DOVER FLEXO ELECTRONICS, INC.
ISO 9001 CERTIFIED

INSTRUCTION MANUAL
True Tension Indicator
MODEL TI14

5 YEAR WARRANTY

DOVER FLEXO ELECTRONICS, INC.

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For assistance, please call:

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CUSTOMER SERVICE - Replacement Parts, Individual Products, Questions about Orders, Manuals. **customerservice@dfe.com**

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READ THIS!

Your TI14 Indicator has been properly configured at our factory. To install it and start it up, it should only be necessary to use these sections of this manual:

Section 2 - Installation

Section 3 - Calibration and Setup

Section 4 - Operating Instructions

The other sections are for reference and for instruction if you wish to change the configuration at some later time.

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SECTION 1 PRODUCT DESCRIPTION

1.1 GENERAL DESCRIPTION

The TI14 True Tension tension indicator is a device to output and display tension measurements. It can be used with any type of DFE tension transducer to display actual web tension on an analog or digital meter for reference by the machine operator. It also has voltage and current outputs that are proportional to tension, and which can be connected to tension recorders, variable speed drive systems, computers, and other devices for tension control or display purposes.

1.2 OUTPUTS

Each tension indicator circuit has four outputs.

1. Two 0 to 1mA (standard) outputs. One for the front door meter and a second for the remotely mounted meter.
2. 4 to 20 mA
3. 0 to +10 Volts dc (standard) or 0 to -10 Volts dc, selectable.
4. 0 to +10 Volts dc Isolated (Option)

1.3 TI14 INDICATOR EXPLODED VIEW

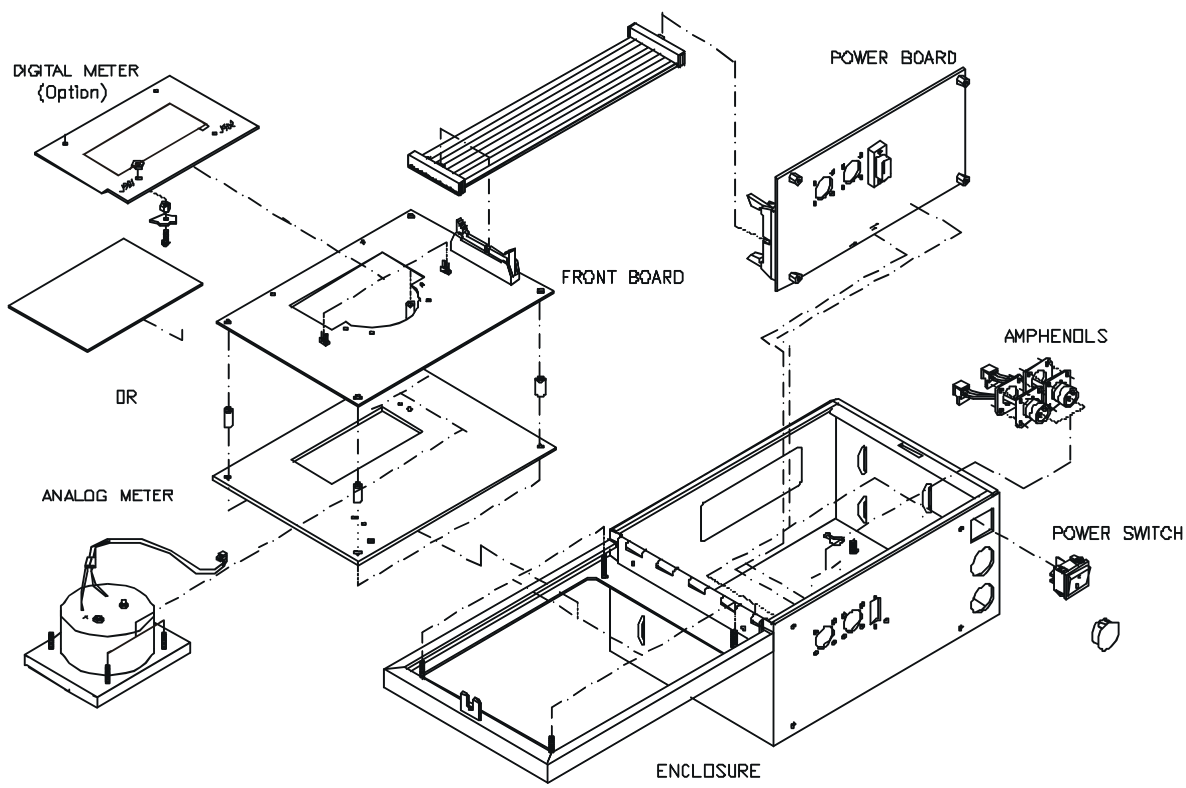

Figure 1 **- TI14 INDICATOR- EXPLODED VIEW**

1.4 SPECIFICATIONS

Power Input	....	115 Volts 60/50Hz single phase @ 1/4 Amp
	....	230 Volts 60/50Hz single phase @ 1/8 Amp
Tension Signal Outputs	....	0 to +10 Volts dc OR 0 to -10 Volts dc @2mA
	....	0 to +10V Isolated (Option)
	....	4-20mA
	....	Two 0 to 1mA outputs
Weight	....	6.6 lbs. (3 KG)
Transducer Signal In	....	500 mVdc at rated load (per pair)
Transducer Excitation	....	5 Volts dc (10 Volts dc with XR option)
Mating Transducer Cable		
Connectors	....	Amphenol MS3106A-10SL-3S
Zero (Tare) Range	....	95% of transducer rating, minimum
Calibration Range	....	25:1
Temperature Range	....	32 to 104° F (0 to 40° C)
System Accuracy	....	1 to 3% typical
Tension Meter	....	Analog, 2%, 1mA, 48 ohm
Standard Tension Meter Scales	....	0 - 1,5,10,25,50,100,150,250,500,1000
Tension Limit Switch Relay		
Contacts (Option)	....	SPDT rated @ 10A/30 Vdc, 10A/250 Vac

1.5 STANDARD FEATURES

SOME OF THESE FUNCTIONS REQUIRE CONFIGURING OR EXTERNAL WIRING. REFER TO SECTION 3 FOR CONFIGURING AND SECTION 2 FOR WIRING.

- **0 to +10 Volt dc Tension Output or 0 to -10 Volt dc Tension Output**. Proportional to web tension. Used as an input to other control systems, computers or data collection devices.
- **Analog Tension Meter**. 1mA, 48 Ohm movement. Std. scales available are 0-1, 5, 10, 25, 50, 100, 150, 250 500, and 1000.
- **Power Voltage Selection**. The TI14 Indicator is designed to operate on two ranges of ac power; 115 Volts 60/50 Hz, and 230 Volts 60/50 Hz. A switch on the power circuit board selects between the two.
- **4-20mA Tension Output**. Used as an input to control systems, computers, or data collection devices.
- **0-1mA Tension Output**. Typically used for an input to a tension readout meter.
- **Status Lights**. Shows status of power On/Off, Dual Meter Scales or TLS High or Low.
- **Meter Damping**. Eliminates vibration of the analog tension meter needle. Also minimizes flicker of the optional digital meter.

1.6 OPTIONS (The option code is shown in parentheses)

SOME OF THESE OPTIONAL FUNCTIONS REQUIRE CONFIGURING OR EXTERNAL WIRING. REFER TO SECTION 3 FOR CONFIGURING AND SECTION 2 FOR WIRING.

- **230 Volt Power (230)**. 230 volt 50/60 Hz power input.
- **Attached Power Cord (APC)**. Type SJ, 3 conductor, 5' long.
- **Dual Calibration (DC)**. Dual meter scale for the standard analog tension meter and/or two running setups. The meter scales may have any ratio, limited only by the range of the transducers. Used in those cases in which a wide range of materials having very wide tension requirements are being run.

- **Digital Meter (DM)**. 4 full digits, red 1" high LED's with over and under range indicators. The maximum range is 0000 to 9999. An over-range indicator lights at values over 9999, and an under-range indicator lights at values below 0. Can be read from further away than the analog meter. Up to 2 decimal places.
- **Extended Range (XRE)**. The transducers are excited by 10 volts instead of the standard 5 volts. Used for low tension applications. The transducers must also have the XR option.
- **Isolated Output (I10)**. Isolates 0-10 volt output signal from ground or circuit common.
- **Negative 10Volt Output (N10)**. Output goes from 0 to -10V instead of 0 to +10V.
- **Nonstandard Meter Scale (NMS).** Any nonstandard analog meter scale. See Specifications, page 2, for standard scales.
- **Tension Limit Switch (TLS)**. Provides relay contact closure at preset tension levels, either high or low. Usually used as a web break detector.

1.7 ACCESSORIES

- **Remote Tension Meter**. Analog, 1 mA, 48 ohm movement. Must be remotely installed. Provides duplicate readout in remote location. (DFE #722-1385). Also available in an enclosure (DFE #723-1453). Connecting Cable for Meter in enclosure (DFE # 721-0967).

1.8 FRONT PANEL

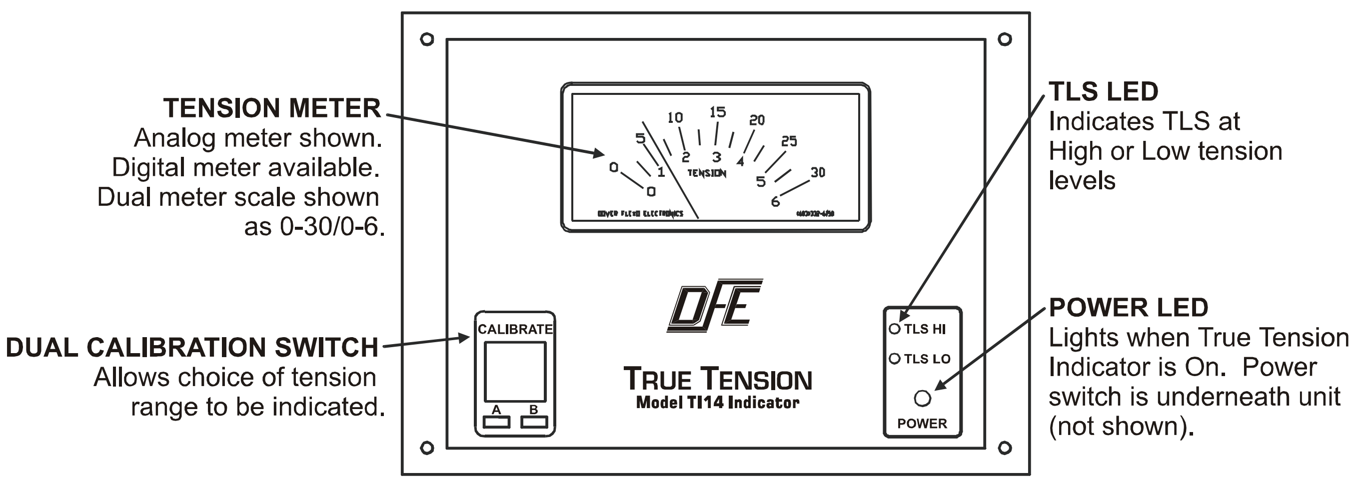

Figure 2 **- FRONT PANEL**

2.1 DIMENSIONS inches (mm)

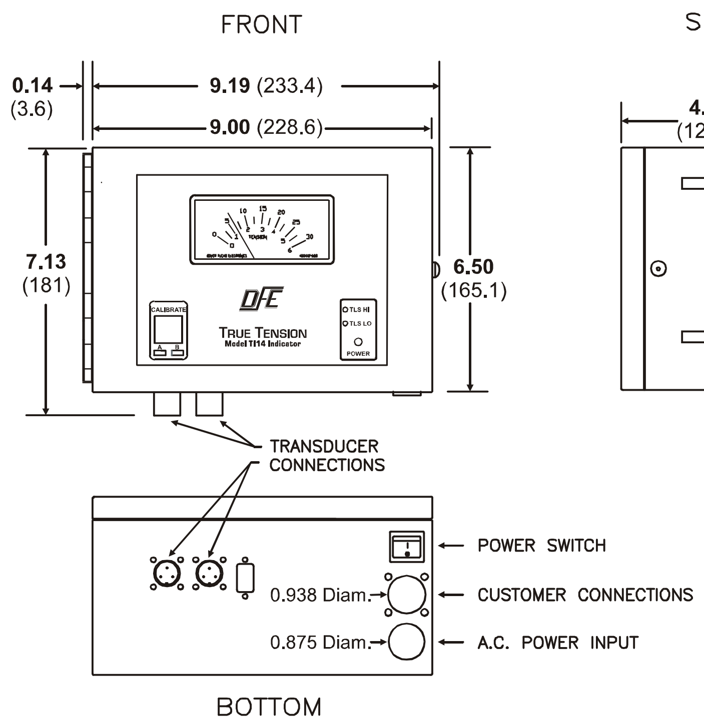

Figure 3 **- TI14 ENCLOSURE DIMENSIONS**

DIMENSIONS OF REMOTE TENSION METER (Accessory)

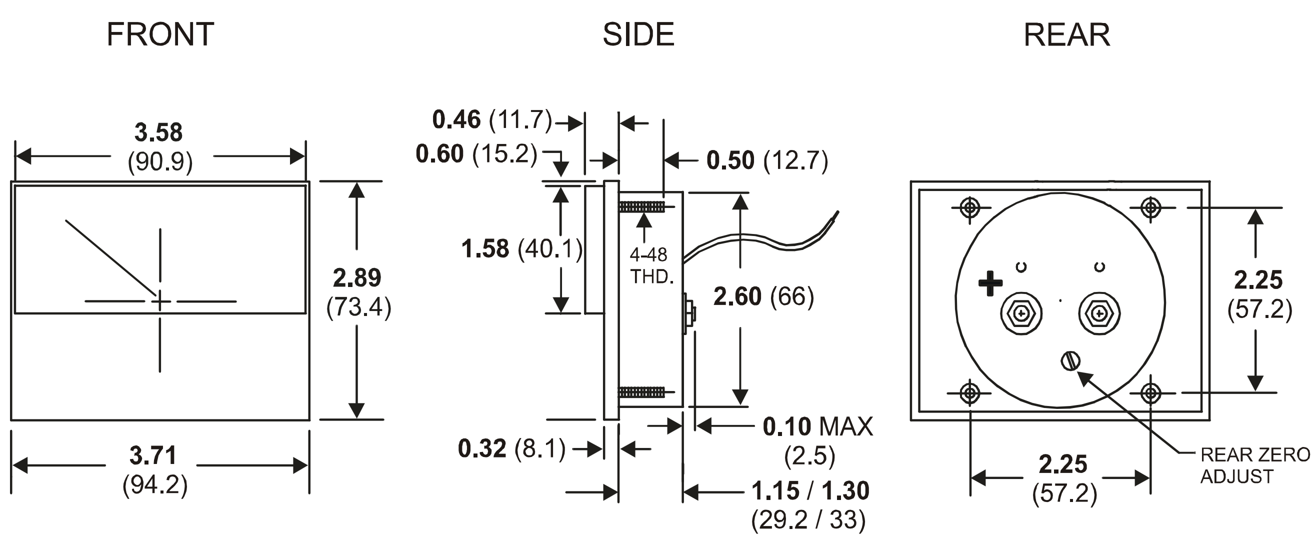

Figure 4 **- REMOTE TENSION METER DIMENSIONS**

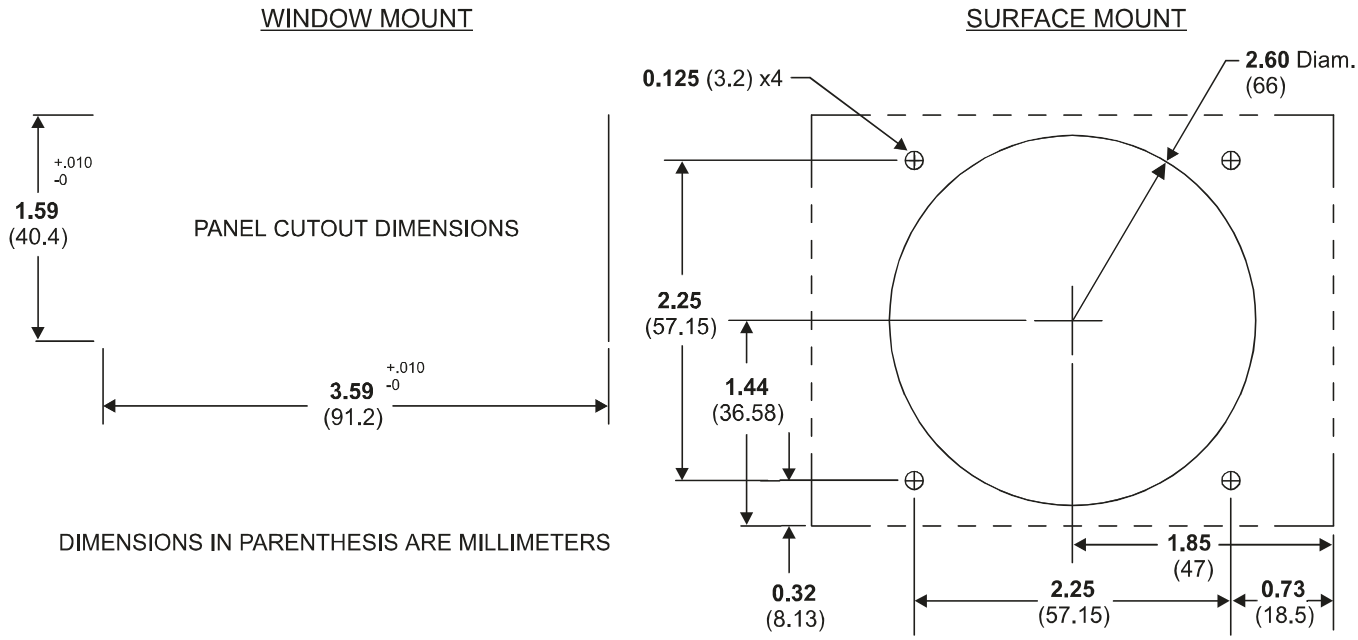

Figure 5 **- REMOTE METER MOUNTING DIMENSIONS**

2.2 SELECTION OF MOUNTING LOCATION

Select a location on the machine frame or a wall that will be convenient for the machine operator to operate the indicator and to see the tension meter easily. Be sure the location is free of vibration, and is dry and clean. Take care to choose a place that the indicator won't be struck and damaged by anything or anyone.

Refer to the dimensions listed in Figure 3 (Figures 4 and 5 if optional meter required) for exact fit. Be sure all connecting wiring is protected.

2.3 INSTALLATION INSTRUCTIONS

The enclosure is fastened to the mounting surface you have chosen by two socket head cap screws (supplied by you). Install the screws in the mounting surface to the dimensions shown in Figure 3. Leave them loose - about six turns. Position the keyholes in the back panel of the enclosure over the screws and slide it down until it locks in place. The door must be open to tighten the mounting screws.

2.4 PREPARING THE POWER CORD

a. The cord must be equipped with a third grounding wire, and the plug must have three prongs.

b. Strip the free end of the wires evenly as shown in Fig. 6.

c. Make the connections of power cord wires to terminal block TB201 shown in Fig. 7 on the following page. (NOTE: Green is ground)

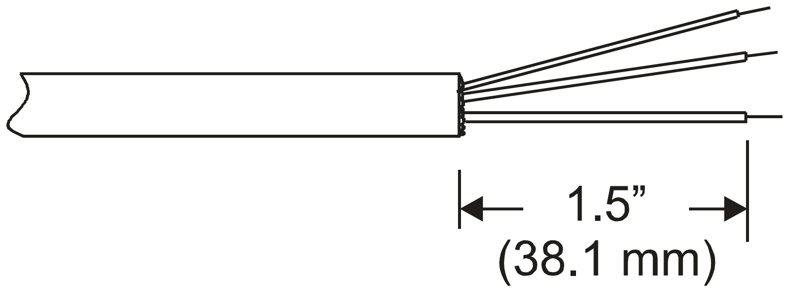

Figure 6 **- PREPARING THE POWER CORD**

2.5 CONNECTING THE TRANSDUCERS

a. The sensor roll includes one or two transducers. These parts sense the tension on the roll, and send a signal back to the True Tension unit. Make the connections for the transducers. If you are using pre-wired connectors supplied by Dover Flexo Electronics, plug in the connectors. It does not matter which one goes to which plug.

Transducer cable types:

TRANSDUCER MODEL	CABLE LENGTH	CURRENT PART NUMBER	OLD PART NUMBER	NUMBER OF CABLES NEEDED
Model C transducer with straight connectors on transducer end.	SPECIFY	721-0085	E197A-15	2
Mode C transducer with right angle connectors on transducer end.	15' (4.6m)	721-0083	E1332A-15	2
Model NW transducer	SPECIFY	721-0962	E1308A-15	1
Model RF Transducer	SPECIFY	721-0995	E1976A-15	1
Model TR Transducer	SPECIFY	721-0995	E1976A-15	1

2.6 ELECTRICAL CONNECTIONS

Refer to the drawing below for electrical connections to the TI14 Power Board.

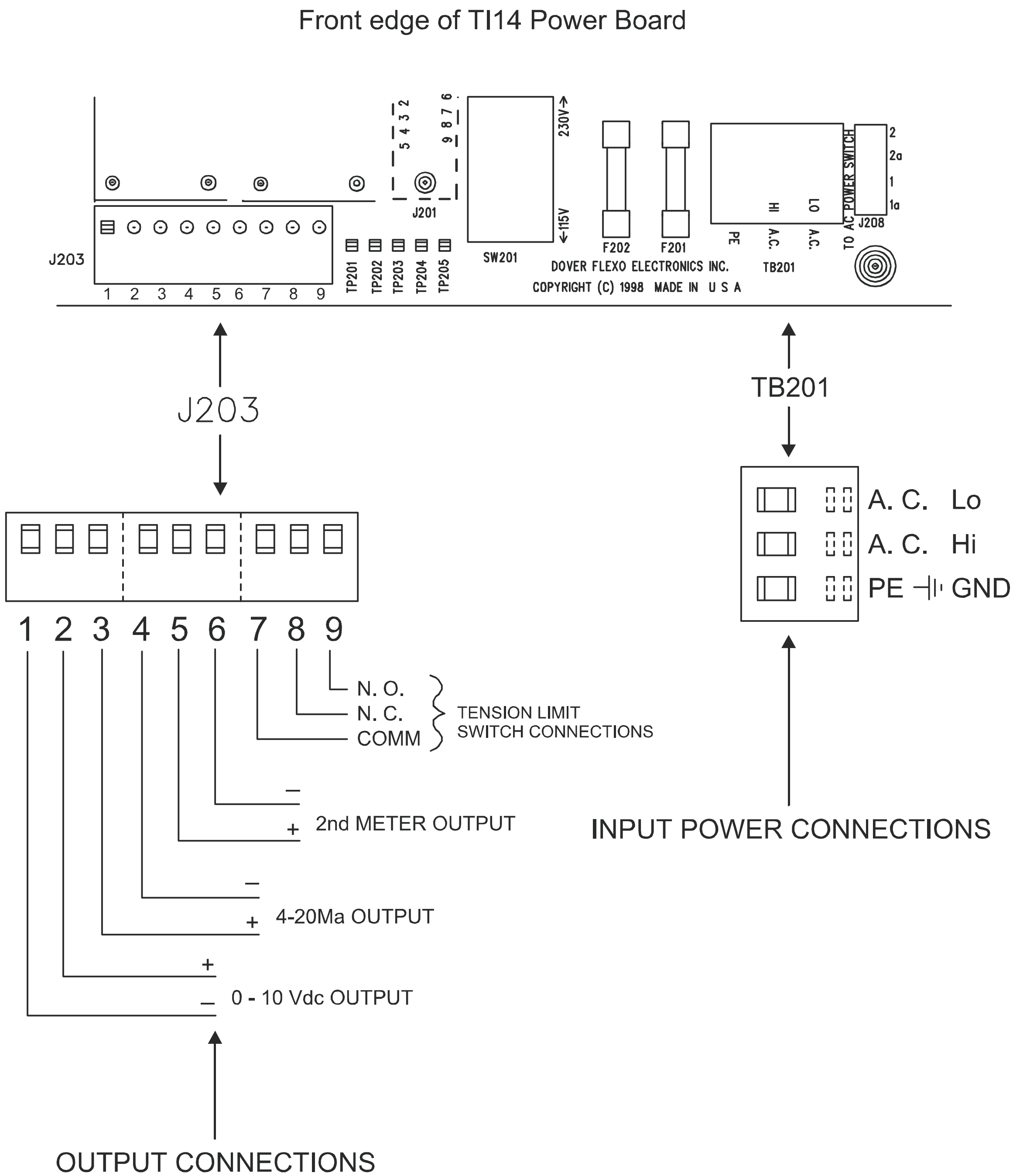

Figure 7 **- TI14 ELECTRICAL CONNECTIONS**

SECTION 3 CALIBRATION AND SETUP

3.1 OPENING THE INDICATOR

The loosening of the hex screw on the right side of the indicator front cover is all that is needed to open the cover. The tool required for this is a M3 (HEX) allen wrench. Opening up the unit is necessary for the following things to be accomplished:

- Zeroing the tension meter for the transducer roll (Tension sensing roll).
- Changing the signal output.
- Changing the transducer excitation voltage.
- Changing the power selection switch.
- Changing amphenol connectors.
- Damping the meter.

CAUTION!

Many of the parts inside the TI14 can be damaged by sparks caused by static electricity. You can prevent this by making sure both you and your work surface are properly grounded before you open the case of the indicator.

3.2 ZERO THE TENSION METER

This step is only necessary if the tension meter needle does not rest on 0 when the power is turned off. Turn off power to the TI14. Turn the adjustment screw on the rear of the meter as required to set the meter needle at 0 on the scale.

3.3 CALIBRATE THE TENSION METER (Refer to Figure 10, page 10 for adjustment pots.)

a. Find an object of known weight at least as heavy as 25% of the tension meter full scale number. (A spring scale can also be used). Get a length of rope, wire or cable about 15 ft.(3 meters) long.

b. Turn on power to the TI14.

c. Turn the CAL pot. (RT4) clockwise 5 turns (This makes the ZERO pot. setting more accurate). Turn the ZERO pot. (RT12) as required to set the meter needle at 0.

d. Fasten one end of the rope in the machine and thread the other end around the transducer roll in exactly the same path as the web will take. Be sure it does not pass around any driven rolls, drag bars, or anything else that can affect tension. Refer to Figure 8 below.

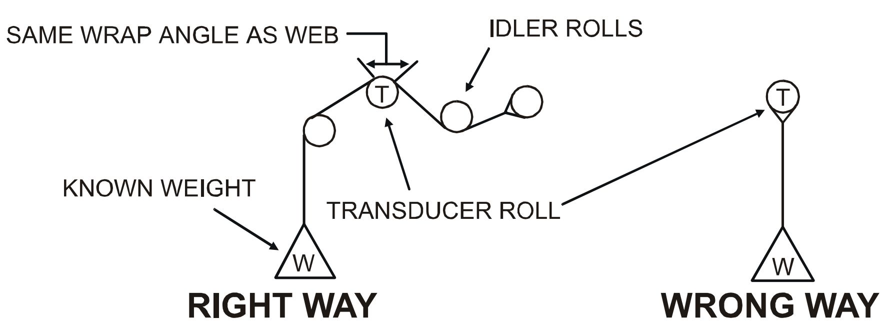

Figure 8 **- WEB PATH FOR METER CALIBRATION**

e. Attach the weight to the free end of the rope as shown above. Adjust the CAL pot. (RT4) as required to set the meter needle at the value of the weight. See Note 2.

f. Remove the weight and observe the tension meter. If the needle is not on 0, adjust the ZERO pot. as needed.

g. Repeat steps "e" and "f " if needed.

h. The 4-20mA output is automatically calibrated along with the 0-1ma output. No additional action need be taken.

i. Adjust the METER DAMPING pot. (RT6) while the machine is running to minimize meter needle movement. Turn the METER DAMPING pot.(RT5 or RT6) clockwise (CW) to stabilize the meter reading. This only affects the meter. The tension output signals are not damped.

TENSION METER CALIBRATION IS COMPLETED!

NOTES: 1. If using remote tension meter, balance it with local meter by adjusting the External Meter Balancing pot. on the Front board.

2. For UPB-type transducers: As web tension is applied, the tension needle (or the reading on the digital meter) should increase. If it goes downward instead, you must reverse either the signal connections or the excitation connections. This can be done by removing the plugs from the standard connectors on the Power board (J204 and J205), and using the other connectors (J206 and J207).

YOUR TI14 TRUE TENSION INDICATOR HAS BEEN PROPERLY CONFIGURED AT THE FACTORY. IT SHOULD NOT BE NECESSARY TO MAKE ANY CHANGES. USE THE FOLLOWING SECTIONS ONLY TO VERIFY THE CONFIGURATION OR TO RECONFIGURE THE INDICATOR IF YOUR APPLICATION REQUIREMENTS CHANGE.

3.4 THE TI14 CIRCUIT CARDS

The following two figures are the two PC boards featured in the TI14. On each is shown the various components you may need to adjust.

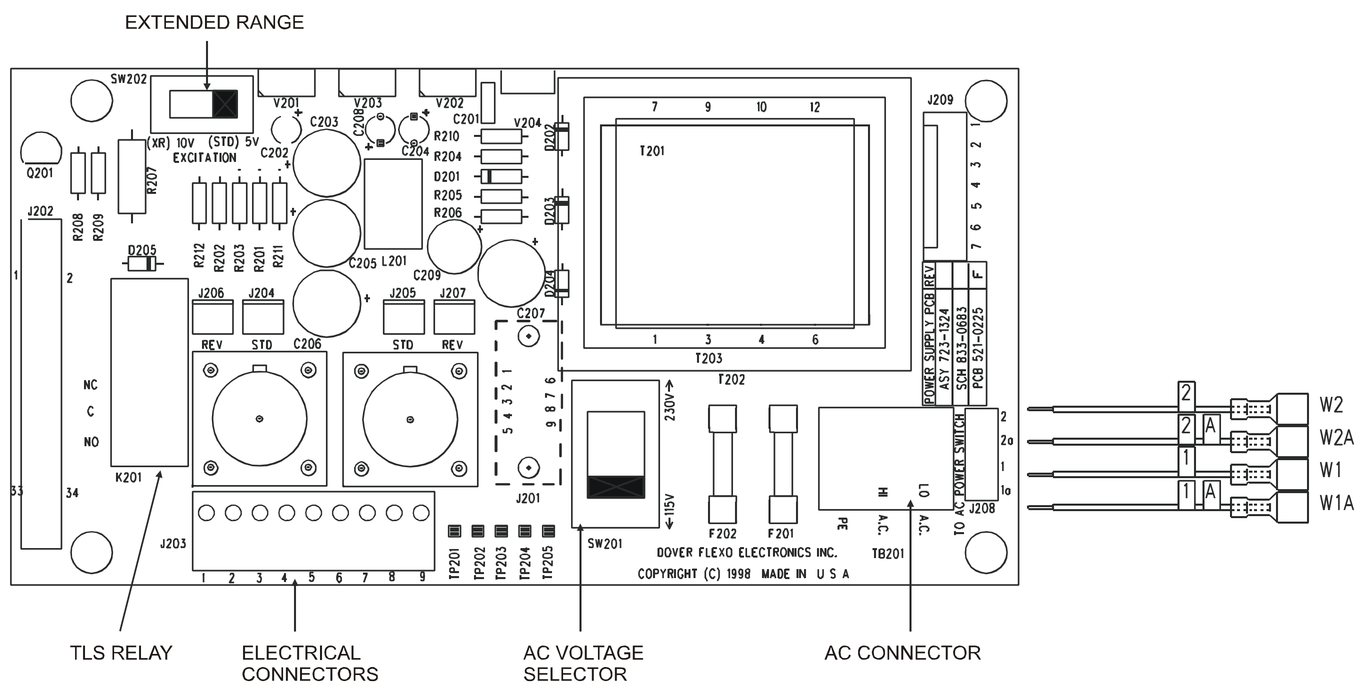

Figure 9 **- TI14 POWER BOARD**

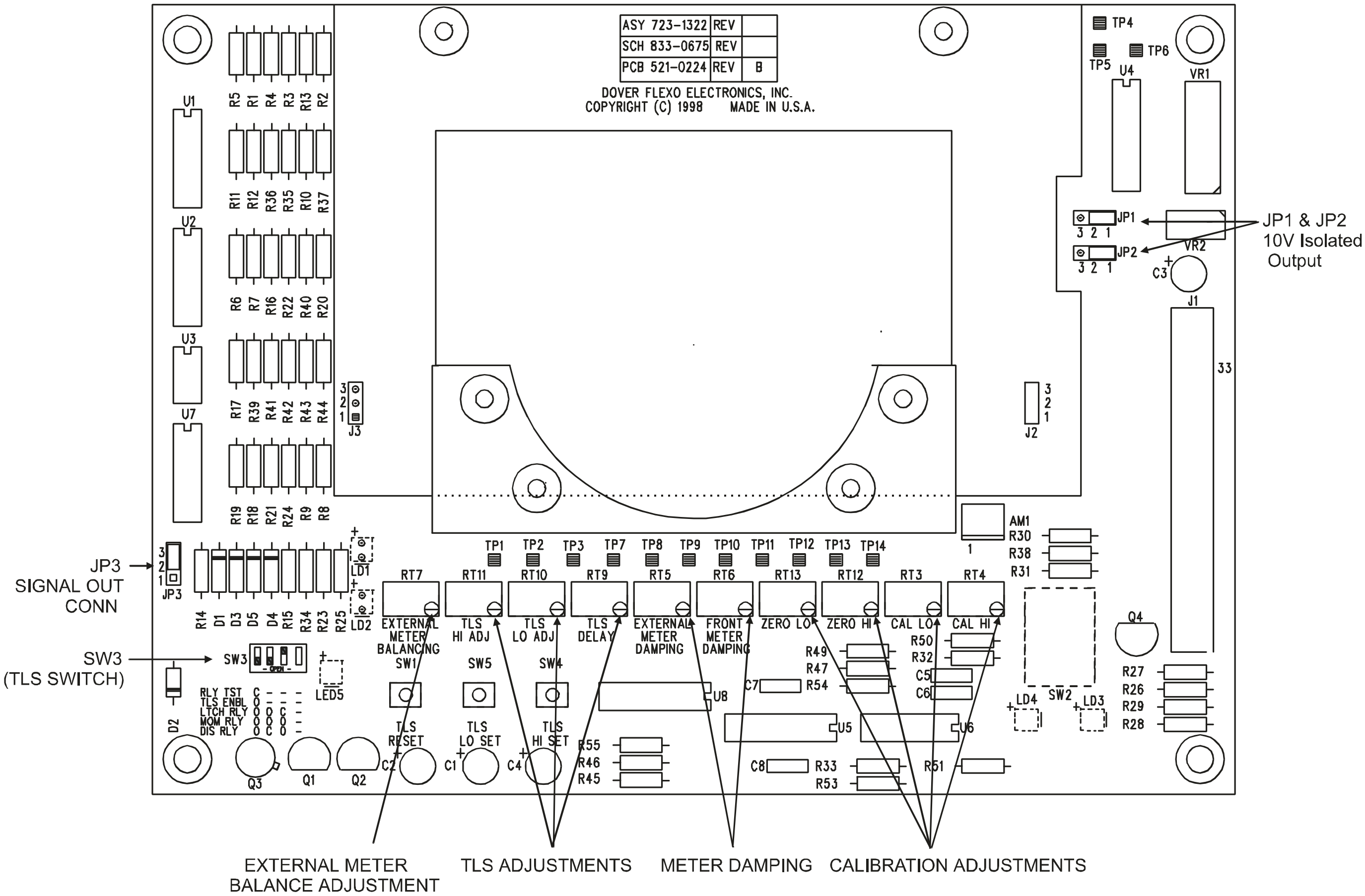

Figure 10 - **TI14 FRONT BOARD**

3.5 POWER VOLTAGE SELECTION (See Figure 9, Power Board)

The TI14 indicator is designed to operate on either 115V-60Hz or 230V-50/60Hz power. Select the correct voltage for your installation with the SW201 switch.

CAUTION! The wrong selection will damage the Indicator!

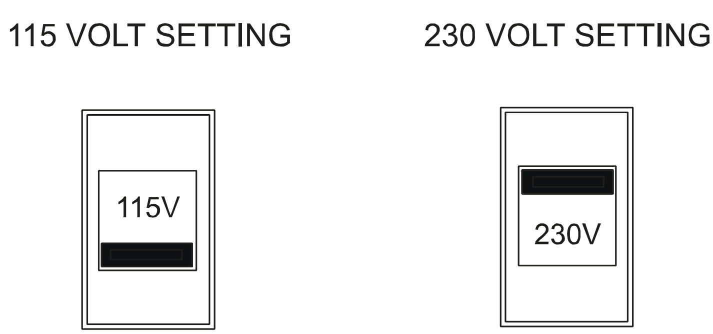

Figure 11 - **POWER SELECTION SWITCH SW201**

3.6 SIGNAL OUTPUT CONNECTIONS

The terminal block on the power PCB includes contacts for an output to a remote meter or indicator. You may select voltage or current-loop outputs, or both. At any moment, the output here is proportional to the percentage of the indicator's full range. For example, if the indicator is set to read 0-100 ounces, and is indicating 50 ounces, the signal output will also be 50% of maximum (+5Vdc, 12mA).

a. To select between 0 to +10V or 0 to -10V necessitates a change on jumper JP3. (See figure 10) JP3 is located on the lower left side of the front card. Position the jumper on 1 and 2 for 0 to -10Vdc, and on 2 and 3 for 0 to +10Vdc

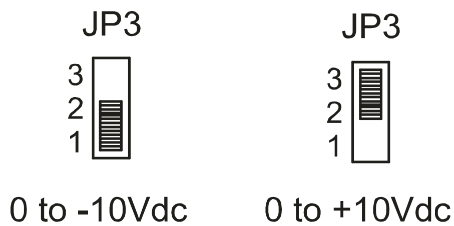

Figure 12 **- SIGNAL OUTPUT CONNECTIONS**

3.7 4-20 ma CURRENT OUTPUTS

No special set up is required. If the tension meter output is calibrated properly, this output will produce ~4ma when the meter reads 0, and ~20mA when the meter reads its full scale value.

3.8 EXTENDED RANGE and CHANGING THE TRANSDUCER EXCITATION VOLTAGE

(See Page 3 for description, Page 9 Figure 9 for Power Board)

This unit can be set to provide two levels of excitation voltage. The "standard/extended range" selection switch (SW202) is located towards the back of the unit on the Power PCB (See Fig. 9). When the switch actuator is set toward the right of the board, the switch is in the normal or 5V excitation position. When the switch is set toward the left of the PCB, it is in the extended range or 10V position. The excitation voltage is marked on the silk screen in front of the switch. Slide the switch actuator to the position appropriate for the transducer(s) you are using.

CAUTION!

Do not use extended range excitation unless the transducer is designed for this. The wrong excitation voltage can damage the transducer! If in doubt about the correct excitation voltage, contact the Service Department at Dover Flexo Electronics for assistance.

10 Volts provides a wider operating range. **CAUTION - The transducers MUST have the XR option if you select 10 Volts! Otherwise they will be damaged.**

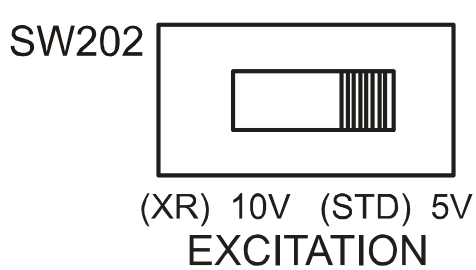

Figure 13 **- SELECT TRANSDUCER EXCITATION VOLTAGE**

3.9 DUAL CALIBRATION (See Page 3 for description)

First determine if your unit has Dual Calibration. Units with this feature will have a label and pushbutton on the front panel located on the lower left corner of the enclosure. If your unit does not have this option and you wish to have it installed, you will need to send the unit back to the factory for installation (refer to Returns, page 28, paragraph 8).

To calibrate for a second scale, follow the calibration procedure in section 3.2 and use RT13 for the ZERO pot. and RT3 for the second CAL pot. Push the front panel button to select between the two different scales, CAL A and CAL B, and the LED indicators will light to indicate which scale is active.

3.10 TENSION LIMIT SWITCH (TLS)

Refer to Figures 10 (page 10) and 14 (below) for location of adjustment pots and switches on the Front board. TLS on the TI14 can have a low setpoint and a high set point, there is also a relay which can be latched N.O. or N.C. when the low or high setpoint has been exceeded. This relay can be enabled or disabled by configuring a DIP switch (SW3) on as shown below.

a. The lower setpoint adjustment is made by pushing in switch SW5 and holding the switch in while adjusting pot RT10. The reason for holding in SW5 is to permit the user to view the actual setpoint on the front panel tension meter, this output is directly proportional to the full scale reading on the meter.

b. To adjust the high setpoint use SW4 and RT11 pot.

c. Use the text directly under SW3 for configurations to enable or disable the relay latching function and to enable or disable the TLS option.

d. The relay outputs can be connected to the J203 terminal block located on the power PCB. See Section below.

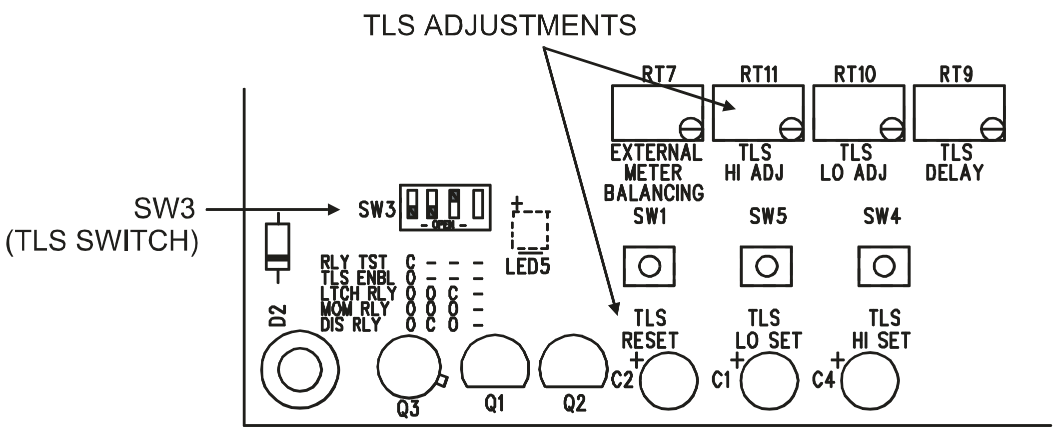

Figure 14 **- TENSION LIMIT SWITCH SETTINGS**

3.11 CONNECTIONS FOR TENSION LIMIT SWITCH FUNCTION (See Figure 7, page 7)

a. Make the connections for the tension limit switch function (TLS) on J203 terminal block on power PCB. This function provides an alarm if the tension moves too high or low. It can be used to detect a break in the web. You set the limits during the set-up process. Connections are terminal 7 (COM- Common), terminal 8 (NC- normally closed), and terminal 9 (NO- normally open). Make one connection to terminal 7.

b. Make the other connection depending on the function you want. If the relay contacts should remain open as long as the tension is correct, use terminal 9 (NO - normally open). If the relay contacts should remain closed as long as the tension is correct, use terminal 8 (NC - normally closed).

3.12 10V ISOLATED OUTPUT

This is a factory installed option. If your unit is not equipped with this option and it is required, the unit will have to be returned for its installation. Please contact Technical Service.

With this option, the ± 0-10 Vdc output can be isolated from ground or circuit common. The user will need to check the position of jumpers JP1 and JP2 for the appropriate selection.

Figure 15 **- 10V ISOLATED OUTPUT JUMPERS**

3.13 DIGITAL METER (See Page 3 for description)

Before using the Digital Meter, it must be adjusted to accommodate the expected maximum tension. THIS HAS BEEN DONE AT THE FACTORY. NO CHANGES SHOULD BE NEEDED!

The calibration procedure is the same as for the analog meter. Refer to Section 3, page 8. **CAUTION:** When setting the ZERO pot. pay attention to the under-range indicator. The correct setting is where the light just goes out as the ZERO pot. is turned clockwise.

***** **OPTIONAL PROCEDURE** *****

The range of the Digital Meter is set at the factory, and is based on the maximum tension desired by the user. Use the following procedure to reset the range if you need to read higher tension than the meter was originally set to read.

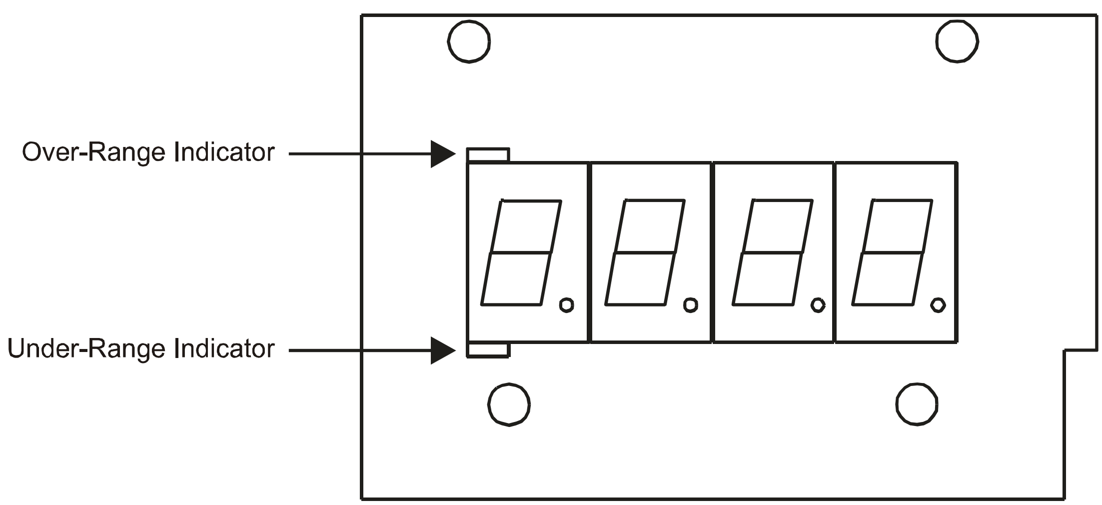

Figure 16 **- DIGITAL METER DISPLAY**

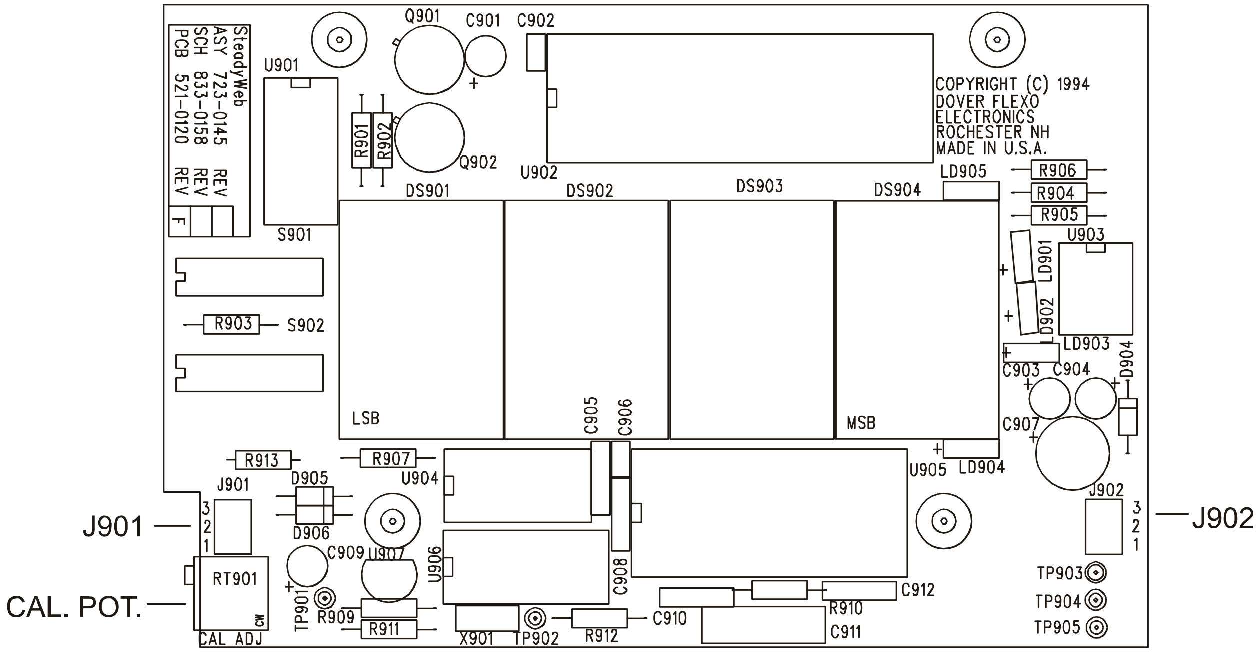

Figure 17 - **DIGITAL METER CARD**

a. Determine the maximum tension to be used. Refer to Specifications, Section 1.4, and select the next highest analog meter scale.

b. Determine the number of decimal places for the display. Unless the full-scale tension is very low, it is best to use the minimum of decimal places. This produces a stable display.

c. Turn off power. Open the unit to expose the back side of the Digital Meter. Set the S901 and S902 switches as follows:

	SWITCH S901								**SWITCH S902**							
RANGE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0 - 9.9*	O	O	C	O	O	C	O	O	O	O	C	O	O	C	C	--
0 - 99	O	O	C	O	O	C	O	O	O	O	O	O	O	C	C	--
0 - 999	O	C	O	O	C	O	O	C	O	O	O	O	C	C	C	--
0 - 9999	C	O	O	C	O	O	C	O	O	O	O	C	C	C	C	--

*Use this range only if you really need the decimal point. Otherwise use the 0-99 range settings.

d. Measure the input voltage to the digital meter at TP7 (+) and TP8 (-) on the front board.

e. Adjust the ZERO A pot. (RT12) on the Front board for 10Vdc at the points in d above.

f. Adjust the CAL ADJ pot. (RT901) on the Digital Meter board to the full-scale value selected.

g. Calibrate the meter according to the procedure in Section 3. **CAUTION:** When setting the ZERO pot. pay attention to the under-range indicator. The correct setting is where the light just goes out as the ZERO pot. is turned clockwise.

SECTION 4

OPERATING INSTRUCTIONS

Once the unit has been installed and electrical connections have been made, turn on the power using the Power On/Off switch located at the bottom of the enclosure. Wait for five minutes for the unit to warm up and for the power supplies to stabilize. If you have not zeroed and calibrated the unit, do so now (refer to section 3). Once the unit has been zeroed and calibrated, the user can choose which features to use. Refer to Section 3, Calibration and Setup to configure the particular feature you wish to use. If any of the features do not seem to work correctly, refer to Section 6 for troubleshooting hints or call Dover technical service.

SECTION 5

CARE AND MAINTENANCE

The True Tension TI14 unit requires very little maintenance. If necessary, clean the overlay on the front panel using a small amount of a gentle solvent like Windex®. Do not use strong petroleum-based solvents - these could damage the panel material. Do not use large amounts of water.

Monitor the tension meter any time there is no web in the machine. It should read near zero. Periodically (at least annually) re-calibrate the unit to verify accuracy.

6.1 INTRODUCTION

Following is a list of common troubleshooting problems. If your unit has a different type of problem not listed below, please see the full troubleshooting procedure in Section 6.2. You may want to contact DFE Technical Support at (603) 332-6150 for immediate help, or if necessary, instructions for return for repair.

A. ***Unable to zero***

This may happen If, during zeroing, the output from the transducers is equal to 95% of the full range of the indicator. (After zeroing, this would only allow the indicator to use 5% of the range.) Before zeroing, be sure the web and any other weights have been removed from the sensor roll.

Inability to zero can also happen if there is a lot of variation in the signals from the transducers while the TrueTension indicator is trying to zero. This could be caused by some sort of weight or load on the sensor roll, or by a problem with the transducers or connecting cables. If necessary, check for a hardware problem by substituting the transducers and cables or simply disconnect them. You should be able to zero with no input. This symptom could also be caused by a faulty power supply for the transducer excitation voltage.

B. ***Unable to calibrate***

This may happen if the setting for the calibration point is not logical (below the zero point). Attach the weight as shown in Fig. 8 on page 8 in the calibration section.

Inability to calibrate can also happen if there is a lot of variation in the signals from the transducers while the True Tension is trying to calibrate. This could be caused by a problem with the transducers or connecting cables. Do not use stretchy material for your rope. Do not let the weight sway. Do not pass the rope over any driven or braked rolls, or drag bars.

C. ***Analog output not working correctly***

If you have chosen the 0-10V voltage output, and the voltage is not present, check for a short-circuit or very low impedance in the circuit to the remote indicator.

If you have chosen 0-20 mA or 4-20mA current-loop output, and the remote indicator does not go through the full range, check for a very low impedance in the circuit to the remote indicator.

D. ***If there is no display on the True Tension Indicator***

Check the AC connections to the terminals on the Power PCB of the TI14. Check the fuses inside the unit (See Fig. 9, F201 and F202). There may also be a problem with the 5V power supply inside the unit.

E. ***If the Tension Limit Switch is not operating***

Check to be sure the operating mode has been set correctly (momentary or latching). Check that the high and low trip points have been set correctly. The relay for this function may be set up for either normally-open or normally-closed action. Check the terminals at the terminal block on the Power PCB.

6.2 TROUBLESHOOTING PROCEDURE

Note: **This procedure should be performed by qualified personnel. DFE assumes NO responsibility for injury or damages resulting from it's use.**

1. Turn Power off. Ensure meter reads zero, see Section 3 : Calibration to adjust. If the meter zero will not adjust call DFE Technical Support (see Note 1 next page).
2. Power on. Connect the negative lead of a voltmeter (DVM preferred) to test point TP204 on the power board in the bottom of the unit.
3. Read voltages thru step 8 prior to any other actions.

4. Connect positive lead to TP205 on the power bd, Meter should read negative 15Vdc. (for analog meters Swap the leads for this test only, it then reads +15Vdc)
5. Connect positive lead to TP201 on the power bd 1, Meter should read Positive 15Vdc.
6. Connect positive lead to TP202 on the power bd, Meter should read Positive 5Vdc.
7. Connect positive lead to TP203 on the power bd, Meter should read Positive 5Vdc or 10Vdc depending on excitation desired for tension transducers. (See Setup)
8. If all Voltages are good proceed, If all voltages are low check the Input power switch for a correct setting. (115 / 230 Vac switch), If all voltages are very low / zero replace both fuses. Use slow-blow type fuses. If this does not help see Note 1 below.
9. With no web on the Tension roller, Can you zero the meter using the zero pot? If yes Skip to Step 13.

   NOTE: These are 25 turn pots, you may have to turn them many turns to see an effect. Turn clockwise to increase the meter position if it reads below zero, Turn counterclockwise to reduce it to zero.
10. Disconnect the cables to the transducers at the bottom of the unit.
11. Can you zero the meter using the zero pot with the cable disconnected? If Yes, Skip to step 15 to Ohm check your cables and Transducers.
12. If not, connect your positive lead to TP7 on the front panel board. Turn the Zero pot to get a zero volt reading. If unable to achieve a zero reading, see Note 1at the end of this section. Info: You may need to turn the pot many turns, it is a 25 turn pot. Turn clockwise to increase the meter position if it reads below zero, turn Counterclockwise to reduce it to zero.
13. If Zero is good, Thread a rope and Hang a weight per the Calibration instructions. If the meter reads negative, Skip to Step 15 To check Transducers. If the meter reads an incorrect weight, Adjust the Cal pot to correct the reading. If the meter reads zero or the correct weight got to next step
14. Check 10 Volt output, It should read a value proportional to the meter scale reading. Thus a mid scale reading is 5Vdc. TP14 is the output on the front board.
    A. If reading is correct, check the 4-20ma output if desired, It should also be correct. TP10 to TP11 on the front board are the 4-20mA output there. Point: The 4-20 circuit must be connected to a load to get a correct reading. If the meter read zero in the previous step check the connector at AM1, If voltage exists at pin 1, the meter has failed, See Note 1 below.
    B. If reading is wrong, Disconnect the output and recheck the reading. If the reading is good with the output disconnected, Check the wiring and equipment receiving the signal for a shorted connection.If the reading is still bad, See Note 1 below.
15. Transducer and Cable Test:
    A. First, Verify your force direction arrows point in the direction the web pulls the roll.
    B. Verify you have proper clearance & play in the transducers per the installation manual.
    C. If you corrected something here, return to the step failed above & retest.
16. At the Indicator end, with the cable connected to the transducer, measure ohms:
    A. On each 3pin Cable connector:
       1. Pin A to Pin B should read 100 ohms.
       2. Pin A to Pin C should read 100 ohms.
       3. Pin B to Pin C should read 200 ohms.

    Info: Double these values for XR transducers. Pressing on the roller should cause some change in these values unless very high load ratings are in use. They should return to original value when released.
17. If test 16 fails, remove the cable from the transducer and re-test the transducer itself using the above test. In the case of the transducer having a 6 pin connector, Pin D to E = A to B, D to F = A to C and E to F = B to C on the second plug. If the Transducer passes, repair or replace the cable. If it fails see Note 1. Point: Be sure you are testing the correct transducer, If in doubt, test both!

6.2 TROUBLESHOOTING PROCEDURE..continued

4. Connect positive lead to TP205 on the power bd, Meter should read negative 15Vdc. (for analog meters Swap the leads for this test only, it then reads +15Vdc)
5. Connect positive lead to TP201 on the power bd 1, Meter should read Positive 15Vdc.
6. Connect positive lead to TP202 on the power bd, Meter should read Positive 5Vdc.
7. Connect positive lead to TP203 on the power bd, Meter should read Positive 5Vdc or 10Vdc depending on excitation desired for tension transducers. (See Setup)
8. If all Voltages are good proceed, If all voltages are low check the Input power switch for a correct setting. (115 / 230 Vac switch), If all voltages are very low / zero replace both fuses. Use slow-blow type fuses. If this does not help see Note 1 below.
9. With no web on the Tension roller, Can you zero the meter using the zero pot? If yes Skip to Step 13.

   NOTE: These are 25 turn pots, you may have to turn them many turns to see an effect. Turn clockwise to increase the meter position if it reads below zero, Turn counterclockwise to reduce it to zero.
10. Disconnect the cables to the transducers at the bottom of the unit.
11. Can you zero the meter using the zero pot with the cable disconnected? If Yes, Skip to step 15 to Ohm check your cables and Transducers.
12. If not, connect your positive lead to TP7 on the front panel board. Turn the Zero pot to get a zero volt reading. If unable to achieve a zero reading, see Note 1at the end of this section. Info: You may need to turn the pot many turns, it is a 25 turn pot. Turn clockwise to increase the meter position if it reads below zero, turn Counterclockwise to reduce it to zero.
13. If Zero is good, Thread a rope and Hang a weight per the Calibration instructions. If the meter reads negative, Skip to Step 15 To check Transducers. If the meter reads an incorrect weight, Adjust the Cal pot to correct the reading. If the meter reads zero or the correct weight got to next step
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    A. If reading is correct, check the 4-20ma output if desired, It should also be correct. TP10 to TP11 on the front board are the 4-20mA output there. Point: The 4-20 circuit must be connected to a load to get a correct reading. If the meter read zero in the previous step check the connector at AM1, If voltage exists at pin 1, the meter has failed, See Note 1 below.
    B. If reading is wrong, Disconnect the output and recheck the reading. If the reading is good with the output disconnected, Check the wiring and equipment receiving the signal for a shorted connection.If the reading is still bad, See Note 1 below.
15. Transducer and Cable Test:
    A. First, Verify your force direction arrows point in the direction the web pulls the roll.
    B. Verify you have proper clearance & play in the transducers per the installation manual.
    C. If you corrected something here, return to the step failed above & retest.
16. At the Indicator end, with the cable connected to the transducer, measure ohms:
    A. On each 3pin Cable connector:
       1. Pin A to Pin B should read 100 ohms.
       2. Pin A to Pin C should read 100 ohms.
       3. Pin B to Pin C should read 200 ohms.

    Info: Double these values for XR transducers. Pressing on the roller should cause some change in these values unless very high load ratings are in use. They should return to original value when released.
17. If test 16 fails, remove the cable from the transducer and re-test the transducer itself using the above test. In the case of the transducer having a 6 pin connector, Pin D to E = A to B, D to F = A to C and E to F = B to C on the second plug. If the Transducer passes, repair or replace the cable. If it fails see Note 1. Point: Be sure you are testing the correct transducer, If in doubt, test both!

7.1 REPLACEMENT PARTS

Tension meter, analog (option)			722-1385 (specify scale)
Fuses:	115V	0.250A/250V	108-0046 SLO-BLO type
	230V	0.125A/250V	108-0045 SLO-BLO type
Fuse cover			108-0005
Ribbon cable			723-1313
Instruction Manual			801-0787 R3

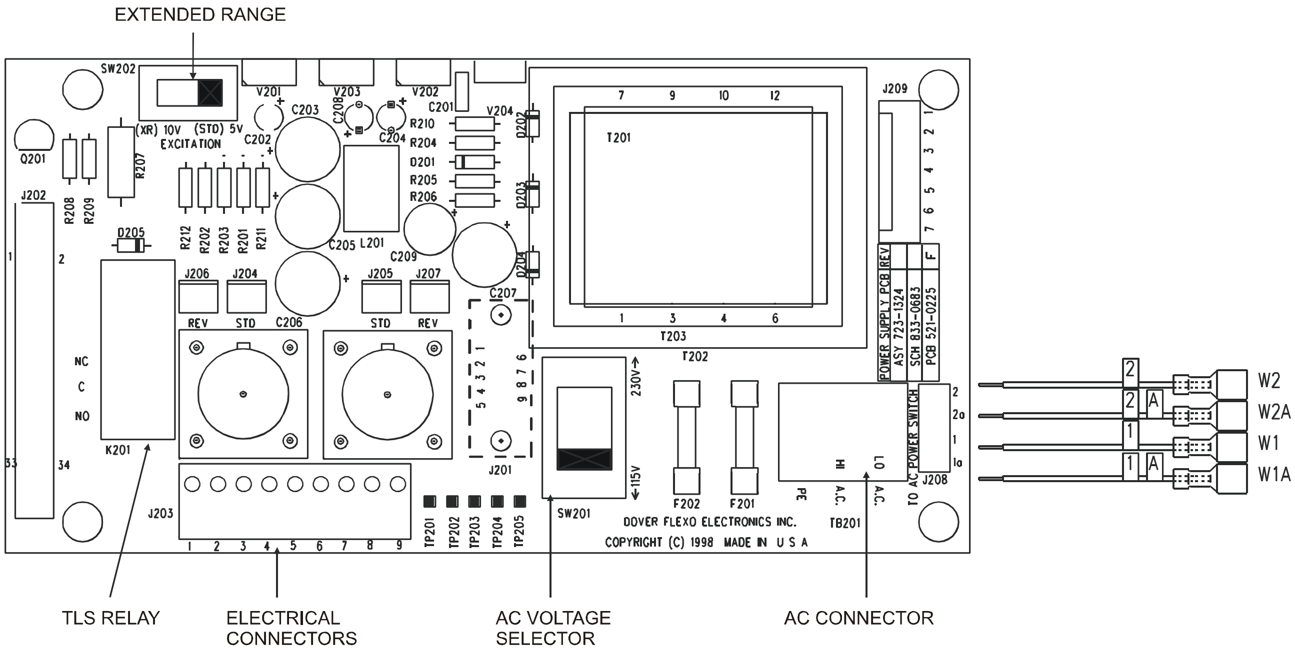

Figure 18 **- POWER BOARD**

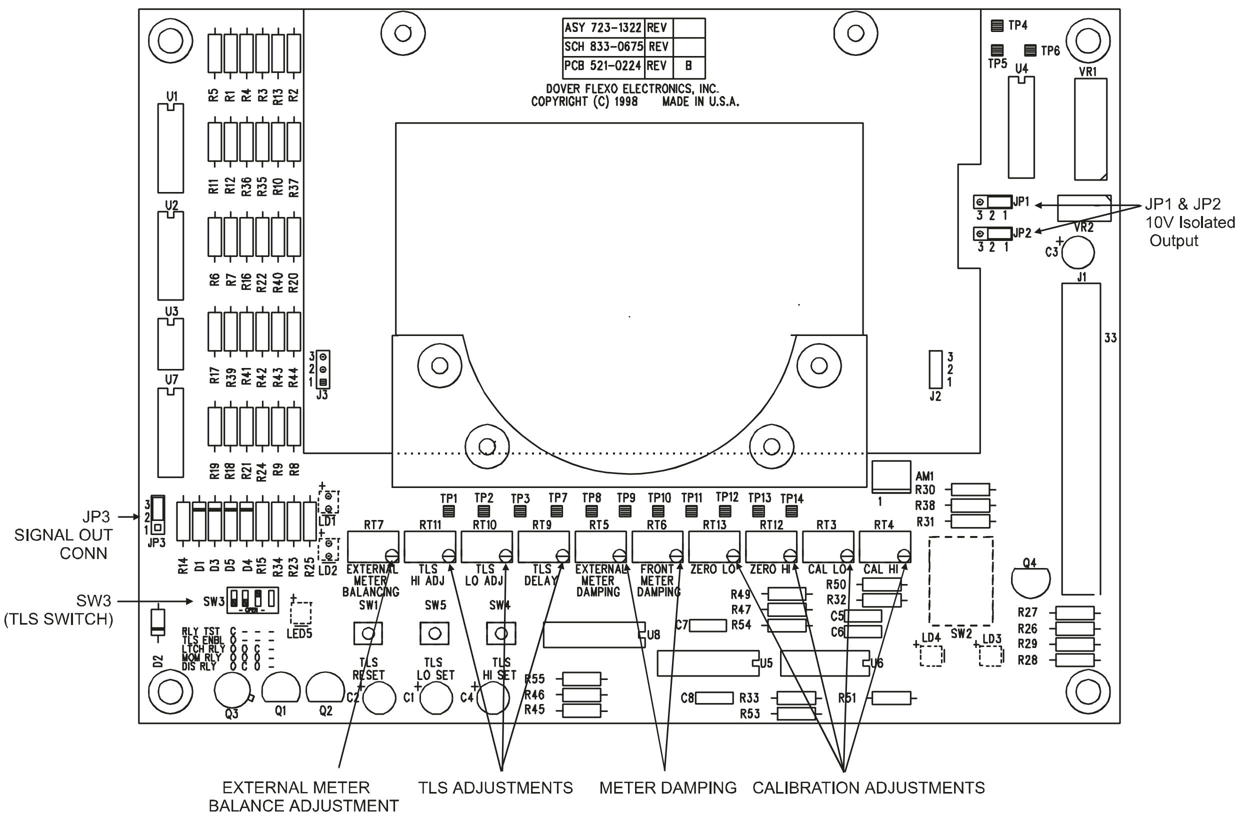

Figure 19 **- FRONT BOARD**

STANDARD ELECTRICAL CONNECTIONS

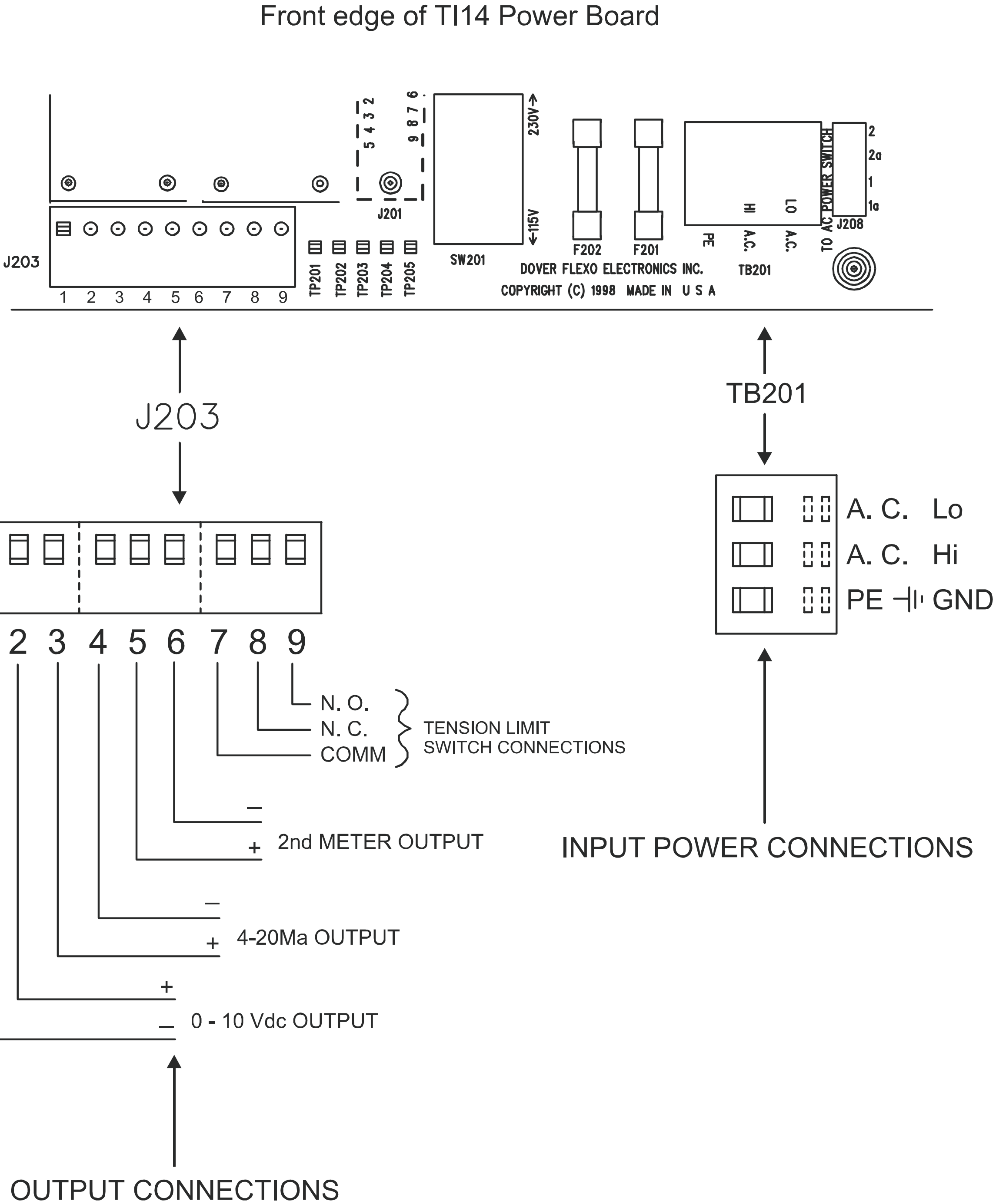

Figure 20 - **STANDARD ELECTRICAL CONNECTIONS**

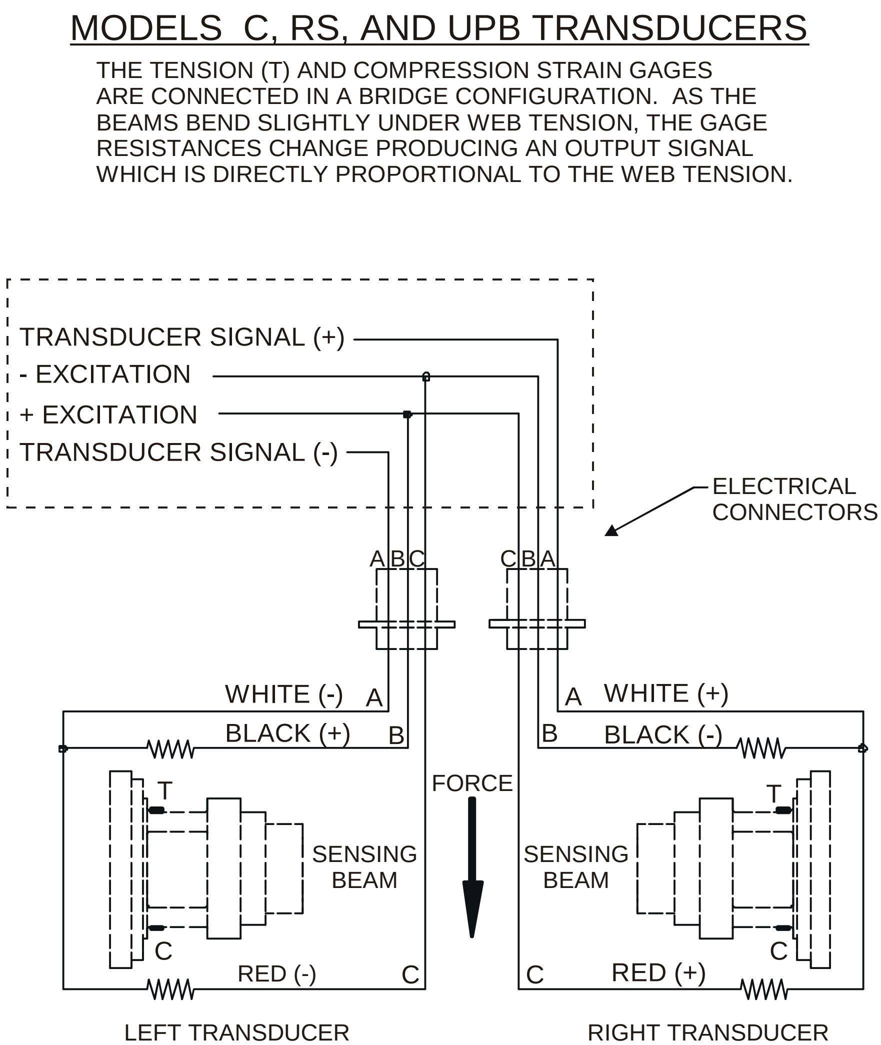

Figure 21 - **MODELS C, RS, & UPB TRANSDUCER WIRING**

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.

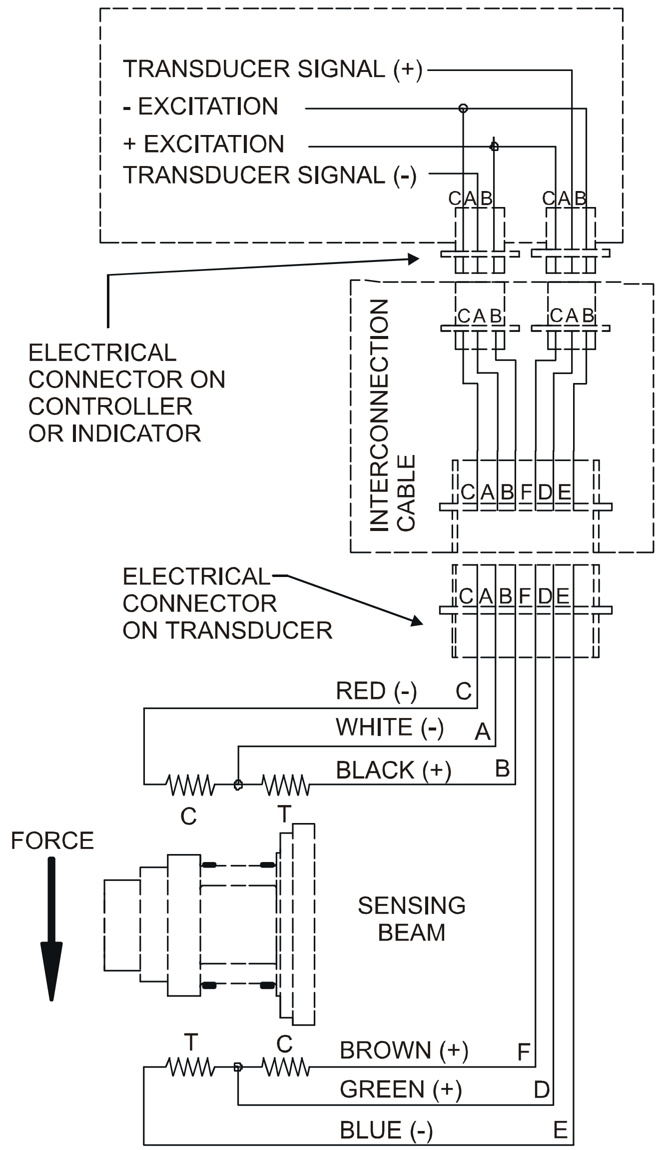

Figure 22 **- RFA TRANSDUCER WIRING**

TENSION ROLL (TR) AND NARROW WEB (NWI) 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.

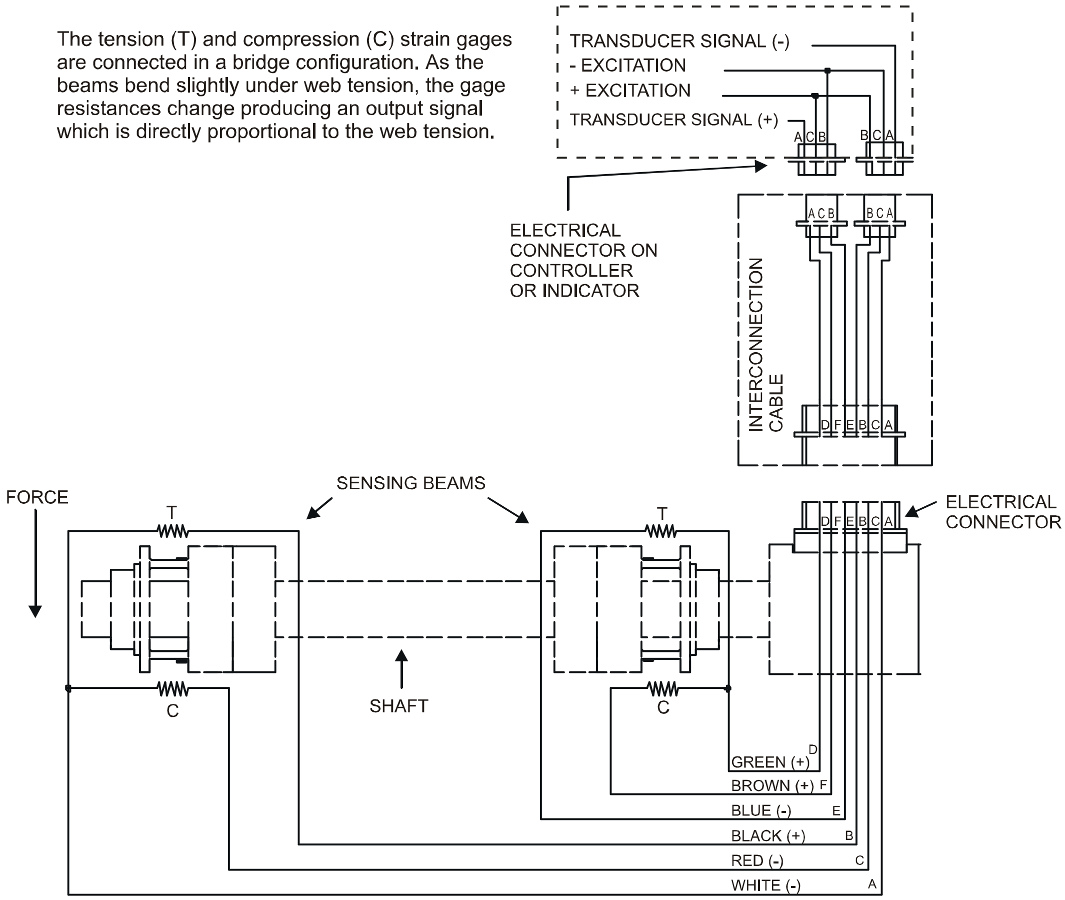

Figure 23 **- TR & NWI TRANSDUCER WIRING**

LOW TENSION (LT) TRANSDUCERS

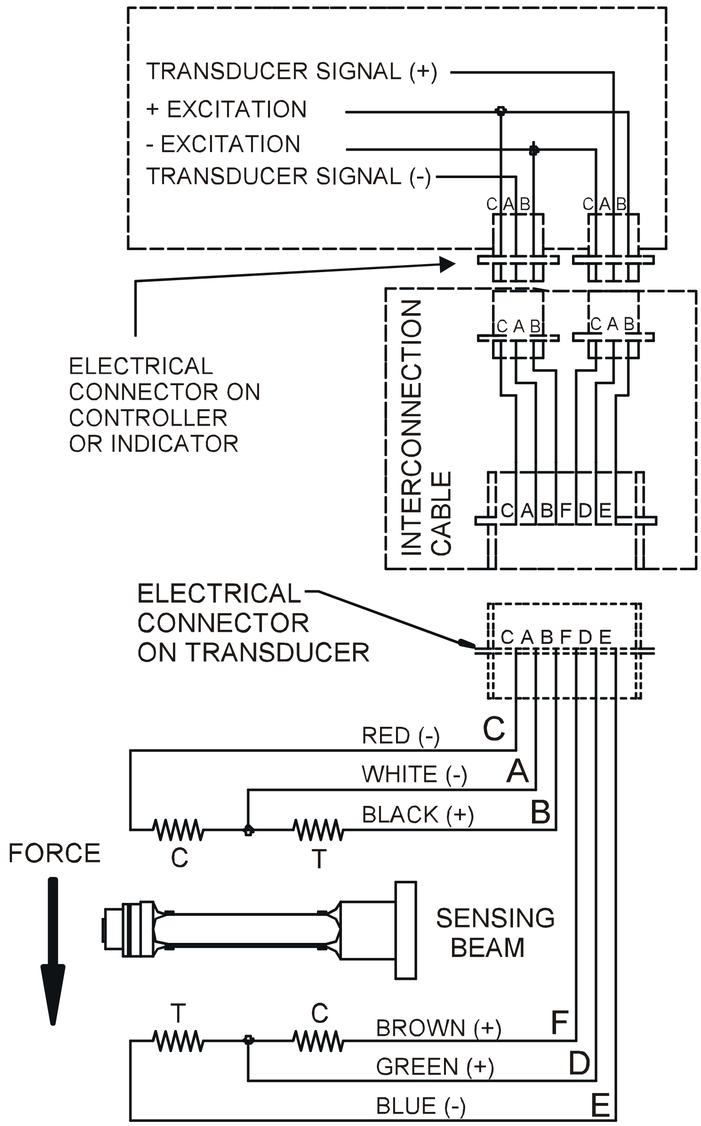

Figure 24 - **LT TRANSDUCER WIRING**

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	GAUGE	AT 25% STRETCH	AT 50% STRETCH
	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	GAUGE - INS	UNWIND-PSI	REWIND-PSI
	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.

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 must be obtained from the Company's factory before returning any material for which the original Buyer expects credit, exchange, or repairs under the Warranty. Returned material (except exchanges or repairs under the Warranty) shall be subject to a minimum re-stocking charge of 15%. Non-standard material or other material provided specially to the Buyer's specification 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.

10. CANCELLATION, CHANGES, RESCHEDULING
Buyer shall reimburse Company for costs incurred for any item on order with the Company which is cancelled by the Buyer. Costs shall be determined by common and accepted accounting practices.
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.

rev.8 8/9 /10

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