DOVER FLEXO ELECTRONICS, INC.

INSTRUCTION MANUAL

MODEL E10
TENSION CONTROLLER

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MODEL E10 ELECTRIC TENSION CONTROLLER

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SECTION

E10 ELECTRIC TENSION CONTROLLER INSTALLATION

ELECTRICAL RATINGS

INPUT --- 120 Volts, 60 HZ. @ 4 Amps., Standard.

OUTPUT--- 0-90 Volts DC @ 3 Amps., Variable, as required to maintain set tension, Standard.

LOCATION OF CONTROLLER

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

WIRING

All external connections are made to terminal strips on the panel. Refer to external connection drawing E1222C. Transducers are connected via amphenol connectors. Transducer cables are shielded. Connect the end marked "G" to the controller.

If the controller is a panel only type, use shielded cable for the tension meter, tension set point potentiometer and transducer wiring. Ground the shield at the controller end ONLY!

DOUBLE CHECK ACCURACY OF ALL CONNECTIONS BEFORE APPLYING POWER TO THE CONTROLLER.

DESCRIPTION OF OPERATION

SYSTEM OPERATION

The model E10 Electric Tension Controller is part of a closed loop (negative feedback) control system. Also included in the system are the tension transducers, brake or clutch, 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 adjusts torque output of the brake or clutch to make actual tension the same as desired tension. The controller automatically varies brake or clutch torque 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.

4. Conditions the web tension signal for other circuit functions.

Amplifier U2 accepts the conditioned web tension signal and compares it to the signal from the tension set point potentiometer. A difference between these two signals will cause a resulting error signal. The error signal will be high if the web tension is too low compared to the tension set point setting and will be low if the tension is too high compared to the tension set point setting.

U3 is a Sample and Hold IC that is used with a multiply/divide circuit to provide smooth operation during flying splices on either unwinds or rewinds.

Amplifier U5 is part of the Soft Start circuitry which prevents brake lock-up when starting with a slack web. Its associated circuitry sets the trip level that determines whether the controller should be in the automatic mode or the soft start mode. The tension signal is continually being monitored by the soft start circuitry. If the tension (on the web) goes below the soft start trip point, the unit will go into the soft start mode after a 3 second time delay. If the tension (on the web) is above the soft start trip point, then the unit will immediately go onto the automatic mode. The soft start trip point automatically tracks and changes as the desired tension level is dialed in. When the tension set point potentiometer is set low, the soft start trip point is at approximately 4% of the tension meter's full scale reading. When the tension set point potentiometer is set high, the soft start trip point is at approximately 10% of the tension meter's full scale reading. When the controller goes into the soft start mode, a low value of voltage is applied to the brake. This low value automatically tracks the adjustment of the auto set point pot. A switch is provided to allow the soft start feature to be enabled or disabled.

The regulator card also contains the stability and gain circuits and the adjustable Max which limits the maximum brake or clutch torque to a value chosen by the machine operator. The Dual Calibration option and the Ratio are also contained on this card.

B. The Driver Card (D1) accepts the resulting error signal (from the regulator card) and triggers the SCR firing circuitry. The Line synchronization circuit times the trigger pulses so that the appropriate SCR will be turned on only when forward conduction is possible. Once enabled, the firing circuit produces a train of 100 microsecond pulses. This establishes SCR on-state current and insures that the SCR's will continue to conduct regardless of any line notching.
Also on the card are emergency stop, manual circuitry with tracking to provide bumpless switching between auto and manual and a minimum output circuit. A fuse protects the output SCR bridge circuit and a snubber network prevents SCR dv/dt-failure due to line spikes and transients.

C. The Power Supply Card (PS6)
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
6. Sync Pulse Supply - Synchronizes SCR gate pulses with the AC line

D. The Rewind Relay Card contains relays for the positive disconnection of AC power and voltage to the clutch. It also contains terminal block connections for AC power and output to the clutch

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%.

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

RESPONSE - Adjusts how quickly the unit is allowed to respond to fast changes that might occur in the web handling 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 voltage output to the brake or clutch.

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. To prevent the roll from coasting while the machine is stopping, set the ratio switch to unwind. Use the unwind ratio pot to adjust the amount of additional voltage applied to the brake or clutch. Set the ratio off delay pot. fully clockwise.

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 voltage increases when the ratio circuit is energized. When fully counterclockwise, 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 voltage 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 brake or clutch to that required by the full roll.

1. Install a full roll.
2. Turn MAX completely CW.
3. Run the machine at 200 FPM 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 ½ 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

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, E10

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
(3) An oscilloscope having at least a 10MHZ. range

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 E10 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 TP18 and TP15 (+) 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. (±3 VDC)
7. The voltage between TP10 (+) and TP11 should be 5 VDC.

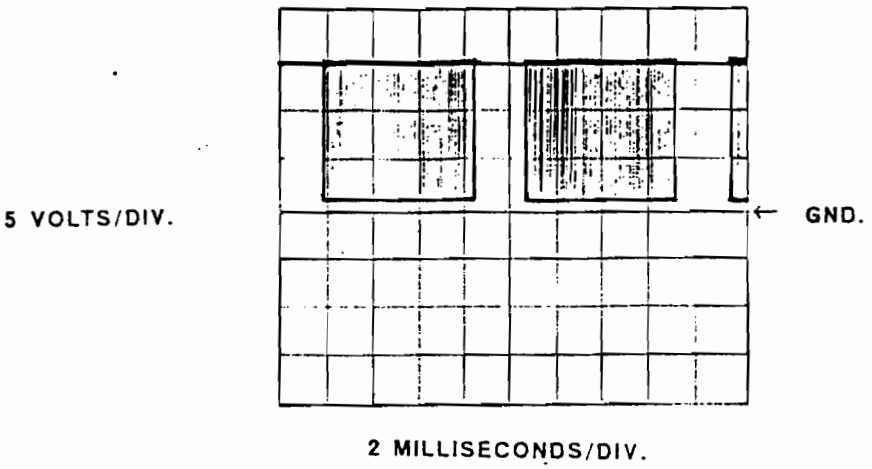
REGULATOR CARD (R4)

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 auto set pot (located on the front cover) to 5. Turn the Max pot fully CW. The voltage between TP2 and TP8 (+) should be 8.6 VDC (±1 VDC).
10. Turn the Max pot fully CW. Switch the soft start on-off switch on. The voltage between TP2 and TP8 (+) should be 1.4 VDC (±.3 VDC)
11. Using the zero pot, adjust CW until the tension meter reads 25% of full scale. The voltage between TP2 and TP8 (+) should be 8.6 VDC (±.3 VDC).
12. Set the auto set pot to off (fully CCW). The voltage between TP8 and TP2 (+) should be .3 VDC (±.3 VDC).
13. Set the auto set pot to 5. Using a jumper wire, jumper between TB6-6 and TB6-5. The voltage between TP2 and TP8 (+) should be 1.4 VDC (±.3 VDC).

    Remove jumper.

DRIVER CARD (D1)

14. The voltage between TP34 (+) and TP35 (-) should be 18 VDC (±3 VDC).
15. The voltage between TP35 (+) and TP 31 (-) should be 9.5 VDC.
16. Using an oscilloscope, observe the waveform at TP32. Use TP35 or GND. for scope reference. The waveform should look like this:



Turn the auto set pot. fully CCW. The pulse width of the waveform should gradually decrease as the firing circuit turns off. When fully off, the waveform at TP32 will be a straight line, 15 VDC above ground.

THIS COMPLETES THE TROUBLESHOOTING PROCEDURE FOR THE BASIC E10 CONTROLLER. CONSULT THE FACTORY IF FURTHER ASSISTANCE IS REQUIRED

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.

DOVER FLEXO ELECTRONICS	E10 ELECTRICAL TENSION CONTROLLER	MODEL E10 DIAGRAM REF. E1140E

	DES	PART NO.	DESCRIPTION	QTY		MFR
1						
2		EA887C	R4, Regulator Card	1		
3		EA1169C	PS6, Power Supply Card	1		
4		EA1155C	D1, Driver Card	1		
5		EA645C	01, Options Card	1		
6						
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18						
19						
20						
21						
22						
23						
24						
25			DIAGRAMS			
26		E1140E	E10 Schematic	1		
27		E1229C	External Connections Drawing	1		
28		E643C	01 Card Schematic	1		
29						
30						
31						
32						
33						
34						
35						
36						

DATE

+10VDC
REMOTE TENSION AMPLIFIER OPTION

POWER

PS6 POWER SUPPLY CARD

TB1

TENSION

TRANSDUCERS

WHT

RED

RED

BLK

BLK

TB2

WHT

CONNECT TO TB5-12 ON R4 BOARD.

CONNECT TO TB5-13 ON R4 BOARD

CONNECT TO TB6-3

TB4

CONNECT TO TB12-5

CONNECT TO TB12-7

CONNECT TO TB13-2

TENSION ON

TENSION OFF

TB7

TB7

PART OF 05 CARD *

* OPTIONAL - IF CONTROLLER HAS TLS, A N.O. CONTACT IS WIRED INTO TENSION ON/OFF CIRCUIT AS SHOWN.

POWER SWITCH

OUTPUT FROM SCR BRIDGE

* 20K 1%

OUTPUT METER

TB13

REWIND RELAY CARD

TB14

TB15

120V/60HZ (STANDARD) OR 240V/50HZ (OPTIONAL)

CLUTCH

TR OR NW CONNECTIONS

TB5

WHT

BRN

BLK

RED

GRN

TB2

* NOTE: RESISTOR SUPPLIED AS PART OF METER

DI DRIVER CARD

TB12

MANUAL SET POINT POT

CW

10K

CONNECT TO TB4-3

CONNECT TO TB4-6

MAN

AUTO

PART OF AUTO/MAN SWITCH

AC INPUT CONNECT TO REWIND RELAY CARD

CLOSE CONTACT FOR EMERGENCY STOP (UNWIND ONLY)

CLOSE CONTACT OR INSTALL JUMPER FOR MINIMUM OUTPUT

CONNECT INPUT FROM MAIN DRIVE ARMATURE FOR INERTIA COMPENSATION

240VDC MAX

120 VDC MAX

R4 REGULATOR CARD

TB6

CLOSE CONTACT TO ACTIVATE SAMPLE AND HOLD. CONTACT MUST REMAIN CLOSED TO KEEP CONTROLLER IN S&H.

CONNECT TO TB4-1

CAL 1(HIGH) OPTIONAL DUAL CAL 2(LOW) METER SCALE

CLOSE CONTACT TO MANUALLY ACTIVATE SOFT START

CLOSE CONTACT TO ACTIVATE RATIO DURING SPLICE

TB5

OFF

TAPER

ON

CW

10K

CONNECT TO TB2-4 OR 5 ON PS6 BOARD.

OPTIONAL RIDER ROLL TAPER POT

1K

CW

AUTO SET POINT POT

CONNECT -15V TO TB2-11 ON PS6

TENSION SIGNAL INPUT FROM TRANSDUCERS

TENSION METER

CONNECT TO TB2-10 ON PS6 BOARD.

PART OF POWER SWITCH

OBSOLETE

K.C.	9-24-92	G	CHG'D TB4-14 TO TB4-11
K.C.	7-15-91	F	ADDED TR OR NW DATA.
RJ	12-20-89	E	
SD	8-25-89	D	
SD	5-10-88	C	
SD	2-2-88	B	
SD	10-30-87	A	

MATL. | REF.

MACHINED LIMITS OTHERWISE | DIMENSION UNLESS SPECIFIED

.X ± .04
.XX ± .02

PART: E10 EXTERNAL CONNECTIONS

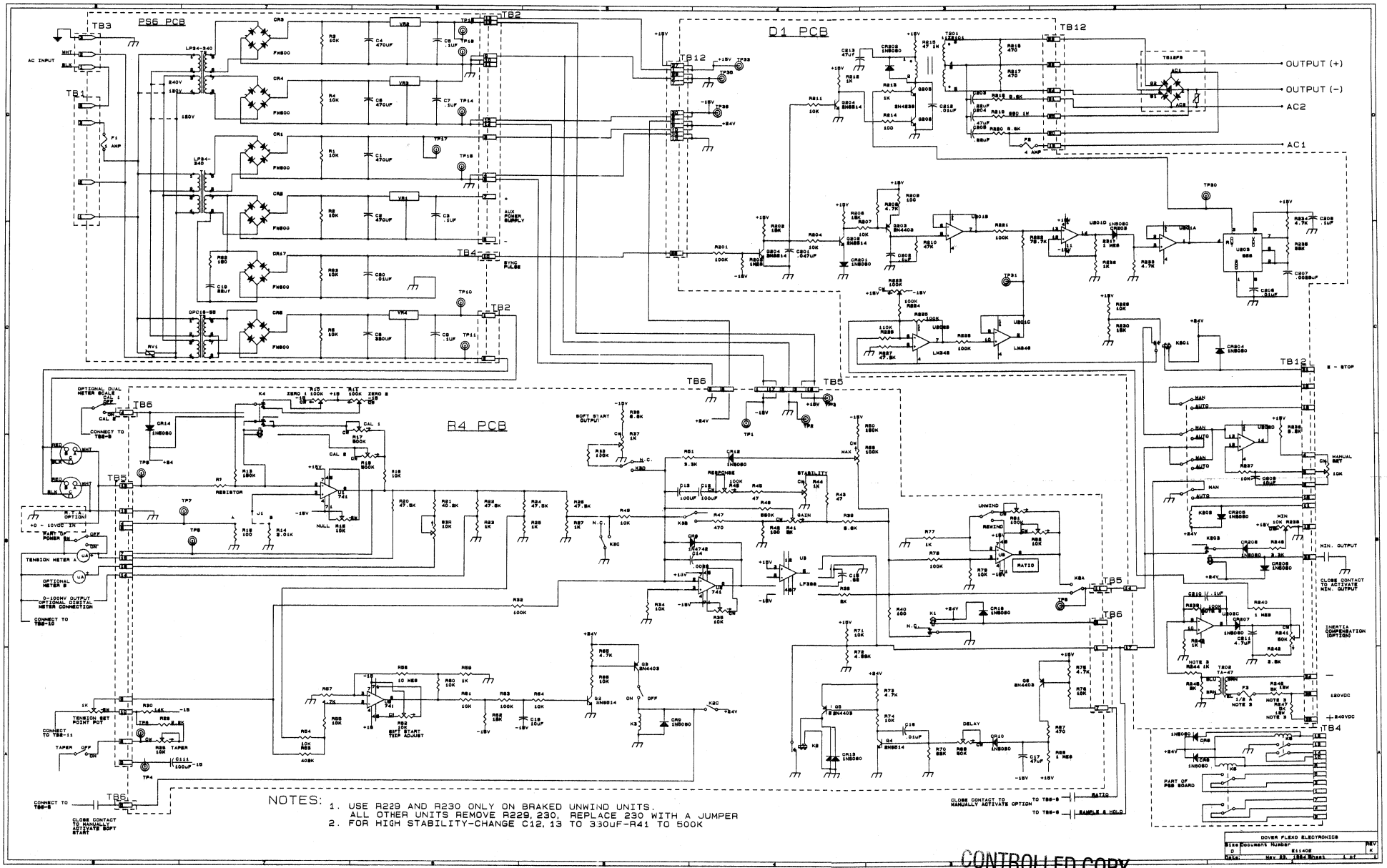
MODEL E10

USE

DOVER FLEXO ELECTRONICS INC.
ROCHESTER, N.H. 03867

DR. BY Sharon | DATE 10-21-87 | SCALE

DRAWING NO. E1229C


PS6 PCB
D1 PCB
R4 PCB
TB1
TB2
TB3
TB4
TB5
TB6
TB12
AC INPUT
OUTPUT (+)
OUTPUT (-)
AC2
AC1
E - STOP
NOTES:
1. USE R229 AND R230 ONLY ON BRAKED UNWIND UNITS. ALL OTHER UNITS REMOVE R229, 230, REPLACE 230 WITH A JUMPER
2. FOR HIGH STABILITY-CHANGE C12, 13 TO 330uF-R41 TO 500K
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