designed to provide a damped meter tension indication, and either a 0-10V isolated OR a 4-20mA isolated output. **Standard Customer Connections are in BOLD**. All other wiring is for reference only.

Make your wiring connections as follows:

1. The insulation rating of all line voltage wiring must be at least 600V
2. Keep line voltage wiring physically separated from signal wiring at the terminal block and at any other point in the installation.
3. Connect cable shields to the Shield terminal on TB1 (Pin 11).



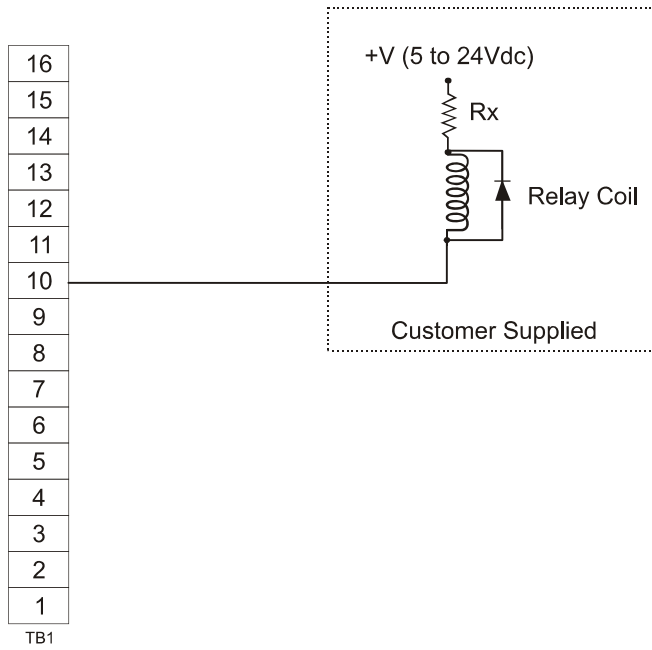
\* Do **NOT** make both power connections at the same time.  
 The 115Vac connection is only for the TI23.  
 The 24Vdc connection is only for the TI24.  
 Leave the unused terminals empty

\*\* Check the Serial Tag for the correct power voltage

Transducer, meter and CAL A-B wiring are shown for customer convenience, These are Factory Wired.

**Figure 7 - STANDARD ELECTRICAL CONNECTIONS**

## 2.8 TENSION LIMIT SWITCH EXTERNAL RELAY CONNECTIONS (Option)



Note: Maximum current through terminal 10 is 250mA. Choose series resistor value ( $R_x$ ) based upon applied voltage and coil resistance so current does not exceed 250mA.

For +V of 5Vdc,  $R_x = 20$  ohms, 2.5W minimum  
For +V of 24Vdc,  $R_x = 96$  ohms, 10W minimum

**Figure 8 - TLS EXTERNAL RELAY CONNECTIONS (Option)**



## 3.1 PREPARATION

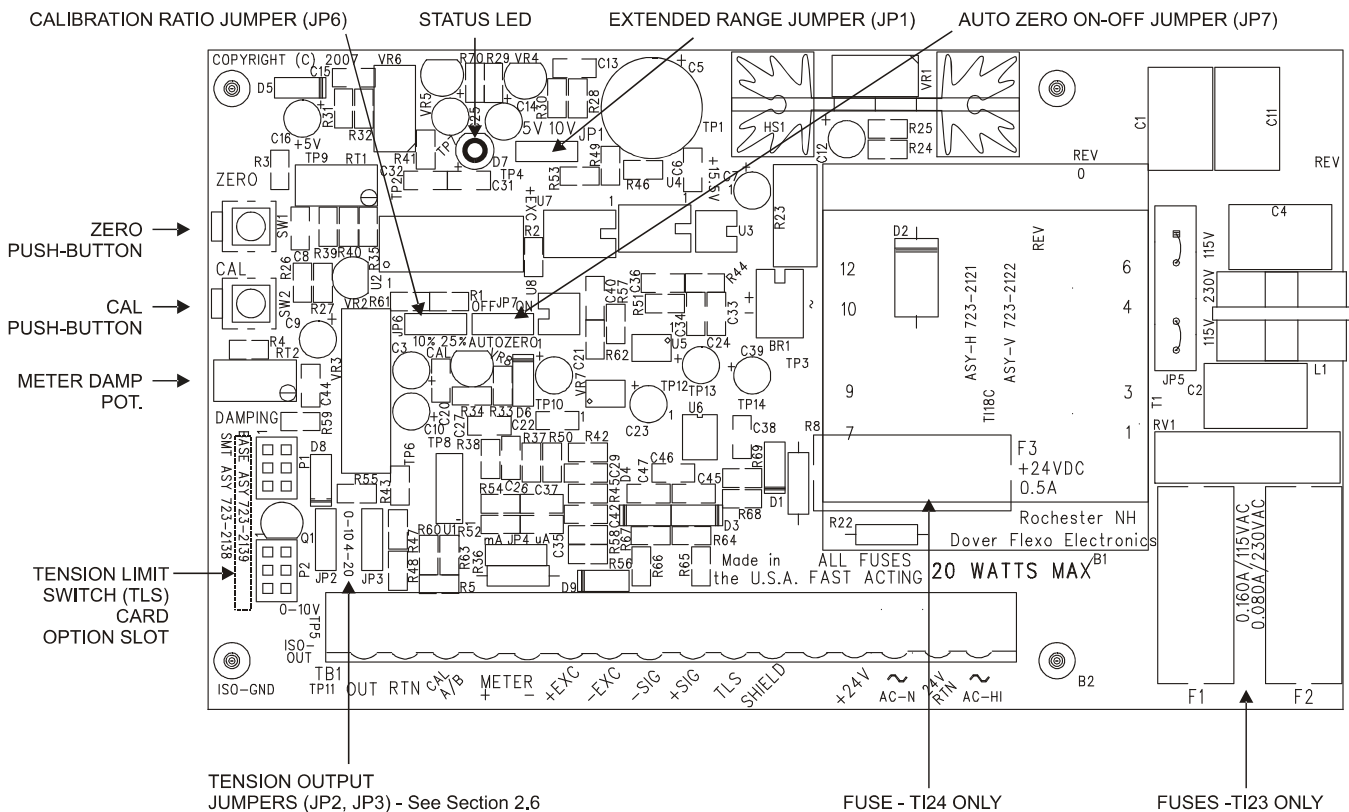
1. Select an appropriate calibration weight. Remember that the weight determines the value of web tension that will produce full output. A 15lb. weight will result in full output at 150 lbs. tension. (If the optional cal. ratio of 25% is used, a calibration weight of 15 lbs. will result in a full output at 60 lbs. tension). A spring scale can also be used, but absolute accuracy may be reduced.
2. Get a length of rope, wire, or cable of appropriate length. It must NOT be extensible (stretchy). This will cause inaccurate calibration.
3. If you wish to use a calibration ratio of 25%, locate jumper JP6 on the PCB and move it to the 25% position.
4. Ground yourself before opening the unit or touching the circuit card.

## 3.2 MECHANICALLY ZERO THE TENSION METER

Turn off power and observe whether the tension meter needle rests at 0. If not, turn the adjustment screw on the rear of the meter as required to set the meter needle at 0 on the scale.

Accessing this adjustment requires you to remove the Circuit card. Be careful to re-install it in the exact way it was assembled: 1) star washer on each stud, 2) circuit card, 3) split lock washer on each stud, and 4) nut on each stud. Tighten to 7 inch pounds. For the optional digital meter, refer to the digital meter manual.

## 3.3 CALIBRATE THE OUTPUT FOR ACCURACY

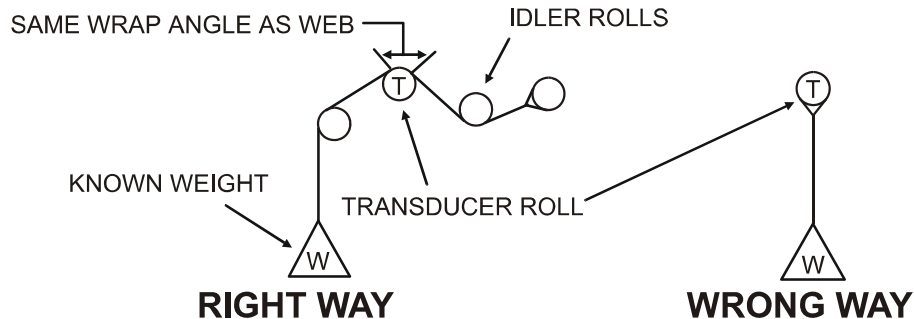


**Figure 9 - TI23 and/or TI24 PC BOARD (enlarged for clarity)**

1. **ZERO:** Ensure nothing is hanging on or pressing on the tension roll (including the calibration rope). Press the ZERO pushbutton on the circuit card for at least 1 second. The unit will store the tension zero one second after the button is pressed. The unit will flash the green status LED ONCE (located on the circuit card near the extended range jumper) to indicate the zero has been stored. Release the button. The output will produce 0Vdc or 4mA depending upon the output selected. The tension meter (if attached) will read zero
2. **CALIBRATION:** If you wish to use a calibration ratio of 25%, locate jumper JP6 on the PCB and move it to the 25% position.

Fasten one end of the rope in the machine and thread the other end around the transducer roll in exactly the same path the web will take. Be sure the rope does not pass around any driven rolls, drag bars, or anything else that can affect tension. Ideally the rope should hit an idler roll immediately before and after the tension sensing roll. It does not have to pass over any other rollers once these three are strung. Refer to Figure 10.

- 2.1 Attach the weight to the free end of the rope as shown in Figure 10. The weight should not touch anything. Wait for the weight to stop swinging.



**Figure 10 - WEB PATH**

- 2.2 Press the CAL pushbutton on the circuit card for at least 1 second. The unit will store the calibration information one second after the button is pressed. The unit will flash the green status LED ONCE (located on the circuit card near the extended range jumper) to indicate the calibration has been stored. The output will read 1.0Vdc or 5.6mA (For 10% calibration percentage) or 2.5Vdc or 8mA (For 25% calibration percentage). The meter will read 10% of full scale or 25% depending upon JP6 setting
- 2.3 Remove the weight and observe the output. It should read 0Vdc or 4mA with nothing touching the tension sensing roller, and if steps 2.1 to 2.3 above were done correctly.
3. **METER DAMPING:** Adjust the MTR DAMP potentiometer while the machine is running to minimize needle movement. Damping only affects the 0-1mA meter output and not the 0-10Vdc or 4-20mA isolated outputs. (See Fig. 9).
4. **DUAL CALIBRATION:** For dual calibration only, set the Cal A-B switch to B and repeat steps 1 (ZERO) through 2 (CALIBRATION). This sets zero and cal for circuit B. Note: You must keep JP6 (Cal % jumper) in the same position for both calibration runs. When the Switch is in "B" position, "B" calibration is active. When the Switch is in "B" position, ZERO and CAL button presses apply to "B". When the Switch is in "A" position, or not installed, the unit defaults to "A" calibration.
5. **AUTO-ZERO:** If you want the unit to automatically re-zero every time power is applied, move jumper JP7 to pins 2-3 (Auto-Zero ON). The default is Auto-Zero OFF (JP7 Pins 1-2). (See Fig. 9).
 

**!CAUTION:** Auto-Zero must be used with care. If power can be cycled to the unit (for any reason) while the web is resting on the tension roller, Auto-Zero should NOT be activated. The unit will store the updated tension input as the new zero on power up. This can damage the web as the actual tension would be higher than reported by the unit.
6. Manual re-zero can be performed at any time. Simply ensure nothing is touching the tension roller, and press ZERO until the green LED (on the PCB) flashes, then release. The zero setting is updated, and the CALIBRATION is maintained.
 

**!CAUTION:** Do NOT press ZERO or CAL pushbuttons while the web is running. The unit will store ZERO or CALIBRATION and the old settings will not be recovered. The only way to recover CALIBRATION is to perform this procedure starting at step 1. The output calibration is now complete.

### 3.4 CALIBRATION AND ADJUSTMENT OF TENSION LIMIT SWITCH OPTION

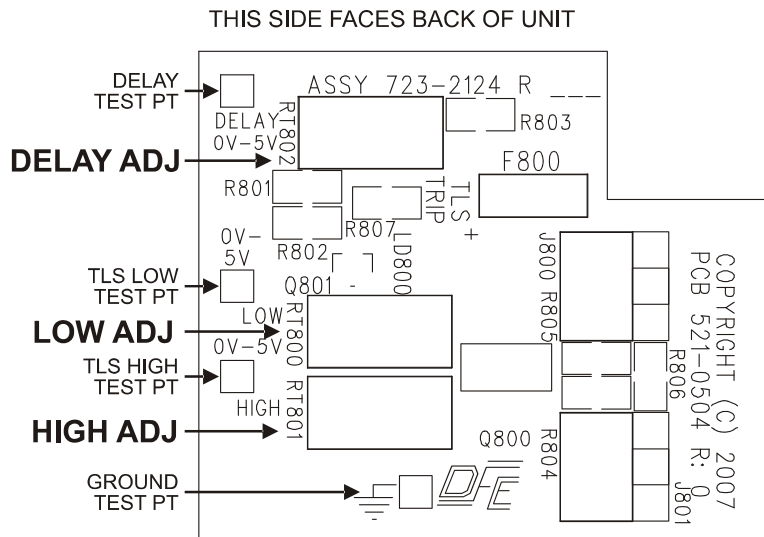
The Tension Limit Switch (TLS) option is used to provide a visual LED indication when the tension output exceeds one value or goes below another value. You can also connect an external relay as shown in Section 2.8 to sound an external alarm, turn the machine off, and so forth.

To calibrate the TLS card, you need to know your system's full scale tension indication (TFULL). You also need to decide what you want for your Low tension trip point (TLO) and your high tension trip point (THI). Note that you can set up TLS for one and not the other or both.

**NOTE:** Your system should be calibrated to measure tension prior to setting up TLS. TLS will not activate properly if the unit has not been zeroed and calibrated.

**!CAUTION:** Do NOT press ZERO or CAL push buttons during this procedure. Pressing the CAL button will invalidate your calibration. Pressing the ZERO button will re-zero the unit. This will not invalidate the calibration, but can cause incorrect zero tension readings if anything is touching the tension sensing roller when the button is pressed.

See Figure 11 or 15 for adjustment and test point locations.



**Figure 11 - TENSION LIMIT SWITCH BOARD ADJUSTMENTS**

1. **Set Delay:** If TLS is to be used, first decide the desired trip delay. This is the amount of time the unit will wait after the tension output crosses the high or low threshold before activating the LED and Open Collector line (TB1 Pin 10). The minimum delay is 32mSec, while the maximum delay is 5 seconds. Most applications should use a delay of 1 second or longer to avoid nuisance trips caused by tension transients. The delay is set by adjusting potentiometer RT802 on the TLS option card.

**NOTE:** The delay only applies to triggering ON. If TLS is already active, it will turn off immediately when tension returns to a level between both trip points.

Attach the positive voltmeter lead to the DELAY test point in front of potentiometer RT802 on the TLS option card. Attach the negative voltmeter lead to the ground test point on the TLS option card (test point with ground symbol). The voltage between these two points is equal to the delay in seconds. To set a delay of 1 second, adjust RT802 until 1VDC is read on the voltmeter. For a delay of 4 seconds, adjust RT802 until 4VDC is read on the voltmeter.

2. **Set TLS Low Trip Point:** (If only TLS high is needed, turn RT800 25 turns counterclockwise to disable TLS Low. Skip to step 3 after disabling TLS Low.)

**NOTE:** TLS low is turned off when the LOW test point voltage is 0.1VDC or below.

To set the TLS low trip point, web the process material in the exact path it will run during machine operation. With the web stopped (zero line speed), subject the web to the tension level you desire for TLS low trip point.

- A. If the TLS LED is off after setting your tension level, TLS low is either deactivated, or set below the tension level you have achieved. Slowly turn RT800 clockwise until the LED turns on. Now, slowly turn RT800 counterclockwise until the LED turns off. Your TLS low trip point is now set to the low tension level.
- B. If the TLS LED is on after setting your tension level, the TLS low trip point is above your tension level. Slowly turn RT800 counterclockwise until the LED turns off. Your TLS low trip point is now set to the low tension level.

**NOTE:** If you are unable to subject the web material to the low tension trip point at zero speed, see the table in Figure 12 below to set the trip point using a multi-meter only.

**3. Set TLS High Trip Point:** (If only TLS low is needed, turn RT801 25 turns clockwise to disable TLS High.)

**NOTE:** TLS High is turned off when the HIGH test point voltage is 0.1VDC or below. It is also turned off when HIGH test point is within 0.1VDC of the 5V power voltage rail.

To set the TLS high trip point, web the process material in the exact same path it will run during machine operation. With the web stopped (zero line speed), subject the web to the tension level you desire for TLS high trip point.

- A. If the TLS LED is off after setting your tension level, TLS high is either deactivated, or set above the tension level you have achieved. Slowly turn RT801 counterclockwise until the LED turns on. Now, slowly turn RT801 clockwise until the LED turns off. Your TLS high trip point is now set to the high tension level.
- B. If the TLS LED is on after setting your tension level, the TLS high trip point is below your tension level. Slowly turn RT801 clockwise until the LED turns off. Your TLS high trip point is now set to the high tension level.

**NOTE:** If you are unable to subject the web material to the high tension trip point at zero speed, see the table in Figure 12 below to set the trip point using a multi-meter only.

TLS TRIP PERCENTAGE OF FULL OUTPUT	TLS LOW TESTPOINT VDC (RT800)	TLS HIGH TESTPOINT VDC (RT801)
5%	0.35V	0.35V
10%	0.58V	0.58V
20%	1.05V	1.05V
30%	1.51V	1.51V
40%	2.00V	2.00V
50%	2.48V	2.48V
60%	2.95V	2.95V
70%	3.45V	3.45V
80%	3.91V	3.91V
90%	4.38V	4.38V
95%	4.62V	4.62V

**Figure 12 - TENSION LIMIT SWITCH TEST POINT VALUES**

Your tension indicator will indicate tension in your system without any further operator intervention. It is a good idea to make a check at roughly one month intervals to verify that no one has changed the calibration. The inherent stability of the Quik-Cal zero and calibration feature make it unlikely that the indicator will require routine calibration. The digital circuitry maintains zero and calibration settings reliably. See Section 3 for calibration and setup.

## **SECTION 5**

# **CARE AND MAINTENANCE**

---

It is not necessary to perform any type of maintenance on the indicator. However, you may find it worthwhile to observe whether there is a buildup of dust, debris, or moisture on or near the unit after a period of time. If so, you may consider putting the unit in a more appropriate location.

Most problems are caused by incorrect installation and misapplication of the equipment. It is very important to be sure these factors are correct before making any changes to calibration and jumper settings.

The green status LED (located on the circuit card) indicates the operating status of the unit. It should be on steady within one second of power application. The green status LED should not be flashing during operation except when pressing ZERO or CALIBRATION pushbuttons (LED will flash once indicating acceptance of ZERO or CAL). Continuous flashing is an indication of a problem, contact DFE technical support if this condition is observed.

If the green status LED is not lit when power is applied, check fuses on the TI23 or TI24. If they need to be replaced, use the correct values listed below (all fuses 5mm x 20mm type):

TI23 (2 Fuses):	<b><u>115V Operation</u></b>	<b><u>230V Operation</u></b>
	160mA, 250V IEC Fast Acting (DFE P/N: 108-0082)	80mA, 250V IEC Fast Acting (DFE P/N: 108-0091)

TI24 (1 Fuse): 500mA, 250V IEC Fast Acting  
(DFE P/N: 108-0097)

**▲ WARNING:** Equipment must be disconnected from **HAZARDOUS LIVE** voltage before changing the fuses.

**▲ WARNING:** Only replace fuses with the correct size, value, and speed rating. Use of non-certified fuses or fuses with incorrect ratings **MAY CAUSE A SHOCK OR FIRE HAZARD.**

The test points on the circuit card can provide an indication of proper operation or problems if they exist. Typical voltages on the test points follow:

Voltmeter positive lead	Voltmeter negative lead	Typical Voltage
TP1	TP3	15.5 Vdc
TP9	TP3	5Vdc
TP4 (+EXC)	TP3	5Vdc (STD), 10.1Vdc (XR)
TP5	TP11	0-10Vdc output, changes depending on tension input and ZERO/CAL settings.

Some variation of the listed voltages should be expected. If any voltage deviation greater than 10% of typical is measured, contact DFE technical support for assistance.

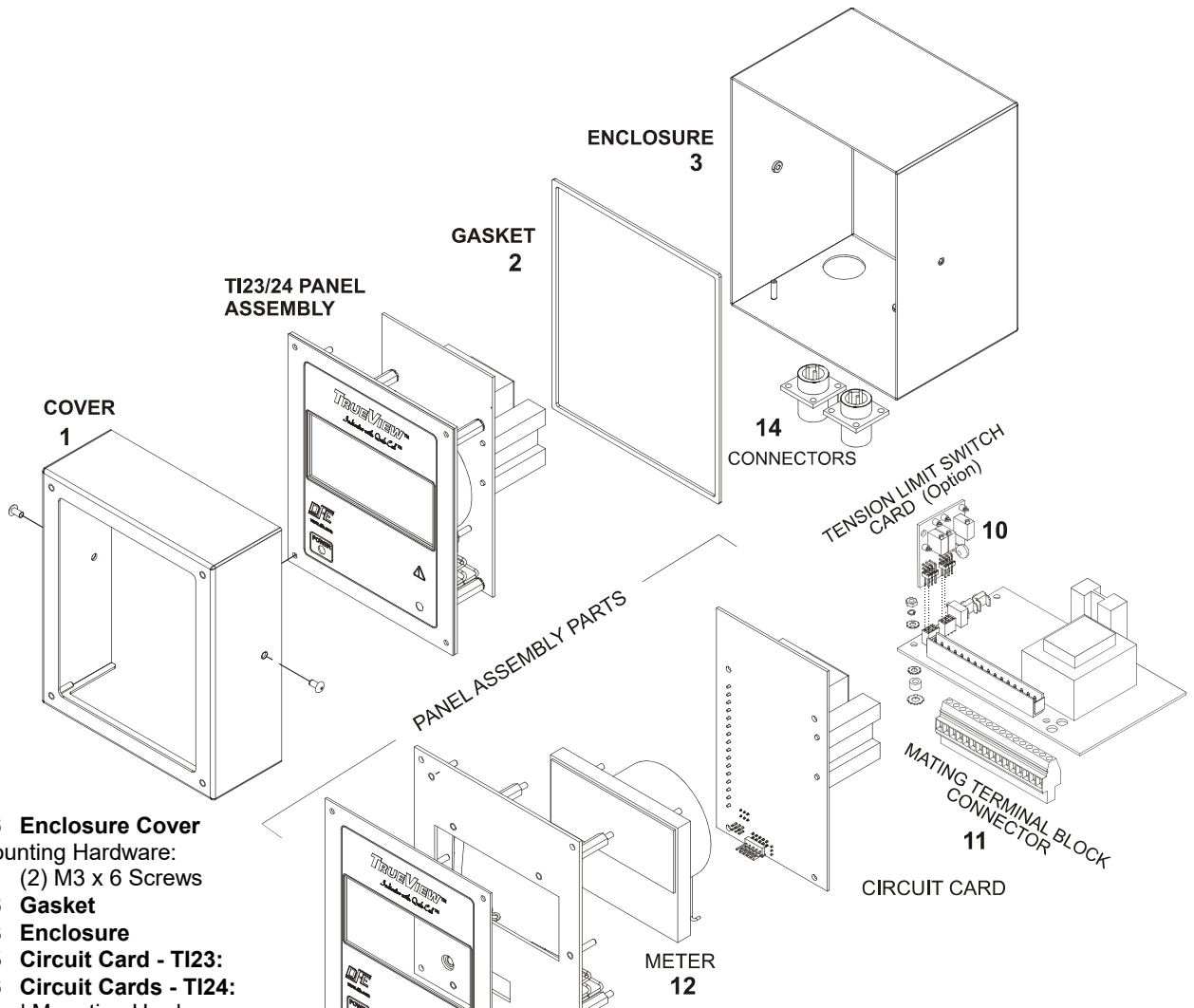
If you have any problems with the functions on your TI23 or TI24 Tension Indicator, please call Technical Service at 603-332-6150 or Fax 603-332-3758. E-mail: [techsupport@dfc.com](mailto:techsupport@dfc.com).

DFE's experienced technicians are responsible to ensure that you are satisfied with your DFE equipment. They will be pleased to assist you.

# SECTION 7

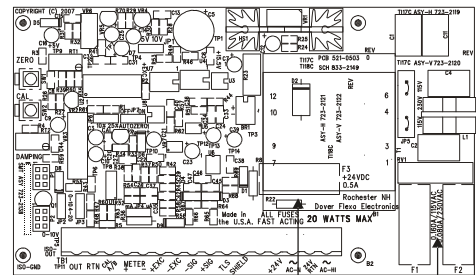
# REPLACEMENT PARTS

**▲ WARNING:** When replacing fuses, use only fuses with ratings as shown below. Failure to do this may compromise personal safety and may create a fire hazard!



1. 620-2726 **Enclosure Cover**  
Cover Mounting Hardware:  
123-0032 (2) M3 x 6 Screws
2. 522-0516 **Gasket**
3. 620-2728 **Enclosure**
4. 721-2295 **Circuit Card - TI23:**
5. 721-2296 **Circuit Cards - TI24:**  
Circuit Card Mounting Hardware:  
124-0040 (8) M3 Star,  
124-0080 (4) M3 Split, and  
125-0012 (4) M3 Nut
6. 108-0082 (2) **Fuses, 160mA 250V for 115Vac - TI23**
7. 108-0091 (2) **Fuses, 80mA 250V for 230Vac - TI23**
8. 108-0097 (1) **Fuse, 500mA, 250V for 24Vdc - TI24**
9. 108-0105 **Fuse Covers - (2) for TI23, (1) for TI24**
10. 723-2124 **Tension Limit Switch Card (Optional)**
11. 721-2151 **Mating Terminal Block Connector**
12. 722-1385 **Tension Meter (specify scale)**
13. 523-0512 **Front Overlay - TI23**  
523-0513 **Front Overlay - TI24**
14. 124-0080 **Connectors**  
Connector Mounting Hardware  
123-0032 (8x) M5 x 50 Socket Head Cap
15. 801-2246 **Instruction Manual (not shown)**

### 4 / 5 CIRCUIT CARD TOP VIEW



- |                               |                                |
|-------------------------------|--------------------------------|
| <b>FUSE - TI24</b>            | <b>FUSES - TI23</b>            |
| <b>8</b> FOR 24 VDC OPERATION | <b>6</b> FOR 115 VAC OPERATION |
| <b>9</b> FUSE COVER           | <b>7</b> FOR 230 VAC OPERATION |
|                               | <b>9</b> FUSE COVERS           |

**Figure 13 - REPLACEMENT PART NUMBERS**



# Appendix A: Locations of Jumpers and Adjustments

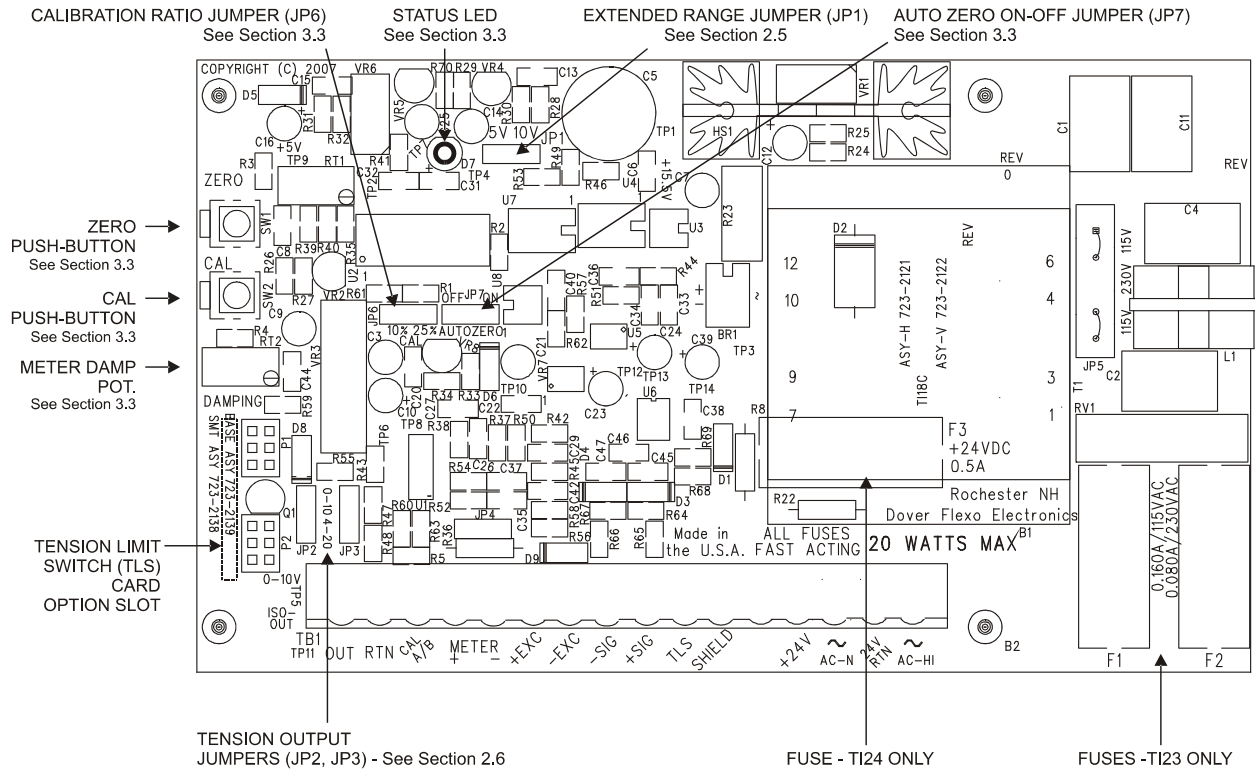


Figure 14 - T123 and/or T124 PC BOARD (Enlarged for clarity)

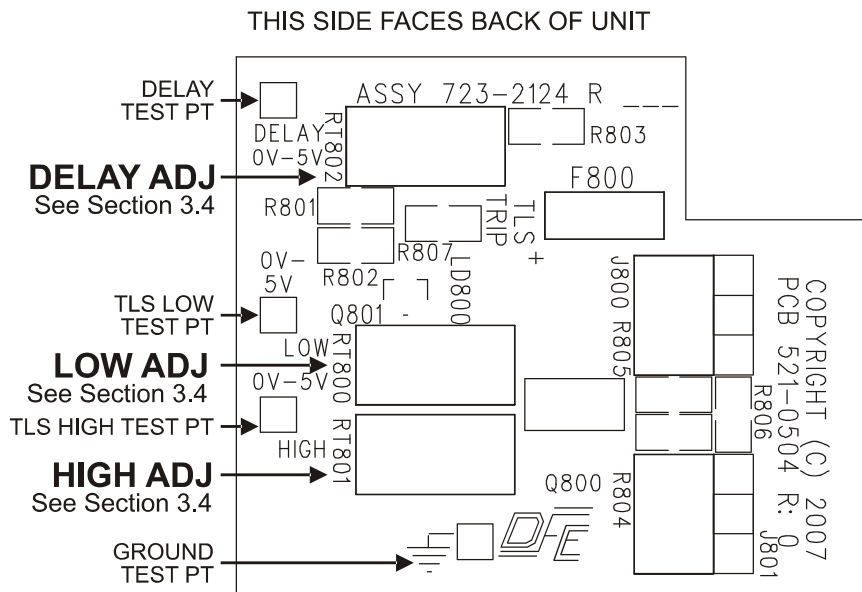
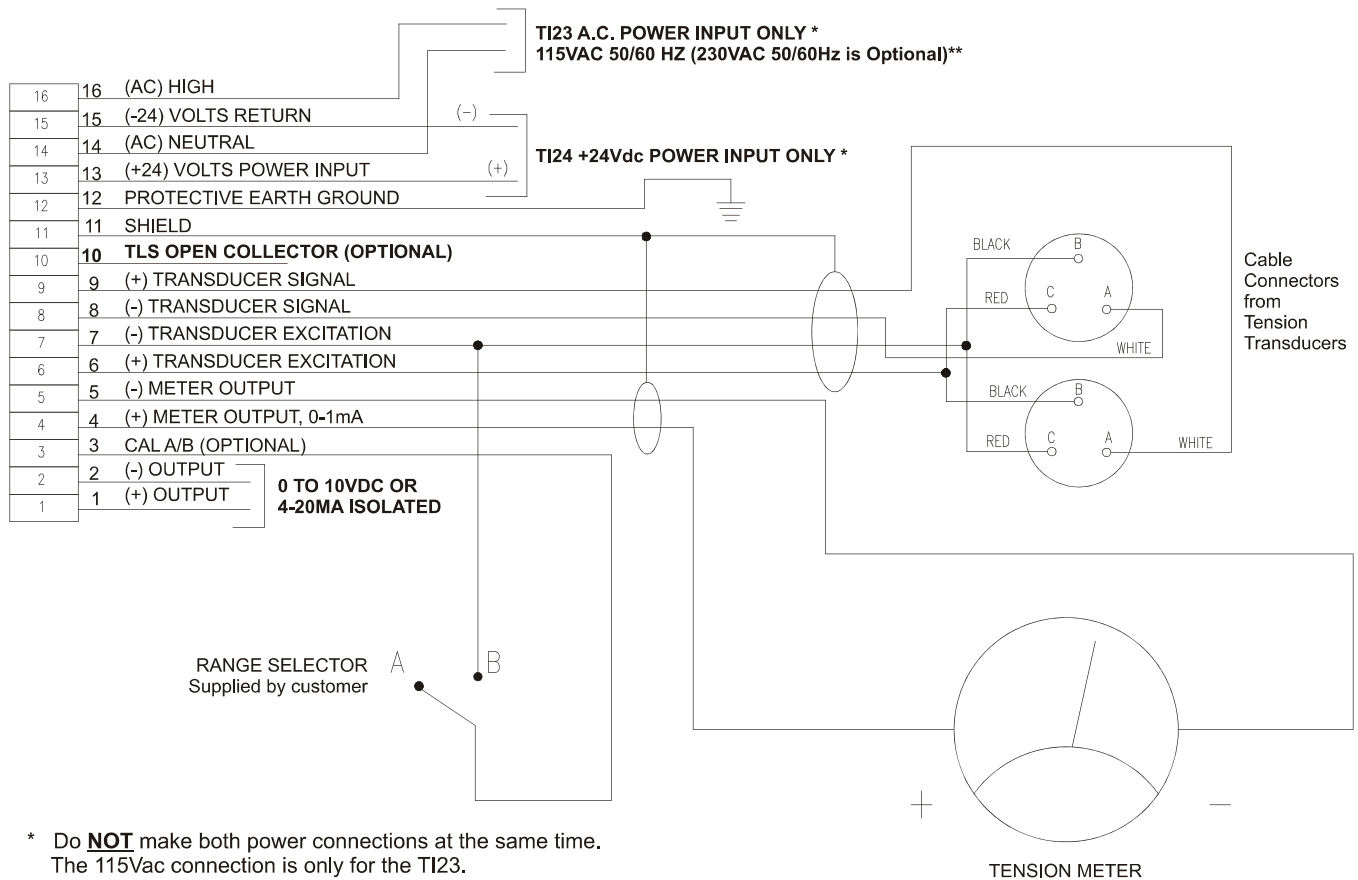


Figure 15 - OPTIONAL TENSION LIMIT SWITCH BOARD (Enlarged for clarity)



\* Do **NOT** make both power connections at the same time.  
 The 115Vac connection is only for the TI23.  
 The 24Vdc connection is only for the TI24.  
 Leave the unused terminals empty  
 \*\* Check the Serial Tag for the correct power voltage

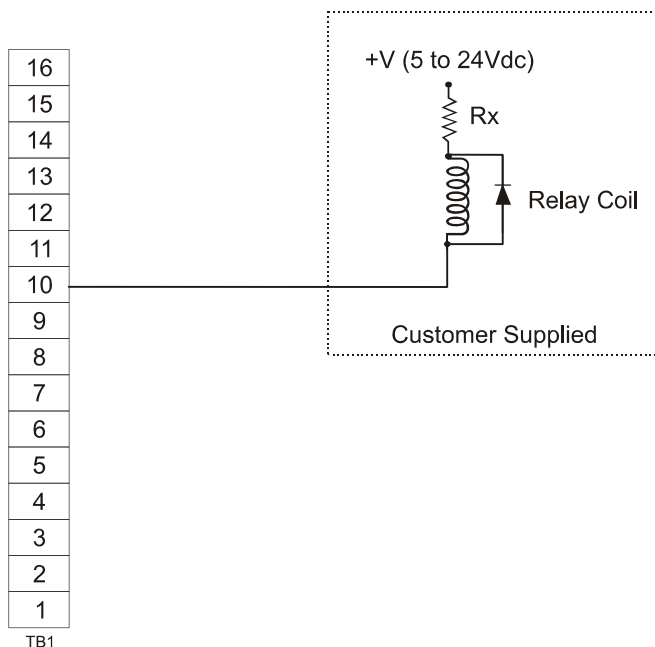
## TI23/TI24 STANDARD CONNECTIONS:

Make your wiring connections as follows:

1. The insulation rating of all line voltage wiring must be at least 600V.
2. Keep line voltage wiring physically separated from signal wiring at the terminal block and at any other point in the installation.
3. Connect cable shields to earth ground.

**Figure 16 - STANDARD ELECTRICAL CONNECTIONS**

## TENSION LIMIT SWITCH EXTERNAL RELAY CONNECTIONS (Option):



Note: Maximum current through terminal 10 is 250mA. Choose series resistor value ( $R_x$ ) based upon applied voltage and coil resistance so current does not exceed 250mA.

For +V of 5Vdc,  $R_x = 20$  ohms, 2.5W minimum

For +V of 24Vdc,  $R_x = 96$  ohms, 10W minimum

**Figure 17 - TLS EXTERNAL RELAY CONNECTIONS (OPTION)**

# Appendix C: Transducer Electrical Connections

## MODELS C, RS, AND UPB TRANSDUCERS

THE TENSION (T) AND COMPRESSION STRAIN GAGES ARE CONNECTED IN A BRIDGE CONFIGURATION. AS THE BEAMS BEND SLIGHTLY UNDER WEB TENSION, THE GAGE RESISTANCES CHANGE PRODUCING AN OUTPUT SIGNAL WHICH IS DIRECTLY PROPORTIONAL TO THE WEB TENSION.

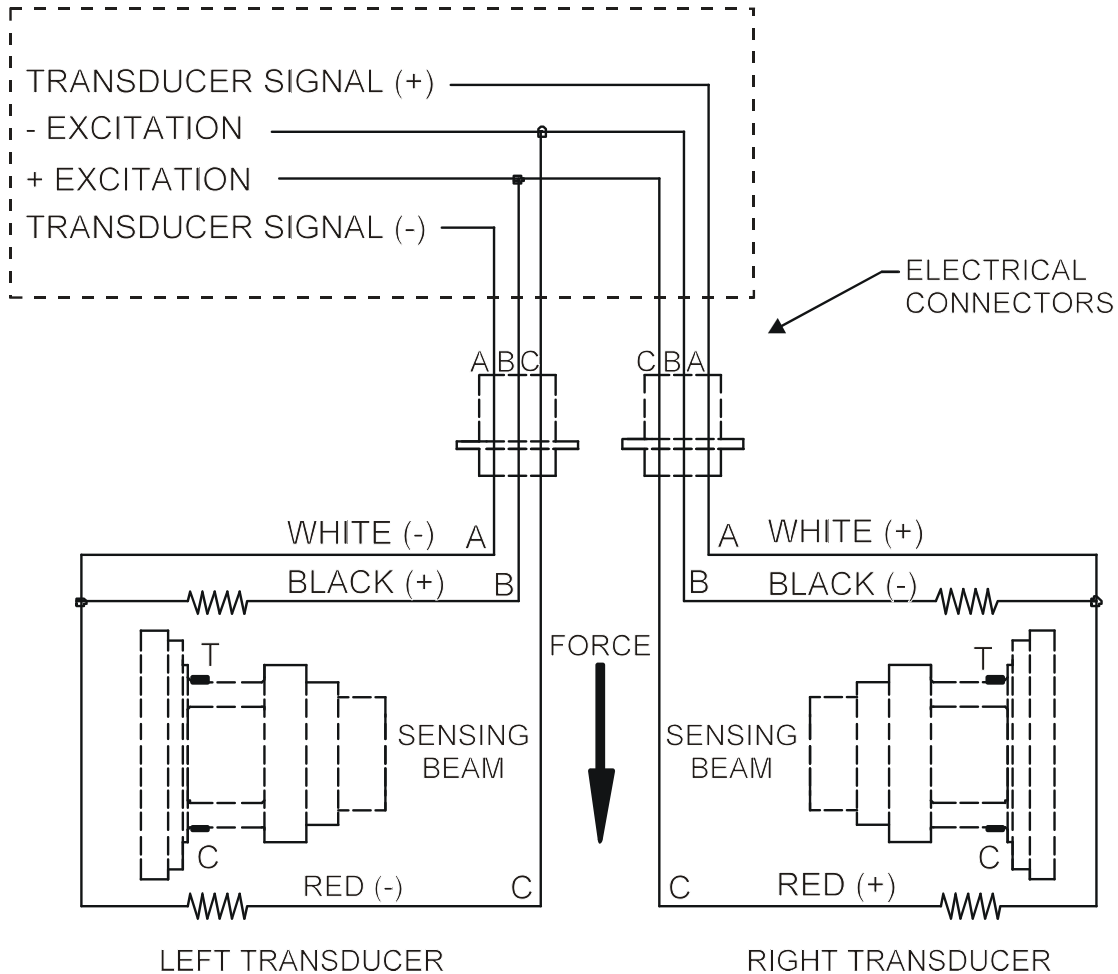
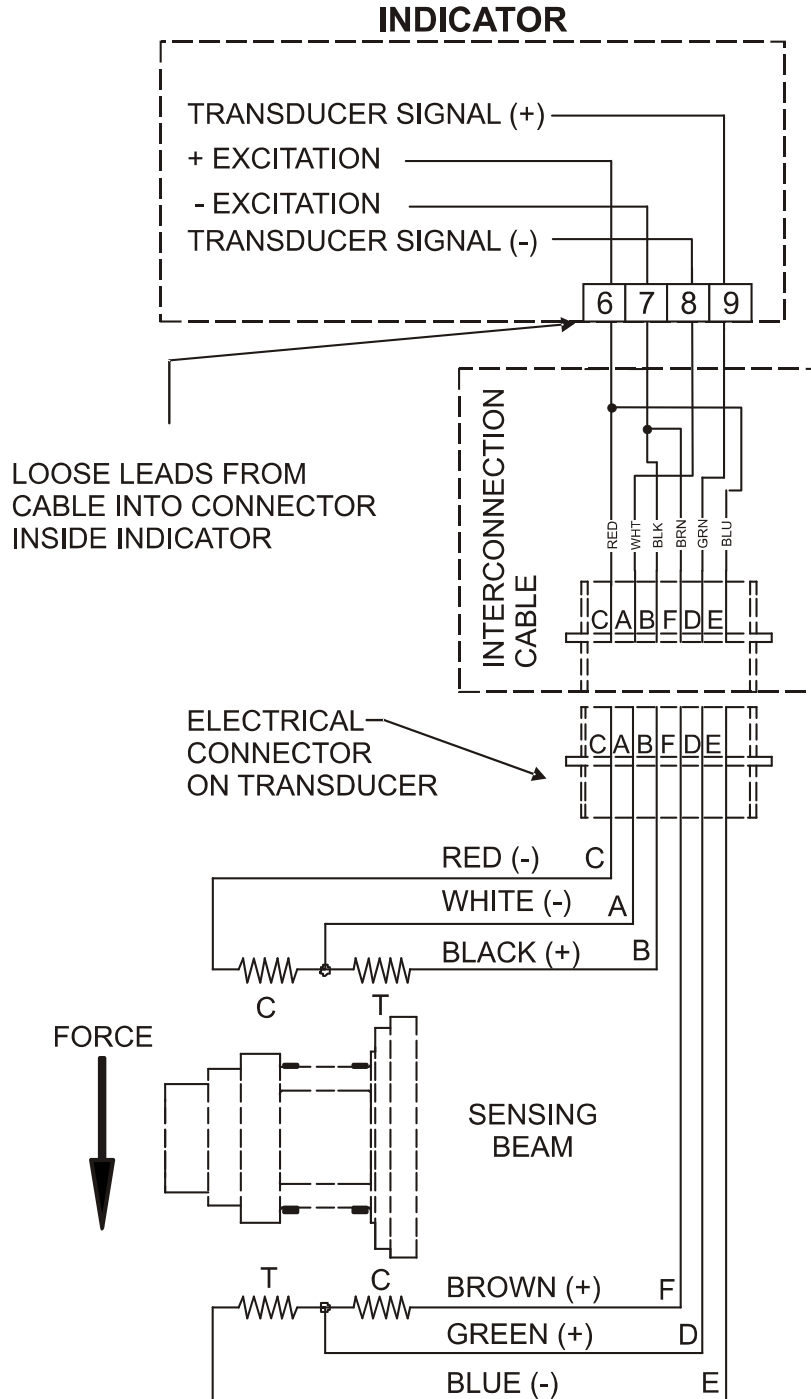


Figure 18 - MODELS C, RS, & UPB TRANSDUCER WIRING

# RIBBON FILAMENT (RFA) TRANSDUCERS

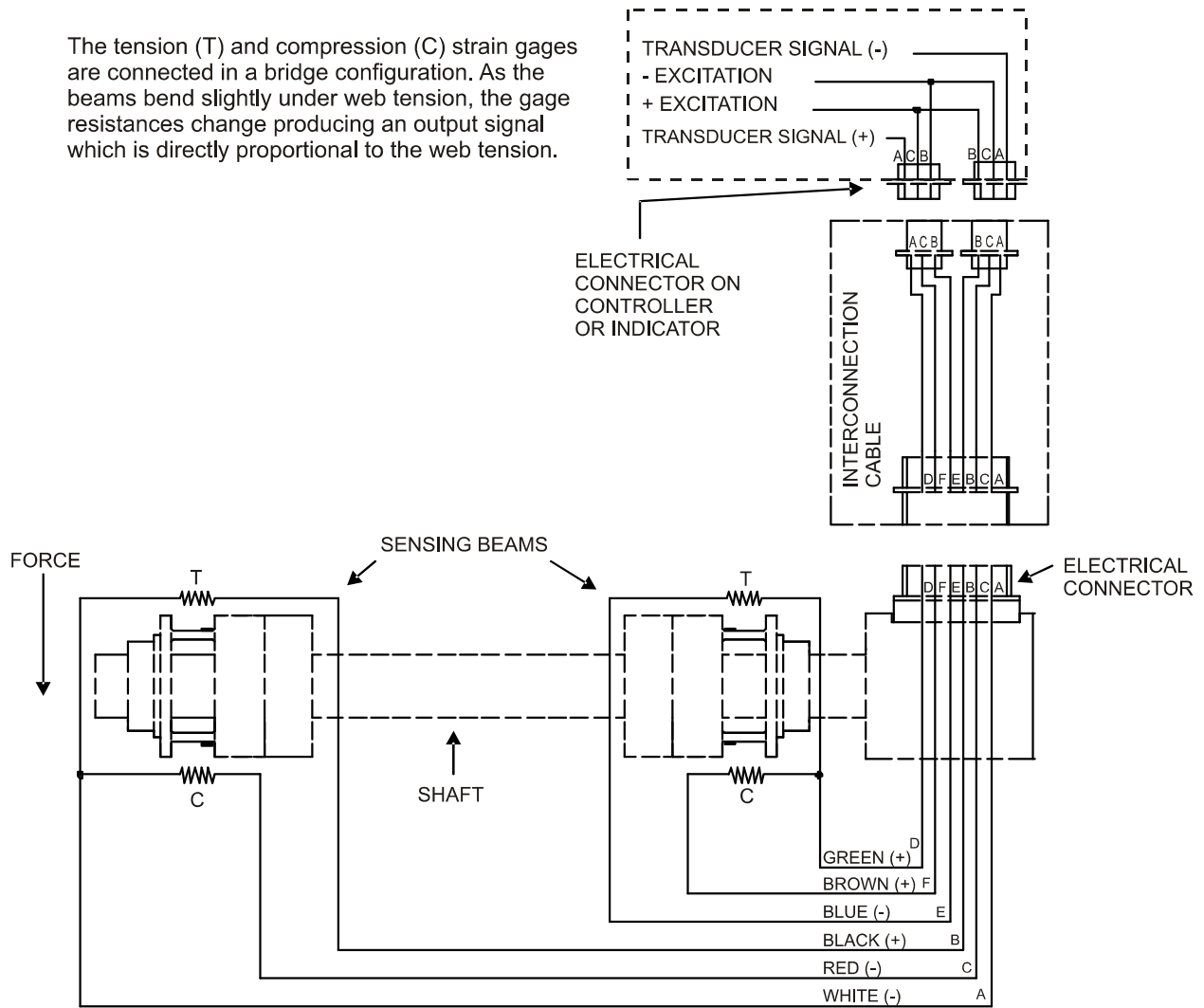
THE TENSION (T) AND COMPRESSION (C) STRAIN GAGES ARE CONNECTED IN A BRIDGE CONFIGURATION. AS THE BEAMS BEND SLIGHTLY UNDER WEB TENSION, THE GAGE RESISTANCES CHANGE PRODUCING AN OUTPUT SIGNAL WHICH IS DIRECTLY PROPORTIONAL TO THE WEB TENSION.



**Figure 19 - RFA TRANSDUCER WIRING**

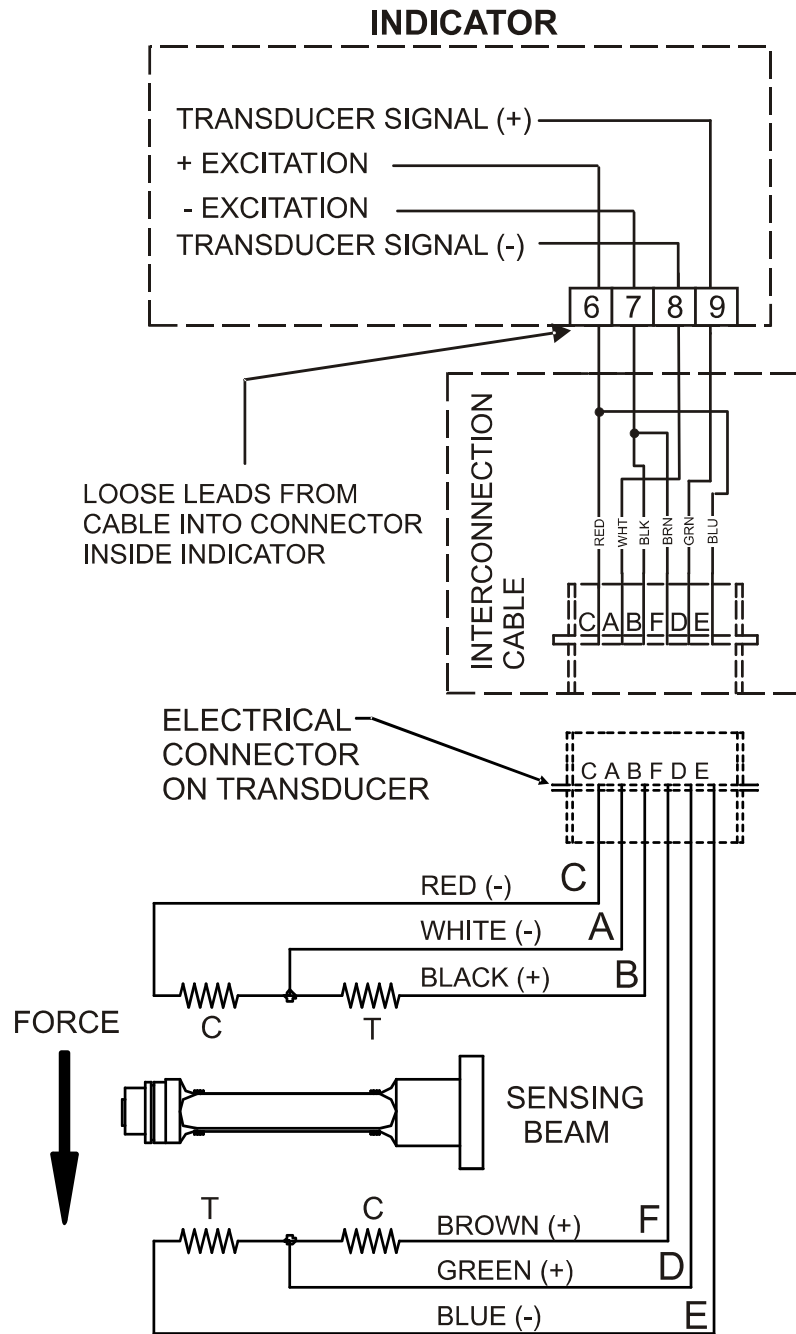
# TENSION ROLL (TR) AND NARROW WEB (NW) TRANSDUCERS

The tension (T) and compression (C) strain gages are connected in a bridge configuration. As the beams bend slightly under web tension, the gage resistances change producing an output signal which is directly proportional to the web tension.



**Figure 20 - TR & NW TRANSDUCER WIRING**

# LOW TENSION (LT) TRANSDUCERS



Note: Extended Range Option (XR) must be used with LT Transducers

**Figure 21 - LT TRANSDUCER WIRING**

# Appendix D: Typical Tensions for Various Materials

## TYPICAL TENSIONS FOR WEB MATERIALS

ACETATE		0.5 lb. per mil per inch of width	
FOIL	Aluminum	0.5 lb. per mil per inch of width	
	Copper	0.5 lb. "	
CELLOPHANE		0.75 lb. per mil per inch of width	
NYLON		0.25 lb. per mil per inch of width	
PAPER 15 lb *		0.4 lb. per inch of width	
	20 lb	0.5 lb. "	
	30 lb	0.75 lb. "	
	40 lb	1.25 lb. "	
	60 lb	2.0 lb. "	
	80 lb	3.0 lb. "	
	100 lb	4.0 lb. "	
* based on 3000 sq. ft. ream			
PAPERBOARD	8pt	3.0 lb. per inch of width	
	12pt	4.0 lb. "	
	15pt	4.5 lb. "	
	20pt	5.5 lb. "	
	25pt	6.5 lb. "	
	30pt	8.0 lb. "	
POLYETHYLENE		0.12 lb. per mil per inch of width	
POLYESTER (Mylar)		0.75 lb. per mil per inch of width	
POLYPROPYLENE		0.25 lb. per mil per inch of width	
POLYSTYRENE		1.0 lb. per mil per inch of width	
RUBBER	<u>GAUGE</u>	<u>AT 25% STRETCH</u>	<u>AT 50% STRETCH</u>
	10 mil	1.75	3.68
	12 mil	1.10	2.03
	16.5 mil	4.09	8.17
	26 mil	2.47	4.97
SARAN		0.15 lb per mil per inch of width	
STEEL	<u>GAUGE - INS</u>	<u>UNWIND-PSI</u>	<u>REWIND-PSI</u>
	0.001 -0.005	1000	4000
	0.006 -0.025	850	3500
	0.026 -0.040	750	3000
	0.041 -0.055	650	2600
	0.058 -0.070	550	2200
	0.071 -0.090	450	1800
	0.091 -0.120	450	1400
	0.121 -0.140	400	1200
	0.141 -0.165	400	1000
	0.166 -0.200	400	900
	0.201 -0.275	400	800
	0.276 -0.380	300	700
VINYL		0.05 lb. per mil per inch of width	

\*\*\* For laminated webs, sum the tension for the individual webs and add 0.1 lb per inch of width.



**OVERVOLTAGE CATEGORY:** Classification of parts of installation systems or circuits with standardized limits for transient overvoltages, dependent on the normal line voltage to earth.

**POLLUTION:** Any addition of foreign matter, solid, liquid or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity.

**POLLUTION DEGREE 2:** Normally only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

# TERMS AND CONDITIONS OF SALE AND SHIPMENT

## 1. THE COMPANY

Dover Flexo Electronics, Inc. is hereinafter referred to as the Company.

## 2. CONFLICTING OR MODIFYING TERMS

No modification of, additions to or conflicting provisions to these terms and conditions of sale and shipment, whether oral or written, incorporated into Buyer's order or other communications are binding upon the Company unless specifically agreed to by the Company in writing and signed by an officer of the Company. Failure of the Company to object to such additions, conflicts or modifications shall not be construed as a waiver of these terms and conditions nor an acceptance of any such provisions.

## 3. GOVERNING LAW

This contract shall be governed by and construed according to the laws of the state of New Hampshire, U.S.A. The parties agree that any and all legal proceedings pursuant to this contract shall take place under the jurisdiction of the courts of the State of New Hampshire in the judicial district of Strafford County.

## 4. PENALTY CLAUSES

Penalty clauses of any kind contained in orders, agreements or any other type of communication are not binding on the Company unless agreed to by an officer of the Company in writing.

## 5. WARRANTY

Dover Flexo Electronics, Inc. warrants, to the original Buyer, its' products to be free of defects in material and workmanship for five years from date of original shipment. Repairs on products are warranted for 90 days from date of shipment. During the warranty period the Company will repair or replace defective products free of charge if such products are returned with all shipping charges prepaid and if, upon examination, the product is shown to be defective. This warranty shall not apply to products damaged by abuse, neglect, accident, modification, alteration or mis-use. Normal wear is not warranteed. All repairs and replacements under the provisions of this warranty shall be made at Dover Flexo Electronics or at an authorized repair facility. The Company shall not be liable for expenses incurred to repair or replace defective products at any other location or by unauthorized persons or agents. This warranty contains all of the obligations and warranties of the Company. There are no other warranties, either expressed or implied. No warranty is given regarding merchantability or suitability for any particular purpose. The Company shall not be liable in either equity or law for consequential damages, losses or expenses incurred by use of or inability to use its' products or for claims arising from same. No warranty is given for products of other manufacturers even though the Company may provide these products with its' own or by themselves. The provisions of this warranty can not be changed in any way by any agent or employee of the Company. Notice of defects must be received within the warranty period or the warranty is void. The warranty is void if the serial number tag is missing or not readable.

## 6. PAYMENTS

Standard terms of credit are net 30 days from date of shipment, providing satisfactory credit is established with the Company. Amounts past due are subject to a service charge of 1.5% per month or portion thereof or 18% per annum. The Company reserves the right to submit any unpaid late invoices to a third party for collection and Buyer shall pay all reasonable costs of such collection in addition to the invoice amount. All quoted prices and payments shall be in U.S. Dollars.

If the Company judges that the financial condition or payment practices of the Buyer does not justify shipment under the standard terms or the terms originally specified, the Company may require full or partial payment in advance or upon delivery. The Company reserves the right to make collection on any terms approved in writing by the Company's Finance Department. Each shipment shall be considered a separate and independent transaction and payment therefore shall be made accordingly. If the work covered by the purchase order is delayed by the Buyer, upon demand by Company payments shall be made on the purchase price based upon percentage of completion.

## 7. TAXES

Any tax, duty, custom, fee or any other charge of any nature whatsoever imposed by any governmental authority on or measured by any transaction between the Company and the Buyer shall be paid by the Buyer in addition to the prices quoted or invoiced.

## 8. RETURNS

Written authorization (MRA) must be obtained from the Company's factory before returning any material for which the original Buyer expects credit, exchange, or repairs. Material returned for credit must be unused, received back within 30 days of original ship date and shall be subject to a re-stocking charge of 15%. Special Product Requests (SPRs), product manufactured specially to customer specifications, and non-DFE product purchased on customer behalf shall not be returnable for any reason. All material returned, for whatever reason, shall be sent with all freight charges prepaid by the Buyer.

## 9. SHIPPING METHOD AND CHARGES

All prices quoted are EXW the Company's factory. The Company shall select the freight carrier, method and routing. Shipping charges are prepaid and added to the invoice of Buyers with approved credit, however the Company reserves the right to ship freight-collect if it prefers. Shipping charges will include a charge for packaging. Company will pay standard ground freight charges for items being returned to Buyer which are repaired or replaced under the Warranty. Claims of items missing from a shipment must be received, in writing, within 30 days of original shipment

## 10. CANCELLATION, CHANGES, RESCHEDULING

Special Product Requests (SPRs), product manufactured specially to customer specifications, and non-DFE product purchased on customer behalf shall not be returnable for any reason. Buyer will be subject to a 15% fee for any standard item on order with the Company which is cancelled by the Buyer. A one-time hold on any item ordered from the Company shall be allowed for a maximum of 30 days. After 30 days, or upon notice of a second hold, Company shall have the right to cancel the order and issue the appropriate cancellation charges which shall be paid by Buyer. Items held for the Buyer shall be at the risk and expense of the Buyer unless otherwise agreed upon in writing. Company reserves the right to dispose of cancelled material as it sees fit without any obligation to Buyer. If Buyer makes, or causes to make, any change to an order the Company reserves the right to change the price accordingly.

## 11. PRICES

Prices published in price lists, catalogs or elsewhere are subject to change without notice and without obligation. Written quoted prices are valid for thirty days only.

## 12. EXPORT SHIPMENTS

Payment for shipments to countries other than the U.S.A. and Canada or to authorized distributors shall be secured by cash in advance or an irrevocable credit instrument approved by an officer of the Company. An additional charge will apply to any letter of credit. There will also be an extra charge for packaging and documentation.

## 13. CONDITION OF EQUIPMENT

Buyer shall keep products in good repair and shall be responsible for same until the full purchase price has been paid.

## 14. OWNERSHIP

Products sold are to remain the property of the Company until full payment of the purchase price is made.

# INDEX

0-10 Volt Tension Output .....	2, 3, 8, 9, 20	Operating Instructions .....	15
230 Volt Power .....	2, 3, 9, 17, 20	Options .....	3
4-20mA .....	2, 4, 8, 9, 20	Output,	
		4-20mA .....	2, 4, 8, 9, 20
		0 to +10V .....	2, 3, 8, 9, 20
AC Power Connections .....	9, 20	Panel Mount .....	2, 5, 7, 18
Auto Zero .....	12	Power Voltage .....	2-3
Cables .....	6	PC Boards .....	19
Calibration,		Quik-Cal™ .....	a, 1, 3
range .....	2	Replacement Parts .....	18
tension meter .....	11	Safety Requirements .....	6
Care and Maintenance .....	16	Set-up .....	11
Circuit Card .....	2, 7, 8, 11, 18, 19	Specifications .....	2
connector .....	18	Standard Features .....	3
Cover .....	1, 5, 18	Tension Limit Switch .....	4, 10, 13-14, 18, 19, 21
Declaration of Conformity .....	29, 30	Tension Meter .....	2, 11, 12, 18, 19
Descriptions .....	1	Temperature Range .....	2
Dimensions .....	5	Terminal Block Connector .....	18
Disassembly .....	1-2	Terms & Conditions of Sale .....	28
Dual Calibration .....	4, 9, 12	Test Points .....	14
Electrical Connections		Transducer,	
standard .....	9, 20	cables .....	6
optional .....	10, 21	connections .....	22-25
transducer .....	22-25	excitation .....	2, 8, 9
Enclosure .....	1, 6, 18	input .....	2
gasket .....	1, 18	Troubleshooting .....	17
Environmental Conditions .....	3	Typical Tensions .....	26
terms .....	27	Warranty .....	28
Excitation .....	2, 8, 9	Weight .....	2
Exploded View .....	1-2	Zero .....	12
Extended Range .....	4, 7	range .....	2
Fuses .....	11, 17, 18, 19		
Input .....	2		
Installation .....	5		
Isolation from Earth Ground .....	3		
Meter,			
analog .....	2, 18		
calibration .....	11-12		
digital .....	4, 11, 18		
damping .....	3, 11, 12, 19		
mechanical zero .....	11		
meter scales .....	2		
non-standard meter scales .....	4		
Mounting Location .....	6		



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