DOVER FLEXO ELECTRONICS, INC.
ISO 9001 CERTIFIED

INSTRUCTION MANUAL
TRUE TENSION INDICATOR
MODEL TI-17A/18

5 YEAR WARRANTY

DOVER FLEXO ELECTRONICS, INC.

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

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SECTION 1 PRODUCT DESCRIPTION

1.1 GENERAL DESCRIPTION

The TI-17A/18 Tension Indicator is designed to provide an 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. It also has a separate output to allow the user to connect an analog meter to indicate operating tension. The circuit card plugs into a single terminal block, to which all external connections are made. This plug-in feature allows easy field installation and servicing.

Model TI-17A/18 is available with three mounting configurations and a choice of 0-10 Vdc or 4-20mA outputs, including those choices as isolated outputs. Dual calibration is a standard feature. The TI-17A model is also CE marked when in its full enclosure configuration.

The only difference between the TI-17A and the TI-18 indicators is their power input requirements. The TI-17A operates on 115Vac 60Hz (230Vac 50Hz optional) and the TI-18 operates on 24Vdc, power supplied separately.

1.2 EXPLODED VIEW OF TI-17A/18

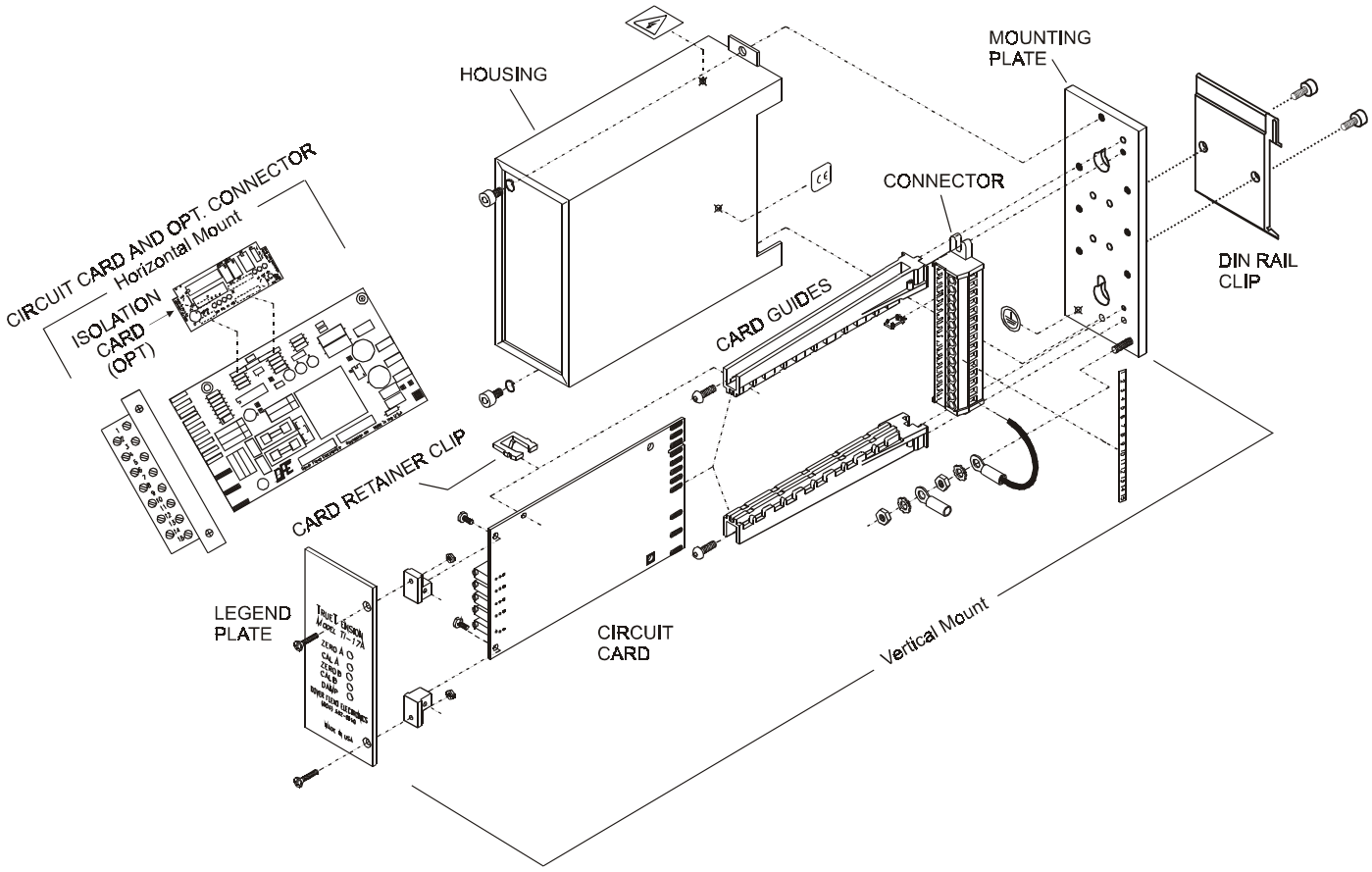


Figure 1 **- EXPLODED VIEW OF TI-17A/18**

1.3 SPECIFICATIONS

Power Input:	Voltage	. . . . .	TI-17A = 115/230V 50/60Hz, TI-18 = 24 Vdc
	Current	. . . . .	TI-17A = 0.125 / 0.080A, TI-18 = 135 mA
Tension Signal Outputs		. . . . .	0 to +10Vdc @ 2mA OR 4 to 20mA (available isolated)
		. . . . .	0 to 1mA damped OR 0-100µ output for external tension meter (jumper selectable)
Weight		. . . . .	0.5 lbs (0.23 kg) to 2.0 lbs (0.91 kg), depending on configuration
Transducer Signal Input		. . . . .	500 mVdc at rated load per pair (1.00Vdc for XR option)
Transducer excitation		. . . . .	5Vdc (10V for the XR option) jumper selectable
Mating circuit card connector		. . . . .	PCD #ELD15110 (DFE P/N: 106-0155) for horizontal mounting. (Connector is included for vertical mounting)
Zero (tare) range		. . . . .	95% of transducer rating
Calibration range		. . . . .	16 : 1
Ambient temperature range		. . . . .	32°F to 104°F (0°C to 40°C)
Optional tension meter types		. . . . .	Analog 1mA, 3.5" (DFE P/N: 722-1385), or 0-100µA, 6" (P/N: 722-1404)
Standard tension meter scales		. . . . .	0 to: 1, 5, 10, 25, 50, 100, 150, 250, 500, 1000

1.4 ENVIRONMENTAL CONDITIONS (Ref. Appendix D for further information)

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

- Indoor use
- Altitude up to and above 2000 meters
- Temperature 41°F to 104°F (5°C to 40°C)
- Maximum relative humidity 80% for temperatures up to 88°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.
- Transient Overvoltages according to Overvoltage Categories I, II, and III. For main supply the minimum and normal category is II
- Pollution Degree 1 or 2 in accordance with IEC 664

1.5 STANDARD FEATURES

SOME OF THESE FEATURES REQUIRE CONFIGURATION OR EXTERNAL WIRING. REFER TO SECTION 2.4 FOR INSTALLATION INSTRUCTIONS AND SECTION 2.9 FOR WIRING.

- **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 also available as isolated outputs. See Section 3.4 for installation and adjustment.
- **0-100µA or 0-1mA Tension Output**. A separate output used for driving an optional analog tension meter.
- **Meter Damping.** Minimizes variation of the optional analog tension meter needle.
- **Power Voltage Selection.** The TI-17A Interface / Indicator is designed to operate at either 115Vac (standard) or 230Vac using jumper selection. The TI-18 operates on 24Vdc.
- **Easily serviceable**. The circuit card can easily be removed and reinstalled into its mating connector (optional with horizontal mounting version).
- **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.
- **Isolated from Earth Ground**. A transformer provides isolation from earth ground, simplifying installations.
- **Dual Calibration**. Allows two calibration settings. Dual calibration option may be used in the following 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.

1.6 OPTIONS

SOME OF THESE OPTIONAL FEATURES REQUIRE CONFIGURATION OR EXTERNAL WIRING. REFER TO SECTION 2.4 FOR INSTALLATION INSTRUCTIONS AND SECTION 2.9 FOR WIRING.

- **Extended Range. (XR)** 10 Vdc excitation for Extended Range transducers. Allows measurement of a much wider range of tension than usual. Transducers must also have the XR option.
- **Isolation Card.** Provides up to 2500 V of isolation from earth ground. Isolated output can be either 0-10V or 4-20mA.

WARNING: Using standard transducers with XR excitation will damage the transducers!

1.7 ACCESSORIES

- **PCB Mating Card Connector.** Allows easy connection of external wiring (Horizontal mounting style only; connector is included for vertical mounting. (P/N: 106-0155)
- **Remote Tension meter**. Analog, 1 mA (P/N: 722-1385) or 0-100µA (P/N: 722-1404). Must be installed by user.
- **Nonstandard meter scale.** Any other meter scale than standard ones offered by DFE. See Specifications for standard scales.

SECTION 2

INSTALLATION

2.1 DIMENSIONS inches (mm)

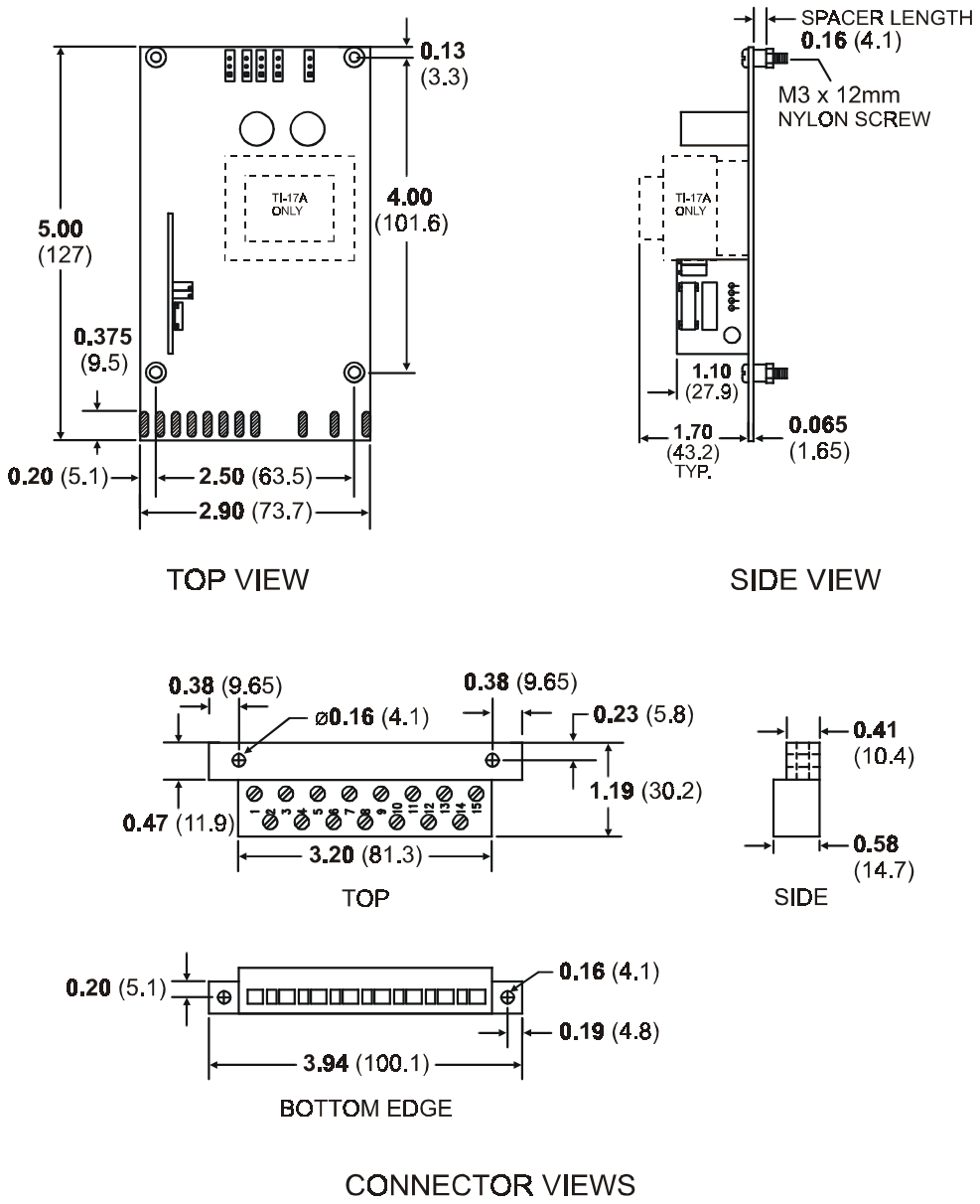


Figure 2 **- HORIZONTAL MOUNTING DIMENSIONS**

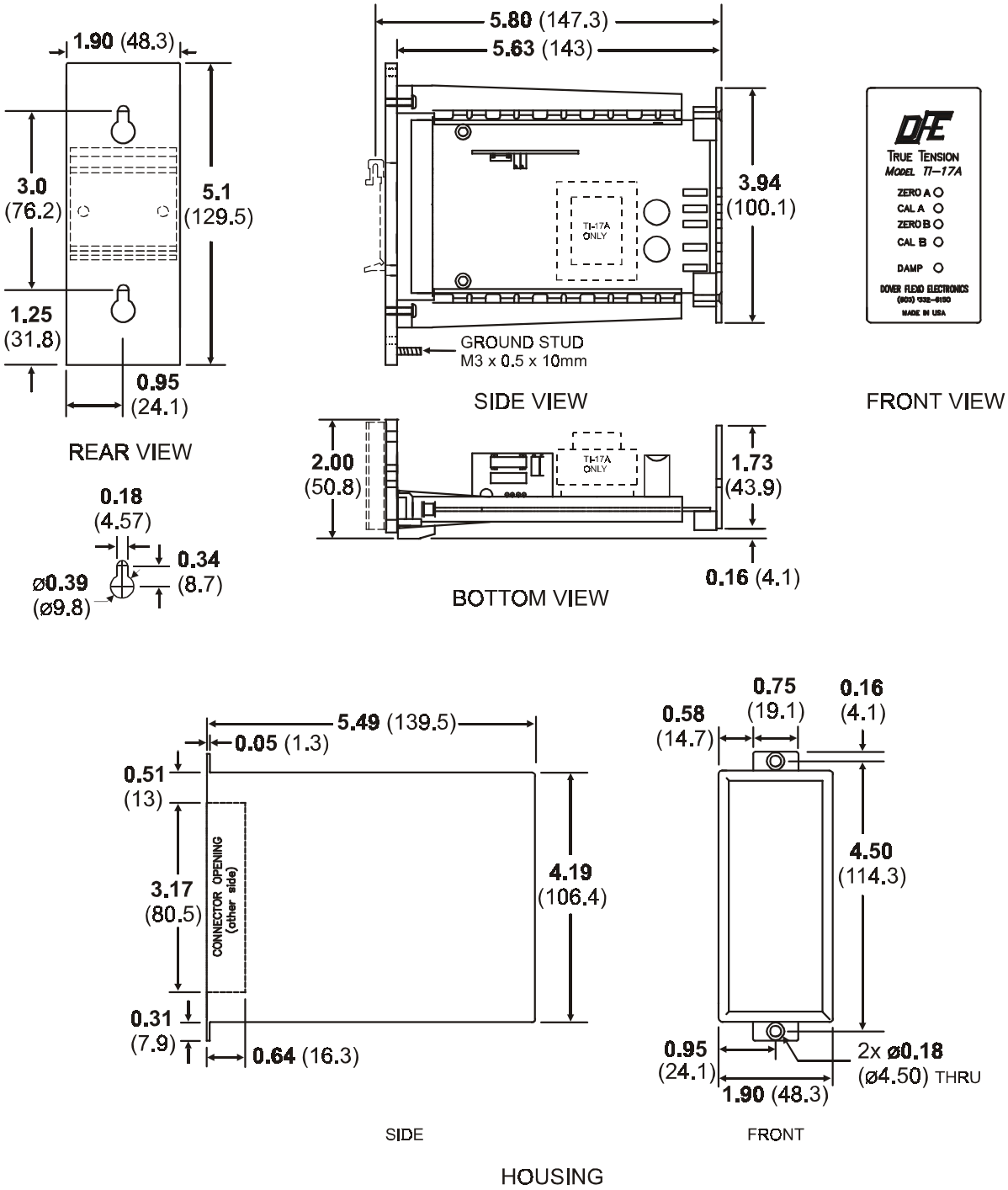
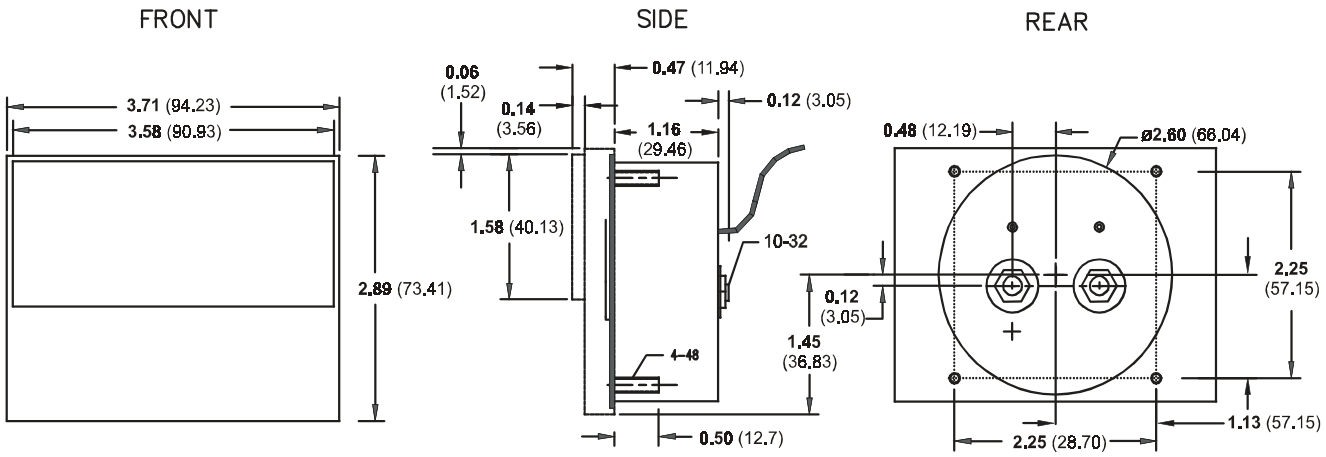


Figure 3 **- VERTICAL MOUNTING DIMENSIONS**



(Also see Opt. 0-100µA Meter dimensions in Appendix B)

Figure 4 **- OPTIONAL 0-1mA METER DIMENSIONS**

2.2 SELECTION OF MOUNTING LOCATION

The TI-17A/18 must be located in a machine cabinet, away from dusty or wet environments. If a dusty environment is anticipated and no cabinet is available, the mounting style with housing should be used.

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 DFE Model TI-17A you have purchased has been tested and meets the European Union's Low Voltage Directive and EMC Directive only when the available enclosure has been used and when installation is done correctly. 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^2). Make your line voltage connection to P1 positions 11 and 13 using wire with a gauge of at least 16 AWG (or a cross-sectional area of at least 1mm^2) for each conductor. Attach this wiring to the panel to prevent inadvertent removal.

An external switch or circuit breaker is required for power disconnection on the TI-17A, and it is recommended that this switch or circuit breaker be near the equipment.

In addition, to meet the EMC Directive, a proper transducer installation, including shielded cables must also be used. The following is a list of cables available from DFE which meet this requirement:

721-0084	CN 3-conductor cable for type C, RS, and UPB transducers
721-0964	CN 6-conductor cable for type RF, LT, and TR1 transducers
721-0984	CN 6-conductor cable for NW and TR2 and TR3 transducers

Cable shielding must be attached to chassis ground. 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 beside or in front of the unit for tool access and for wiring.

If you are using the vertical mounting style, remove the indicator circuit card from the connector/card guide assembly. Then mount the connector/card guide assembly to your panel. If you are using the horizontal mounting style, mount the indicator circuit card to your panel. If an optional analog meter is used, drill mounting holes per dimensions in Figure 4 (0-1mA meter) or Figure 16 (0-100µA meter) in Appendix B.

2.5 POWER VOLTAGE SELECTION (TI-17A Only. Refer to Appendix A for board drawing.)

The True Tension TI-17A is designed to operate on either 115V-50/60Hz or 230V-50/60Hz power. Verify that your unit is set up for the correct line voltage. See below for location of jumpers for this selection. Also verify that the correct value fuses are installed based upon your line voltage selection.

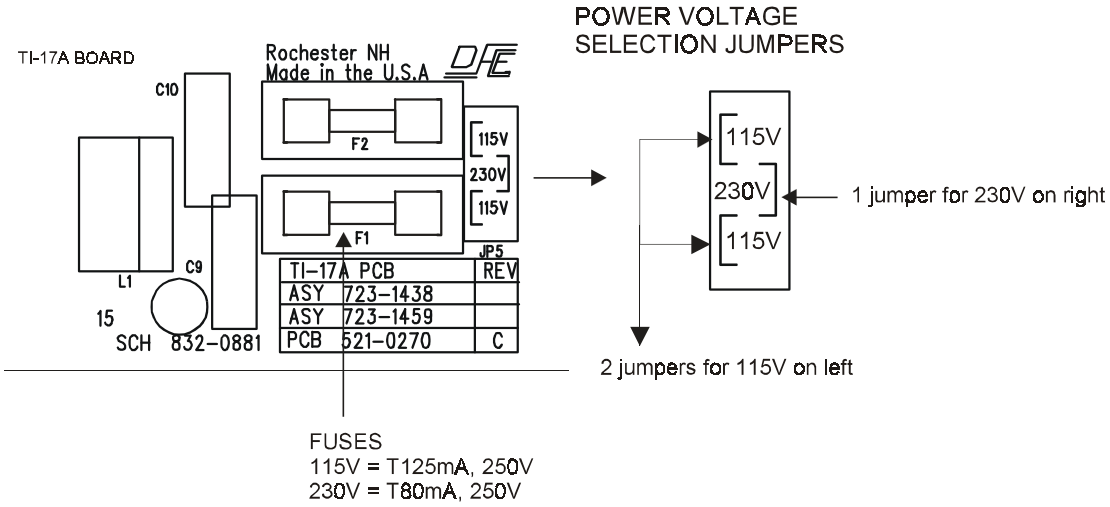


***Figure 5* - POWER VOLTAGE SELECTION**

The True Tension TI-18 is designed to operate on 24 Vdc so no voltage selection is necessary.

2.6 TRANSDUCER VOLTAGE (Refer to Appendix A for board drawing.)

The tension transducers are excited by either the standard 5 Vdc or, 10 Vdc with the Extended Range option or 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 WILL be DAMAGED!

Set the transducer excitation jumpers as follows: 5 Vdc - jumper on JP2 10 Vdc - jumper on JP1

***Figure 6* - TRANSDUCER VOLTAGE JUMPERS**

2.7 METER OUTPUT (Refer to Appendix A for board drawing.)

Verify that your TI-17A/18 is set-up with the correct meter output. 0-1mA is standard. 0-100µA is optional.

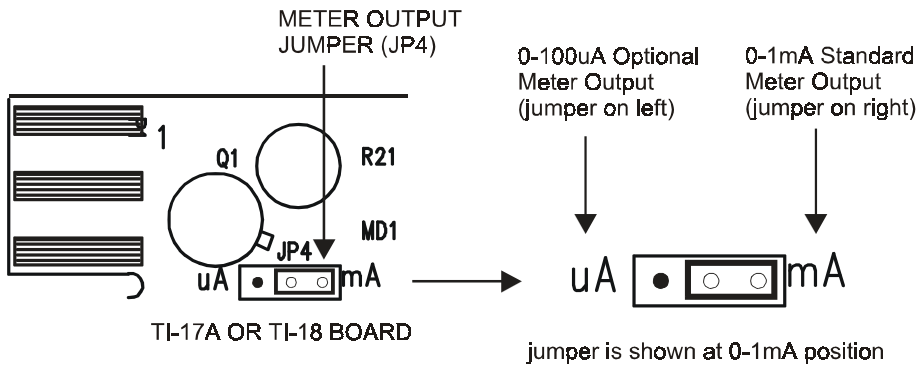


***Figure 7* - METER OUTPUT JUMPERS**

2.8 TENSION OUTPUT (Refer to Appendix A for board drawing.)

Verify that your TI-17A/18 is set-up with the correct tension output. There will be a set of jumpers on J2 on the main board. If 0 to 10V is required, pins 1 to 2, and 4 to 5 will have a jumper. If 4-20mA is required, pins 2 to 3, and 4 to 5 will have a jumper. See figure below.

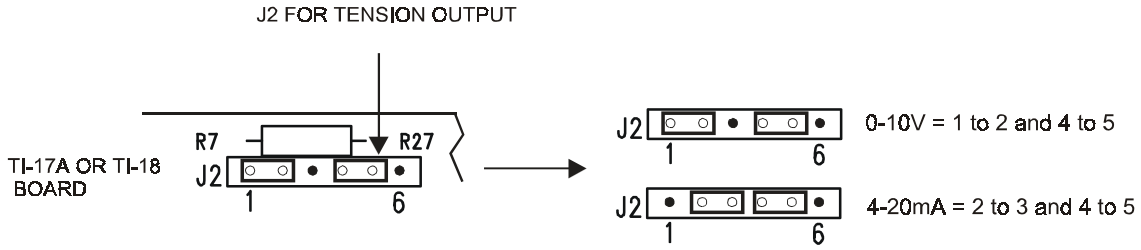


Figure 8 **- TENSION OUTPUT JUMPERS**

2.9 ELECTRICAL CONNECTIONS

Refer to the drawing below for electrical connections. Keep in mind that the indicator is designed to provide a 0-1mA damped meter output, and either a 0-10V OR a 4-20mA output. If more than one output is used simultaneously, the outputs may not agree and the unit may not be CE compliant.

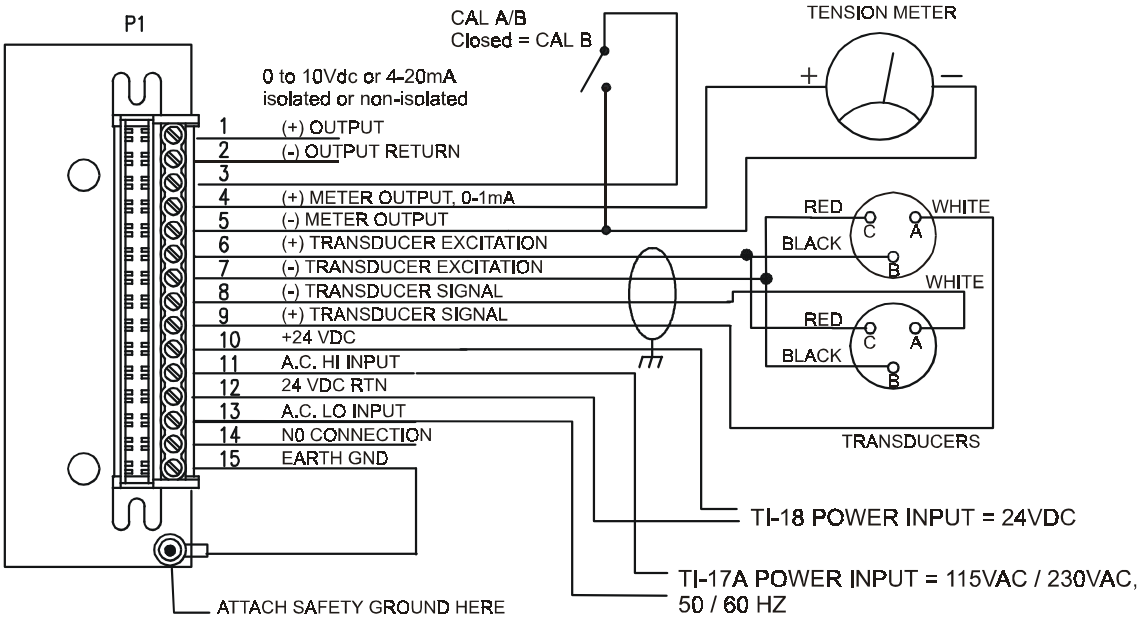


Figure 9 **- ELECTRICAL CONNECTIONS**

Make your wiring connections in accordance with the above drawing.

1. The insulation rating of all line voltage wiring must be at least 300V
2. Keep line voltage wiring physically separated from signal wiring at the terminal block and at any other point in the installation. If this is not possible, the insulation rating of your signal wiring must also be at least 300V.
3. Connect cable shields to chassis ground.
4. Verify that a good ground bond exists between the external safety ground, the enclosure base plate, and the enclosure housing (if used).

If you are using the vertical mounting style, you may now reinsert the indicator circuit card into the connector/card guide assembly. Snap in the yellow card retainer clip located in one of the card guides to lock the card in place. Reference Figure 1 on page 1 for proper location of this clip.

NOTE: If wiring a model UPBV transducer and the direction of force is pulling away from the top plate you must reverse the two return signal (transducer signal) wires at P1 terminals 8 and 9. (See figure 9 above).

SECTION 3

CALIBRATION and SETUP

3.1 PREPARATION

The best way to calibrate your system is to attach the device which will be accepting the output from the indicator. Otherwise attach a voltmeter or milliammeter, as appropriate for the type of output you intend to use.

3.2 MECHANICALLY ZERO THE TENSION METER

(This step is necessary only if the optional analog tension meter is to be used).

Turn off power to the TI-17A/18 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.

3.3 CALIBRATE THE OUTPUT FOR ACCURACY

a) Find an object of known weight at least as heavy as 25% of the tension meters full scale output, and preferably as close to 100% as you can find. A spring scale can also be used. Get a length of rope, wire or cable about 15 feet (3 meters) long.

b) Turn on power to the TI-17A/18

c) Turn the CAL pot (Cal A or Cal B as appropriate) clockwise at least 5 turns (this makes the ZERO A or B pot setting more accurate). Then turn the ZERO pot as required to make the output equal to its zero point (0V for the 0 to 10V output; 4 mA for the 4-20mA output; 0 mA for the meter output).

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 below.

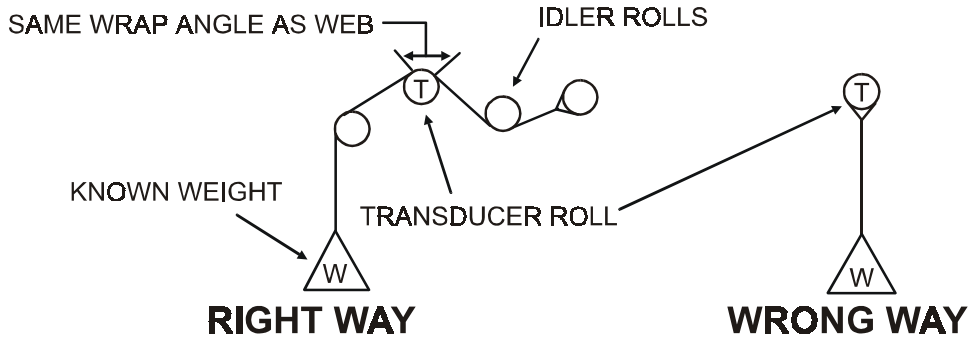


Figure 10 **- WEB PATH**

e) Attach the weight to the free end of the rope as shown above. The weight should not touch anything. Adjust the CAL pot (Cal A or Cal B as appropriate) as required to set the meter needle at the value of the weight.

f) Remove the weight and observe the tension meter. If the needle is not on zero, adjust the ZERO pot (A or B) as needed. Repeat step e.

g) Repeat steps e and f if needed.

h) If the optional analog meter is used, adjust the DAMP pot while the machine is running to minimize meter needle movement.

i) Repeat steps c through g with Cal A/B line grounded (P1, position 3) for Dual Calibration only.

The output calibration procedure is now complete.

3.4 INSTALLATION AND ADJUSTMENT OF ISOLATED TENSION OUTPUT

(Refer to Appendix A for board drawing.)

Regular 0 to +10V and 4 to 20mA tension outputs are configured at factory. Verification instructions are in Section 2.8. Isolated 0 to +10V or 4 to 20mA requires the installation of an ISO card to the main TI-17A/18 board. The following instructions are for the installation of this card and adjustment of your output.

If your TI-17A/18 was received with this Isolation card already installed, you need not make the above adjustments as they already have been done at the factory.

CAUTION! Standard precautions against static discharge should be taken when working with any electronic components.

1. You will need to select your output on the isolation card prior to installing on main card by configuring jumper JP1. If 0 to 10V is required, install jumper on pins 1 and 2. If 4-20mA is required, install jumper on pins 2 and 3. See diagram below

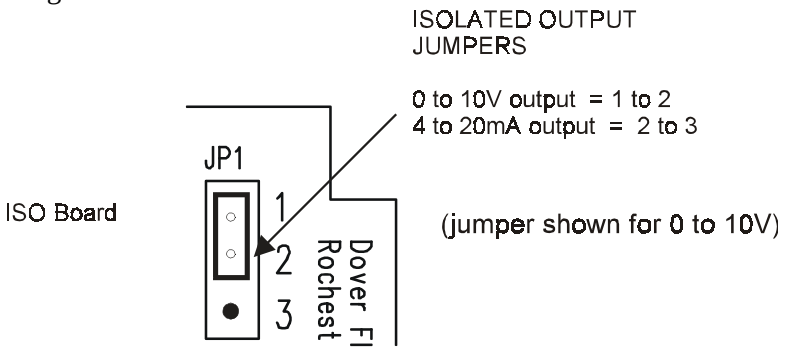


Figure 11 **- ISOLATED OUTPUT JUMPERS**

2. To install the isolation card, it will be necessary to remove the jumpers from J2 on the main card.
3. Install the isolation card by lining up the 4 position and 6 position connectors to the J1 and J2 pins on the main card. Press the card down firmly.
4. If the output for the 4mA or 20mA is not exactly 4 or 20, some further calibration can be accomplished by adjusting RT1 (20mA) and RT2 (4mA).

SECTION 4

OPERATING INSTRUCTIONS

Your tension interface / 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 the output returns to zero when no web is touching the transducer.

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 enclosure.

SECTION 6

TROUBLESHOOTING GUIDE

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 potentiometer and jumper settings.

If your unit fails to operate, check fuses on the TI-17A/18. If they need to be replaced, use the correct values listed below:

	115V Operation	230V Operation
TI-17A:	T125mA, 250V	T80mA, 250V
TI-18:	T250mA, 250V	

Warning! Equipment must be disconnected from the **HAZARDOUS LIVE** voltage before changing the fuses.

If you have any problems with the functions on your TI-17A/18 Tension Indicator, please call Technical Service at 603-332-6150 or fax 603-332-3758. E-mail: techsupport@dfe.com.

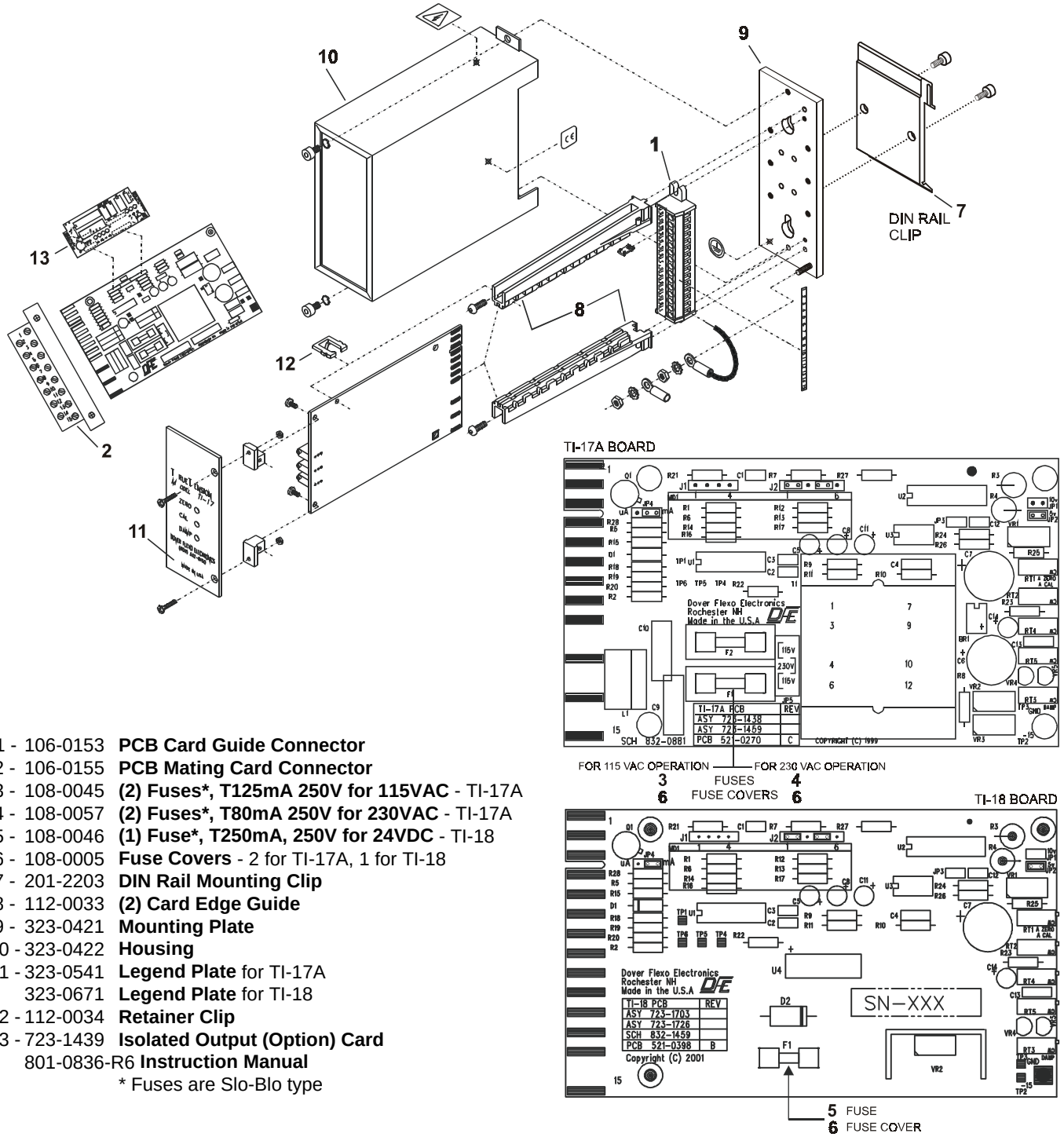
DFE's experienced technicians are responsible to ensure that you are satisfied with your DFE equipment. They will be pleased to assist you.

SECTION 7

REPLACEMENT PARTS

See diagram below for separate components. For complete item descriptions, see Appendix F on page 24.

Warning!: When replacing fuses, use only fuses with ratings as shown below, or a lower rating. Failure to do this may compromise personal safety and may create a fire hazard!



1 - 106-0153 **PCB Card Guide Connector**
2 - 106-0155 **PCB Mating Card Connector**
3 - 108-0045 **(2) Fuses*, T125mA 250V for 115VAC** - TI-17A
4 - 108-0057 **(2) Fuses*, T80mA 250V for 230VAC** - TI-17A
5 - 108-0046 **(1) Fuse*, T250mA, 250V for 24VDC** - TI-18
6 - 108-0005 **Fuse Covers** - 2 for TI-17A, 1 for TI-18
7 - 201-2203 **DIN Rail Mounting Clip**
8 - 112-0033 **(2) Card Edge Guide**
9 - 323-0421 **Mounting Plate**
10 - 323-0422 **Housing**
11 - 323-0541 **Legend Plate** for TI-17A
323-0671 **Legend Plate** for TI-18
12 - 112-0034 **Retainer Clip**
13 - 723-1439 **Isolated Output (Option) Card**
801-0836-R6 **Instruction Manual**
* Fuses are Slo-Blo type

Figure 12 **- REPLACEMENT PART NUMBERS**

Appendix A: TI-17A/18 Board Diagrams

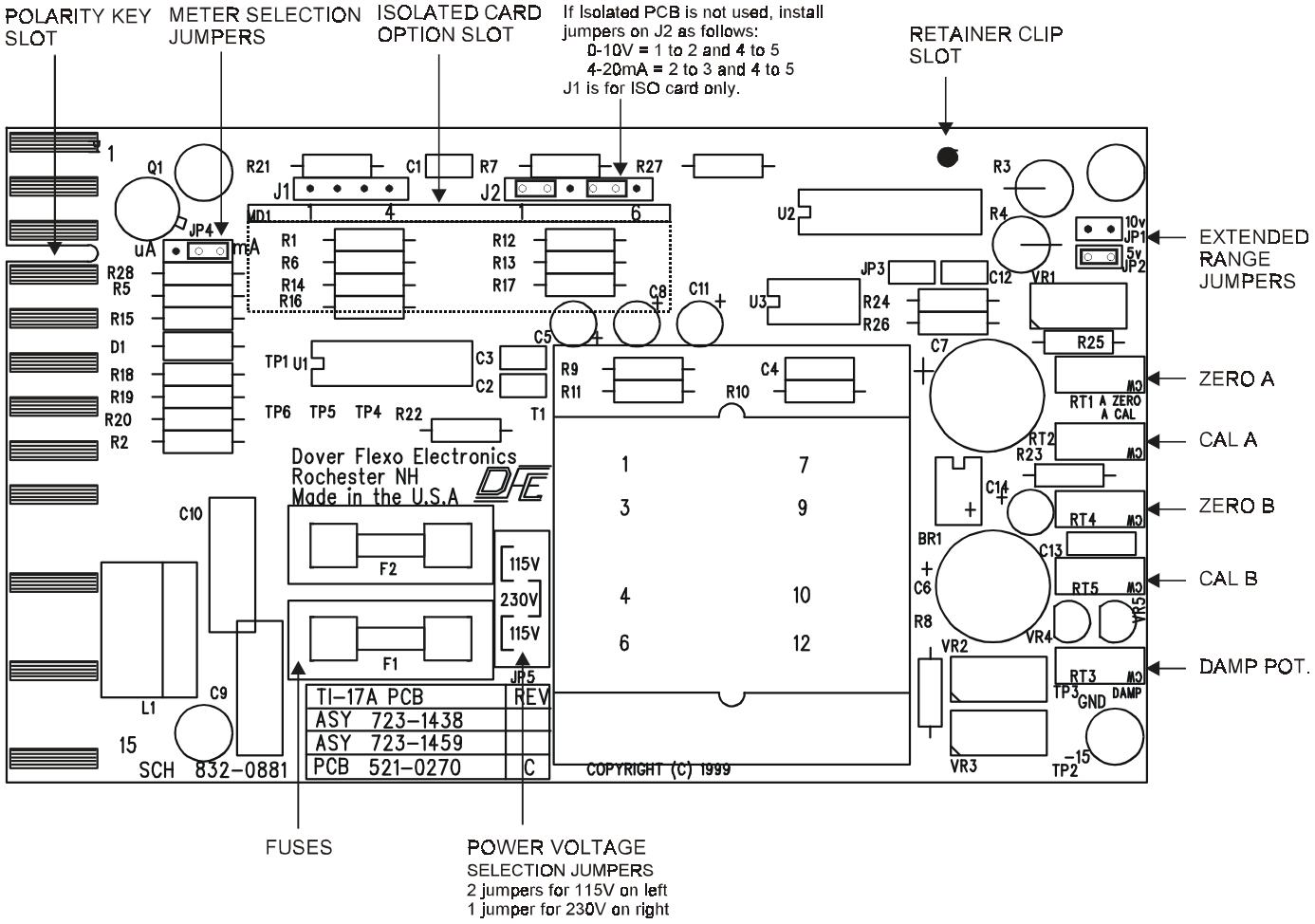


***Figure 13* - TI-17A PC BOARD** (Enlarged for clarity)

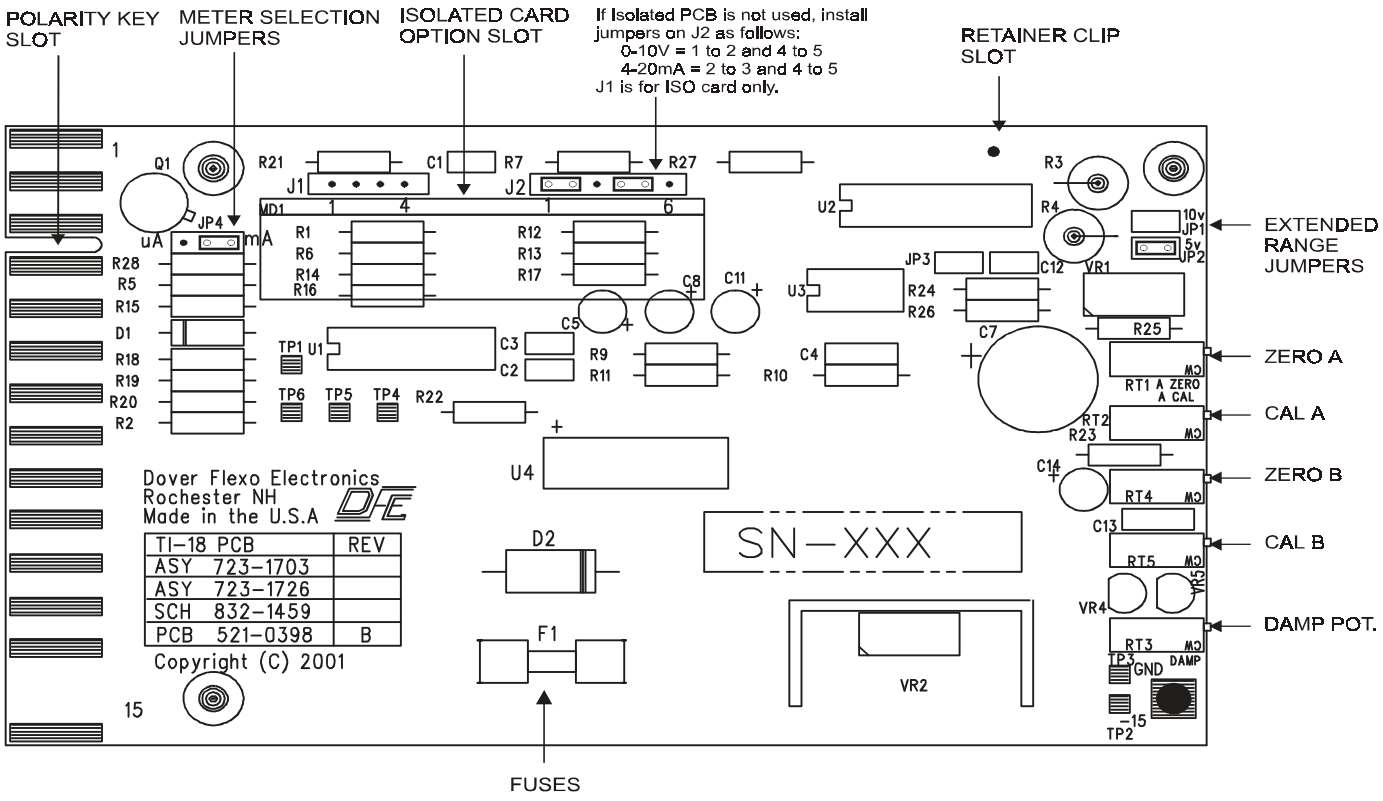


Figure 14 **- TI-18 PC BOARD** (Enlarged for clarity)

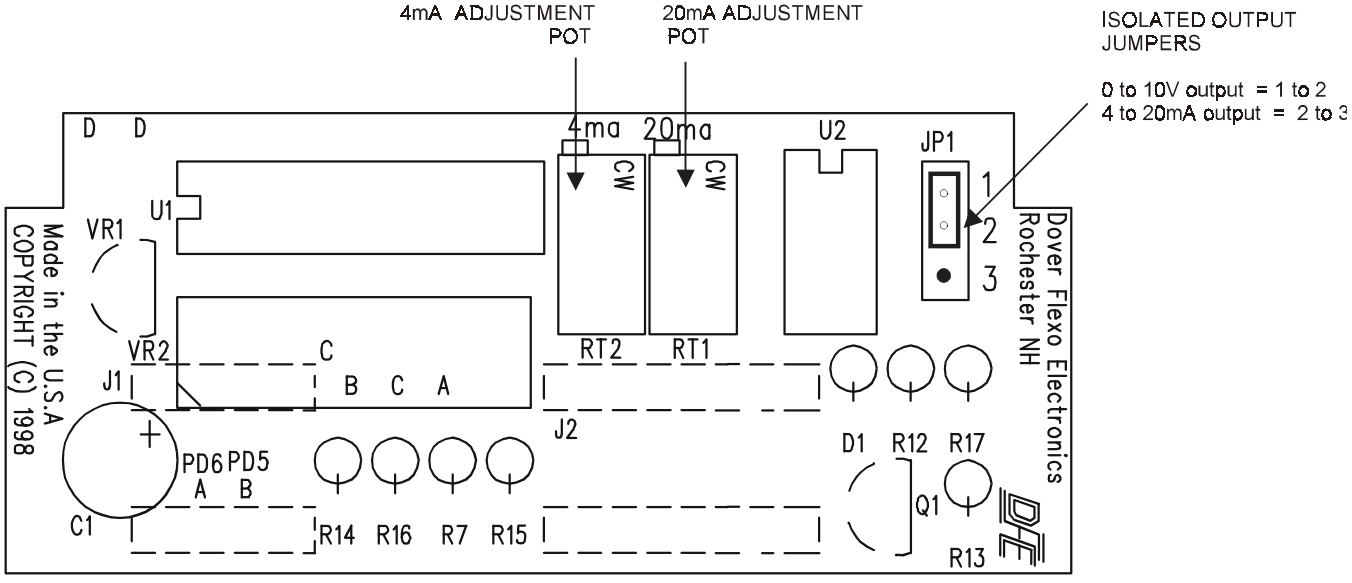


Figure 15 **- OPTIONAL ISOLATED PC BOARD** (Enlarged for clarity)

Appendix B: Optional Meter Dimensions

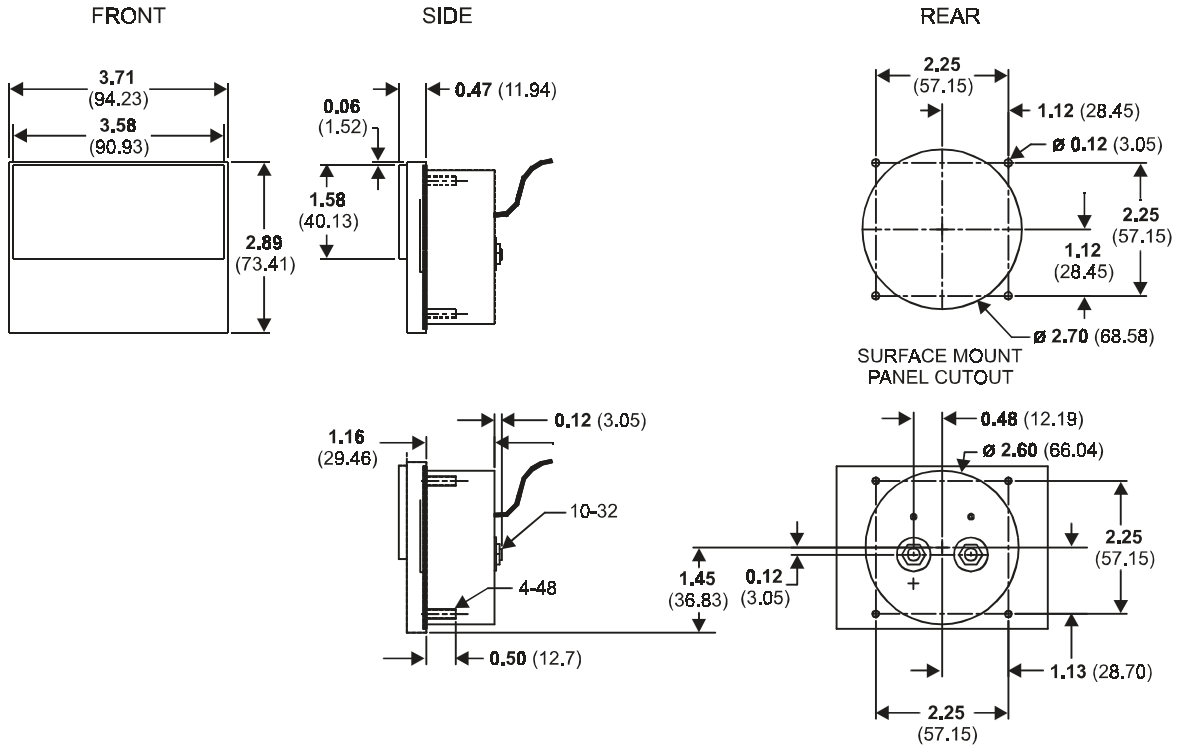


Figure 16 **- 3.5" OPTIONAL 1mA TENSION METER DIMENSIONS**

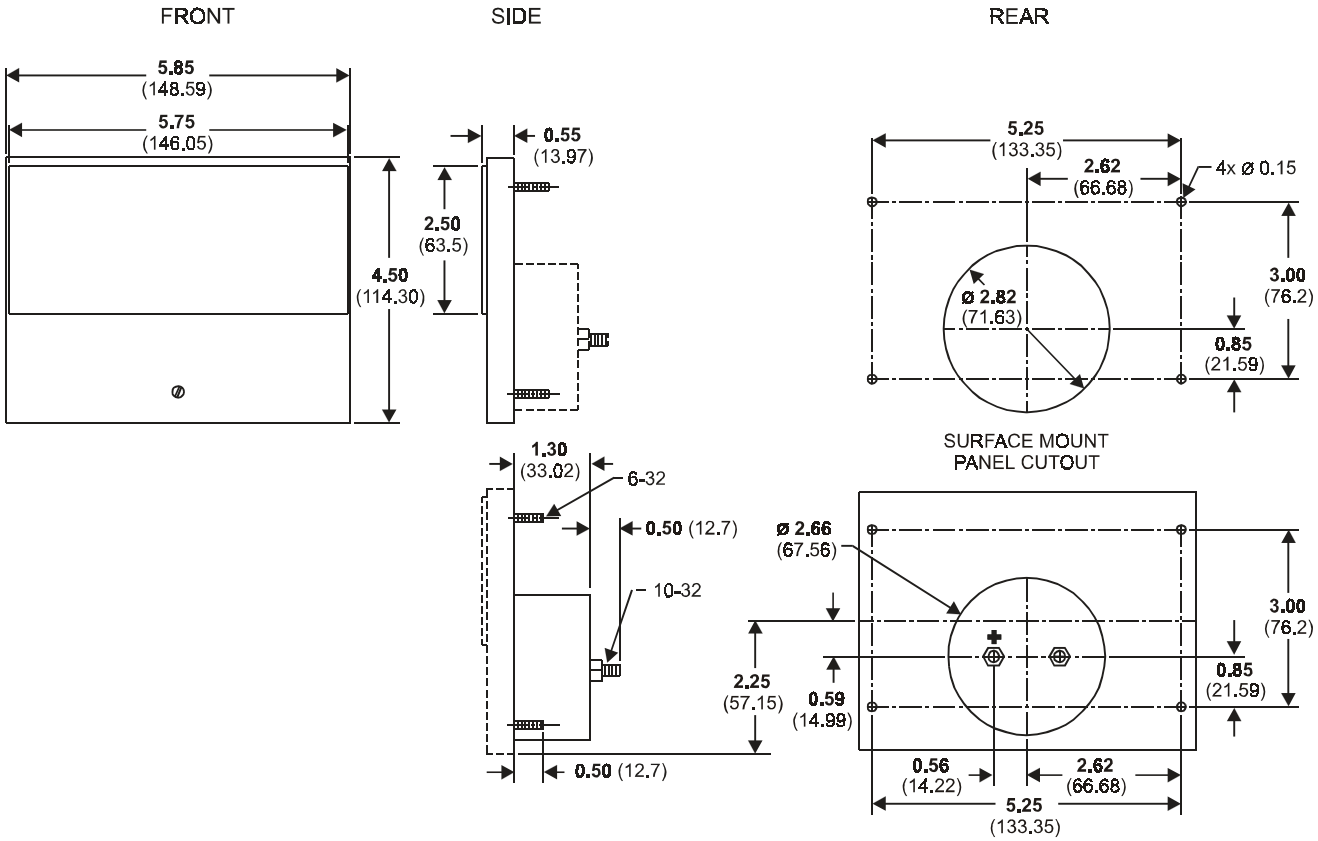


Figure 17 **- 6" OPTIONAL 0-100µA TENSION METER DIMENSIONS**

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.

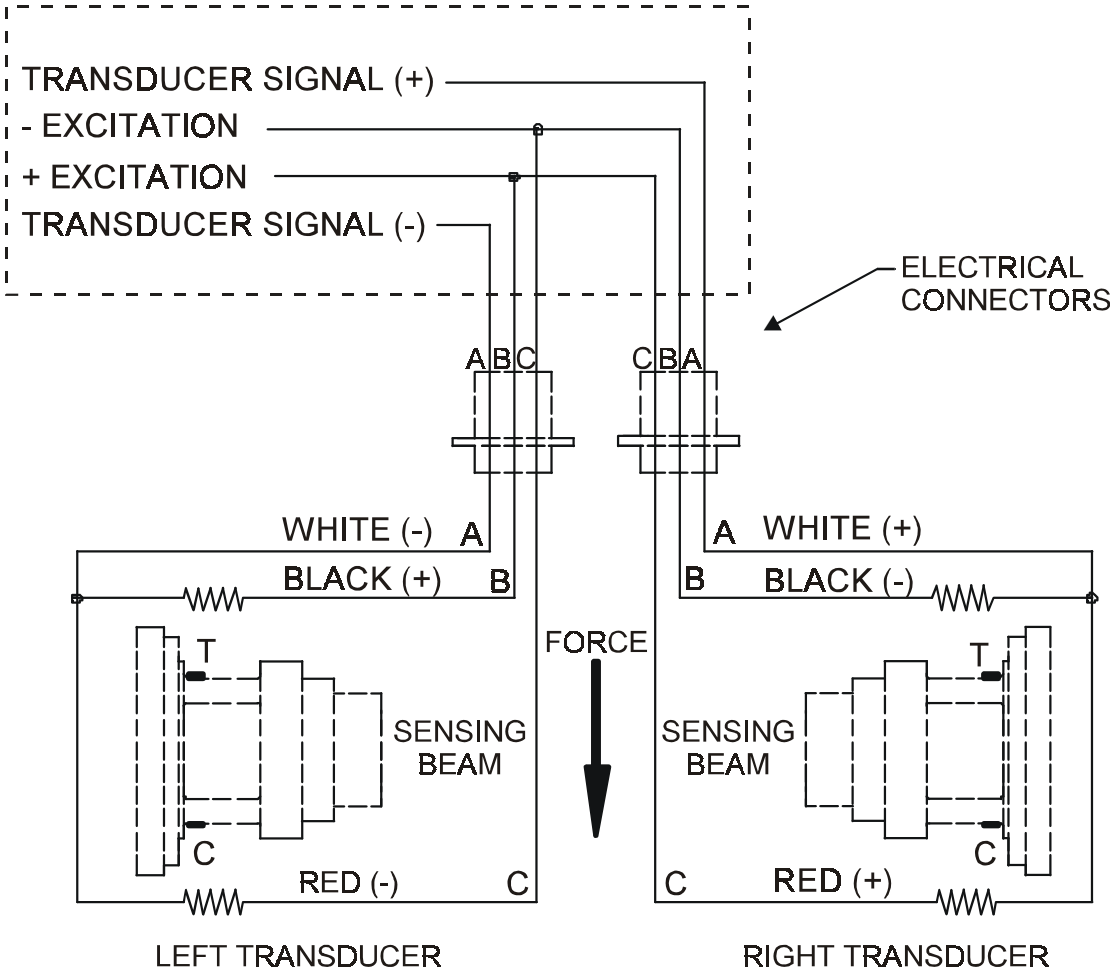


Figure 18 **- MODELS C, RS, & UPB TRANSDUCER WIRING**

RIBBON FILAMENT (RF) 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.

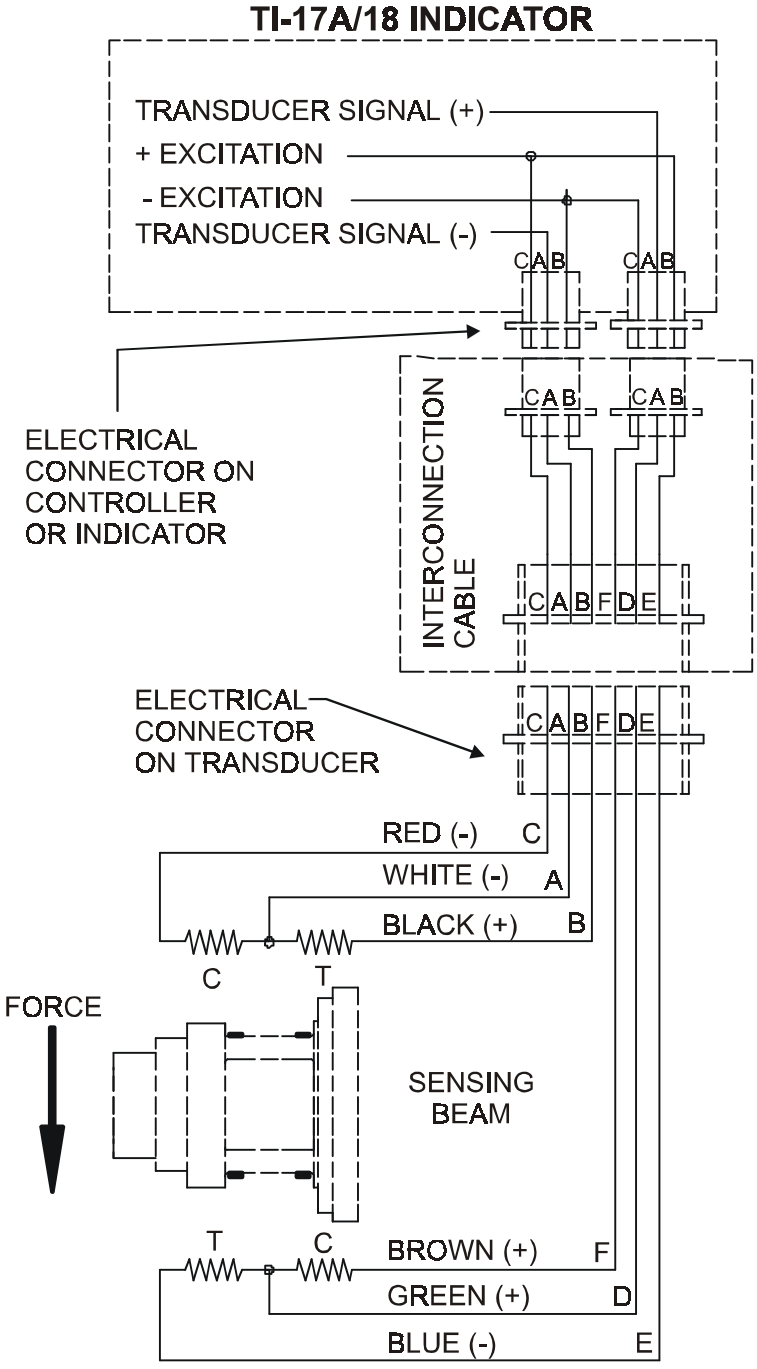


Figure 19 **- RF TRANSDUCER WIRING**

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

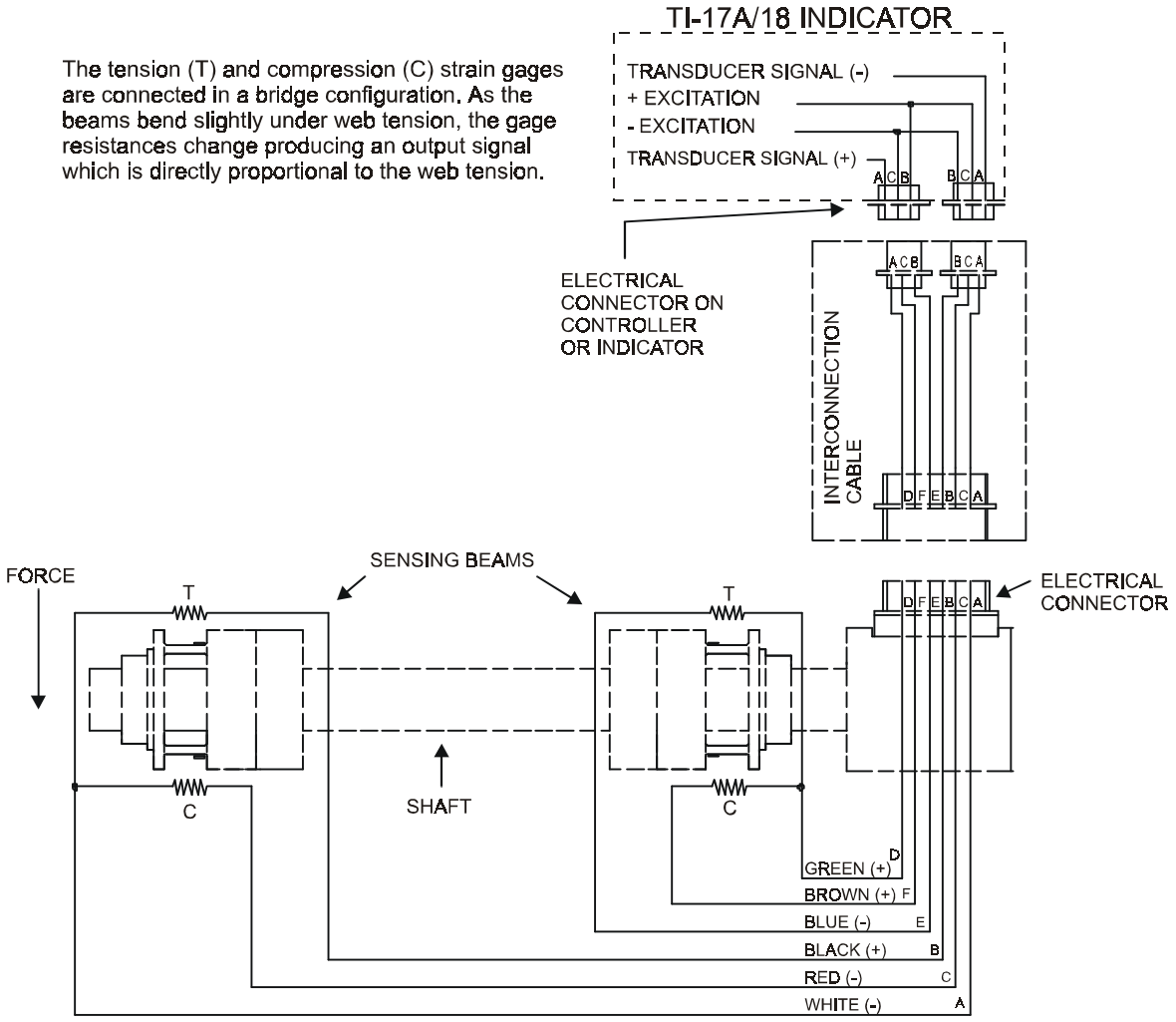


Figure 20 **- TR & NW TRANSDUCER WIRING**

LOW TENSION (LT) TRANSDUCERS

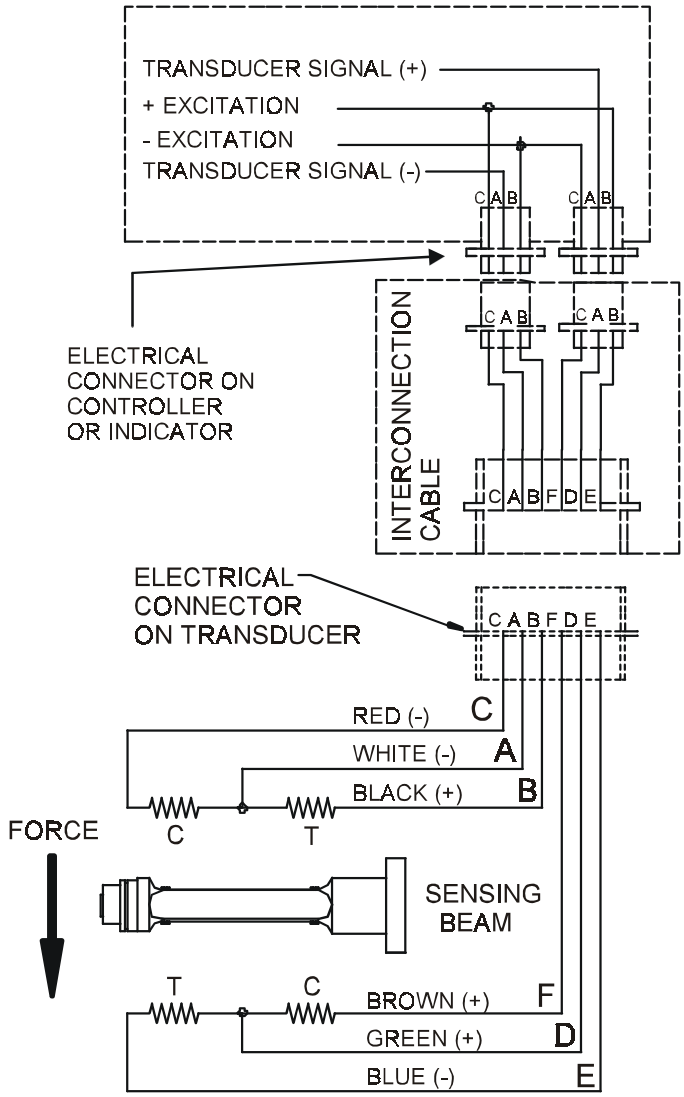


Figure 21 **- LT TRANSDUCER WIRING**

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	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.

Appendix E: Environmental Terms

OVERVOLTAGE CATEGORY: Classification of parts of installation systems or circuits with standardized limits for transient overvoltages, dependent on the normal line voltage to earth. (Ref. IEC 664)

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: For the purpose of evaluating clearances the following two degrees of POLLUTION in the micro-environment are recognized for use in accordance with IEC 664.

POLLUTION DEGREE 1: No POLLUTION or only dry non-conductive POLLUTION occurs. The POLLUTION has no influence.

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

Appendix F: Descriptions of Replacement Parts

These descriptions correspond to numbers pictured in Figure 12 on page 14.

	DFE PART#	
1.	106-0153	**PCB Card Guide Connector:** 22 to 14 AWG, 5/10 A, 300 V, 15 position. Allows electrical connection to card in vertical mounting configuration.
2.	106-0155	**PCB Mating Card Connector:** 0.200" spacing, 300V, 10 amp. Optional connector for electrical connection to card in horizontal mounting configuration.
3.	108-0045	**(2) Fuses:** T125mA 250V, for 115V operation, Slo-Blo, - TI-17A
4.	108-0057	**(2) Fuses:** T80mA 250V, for 230V operation, Slo-Blo, - TI-17A
5.	108-0046	**(1) Fuse:** T250mA, 250V, for 24Vdc, Slo-Blo, - TI-18
6.	108-0005	**Fuse Cover:** 600V, 105°, blue flex PVC. Insulate and protect fuses. (2) for TI-17, (1) for TI-18.
7.	201-2203	**DIN Rail Mounting Clip:** Aluminum. For vertical mounting with DIN rail.
8.	112-0033	**(2) Card Edge Guide:** 4.724" high. Holds card for vertical mounting.
9.	323-0421	**Mounting Plate:** Sheet metal, black finish. For vertical mounting with DIN rail, housing, or both.
10.	323-0422	**Housing:** Sheet metal, black finish. Used as unit enclosure.
11.	323-0541	**Legend Plate for TI-17A: OR**
	323-0671	**Legend Plate for TI-18:** Aluminum with TI-17A/18 artwork. Shows front of unit with adjustments.
12.	112-0034	**Retainer Clip**: Plastic clip that anchors PCB to card guides in the vertical mounting configuration.
13.	723-1439	**Isolated Output Option Card:** Optional PCB to provide up to 2500 V of isolation from earth ground. Configurable to either 0 to 10V or 4 to 20mA.

TERMS AND CONDITIONS OF SALE AND SHIPMENT

1. THE COMPANY **5/1/00**

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 its' products to be free of defects in material and workmanship for five years from date of original shipment. Warranty is valid on products purchased on or after April 2, 1999. 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.

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 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 F.O.B. 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 canceled 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 canceled 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 of 10% will apply to any letter of credit. There will 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.

DECLARATION OF CONFORMITY

We,

Dover Flexo Electronics
217 Pickering Road
Rochester, NH 03867 USA
Tel: (603) 332-6150
Fax: (603) 332-3758

declare under our sole responsibility that the product:

TI-17A Web Tension Interface,

manufactured after the date 1 March 2000, and to which this declaration relates, is in conformity with the following standards or other normative documents:

EN 55011: Radiated and Conducted Emissions, Class A

EN 50082-1: 1992 Electromagnetic compatibility - Generic immunity standard

IEC 1000-4-2: 1995, Electrostatic Discharge

IEC 1000-4-3: 1994, Immunity testing for 3 V/M

IEC 1000-4-4: 1995, Electrical Fast Transient Bursts

following the provisions of Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility (the "EMC Directive"); and also

IEC 1010-1: Safety Requirements for electrical equipment for measurement, control, and laboratory use

following the provisions of Council Directive 73/23/EEC on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (the "Low Voltage Directive").

The Technical Construction File is maintained at:

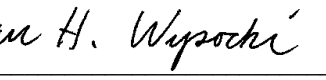
Dover Flexo Electronics
217 Pickering Road
Rochester, NH 03867 USA

Per Annex II R of the Machinery Directive (89/392/EEC):

The machinery, product, assembly, or sub-assembly covered by this Declaration of Conformity must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the applicable Directive(s).

Date of issue: 22 November, 1999

Place of issue: Rochester, NH USA

Signed: 

Alan H. Wysocki, Engineering Manager

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