TECHNICAL MANUAL

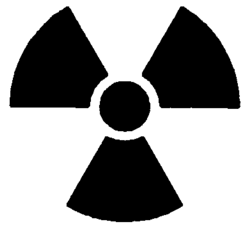
DIRECT SUPPORT MAINTENANCE MANUAL
RADAR SET
AN/MPQ-4A
(NSN 5840-00-543-0759)

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 JANUARY 1981

WARNING

RADIATION HAZARD



STD- RW-2

Co. 60
Ni 63

Tube types OB2WA and 6560/BL-35 (TR tube) used in this equipment contain radioactive material. These tubes are potentially hazardous when broken; see qualified medical personnel and the Safety Director if you are exposed to or cut by broken tubes. Be extremely careful when replacing these tubes and follow safe procedures in their handling, storage, and disposal.

Do not place radioactive tubes in your pocket.

Be extremely careful not to break radioactive tubes while handling them.

Do not remove radioactive tubes from carton until ready to use them.

WARNING

When overheated, selenium rectifiers give off poisonous fumes (smell like garlic or rotten eggs) that are harmful to the human body. When this odor is first noticed shutoff the equipment and evacuate the area. DO NOT reenter the area until it has been well ventilated. DO NOT handle selenium rectifiers that have been overheated (even after cooling) with the bare hands.

MICROWAVE RADIATION HAZARD

Potentially hazardous levels of microwave radiation exist immediately in front of Reflector, Antenna AT-634/MPQ-4A. Turn off the transmitter before standing on the radar trailer in front of the reflector. When it is absolutely necessary to use the telescope while the transmitter is turned on, remain in a crouched position while making observations through the telescope, and use maximum antenna angles whenever possible.

IONIZING RADIATION HAZARD

Potentially hazardous ionizing radiation may exist within the transmitter compartment. If the radar set is on and radiating with the door to the transmitter compartment open, keep 3 feet away from the type 5949A thyratron tube. If it is necessary to work within 3 feet of this tube while the radar set is operating with the transmitter compartment door open, keep exposure to a minimum. Limit the time of exposure to not more than 1 hour per week.

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING UNITS:

Duplexer TR tube assembly	700 volts
Power Supply PP-1588/MPQ-4A	700 volts
Azimuth and Range Indicator IP-375/MPQ-4A	14,000 volts
Modulator-transmitter	26,000 volts

Technical Manual
No. 11-5840-208-30-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 January 1981

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RADAR SET AN/MPQ-4A
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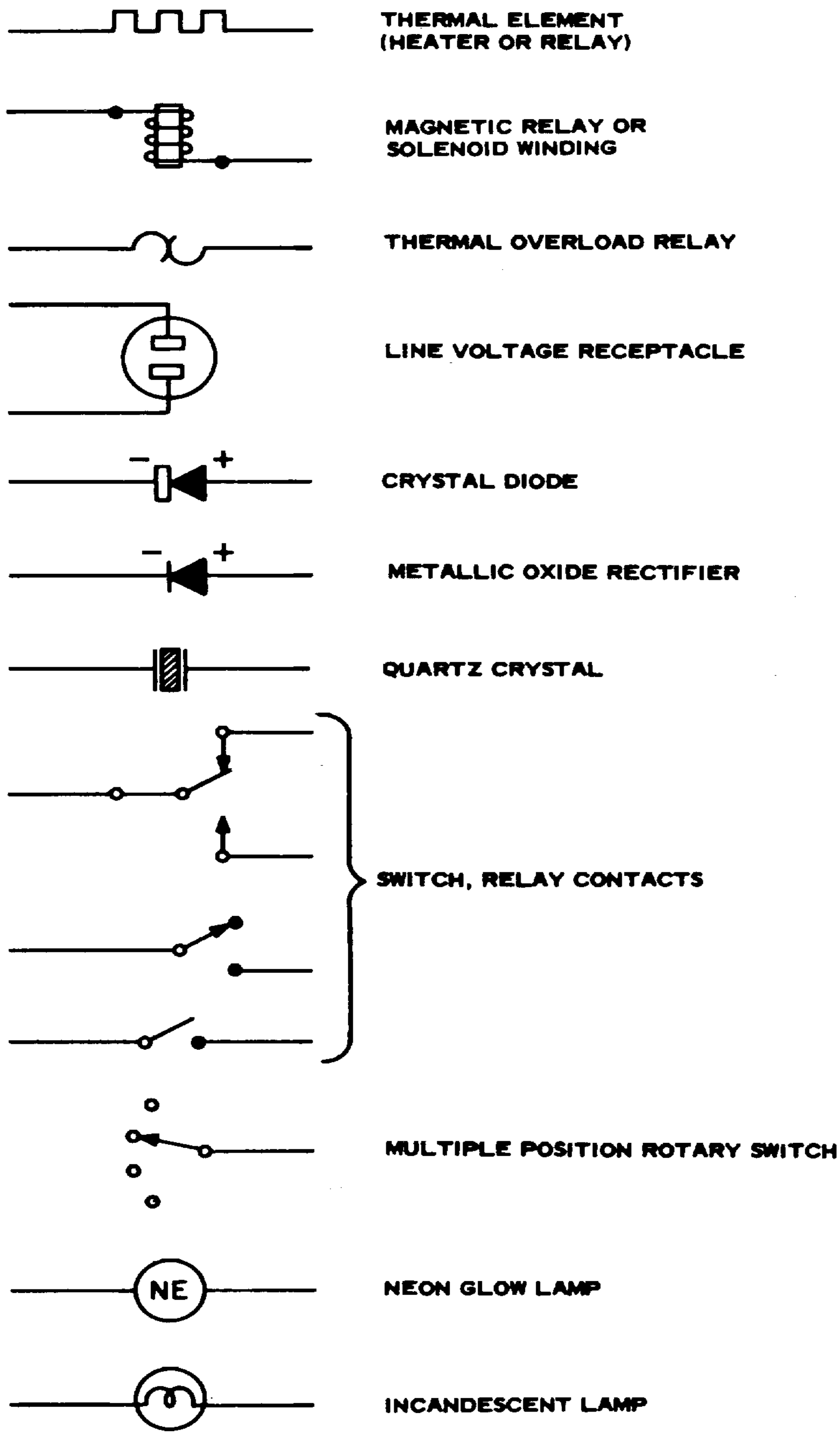
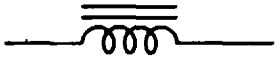
CHAPTER 1

SYMBOLS AND COLOR CODES

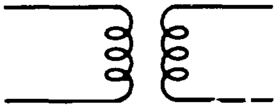
1-1. CONVENTIONAL SYMBOLS



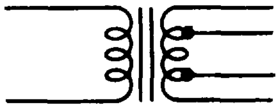
INDUCTOR WITH AIR CORE



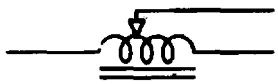
INDUCTOR WITH MAGNETIC CORE



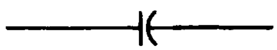
TRANSFORMER WITH AIR CORE



TRANSFORMER WITH MAGNETIC CORE, FIXED TAPS

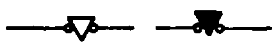


AUTOTRANSFORMER WITH VARIABLE TAP



CAPACITOR, FIXED
NOTE: CURVED PLATE INDICATES NEGATIVE TERMINAL OR OUTSIDE FOIL

CAPACITOR, VARIABLE
NOTE: DIAGONAL ARROW THROUGH ANY COMPONENT INDICATES THE VALUE OF THE COMPONENT IS VARIABLE



INTERLOCK SWITCH

PUSHBUTTON SWITCH (NORMALLY OPEN)

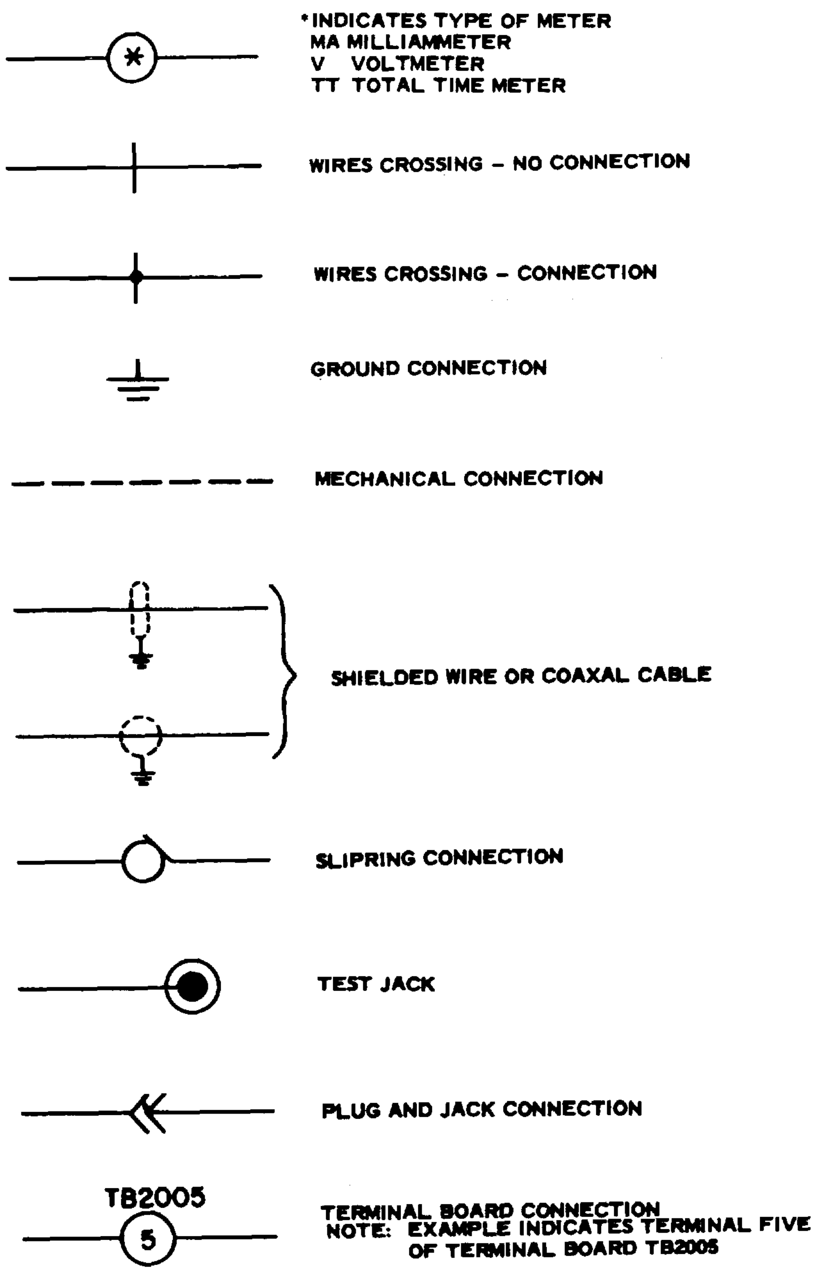
PUSHBUTTON SWITCH (NORMALLY CLOSED)

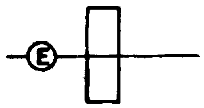
RESISTOR, FIXED

RESISTOR, VARIABLE (POTENTIOMETER)

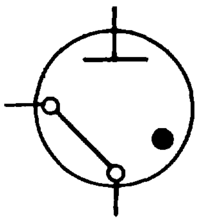
RESISTOR, VARIABLE (RHEOSTAT)

RESISTOR, TAPPED

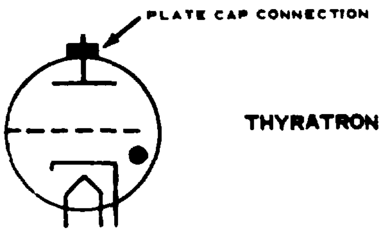

*INDICATES TYPE OF METER
MA MILLIAMMETER
V VOLTMETER
TT TOTAL TIME METER
WIRES CROSSING – NO CONNECTION
WIRES CROSSING – CONNECTION
GROUND CONNECTION
MECHANICAL CONNECTION
SHIELDED WIRE OR COAXAL CABLE
SLIPRING CONNECTION
TEST JACK
PLUG AND JACK CONNECTION
TB2005
5
TERMINAL BOARD CONNECTION
NOTE: EXAMPLE INDICATES TERMINAL FIVE
OF TERMINAL BOARD TB2005



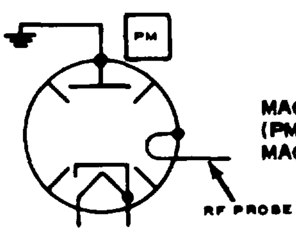
RECTANGULAR WAVEGUIDE CONNECTION (LETTER DENOTES PLANE INTO WHICH SIGNAL IS INSERTED)



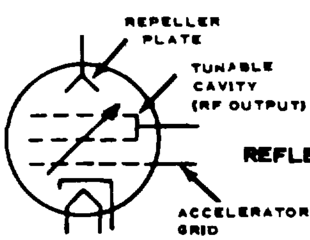
VOLTAGE REGULATOR TUBE (COLD CATHODE) BLACK DOT SIGNIFIES TUBE IS GAS FILLED



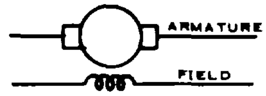
THYRATRON (GAS FILLED)



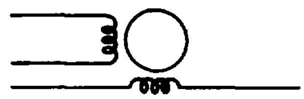
MAGNETRON (PM DENOTES PERMANENT MAGNET FIELD)



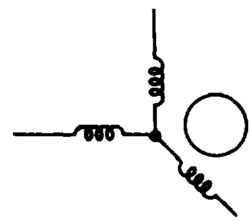
REFLEX KLYSTRON



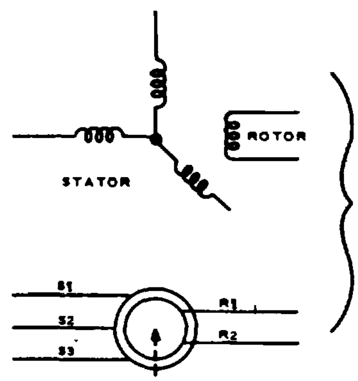
DC MOTOR



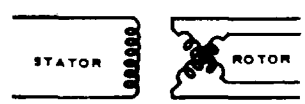
2-PHASE AC MOTOR



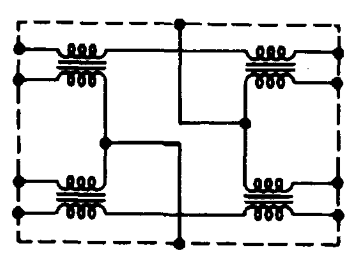
3-PHASE AC MOTOR



SYNCHRO TRANSMITTER OR CONTROL TRANSFORMER



SYNCHRO RESOLVER

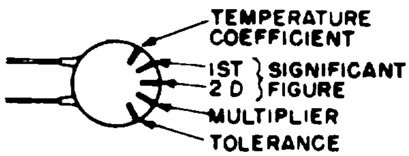


SATURABLE REACTOR

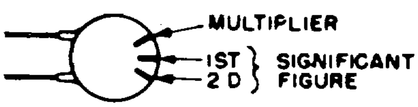
NOTES

1-2. COLOR CODING FOR CAPACITORS AND RESISTORS

5-DOT SYSTEM



3-DOT SYSTEM



DISK CERAMIC CAPACITOR COLOR CODES

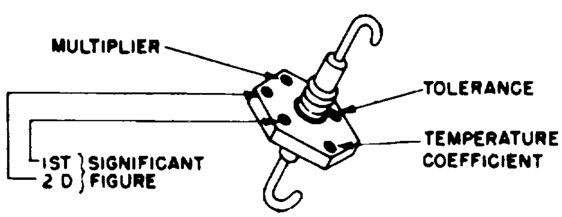
COLOR	SIG FIG	MULTIPLIER	TOT. A	TOT. B	TEMP. COEFF
BLACK	0	1	2	20	0
BROWN	1	10	0.1	1	-30
RED	2	102	-	2	-80
ORANGE	3	103	-	2.5	-150
YELLOW	4	104	-	-	-220
GREEN	5	-	0.5	5	-330
BLUE	6	-	-	-	-470
VIOLET	7	-	-	-	-750
GRAY	8	0.01	0.25	-	30
WHITE	9	0.1	1	10	120 TO -750 (RMA) 500 TO -330 (JAN)
GOLD	-	-	-	-	100
SILVER	-	-	-	-	BYPASS OR COUPLING

NOTES: CAPACITANCE IN μμFD
COLUMN A LISTS TOLERANCE IN μμFD FOR VALUES OF 10 μμFD OR LESS. COLUMN B LISTS TOLERANCE IN PERCENT FOR VALUES OVER 10 μμFD.
--PARTS PER MILLION PER DEGREE CENTIGRADE.

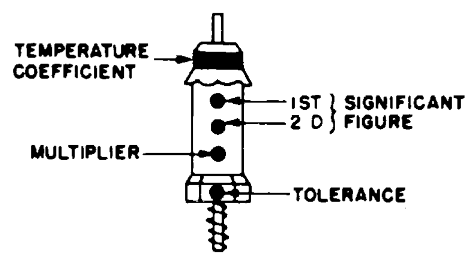
CERAMIC CAPACITOR COLOR CODES

SEE CODES AND NOTES FOR DISK-CERAMIC CAPACITORS

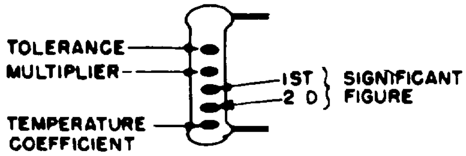
FEED-THRU TYPE



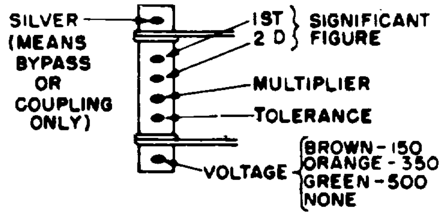
STANDOFF TYPE



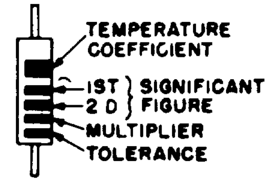
5-DOT RADIAL LEAD



6-DOT RADIAL LEAD

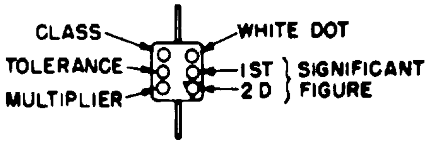


AXIAL LEAD

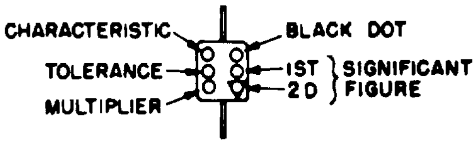


MOLDED MICA CAPICITOR COLOR CODES

RMA CODE



JAN CODE



COLOR	SIG FIG	MULTIPLIER	TOLERANCE PERCENT	CHARAC-TERISTIC
BLACK	0	1	20	A
BROWN	1	10	-	B
RED	2	102	2	C
ORANGE	3	103	3(RMA)	D
YELLOW	4	104	-	E
GREEN	5	-	5(RMA)	F(JAN)
BLUE	6	-	-	G(JAN)
VIOLET	7	-	-	-
GRAY	8	-	-	I(RMA)
WHITE	9	-	-	J(RMA)
GOLD	-	0.1	S(JAN)	-
SILVER	-	0.01	10	-
NONE	-	-	20(RMA)	-

STANDARD RESISTOR COLOR CODE

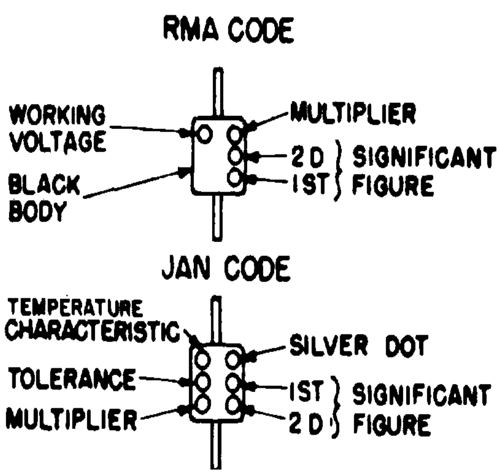
COLOR	SIG FIG	TOLERANCE PERCENT
BLACK	0	-
BROWN	1	-
RED	2	-
ORANGE	3	-
YELLOW	4	-
GREEN	5	-
BLUE	6	-
VIOLET	7	-
GRAY	8	-
WHITE	9	-
GOLD	)-SEE NOTES	PLUS OR MINUS 5%
SILVER	)	PLUS OR MINUS 10%
NONE		PLUS OR MINUS 20%

NOTES: BAND NEAREST END IS FIRST FIGURE. SECOND BAND IS THE SECOND FIGURE. THIRD BAND IS THE NUMBER OF ZEROS OF THE DECIMAL MULTIPLIER IF GOLD OR SILVER. FOURTH BAND IS PERCENT TOLERANCE

Letter Prefix	Part Name	Letter Prefix	Part Name
B	Motor or synchro	L	Inductor
C	Capacitor	MG	Motor-generator
Y	Quartz crystal	P	Plug
E	Terminal strip	R	Resistor
F	Fuse	S	Switch
G	Generator	T	Transformer
I	Lamp	V	Tube
J	Jack or receptacle	X	Tube socket and plug-in resistor
K	Relay	CR	Crystal recitifier
		Z	Filter network

TRANSFORMER COLOR CODE (RMA STANDARD)

COLOR OF LEAD	POWER TRANSFORMER	A-F TRANSFORMER (ALSO LINE-TO-GRID AND TUBE-TO-LINE)	I-F XFMR	LOUDSPEAKER FIELD	LOUDSPEAKER VOICE
BLACK	PRIMARY (COMMON FOR TAPPED PRIMARY)	GRID RETURN RETURN	GRID OR DIODE		START
BLACK AND RED	FINISH OF TAPPED PRIMARY			START	
BLACK AND YELLOW	PRIMARY TAP				
RED	HIGH VOLTAGE	B PLUS	B PLUS		
RED AND YELLOW	HIGH VOLTAGE TAP			FINISH	
YELLOW	RECTIFIER FILAMENT (CT-YELLOW AND BLUE)	GRID OR CENTER-TAPPED SECONDARY			
GREEN	FILAMENT NO. 1 (CT-GREEN AND YELLOW)	GRID	GRID OR DIODE		FINISH
BROWN	FILAMENT NO. 2 (CT-BROWN AND YELLOW)	PLATE OR CENTER-TAPPED PRIMARY			
SLATE	FILALENT NO. 3 (CT-BROEM AND YELLOW			TAP-SLATE AND RED	
BLUE		PLATE	PLATE		

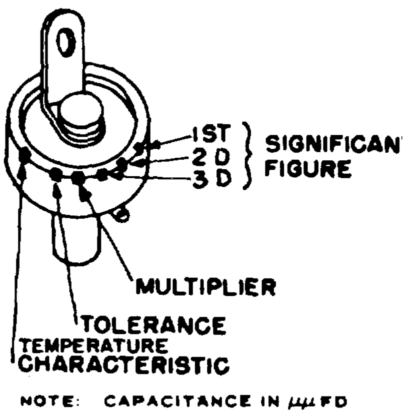


MOLDED FLAT PAPER CAPACITOR COLOR CODES

COLOR	SIG FIG	MULTIPLIER	TOL	TEMPERATURE CHARACTERISTIC	WORKING VOLTAGE
BLACK	0	1	20	A	-
BROWN	1	10	-	B	100
RED	2	10^2	-	C	200
ORANGE	3	10^3	30	D	300
YELLOW	4	10^4	40	E	400
GREEN	5	10^5	5	F	500
BLUE	6	10^6	-	G	600
VIOLET	7	-	-	-	700
GRAY	8	-	-	-	800
WHITE	9	-	10	-	900
GOLD	-	0.1	5	-	-

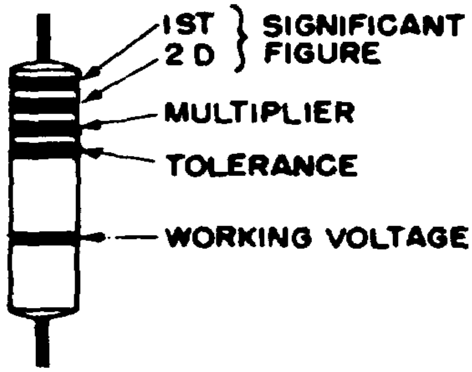
NOTES: CAPACITANCE IN $\mu\mu$FD. VOLTAGE RATINGS EXPRESSED IN HUNDREDS OP VOLTS. VOLTAGE RATINGS OVER 500 V EXPRESSEO IN TWO-DOT VOLTAGE CODE

BUTTON SILVER MICA CAPACITOR COLOR CODE



COLOR	SIG FIG	MULTIPLIER	TOLERANCE PERCENT	TEMPERATURE CHARACTERISTIC
BLACK	0	1	20	A
BROWN	1	10	-	B
RED	2	12	-	C
ORANGE	3	103	3(RMA)	D
YELLOW	4	104	-	E
GREEN	5	-	5 (RMA)	F (JAN)
BLUE	6	-	-	G (JAN)
VIOLET	7	-	-	-
GRAY	8	-	-	I (RMA)
WHITE	9	-	-	J (RMA)
GOLD	-	0.1	0.5	-
SILVER	-	0.01	10	-
NONE	-	-	20 (OLD RMA)	-

MOLDED TUBULAR PAPER CAPACITOR COLOR CODE



COLOR	SIG FIG	MULTIPLIER	TOLERANCE PERCENT
BLACK	0	1	20
BROWN	1	10	-
RED	2	10^2	-
ORANGE	3	10^3	30
YELLOW	4	10^4	40
GREEN	5	10^5	5
BLUE	6	10^6	-
VIOLET	7	-	-
GRAY	8	-	-
WHITE	9	-	10
GOLD	-	0.1	-

NOTES CAPACITANCE IN μμFD.
VOLTAGE RATINGS
EXPRESSEDO IN HUNDREDS
Of VOLTS.
VOLTAGE RATINGS OVER
900 V EXPRESSED IN TWO-
BAND V CODE

JAN: JOINT ARMY-NAVY STANDARDS

RMA: RADIO- TELEVISION MANUFACTURERS ASSOCIATION STANDARDS

CHAPTER 2

PREOPERATION AND PERFORMANCE CHECKS

2-1. GENERAL

Adherence to the procedures outlined in this section is necessary for efficient operation of the radar set AN/MPQ-4A. The procedures should be performed in sequence when possible.

2-2. PRELIMINARY ADJUSTMENTS

Before applying power to the radar set AN/MPQ-4A, perform the following preliminary adjustments:

a. Receiver-Transmitter Group. Set the AFC-MANUAL switch on the control-monitor panel to the AFC position. Secure the control-monitor panel, the power supply drawer, and the transmitter door. Open the air intake and air exhaust panels on the rear of the cabinet and the air exhaust panel on the left side. Remove the vent cap at the upper left rear of the cabinet.

b. Antenna Group. Open the vents on both ends of the scanner and under the pedestal. Place circuit breaker switch to on (HD-264A/MPQ-4A), open the purge valve. Open the air intake/exhaust panel on the front of the dehydrator. Be sure that the azimuth stowlock is disengaged and that the fenders are down. Place the azimuth handwheel in the desired operating position (normally all the way out). Open the vent under the elevation dial indicator housing (AN/MFP-4A only).

c. Control-Indicator Group. Secure the control-power supply, indicator, and computer drawers. Open the air intake and exhaust panels on the left and right sides of the cabinet. Remove the vent cap at the upper right rear of the cabinet. Set the following switches in the position indicated:

Switch	Position
MAIN POWER switch	OFF
AFC-MANUAL switch	MANUAL
TEST METER SELECTOR switch	27V

2-3. STARTING PROCEDURE

a. Check and start the generator PU-304C as outlined in TM 5-6115-450-15, section IV.

b. Check the power unit output for proper voltage and frequency. When these requirements are met, turn the power unit 400-hertz circuit breaker to ON. The POWER UNIT indicator lamp on the control-indicator group will light, providing the output phases of the generator are connected in the proper sequence.

c. Turn the MAIN POWER switch to ON. The MAIN POWER ON & INTLK CLOSED indicator lamp will light, and the test meter on the control-power supply will indicate 27 volts. If the meter does not indicate 27 volts + 3 volts, turn the MAIN POWER switch off at once and check power input voltages and connections. If the 27V fuse blows, turn

d.

the power off and check the cable connections between the control unit and the pedestal for improper mating.

d. Check for operation of the system blowers. There are three blowers to be checked.

(1) Check the blowers in the receiver-transmitter cabinet. To accomplish this, hold a piece of paper to the intake vents at the rear of the cabinet. If inrushing air draws the paper against the vent, the blower is operating. This must be done on both the left and right sections of the vent to insure operation of both the main blower and the magnetron blower.

(2) The control-indicator blower is operating if air is being discharged at the exhaust vent on the right side of the cabinet.

e. While waiting for the 5-minute delay relay to close, perform the following checks and adjustments:

(1) After 30 seconds, rotate the TEST METER SELECTOR switch on the control-power supply and on the control-monitor through the positions listed in (a) and (b) below. The meter should read as follows:

(a) At the control-power supply:

Switch position	Meter scale	Typical reading	Actual value
440 V X100	0-5	4.4	440 volts
220 V X50	0-5	4.4	220 volts
27 V X10	0-5	2.7	27 volts
-220 V X50	0-5	4.4	-220 volts

(b) At the control-monitor:

Switch position	Meter scale	Typical reading	Actual value
XTAL 1	0-5	2.5	0.5 ma
XTAL 2	0-5	2.5	0.5 ma
+300V X100	0-5	3.0	300 volts
+150V X50	0-5	3.0	150 volts
-300V X100	0-5	3.0	-300 volts

(2) Operate the AZIMUTH switch to the CW position and then to the CCW position. The antenna should rotate in a corresponding direction.

(3) Operate the ELEVATION switch. The reflector should tilt up-ward when the switch is placed in the RAISE position; it should tilt downward when the switch is placed in the LOWER position.

f. After the 5-minute delay, the READY indicator lamp on the control-power supply panel will light. Close purge valve. Check to see that the dehydrator pressure gage reads approximately 16 psi (pounds per square inch) and that the dry air indicator is blue.

g. Adjust the MAGNETRON POWER variac to a position between 0 and 25. Press the START button. The RADIATE indicator lamp will light. Adjust the variac until the MAGNETRON CURRENT meter reads 18 ma (milliamperes).

h. Set the VIDEO control at maximum and the IF GAIN at minimum.

i. With the RANGE SELECTOR switch in the 15000 M position, adjust the INTENSITY control until raster is just visible.

j. Switch the RANGE SELECTOR switch to the 3750 M position. If intensity of raster changes noticeably, adjust the intensity balance (page 208).

k. Adjust the FOCUS control to obtain the sharpest lines and images.

l. Adjust the IF GAIN control until the background noise is just noticeable.

m. Adjust the RANGE MARK control until the range strobe is visible.

n. Adjust the AZIMUTH MARK control until the azimuth strobe is visible.

o. Place the AFC-MANUAL switch in the AFC position.

p. Turn the MARKERS switch to ON. Range markers should appear at ranges of 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, and 14,000 meters. If the markers do not appear, the most probable cause is improper tuning of the local oscillator.

q. Tune the local oscillator.

(1) Place the AFC-MANUAL switch in the MANUAL position.

(2) If the markers did not appear in above, operate the LO switch in the RAISE position until the markers appear. If no markers appear within 40 seconds, operate the LO switch in the LOWER position.

(3) When the range markers appear, operate the LO switch in the RAISE position and then in the LOWER position until maximum marker intensity is obtained. Return the AFC-MANUAL switch to the AFC position. The marker intensity should remain unchanged.

(4) If a decrease in marker intensity occurs, the AFC circuit probably requires adjustment (page 211).

Note: There are two local oscillator frequencies that will cause the range markers to appear at full brilliance; one is 30 MHz above the transmitter frequency, the other is 30 MHz below. The lower frequency is correct and is the only frequency at which the AFC circuit will "lock in. " Proper action of the AFC circuit is indicated by the stability of the range marker intensity and the AFC crystal current when the AFC- MANUAL switch is placed in the AFC position. AFC crystal current may be measured on the test meter by setting the TEST METER SELECTOR switch in the AFC XTAL CUR position. The normal meter reading is 2. 5 (0. 5 ma).

(5) If the range markers fade out entirely when the AFC-MANUAL switch is placed in AFC, the local oscillator is probably tuned to the wrong frequency. To correct this, place the AFC-MANUAL switch to MANUAL and operate the LO switch in LOWER position until the range markers reappear. Adjust the local oscillator for maximum intensity of the range markers. Return the AFC-MANUAL switch to AFC. No change in marker intensity should occur.

r. Turn the MARKERS switch to OFF.

2-4. RANGE CALIBRATION

a. General. In order to obtain accurate range data and an end result of accurate weapons locations, the radar set AN/MPQ-4A must be range calibrated. Range calibration consists of alining the range circuits so that the radar will read the correct range. Range markers are used to calibrate, and a fixed point may be used to check calibration. Range calibration should be performed each time the set is emplaced and checked at least once a day during operation.

b. Procedure for Range Calibration. To prepare the radar for range calibration, insure that power is applied to the radar, the transmitter is turned on, the local oscillator is tuned, the RANGE SHIFT switch is turned to the OFF position, the DETENT switch is set to the OFF position, and ∆ RANGE is set in detent. (The latter allows the operator to set any given range into the computer.)

(1) Using the LOWER BEAM RANGE control, set the range at 2, 000 meters.

(2) Turn the RANGE SELECTOR switch to the 3750 M position to expand the sweep.

(3) Turn the EXPANDED SWEEP DELAY switch to position 0.

(4) Turn the MARKERS switch to ON.

Note: It may be necessary to adjust the IF GAIN control and/or local oscillator to cause the markers to appear at the proper intensity.

(5) Adjust the RANGE ZERO control, if necessary, until the range marker falls exactly over the strobe.

(6) Turn the EXPANDED SWEEP DELAY switch to position 12.

(7) Move the range strobe to 14, 000 meters.

(8) Adjust the RANGE SLOPE control, if necessary, until the range marker appears exactly over the strobe.

Note: Since the RANGE ZERO and RANGE SLOPE controls interact, it will be necessary to recheck slope at 14, 000 meters after each change-in zero at 2, 000 meters and to recheck zero at 2, 000 meters after each change in slope at 14, 000 meters.

2-5. RADAR PERFORMANCE CHECKS

a. General. Upon receipt of the radar set in the unit, maintenance personnel, using the echo box in conjunction with the indicator B-scope, should test the overall operation of the system by performing a ringtime check. The results of this check should be entered in the radar log for future reference. Subsequently, the operator should make performance checks daily, enter the readings in the radar log, and compare the readings with those resulting from the initial checks to determine whether the set is operating at peak efficiency or whether its effectiveness has decreased. Because of the difficulty of obtaining a high degree of accuracy during the measurement of ringtime, it is extremely important that the measurements be made as carefully as possible. Preferably, all measurements should be made by the same operator. The local oscillator must be properly tuned before the ringtime check is made.

b. Ringtime Check.

(1) Turn on the radar set and elevate the antenna to minimize clutter on the B-scope.

(2) Check the MAGNETRON CURRENT meter reading to assure a reading of 18 ma.

(3) Set the indicator RANGE SELECTOR switch to the 15000 M position.

(4) Turn the MARKERS switch to ON.

(5) Tune the echo box until a peak reading is obtained on the relative power meter.

(6) Rotate the EXPANDED SWEEP DELAY switch until the bright band covers the area where the noise on the B-scope starts to build up.

(7) Set the RANGE SELECTOR switch to the 3750 M position.

(8) Adjust the IF GAIN control for maximum ringtime display.

(9) Using the LOWER BEAM RANGE control, place the range strobe over the point where the noise starts to build up.

(10) Read the RANGE counter to obtain the ringtime distance.

(11) Record the ringtime distance, the relative power, and the transmitted frequency of the radar. The minimum acceptable ring-time is 1, 200 meters.

(12) Detune the echo box.

(13) Return the RANGE SELECTOR switch to the 15000 M position.

2-6. NORMAL STOPPING PROCEDURE

a. Turn the magnetron power variac fully counterclockwise, then press the STOP button on the control-power supply panel to turn the transmitter off.

b. Elevate the antenna to +175 mils.

c. To completely stop the radar set, turn the MAIN POWER switch to the OFF position. The READY indicator lamp and MAIN POWER ON & INTLK CLOSED indicator lamp will go out.

d. To stop the power unit, hold the POWER UNIT switch in the STOP position until the engine completely stops. The POWER UNIT indicator lamp will go out.

Note: Place AFC/MAN switch (on the control indicator in the MANUAL position.

2-7. EMERGENCY STOPPING PROCEDURE

To stop the equipment in case of emergency, turn the MAIN POWER switch to OFF and hold the POWER UNIT switch to STOP until the engine stops. These two actions cut off all power to the radar.

2-8. AZIMUTH COLLIMATION AND ORIENTATION

a. Azimuth Collimation Check. The purpose of this check is to determine the angular separation between the optical axis and the center of scan. This check is performed as follows:

(1) Determine the field correction in the following manner:

(a) Turn the transmitter on and allow the set to operate at least 30 minutes.

(b) Tune the echo box for maximum deflection of the meter.

(c) Read the transmitter frequency from the dial above the echo box tuning knob.

(d) Apply this frequency to the chart on the inside of the echo box cover (page 91), interpolating if necessary. The figure obtained is called the field correction.

(2) Select any target which can be positively identified both on the B-scope and through the orienting telescope. This target can be improvised, if necessary, and should be at least 500 meters from the radar.

(3) Move the radar in azimuth and elevation until the target is centered in the orienting telescope.

Note. The use of the AZIMUTH switch on the control-power supply to move the antenna small amounts may cause excessive wear on the azimuth brake. Use the handwheel on the frame of the radar for these small movements, or move the antenna by hand.

(4) Place the RANGE SELECTOR switch in the 3750 M position, and set the EXPANDED SWEEP DELAY switch so that the target is displayed on the B-scope.

(5) Set the DETENT switch in the AZIMUTH ORIENT position, and place both the A AZIMUTH and the LOWER BEAM AZIMUTH controls in detent.

(6) The azimuth strobe should be off the center of the echo by the amount of the field correction; the strobe should be to the left if the correction is negative or to the right if the correction is positive. To verify the distance between the strobe and the center of the echo, note the azimuth reading; then place the DETENT switch in the OFF position, use the LOWER BEAM AZIMUTH control to move the azimuth strobe over the center of the echo, and reread the azimuth counter. The difference between

the two readings should be numerically the same as the field correction. If it is not, the error should be noted and a correction carried until the radar can be correctly boresighted.

b. Azimuth Orientation. The purpose of azimuth orientation is to obtain the correct reading on the azimuth counters.

(1) Azimuth orientation (electrical method).

(a) Place the RANGE SELECTOR switch in the 3750 M position and the EXPANDED SWEEP DELAY switch to the range which will display the orienting point. Rotate the antenna until it is pointed generally toward the orienting point. Move the antenna in elevation, if necessary, until the orienting point shows up as a target on the B-scope.

(b) Set the DETENT switch to the OFF position, and place the A AZIMUTH control in detent.

(c) Rotate the LOWER BEAM AZIMUTH control until the azimuth strobe bisects the target (orienting point) on the B-scope.

Note: It may be necessary to adjust the IF GAIN con-trol to reduce the size of the echo so that it can be more easily bisected.

(d) Hold the RADAR LOCATION AZ ORIENT switch in the ADD (or SUBT) position until the AZIMUTH counter reads the azimuth to the orienting point.

(e) Set the DETENT switch to the AZIMUTH ORIENT position, and place the A AZIMUTH and LOWER BEAM AZIMUTH controls in detent.

(f) Apply the field correction (a(l) above) with the sign changed to the reading on the computer AZIMUTH counter. Set the resulting figure into the azimuth counter on the frame of the radar.

(2) Azimuth orientatioh (optical method).

(a) Position the antenna so that the orienting point is centered in the orienting telescope. (Comply with the instructions in the note in a (3) above.)

(b) Set the azimuth to the orienting point into the azimuth counter bn the frame of the radar.

(c) Set the DETENT switch to the AZIMUTH ORIENT position, and place the A AZIMUTH and LOWER BEAM AZIMUTH controls in detent.

(d) Apply the field correction (a(l) above), as indicated by its sign, to the azimuth to the orienting point. A corrected azimuth will result.

(e) Hold the RADAR LOCATION AZ ORIENT switch in the ADD (or SUBT) position until the AZIMUTH counter on the computer reads the corrected azimuth.

(f) Move the antenna in azimuth and elevation until a target echo, which can be easily identified, is found. Read and record the azimuth and range to this target. This target can now be used as an electrical orienting point and for orientation checks during periods of poor visibility.

2-9. ELEVATION ORIENTATION CHECK

An elevation orientation check is made to verify the alinement of the orienting telescope with the elevation dials. Since there is no satisfactory means at unit level of checking the alinement of the telescope with the electrical beam, this check is of little value when the set is to be used for weapon location, but it is valuable for such other applications as high-burst registration of artillery. The checkpoint may be a fixed point of known elevation or a fire control instrument, such as an aiming circle.

a. Check the level of the set.

b. Position the antenna so that the checkpoint is centered in the orienting telescope. Comply with the instructions in the note in paragraph 2-8a(3).

c. Check the elevation counter on the frame of the radar. It should indicate the correct elevation to the checkpoint. Record for future reference any error greater than 1 mil.

2-10. COMPUTER ALINEMENT CHECK

The purpose of the computer alinement check is to insure that the computer provides correct locations. This check should be performed daily and after each move.

a. Check linearity between the antenna elevation counter and the computer LOWER BEAM ELEVATION counter in the following manner:

(1) Using the ELEVATION RAISE-LOWER switch, position the antenna in elevation so that the following readings are obtained on the LOWER BEAM ELEVATION counter: -100, -50, 0, 50, 100, 150, 200 mils.

(2) Check that the corresponding readings are obtained on the antenna elevation counter. The readings should be within ±75 mils.

b. Check the azimuth controls and the B-scope indicator as follows:

(1) Set the DETENT switch at OFF, and place the A AZIMUTH control in detent.

(2) Rotate the LOWER BEAM AZIMUTH control clockwise. The AZIMUTH counter reading increases, and the azimuth strobe moves to the right.

(3) Rotate the LOWER BEAM AZIMUTH control counterclockwise. The AZIMUTH counter reading decreases, and the azimuth strobe moves to the left.

(4) Make a short, very thin vertical mark with a grease pencil on the B-scope.

(5) Using the LOWER BEAM AZIMUTH control, superimpose the azimuth strobe on the mark, with the last movement of the control in the clockwise direction. Note the reading of the AZIMUTH counter.

(6) Repeat the step in (5) above, with the last movement of the control in the counterclockwise direction. The same AZIMUTH counter reading should be obtained.

(7) Set the DETENT switch to DETENT RELEASE and check to see that the SET DETENT light is on.

(8) Rotate the A AZIMUTH control clockwise. The AZIMUTH counter reading decreases, and the strobe moves to the right.

(9) Rotate the A AZIMUTH control counterclockwise. The AZIMUTH counter reading increases, and the strobe moves to the left.

c. Check the range controls and the B-scope as follows:

(1) Rotate the LOWER BEAM RANGE control clockwise. The RANGE counter reading increases, and the range strobe moves. up.

(2) Rotate the LOWER BEAM RANGE control counterclockwise. The RANGE counter reading decreases, and the range strobe moves down.

(3) Rotate the A RANGE control clockwise. The RANGE counter reading decreases, and the range strobe moves up.

(4) Rotate the A RANGE control counterclockwise. The RANGE counter reading increases, and the range strobe moves down.

(5) Move the DETENT switch to OFF and place the ∆ RANGE and A AZIMUTH controls in detent.

d. Check the RADAR HEIGHT counter by rotating its adjustment screw; note that the counter reading changes. The weapon HEIGHT counter reading should change by the same amount.

e. Check the weapon HEIGHT counter by rotating the control knob; note that the reading changes on the weapon HEIGHT counter only.

f. Check the RADAR LOCATION and WEAPON LOCATION counters as follows:

(1) Hold the RADAR LOCATION EASTING switch in the SUBT position; both EASTING counter readings decrease.

(2) Hold the RADAR LOCATION EAS'£ING switch in the ADD position; both EASTING counter readings increase.

(3) Repeat the steps in (1) and (2) above with the RADAR LOCATION NORTHING switch and counters.

g. Check the accuracy of the azimuth counter movement as follows:

(1) Note the reading on the azimuth counter on the frame of the radar. Use the LOWER BEAM AZIMUTH control to set the same reading into the computer AZIMUTH counter.

(2) Open the computer drawer far enough to open the computer drawer interlock.

(3) Rotate the antenna approximately 1, 500 mils.

(4) Close the computer drawer.

(5) When the AZIMUTH counter on the computer stops, compare the reading with the reading on the counter on the radar frame. The readings should agree within 1 mil.

(6) Repeat the steps in (1) through (5) above at two additional positions of the antenna.

h. Check the ∆ TIME counter by rotating its control knob clockwise to increase its reading and counterclockwise to decrease its reading.

i. Check the accuracy of the computer (after all components of the computer have been checked).

(1) The accuracy check for dual beam operation consists of a series of four problems (fig 1), which are set into the computer. These problems produce weapon locations which are compared against a set of answers.

This set of answers or output data is determined by the radar repairman for the particular set after he alines the computer. After alining the computer, the repairman sets the beam separation to its normal position (correct setting is indicated on the BEAM SEPARATION plate on the antenna). He then sets each of the four problems into the computer and records the weapon location easting and northing. These locations, along with the problems, are recorded in the radar log book.

Radar set ser no____________ Date of alinement__________ Alined by___________ Beam separation__________

Computer ser no____________ Date of recorded output data____________ Recorded by___________

Problem no	Lower beam azimuth	Elevation	Lower beam range	Upper beam azimuth	Upper beam range	Time	Weapon height	Output data Easting	Output data Northing
1	0000	+20	8,000	0030	8,200	2.0	300		
2	1600	+40	5,000	1620	5,100	2.0	400		
3	3200	+10	8,000	3170	7,800	1.5	50		
4	4800	+40	5,000	4780	4,900	4.0	200		

Figure 1, Computer accuracy check (dual beam).

(2) Each day or every time the set is moved, the operator should perform the accuracy check and compare his output data with the data entered in the log by the radar repairman. These data are also used in the performance of equipment serviceability criteria (ESC) checks. The tolerances for the check results compared to the logged output data are as follows:

(a) The error in easting or northing should not exceed 20 meters.

(b) The sum of the easting and northing errors should not exceed 36 meters.

(3) The results of the check should be entered in the log book.

(4) Check the set for dual-beam operation as follows:

(a) Emplace the radar, apply power, and turn on the transmitter. Set DUAL-SINGLE BEAM switch to DUAL.

(b) Open the computer drawer, and close the INTERLOCK SHORT switch.

Note: The interlock short switch is located under a red cover in upper left corner of the computer compartment.

(c) Verify that the BEAM SEPARATION dial on the left side of the computer drawer reads the same as the BEAM SEPARATION plate on the antenna.

(d) Set in the radar location data as follows:

1. Use the EASTING and NORTHING switches to set the RADAR LOCATION EASTING and NORTHING counters to zero.

   Note: If the correct radar location is already set into the EASTING and NORTHING counters, it is not necessary to change them. Add the radar easting and northing to the corresponding answers in the log book solutions to these problems, and use these new figures for comparison with the test results obtained in (e) through (r) below.

2. Set the RADAR HEIGHT counter to 300 meters.

(e) Set the radar on the proper angle of elevation.

(f) Set the DETENT switch to OFF.

(g) Place the A RANGE and A AZIMUTH controls in detent.

(h) Using the AZIMUTH switch and the LOWER BEAM AZIMUTH control, set in the proper azimuth.

(i) Set in the proper lower beam range.

(j) Turn the TEST-NORMAL switch to TEST.

(k) Set the DETENT switch to DETENT RELEASE.

(l) Set in the upper beam azimuth with the A AZIMUTH control.

(m) Set in the upper beam range with the A RANGE control.

(n) Turn the TEST-NORMAL switch to NORMAL.

(o) Set in the A time with the A TIME knob.

(p) Set the weapon height into the computer.

(q) Check the reading of the WEAPON LOCATION EASTING and NORTHING counters against the most recent set of out-put data entered in the radar log book.

(r) Repeat the steps in (d) through (a) above for the remaining problems.

(5) Check the set for single-beam operation as follows:

(a) Set AT to zero.

(b) Set HW and HR to 1000.

(c) Set AA and AR controls in detent.

(d) Set range to weapon at 5000.

(e) Set single-dual switch to single.

(f) Set EL to +7 mils.

(g) "C" dials should read zero.

(h) Set EL to +21 mils.

(i) "C" dials should read one.
Note: Test-normal switch must be in normal.

2-11. RADAR LOCATION DATA

At the completion of the computer accuracy check, the true radar location is set into the computer.

a. Use the RADAR LOCATION EASTING and NORTHING switches to set the grid reference of the radar into the computer.

b. Use the RADAR HEIGHT knob to set the altitude of the radar in meters into the computer. Normally, the weapon HEIGHT counter is now set to read the same as the RADAR HEIGHT counter.

NOTES

CHAPTER 3

SYMPTOMS COLLECTION PROCEDURE

Section I GENERAL INSTRUCTIONS

3-1. TROUBLESHOOTING THE AN/MPQ-4A RADAR SET

a. Troubleshooting should normally be performed in the following three steps:

(1) Symptoms collection: Use built-in indicators and test equipment to assist in isolating a malfunction to a specific channel or to a specific area within the channel.

(2) Signal tracing: Use the test equipment that is provided to measure voltages and monitor signals within the suspected area to isolate the malfunction to a stage (usually performed by using the detailed schematic).

(3) Component troubleshooting: Use the test equipment that is provided to find the specific component that is causing the malfunction.

b. The symptoms collection block diagram and charts are designed to aid in the first two steps of troubleshooting, with the greatest emphasis on step (1) in a above (symptoms collection).

(1) Isolation to a system: The overall block diagram is broken down into NINE systems. By performing the given checks in order, a malfunction can be isolated to a channel. A bad check indicates a malfunction in that particular system.

(2) Isolation to a system (overall block diagram, fig 1): Advance to the block diagram of that particular system. These blocks show the general operation of that particular system and the necessary checks to make in the system. ALL CHECKS SHOULD BE MADE IN THE ORDER GIVEN, USING THE INDICATORS THAT ARE PROVIDED ON THE SYSTEM, ALONG WITH TEST EQUIPMENT.

c. Signal tracing is performed by using the block diagram and detailed circuit. As an aid in circuit location, there is a column in the block diagram chart headed KEY POINTS. Key points are listed for each circuit. Along with each key point is the circuit diagram page number on which the key point is located.

3-2. GENERAL SYMPTOMS COLLECTION INSTRUCTIONS FOR THE AN/MPQ-4A RADAR SET

a. The three steps of general symptoms collection are as follows:

(1) Upon verification of a symptom, perform symptoms collection checks on the AN/MPQ-4A overall block diagram (fig 1). Perform these checks in order, starting with paragraph 3-3, until a bad indication is found.

(2) Go to the block diagram of the bad system or channel noted in paragraph 3-3. Make checks in the order given until a bad indication is found. This will tell you which channel is malfunctioning.

(3) Using the key points associated with the circuit being checked and the page reference, go to the detailed circuit and signal trace in that circuit until a bad indication is found. At this time you should be able to locate the bad stage or component with the test equipment issued with the radar.

b. The following is an example of general symptoms collection:

SYMPTOM: AN/MPQ-4A operator reports that the B-scope is blank.

(1) Perform all steps on the overall block diagram (para 3-3, fig 1) until you reach paragraph 3-7, which is titled INDICATOR SYS- TEM. Paragraph 3-7 on the overall block will refer you to figure 5. (Paragraph 3-7 is the first place you had a bad indication.)

(2) You are now using the block diagram for the SYNCHRONIZER AND INDICATOR SYSTEMS. Perform all steps indicated on the left. When you find a bad indication, stop and go to the detailed circuit in the CD Manual. (ALL CONDITIONS IN THE CHECK COLUMN MUST BE MET.) Blank scope is any scope that has any abnormal condition and that does not have a short gate, range strobe, azimuth strobe, noise, and STC action. If the transmitter will energize and the scope is blank, you must assume that the STC is working.

(3) Begin signal tracing on the block diagram until you get a bad indication, using the KEY POINTS that are provided. When a bad check is noticed, refer to the CD Manual on the page given and signal trace down to the stage. Once the stage is found, determine what is causing the stage to malfunction, using the test equipment that is provided with the AN/MPQ-4A radar.

c. Test points and waveforms are color coded as follows:

(1) 50% screening. PRF frequency, 7000 hertz, time duration, 143 p sec; oscilloscope setting, 50 I sec.

(2) 20% screening. Scanner frequency, 17 or 34 hertz; time duration, 30, 000 A sec; oscilloscope setting, 5K u sec.

Section II OVERALL CHECKS

GENERAL INSTRUCTIONS FOR OVERALL CHECKS

Make the following checks in sequence. When a malfunctioning check is found turn to the paragraph listed to the right, and continue the checks in that paragraph.

3-3. INDICATOR LOW VOLTAGE POWER SUPPLY AND METER PANEL CHECK

		CHECK	PARA	PAGE
a.		Power unit indicator	3-10	32
b.		Main power ON and INTLK closed indicator	3-11	32
c.		M-652, cabinet interlocks		
	(1)	+27VDC (2. 7)	3-11	32
		Check blowers (intake and exhaust) RCVR-XMTR and control-indicator	3-10 3-11	32
	(2)	-220VDC (4. 4)	3-12	32
	(3)	+ZZOVDC (4. 4)	3-13	33
	(4)	+440VDC (4.4)	3-14	33
	(5)	AFC XTAL CUR (2. 5) If this check is BAD, advance to paragraph 3-5		

3-4. ANTENNA POSITIONING SYSTEM

a.	Elevation, operate to both limits (-100 to +200)	3-20	40
b.	Azimuth, operate in both positions (CW, CCW)	3-21	40

3-5. RECEIVER-TRANSMITTER LOW VOLTAGE POWER SUPPLIES

a.		M-1402, cabinet interlocks		
	(1)	-300VDC (3. 0)	3-15	33
	(2)	+300VDC (3. 0)	3-16	34
	(3)	+150VDC (3. 0)	3-17	34
	(4)	IF Crystal #1 (2. 5)	3-18, 3-32	38, 46
	(5)	IF Crystal #2 (2. 5)	3-18, 3-32	38, 46
	(6)	AFC Crystal (2. 5)	3-18, 3-32	38, 46

CHECK	PARA	PAGE
3-6. SYNCHRONIZER AND INDICATOR SYSTEM		
a. Range sweep, 0-15 KM bottom to top of scope, RANGE SELECTOR switch in 15KM position, intensified band must be visible and variable by AT101.	3-22 3-23	42
b. Azimuth sweep, left to right of scope	3-22, 3-23	42
c. Intensity	3-30	43
d. Focus	3-29	43
e. Azimuth strobe, thin vertical line that moves from left to right of the scope as determined by the movement of delta and lower beam azimuth handwheels.	3-28	43
f. Range strobe, thin horizontal line (two lines if range shift is on) that moves from bottom to top of the scope as determined by the movement of delta and lower beam range handwheels.	3-27, 3-31	43
g. Short gate, range selector at 3. 75KM position.	3-24	42
h. Range shift	3-26	42
3-7. RECEIVER SYSTEM		
a. Video. Background noise and or targets. Adjust video gain to maximum clockwise.	3-33, 3-34	46
b. IF gain. Adjust to the lowest comfortable level. Observe video with beam video switch in upper, lower, and both. With beam video set to upper and then to lower, observe for a slight amount of flickering of the video.	3-37	46
c. Sensitivity time control (STC). The reduced portion of video beginning at the bottom of the scope and extending vertically to a range of approximately 2. 5KM meters.	3-36	46
d. Range marks. Transmitter must be fired and range mark switch must be on.	3-33, 3-35	46
3-8. TRANSMITTER SYSTEM		
a. Ready light. Should come on after 5-minutes sometimes it may be necessary to wait longer than 5-minutes.	3-48	52

	CHECK	PARA	PAGE
b.	Radiate light. After 5-minutes or sufficient time depending upon differences among sets.	3-48	52
c.	Transmitter. Press radiate button and adjust magnetronvariac for 18 MA on magnetron current meter.	3-48, 3-49, 3-50	52

3-9. COMPUTER SYSTEM

a.	Elevation and "C" dial should move when the antenna is moved in elevation. Leave at +70 mils ("C" dial should read 2. 0) (A handwheels detented & time 0. 0, & weapon height same as radar height)	3-38	48
b.	Azimuth. Moving the antenna in azimuth should move EW, NW and AZW dials.	3-39	48
c.	"C" dial With the antenna set to +35 mils the "C" dial should read 1. 0, +70 mils "C" dial should read 2. 0 with test normal switch in NORMAL. When test normal switch is in test "C" dial should read 1. 0.	3-45	49
d.	Range counter. $_{RL}$ and AR handwheels should move the range strobe, EW, NW, RW, and "C" dial	3-40	48
e.	Delta azimuth. Delta azimuth handwheel should move the azimuth strobe, EW, NW, and AZW counter.	3-40	48
f.	A Height. Should move height counter and "C" dial.	3-42	49
g.	Delta time. Should move time counter and "C" dial.	3-42	49

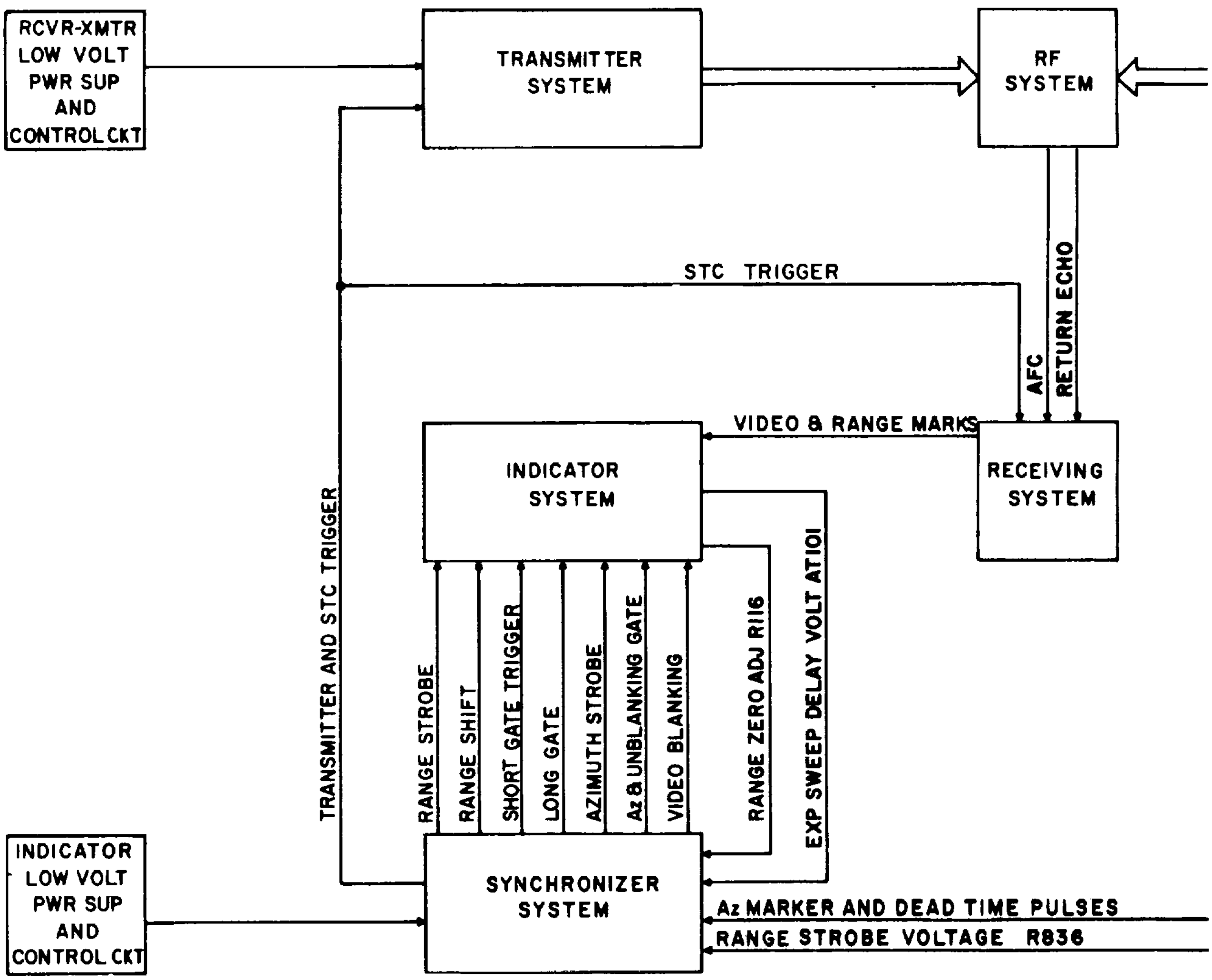


Figure 1. Overall block diagram, AN/MPQ-4A radar.

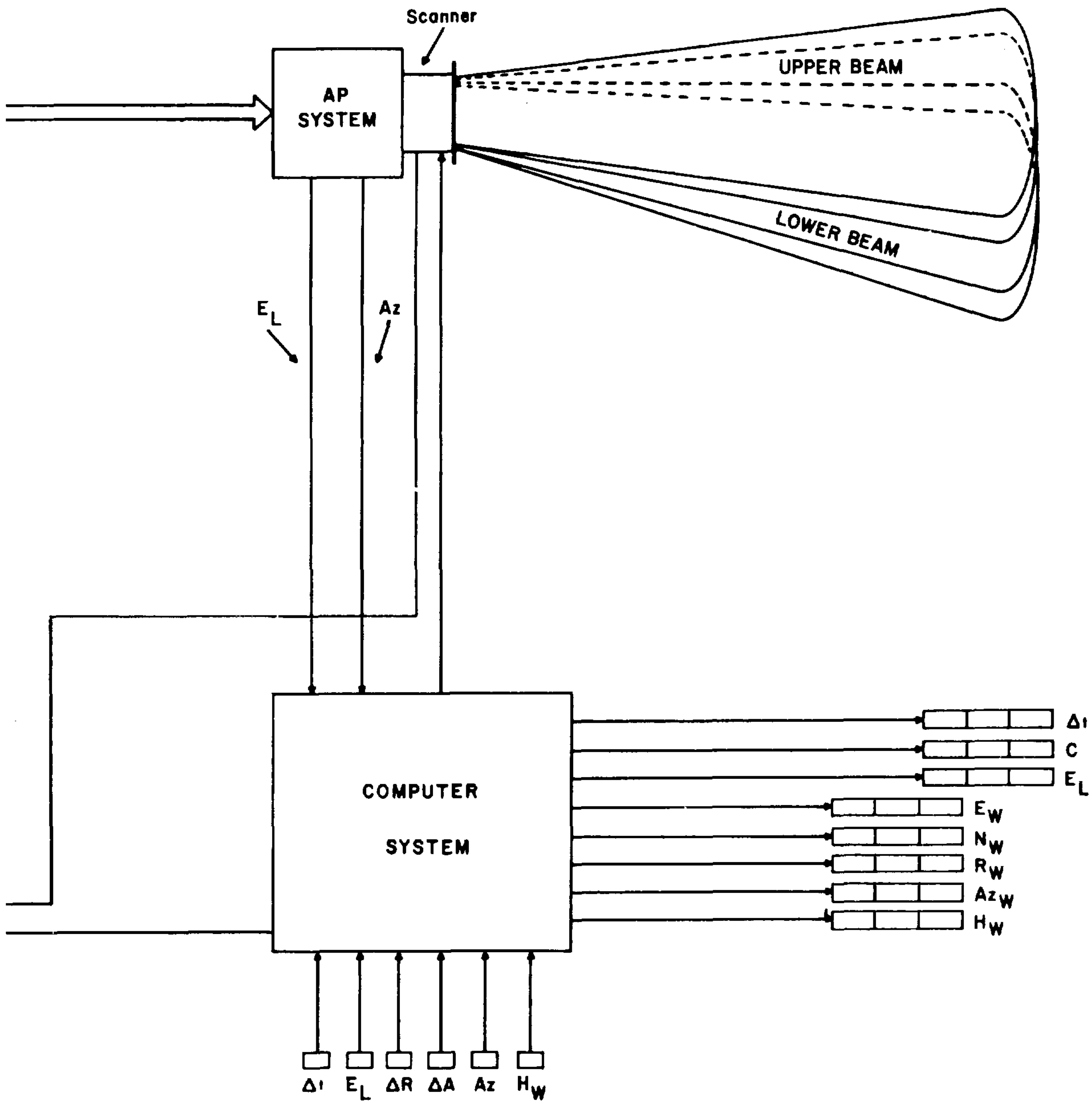


Figure 1. Overall block diagram, AN/MPQ-4A radar--Continued.

Section III AC AND DC CHECKS

PARA		SYMPTOMS	CIRCUIT	CHECKS	PAGE
3-10	a.	Control unit power light does not come on	POWER UNIT LIGHT	a. FL1001-1004 (120 VAC)	58
				b. TB1001-1, 2, 3 (120 VAC)	58
	b.	Control unit blower motor do not come on	AC DISTRI-BUTION	a. TB1001-1, 2, 3 (120 VAC)	58
				b. TB1002-1, 2, 3 (120 VAC)	61
	c.	Power unit light comes on but blower motors run at a reduced speed.	AC DISTRI-BUTION	a. C651	58
3-11	a	27VDC varying	GENERATOR	a. CHECK GENERATOR FOR STEADY OUTPUT	
	b.	27VDC zero	27VDC POW-ER SUPPLY	a. F651	60
				b. TB601-6 (120 VAC)	61
				c. T603-3 (120 VAC)	64 64
				d. CR601	64
	c.	Main power on but INTLK closed lamp does not light.	27VDC DIS-TRIBUTION	a. S1001-S1008 (27VDC)	64
	d.	RCVR-XMTR blowers, scanner and dehydrator are inoperative	AC DISTRI-BUTION	a. TB1002-2,3,4,5,6 (120VAC)	61
				b. TB2003-1,3,4, 5 (IZOVAC)	63
				c. TB2001-16 (12OVAC)	63

PARA		SYMPTOMS	CIRCUIT	CHECKS	PAGE
3-12		-220VDC			
	a.	Zero	-220V RECTIFIER	a. K601-1,4,6,7	68
				b. K602-8	68
				c. T605-3 (120 VAC)	70
				d. T605-6,8 (46 VAC)	70
				e. T602-3 (120 VAC)	70
				f. T602 secondary (5VAC)	70
				g. V610-8 (+IOOVDC)	70
				h. L603	70
	b.	High	-220V AMPLIFIER	a. V612-1, 7 (more than -115VDC)	70
				b. V611A-1 (less than -22VDC	71
	c.	Low	-220V REGULATOR	a. V612-1, 7 (less than -115VDC	71
				b. V611A-1 (more than -22VDC)	71
3-13		+220VDC			
	a.	Zero	+220V RECTIFIER	a. T601-3	72
				b. L602	72
	b.	High	+220V AMPLIFIER	a. V609-1 (less THAN -2VDC	73
				b. V606-4 (less than +185VDC)	73
	c.	Low	+220V REGULATOR	a. V609-1 (more than -2VDC)	73
				b. V606-4 (more than +185VDC)	73

PARA	SYMPTOMS	CIRCUIT	CHECKS	PAGE
3-14	+440 VDC	RECTIFIER		
	a. Zero	+440 V	a. L601	74
	b. High	+440 V AMPLIFIER	a. V603-1 (more than +215VDC)	75
			b. V602-3 (less than +400VDC)	75
	c. Low	+440V REGULATOR	a. V603-1 (less than +2I5VDC)	75
			b. V602-3 (more than +400VDC)	75
3-15	-300VDC			
	a. Zero	-300V RECTIFIER	a. K1601-3 (+Z7VDC)	78
			b. K1602-2 (+27VDC)	78
			c. K1602-10,11 (115VAC)	78
			d. V1605-8 (+18OVDC)	80
			e. T1601-2 (12OVAC)	80
			f. T1601 (secondary 5VAC)	80
			g. L1601	80
	b. High	-300V AMPLIFIER	a. V1612-1 (more than -195VDC)	81
			b. V1612-7 (more than -195VDC)	81
			c. V1609-3 (less than -5VDC)	81

PARA		SYMPTOMS	CIRCUIT	CHECKS	PAGE
3-15	c.	Low	-300V REGULATOR	a. V1612-1 (less than -195VDC)	81
				b. V1612-7 (less than -195VDC)	81
				c. V1609-3 (more than -5VDC)	81
3-16	+30OVDC				
	a.	Zero	+300V RECTIFIER	a. V1602-8 (620VDC)	82
				b. T1604-1 (115VAC)	82
				c. T1604 secondary (700VAC to CT)	82
				d. T1601 secondary (5VAC)	82
				e. L1602	82
	b.	High	+300V AMPLIFIER	a. V1610-1 (less than 3. 5VDC)	82
				b. V1606-3 (less than +27OVDC)	82
	c.	Low	+300V REGULATOR	a. 1610-1 (greater than -3. 5VDC)	83
				b. V1606-3 (greater than +270VDC)	83
3-17	+15OVDC				
	a.	Zero	+150 RECTIFIER	a. V1603-8, V1604-8 (+300VDC)	84
				b. T1604-1 (115VAC)	84
				c. T1604 (secondary 330VAC to CT)	84
			+15OVDC	d. L1603	84
	b.	High	+150V AMPLIFIER	a. V1611-1 (less than -3VDC)	85
				b. V1607-4 (less than +1OOVDC)	85
	c.	Low	+150V REGULATOR	a. V1611-1 (greater than -3VDC)	85
				b. V1607-4 (greater than +1OOVDC)	85

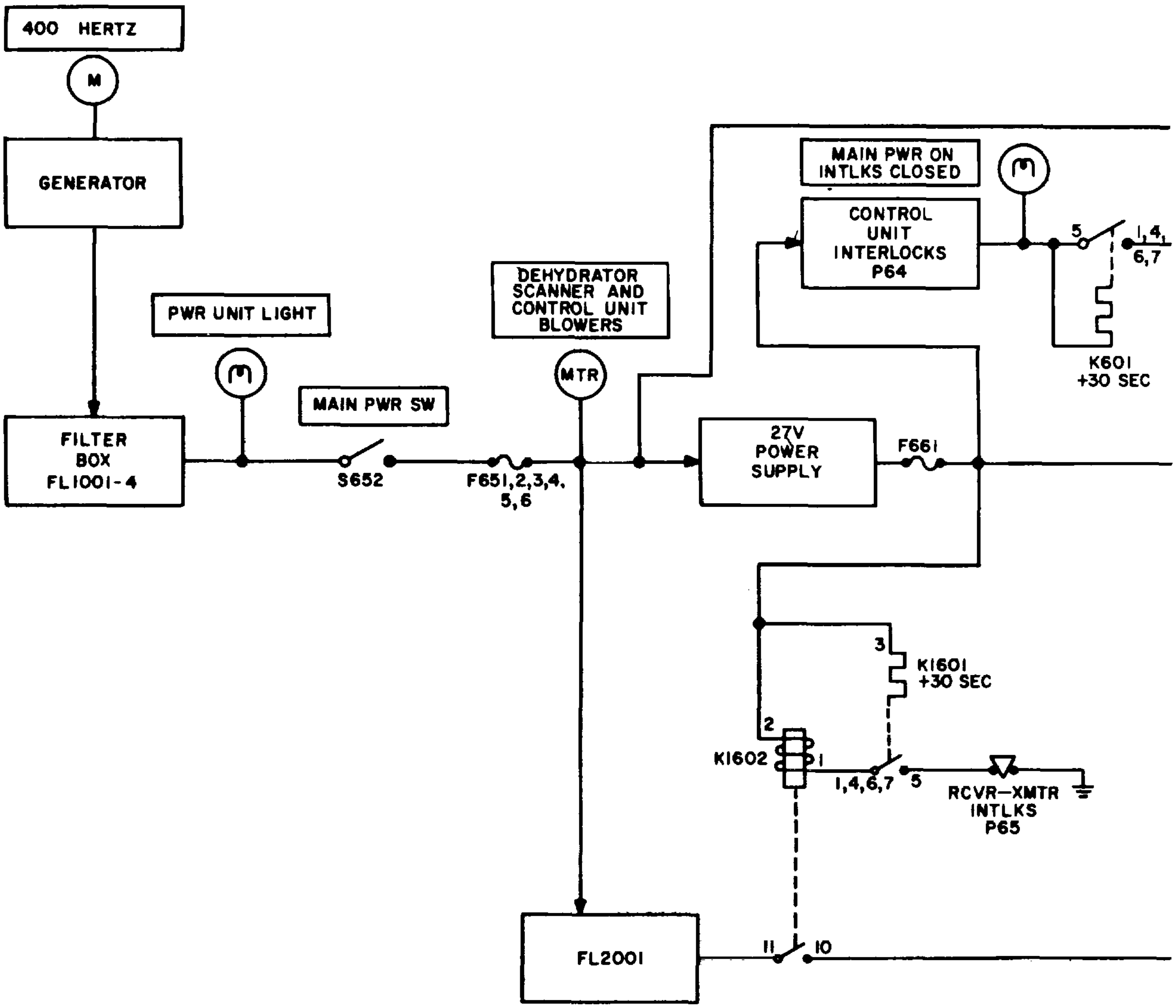


Figure 2. AC and DC block diagram.

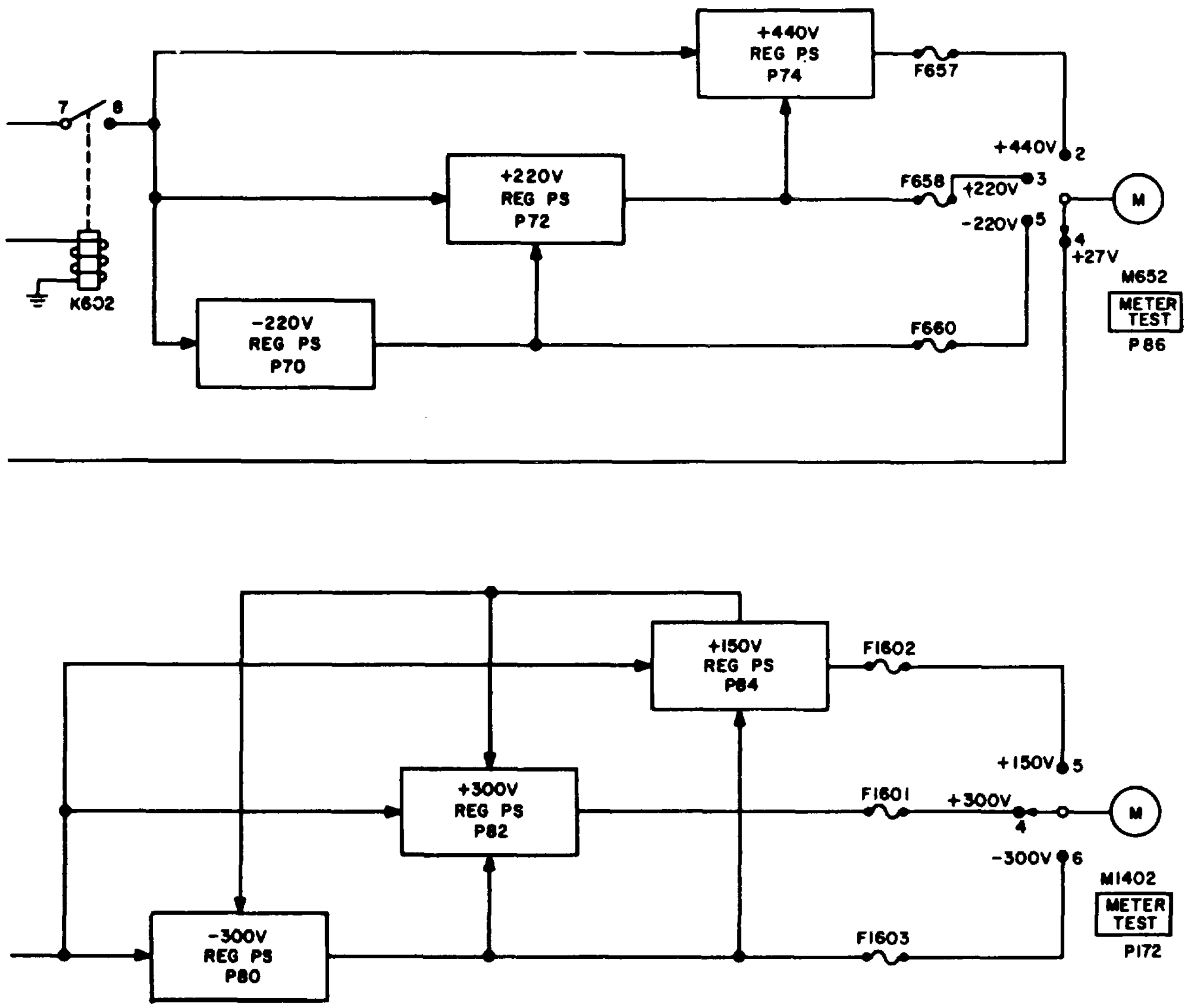


Figure 2. AC and DC block diagram--Continued.

Section IV. DUPLEXER AND DEHYDRATOR CHECKS

PARA		SYMPTOMS	CIRCUIT	CHECKS	PAGE
3-18	a.	No crystal current, keep alive readings on AFC and Klystron IF crystals.		a.J1602A or B (-600VDC)	86
				b. TB1501-11 to pin 12 (6. 3VAC)	169
	b.	No AFC crystal current MXR OSC.		a. CR1503	90, 158, 184.
	c.	No IF crystal current NO. 1 MXR OSC		a. CR1501	90, 158, 160.
	d.	No IF crystal current NO. 2 MXR OSC		a. CR1502	90, 158, 160.
3-19	a.	Zero reading on pressure gage dehydrator		a. F3301, F3302, F3303	104
				b. Check for leaks in wave guide,	65

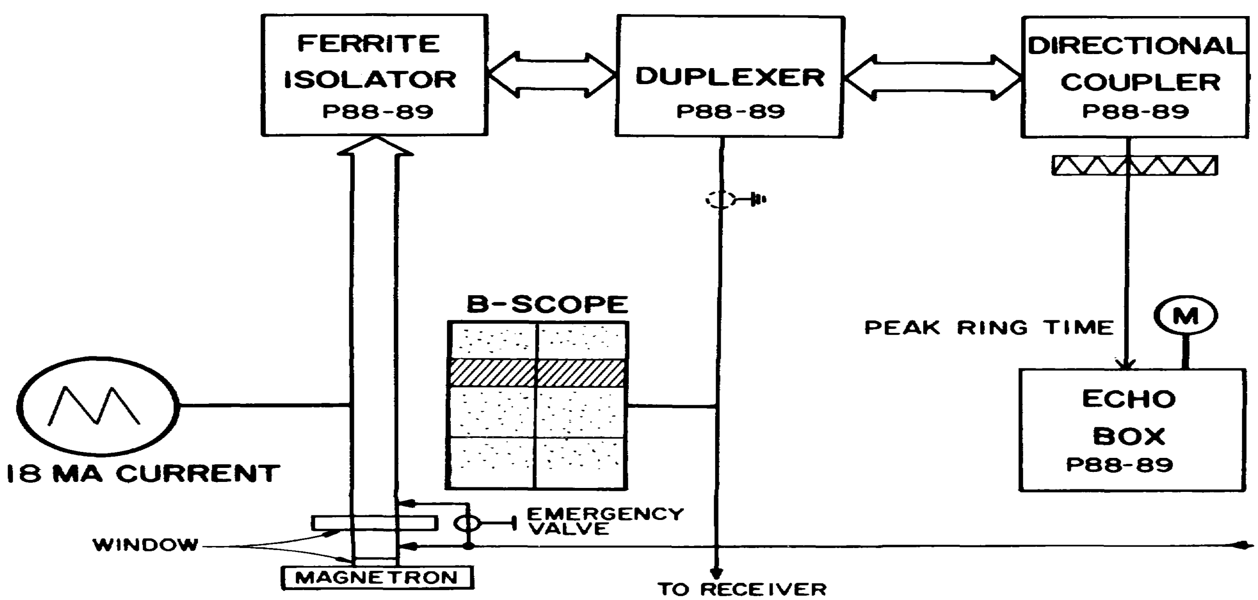


Figure 3. RF system block diagram.

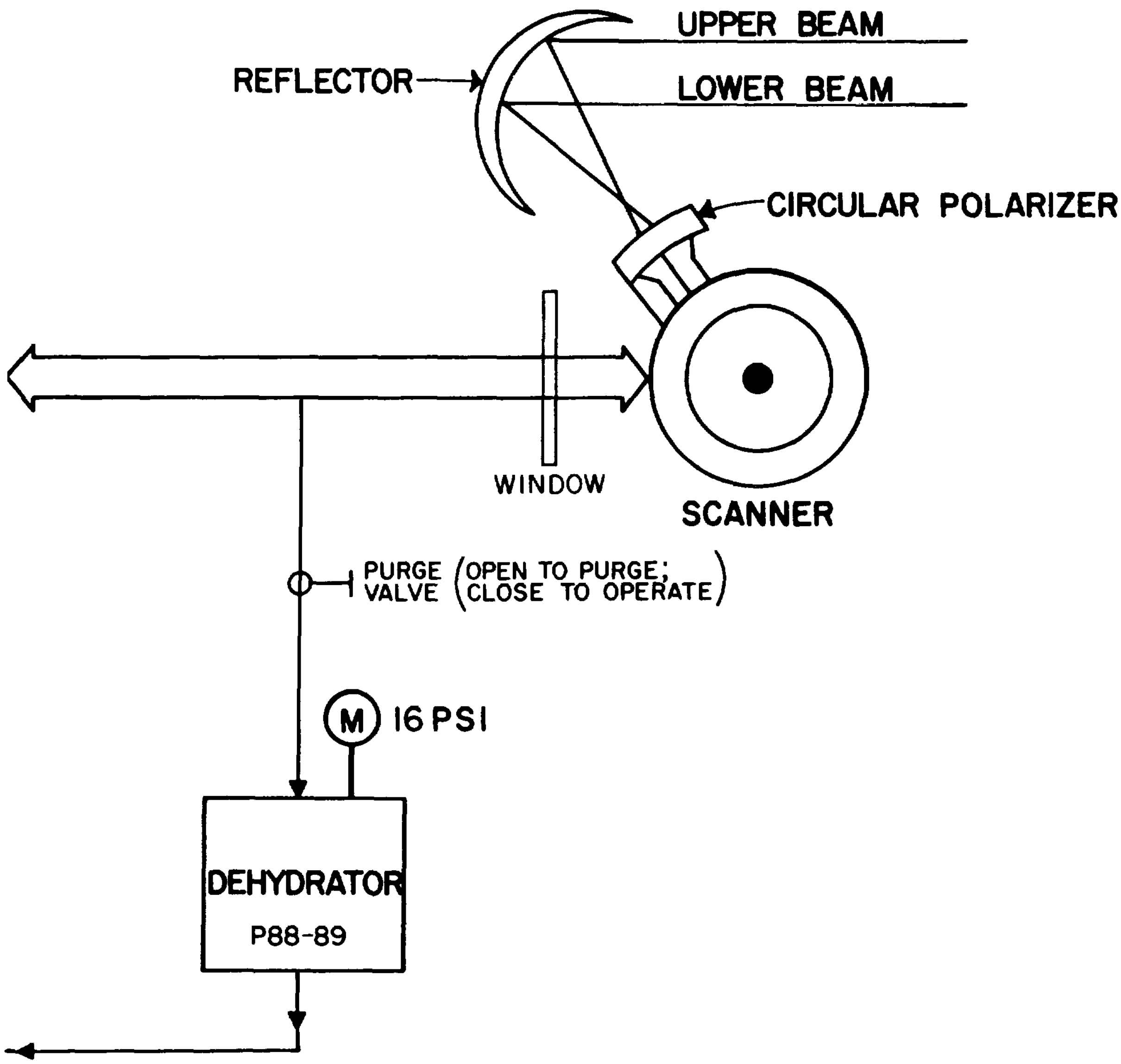


Figure 3. RF system block diagram--Continued.

Section V. ANTENNA POSITIONING CHECKS

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-20	a.	Antenna will not move up	ELEVATION	a. TB1006-1 (+27VDC S655 in raise)	100
				b. S655	100
	b.	Antenna will not move down	ELEVATION	a. TB1005-9 (+27VDC S655 in lower)	100
				b. S655	100
	c.	Antenna will not move up or down	ELEVATION	a. S655 center terminal (+27VDC)	100
				b. B3004	101
				c. Limit switches S3008, S3009.	101
				d. AC brake	101
	d.	K1501, K1502 chatters when S655 is placed in raise or lower.	ELEVATION	a. CR1504 or CR1505	100
	e.	K1501, K1502 shows signs of arcing.	ELEVATION	a. C1501, C1502, C1503, C1504	100
3-21	a.	Antenna will not move in CCW position.	AZIMUTH	a. TB3001-9 (+27VDC) S656 in CCW position.	102
				b. TB1005-7 (+27VDC S656 in CCW position.	102
				c. Center terminal of S656 (+27VDC)	102
	b.	Antenna will not move in CW position	AZIMUTH	a. TB3001-8 (+27VDC) S656 in CW position.	102
				b. TB1005-8 (+27VDC) S656 in CW position.	102
	c.	Antenna will not move in CW or CCW positions	AZIMUTH	a. B3003	103
				b. TB3001-5 (0) +27VDC return	103
				c. TB3002-8 (OV) +27VDC return	103
				d. S656 center terminal (+27VDC)	102
				e. TB3003-5 DC brake	103

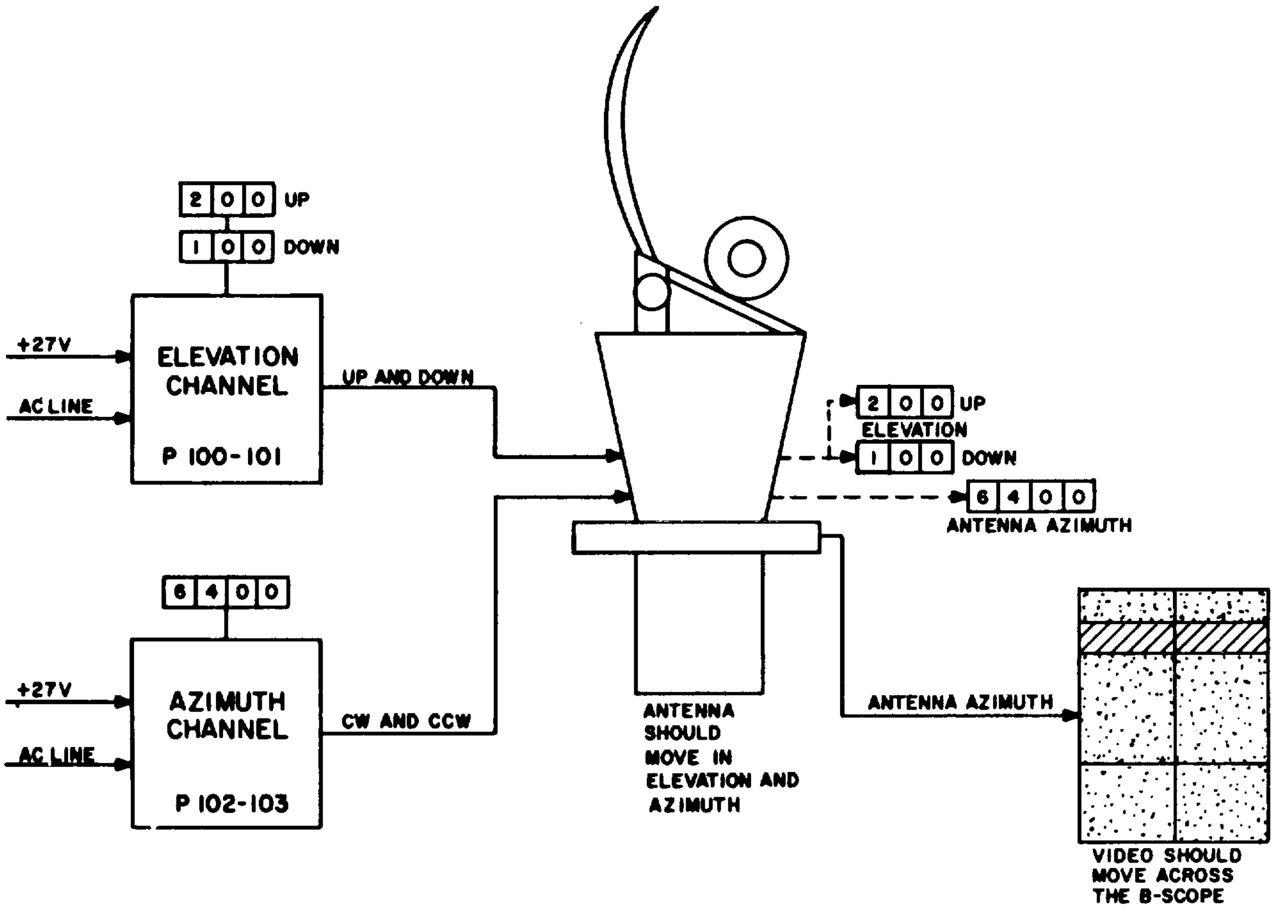


Figure 4. AP system block diagram.

Section VI SYNCHRONIZER-INDICATOR CHECKS

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-22	a.	Blank scope or partial scope and XMTR will not fire	Z102	a. TP234	113
				b. TP321	112
			Z101	c. TP204	111
				d. TP201	110
			Z150	e. TP506	121
				f. TP501	120
				g. TP510	120
			PULSE SHAPER	h. J4707	119
				i. J4708	119
			SCANNER	j. B3201	99
3-23	a	Blank scope or partial scope and XMTR DOES fire.	Z150	a. TP504	121
			Z149	b. TP4655	141
	b.	No range sweep (observe high volt dot) or sweep at top or bottom of scope.	Z144	a. TP4403	131
				b. Pin M of Z144	130
			Z102	c. TP234	113
	c.	No azimuth sweep (observe high volt dot) or sweep at left or right of scope, expanded or decreased sweep	Z145	a. TP4501	134
				b. TP4506	135
				c. TP234	113
	d.	No high volt dot		a. TP161	146
				b. V101	147
				c. Intensity adjustments (RI12 and R142)	140
3-24	a.	No short gate (intensified band in 15K pos-sweep 3. 75K pos) or otherwise abnormal	Z108	a. TP404	114
				b. TP4655	141
				c. TP4651	140
			AT101	d. Pin C	115

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-25	a.	XMTR will not fire and no STC	Z107	a. TP404	114
			Z147	b. TP4573	123
			Z150	c. V501A-1	123
	b.	XMTR fires through deadtime.	Z147	a. V4571-7	123
				b. TP4572	123
			Z150	c. V501A-1	123
3-26	a.	No range shift and or no upper or lower beam blanking.	Z146	a. TP4551, 4552, 4553	124
				b. TP4554	124
			Z150	c. TP505	121
			Z144	d. TP4402	130
3-27	a.	No range strobe.	Z109	a. TP404	114
			Z148	b. V4604	144
			COMPUTER	c. R836	194
3-28	a.	No azimuth strobe	Z150	a. TP513	121
			Z149	b. TP4655	141
3-29	a.	No focus control	Z147	a TP4574 (-1 3VDC)	147
				b. Pin A Z147	147
			FOCUS ADJ	c. R121	147
3-30	a.	High or low intensity on the B-scope.	Z149	a. V4652-8	141
				b. R4657	141
			INTENSITY ADJ.	c. R112, R142, R1100	140
3-31	a.	No video, no range strobe, and no range markers.	Z148	a. TP4604	145
	b.	No video and no range markers.	Z148	a. TP4602	144

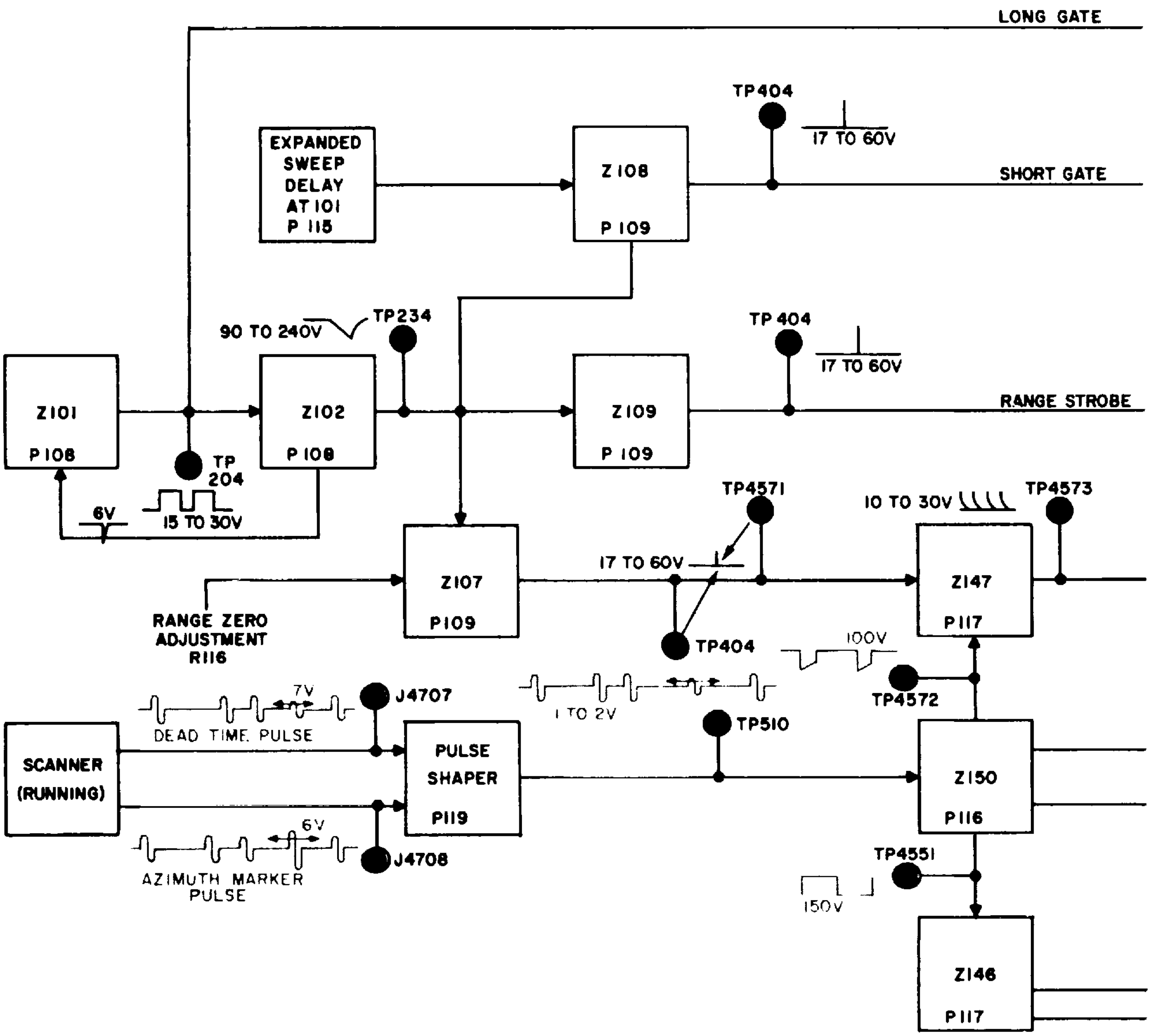


Figure 5. Synchronizer and indicator block diagram.

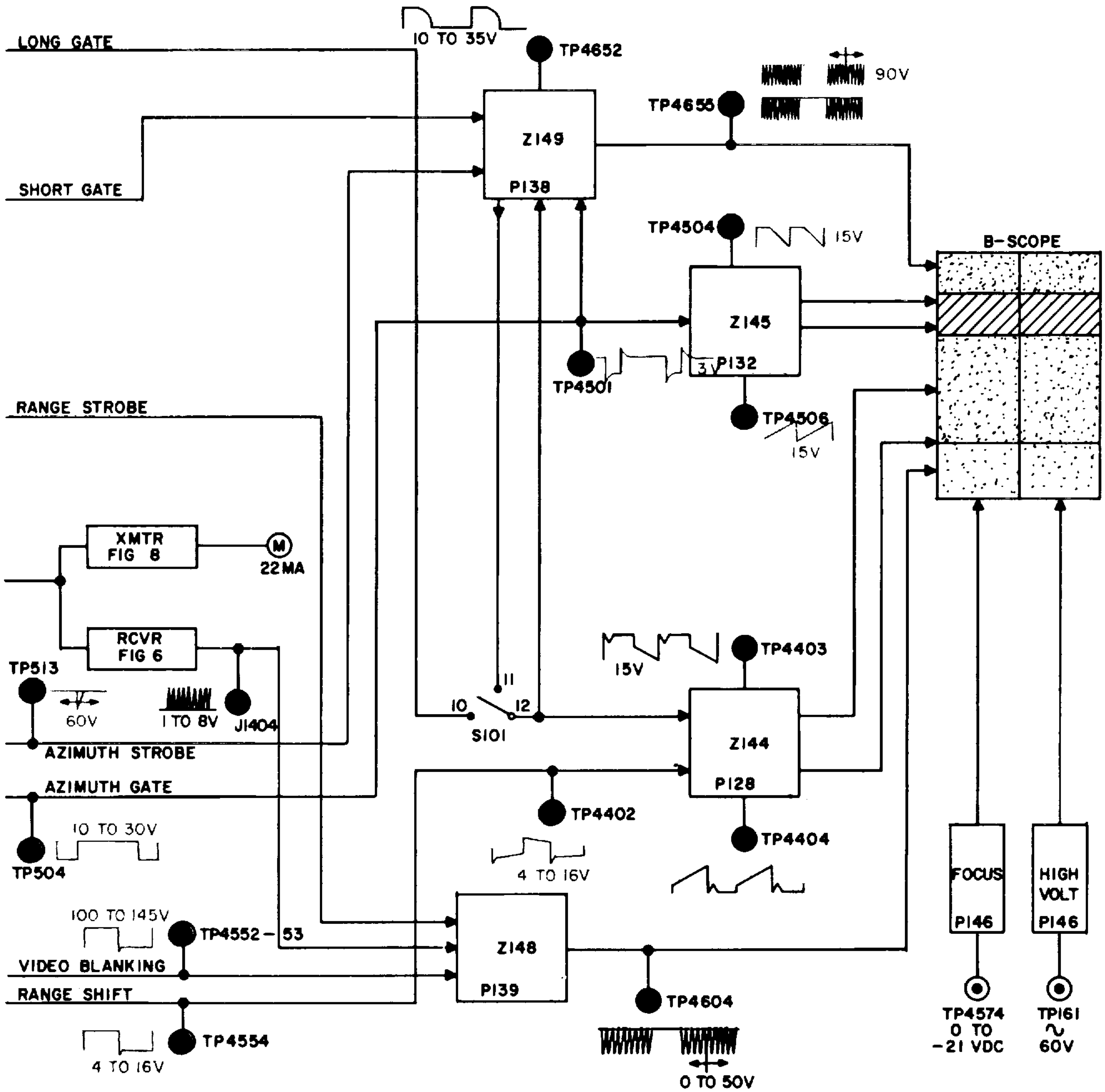


Figure 5. Synchronizer and indicator block diagram--Continued.

Section VII. RECEIVER, AFC, AND STC CHECKS

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-32	a.	No AFC crystal current.	AFC	a. Refer to para 3-18	38
	b.	No IF crystal current NO. 1 and NO. 2.	IF	a. Refer to para 3-18	38
3-33	a.	Intermittent video AFC, and range marks oscil-lating crystal current.	IF	a. TP1304	165
				b. V1301-5	164
	b.	No crystal current, no video, no range marks, no AFC.	MXR-OSC.	a. V1306-5	165
				b. V1501	169
	c.	No video, no range marks.	IF	a. J1209	161
				b. J1404	161
3-34	a.	No video	IF	a. V1201-1	160
				b. V1202-1	160
3-35	a.	No range marks.	AFC	a. V1302-5	164
				b. K1301	165
3-36	a.	No STC	STC	a. J4706	171
	b.	Continuous STC (with range marks-markers switch on).	AFC	a. TB1003-4	164
				b. TB2002-5	164
				c. S105 Pins 5 and 6	164
			+27V DIST.	d. TB1002-7	64
	c.	Continuous STC (with range markers normal-marker switch on.	STC	a. K4701	171
3-37	a.	No IF gain	STC	a. CR4703	171
				b. TB1003-6	170

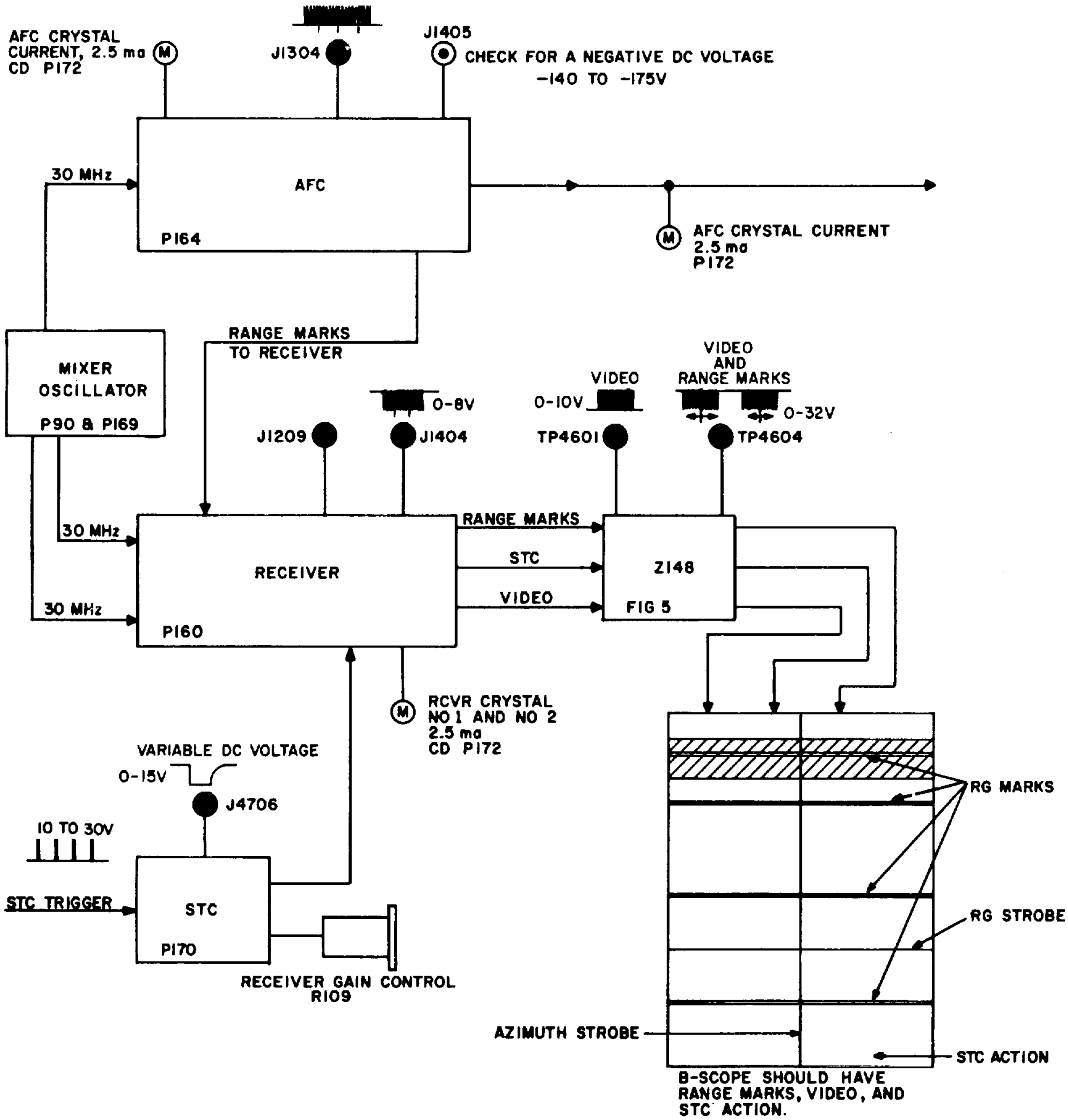


Figure 6. AFC-STC and receiver block diagram.

Section VIII. COMPUTER CHECKS

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-38	a.	Elevation dials will not move, or will drive to a limit.	ELEVATION SECTION	a. AR927B	198
	b.	"C" dial will not move with test normal switch in either position, or will drive to a limit.	C SECTION	a AR927A (C-dial should move to 1. 0 with test normal switch to test. When test normal switch is set to normal "C" dial should read 2. 0 if elevation is set to +70 mils & A time is "0", A range detented, & A height same as radar height.)	203
3-39	a.	AZW dial will not move when the antenna is moved or are sluggish	AZIMUTH SECTION	a. AR926B (AZW dial should move)	189
				b. AR951B	188
3-40	a.	Delta AZ handwheel will not move AZW and coordinate dials or dials will drive to a limit.	AZIMUTH SECTION	a. AR926A (AZ strobe should move)	186
				b. AR929B (AZ dial should move)	187
	b.	AZ handwheel will not move AZ strobe, or will drive to a limit.	AZIMUTH SECTION	a. AR926A	186
3-41	a.	A R handwheel will not move RW and coordinate dials.	RANGE SECTION	a. R836	194
				b. AR928B	195
	b.	RL or A R handwheel will not move coordinate dials.	RANGE SECTION	a. AR951A	195
3-42	a.	A T handwheel will not move "C" dial.	ATIME	a. J871	202
				b. J886 ("C" dial should move)	202

PARA		SYMPTOM	CIRCUIT	CHECKS	PAGE
3-43	a.	A H handwheel will not move "C" dial	A HEIGHT SECTION	a J882 b. R806 ("C" dial should move)	203 203
3-44	a.	Test normal switch to test. *Return to normal	"C" SECTION	a. AR927A ("C" dial should read 1. 0)	203
3-45	a.	No electrical movement of computer dials.	AC DISTRIBU-TION	a T859 c. K852 b. T861 c. K852 d. S854	190 190 190 190 190
3-46	a.	Single-dual switch to single beam.		a With single dual switch in dual, set EL to read +21 mile and then set witch to single beam, "C" dial should read 1. 0. With the single beam dual switch in the single-beam position set elevation to read +7 mile; the "C" dial should read 0. 0.	

*Denotes action that must be taken

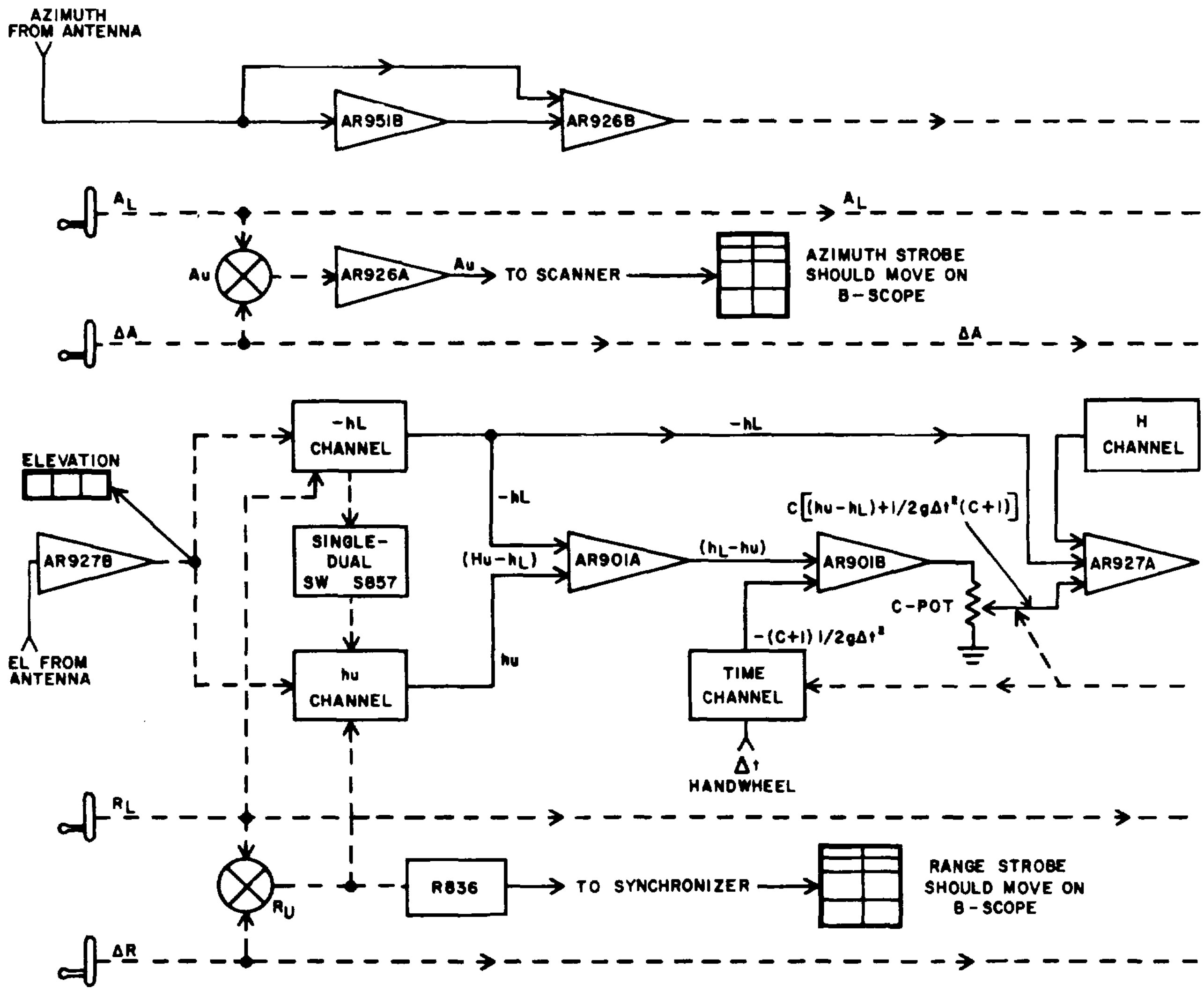


Figure 7. Computer block diagram data flow chart.

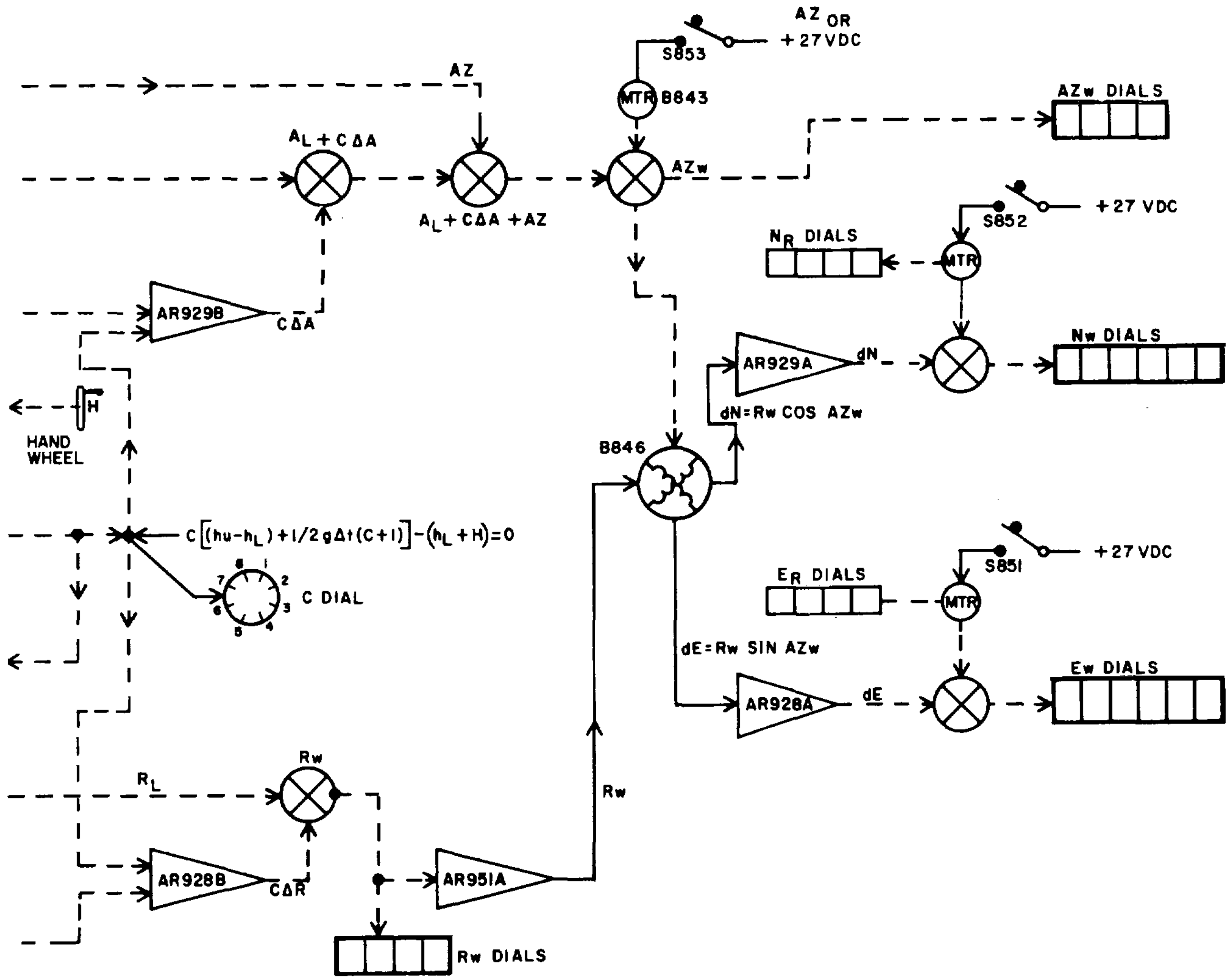


Figure 7. Computer block diagram data flow chart--Continued.

Section IX. TRANSMITTER CONTROL CHECKS

PARA		SYMPTOM	CIRCUIT	CHECK	PAGE
3-47	a.	Radiate and ready lights do not come on.	27VDC	a. Interlocks	64
				b. K603-7 (+27VDC)	64
				c. K603-5 (+27VDC)	64
	b.	Radiate light does not come on.	LIGHTING CIRCUIT	a. S658	64
				b. FL1105	64
				c. S1108	64
				d Ground circuit from TB1105-6	64
	c.	Radiate light comes on but goes out when start button in released.	HOLDING CIRCUIT	a TB1106-3 (+27VDC) constant	64
				b. S659-4thru TB1105-6	64
	d.	Radiate ready and radiate light function normally but there is no magnetron current	K1104	a TBIIO1-1 (120 VAC)	65
				b. TB1101-2	65
	e.	Transmitter will not fire, ready light is normal	FIRING CIRCUIT	a. TB1006-2 (+27VDC) S658 pressed	64
				b. TB1101-3 (+27VDC) S658 pressed	65
3-48	a.	Transmitter will not fire (V1104 does not glow)STC is present.	XMTR	a. J1152 (880V pulse)	153
3-49	a	Transmitter will not fire (V1153 does not glow)	TRIGGER AMPLIFIER	a. P1151 (pulses 10-30V)	152
				b. V115ZB-7 (200V pulse)	153
				c. V1151B-7 (30V pulse)	153
				d S1106 (1ZOVAC) interlock	152

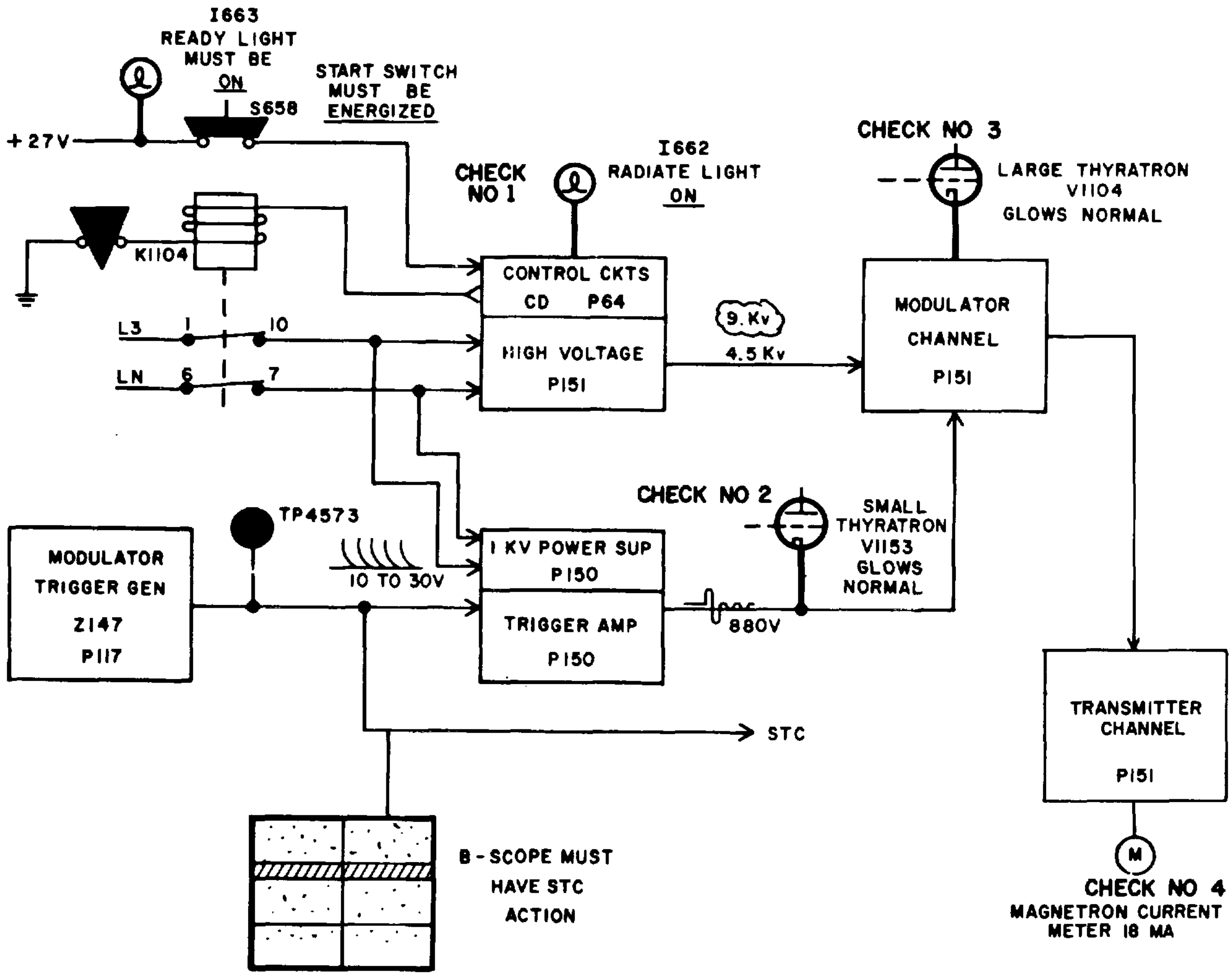
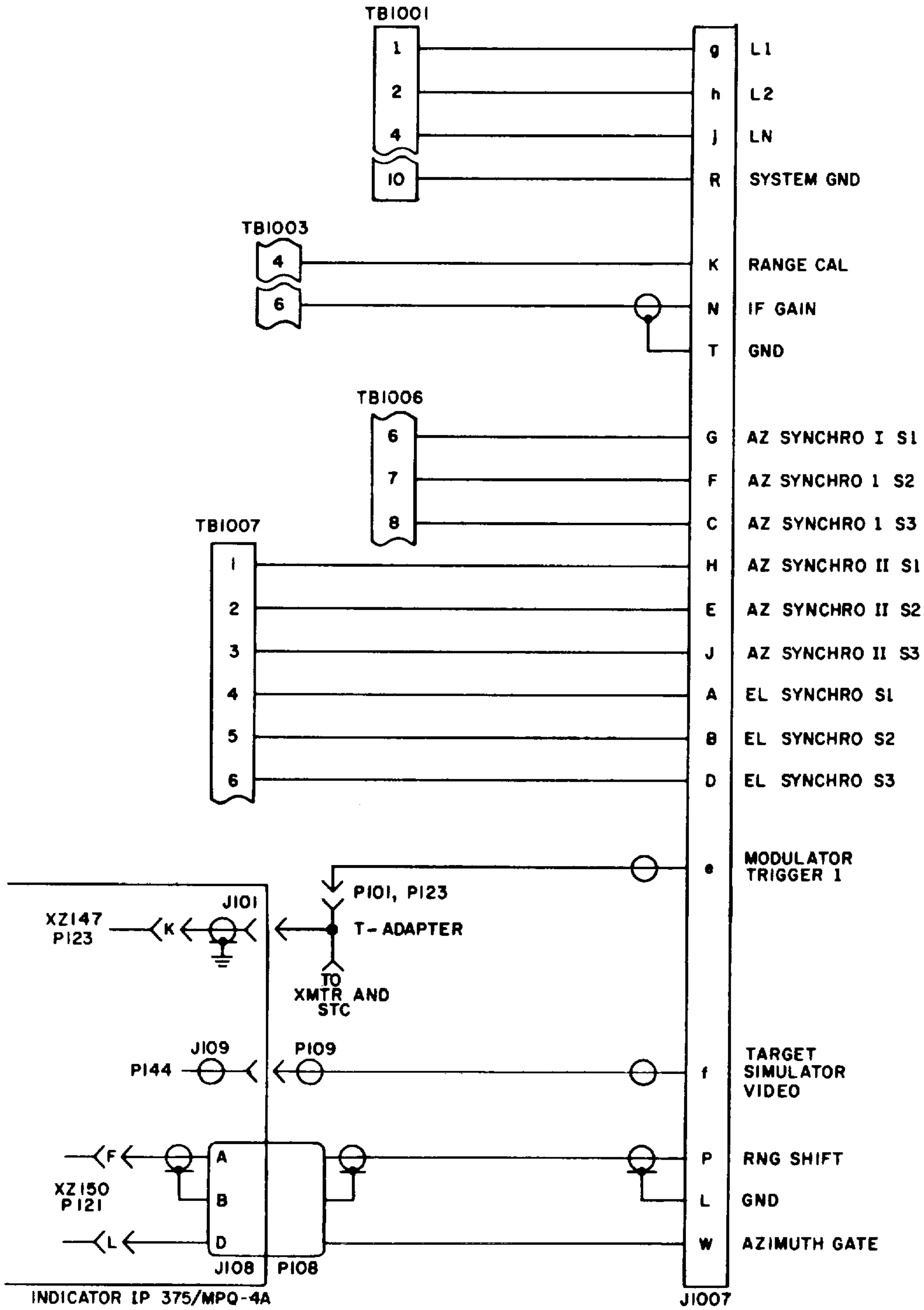


Figure 8. Control circuits and transmitter block diagram

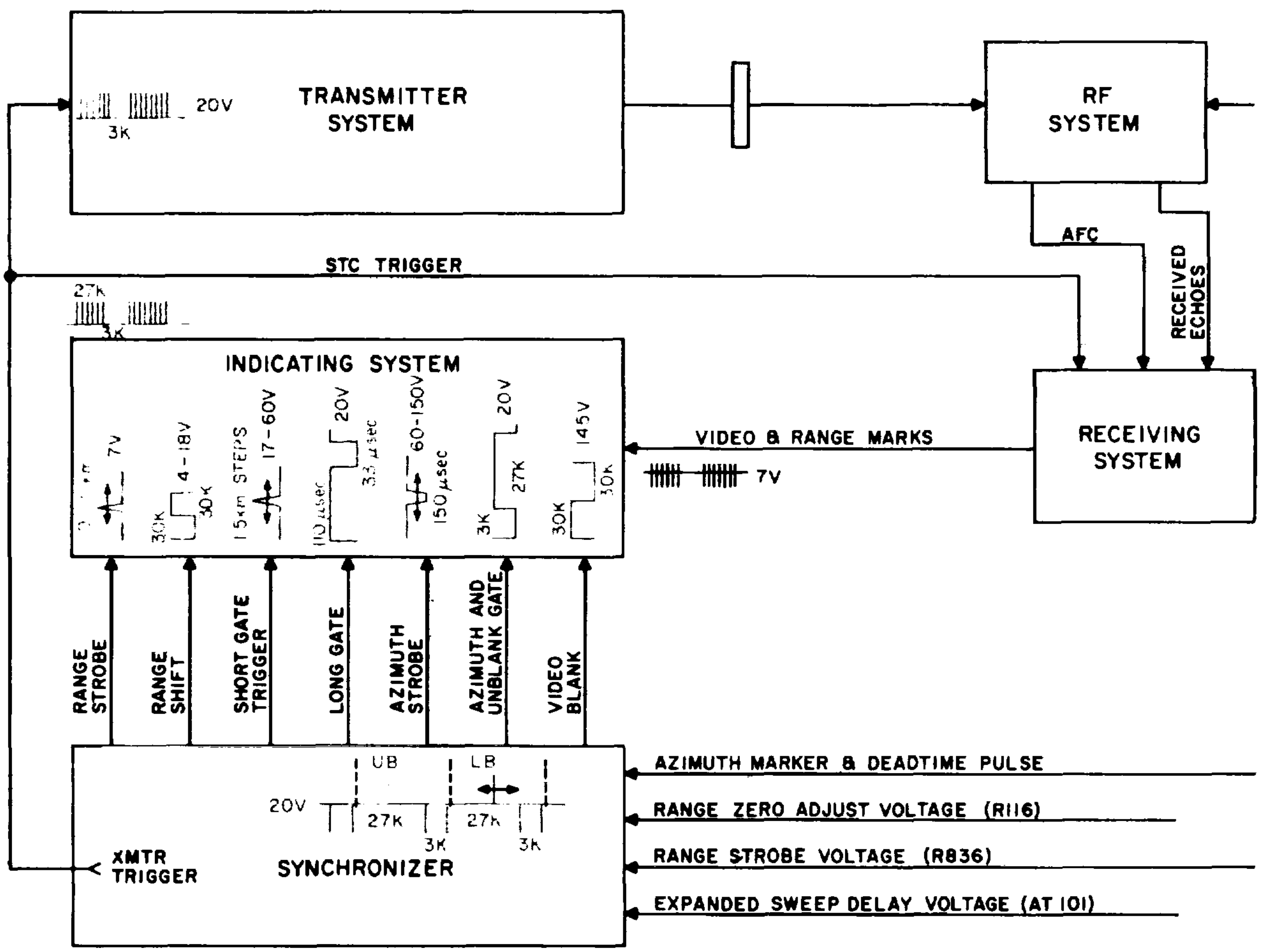
NOTES

CHAPTER 4

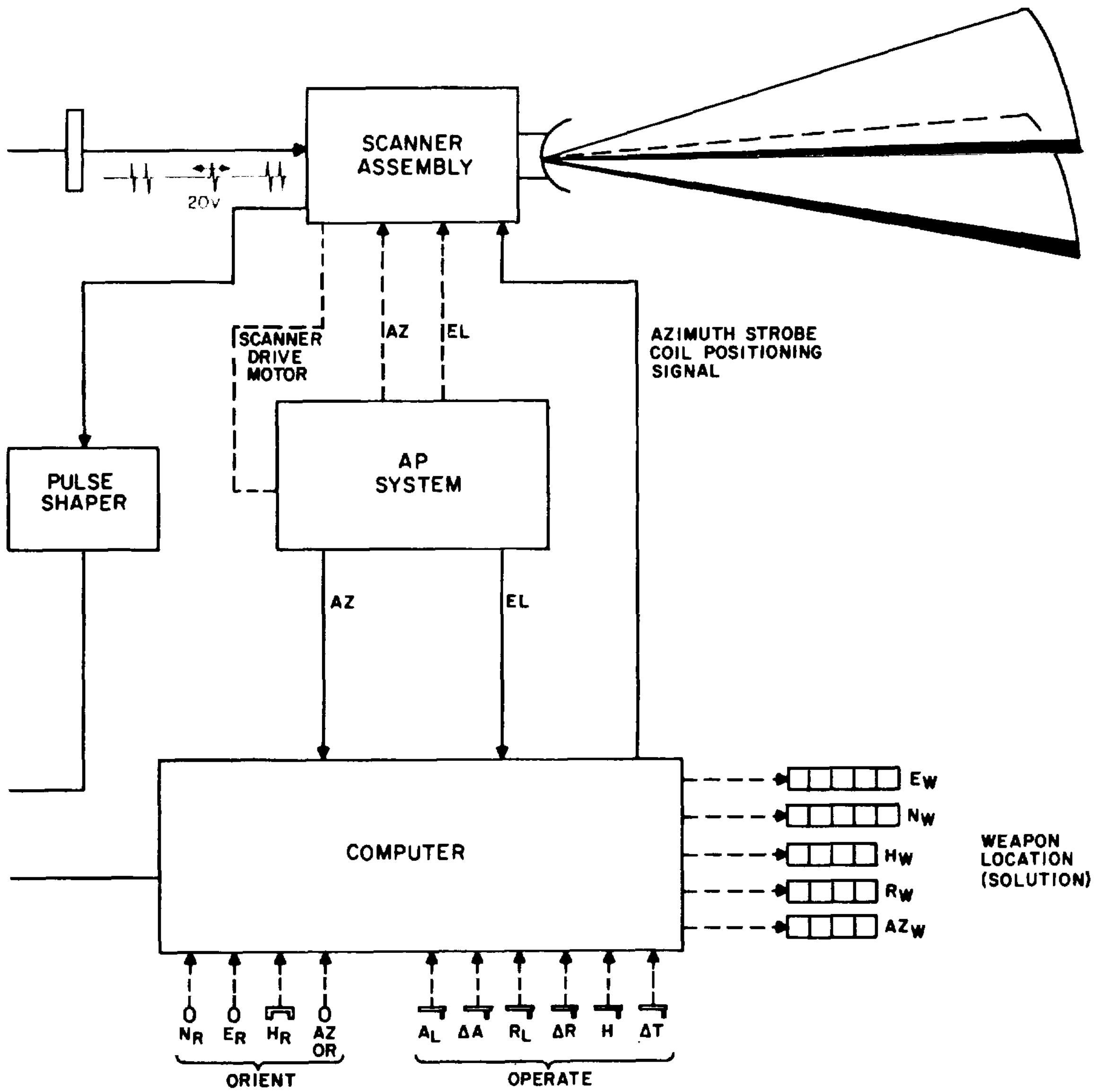
DIAGRAMS



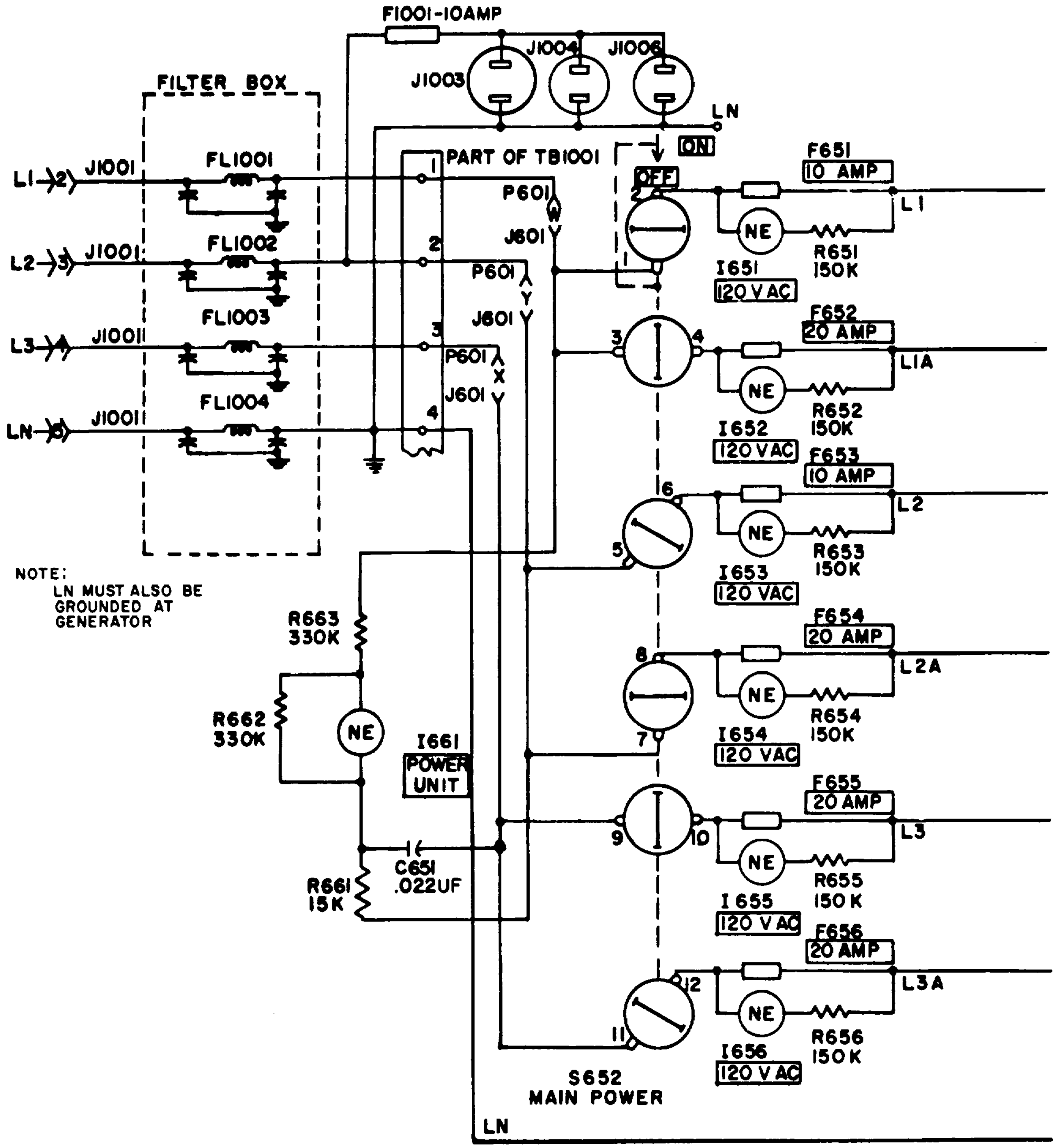
Wiring for TPA-7 (J1007).



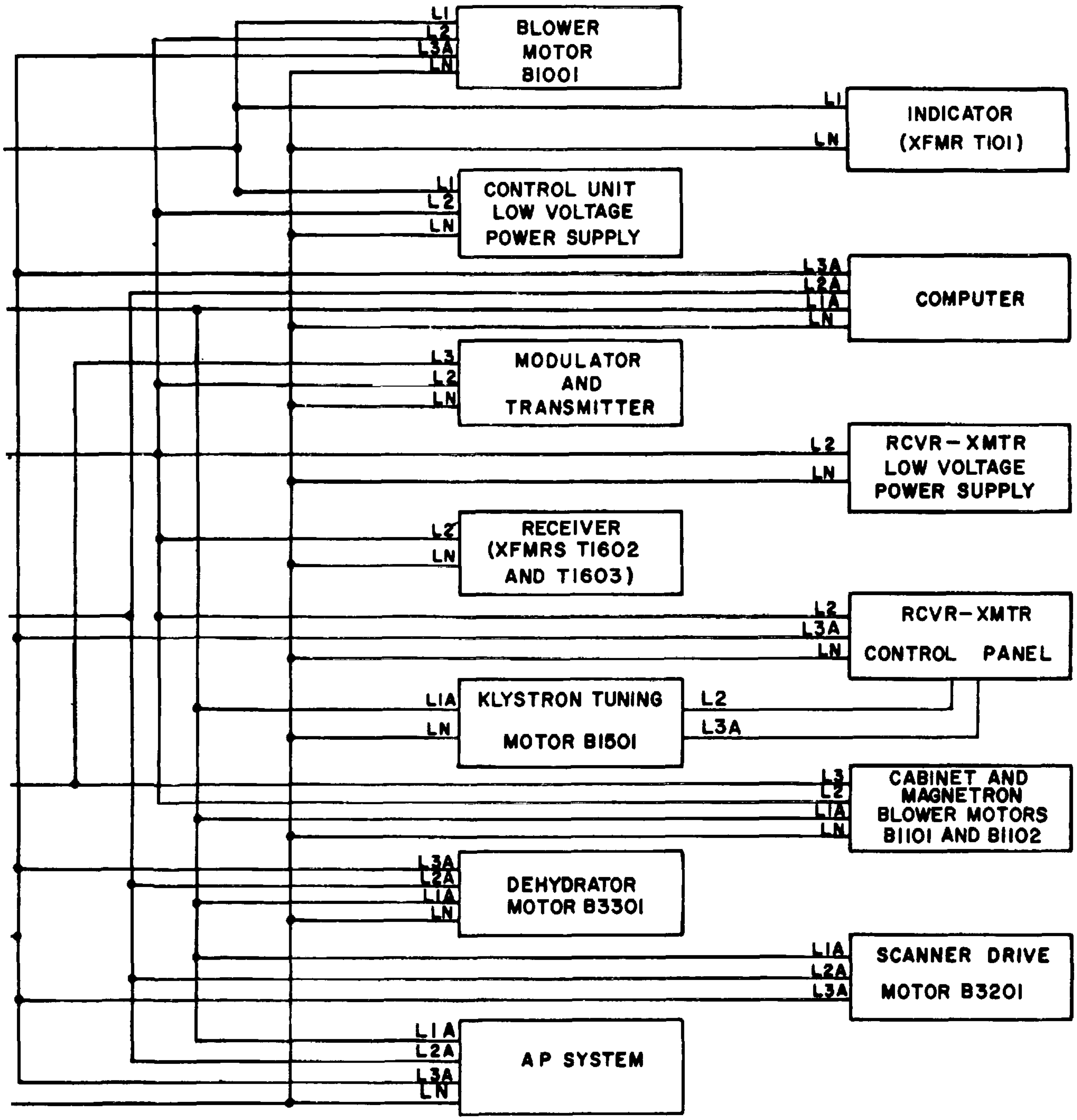
AN/MPQ-4A simplified block diagram.



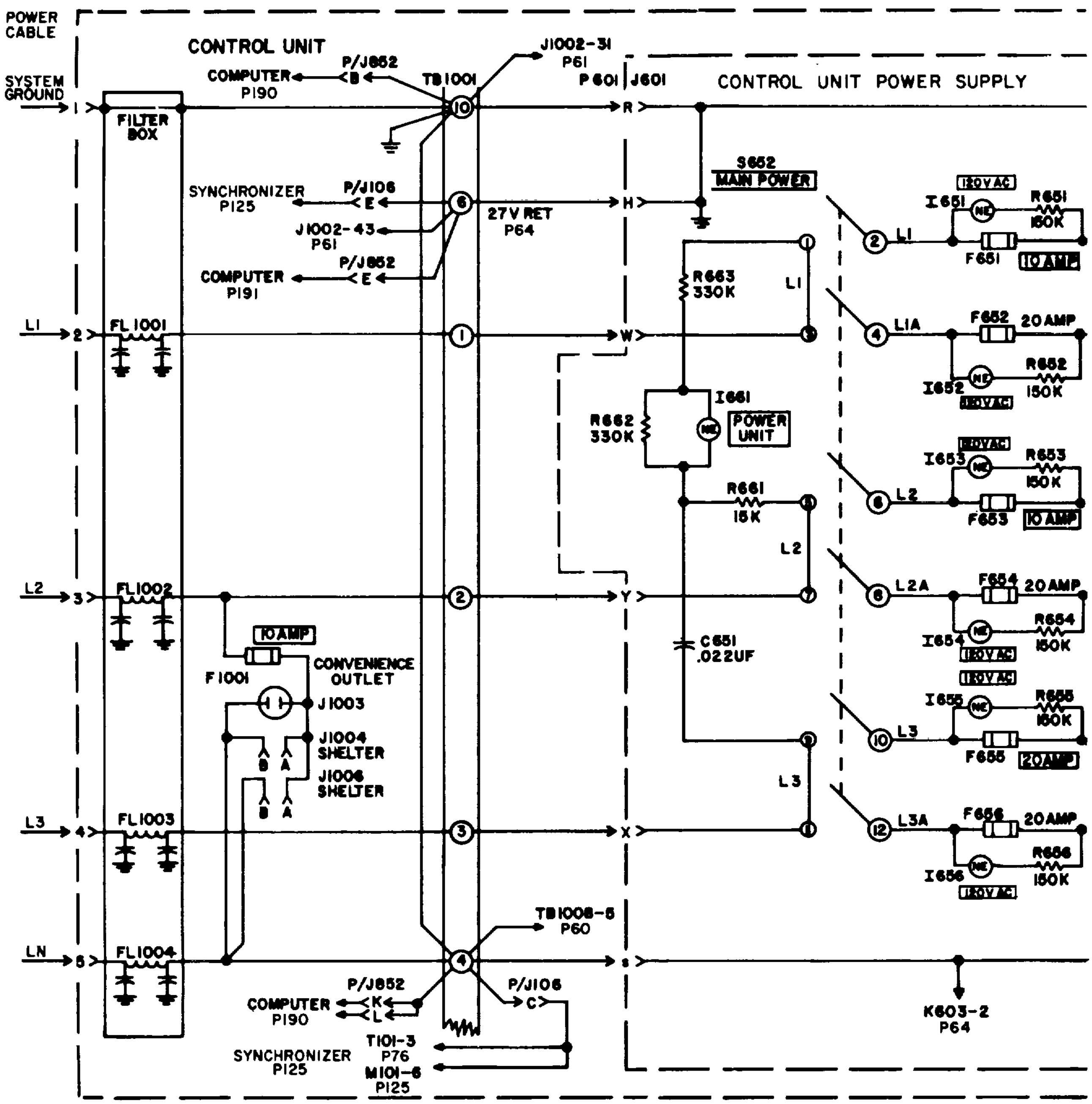
AN/MPQ-4A simplified block diagram.



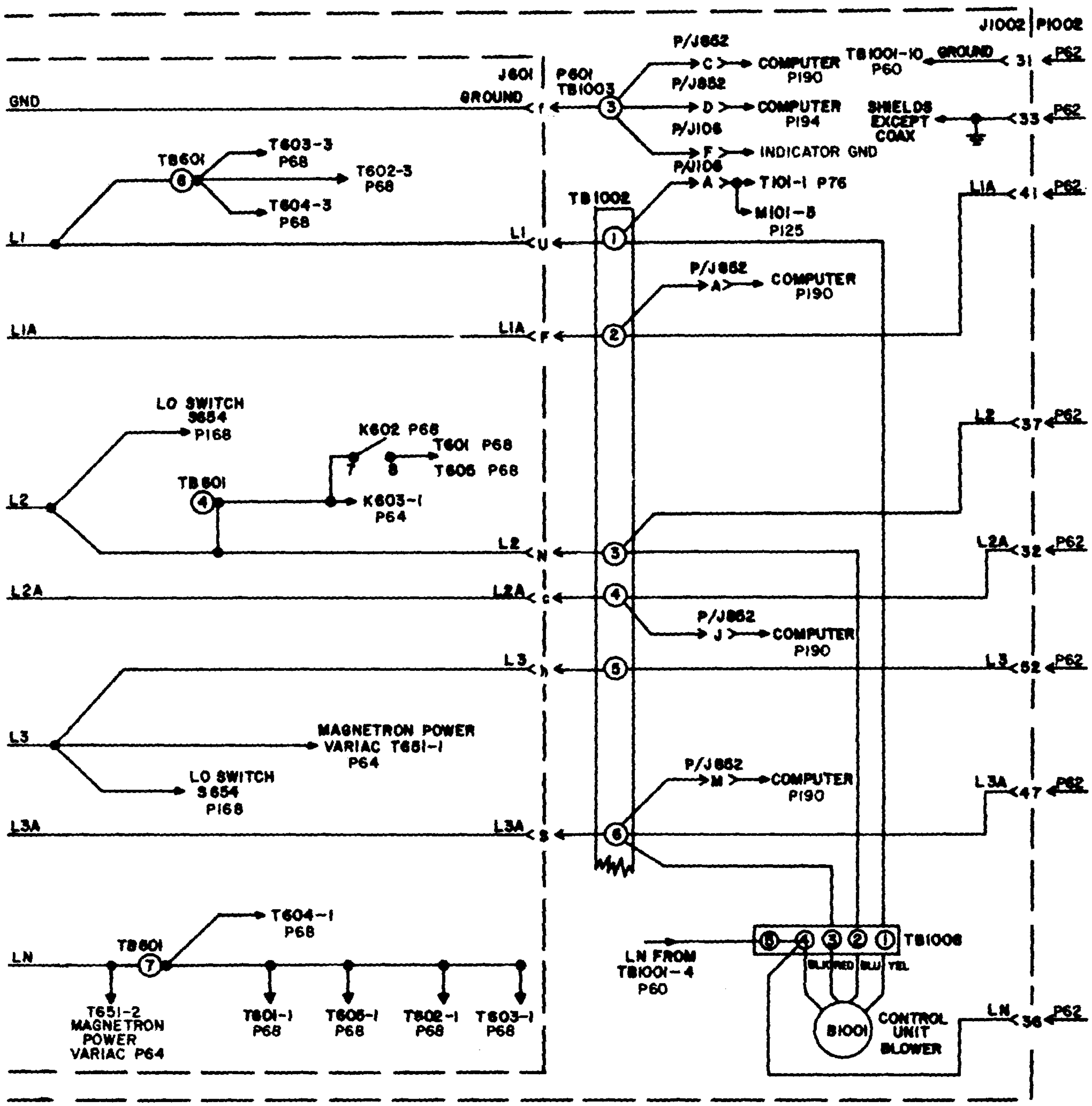
AC distribution block diagram.



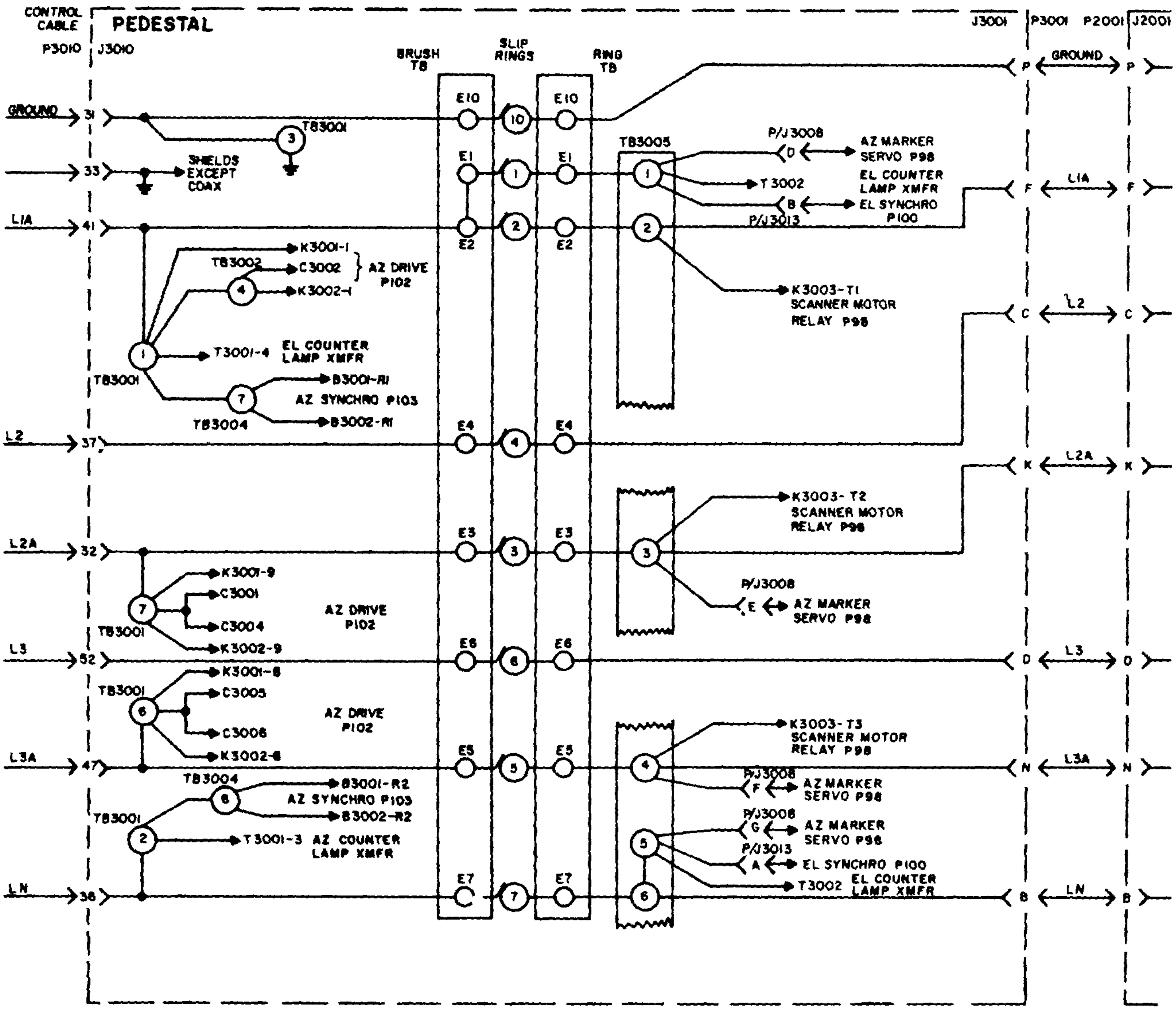
AC distribution block diagram--Continued.



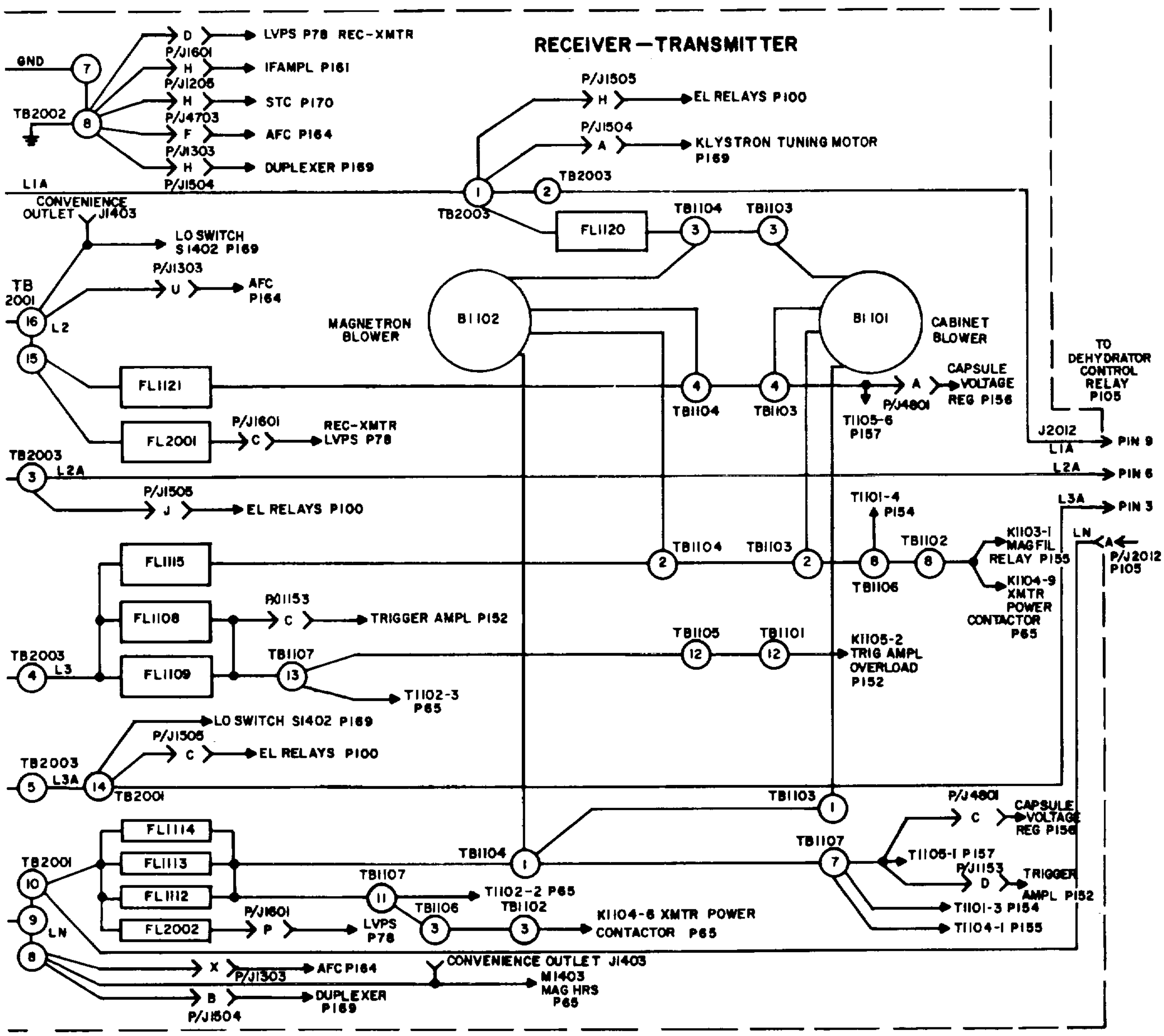
Ground and AC distribution wiring diagram.



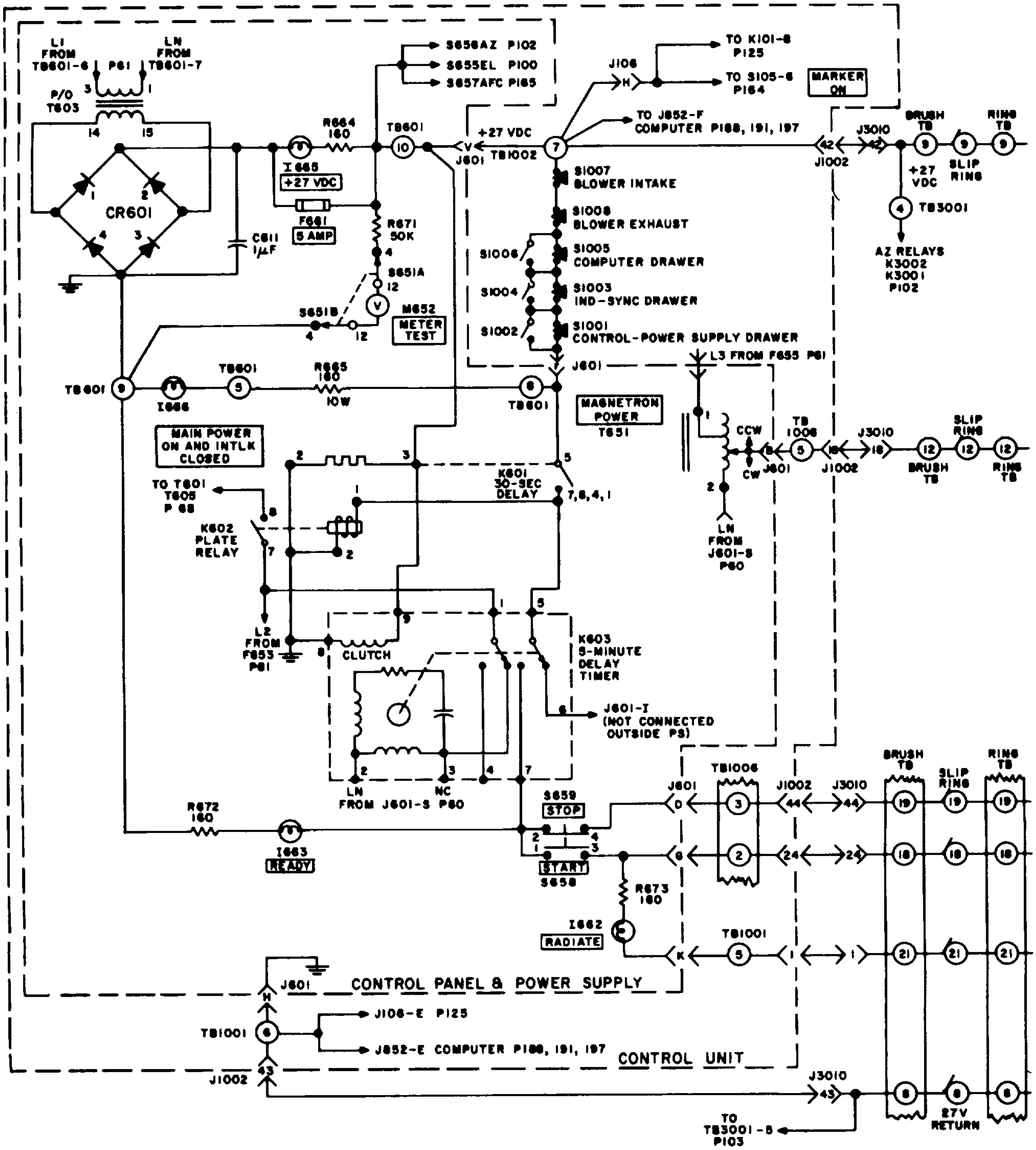
Ground and AC distribution wiring diagram--Continued.



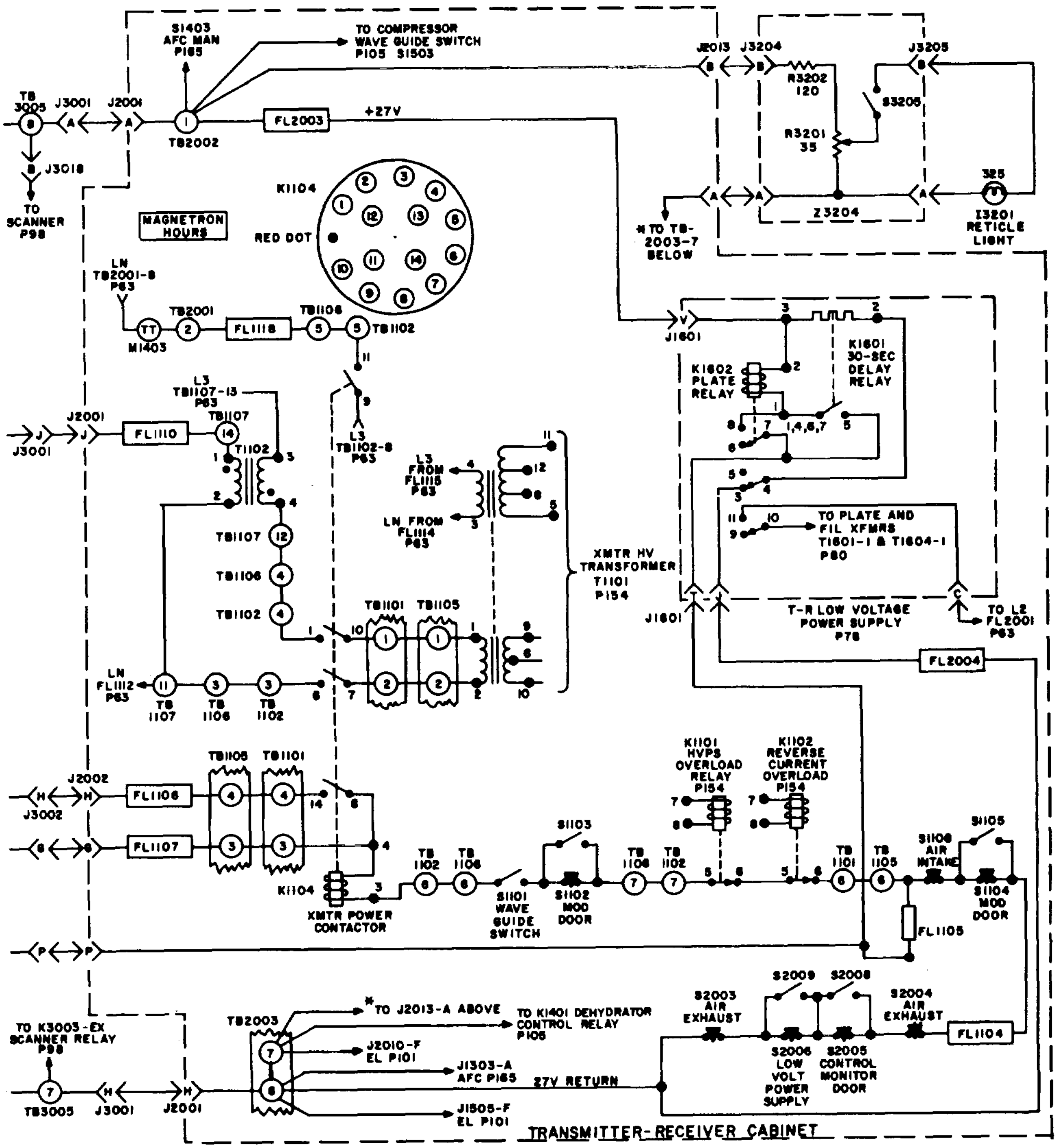
Ground and AC distribution wiring diagram--Continued.



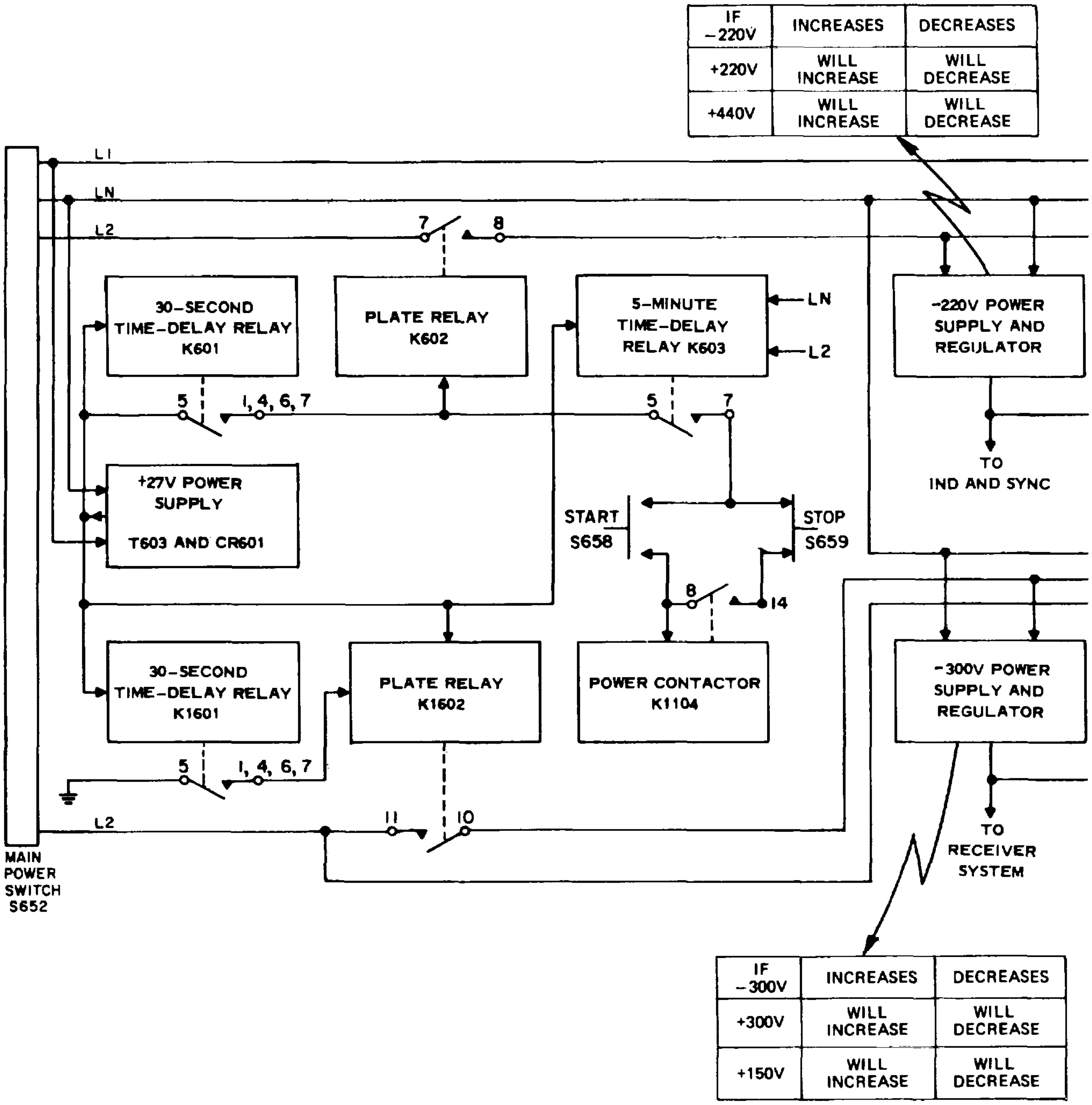
Ground and AC distribution wiring diagram--Continued.



27v distribution and transmitter control circuits.



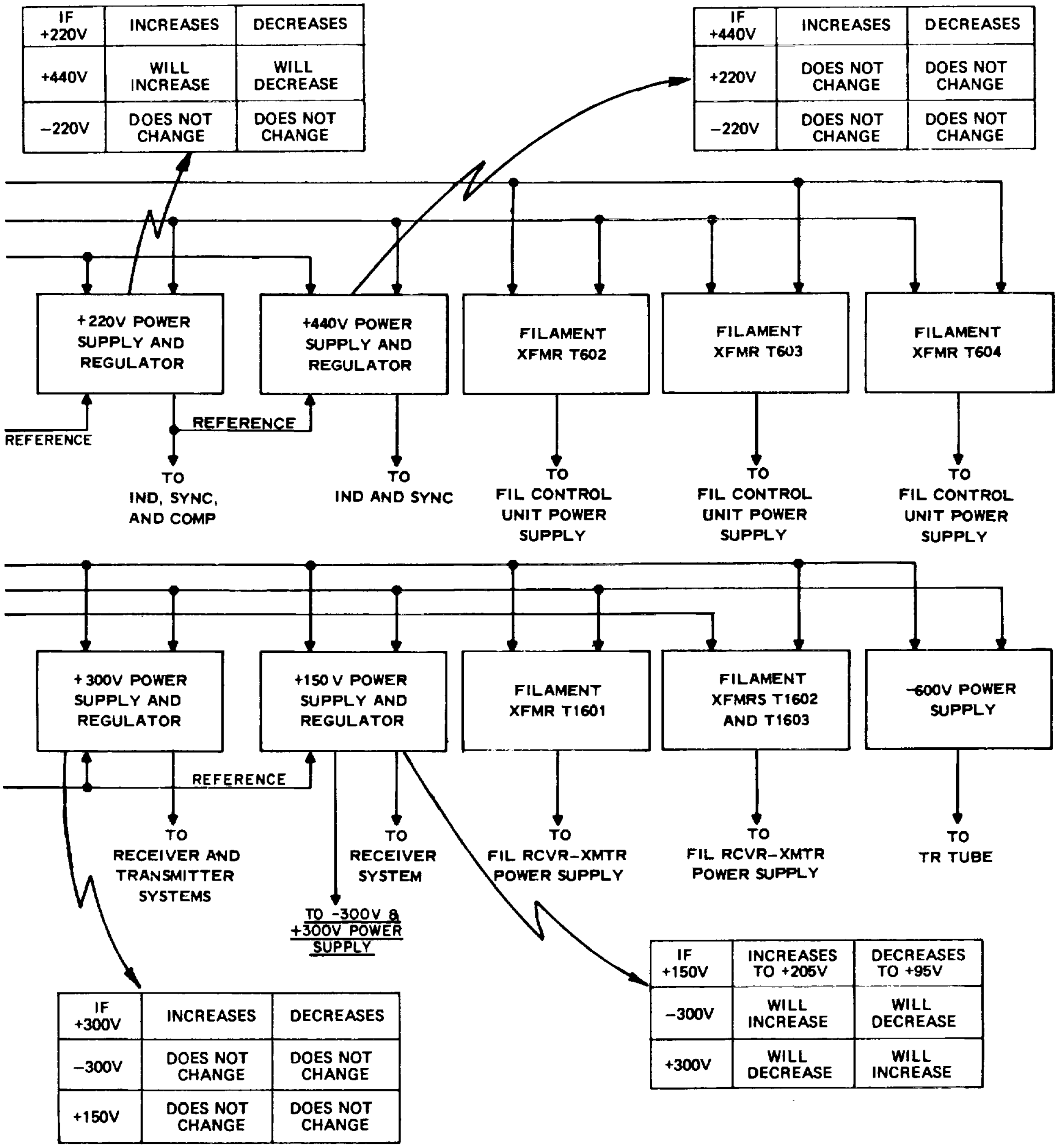
27v distribution and transmitter control circuits--Continued.



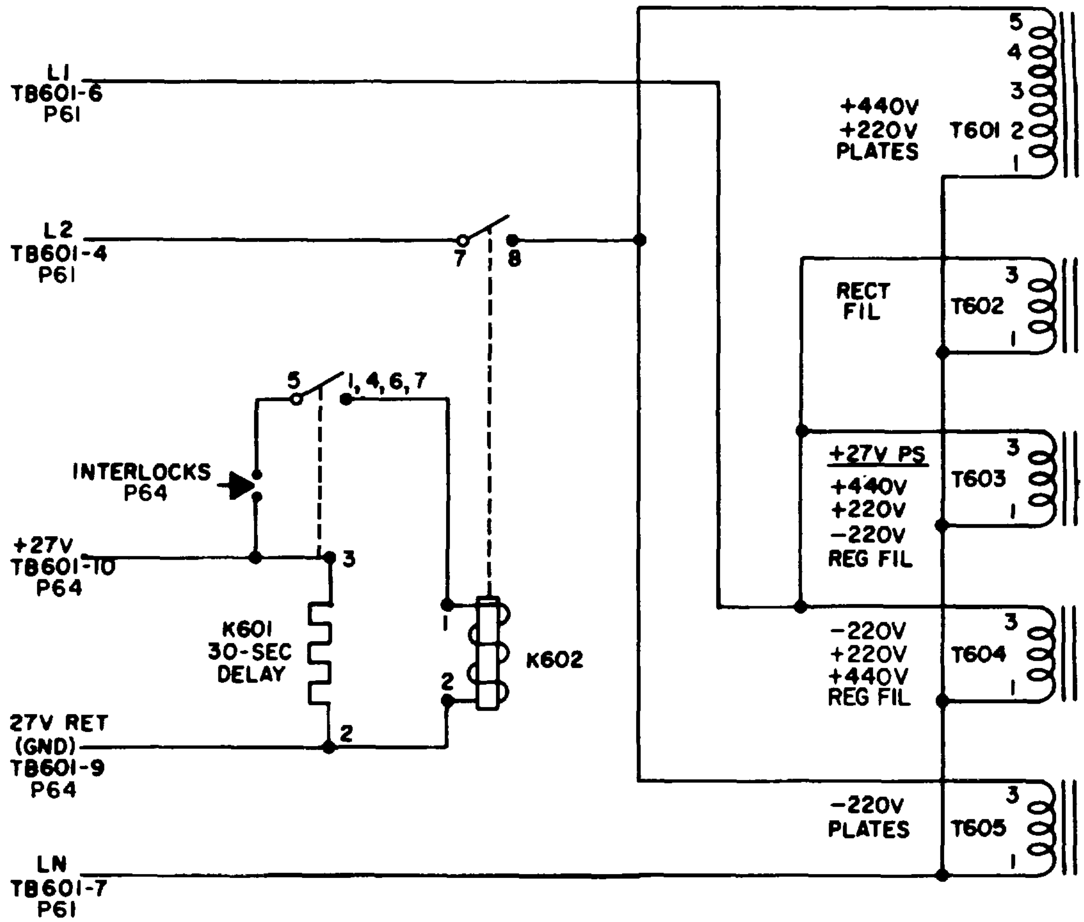
IF −220V	INCREASES	DECREASES
+220V	WILL INCREASE	WILL DECREASE
+440V	WILL INCREASE	WILL DECREASE

IF −300V	INCREASES	DECREASES
+300V	WILL INCREASE	WILL DECREASE
+150V	WILL INCREASE	WILL DECREASE

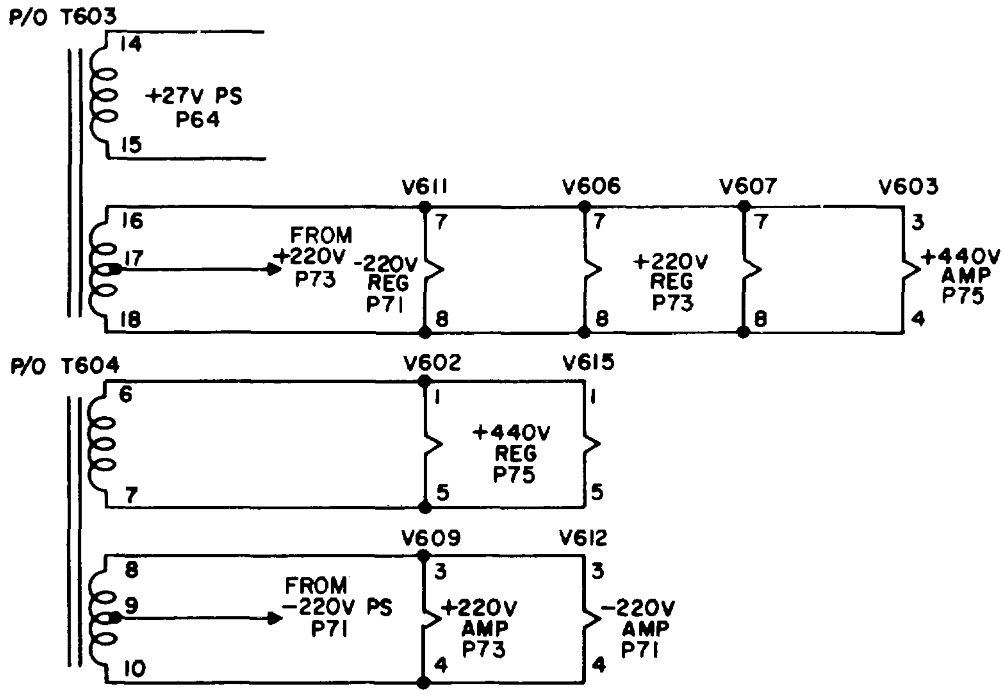
DC power supply system, block diagram.



DC power supply system, block diagram--Continued.

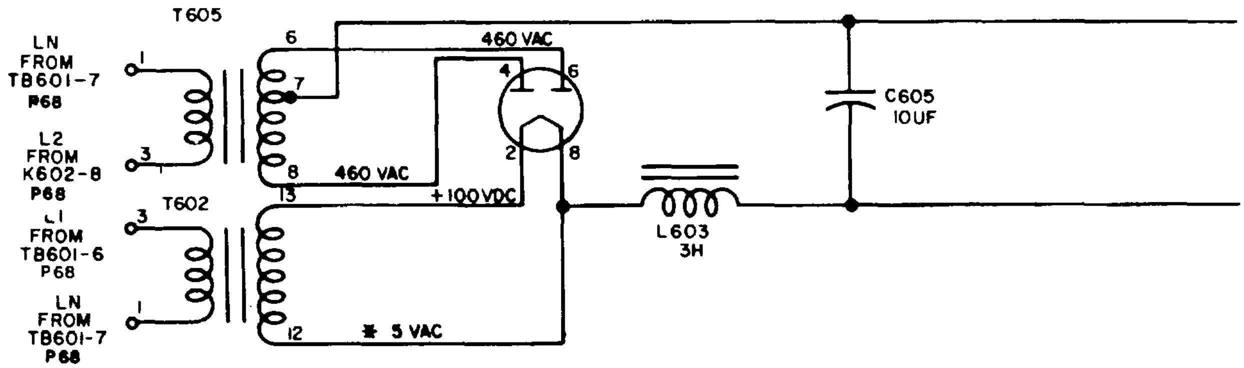


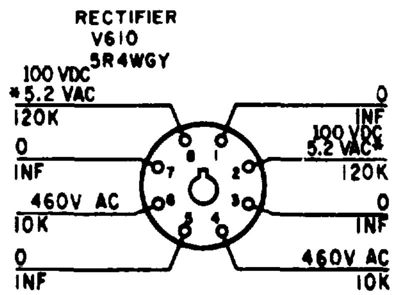
Control--power supply control circuit.



NOTE: FILAMENTS FOR RECTIFIERS V601, V604, V605, V608, V610, AND V614 ARE FURNISHED BY T602 SHOWN WITH EACH RELATED POWER SUPPLY ON P70, 72, 74

Control--power supply filaments.





IF -220V	INCREASES	DECREASES
+220V	WILL INCREASE	WILL DECREASE
+440V	WILL INCREASE	WILL DECREASE

Effect of negative 220-volt power supply on positive 220-volt and positive 440-volt power supplies.

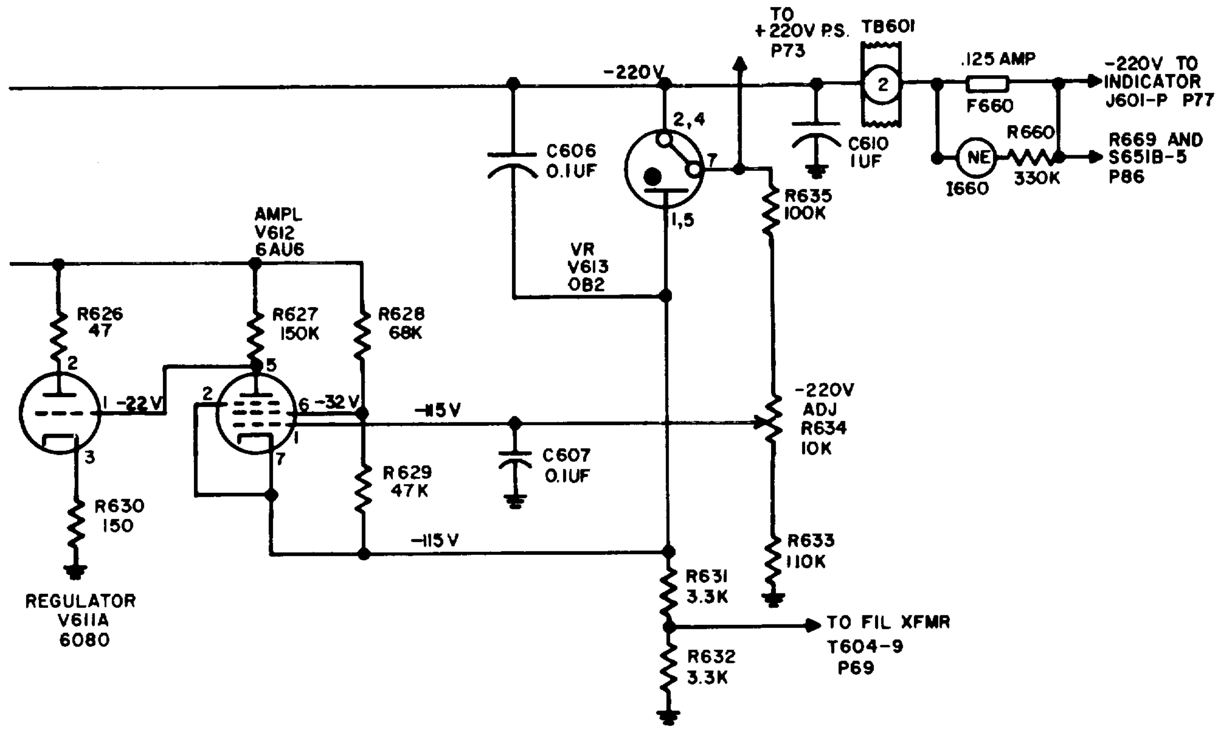
T 605 602

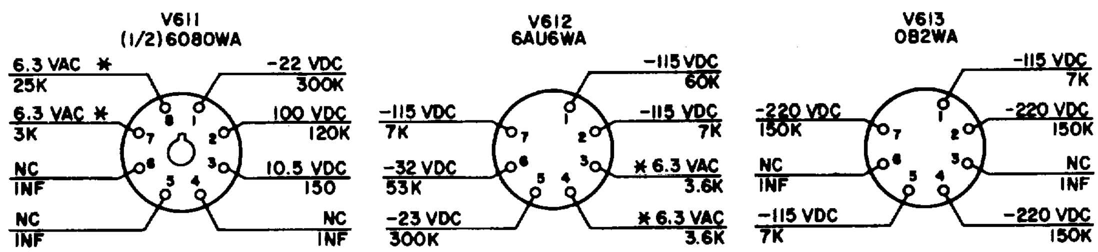
V 610

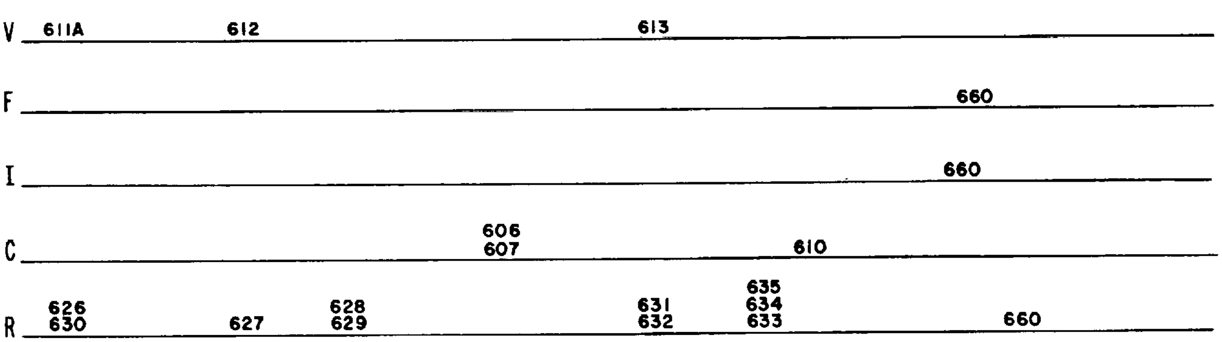
C 605

L 603

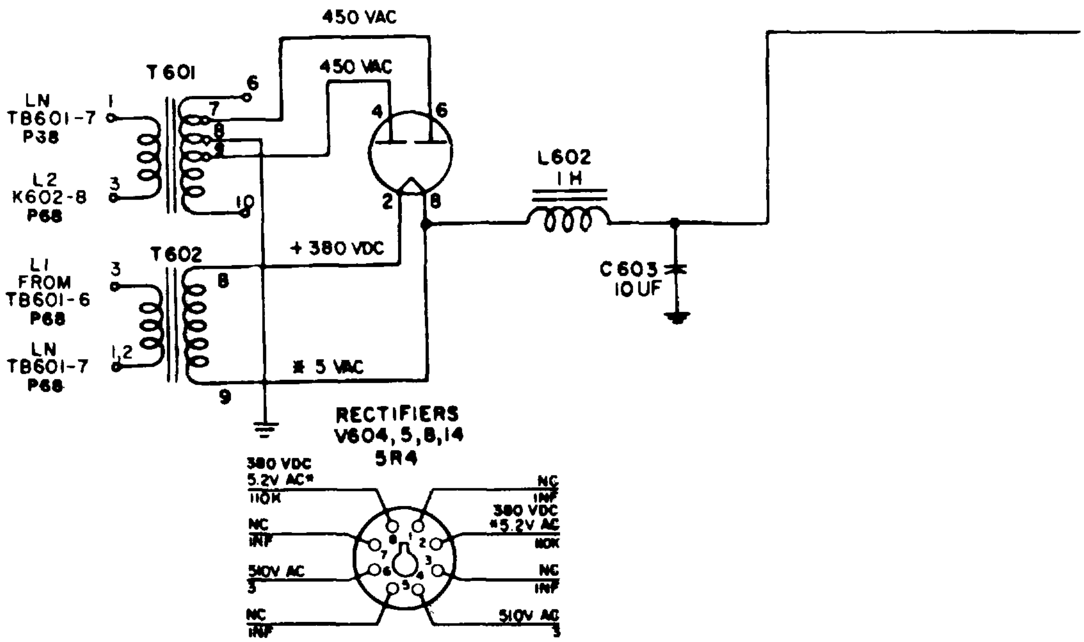
-220v rectifier







-220v regulator



IF +220V	INCREASES	DECREASES
+440V	WILL INCREASE	WILL DECREASE
-220V	DOES NOT CHANGE	DOES NOT CHANGE

Effect of positive 220-volt power supply on positive 440-volt and negative 220-volt power supplies.

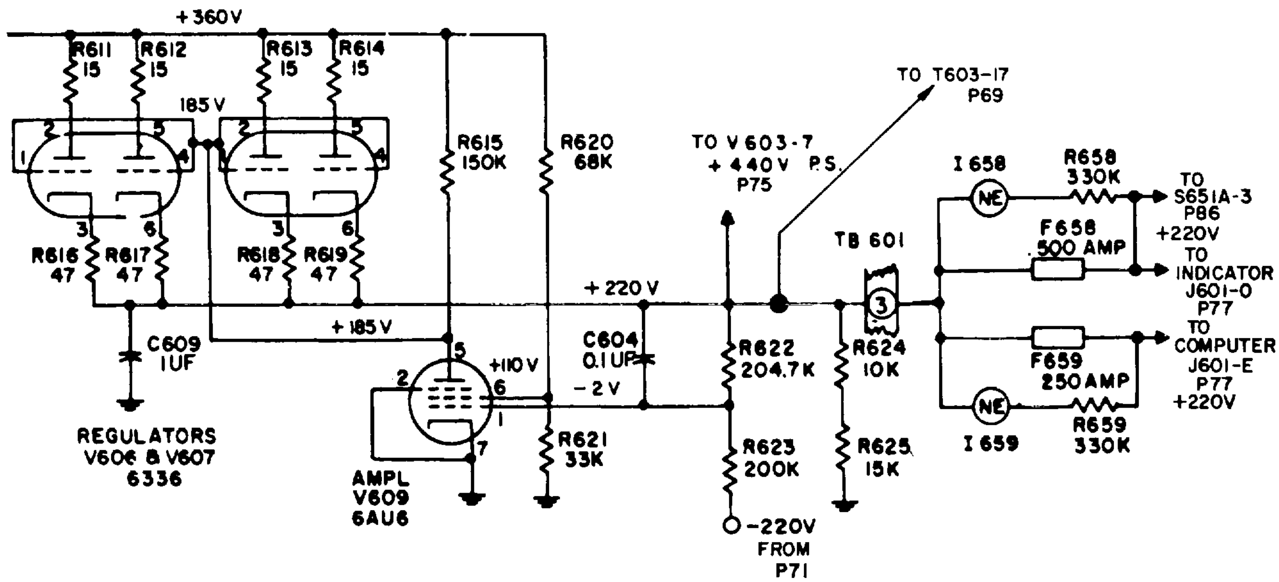
V 604, 5, 8, 14

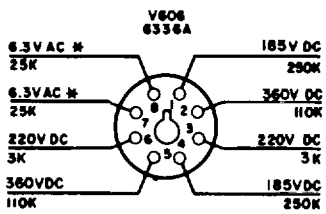
T 601, 602

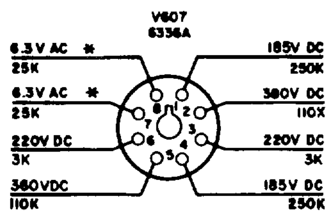
L 602

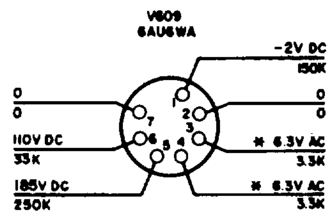
C 603

+220v rectifier.



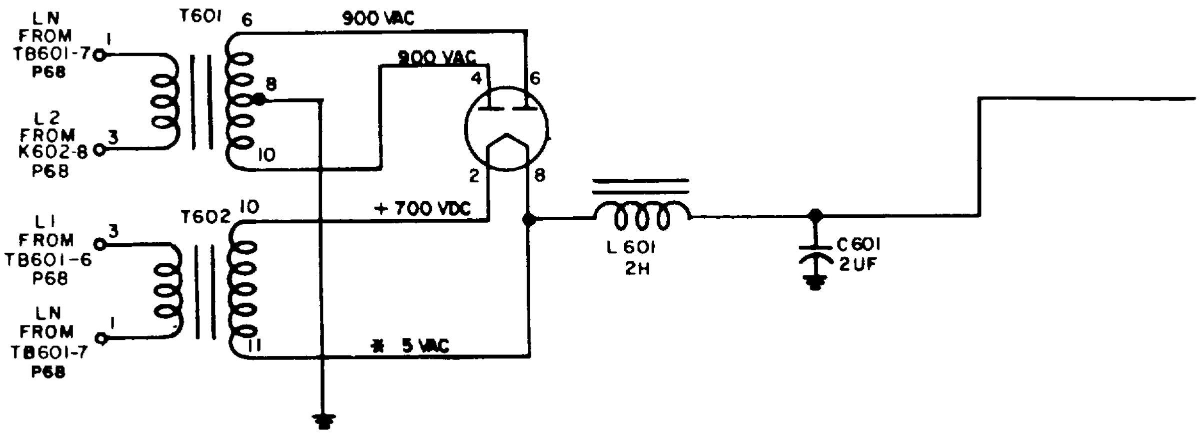




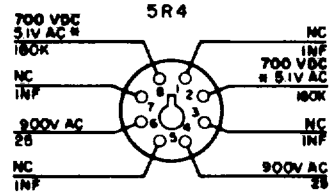


V	606 607 609
F	658 659
I	658 659
C	609 604
R	611 616 612 617 613 618 614 619 615 620 621 622 623 624 625 658 659

+220v regulator



RECTIFIER
V601
5R4



IF +440V	INCREASES	DECREASES
+220V	DO NOT CHANGE	
-220V		

<u>Effect of positive 440-volt power supply on positive 220-volt and negative 220-volt power supplies.</u>

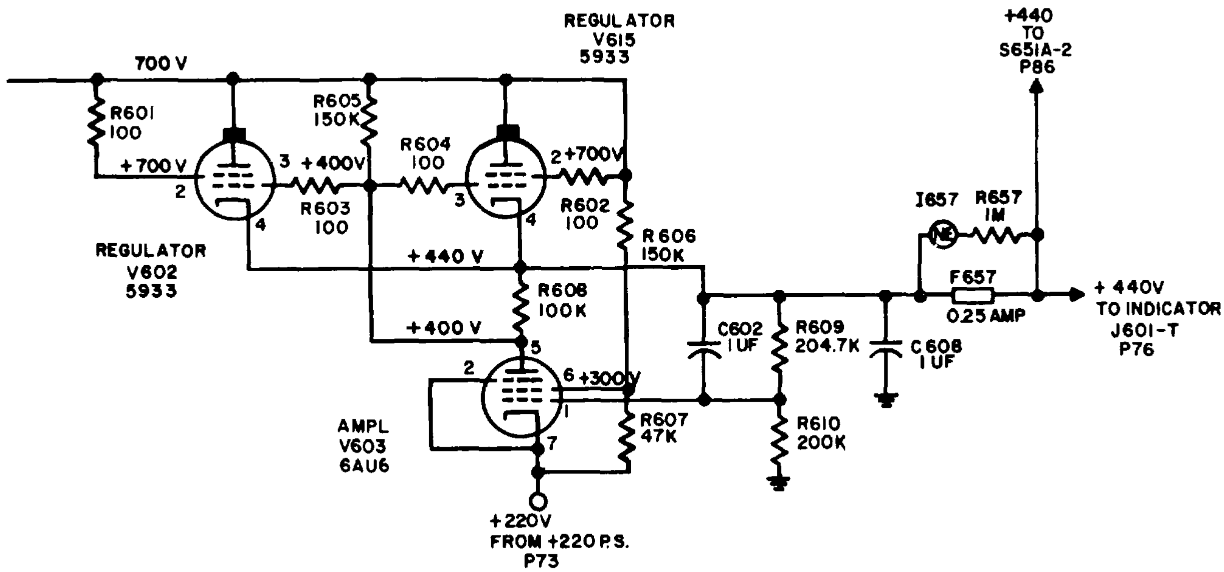
T ______ 601 602 ______

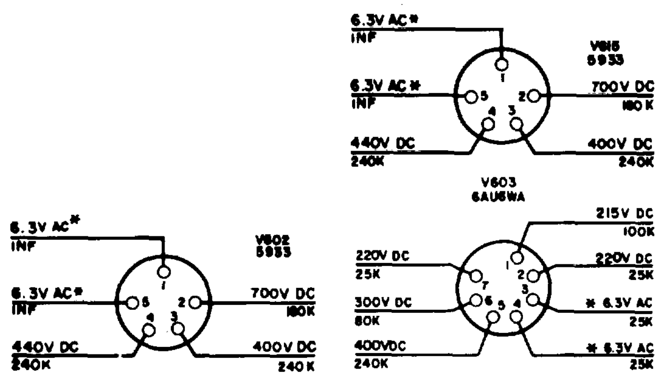
V ______ 601 ______

L ______ 601 ______

C ______ 601 ______

+440v rectifier.





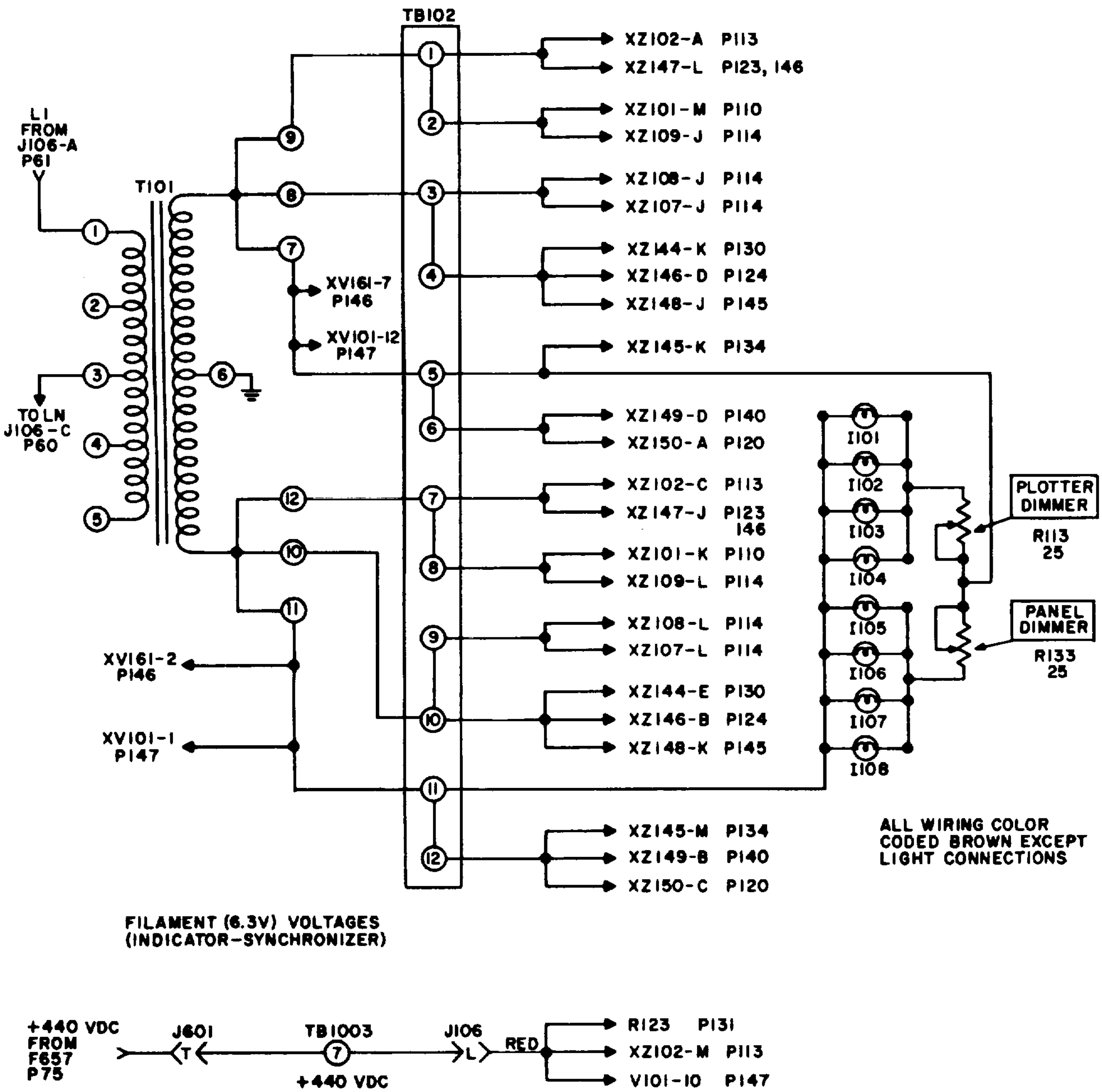
V 602 615 603

C 602 608

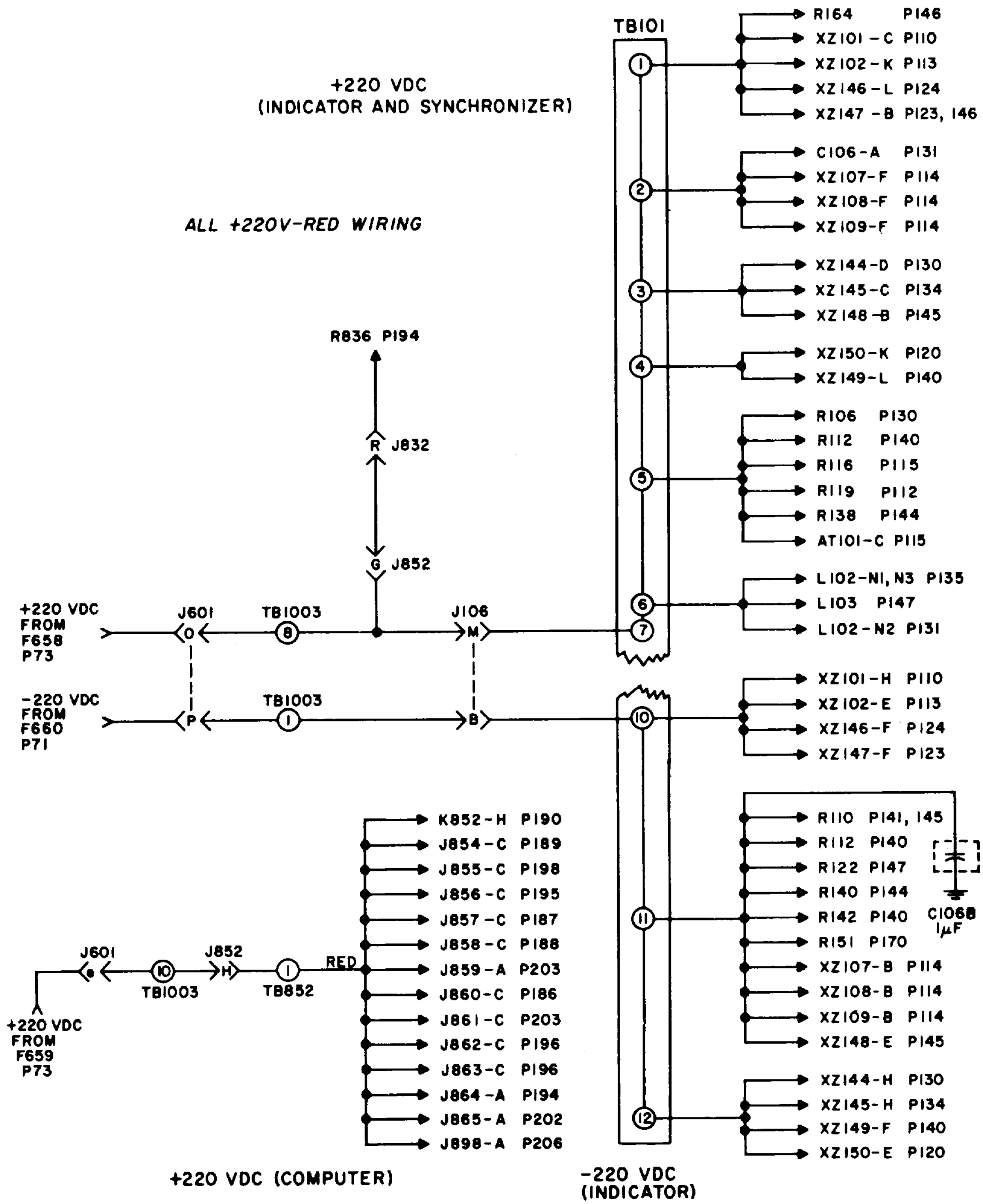
F 657

I 657

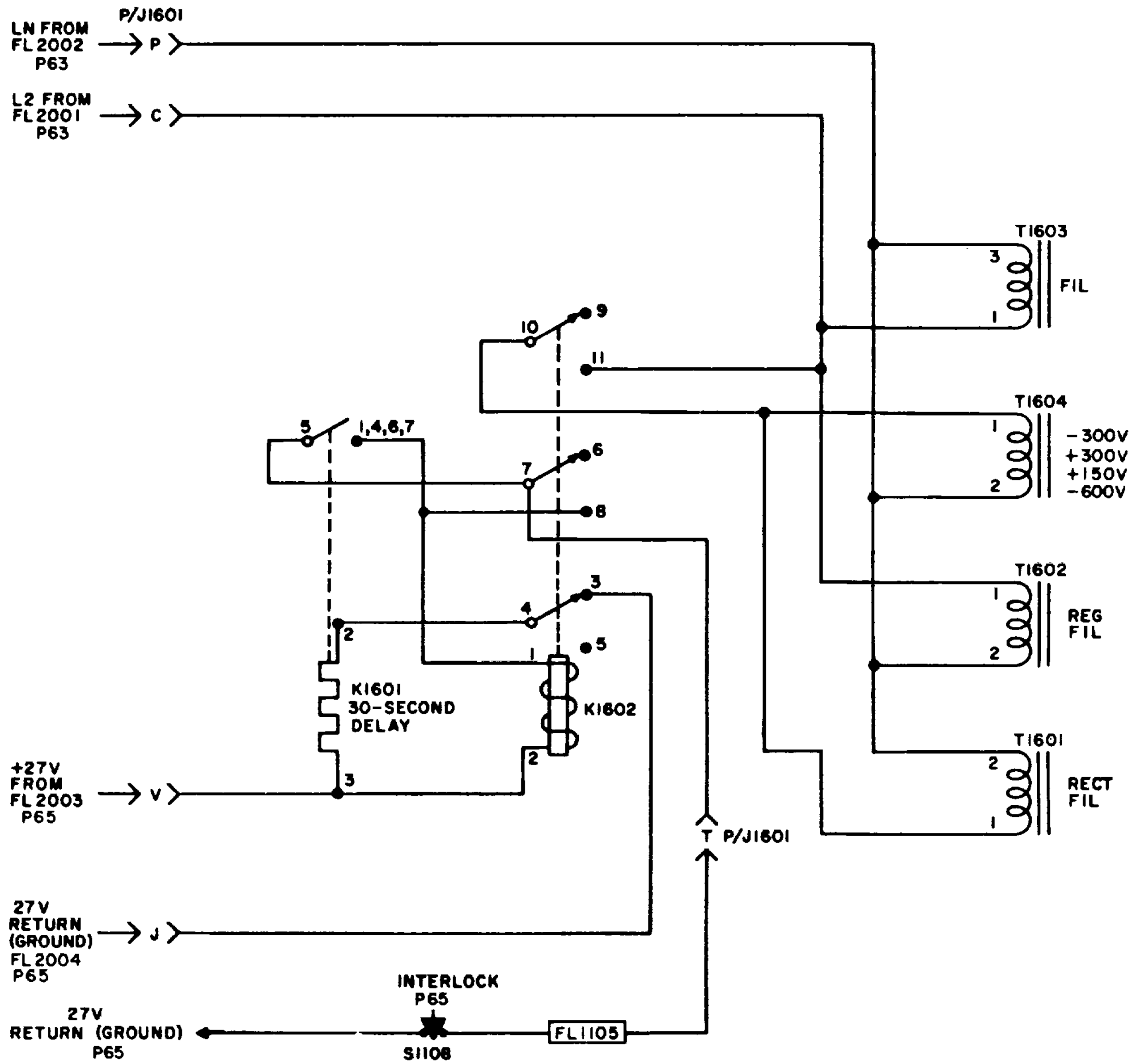
R 601 603 605 604 608 602 606 607 609 610 657



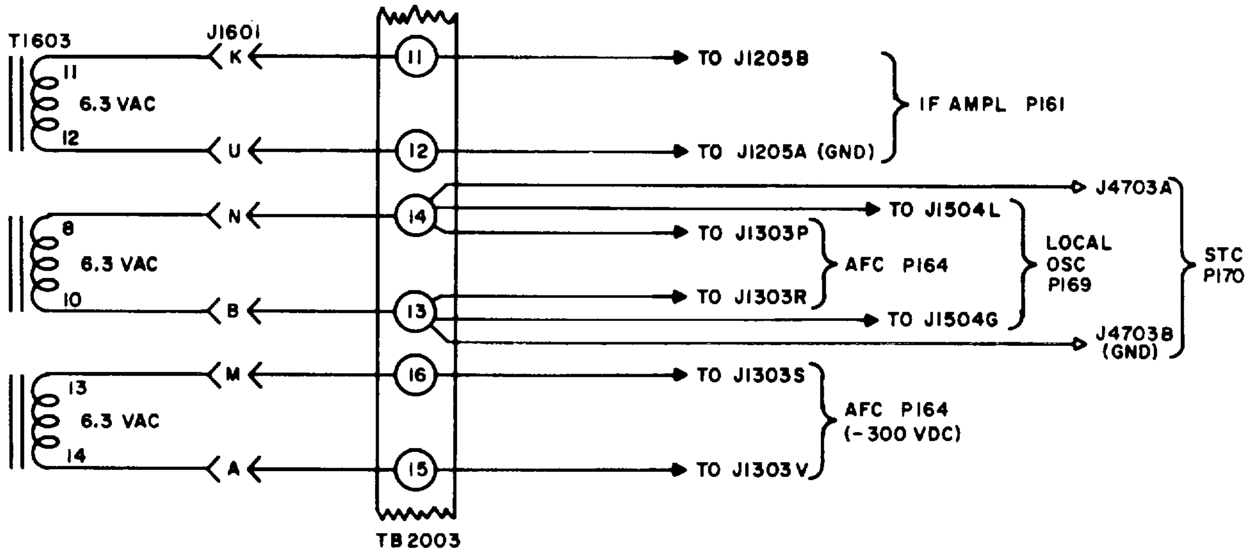
Control unit voltage distribution



TB101
+220 VDC
(INDICATOR AND SYNCHRONIZER)
ALL +220V-RED WIRING
R164 P146
XZ101 - C P110
XZ102 - K P113
XZ146 - L P124
XZ147 - B P123, 146
C106-A P131
XZ107-F P114
XZ108-F P114
XZ109-F P114
XZ144-D P130
XZ145-C P134
XZ148-B P145
XZ150-K P120
XZ149-L P140
R106 P130
R112 P140
R116 P115
R119 P112
R138 P144
AT101-C P115
L102-N1, N3 P135
L103 P147
L102-N2 P131
R836 P194
R J832
G J852
+220 VDC FROM F658 P73
J601
TB1003
J106
-220 VDC FROM F660 P71
XZ101-H P110
XZ102-E P113
XZ146-F P124
XZ147-F P123
R110 P141, 145
R112 P140
R122 P147
R140 P144
R142 P140
R151 P170
XZ107-B P114
XZ108-B P114
XZ109-B P114
XZ148-E P145
C106B 1µF
XZ144-H P130
XZ145-H P134
XZ149-F P140
XZ150-E P120
K852-H P190
J854-C P189
J855-C P198
J856-C P195
J857-C P187
J858-C P188
J859-A P203
J860-C P186
J861-C P203
J862-C P196
J863-C P196
J864-A P194
J865-A P202
J898-A P206
J601
J852
RED
TB1003
TB852
+220 VDC FROM F659 P73
+220 VDC (COMPUTER)
-220 VDC (INDICATOR)



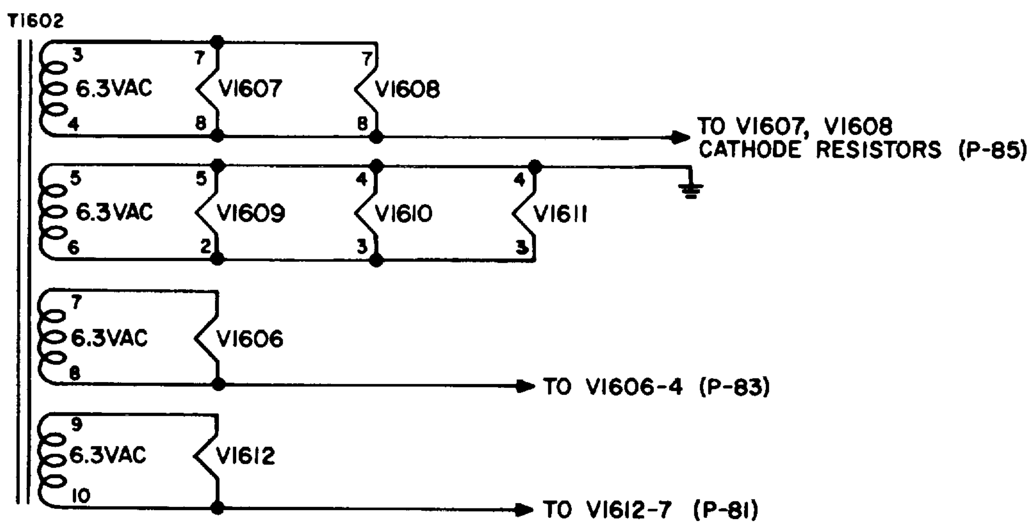
RECEIVER - TRANSMITTER POWER SUPPLY CONTROL CIRCUIT



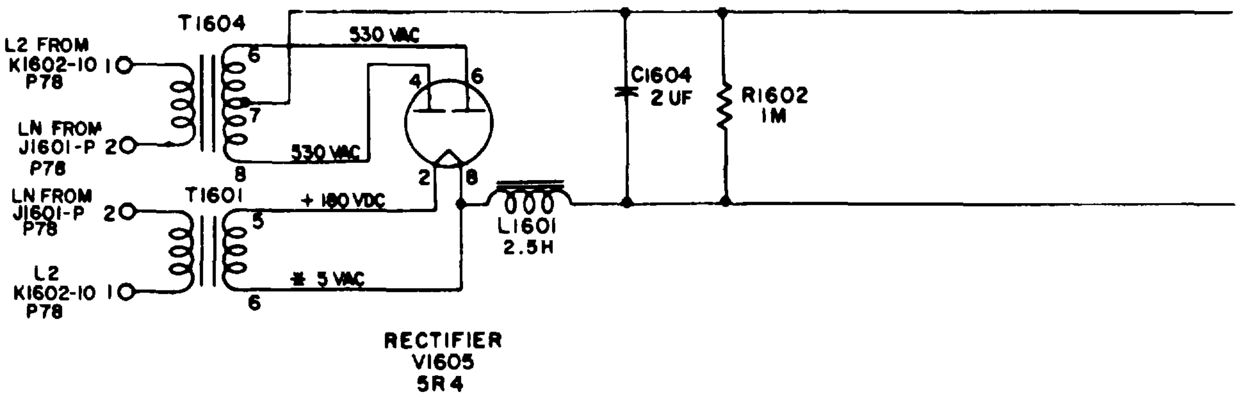
Receiver Filaments

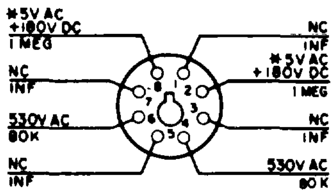
NOTES

1. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER.
2. VOLTAGE READINGS ABOVE THE LINE, RESISTANCE READINGS BELOW THE LINE.
3. NC INDICATES NO CONNECTIONS
4. FOR RESISTANCE MEASUREMENTS ONLY, DISCONNECT ALL EXTERNAL PLUGS.
5. * INDICATES MEASUREMENTS ACROSS FILAMENTS.
6. K DENOTES THOUSAND, MEG DENOTES MILLION, INF DENOTES INFINITY.



Receiver-transmitter power supply filaments





IF -300V	INCREASES	DECREASES
+300V	WILL INCREASE	WILL DECREASE
+150V	WILL INCREASE	WILL DECREASE

<u>Effect of negative 300V power supply on positive 300V and positive 150V power supplies.</u>

V 1605

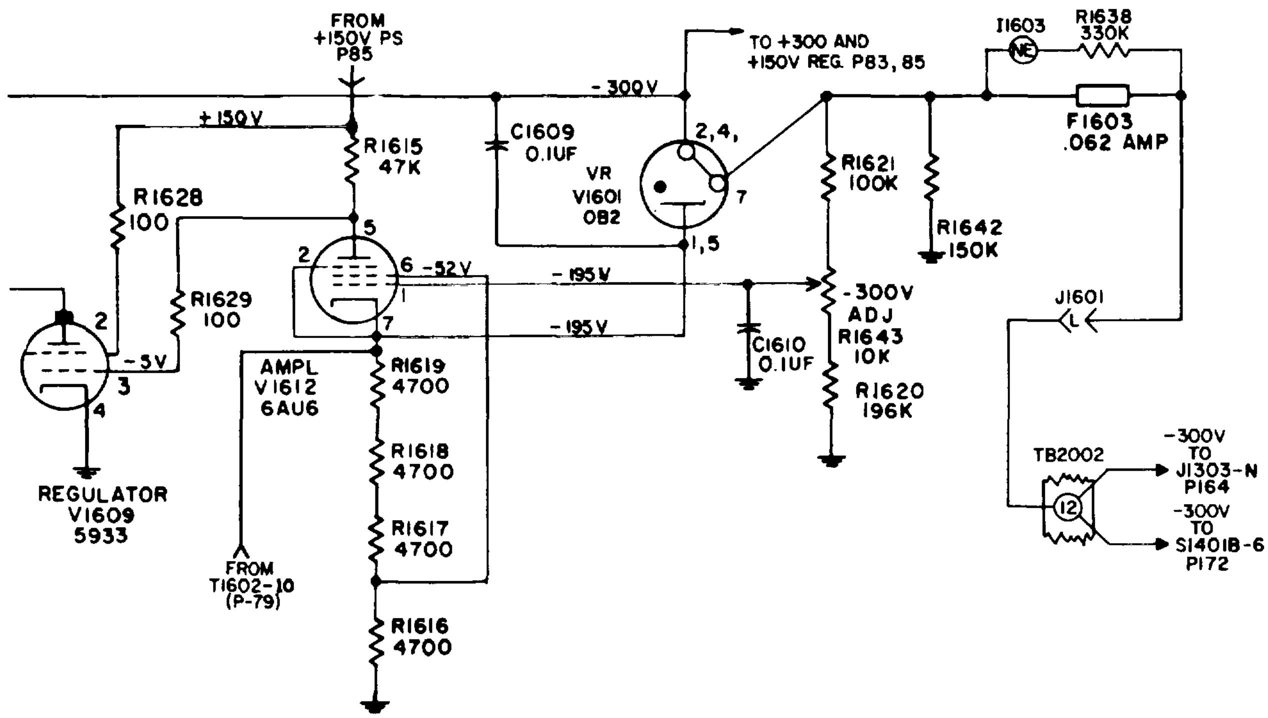
T 1604 1601

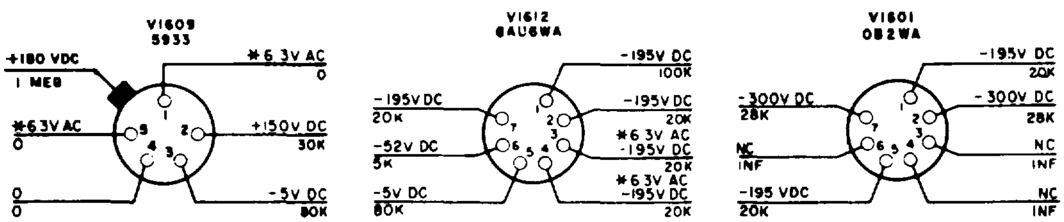
C 1604

L 1601

R 1602

<u>-300 v rectifier</u>





V 1609 1612 1601

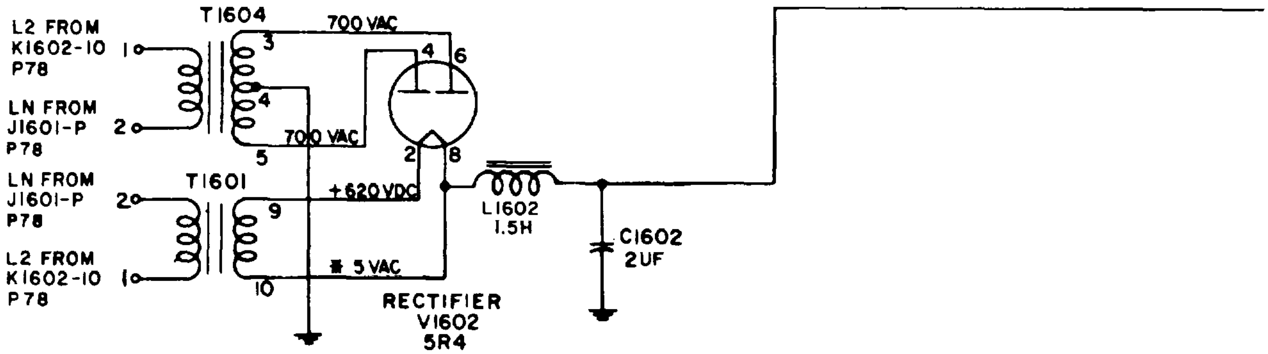
C 1609 1610

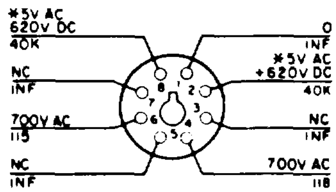
F 1603

I 1603

R 1628 1629 1615 1619 1618 1617 1616 1621 1643 1620 1642 1638

-300v regulator





IF +300V	INCREASES DECREASES
-300V	DO NOT CHANGE
+150V	

Effect of positive 300V power supply on negative 300V and positive 150V power supplies.

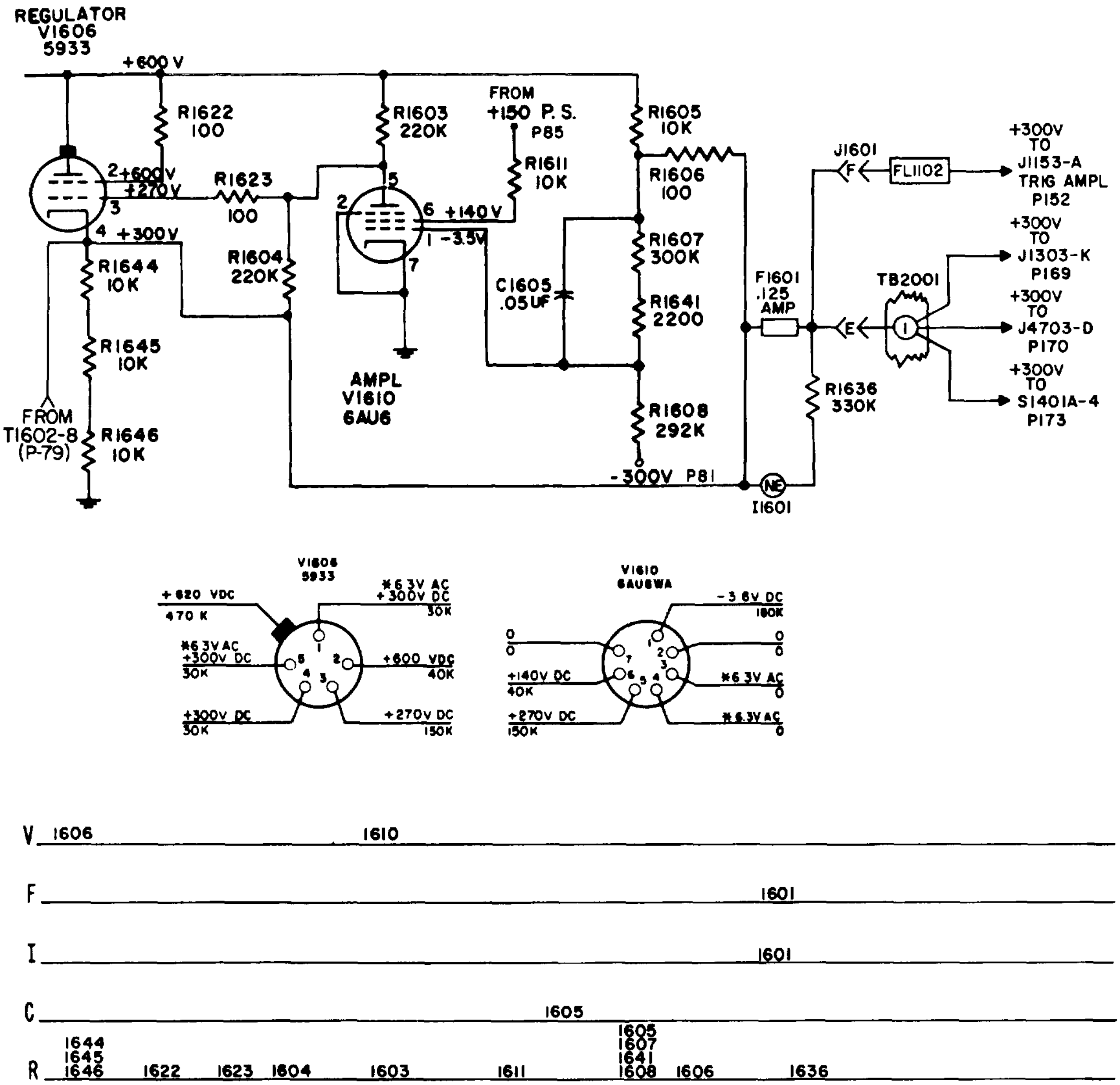
V ______ 1602 ______

T ______ 1604 1601 ______

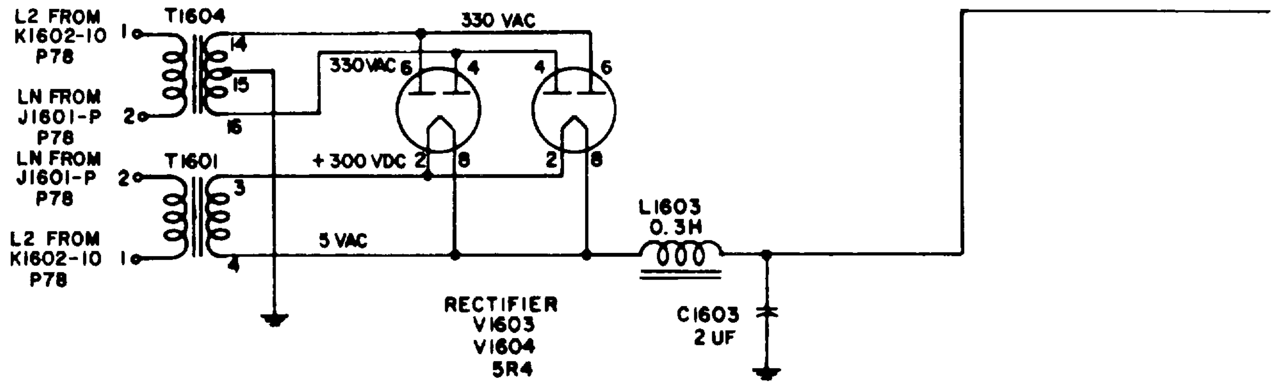
L ______ 1602 ______

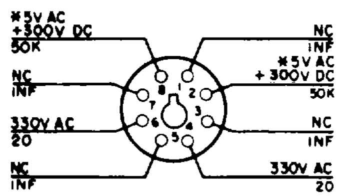
C ______ 1602 ______

+300 v rectifier



+300 v rectifier





IF +150V	INCREASES TO +205V	DECREASES TO +95V
-300V	WILL INCREASE	WILL DECREASE
+300V	WILL DECREASE	WILL INCREASE

Effect of positive 150 V power supply on negative 300V and positive 300V power supplies.

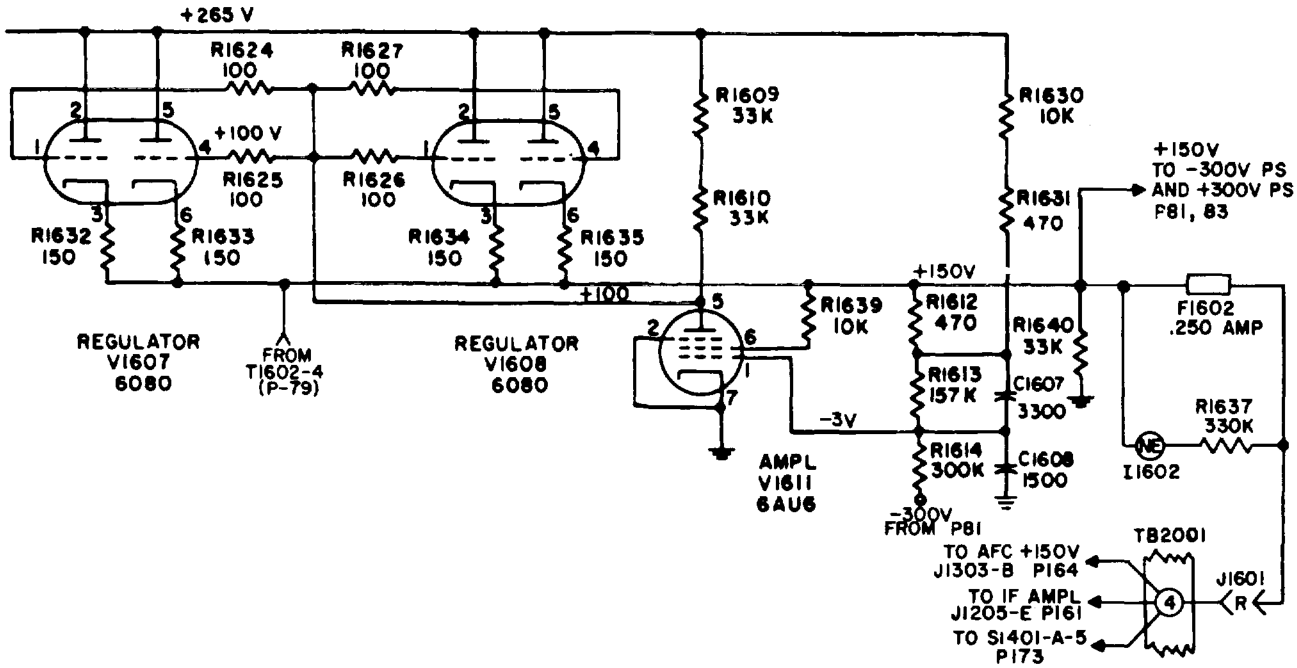
T 1604 1601

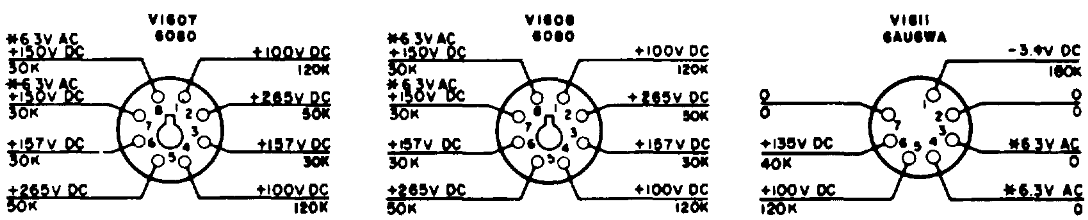
V 1603 1604

C 1603

L 1603

+150v rectifier





V 1607 1608 1611

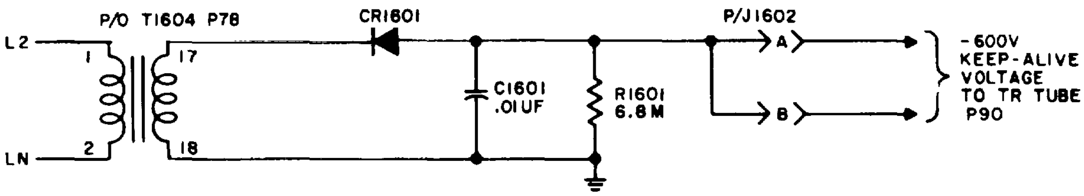
C 1607 1608

F 1602

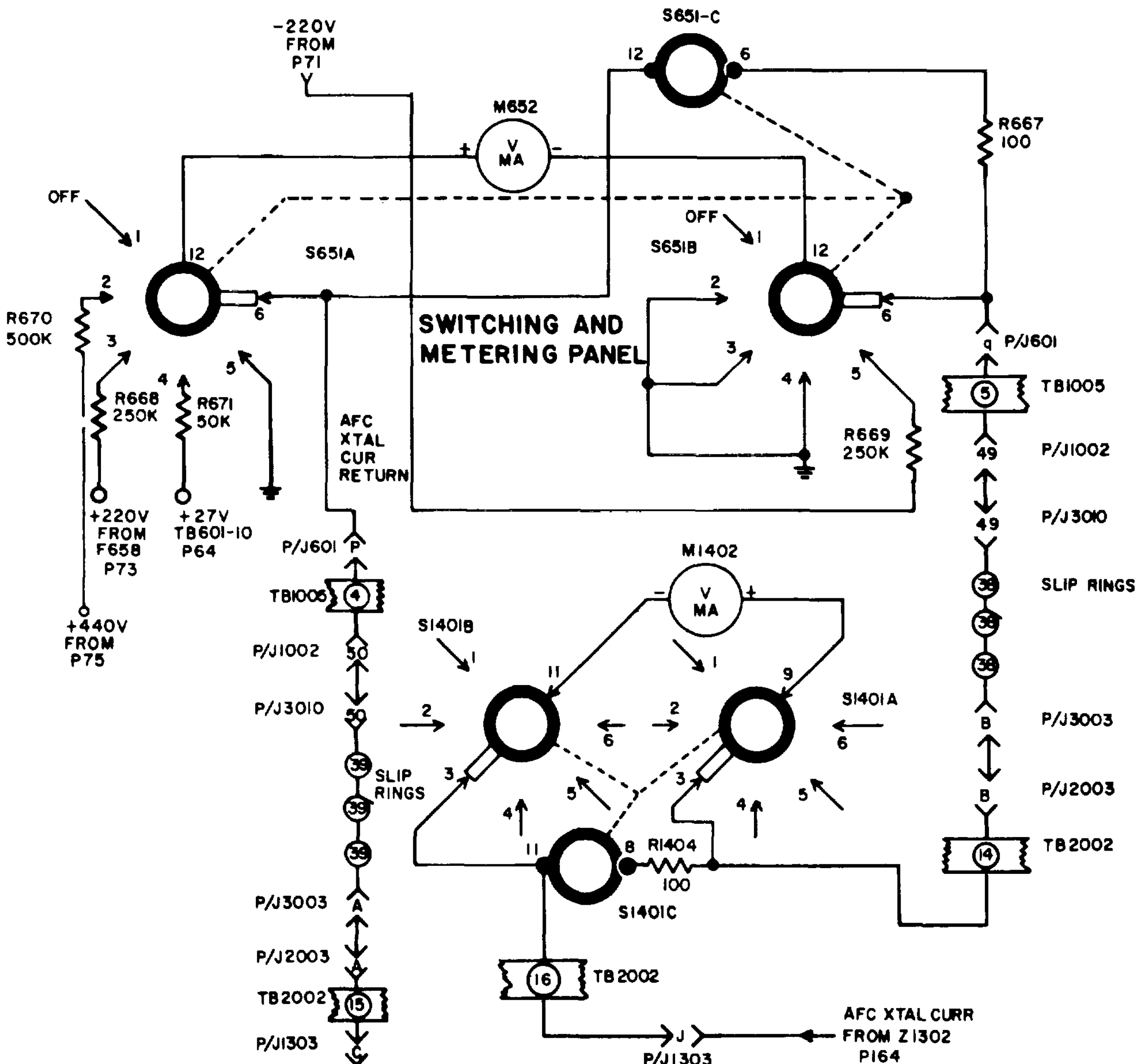
I 1602

R 1632 1633 1624 1625 1627 1626 1634 1635 1609 1610 1639 1612 1613 1614 1630 1631 1640 1637

+150v rectifier



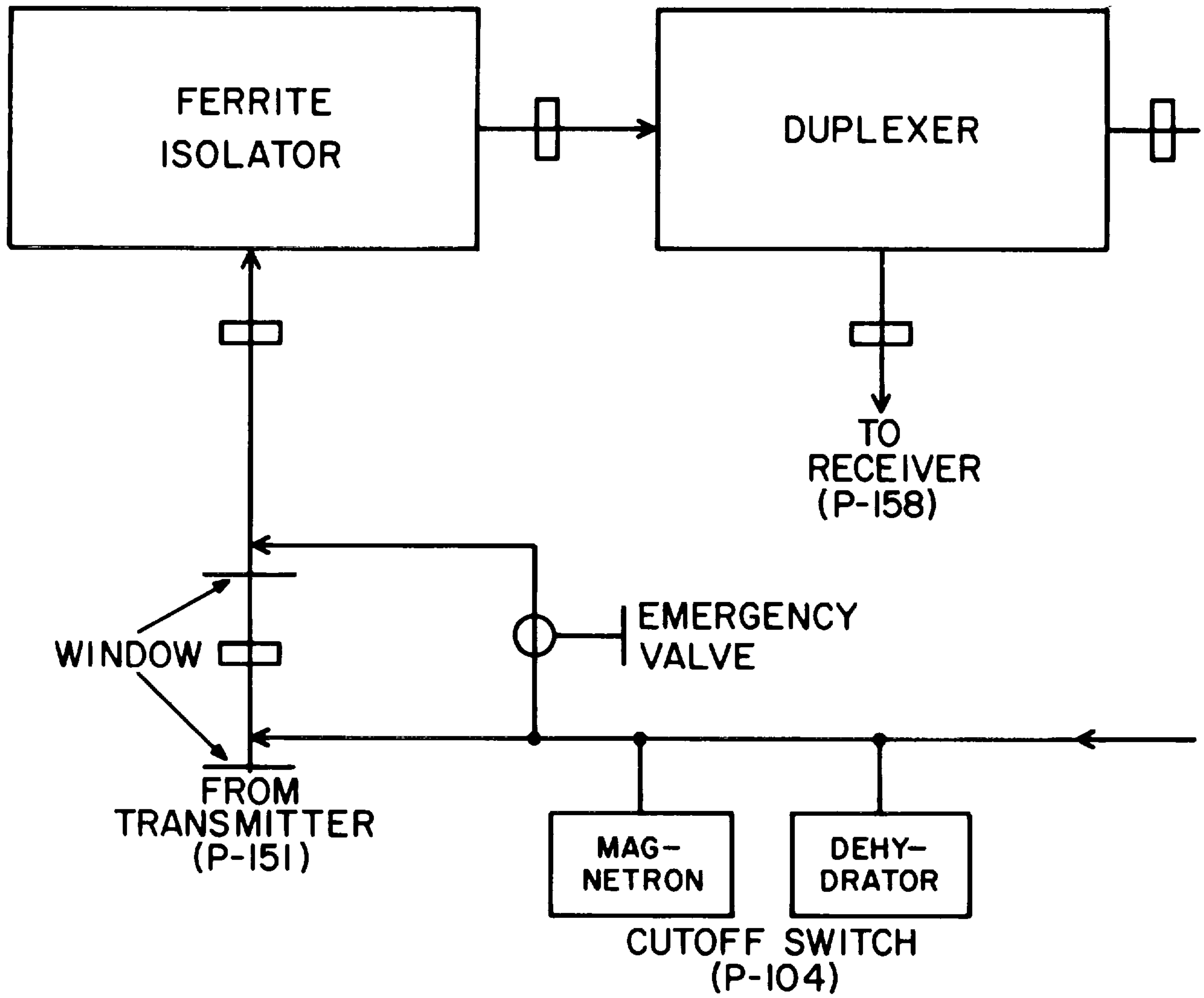
KEEP-ALIVE POWER SUPPLY



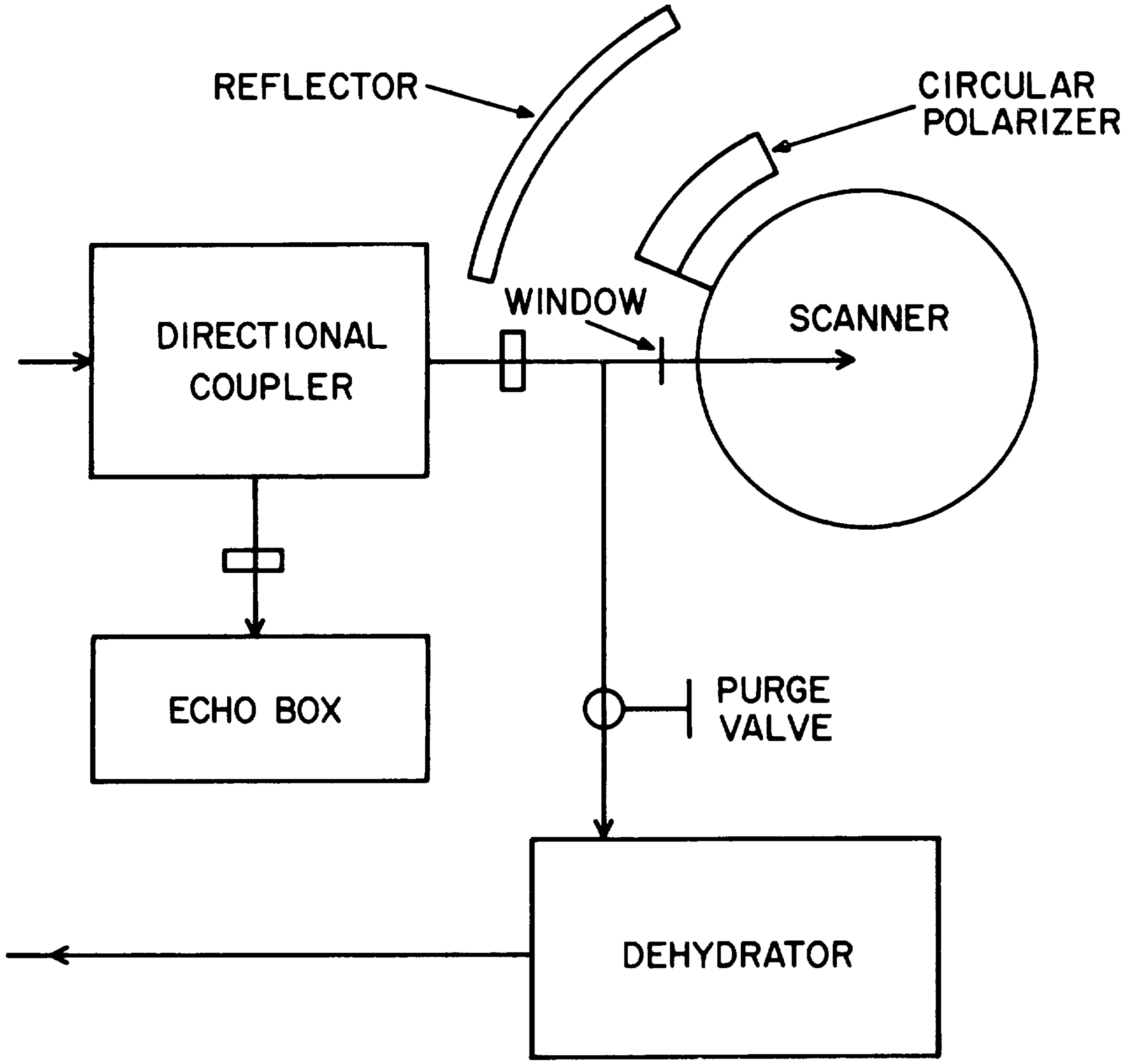
Switching and metering panel.

Switching and metering panel

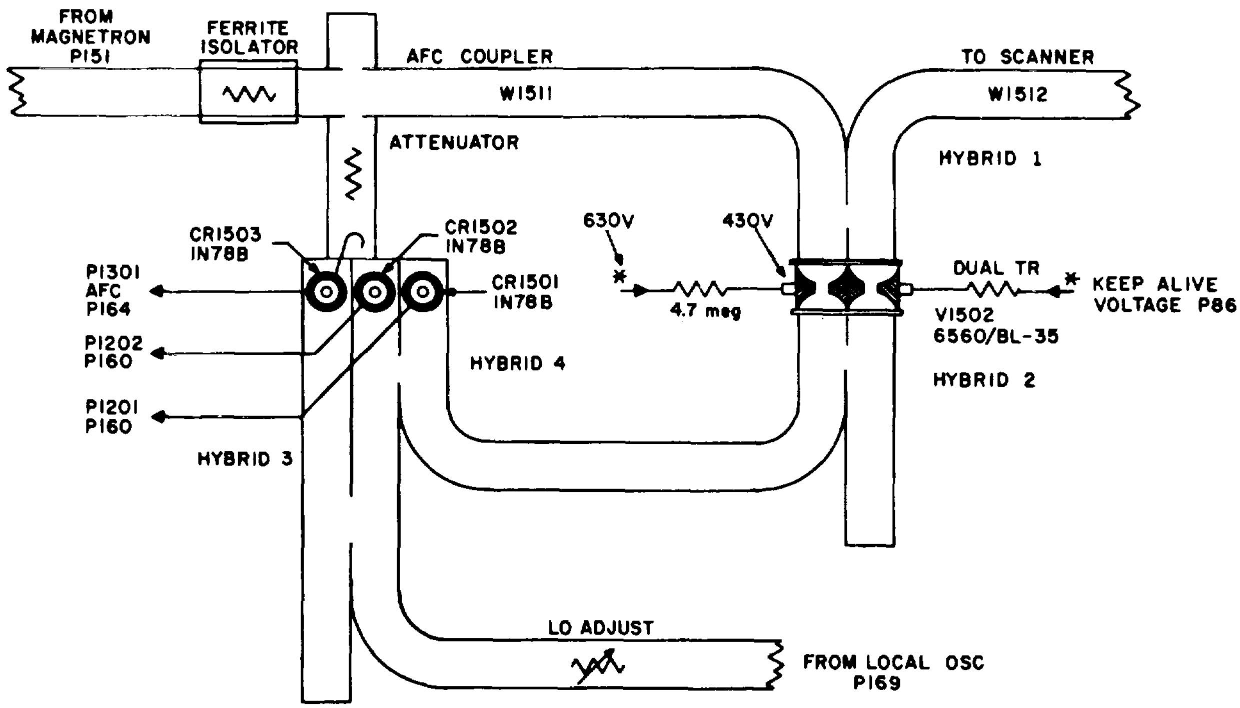
NOTES



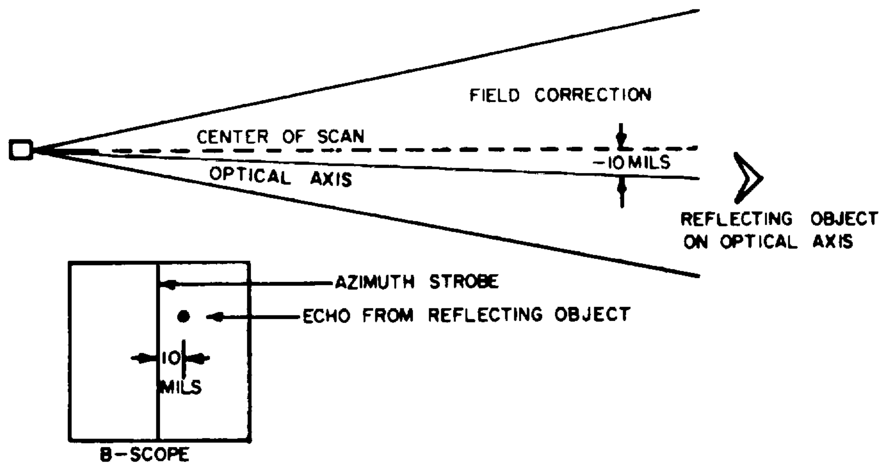
RF system block diagram



RF system block diagram –Continued.



Duplexer and mixer assemblies

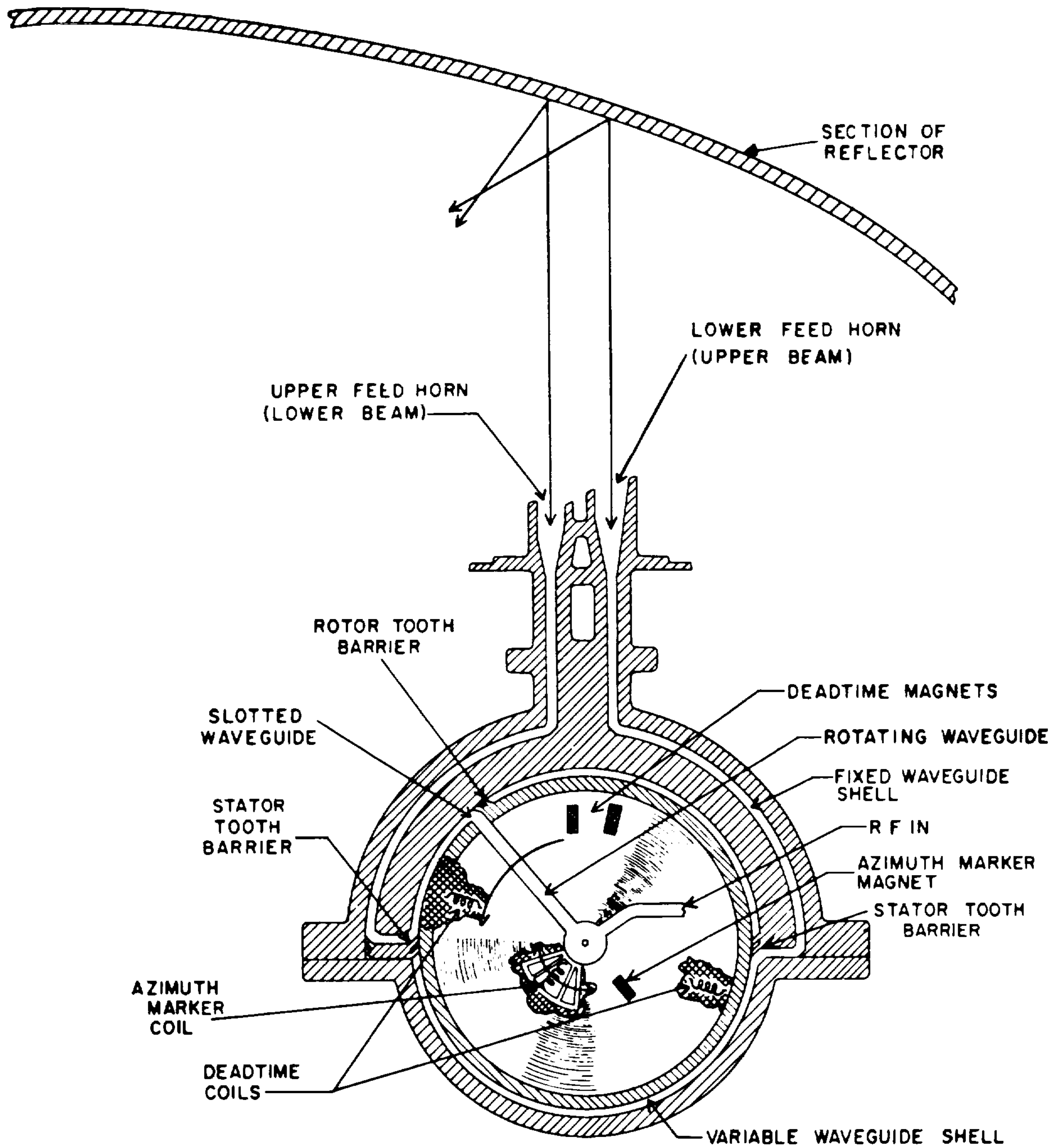


A FREQUENCY OF LESS THEN 16,000 MEGACYCLES SHIFTS THE CENTER OF SCAN TO THE LEFT.

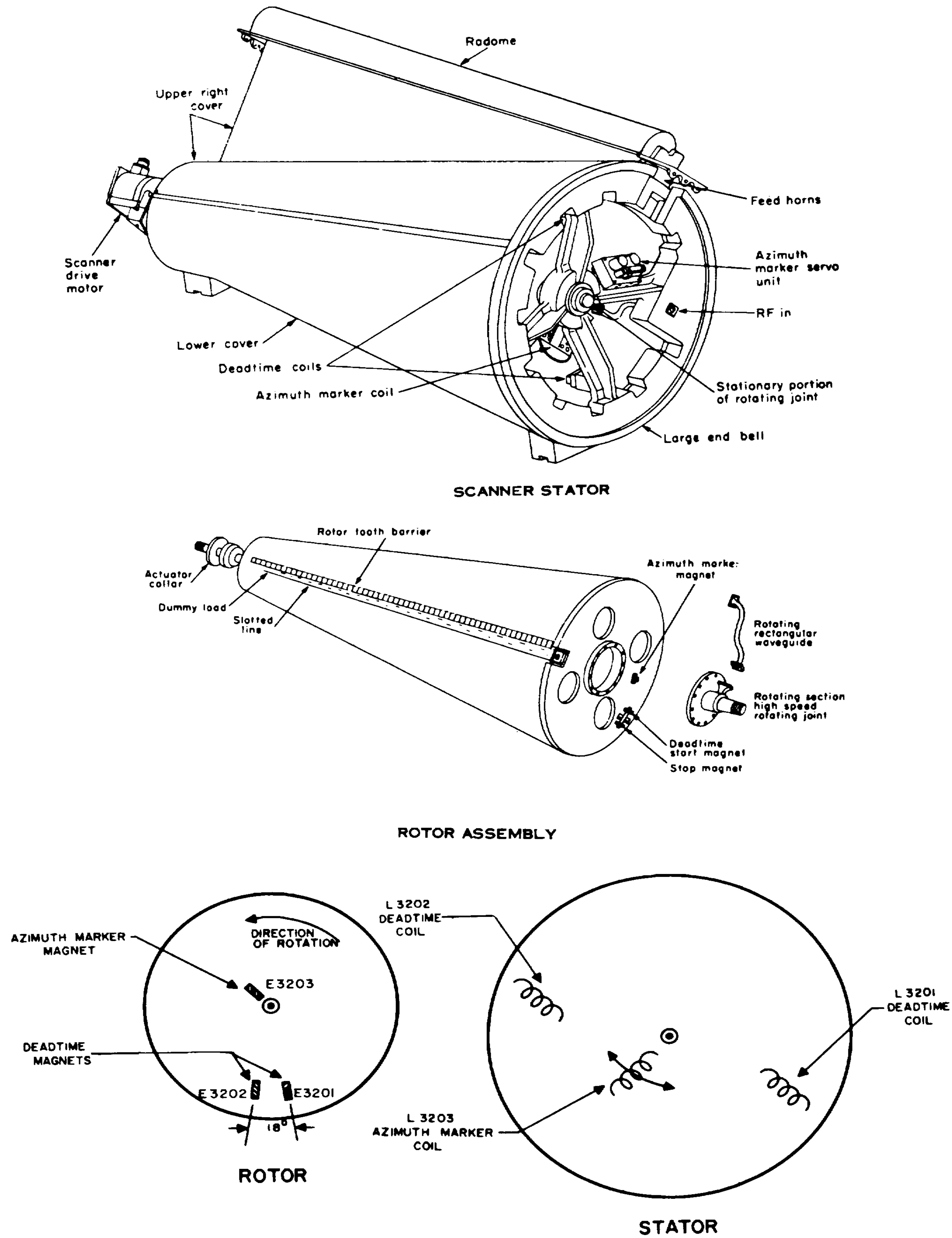
COLLIMATION CHECK

FREQUENCY	FIELD
16192	+12
16176	+11
16160	+10
16144	+9
16128	+8
16112	+7
16096	+6
16080	+5
16064	+4
16048	+3
16032	+2
16016	+1
16000	0
15984	-1
15968	-2
15952	-3
15936	-4
15920	-5
15904	-6
15888	-7
15872	-8
15856	-9
15840	-10
15824	-11
15808	-12

Frequency correction chart.



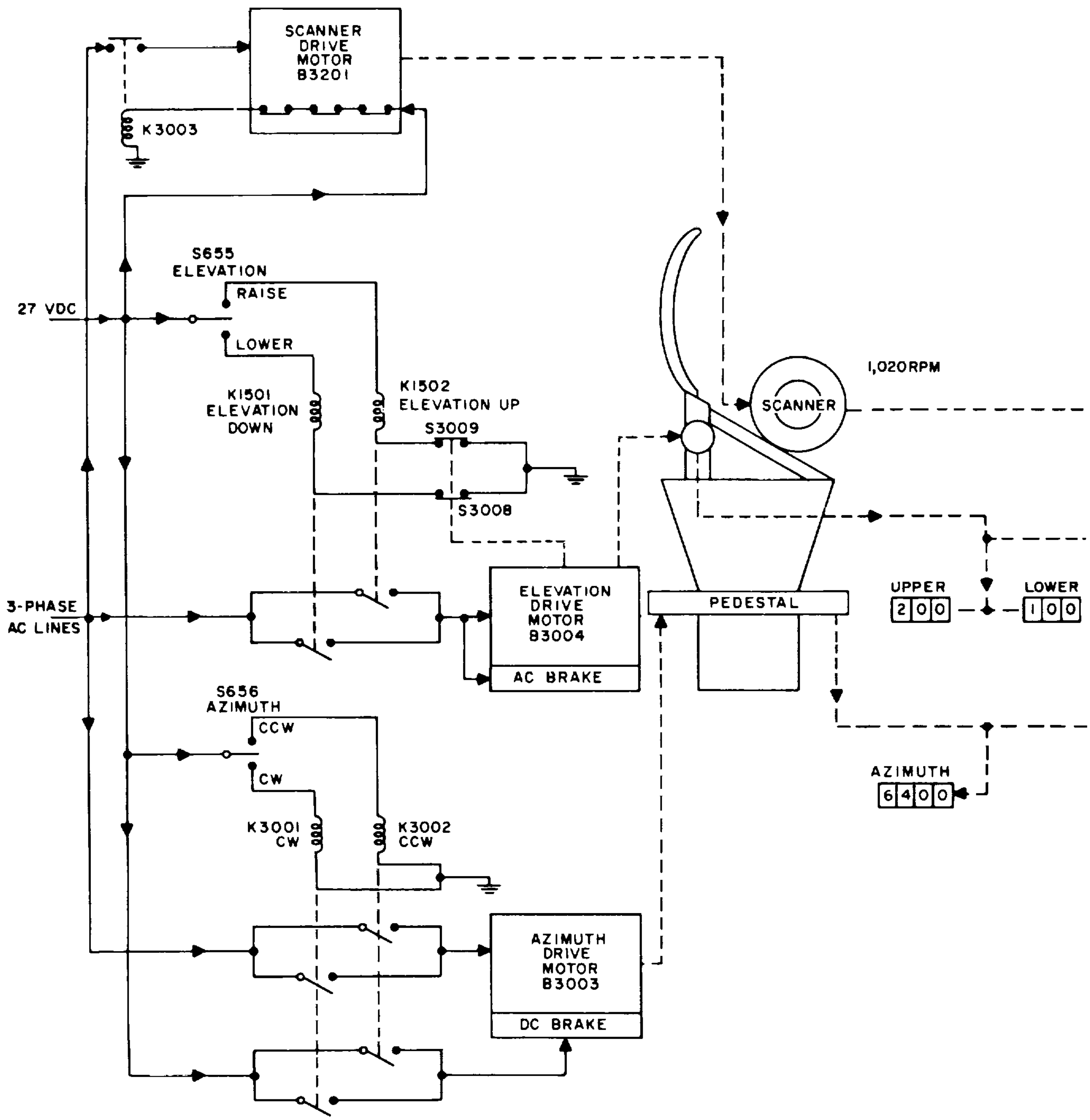
Scanner cross section


Radome
Upper right cover
Feed horns
Azimuth marker servo unit
Scanner drive motor
RF in
Lower cover
Deadtime coils
Azimuth marker coil
Stationary portion of rotating joint
Large end bell
SCANNER STATOR
Rotor tooth barrier
Actuator collar
Dummy load
Slotted line
Azimuth marker magnet
Rotating rectangular waveguide
Rotating section high speed rotating joint
Deadtime start magnet
Stop magnet
ROTOR ASSEMBLY
AZIMUTH MARKER MAGNET
DIRECTION OF ROTATION
E3203
DEADTIME MAGNETS
E3202
E3201
18°
ROTOR
L 3202 DEADTIME COIL
L 3201 DEADTIME COIL
L 3203 AZIMUTH MARKER COIL
STATOR

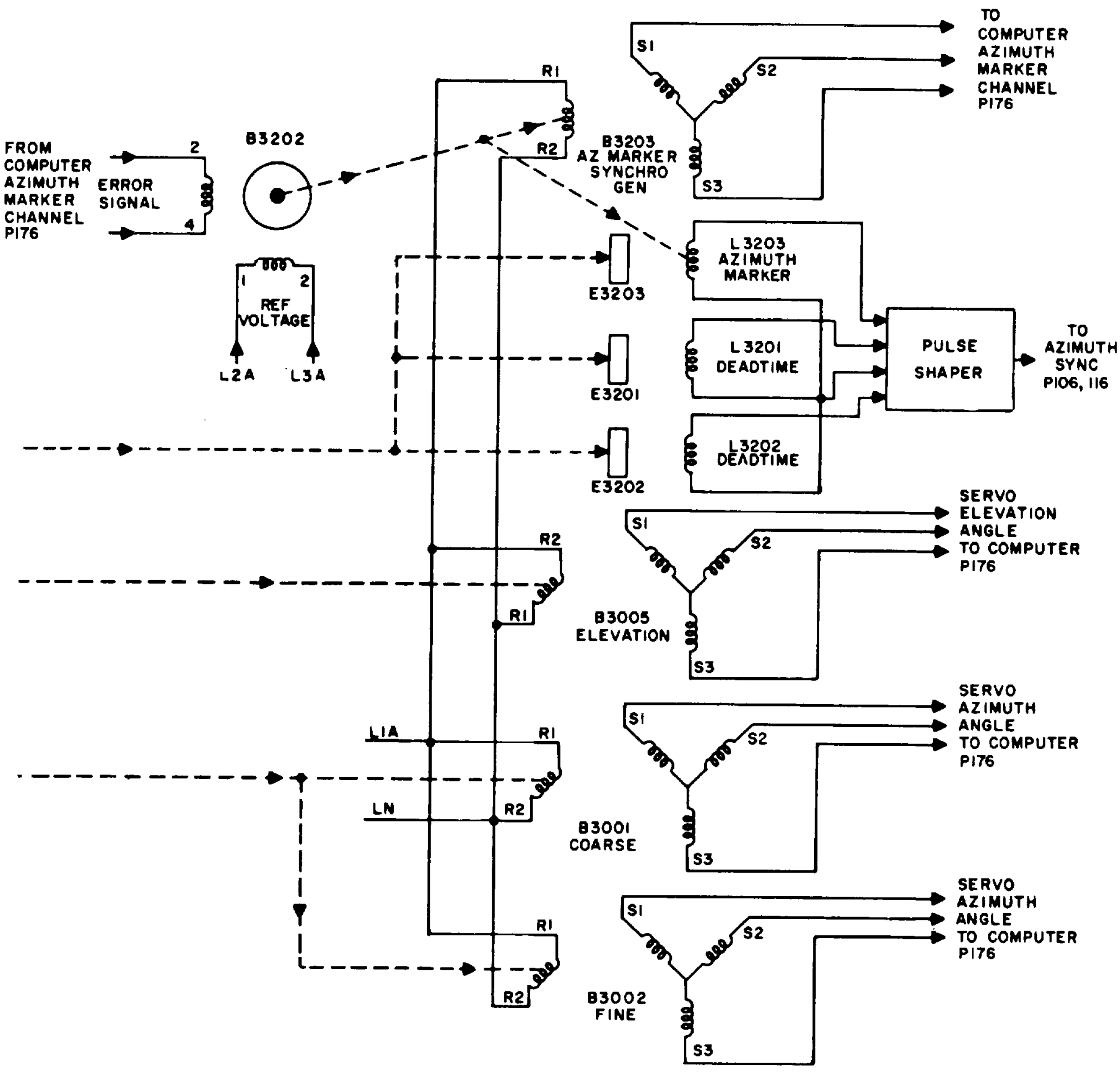
Scanner

NOTES

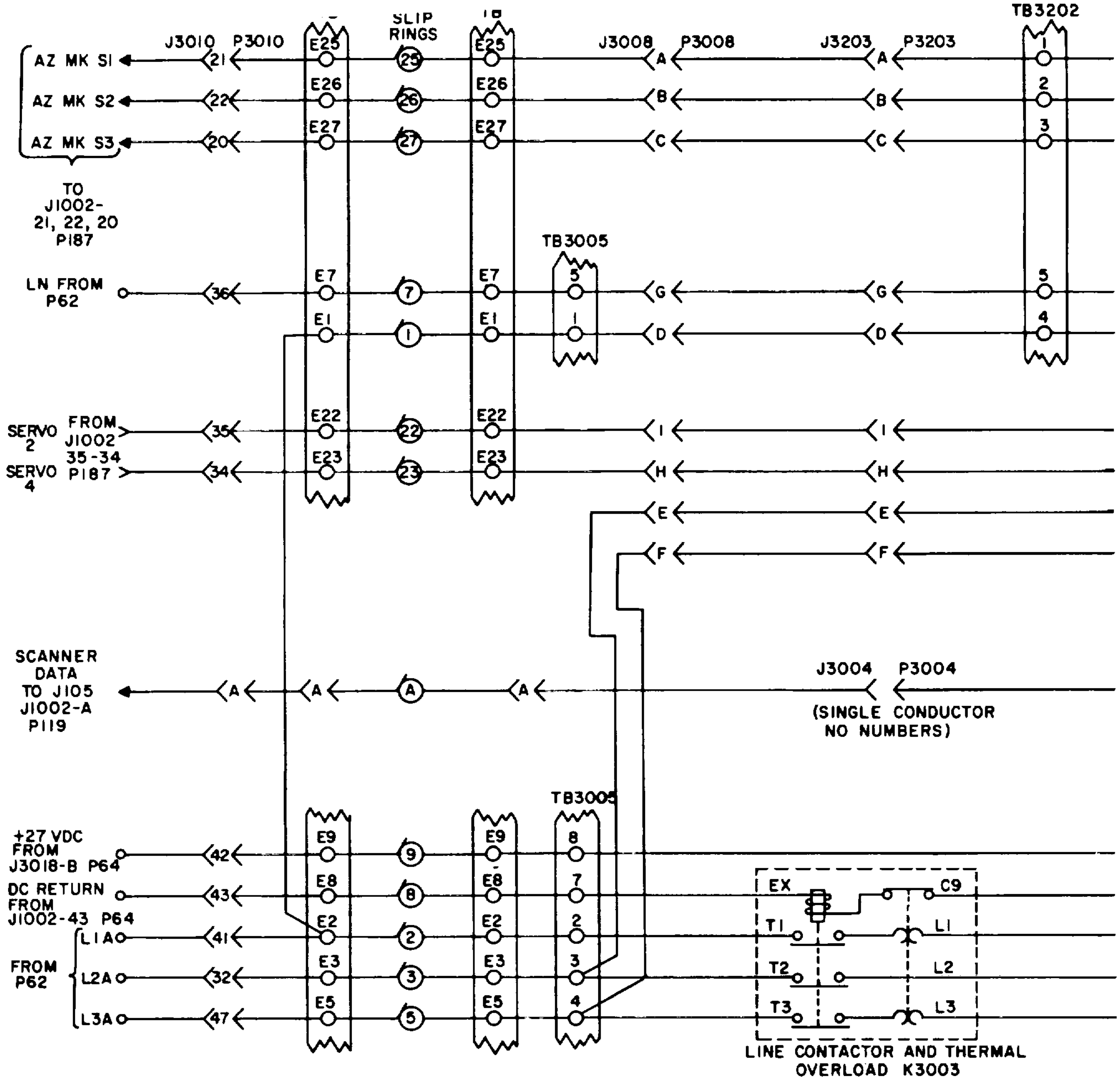
NOTES



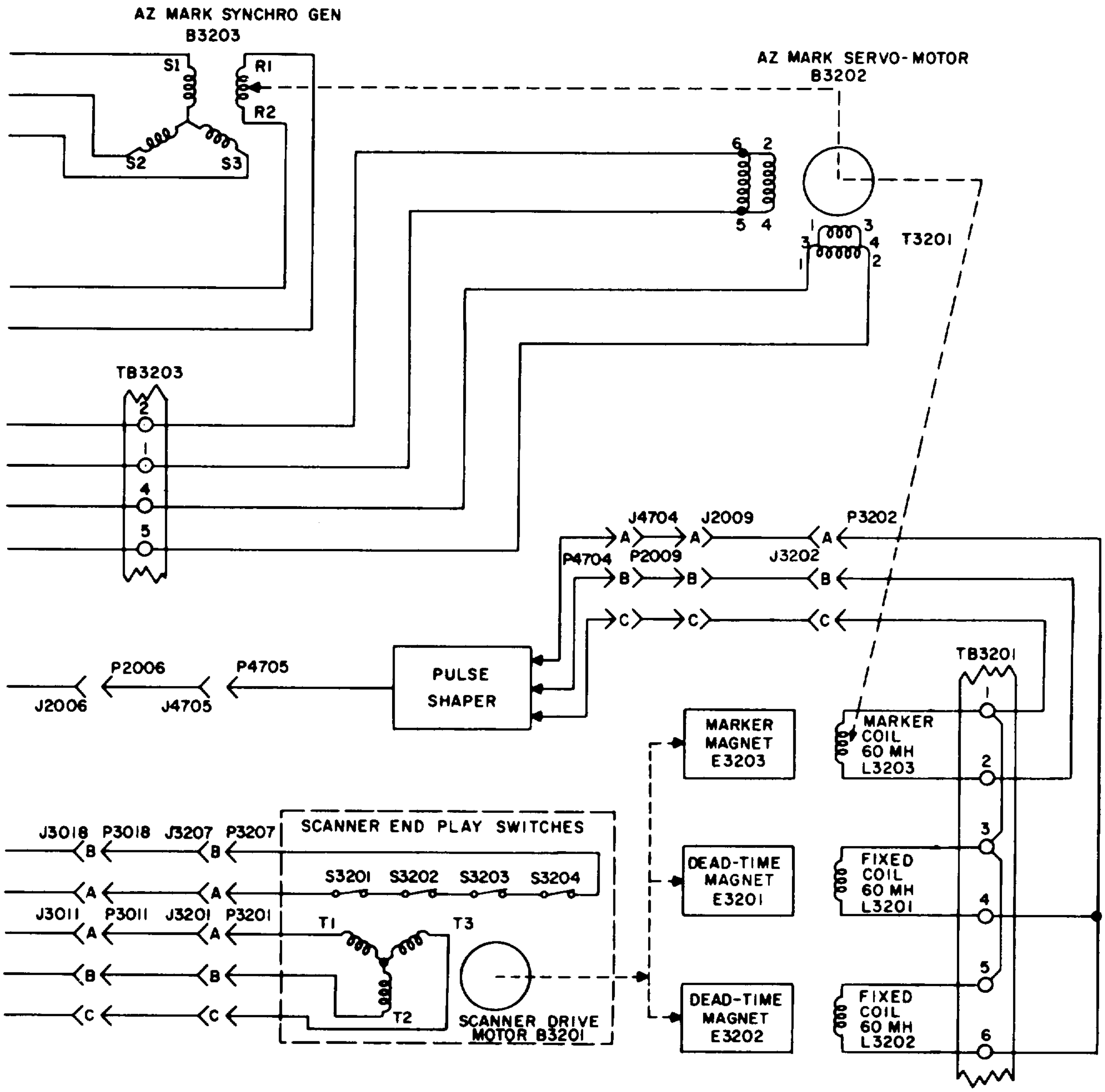
Antenna positioning system detailed block diagram.



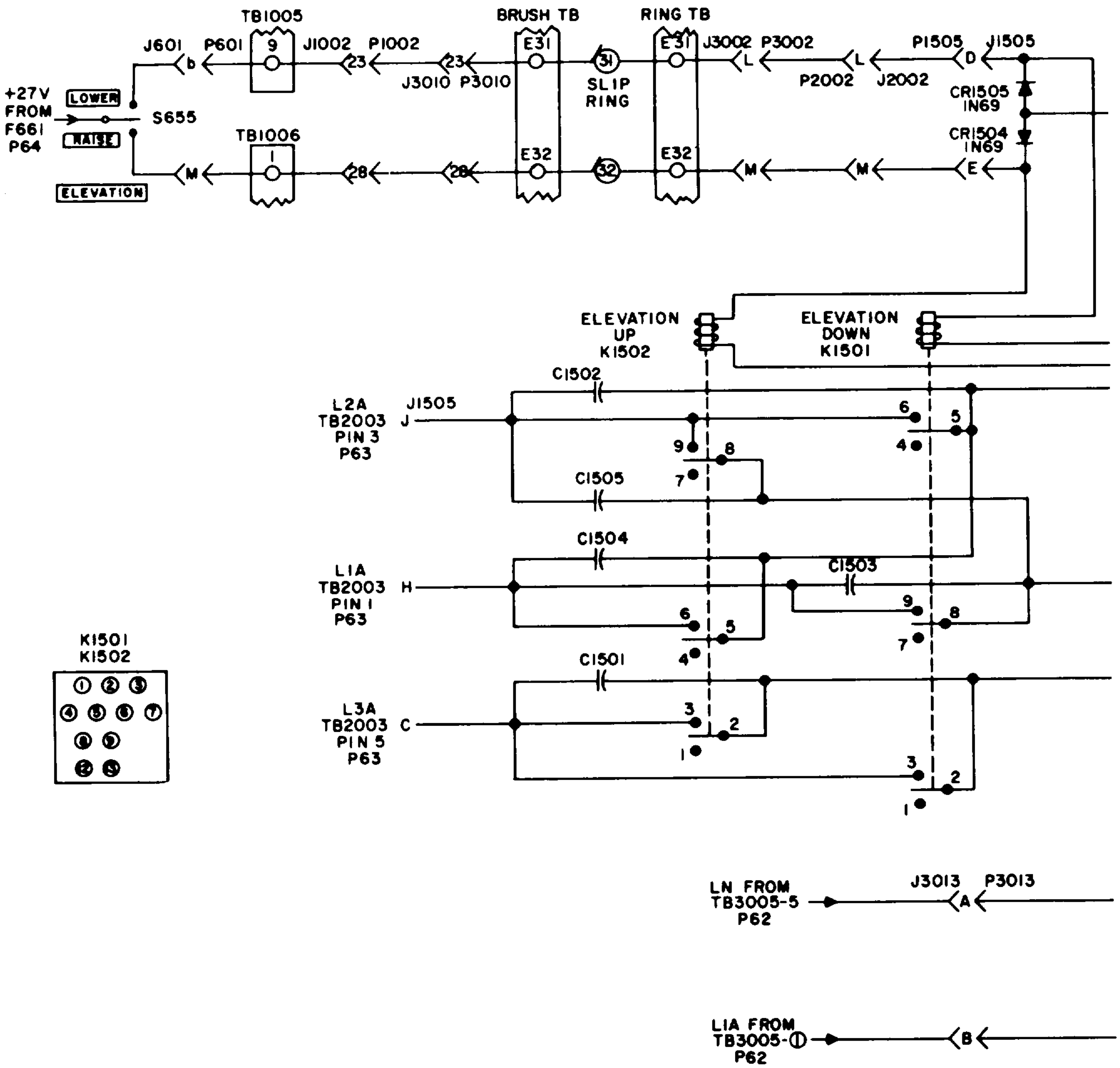
Antenna positioning system detailed block diagram – Continued



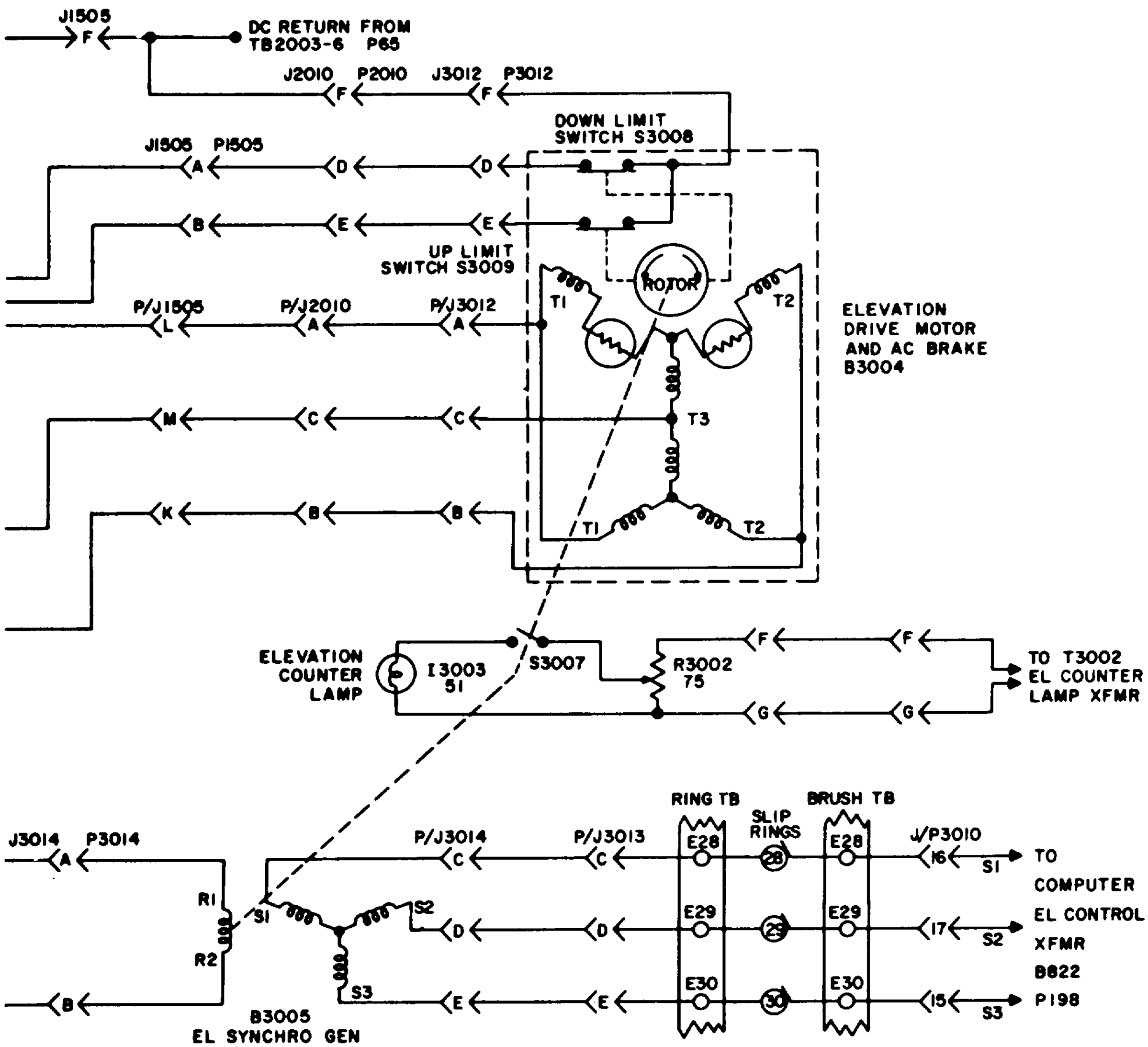
Scanner drive and data takeoff.



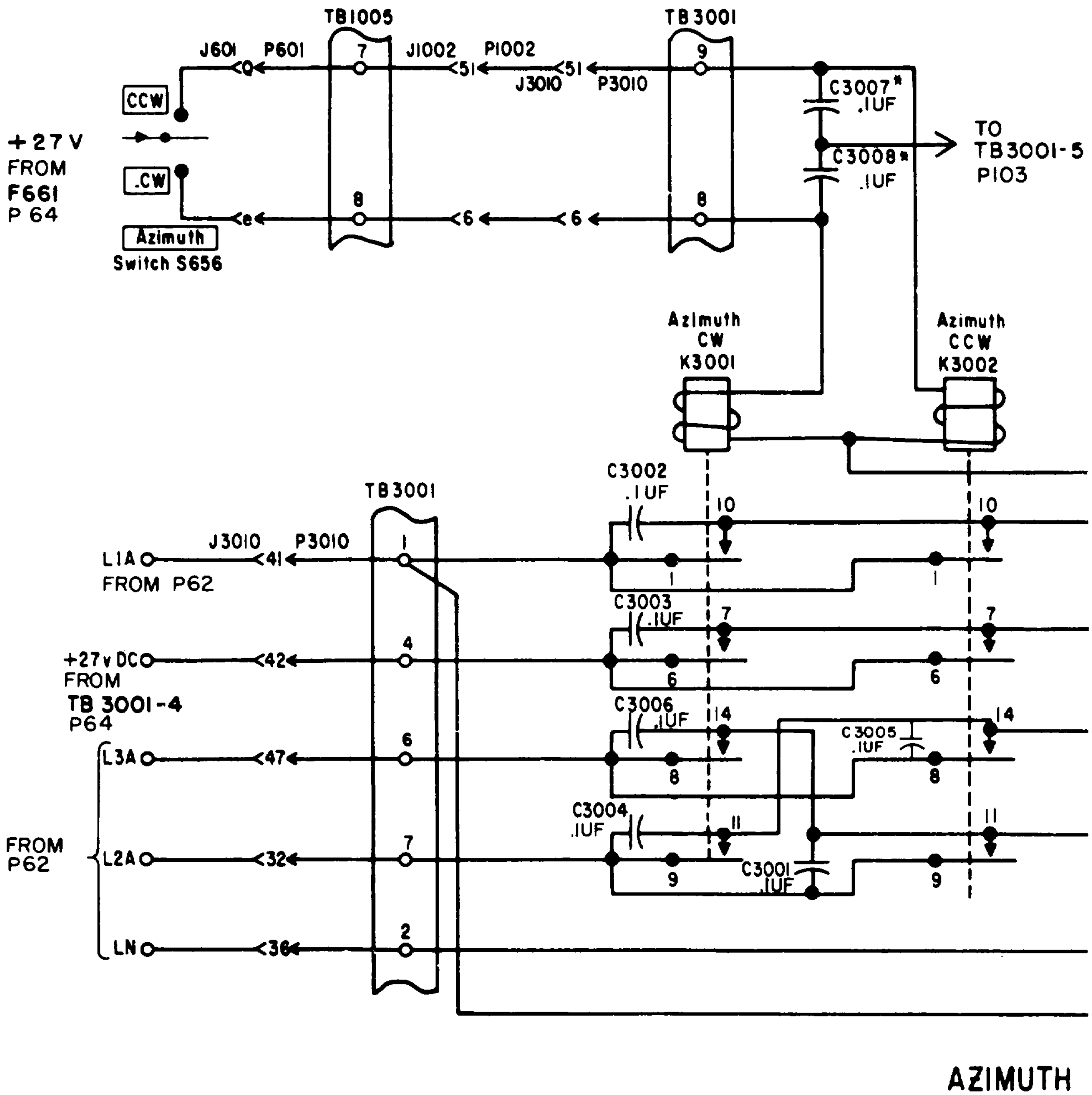
<u>Scanner drive and data takeoff</u>--Continued.



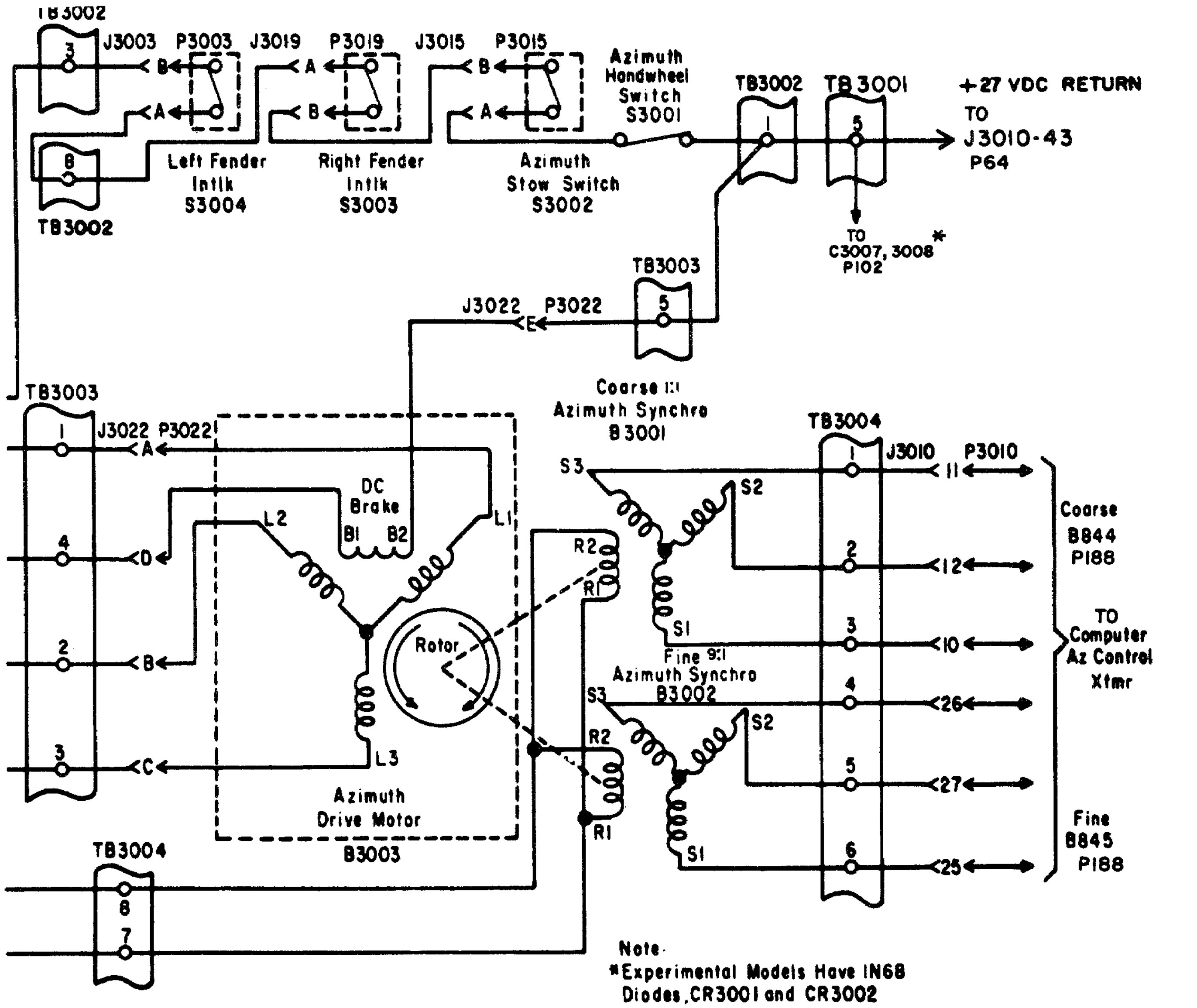
Elevation channel.



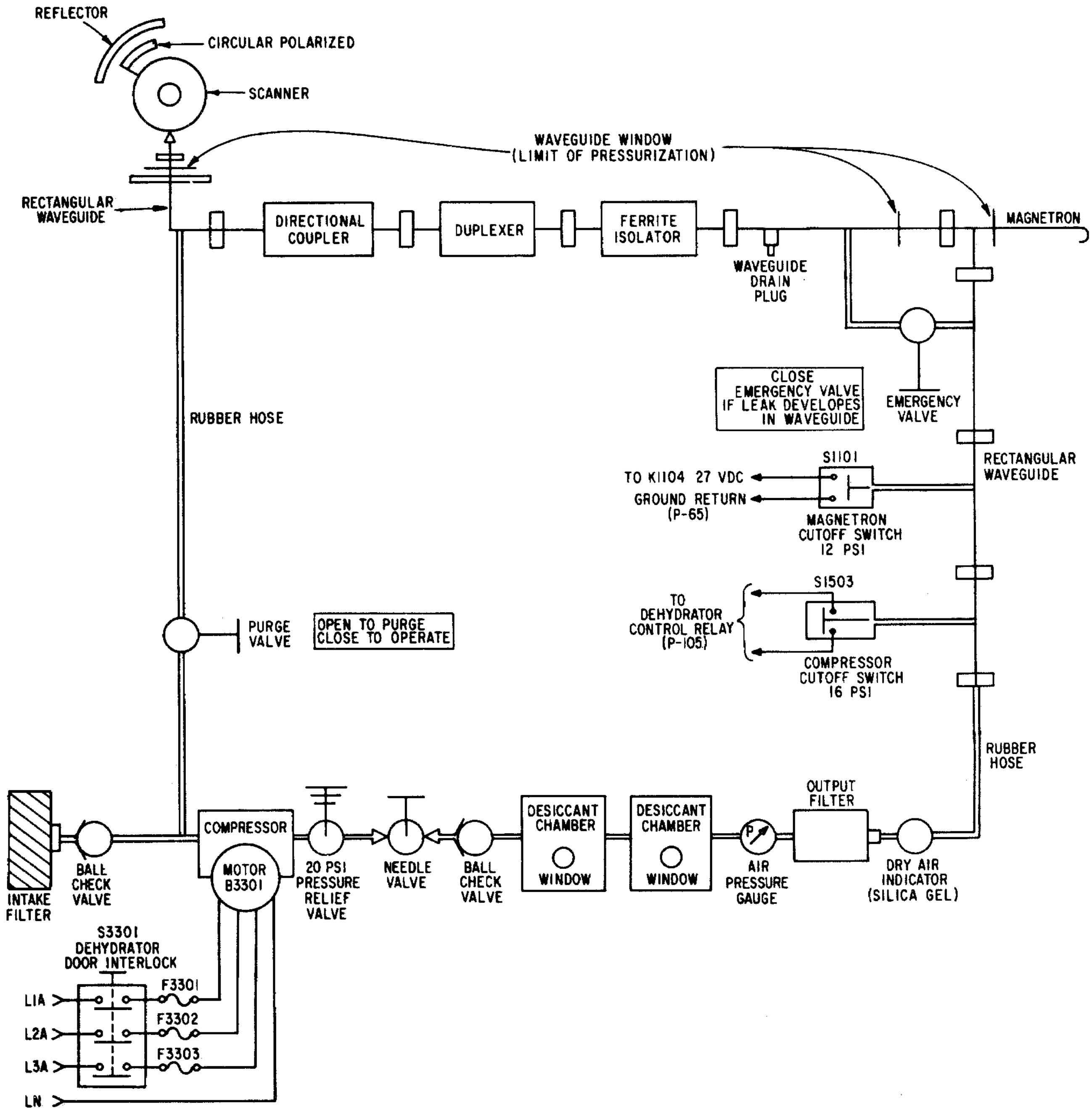
Elevation channel-- Continued.



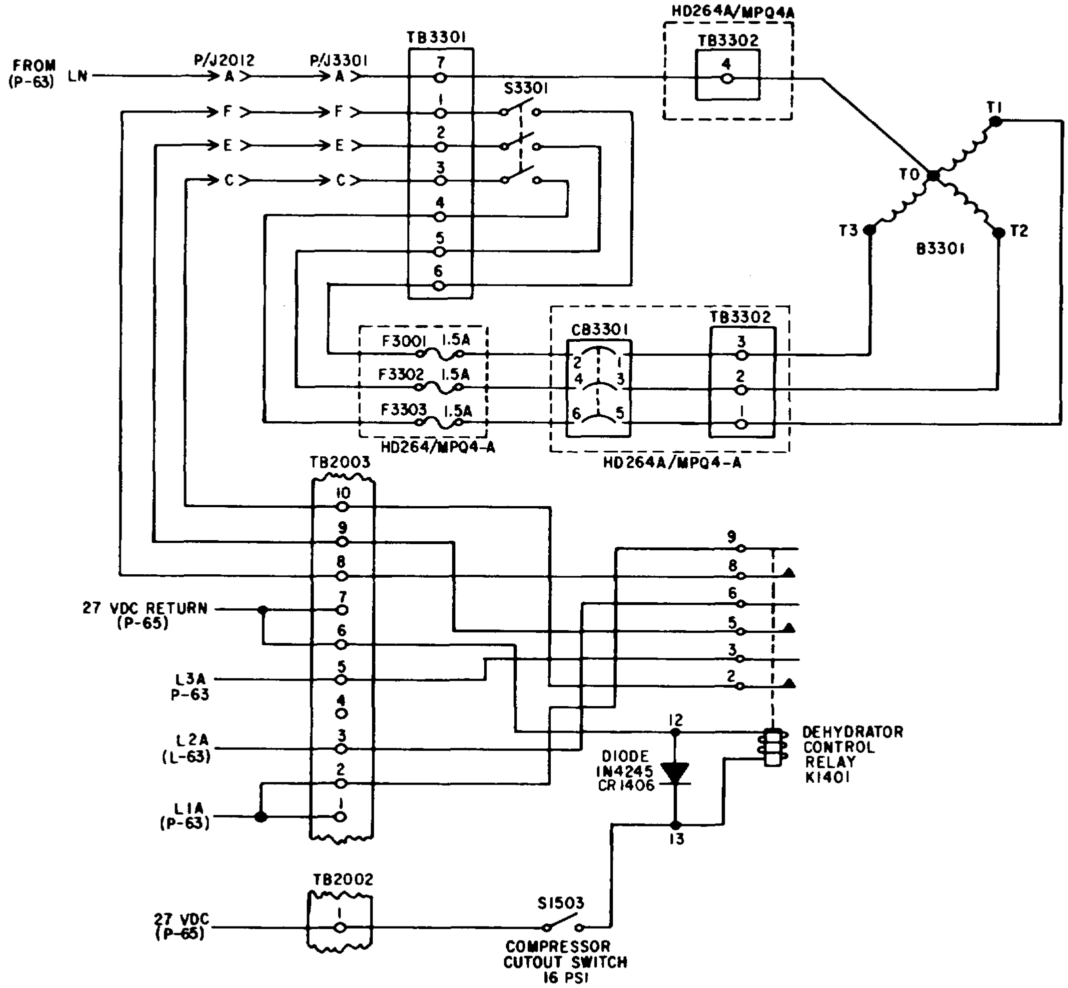
Azimuth channel.



<u>Azmith channel</u> –Continued

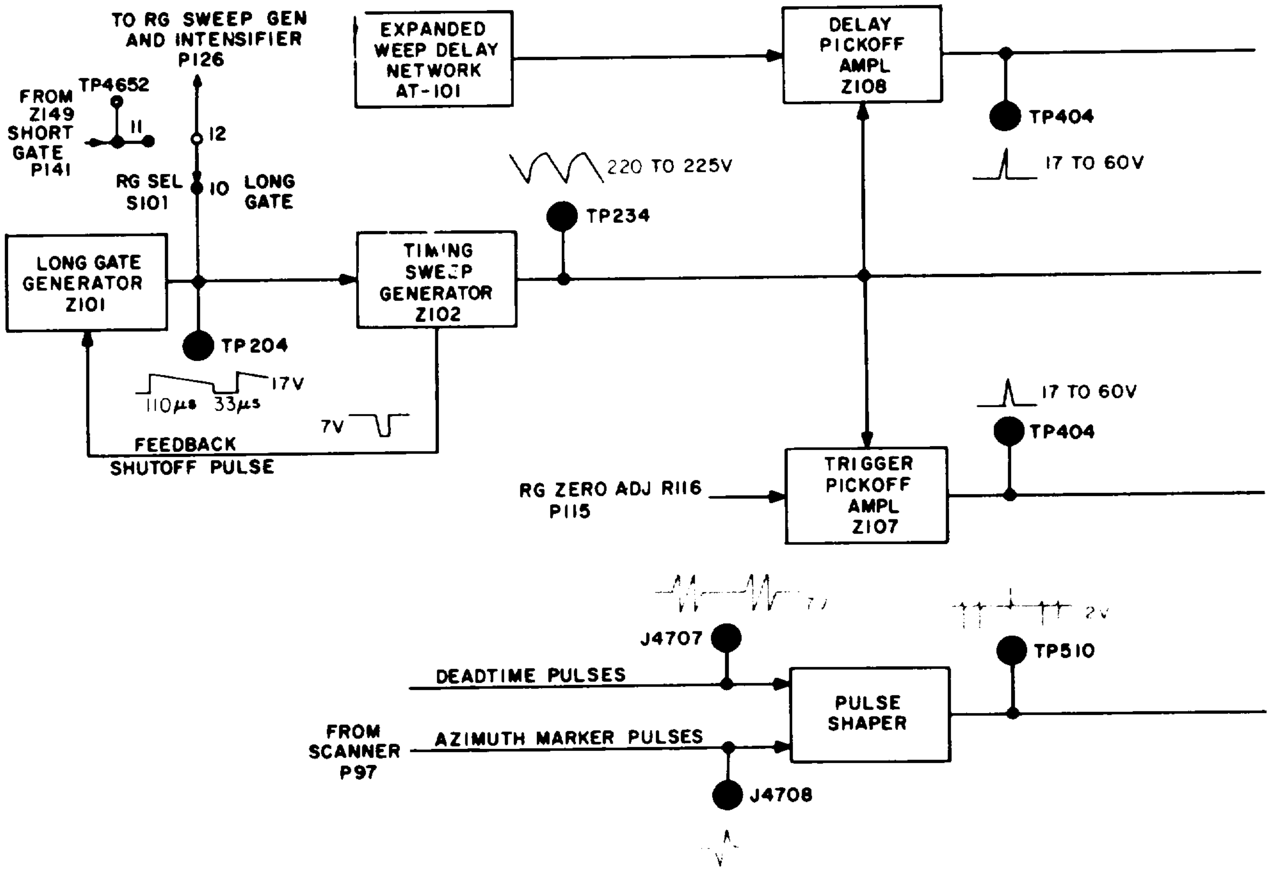


Dehydrator block diagram.

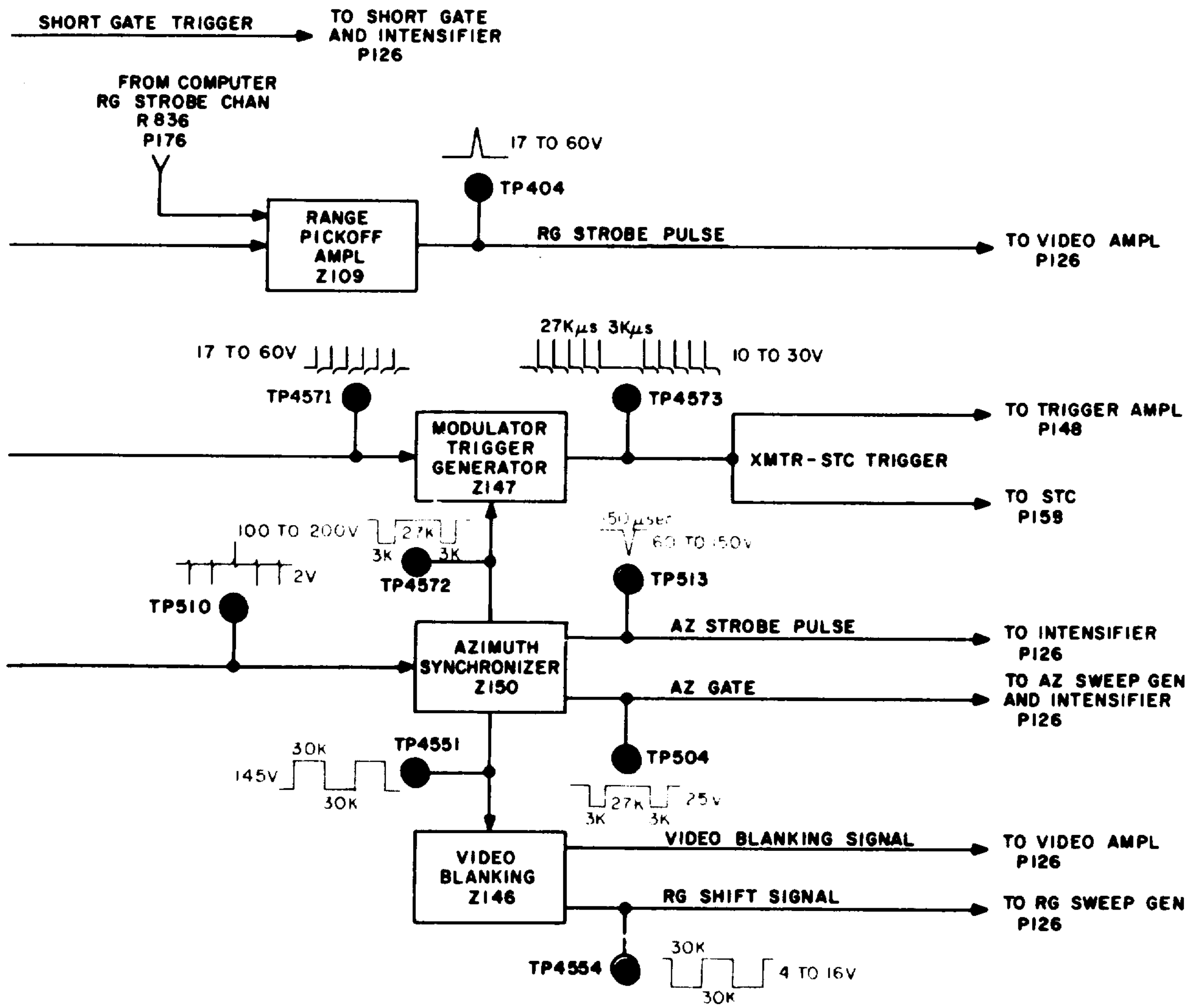


Dehydrator schematic diagram (modified)

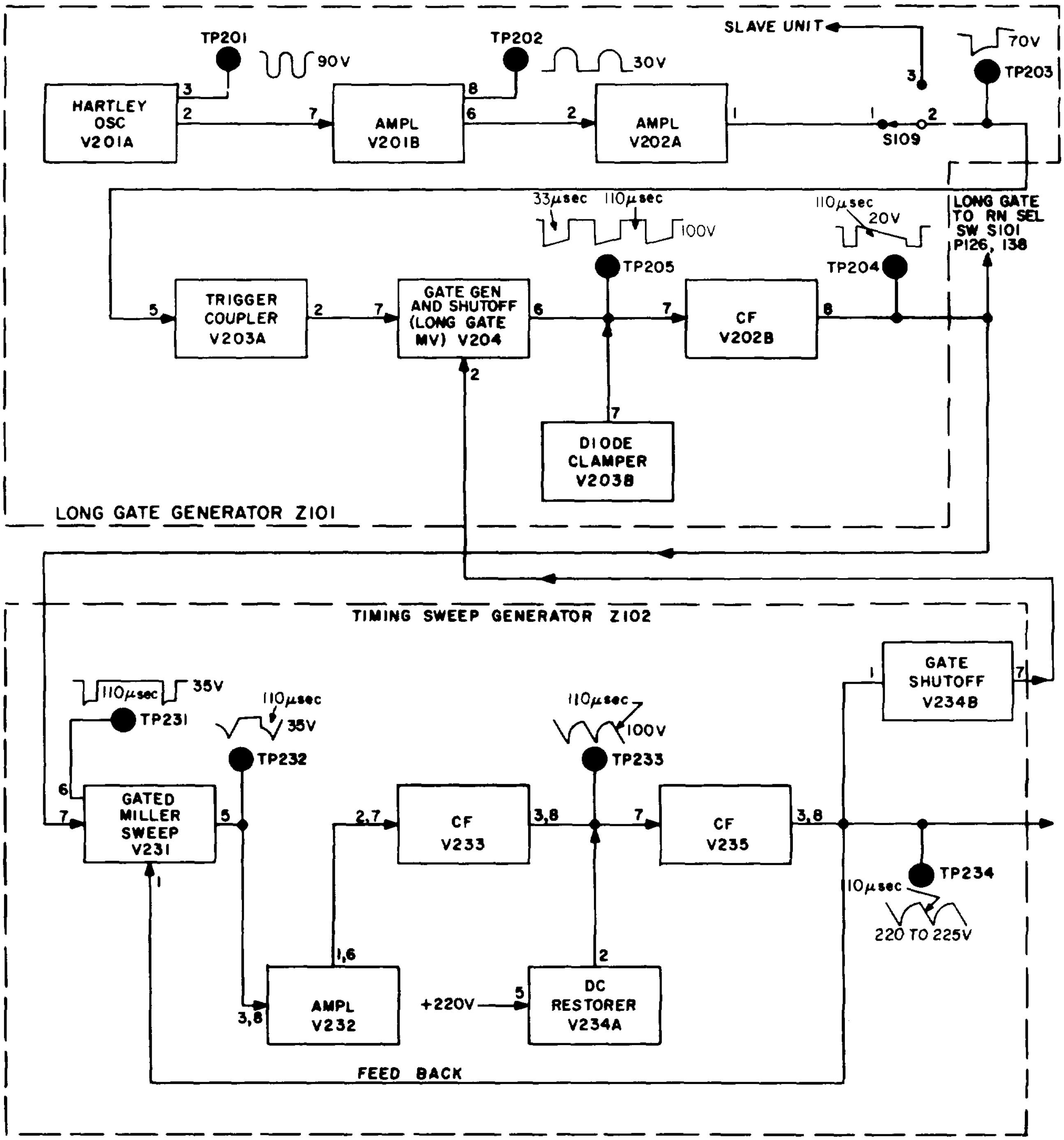
SYNCHRONIZING SYSTEM



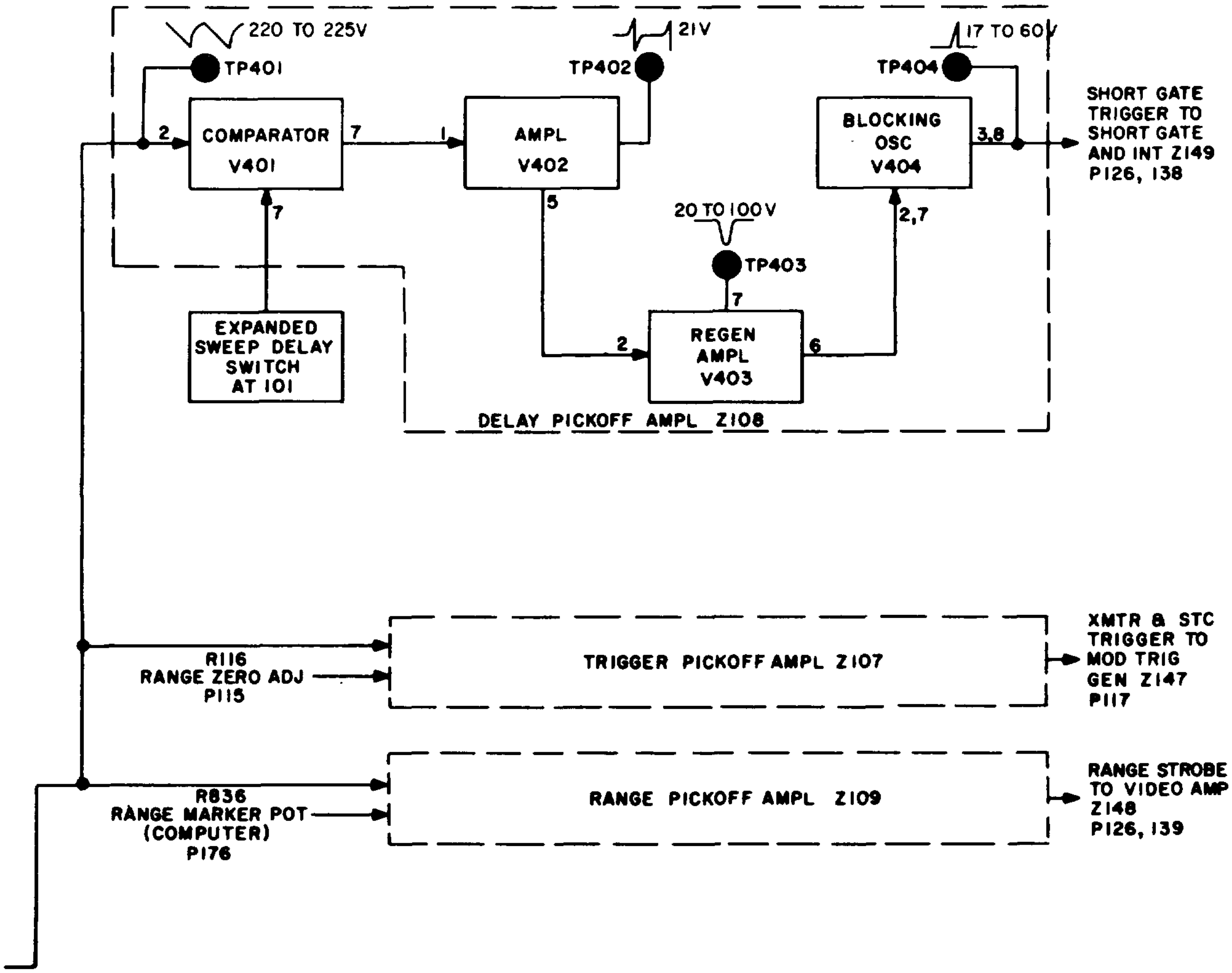
Synchronizer system block diagram.



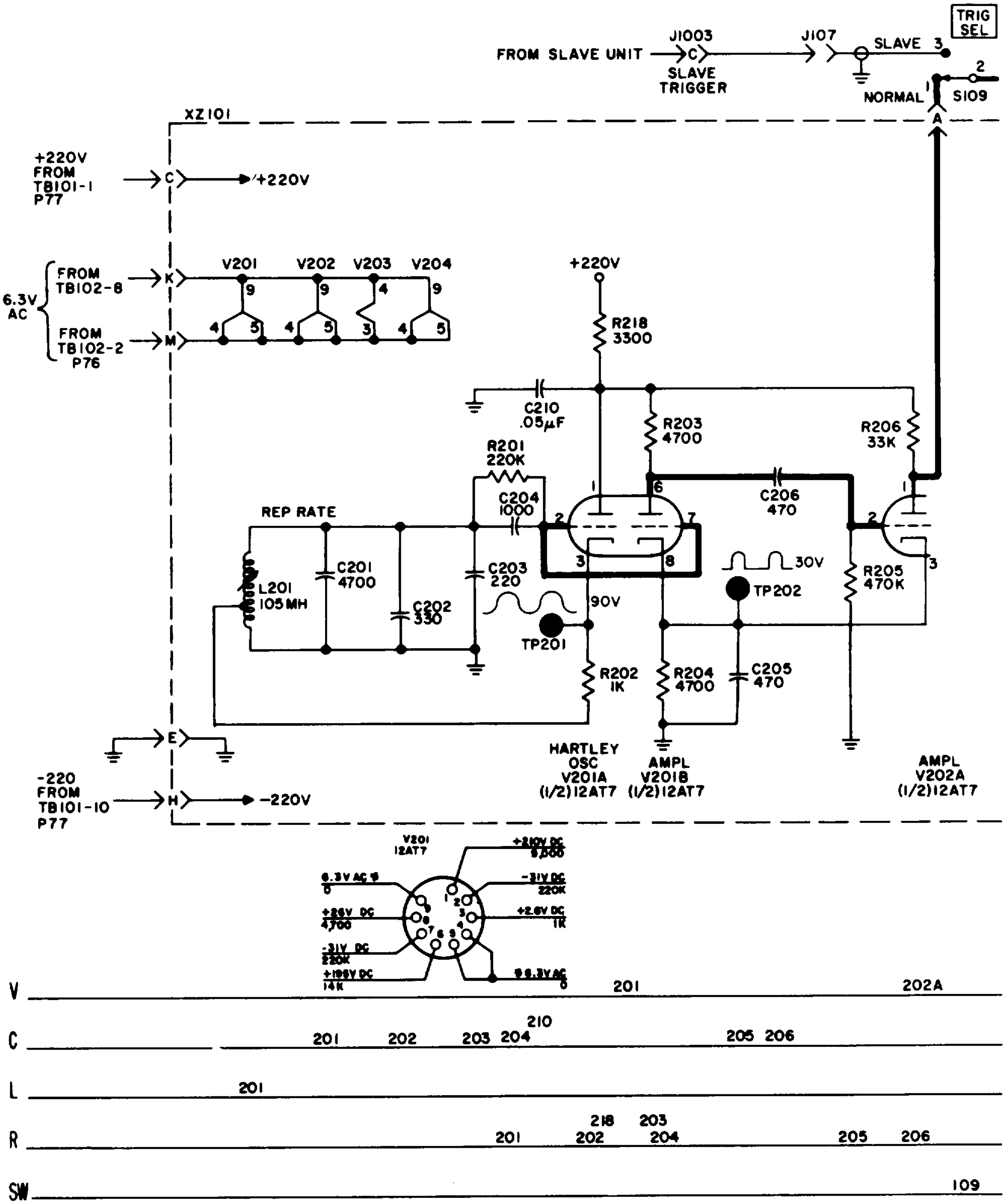
Synchronizer system block diagram-- Continued.



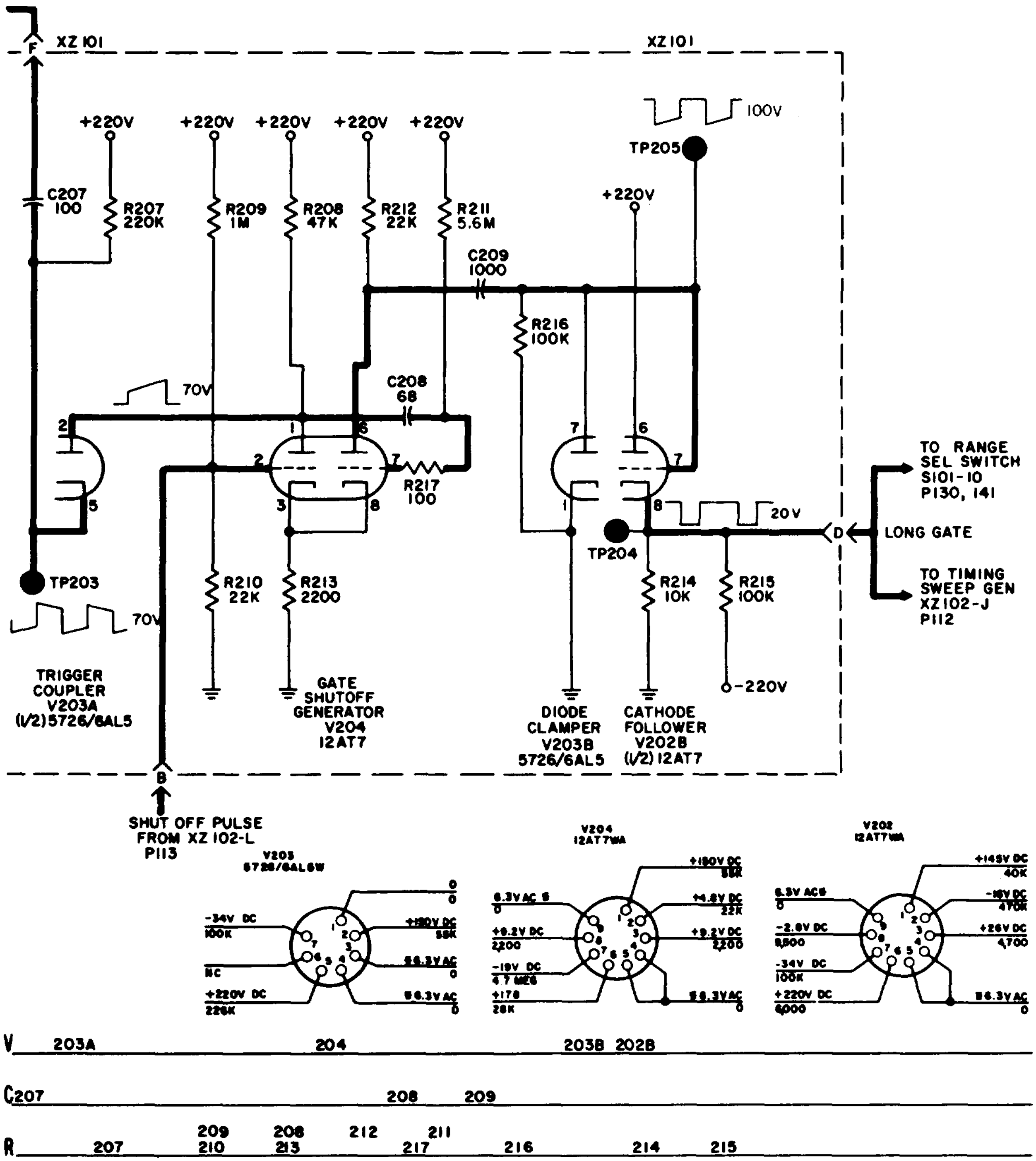
Long gate generator, timing sweep generator block diagram.



Pickoff amplifier block diagram

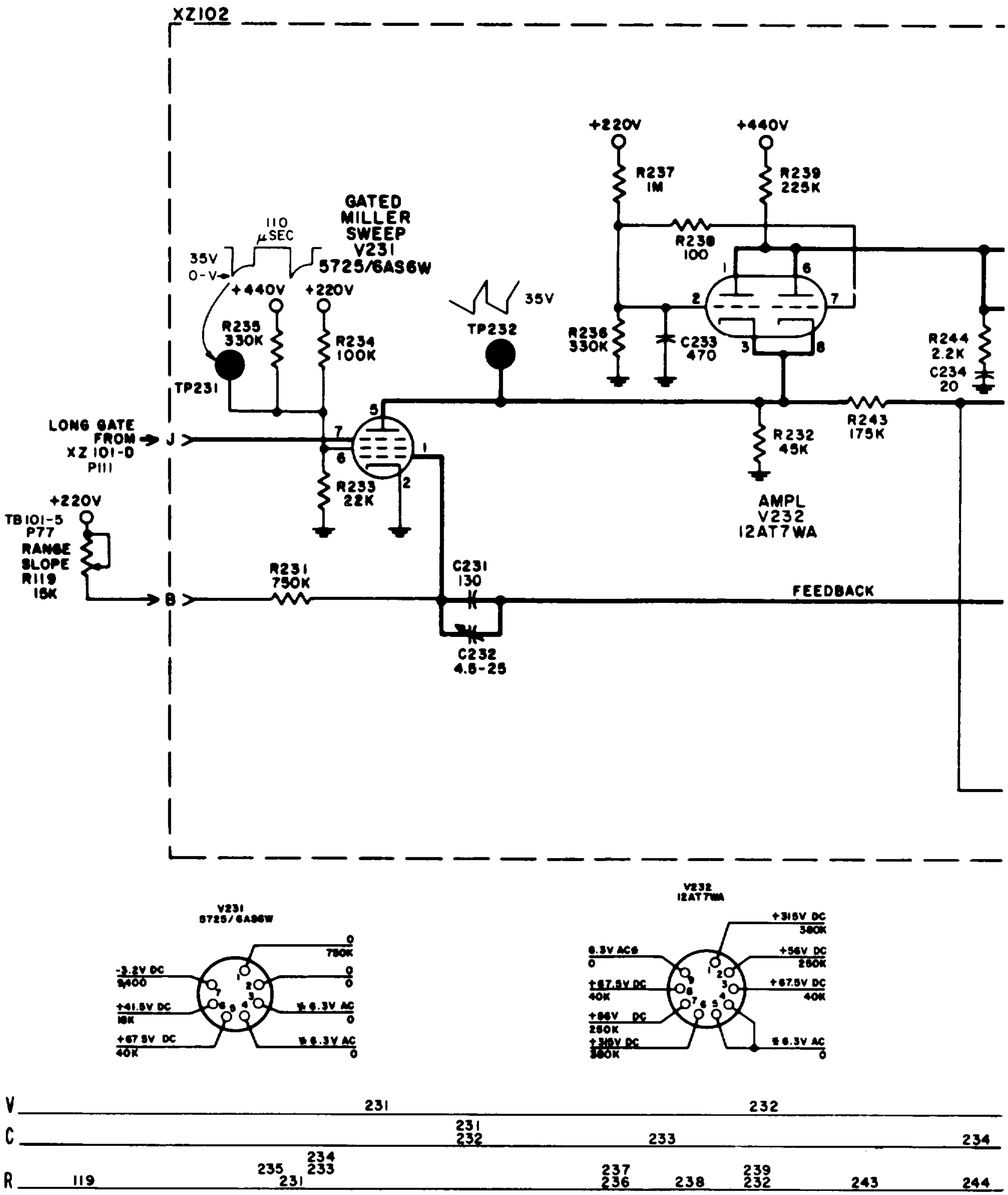


Long gate generator ZO11.

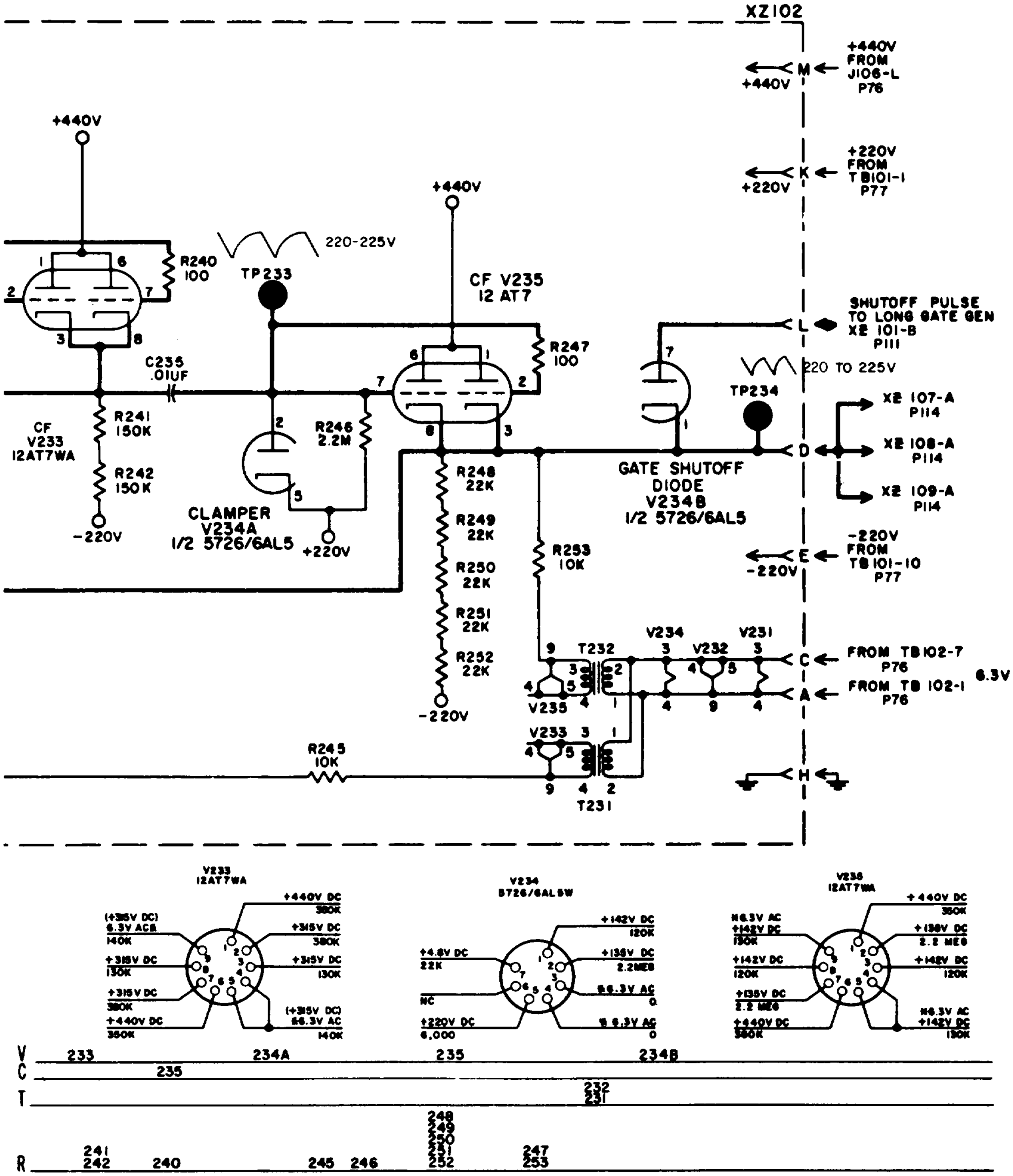


Long gate generator Z101--Continued.

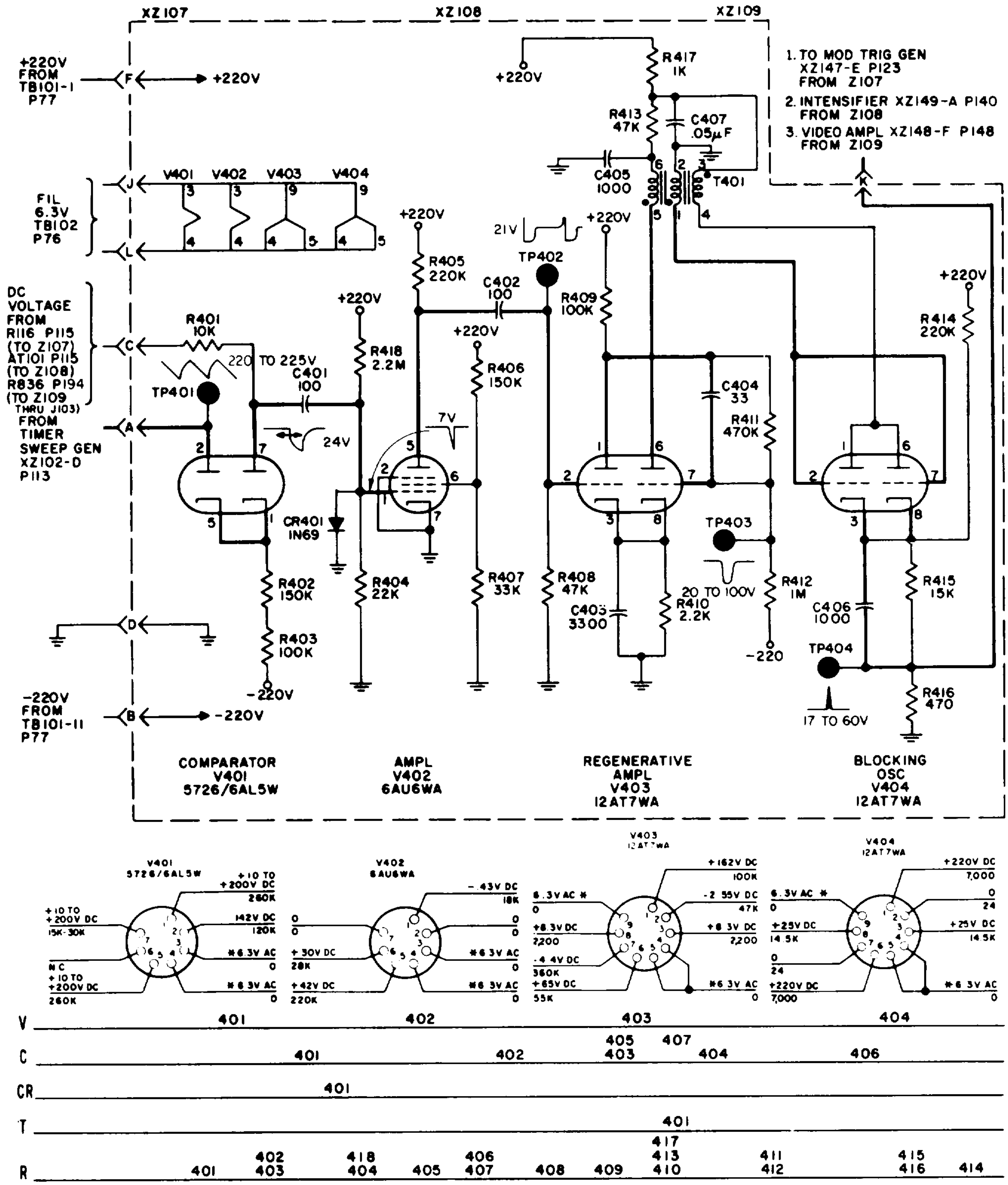
Long gate generator Z101—Continued.



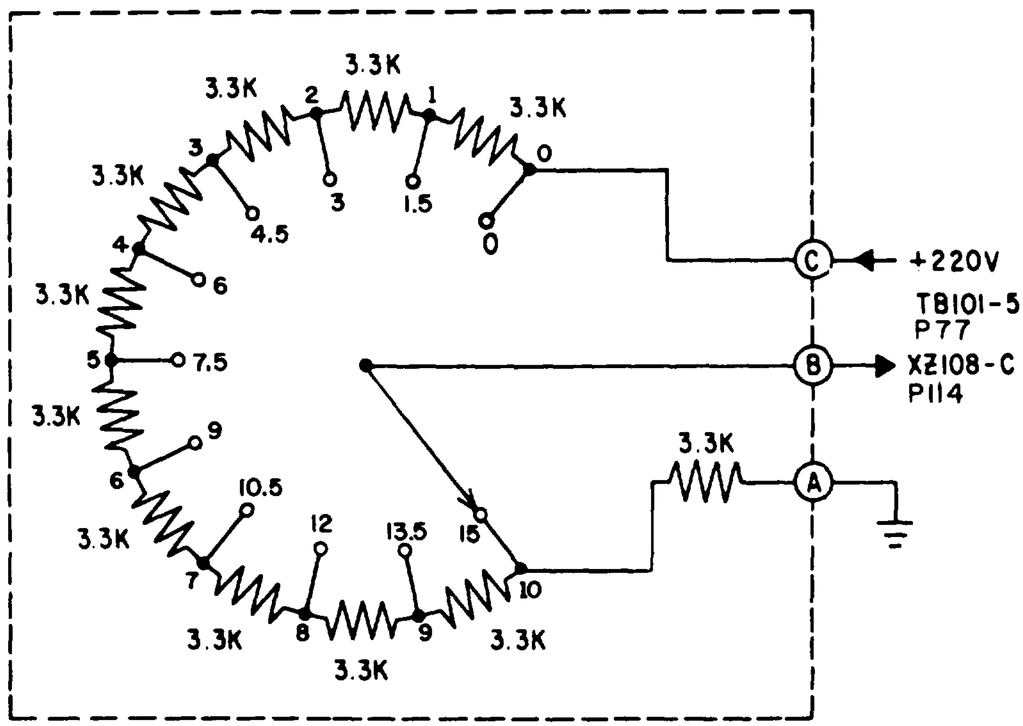
Timing sweep generator Z102.



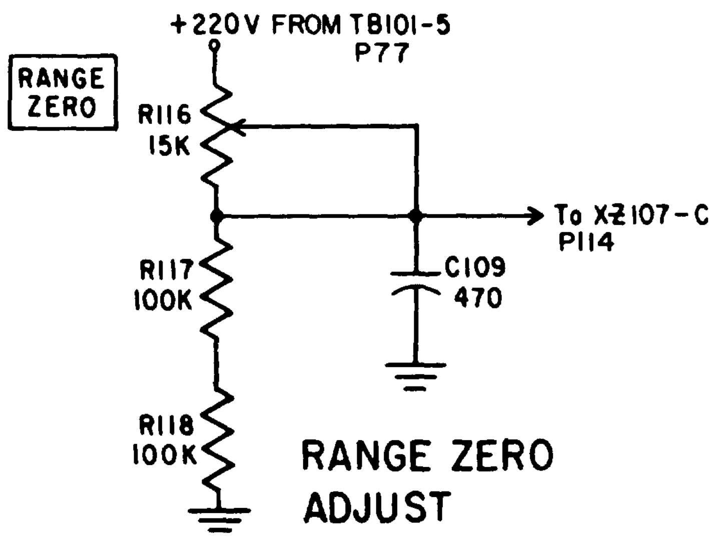
Timing sweep generator Z1OZ--Continued.



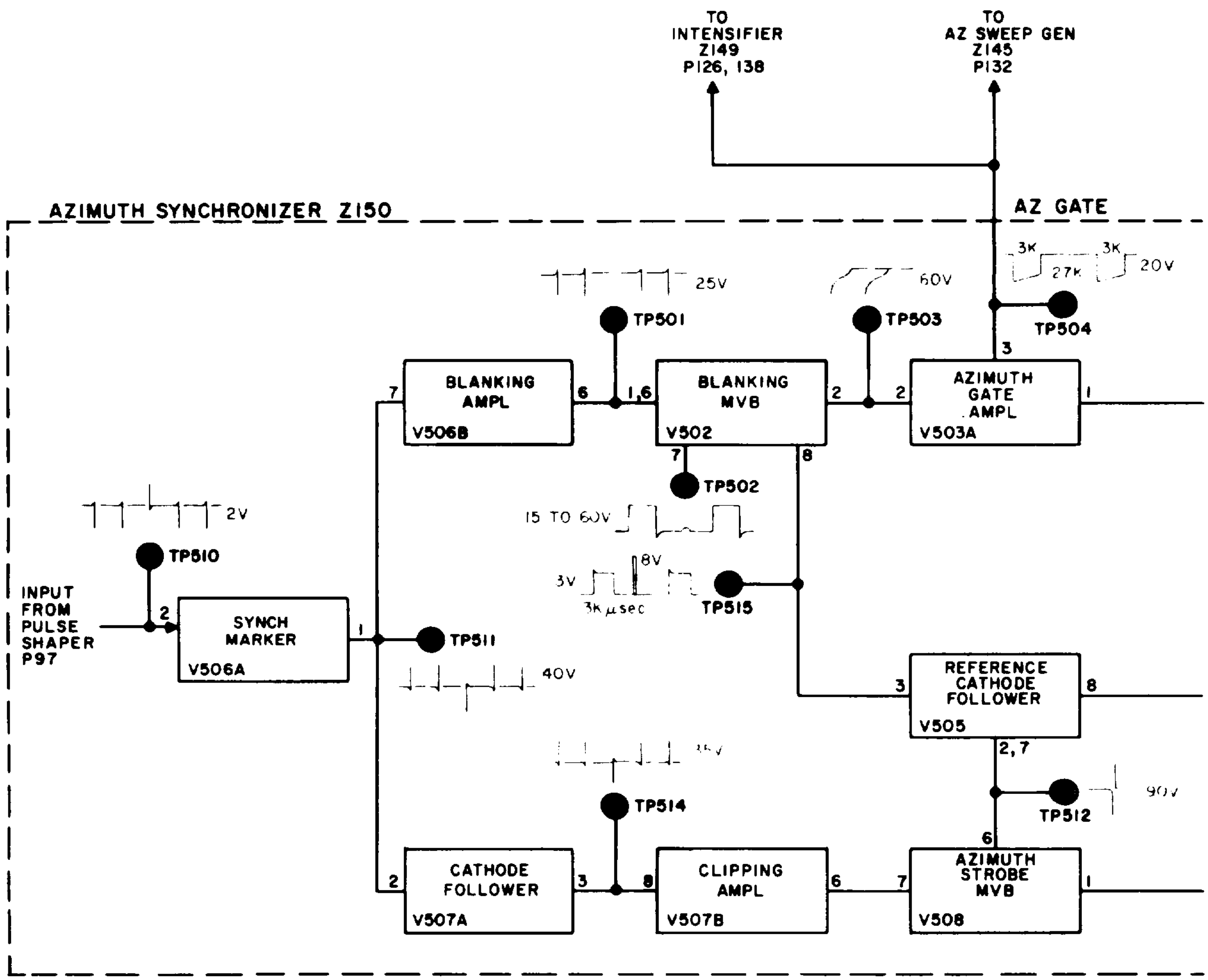
Pickoff amplifier Z107, Z108, and Z109.



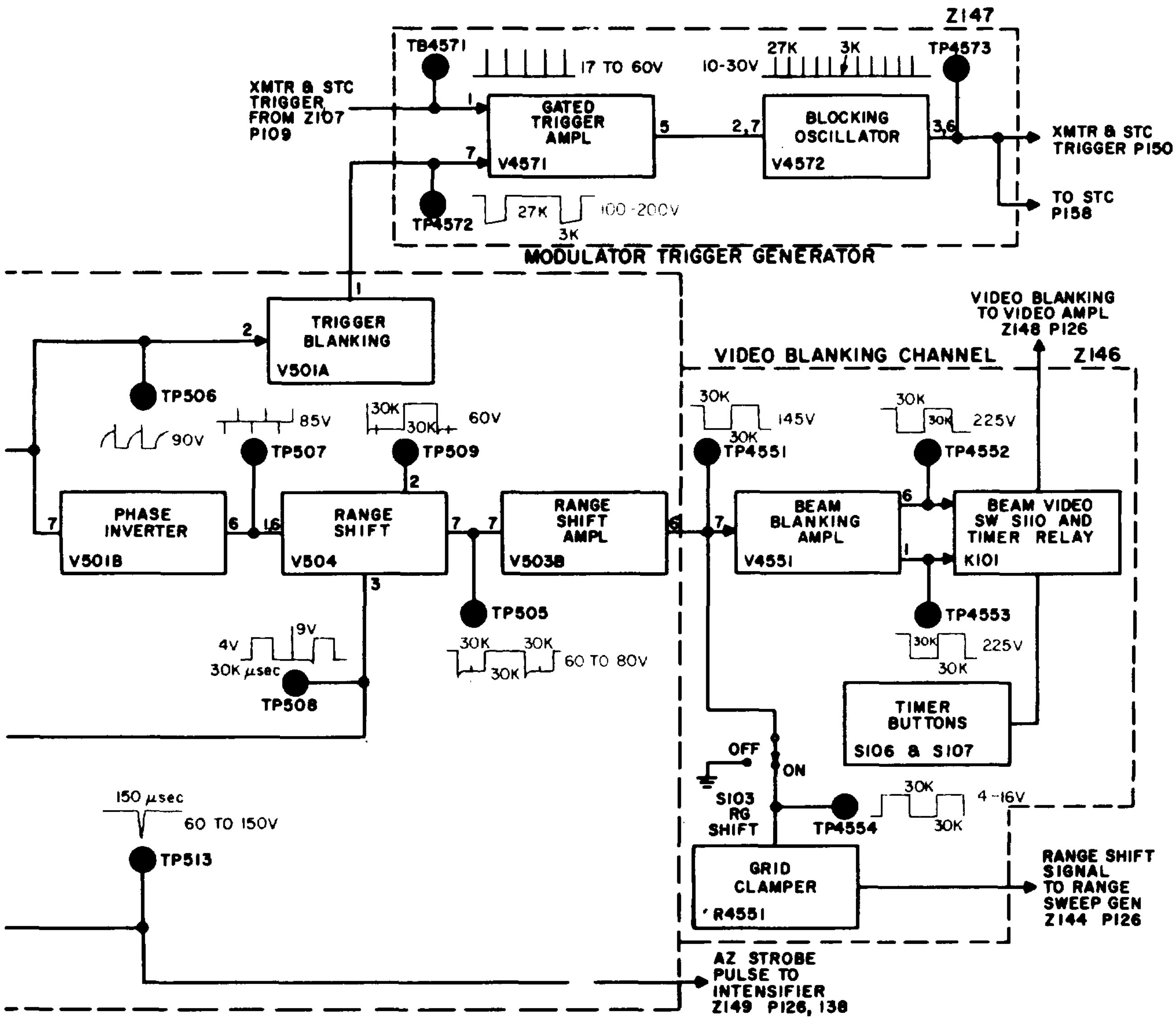
AT101
EXPANDED SWEEP
DELAY NETWORK



AT101 Expanded Sweep Delay Network



Azimuth synchronizer, video blanking, and modulator trigger generator detailed block diagram.



Azimuth synchronizer, video blanking, and modulator trigger generator detailed block diagram- Continued.

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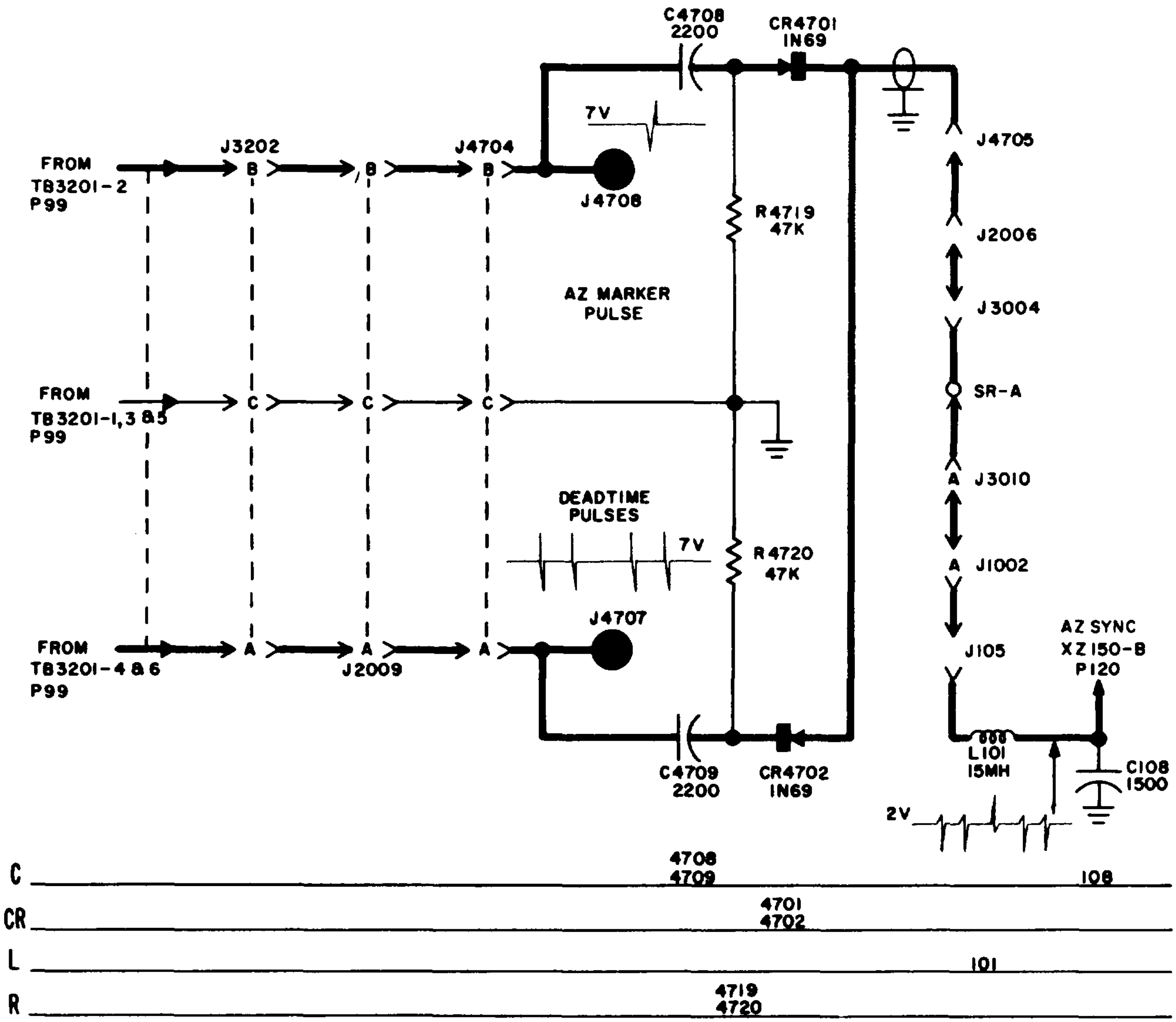
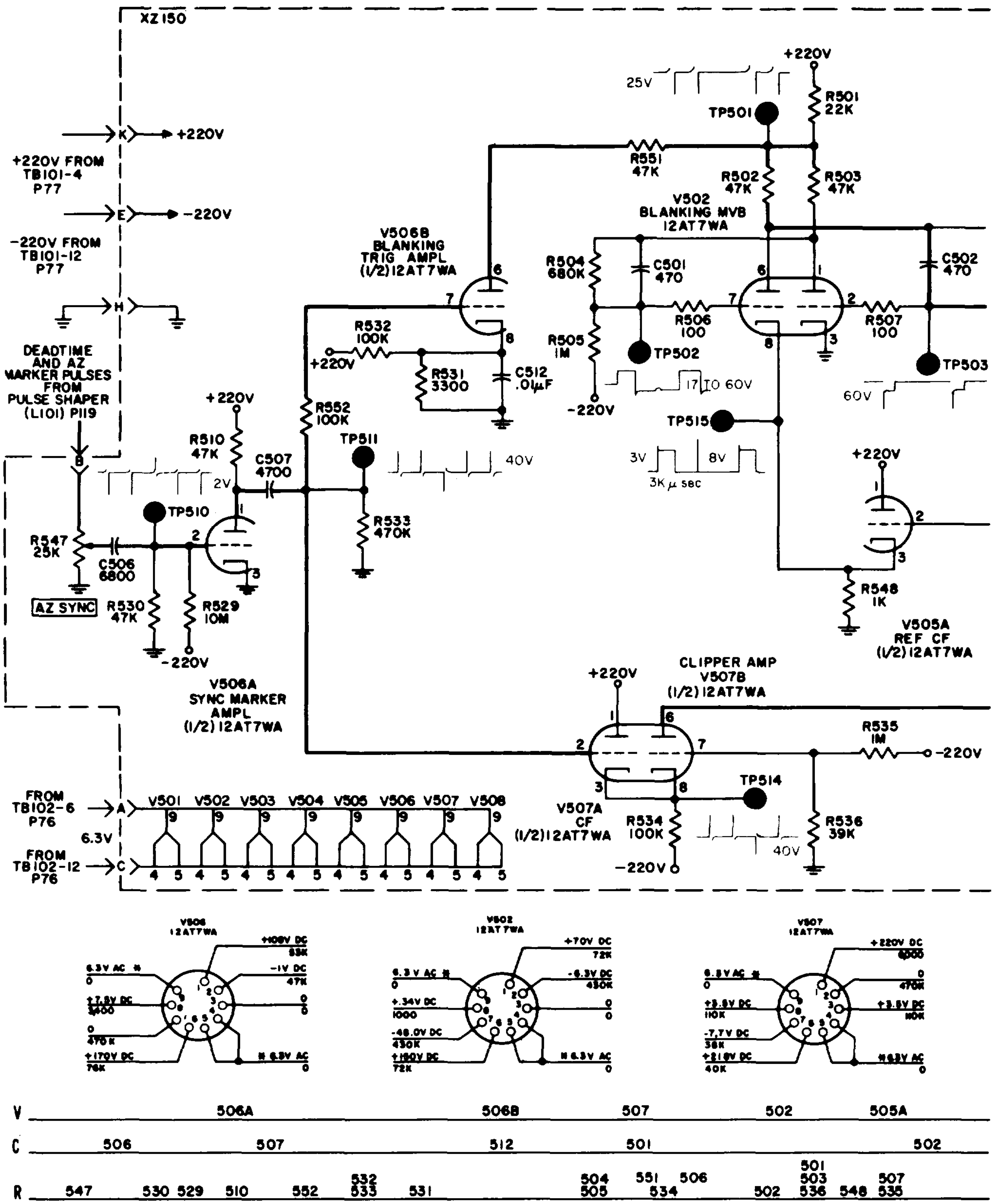
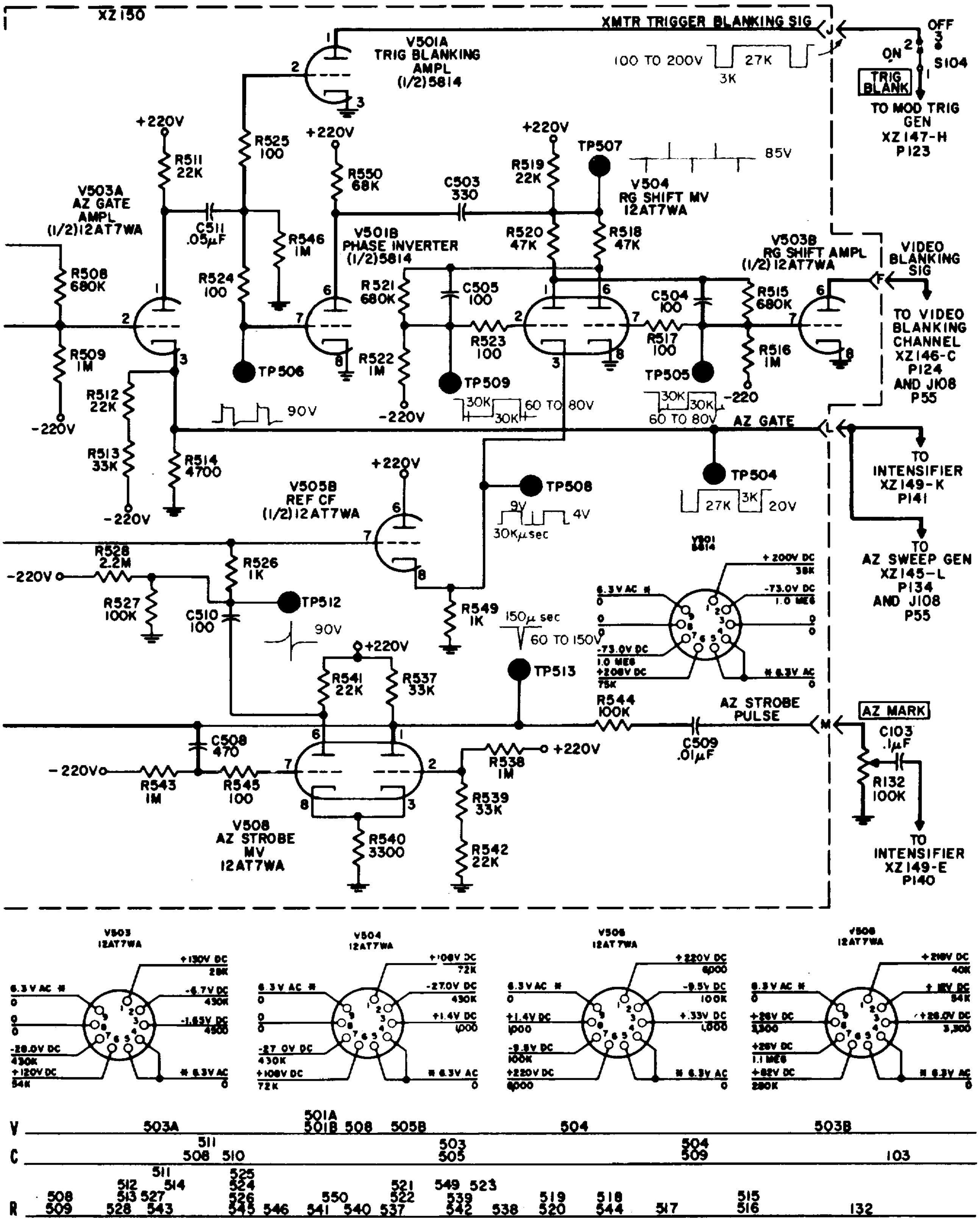


PULSE SHAPER

Pulse shaper.



Azimuth synchronizer Z150.



Azimuth synchronizer Z150--Continued.

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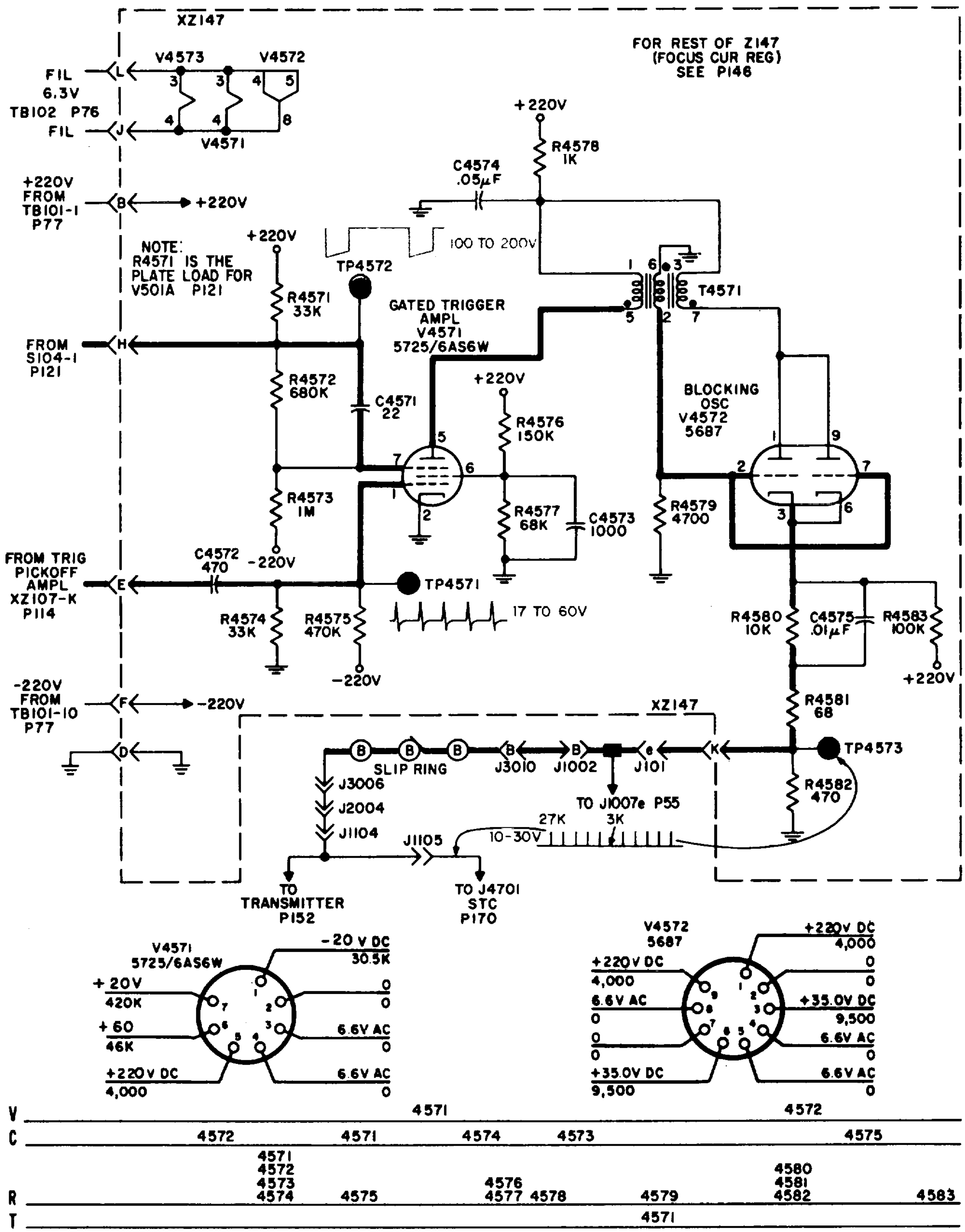
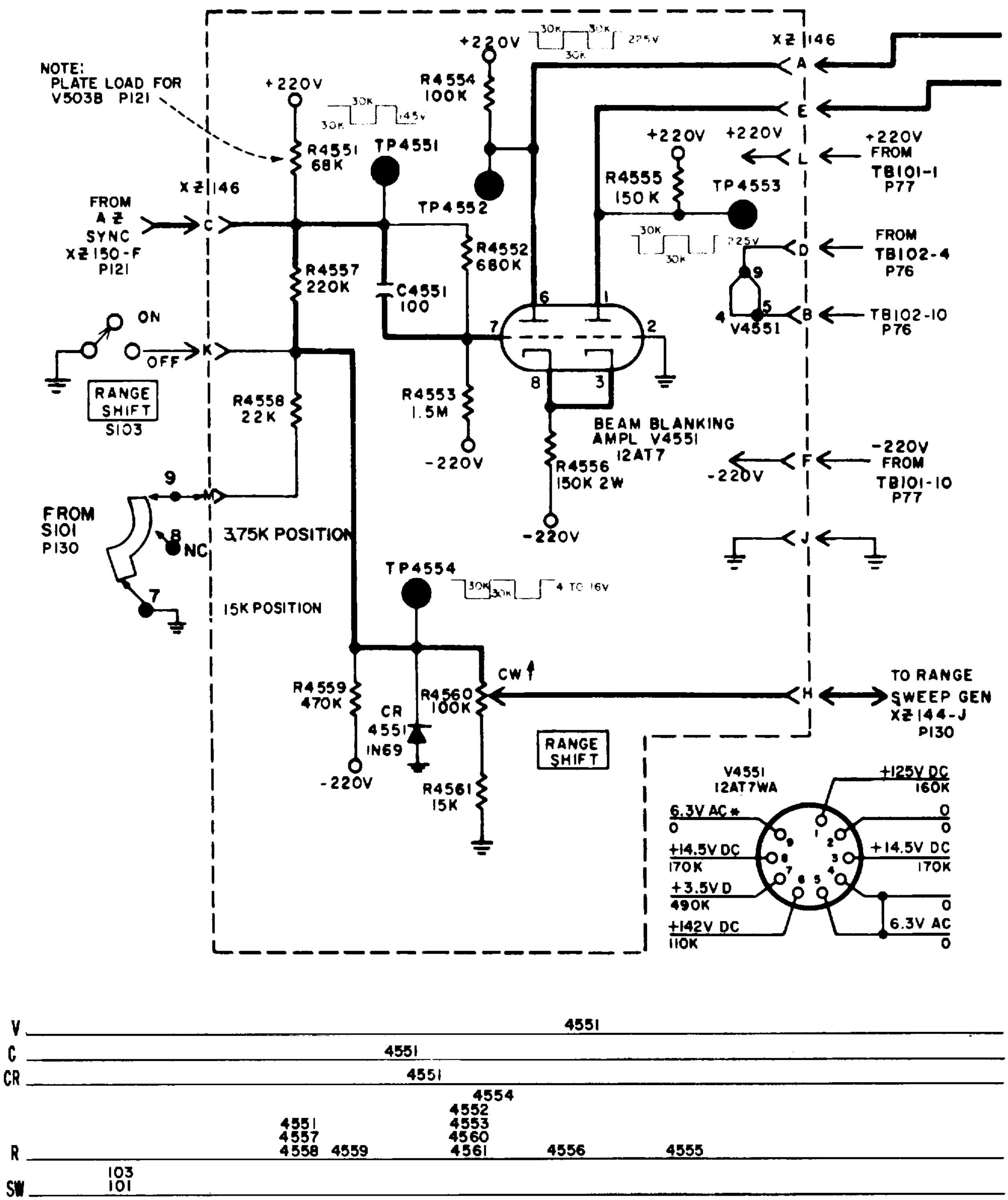
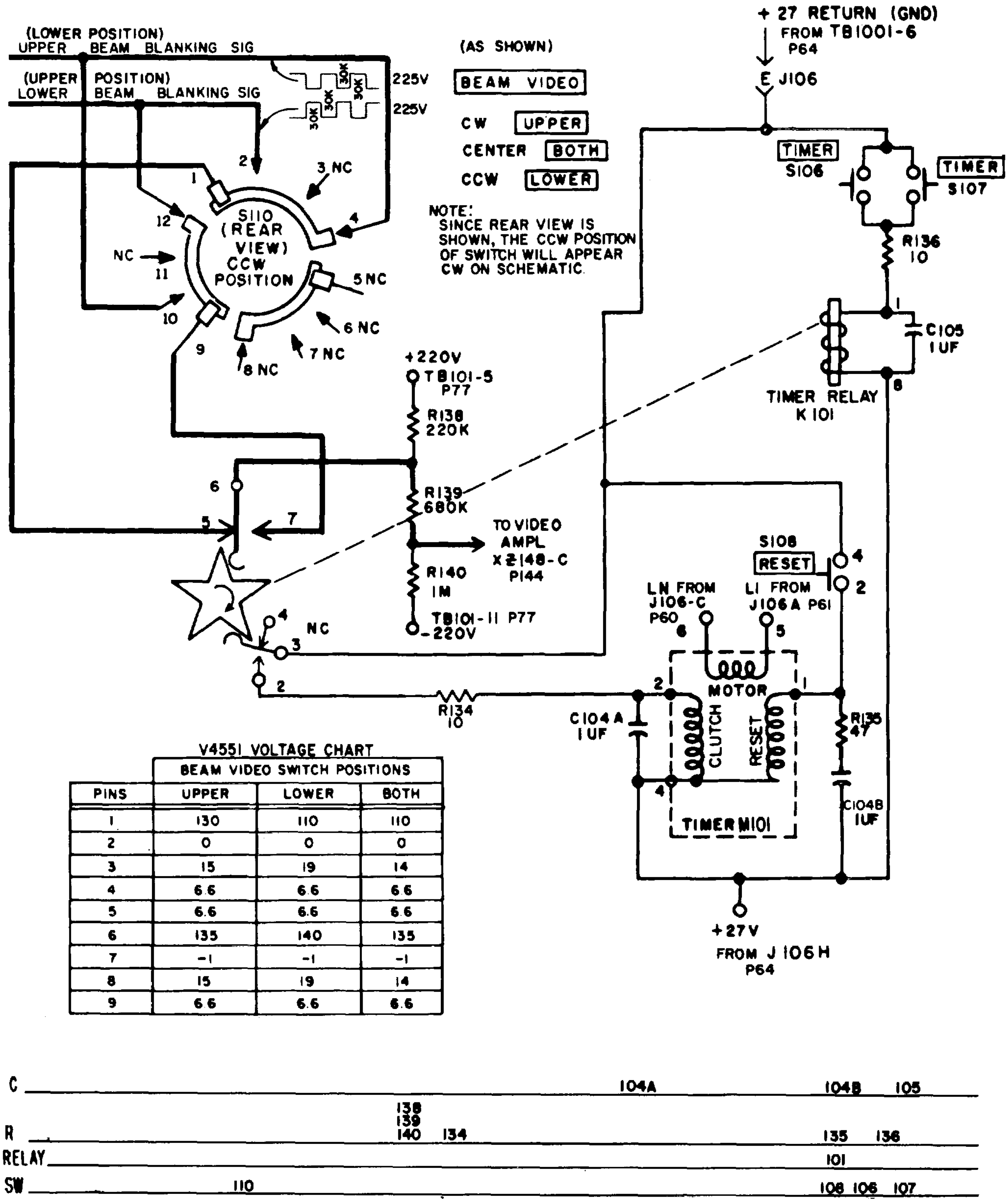


Modulator trigger generator Z147.



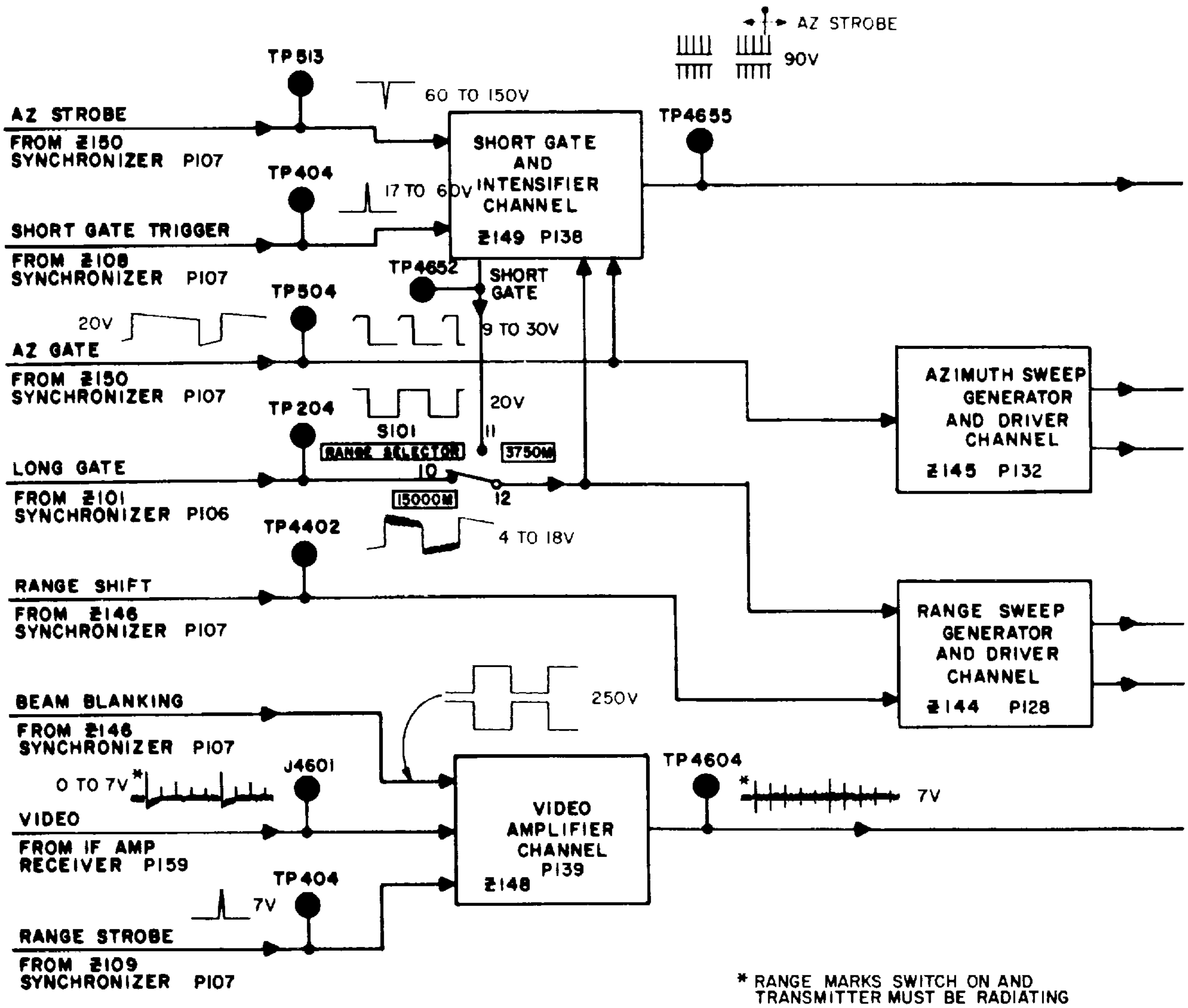
Video blanking Z146.



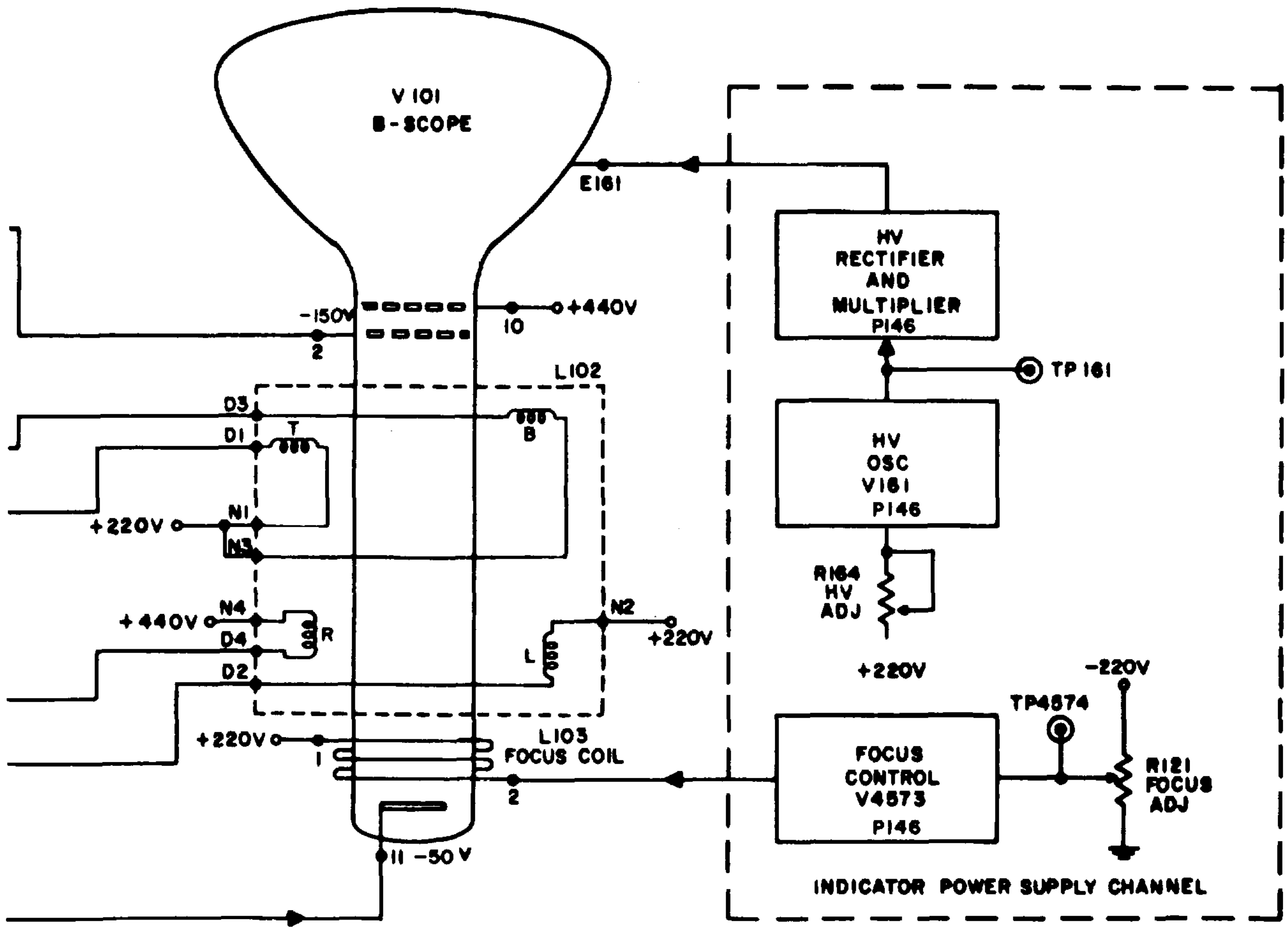
V4551 VOLTAGE CHART

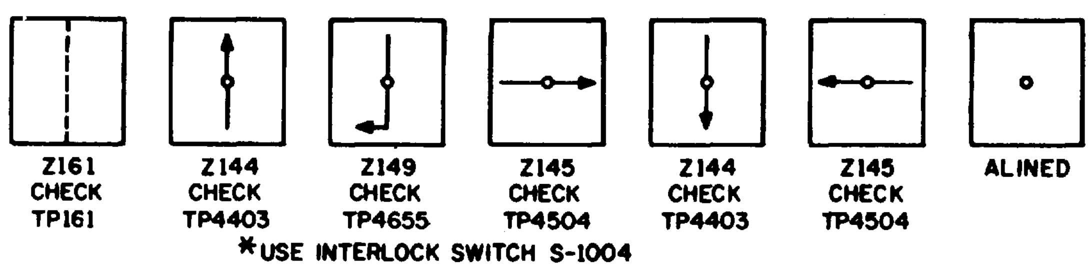
PINS	BEAM VIDEO SWITCH POSITIONS UPPER	LOWER	BOTH
1	130	110	110
2	0	0	0
3	15	19	14
4	6.6	6.6	6.6
5	6.6	6.6	6.6
6	135	140	135
7	-1	-1	-1
8	15	19	14
9	6.6	6.6	6.6

Video blanking Z146--Continued.

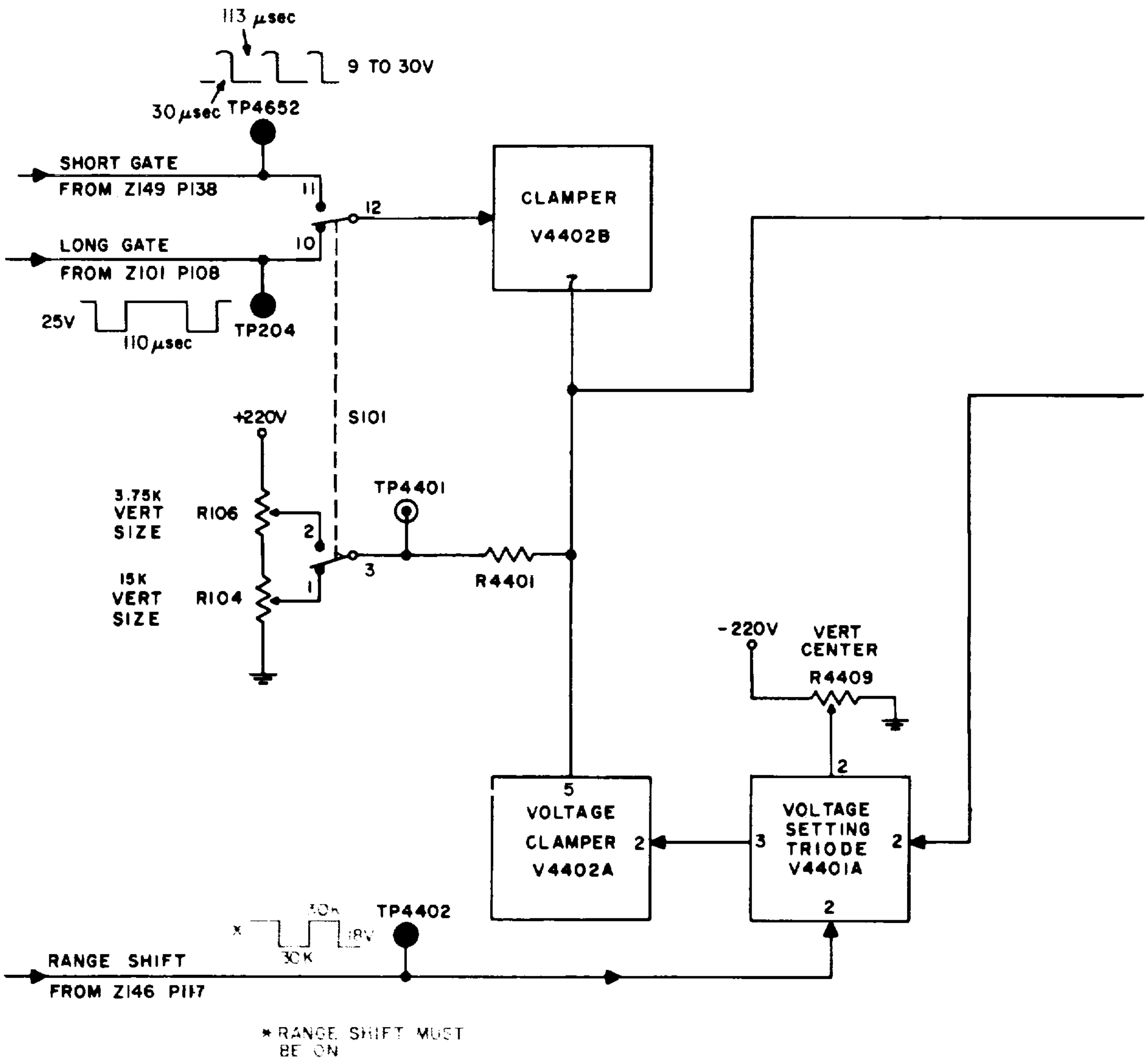


Indicating system block diagram (simplified).

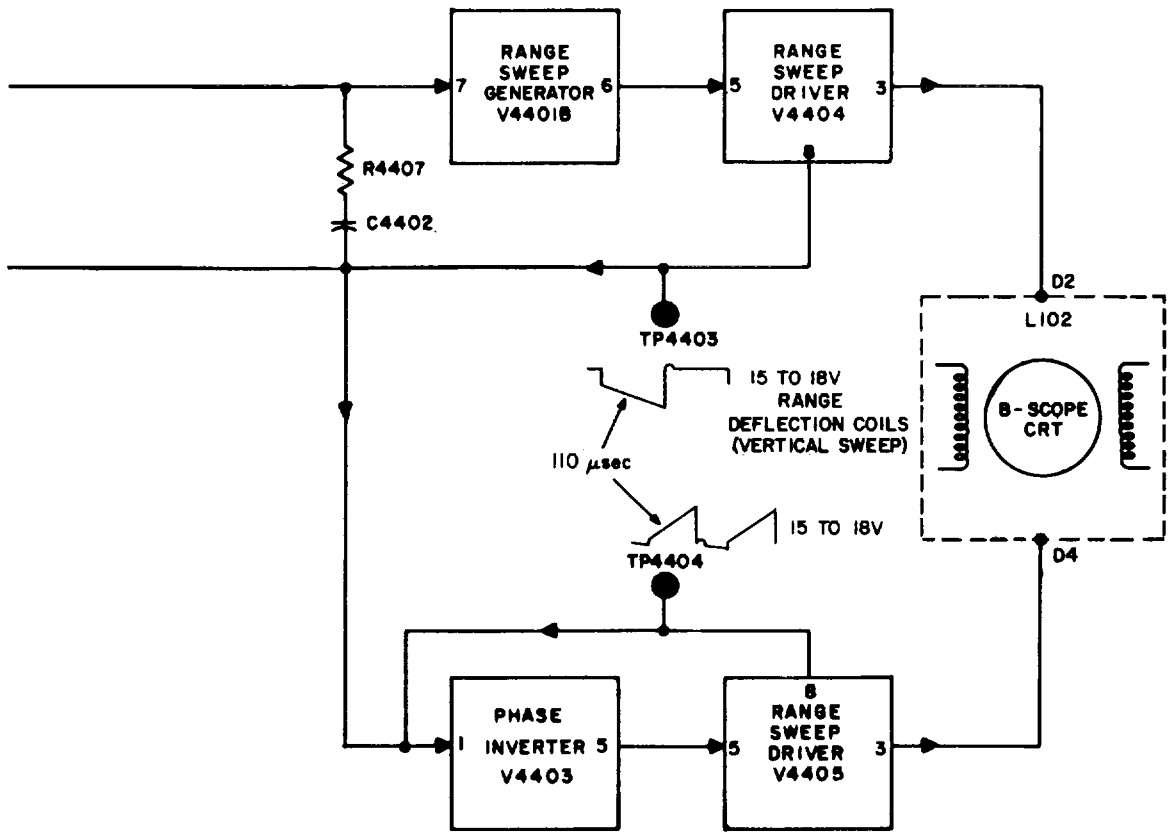




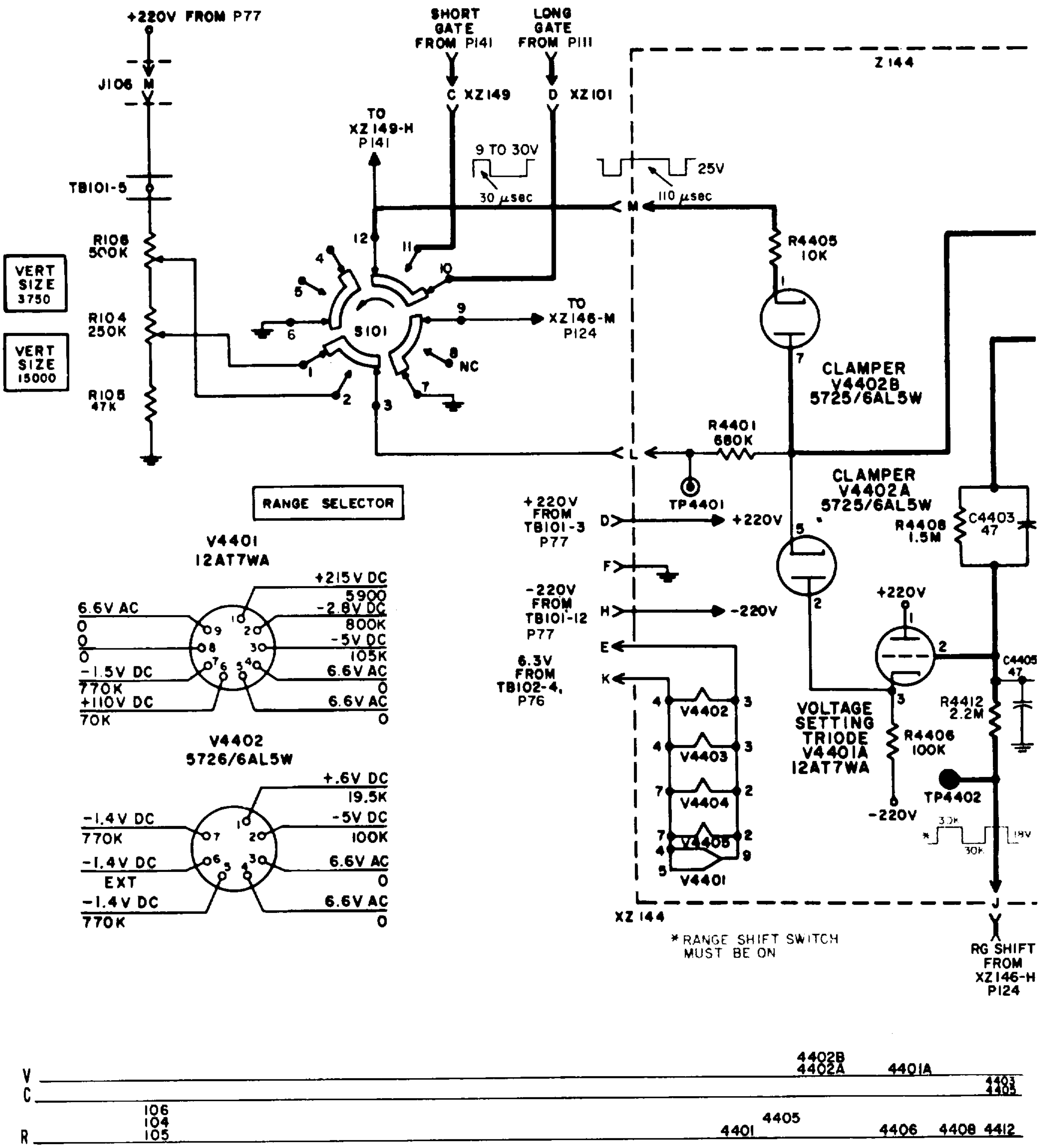
Indicating system block diagram (simplified)--Continued.



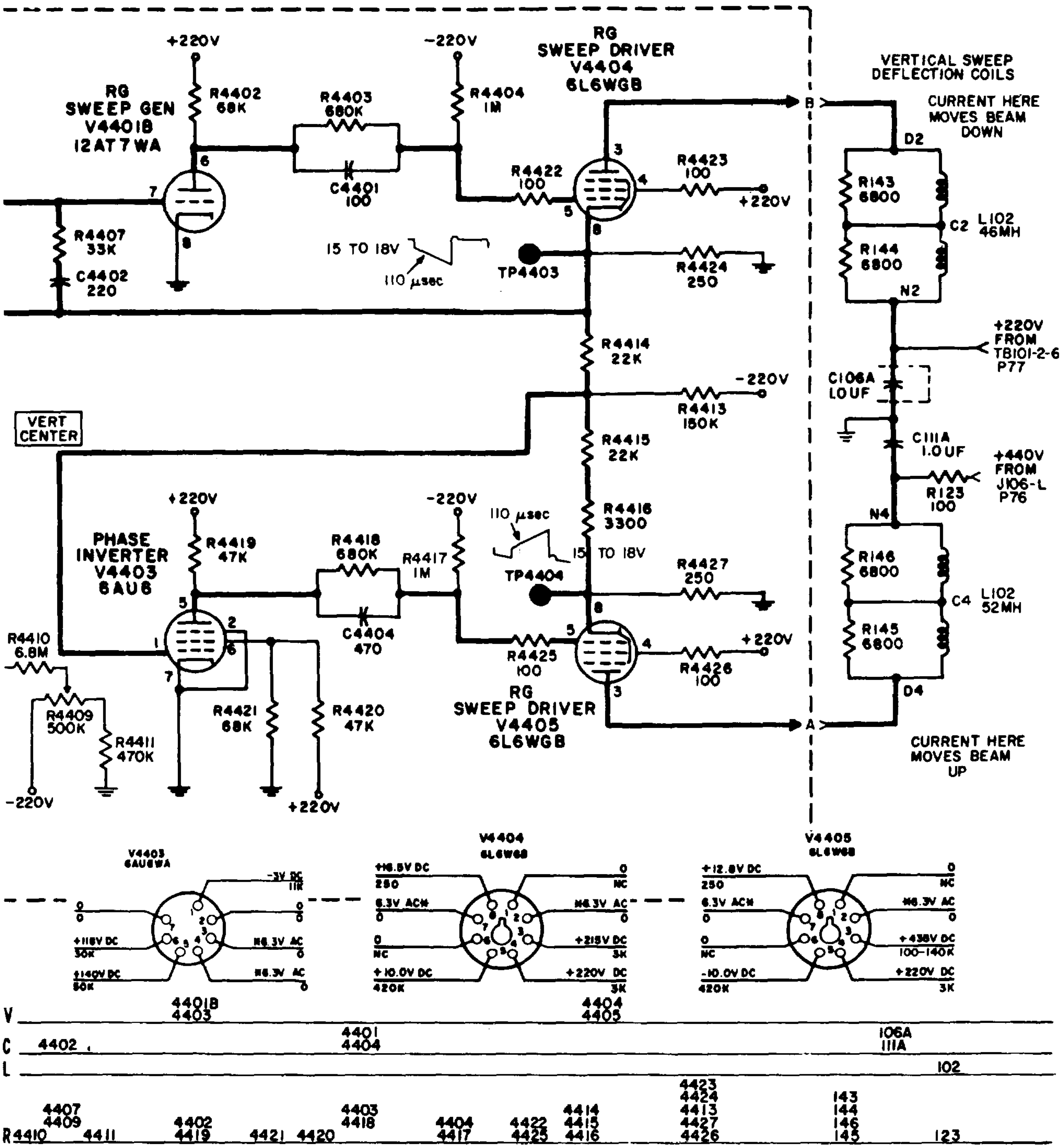
Range sweep generator and driver Z144 detailed block diagram.



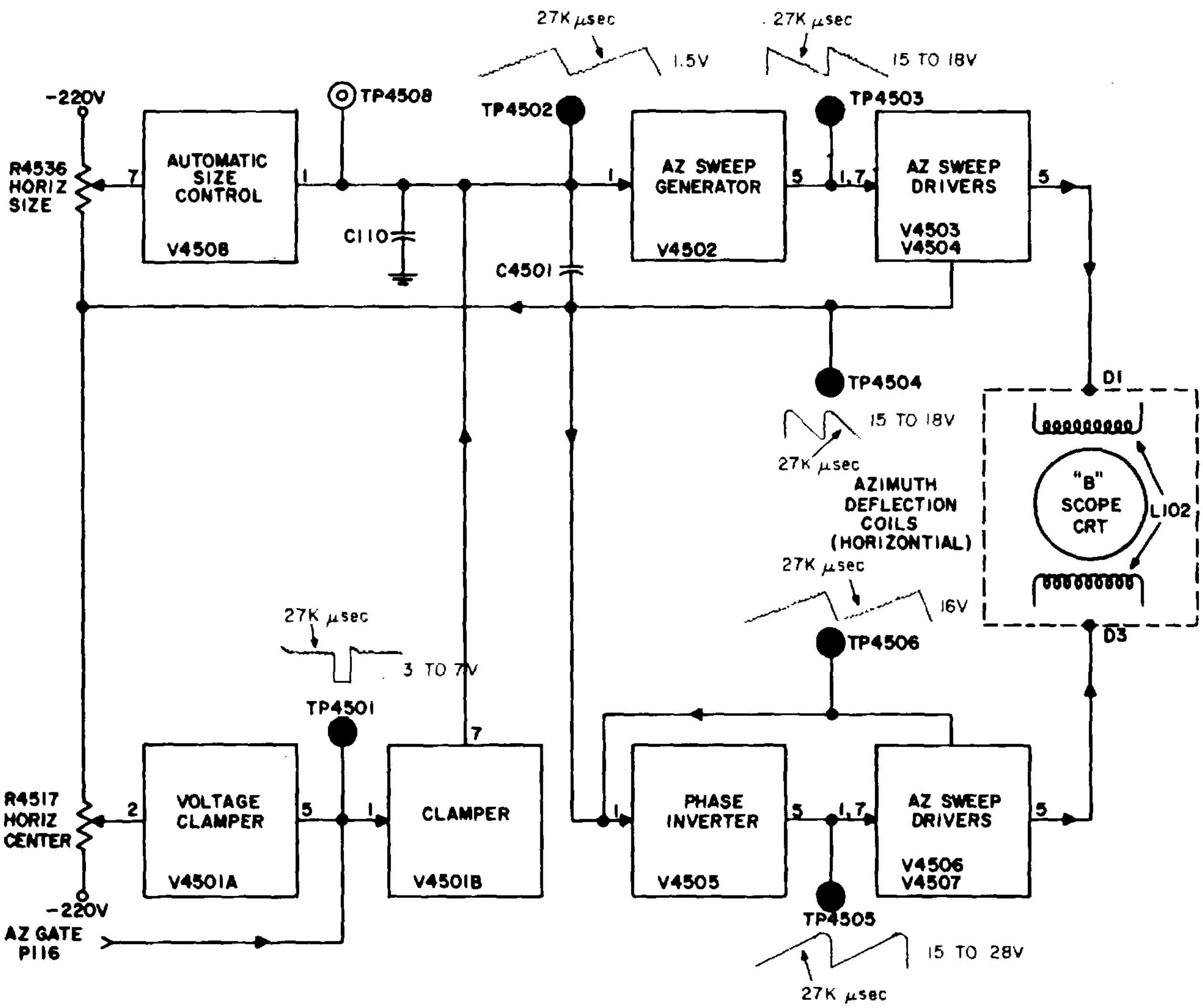
Range sweep generator and driver Z144 detailed block diagram.



Range sweep generator and driver Z144 detailed block diagram--Continued.



Range sweep generator and drivers Z144.



Range sweep generator and drivers Z144--Continued.

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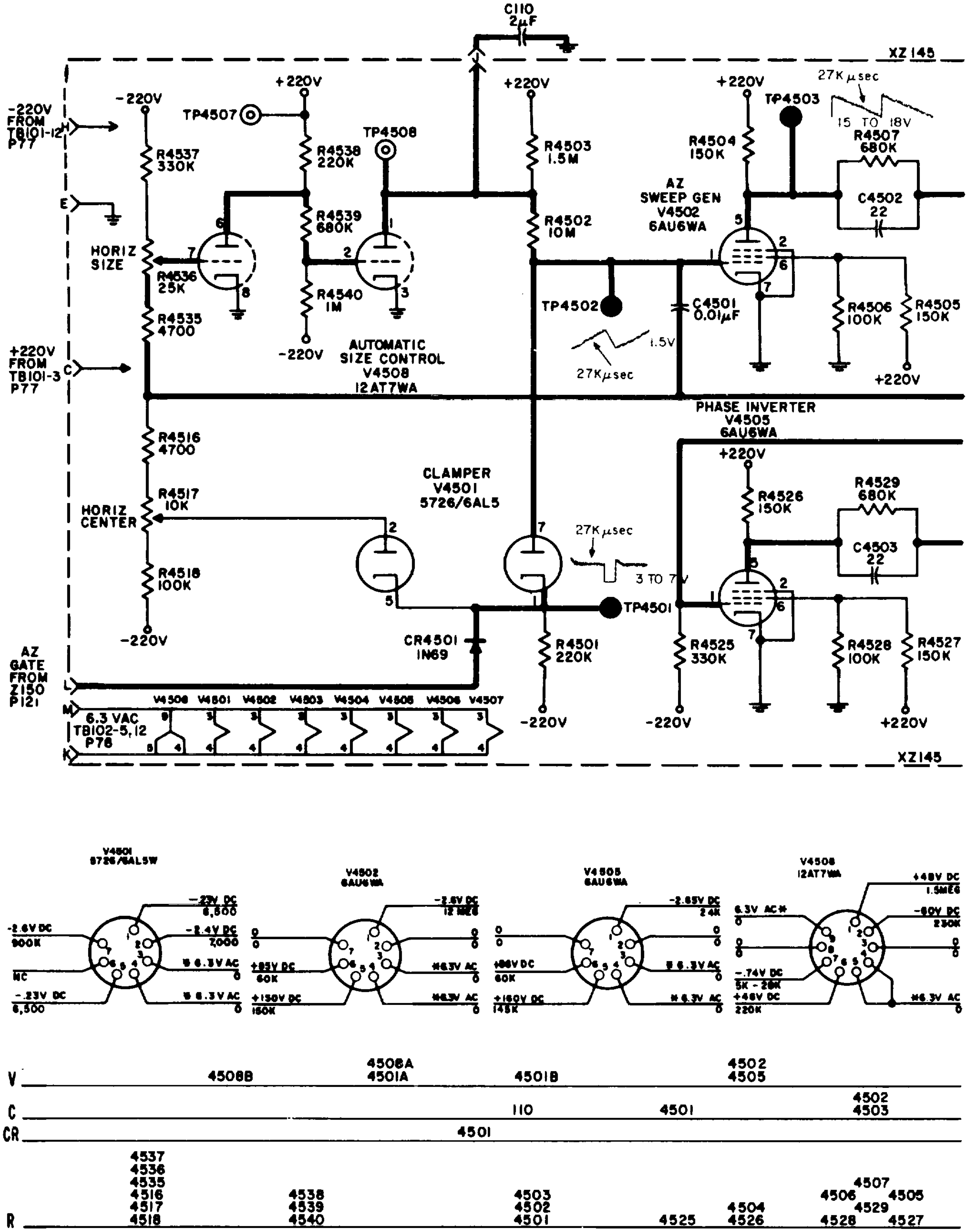
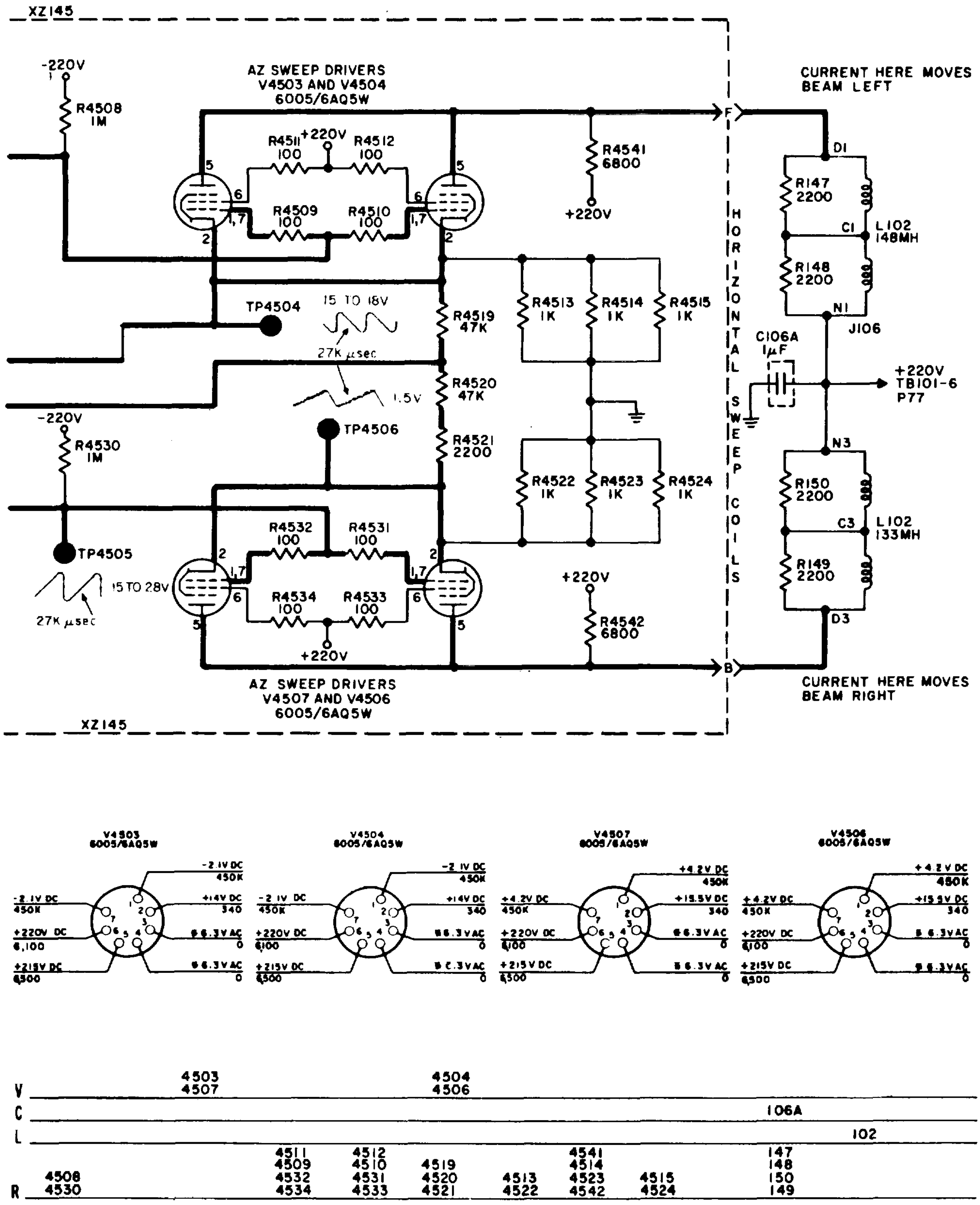


Azimuth sweep generator and driver Z145 detailed block diagram.



Azimuth sweep generator and drivers Z145.

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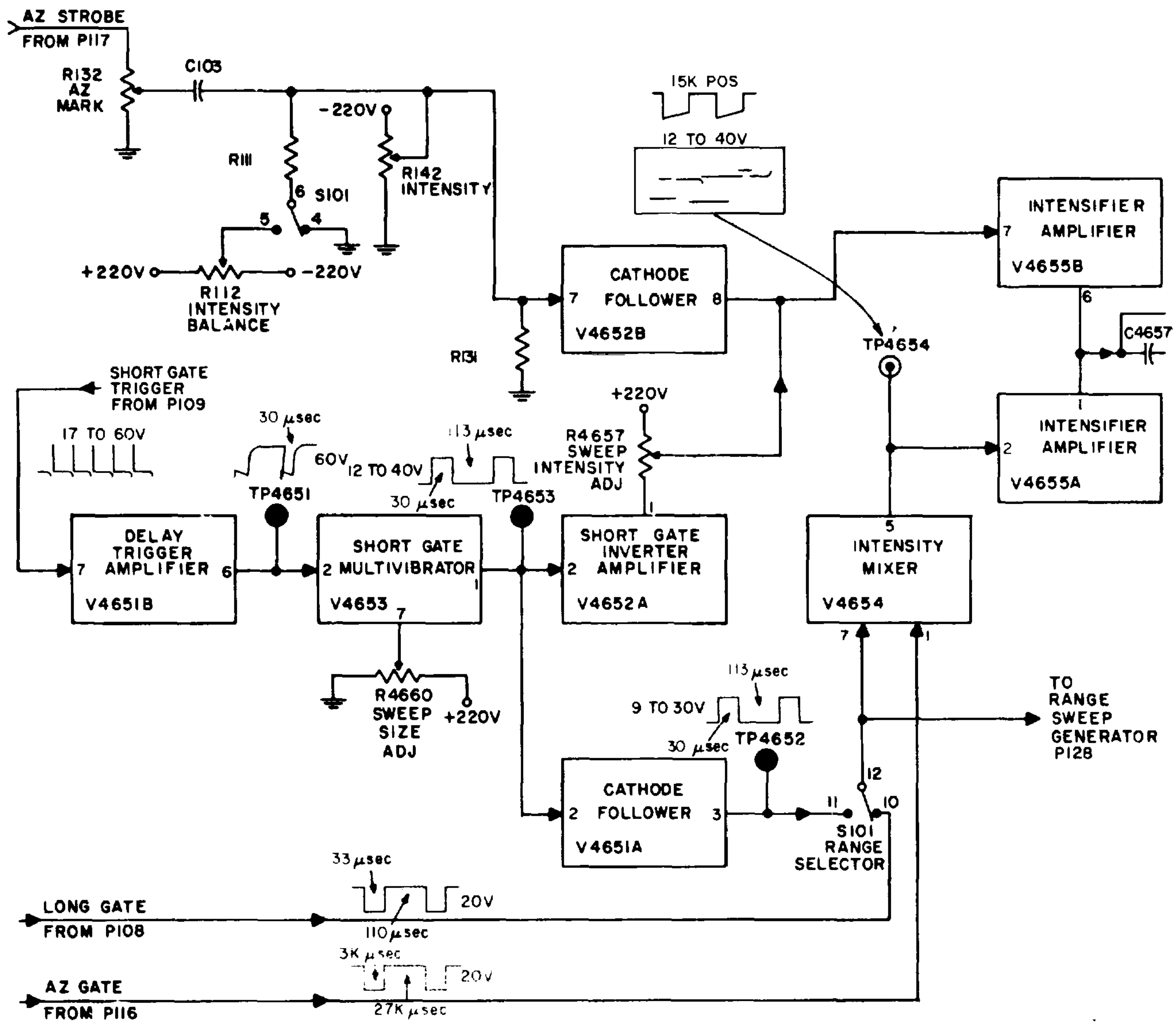
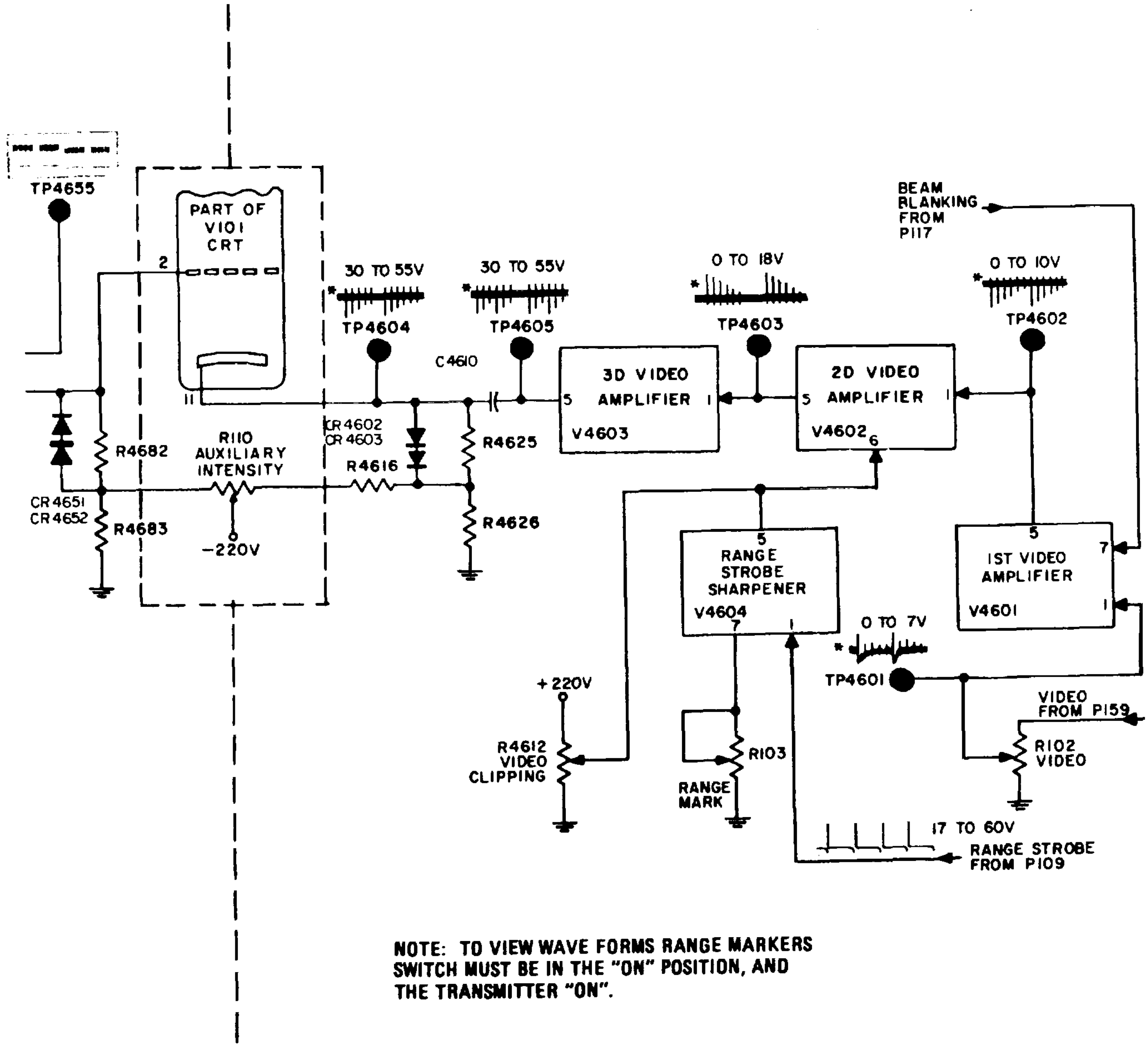
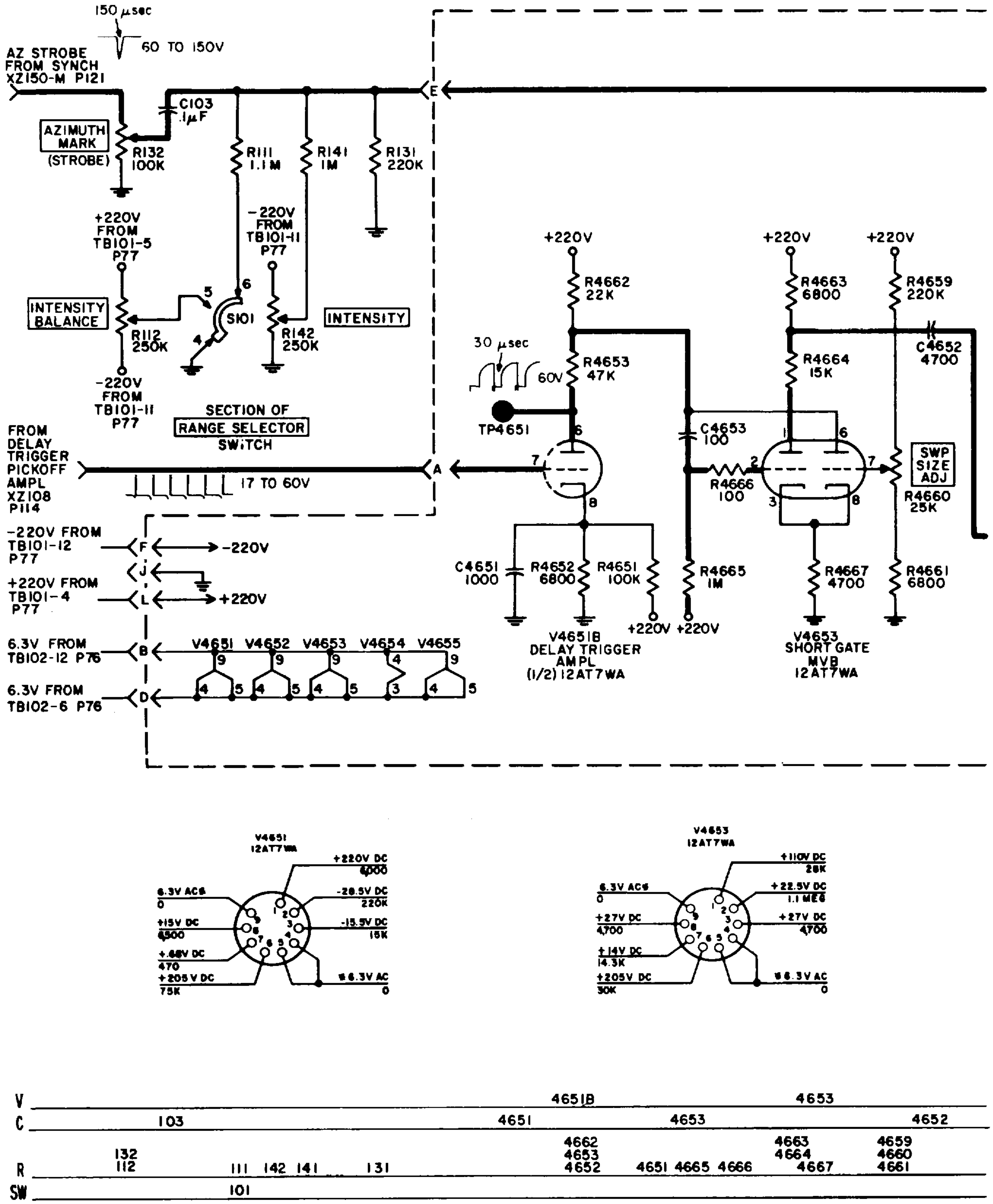


Short gate and intensifier Z149 detailed block diagram

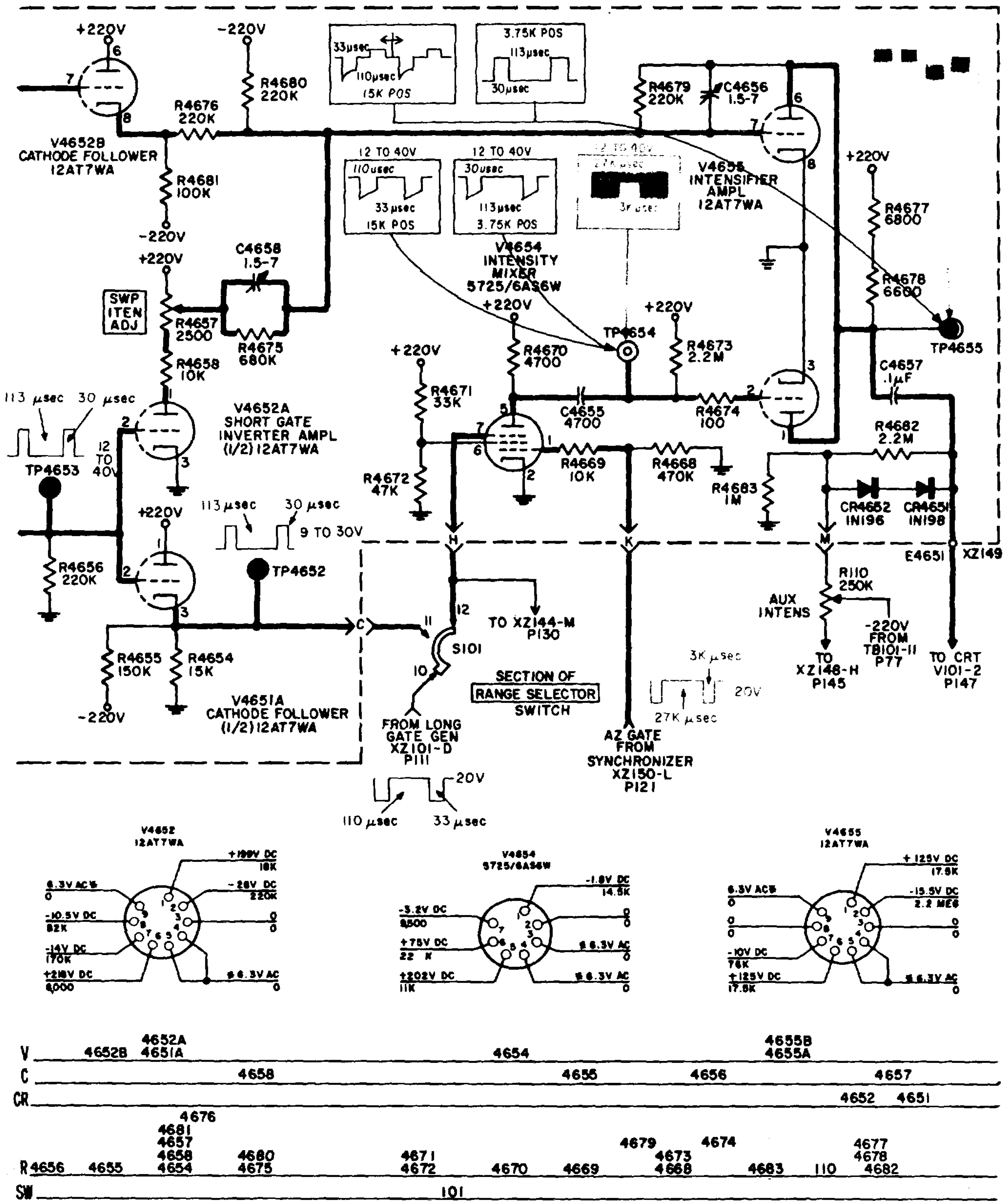


NOTE: TO VIEW WAVE FORMS RANGE MARKERS SWITCH MUST BE IN THE "ON" POSITION, AND THE TRANSMITTER "ON".

Video amplifier Z148 detailed block diagram



Short gate and intensifier Z149.



Short gate and intensifier Z149--Continued.

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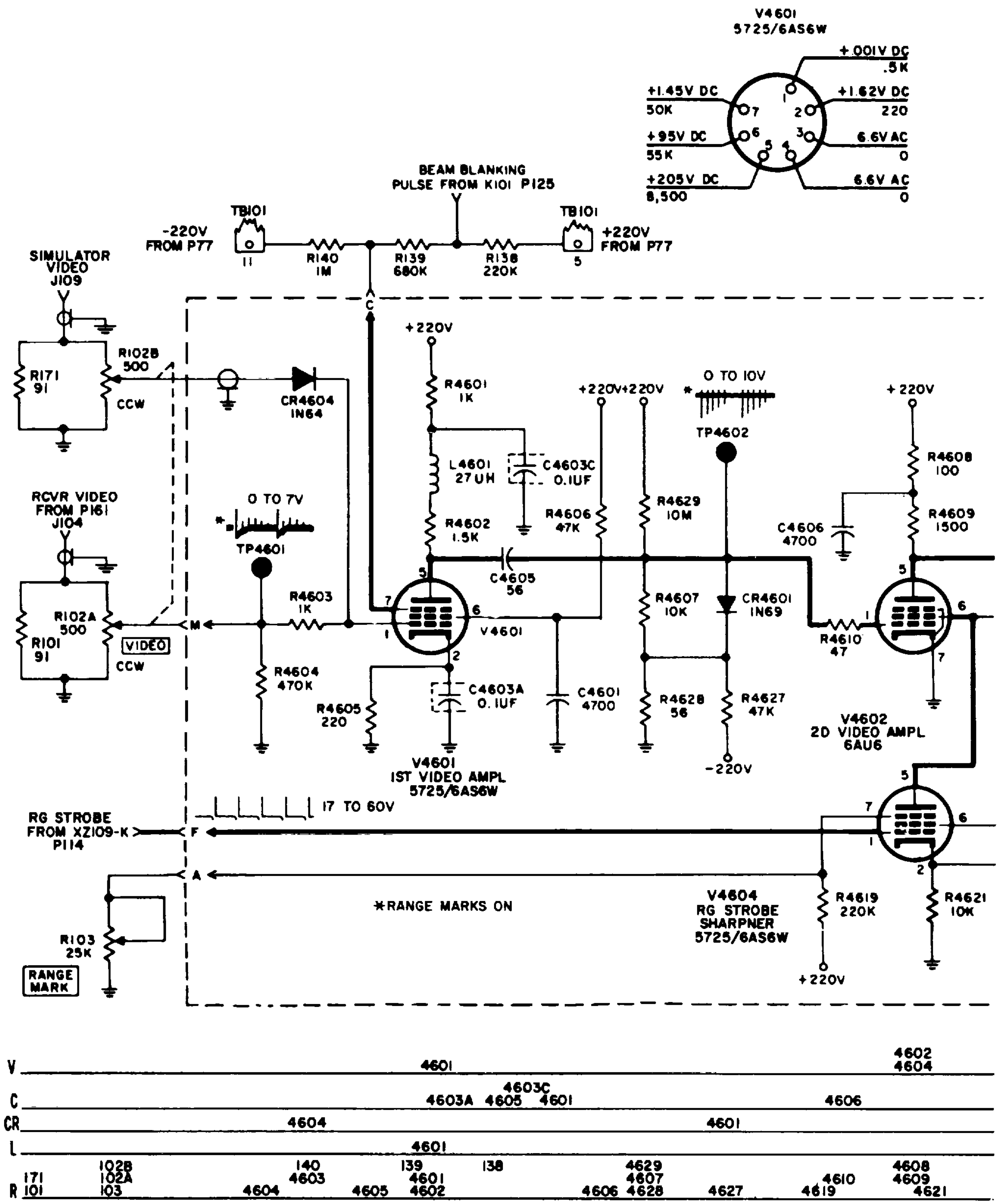
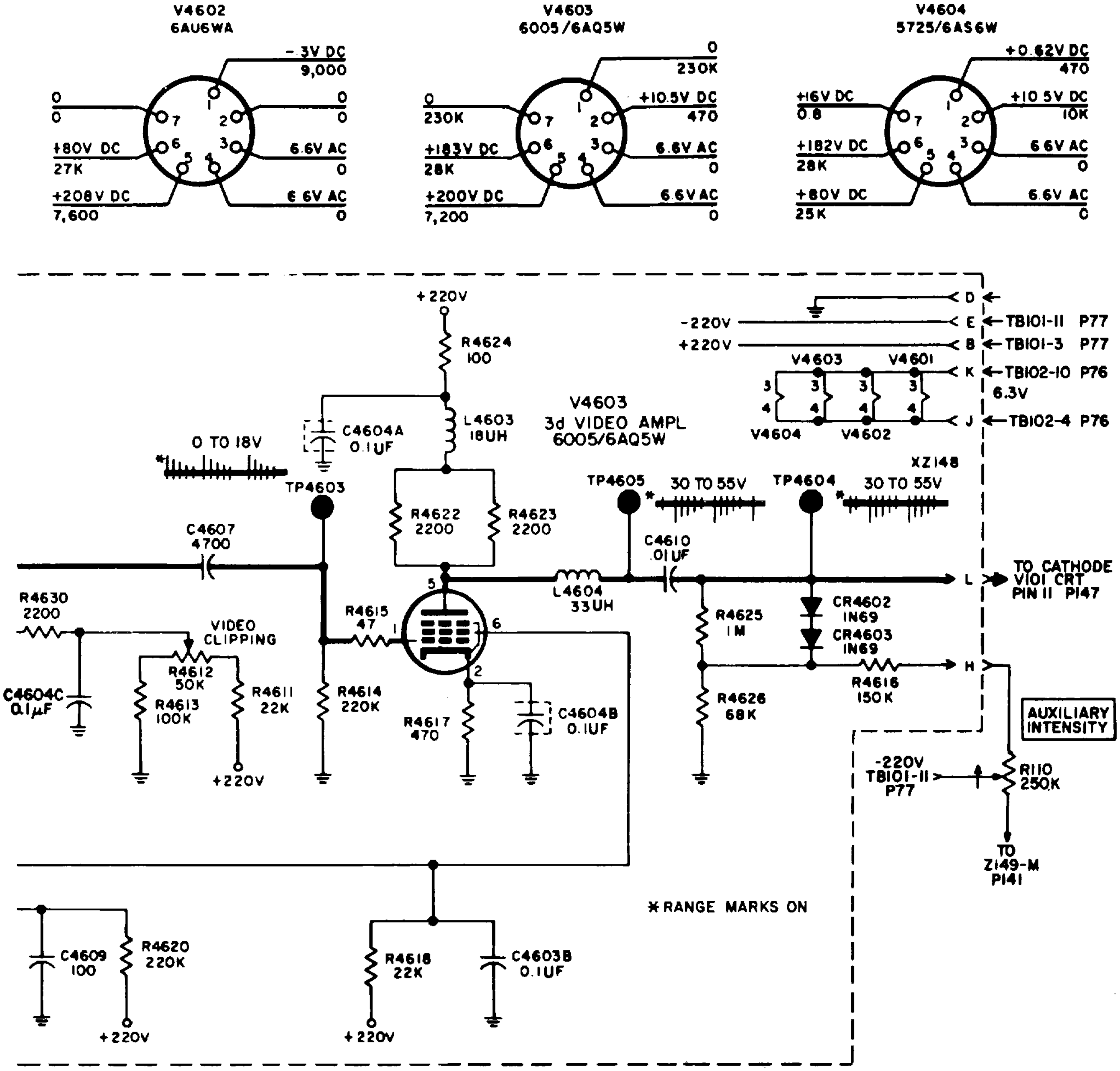
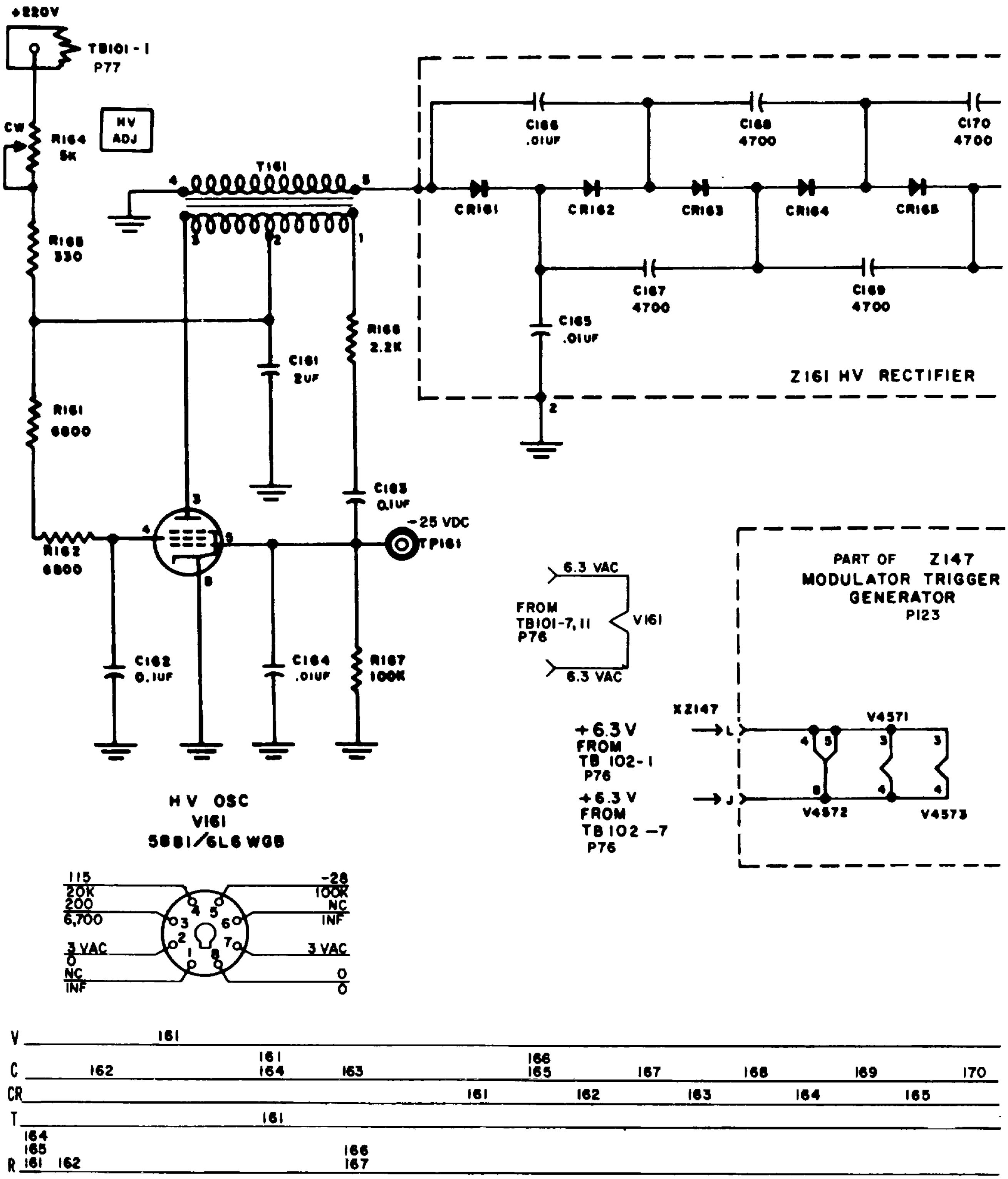


Z148 video amplifier (modified).

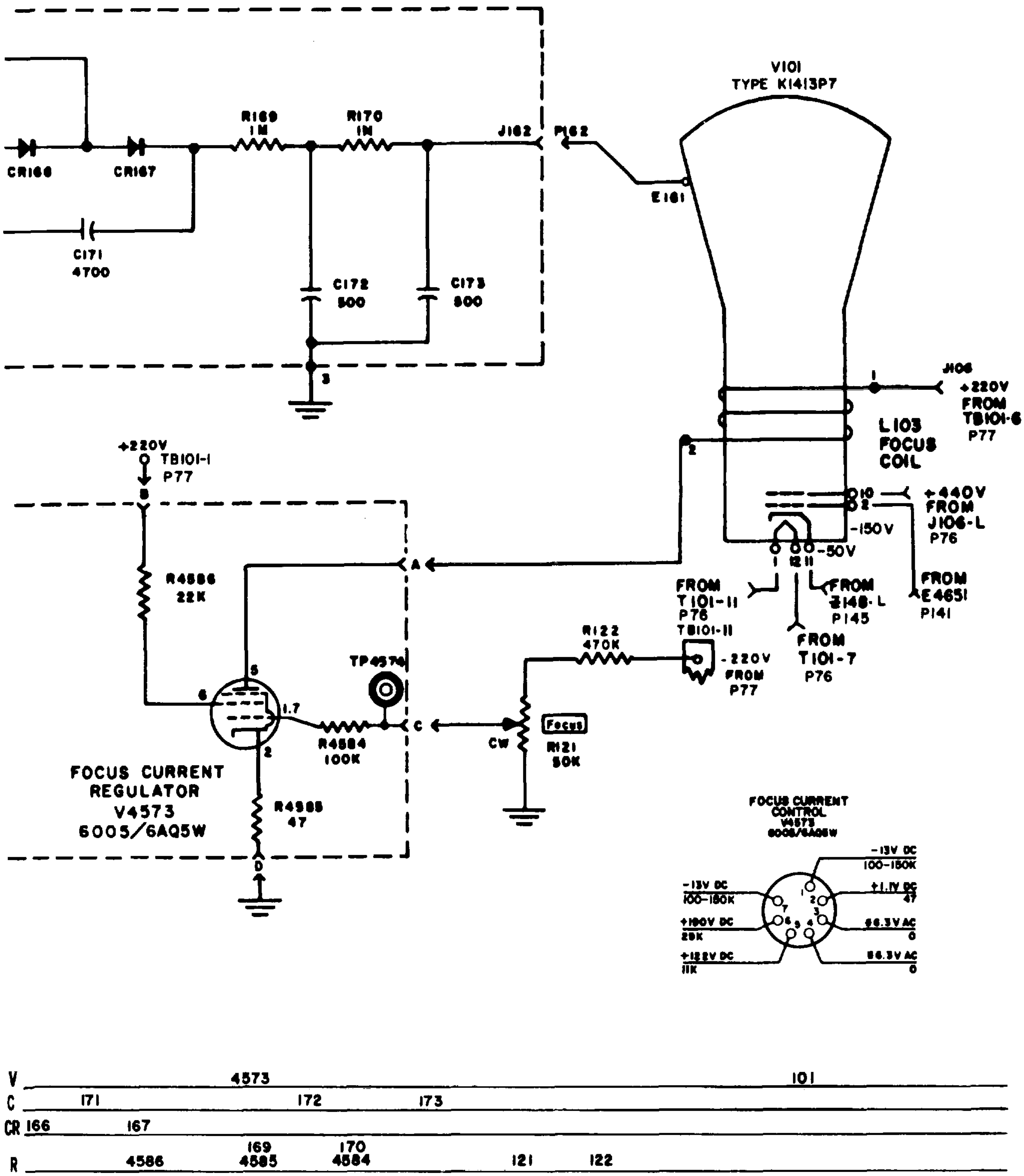


V				4603					
C	4604C 4609	4607	4604A	4604B 4603B	4610				
CR						4602,3			
L				4603	4604				
R	4630	4613 4620 4612 4611	4614	4622 4615 4618	4624 4623 4617	4625 4626	4616	110	

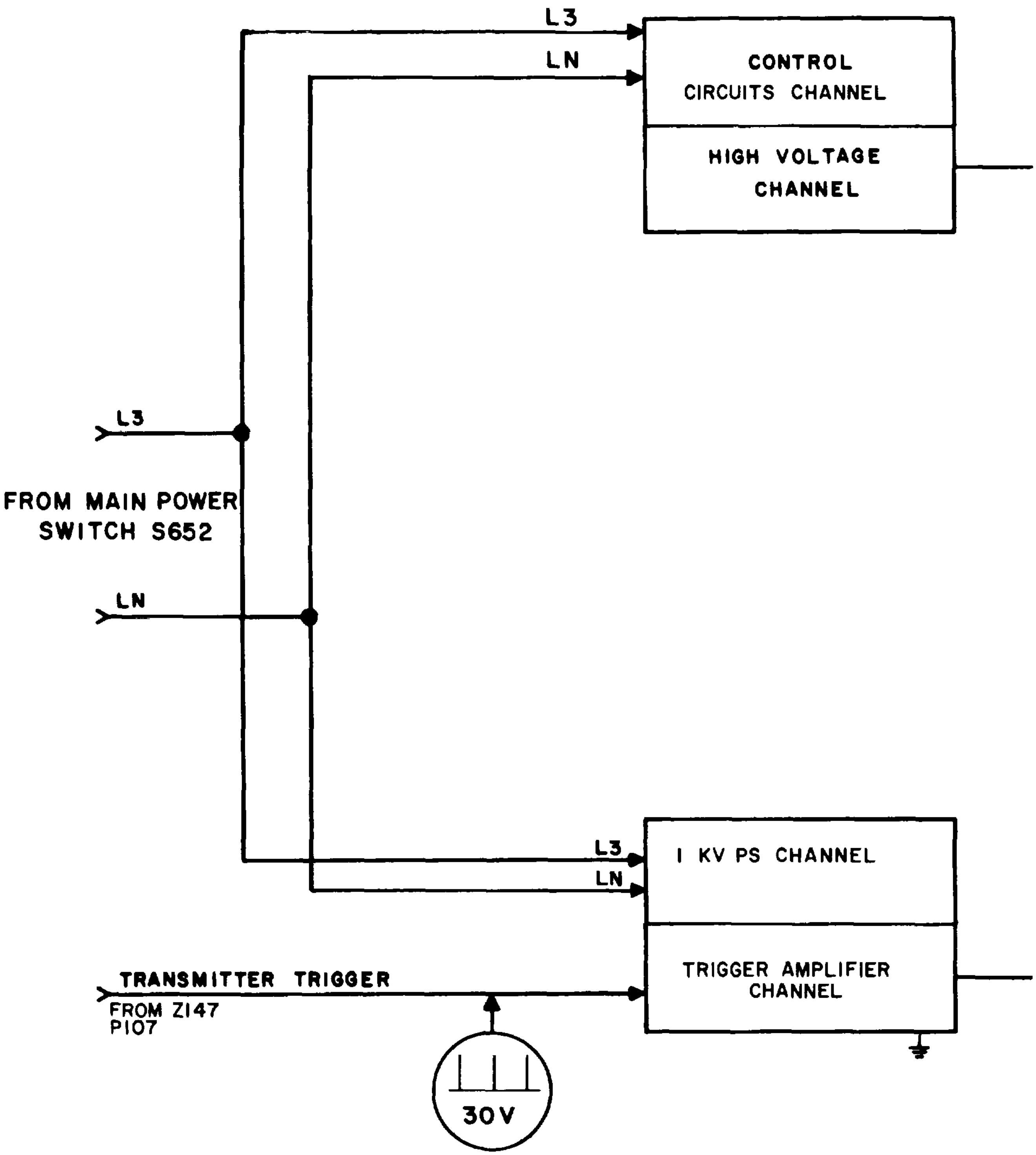
Z148 video amplifier (modified)--Continued.



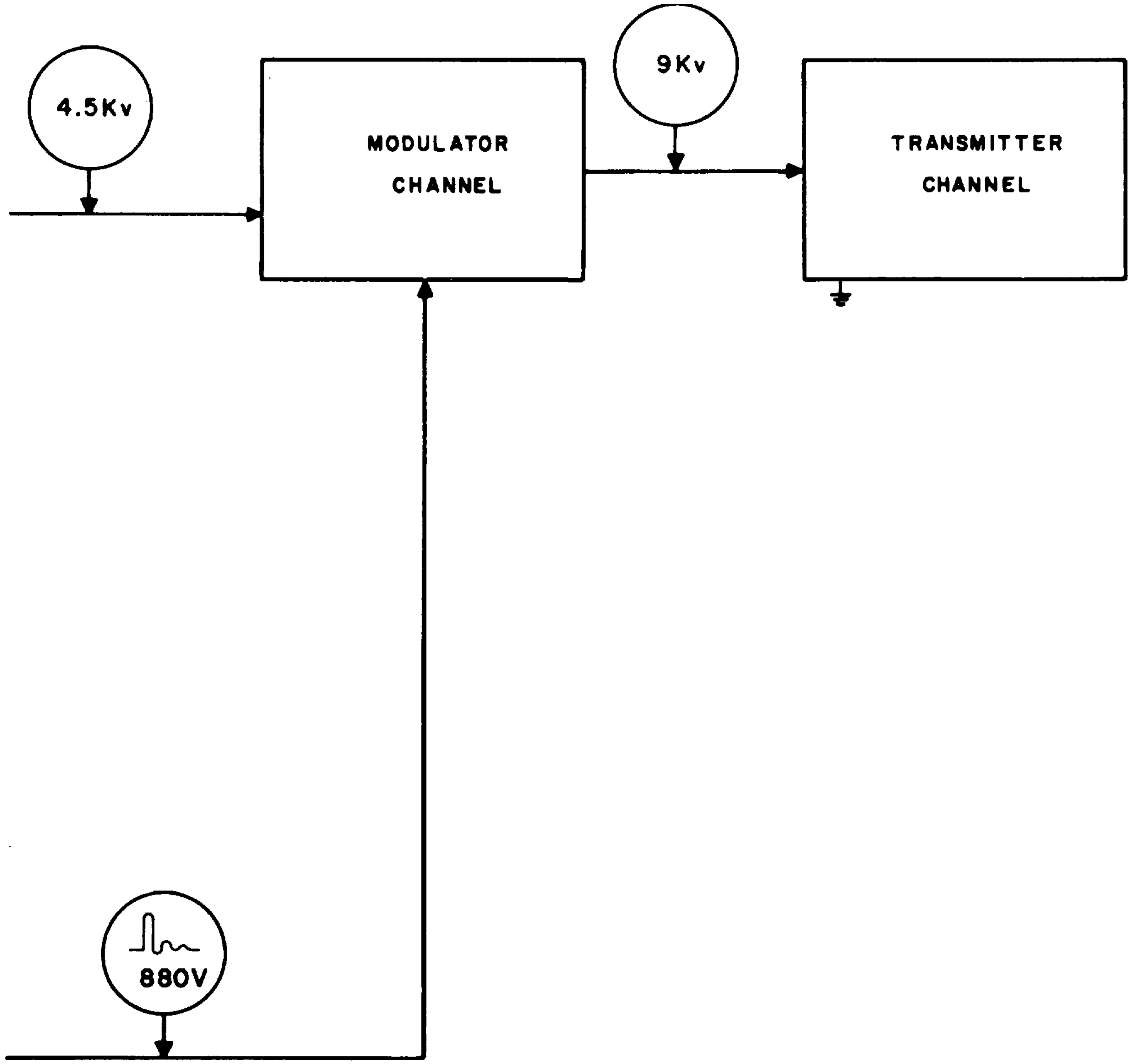
Z161 HV rectifier/Z147 focus control.



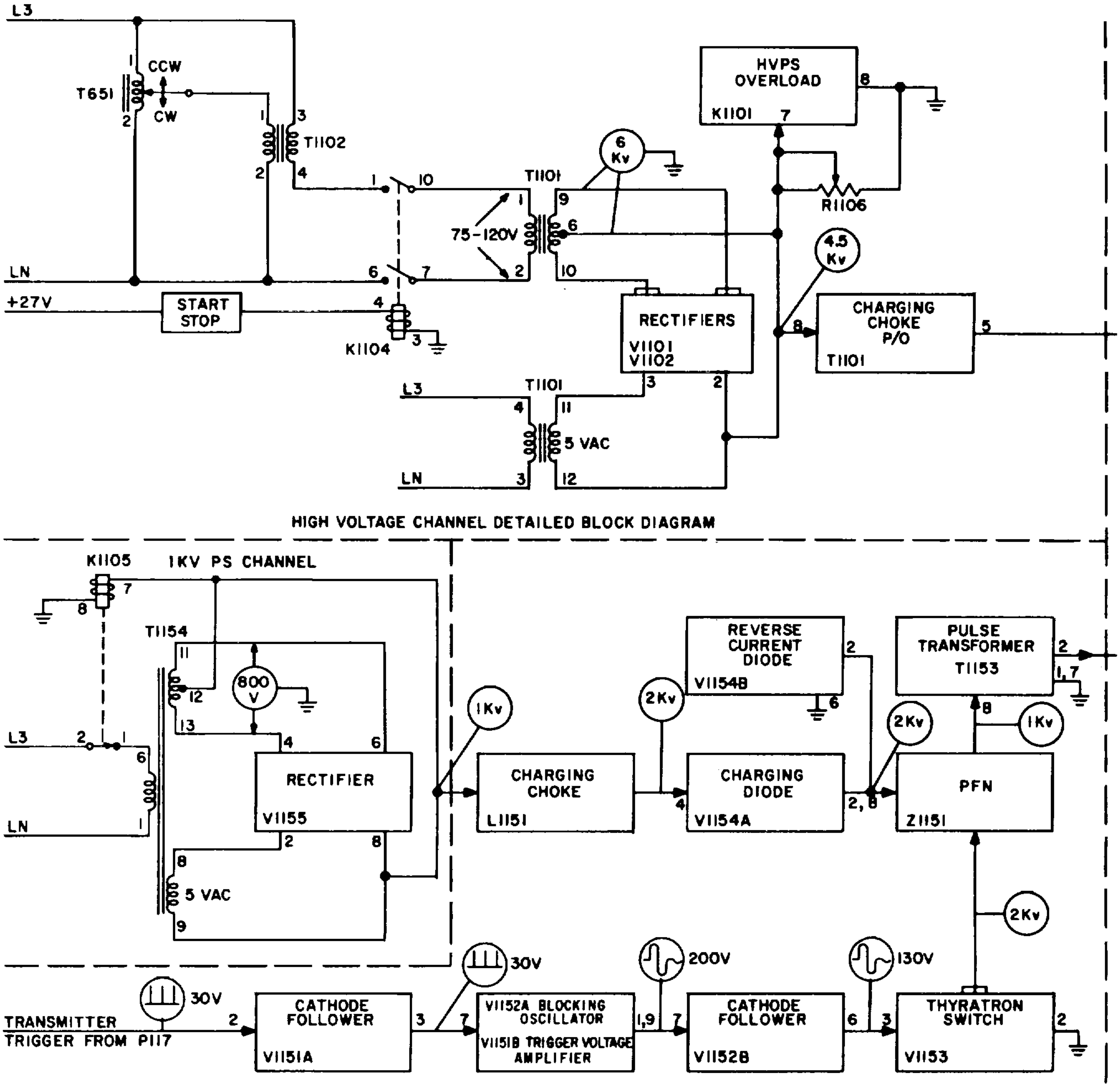
Z161 HV rectifier/Z147 focus control--Continued.



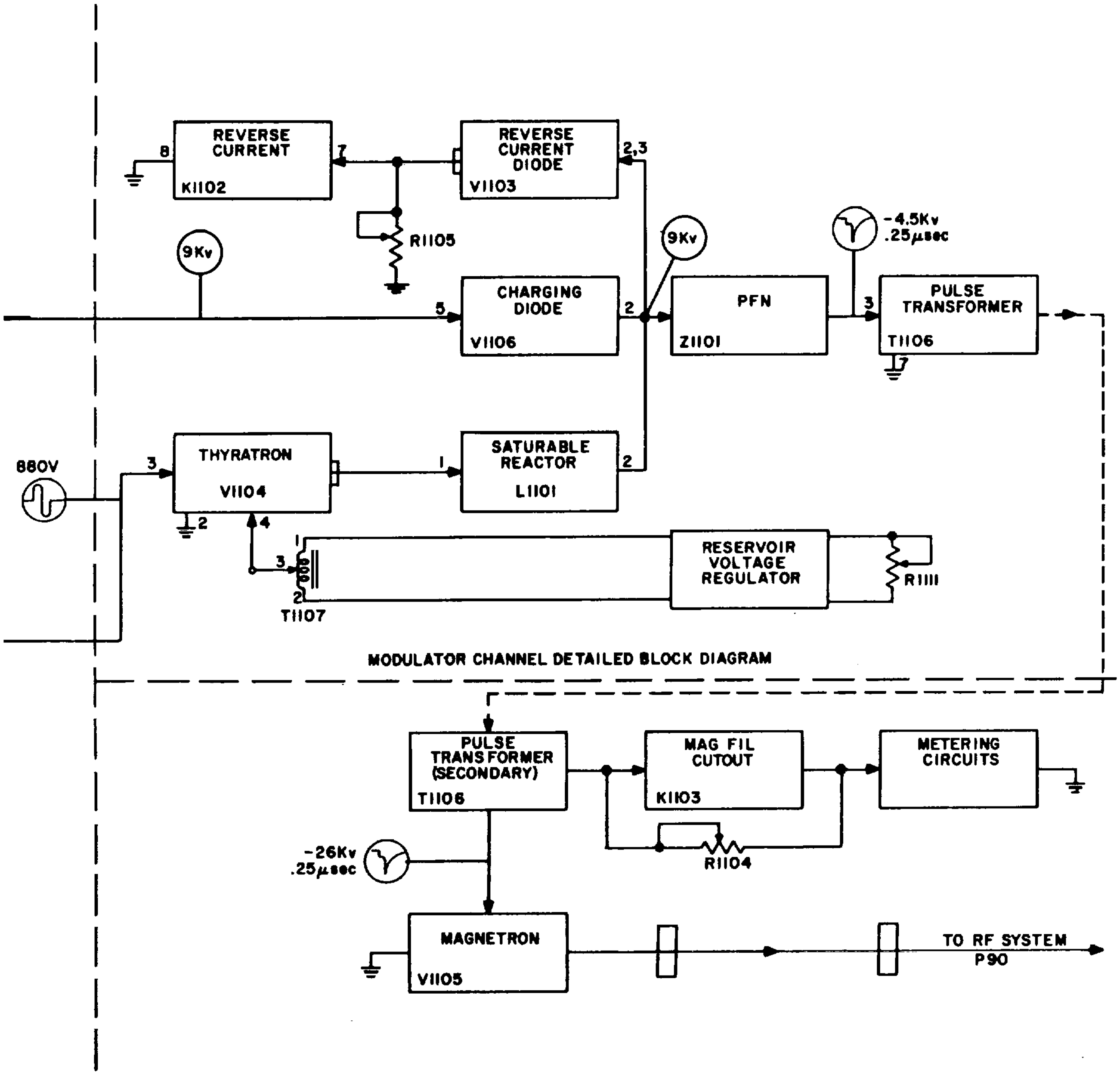
Transmitter system block diagram (simplified).



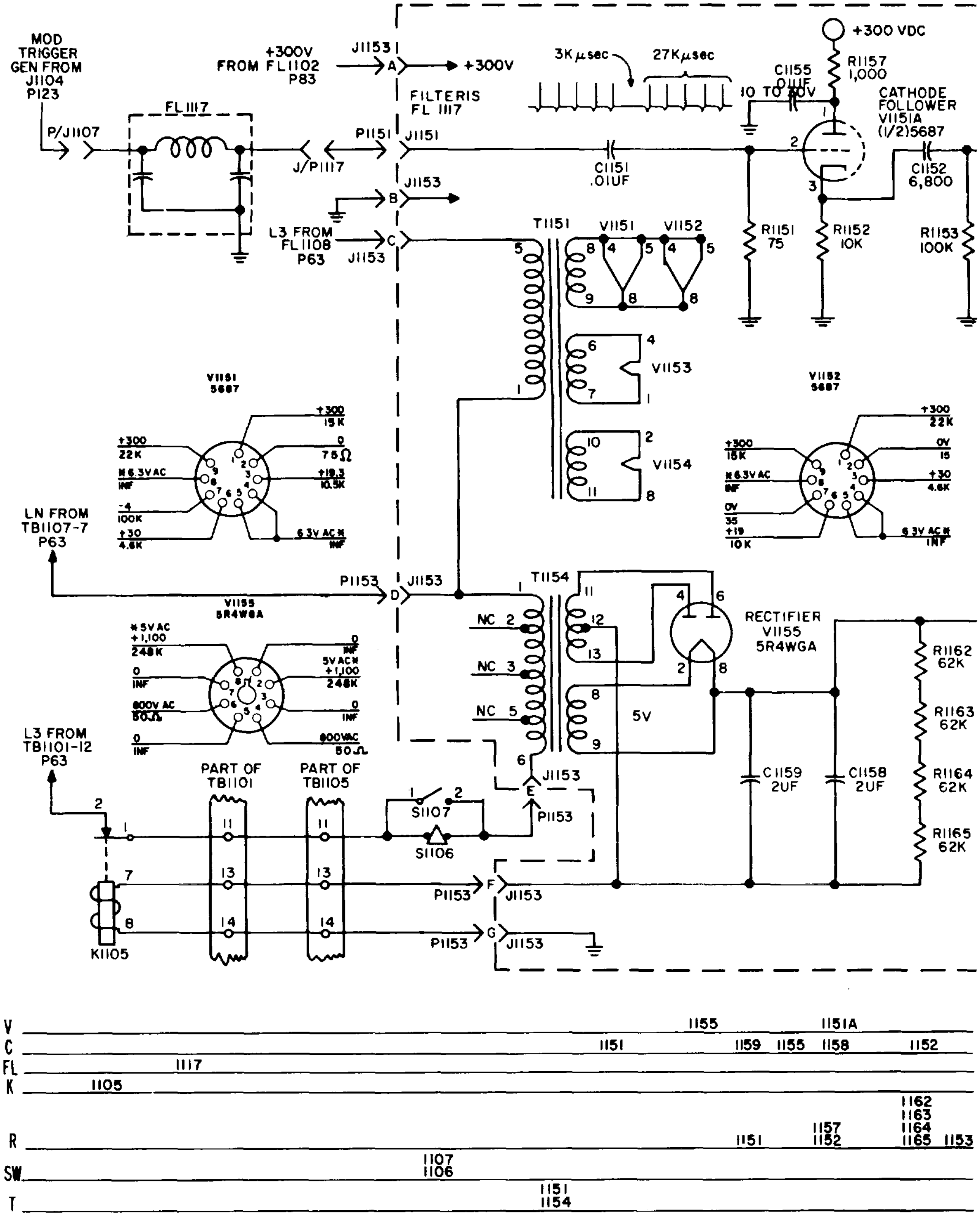
Transmitter system block diagram (simplified)--Continued.



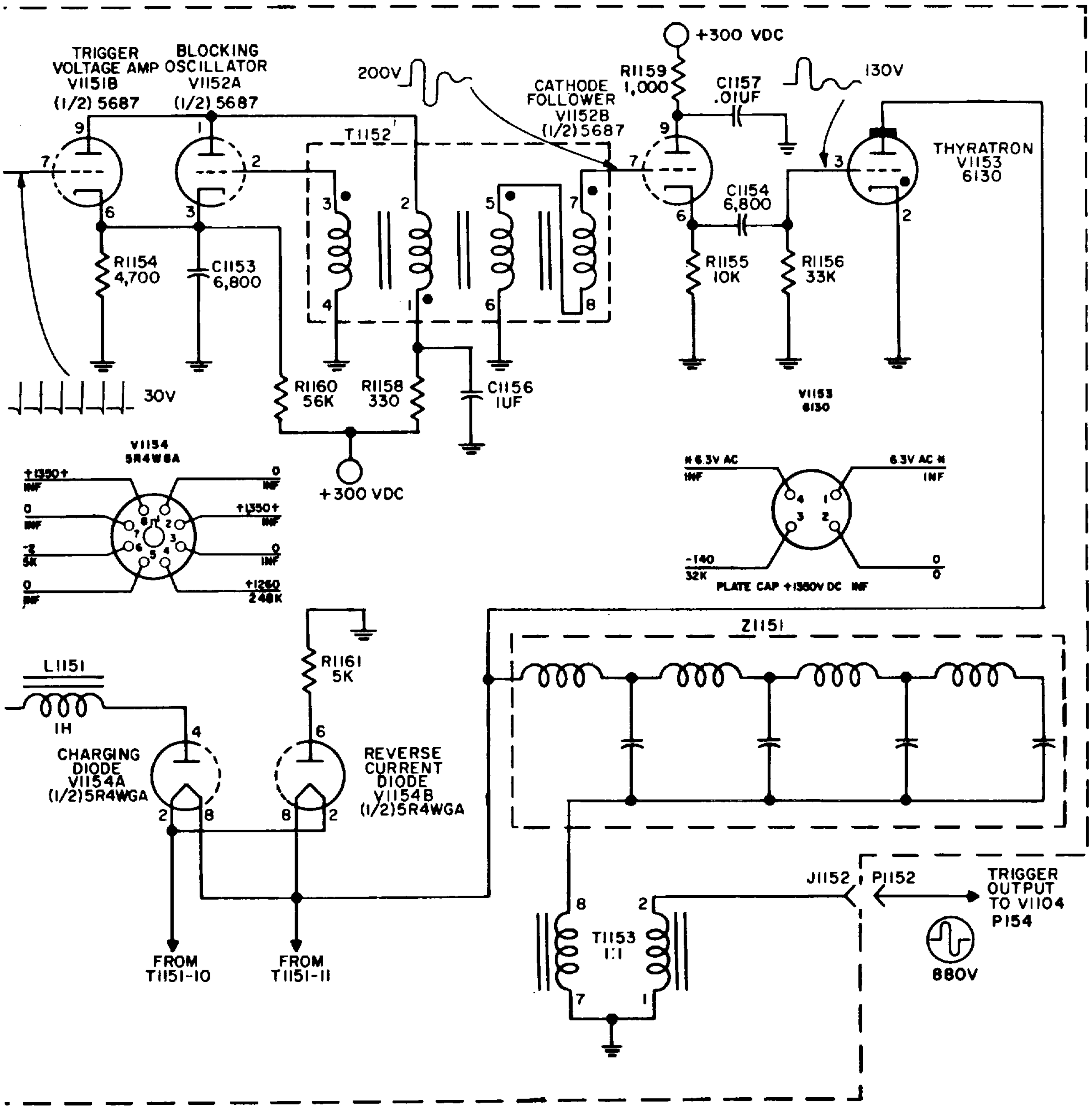
Trigger amplifier channel detailed block diagram.



Magnetron channel detailed block diagram.



1KV power supply and trigger amplifier.



V 1151B,A 1154A, B 1152B 1153

C 1153 1156 1157 1154

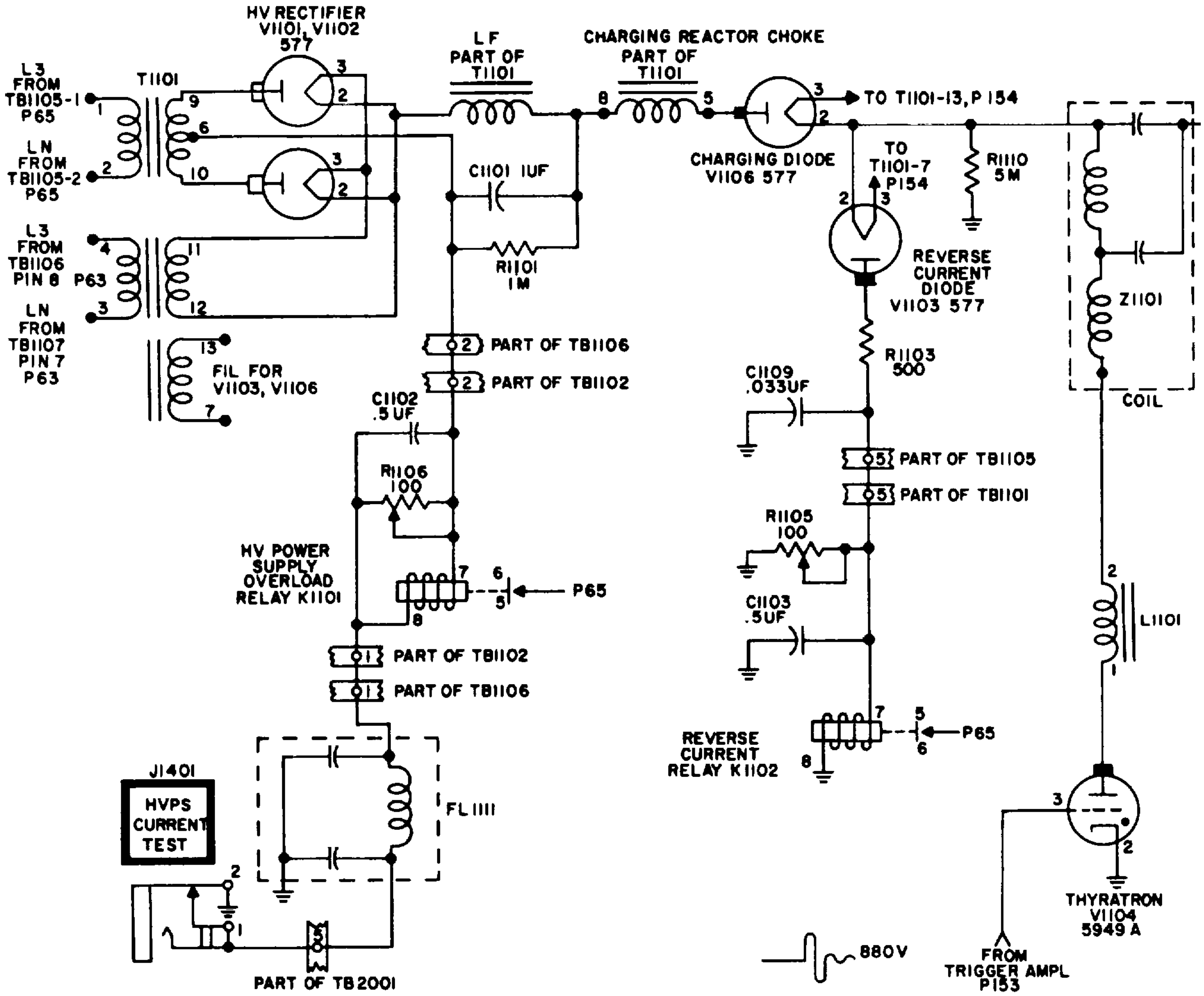
L 1151

R 1154 1160 1161 1158 1159 1155 1156

T 1152 1153

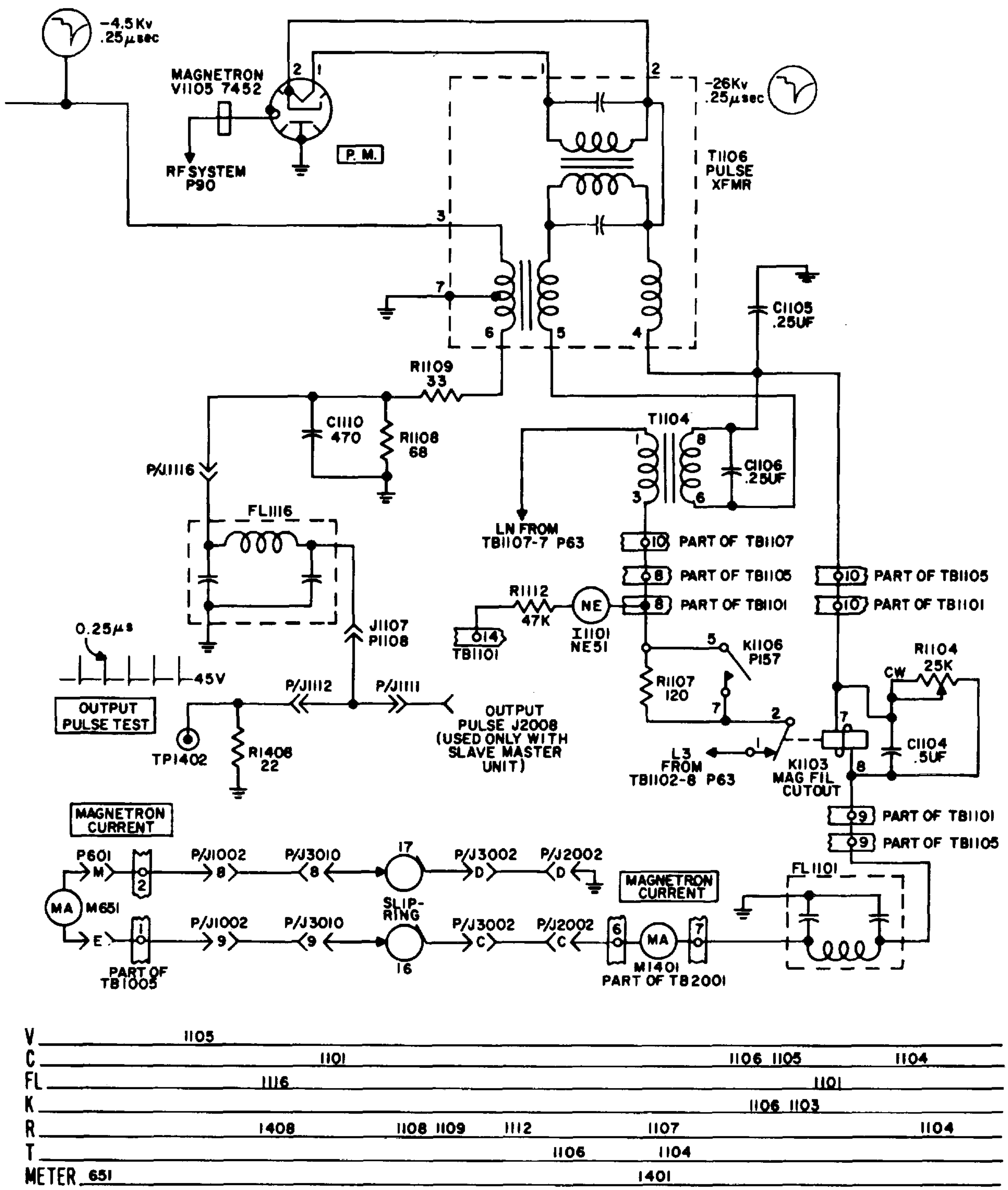
Z 1151

1KV power supply and trigger amplifier--Continued.

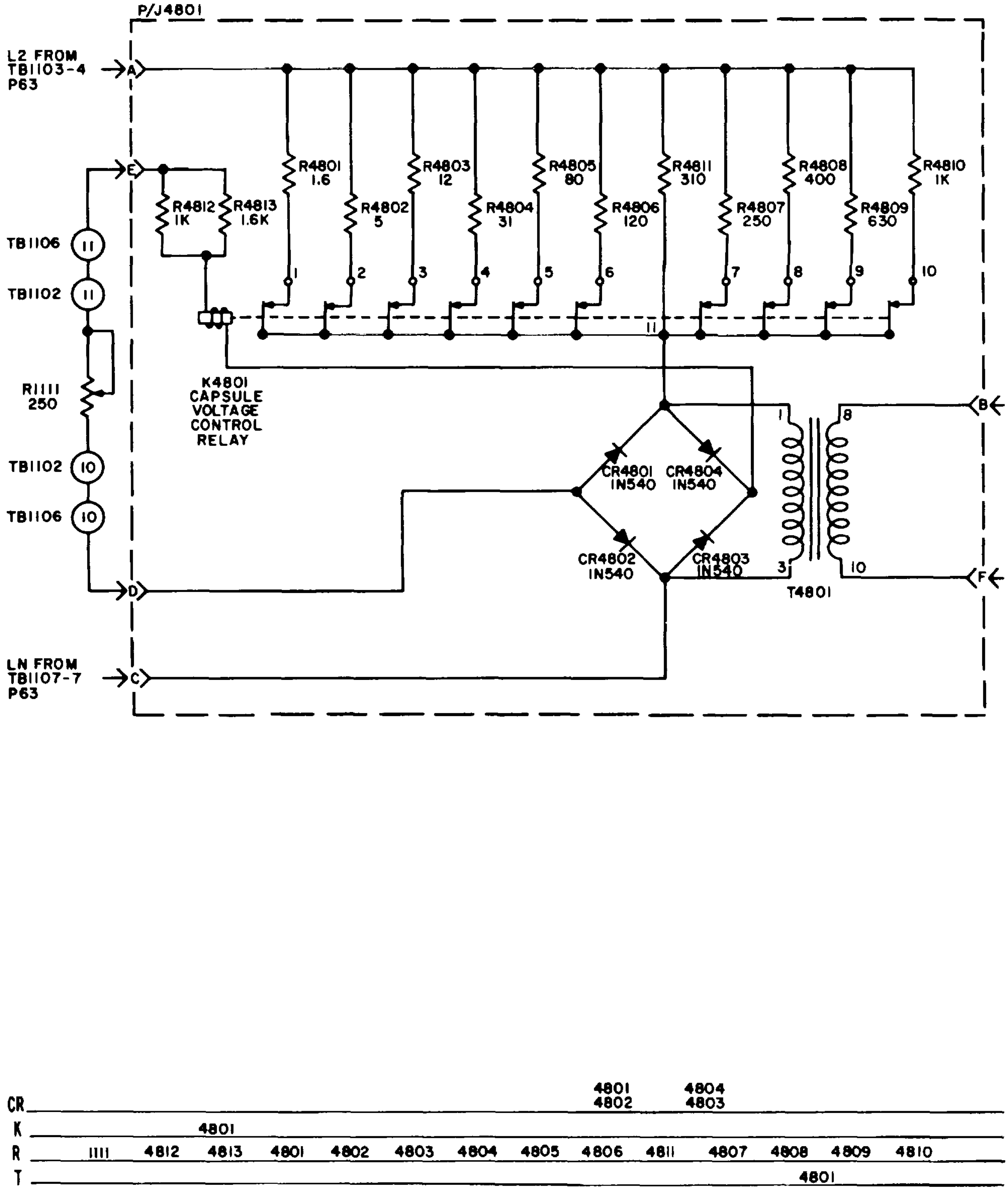


V	1101 1102	1106	1103	1104		
C	1102	1101	1109 1103			
CHOKE	FILTER	CHG REACTOR				
FL	1111					
K	1101	1102				
L	1101					
R	1106	1101	1105	1103	1110	
T	1101					
Z	1101					

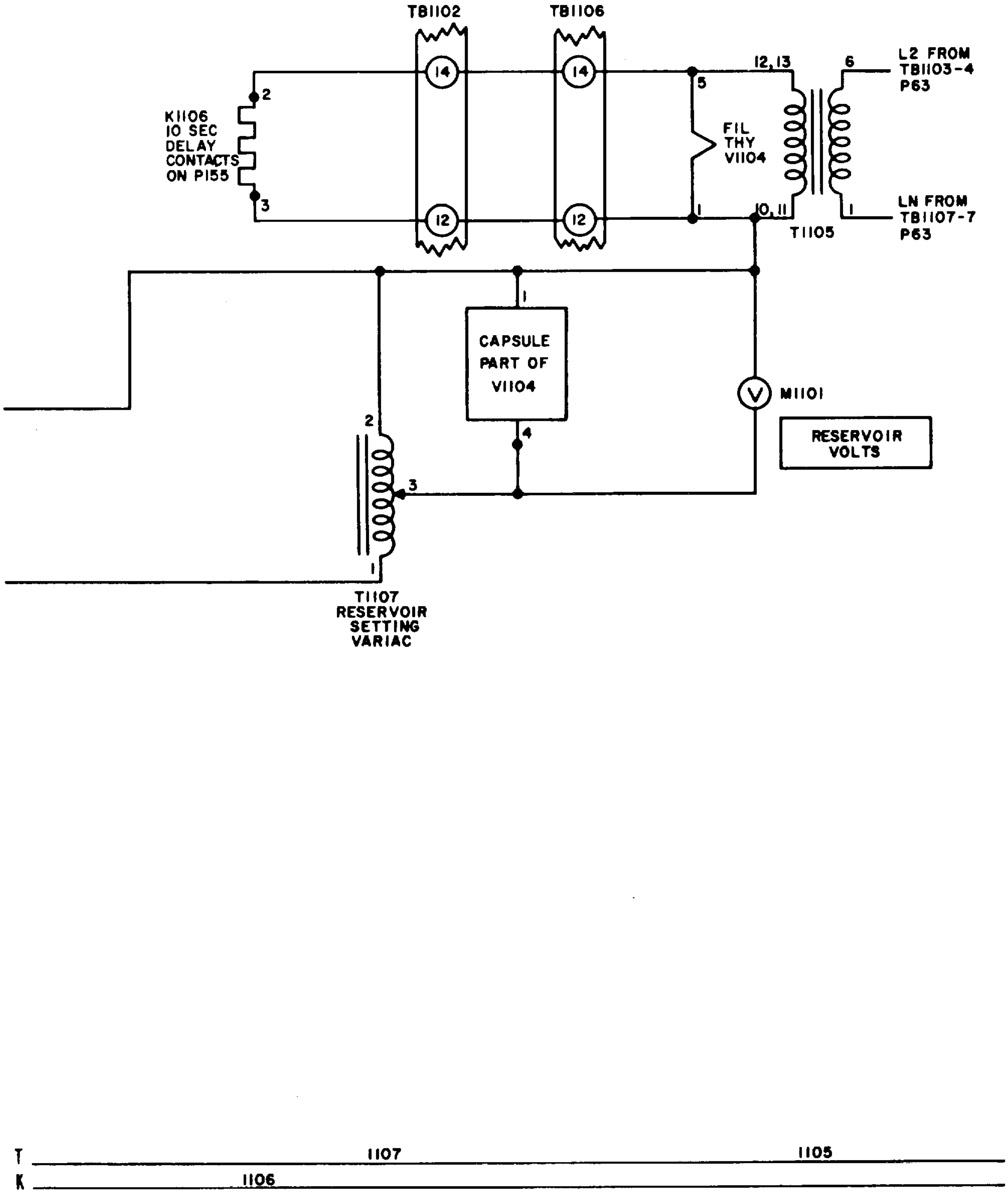
Modulator Transmitter



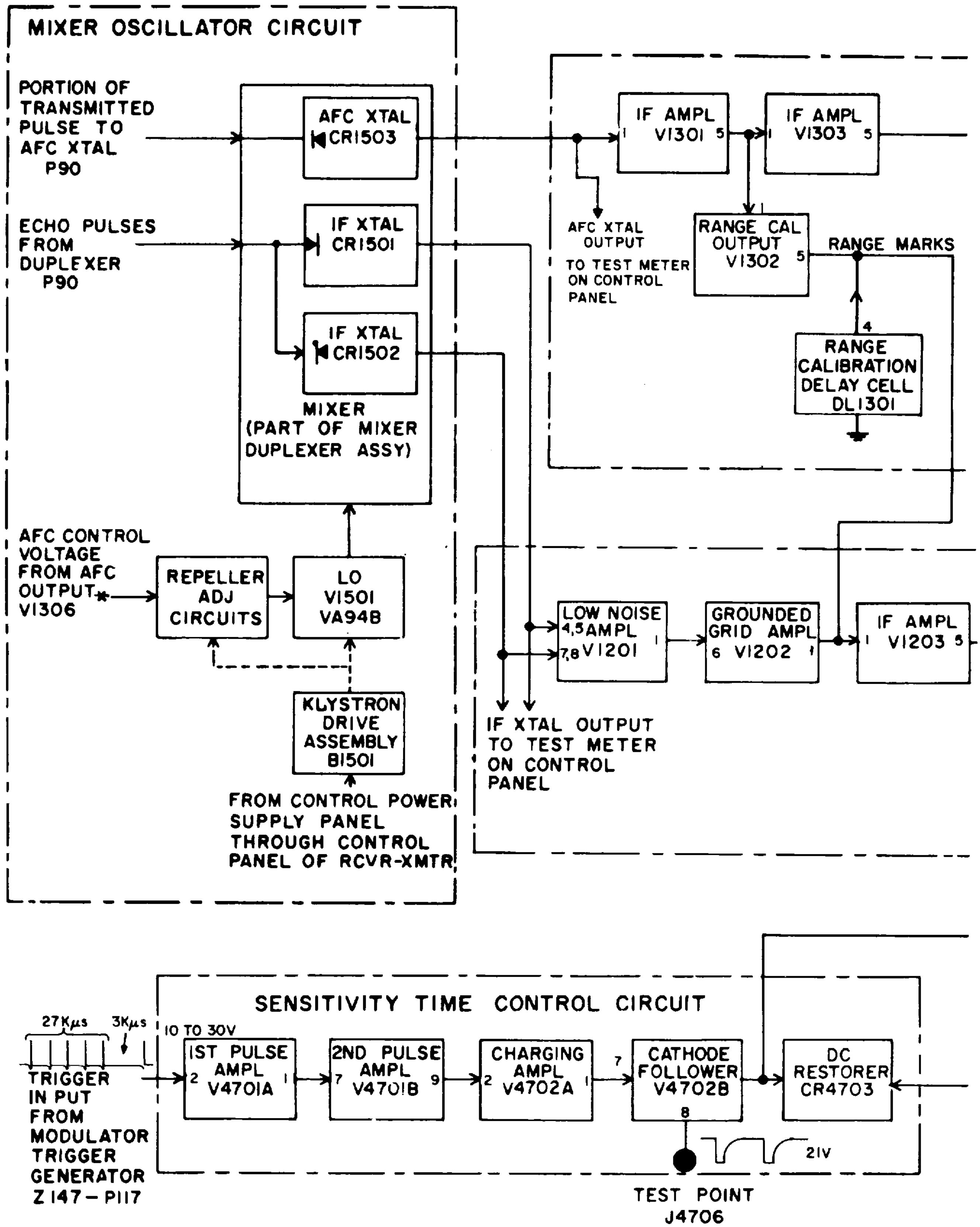
<u>Modulator transmitter</u>--Continued.



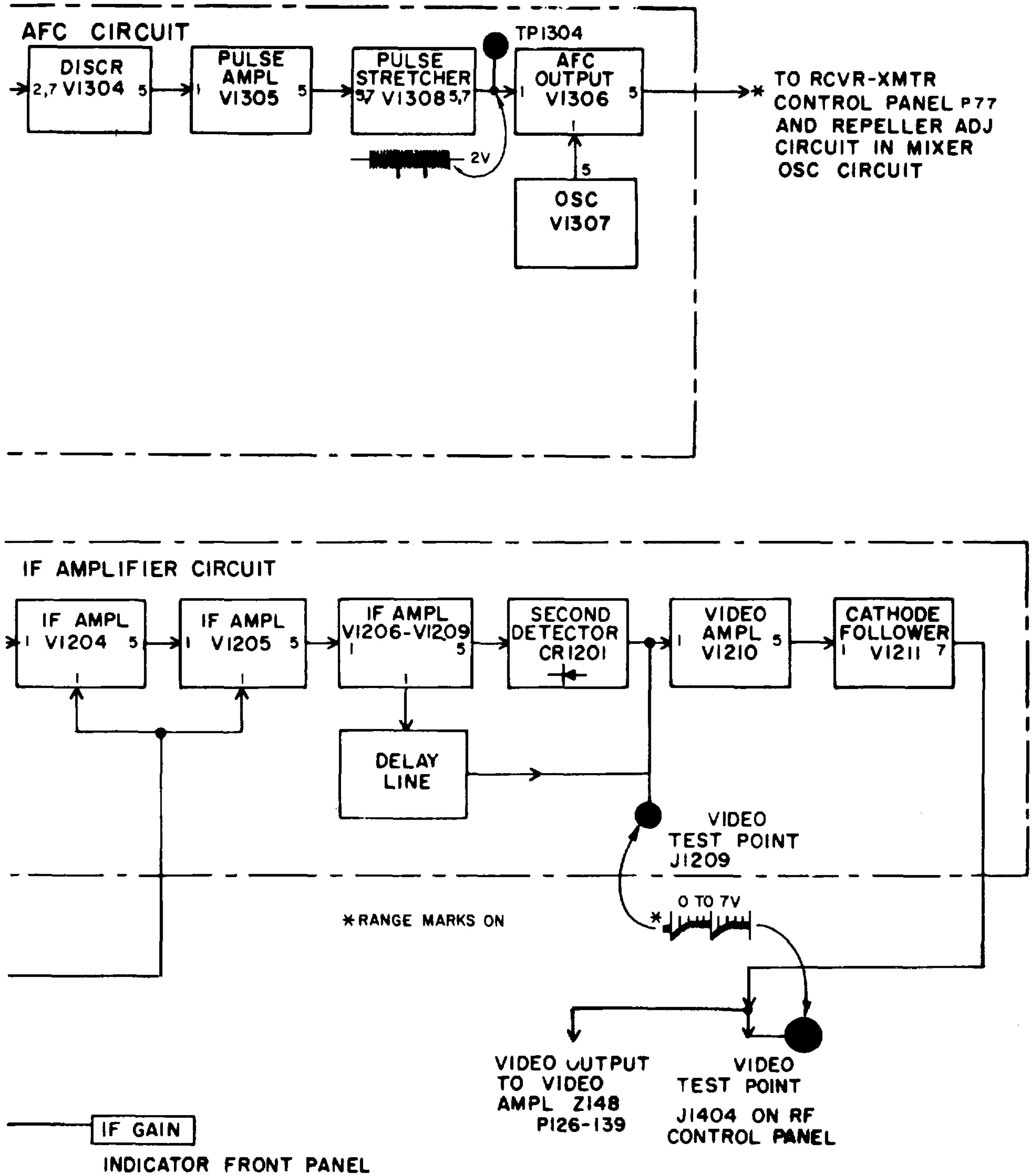
Reservoir voltage regulator.



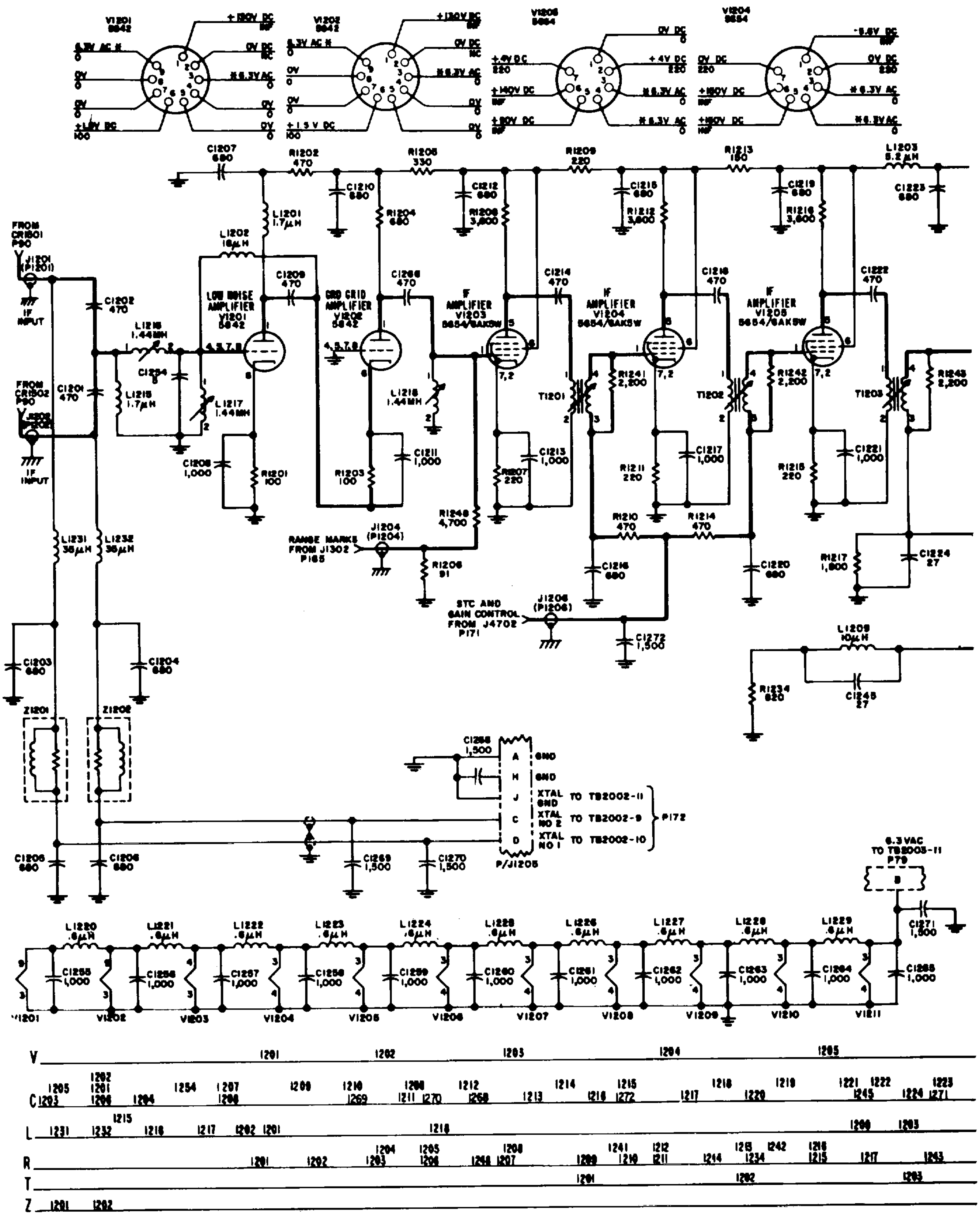
<u>Reservoir voltage regulator</u>--Continued.



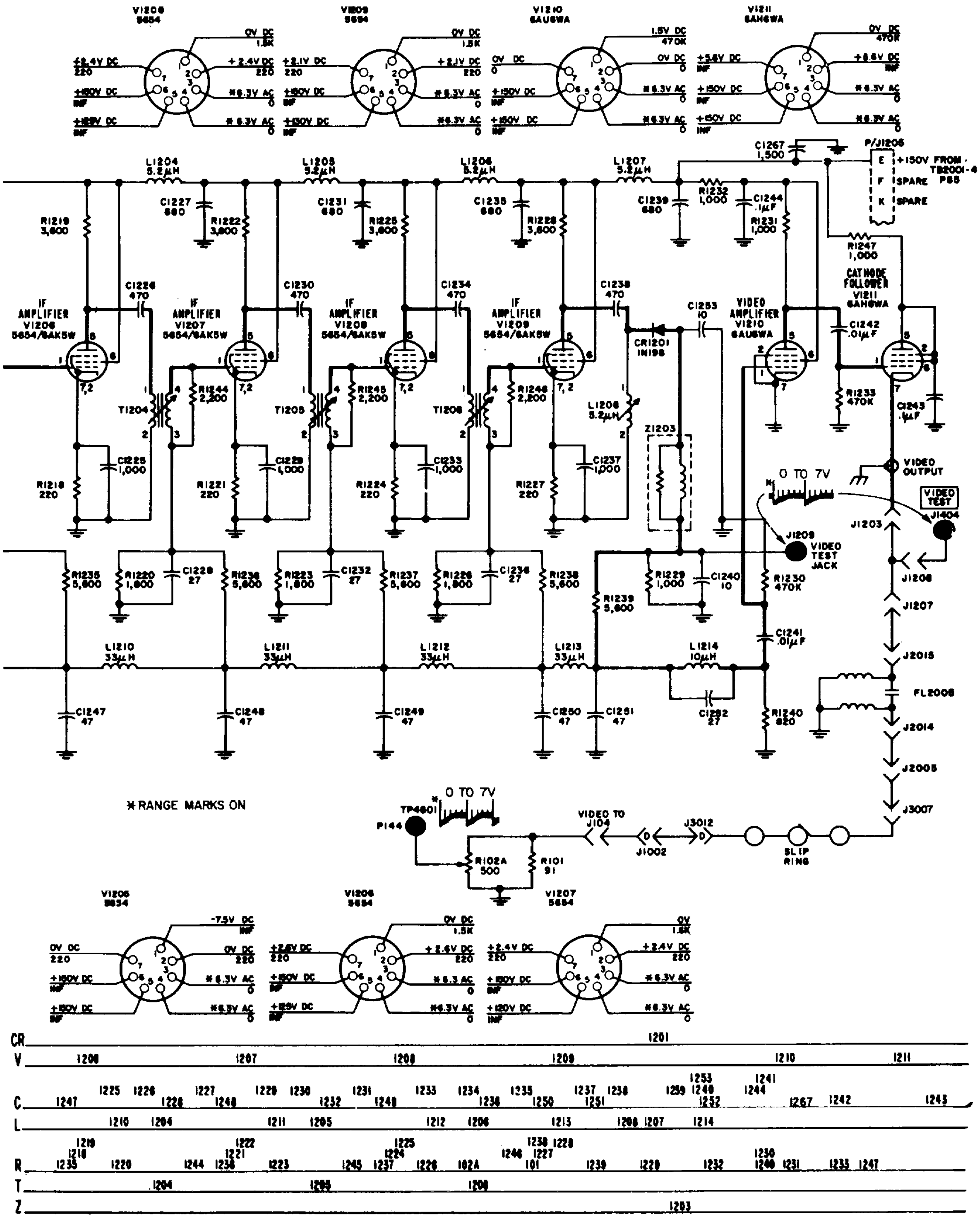
Receiver block diagram.



Receiver block diagram--continued.



Receiver if channel.



<u>Receiver if channel</u>--continued.

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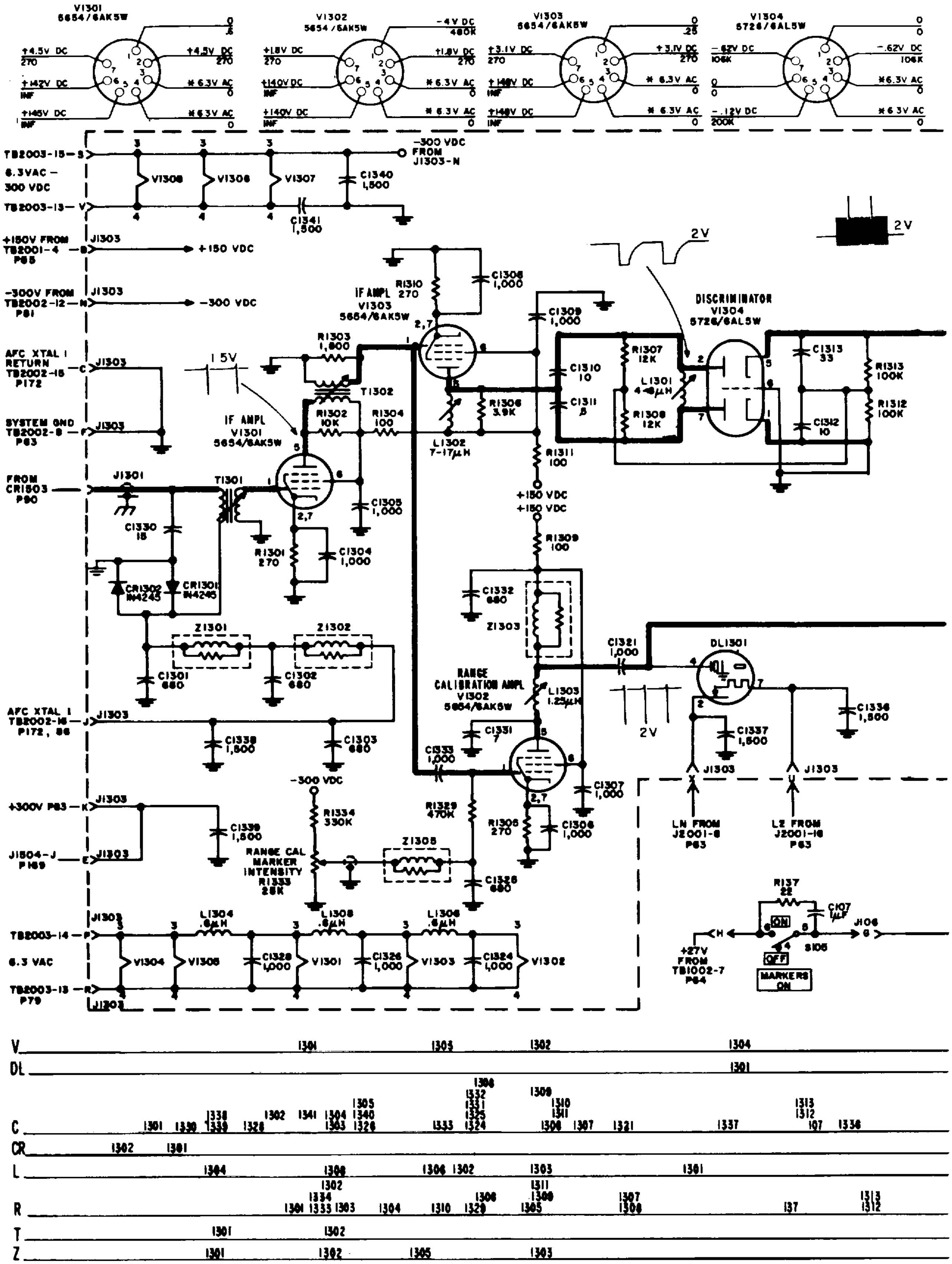
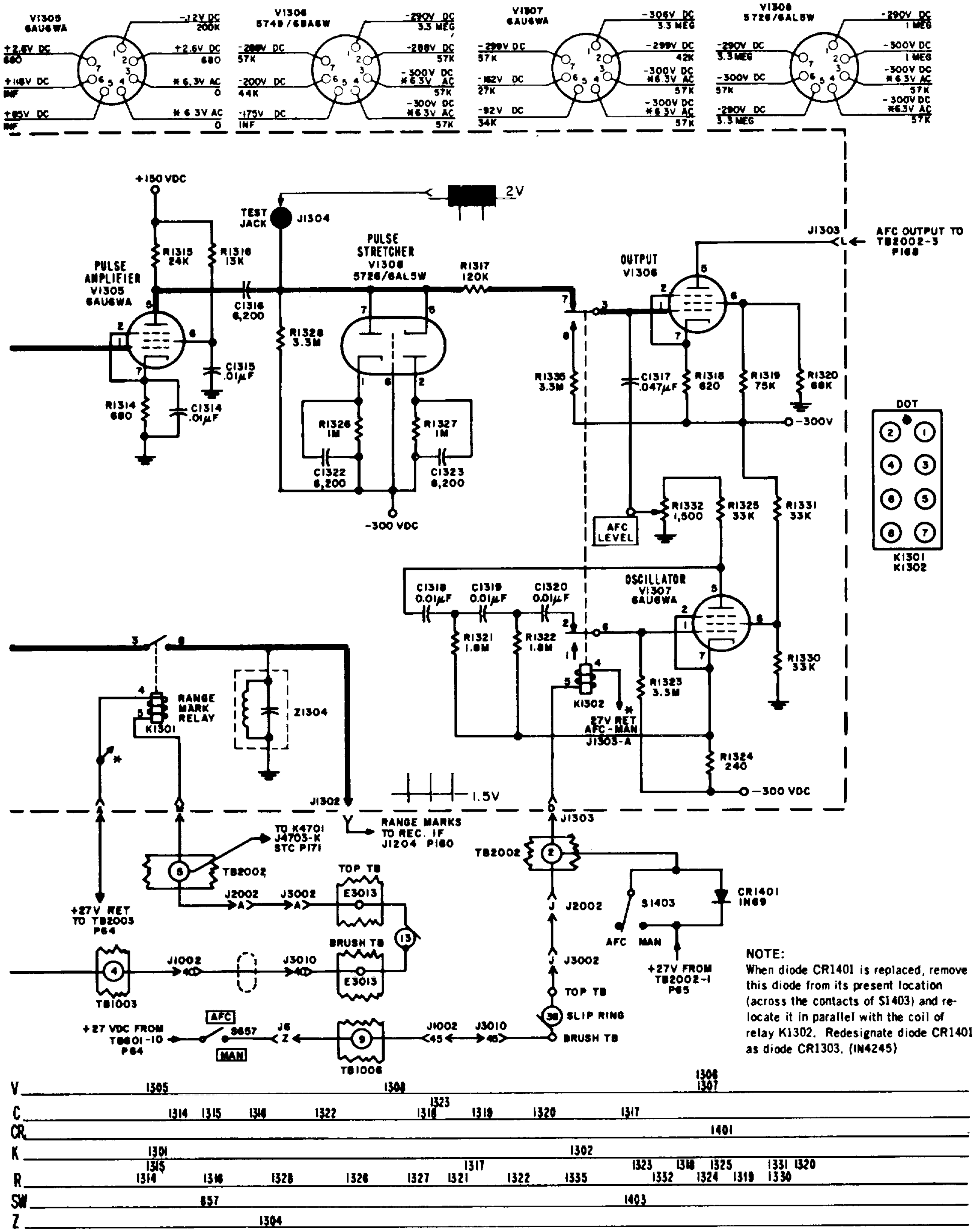


Receiver AFC channel.



Receiver AFC channel--Continued.

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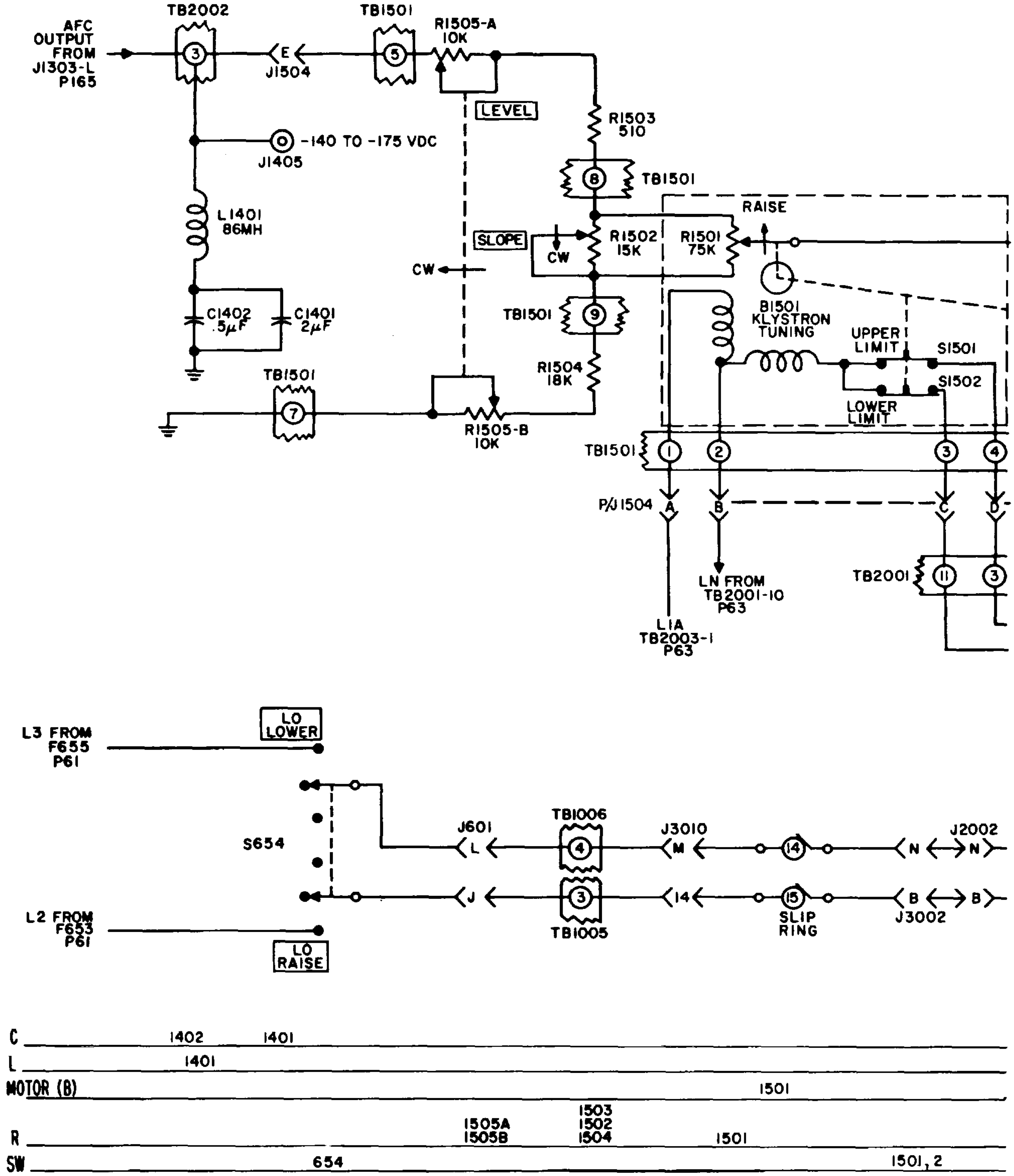
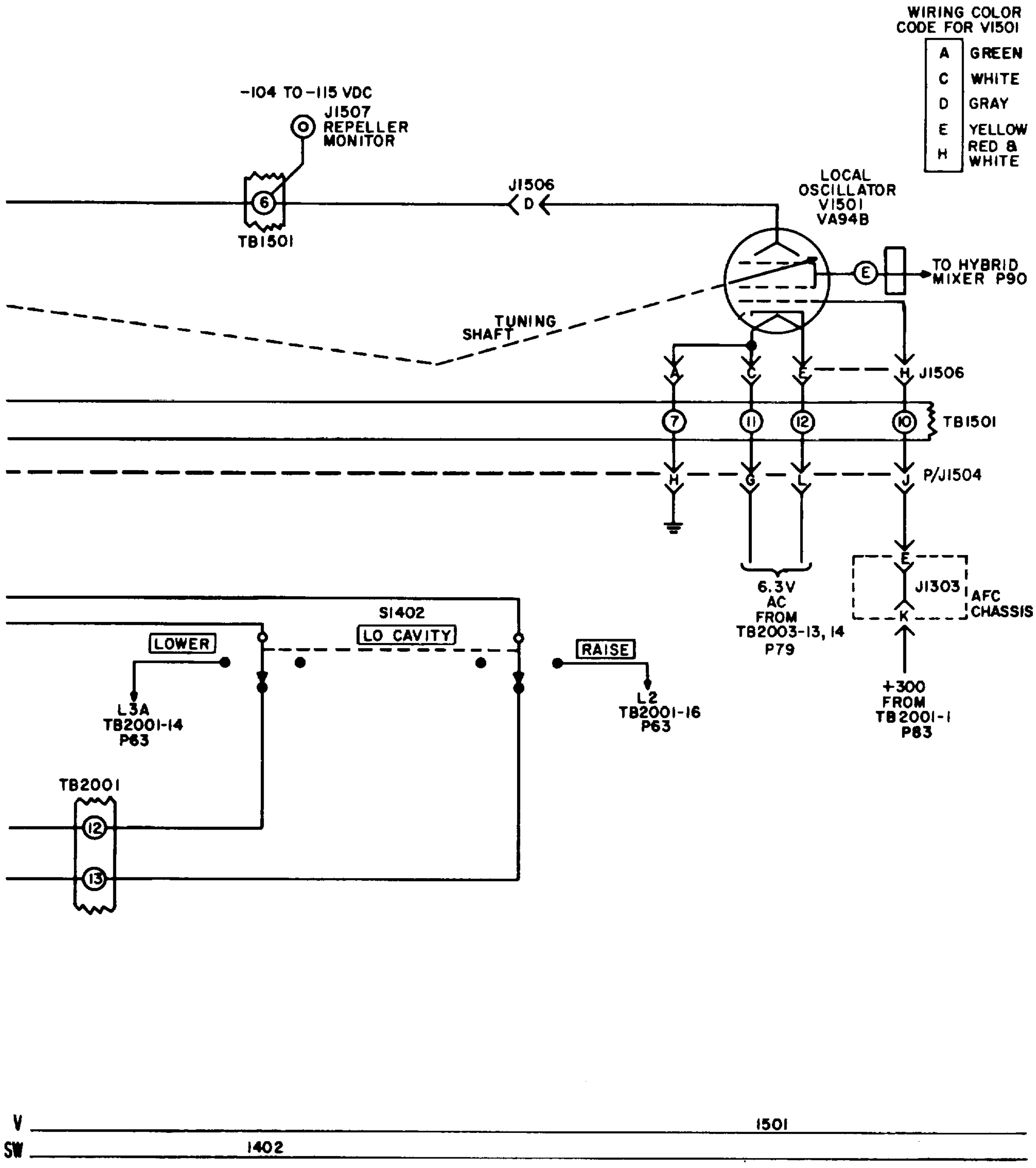
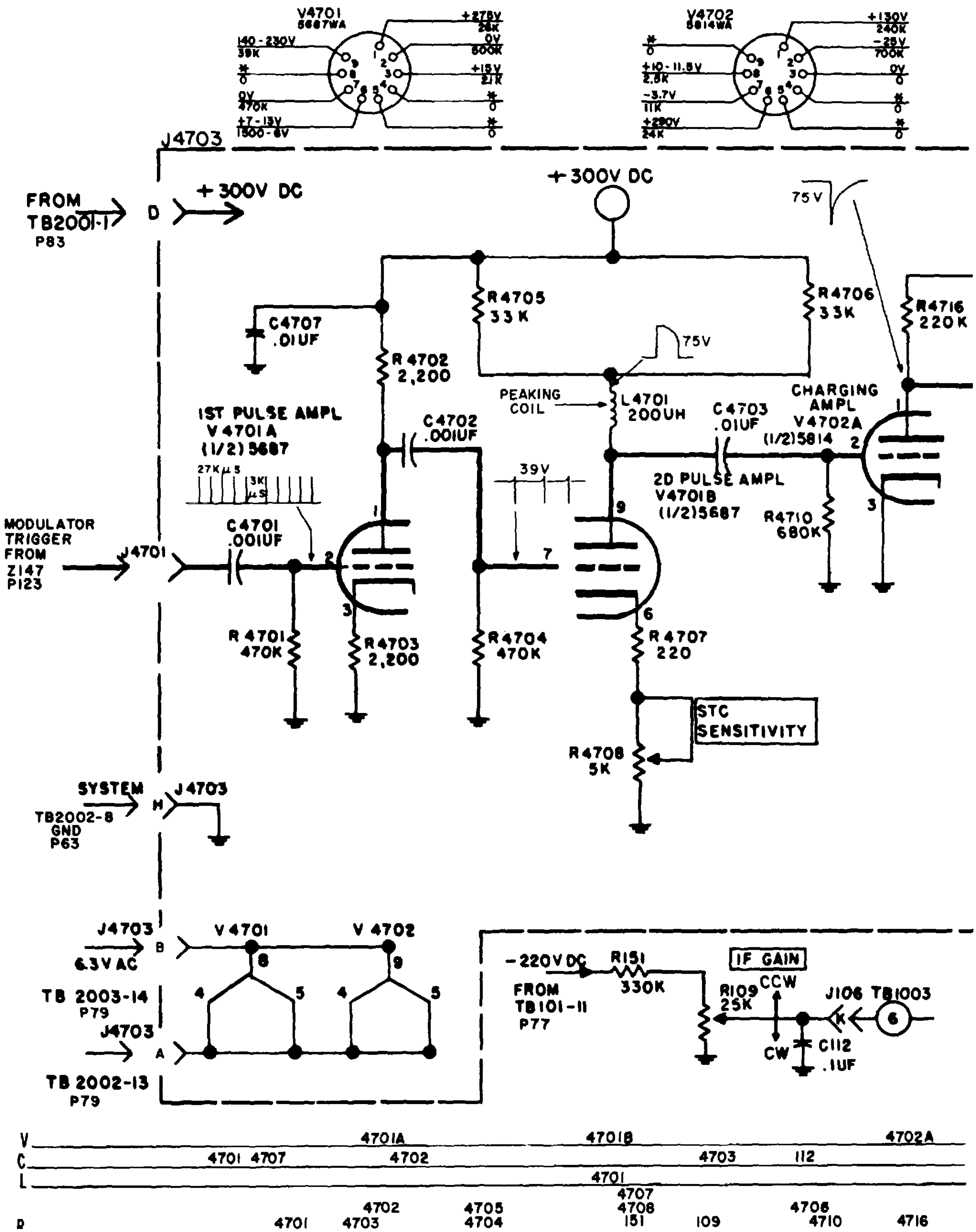


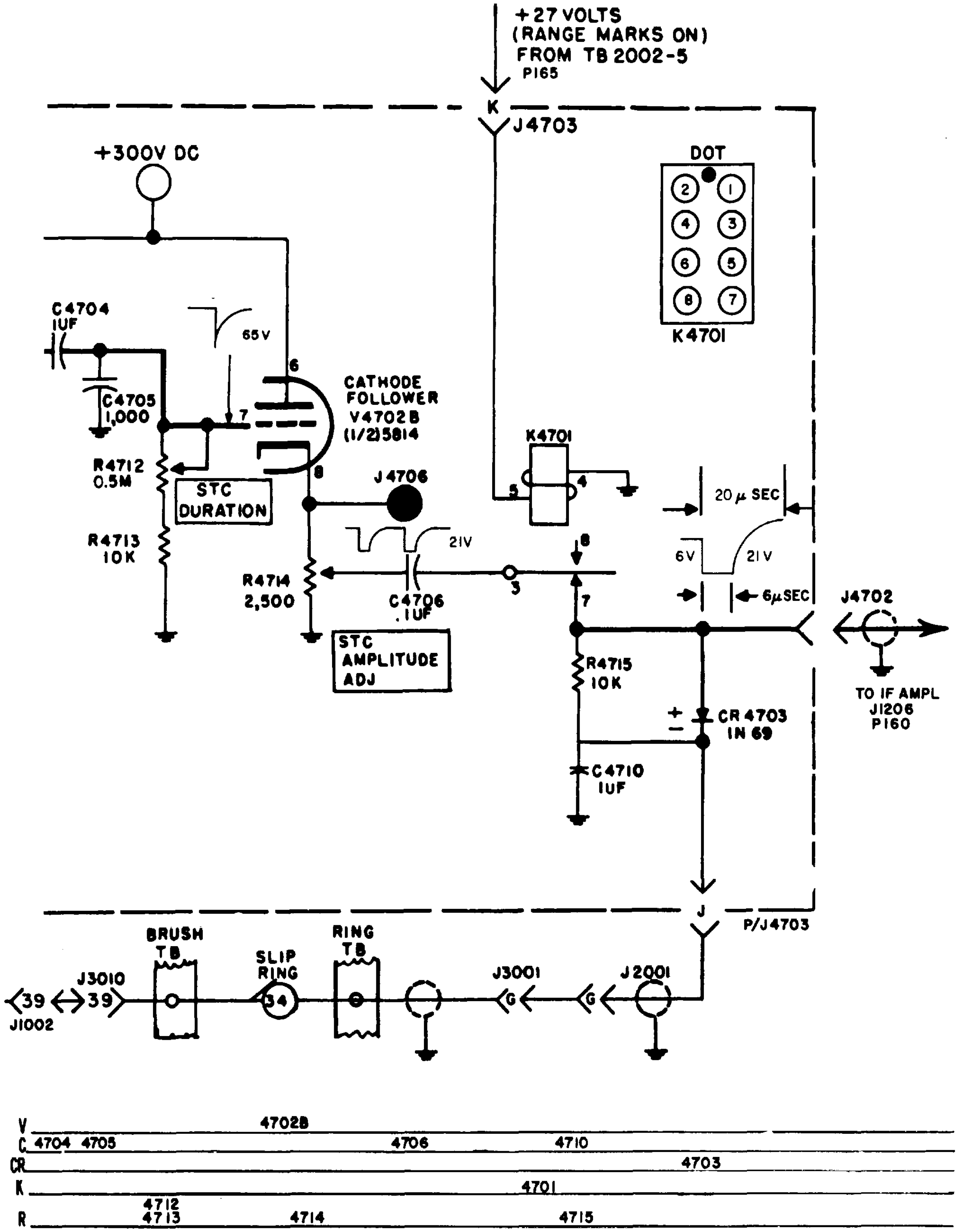
Local oscillator and associated circuits



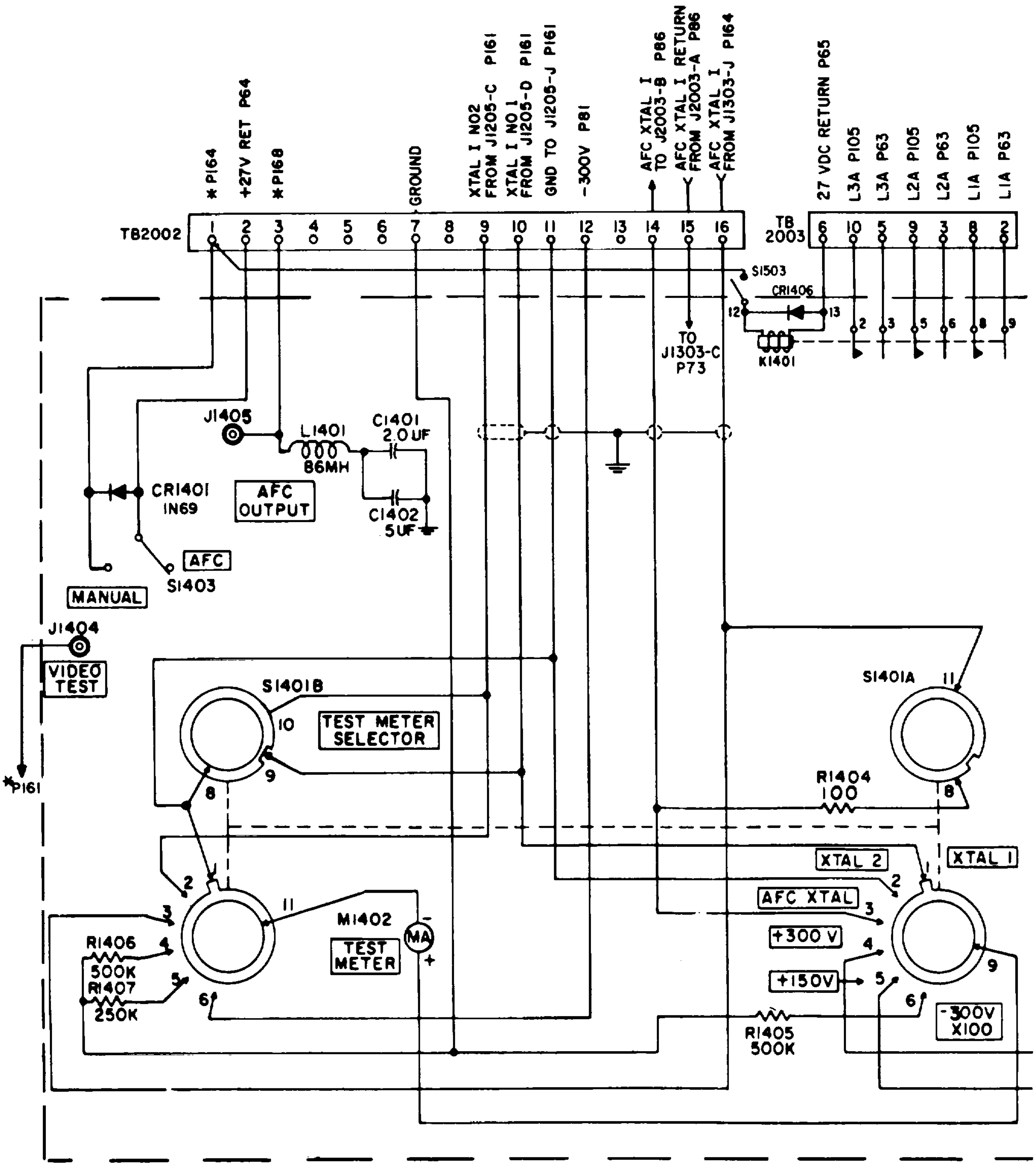
Local oscillator and associated circuits--Continued.



Receiver STC channel.

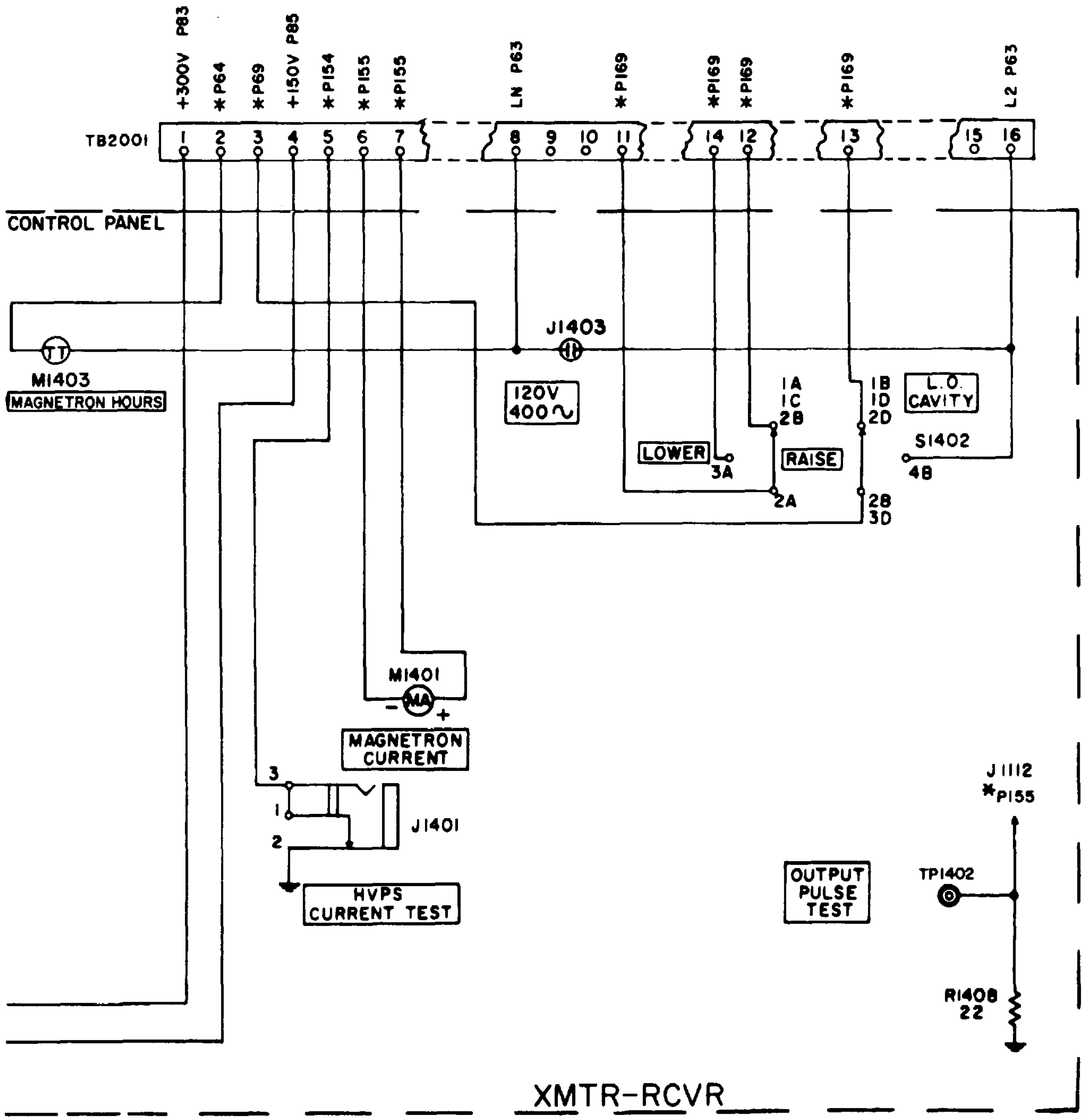


Receiver STC channel--continued.



Switching and metering circuit.

*NOTE: CIRCUITS ALSO SHOWN ON INDICATED PAGE



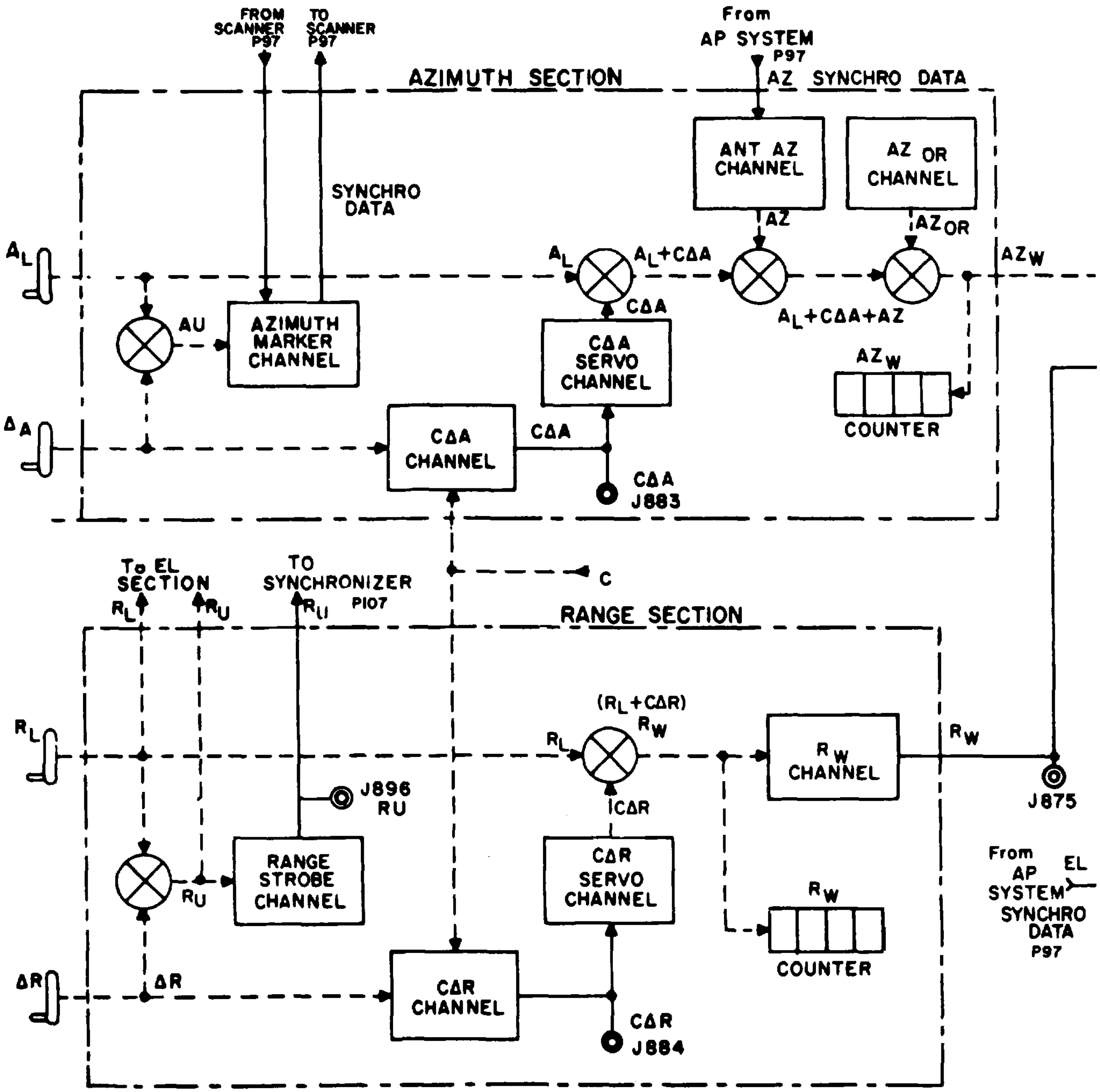
Switching and metering circuit--continued.

COMPUTER
GLOSSARY OF SYMBOLS

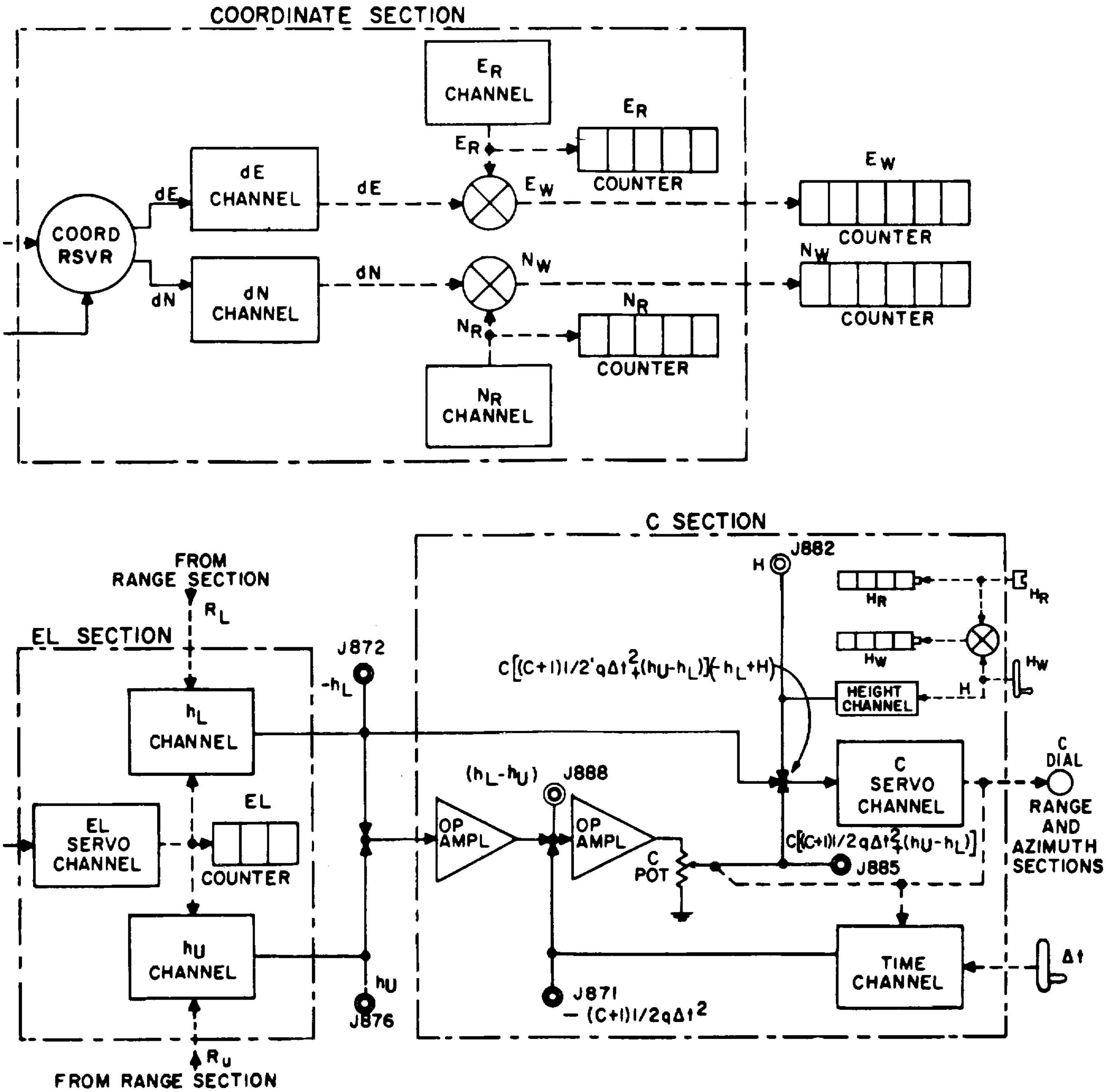
The following symbols are used throughout this manual to represent various items of data to simplify the explanation of system functioning.

Symbol	Name	Definition
A_L	Lower beam horizontal angle.	Horizontal angle at the radar from antenna azimuth axis to lower beam intercept point.
A_U	Upper beam horizontal angle.	Horizontal angle at the radar from antenna azimuth axis to upper beam intercept point.
ΔA	ΔAzimuth.	A_U - A_L.
AZ_W	Weapon azimuth.	Azimuth angle from grid north to weapon position.
AZ	Antenna azimuth.	Angle at the radar from grid north to antenna axis (center of sector scan).
AZ_{OR}	Azimuth orient information.	
C	A term used in azimuth and range computations.	The ratio of the extrapolated portion to the sampled portion of the trajectory. d_L/D.
D	---	Datum plane projection of the distance between the two intersections of the radar beam with the projectile trajectory.
d_L	---	Datum plane projection of the distance from the weapon position to the interception of the lower beam with the projectile trajectory.
d_U	---	Datum plane projection of the distance from the weapon position to the interception of the upper beam with the projectile trajectory
E_L	Lower beam elevation.	Angle of elevation of lower radar beam above a horizontal datum plane.
E_R	---	Radar easting.
E_U	Upper beam elevation	Angle of elevation of upper radar beam above a horizontal datum plane.
E_W	---	Weapon easting.
H_R	Radar height.	Height of radar set above sea level.
H_W	Weapon height	Height of weapon above sea level.

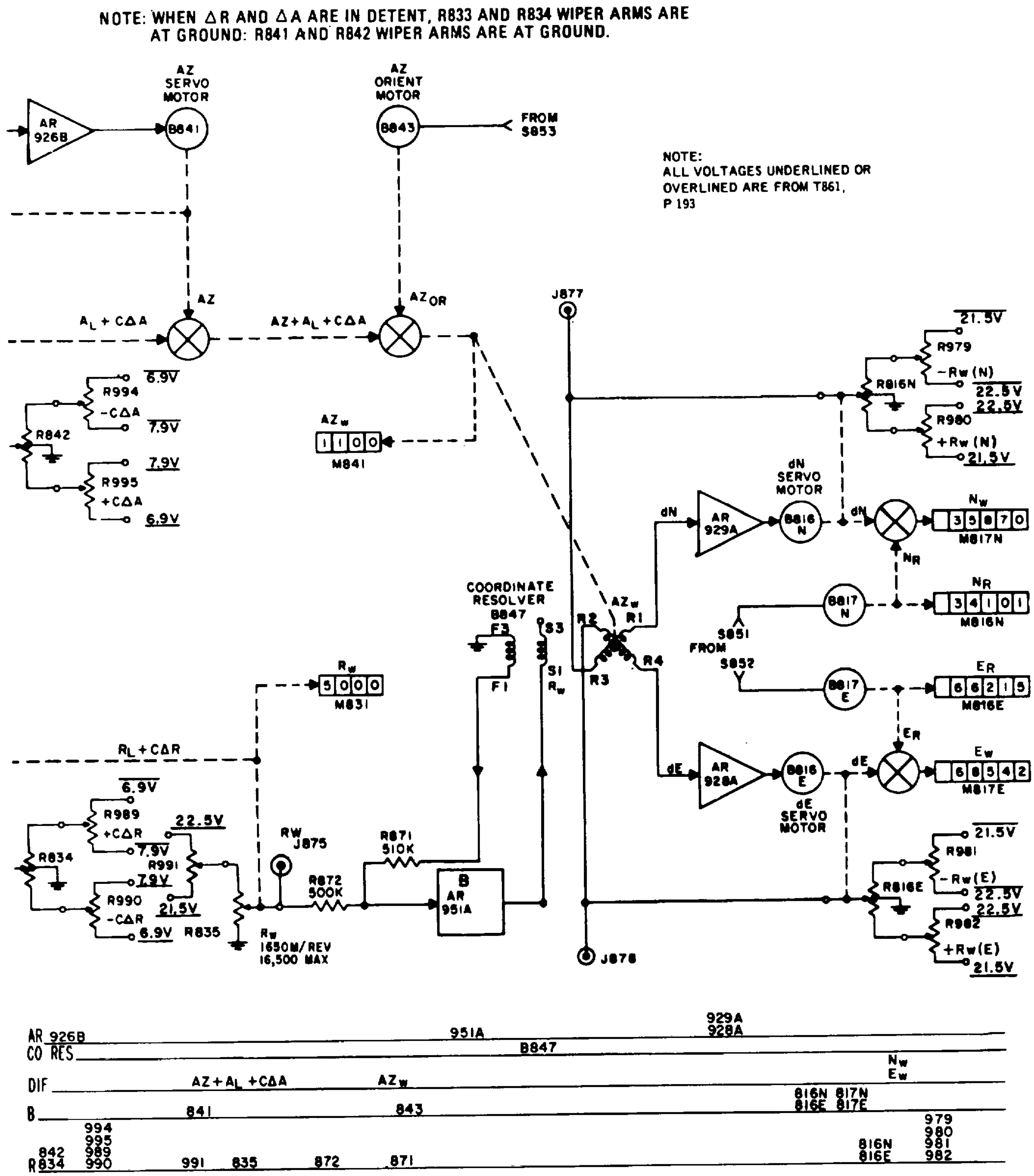
Symbol	Name	Definition
H	Height.	H_R - H_W
h_L	Height of beam intercept.	Height of lower beam projectile intercept above a horizontal plane through the radar.
H_U	Height of beam intercept.	Height of upper beam projectile intercept above a horizontal plane through the radar.
N_R	--	Radar northing.
N_W	--	Weapon northing.
R_L	Lower beam range	Slant range from radar set to lower beam intercept point.
R_U	Upper beam range.	Slant range from radar set to upper beam intercept point.
R_W	Weapon range.	Ground range from radar set to weapon location.
ΔR	Δ range.	R_U - R_L.
$R_{W(E)}$	dE.	Difference in easting between radar and weapon.
$R_{W(N)}$	dN.	Difference in northing between radar and weapon.
t_L	--	Time required for projectile to travel from the weapon location to point L.
t_U	--	Time required for projectile to travel from the weapon location to point U.
ΔT	Δ time.	t_L - t_U.
$\cong$	--	Symbol for "approximately equals."



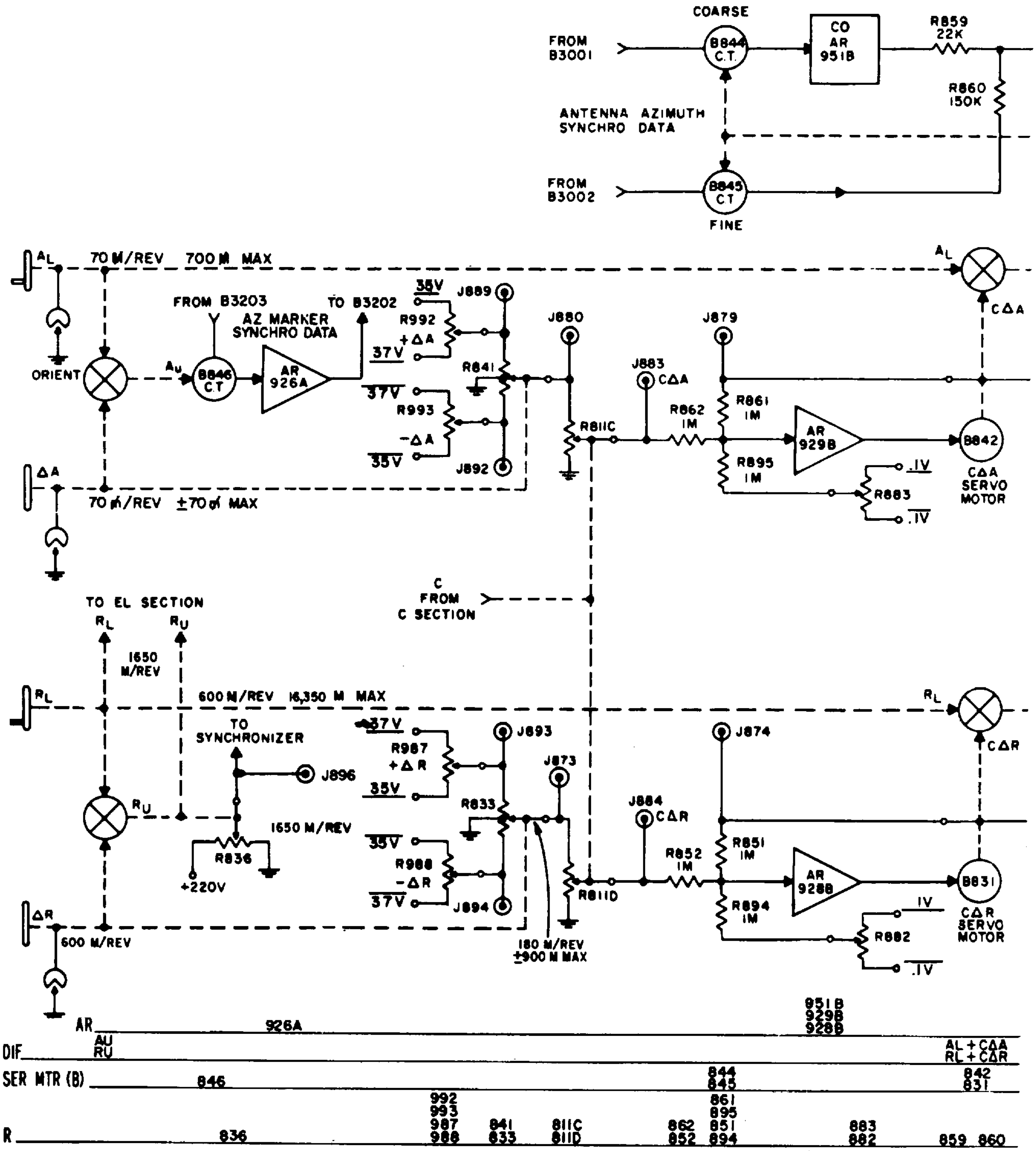
Computer block diagram.



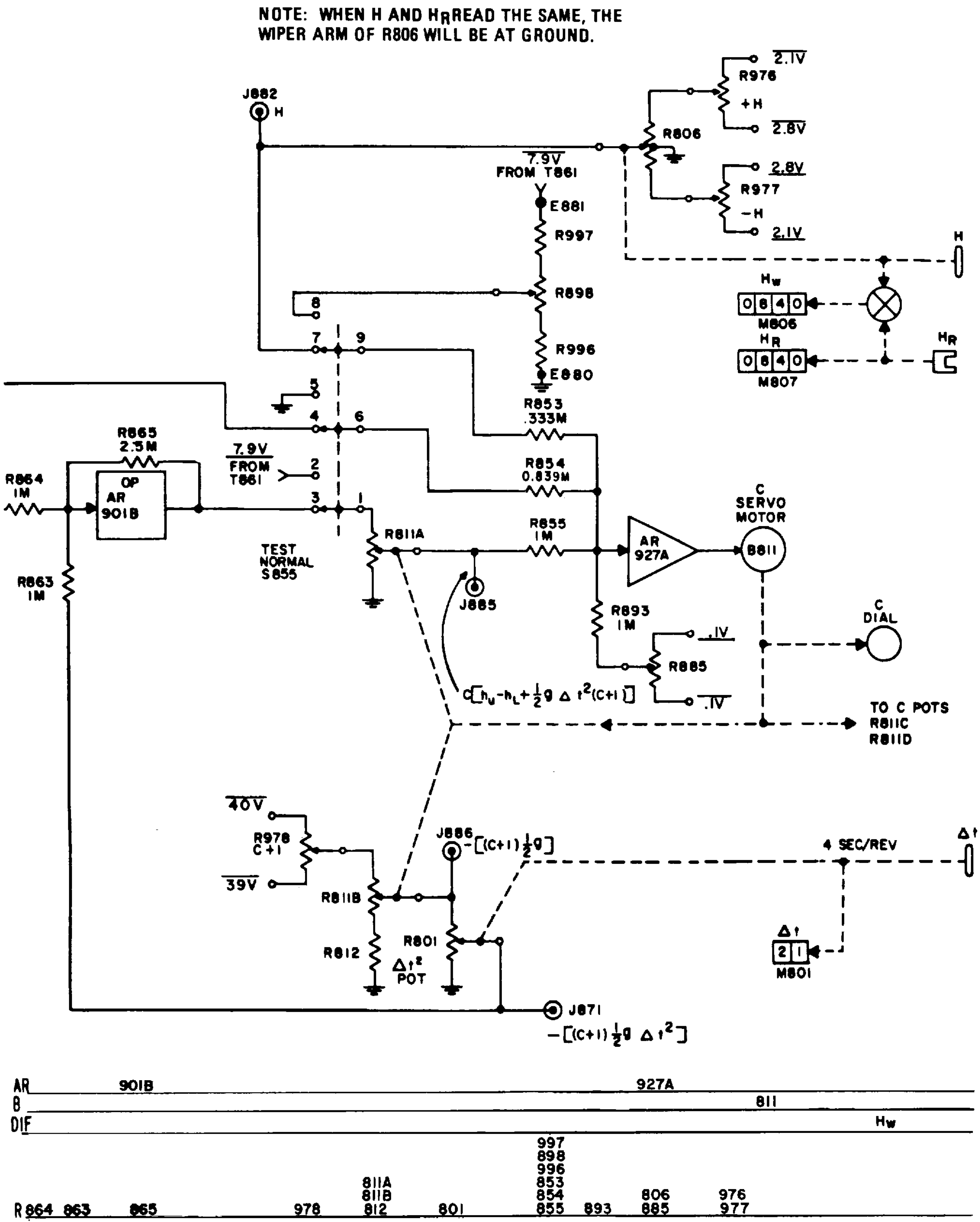
Computer block diagram—continued..



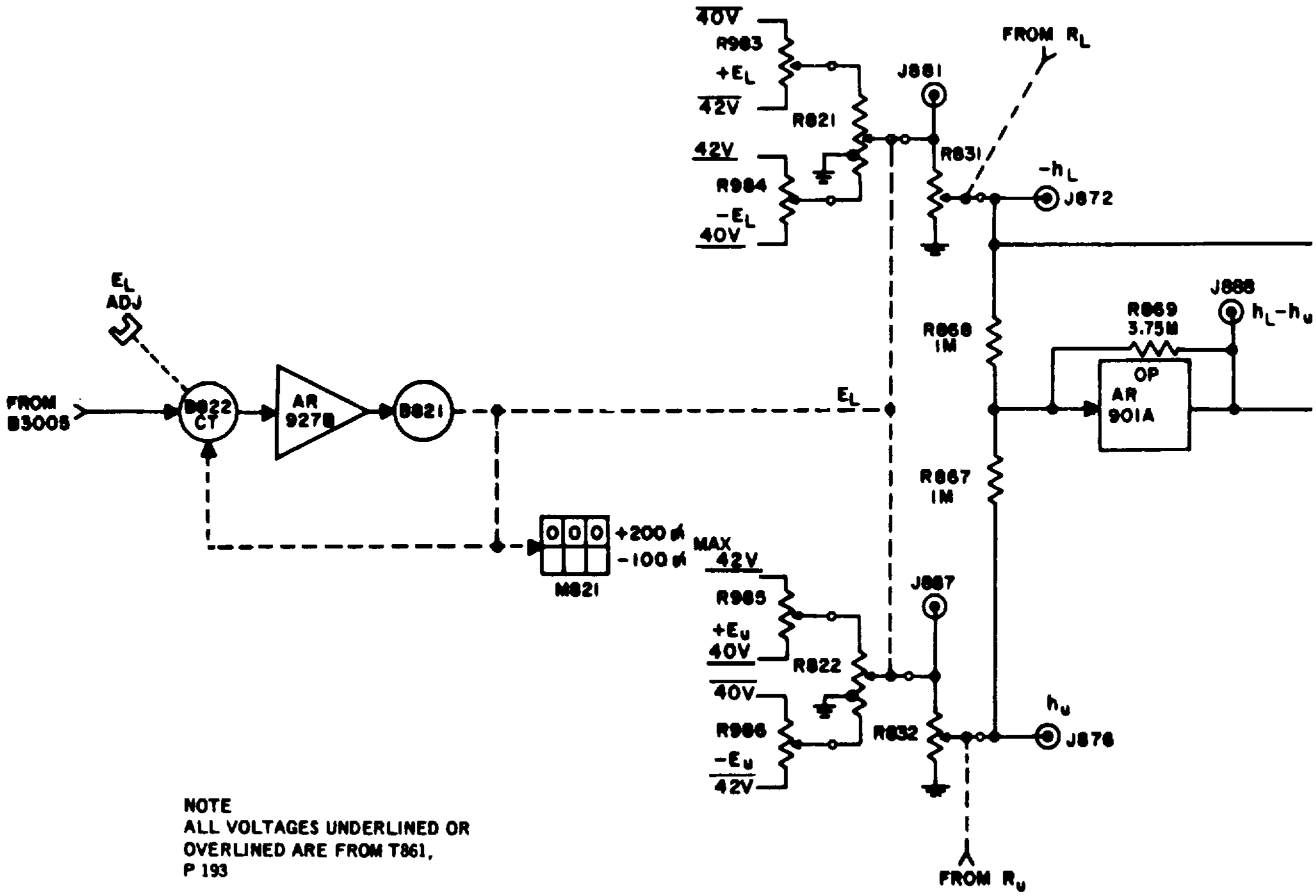
Computer data flow chart I.



Computer data flow chart I--continued.

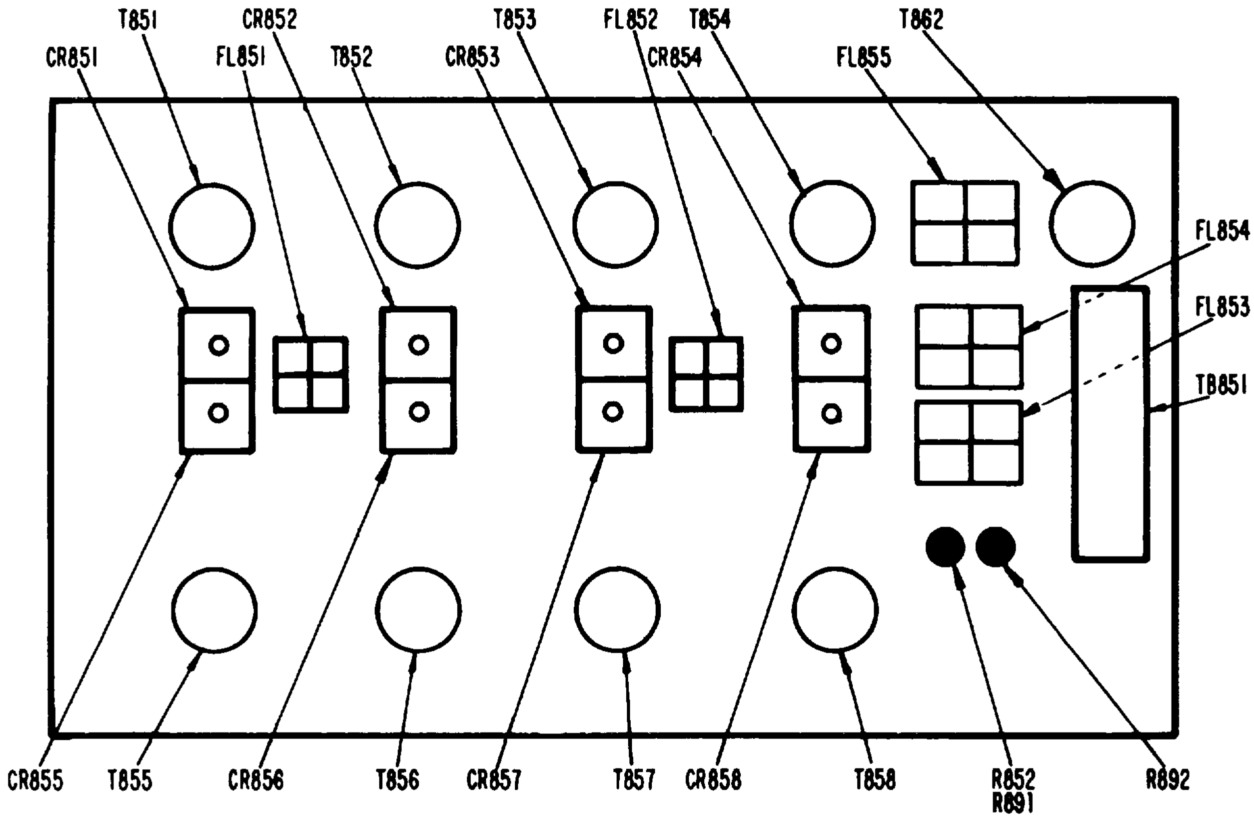


Computer data flow chart II.



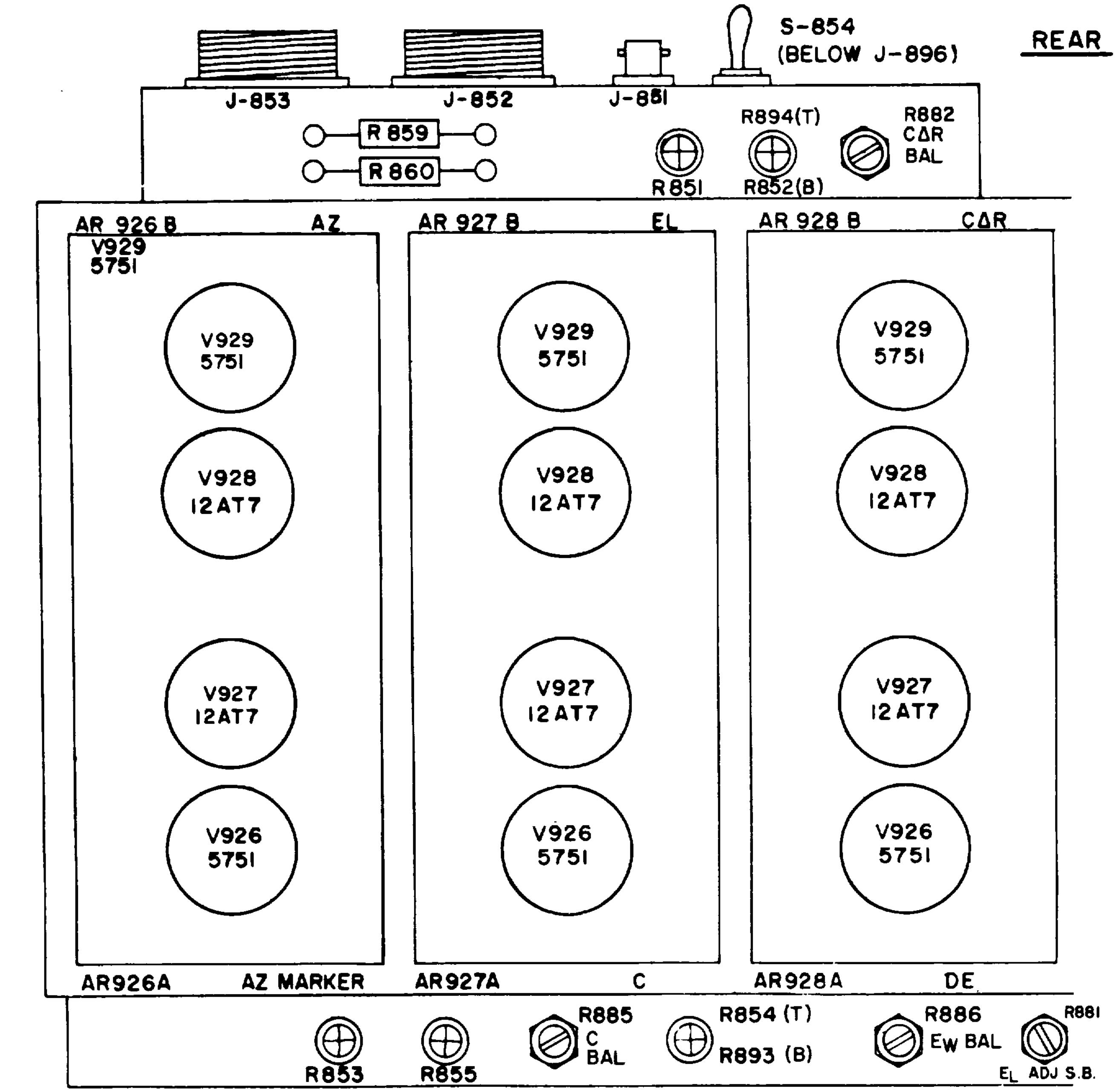
AR	927B						901A
B	822	821					
R			983 984 985 986	821 822	831 832	868 867	869

Computer data flow chart II—continued.

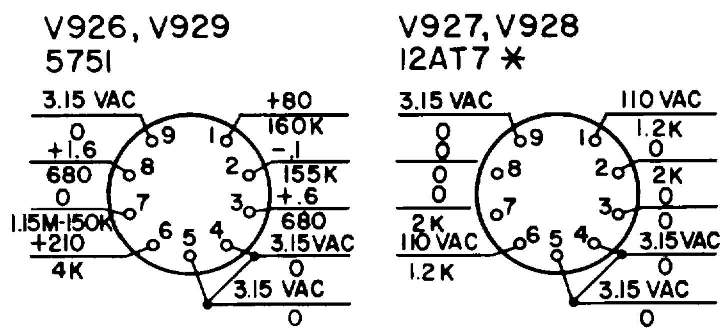


Computer chassis, lower deck, left side view.

NOTES:



NOTE: AR926, AR927, AR928, AND AR929 CAN BE INTERCHANGED OR TURNED AROUND.

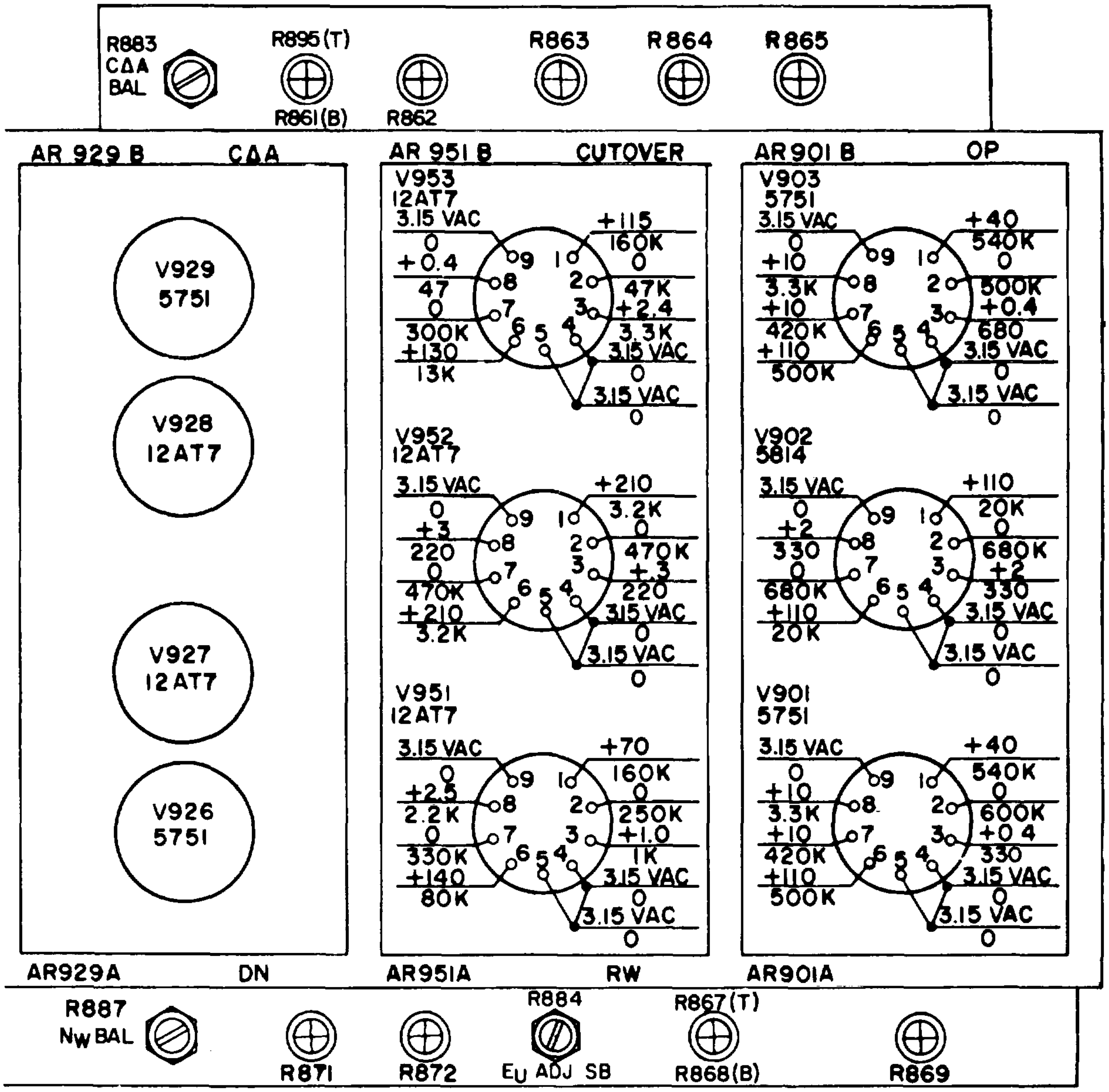


* Set must have neutral line (LN) grounded (terminals 4, 10, TB1001, page 6) to obtain indicated readings at these tubes. On AR928A and AR 929A, resistance to ground on Pins 3 and 8 may vary from 0 to 250 Ohms.

All measurements are made to chassis ground.

Voltage measurements are made with radar operating normally, handwheels in detent, and C=1.

Computer voltage and resistance chart.



NOTE:

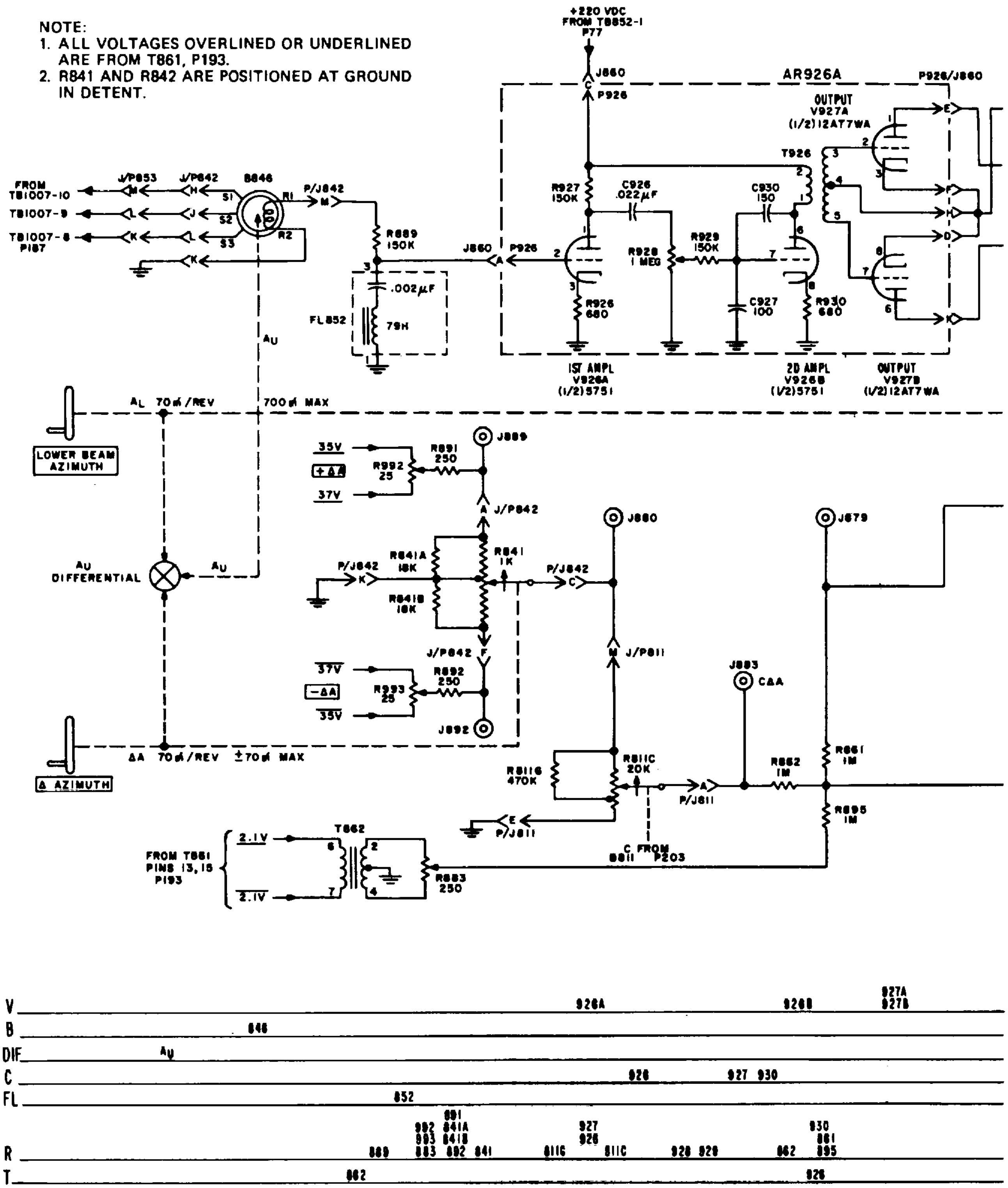
AR951 cannot be interchanged or turned around.

AR901 cannot be interchanged but can be turned around.

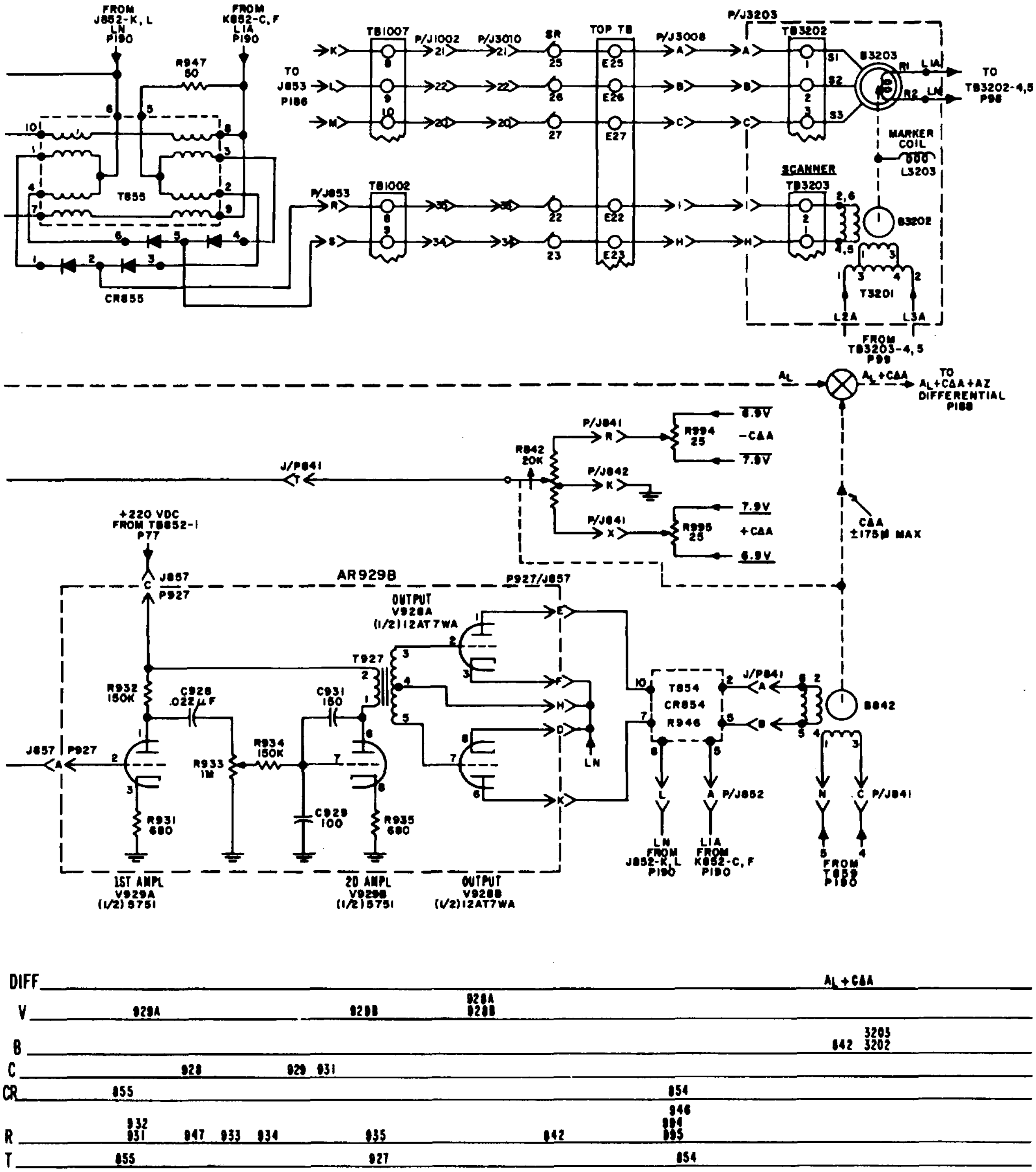
All measurements are made to chassis ground. 6. 3VAC from pin 9 to pins 4 or 5 on all tubes. Voltage measurements are made with radar operating normally, handwheels in detent, and C=1.

Computer voltage and resistance chart--continued.

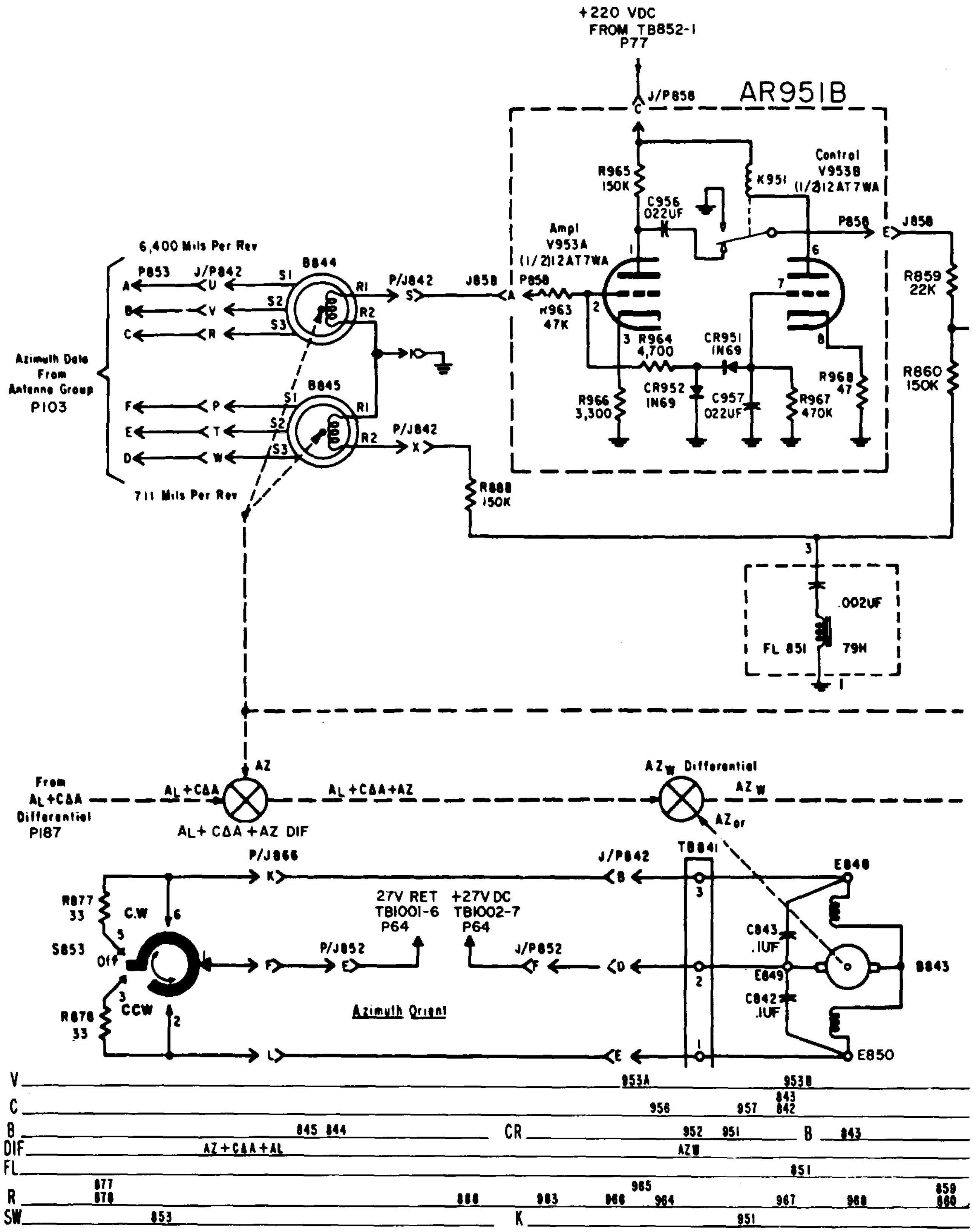
NOTE:
1. ALL VOLTAGES OVERLINED OR UNDERLINED ARE FROM T861, P193.
2. R841 AND R842 ARE POSITIONED AT GROUND IN DETENT.



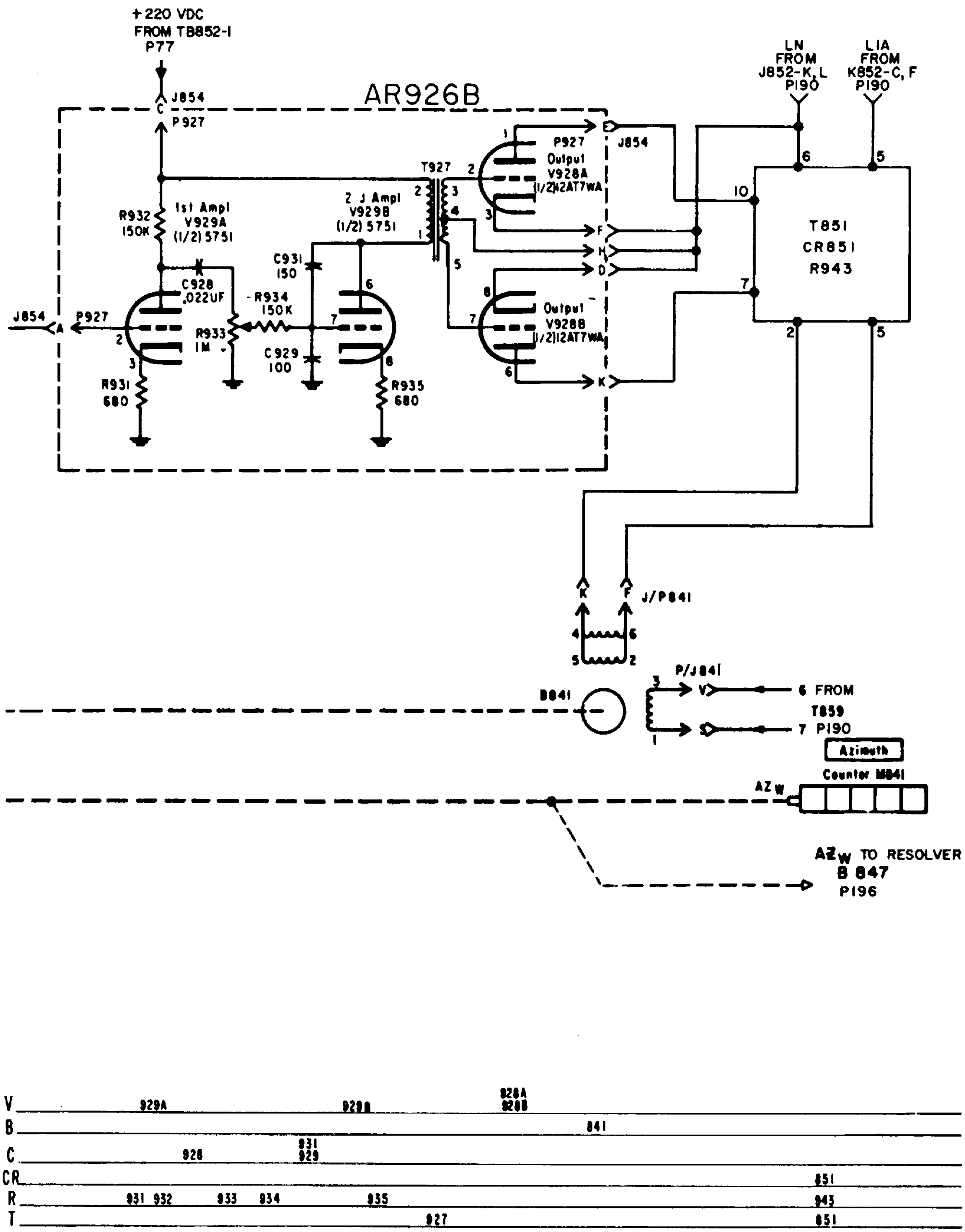
Azimuth section I.



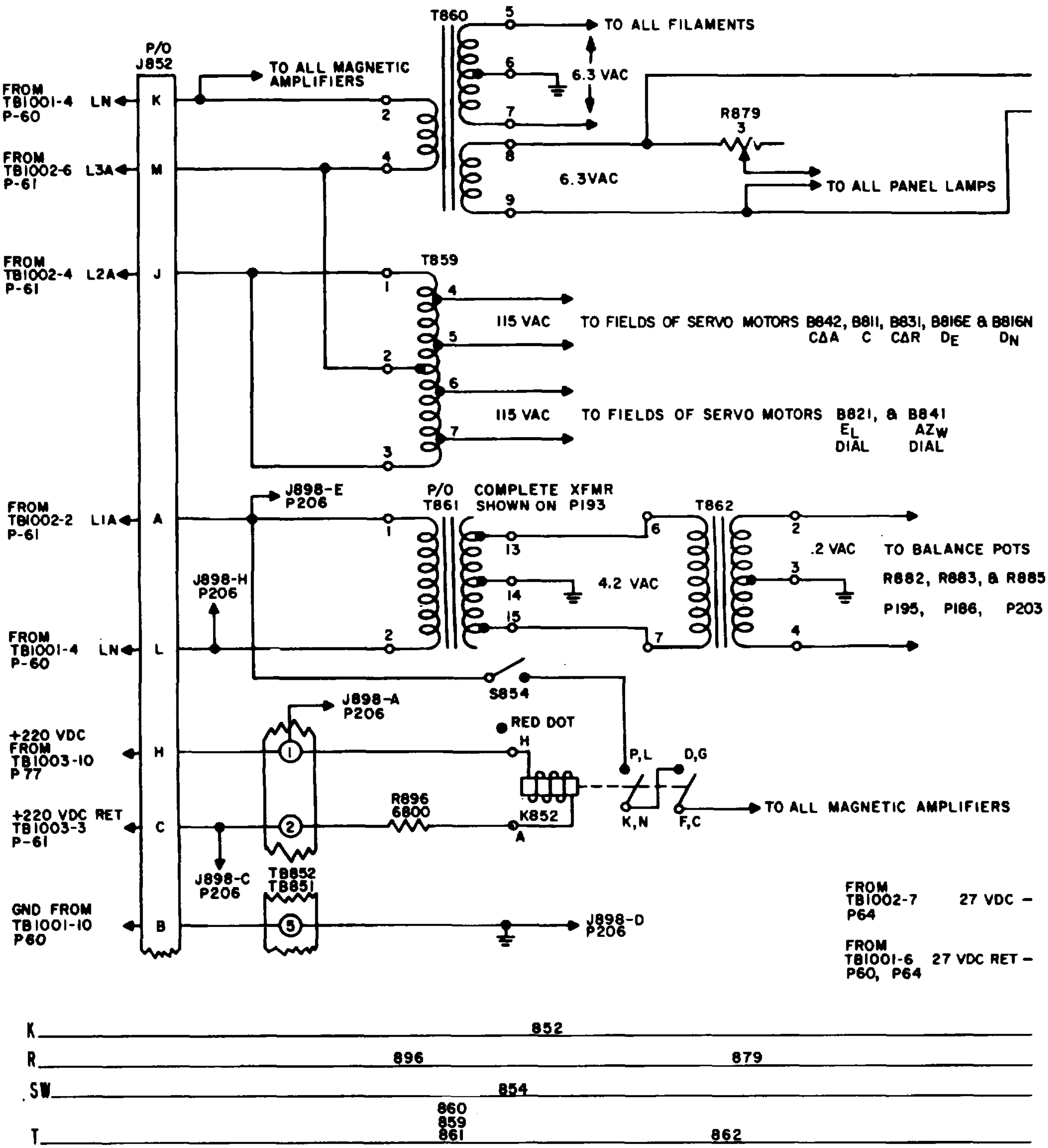
Azimuth section I--continued.



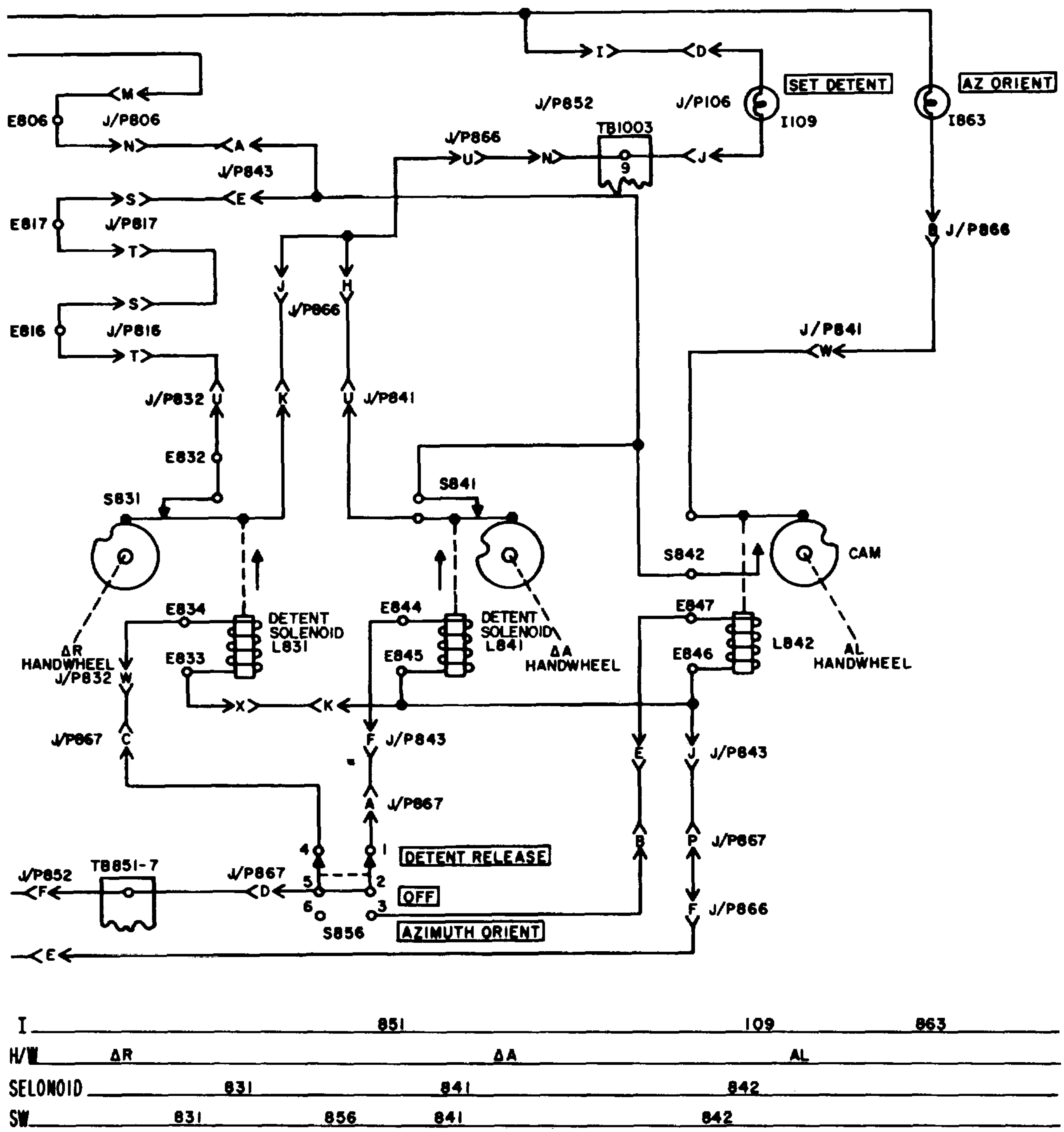
Azimuth section II.



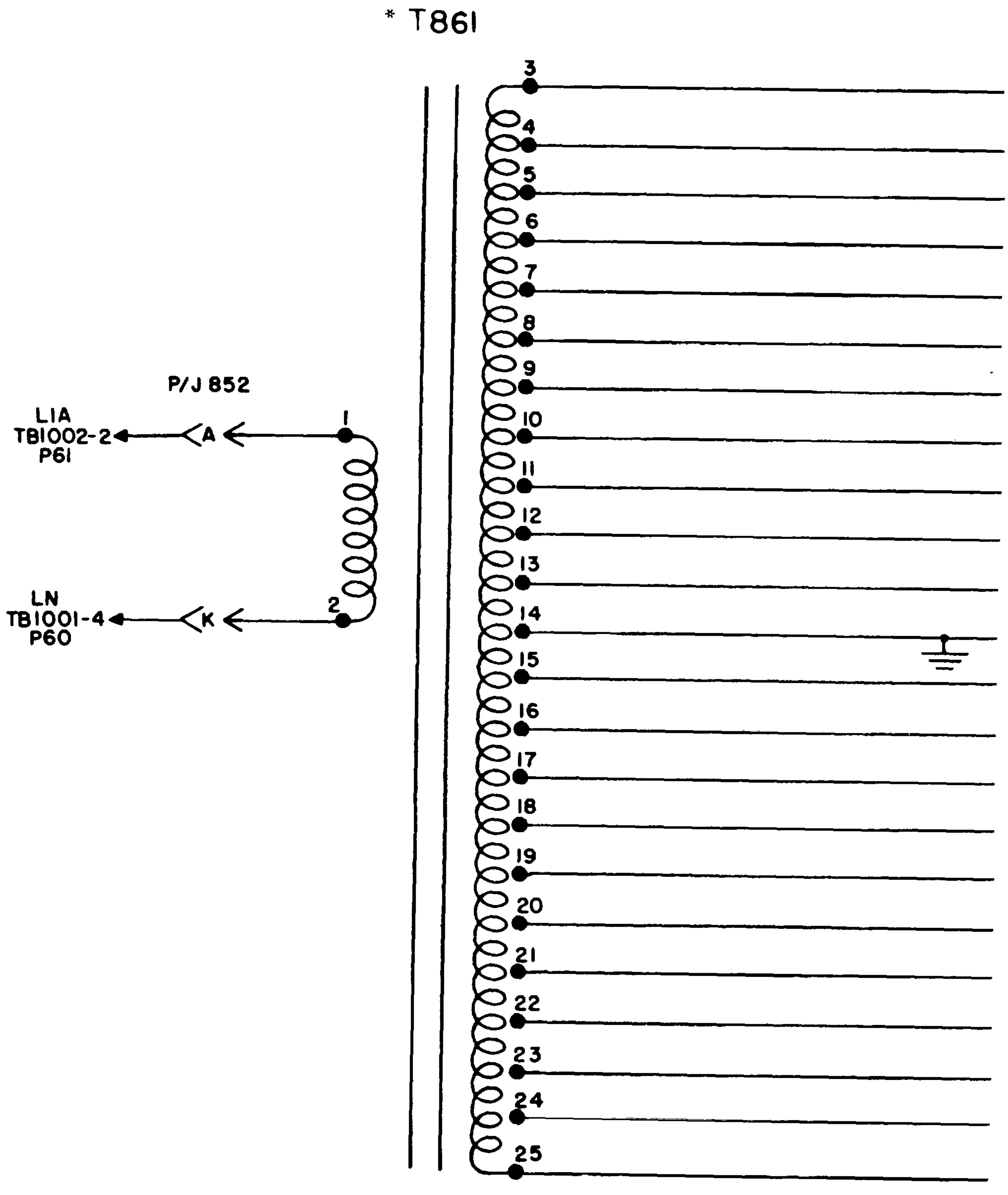
Azimuth section II--continued.



AC distribution and control circuits.

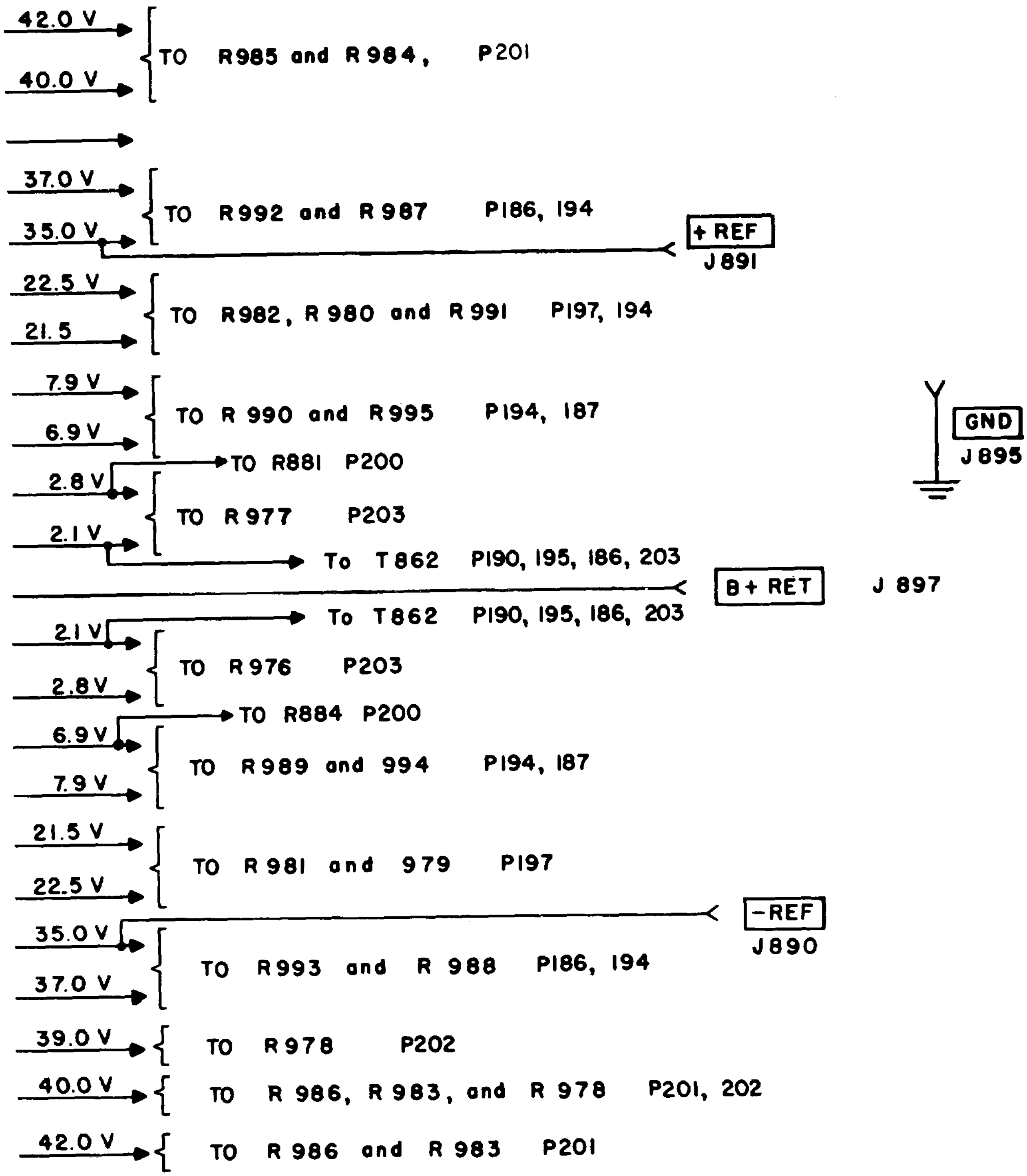


AC distribution and control circuits--continued.



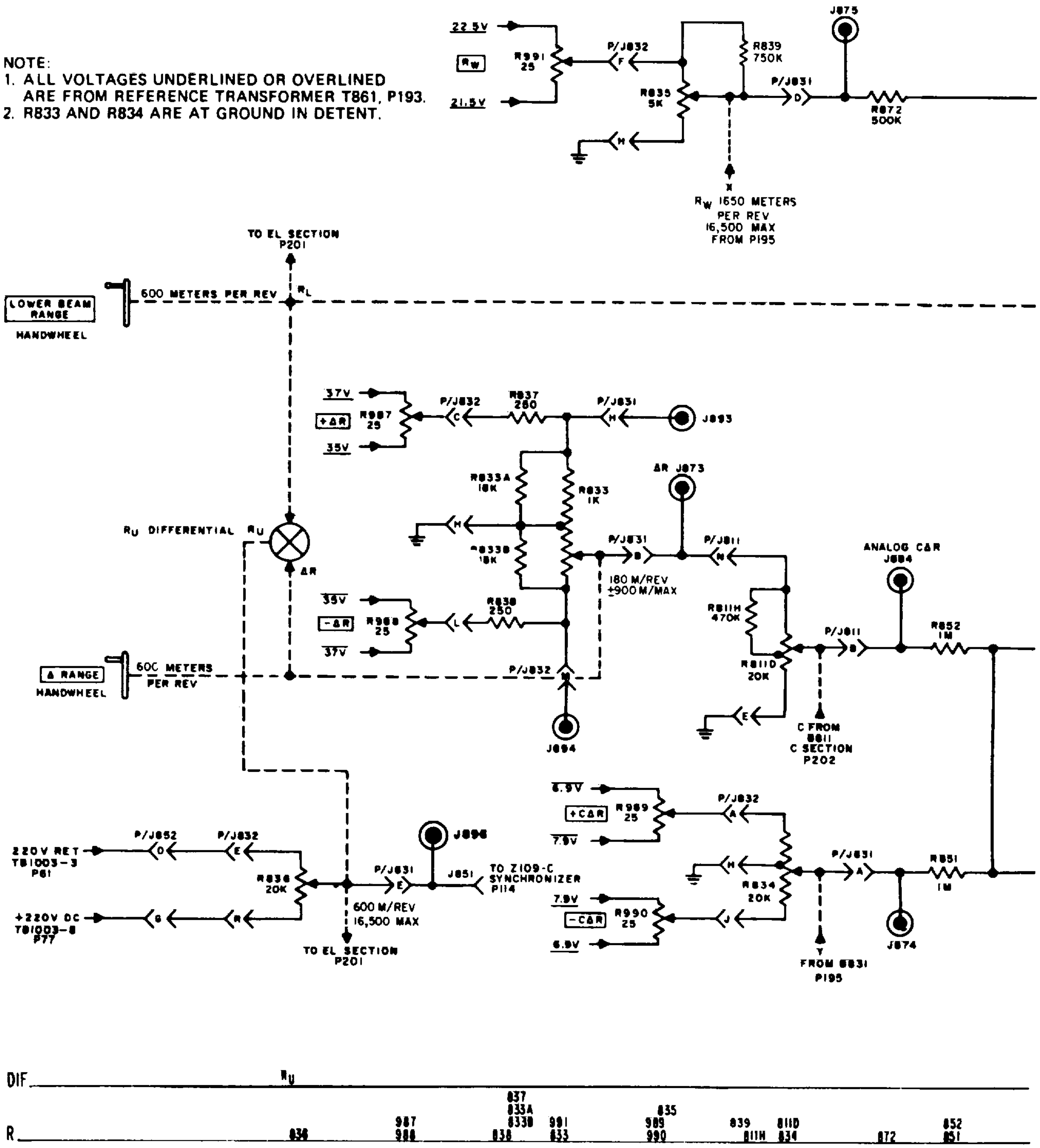
*There are two different Pin Numbering Systems for T861. Make sure you wire it correctly.

Reference transformer.

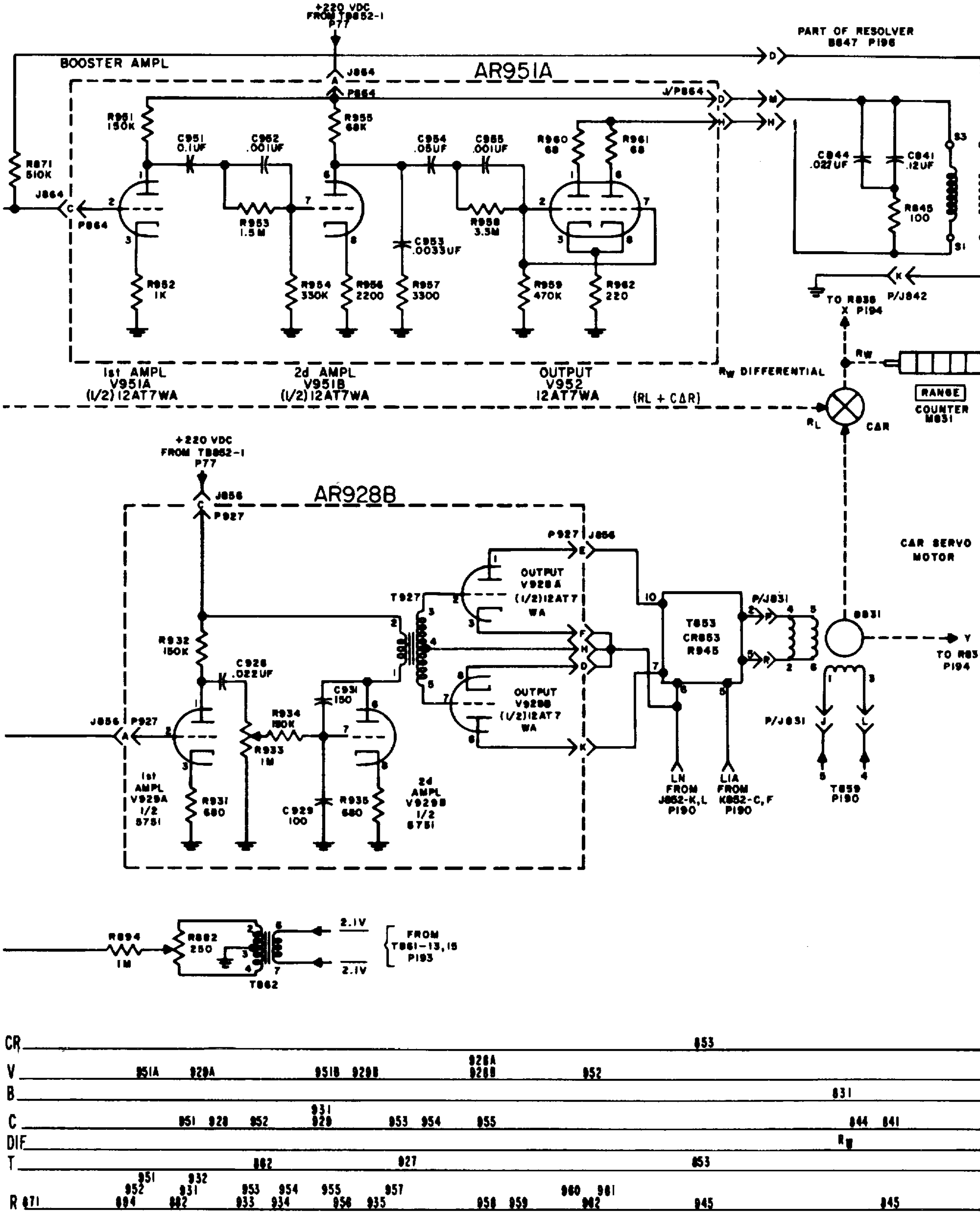


*There are two different Pin Numbering Systems for T861. Make sure you wire it correctly.

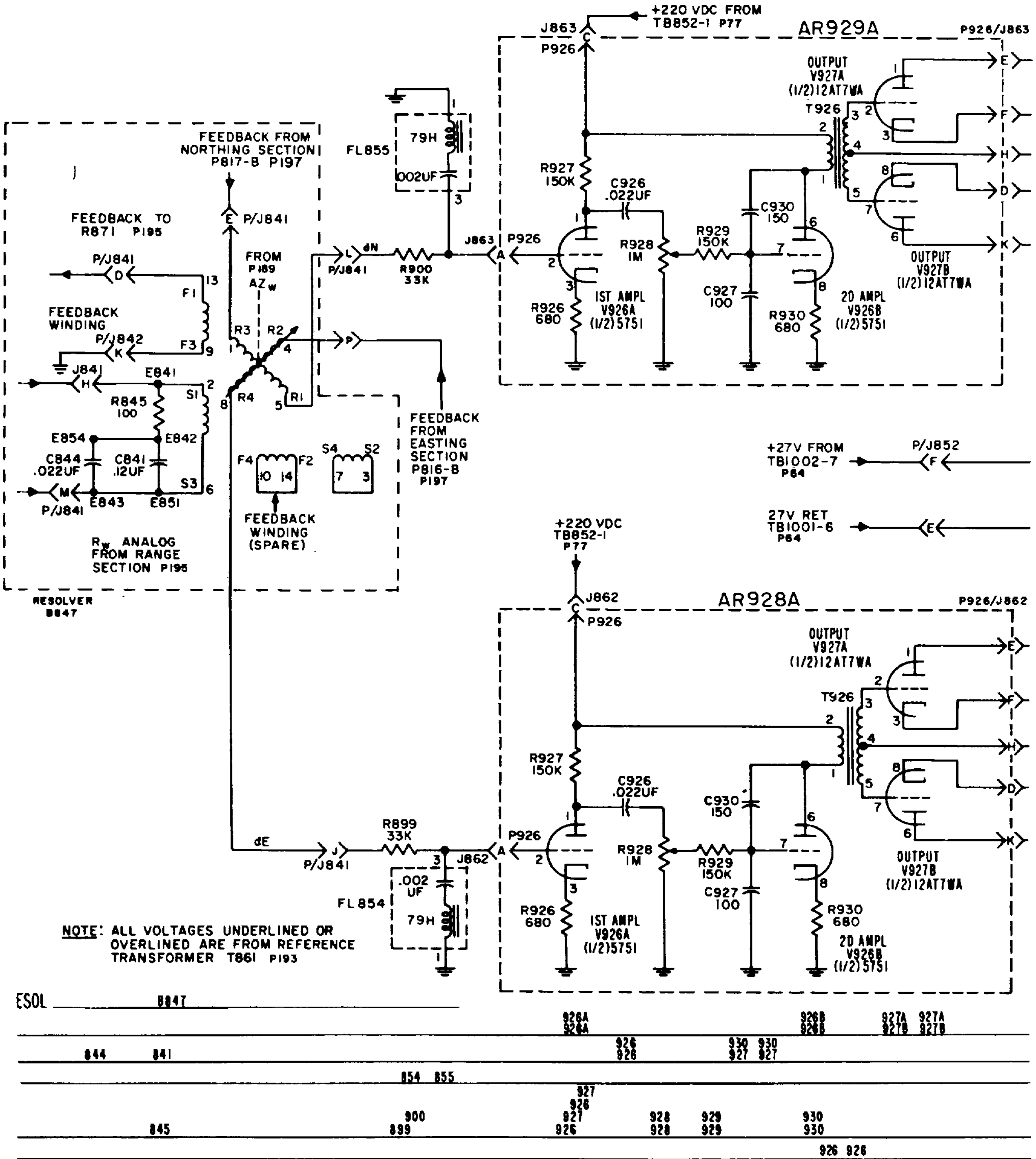
Reference transformer--continued.



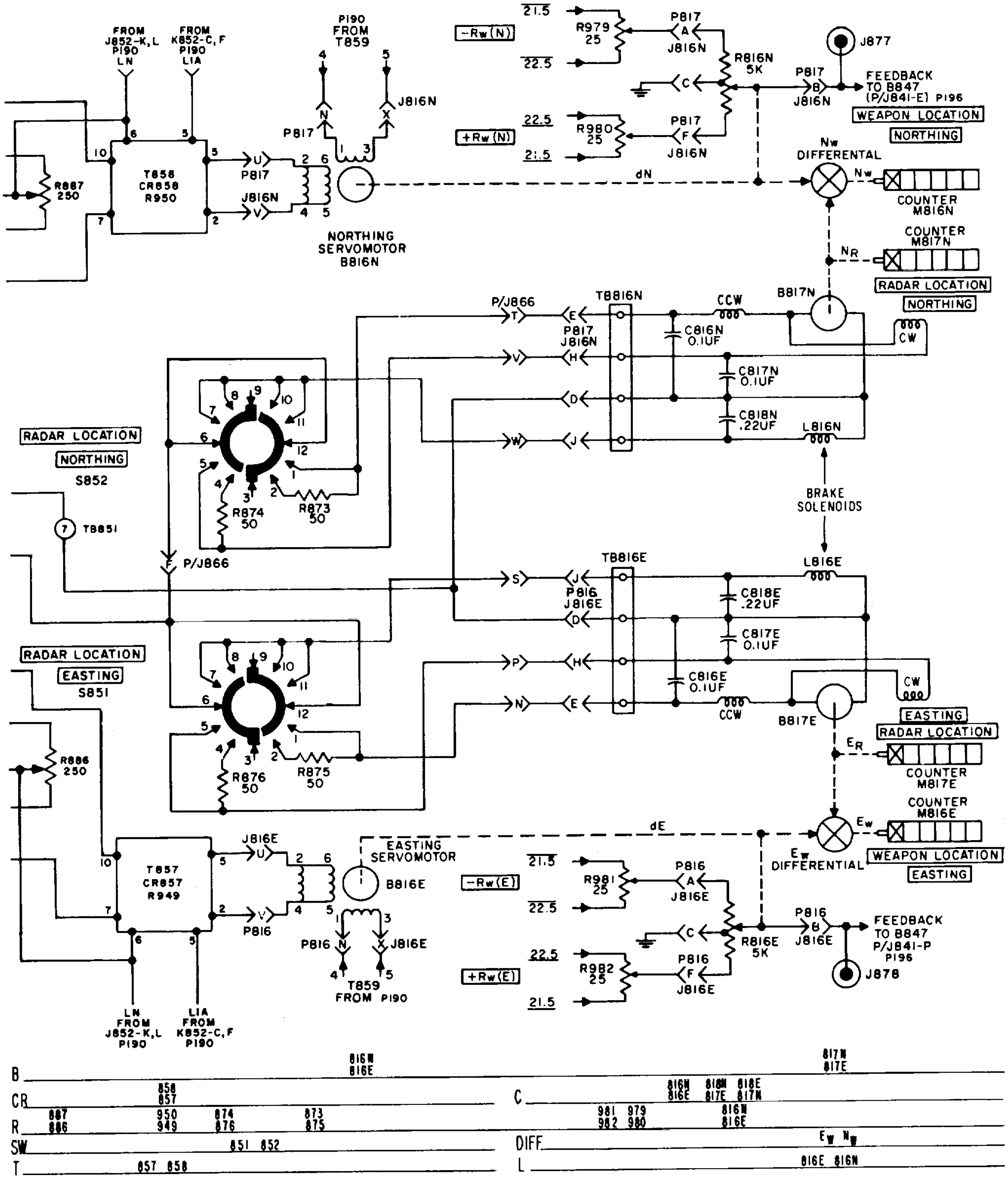
Range section.



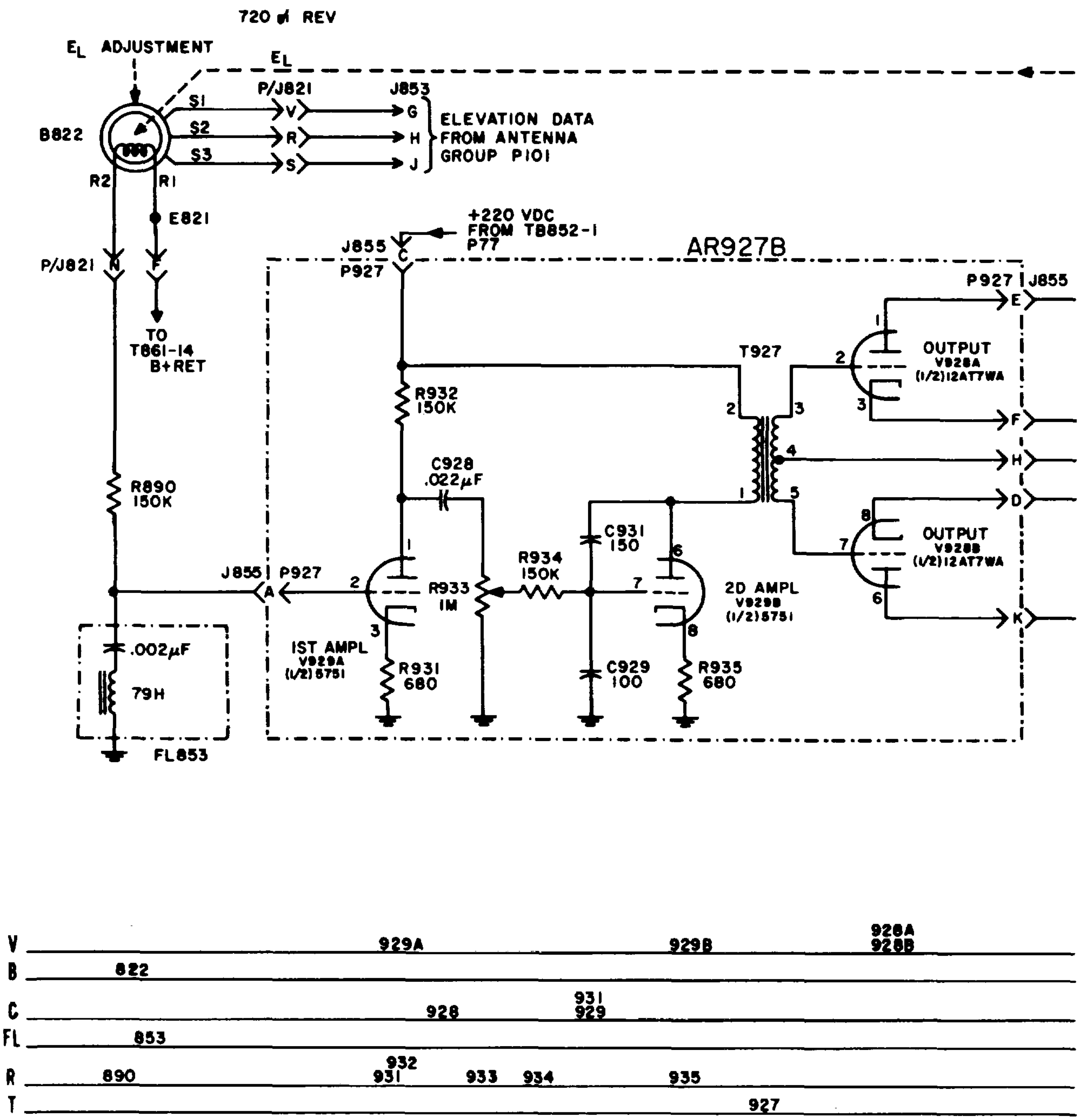
Range section--continued.



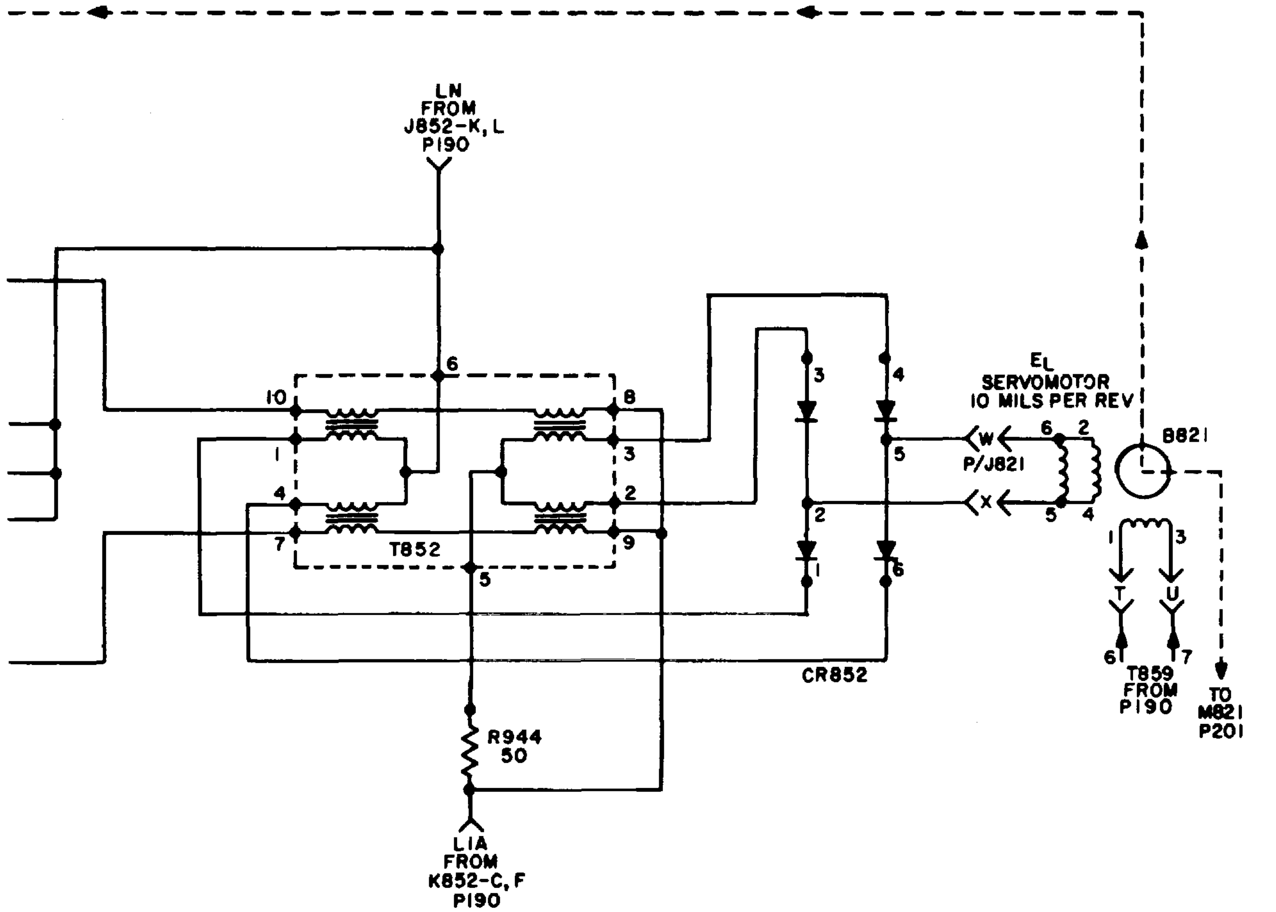
Coordinate section.



coordinate section--continued.

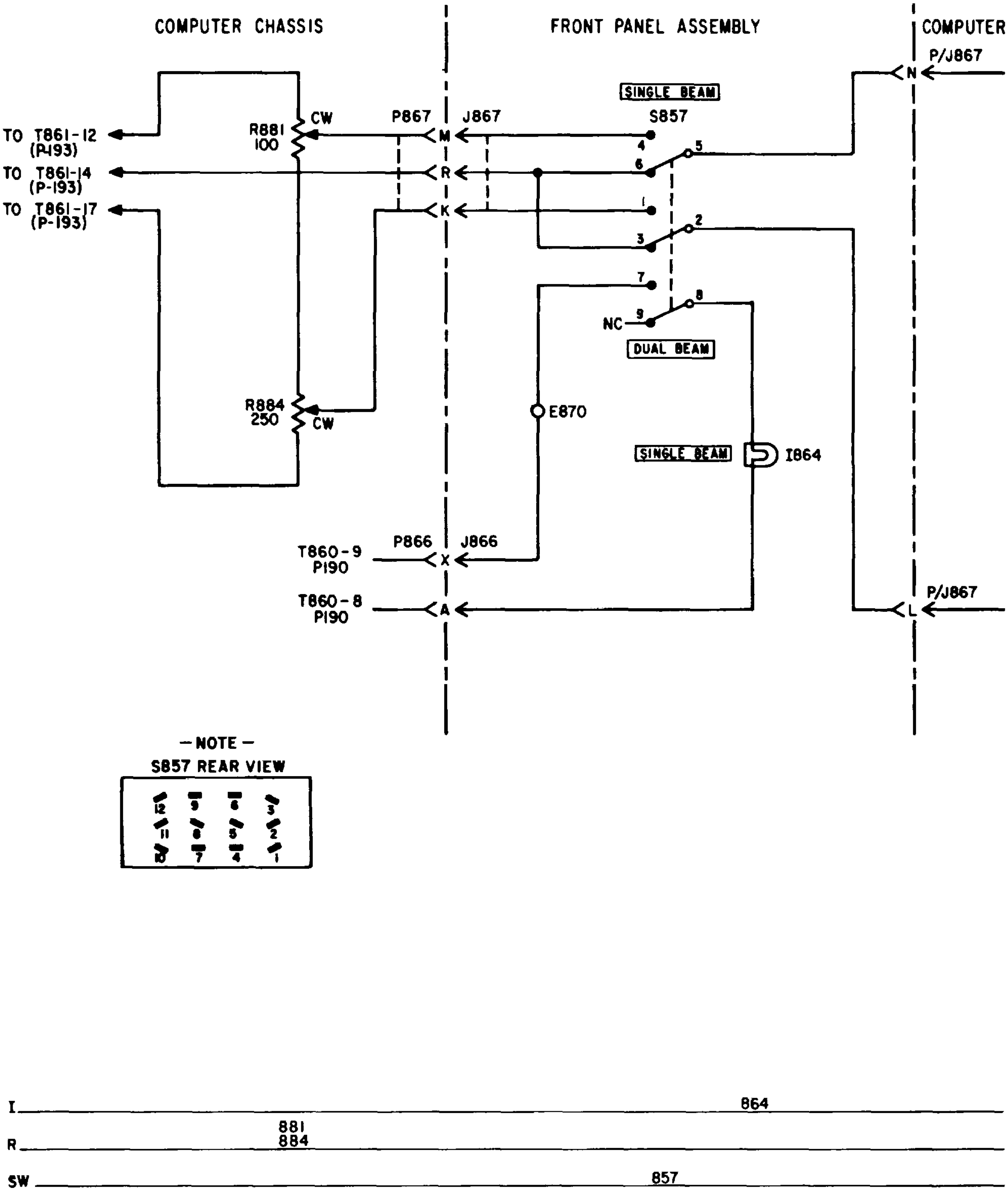


Elevation section I modified.

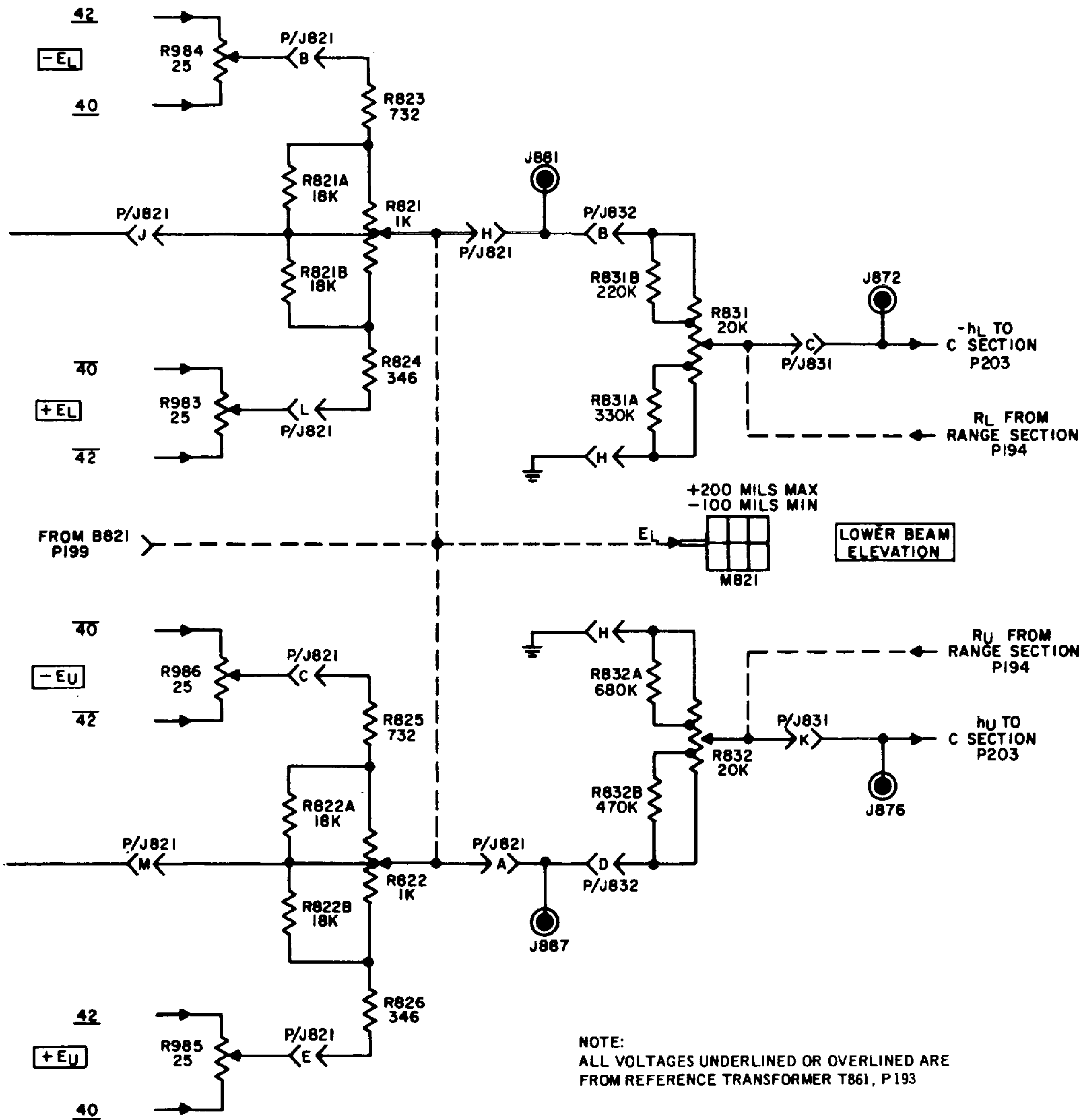


B	821
CR	852
R	944
T	852

Elevation section I modified -- continued.



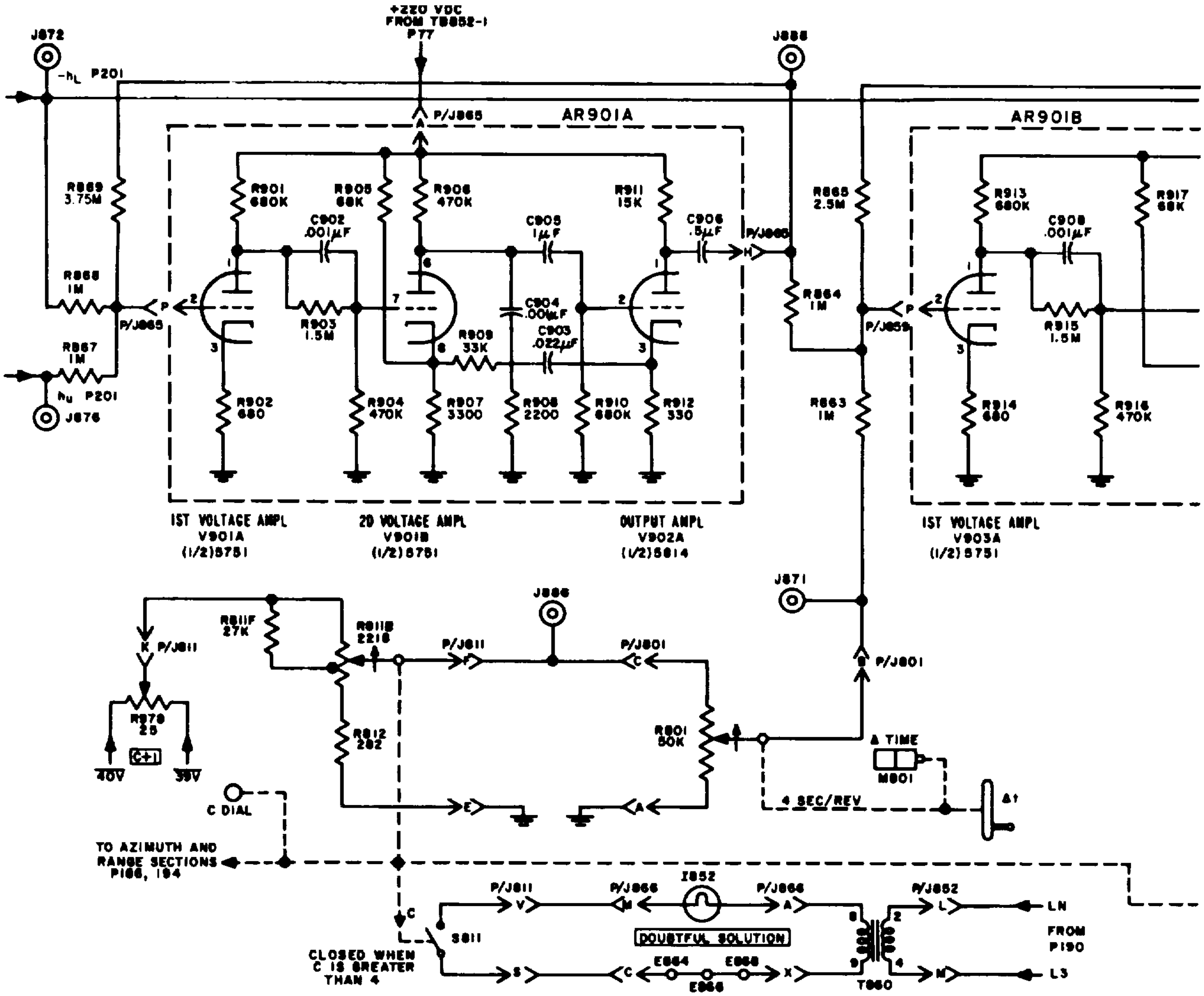
Elevation section II modified.



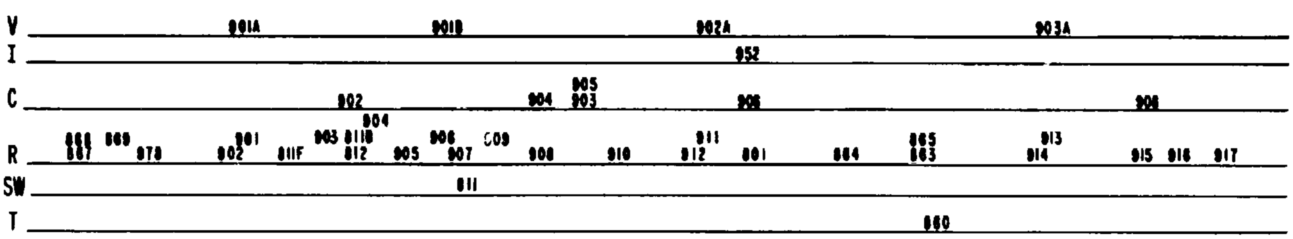
823
821
984 821A 824 831B
983 821B 825 831A
986 822A 822 832A 831
985 822B 826 832B 832

R

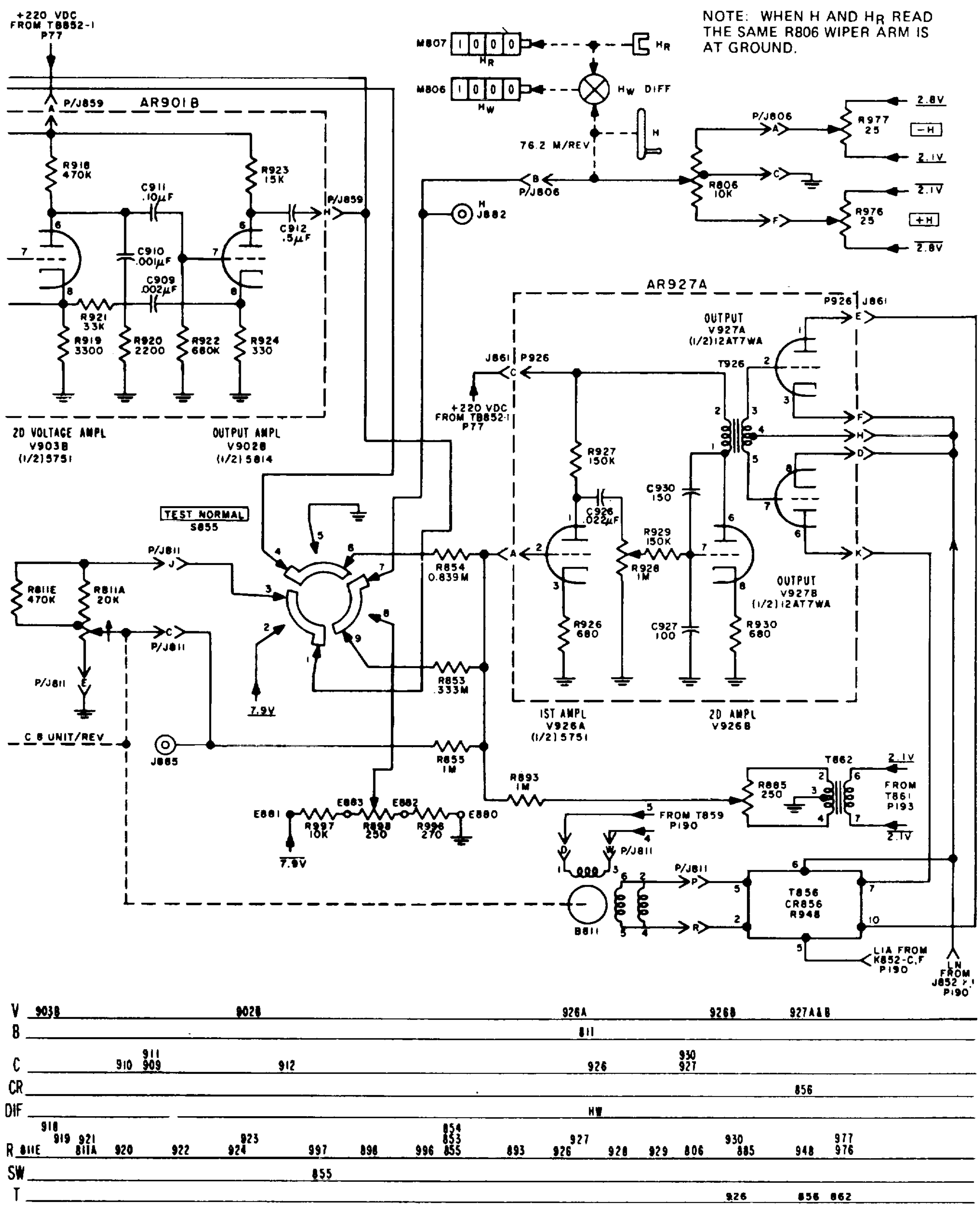
Elevation section II modified--continued.



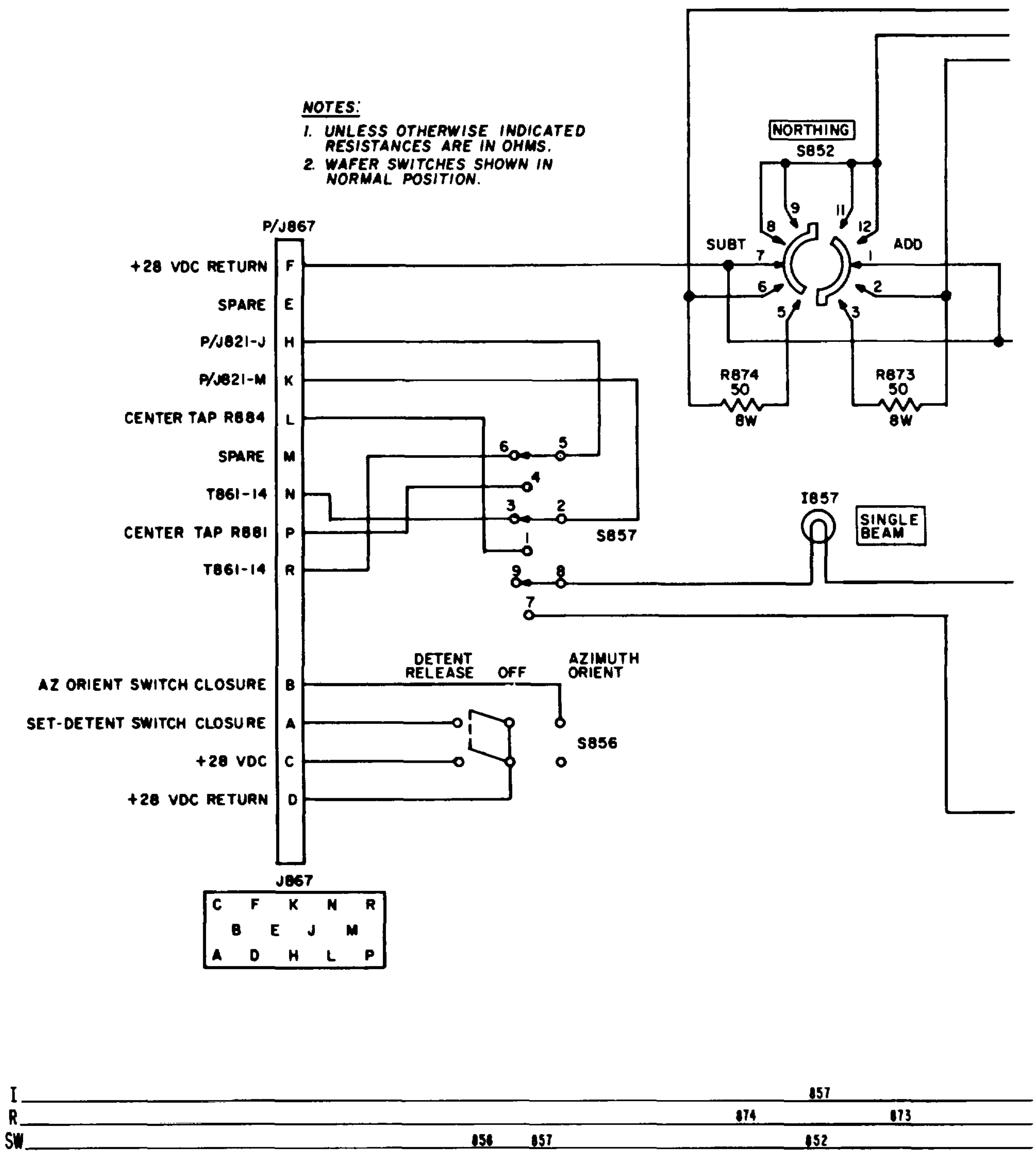
NOTE:
ALL VOLTAGES UNDERLINED OR OVERLINED ARE FROM REFERENCE TRANSFORMER T861, P193



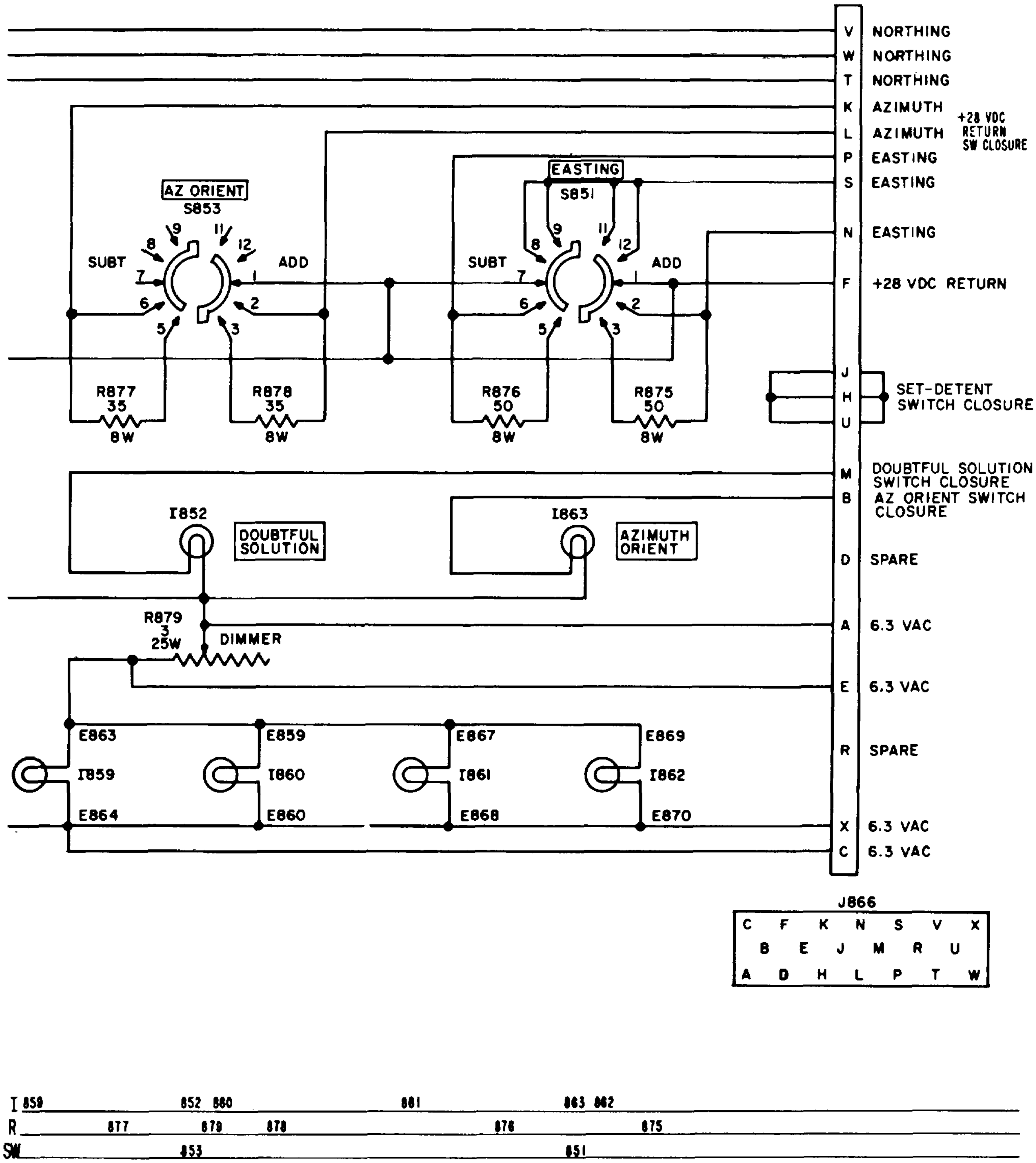
Height, time, and C sections.



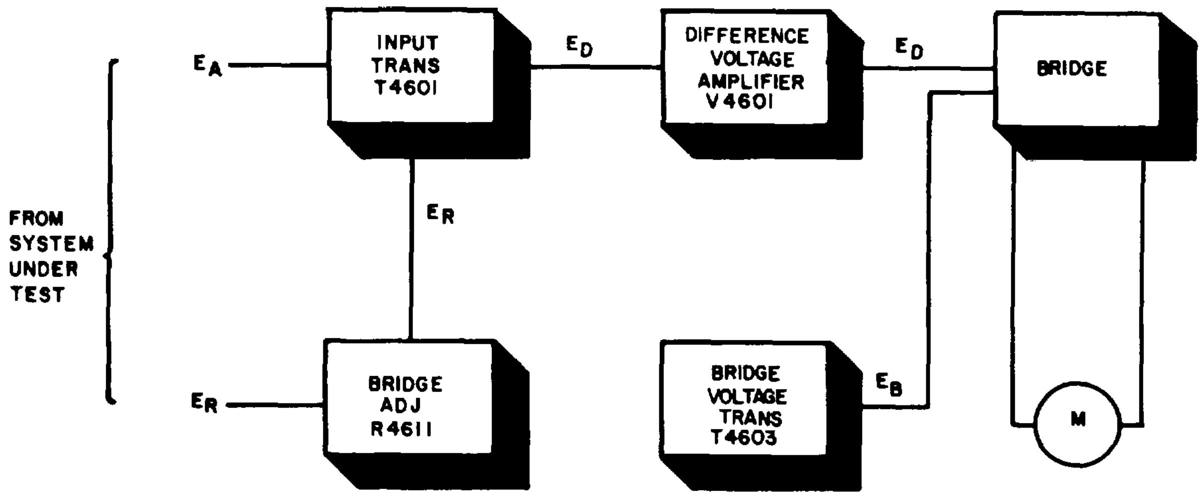
Height, time, and C sections--continued.



Front panel assembly, radar data computer CP-319/MPQ-4A, schematic diagram (with modification of single beam extrapolation).



Front panel assembly, radar data computer CP-319/MPQ-4A, schematic diagram (with modification of single beam extrapolation)--continued.



E_A ANALOG VOLTAGE UNDER TEST

E_R REFERENCE VOLTAGE

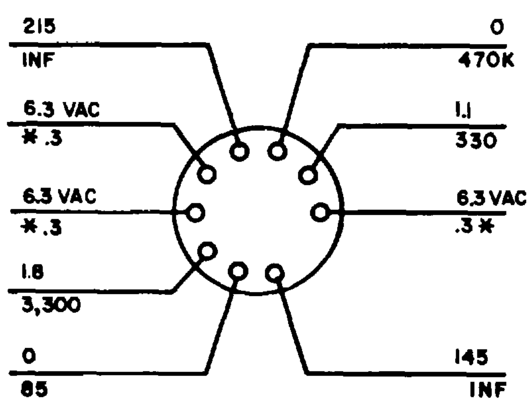
E_D DIFFERENCE VOLTAGE ($E_A - E_R$)

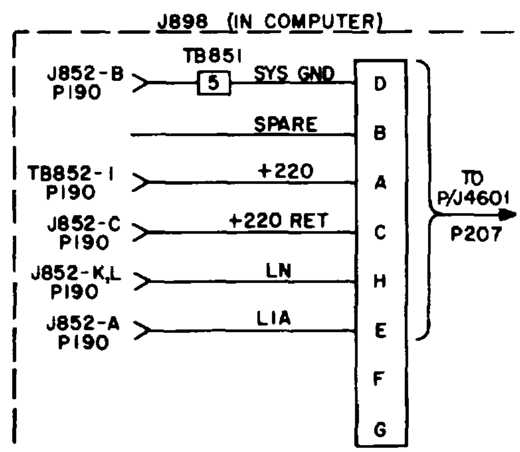
E_B BRIDGE STANDARD VOLTAGE FOR PHASE DETERMINATION

DIFFERENCE VOLTAGE AMPLIFIER

V4601

5751/12AX7

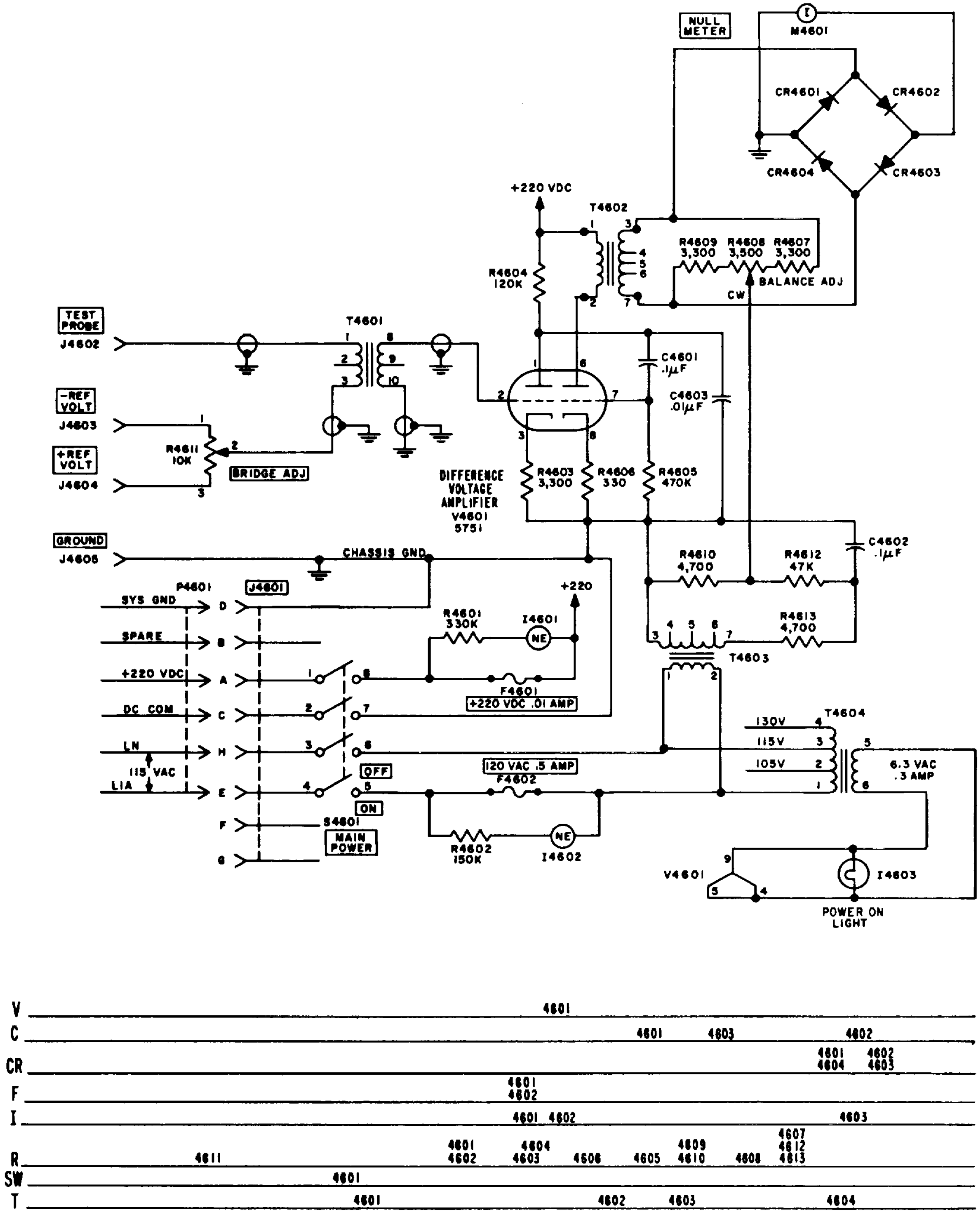




NOTES

1. V & R MEASUREMENTS TAKEN WITH A 20,000 OHMS-PER-VOLT METER.
2. NULL METER ZEROED.
3. INF DENOTES INFINITY.
4. READING TAKEN FROM SOCKET TO GROUND EXCEPT FILAMENTS. PINS 4 AND 5 ARE CONNECTED. MEASURE TO PIN 9.
5. RESISTANCE READINGS TAKEN WITH MAIN POWER SWITCH S4601 OFF
6. *TUBE REMOVED. READINGS TAKEN FROM 4 AND 5 TO 9.

TS 909/PPM block diagram.



TS 909/PPM detailed circuit diagram.

CHAPTER 5

FIELD ADJUSTMENTS

Section I. RADAR ADJUSTMENTS

5-1. GENERATOR ADJUSTMENTS

Check the frequency of the generator set PU-304C and, if necessary, adjust as follows:

a. Start the engine and allow at least 15-minutes warm-up. (Set governor control in govern position.)

b. Loosen the locknut on the minimum speed stop screw (hex head bolt).

c. Apply load and adjust minimum speed stop screw for a frequency meter reading of 400 hertz.

d. Remove the load. Frequency meter should read 412 hertz; if not, perform steps e and f.

e. Loosen the locknut (inner nut) on spring tension eyebolt and adjust the governor spring adjustment nut (outer nut) for a frequency meter reading of 412 hertz. Tighten the locknut,

f. Repeat steps c, d, and e until correct readings are obtained with and without loads.

5-2. POWER SUPPLY ADJUSTMENTS

a. Power Supply PP-1588. With TEST METER M1402 in the -300 volt position, loosen the locknut on R1643 and adjust until meter indicates -300 volts.

b. Control Power Supply C-2014. With TEST METER M652 in the -220 volt position, loosen the locknut on R634 and adjust until meter-indicates -220 volts.

5-3. SYNCHRONIZER AND INDICATOR ADJUSTMENTS

a. General. Adjustments within the indicator are primarily those which insure that the B-scope sweeps are of the proper size and intensity and in the proper position at various ranges. Since most of the triggers and gates are not produced in the indicator, the indicator cannot be adjusted properly unless all inputs are correct. Therefore, the outputs of the synchronizer should be checked if any difficulty is encountered in making indicator adjustments.

b. Azimuth Synchronizer Gain. This adjustment (R547) is located on the azimuth synchronizer chassis. It is used to attenuate the synchronizing pulses fed into the azimuth synchronizer from the scanner.' Rotate R547 clockwise and counterclockwise until the (CRT) raster and the azimuth strobe are unstable. Adjust R547 to an approximate midpoint between these two positions or until a stable raster and strobe are obtained. If there is another bright line on the left side of the raster, rotate R547 slightly counterclockwise until the line disappears.

c. Auxiliary Intensity.

(1) Set the RANGE SELECTOR switch to the 15000 M position.

(2) Set the INTENSITY control on the front panel to midposition.

(3) Adjust the AUXILIARY INTENSITY potentiometer R110 until the raster is just' visible on the CRT.

d. Intensity Balance.

(1) Note the intensity of the raster on the CRT, and then change the RANGE SELECTOR switch to the 3750 M position.

(2) Adjust the INTENSITY BALANCE potentiometer R112 until the sweep intensity in the 3750 M position is the same as that in the 15000 M position.

Note: This does not refer to the intensified band displayed in the 15000 M position, but to the rest of the CRT display.

e. Azimuth Sweep Generator.

(1) Adjust the HOR CENTERING potentiometer R4517 until the raster is horizontally centered.

(2) Adjust the HOR SIZE potentiometer R4536 until the raster just covers the CRT (horizontally).

(3) Repeat the steps in (1) and (2) above as necessary to meet both conditions.

f. Sweep Intensity.

(1) Set the RANGE SELECTOR switch to the 15000 M position.

(2) Set the EXPANDED SWEEP DELAY switch to position 7. 5.

(3) Adjust the SWP INTEN ADJ potentiometer R4657 until there is an intensified horizontal band slightly brighter than the rest of the display on the CRT

g. Video Clipping.

(1) Turn the range markers on, and adjust the range marker intensity potentiometer R1333 on the AFC chassis for maximum marker intensity.

(2) Observing the B-scope presentation, adjust the VIDEO CLIPPING potentiometer R4612 for maximum marker intensity without "blooming. "

(3) Readjust potentiometer R1333 for desired range marker intensity.

h. Range Calibration.

(1) Perform range calibration as indicated on page 13, paragraph 2-4.

(2) If correct results cannot be obtained with RANGE SLOPE potentiometer R119, return it to midposition and adjust C232 until the seventh range marker coincides with the strobe set at 14, 000 meters.

Note: Capacitor CZ32, located on the timing sweep generator chassis Z102, is the coarse range slope adjustment.

(3) Continue with range calibration procedure on page 13, paragraph 2-4.

i. Range Shift Adjustment.

(1) Turn range markers on.

(2) Position the range strobe so that it coincides with any range marker.

(3) Turn range shift on.

(4) Observing the RW counter, move the range strobe out 750 meters.

(5) Set the RANGE SELECTOR switch to the 3750 M position.

(6) Set the EXPANDED SWEEP DELAY switch so that the range strobes and the selected range markers (step in (2) above) are displayed on the CRT.

(7) Adjust the RANGE SHIFT potentiometer R4560 until the upper beam range marker presentation coincides with the lower beam range strobe presentation.

j. Vertical Centering and 15-Kilometer Vertical Size Adjustment.

(1) Set the RANGE SELECTOR switch to the 15000 M position.

(2) Adjust the VERTICAL CENTERING potentiometer R4409 until the main bang presentation is just hidden at the bottom of the CRT.

(3) Adjust the VERT SIZE 1 5, 000 M potentiometer R104 until the top of the presentation just reaches the top of the CRT.

(4) Repeat the steps in (2) and (3) above until both conditions are met.

k. Adjustment of 3, 750 Meter Sweep Length and Vertical Size.

(1) Set the RANGE SELECTOR switch to the 3750 M position.

(2) Set the EXPANDED SWEEP DELAY switch to position 7. 5.

(3) Position the range strobe so that it is barely visible at the bottom of the CRT.

(4) Set the RANGE SELECTOR switch to the 1 5000 M position.

(5) Observing the RW counter, move the strobe out 3, 750 meters.

(6) Adjust the SWP SIZE ADJ potentiometer R4660 until the top of the intensified band coincides with the range strobe.

(7) Set the RANGE SELECTOR switch to the 3750 M position.

(8) Adjust the VERT SIZE 3750 M potentiometer R106 until the range strobe is just visible at the top of the CRT.

(9) Repeat the steps in (1) through (8) above until all conditions are met.

5-4. RECEIVER ADJUSTMENTS

a. AFC Adjustment.

(1) Tune the receiver as indicated on page 12, paragraph Z-3q.

(2) If the range marker intensity diminishes when the AFC-MANUAL switch is placed in the AFC position, adjust the discriminator secondary L1301 on the AFC chassis until the range marker intensity in AFC is no less than in MANUAL.

(3) Adjust the LO ADJUST attenuator in the receiver compartment until the crystal current meter reading is between 2 and 3.

b. STC Adjustment. The three adjustment controls for the STC assembly are on the top portion of the chassis. These controls are preset at the factory and ordinarily require no adjustment. The interrelationship between STC sensitivity adjust R4708 and time constant adjust R4712 is extremely critical. These adjustments should be referred to a higher echelon. The adjustment procedure for STC amplitude adjust R4714 is given below.

(1) Loosen the two knurled thumbscrews on the front flange of the STC chassis and slide the chassis part way out.

(2) Disconnect W1 508 from J4702.

(3) Connect an oscilloscope to J4702; use the coaxial cable supplied with the oscilloscope.

(4) Adjust the oscilloscope for a presentation of the STC sawtooth waveform.

(5) Adjust R4714 until the amplitude on the waveform is 6 volts peak to peak.

(6) Disconnect the oscilloscope from J4702 and reconnect WI 508 to the same jack.

(7) Slide the chassis back into position and tighten the thumbscrews.

c. Range Markers. If the amplitude of the range markers is not satisfactory, adjust R1333 on the AFC assembly until sufficient amplitude is obtained.

5-5. TRANSMITTER ADJUSTMENTS

a. General. The transmitter operates on a fixed frequency and requires no tuning. However, certain control circuit adjustments are necessary due to component aging or replacement.

Warning: Do not reach into the transmitter compartment during the following adjustments--voltage in excess of 26,000 volts is present. Avoid touching terminal boards TB 1101 and TB 1102 mounted on the transmitter compartment door. These boards have potentials up to 300 volts. Under no circumstances should the following terminals be disconnected while the transmitter is on, nor should the transmitter be turned on while they are disconnected: TB 1101, pins 5, 10; TB 1102, pins 1, 2. The voltage at these terminals is normally low; however, if they are opened while the transmitter is on, the voltage may rise as high as 30 kilovolts.

b. Thyratron Switch Adjustments.

(1) Open the transmitter compartment door and close shorting switches S1103, S1105, and S1107.

Caution: Do not adjust T1107 while the transmitter is on. After making any adjustment of Tl107, wait at least 3 minutes before turning the transmitter on. This permits the hydrogen pressure in the thyratron to stabilize at the new setting.

(2) Set T1107 at midposition. While observing voltmeter M1101, adjust Rllll into each limit. Adjust RI ll so that the voltmeter reading is halfway between the high and low readings just obtained.

(3) Adjust T1107 for a reading on Ml101 that is 0.3 volt higher than the voltage stamped on the base of the thyratron (V1104).

(4) After 3 minutes, set the MAGNETRON POWER variac at 80 and press the START button. A bright flickering violet glow should be observed in the two "windows" near the top of the electrode structure inside V1104, which will cease when the START button is released. This indicates that the tube is firing through due to high reservoir voltage. If the glow is steady rather than flickering, refer to (7) below before proceeding.

Caution: Press the STOP button immediately if a steady cherry-red glow is seen through the upper window of the tube. Refer to (8) below.

(5) Press the STOP button and decrease the reservoir voltage in increments of 0. 1 volt (observing the caution in (1) above and starting and stopping the transmitter after each adjustment) until a steady bright violet glow is observed through both windows.

(6) The reservoir voltage is now correctly set. The required reservoir voltage may change with age and temperature extremes, requiring a slightly different setting (usually lower than that stamped on the base of the tube) to prevent irregular firing and plate overheating.

(7) If the thyratron exhibits a steady violet glow when the START button is initially pressed, press the STOP button and increase the reservoir voltage by another 0. 3-volt. Repeat the procedures in (4) through (6) above.

(8) If a steady bright red glow is observed through the upper window and a steady bright violet glow is observed through the lower window, the tube has a hot plate resulting from too low reservoir voltage. This condition can result in serious damage to the tube. Adjust T1107 for an increase of 0. 6-volt and repeat the procedures in (4) through (6) above.

c. Adjustment of Relays K1101, K110Z, and K1103.

(1) Relays K1101 (high voltage power supply overload) and K1102 (reverse current - overload) are normally adjusted only at general support level. However, should it be necessary to perform this adjustment in the field, the following procedures will suffice until general support personnel are available. The transmitter must be off during these adjustments.

(a) Remove relay K1101 from its socket and connect an ohmmeter between pins 7 and 8 of the socket.

(b) Adjust R1106 for an ohmmeter reading of 16 ohms. Disconnect the meter and replace the relay.

(c) Remove relay Kl10Z from its socket and connect an ohmmeter between pins 7 and 8 of the socket.

(d) Adjust R1105 for maximum resistance (approximately 100 ohms). Disconnect the meter and replace the relay.

(2) Two persons are needed in making the adjustment of relay K1103--one at the control-indicator group and the other at the transmitter compartment.

(a) Turn the MAIN POWER switch off, and turn the MAGNETRON POWER variac fully counterclockwise.

(b) Connect a voltmeter adjusted to measure at least 150 volts AC between terminal 8 of TB 1101 and terminal 3 of TB 1102.

(c) Close interlock shorting switches S1103, S1105, and S1107 and apply main power.

(d) While waiting for the 5-minute time delay period to expire, adjust R1104 fully counterclockwise.

Caution: Make the following adjustments and observations within 60 seconds after pressing the START button and adjusting the MAGNETRON POWER variac for 13-ma magnetron current, because operation at lower than normal current may damage the magnetron.

(e) Press the START button, and rotate the MAGNETRON POWER variac clockwise to a magnetron current reading of 13 milliamperes.

(f) Note the voltmeter reading (should be 120 volts). Adjust R1104 clockwise until the neon light (11101) just goes out.

(g) Adjust the MAGNETRON POWER variac for 18 ma of magnetron current.

(h) To check the relay for proper operation, turn the transmitter off and rotate the MAGNETRON POWER variac fully counterclockwise.

(i) Press the START button and slowly rotate the MAGNETRON POWER variac clockwise, observing the AC voltmeter and the magnetron current meter.

(i) Note the current at which K1103 energizes; it should be between 14 and 16 millamperes.

(k) Turn the MAIN POWER switch off, and disconnect the AC voltmeter.

d. Adjustment of S1101 and S1503. See page 157 of TM 11-5840-208-20.

NOTES

NOTES

Section II. COMPUTER CHECKS AND ADJUSTMENTS

5-6. GENERAL

a. This section contains procedures to be followed in maintenance of the computer. Paragraph 7 provides data for checking computer accuracy, and paragraph 8 contains computer alignment procedure.

b. It is recommended that replacement of a defective component be followed by an adjustment or alignment of the associated subassembly.

c. Mechanical alignment of the computer subassemblies is accomplished at direct support maintenance facilities.

5-7. COMPUTER ACCURACY CHECKS

a. The overall accuracy of the computer can be checked by using the computer to solve a series of 18 static problems (chart I). Comparison of the approved solutions with the computed solutions may indicate the need for an accuracy check, adjustment, or alignment of a particular subassembly.

(1) Set the beam separation dial to read 35 mils.

(2) Set the SINGLE DUAL switch to DUAL.

(3) Operate the NORTHING switch until the $_{NR}$ counter reads 000000.

(4) Operate the EASTING switch until the $_{ER}$ counter reads 000000.

(5) Adjust the RADAR HEIGHT shaft until the HR counter reads 1,000 meters.

(6) Place the Δ R and Δ A handwheels in DETENT.

(7) With the LOWER BEAM AZIMUTH handwheel, position the azimuth strobe near the center of the scope. Rotate the antenna until the $_{AZW}$ counter reads approximately the value of AL in the chart. (The AZ ORIENT switch may be used when the radar is not oriented.)

(8) Insert values of Δt, H, RL, AL, and EL given in chart I.

(9) Place the TEST-NORMAL switch in TEST.

(10) Release the Δ R and Δ A handwheels from DETENT and position them for the values of Δ R and Δ A given in chart I.

(11) Place the TEST-NORMAL switch in NORMAL.

(12) Compare the computed solutions with the approved solutions.

(13) Set the beam separation dial to the value stamped on the reflection BEAM SEPARATION plate, and compute the problems listed on page VIII, paragraph 10i.

b. The accuracy of the C subassembly can be checked by inserting a series of eight static problems. Comparison of computed and approved solutions may indicate the need for alignment of the C subassembly.

Chart I . AN/MPQ-4A Computer Accuracy Check

TEST NORMAL SWITCH IN TEST								TEST NORMAL SWITCH IN NORMAL				
M	t	HW	RL	AZ	EL	R	A	RW	AZW	EW	NW	C
1	0	863	2000	0	-50	100	0	2055	0	0	2055	0. 55
2	0	863	3000	200	-35	100	5	3033	202	596	2974	0.33
3	0	1000	5000	800	35	100	20	5104	821	3682	3535	1.04
4	0	1000	2500	1600	50	200	0	2855	1600	2855	0000	1.78
5	0	1000	2500	2000	50	400	-10	3437	1977	3311	99077	2. 34
6	0	1000	2500	2400	50	-100	-20	2370	2374	1718	98368	1.31
7	0	1000	2500	2800	50	-300	-30	2168	2767	894	98026	1.11
8	0	954	2500	3200	50	100	15	2718	3233	99913	97283	2.18
9	0	908	2500	3200	50	100	15	2776	3241	99887	97226	2. 76
10	0	1092	2500	3200	50	100	15	2541	3206	99984	97459	0. 41
11	2.0	1000	2500	3400	50	100	10	2605	3411	99466	97451	1. 05
12	4.0	1000	2500	3400	50	100	10	2560	3406	99486	97492	0. 60
13	0	1000	5000	3600	50	50	5	5073	3607	98025	95327	1.47
14	0	1000	5000	4200	50	300	20	5503	4234	95326	97095	1. 68
15	0	1000	5000	4600	50	-50	30	4930	4642	95129	99238	1.40
16	0	1000	6400	600	50	-50	10	6330	614	3589	5214	1.41
17	0	954	6400	1600	50	100	35	6571	1660	6559	99615	1. 71
18	4.0	1000	6400	1800	50	100	10	6488	1809	6352	98680	0.88
19	0	1000	13000	0000	50	500	0	13795	0000	0000	013800	1. 58
20	0	1000	14500	1600	35	400	0	14930	1600	14925	000000	1.06

Unacceptable errors: When any computed solution contains a northing or easting error greater than 21 meters; when more than 2 of the 20 solutions contain a northing or easting error greater than 17. 5 meters; when any C error is greater than 0. 1; or when any two C errors exceed 0. 06.

(1) Place the ΔR handwheel in DETENT.

(2) Set the HR counter to 1, 000 meters.

(3) Set in values of Δ t, HW, RL, and EL as given in chart II.

(4) Place the TEST-NORMAL switch in TEST.

(5) Release the ΔR handwheel from DETENT and position it for a change in the $_{RW}$ counter reading as given in the ΔR column of chart II.

(6) Place the TEST-NORMAL switch in NORMAL.

(7) Read the value of C from the graduated gears.

Chart II. C Section Accuracy Check

Δt	H_W	R_L	E_L	ΔR	C Value
0.0	1000	5000	+20	+100	0.59
0.0	1000	5000	+50	+100	1.50
0.0	1046	5000	+50	+100	1.ZZ
0.0	0863	5000	+50	+100	2.34
2.0	1000	5000	+50	+100	1.19
2.0	1000	6400	+50	+100	1.23
0.0	1000	6400	+50	-300	1.28
0.0	1000	6400	+50	+400	1.69

Unacceptable error: When more than one computed solution for C is not within ±0.06. The one permissible error greater than ±0.06 must not cause the error in C Δ R to be greater than 10 meters.

c. If the correct value of C cannot be obtained, make the following adjustments:

(1) Set the lower beam elevation to +35 mils.

(2) Position the ΔR handwheel to DETENT.

(3) Set the weapon and radar height to 1, 000 meters.

(4) Set the Δt at 0.

(5) Set the weapon range at 2, 000 meters.

(6) Connect the black test lead to J897.

(7) Connect the red test lead to J890.

(8) Connect the coaxial test lead to J872.

(9) Set the bridge potentiometer to 0202. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R831 is required. See paragraph 5-6c.

(10) Connect the red test lead to J891.

(11) Connect the coaxial test lead to J876.

(12) Set the bridge potentiometer to 0404. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R832 is required. The C dial should be 1.00 $\pm$ .03; if it doesn't, adjust the arm of R885.

Note: Rotate the lower range handwheel to 10,000 meters; the C dial should remain at 1.00 $\pm$ .03. Oscillation may start at approximately 7, 000 meters; if it does, reduce the gain of AR 927A until the oscillation stops. If the C dial does not remain at 1.00 $\pm$ .03, realign R831 and R832.

d. The accuracy of the coordinate subassembly can be checked by inserting a series of 10 static problems (chart III). Comparison of the computed solutions with the approved solutions may indicate the need for alignment of the coordinate subassembly.

(1) Operate the EASTING switch until the E_R counter reads the value listed in chart III.

(2) Operate the NORTHING switch until the N_R counter reads the value listed in chart III.

(3) Place the ΔA and ΔR handwheels in DETENT.

(4) Position the R_L handwheel until the RW counter reads the value listed in chart III.

(5) Operate the AZ ORIENT switch until the AZ_W counter reads the value given in chart III.

(6) Compare the computed solution with the approved solution.

Chart III. Coordinate Subassembly Accuracy Check

E_R	N_R	R_W	AZ_W	E_W	N_W
000000	000000	10000	0000	000000	010000
000000	000000	5000	0000	000000	005000
000000	000000	4000	533	002000	003464
000000	000000	3000	800	002121	002121
000000	000000	1000	1333	000966	000259
005000	005000	2000	1600	007000	005000
005000	0050Q0	3500	2667	006750	001969
005000	005000	4500	3733	002750	001103
008000	005000	6000	4800	002000	005000
008000	005000	8000	5600	002343	010657
008000	005000	4000	6133	006965	008864
000000	000000	5000	1600	005000	000000
000000	000000	5000	3200	000000	995000
000000	000000	5000	4800	995000	000000

Unacceptable errors: When any easting or northing error exceeds 15 meters or when more than 5 easting or northing errors exceed 10 meters.

NOTES

5-8. COMPUTER ALINEMENT

a. General. Computer test set TS-909/PPM is the only item of test equipment required to align the computer. Instructions for operating the test set are contained in TM 11-1223.

b. Preliminary Procedure.

(1) Connect the power cable of the test set to receptacle J898, located underneath the computer drawer.

(2) Connect the black ground lead W4605 of the test set to a good ground in the computer drawer.

(3) Adjust the gain potentiometers on all eight servoamplifiers fully clockwise. After adjusting each potentiometer to its clockwise limit, check the associated gear train for chatter and hunting. If gear chatter exists, turn the adjusting potentiometer slowly counterclockwise until the chatter stops. On amplifier AR927A, check the C subassembly dials for proper torque at range setting of 2, 000 meters, with a minimum of chatter for a range setting of 10, 000 meters. If some compromise is necessary in this adjustment, a slight chatter at 10, 000 meters is preferable to a lack of torque at 2, 000 meters.

(4) Set the beam separation dial on R822 to 35 mils.

Note: Each adjustment potentiometer in the computer is locked by a locknut on the potentiometer shaft. To adjust the potentiometers, first loosen the locknut. After the adjustment has been made, hold the shaft in position while tightening the locknut, observing the null meter of the TS-909. Only after each adjustment is locked into the correct adjustment should you proceed to the next adjustment.

(5) Set RADAR LOCATION EASTING and NORTHING counters to. 000000.

(6) Alignment.

(a) Set time to zero.

(b) Black lead to J897.

(c) Red lead to J890.

(d) Coax lead to J871.

(e) Bridge to 0000.

Meter should null; if not, adjust R801.

(f) Single beam-dual beam switch to dual beam position.

c. Alignment of the Height Subassembly.

(1) Connect the red test lead to J890.

(2) Connect the black test lead to J897.

(3) Connect the test probe to J882.

(4) Set the H_R and H_W counters to 1, 000 meters.

(5) Set the bridge potentiometer to 0000. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R806 is required. See paragraph 5-6c.

(6) Set the bridge potentiometer to 0357.

(7) Position the H handwheel for an H_W reading of 542. 5 meters.

(8) Adjust +H potentiometer R976 for meter null.

(9) Connect the red test lead to J891.

(10) Position the H handwheel for an H_W reading of 1,457. 5 meters.

(11) Adjust -H potentiometer R977 for meter null.

(12) Disconnect the test leads.

d. Alignment of the Elevation Subassembly.

(1) Set E_L to zero mils (antenna pedestal counter).

(2) Adjust control transformer B822 for E_L of zero mils (computer counter).

(3) Insure that the beam separation is set at 35 mils.

(4) Connect the red test lead to J890.

(5) Connect the black test lead to J897.

(6) Connect the test probe to J881.

(7) Set the bridge potentiometer to 0000. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R821 is required. See paragraph 5-6c.

(8) Set E_L to -35 mils.

(9) Connect the test probe to J887. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R822 is required. See paragraph 5-6c.

(10) Connect the test probe to J881.

(11) Set E_L to +50 mils.

(12) Set the bridge potentiometer to 1593.

(13) Adjust $+E_L$ potentiometer R983 for meter null.

(14) Connect the red test lead to J891.

(15) Connect the test probe to J887.

(16) Set the bridge potentiometer to 2716.

(17) Adjust $+E_U$ potentiometer R985 for meter null.

(18) Set E_L to -50 mils.

(19) Connect the red test lead to J890.

(20) Set the bridge potentiometer to 0472.

(21) Adjust $-E_U$ potentiometer R986 for meter null.

(22) Connect the red test lead to J891.

(23) Connect the test probe to J881.

(24) Set the bridge potentiometer to 1593.

(25) Adjust $-E_L$ potentiometer R984 for meter null.

(26) Disconnect the test leads.

e. Alignment of C Potentiometer R811B.

(1) Connect the red test lead to J890.

(2) Connect the black test lead to J897.

(3) Connect the test probe to J886.

(4) Set into the computer elevation and/or height data to make the C dials read 2.00.

(5) Set the bridge potentiometer to 3838.

(6) Adjust C+1 potentiometer R978 for meter null.

(7) Disconnect the meter leads.

f. Adjustment of C Balance Potentiometer R885.

(1) Set Δtime at 0. 0.

(2) Set the H_R and H_W counters to 1000.

(3) Set detent switch S856 at OFF and place the Δ RANGE and Δ AZIMUTH handwheels in detent.

(4) Insure that the beam separation dial is set at 35 mils.

(5) Set E_L at +35 mils.

(6) With the TEST-NORMAL switch at NORMAL, adjust C balance potentiometer R885 for a C dial reading of 1.00.

(7) With the TEST-NORMAL switch at TEST, adjust test calibration potentiometer R898 for a C dial reading of 1.00.

(8) Repeat steps in (6) and (7) above until the C dials read correctly in both switch positions. Return the switch to NORMAL.

(9) Raise elevation to +70 mils. The C dials should read 2. 00. If not, adjust R983 for one half the difference and R985 for the remainder.

(10) Raise elevation to +105 mils. The C dials should read 3. 00.

Note: If correct readings are not obtained in steps in (10) above, readjust the gain potentiometer in C servoamplifier AR927A (b(3) above). This may, in turn, require further adjustment of R885 and R898 as in (6) and (7) above.

g. Alignment of ΔA Potentiometer R841.

(1) Connect the red test lead to J891.

(2) Connect the black test lead to J3897.

(3) Connect the test probe to 3880.

(4) Set detent switch S856 at OFF and place the Δ RANGE and Δ AZIMUTH handwheels in detent.

(5) Set the bridge potentiometer at 0000. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R841 is required. See paragraph 5-6c.

(6) Connect the red test lead to J889.

(7) Set the bridge potentiometer to 5000.

(8) Set detent switch S856 at DETENT RELEASE and position the Δ AZIMUTH handwheel for meter null.

(9) Connect the red test lead to J891.

(10) Set the bridge potentiometer to 3372.

(11) Adjust Δ A potentiometer R992 for meter null.

(12) Connect the red test lead to J892.

(13) Set the bridge potentiometer to 5000.

(14) Position the Δ AZIMUTH handwheel for meter null.

(15) Connect the red test lead to J890.

(16) Set the bridge potentiometer to 3372.

(17) Adjust Δ A potentiometer R993 for meter null.

(18) Disconnect the test leads.

h. Alignment of C Δ A Potentiometer R842.

(1) Connect the red test lead to J890.

(2) Connect the black test lead to J897.

(3) Connect the test probe to J879.

(4) Set detent switch S856 at OFF and place the Δ RANGE and Δ ZIMUTH handwheels in detent.

(5) Set the bridge potentiometer to 0000.

(6) Adjust potentiometer R883 for meter null.

Note: If necessary to obtain meter null, slightly reduce the gain of C Δ A servoamplifier AR929B.

(7) Record the AZ_W counter reading__________________________.

(8) Connect the red test lead to J889.

(9) Connect the test probe to J880.

(10) Set the bridge potentiometer to 5000.

(11) Set detent switch S856 to DETENT RELEASE and position the Δ AZIMUTH handwheel for meter null.

(12) Disconnect the red test lead and the test probe.

(13) Set the TEST-NORMAL switch at TEST (C dials must read 1.00).

(14) Adjust -C Δ A potentiometer R994 for an AZW reading 35 mils less than the reading recorded in (7) above.

(15) Connect the red test lead to J892.

(16) Connect the test probe to J880.

(17) Position the Δ AZIMUTH handwheel for meter null.

(18) Disconnect the test leads.

(19) Adjust +C Δ A potentiometer R995 for an AZW reading 35 mils more than the reading recorded in (7) above.

(20) Return the TEST-NORMAL switch to NORMAL.

i. Alignment of A R Potentiometer R833.

(1) Connect the red test lead to J890.

(2) Connect the black test lead to J897.

(3) Connect the test probe to J873.

(4) Set detent switch S856 at OFF and place the Δ RANGE and Δ AZIMUTH handwheels in detent.

(5) Set the bridge potentiometer at 0000. If the meter nulls, proceed to the next step. If the meter does not null, mechanical alignment of R833 is required. See paragraph 5-6c.

(6) Connect the red test lead to J893.

(7) Set the bridge potentiometer to 5000.

(8) Set detent switch S856 to DETENT RELEASE and position the Δ RANGE handwheel for meter null.

(9) Connect the red test lead to J891.

(10) Set the bridge potentiometer to 3372.

(11) Adjust + Δ R potentiometer R987 for meter null.

(12) Connect the red test lead to J894.

(13) Set the bridge potentiometer to 5000.

(14) Position the Δ RANGE handwheel for meter null.

(15) Connect the red test lead to J890.

(16) Set the bridge potentiometer to 3372.

(17) Adjust - Δ R potentiometer R988 for meter null.

(18) Disconnect the test lead.

j. Alignment of C Δ R Potentiometer R834.

(1) Connect the red test lead to J890.

(2) Connect the black test lead to J897.

(3) Connect the test probe to J874.

(4) Set detent switch S856 at OFF and place the Δ RANGE and Δ AZIMUTH handwheels in detent.

(5) Set the bridge potentiometer to 0000.

(6) Adjust potentiometer R882 for meter null.

Note: If necessary to obtain meter null, slightly reduce the gain of C Δ R servoamplifier AR928B.

(7) Set R_W counter to 7500.

(8) Connect the red test lead to 3893.

(9) Connect the test probe to J873.

(10) Set the bridge potentiometer to 5000.

(11) Set detent switch S856 to DETENT RELEASE and position the Δ RANGE handwheel for meter null.

(1Z) Disconnect the red test lead and the test probe.

(13) Set the TEST-NORMAL switch to TEST (C dials must read 1.00).

(14) Adjust +C Δ R potentiometer R989 for an RW counter reading of 7050 meters.

(15) Connect the red test lead to J894.

(16) Connect the test probe to J873.

(17) Position the Δ RANGE handwheel for meter null.

(18) Disconnect the test leads.

(19) Adjust -C Δ R potentiometer R990 for an R_W counter reading of 7950 meters.

(20) Return the TEST-NORMAL switch to NORMAL.

k. Alignment of R_W Potentiometer R835.

(1) Set the detent switch S856 at OFF and place the Δ RANGE and Δ AZIMUTH handwheels in detent.

(2) Connect the red test lead to J891.

(3) Connect the black test lead to J897.

(4) Connect the test probe to J875.

(5) Set the bridge potentiometer to 2857.

(6) Position the R_L handwheel for an R_W reading of 7, 500 meters.

(7) Adjust R_W potentiometer R991 for meter null.

(8) Disconnect the test leads.

l. Alignment Check of Resolver B847.

(1) Set the AZ_W counter to 0000 mils.

(2) Observing the E_W counter, rotate the R_L handwheel from its counterclockwise limit to its clockwise limit.

(3) If the E_W counter reading varies more than 10 meters, mechanical alignment of resolver B847 is required. See paragraph 5-6c.

m. Alignment of Coordinate Subassembly.

(1) Set detent switch S856 at OFF and place the Δ RANGE and Δ ZIMUTH handwheels in detent.

(2) Position the R_L handwheel for an R_W counter reading of 7, 500 meters.

(3) Operate the AZ ORIENT switch for an AZ_W counter reading of 0000 mils.

(4) Adjust potentiometer R886 until the EW counter reads 000000 meters.

(5) Adjust +RW(N) potentiometer R980 until the N_W counter reads 007500 meters.

(6) Operate the AZ ORIENT switch for an AZ_W counter reading of 1, 600 mils.

(7) Adjust potentiometer R887 until the N_W counter reads 000000 meters.

(8) Adjust +RW(E) potentiometer R982 until the E_W counter reads 007500 meters .

(9) Operate the AZ ORIENT switch for an AZ_W counter reading of 3, 200 mils.

(10) Check the EW counter reading. If it is not 000000 meters, adjust potentiometer R886 until the error is halved.

(11) Adjust -RW(N) potentiometer R979 until the NW counter reads 992500 meters.

(12) Operate the AZ ORIENT switch for an AZ_W counter reading of 4, 800 mils.

(13) Check the NW counter reading. If it is not 000000 meters, adjust potentiometer R887 until the error is halved.

(14) Adjust -RW(E) potentiometer R981 until the EW counter reads 992500 meters.

(15) Repeat (3) through (14) above until the best possible accuracy is obtained in all four quadrants.

n. Computer Accuracy Recheck. Upon completion of the alignment procedures in b through m above, recheck computer accuracy as indicated in paragraph 5-7.

o. Test Problems, Before the set is operated, the beam separation must be set at the value indicated on the beam separation plate on the antenna reflector and the problems used by the operator must be solved by the computer. See page 20, paragraph 2-10i.

5-9. SINGLE BEAM ALINEMENT PROCEDURE OF THE COMPUTER

a. General. To align the computer for SINGLE-BEAM OPERATION, two procedures are given for adjustment of SINGLE-BEAM potentiometers R881 and R884. One procedure uses Computer Test Set TS-909/PPM and the other procedure uses the TOE oscilloscope. Either procedure is acceptable. If proper results cannot be achieved during adjustment and testing, higher category maintenance is required.

b. Using the TOE oscilloscope procedure, set the SINGLE BEAM-DUAL BEAM switch to the DUAL-BEAM position and make the following computer control settings:

(1) Set Δ TIME counter to 0.0 SECONDS.

(2) Set weapon HEIGHT and RADAR HEIGHT counters to 1000 METERS.

(3) With the detent switch in the OFF position, set Δ RANGE handwheel in detent.

(4) Set RANGE counter to 7500 METERS.

(5) Set TEST-NORMAL switch on right side of computer to TEST (prevents "C" unit from running to stops).

(6) Set LOWER BEAM ELEVATION counter to 0 MILS, using the ELEVATION switch on the C-2014/MPQ-4A.

(7) Connect the oscilloscope signal input lead to $_{EL}$ jack J881, and the ground lead to B+RET jack J897 (fig 257, TM 11-5840-208-30).

(8) Loosen the gear clamp on potentiometer R821 (fig 288, TM 11-5840-208-30), and adjust for minimum amplitude 400-hertz signal on the oscilloscope. Tighten the gear clamp on the shaft of R821, and replace the elevation subassembly in the computer.

(9) Set SINGLE BEAM-DUAL BEAM switch to SINGLE BEAM, and set LOWER BEAM ELEVATION counter to +7 mils.

(10) Adjust new potentiometer R881 for minimum signal on the oscilloscope. The C dials should read 0. 0. Remove oscilloscope leads from J881 and J897.

(11) Set elevation to +21 MILS. Test - Norm SW. To Normal.

(12) Adjust new potentiometer R884 for reading of 1. 00 on the calibrated "C" gears (right side of computer).

(13) Perform computer accuracy checks (single beam operation, 5-10) page 230.

c. Using the Computer Test Set TS-909/PPM procedure, set the SINGLE BEAM-DUAL EAM switch to the DUAL-BEAM position and make the following computer control settings:

(1) TIME counter M801 to 0. 0 second.

(2) Weapon HEIGHT and RADAR HEIGHT counters to 1000 meters.

(3) Detent switch S856 to OFF and ARANGE handwheel in detent.

(4) RANGE counter M831 to 7, 500 meters.

(5) TEST-NORMAL switch S855 to TEST.

d. Connect the test set as follows:

(1) Power cable to receptacle J898 in the bottom of the computer drawer.

(2) Test probe to E_L jack J881.

(3) Red test lead to -REF jack J890.

(4) Black test lead to B+ RET jack J897.

(5) Black ground lead W4605 to test set GROUND jack and to a good ground on the computer drawer.

(6) Set BRIDGE ADJ dial to 0000.

(7) Set SINGLE BEAM-DUAL BEAM switch S857 to SINGLE BEAM.

(8) Set LOWER BEAM ELEVATION counter M821 to +7 mils.

(9) Adjust potentiometer R881 for a null on test set.

(10) Disconnect test probe and red test lead.

(11) Set LOWER BEAM ELEVATION counter M821 to +21 mils.

(12) TEST NORMAL switch to NORMAL.

(13) Adjust potentiometer R884 for reading of 1. 00 on the calibrated C gears.

(14) Perform computer accuracy checks (single beam operation).

5-10. COMPUTER ACCURACY CHECK (SINGLE-BEAM OPERATION)

It is assumed that the requirements of the normal (dual-beam operation) check of computer accuracy given in paragraph 44, TM 11-5840-208-20 have been met prior to this modification procedure. The accuracy of the computer during single-beam operation is checked by performing the series of problems listed in the chart in e below. The accuracy of the computer is not acceptable when the computed solution of any problem contains an error of more than 40 meters for weapon easting (E_W) or northing (N_W), or more than 70 meters for combined easting and northing, or more than .15 for "C". Preliminary instructions are included below.

a. On the computer, set RADAR LOCATION EASTING and NORTHING counters to 000000 METERS.

b. Set SINGLE BEAM-DUAL BEAM switch to SINGLE BEAM.

c. Set weapon HEIGHT and RADAR HEIGHT counters to 1000 METERS.

d. With the detent switch in the OFF position, set Δ RANGE and Δ AZIMUTH handwheels in detent.

e. For each problem in the chart given below, with the TEST-NORMAL switch on the right side of the computer at TEST, set Δ T, HW, RL, AZ, EL, Δ R and Δ A as given in the chart. Then set the TEST-NORMAL switch to NORMAL and read weapon range (R_W), weapon azimuth (A_W), weapon easting (EW), weapon northing (N_W) and "C" solutions on the computer, and compare these solutions with those in the chart.

Note: When setting AZ into the computer, first use the AZ ORIENT switch, followed by a fine setting, using the LOWER BEAM AZIMUTH control. Just prior to setting Δ R and Δ A into the computer, set the detent switch to the DETENT RELEASE position.

Computer accuracy check (single-beam operation)

Problems								Correct solutions				
Problem No.	ΔT	HW	RL	AZ	EL	ΔR	ΔA	RW	AW	EW	NW	C
1	0.0	0930	5000	6390	07	0	+10	5000	0000	000000	005000	1.00
2	0.0	1000	5000	0000	21	+100	0	5103	0000	000000	005103	1.03
3	0.0	1000	6000	1600	28	-100	0	5856	1600	005856	000000	1.44
4	0.0	1000	5600	0800	28	+50	0	5677	0800	004014	004014	1.53
5	0.0	1070	4500	5600	35	-50	0	4457	5600	996849	003151	.86
6	0.0	1000	4900	3990	21	0	+10	4900	4000	996536	996536	1.00
7	0.0	1000	12000	1600	35	+200	0	12370	1600	012365	000000	1.91
8	0.0	1000	14000	1600	20	+50	0	14045	1600	014040	000000	0.94

CHASSIS INDEX

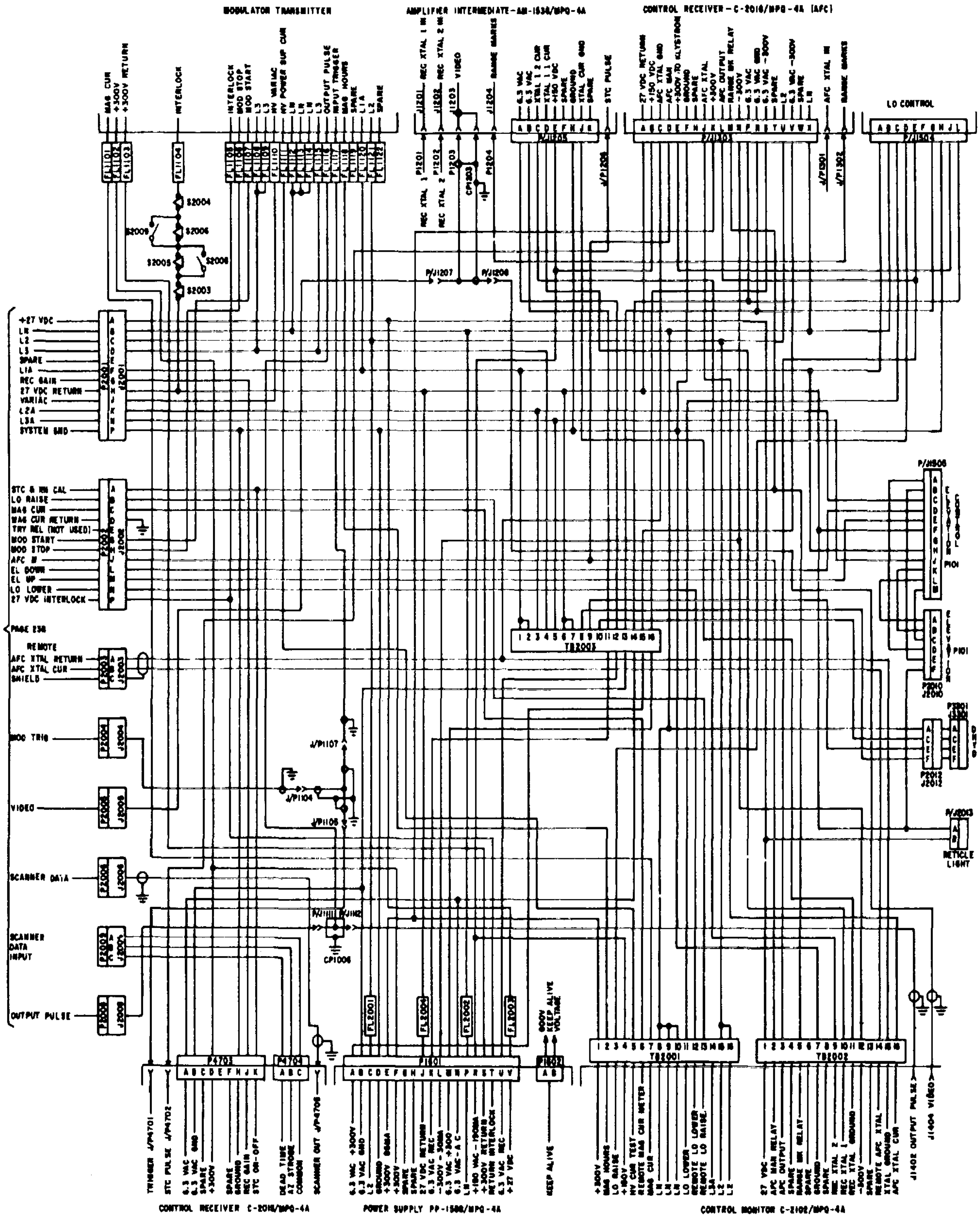
Chassis number	Common name of chassis	Chassis nomenclature
100-151	Indicator drawer	Azimuth and range indicator IP-375/MPQ-4A
161-199	HV rectifier	Z161
200-Z30	Long-gate generator	Z101
231-260	Timing sweep generator	Z102
400-420	Pickoff amplifiers	Z107, Z108, Z109
500-560	Azimuth synchronizer	Z150
600-699	Control-indicator group power supply	Control-power supply C-2014/MPQ-4A
700-799	System intercabling and waveguides	
800-899	Computer	Radar data computer CP-319/MPQ-4A
900-999	Control amplifier	
1000-1099	Control unit cabinet	Control-indicator group OA- 1256/MPQ-4A
1100-1106	Transmitter compartment	Receiver-transmitter group OA-1257/MPQ-4A
1151-1154	Trigger amplifier	Trigger pulse amplifier AM- 1537/MPQ-4A
1200-1299	IF amplifier	IF amplifier AM- 1538/MPQ-4A
1300-1399	AFC assembly	Control receiver C-2016/MPQ-4A
1400-1499	Control-monitor	Control-monitor C-2102/MPQ-4A
1500-1599	Duplexer	
1600-1699	Low voltage power supply	Power supply PP-1588/MPQ-4A

CHASSIS INDEX

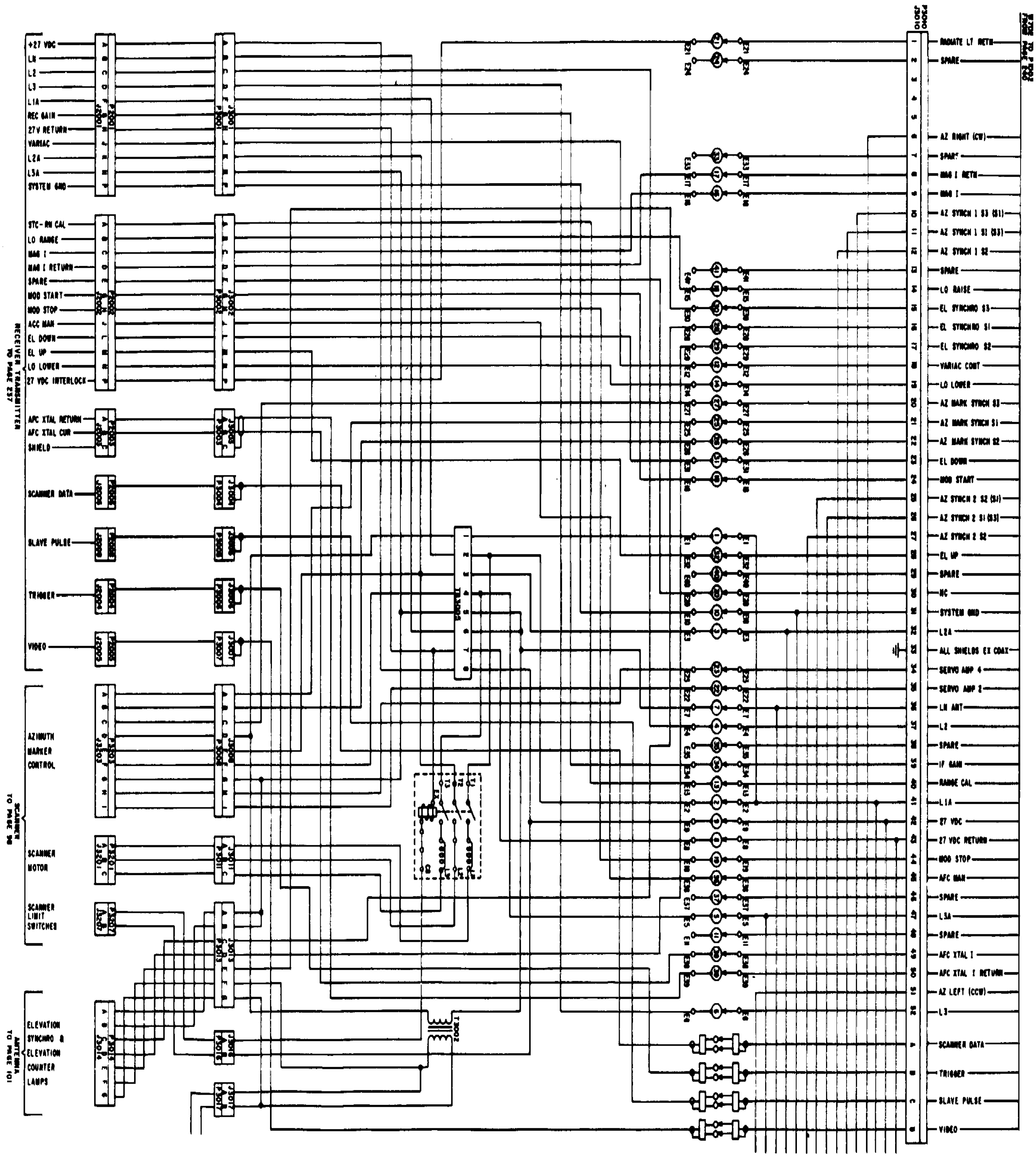
Chassis number	Common name of chassis	Chassis nomenclature
1700-1799	Echo box	Tuned cavity FR-111/MPQ-4A
1900-1920	Blower	Blower assembly shelter intake HD-339/MPQ-4A
2000-2099	Receiver compartment	Receiver-transmitter group OA-1257/MPQ-4A
3000-3099	Pedestal	Pedestal, antenna AB-486/MPQ-4A
3200-3299	Scanner	Antenna AS-835/MPQ-4A
3300-3399	Dehydrator	Electric desiccant dehydrator HD-264/MPQ-4A
4400-4499	Range sweep generator and drivers	Z144
4500-4550	Azimuth sweep generator and drivers	Z145
4551-4570	Video blanking channel	Z146
4571-4599	Modulator trigger generator	Z147
4600-4650	Video amplifier	Z148
4651-4699	Intensifier and shortgate generator	Z149
4700-4799	STC assembly	Control receiver C-2015/MPQ-4A
4800-4899	Thyratron voltage regulator	VR1101
6000-6053	Shelter	Shelter electrical equipment S-134A/MPQ-4A

ADJUSTMENT INDEX

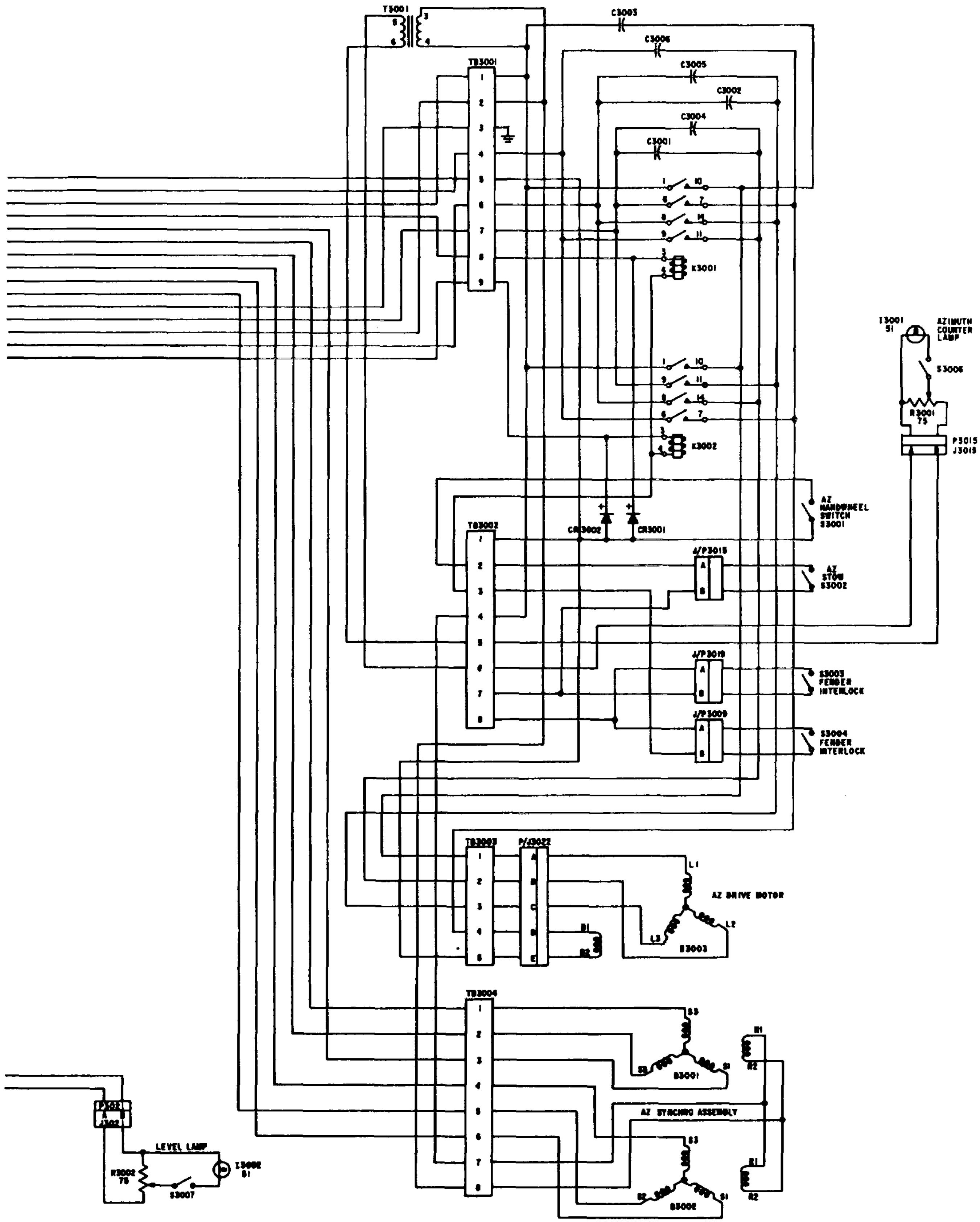
ADJUSTMENT INDEX



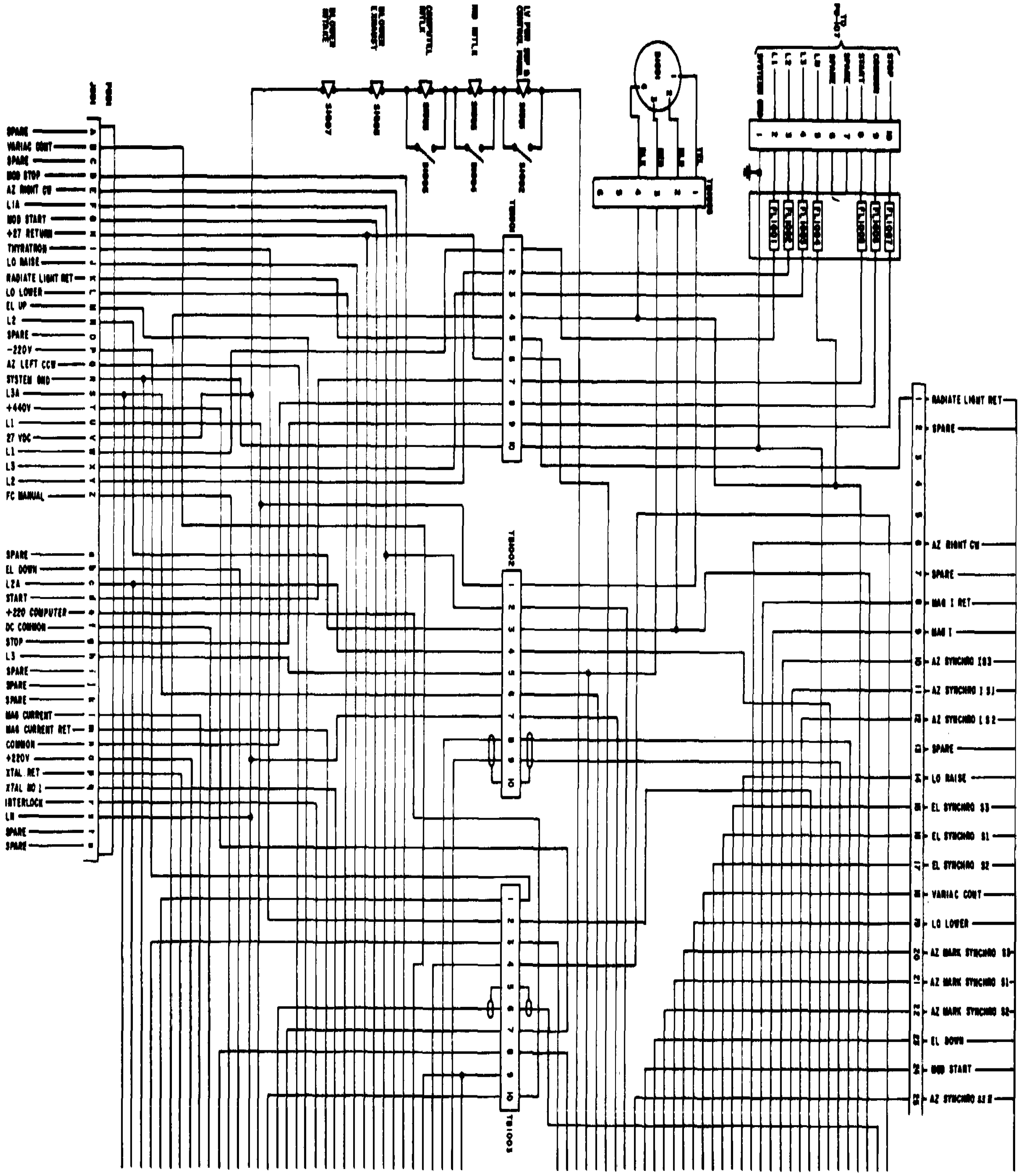
Interwiring diagram I.



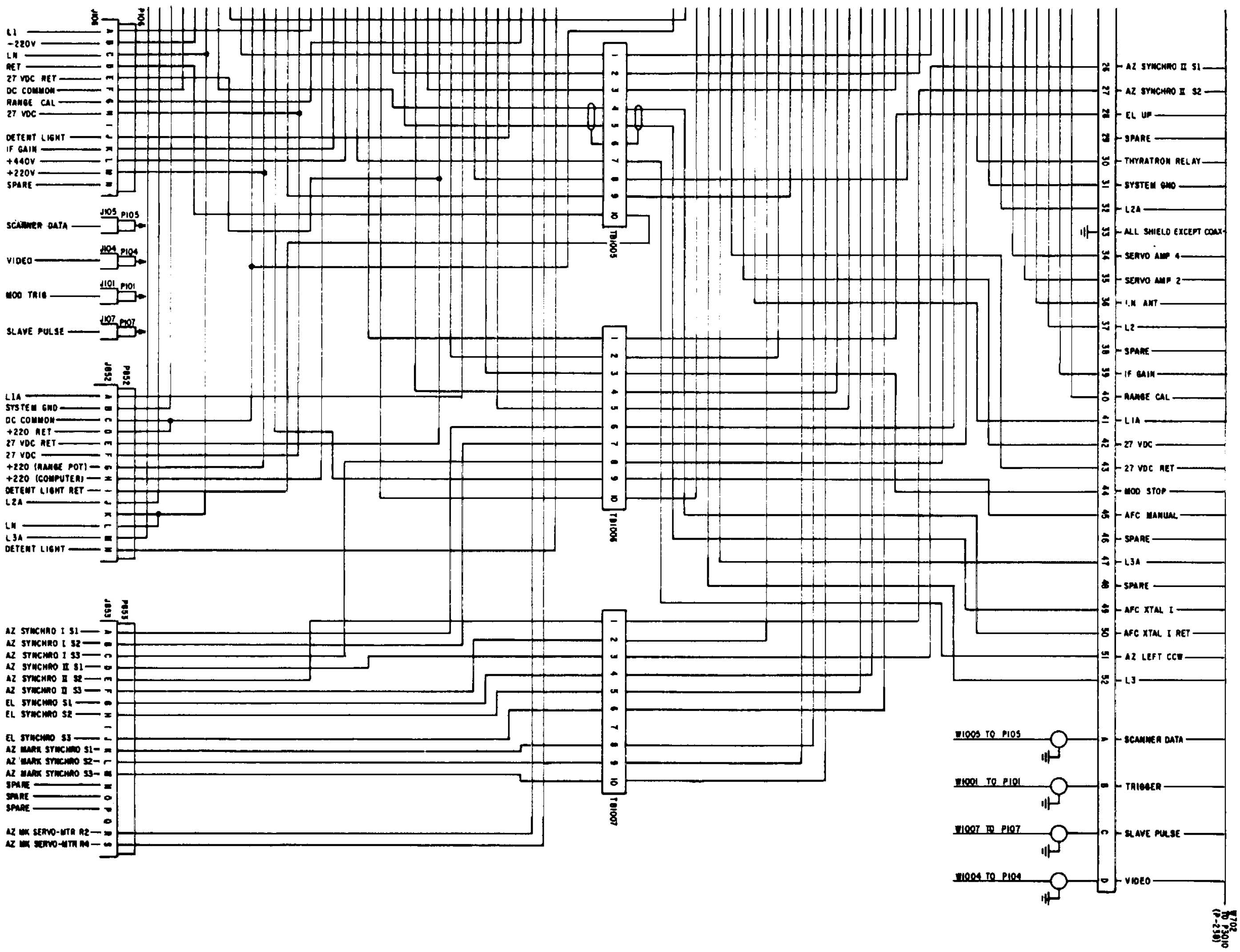
Interwiring diagram II.



Interwiring diagram II- - continued,



Interwiring diagram III



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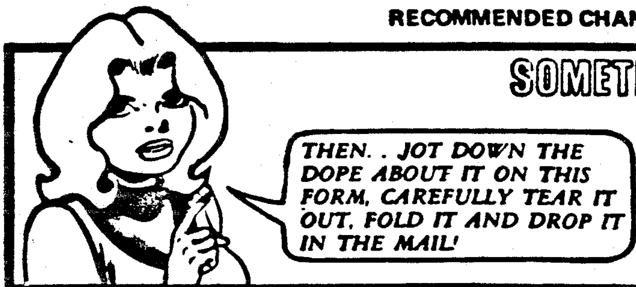

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