MODEL E11 ELECTRIC TENSION CONTROLLER &
SPLICER SYSTEM

TABLE OF CONTENTS

SECTION

E11 ELECTRIC TENSION CONTROLLER INSTALLATION

ELECTRICAL RATINGS

INPUT --- 120 Volts, 60 HZ. @ 8 Amps., Standard.

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

--- 0-90 Volts DC @ 3Amps., Proportional to press speed.

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 E1295D. Transducers are connected via amphenol connectors. Transducer cables are shielded. Connect the end marked "G" to the controller. Use shielded cable for tachometer connections. Ground the shield at the controller end only.
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 E11 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.

The E11 also contains flying splice sequencing logic and a core speed matching circuit for use on a turret rewind. It automatically speed matches the empty core to the web and transfers tension control from the full roll to the core after the cut web is tagged on.

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 OVDC 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 into 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 meters full scale reading. When the tension set point potentiometer is set high, the soft start trip point is at approximatley 10% of the tension meters full sclae 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 contain 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 approximate 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.
Alson on the card are emergency stop, manual circuitry with tracking to provide bumpless switching 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 Speed Matching Card (SC2) compares the line tach voltage to the clutch tach voltage. The resulting error signal triggers the SCR firing circuit. The output voltage varies to match the speed of the empty core to the web speed.The card also contains Dual Calibration for speed matching 2 core sizes.

E. The Splicer Logic Card (SLC2) contains the necessary sequencing for a flying splice. Relays switch AC power, energize clutches, enable the speed matching circuit, rotate the turret, fire the knife and transfer the empty core from speed match to tension control. It also contains a relay to reverse clutch tach polarities for winding "under".

START-UP PROCEDURE

TENSION CONTROLLER PORTION

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.

350 = 10 V

300 – 350 – 400

CALIBRATION Ref. Dwg#1697C

1. Install a new core on each rewind shaft. If 2 core sizes will be used, install the small core first.

2. Do not web the press or attach the web to either core.

3. Turn auto set pot to "off". Put the core switch in "small" position. Turn the RED clutch on first to put it in tension control.

4. Turn the YELLOW clutch on to put it in the speed-follower mode.

5. With the press stopped, adjust the Zero 1 pot clockwise until the yellow core just starts to turn. Turn it back CCW until the core stops.

6. Run the press at splicing speed. Using a hand tachometer, measure the press speed at the plate cylinder. Using the same tachometer, measure the YELLOW core speed and adjust CAL 1 until core speed is equal to the press speed.

7. Turn off both clutches. Turn the YELLOW clutch on first. Then turn the RED clutch on to put it in the speed-follower mode.

8. Measure the red core speed and turn the balance pot until the RED speed is the same as the YELLOW speed.

9. Adjust the Zero 1 pot clockwise until the RED clutch speed is 10 FPM faster than press speed. Note: This one adjustment is all that is needed to overspeed both Red and Yellow.

10. If 2 different core sizes are used, put the core switch in the "Large" position. Install the larger core on the yellow shaft. Repeat steps 2 thru 9 but adjust Cal2 and Zero 2 instead of CAL 1 and Zero 1.

TROUBLE SHOOTING PROCEDURE, E11

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 E11 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)

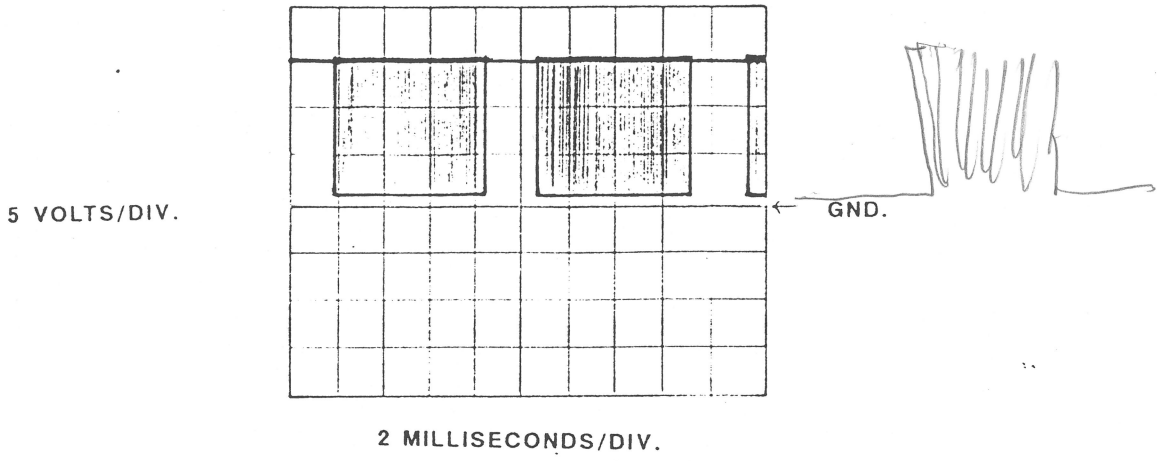
4. The voltage between TP18 and TP15 (+) should be 15 VDC.
5. The voltage between TP18 (+) and TP14 should be 15 VDC.
6. The voltage between TP18 and TP17 (+) should be 24 VDC. (±3 VDC)
7. The voltage between TP10 (+) and TP11 should be 5 VDC.

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 E1.1 CONTROLLER. CONSULT THE FACTORY IF FURTHER ASSISTANCE IS REQUIRED

SPEED MATCHING CARD (SC2)

1. Most problems are the result of improper calibration or connection of the SC2. If core speed cannot be adjusted to line speed, check the dip switch configuration on SC2. Refer to Drawing E1259C. Check core and wind switches to be sure they are in the correct position. Repeat Calibration Procedure.

2. If the new core does not turn when controller is put in speed match, it usually indicates that the line speed tach input is not reaching the SC2 of its polarity is wrong. Check for the input on TB16-17 (+) and TB16-18(-).

3. If the new core runs at maximum speed when controller is put in speed match, it usually indicates that the clutch tach input is not reaching the SC2 or its polarity is wrong. Check the yellow clutch tach input on TB16-16(+) and TB16-15(-). Check the RED clutch tach input on TB16-14(+) and TB16-13(-).

SPLICER LOGIC CARD (SLC2)

1. If the sequencing of the splice is malfunctioning, one clutch does not have an output, or tach polarities are incorrect at the SC2, but correct at the input, the problem may be on the SLC2 Card.

2. Refer to drawing E1295D for a schematic of the card and Drawing E1286C for a ladder diagram simplifying the sequence.

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.

INSTRUCTIONS FOR USING TLS

(TENSION LIMIT SWITCH)

Overview: Theory of operation, Adjustments of the Low Set and High Set potentiometers and the Delay potentiometers.

Theory of Operation: Refer to Drawing E1300D

The TLS circuit uses two OP-Amps and other discrete components to monitor the tension signal produced on the regulator card.

Low Set and High Set potentiometers are adjusted to set low and high reference voltages to U110 and U111, which change states when the tension input signal falls below or rises above these preset reference voltages.

When U110 or U111 output is high, relay K102 or K103 is energized through Q112, 113 or Q114, 115 when U110 or U111 output is low, relay K102 or K103 is de-energized.

The amount of time it takes relay K102 or K103 to de-energize is dependent on delay 1 pot or delay 2 pot. At fully (ccw) there is no delay, at fully (cw) there is a delay of about 3 or 3 1/2 seconds before the appropriate relay de-energizes.

ADJUSTMENT OF THE SET POTENTIOMETERS

LOW SET: Ref. E1300D Drawing

Low set pot R169 is used to set the low end tension limit of detection. From 0 to about 60% off full scale is the range of adjustability.

Refer to Fig. A. for an approximate setting of R169.

RELAY K102	PERCENTAGE OF FULL SCALE								
ENERGIZE	60%	57%	50%	42%	32%	22%	13%	8%	6%
DE-ENERGIZE	55%	52%	45%	38%	26%	16%	8%	2%	1%
POT SETTING R169	 4 O'CLOCK	 3 O'CLOCK	 2 O'CLOCK	 1 O'CLOCK	 12 O'CLOCK	 11 O'CLOCK	 10 O'CLOCK	 9 O'CLOCK	 8 O'CLOCK

FIG. A

With A.C. power applied, relay K102 is de-energized until tension is brought higher than set pot R169. In this example, R169 is set at 12 o'clock.

As tension increases past 32% of full scale (16 minor divisions on the tension meter) Relay K102 energizes, closing the contacts of TB7-14 & 15, TB7-16 & 17, and also opens the contacts of TB7-13 & 15, TB7-17 & 18.

When tension decreases below 26% of F.S. (13 minor div) relay K102 de-energizes, closing the contacts of TB7-13 & 15/17 & 18, and opening the contacts of TB7-14 & 15/ 16 & 17.

HIGH SET Ref. E1300D Drawing

High Set pot R184 is used to set the high end tension limit of detection, from 0% to over full scale is the range of adjustability. Refer to Fig. B for an approximate setting of R184.

FIG. B

RELAY K103	PERCENTAGE OF FULL SCALE								
DE-ENERGIZE	42%	44%	54%	64%	74%	84%	96%	110%	125%
ENERGIZE	38%	40%	50%	58%	68%	80%	90%	110%	125%
POT SETTING R184	8 O'CLOCK	9 O'CLOCK	10 O'CLOCK	11 O'CLOCK	12 O'CLOCK	1 O'CLOCK	2 O'CLOCK	3 O'CLOCK	4 O'CLOCK

With A.C. power applied relay K103 is automatically energized, unless, at that time tension is higher than set pot R184.

In this example, R184 is set at 12 o'clock, as tension increases past 74% of full scale (37 minor divisions) relay K103 de-energizes, closing contacts on TB7-23 & 24/26 & 27 and also opening contacts TB7-22 & 23/25 & 27. Relay K103 will energize again when tension is allowed to drop below pot 184 setting (68% of full scale) 34 minor divisions.

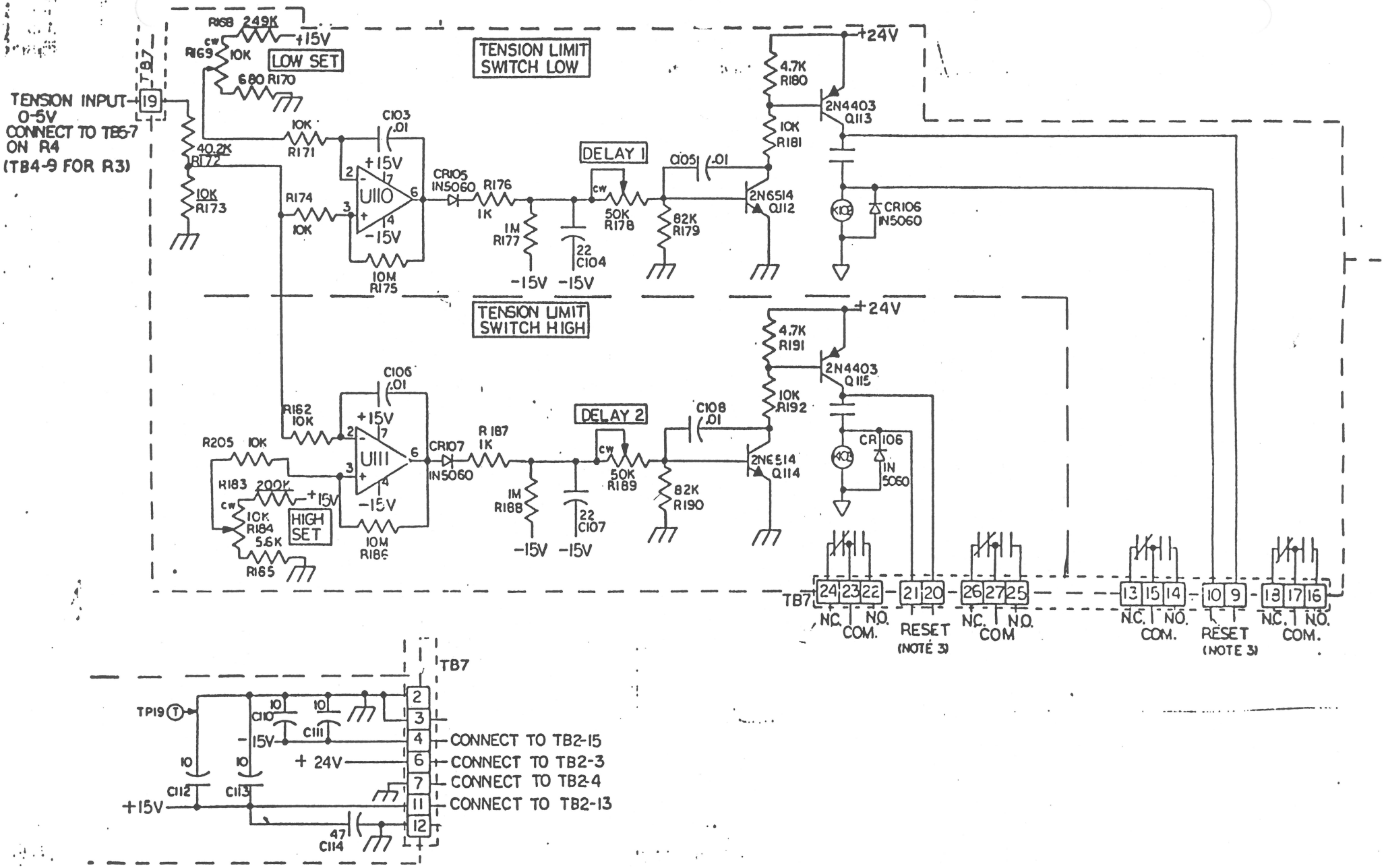
DELAY POTENTIOMETERS R178 & R189

The delays pots are adjustable from 0 sec. (ccw) to about 3 1/2 sec. (cw).

The low set delay starts when tension drops below low set pot R169 setting.

The high set delay starts when tension increases above high set pot 184 setting.

The delay set pot's R178 & 189, delay the <u>de-energizing</u> of relays K102 and K103.


TENSION LIMIT SWITCH LOW
LOW SET
TENSION INPUT 0-5V CONNECT TO TB5-7 ON R4 (TB4-9 FOR R3)
TB7
19
R168 249K
+15V
R169 CW 10K
680 R170
40.2K R172
10K R173
10K R171
C103 .01
U110
+15V
-15V
10M R175
R174 10K
CR105 IN5060
R176 1K
1M R177
22 C104
-15V -15V
DELAY 1
50K R178
C105 .01
82K R179
2N6514 Q112
4.7K R180
10K R181
+24V
2N4403 Q113
CR106 IN5060
TENSION UMIT SWITCH HIGH
C106 .01
R162 10K
R205 10K
R183 200K
+15V
CW 10K R184
5.6K R165
HIGH SET
U111
+15V
-15V
10M R186
CR107 IN5060
R187 1K
1M R188
22 C107
-15V -15V
DELAY 2
50K R189
C108 .01
82K R190
2N6514 Q114
4.7K R191
10K R192
+24V
2N4403 Q115
CR 106 IN 5060
TB7
24 23 22 21 20 26 27 25 13 15 14 10 9 13 17 16
N.C. NO. COM. RESET (NOTE 3) N.C. NO. COM. N.C. NO. COM. RESET (NOTE 3) N.C. NO. COM.
TB7
TP19
C110 10
C111 10
-15V
+24V
C112 10
C113 10
+15V
47 C114
2 3 4 6 7 11 12
CONNECT TO TB2-15
CONNECT TO TB2-3
CONNECT TO TB2-4
CONNECT TO TB2-13

DOVER FLEXO ELECTRONICS

MODEL: E11
DIAGRAM: E1140E
REF:

	DES	PART	DESCRIPTION	QTY		MFR
1		EA887C	R4, REGULATOR CARD			
2		EA1169C	PS6, POWER SUPPLY CARD			
3		EA1155C	D1, DRIVER CARD			
4		EA1296C	O5, OPTIONS CARD			
5		EA1255C	SC2, SPLICER CARD			
6		EA1282D	SLC2, SPLICER LOGIC CARD			
7						
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25						
26		E1140E	E11 SCHEMATIC			
27		E1300D	O5 CARD SCHEMATIC			
28		E1697C	SC2 SCHEMATIC - 1295C			
29		E1295D	SLC2 SCHEMATIC & EXTERNAL CONNECTIONS			
30		E1286C	SPLICING LOGIC LADDER DIAGRAM			
31		E1715D	INTERNAL CONNECTIONS			
32		E1685D	EXTERNAL CONNECTIONS			
33		1314C-				
34						
35						
36						
37						
38						
39						

DATE:

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.

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.

6. WARRANTY
Dover Flexo Electronics,Inc. warrants its' products to be free of defects in material and workmanship for one year from date of original 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. 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.

7. 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. 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.

8. 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.

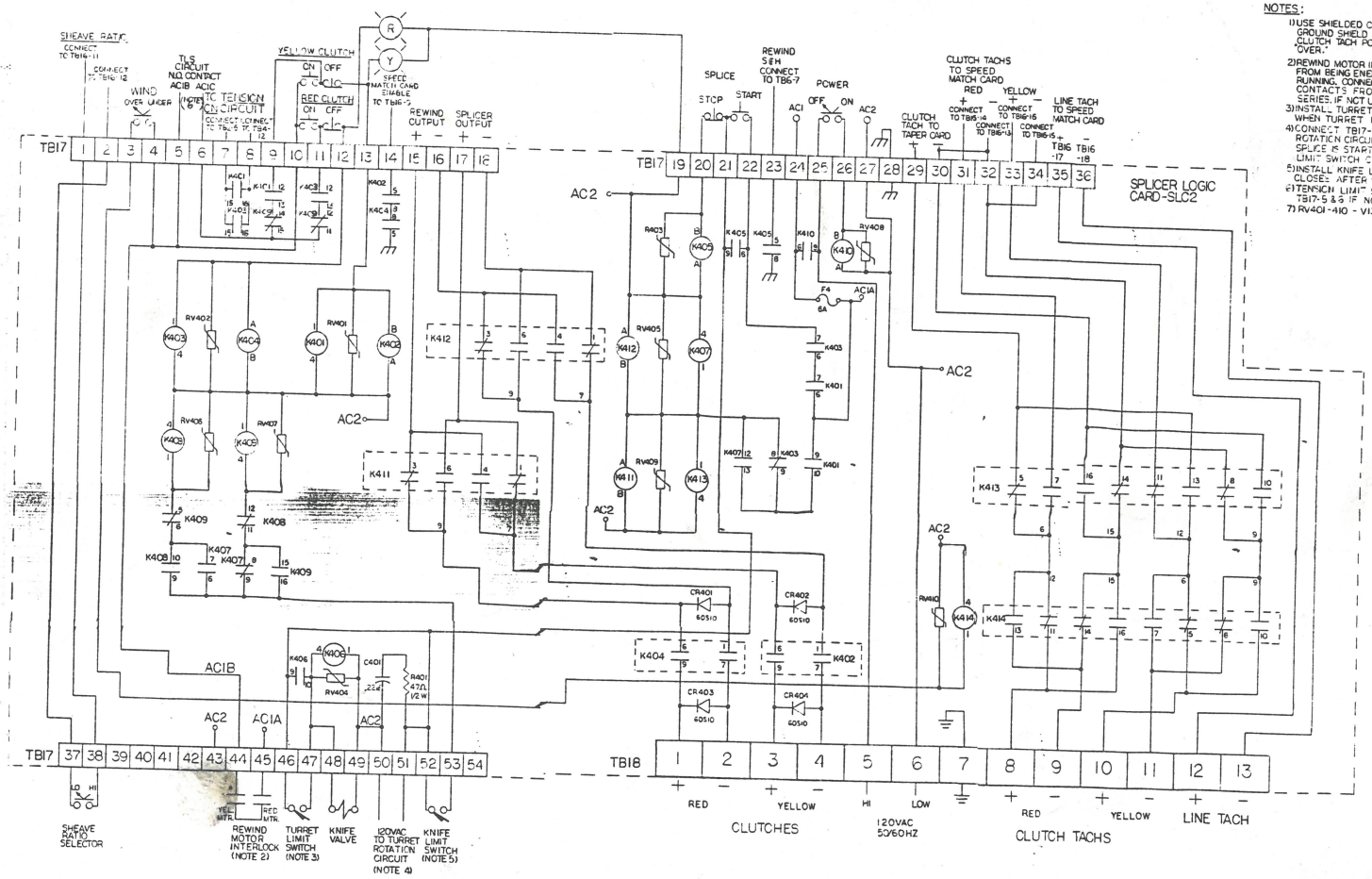
9. RETURNS
Written authorization must be obtained from the Company's factory before returning any material for which the Buyer expects credit, exchange, repairs under the Warranty or refund. Returned material (except exchanges or repairs under the Warranty) shall be subject to a minimum re-stocking charge 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.

10. 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.

11. 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.

12. 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.

13. 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 letter of credit 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.

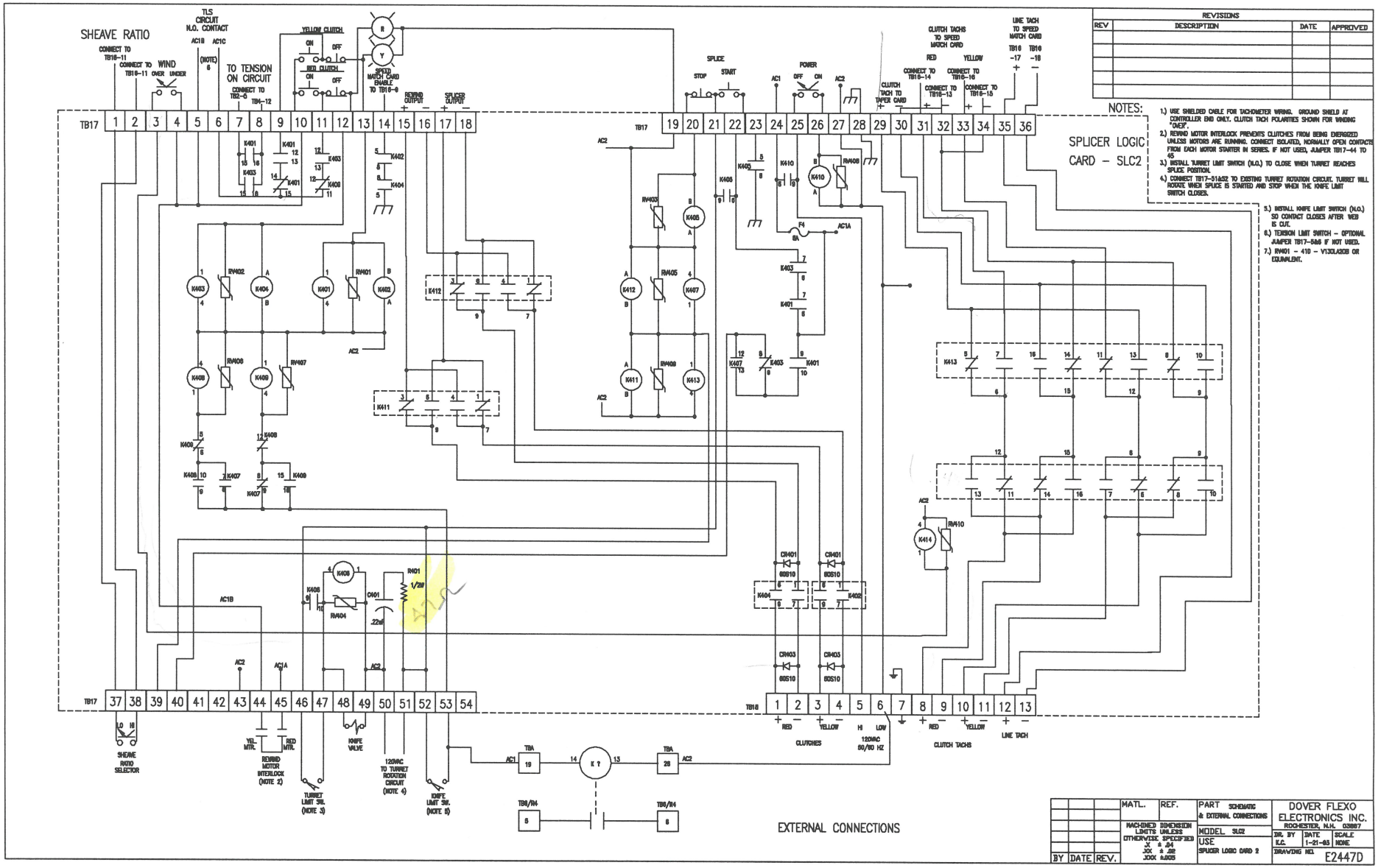


NOTES:

1) USE SHIELDED CABLE FOR TACHOMETER WIRING. GROUND SHIELD AT CONTROLLER END ONLY. CLUTCH TACH POLARITIES SHOWN FOR WINDING OVER.
2) REWIND MOTOR INTERLOCK PREVENTS CLUTCHES FROM BEING ENERGIZED UNLESS MOTORS ARE RUNNING. CONNECT ISOLATED, NORMALLY OPEN CONTACTS FROM EACH MOTOR STARTER IN SERIES. IF NOT USED, JUMPER TB17-44 TO -45
3) INSTALL TURRET LIMIT SWITCH (N.C.) TO CLOSE WHEN TURRET REACHES SPLICE POSITION.
4) CONNECT TB17-51 & 52 TO EXISTING TURRET ROTATION CIRCUIT. TURRET WILL ROTATE WHEN SPLICE IS STARTED AND STOP WHEN THE KNIFE LIMIT SWITCH CLOSES.
5) INSTALL KNIFE LIMIT SWITCH (N.C.) SC CONTACT CLOSES AFTER WEB IS CUT.
6) TENSION LIMIT SWITCH - OPTIONAL - JUMPER TB17-5 & 6 IF NOT USED
7) RV401-410 - V130LA20B OR EQUIVALENT

EXTERNAL CONNECTIONS

		MATL.	REF.	PART SCHEMATIC & EXTERNAL CONNECTIONS	DOVER FLEXO ELECTRONICS INC. ROCHESTER, N.H. 03867	
		MACHINED LIMITS UNLESS OTHERWISE SPECIFIED: .X ± .06, .XX ± .03, .XXX ± .005	DIMENSION UNLESS SPECIFIED	MODEL SLC2		
BSK	12-29-89	A		USE SPLICER LOGIC CARD 2	DR. BY BSK	DATE 3-15-88
SS	6-1-88	B				SCALE ~
BY	DATE	REV.			DRAWING NO. E1295C	



SPLICER LOGIC CARD – SLC2

NOTES:

1.) USE SHIELDED CABLE FOR TACHOMETER WIRING. GROUND SHIELD AT CONTROLLER END ONLY. CLUTCH TACH POLARITIES SHOWN FOR WINDING "OVER".

2.) REWIND MOTOR INTERLOCK PREVENTS CLUTCHES FROM BEING ENERGIZED UNLESS MOTORS ARE RUNNING. CONNECT ISOLATED, NORMALLY OPEN CONTACTS FROM EACH MOTOR STARTER IN SERIES. IF NOT USED, JUMPER TB17-44 TO 45

3.) INSTALL TURRET LIMIT SWITCH (N.O.) TO CLOSE WHEN TURRET REACHES SPLICE POSITION.

4.) CONNECT TB17-51&52 TO EXISTING TURRET ROTATION CIRCUIT. TURRET WILL ROTATE WHEN SPLICE IS STARTED AND STOP WHEN THE KNIFE LIMIT SWITCH CLOSES.

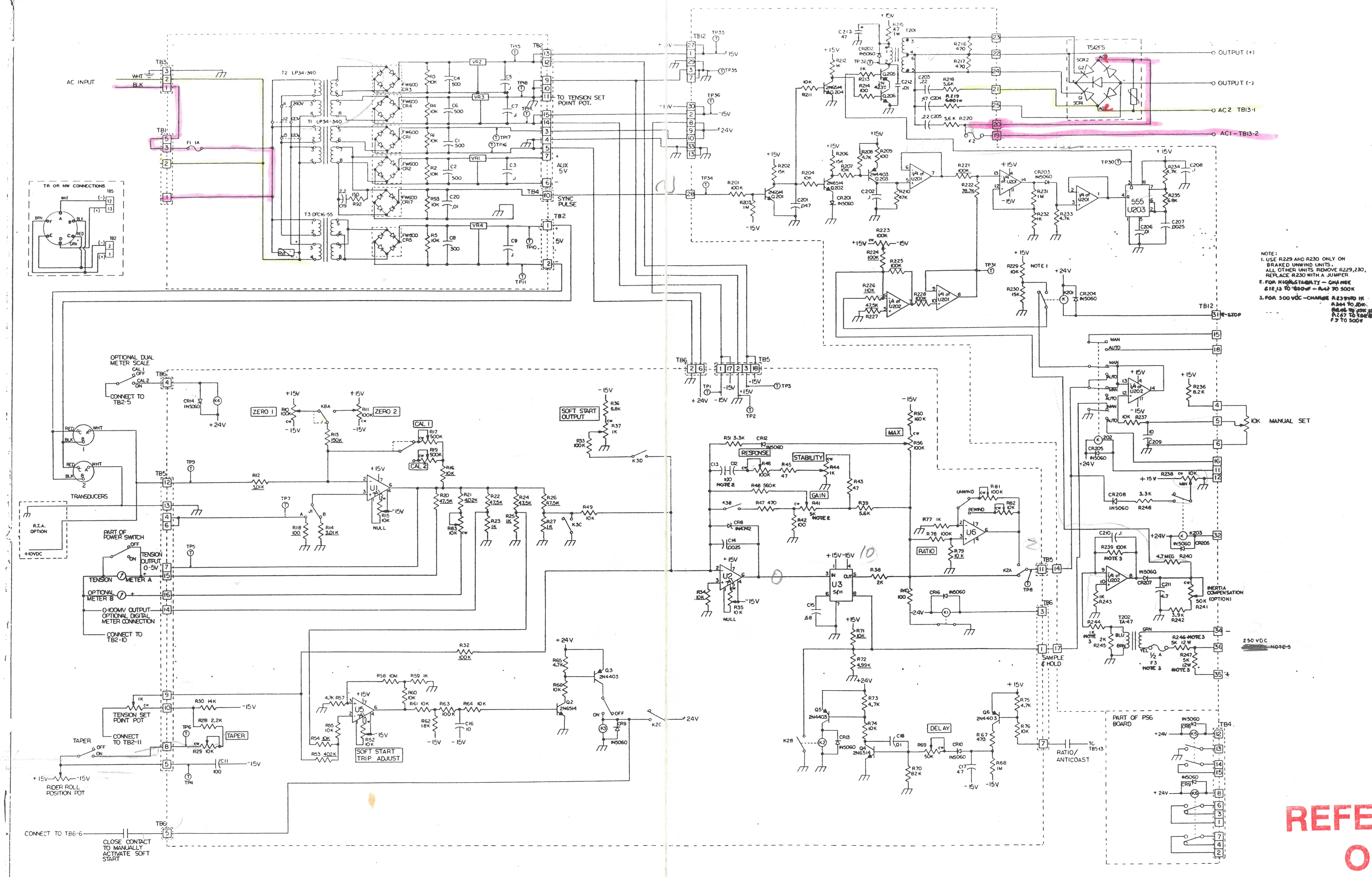
5.) INSTALL KNIFE LIMIT SWITCH (N.O.) SO CONTACT CLOSES AFTER WEB IS CUT.

6.) TENSION LIMIT SWITCH – OPTIONAL JUMPER TB17-5&6 IF NOT USED.

7.) RW401 – 410 – V130LA20B OR EQUIVALENT.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

				MATL.	REF.	PART SCHEMATIC & EXTERNAL CONNECTIONS	DOVER FLEXO ELECTRONICS INC. ROCHESTER, N.H. 03867
				MACHINED DIMENSION LIMITS UNLESS OTHERWISE SPECIFIED X ± .04 .XX ± .02 .XXX ±.005		MODEL SLC2	DR. BY K.C.
						USE SPLICER LOGIC CARD 2	DATE 1-21-03
BY	DATE	REV.					SCALE NONE
							DRAWING NO. E2447D



REFERENCE ONLY

				5-16-91	F	MATL.	REF.	PART SCHEMATIC	DOVER FLEXO ELECTRONICS INC. ROCHESTER, NH 03867
				11-28-90	E				
				10-6-89	D				
	7-15-92	J		8-24-88	C	MACHINED DIMENSION LIMITS UNLESS OTHERWISE SPECIFIED		MODEL E7,E10,E11	
	10-11-91	H		5-9-88	B	X ± .04		USE	DRBY SHARON / DATE 4-7-87 / SCALE --
	7-15-91	G		12-16-87	A	XX ± .02			
BY	DATE	REV.	BY	DATE	REV.	XXX ± .005			DRAWING NO. E1140E