

## WOEPV QSK-1K AMPLIFIER T/R SWITCH

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- EXTERNAL TYPE -

This unit employs the Radio Shack 2.5 Amp, 1 KV, silicon diodes, two in parallel (to the RF) in each amplifier switch (input and output) and two in series in the receive by-pass switch. They take a KW thru the output switch in the CW or SSB mode with little heating. To handle this power in the RTTY mode the size of the heat sinks may need be increased. The loss in the receiving direction is also low with no noticeable noise or tuned circuit affects from the amplifier. This diode measures only 4 mmF with 25 volts reverse bias. The circuit provides 25 volts reverse bias to each diode in the input and output switches while in the receive mode. They are forward biased about 300 mA while transmitting. The 1K PIV rating of this diode gives D4 and D5 in the receive bypass switch plenty of margin while transmitting, being reverse biased by the diode string D8-D15.

The circuit switches at about the one watt input level, switching ON in a fraction of a millisecond and OFF in about a millisecond. Over-voltage protection (high SWR) is provided by the SCR via the 3 and 1 turn links on T1 and T2 putting a short-circuit (RF) on the input via D3 when triggered. The input voltage protection (T1) is provided for operation with tube-type transceivers operating in the barefoot mode to protect D3 which is reverse biased only 145 volts. The link on T1 and diode D16A are not required with all-solid-state transceivers which have the SWR output protection. The relay, RLY, protects the switching diodes should the power supply be OFF. A TUBE-TYPE TRANSCEIVER SHOULD NOT BE LOADED into this unit if the power supply is OFF or if the LED is ON as D3 could be overloaded. Operating the PB switch will test the power supply, lighting the LED if OK.

The return side (KEY RTN) of the keying output circuit may be connected to a point OFF-GND a few volts if required in keying some amplifiers. The Heathkit SB-221 and SB-1000 amplifiers are keyed in the cathode circuit, returning to the junction of the grid and plate meter shunt resistors which will be a fraction of a volt above GND when there is grid current flowing.

In keying the SB-221, Term No.3 of the ANT RLY, RL-1, must be cleared (provide another tie-point for the wires) or the contact be bent back and insulated to keep the 120 volts off the cathode circuit. Further, a 47K, 1/2 watt, resistor should be added between Term. No.9 and GND, limiting the voltage to the collector of Q4 to about 40 volts. 30 volts here will fully cut-off the tubes. The keying circuit is connected in series with the lead to the zener diode anode (the outer terminal), KEY (Q4 COL) to the anode and KEY RTN (Q4 EMTR) to the lead (to the junction of R1,R2 and R3).

The attached sketch of a suggested layout for a perfboard 1.9 by 4.7 inches fits into a Radio Shack 270-238 aluminum box. If four SO-239 sockets are provided the power transformer will probably need be mounted on the outside. Have used the smaller power transformer (which heats a little) inside with SO-239 sockets on each end for TCVR and ANT connections. Short coax cables connected directly to the board and terminated in PL-259s went to the SB-221 amplifier RF INPUT and RF OUTPUT jacks. The LED (red) and the PB switch were mounted in a small remote box along with a green LED in series with an ON/OFF switch in a circuit to the ANT RLY jack on the amplifier.

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- INTERNAL TYPE -

This unit is designed to be mounted within the amplifier, wiring between the antenna relay and the amplifier's input and output networks. The RF part of this unit is almost identical to that in the EXTERIOR TYPE except for an additional 60 turn winding on T1 in connection with the SCR circuit and no 3 turn link. The perfboard size measures 2 3/4 by 4 1/4 inches.

This unit requires no additional power supply since the forward bias for the transmitting switching diodes is provided by the cathode current of the amplifier. A tap to the hot side of the 120 VAC supplies the biasing for the receiving direction. The unit also keys the cathode circuit of the amplifier and takes the place of the zener diode which normally furnishes the bias for the tubes. The diode string, D24 to D28 provides a voltage build-out for the value of bias desired. With the five diodes about 7.5 volts bias is provided at 500 mA of cathode current in my SB-1000. This voltage may be varied by employing more or fewer diodes in the string, each contributing 1/2 volt. Since RF from the transceiver can't reach the switching diodes without power being present to operate the antenna relay, the little fail-safe relay used in the EXTERNAL unit is not required. Also, with this arrangement barefoot operation does not involve this unit so the SCR circuit need not be coupled to T1.

Additional circuitry was provided on this board to increase the OFF delay switching time which was found desirable for higher quality SSB operation. Positive switching feedback with hysteresis provides a fast ON time and a delay to OFF of six to eight milliseconds. This prevents switching in the troughs of the SSB envelope. This delay is about a third the space between dots at 60 WPM (50/50 Wtg) so has little effect on most QSK CW operation. A SPDT switch to open D21 and short D19/D20 could be provided to remove most of this delay if desired.

This unit could be located, unshielded, almost anywhere in the amplifier outside the field of the output network inductors. If distant from the antenna relay, coax cables may be used to minimize a change in input SWR.

No LED is shown in the circuit in that the overload condition will be indicated by the presence of static plate current and, of course, no output. The circuit may be restored by releasing the antenna relay. If an LED and restoring switch is desired it can be connected around R15 with the 180 ohm resistor as in the other unit. The switch should ground the T1 side of R15.

Almost any good heat conducting metal can be used for the heat sinks. Good heat conduction should be maintained as close to the body of the diode as possible without introducing mechanical strain or over heating when soldering. Have used aluminum with the components soldered to a tinned metal strip mounted with thermal compound to it and held to the perfboard with a 4-40 screw with a soldering lug under the nut on the back side of the two short sinks to attach the leads from T2.

73s and lots of luck,

E. B. B. 3/27/90

## WOEPV QSK-1K AMPLIFIER T/R SWITCH -- PARTS LIST --

(EXTERNAL TYPE)

All resistors not indicated otherwise are 1/4 watt.

R1, R2, R3, R4, R11 - - - -	220K	C1 - C9, C11 - - - -	.01 mF, 500V
R5 - Two 33K, 1/2 W, in series		C10, C14 - - - - -	.001 mF, 500V
R6 - - - - -	47 OHM, 1/2 W	C12 - - - - -	470 mF, 16V
R7 - - - - -	180 OHMS	C13 - - - - -	1.0 mF, 200V
R8 - - - - -	10 OHMS	C15, C16 - - - - -	.1 mF, 50V
R9, R10, R13 - - - - -	330 OHMS	D1, D2, D4-D7 - RS PTC205,	2.5A, 1KV
R12 - - - - -	33K, 1/2 W	D3, D17 - - - - -	1N4004, 400V
R14 - - - - -	100 OHMS	D8-D15, D16, D16A, D18 -	1N914/4148
R15 - Three 10 OHMS in Parallel		(RS 276-1122 not RS 276-1620)	
R16, R17 - - - - -	10K	ZD - - -	1N4739, 9.1V, RS 276-562
RLY - - - - -	RS 275-241	F1, F2 - - - - -	1/2 A, 5 X 20 mm
SCR - - - - -	6A, 200V	LED - - -	Jumbo Red, RS 276-041
Q1 - - - - -	MPS2907, PNP	BR - - - - -	1A, 50V, RS 276-1161
Q2, Q4 - - - - -	TIP3015, NPN	T3 - - -	12.6V, 300mA or 450mA
Q3 - - - - -	MJE34, PNP	RS 273-1385 or RS 273-1365	
VR - - - - -	7805, 5V	(The smaller runs a little warm)	

T1 and T2 are wound on RS 273-102, 100 uH RF Choke cores with small pieces of perfboard, .4 inches square, cemented to the ends. (See Note 1, over)

Windings 1 and 2 on each are 58-60 turns of No. 26 Enam. wire.

Winding 3 on T1 is 10 turns No. 26 or 28.

Winding 3 on T2 is 70 turns No. 28 Enam. tapped at 60 turns.

The link on T1 is 3 turns and on T2 1 turn.

Use single thickness of Scotch Magic or Equiv. 2 mil tape between layers.  
( See NOTE 2 other side )

Be sure all windings, indicated with a dot on the hot end, are wound in the same direction and are connected to the main board as indicated.

( over )

WOEPV QSK-1K AMPLIFIER T/R SWITCH -- PARTS LIST --

(INTERNAL TYPE)

All resistors not indicated otherwise are 1/4 watt.

R1, R2, R3, R4, R6 - - - - -	270K	C1 - C9, C12, C15 - - -	.01 500V
R5 - Two 33K, 1/2 watt, in series		C10, C11, C14 - - - -	.001 500V
R7 - - - - -	33K, 1/2 watt	C13 - - - - -	1.0 mF, 200V
R8, R9, R10, R16 - - - - -	470 ohms	C16, C17 - - - - -	0.1 mF, 50V
R11, R12 - - - - -	10K	D1, D2, D4-D7 - RS PTC205,	2.5A, 1KV
R13 - - - - -	100K	D3, D17 - - - - -	1N4004, 400V
(120K if Ckt. hangs ON)		D8-D16, D18, D21-D23 - 1N914/4148,	150V - - RS 276-1122 OK
R14 - - - - -	100 ohms	D19, D20, D24-D28 - 1N914/4148, 20V	RS 276-1122 or RS 276-1620 OK
R15 - - - - -	47 ohms, 1/2 watt	ZD - - -	1N4739, 9.1V, RS 276-562
SCR - - - - -	6A, 200V	T1 - Same as T1 in EXTERNAL TYPE	except the following;
Q1 - - - - -	MJE34, PNP	Winding No.3, 60 turns No. 28	Winding No.4, 10 turns No. 26/28
Q2 - - - - -	MPS2222A, NPN	T2 - Same as T2 in EXTERNAL TYPE	
Q3 - - - - -	TIP3015, NPN		
F - - - - -	1/2 A, 5 X 20 mm		

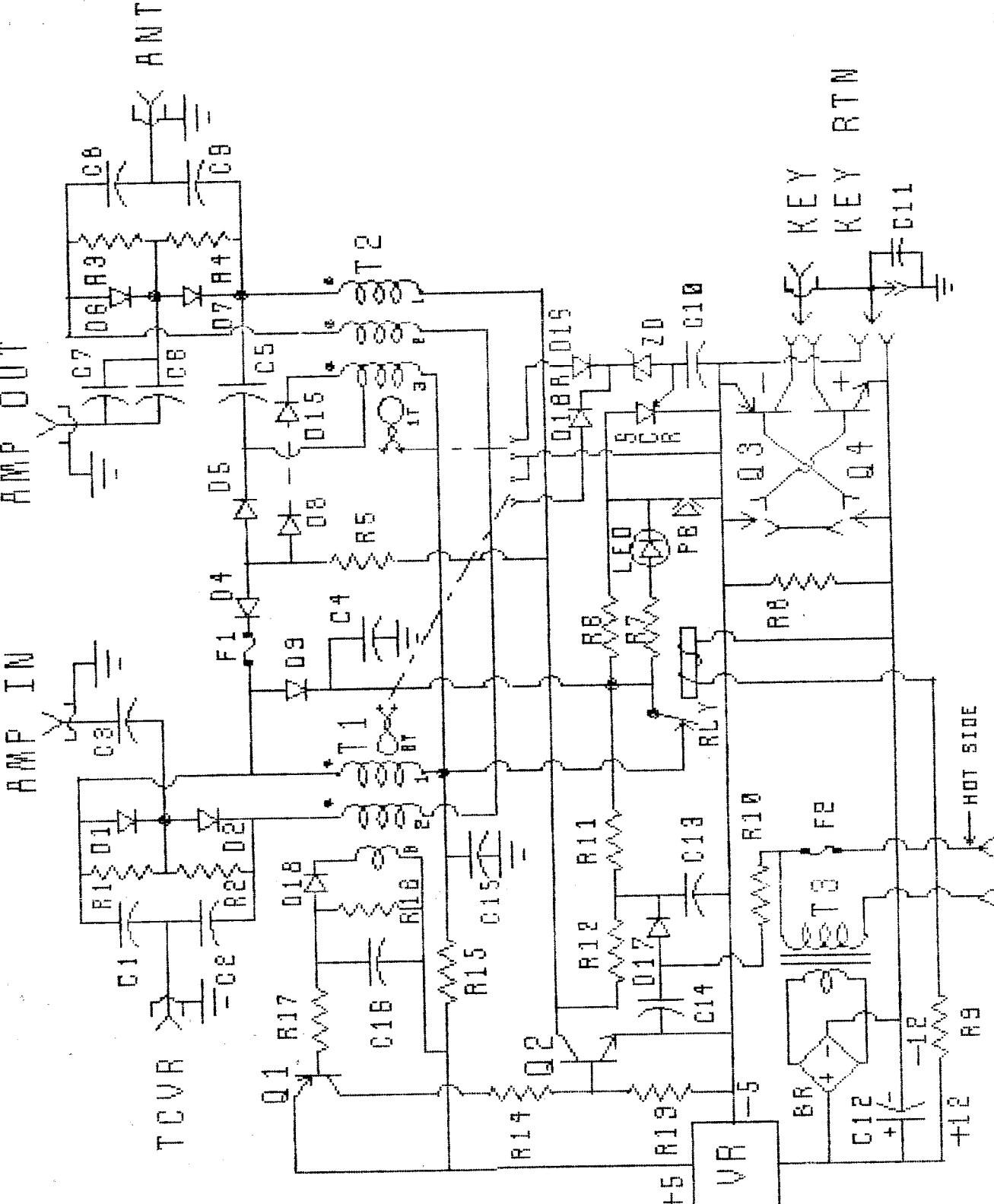
Be sure all windings, indicated with a dot on the hot end, are wound in the same direction and are connected to the main board as indicated.

NOTE 1 - T1 and T2 are mounted at right-angle to each other by the wire leads from the core, 3/8 IN or so off the back side of the board. Winding No.1 is the one next to the core. It may facilitate mounting and wiring T1 on the INTERNAL board if winding No.2 is terminate on the core leads. Either windings No.1 or No.2 on the other transformers could be terminated on the mounting leads.

NOTE 2 - Place the plastic tape lengthwise between layers trimming second strip to overlap first about 1/8 th inch. Cut lengths 1/16 th inch longer than distance between end plates and serrate ends every 1/16 th inch. Keeps wire from dropping a layer at ends.

3/28/90

# WØEPV QSK-1K AMPLIFIER T/R SWITCH (EXT)



( EXTERNAL TYPE )

03/23/90

120VAC

HOT SIDE

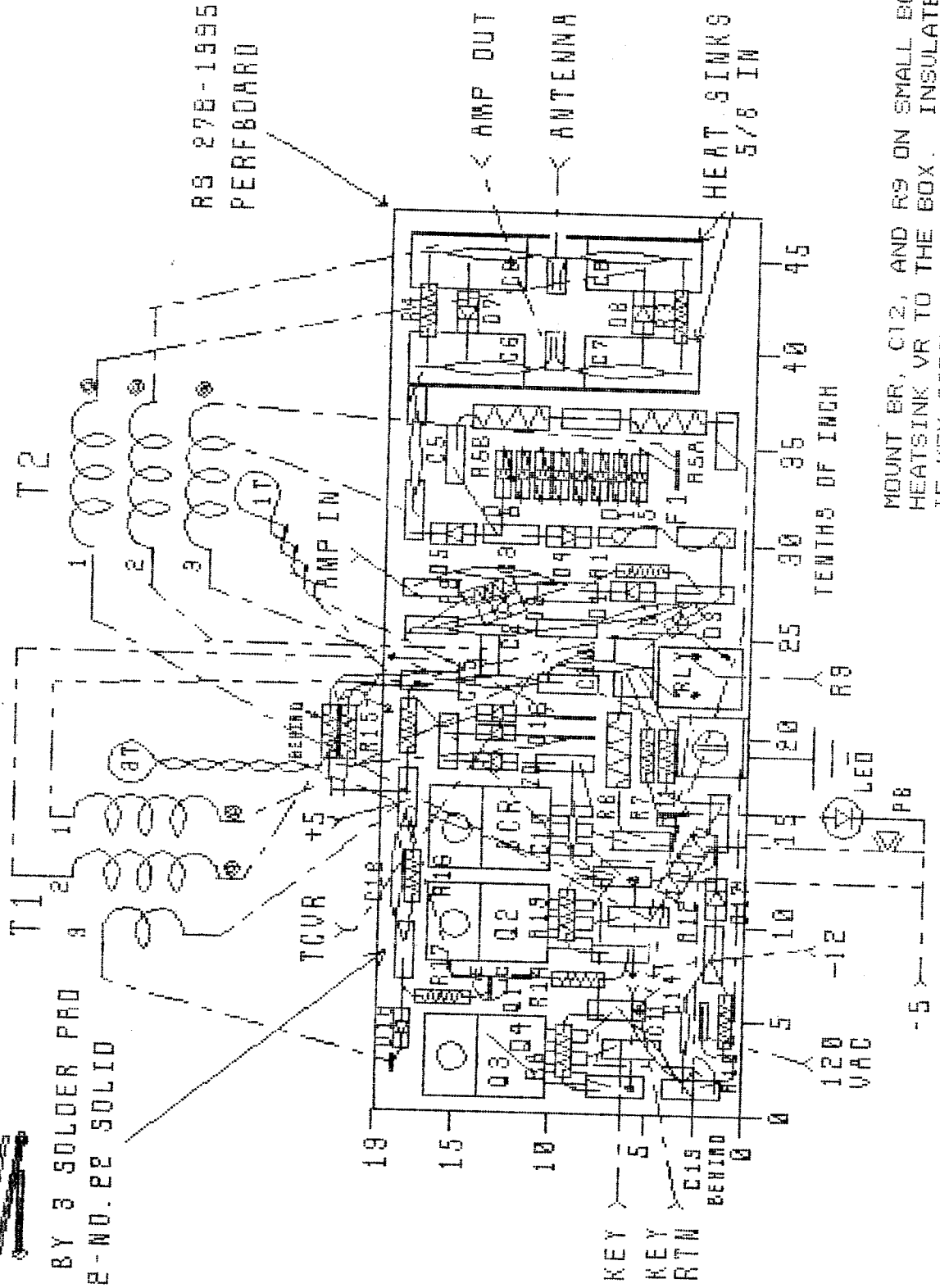
# WØEPV QSK-1K AMPLIFIER T/R SWITCH

(EXTERNAL TYPE)

COMPONENT SIDE



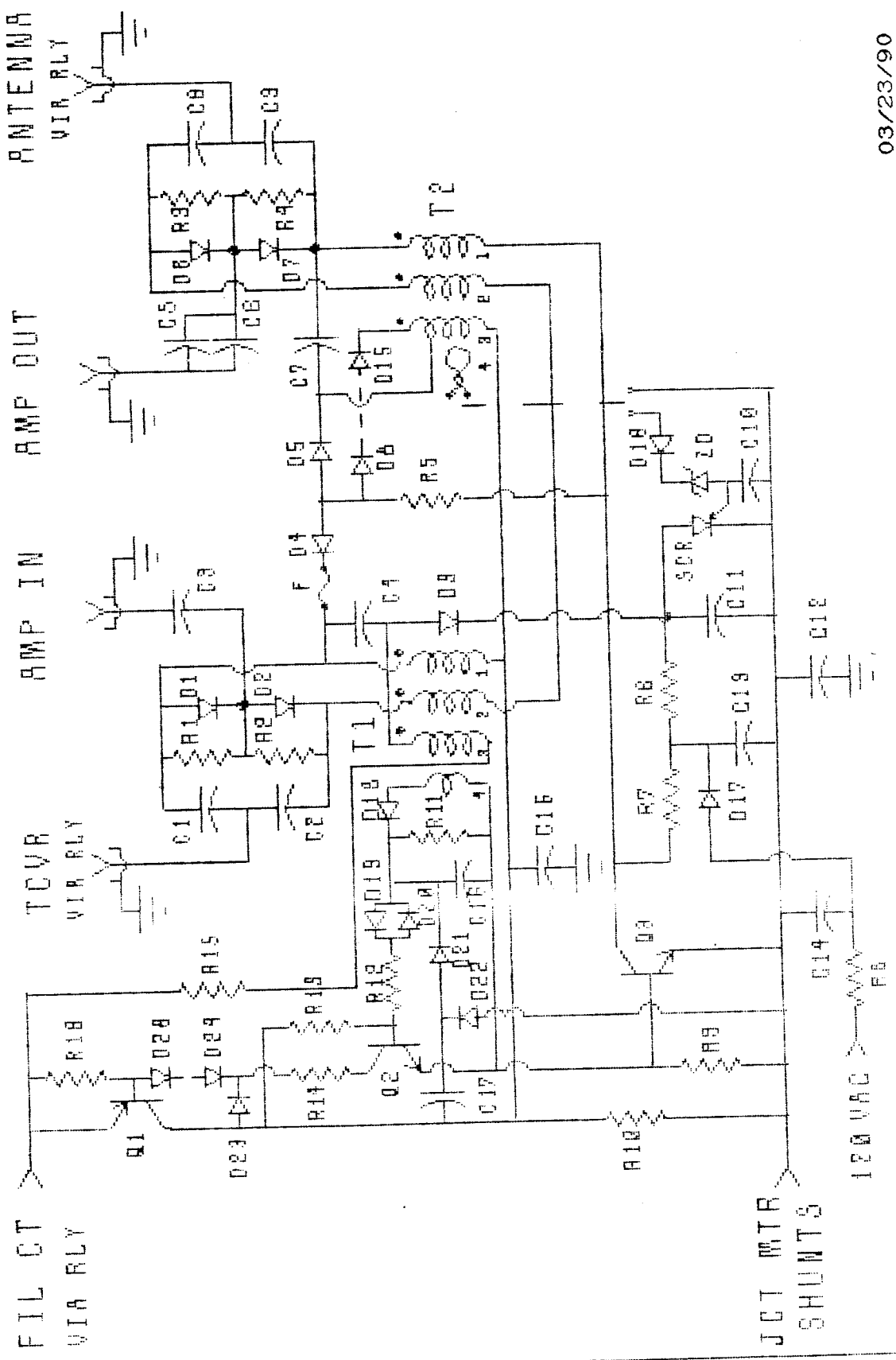
1 BY 3 SOLDER PRO  
2-NO. 22 SOLID



MOUNT BR, C12, AND R9 ON SMALL BOARD.  
HEATSINK VR TO THE BOX. INSULATE VR  
IF KEY CIRCUIT REQUIRES. - 06/27/90

# WØEPV QSK-1K SOLID STATE T/R SWITCH

< INTERNAL TYPE >



03/23/90

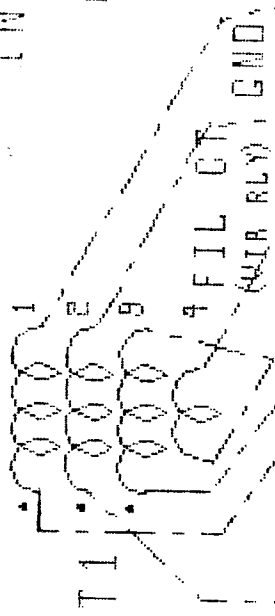
# WØEPV QSK-1K AMPLIFIER T/R SWITCH

## INTERNAL TYPE

AS 278-1395 PERFORBOARD

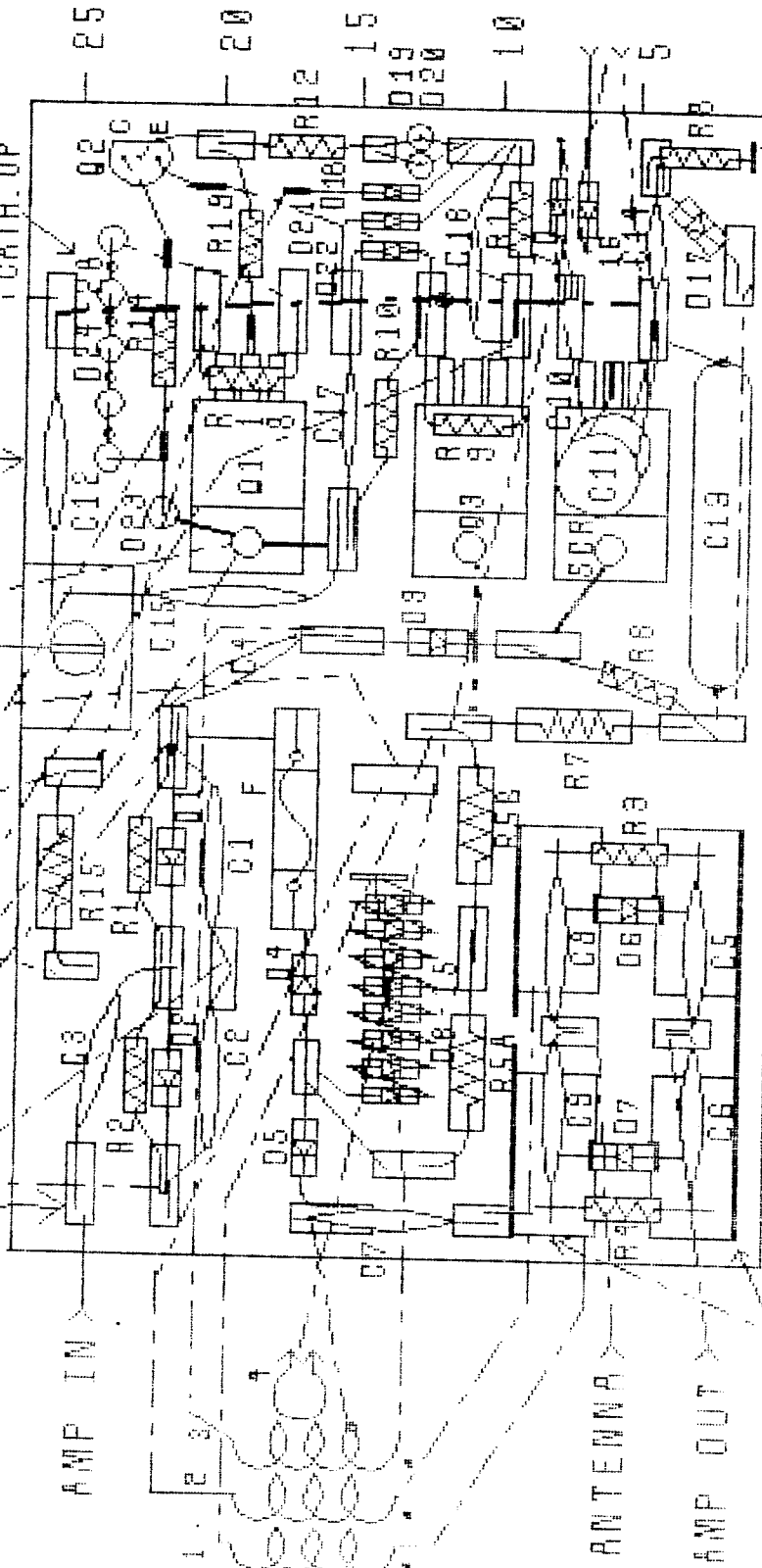


- 1 BY 3 SOLDER TAB (COMPONENT SIDE)
- 2-NO.22 SOLID



JCT MTR SHUNTS

↑ CATH. UP



HEAT SINKS  
3/8 IN DIA

TENTHS OF INCHES

03/23/90

120 VAC