TEKTRONIX®

147A
NTSC
TEST SIGNAL GENERATOR

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

Serial Number _____

070-1645-00

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

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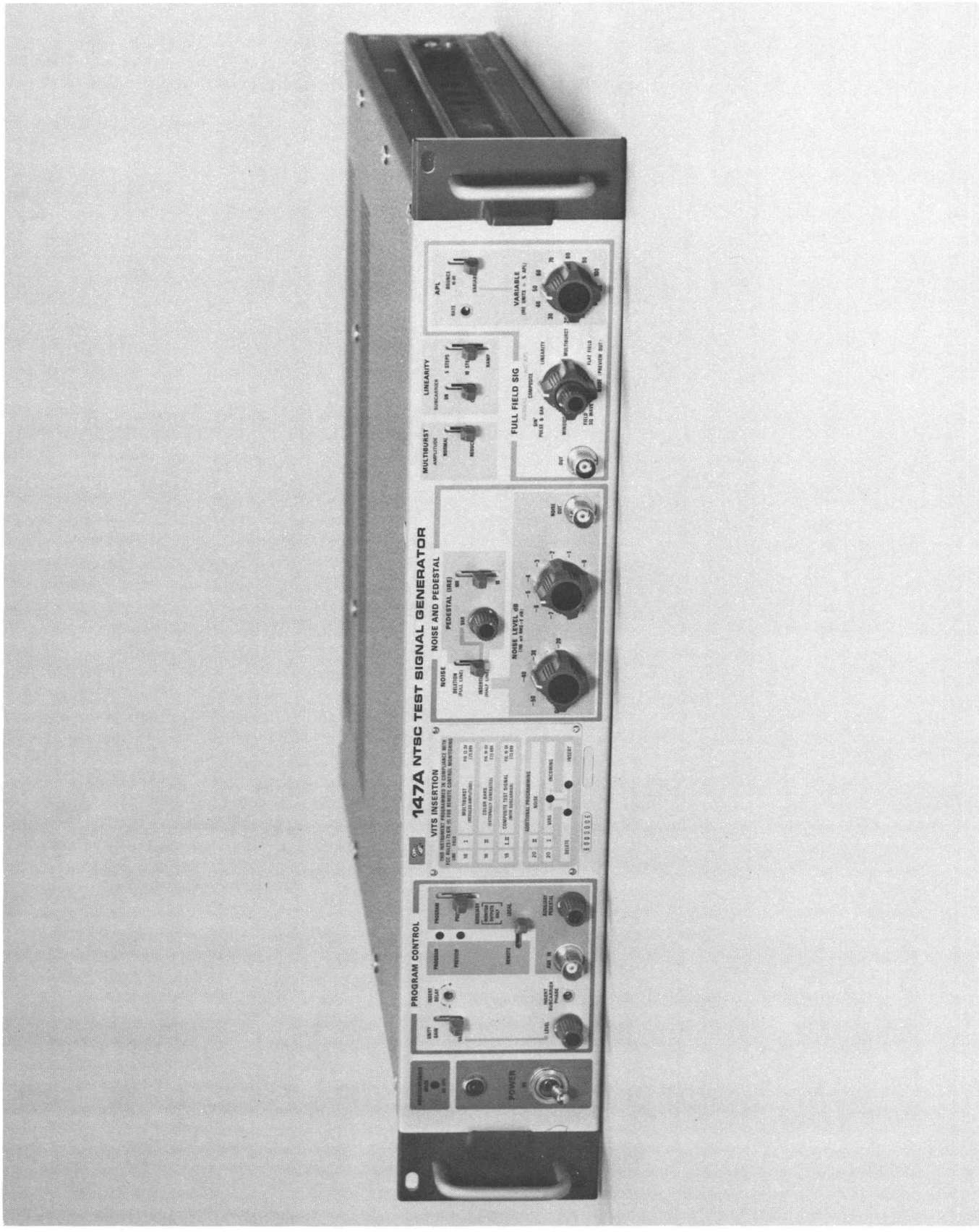

147A NTSC TEST SIGNAL GENERATOR
VITS INSERTION
NOISE AND PEDESTAL
PROGRAM CONTROL
FULL FIELD SIG
MULTIBURST
LINEARITY
POWER

A11 147 NTSC TEST SIGNAL GENERATORS, serial number B101000 and up, have been modified to 147A NTSC TEST SIGNAL GENERATORS.

The 147A is similar to the 147, with the following additional features:

1. Black burst synchronization is selected only by a remotely controlled relay. When black burst is selected, the 147A goes automatically to bypass.

2. With incoming program loss, the 147A goes to one of two internally selected operating modes.

   a. Either a Full Field signal, or Flat Field signal (as programmed by plug-jumpers) will appear at the PROGRAM OUT connector.

   b. Bypass.

3. The VIR Signal can be programmed for lines 10 through 21.

4. With a monochrome program signal, the VIR Signal insertion can be selected to continue or stop.

5. Processing amplifier modes are plug-jumper selectable, as follows:

   a. Off.

   b. Chroma signal---- sync and burst regenerated.

   c. Monochrome signal- sync and burst regeneration inhibited.

   c. Chroma signal---- sync and burst regenerated.
      Monochrome signal- sync only regenerated.

6. In the processing amplifier modes, incoming VITS on lines 16 to 21 will not be deleted, except when internally generated VITS programming takes priority.

7. Internal plug-jumpers provide the option of four out of five line APL, alternate line APL or Full Field signal only at the FULL FIELD SIG OUT connector.

The information contained in the remainder of this instruction manual insert pertains to the additional features just listed.

The front panel has been changed to include a new switch concentric with the FULL FIELD SIG switch.

NORMAL/ALT APL Two position rotary switch to select Full Field mode.

NORMAL Full Field signal on all active lines.

ALT APL Full Field signal alternating with one line or four lines of APL signal as selected by P4662.

FIRST TIME OPERATION

Complete steps 1 through 17 on pages 2-8 and 2-9.

17a. Set the FULL FIELD SIG switch to MULTIBURST and the NORMAL/ALT APL switch to ALT APL. Note the FLAT FIELD signal superimposed on the MULTIBURST signal. Rotate the APL VARIABLE control. Note the change in level of the FLAT FIELD signal. Set the APL VARIABLE to 50 IRE.

Set the waveform monitor for 2 Field display and Magnifier to X25. Note that the field signal consists of 1 line of MULTIBURST followed by 4 lines of FLAT FIELD. Move plug-jumper P4662 from pins 2 and 3 to pins 1 and 2. Note that the field signal now consists of alternate MULTIBURST and FLAT FIELD signals. Return plug-jumper P4662 to pins 2 and 3.

Complete steps 18 through 33 on pages 2-9 to 2-11.

33a. Display the PROGRAM OUT signal on Input A of the waveform monitor. Remove the signal input to the PROGRAM IN. Note that the waveform monitor now displays the internally generated FLAT FIELD signal. Move plug-jumper P9086 (Relay board) so that it connects pin 2 to 3 and pin 4 to 5. Note that there is no output from the PROGRAM OUT connector. Move P9086 to connect pin 1 to 2 and pin 5 to 6. (Bypass)

33b. Rotate the FULL FIELD SIG switch and note that the PROGRAM OUT signal is selectable. Move plug-jumper P4642 (Alt Line APL board) from pins 1 and 2 to pins 2 and 3. Note that the PROGRAM OUT displays the FLAT FIELD signal. Rotate the FULL FIELD SIG switch and note that it has no control. Control of this signal is only from the FLAT FIELD controls. Move P4642 to connect pins 1 and 2. Connect the program signal to the PROGRAM IN connector.

33c. Set the waveform monitor to view the line selected for the VIR Signal. Remove the burst from the program signal. Note that the VIR Signal is gone. Move plug-jumper P4779 (VIT & FF board) to pins 1 and 2. Note that the VIR Signal is displayed. Restore the burst to the program signal.

33d. Set the waveform monitor for 2 Line display. Set the UNITY GAIN/VAR switch to VAR. Rotate the VAR LEVEL control. Note that the amplitude of the entire video signal changes. Move plug-jumper P4780 to connect pins 2 and 3. Rotate the VAR LEVEL control and note that the active portion of the video signal changes while burst and sync remain the same. Remove burst from the program signal. Rotate the VAR LEVEL control and note that the entire video signal changes amplitude. Restore burst to the program signal. Move P4780 to connect pins 3 and 4. Rotate the VAR LEVEL control and note that only the active portion of the video signal changes amplitude, while sync and burst remain the same. Remove burst from the program signal. Rotate the VAR LEVEL control and note that only the active portion of the video signal changes amplitude, while sync remains the same and regenerated burst turns off. Restore burst to the program signal. Move P4780 to connect pins 1 and 2.

CIRCUIT DESCRIPTION

ALT LINE APL

Circuitry on this diagram allows selection of Full Field signal modes, Processing amplifier modes and VIR Signal modes.

The Field Reset pulse is applied to U4662, pins 2 and 3, from U4174 pin 4 on Diagram 4. U4662 is a divide by 2, divide by 5 counter. U4662 pin 1 (÷ 2 clock) and pin 14 (÷ 5 clock) receive characteristic instant 32 from P4590-9, thus counting by 2 and 5 horizontal lines.

The divide by 2 output (pin 12) is applied to pin 1, and the divide by 5 output (pin 11) applied to pin 3 of plug-jumper P4662.

Pin 2 of P4662 routes one of these two signals to U4642C pin 9 and to U4642A pin 2 through the NORMAL/ALT APL switch on the front panel. The output of U4642A (pin 3) drives inverter U4642B and U4171A pin 2, enabling the FLAT FIELD signal for 2 or 5 lines as selected by P4662. The output of U4642C (pin 8) drives J9014 pin 7 and through the remote plug, inhibits the selected Full Field signal for those lines enabled for FLAT FIELD.

PASS VITS

R-S flip-flop U4622A&D. pin 13 is set by an integrated pulse at the start of vertical blanking, and reset at line 16 by a low from U4351 pin 8. U4622A&D's output (pins 2 & 11) is a high pulse, extending from the start of vertical blanking to line 16 and is applied to pin 10 of high input Nand gate U4622C. Pin 9 of U4622C receives inverted vertical blanking from U4622B pin 6. The output of U4622C (pin 8) is negative-going from the start of vertical blanking to line 16 and drives U4641D pin 12, ultimately gating the

Program Switch on Diagram 0b through U4661C and U4681C. U4622B ensures that when the vertical blanking pulse has passed, the Program Switch on Diagram 0b will be switched to the program channel.

RELAY

Circuitry on the Relay board is used to route the program signal either from the PROGRAM IN connector straight to the PROGRAM OUT connector (bypass), or from the PROGRAM IN connector through the VITS Insertion circuits to the PROGRAM OUT connector; and to provide various modes of operation if the program signal is lost or Black Burst sync is desired.

Should the program signal be lost, the PROGRAM OUT will be one of two signals: 0 volts (bypass), or Full Field signal. This operational mode is selectable by plug-jumper P9086.

If Black Burst synchronization is desired, Pin 9 of J9014 must be grounded. This actuates two relays. K9080 removes the program line ground, switching to bypass, and K9082 routes the Black Burst signal to the Gen Lock board (Diagram 5a) and applies ground to the PROGRAM sync source resistor, R9083.

Q9083 and Q9084 form a "slow on-fast off" relay control circuit. The function of this circuit is to delay energizing relay K9089 during instrument turn-on until the power supplies have risen close to their nominal levels, and to switch the relay to bypass rapidly, as soon as the supplies have started down during power loss.

Q9084 controls the time of relay energizing by time constant C9090-R9090. These components delay turn on of Q9084 which supplies base current for Q9083.

The rapid switch to bypass when power is lost is a function of C9091-R9091. When the supplies start to fall, C9091 holds the

base of Q9083 up. As soon as the emitter voltage falls below the base voltage, the relay is deenergized.

TRANSMITTER PROTECTION

A wire has been added from P301-3 on Diagram 9a to P501-2 on Diagram 0b, that gates the Program Switch, U761, to VIT FULL FIELD channel if incoming sync is lost.

On Diagram 9a, composite sync from the Sync Stripper on Diagram 5a is applied through P101-1 to U21B pin 5. When incoming sync is lost, U21B pin 5 goes high, ultimately causing a high output at the collector of Q355. This high is applied through P301-3 and P501-2 to the base of Q658 on Diagram 0b.

Q658 is turned off by the high from Diagram 9a, saturating Q560 and applying a constant high to pin 4 of the Program Switch U761. The program signal out, then, is either flat field or whatever signal is selected by the FULL FIELD SIG switch, as determined by the position of plug-jumper P4642 on the Alt Line APL board.

TRANSMITTER PROTECTION DELAY

C345, in the collector circuit of Q250 on Diagram 9a, delays the switch to the VITS & Full Field channel of U761 by a half second. If half a second is too long a time to provide adequate protection for the transmitter, decreasing the value of C345 will decrease the delay time. A minimum value (15 μF) should be retained in the circuit to avoid relay chatter during turn on when operating in the Auto Bypass mode. The minimum value of C345 is further desirable to avoid switching to transmitter protection mode with a temporary loss of sync.

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

CHANGE TO:

A4	670-1469-01	VIT & FULL FIELD Circuit Board Assembly
A7	670-2042-02	OUTPUT AMP Circuit Board Assembly
C7301	283-0205-00	5.5-65, Var
C7303	283-0625-00	220 pF, Mica, 500 V, 1%
C7310	283-0647-00	70 pF, Mica, 100 V, 1%
C7401	283-0635-00	51 pF, Mica, 100 V, 1%
C7505	283-0663-00	16.8 pF, Mica, 500 V, 10%
C7601	283-0601-00	22 pF, Mica, 300 V, 10%
C7671	283-0000-00	0.001 μF, Cer, 500 V, +100%-0%
C7783	290-0529-00	47 μF, Elect., 20 V, 20%
C7951	283-0111-00	0.1 μF, Cer, 50 V
CR7041	152-0141-02	Silicon, replaceable by 1N4152
CR7091	152-0141-02	Silicon, replaceable by 1N4152
CR7093	152-0141-02	Silicon, replaceable by 1N4152
CR7341	152-0141-02	Silicon, replaceable by 1N4152
CR7343	152-0141-02	Silicon, replaceable by 1N4152
CR7345	152-0141-02	Silicon, replaceable by 1N4152
CR7347	152-0141-02	Silicon, replaceable by 1N4152
CR7581	152-0141-02	Silicon, replaceable by 1N4152
CR7711	152-0141-02	Silicon, replaceable by 1N4152
CR7951	152-0141-02	Silicon, replaceable by 1N4152
K9080	148-0086-00	Relay, reed, SPDT, 5 V, 150 Ω
Q6858	151-0271-00	Silicon, PNP, replaceable by SAB4113
Q7001	151-0269-00	Silicon, NPN, replaceable by SE3005
Q7191	151-0325-00	Silicon, PNP, replaceable by 2N4258

CHANGE TO:

R6848	315-0472-00	4.7 kΩ, 1/4 W, 5%
R7131	311-1228-00	10 kΩ, Var
R7143	311-1263-00	1 kΩ, Var
R7181	315-0393-00	39 kΩ, 1/4 W, 5%
R7357	311-1225-00	1 kΩ, Var
R7383	315-0105-00	1 MΩ,1/4 W, 5%
R7453	311-1227-00	5 kΩ, Var
R7561	311-1223-00	250 Ω, Var
R7571	315-0271-00	270 Ω, 1/4 W, 5%
R7691	321-0224-00	2.1 kΩ, 1/8 W, 1%
R7711	321-0168-00	549 Ω, 1/8 W, 1%
R7731	321-0126-00	200 Ω, 1/8 W, 1%
R7735	311-1223-00	250 Ω, Var
R7841	321-0219-00	1.87 kΩ, 1/8 W, 1%
R7995	311-1221-00	50 Ω, Var
R9291	321-1170-03	583 Ω, 1/8 W, 1/4%
R9292	321-0180-03	732 Ω, 1/8 W, 1/4%
R9293	321-0190-03	931 Ω, 1/8 W, 1/4%
R9294	321-0202-03	1.24 kΩ, 1/8 W, 1/4%
R9295	321-1216-03	1.76 kΩ, 1/8 W, 1/4%
R9296	321-0233-03	2.61 kΩ, 1/8 W, 1/4%
R9297	321-1254-03	4.37 kΩ, 1/8 W, 1/4%
R9298	321-1283-03	8.76 kΩ, 1/8 W, 1/4%
R9299	321-1329-03	26.4 kΩ, 1/8 W, 1/4%
R9804	308-0590-00	0.25 Ω, 3 W, 5%
S9260	260-1587-00	Rotary, FULL FIELD SIG Mode
S9290	260-1374-00	Rotary, APL VARIABLE

REMOVE:

C597	283-0060-00	510 pF, Mica, 500 V, 2%
C7001	283-0602-00	53 pF, Mica, 300 V, 5%
C7021	283-0111-00	0.1 μF, Cer, 50 V
C7121	283-0059-00	1 μF, Cer, 25 V, +80%-20%
C7211	281-0627-00	1 pF, Cer, 600 V
C7221	283-0004-00	0.02 μF, Cer, 150 V
C7491	283-0065-00	0.001 μF, Cer, 100 V, 5%
C9082	283-0003-00	0.01 μF, Cer, 150 V, +80%-20%
C9084	283-0003-00	0.01 μF, Cer, 150 V, +80%-20%
C9086	283-0003-00	0.01 μF, Cer, 150 V, +80%-20%
C9088	281-0625-00	35 pF, Cer, 500 V, 5%
CR7001	152-0153-00	Silicon, replaceable by FD7003 or CD5574
CR7095	152-0185-00	Silicon, selected from 1N4152 or 1N3605
CR7210	152-0075-00	Germanium, replaceable by GC238 or ED48
Q7441	151-0192-00	Silicon, NPN, selected from MpS6521
Q7761A,B	151-0236-00	Silicon, NPN, replaceable by SA2700 or ITS1074
Q7771	151-0220-00	Silicon, PNP, replaceable by 2N4122
R7001	315-0102-00	1 kΩ, 1/4 W, 5%
R7021	315-0472-00	4.7 kΩ, 1/4 W, 5%
R7023	321-0164-00	499 Ω, 1/8 W, 5%
R7025	315-0152-00	1.5 kΩ, 1/4 W, 5%
R7121	321-0289-00	10 kΩ, 1/8 W, 1%
R7123	321-0030-00	20 Ω, 1/8 W, 1%
R7141	321-0053-00	34.8 Ω 1/8 W, 1%
R7221	321-0256-00	4.53 kΩ, 1/8 W, 1%

REMOVE:

R7563	321-0178-00	698 Ω, 1/8 W, 1%
R7721	321-0101-00	110 Ω, 1/8 W, 1%
R7727	321-0260-00	4.99 kΩ, 1/8 W, 1%
R9080	315-0102-00	1 kΩ, 1/4 W, 5%
R9082	315-0153-00	15 kΩ, 1/4 W, 5%
S9000	260-0583-01	Slide, SYNC SOURCE

ADD:

	670-2993-00	ALT APL, Circuit Board Assembly
C4622	283-0028-00	0.0022 µF, Cer, 50 V
C4662	283-0620-00	470 pF, Mica, 300 V, 1%
C6108	283-0000-00	0.001 µF, Cer, 500 V, +100%-0%
C7212	283-0634-00	65 pF, Mica, 100 V
C7932	283-0164-00	2.2 µF, Cer, 25 V
C9083	283-0003-00	0.01 µF, Cer, 150 V
C9090	290-0527-00	15 µF, Elec, 20 V
C9091	290-0527-00	15 µF, Elec, 20 V
C9092	283-0003-00	0.01 µF, Cer, 150 V
C9094	283-0003-00	0.01 µF, Cer, 150 V
C9095	281-0625-00	35 pF, Cer
CR4572	152-0141-02	Silicon, replaceable by 1N4152 (B110000X)
CR7008	152-0141-02	Silicon, replaceable by 1N4152
CR7190	152-0141-02	Silicon, replaceable by 1N4152
CR7215	152-0141-02	Silicon, replaceable by 1N4152
CR7218	152-0141-02	Silicon, replaceable by 1N4152
CR9085	152-0141-02	Silicon, replaceable by 1N4152
CR9089	152-0141-02	Silicon, replaceable by 1N4152

ADD:

CR9091	152-0141-02	Silicon, replaceable by 1N4152
K9082	148-0034-00	Relay, armature, DPDT
K9089	148-0034-00	Relay, armature, DPDT
Q7630	151-0190-00	Silicon, NPN, replaceable by 2N3904 or TE3904
Q7651	151-0269-00	Silicon, NPN, replaceable by SE3005
Q7777	151-0220-00	Silicon, PNP, replaceable by 2N4122
Q9083	151-0188-00	Silicon, PNP, replaceable by 2N3906
Q9084	151-0188-00	Silicon, PNP, replaceable by 2N3906
R4571	315-0472-00	4.7 kΩ, 1/4 W, 5%
R4622	315-0472-00	4.7 kΩ, 1/4 W, 5%
R4641	315-0102-00	1 kΩ, 1/4 W, 5%
R4642	315-0472-00	4.7 kΩ, 1/4 W, 5%
R4644	315-0472-00	4.7 kΩ, 1/4 W, 5%
R4662	315-0271-00	270 Ω, 1/4 W, 5%
R7005	315-0102-00	1 kΩ, 1/4 W, 5%
R7030	315-0153-00	15 kΩ, 1/4 W, 5%
R7034	315-0752-00	7.5 kΩ, 1/4 W, 5%
R7138	311-1228-00	10 kΩ, Var
R7215	315-0181-00	180 Ω, 1/4 W, 5%
R7236	315-0103-00	10 kΩ, 1/4 W, 5%
R7237	315-0362-00	3.6 kΩ, 1/4 W, 5%
R7238	315-0222-00	2.2 kΩ, 1/4 W, 5%
R7442	321-0202-00	1.24 kΩ, 1/8 W, 1%
R7546	315-0100-00	10 Ω, 1/4 W, 5%
R7554	315-0101-00	100 Ω, 1/4 W, 5%
R7564	321-0126-00	200 Ω, 1/8 W, 1%

ADD:

R7760	315-0101-00	100 Ω, 1/4 W, 5%
R7753	321-0159-00	442 Ω, 1/8 W, 1%
R7777	321-0260-00	4.99 kΩ, 1/8 W, 1%
R9081	315-0151-00	150 Ω, 1/4 W, 5%
R9083	315-0153-00	15 kΩ, 1/4 W, 5%
R9084	315-0153-00	15 kΩ, 1/4 W, 5%
R9086	315-0622-00	6.2 kΩ, 1/4 W, 5%
R9087	315-0512-00	5.1 kΩ, 1/4 W, 5%
R9088	315-0202-00	2 kΩ, 1/4 W, 5%
R9089	315-0103-00	10 kΩ, 1/4 W, 5%
R9090	315-0303-00	30 kΩ, 1/4 W, 5%
R9091	315-0202-00	2 kΩ, 1/4 W, 5%
R9093	315-0102-00	1 kΩ, 1/4 W, 5%
U4622	156-0030-00	Quad 2-input positive nand gate, replaceable by SN7400N
U4642	156-0145-00	Quad 2-input nand, SN7438N
U4662	156-0079-00	Decade Counter, dual, SN7490N

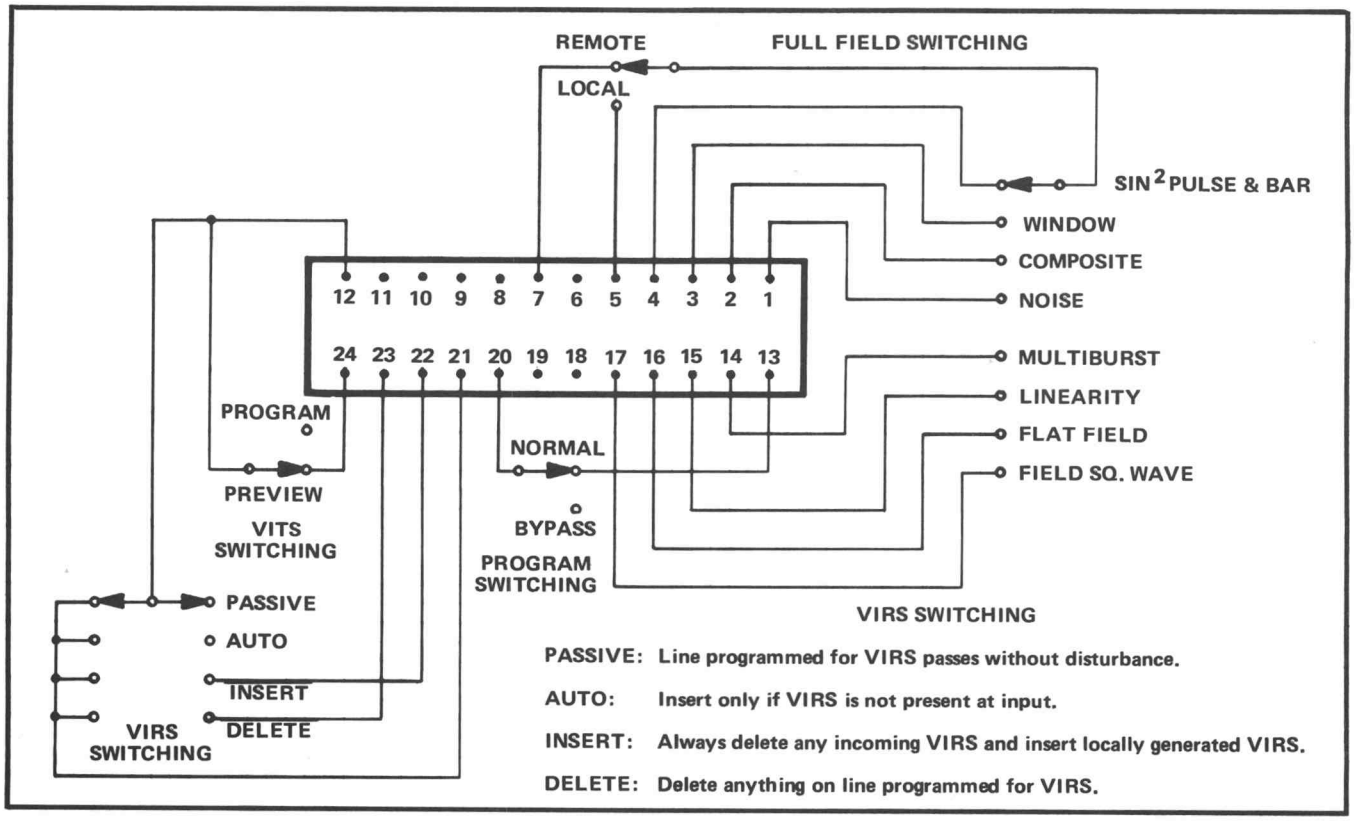


Fig. 1. P9014 wiring for Remote operation.

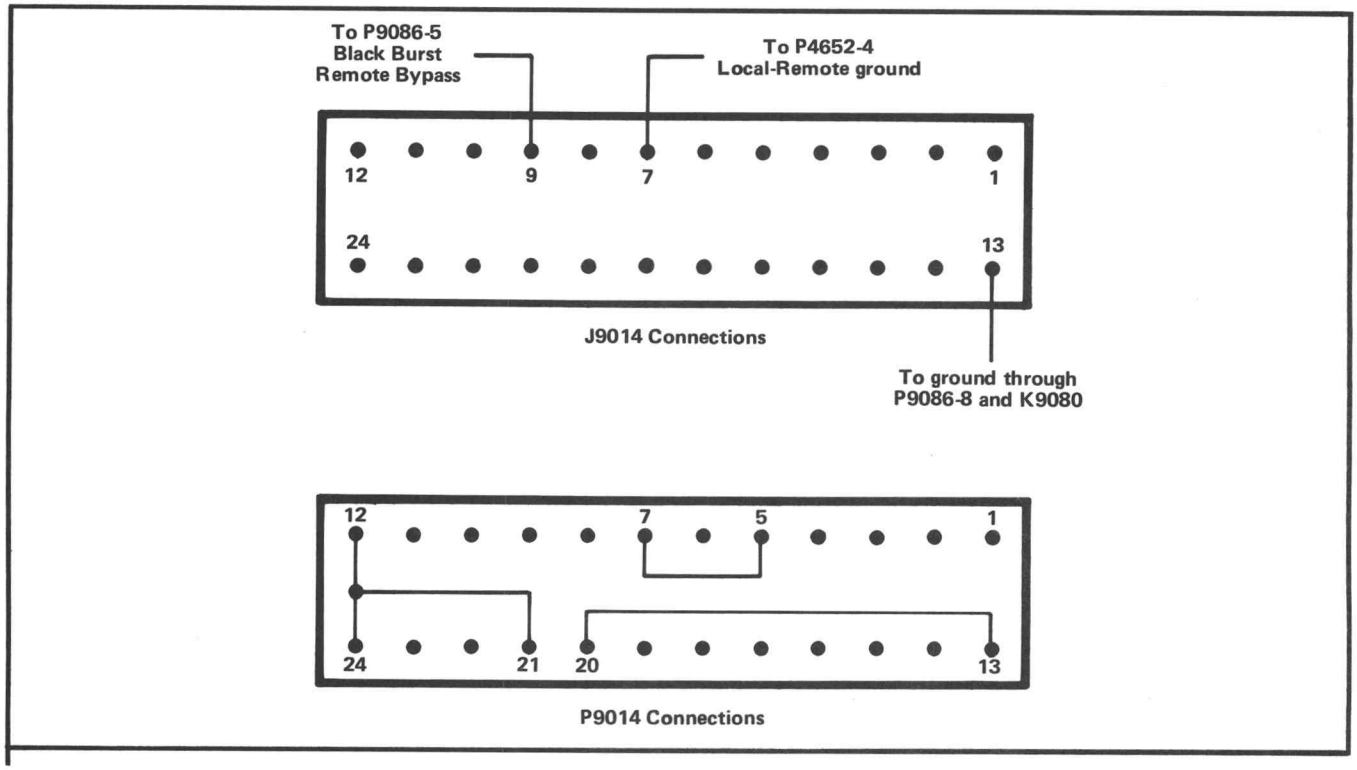


Fig. 2. P9014 wiring for Local operation.

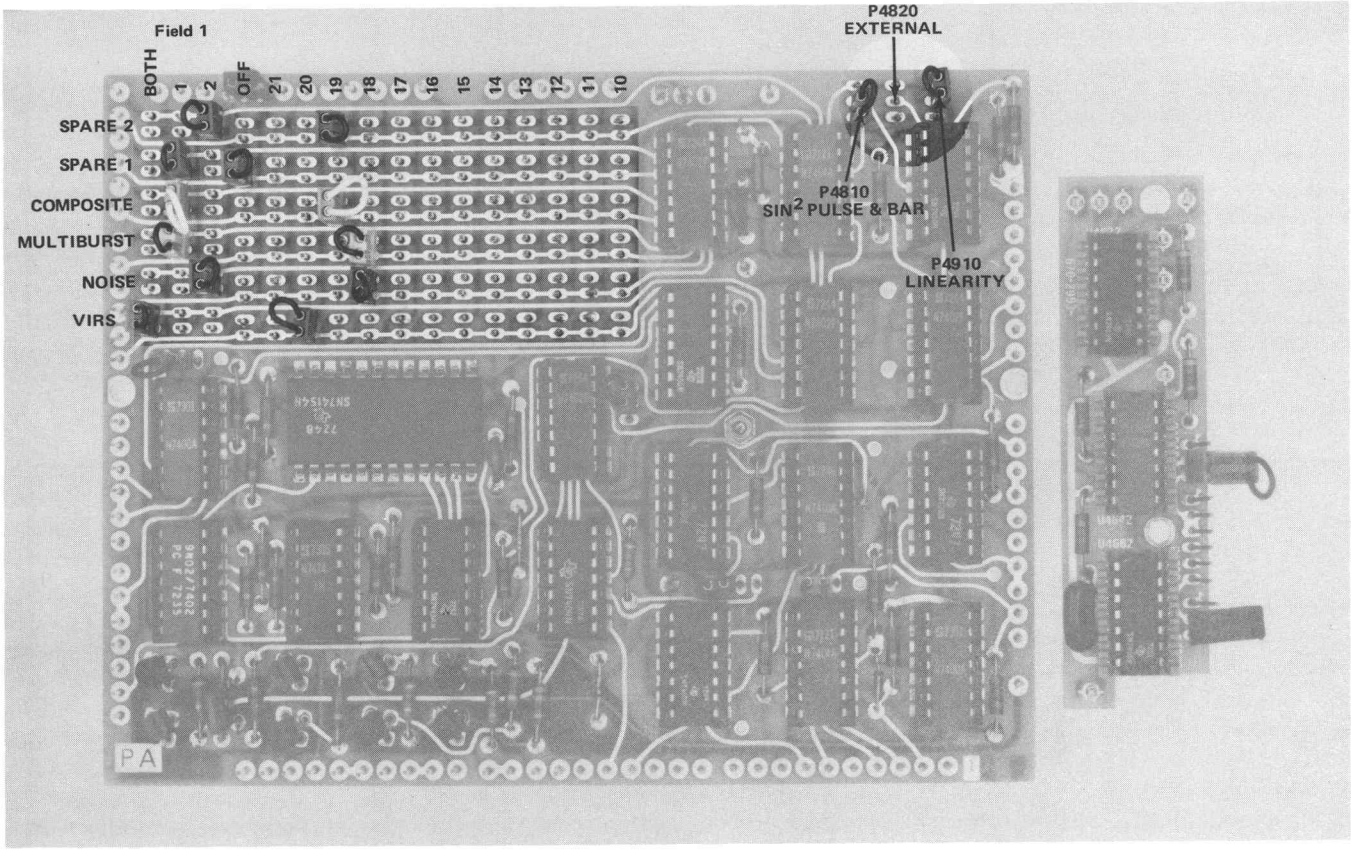


Fig. 3. VIT & FF circuit board showing location of VIT line and Field plugs.

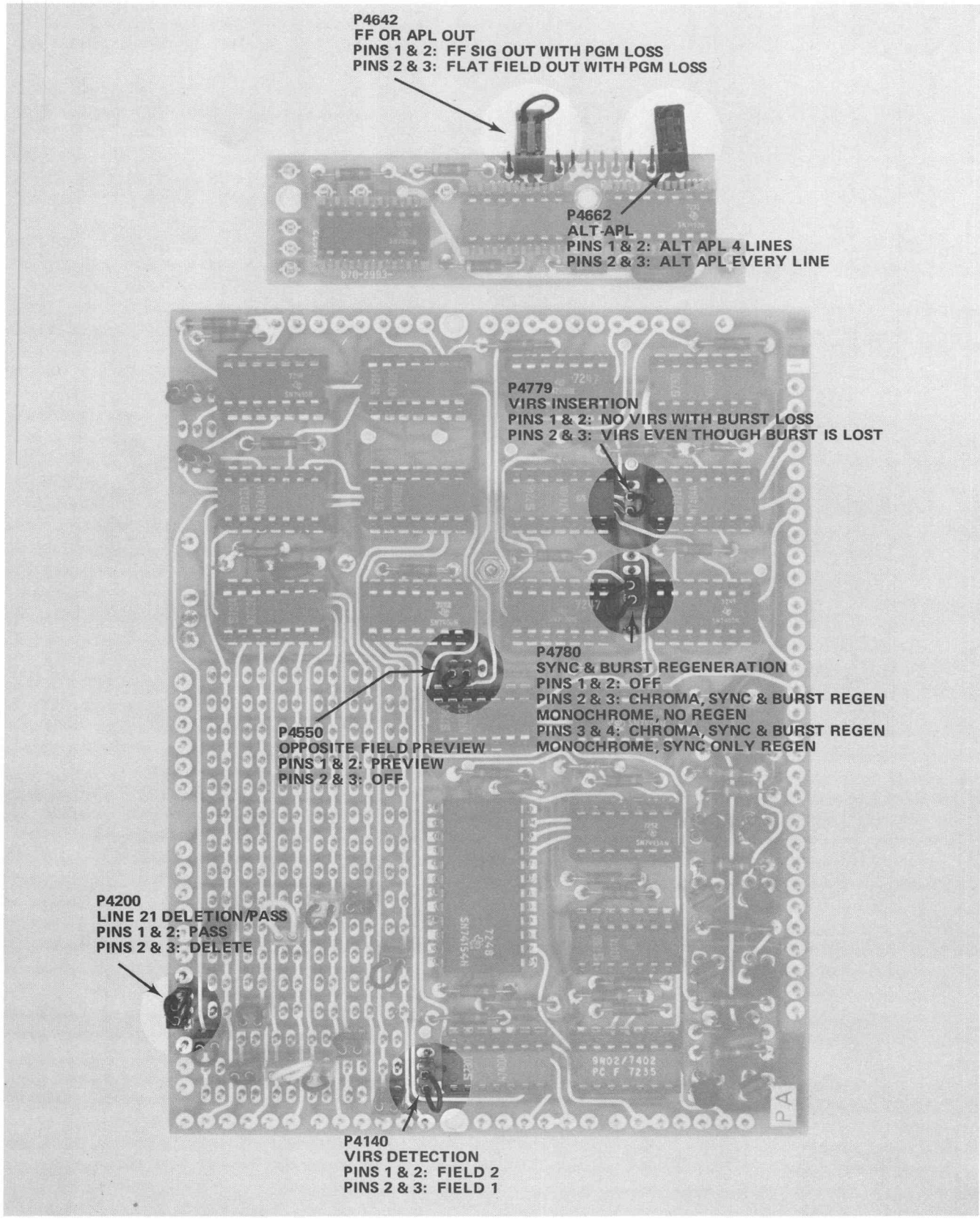


Fig. 4. VIT & FF circuit board showing location of operation change plugs.

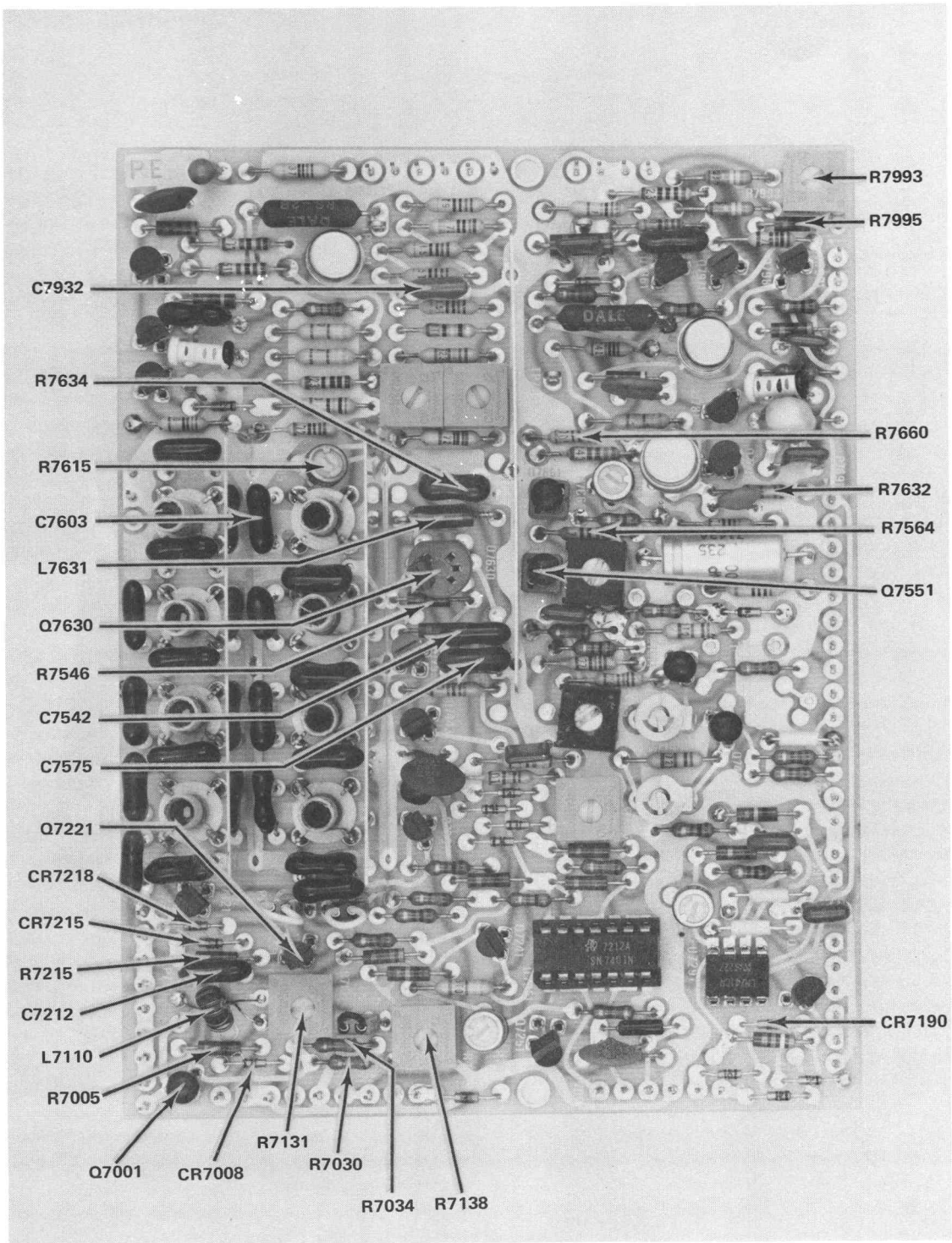


Fig. 5. Output board showing component changes.

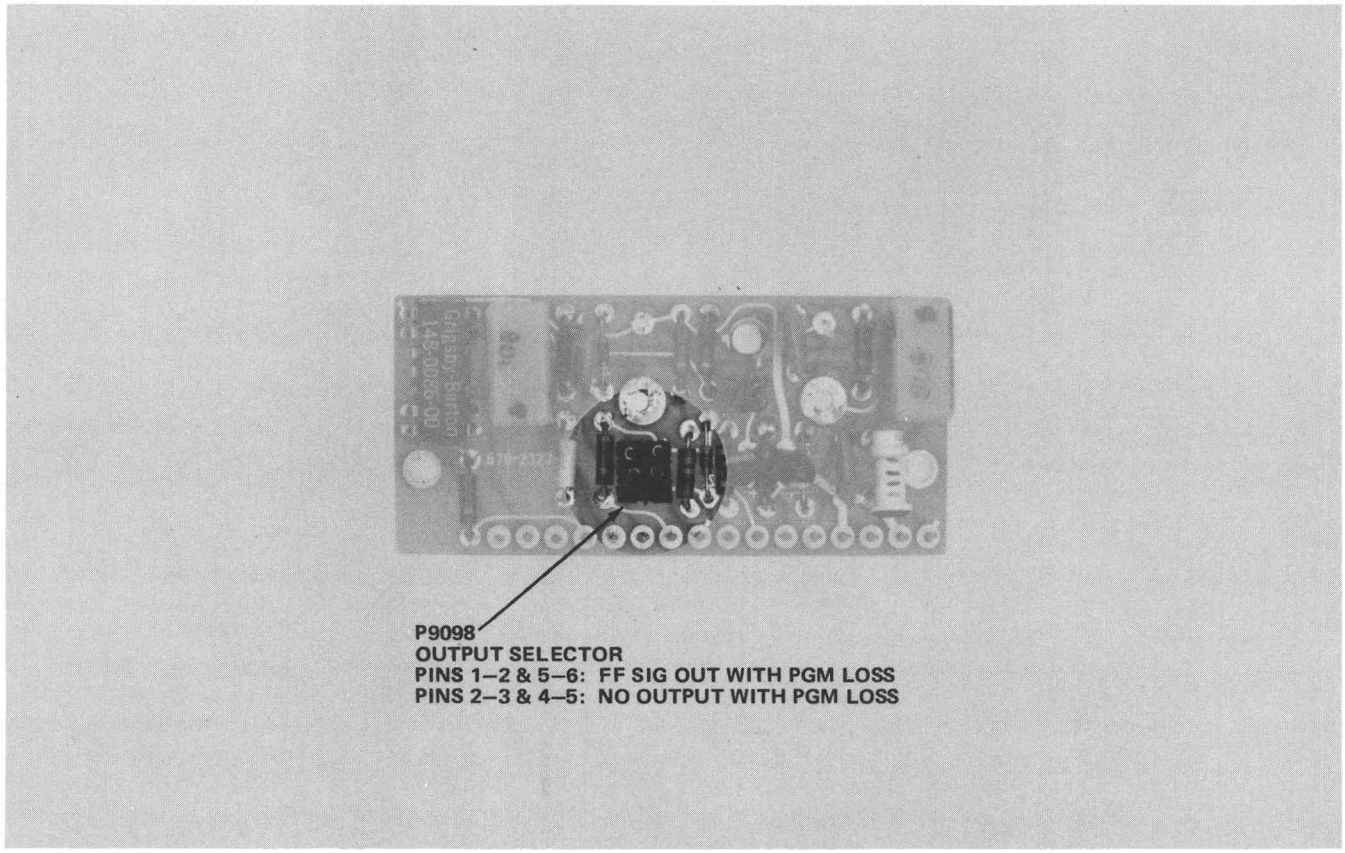
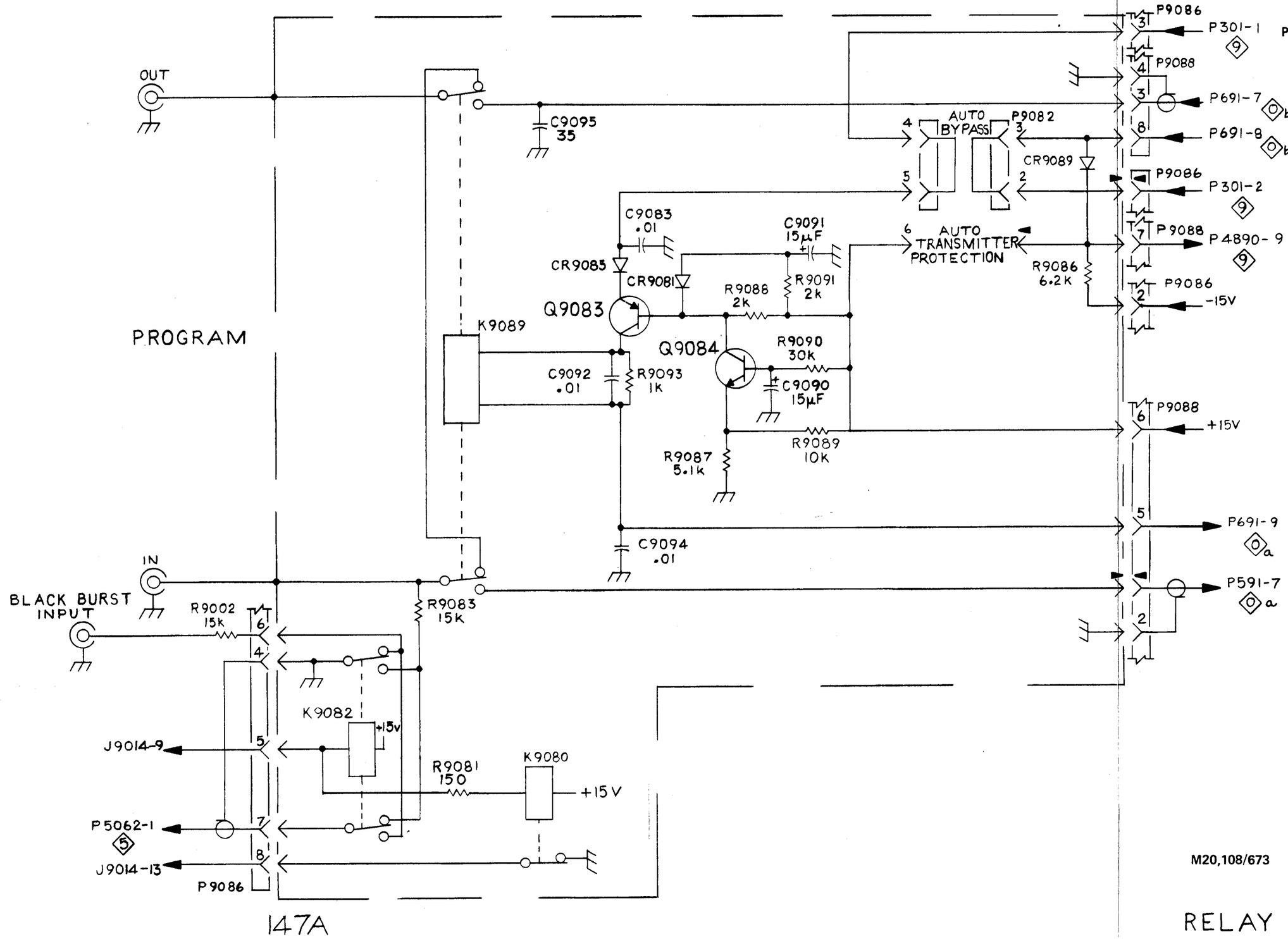


Fig. 6. Relay circuit board showing location of Output Selector plug.



147A

M20,108/673

RELAY

FIELD RESET
U4171 PIN4

C4662
470

R4662
270

P4652
H-RATE
P4590-9
4

2,3
1,14
11
12
6,7,10
U4662

P4652
6
P4662
3
2
÷5
÷2

P4652
ALTERNATE
NORMAL
P301-5
9
DS9202
9
P4642
2
3

+5V
R4642
4.7k
+5V
R4622
4.7K
U4642C
9
8
10
+5V
R4644
4.7k
1
2
3
4,5
6
U4642A U4642B

P4652
4
TO J9014-7
FULL FIELD
APL
U4171 PIN2
4

U4622A&D

VERT BLANK
U4661 PIN 4
4

13
S
1
C
2,11
U4622C
10
9
8

LINE 16
U4351 PIN8
4

VERT BLANK
P1001-3
1

4,5
6
U4622B

R4741
200
U4641 PIN12
C4721
.002

ALT LINE APL

U4351

U4741B
5
4
6

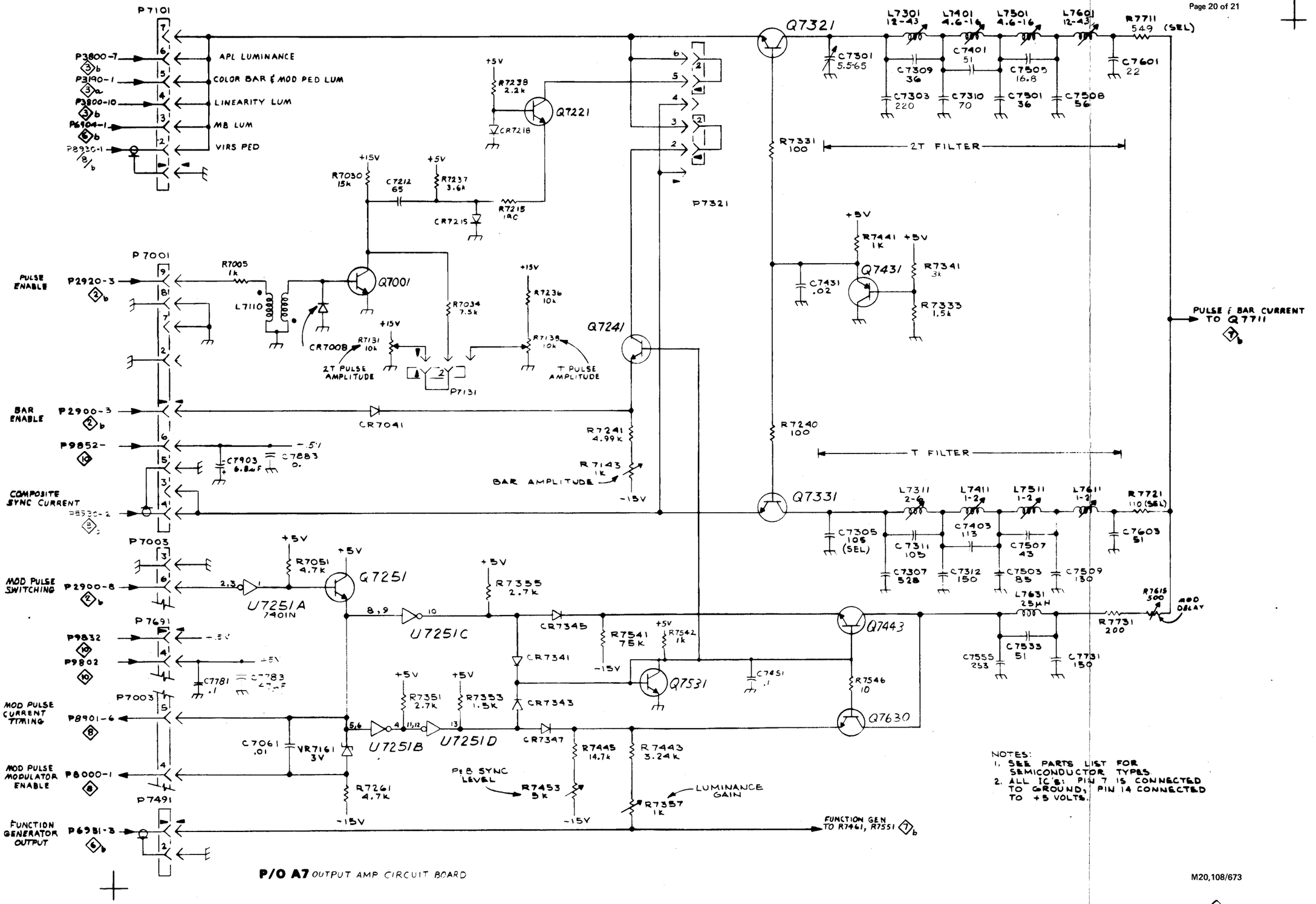
+5V
R4996
1k
P
9
10
U4761C
3
P301
9
2
P501
0

U4571C
REMOVED
SN B110000
CR4572
4
5
6
P4590
6
P8500-10 TO
EMITTER
Q8620 FOR 147
P4780
3
2
1
TO CATHODE
CR8603 FOR 149

M20,108/673

147A

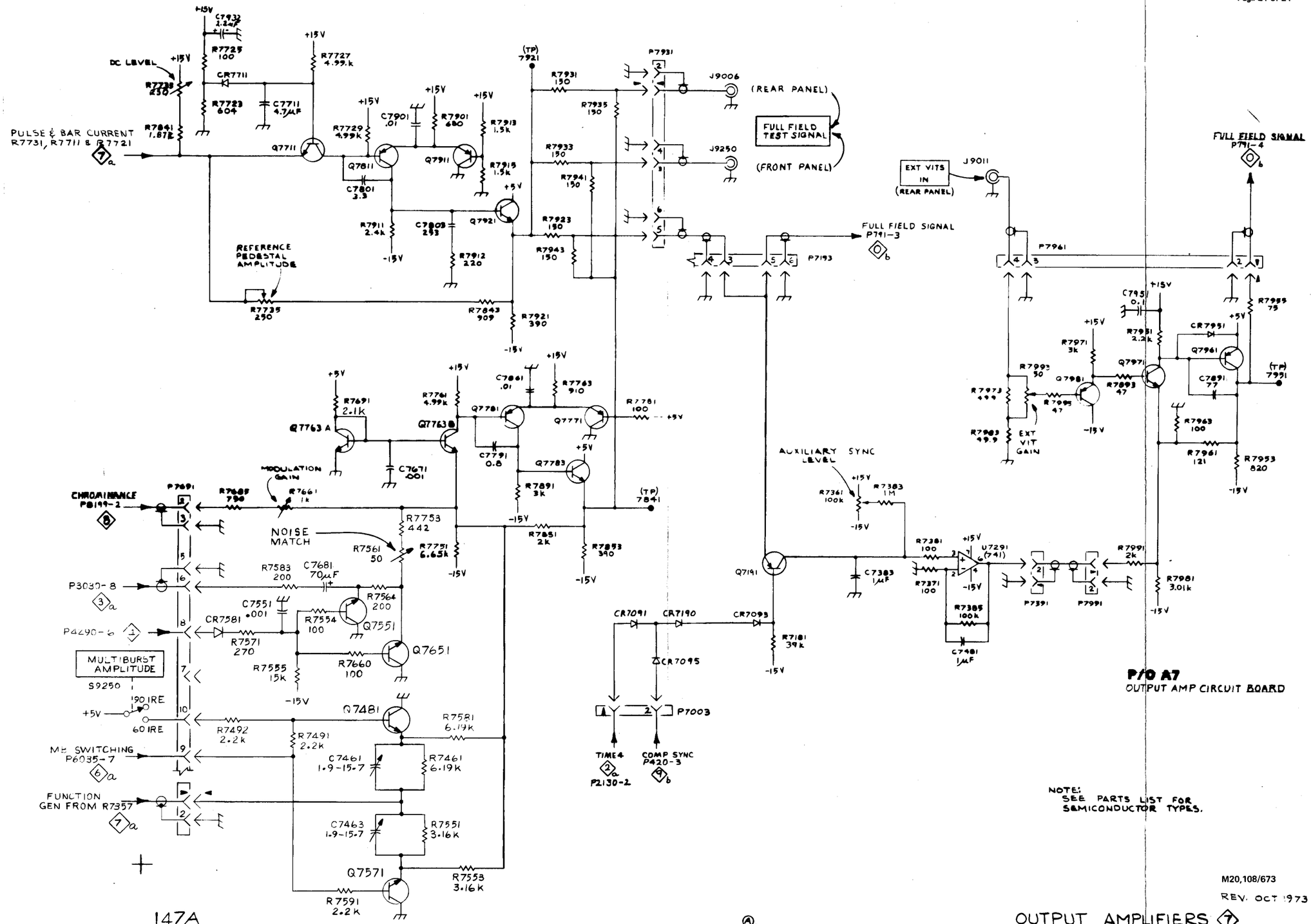
PARTIAL VIT & FF LOGIC REV. JAN. 1974



NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. ALL IC'S: PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.

P/O A7 OUTPUT AMP CIRCUIT BOARD

M20,108/673



P/O A7
OUTPUT AMP CIRCUIT BOARD

NOTE:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

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A1

M20,108/673
REV. OCT 1973

OUTPUT AMPLIFIERS 7b

DAJ