

# **INSTRUCTION MANUAL**

## **MODEL E9-R or E9U TENSION CONTROLLER**

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E9R or U TENSION CONTROLLER

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## E9R or U TENSION CONTROLLER INSTALLATION

### ELECTRICAL RATING:

Input --- 117 volts, 60 HZ. @ .5 Amps

Output --- 0 to 10 VDC @ 0.06 Amps

### LOCATION OF CONTROLLER

Mount the controller in a dry place, away from any source of heat. It should not be more than 7 feet from the floor. The mounting surface should be free of excessive vibration.

### WIRING

All external connections are made at the terminal strips on the panel. Refer to the external connection diagram provided.

1. Use shielded cable for tension meter, tension set-point potentiometer, and transducer wiring.  
Ground the shield at the controller end only!
2. Double check accuracy of all connections before applying power to the controller.

## DESCRIPTION OF OPERATION

### SYSTEM OPERATION

The model E9 Tension Controller is part of a closed loop (negative feedback) control system. Also included in the system are the tension transducers, a motor and drive, and the tension set point potentiometer.

Briefly, the system functions in this way: The press operator sets the tension set point pot to the desired tension. The transducers measure actual tension. The controller compares actual tension with desired tension and varies a 0 to 10 VDC reference signal. This reference is fed into a drive to vary the torque output to the motor. The controller automatically varies the reference signal to compensate for speed changes, roll diameter changes and other factors to maintain desired tension. Web tension is displayed on a large meter so the operator can see it easily at a glance.

### TRANSDUCER OPERATION

The tension transducers convert web tension into an electrical signal which is linearly proportional to tension. Two transducers are used, one on each end of an idler roll. The two signals are added together so the sum represents average web tension.

Each transducer contains two strain gages connected in series. They are wired so the four gages form a bridge which is excited by 5 Volts DC. As web tension applies force to the transducers, the resistance of the strain gages changes and a small output voltage signal is produced.

### CIRCUIT CARD FUNCTION

- A. The Regulator Card (R4) accepts the transducer signal and amplifies it via amplifier U1. This amplified web tension signal is used for many functions.
1. Provides an external 0VDC to +5VDC output signal.
  2. Provides an external 0VDC to +100mVDC output signal.
  3. Provides (2) separate tension meter outputs.

The regulator card also contains the stability and gain circuits and the adjustable Max which limits the maximum reference voltage applied to the drive. The Dual Calibration option and the Ratio are also contained on this card.

B. The POWER SUPPLY CARD (PS6) Accepts the resulting error signal (from the regulator card) and via drive circuitry controls the 0 - 10 V output.

This card contains the following power supplies:

1. +15VDC - Powers Electronic circuitry
2. -15VDC - Powers Electronic circuitry
3. +24VDC - Powers all relays
4. 5VDC (isolated) - Powers Transducers
5. 5VDC (isolated) - Optional Power Supply

Also located on this card is the optional remote tension switching relay and the Minimum output circuitry. The MIN. pot. can be used to vary the minimum reference voltage from 0 VDC (fully CCW) to 15 VDC (fully CW).

C. The OPTIONS CARD (01 or 05) contains optional taper tension by diameter computer circuitry and tension limit circuitry. It also contains the reverse output circuit required for the E9 U. The circuit takes the signal from the regulator card and reverses it for use on unwinds (10 volts in, 0 volts out and 0 volts in, 10 volts out).

## START-UP PROCEDURE

DESCRIPTION OF ALL ADJUSTMENTS Located on the regulator (R4).

ZERO 1 - Used to adjust the tension meter to zero.

ZERO 2 - (Option) used to adjust the tension meter to zero.

CALIBRATE 1 - Used to calibrate the tension meter to a known tension applied at the tension sensing roll.

CALIBRATE 2 - (Option) used to calibrate the tension meter to a known tension applied at the tension sensing roll.

TAPER - Adjusts the amount (percent) that the tension decreases as the roll diameter increases. Adjustable from zero percent to as much as 50%. Requires optional rider roll pot or diameter computer taper card.

STABILITY - Used to tune the unit for overall stability and stable operation. Also determines the amount of integration occurring in the processing (or regulator) section.

RESPONSE - Adjustment used to allow the unit to respond to fast changes that might occur during the winding process. When fast or large tension changes occur on the web the response pot determines how much the output of the unit should change to correct for these tension changes.

MAX - Used to limit the maximum reference signal applied to the drive.

RATIO OFF DELAY - Adjusts the amount of time delay (0 to 8 seconds) that the ratio off delay circuit is enabled once the splice sequence has ended.

RATIO SELECTOR SWITCH - Set this switch according to the application. When in the unwind position, the output is multiplied when the circuit is activated. When in the rewind position, the output is divided down when the circuit is activated.

SOFT START ON-OFF SWITCH - Activates or de-activates the soft start circuitry.

GAIN - (Should not be adjusted unless stability cannot be achieved). Used to adjust the controller overall circuit gain in the processing (or regulator) section.

UNWIND RATIO - Used to adjust the amount the output increases when the ratio circuit is energized. When fully counter-clockwise, there will be little change (the ratio is approximately 1:1). When the pot is fully CW, the ratio is approximately 10:1.

REWIND RATIO - Used to adjust the amount the output decreases when the ratio circuit is energized. When fully clockwise, the ratio is approximately 1:1. When the pot is fully CCW, the ratio is approximately 1:10.

## CALIBRATION

1. Check the transducers to be sure they are properly mounted and oriented. (Refer to the TRANSDUCER INSTALLATION instructions).
2. Before applying power to the tension controller, check the tension meter needle. If it is not on zero, adjust the small screw below the meter scale until the needle rests on zero.
3. Turn on power to the controller and let it warm up for 5 minutes.
4. Turn the ZERO 1 pot. on the regulator card until the meter reads zero. (Turning the pot. clockwise will increase the meter reading).
5. Thread a length of rope over the center of the tension sensing roll following the exact same path as the web will take. Do not pass the rope over dead bars, driven rolls, braces or any other non-free wheeling member. The sliding friction introduced by these members will cause inaccurate calibration. Fasten one end of the rope securely.
6. Attach a weight of known value to the other end of the rope. (Its weight should be about half the maximum scale reading of the tension meter). Or use a spring scale to apply the required force.
7. Turn the CALIBRATE 1 pot. on the regulator card until the meter reading is the same as the weight.
8. If the tension meter reads backwards, reverse the two white wires in the transducer cables.
9. Remove the load from the sensing roll and observe the tension meter. If it does not return to zero, repeat steps 4, 7, and 9.

REPEAT STEPS ABOVE FOR DUAL CALIBRATION

## TUNING THE CONTROLLER FOR STABLE OPERATION

1. Web up the press.
2. Locate the regulator card.
  - A. Stability - The stability pot is a 1 turn (320°) pot. Set the stability pot 60% CW.
  - B. Response - The response pot is a 1 turn (320°) pot. Set the response pot 25% CW.



3. Run the press at 150 FPM and observe the tension meter. If tension fluctuates more than 2 or 3 divisions, adjust the stability and response pots to minimize fluctuation.

#### TURN THE POTS VERY SLOWLY

NOTE: Stability is usually set high and response is usually low. If response is too high it will cause instability.

4. If adjusting the stability and response pots doesn't stabilize the controller, turn the GAIN pot. CCW slowly until stability is achieved.
5. Run the press at maximum speed and observe the tension meter. If necessary, tension variations can be minimized by slowly adjusting the stability and response pots.

#### ADJUSTING THE MAX CIRCUIT

The MAX circuit prevents web breakage or stretching during splicing or while the machine is starting. This is accomplished by limiting the maximum torque of the motor that is required by the full roll.

1. Install a full roll.
2. Turn MAX completely CW.
3. Run the machine at maximum speed and adjust tension to the desired value.
4. Turn MAX CCW slowly until tension just begins to decrease. Leave at this setting.

#### TAPER ADJUSTMENT

This circuit allows the tension to decrease as the roll diameter increases.

1. Turn the TAPER on/off switch ON.
2. Set the TAPER adjustment pot  $\frac{1}{2}$  turn CW. Run the machine and wind up to a full roll while watching the tension meter. Adjust the TAPER adjustment pot as required until the desired amount of tension decrease is achieved.

#### RATIO OFF DELAY

The RATIO OFF DELAY pot is a 1 turn (320°) pot. Set the RATIO OFF DELAY pot 50% CW. Run the machine and make a splice. While watching the tension meter, note how long it takes for the web to stabilize after the splice has been made. Adjust the RATIO OFF DELAY pot for about 1 second longer than it takes for the web to stabilize.

### SOFT START OPERATION

1. SOFT START circuitry has been designed to eliminate "locked up" and/or high tension start ups when the controller is used as an unwind.

NOTE: If this controller is used as a rewind the SOFT START OPERATION is not desirable. To eliminate the SOFT START OPERATION when the controller is used as a rewind, switch the SOFT START on/off switch OFF.

## TROUBLE-SHOOTING PROCEDURE, E9R or U

The procedure detailed here is intended to help the electrician to determine which circuit card is faulty so it may be replaced with a new one. No instruction is given for repair of the cards themselves.

EQUIPMENT REQUIRED: (1) AC-DC multi-meter having 0-1 volt and 0-100 volt scales  
(2) Small screwdriver or TV tuning tool to adjust potentiometers

TEST CONDITIONS: The machine must be stopped.  
The web must lay slack or be removed from over the transducer roll.

### ALL TESTS SHOULD BE DONE BY A QUALIFIED ELECTRICIAN

POINTS TO REMEMBER: \*All voltages given are approximate  
Actual values may vary 20%.  
\*The tests are written to describe proper operation of each card. Results which are much different from those given indicate that a problem exists.  
\*Do not change the setting of any pot. until told to do so.

**\*\*\*\*EACH STEP IN THE FOLLOWING PROCEDURE MUST BE PERFORMED IN THE ORDER GIVEN!!**

1. Turn off power to the E9 controller panel.
2. Take a few moments to locate and identify each circuit card. Notice, each card has several test jacks that are identified by a number such as TP1, TP2, etc. These test points will be "referred to" throughout the trouble-shooting procedure. The test jacks will accept the standard .080 "diameter test probes on most multimeters."

3. Turn on power to the controller.

POWER SUPPLY CARD (PS6)

4. The voltage between TP15 (+) and TP18 should be 15 VDC.
5. The voltage between TP18 (+) and TP14 should be 15 VDC.
6. The voltage between TP18 and TP17 (+) should be 24 VDC. ( $\pm 3$  VDC)
7. The voltage between TP10 (+) and TP11 should be 5 VDC.

REGULATOR CARD (R4)

8. Using the zero pot, adjust CW until the tension meter reads full scale. Unless the cal pot is at least 25% CW, the zero pot will not have enough range. The voltage between TP2 and TP5 (+) should be 4.8 VDC.
9. Using the zero pot adjust CCW until the tension meter reads zero. Switch the soft start on-off switch off. Set the tension set point pot (located on the front cover) to 5. Turn the Max pot fully CW. The voltage between TP2 and TP8 (+) should be: 10 VDC ( $\pm 3$  VDC).

POWER SUPPLY CARD (PS6)

10. Turn the min. pot fully CCW. The voltage between TP18 and TP12 (+) should be: 10 VDC ( $\pm 3$  VDC) for the E9R, 0 VDC for the E9U.
11. Turn the max pot (located on the regulator card) fully CCW. The voltage between TP18 and TP12 (+) should be 0 VDC for the E9R, 10 VDC for the E9U.

REGULATOR CARD (R4)

12. Turn the Max pot fully CW. Switch the soft start on-off switch on. The voltage between TP2 and TP8 (+) should be 1.6 VDC ( $\pm 3$  VDC)
13. Using the zero pot, adjust CW until the tension meter reads 25% of full scale. The voltage between TP2 and TP8 (+) should be 10 VDC ( $\pm 3$  VDC).
14. Set the tension set point pot (located on the front cover) to off (fully CCW). the voltage between TP8 and TP2 (+) should be .3 VDC ( $\pm 3$  VDC).

15. Set the tension set point pot (located on the front cover) to 5. Using a jumper wire, jumper between TB6-6 and TB6-5. The voltage between TP2 and TP8 (+) should be 1.6 VDC ( $\pm 0.3$  VDC). Remove jumper.

This completes the trouble-shooting procedure for the basic controller (without options). Refer to the Start-Up Procedure section for calibration and tuning, or, continue with the trouble-shooting procedure covering any option your controller may have. It is not necessary to follow the "options" trouble-shooting procedure in the order given, go directly to the options your controller has.

#### DUAL SCALE TENSION METER WITH SWITCH OPTION (R4 CARD)

1. Switch the dual scale meter switch to HI. Using the zero 1 pot, adjust the tension meter to full scale. The voltage between TP2 and TP5 (+) should be 4.85 VDC. Using the ZERO 1 pot, adjust the tension meter to zero.
2. Switch the dual scale meter switch to LO. Using the ZERO 2 pot, adjust the tension meter to full scale. The voltage between TP2 and TP5 (+) should be 4.85 VDC. Using the ZERO 2 pot, adjust the tension meter to zero.

## PREVENTIVE MAINTENANCE

Preventive maintenance for electronic equipment consists of keeping it clean. Layers of dust cause overheating of electronic components. If the dust is conductive it can cause short circuits and produce all kinds of strange behavior.

Check the equipment at least once a month. It doesn't take long and could prevent costly down-time.

**DO NOT USE COMPRESSED AIR FOR CLEANING. DAMAGE COULD RESULT.**

Use a dry, soft brush to remove dust.

If a solvent is necessary, use denatured alcohol.

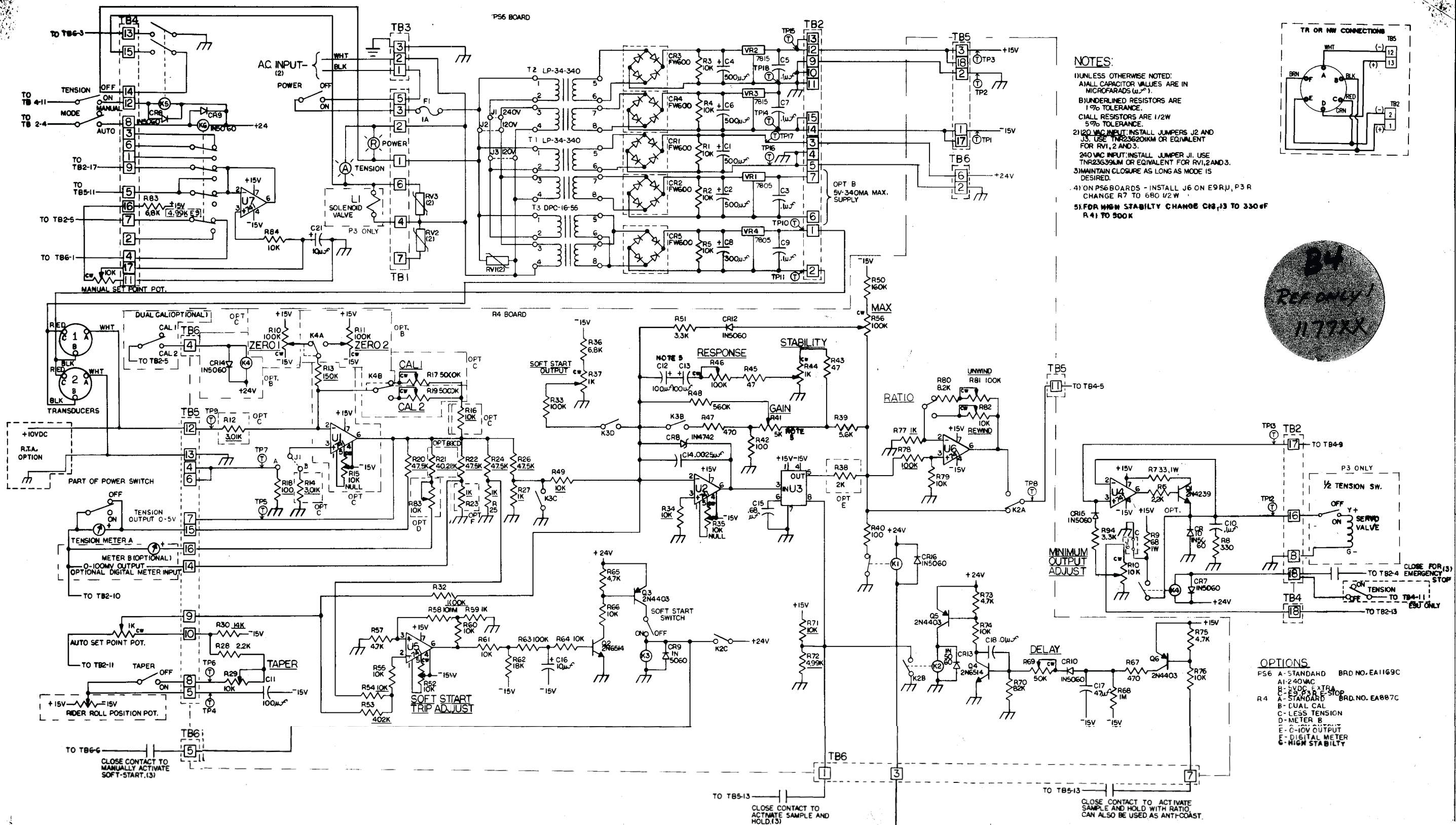
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MODEL: E9 R or U  
 DIAGRAM: E1177D  
 REF:

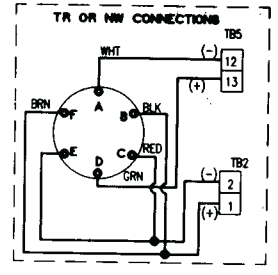
	DES	PART	DESCRIPTION	QTY		MFR
1		PS6-A	POWER SUPPLY BOARD-Standard Circuitry	1		
2		PS6-A1	POWER SUPPLY BOARD-220 VAC (option)	1		
3		PS6-B	POWER SUPPLY BOARD-Extra 5VDC power sup	1		
4						
5		R4-A	REGULATOR BOARD-Standard Circuitry	1		
6		R4-B	REGULATOR BOARD-Dual cal/dual zero (opt)	1		
7		R4-C	REGULATOR BOARD-Remote Tension Amp (opt)	1		
8		R4-D	REGULATOR BOARD-Auxiliary Tension Meter	1		
9		R4-E	REGULATOR BOARD-E9 Controller (opt) 0-10	1		
10		R4-F	REGULATOR BOARD-Digital Meter(opt) output	1		
11						
12		O5-A	OPTION BOARD-Standard Taper	1		
13		O5-B	OPTION BOARD-Taper Tension w/Pos Line Tac	1		
14		O5-C	OPTION BOARD-Taper Tension w/Pos Clutch	1		
15		O5-D	OPTION BOARD-Taper tension w/Extended Ran	1		
16		O5-E	OPTION BOARD-Tension Limit Switch (opt)	1		
17		O5-F	OPTION BOARD-Speed Switch (opt)	1		
18		O5-G	OPTION BOARD-Reverse Output (opt)	1		
19						
20			DIAGRAMS			
21						
22		E1177D	E9 R or U SCHEMATIC	1		
23		E1730D	WIRING DIAGRAM E9 R, U	1		
24		E1300D	O5 SCHEMATIC	1		
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- NOTES:**
- UNLESS OTHERWISE NOTED: ALL CAPACITOR VALUES ARE IN MICROFARADS ( $\mu F$ ).
  - UNDERLINED RESISTORS ARE 1% TOLERANCE.
  - ALL RESISTORS ARE 1/2W 5% TOLERANCE.
  - 240 VAC INPUT: INSTALL JUMPERS J2 AND J3. USE TNR23520XMM OR EQUIVALENT FOR RV1, 2 AND 3.
  - 240 VAC INPUT: INSTALL JUMPER J1. USE TNR23539UM OR EQUIVALENT FOR RV1, 2 AND 3.
  - MAINTAIN CLOSURE AS LONG AS MODE IS DESIRED.
  - ON P56 BOARDS - INSTALL J6 ON E9R, P3 CHANGE R7 TO 680  $\Omega$  W
  - FOR HIGH STABILITY CHANGE C18, 13 TO 330  $\mu F$  R41 TO 500K



**B4**  
REF ONLY  
1177XX

- OPTIONS**
- PS6 A - STANDARD BRD NO. EA1169C
  - A1 - 240VAC
  - B - 5VDC EXTRA
  - C - 5VDC STOP
  - R4 A - STANDARD BRD NO. EA887C
  - B - DUAL CAL
  - C - LESS TENSION
  - D - METER B
  - E - 0-10V OUTPUT
  - F - DIGITAL METER
  - G - HIGH STABILITY

REV	DATE	BY	DESCRIPTION	REF.	PART	DOVER FLEXO ELECTRONICS INC. ROCHESTER, NH 03867
5-14-90	F	MATL.				
7-5-88	E					
5-10-88	D					
7-15-91	J					
3-21-88	C	MACHINED DIMENSION LIMITS UNLESS OTHERWISE SPECIFIED				
3-22-91	H					
11-24-87	B					
11-5-87	A					

TO TB5-13 CLOSE CONTACT TO ACTIVATE SAMPLE AND HOLD (15)  
TO TB4-13 P3, E9R, E9U  
TO TB5-13 CLOSE CONTACT TO ACTIVATE SAMPLE AND HOLD WITH RATIO CAN ALSO BE USED AS ANTI-COAST.





