TELETYPE CORPORATION
Skokie, Illinois, U.S.A.

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DESCRIPTION, SERVICING, AND ADJUSTMENTS FOR 323810 DUAL INPUT (OR LOGIC), SELECTOR MAGNET DRIVER (SMD) WHEN INSTALLED IN AN ELECTRICAL SERVICE ASSEMBLY EQUIPPED FOR LOW LEVEL RFI (POLAR-EMC) OPERATION

CONTENTS PAGE

1. DESCRIPTION

1.01 The 323810 dual input selector magnet driver (SMD) circuit card assembly (Figure 1), when installed (plugged) in a shielded electrical service assembly (ESA) containing the proper power supply and filter assemblies, is intended for radio frequency interference (rfi) suppression of receiving selector operation in systems requiring low level rfi (Polar-EMC) kits. The complete SMD assembly is mounted on a single 4-1/4 inch by 2-1/2 inch plug-in card (Figures 2 and 3).

1.02 The two (dual) SMD inputs perform OR logic and enable reception from either one of two separate transmitters (single input operation) while the input line from the other transmitter is open. To obtain optimum rfi suppression, the receiving system must utilize a 319204 selector assembly. The SMD functions as a direct coupled amplifier and provides 60 milliampere operation only. A spacing signal at either SMD input, with the other input open, will provide a spacing output (Figure 4 or schematic wiring diagram 8143WD). The SMD should be used with the proper associated equipment.

1.03 One 323810 SMD assembly is plugged into each 15-pin 148458 connector, in an ESA, that has a 198650 polarizing key located to accommodate the card slot between pins E and F (Figure 3).

1.04 The 323810 selector magnet driver (SMD) is adaptable to various types of 28 equipment through the use of special modification kits that are applicable in either field or factory installation. Each SMD, one or more, is a part of, or associated with, some electrical service assembly (ESA) with power supply. Each ESA is a part of some special modification kit. The quantity of SMDs and the associated equipment will depend upon which modification kit is used. For wiring diagrams and additional information, refer to Specification 50505S covering electrical service assemblies for low level operation.

2. TECHNICAL DATA

2.01 The 323810 selector magnet driver (SMD) receives signals from low level polar line keyers (low level +6 volts mark, -6 volts space) and operates a 28 selector.

2.02 A spacing signal (-6 volts) at either input (with the other input open) causes a spacing output. A marking signal (+6 volts) at either input (with the other input open) causes the output to mark.

2.03 The 323810 SMD functions properly when a single signal line is connected to either input while the other input is open (single input operation).

2.04 The output current (selector) is 60 milliamperes ±10 percent during the marking state. The output is zero in the spacing state.

2.05 The 323810 SMD assumes the marking state with positive input voltages not greater than +0.5 volts and the spacing state with negative voltages not greater than -0.5 volts.

2.06 The marking and spacing switching levels as defined in Paragraph 2.05 are adjustable to within 10 percent of each other.

2.07 The 323810 SMD should have a minimum input resistance of 50,000 ohms.

2.08 The maximum input capacitance should be 2500 picofarads.

2.09 Overall receiving margins of properly adjusted 28 selectors driven by the 323810 selector magnet driver (polar rectangular wave input) should exceed 70 points.

2.10 The selector magnet driver provides a marking output when the input line is open.

2.11 Paragraphs 2.05 to 2.11 are applicable to each input.

2.12 The 323810 SMD operates at bit rates up to 75 baud.

2.13 The SMD operates in a maximum free air ambient temperature of 70°C (158°F). Storage temperatures should not exceed 85°C (185°F).

2.14 The SMD operates from a power supply delivering 47 to 53 v dc.

2.15 Power consumption under any combination of power source, environmental, and components conditions should be 8.5 watts maximum.

2.16 The 323810 selector magnet driver when used with associated electrical service assembly and power supply is intended for use with equipment requiring low level rfi (Polar-EMC) operation.

3. PRINCIPLES OF OPERATION

3.01 All circuit references in the following paragraphs are made with respect to the 323810 circuit card assembly drawing and schematic wiring diagram 8143WD of the 323810 selector magnet driver (SMD). Refer to Figures 2, 3, and 4.

3.02 The selector magnet driver (SMD) 323810 is basically a direct coupled amplifier providing a current gain of approximately 80 db. The first two stages (Q1, Q6, or Q5, Q7) provide the necessary gain to drive a Schmitt Trigger (Q8 and Q9). Q2, Q3, and Q4 comprise a power regulator stage which provides the power supply with a constant load.

3.03 In the marking state with a positive voltage with respect to common applied to each input (or a positive voltage on one input, the other open), Q1 and Q5 conduct, which in turn saturate Q6 and Q7. In this marking state the voltage drop from the emitter of Q6 to the collector of Q7 is less than the voltage drop from the CR15 anode to the Q8 emitter. Under this condition, the base-emitter junction of Q8 is reverse biased, thus turning Q8 off. With Q8 off, the Q9 base will conduct through R26 and thus energize the external selector magnet in the collector circuit. Transistor Q9 base current is sufficient to saturate the collector. In this condition, selector magnet current is determined primarily by the value of the limiting resistor R23 and the power regulator output voltage.

3.04 In the spacing state, with a negative voltage on input 1, input 2, or both inputs, the respective input transistor or transistors (Q1, Q5) are off. In this condition Q6 - Q7 collector current is cut off and the base of Q8 conducts. Transistor Q8 base current is sufficient to saturate the

collector. The Q8 emitter-collector saturation voltage is less than the forward drop across CR13 thus reverse biasing the base emitter junction of Q9. With this junction reverse biased, Q9 collector current is cut off and the selector magnet is de-energized.

3.05 Because of the difference in magnitude of Q8 and Q9 load currents, the drop across R21 will be greater in the marking state than in spacing. This means that the input voltage to the third stage (Q6 VCE + Q7 VCE) necessary to change the state of Q8 will be different depending on the previous state. Specifically, a larger combined Q6 and Q7 collector-emitter voltage is required to turn on Q8 than to turn off Q8. This hysteresis, peculiar to Schmitt Triggers, enables positive driver input signals to energize the selector coil and negative going input signals to de-energize the coil.

3.06 Resistors R4, R16, and potentiometers R3 and R15 serve to bias Q1 and Q5 and set the center of the switching interval. Emitter resistors R7 and R18 assist in gain stabilization. Resistors R6, R8 and R19, R20 form voltage dividers to bias CR2, 3, 4 and CR10, 11, 12. These diodes exhibit temperature characteristics such that together with R7 and R18, effective temperature compensation is obtained to stabilize the switching level of the SMD. Diode CR5 establishes a voltage reference for the first stages to insure switching level stability.

3.07 When low resistance transmitters (about 100 ohms) are used to key the driver, R1 and R13 have no significant effect on the operation of the circuit. However, when the line resistance is high (open line), R1 and R13 apply sufficient bias to drive Q1 and Q5 into conduction. This operation will maintain the terminal equipment in the idle state when input lines are open, or allow single line operation by simulating a marking signal on the other input.

3.08 In the power regulator, CR8 and the base-emitter junction of Q4 establish a voltage reference for R11 which determines the current drain of the unit. Diode CR6, CR7 and the base-emitter junction of Q3 serve to clamp the Q4 collector at a low voltage so as to minimize power dissipation in Q4. As the power requirement of the circuitry following the regulator decreases, the output voltage of the regulator will begin to rise. This rise corresponds to a decrease in Q4 collector-base voltage. The effect is to increase the forward bias on the base-emitter junction of Q3 and cause increased collector conduction. This collector current increases the conduction of Q2 whereby Q2 and R10 absorb the excess power. Q2 functions as a variable resistance so as to maintain a constant resistance across the output of the regulator regardless of the state of the driver circuitry. As a consequence of this, the power supply sees a constant load, regardless of driver state.

3.09 Capacitors C4 and C5 provide negative feedback to reduce transient generation in the driver. Capacitors C3 and C7 and C8 are radio frequency bypass capacitors to eliminate any parasitic oscillations that may occur as a result of switching.

3.10 Capacitors CR14, C6 and R24 form a transient limiting network to protect Q9 from excessive reverse transients associated with switching inductive loads.

4. SERVICING

Note: Installation instructions are included in the specifications for the modification kit and electrical service assembly to be used. The 323810 selector magnet driver (SMD) is a circuit card assembly that need only to be plugged into a properly keyed (polarizing key between pins E and F) 15-pin receptacle which is wired into an appropriate electrical service assembly (ESA).

4.01 It is recommended, that any damaged 323810 selector magnet driver (SMD) unit be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions.

4.02 It is also recommended that the SMD be radio frequency interference (rfi) suppression tested after servicing and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

4.03 The following information may be used as a guide for troubleshooting:

Symptom	Probable Cause
(a) Switching levels out of tolerance	(1) Improper adjustment of R3 and/or R15 (2) Q1 and/or Q5 low gain (3) CR5 defective or out of tolerance
(b) Circuit always marking	(1) Q8 open (2) Q1, Q5, Q6, Q7, or Q9 collector-emitter shorted
(c) Circuit always spacing	(1) Q1, Q5, Q6, Q7, or Q9 collector-emitter open (2) Q8 collector-emitter shorted (3) CR13 open

(d)	Output current too high	(1) R23 out of tolerance
(e)	Output current too low	(1) R23 out of tolerance
(f)	Transient suppressor network ineffective	(1) CR14 open (2) R24 open (3) C6 open
(g)	Loss of receiving margin	(1) Q8, Q9 improper gain (2) C4, C5, or C6 out of tolerance or defective (3) CR14 shorted

5. ADJUSTMENTS

Note: No mechanical adjustments are required on the 323810 selector magnet driver (SMD).

5.01 Terminate the output of the driver with a 28 selector wired for 60 ma operation (pins A or B and H, J, K, L or M) see Figure 4.

(a) Apply +47 to +53 v dc to the driver (pins C or D to H, J, K, L, or M).

(b) With input 2 (pins E, F) open circuited, short input 1 to common (pins N, P to H, J, K, L, or M).

(c) Adjust R3 until the selector magnet changes state. Note the position of the potentiometer.

(d) Rotate R3 until the selector returns to its initial state.

(e) Set the potentiometer midway between the two positions obtained in (c) and (d).

(f) Secure the adjustment by applying an appropriate cement to the potentiometer adjustment screw.

5.02 Repeat 5.01 (a) through (f), this time adjusting R15 with input 1 (pins N, P) open circuited and input 2 shorted to common (pins E, F to H, J, K, L, or M) see Figure 4.

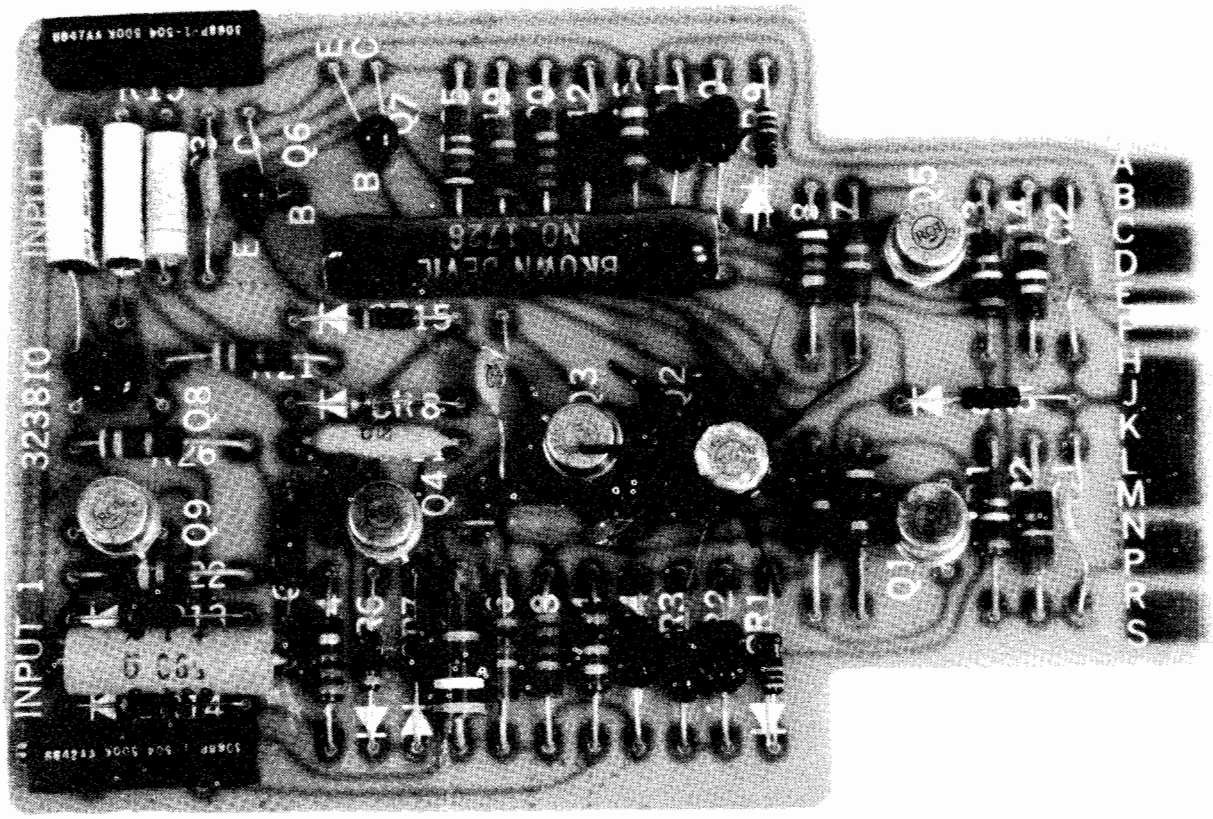
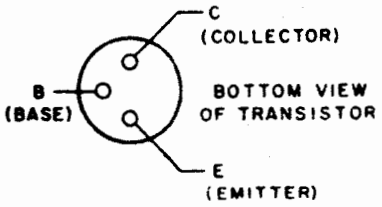


Figure 1 - Selector Magnet Driver (SMD) 323810

REF. DESIG.	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
C1	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C2	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C3	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C4	171829	1	CAPACITOR, .15 MFD	Q8 FEEDBACK CAP.
C5	326776	1	CAPACITOR, .47MFD	Q9 FEEDBACK CAP.
C6	321260	1	CAPACITOR, 1 MFD 50V	TRANSIENT SUPP.
C7	321157	1	CAPACITOR, 500 pf	R.F. BY-PASS CAP.
C8	178860	1	CAPACITOR, .022 MFD	R.F. BY-PASS CAP.
R1	118720	1	RESISTOR, 100K, 1/2W	Q1 OPEN LINE BIAS
R2	118720	1	RESISTOR, 100K, 1/2W	INPUT 1 RES
R3	323964	1	POTENTIOMETER 500K	Q1 BIAS
R4	129854	1	RESISTOR, 10K, 1/2W	Q1 BIAS
R5	118177	1	RESISTOR, 22K, 1/2W	Q1 LOAD RES.
R6	137604	1	RESISTOR, 620, 1/2W	VOLTAGE DIVIDER
R7	118196	1	RESISTOR, 4.7K, 1/2W	Q1 EMITTER RES.
R8	129850	1	RESISTOR, 680, 1/2W	VOLTAGE DIVIDER
R9	309868	1	RESISTOR, 1.3K, 3W	CR5 CURRENT LIMITER
R10	323841	1	RESISTOR, 300, 12 W	Q2 LOAD RES.
R11	323842	1	RESISTOR, 21, 1/2W, 1%	REG. CURRENT SET
R12	178864	1	RESISTOR, 3.9K, 1W	CR8 CURRENT LIMITER
R13	118720	1	RESISTOR, 100K 1/2W	Q5 OPENLINE BIAS
R14	118720	1	RESISTOR, 100K, 1/2W	INPUT 2 RES.
R15	323964	1	POTENTIOMETER 500K	Q5 BIAS
R16	129854	1	RESISTOR, 10K, 1/2W	Q5 BIAS
R17	118177	1	RESISTOR, 22K, 1/2 W	Q5 LOAD RES.
R18	118196	1	RESISTOR, 4.7K, 1/2W	Q5 EMITTER RES.
R19	137604	1	RESISTOR, 620, 1/2W	VOLTAGE DIVIDER
R20	129850	1	RESISTOR, 680, 1/2W	VOLTAGE DIVIDE'
R21	321975	1	RESISTOR, 33, 1/2W	Q8 EMITTER RES.
R22	118177	1	RESISTOR, 22K, 1/2W	CR13 BIAS RES.
R23	323843	1	RESISTOR, 590, 5W, 1%	COIL CURRENT LIMITER
R24	137442	1	RESISTOR, 1.5K, 1/2W	C6 BLEEDER RES.
R25	118154	1	RESISTOR 47K, 1/2W	Q6,Q7 LOAD RES.
R26	165360	1	RESISTOR 4.3K, 1/2W	Q8 LOAD RES.
CR1	321154	1	DIODE, 1N457A	Q1 BASE PROT.
CR2	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR3	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR4	178844	1	VARISTOR, 100-A	TEMP COMP.
CR5	181667	1	DIODE, 1N750A	TEMP. COMP. REF.
CR6	321156	1	DIODE, 1N482A	Q4 COLLECTOR CLAMP
CR7	321156	1	DIODE, 1N482A	Q4 COLLECTOR CLAMP
CR8	321161	1	DIODE, 1N748A	REG. VOLT REF.
CR9	321154	1	DIODE, 1N457A	Q5 BASE PROT.
CR10	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR11	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR12	178844	1	VARISTOR, 100-A	TEMP. COMP.
CR13	321156	1	DIODE, 1N482A	Q9 EMITTER DIODE
CR14	321154	1	DIODE, 1N457A	TRANSIENT SUPP.
CR15	321156	1	DIODE, 1N482A	Q8 EMITTER DIODE
Q1	321166	1	TRANSISTOR, 2N1893	DC AMP.
Q2	323844	1	TRANSISTOR, 2N3053	SHUNT REG
Q3	321261	1	TRANSISTOR, 2N4036	SHUNT REG. AMP.
Q4	323845	1	TRANSISTOR, 40319	SERIES REG.
Q5	321166	1	TRANSISTOR, 2N1893	DC AMP.
Q6	324144	2	TRANSISTOR, 2N4121	DC AMP.
Q7			SAME AS Q6	
Q8	321165	1	TRANSISTOR, 2N3638A	DC AMP.
Q9	321261	1	TRANSISTOR, 2N4036	DC AMP.
	324147	2	PAD, TRANSISTOR	
	144495	6	PAD, TRANSISTOR	
	323846	1	PAD, TRANSISTOR	
	323847	1	HEAT SINK	
	323835	1	CIRCUIT BOARD, ETCHED	

Figure 2 - Selector Magnet Driver 323810 List of Components



Note: Transistor Q2 has heat sink 323847 pressed on. Transistor pad 323846 is used under Q3.

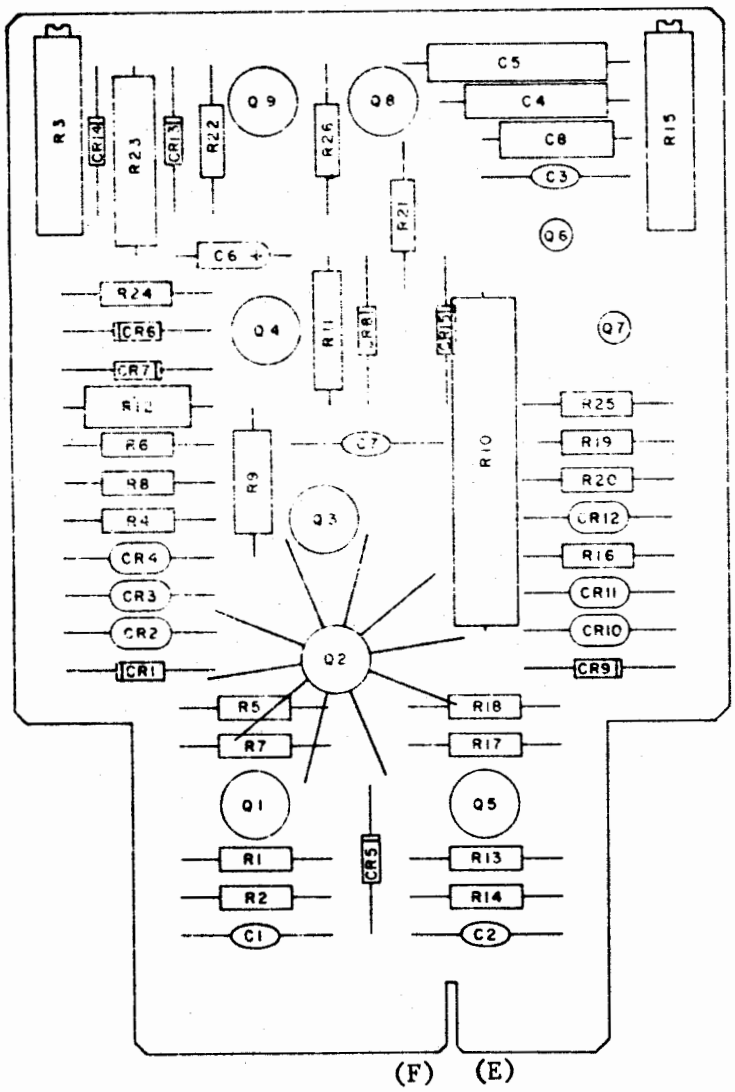


Figure 3 - Selector Magnet Driver 323810 Arrangement of Components

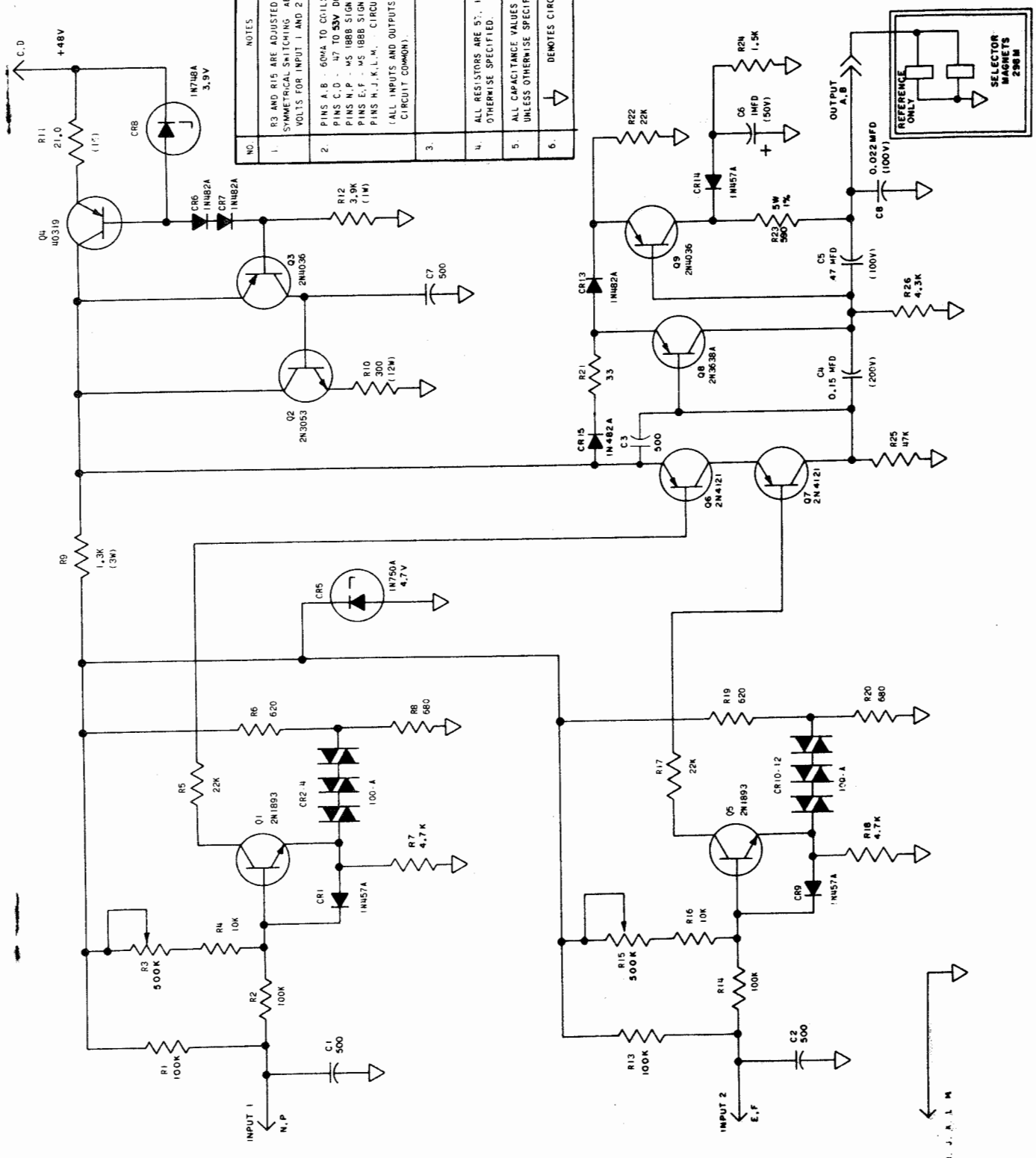


Figure 4 - Selector Magnet Driver 323810 Schematic Wiring Diagram