INSTRUCTION MANUAL

MODEL 907
7 TO 11 GHz
SIGNAL GENERATOR

WAVETEK®

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WARRANTY

Wavetek warrants that all products of its own manufacture conform to Wavetek specifications and are free from defects in material and workmanship when used under normal operating conditions and within the service conditions for which they were furnished.

The obligation of Wavetek hereunder shall expire one (1) year after delivery and is limited to repairing, or at its option, replacing without charge, any such product which in Wavetek's sole opinion proves to be defective within the scope of this Warranty. In the event Wavetek is not able to repair or replace defective products or components within a reasonable time after receipt thereof, Buyer shall be credited for their value at the original purchase price.

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

While the very low power of the rf energy generated in this instrument makes it ordinarily nonhazardous, extremely close and prolonged proximity of an eye and an rf output connector could cause injury.

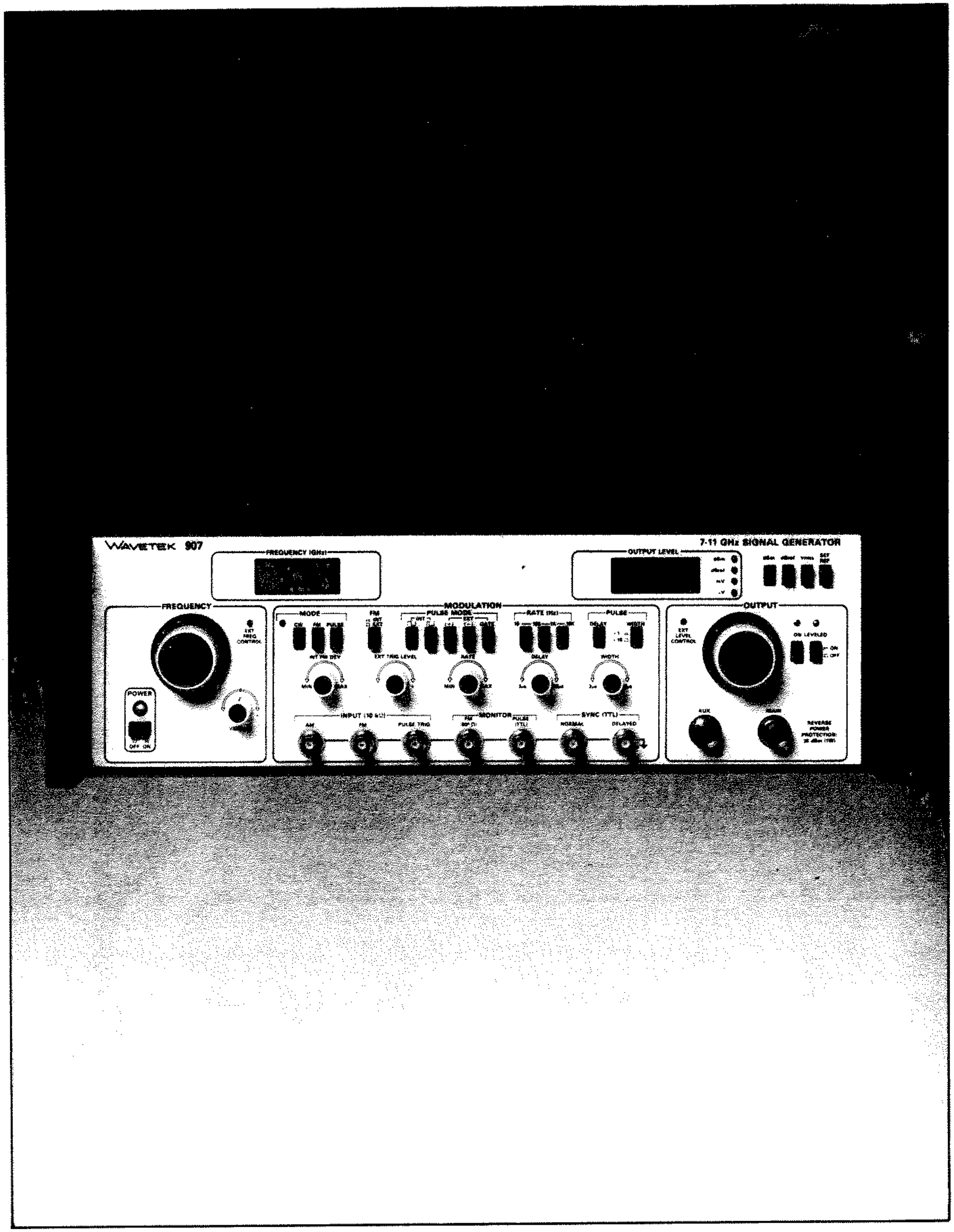
BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

The instrument power receptacle is connected to the instrument safety earth terminal with a green/yellow wire. Do not alter this connection. (Reference: ⏚ or ⚠ stamped inside the rear panel near the safety earth terminal.)

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.



Model 907, 7 to 11 GHz Signal Generator

SECTION 1
GENERAL DESCRIPTION

1.1 MODEL 907

The Model 907 Signal Generator is a lightweight, compact source of RF signals. The 7 to 11 GHz frequency range is continuously variable with front panel or external voltage control; frequency is displayed on a 3½ digit LCD. Output level is continuously adjustable from 0 to −127 dBm by front panel or external voltage control; a 3½ digit LCD displays the level. Modes of operation include CW, AM, FM and Pulse with internal or external modulation and trigger signals. In addition to the main RF output, there is a constant level auxiliary output. Two sync outputs and two monitor outputs allow timing and monitoring of modulation and triggering functions.

1.2 SPECIFICATIONS

1.2.1 Versatility

The Model 907 Signal Generator is a signal source with AM, FM, pulse modulation and external sweep capabilities. All parameters are independently adjustable.

Pulse and FM modulation signals may be externally provided or selected from the internal modulation generator.

Frequency and output level may also be externally (remotely) controllable. External 0 to +5V ramp with repetition rates to 15 Hz will sweep the entire RF frequency range.

Internal modulator signals are available for monitoring and system synchronization.

Modes

CW: Continuous RF output. Frequency and level adjustable.

FM: Internal or external signals can frequency modulate the RF output. Rate and deviation are adjustable.

Pulse: Internal or external signals can pulse modulate the RF output. Pulse width adjustable or fixed 50% duty cycle; rate and delay adjustable. External pulse mode can trigger the pulse circuits on rising or falling edge of input signal. A gate mode allows the external input to control pulse width.

1.2.2 Output

NOTE

Output specifications applicable to non-swept operation only.

Frequency

Varied by a 10-turn potentiometer and a ±4 MHz vernier or by an external 0 to +5V.

Range: 7.0 to 11.0 GHz.

Readout: 3½ digit LCD, 10 MHz resolution.

Accuracy: ±1% of reading.

Stability: 60 ppm/°C; less than 20 ppm (±10% line variation).

Signal Purity

(Internal frequency control, CW).
Residual FM: <15 kHz peak.

Harmonics: < −30 dBc

Spurious: < −55 dBc

Level

Varied by a 10-turn potentiometer or external 0 to + 13.6V (−10 dB/V). Output can be switched on and off.

Range (Leveled): 0 to −127 dBm; 0.225V to 0.100μV (into 50Ω).

Maximum Output: > +3 dBm unleveled.

Readout: 3½ digit LCD, calibrated in dBref, dBm and Vrms.

Resolution: 0.1 dB.

Amplitude Accuracy:

Accuracy	Output Level
±1 dB	0 dBm
±2 dB	0 to −60 dBm
±3 dB	−60 to −127 dBm

Below −127 dBm power decreases monotonically, but is uncalibrated. Output level is continuously adjustable.

Impedance: 50Ω.

VSWR: <1.5

Connector: Female type N coax.

Auxiliary Output Power: > −5 dBm CW signal.

Reverse power protection: +30 dBm average.

1.2.3 Pulse Modulation

Transition Times: <35 ns for leading and trailing edges; typically 12 ns/25 ns, respectively.

On-Off Ratio: > 80 dB when main output is set at 0 dBm.

Width: 200 ns to 100 μs in 2 ranges; for greater widths, use external gated mode.

Delay Range: 3 μs to 1 ms in 2 ranges, relative to normal sync. (Not applicable to gate mode.)

Internal Mode: Fixed square wave or variable width pulses; 10 Hz to 10 kHz in 3 ranges.

External Pulse Mode: Triggers internally generated pulse delay and width from PULSE TRIG Input.

PULSE TRIG Input: 1 Vp-p minimum trigger; slope and trigger point adjustable; ±10V maximum.

External Gate Mode: RF output occurs for the duration that PULSE TRIG INPUT signal exceeds trigger level setting.

1.2.4 FM - Frequency Modulation

Maximum RF Output Deviation: >5 MHz p-p.

Internal Sawtooth Modulator: 10 Hz to 10 kHz in 3 ranges.

External FM Input: >1 MHz/V; ± 2.5V max level; 0 to >10 kHz; 10 kΩ input impedance.

1.2.5 AM - Amplitude Modulation

Ext. Modulation Frequency Range: 0 to 10 kHz.

Maximum Source Level: ± 2V peak.

Input Impedance: 10 kΩ.

Sensitivity: 27 dB/V (nominal).

1.2.6 Modulator Outputs

FM: Signal from external or internal modulation generator. 600Ω source impedance.

Pulse: Positive TTL level pulse occurring at selected repetition rate, pulse delay and pulse width of modulator pulse.

Normal Sync: Positive TTL level pulse occuring at selected repetition rate.

Delayed Sync: Positive TTL level pulse synchronous with modulator pulse with selected delay.

1.2.7 General

Environmental

Specifications apply for 25° ±10°C after 1 hour warm-up. Instrument will operate from 0°C to +50°C, to 10,000 ft. and to 90% relative humidity.

Storage Temperature

−25°C to +65°C.

Weight

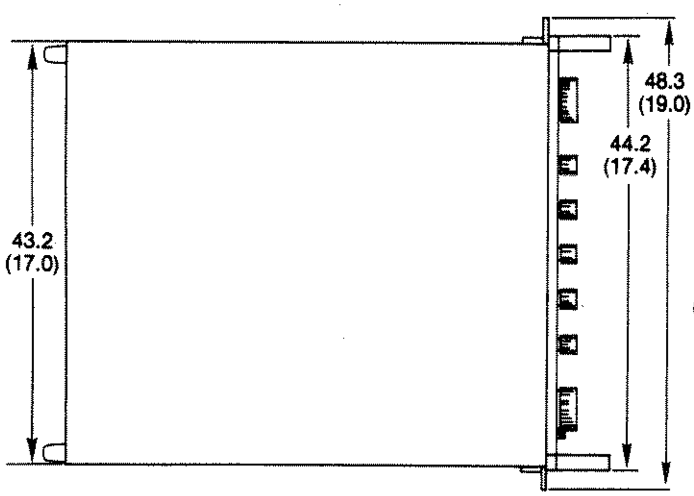
19.1 kg (42 lb) net; 22.3 kg (49 lb) shipping.

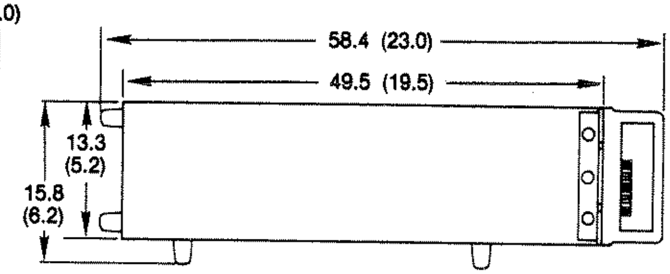
Maximum Dimensions

44.5 cm (17½ in.) wide; 15.9 cm (6¼ in.) high; 58.4 cm (23 in.) deep. Adapters available for rack mounting.

Power

90 to 105V, 108 to 126V, 198 to 231V; 50 to 400 Hz; 140 VA maximum.





DIMENSIONS IN CENTIMETERS AND (INCHES)

SECTION 2
INITIAL PREPARATION AND INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

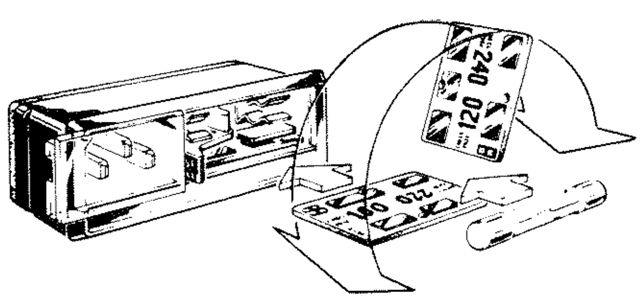
2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 120 Vac line supply and with a 1 ½ amp fuse.

Conversion to other input voltages requries a change in rear panel fuse holder votlage card position and fuse (figure 2-1) according to the following procedure.



Card Position	Input Vac	Fuse (Slo-Blo)
100	90 to 105	1 ½ amp
120	108 to 126	1 ½ amp
220	198 to 231	¾ amp
240	216 to 252	¾ amp

Figure 2-1. Voltage Selector and Fuse

1. Disconnect the power cord at the instrument, open fuse holder cover door and rotate fuse-pull to left to remove the fuse.
2. Remove the small printed circuit board and select operating voltage by orienting the printed circuit board to position the desired voltage to the top left side. Push the board firmly into its module slot.
3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

When connecting the MAIN and AUXiliary outputs to associated equipment, use 50Ω coaxial cables equipped with male type N connectors that are compatible with those specified in US MIL-C-39012.

CAUTION

Reverse power in excess of 30 dBm may damage the Model 907 output circuits.

Use mating BNC connectors with 50Ω coaxial cable for all other input and output connections.

NOTE

The use of specially constructed and shielded coax connectors is recommended for operation at low power levels (e.g., less than −80 dBm). Otherwise, the relatively strong AUX output signal will "leak" into the coax connector at the MAIN output. This will cause apparent inaccuracies in output level control.

2.3 INITIAL CHECKOUT PROCEDURE

The procedure of table 2-1 provides an initial operational checkout of all controls and connections of the

907. The required test equipment is listed below. Equipment interconnection drawings are referenced in the table. An acceptance test record (table 2-2) may be copied and used for a permanent record of a unit's test.

The following test equipment, or its equivalent, is required for the operational checkout.

Equipment	Manufacturer	Model
Spectrum Analyzer	Tektronix	492
Power Meter	HP	436A with 8484A Sensor, 30 dB Pad
Test Generator	Wavetek	182A
Frequency Counter	EIP	371
Xtal Detector	HP	423A
Dual Channel Scope	Tektronix	7603
50Ω Terminations	Tektronix	011-0049-01
Cables		50Ω Coax
0 to +15Vdc Source	Datel	DVC-8500

Table 2-1. Checkout Procedure

Step	Test	Tester and Setup	Program	Desired Results
1	Primary Power	None	POWER: OFF	Verify correct fuse installed. (Sec. 2.2.1). Verify correct primary voltage selected. (Sec. 2.2.1).
2			Connect to facility power source. POWER: ON	POWER ON LED is lit
3	Initial Setup		FREQ CONTROL: INT. OUTPUT LEVEL CONTROL: INT (Rear Panel Controls)	Front panel EXT FREQ CONTROL and EXT LEVEL CONTROL LEDS OFF
4			Frequency VERNIER: Centered on 0. Frequency knob: Full ccw	Display reads 6.95 GHz (± 0.04 GHz)
5			MODE: CW	CW LED lit
6			dBm button: Pressed	dBm LED lit
7			Output level knob: Full cw	OUTPUT LEVEL display: (+1.0 ±0.3) dBm
8			RF output ON/OFF Switch: ON. RF output LEVELED Switch: ON Allow 1 hour warm-up	ON LED lit, LEVELED LED lit
9	Frequency Accuracy	Frequency counter: Connect to 907 AUX output (figure 2-2)	Frequency knob: From ccw to cw, then 7.00 GHz (on display)	Counter: 7.00 GHz ± 70 MHz
10			Frequency knob: 8.00 GHz (on display)	Counter: 8.00 GHz ±80 MHz
11			Frequency knob: 9.00 GHz (on display)	Counter: 9.00 GHz ± 90 MHz
12			Frequency knob: 10.00 GHz (on display)	Counter: 10.00 GHz ± 100 MHz
13			Frequency knob: 11.00 GHz (on display)	Counter: 11.00 GHz ± 110 MHz

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
14	Frequency vs Output Level	Power meter. Connect to 907 MAIN RF output (figure 2-3). NOTE: Account for power sensor and 30 dB pad errors in order to reduce measurement errors. Ensure power meter sensor has been "zeroed".	Frequency knob: 7.00 GHz (on display). Output level knob: + 0 dBm (on display)	Power meter: (0 ± 1) dBm. NOTE: Power meter results not corrected for 30 dB pad.
15			Frequency knob: From 7 to 11 GHz in 0.1 GHz steps.	Power meter: Reading should not deviate more than ± 1.0 dB.
16	Output Attenuation		Frequency knob: 9.00 GHz (on display). Output level knob: − 10 dBm (on display).	Power meter: (− 10 ± 2) dBm
17			Output level knob: − 20 dBm (on display)	Power meter: (− 20 ± 2) dBm
18		Remove 30 dB pad.	Output level knob: − 40 dBm (on display)	Power meter: (− 40 ± 2) dBm
19			Output level knob: − 60 dBm (on display)	Power meter: (− 60 ± 2) dBm
NOTE: Steps 16 through 19 have assured proper attenuator operation. Power measurements below − 60 dBm require methods beyond the scope of this checkout procedure.				
20	Unleveled Output		Output level knob: Fully cw. LEVELED button: Released	Power meter: > + 3 dBm LEVELED LED: Off
21	CW Spectral Purity	Spectrum analyzer: Connect to MAIN output (figure 2-4)	Output level knob: + 0.0 dBm (on display). Frequency knob: 7.00 GHz (on display). MODE: CW	Spectrum Analyzer: Presence of fundamental at 7 GHz with < 15 kHz peak residual FM. Harmonics < − 30 dBc. CW LED lit. Spurious < − 55 dBc
22			Frequency knob: 9.00 GHz (on display)	Spectrum analyzer: Presence of fundamental at 9 GHz with < 15 kHz peak residual FM. Harmonics < − 30 dBc. Spurious < − 55 dBc.

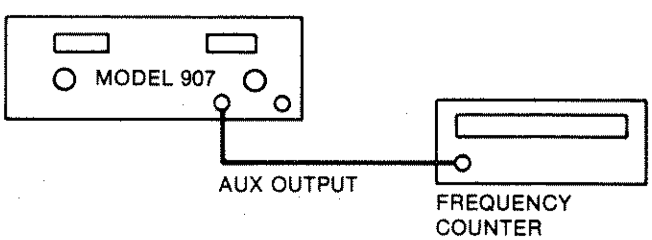


Figure 2-2. Frequency Measurement

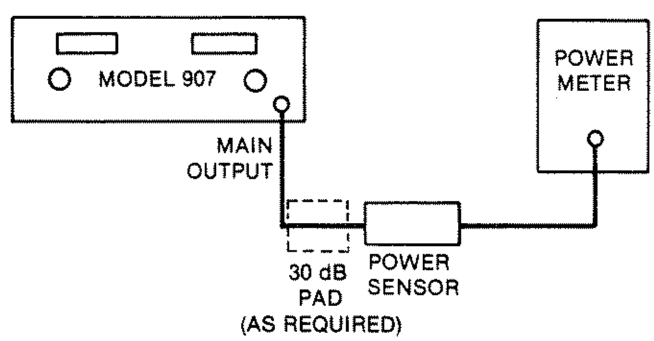


Figure 2-3. Output Level Measurement

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
23			Frequency knob: 10 GHz (on display)	Spectrum analyzer: Presence of fundamental at 10 GHz with <15 kHz peak residual FM. Harmonics < −30 dBc. Spurious < −55 dBc.
24			Frequency knob: 11 GHz	Spectrum analyzer: Presence of fundamental at 11 GHz with <15 kHz peak residual FM. Harmonics < −30 dBc. Spurious < −55 dBc.
25	Internal Frequency Modulation		Frequency knob: 9.00 GHz (on display). Output level knob: 0 dBm (on display). Mode: FM. FM: INT. RATE range: 1K-10K. RATE vernier: MAX. INT FM DEV: MIN.	Spectrum analyzer: <100 kHz peak-to-peak deviation
26			INT FM DEV.: MAX	Spectrum analyzer: >5 MHz peak-to-peak deviation
27	External FM Mode	Same as previous setup plus test generator: 10 kHz, 5 Vp-p sine wave (figure 2-4)	FM: EXT	Spectrum analyzer: >5 MHz peak-to-peak deviation

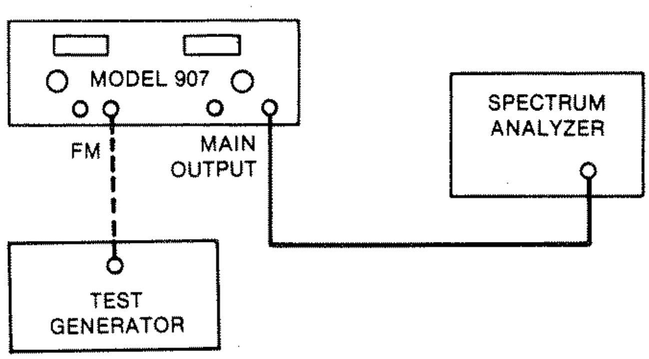


Figure 2-4. Spectrum Analyzer

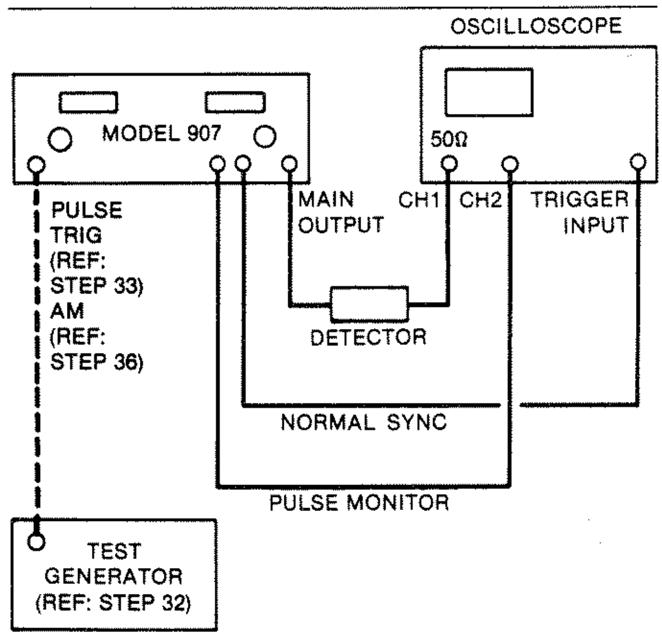


Figure 2-5. Pulse Mode/AM Tests

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
28	Internal Pulse Mode	Xtal detector: From MAIN output to scope. (50Ω term). Scope: Channel 1 to detector output. Channel 2 to PULSE MONITOR. Sync Scope on CH2. (Figure 2-5)	OUTPUT LEVEL: −5 dBm MODE: PULSE PULSE MODE: INT ⌐⌊ RATE range: 1K-10K RATE vernier: Centered (≈5 kHz). DELAY range: X1 DELAY vernier: Full ccw	Pulses on channel 1 should have rise/fall times <35n and a 50% duty cycle (±3%)
29		NORMAL SYNC to Trigger Input (Figure 2-5)	PULSE MODE: INT ⊓⊔ WIDTH range: X1. WIDTH vernier: Vary from full ccw to cw	Channel 1: Pulse width varies from approximately 0.2μs to 10μs
30			WIDTH range: X10. WIDTH vernier: Vary from full ccw to cw	Channel 1: Pulse width varies from approximately 2 to 100 μS
31			RATE range: 100-1K. RATE vernier: ccw (approximately 1 kHz). DELAY range: X1. DELAY vernier: Vary from full ccw to cw	Channel 1: Pulse occurrence varies with respect to scope trigger (approximately 3 to 100μs variance)
32			DELAY range: X10. DELAY vernier: Vary from full ccw to cw	Channel 1: Pulse occurrence varies with respect to scope trigger (approximately 30μs to 1 ms)
33	External Pulse Mode	Same as previous setup plus test generator: 1 kHz, 10Vp-p, triangle connected to PULSE TRIG input. (figure 2-5)	PULSE MODE: EXT (+). WIDTH range: X10. WIDTH vernier: Full cw (100μs). DELAY range: X1. DELAY vernier: Full ccw (3μs). EXT TRIG LEVEL: Center knob	Channels 1 and 2: 100μs pulse at 1 kHz rate
34			PULSE MODE: EXT (−)	
35		Reset test generator: 10 kHz, 10 Vp-p triangle (figure 2-5)	PULSE MODE: EXT GATE. EXT TRIG LEVEL: Vary ccw and cw	Channels 1 and 2: Pulse whose width is relative to the EXT TRIG LEVEL setting. Duty cycle varies 100 to 0%.
36	External AM Input	Reset test generator: 1 kHz, 2 Vp-p square wave. Connect to AM input (figure 2-5)	Output level knob: −27 dBm (on display)	Channel 1: Square wave with rise/fall times <35 μs.
37	External Frequency Control	DC source: Set for 0V. Connect to EXT FREQ CONTROL BNC. Frequency counter: Connect to AUX output (figure 2-6)	INT/EXT FREQ CONTROL: EXTERNAL. MODE: CW	EXT FREQ CONTROL LED: Lit. CW LED: Lit. FREQUENCY display: 6.95 ± 0.04 GHz Counter 6.95 GHz (± 70 MHz)

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
38		Reset dc source: + 5V ± 2 mVdc		FREQUENCY display: 11.05 (±0.04) Counter: 11.05 GHz (± 110 MHz)
39	External Level Control	Reset dc source: 0.V. Connect to EXT LEVEL CONTROL BNC (figure 2-7)	INT/EXT FREQUENCY CONTROL: INT. Frequency knob: 7.00 GHz (on display.) INT/EXT OUTPUT LEVEL CONTROL: EXT	EXT FREQ CONTROL LED: Out. EXT LEVEL CONTROL LED: Lit. OUTPUT LEVEL display: (+1.0 ±0.5) dBm.
40		Reset dc source: + 2.00V		OUTPUT LEVEL display: (−19 ±0.5) dBm

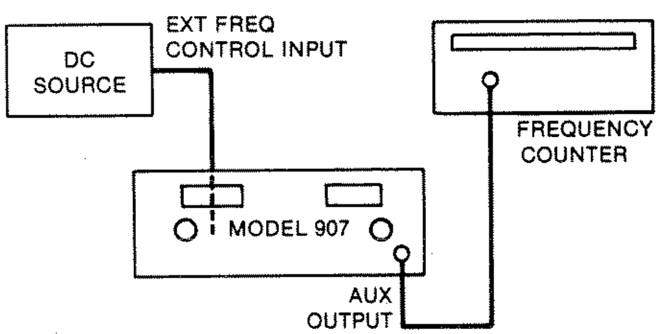


Figure 2-6. External Frequency Control

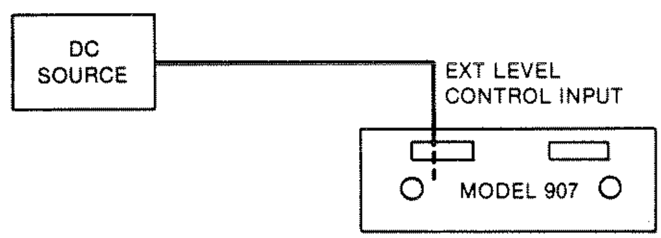


Figure 2-7. External Level Control

Table 2-2. Model 907 Acceptance Test Record S/N ________

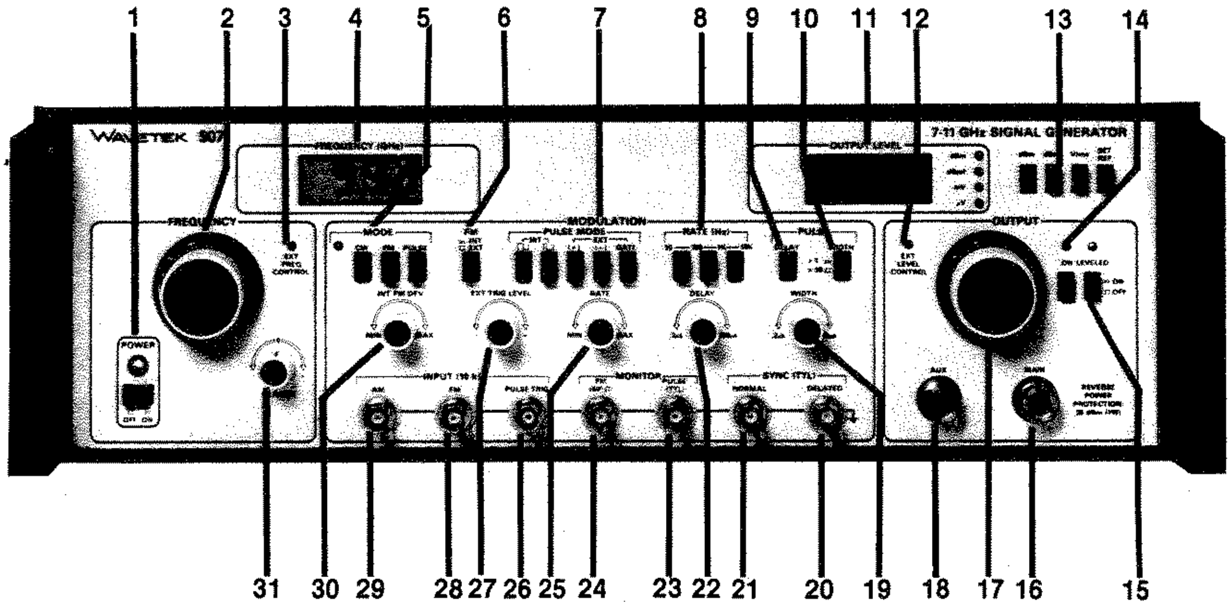
Step (Table2-1)	Performance Check	Reading	Acceptable (✓)
	Frequency Accuracy	**Counter**	
9	7.00 GHz (±70 MHz)	________	( )
10	8.00 GHz (±80 MHz)	________	( )
11	9.00 GHz (±90 MHz)	________	( )
12	10.00 GHz (±100 MHz)	________	( )
13	11.00 GHz (±110 MHz)	________	( )
	Frequency vs Output Level	**Power Meter**	
14	7 GHz, (0 ±1) dBm	________	( )
15	7-to-11 GHz, (0 ±1) dBm	________	( )
	Output Attenuation		
16	(−10 ±2) dBm	________	( )
17	(−20 ±2) dBm	________	( )
18	(−40 ±2) dBm	________	( )
19	(−60 ±2) dBm	________	( )
	Unleveled Output		
20	> +3 dBm	________	( )
	CW RF Spectral Purity	**Analyzer**	
21	7.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	________	( )
22	9.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	________	( )
23	10.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	________	( )
24	11.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	________	( )
	Spurious Output		
21-24	7 to 11.0 GHz, spurious < −55 dBc	________	( )
	Internal Frequency Modulation	**Deviation**	
25	Minimum FM deviation <100 kHz p-p	________	( )
26	Maximum FM deviation >5 MHz p-p	________	( )
	External FM		
27	5 Vp-p gives >5 MHz p-p dev.	________	( )

Table 2-2. Model 907 Acceptance Test Record (Continued) S/N ________

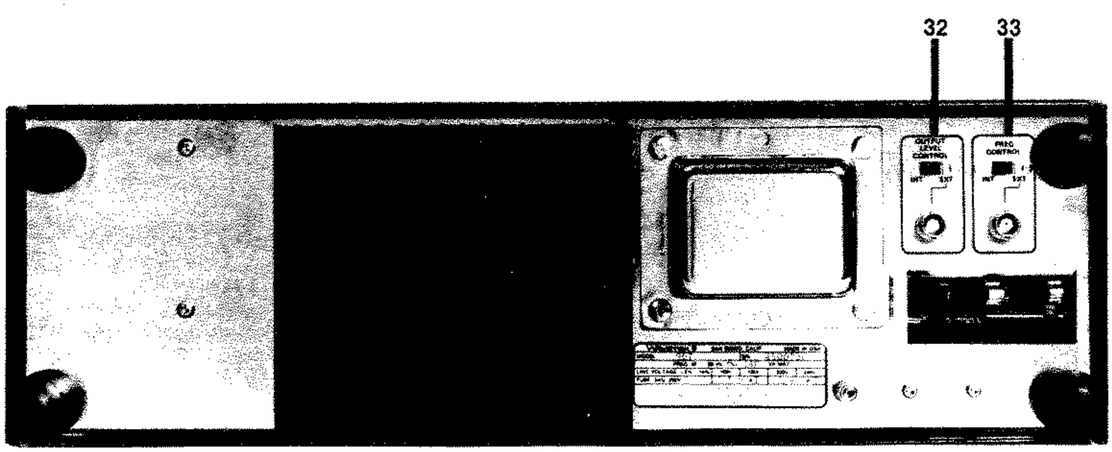
Step (Table 2-1)	Performance Check	Reading	Acceptable (✓)
	Internal Pulse Mode	**Oscilloscope**	
28	Rise and Fall Time (CH1).	________	( )
	Source Wave Duty Cycle	________	( )
29	Pulse Width (X1)	________	( )
30	Pulse Width (X10)	________	( )
31	Delay (X1)	________	( )
32	Delay (X10)	________	( )
	External Pulse Mode		
33	Ext (+)	________	( )
34	Ext (−)	________	( )
35	Ext Gate	________	( )
	Ext AM Input		
36	Rise/Fall Times $<35\ \mu s$	________	( )
	Ext Frequency Control	**Counter**	
37	0V: 6.95 GHz (±70 MHz)	________	( )
38	+5V: 11.05 GHz (±110 MHz)	________	( )
	Ext Level Control	**Output Level Display**	
42	0V: (1 ±0.5) dBm	________	( )
43	+2V: (−19 ±0.5) dBm	________	( )

Comments

Technician ________________________________ **Date** ________



FRONT PANEL



REAR PANEL

Figure 3-1. Controls and Connectors

SECTION 3
OPERATION

3.1 CONTROLS AND CONNECTORS

Controls and Connectors are illustrated in figure 3-1. The following descriptions are keyed to this figure.

1 **POWER Button and Indicator —** Turns line power on and off. Indicator is lit when power is on.

2 **FREQUENCY Control Knob —** A ten turn knob with locking ring to adjust RF frequency output **16, 18** and readout **4** from 7 to 11 GHz.

3 **EXT FREQ CONTROL Indicator —** Lights when frequency is being controlled externally (remotely) rather than by front panel control.

4 **FREQUENCY (GHz) Readout —** A 3½ digit LCD display showing in GHz the frequency setting. Decimal point is fixed with two digits to its right (10 MHz resolution).

5 **MODE Buttons —** Three buttons set the mode to continuous wave output (CW), frequency modulated output (FM) or pulsed output (PULSE). Submodes to FM and pulse are further selected by **6** and **7** respectively. The CW mode LED indicator lights when CW is selected. The 907 can be in FM and PULSE modes at the same time, but no other combinations of these three modes are possible. Buttons are press-to-hold, press-to-release. Should all three buttons be released, the mode will be CW (the indicator will not be lit).

CW — Continuous RF output; frequency and level are adjustable.

FM — Internal or external signal frequency modulates the RF output. Rate **8, 25** and deviation **30** are adjustable for internal FM **6**.

PULSE — A selectable internal or external signal pulse **7** modulates RF output.

6 **FM (INT/EXT) —** Submode selector of FM **5**. When pressed in, modulation source is the front panel controlled internal sawtooth generator. When the button is extended, the modulator source is the externally applied signal at **28**. (Ref: Figure 3-2.)

7 **PULSE MODE —** Submodes of PULSE **7**.

INT ⎍ — Pulsed RF output at 50% duty cycle controlled by the internal pulse generator whose rate is set by **8** and **25**. (Ref: Figure 3-2.)

INT ⎍ — Pulsed RF output controlled by the internal generator whose rate is set by **8** and **25** and whose width is set by **10** and **19**. Delay relative to NORMAL SYNC **21** is adjusted by **9** and **22**. (Ref: Figure 3-2.)

EXT [+] — Pulsed RF output controlled by and external source at **26**. Pulse is triggered on when the external signal crosses from below to above the level determined by **27**. Width and delay are adjustable by **10, 19, 9** and **22**.

EXT [−] — Same as EXT [+] except the pulse is triggered on when the external signal crosses from above to below the level determined by **27**.

EXT GATE — The main RF output **16** is on while the external signal applied to pulse trigger input **26** exceeds threshold adjusted by the external trigger level **27**. Otherwise the main RF output is off (isolation state).

8 **RATE (Hz) Buttons —** Selects the frequency range of the internal modulation generator: 10-100Hz, 100Hz-1kHz or 1-10kHz. Frequency within a range is set by **25**. In terms of RF output: When in internal FM mode, these buttons set the range for FM deviation rate. When in internal pulse modes, these buttons set the range for the repetition rate of pulsed RF.

9 **PULSE DELAY Button —** Selects the delay multiplier of **22**: X1 or X10. Delay control delays the occurrence of the pulsed RF output relative to NORMAL SYNC **21**.

10 **PULSE WIDTH Button —** Selects the pulse width multiplier of **19**: X1 or X10. Width control varies the width of the internally or externally triggered pulse, which in turn varies the width of the pulsed RF output.

11 **OUTPUT LEVEL Readout —** A 3½ digit LCD display or output level setting. Unit of measure is dB, mV or μV as indicated by LED indicators.

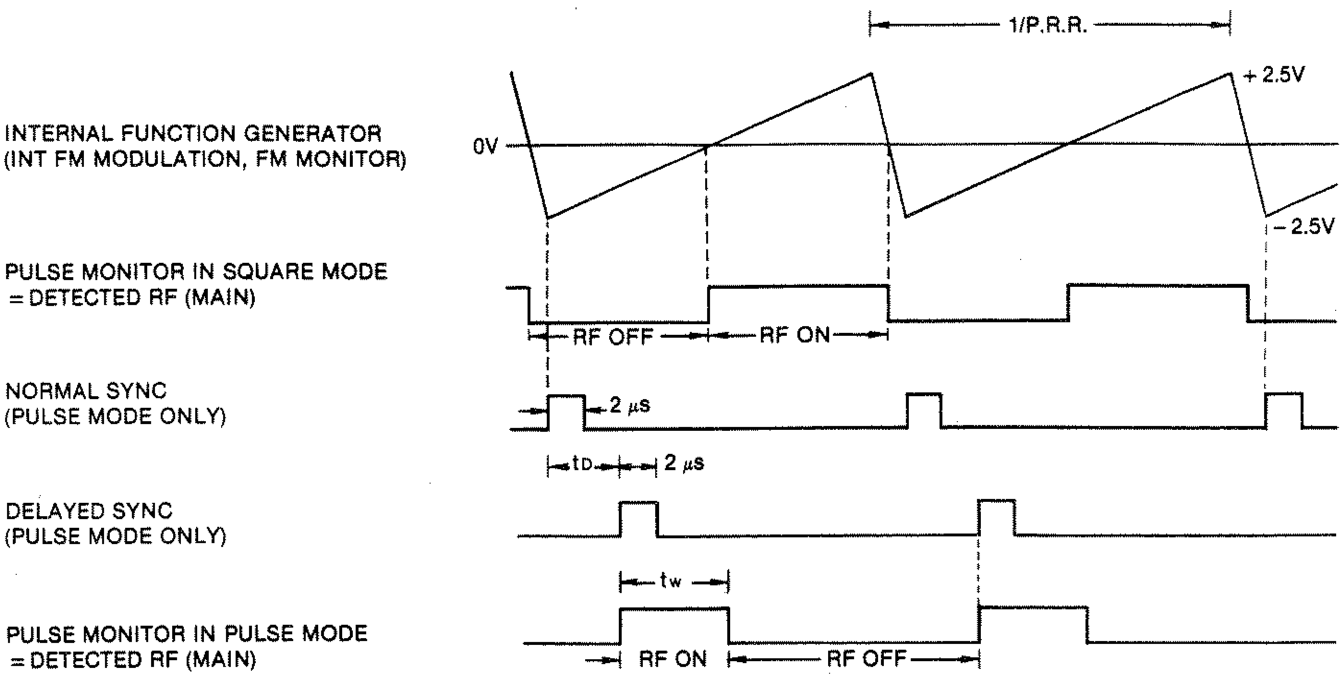


Figure 3-2. Pulse Mode Timing Diagram

Actual output level and readout correspond when output is 50Ω loaded and output is leveled and on.

12 **EXT LEVEL CONTROL Indicator** — Lights when the level is being controlled externally (remotely) **32**.

13 **Output Level Display Mode Buttons — Vrms/dBm Buttons** — Alternate action. When dBm is pressed the RF output level is displayed in decibels referenced to 1 milliwatt. When Vrms is pressed the RF output level is displayed in volt rms.

dBref/SET REF Buttons — The decibel reference (dBref) mode, when selected, allows any level to become the reference level (rather than 0 dBm, a 1 milliwatt reference). When SET REF is pressed, the present output level becomes the reference level; readout changes to +0.0 dBref upon release.

14 **OUTPUT ON button and indicator** — When button is depressed, RF is output at **16** and **18**, and indicator is lit; when button is extended, RF oscillator is off and no RF output is generated.

15 **OUTPUT LEVELED ON/OFF Button and Indicator** — When button is depressed, LED is lit and output is leveled to accuracies specified (ref: paragraph 1.2.2); e.g., ±0.5 dB at 0 dBm setting. When button is extended, output is unleveled; actual output level is greater than 2 dB above indicated level; e.g., at +1 dBm setting, actual output is greater than +3 dBm. Note that the LEVELED LED will not light unless the RF ON LED is lit.

16 **MAIN RF OUTPUT "N" Connector** — The primary output of RF signal; affected by both frequency and level controls.

17 **LEVEL Control Knob** — A ten turn knob with locking ring to continuously adjust RF output level **16** and readout **11** from +1 to −127 dBm. Actual output level and readout correspond (within stated tolerances) when the output is 50Ω loaded.

18 **AUX RF OUTPUT "N" Connector** — The source of RF oscillator signal without attenuation. Signal is same frequency as main RF output **16** but is not pulsed. Output level is greater than −5 dBm.

19 **WIDTH Vernier Knob** — Varies the pulse width for the internally or externally triggered pulse within the range set by **10**. The pulse width controls vary the duty cycle of the pulsed RF output **16**. Overall width range is 0.2 to 100µs.

20 **DELAYED SYNC (TTL) BNC Connector** — Positive TTL level pulse synchronous with the RF pulse from the main RF output **16**. (Ref: Table 3-1.)

21 NORMAL SYNC (TTL) BNC Connector —Positive TTL level pulse synchronous with the pulse repetition rate and used as primary reference when delaying the pulsed RF output. (Ref: Table 3-1.)

Table 3-1. Monitor and Sync Outputs for Individual Modes

Mode	Sync		Monitor	
	Normal	Delayed	FM	Pulse
PULSE - INT ⊓⊔	NO	NO	NO	YES(1)
PULSE - INT ⊓_⊔	YES(1)	YES	NO	YES
PULSE - EXT (+ or −)	YES(2)	YES	NO	YES
PULSE - EXT GATE	NO	NO	NO	YES(2)
FM - INT	NO	NO	YES(1)	NO
FM - EXT	NO	NO	YES	NO

(1) Ref: Figure 3-2
(2) Ref: Figure 3-3

22 DELAY Vernier Knob — Varies the delay of the pulsed RF output **16** within the range set by **9**. Overall delay range is 3μs to 1ms. Has no effect in external gate and square pulse modes.

23 PULSE MONITOR (TTL) BNC Connector —Positive TTL level signal synchronous with the modulator pulse with selected delay, modulator pulse repetition rate and width. (Ref: Table 3-1.)

24 FM MONITOR (600Ω) BNC Connector — Buffered FM modulator signal from internal or external source. Source impedance is 600Ω. (Ref: Table 3-1.)

25 RATE Vernier Knob — Sets frequency of the internal ramp generator within a range set by **8**. In terms of RF output: When in internal FM mode, this control sets the rate of FM deviation. When in internal pulse modes, this control sets the repetition rate of pulsed RF. Overall rate range is 10Hz to 10kHz.

26 PULSE TRIG INPUT (10KΩ) BNC Connector —Receives ± 14V (maximum) signal to trigger or gate pulsed RF output according to pulse mode **7**. The external trigger level control **27** determines what level of input will trigger or gate RF output. Pulse width and delay are set by **19** and **22** respectively.

27 EXT TRIG LEVEL Knob — Determines the threshold voltage of the input waveform **26** which will trigger the delay and width or external gate circuitry(±14V range). See Figure 3-3.

28 FM INPUT (10KΩ) BNC Connector — Receives a signal to frequency modulate the RF output signal **16, 18** up to 5MHz peak to peak deviation. Input frequency determines deviation rate. Sensitivity is greater than 1MHz/V.

29 AM INPUT (10KΩ BNC Connector) — Receives a ± 2V peak range of 0 to 10kHz signal to amplitude modulate the RF output signal at 27.2dB/V (nominal).

30 INT FM DEV Knob — Varies the amplitude of the internal ramp waveform, thereby varying the frequency deviation above and below the center frequency of the RF output signal. Maximum RF output deviation is 5MHz peak to peak.

31 Frequency VERNIER Knob — An adjustment (± 4 MHz typical) to the RF output frequency **16, 18** and displayed value **4.**

32 OUTPUT LEVEL CONTROL INT/EXT Slide Switch and BNC Connector — Switch selects front panel control **17** or external voltage input at this rear panel BNC to control output level of RF signal **16** and readout **11**. Zero to +13.6V covers the +1 to −135 dBm range (−10dBm/V). Switch position indicated by **12**.

33 FREQ CONTROL INT/EXT Slide Switch and BNC Connector — Switch selects the front panel control **2** or external voltage input at this rear panel BNC to control RF frequency output **16, 18** and readout **4**. Zero to +5V covers the 7 to 11 GHz range. Switch position indicated by **3**.

0V = 6.95 GHz (Nominal)
+5V = 11.05 GHz (Nominal)

3.2 OPERATION

The following operation is discussed in terms of modes (CW, FM and Pulse), external trigger, and gated pulse, external AM and FM inputs and external frequency and level controls along with the related controls and connections.

NOTE

In FM and pulse modes, the RF output may be amplitude modulated by providing an external signal source at the AM INPUT connector.

The FM and pulse modes can be selected independently or simultaneously. The CW mode is exclusive and, should other mode buttons be pressed, the CW mode has precedence. AM input has no effect in CW mode.

It is important to observe proper signal termination when using the Model 907. The input and output impedances of the generator are listed below:

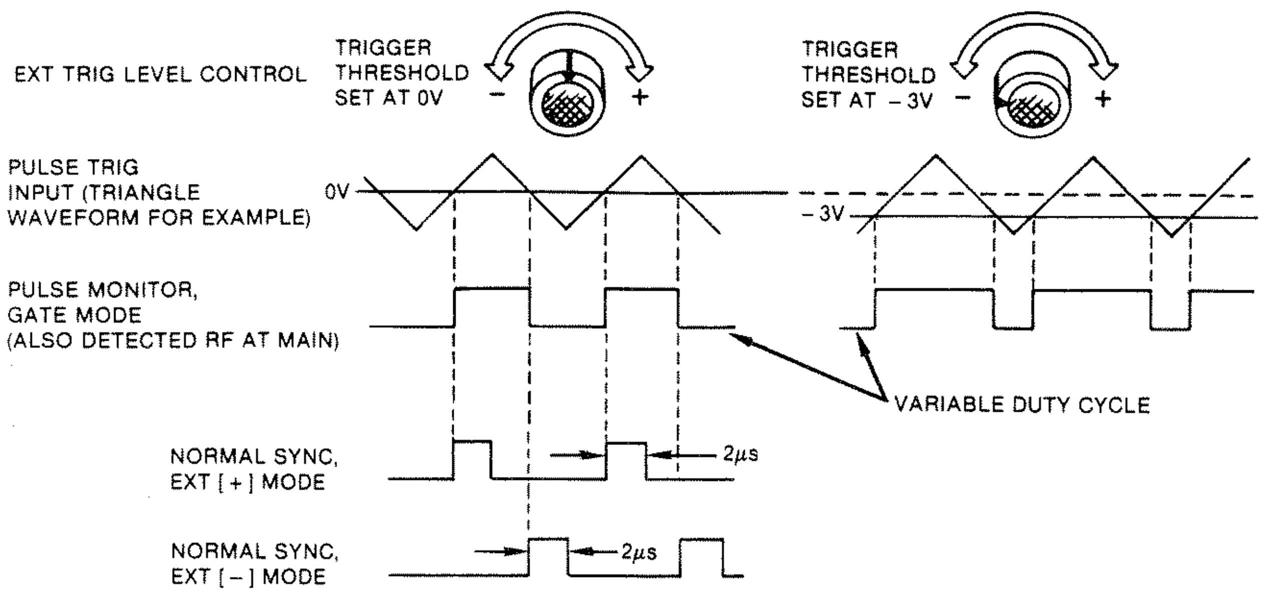


Figure 3-3. Effect of External Trigger Level Control

Connector	Impedance
MAIN	50Ω
AUX	50Ω termination recommended
FM INPUT	10kΩ
AM INPUT	10kΩ
PULSE TRIG	10kΩ
FM MONITOR	600Ω
PULSE MONITOR	TTL
NORMAL SYNC	TTL
DELAY SYNC	TTL
EXT FREQ CONTROL	10kΩ
EXT OUTPUT LEVEL CONTROL	10kΩ

TTL outputs can drive up to 20 TTL loads. The TTL low level is between 0V and 0.4V and high level is between 2.4V and 5V.

The MONITOR and SYNC outputs may be used as needed. Signal characteristics are discussed in paragraph 3.1.

3.2.1 CW Operation

In the CW mode, the RF output is unmodulated (neither AM or FM). The following controls, as discussed in paragraph 3.1 and figure 3-1, affects CW operation.

Control or Connector	Key
MODE set to CW	**5**
FREQUENCY	**2 3 4 31 33**
OUTPUT	**11 12 13 14 15 16 17 18 32**

3.2.2 FM Operation

NOTE

Be aware that FM operation, pulse operation and amplitude modulation can occur simultaneously. Ensure that the MODE buttons are extended for undesired modes and that no signal is applied to the AM INPUT connector if AM is not desired. For simultaneous FM and pulse operation, controls and connectors of both paragraphs 3.2.2 and 3.2.3 are applicable.

In the FM mode, the RF output is frequency modulated by an internal rate generator or an external FM signal source.

The following controls, as discussed in paragraph 3.1, affect FM operation.

Internal FM operation: All controls as in CW mode (except MODE is set to FM) plus these additional controls affect internal FM operation.

Control or Connector	Key
MODE set to FM	**5**
FM set to INT	**6**
RATE	**8 25**
INT FM DEV	**30**
FM MONITOR	**24**

External FM operation: All controls as in CW mode plus these additional controls affect external FM operation.

Control or Connector	Key
MODE set to FM	5
FM set to EXT	6
FM INPUT (up to ± 2.5 volt signal; 1 MHz change per volt input)	28
FM MONITOR	24

3.2.3 Pulse Operation

NOTE

Be aware that FM operation, pulse operation and amplitude modulation can occur simultaneously. Ensure that the MODE buttons are extended for undesired modes and that no signal is applied to the AM INPUT connector if AM is not desired. For simultaneous FM and pulse operation, controls and connector of both paragraphs 3.2.2 and 3.2.3 are applicable.

In the pulse mode, the RF output is modulated between two output levels: the level control setting (pulse "on" time) and >80 dB below the level control setting (pulse "off" time).

The following controls, plus the controls used in the CW mode, affect pulse modulation. (Controls are discussed in paragraph 3.1.)

Square wave pulse modulation:

Control or Connector	Key
MODE set to PULSE	5
PULSE MODE set to INT ⊓⊔	7
RATE	8, 25
PULSE MONITOR	23

Internal pulse modulation:

MODE set to PULSE	5
PULSE MODE set to INT ⊓__⊔	7
RATE	8, 25
DELAY	9, 22
WIDTH	10, 19
SYNC	20, 21
PULSE MONITOR	23

External pulse modulation:

MODE set to PULSE	5
PULSE MODE set to EXT (+) or (−)	7
DELAY	9, 22
WIDTH	10, 19
EXT TRIG LEVEL	27
PULSE TRIG INPUT	26
SYNC	20, 21
PULSE MONITOR	23

External gate operation:

MODE set to PULSE	5
PULSE MODE set to EXT GATE	7
EXT TRIG LEVEL	27
PULSE TRIG INPUT	26
PULSE MONITOR	23

3.2.4 External Output Level and Frequency Control

Frequency and output level can be remote controlled by providing analog inputs to the EXT FREQ CONTROL BNC **33** and EXT OUTPUT LEVEL CONTROL **32** on the rear panel.

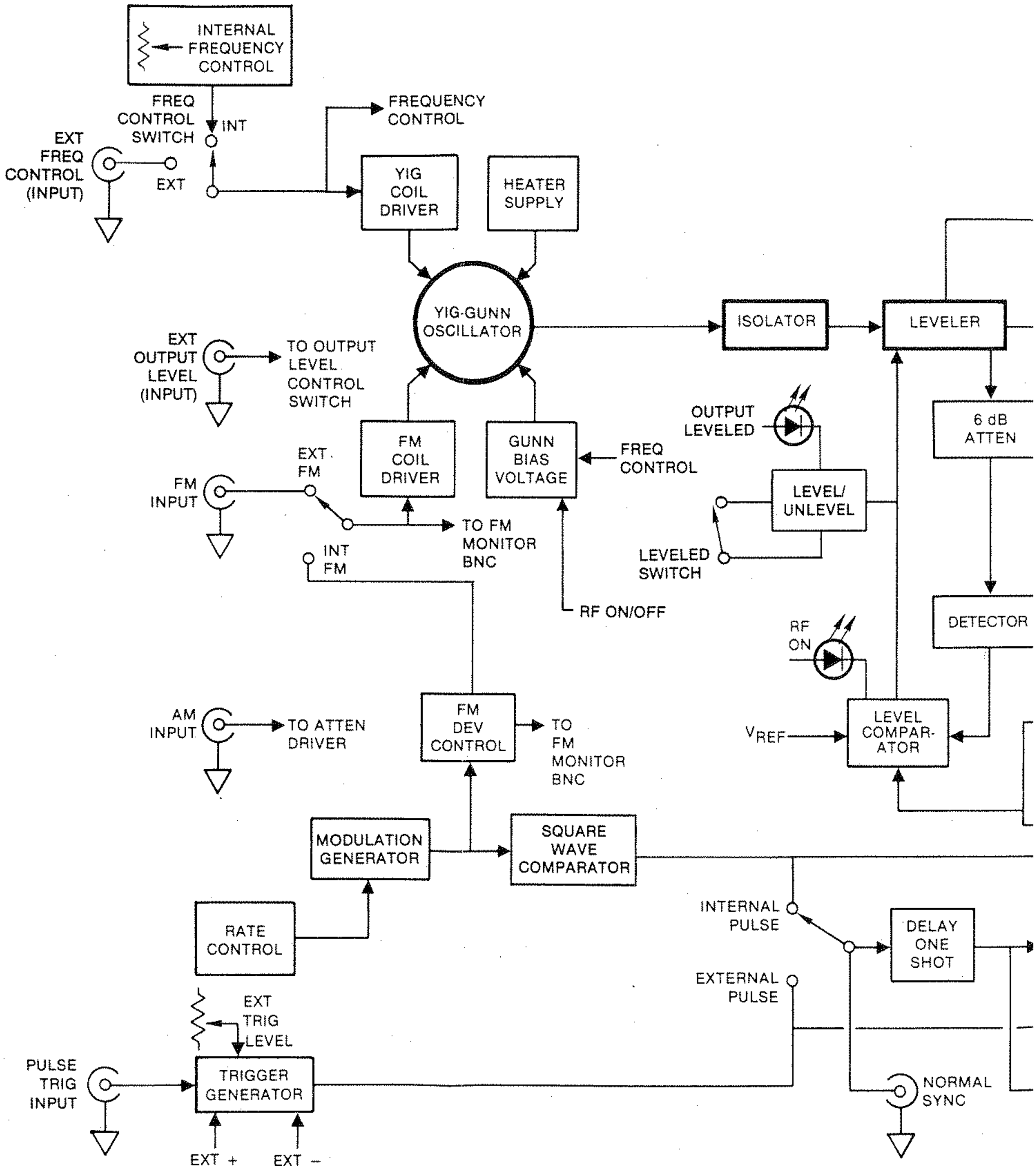


Figure 4-1. Simplified Block Diagram

SECTION 4
CIRCUIT DESCRIPTION

4.1 INTRODUCTION

The major components of the Model 907 are shown in figure 4-1. The following paragraphs describe the overall operation, the circuit elements and their interrelationship. Each block is described as it relates to the major components in the RF drive chain.

4.2 GENERAL OPERATION

The 7 to 11 GHz frequency span of the Model 907 is controlled by a 0 to +5V voltage. This voltage comes from the front panel frequency control or externally via a rear panel BNC. The external control voltage may be 0 to +5Vdc, a low frequency (to 15 Hz) ramp for sweeping or it may be a composite signal. For systems applications, a frequency digital-to-analog converter can supply the control voltage to the 907 to take advantage of the 907's voltage-controlled tuning capability.

The frequency control voltage is converted into a current in the YIG coil driver to vary the magnetic field of the YIG sphere. This control voltage is also used to properly set the gunn bias as a function of frequency and drive the frequency display.

An internal sawtooth signal from the modulation generator or an external signal may be applied to the FM coil driver. The FM coil is capable of deviating the output frequency > ±2.5 MHz. The selected FM modulation signal is available for monitoring at the FM MONITOR BNC.

The YIG filter coil, a part of the YIG-Gunn oscillator, sets up a strong magnetic field through an axis of the YIG sphere; this field aligns the magnetic dipoles within the sphere along that axis. Gunn bias stimulates the gunn diode to produce microwave power, and the YIG filter tunes the output to the selected frequency.

The YIG-tuned gunn diode oscillator output is sent through an isolator (circulator) where forward power passes to the output, and reverse power is shunted to a passive load. The leveler assembly contains a coupler for the auxiliary output — an unleveled output, greater than −5 dBm. Another coupler sends a sample of the output level to a detector which produces a voltage proportional to the instantaneous output level. The level comparator compares this dc level against a reference voltage and produces a drive signal to the PIN diode attenuator in the leveler to maintain the leveler output at a nominal +7 dBm. This 7 dBm compensates for the insertion loss from leveler to main RF output. A leveler correction circuit responds to the frequency selection and produces the correction signal to the auto-leveling loop to cancel any anomalies in its frequency response. Each Model 907 has a unique PROM in the leveler correction circuit to accomplish this. The leveler diode can be reverse biased to produce an unleveled output. The output of the leveler is applied through an isolator to the attenuator where 0 to 128 dB of attenuation is applied. The attenuator can be driven harder, but the output level is not calibrated below −127 dBm. The PIN diode attenuator responds to the output level control signal to produce an accurate signal level. This level may be modulated up to ±54 dB by the external AM input signal.

The internally generated sawtooth, used for FM, is converted into a square wave in the square wave comparator. An external signal may be applied to the trigger generator circuit where it is squared up according to the settings for rising or falling edge triggering and the trigger level control. Either the square wave from the internal modulation generator or from the external trigger signal may be selected to trigger the delay and width one-shots. Either the internal square, the internally triggered pulse or the gated external signal may be selected to activate the switch thereby switching the output over an 80 dB range; the maximum output level is determined by the output level control signal.

The inputs to the attenuator driver are either the front panel level control or the external level signal from a rear panel BNC (switch selected) and a modulating signal from the front panel AM BNC. The selected output level control signal is applied to the attenuation correction circuit where a unique PROM generates correction for optimum accuracy. The output level control signal is distributed to the attenuator driver and display circuits. The attenuator driver produces a signal to the attenuator pin diodes that attenuates the RF signal to the desired output level.

The output level control signal at the display is in dBm, dBref, mVrms or μVrms.

4.3 YIG-GUNN OSCILLATOR

4.3.1 Introduction

The YIG (Yttrium-Iron-Garnet)-gunn oscillator (figure 4-2) is the source of microwave power. External or internal low frequency signals tune the RF frequency by varying the gunn diode bias and the YIG's magnetic field. A heater maintains the YIG at a constant temperature to stabilize the tuning characteristic. Each circuit related to the YIG gunn oscillator is described in the following paragraphs.

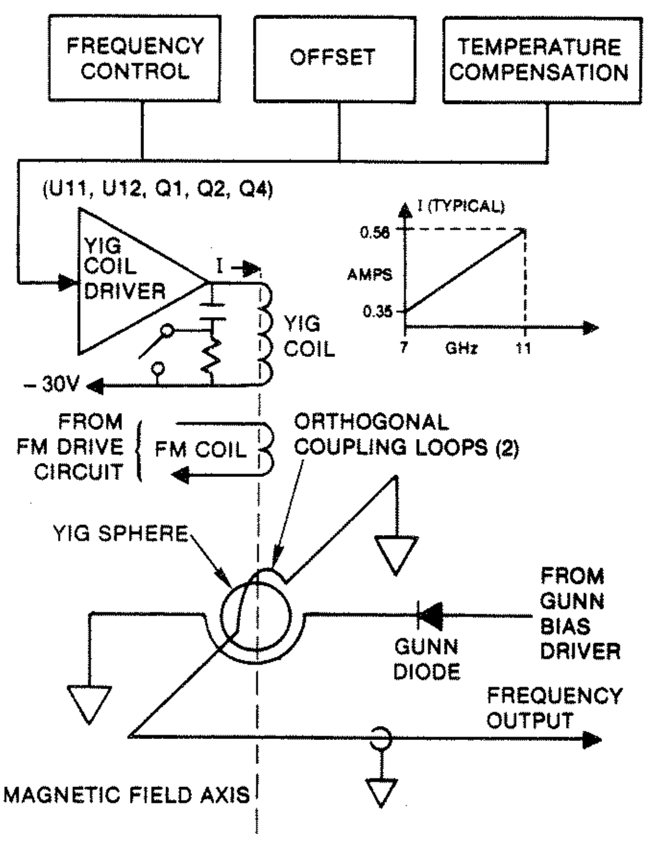


Figure 4-2. YIG-Gunn Oscillator (RF Drive PCA)

4.3.2 Gunn Diode and Gunn Bias

The gunn diode (figure 4-3) is a bulk effective negative resistance device capable of generating microwave signals. As the bias voltage is decreased, the frequency of maximum output power will increase; for example, approximately 14V bias generates 7 GHz and approximately 6 V bias generates 11 GHz. Diode bias is controlled by the frequency control signal (ref: paragraph 4.3.3.1).

U19, Q13 and Q14 (ref: schematic 0103-00-0733, sheet 3, coordinates B5) comprise the gunn bias drive circuit. Frequency control, RF on/off bias and temperature compensation are summed at the input to U19.

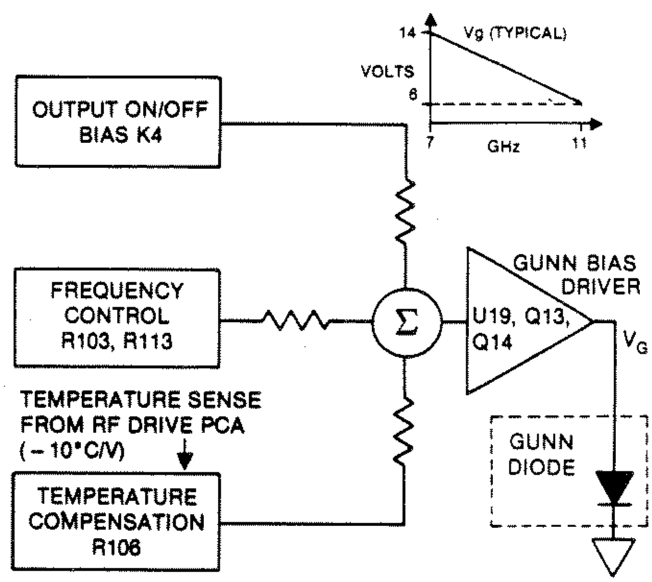


Figure 4-3. Gunn Bias (Main PCA)

4.3.3 YIG Sphere and Coil

The YIG filter coil (figure 4-2) produces a strong magnetic field through the axis of the YIG sphere. The field aligns the magnetic dipoles within the sphere along the axis with the YIG coil. The gunn bias stimulates the gunn diode to produce a microwave signal; the YIG sphere's influence tunes the oscillator to the selected output frequency. The YIG sphere operates as a tuning element.

The YIG coil current is controlled by the frequency control signal. An increase in control signal increases coil current thus increasing the output frequency.

U11, U12, Q1, Q2 and Q4 comprise the YIG coil drive circuit. The frequency control signal, offset and temperature correction circuit are summed at the input to the coil driver curcuit.

A relay is used to change the time constant of the R-C filter across the YIG coil. For internal frequency control (SW mode) the short time constant reduces residual FM. The long time constant is used for external frequency control modes to allow rapid frequency change.

4.3.3.1 Internal Frequency Control

Two front panel controls (main frequency tuning R69 and frequency vernier R70) set the oscillator frequency (figure 4-4). The two controls are summed at the input of U16. Inputs to U16 are filtered to reduce noise. U16 output, the frequency control signal, provides input to the YIG coil drivers, gunn bias driver (buffered by U18), leveler correction circuit and frequency display (buffered by U18).

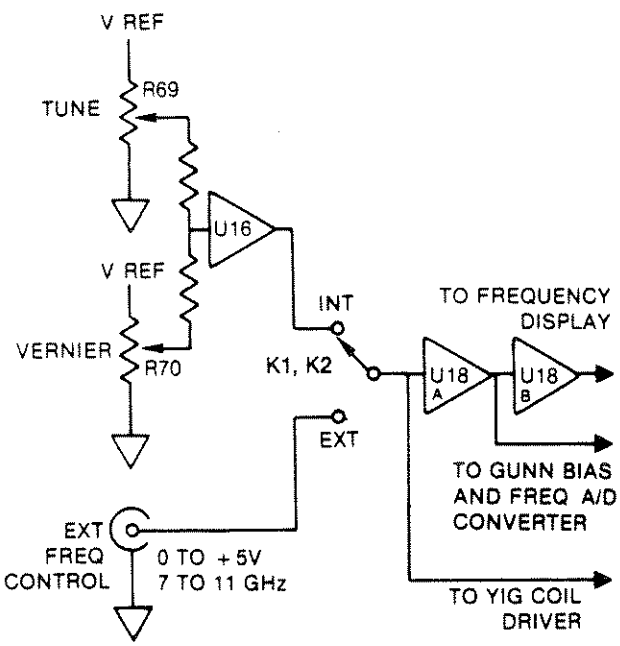


Figure 4-4. Frequency Control Signals (Main PCA)

4.3.3.2 External Frequency Control

A rear panel switch selects internal or external frequency control. In external frequency control, an external voltage level (0 to +5V) tunes the instrument between 7 to 11 GHz (figure 4-4). The external frequency control provides the same frequency control signal supplied by the frequency tuning and frequency vernier controls that are provided in the internal control mode (ref: paragraph 4.3.3.1). In external frequency control, the residual FM may be greater than in internal frequency control.

4.3.4 FM Coil Driver

The YIG-Gunn Oscillator is frequency modulated by an internally generated sawtooth or external modulating source. The FM coil, smaller than the YIG coil, influences the magnetic field of the YIG sphere and deviates the microwave frequency up to 5 MHz.

The FM coil driver (figure 4-5) consist of U44, Q11 and Q12 (ref: schematic 0103-00-0733, sheet 3, coordinates C6). A front panel switch (FM INT/EXT) selects the input to the FM coil driver. In external FM, the FM input BNC drives U44 and in internal FM the internal generator drives U44.

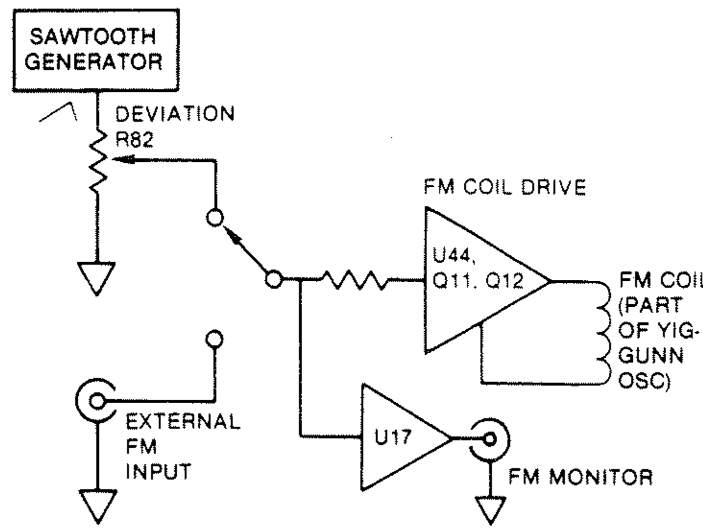


Figure 4-5. FM Drive Circuit (Main PCA)

4.3.4.1 FM Deviation Control

Internal FM deviation (INT FM DEV) pot R82, shown in figure 4-5, controls the peak to peak frequency deviation by varying the level of the internally generated sawtooth, connected to the FM coil driver.

When switched to external FM, the oscillator frequency is modulated by an external source. The rate and peak to peak frequency deviation are determined by the external source frequency and amplitude, respectively. The FM coil driver is directly driven by the external FM input.

The internally generated ramp or external signal is available as an FM monitor at the FM Monitor BNC.

4.3.4.2 Modulation Generator

The generator (figure 4-6) consists of a function generation that creates the sawtooth signal for internal FM and the time base for pulse mode.

The rate is controlled by a potentiometer R4 and a set of range capacitors (C42, 43, 44 and 45). The potentiometer controls the magnitude of the current source (U1 and Q5) and current sink (U1 and Q6) to determine the charging and discharging rate of the

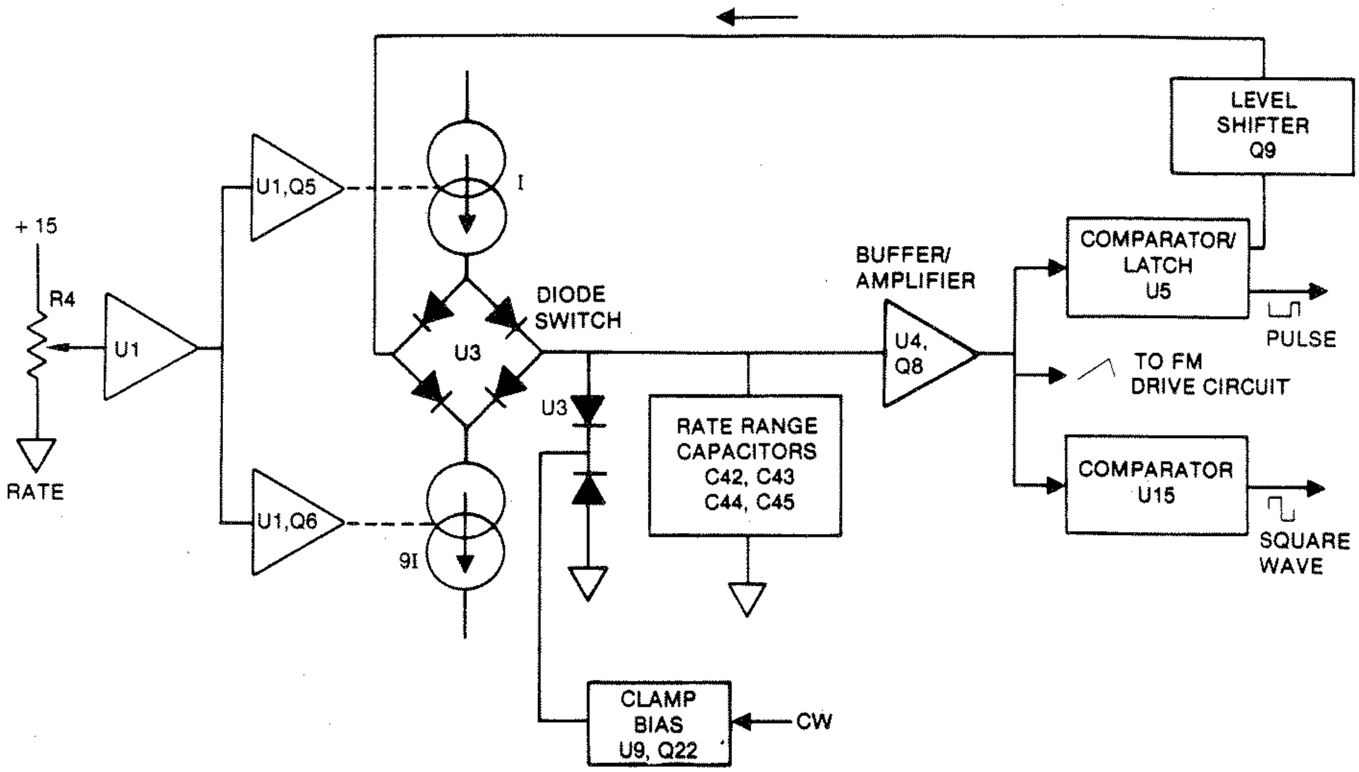


Figure 4-6. Modulation Generator (Main PCA)

selected capacitor. Comparator U5 controls a current switch U3 to select either the current source or current sink.

When the comparator output is a TTL High (+4V) current (I) charges the selected range capacitor. The resultant ramp increases until reaching +1.25V when the ramp, buffered by U4 and Q8, causes the level comparator to switch.

The low comparator output switches to the current sink, which discharges the range capacitor. The capacitor discharges at a 9I rate until the ramp reaches −1.25V; this causes the comparator output to switch to TTL high and start the cycle again.

In the CW mode, the generator is disabled. A diode clamp, part of U3, disables the generator by holding the ramp base line to 0V. The diode clamp is enabled by Q22 and U9.

4.3.5 Heater

The efficiency of the YIG sphere is increased and external influences are minimized when the sphere works at a constant elevated temperature. A heater, located in the oscillator, maintains the YIG sphere at constant temperature of 100°C. The heater is a positive temperature coeffecient device; as the temperature increases, the resistance of the heater element also increases, decreasing the heater current (supplied by the ±14V heater supply) thus decreasing the temperature.

4.4 ISOLATOR

The isolator (circulator) is a buffer between two circuit blocks in the RF drive train. In the isolator, forward power passes through to the next circuit and reflected power terminates in a passive 50Ω load to ground.

4.5 LEVELER LOOP

4.5.1 Leveler

The leveler (figure 4-7) automatically corrects level deviations related to frequency. The leveler is a pin-diode attenuator, the greater the forward bias of the diode, the greater attenuation (reduced level). The leveler is used to correct frequency response characteristics of the RF string in order to provide a constant RF level at the front panel output. Stored-in-memory level correction bias (for any given oscillator frequency) is added to the leveler loop circuits.

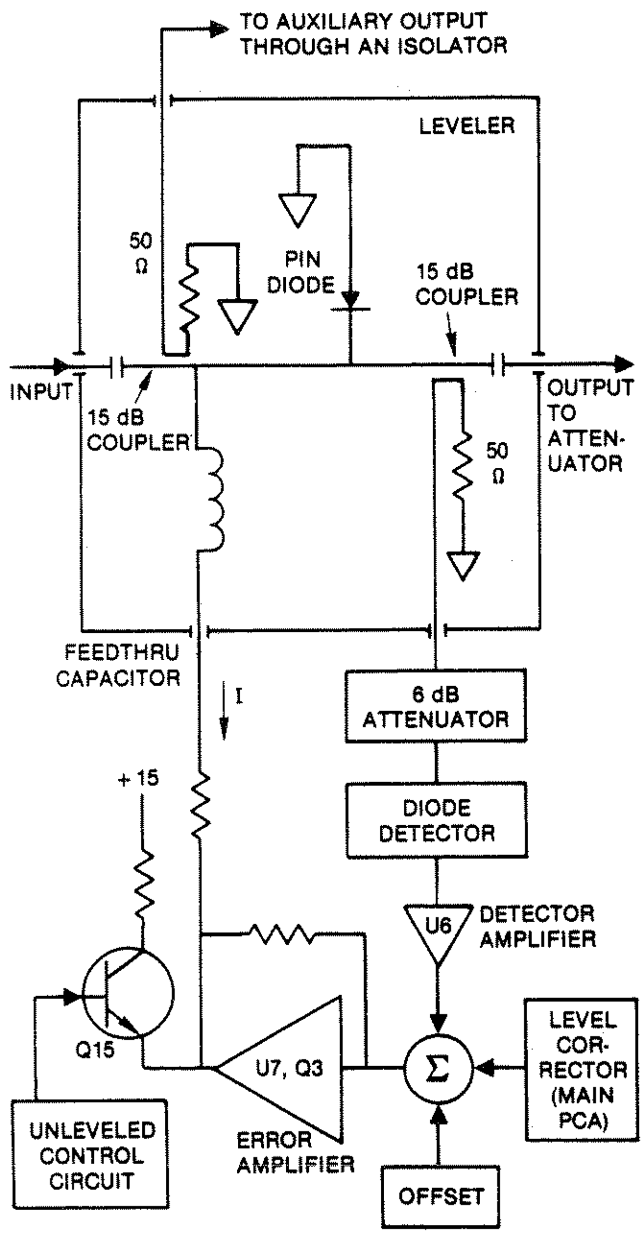


Figure 4-7. Leveler and Level Corrector (RF Drive PCA)

Two couplers provide sample outputs from the leveler, one for the front panel auxiliary output and the other (detector output) for the correction circuits. The AUX output is buffered by an isolator (ref: paragraph 4.4).

4.5.2 Leveler Loop

The leveler loop circuit consists of the components shown in figure 4-7. The error amplifier sums the detector amplifier output, a signal from the leveler correction circuit and an adjustable offset current. When unleveled output is selected, Q15 is turned on, reverse biasing the leveler diode, which ensures no attenuation.

4.5.3 Detector

A tunnel diode detector (figure 4-7) converts microwave power to a dc level. This dc level is an input to the leveler loop circuit.

A 6 dB pad (figure 4-7) is inserted between the coupler and the detector, to provide attenuation and impedance matching between the two circuits.

4.5.4 Level Corrector

The RF string insertion loss is not constant over the 7 to 11 GHz frequency range. However, it is constant for any given frequency. Because of the repeatable frequency-to-level characteristic of the RF string and detector, a ROM can be programmed to correct the level at specific frequencies.

Basically, the correction circuit is an analog-to-digital-to-analog converter. The frequency control signal is input to a successive approximation analog-to-digital (A to D) converter; this converter produces a ROM address. The ROM address locates a digital stored correction value which is sent to a digital-to-analog (D to A) converter. The resultant analog value is the level correction signal. The following paragraphs describe this leveler correction circuit in greater detail.

The level corrector input is the frequency control signal, an analog signal proportional to the oscillator frequency. This frequency proportional signal is applied to a successive approximation A to D converter (figure 4-8) consisting of U31 (a comparator), U25 (a successive approximation register) and U24 (an 8 bit DAC). The converter produces digital addresses at the output of U25. The addresses are directly related to the frequency control signal, from 1111 1111 for 7 GHz to 0000 0000 for 11 GHz.

The digital address from U25 provides digital data to the latch U32 (figure 4-9). A latch clock transfers data into U33. U32 input and output are compared by two exclusive-OR gates (U35 and U36) connected as a digital comparter. When the input and output data are unequal for 16 successive clock pulses (internal frequency control mode) or 4 clock pulses (external frequency control mode) the latch is updated.

The ROM U33 possesses data unique to a specific RF string. The data adjusts the output level relative to oscillator frequency. The digital addresses, generated by the A to D converter, select programmed data stored in the ROM. ROM output data provides control data for the D to A converter, U34. D to A converter output current drives the amplifier U49, a driver for leveler corrector output. This output is summed into the leveler loop (figure 4-7).

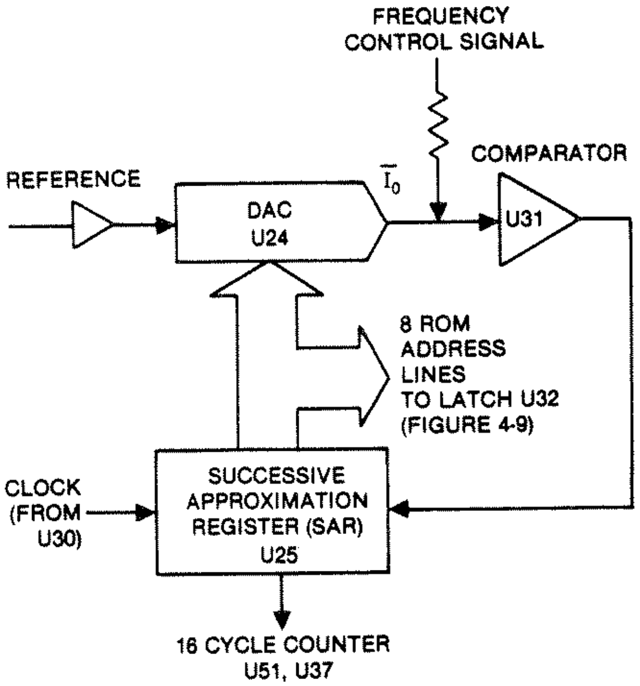


Figure 4-8. Frequency Control Signal To ROM Address Converter (Main PCA)

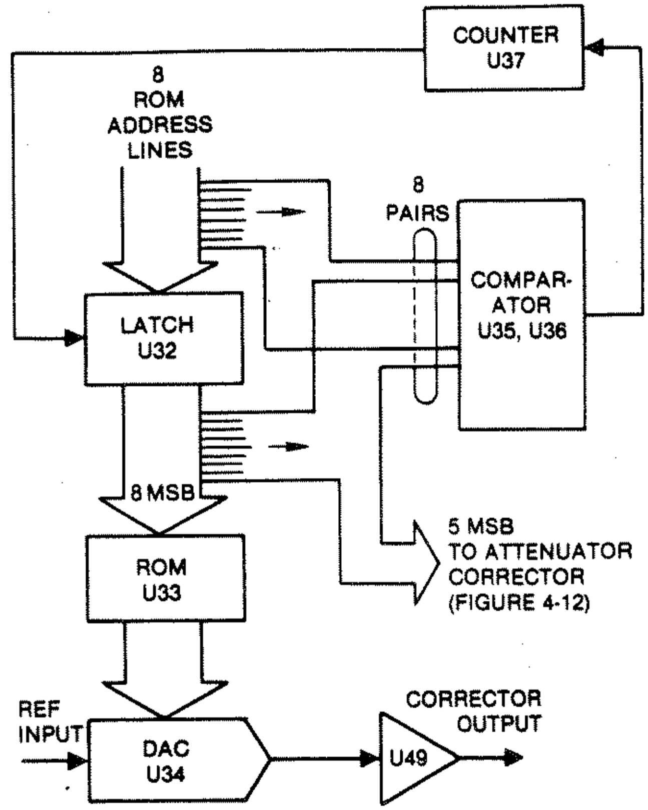


Figure 4-9. ROM Address To Level Corrector Converter (Main PCA)

4.6 ATTENUATOR CIRCUITS

Two pin diode attenuators and their drivers comprise the attenuator and its control circuits. The purpose of the attenuator is to set the output level. The attenuator is controlled by an internal or external level input and an automatic correction input for corrections relative to frequency and output level.

4.6.1 Attenuator

The attenuator is a two section pin diode reflective type attenuator as shown in figure 4-10; each section is adjustable from 0 to 64 dB for a total attenuation of 0 to 128 dB. The pin diodes shunt a 50Ω strip transmission line; as the diode current increases shunt resistance decreases, reducing the power level at the attenuator output.

4.6.2 Attenuator Driver

Each attenuator section is driven by its own current source. The current source is only one portion of a voltage to current converter, as shown in figure 4-10.

The voltage to current converter receives its input from the attenuator drive signal, the output of U28 (figure 4-12), nominally 15 dB/V. This signal drives the input of amplifier U1A . U1A contains temperature compensation in the feedback loop to provide gain correction relative to temperature nominally 0.002 dB/dB/°C.

The output of U1A provides input for an inverting voltage follower U1B and Q13. The voltage follower supplies enough current to drive a piece-wise linear segment approximation "logarithmic" converter. The log converter transfer characteristic is shown in figure 4-11. Amplifier U2 converts the "log" current into a proportional voltage level that drives the separate attenuator drivers.

U4 and Q8 comprise the current source for attenuator "A" while U4 and Q11 comprise the current source for attenuator "B". As the level at the input of U4 increases, the current drawn through the attenuator diodes increases. Each current source has gain and offset adjustments.

4.6.3 Attenuator Control

The attenuator control circuits, figure 4-12, generate the attenuator drive signal for the attenuator drive cir-

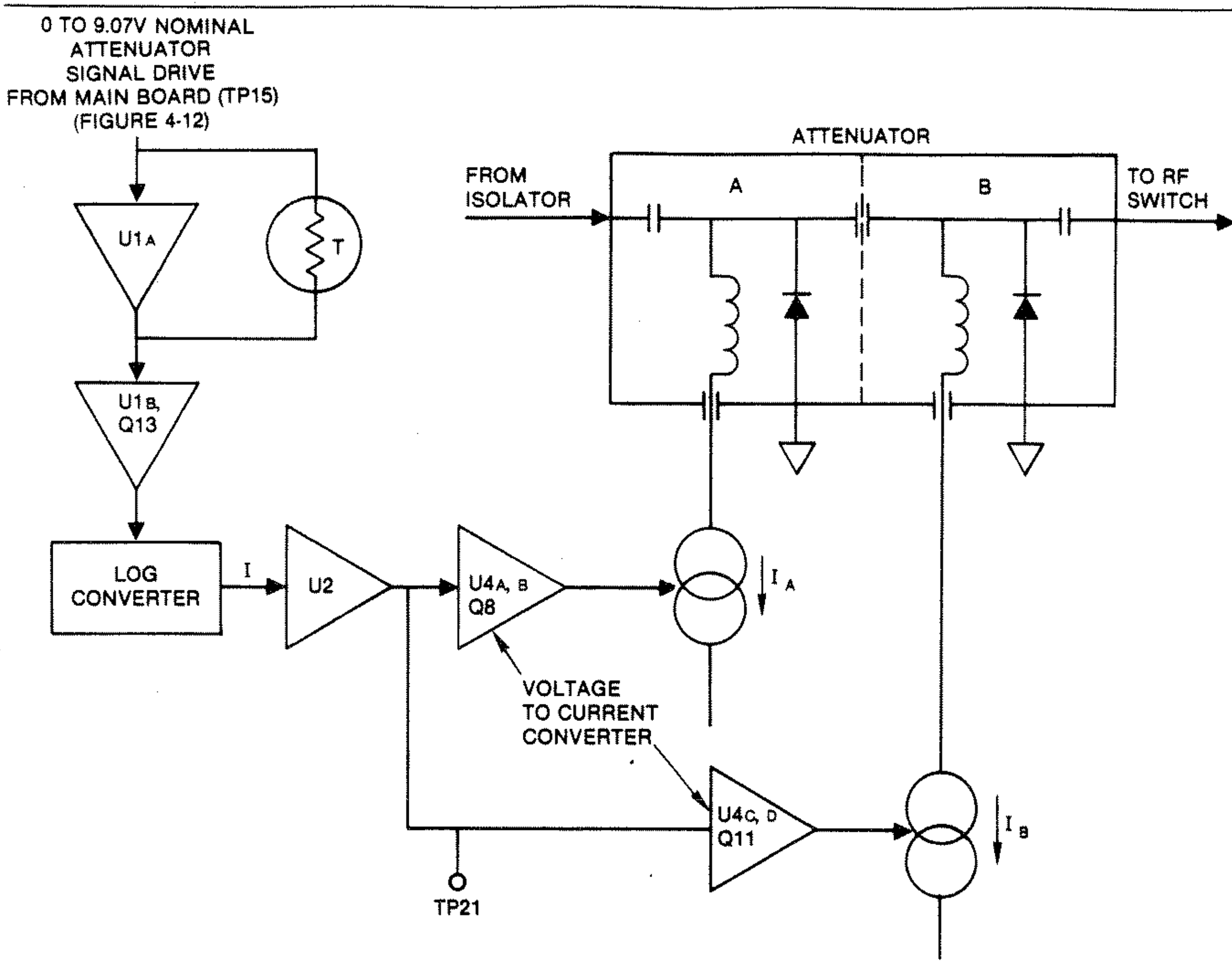


Figure 4-10. Attenuator and Attenuator Driver (RF Drive PCA)

cuits. Front panel output level control, external level control and AM input are inputs to the attenuator control circuit.

The output level is set by a front panel pot or a rear panel external level control BNC input. A slide switch selects internal (front panel) or external (BNC input) control. The output level control is buffered by U26. If External Level Control is selected, the signal is buffered by U64, which drives U26. The buffered output level signal from U26 drives the display circuits, inverting amplifier U27 and analog input for the attenuator correction circuit. The control circuit output amplifier U28 receives its inputs from U27, the correction circuit and the AM input.

4.6.4 Attenuator Corrector

The attenuator correction circuit corrects repeatable deviations in level relative to frequency and output level. Because of the repeatable frequency and level

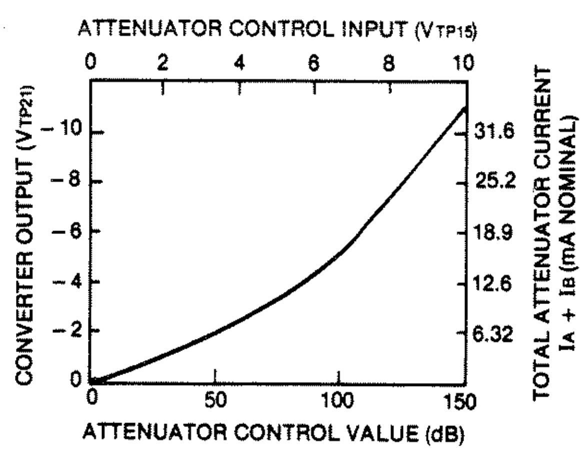


Figure 4-11. Log Converter Transfer Characteristic

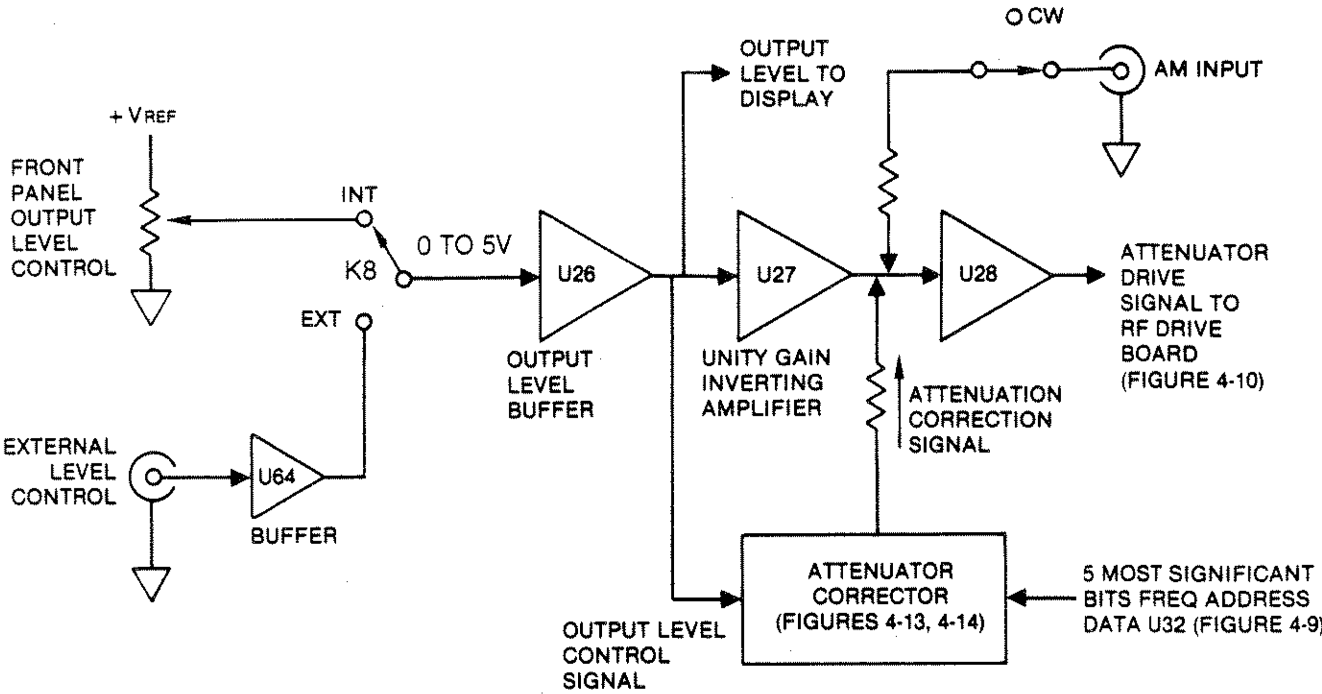


Figure 4-12. Attenuator Control (Main PCA)

characteristics, an EPROM can be programmed to correct the level at a specific frequency and output level.

Basically, the correction circuit is an analog to digital to analog converter. The output level control signal is input to a successive approximation analog to digital (A to D) converter (figure 4-13), this converter produces a ROM address. The ROM address locates a stored digital correction value that is sent to a digital to analog (D to A) converter (figure 4-14). The resultant analog value is the attenuator correction signal. The following paragraphs describe this attenuator correction circuit in greater detail.

Input to the attenuator corrector is the Output Level Control signal, an analog signal proportional to the output level. The output level signal is either front panel supplied or an external signal at the rear panel BNC. This signal is applied to a successive approximation A to D converter (figure 4-13) consisting of a comparator U50, a successive approximation register U39 and an 8 bit DAC U38. The converter produces digital addresses at the output of U39. The addresses are directly related to the output level control signal. A digital filter circuit (U42, U43, U47, U53 and U40) is used to reduce variations due to noise in the output of the successive approximation converter.

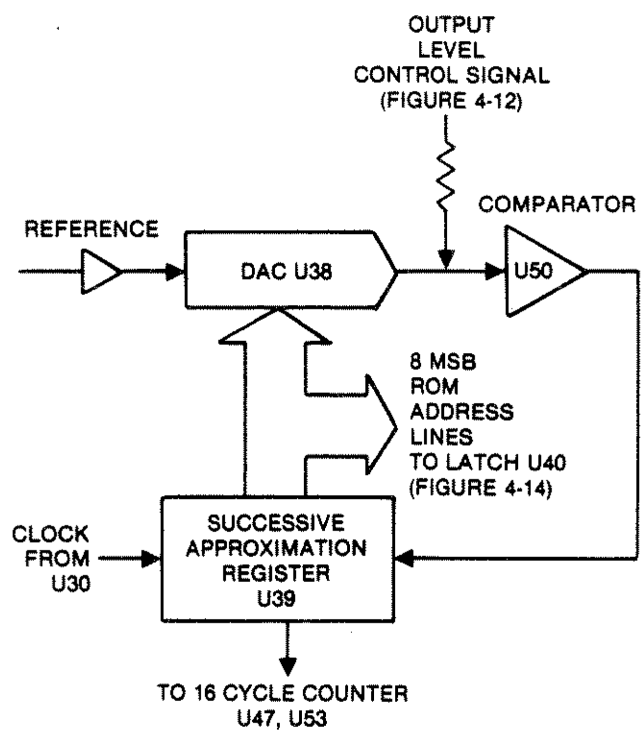


Figure 4-13. Attenuation A to D Converter (Main PCA)

The digital address from U39 provides digital data to the latch U40 (figure 4-14). A latch clock transfers the data into U40. U40 input and output are compared by exclusive - or gates (U42 and U43) connected as a digital comparator. When the input and output data are unequal for 16 successive converter cycles, the latch is updated.

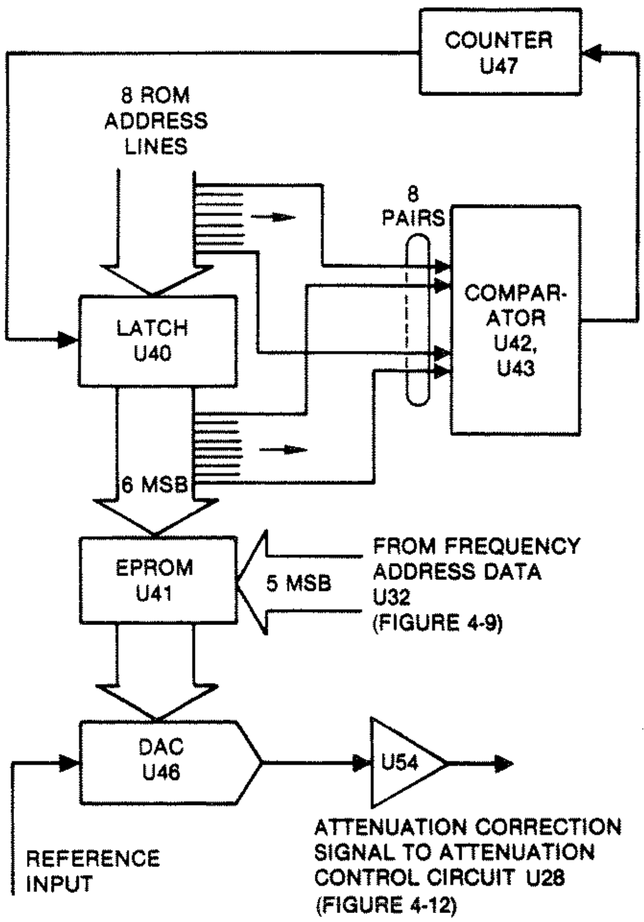


Figure 4-14. Digital Filter and Attenuation Correction Circuit (Main PCA)

The EPROM U41 possesses data unique to a specific attenuator: the data to make fine adjustments of the output level attenuation relative to output level and frequency. The six most significant bits from U40 and the five most significant bits from U32 (frequency A to D converter, figure 4-9) supply addresses for the EPROM. The EPROM output data provides control data for the D to A converter U46. U46 converts the digital data from the EPROM into a proportional current that is summed into amplifier U54. The output of U54 feeds the attenuator control circuits at U28.

4.7 RF SWITCH

In pulse modes, the switch controls pulse modulation with high speed pin diodes. The pin diodes shunt the 50Ω strip transmission line to form a reflective type attenuator, figure 4-15. Because the switch diodes shunt the transmission line, biasing the diodes on turns the switch off. When the diodes are forward biased sufficiently, they conduct to shunt the line, thereby reducing the power greater than 80 dB. If the diodes are reverse biased, they present a high impedance across the line, resulting in a minimum insertion loss.

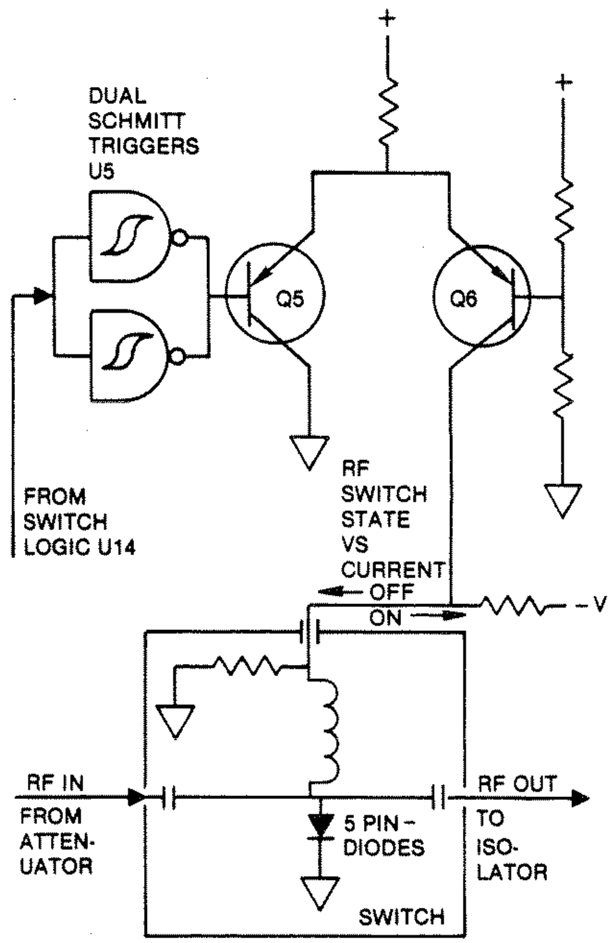


Figure 4-15. Switch and Switch Driver (RF Drive PCA)

4.7.1 Switch Driver

Dual schmitt trigger U5 and differential switch Q5 and Q6 comprise the switch driver, figure 4-15 (ref: schematic 0103-00-0732, coordinates D3). When forward biased, the collector of Q6 supplies bias current to the switch diodes. The switch logic U14 routes the selected pulse modulation (internal square wave, internal or external pulse, or external gate) to the switch driver input. These four modulation modes are discussed in the following paragraphs.

4.7.2 Internal Square Wave (⊓⊔)

The square wave comparator U15 converts the modulation generator sawtooth (ref: 4.3.4.2) into a square wave, figure 4-16. Pot R61 (symmetry adjustment) sets the comparator threshold to approximately 0 Vdc. The comparator output provides input to switch logic U14. If internal square wave modulation is selected at the front panel, switch logic sends the square wave to the RF switch (and the monitor output PULSE MONITOR).

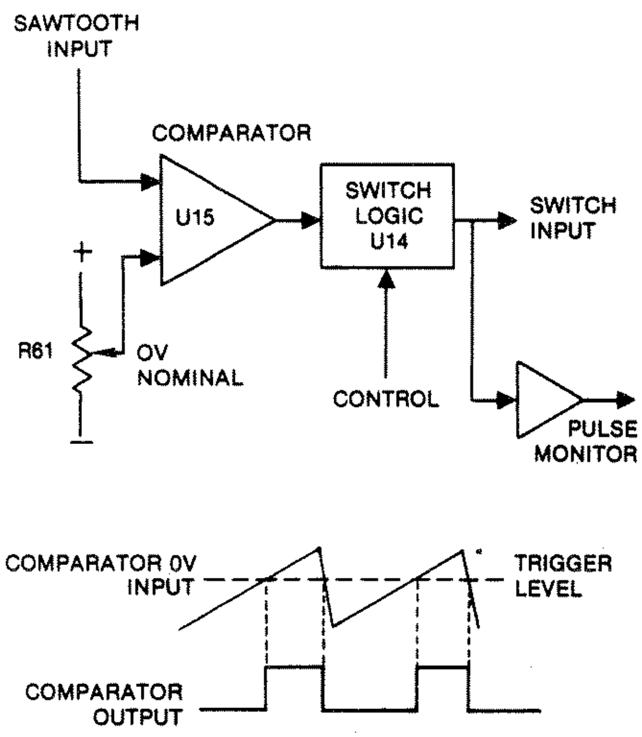


Figure 4-16. Internal Square Wave (Main PCA)

4.7.3 Internal Pulse (⊓⊔)

The pulse originates at the comparator/latch U5 of the modulation generator (ref: figure 4-6). The sync trigger selector logic at U8 routes the pulse from U5 to the delay and width one-shots as shown in figure 4-17.

4.7.3.1 Delay One-Shot

In internal or external pulse mode the delay one-shot determines the pulse delay period relative to normal sync.

The delay one-shot is comprised of a monostable multivibrator U10A and an RC time constant controlled by the front panel DELAY vernier R50 and range capacitors C62, C63 and C66 (figure 4-16). Input to the delay one-shot is a pulse from the sync trigger selector U8. The delay triggers on the negative going edge of the inverted output of U8. When triggered, the delay one-shot produces a positive pulse for the period determined by the delay RC time constant and then remains inactive until it receives another trigger. The delay one-shot triggers inputs at the width, normal sync and delayed sync one-shots. Notice the triggering notation in figure 4-17; width and delay sync one-shots are delayed by the duration of the delay pulse but the normal sync is not.

4.7.3.2 Width One-Shot

The width one-shot sets the width of the modulation pulse. The width one-shot is comprised of a monostable multivibrator U10B and an RC time constant (figure 4-17), whose input is directly from the delay one-shot. The time constant is controlled by the front panel WIDTH pot R53 and range capacitors C68 and C69. The one-shot triggers on the negative going edge of the delay pulse. When triggered, the one-shot produces a positive pulse for the period determined by the width RC time constant and then remains inactive until it receives another trigger. The one-shot output is connected to the switch logic U14, where the pulse may be routed to the switch driver.

4.7.3.3 Sync One-Shots

The delay one-shot also drives two sync one-shots (figure 4-17). Both sync one-shots are identical except for their triggering edge. The normal sync one-shot (U12A) triggers on the rising edge while the delayed sync one-shot (U12B) triggers on the falling edge. Each one-shot is a monostable multivibrator with a fixed time constant, approximately 2 μs. Each has a buffered output to the front panel connectors.

4.7.4 External Pulse (+) and (−)

The switch driver can also be driven by an external pulse trigger input as shown in figure 4-18.

In any external mode (+ or − pulse or gate) an external trigger input is required. The trigger generator U6 is a comparator that converts the input signal into a logic level. The level at which the comparator will trigger is set by front panel EXT TRIGGER LEVEL R38. As the trigger input crosses from below to above the trigger level, the output is switched on and as the trigger input crosses from above to below the trigger level the output is switched off.

In external pulse mode, the output of U6 is routed to the slope selector U8. This slope selector is a logic gate that is set at the front panel to gate on the selected positive going or negative going edge of the U6 pulse. The slope selector output feeds the sync trigger selector (figure 4-17) of the delay and width one-shot circuits in exactly the same manner as the internal pulse (ref: paragraph 4.7.3).

4.7.5 External Gate

The logic output of U6 is routed by switch logic U14 directly to the switch driver as shown in figure 4-18.

4.8 DISPLAY

Two liquid crystal displays give a visual indication of frequency and output level. LED annunciators show instrument operating conditions. The frequency display circuit is located on the main display board, while the output level circuit is divided between the main display board and display computer board.

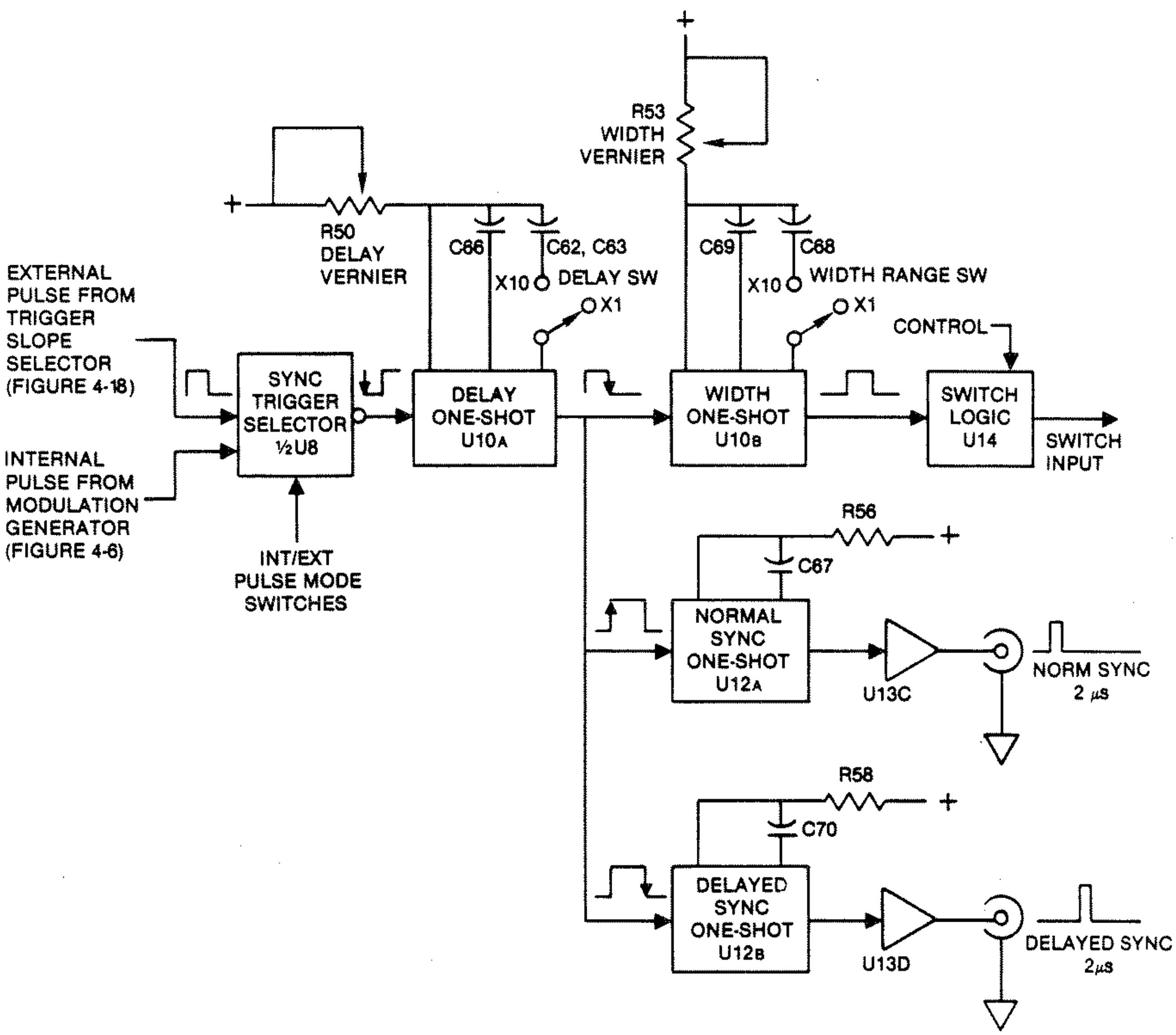


Figure 4-17. Internal and External Pulse

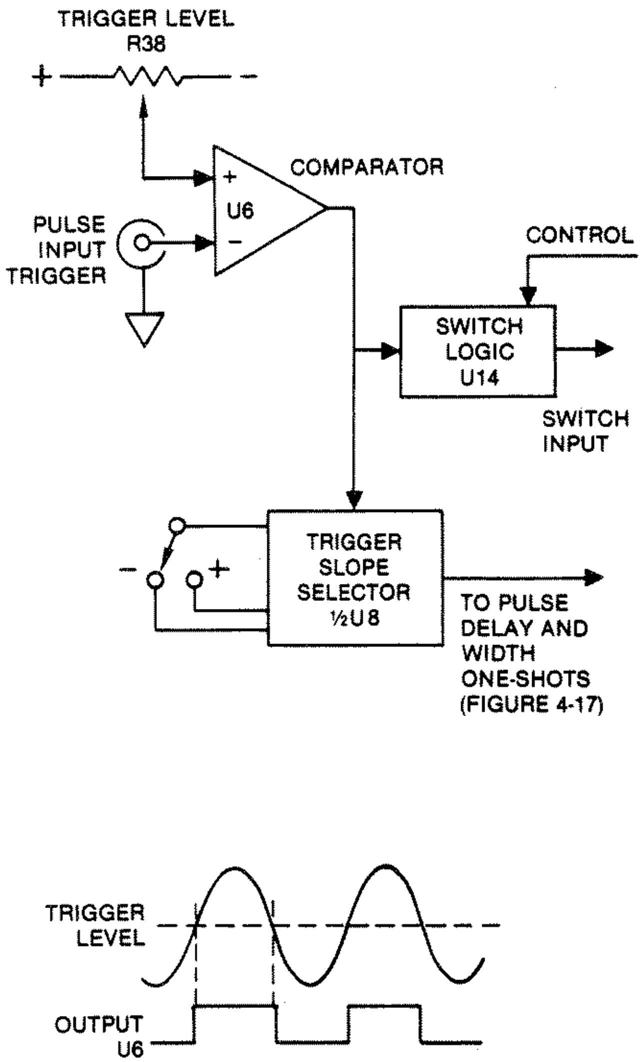


Figure 4-18. External Pulse and External Gate (Main PCA)

4.8.1 Frequency Display

The frequency display is a 3½ digit voltmeter, figure 4-19. On the main board, U18 provides a scaled input (−0.7 to −1.1V) to the voltmeter U2. The voltmeter converts the analog input into digital data to drive the liquid crystal display U1.

4.8.2 Output Level Display

The output level display, figure 4-20, is a microprocessor controlled circuit. The microprocessor circuit (microprocessor U1, program EPROM U4 and address latch U3) processes inputs from a voltage-to-frequency converter and output level display mode control switches to produce multiplexed

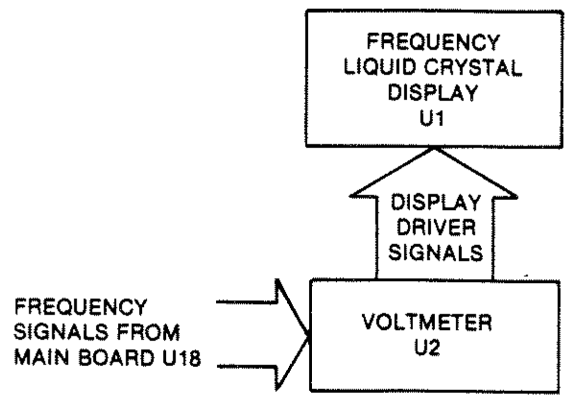


Figure 4-19. Frequency Display (Main Display PCA)

display data. This data from U1 drives the display decoder-driver U6, which controls the segments of the output level liquid crystal display U4.

U5 and U6 on the Display Computer board make up the voltage to frequency converter. The output level control signal from U26 on the main board is converted from 0 to +5V to 200 Hz to 2 kHz representing the 0 to 136 dB attenuation range. The converter output is applied to the microprocessor input. The microprocessor converts level proportional frequency to level proportional digital data for the display decoder/driver. The μV and mV LEDs are also multiplexed with the digital data from the microprocessor. The dBm and dBref front panel annunciators are controlled by switch closure.

4.9 POWER SUPPLY

Power supplies to supply voltage and current to instrument circuits are located on the main board and the rear panel. The supplies consist of rectifiers, IC regulators and, on the rear panel, primary input, thermal cutoff and a transformer. If the rear panel heat sink temperature exceeds 85°C, the primary input is interrupted. The ±15V, +21V and ±5V supplies share a common ground, while the −22V supply for the YIG coil is isolated from the other supplies.

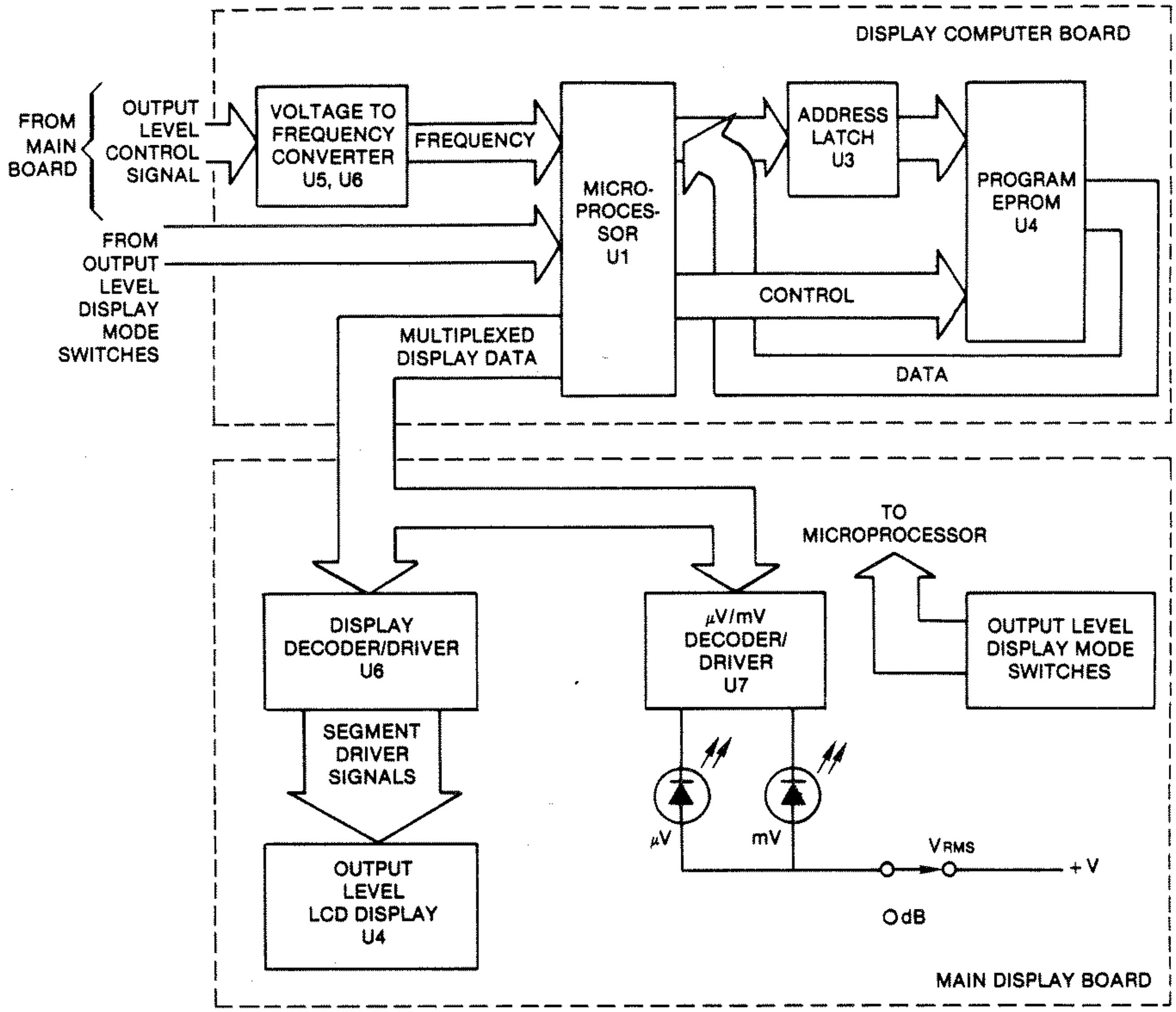


Figure 4-20. Output Level Display (Display PCA)

SECTION 5
TROUBLESHOOTING

5.1 FACTORY REPAIR

Wavetek maintains a Customer Service department for those customers not possessing the necessary personnel or test equipment to maintain their instrument. If an instrument is returned to Wavetek for repair or calibration, a detailed description of the specific problem should be attached to minimize turn around time.

5.2 PROBLEM ISOLATION

To determine proper or improper instrument operation, perform the checkout procedure (table 2-1). Note, if any, the areas where operation is not correct. If the instrument seems to operate correctly but does not operate within specifications, refer to Section 6, Calibration. When improper operation has been determined, refer to table 5-2 for troubleshooting suggestions. Equipment that may be required for troubleshooting is listed in table 5-1.

5.3 CABLES AND CONNECTORS

WARNING

While the very low power of the RF energy generated in this instrument makes it ordinarily nonhazardous, extremely close and prolonged proximity of an eye and an active RF output connector could cause injury.

CAUTION

Disconnecting and reconnecting RF connectors within the RF box may adversely affect instrument performance. Do not twist or bend the semi-rigid coax cables from their original shape. Use specified torque when tightening SMA type connectors.

RF transmission between components of the RF string is via semi-rigid coax cable and SMA type connectors. Do not twist or bend these cables from their original shape. Use 8 ±0.3 in.-lb torque when reassembling the SMA type connectors.

Table 5-1. Troubleshooting Test Equipment

Instrument	Critical Specification	Suggested Model
DC Voltmeter	0.1 mV resolution, 3½ digits.	Fluke 8050A
Power Meter	0.01 dB resolution, 7 to 12.4 GHz, −60 dBm range.	HP 436A with 8484A Power Sensor, 30 dB pad (DC −12.4 GHz)
Microwave Frequency Counter	1 to 18 GHz, 1 MHz resolution.	EIP 371
Oscilloscope	5 mV/div sensitivity, 75 MHz bandwidth	Tek 7603 with plug-ins 7A18, 7B53A and ×10 probe P6105
SMA-to-Type N Connector adapters	DC to 12.4 GHz.	

NOTE

If a component in the RF box is defective, Wavetek recommends the return to Wavetek of the RF box, its contents, the two semi-rigid coax cables leading to the front panel, and the two PROMs in socket positions U33 and U41 on the main PC board. Wavetek will make the necessary repairs and assure proper operation and calibration of the entire RF section. When preparing the RF box for shipment, remove the two semi-rigid coax cables from the box and front panel, carefully pack and ship the two cables with the box. Remove the U33 and U41 PROMs from the mainboard and install them in their shipping sockets on the RF box (ref: schematic 0102-00-0881, item 6).

Table 5-2. Troubleshooting Hints

	Symptom	Discussion	Test
1.	Any problem	If any circuitry is not operating properly, the power supply voltages should be checked. Main board schematic 0103-00-0733, sheet 1 shows the voltage regulators and rectifiers. The jumpers at the output of the regulators may be lifted to verify the regulators are operating properly in no load condition.	Verify proper power supply voltages.
2.	OUTPUT ON indicator doesn't light.	If there is no RF output power, generally the RF ON light, which is in the output area of the front panel will not light. This indicates that there is not sufficient power being generated by the oscillator to operate the leveling loop.	Measure MAIN and AUX output power.
3.	Improper RF output power or frequency.	1. Remove the RF box assembly for testing per instructions in section 6.2. Possible areas of malfunction in the leveler loop include the leveler itself, the detector or the circuitry on the RF drive board: U6 and U7 and associated components (ref: figure 4-1 and 4-7).	Verify the correct oscillator operating current and bias voltage. The correct voltages are given on the calibration decal located on the RF box cover and are peculiar to the RF assembly that you are working on. The gunn bias voltage can be monitored either across the oscillator connector or back on the main board (TP27). The YIG tune current can be measured or monitored at TP6 on the RF drive board and across TP12 and TP13. The latter is a voltage across R31, a 15Ω sense resistor. Its voltage should be the same as that at TP6 to indicate the circuitry is working properly. (Ref: figure 4-2.)
		2. If the current through the YIG coil and the gunn bias are both within normal ranges, then the oscillator may not be working.	Separate the RF chain between the isolator and the leveler input and verify that the RF output of the oscillator is within the normal power levels for that oscillator; normally between +13 and +18 dBm across the band. That test must be made with the oscillator properly heat sinked and isolator on the output of the oscillator. See NOTE, paragraph 5.3.

Table 5-2. **Troubleshooting Hints (Continued)**

Symptom	Discussion	Test
		CAUTION When changing the gunn oscillator, it is very important to lift the gunn bias voltage wires at E28 and E10 on the main board before reconnecting a new oscillator. Otherwise, if the gunn bias circuitry is not operating properly, excessive voltage may be applied to the new gunn oscillator and destroy the gunn diode. Once the gunn oscillator drive circuitry is checked out at TP27 (described in the previous discussion), then the wires at E28 may be replaced. If the problem was a faulty oscillator, make the new bias voltage and current adjustments for the replacement oscillator. The remainder of the RF chain need not be readjusted for a simple replacement of the oscillator. Both Gunn Bias and YIG coil current drivers must have their temperature compensation curcuits readjusted. See Section 6.
	3. If the OUTPUT ON light is working but there is no output power or very little output power, the problem is downstream of the leveler. That is, between the leveler and the front panel connector. The problem there could be in the attenuator or the RF switch.	Verify that the attenuator and the RF switch are not causing a problem by shorting the feedthru capacitors on the attenuator and on the RF switch. If the RF output is not at the proper power level, approximately 2 or 3 dBm, then there is a problem in the attenuator or the switch. By shorting out the drive signals it guarantees that the PC board signals cannot be causing any unusual or undesired attenuation in the attenuator or the RF switch. If the problem is isolated to the attenuator or RF switch, replace the RF chain from the leveler through the final isolator. The attenuator correction EPROM and leveler correction PROM are part of this RF chain assembly. Factory recalibration will be necessary. See NOTE, paragraph 5.3.

Table 5-2. Troubleshooting Hints (Continued)

Symptom	Discussion	Test
	4. If a problem does exist with the circuitry, further examination is required on the RF drive board or the main board.	If the attenuator drive circuitry has a fault then start troubleshooting at TP21 on the RF drive board. The voltage at TP21 should vary between 0 and approximately +9V as the OUTPUT level control on the front panel is varied from maximum to minimum output power, respectively.
	5. If the voltage at TP21 does cover the nominal range, 0 to 9V, then the most likely problem is in the voltage to current converter stages for one or possibly both of the two sections for the attenuator (figure 4-10). If both sections have failed, a likely cause would be the −10V reference, which provides −10V to both drivers. This circuit is located at U3 and Q9. The output is TP24. This −10V reference circuit is located on the RF drive board schematic, zone C1.	Check for −10V at TP24. Check the voltage to current output drive stages by substituting a current meter at the output of the attenuator driver in place of the attenuator itself.
	6. The RF switch is ok in discussion 3 above and the RF switch driver is suspect.	Substitute a current meter for the RF switch at E53 and E54 in the RF drive box. When the RF switch is on (high output power, the insertion loss state) then the current flowing from E53 to E54 should be approximately 9 mA (factory calibrated value). Whereas in the switch off state, the output is at the isolation condition and the current from E54 to E53 should be a nominal 10 mA.
	7. If the oscillator does generate the proper power level but the leveler loop does not respond and the leveler is operating, then the detector might be malfunctioning. The RF detector is a tunnel diode detector which generates a low level output voltage when given sufficient input power; approximately −12 dBm is the typical operating point. This low level voltage (approximately 25 mV) is fed into E47 and E48 on the RF drive board where it is amplified by U6.	Check voltage of TP9, normally between 2 and 10V dc when the frequency is not being changed. Check TP14 voltage; it is between −0.6 and −10 Vdc under normal operating conditions.

Table 5-2. Troubleshooting Hints (Continued)

Symptom	Discussion	Test
	8. Q1 and Q2 (on first sheet of Main board schematic) regulate the ±15 volts to provide ±14 volts for the heater of the oscillator. If these transistors are shorted, the heater will not be receiving the proper voltages and may overheat or not heat at all causing unreliable operation of the oscillator.	Verify proper operation of Q1 and Q2.
	9. The RF output can't be turned off or on.	Check relay K4 (main board schematic sheet 3) for proper logic through U22 and all the way to K4.
	10. When K4 is switched on, a positive bias is applied to U19, Pin 2, which tends to reduce the gunn bias voltage to 0 volts, effectively shutting off the gunn oscillator. So if K4 is latched on all the time, then the gunn bias will never reach the appropriate operating value.	Verify proper operation of K4.
4. OUTPUT ON indicator off but there is power at output	If the OUTPUT ON light is off but there still is proper output power from MAIN OUTPUT, then the circuitry which drives the OUTPUT ON LED should be checked.	Troubleshoot the RF drive board at Q12 and half of U5. That signal is then routed to the display board and the LED itself.
5. No unleveled mode of power	1. Failure of the unleveled enable signal.	Check the logic signal at E35 on the RF drive board, labeled UNLEVEL. If this signal is a TTL high, then an unlevel condition should exist. If at logic zero, which should be the case when in the leveled condition (signal generated on sheet 3, zone B1 main board schematic), the leveled switch on the display board and the logic gates at U61 and U62 should be checked for proper operation.
	2. Unleveled signal is correct.	If the output power is still not unleveled, verify that Q15 and CR24 circuitry is operating properly, which will pump current into R51 and cause the U7 and Q3 error amplifier to saturate at TP14 where the voltage will be approximately −14V.

Table 5-2. Troubleshooting Hints (Continued)

Symptom	Discussion	Test
6. Output unleveled all the time	1. When unleveled output is selected, Q15 is turned on, reverse biasing the leveler diode, which ensures no attenuation.	Check Q15 to ensure that it is not shorted.
	2. If the unleveled condition persists the leveler itself may be open, in which case the leveler diode will not be operating.	If the problem is isolated to the leveler, replace the RF chain from the leveler through the final isolator. The leveler correction PROM and the attenuator correction EPROM are part of this RF chain assembly. See NOTE, paragraph 5.3.
7. Excessive frequency drift	If the oscillator exhibits excessive frequency drift (greater than 60 ppm/°C) then the temperature sense circuitry may be in error.	Monitor the temperature sense voltage at TP4 on the RF drive board or TP26 on the main board. Normally this voltage will change approximately −1V for every 10°C increase in the temperature of the oscillator heat sink. At room temperature the voltage should be approximately 0V. Refer to temperature compensation in section 6, Calibration, for adjustment of the frequency temperature compensation.
8. Excessive residual FM	If there is excessive residual FM on the RF output signal while operating with the front panel FREQUENCY control, then relay K1 on the RF drive could be the problem. Capacitor C10, controlled by K1, varies the time constant of the filter which is applied across the YIG coil. This filters out any 60 Hz components across the YIG coil and stabilizes the output frequency.	Verify operation of K1, C10 and R30. Also check +21V and −22V power supplies for proper operation, output ripple less than 20 mVp-p.
9. Front panel displays not operating properly	1. If the front panel displays are not operating properly, then the most likely problem is a loose connector on the front panel or the ±5V references are malfunctioning. If the +5V reference is defective then the −5V reference is also defective because the −5V is derived from the +5V. (Also the −10V reference in the RF drive board is generated from the −5V reference.) The +5V reference is generated at U8, TP1 and TP2 on the RF drive board. U9 and Q14 form the inverter for the −5V reference. The +5V reference is used to offset the voltage on the temperature sense diode at U10.	Verify operation of the +5V and −5V references.

Table 5-2. Troubleshooting Hints (Continued)

Symptom	Discussion	Test
	2. Frequency display is basically a single chip voltmeter (U2) which takes a voltage generated on the main board at TP25 and displays its value. Voltage at TP25 is normally −0.7 to −1.1Vdc. U18 on the main board adjusts offset and gain and translates the 0 to 5V frequency control signal level into the proper voltage level for the display.	Verify operation of U18 on the main board and U2 on the main display board.
	3. If, during power-up, the output level display is invalid or a series of bars are displayed across it (all minus signs), then it is quite possible that the microprocessor did not receive the power-on reset which is generated on the main board at U45, Pin 8. Another possible problem is a negative voltage at U26 (TP1).	Verify presence of power on reset at U45, Pin 8 (schematic sheet 2, zone A6). Verify input to K8 is not a floating open or a negative polarity (sheet 4, zone D6).
	4. The EPROM containing the program which is stored at U4 on the display computer board might be defective. In the beginning of the power-up procedure the check sum is generated for the memory in U4. If this agrees with the program content for the check sum then the microprocessor continues ahead in the program and displays the set output power level. If however, the check sum does not agree chances are the program will fail and either hang up, displaying all minus signs, or will not operate in the first place.	Debugging the microprocessor board including U1, U3 and U4.
	5. Assuming that the microprocessor is working properly, but the output level displayed is in error or severely off scale, then the voltage to frequency converter (located at Zone B6 of schematic 0103-00-0795) consisting of U5 and U6 and partly of U2 may be at fault.	Verify operation of voltage to frequency converter (U2, U5 and U6). The input voltage at P1-9 is the output level signal, 0 to 5 volts. This signal is adjusted for offset with R2 and gain with R4 and R12 in order to provide a frequency ranging between 200 Hz and 2 kHz at TP5. The voltage at TP3 will vary between −1 and −10 volts for a 0 to 5 volt input signal change.
	6. Poor contact on the pc board between the zebra type connectors and the pc board itself.	Disassemble the display board and check the contact integrity. Remove any foreign matter with alcohol.

Table 5-2. Troubleshooting Hints (Continued)

Symptom	Discussion	Test
10. No external control or no internal control for frequency or output level	If there is no external or internal control for the frequency or output level, then the relays which switch the signal from internal control to external control should be checked.	For the output level signal check relay K8 (on sheet 4, zone D6 of the main board schematic). For the frequency, check relays K1 and K2 (on main board schematic sheet 3, zone C5).
11. Square wave mode not operating properly but FM mode ok	U15 is a comparator which converts the sawtooth waveform at TP10 into the square wave signal fed into U14, Pin 4.	Verify operation of U15.

SECTION 6
CALIBRATION

6.1 FACTORY REPAIR

Wavetek maintains a Customer Service department for those customers not possessing the necessary personnel or test equipment to maintain their instrument. If an instrument is returned to Wavetek for repair or calibration, a detailed description of the specific problem should be attached to minimize turn around time.

6.2 CALIBRATION

Table 6-1 lists the equipment required to perform the calibration procedures given in table 6-2. These procedures cover routine adjustment of the 907 at specified service intervals.

This procedure does not cover output level flatness at 0 dBm (leveler correction circuit) nor output level accuracy (attenuation correction circuit). Both require special semi-automated test equipment. The PROMS for leveler correction and attenuation correction are uniquely programmed for each RF assembly. If the output power level is not within the flatness specification (at 0 dBm) or the output power level accuracy specifications are not met (at any power level and frequency), refer to Wavetek's Customer Service department for factory calibration service.

CAUTION

Disconnecting and reconnecting RF connectors may adversely affect instrument performance. Review paragraph 5.3 before proceeding.

1. Prepare the instrument by removing the covers; disconnect the semi-rigid coax cables (box-to-front panel) at the box, remove the RF box from the instrument and remove the cover from the RF box. (Ref: section 7 drawings).

2. Connect the RF assembly to the Main board. If desired, use an extension cable for J23 to P23 (ref: paragraph 6.3).

3. Warm up for one hour with OUTPUT ON and OUTPUT LEVELED ON. Cooling the RF box heat sink with a fan is recommended.

6.3 EXTENSION CABLE

Although not mandatory, an extension cable between the RF box and the main board is a convenience. Construction information is given in table 6-3.

Table 6-1. Calibration Test Equipment

Instrument	Critical Specification	Suggested Model
DC Voltage Calibrator	±15V Range, 1 mV Resolution, 5 mV Accuracy	Datel DVC 8500
DC Voltmeter	0.1 mV resolution, 3½ digits.	Fluke 8050A
Power Meter	0.01 dB resolution, 7 to 11 GHz, −60 dBm range.	HP 436A with 8484A Power Sensor, 30 dB pad for up to 12.4 GHz
Microwave Frequency Counter	1 to 18 GHz, 1 MHz resolution.	EIP 371
Digital Thermometer	25°C to 50°C.	Basic 402A
Environmental Test Chamber	25°C to 50°C, ±1°C stability, Must accommodate one 907.	Associated BK 1108
SMA to Type N Adapters	To 12.4 GHz.	

Table 6-2. Calibration Procedure

Note: Open column indicates previous entry remains applicable.

Step	Check	Tester	Cal Point	Program	Adjust	Desired Results	Remarks
1	Temperature Compensation Null	Voltmeter	RF Drive PCB: TP4 to TP8	Disconnect P1 from J1 on RF Drive PCB.		9 to 15 Vdc	Disconnecting temperature sense diode cable simulates a large temperature change, generating a large sense voltage.
2			TP10 to TP11		R41 on RF Drive PCB	0 ±1 mVdc	Leveler. (Not used.)
3			TP19 to TP20		R73 on RF Drive PCB		Prelog Converter. (Not used.)
4			TP22 to TP23		R101 on RF Drive PCB		Postlog Converter. (Not used.)
5			Main PCB: TP13 to TP20		R106 on Main PCB	0±5 mVdc	Gunn Bias. (Turn full cw.)
6			RF Drive PCB: TP7 to TP5		R24 on RF Drive PCB	0 ±5 mVdc	Frequency (Turn 20 times cw).
7			RF Drive PCB: TP4 to TP8	Reconnect P1 to J1 on RF Drive PCB.	R12 on RF Drive PCB	0 ±0.1 Vdc	Temp comp offset adusted to room temp.
8	+5V Reference		RF Drive PCB: TP1 to TP2 (Gnd)		R4 on RF Drive PCB	5 Vdc ±2 mV	+5V Reference is used by all critical circuits to maintain accuracy.
9	Frequency Control		Main PCB TP7 to TP8	MODE: CW. FREQ CNTL (Rear Pnl): INT. FREQUENCY: Full ccw. VERNIER: 0	R272 on Main PCB	0 ±1 mVdc	Offset pot adjustment sets 0V equal to 7 GHz (nominal).
10				FREQUENCY Control: Full cw	R80 on Main PCB	5 Vdc ±2 mV	Gain pot sets 5V equal 11 GHz (nominal).
11	Gunn Bias Voltage and Tuning Current Adjust		P5-5 to P5-9 on RF Drive PCB	FREQUENCY Control: Full ccw	R113 on Main PCB	V_{GC} ± 10 mV	Gunn bias voltage at 7 GHz. (Leave voltmeter connected.) Compute V_{GC} per following note.

NOTE: The Gunn bias voltage must be compensated for the difference in RF heat sink temperature during the factory calibration (nominally 32°C) and during present recalibration. To compute the actual voltage to be used, refer to the following equation (remember as the heat sink temperature increases, the Gunn bias voltage decreases): $V_{GC} = V_{GF} - V_{GTC}(T_C - T_F)$

Where,

V_{GC} = Gunn bias voltage to be used in present calibration.

V_{GF} = Gunn bias voltage recorded on factory calibration sticker for appropriate frequency.

V_{GTC} = Gunn bias voltage temperature coefficient recorded on calibration sticker (V/°C).

T_C = RF heat sink temperature (°C) at time of recalibration.

T_F = RF heat sink temperature at time of factory calibration. If value is not noted on RF box calibration sticker, use nominal value of 32°C.

Table 6-2. Calibration Procedure

Note: Open column indicates previous entry remains applicable.

Step	Check	Tester	Cal Point	Program	Adjust	Desired Results	Remarks
12		Frequency Counter	AUX Output		R115 on RF Drive PCB.	6.950 GHz ±5 MHz	Leave counter connected.
13		Voltmeter	P5-5 to P5-9 on RF Drive PCB.	FREQUENCY Control: Full cw	R103 on Main PCB.	V_{GC} ±10 mV	Gunn Bias Voltage at 11 GHz. See note, step 11.
14		Frequency Counter	AUX Output		R19 on RF Drive PCB	11.050 GHz ±5 MHz	
15	Frequency Display		Frequency Display	FREQUENCY Control: Full ccw	R95 on Main PCB	6.95 GHz (exactly) on display	
16				FREQUENCY Control: Full cw	R98 on Main PCB	11.05 GHz (exactly) on display	
17	Gunn Bias Temp Comp			AC Power OFF.			Lift E14 terminal of R109 on Main PCB. Connect Vdc Calibrator (set at 0.0V) to lifted terminal and TP20 (analog ground).
18		Voltmeter	TP27 to TP20 on Main PCB	AC Power ON. FREQUENCY Control: Full cw. Calibrator: −3.5 0 Vdc	R106 on Main PCB	V_{GC} −35 (V_{GTC})	Use V_{GC} and V_{GTC} values computed in step 13. After R106 adjustment, turn ac power off, remove calibrator, replace lifted terminal of R109. Turn ac power ON.
19	Square Wave Symmetry	Oscilloscope	PULSE MONITOR	PULSE MODE: ⎍ RATE: 1K - 10K pushbutton, set pot for 1 kHz (nominal)	R61 on Main PCB	50% ±1% duty cycle	Requires no additional setup.
20	Output Level Display	Voltmeter	TP3 to TP4 on Display Computer PCB	OUTPUT Level Control: Full cw	R2 on Display Computer PCB	−1.0 Vdc ±5 mV	Leave voltmeter connected.
21			Output Level Display		R12 on Display Computer PCB	+1.0 dBm (exactly) on display	
22				OUTPUT Level Control: Full ccw	R4 on Display Computer PCB	−135.0 dBm (exactly) on display	
23		Voltmeter	TP3 to TP4 on Display Computer PCB			−10 Vdc ±0.2V	Verify.

Table 6-2. Calibration Procedure (Cont)

Note: Open column indicates previous entry remains applicable.

Step	Check	Tester	Cal Point	Program	Adjust	Desired Results	Remarks
24	Ext Level Control Adj.	Vdc Calibrator	Output Level Display	OUTPUT LEVEL CONTROL: EXT. Apply 13.1 Vdc with DC calibrator	R154 on Main PCB	(−130.0 ±0.1) dBm	−10 dB/V gain adjustment. After adjustment, remove calibrator and set OUTPUT LEVEL CONTROL to INT.
25	Output Level Control	Voltmeter	TP5 to TP23 Main PCB	Plug P59 on Main PCB: To CAL position. OUTPUT Level Control: Full cw	R169 on Main PCB	0 ±2 mVdc	Offset adjustment.
26				OUTPUT Level Control: Full ccw	R174 on Main PCB	V_{OLC} ±2 mV	V_{OLC} is voltage recorded on RF assy calibration sticker. OUTPUT LEVEL CONTROL Gain adjustment.
27			TP21 to TP8 on RF Drive PCB	OUTPUT Level Control: Full cw	R121 on RF Drive PCB	0 ±1 mVdc	
28	Attenuator Offset and Gain Adjustment	*NOTE: Steps 28-33 (Attenuator Offset and Gain Adjustment) should be performed only if the attenuator drive circuit offset or gain adjustments are required. If these calibration steps do not restore attenuation performance per output level specifications, factory recalibration of the attenuator correction EPROM may be required. (See section 6.2, Calibration, paragraph 2.)*					
		Power Meter	MAIN Output	FREQUENCY Control: Set to display 10.00 GHz OUTPUT LEVELED: ON	*NOTE: Connect 2 jumper wires between the attenuator feedthru capacitors and the solder lug. (Shorts out attenuator drive current for attenuation "A" and "B" circuits.) Record the power level to 0.01 dB resolution. (If the power meter has a reference level capability, set 0.00 dB reference equal to this power level.) Power level is nominally +2.5 dBm.*		
29					R60 on RF Drive PCB	Step 28 power level −(0.5 ± 0.02) dB	Attenuator "A" offset. Remove jumper from attenuator "A" to make this adjustment.
30					R109 on RF Drive PCB	Step 28 power level −(0.5 ± 0.02) dB	Attenuator "B" offset. Remove jumper from attenuator "B" and connect to attenuator "A" to make this adjustment.
31				OUTPUT Level Control: Set to display −130.0 dBm.	R105 on RF Drive PCB	Step 28 power level −(67.0 ± 0.1) dB	Attenuator "B" gain. Ensure only attenuator section "A" is shorted.
32					R62 on RF Drive PCB	Step 28 power level −(67.0 ± 0.1) dB	Attenuator "A" gain. Remove jumper on attenuator "A". Reconnect jumper across attenuator "B" before adjustment.

Table 6-2. Calibration Procedure (Cont)

Note: Open column indicates previous entry remains applicable.

Step	Check	Tester	Cal Point	Program	Adjust	Desired Results	Remarks
33				Plug P59 on Main PCB: Set to NORM position			Remove any jumpers across attenuator.
34	Frequency Temperature Compensation Setup	*NOTE: Ensure that all the preceding adjustments in the RF subassembly have been made. Reassemble the RF subassembly and install it in the 907. Ensure that fastening hardware is exactly as shown in drawings 0102-00-0881 and 0102-00-0745. Do not replace the top cover on the 907. Place the 907 in a test chamber maintained at a nominal 30° ±2°C. Monitor the temperature with a digital thermometer. Connect a cable at TP26/TP20 on the Main PCB in order to monitor the temperature sense voltage. Connect a cable to TP27/TP20 in order to monitor Gunn bias voltage. Connect a frequency counter at AUX output and adjust the 907 output to 9.00 GHz ±50 MHz.*					
35	Leveler Offset	Power Meter	MAIN Output	OUTPUT Level Control: Set to display +0.0 dBm. LEVELED: ON FREQUENCY Control: Set to display 9.00 GHz (Lock Knob)	R44 on RF Drive PCB	(0.0 ±0.1) dBm	Be sure to correct the Power Meter for any pad or sensor errors. After this check, allow temperature to stabilize (45 to 60 min.).
36	Frequency Temperature Compensation	Voltmeter	TP27 to TP20 on Main PCB (Gunn bias)				Record Gunn bias voltage.
37			TP26 to TP20 on Main PCB (Temp Sense)		R12 on RF Drive PCB (Temp Sense Offset)	0 ±50 mVdc	After performing this step once, allow 10 min. for temperature stabilization.
38			TP27 to TP20 on Main PCB (Gunn bias)		R113 on Main PCB	Voltage noted in step 36.	Allow temperature to stabilize for 10 min.
39		Frequency Counter	AUX Output				Record the 907 frequency to 1 MHz resolution. Do not disturb the frequency setting.
40		Thermometer		Increase chamber temperature to 50°C ±5°C		50°C±5°C	Allow 45 to 60 minute stabilization after reaching chamber temperature.
41		Frequency Counter	AUX Output		R24 on RF Drive PCB	Step 39 frequency ±2 MHz	After adjustment, disconnect all test equipment. Allow 907 to cool down. Replace cover (ref: 0102-00-0745).

Table 6-3. RF Box/Main PCB Extension Cable

Length: 36 Inches
Wire Type: 22 AWG
Connectors: Amphenol P/N 57-30360 and 57-40360 (Ref: P23/J23)

Jack Pin, Plug Pin	Wire Type	Suggested Color	Signal	Jack Pin, Plug Pin	Wire Type	Suggested Color	Signal
1	Part of Twisted Pair (Ref: 19)	Black	+14V (YIG Heater)	19	Part of Twisted Pair (Ref: 1)	Red/Wht	−14V (YIG Heater)
2		Brown	YIG Coil Supply Voltage	20		Orn/Wht	YIG Coil Supply Voltage
3		Red	+15V	21		Yellow/Wht	−15V
4		Orange	+5V	22		NC	
5	Coax Center (Ref: 23)		Pulse	23	Coax Shield (Ref: 5)	Blk/Wht	(Logic Ground)
6	Coax Center (Ref: 8)		Leveler Correction	24		Blu/Wht	Int/Ext Relay
7		Vio/Wht	RF-ON LED	25	Coax Center (Ref: 26)		Atten Drive Sig
8	Coax Shield (Ref: 6)		Leveler Correction Shield	26	Coax Shield (Ref: 25)		Atten Drive Gnd
9	Part of Twisted Pair (Ref: 27)	Red	FM Coil Drive (−)	27	Part of Twisted Pair (Ref: 9)	Black	FM Coil Drive (+)
10	Part of Twisted Pair in Shield (Ref: 11, 28, 29)	Red	Gunn Bias	28	Part of Twisted Pair in Shield (Ref: 10, 11, 29)	Black	Gunn Bias
11	Shield of Twisted Pair in Shield (Ref: 10, 28, 29)		Gunn Return	29	Shield of Twisted Pair in Shield (Ref: 10, 11, 28)		Gunn Return
12		Violet	Yig Coil Return	30		Orange	Yig Coil Return
13		Grey	±15V Return	31		Yellow	±15V Return
14		White	Temp Sense	32		Green	Leveler Loop Filter
15		Blk/Wht	Ref Gnd	33		Blue	Ref Gnd
16		Brn/Wht	+5 VRef	34		Violet	−5V Ref
17	Shield of Twisted Pair in Shield (Ref: 18, 36)		Freq Cont Shield	35		Grn/Wht/Blk	Unlevel
18	Part of Twisted Pair in Shield (Ref: 17, 36)	Red	Freq Cont	36	Part of Twisted Pair in Shield (Ref: 17, 18)	Blk	Freq Cont Return

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings, parts lists and schematics are in the arrangement shown below.

7.2 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

7.3 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit, and, if applicable, the function performed.

CAUTION

An assembly drawing number is not necessarily the assembly part number. The drawing numbers below that are marked with an asterisk (*) are also the assembly part number.

DRAWING	DRAWING NUMBER	DRAWING	DRAWING NUMBER
Instrument Schematic	0004-00-0175	Rear Panel Assembly	0102-00-0744
Instrument Parts List	1000-00-0175	Rear Panel Parts List	1101-00-0744*
Chassis Assembly	0102-00-0745	RF Box Assembly	0102-00-0881
Chassis Parts List	1101-00-0745*	RF Box Parts List	1101-00-0881*
Front Panel Assembly	0102-00-0736	PROM Kit Assembly	0101-00-0875
Front Panel Parts List	1101-00-0736*	PROM Kit Parts List	1208-00-0875*
Main Display Board Schematic	0103-00-0734	RF Drive Schematic	0103-00-0732
Main Display Board Assembly	1100-00-0859*	RF Drive Assembly	1208-00-0732*
Main Display Board Parts List	1100-00-0859	RF Drive Parts List	1208-00-0732
Display Computer Board Schematic	0103-00-0795	Main Board Schematic	0103-00-0733
Display Computer Board Assembly	1208-00-0795*	Main Board Assembly	1100-00-0733*
Display Computer Board Parts List	1208-00-0795	Main Board Parts List	1100-00-0733

*This drawing number is also the assembly part number.

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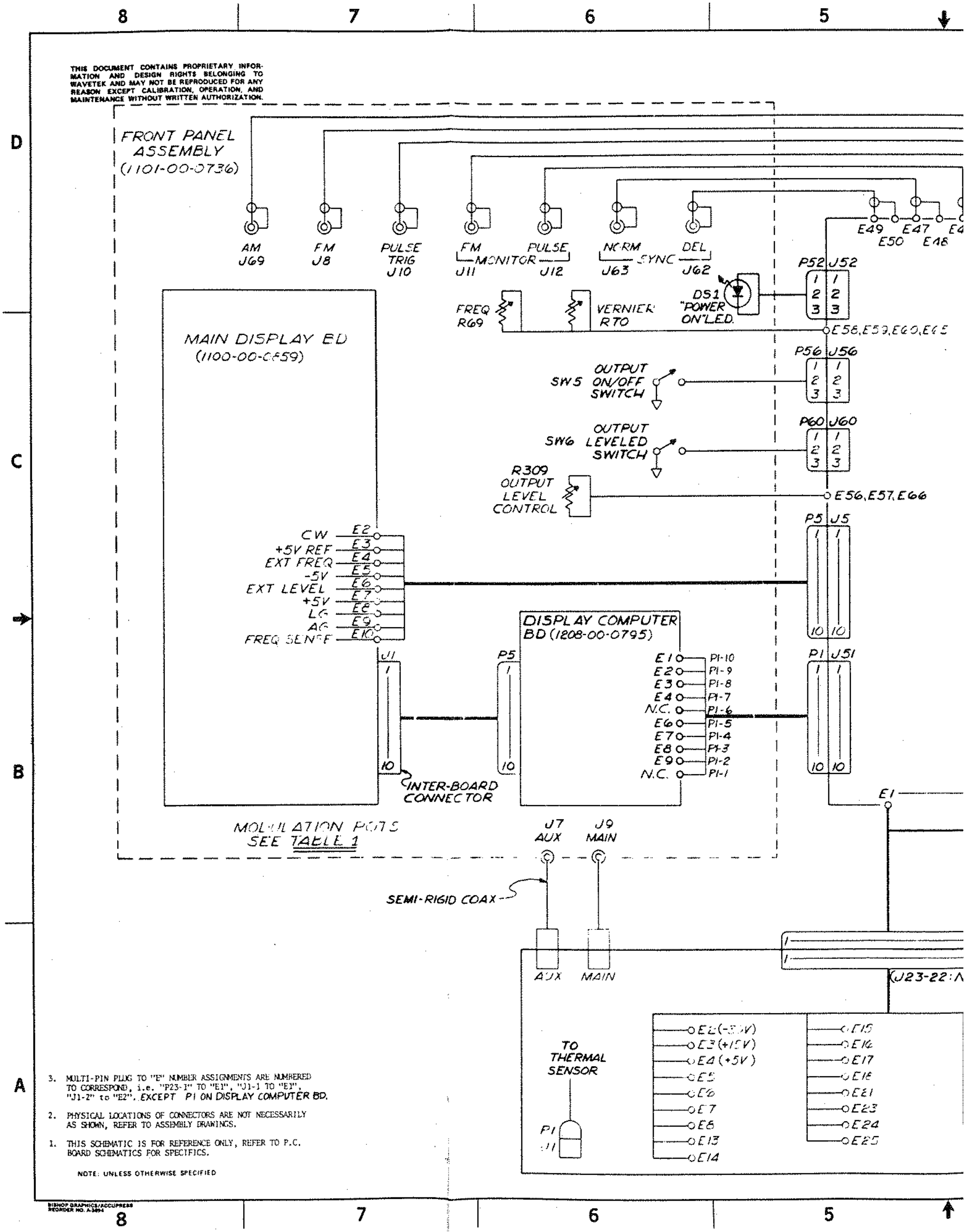

3. MULTI-PIN PLUG TO "E" NUMBER ASSIGNMENTS ARE NUMBERED TO CORRESPOND, i.e. "P23-1" TO "E1", "J1-1 TO "E1", "J1-2" to "E2". EXCEPT P1 ON DISPLAY COMPUTER BD.

2. PHYSICAL LOCATIONS OF CONNECTORS ARE NOT NECESSARILY AS SHOWN, REFER TO ASSEMBLY DRAWINGS.

1. THIS SCHEMATIC IS FOR REFERENCE ONLY, REFER TO P.C. BOARD SCHEMATICS FOR SPECIFICS.

NOTE: UNLESS OTHERWISE SPECIFIED

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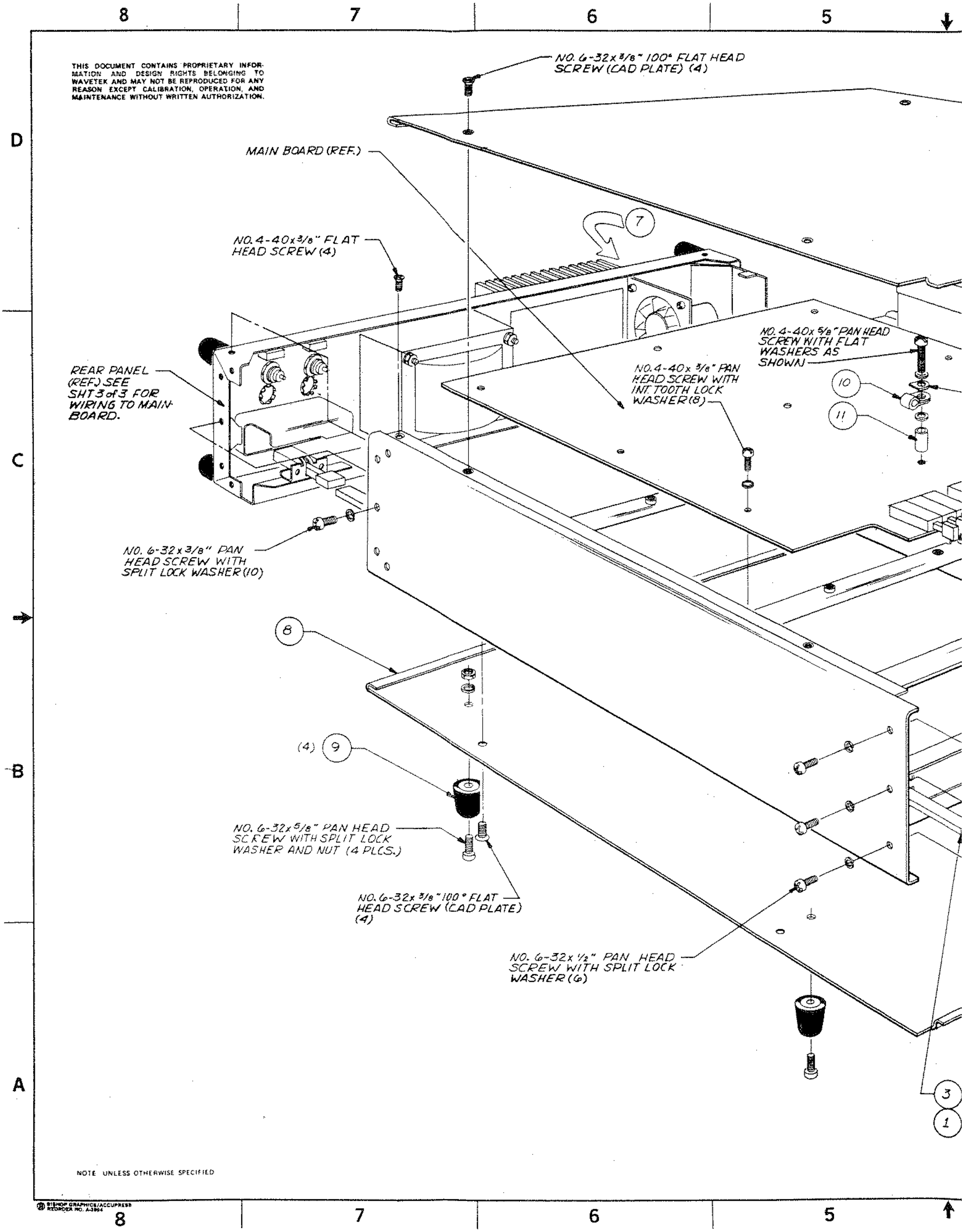

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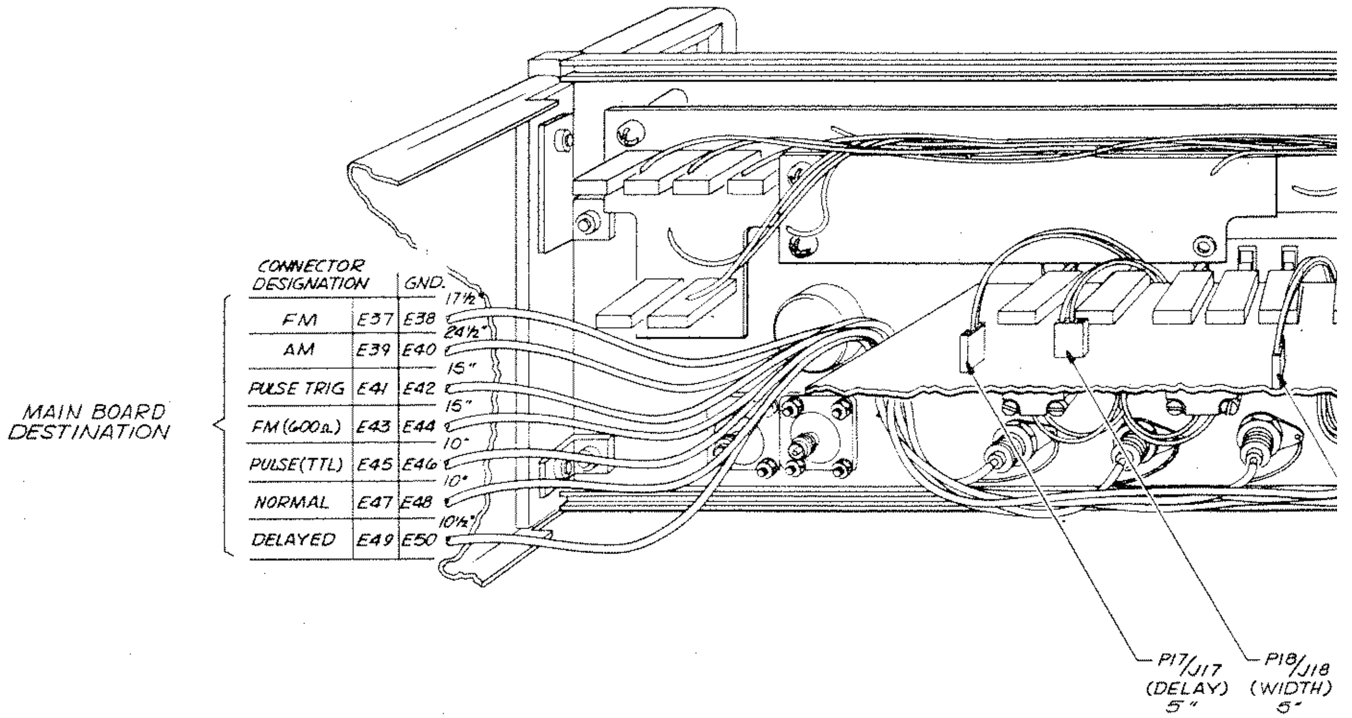

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WIRE DESTIN
MAIN BC

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1. ROUTE ALL CABLE AND WIRE AS SHOWN

NOTE UNLESS OTHERWISE SPECIFIED

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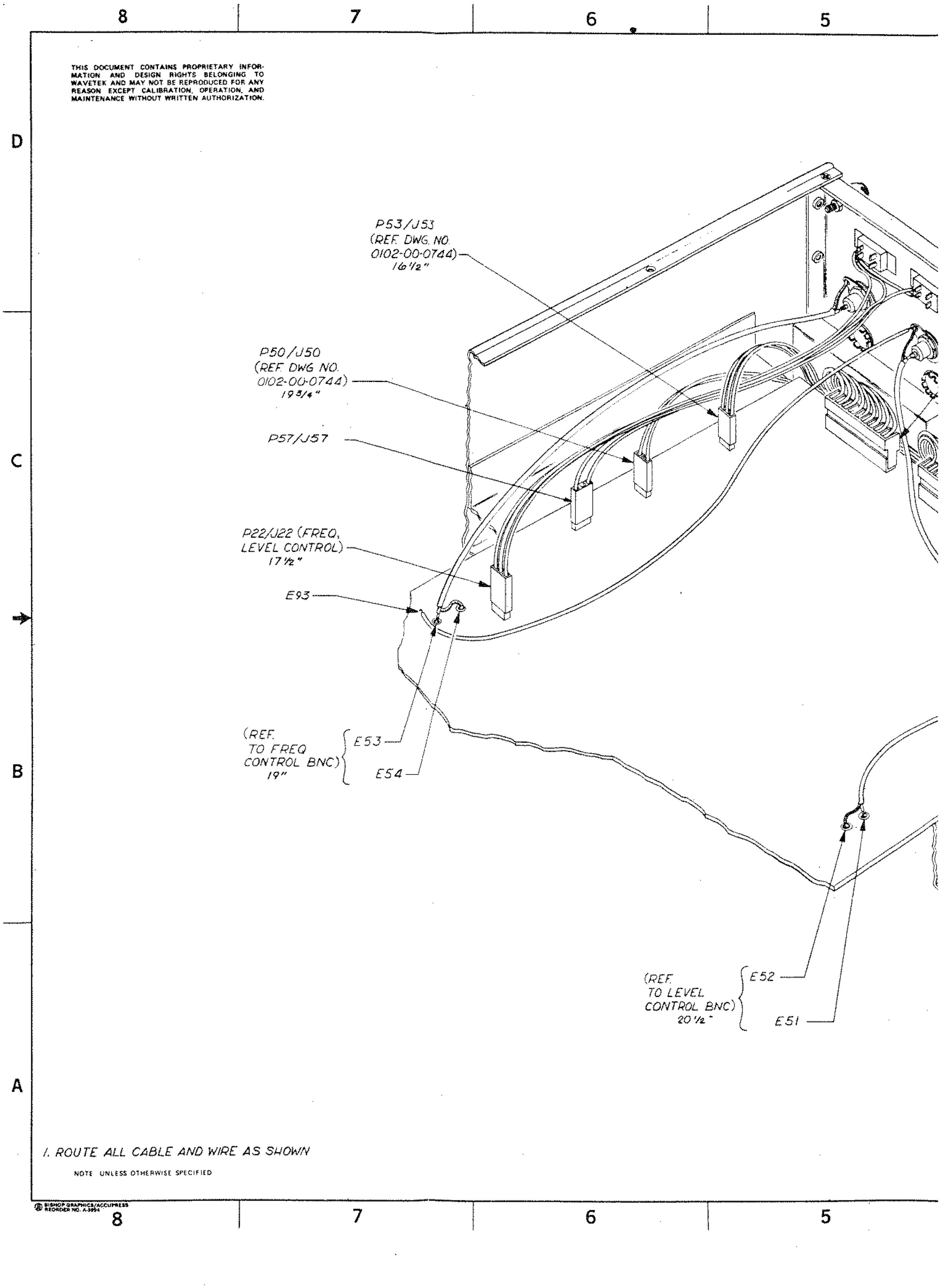

1. ROUTE ALL CABLE AND WIRE AS SHOWN

NOTE: UNLESS OTHERWISE SPECIFIED

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NOTE: UNLESS OTHERWISE SPECIFIED

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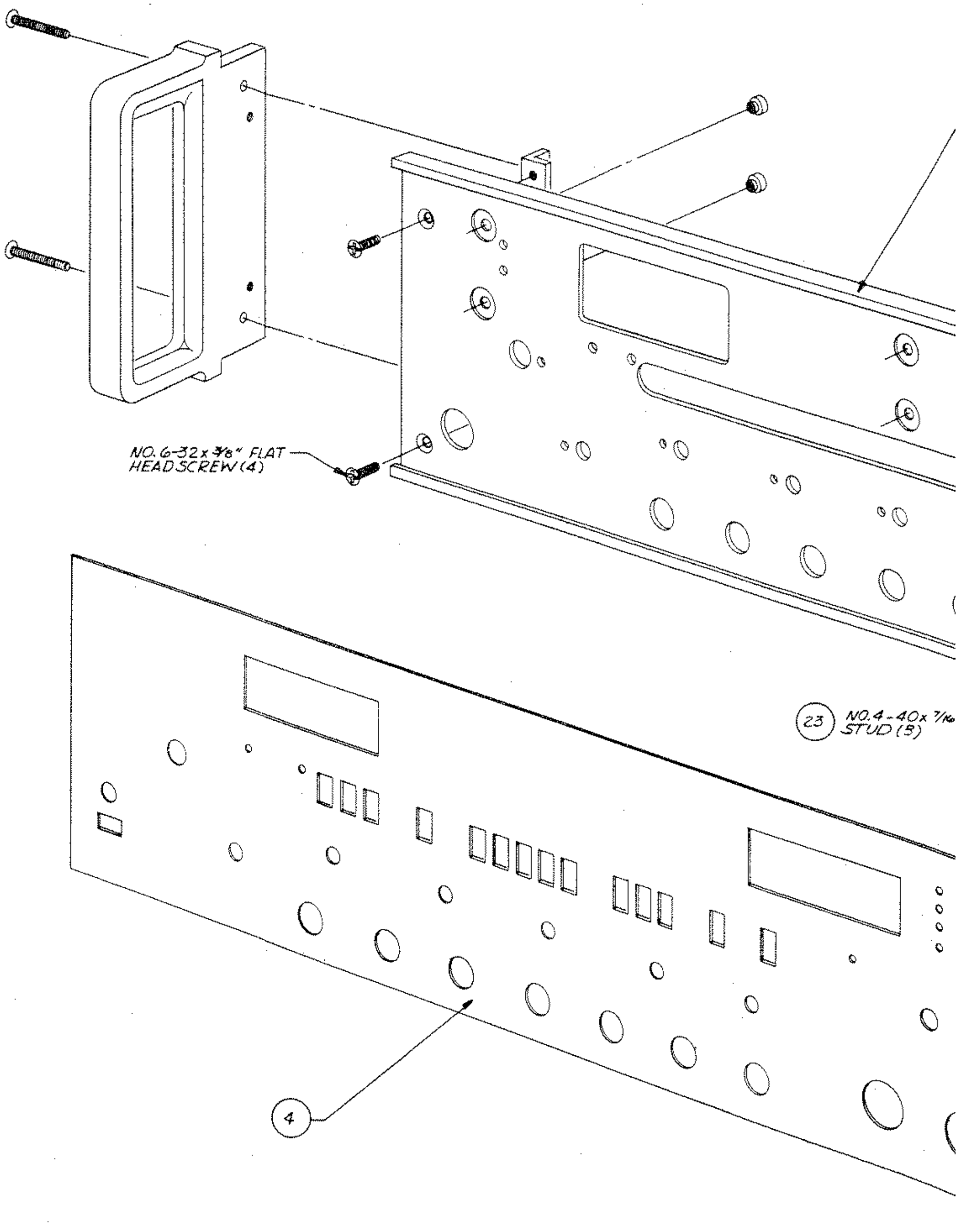

NOTE: UNLESS OTHERWISE SPECIFIED

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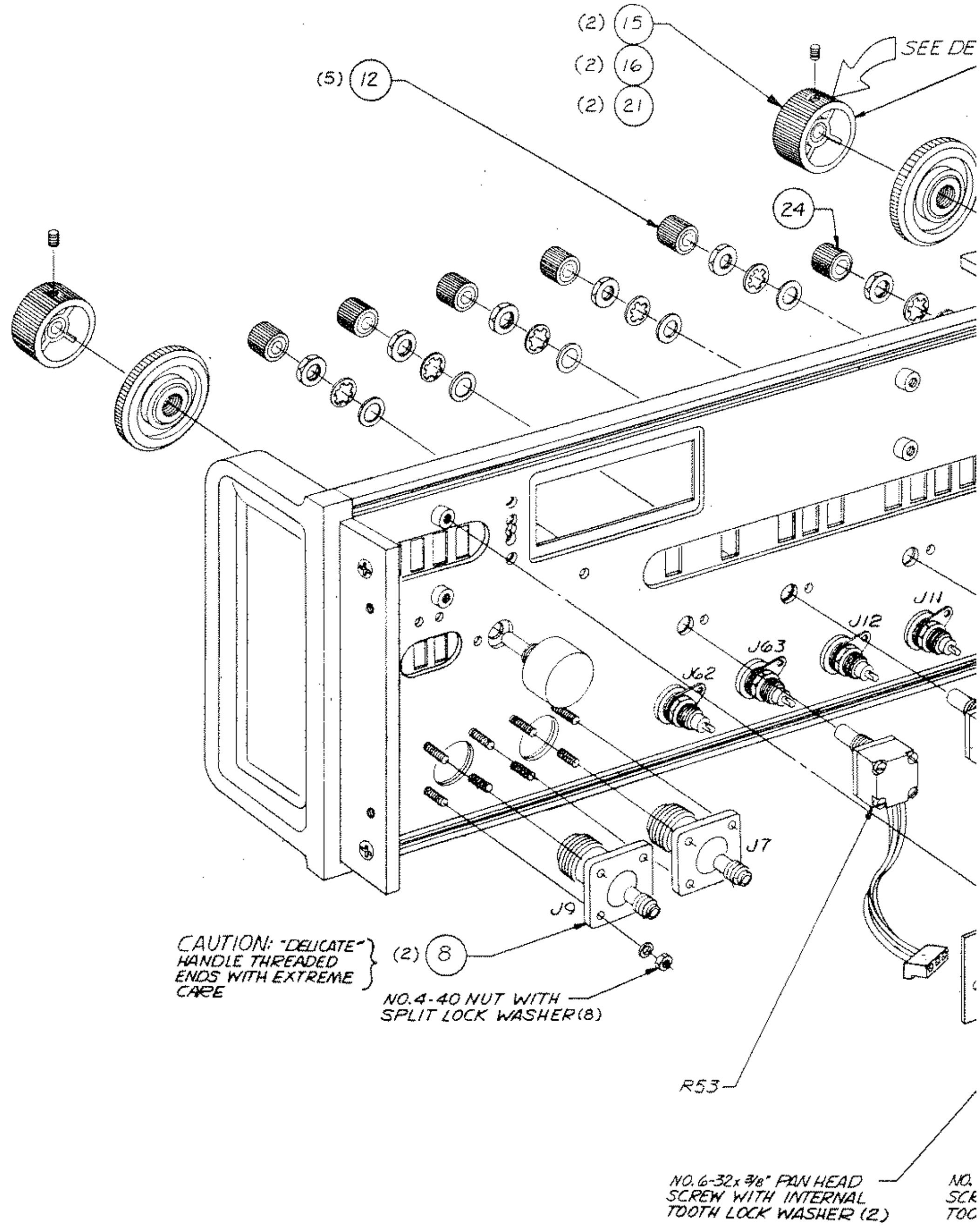

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NOTE: UNLESS OTHERWISE SPECIFIED

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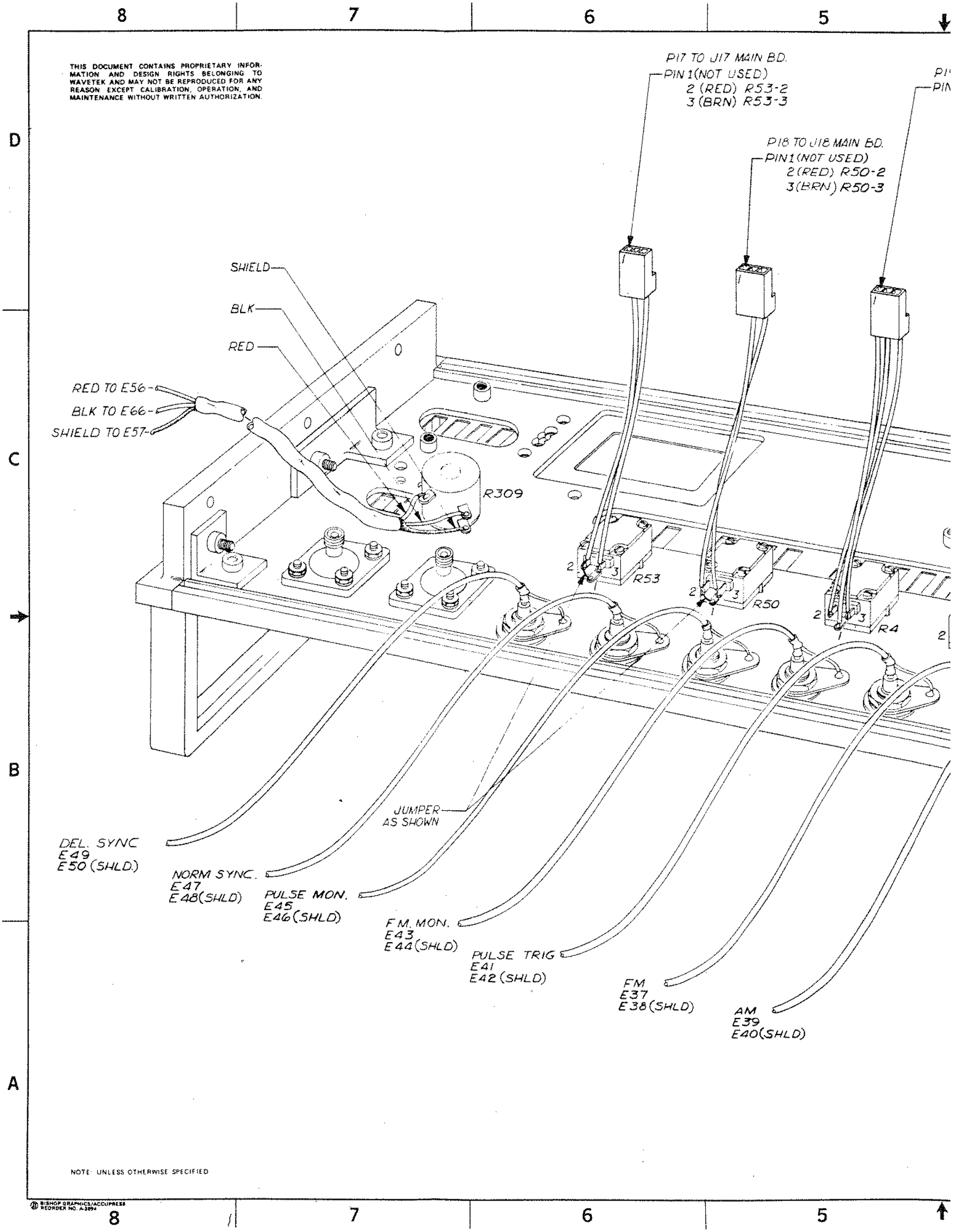

NOTE: UNLESS OTHERWISE SPECIFIED

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NOTE: UNLESS OTHERWISE SPECIFIED

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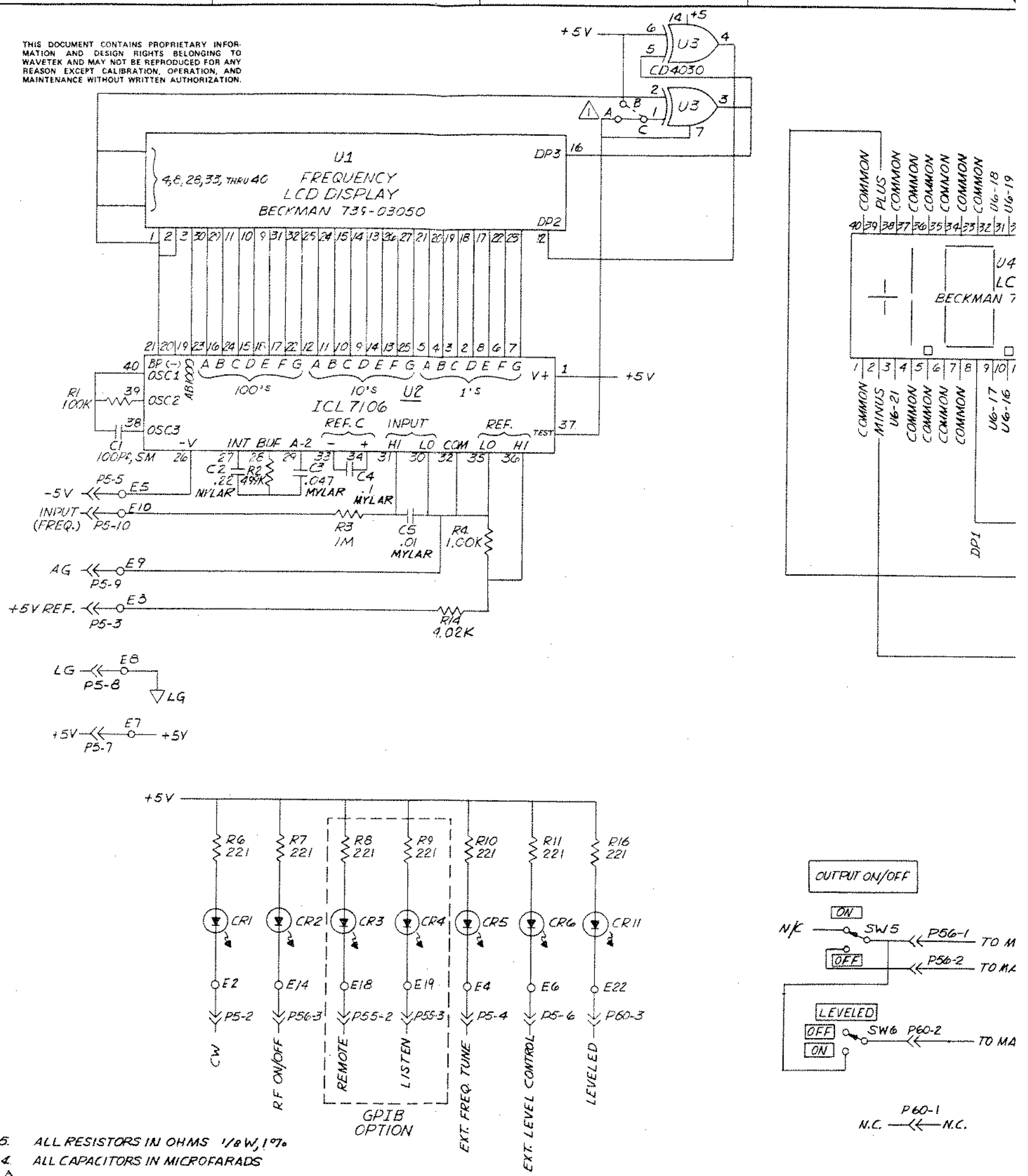

5. ALL RESISTORS IN OHMS 1/8 W, 1%

4. ALL CAPACITORS IN MICROFARADS

△3 INSTALL JUMPER FROM E20 TO E21 FOR MODEL 910 ONLY.

△2 SET REF. SWITCH S4 IS MOMENTARY ON. SW1 - SW3 ARE MUTUALLY EXCLUSIVE INTERLOCKING.

△1 WIRE JUMPER A TO C FOR XX.XX TYPE DISPLAYS. (MODEL 907, 907A, 910

NOTE UNLESS OTHERWISE SPECIFIED

R16, C10, CR11, SW6, E22, U7

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D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.
NONE	ASSY DRWG, DISPLAY	0101-00-0859	WVTK	0101-00-0859
NONE	SCHEMATIC, DISPLAY BD	0103-00-0734	WVTK	0103-00-0734
NONE	COMPUTER BD	907A-0795	WVTK	1208-00-0795
1	SPACER	1400-01-1153	WVTK	1400-01-1153
C6 C7 C9	CAP, CER, MN, .01MF, 50V	CAC02Z5U103Z100A	CORNG	1500-01-0310
C1	CAP, MICA, 100PF, 500V	DM15-101J	ARCO	1500-11-0100
C8	CAP, MICA, 68PF, 500V	DM15-680J	ARCO	1500-16-8000
C10	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE SERIES 100/16	CAPAR	1500-31-0111
C5	CAP, MYLAR, .01MF, 100V	225P10391WD3	SPRAG	1500-41-0314
C4	CAP, MYLAR, .1MF, 100V	225P10491WD3	SPRAG	1500-41-0444
C2	CAP, MYLR, .22MF, 50V	601PE	TRW	1500-42-2413
C3	CAP, MYLAR, .047MF100V	225P47391WD3	SPRAG	1500-44-7314
2	DISPLAY BD	1700-00-0734	WVTK	1700-00-0734
P5	HOUSING	1-640433-0	AMP	2100-02-0080
P2 P56 P60	HEADER, CONN 3 PIN	640440-3	AMP	2100-02-0117
NONE	CONN	CA-S36SP-100-9001230	CA	2100-05-0052
3	DISPLAY, LIQUID CRYS	739A-3-5	BECK	2400-03-0006

WAVETEK PARTS LIST — TITLE: PCA, DISPLAY BD — ASSEMBLY NO. 1100-00-0859 — PAGE: 1

C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.
4	HOLDER, LIQUID CRYSTL	09-19102	TECNT	2400-03-0007
7	STANDOFF, SWAGE .625 H, .250 HEX 6-32, .093 MAT'L	B1531-C-5/8-11	USECO	2800-05-0002
R4	RES, MF, 1/8W, 1%, 1K	RN55D-1001F	TRW	4701-03-1001
R1	RES, MF, 1/8W, 1%, 100K	RN55D-1003F	TRW	4701-03-1003
R3	RES, MF, 1/8W, 1%, 1M	RN55D-1004F	TRW	4701-03-1004
R10 R11 R13 R16 R6 R7	RES, MF, 1/8W, 1%, 221	RN55D-2210F	TRW	4701-03-2210
R12	RES, MF, 1/8W, 1%, 301K	RN55D-3013F	TRW	4701-03-3013
R14	RES, MF, 1/8W, 1%, 4.02K	RN55D-4021F	TRW	4701-03-4021
R2	RES, MF, 1/8W, 1%, 499K	RN55D-4993F	TRW	4701-03-4993
CR1 CR10 CR11 CR2 CR5 CR6 CR7 CR8 CR9	LED	TIL209A	TI	4899-00-0005
Q1	TRANS	SD219DE	SIG	4902-00-2140
6	SWITCH	5103-00-0028	WVTK	5103-00-0028
5	SWITCH ASSY PB	5103-00-0031	WVTK	5103-00-0031
NONE	BUTTON	J-52305-BLACK	CRL	5103-04-0003
U3 U5	IC	CD4030AE	RCA	8000-40-3001
U2	IC	ICL7106CPL	INTSL	8000-71-0600

B

WAVETEK PARTS LIST — TITLE: PCA, DISPLAY BD — ASSEMBLY NO. 1100-00-0859 — PAGE: 2

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NOTE: UNLESS OTHERWISE SPECIFIED

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORI
NONE	ASSY DRWG, DISPLAY	010
NONE	SCHEMATIC, DISPLAY BD	010
NONE	COMPUTER BD	907
1	SPACER	140
C6 C7 C9	CAP, CER, MN, .01MF, 50V	CAC
C1	CAP, MICA, 100PF, 500V	DM1
C8	CAP, MICA, 68PF, 500V	DM1
C10	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE
C5	CAP, MYLAR, .01MF, 100V	225
C4	CAP, MYLAR, .1MF, 100V	225
C2	CAP, MYLR, .22MF, 50V	601
C3	CAP, MYLAR, .047MF100V	225
2	DISPLAY BD	170
P5	HOUSING	1-6
P2 P56 P60	HEADER, CONN 3 PIN	640
NONE	CONN	CA-
3	DISPLAY, LIQUID CRYS	739

WAVETEK PARTS LIST

TITLE PCA, DISPLAY BD

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NOTE UNLESS OTHERWISE SPECIFIED

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A3894

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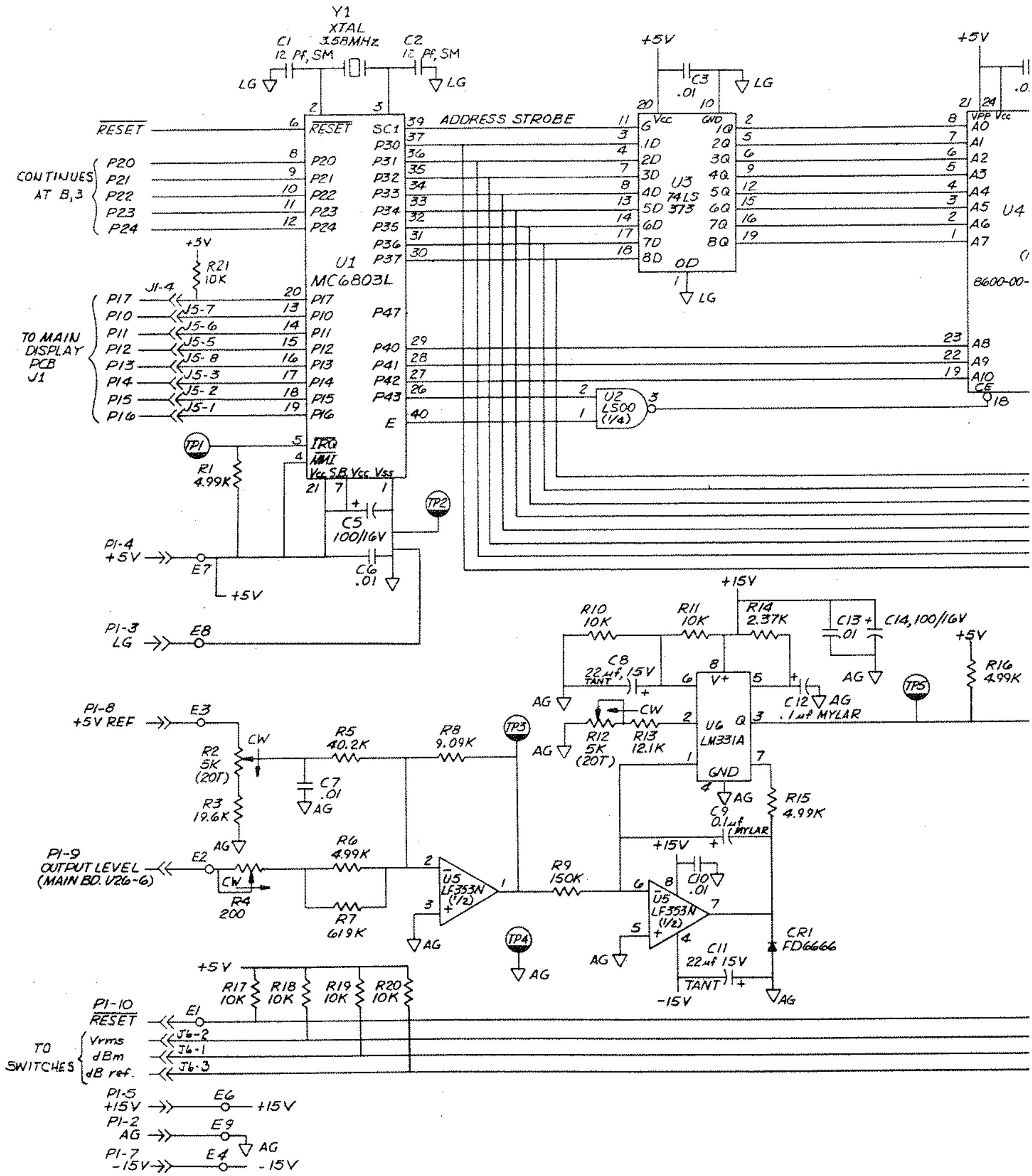

3. ALL CAPACITORS IN MICROFARADS
2. ALL RESISTORS IN OHMS: 1/8W, 1%
⚠1 WIRE JUMPER No. 2 FROM "B" TO "C" WHEN USING MC6801F (WITHOUT U3 AND U4)

NOTE: UNLESS OTHERWISE SPECIFIED

TP5, R21, C16
E5, E10 } NOT USED

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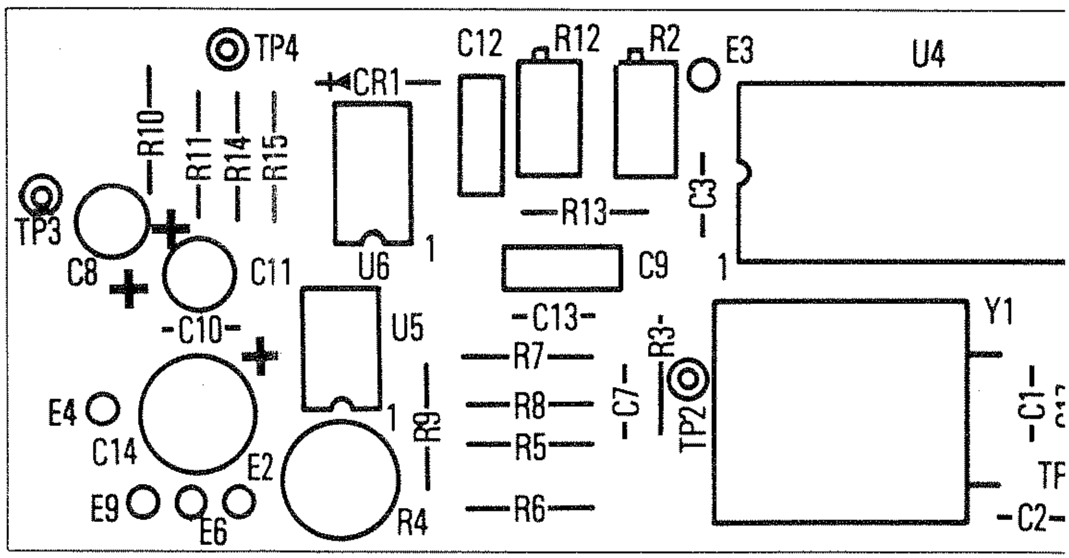

PART NO. 1208-00-0795

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG
NONE	ASSY DRWG, COMPUTER	0101
NONE	SCHEMATIC, COMPUTER	0103
C10 C13 C16 C3 C4 C6 C7	CAP, CER, MN, .01MF, 50V	CACO
C1 C2	CAP, MICA, 12PF, 500V	DM15
C14 C5	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE
C12 C9	CAP, MYLAR, .1MF, 100V	225P
C11 C8	CAP, TANT, 22MF, 15V	196D
NONE	COMPUTER BD	1700
P1	HOUSING	1-64
J5	CONN PC.	22-1
J6	CONN HEADER 3 PIN	6404
J7	SKT, IC, 24PIN	DILB
J8	SKT, IC, 40PIN	DILB
NONE	PIN, MALE	6118
Y1	CRYSTAL, 3.579545 MHZ	1107
NONE	SPACER, SWAGE .625 H, .250 DIA	8157

WAVETEK PARTS LIST

TITLE COMPUTER BD

C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG
	.150 DIA THRU, .09MTL	
R4	POT, TRIM, 200	91AR
R12 R2	POT, 20T, TRIM, 5K	68XR
R10 R11 R17 R18 R19 R20 R21	RES, MF, 1/8W, 1%, 10K	RN55
R13	RES, MF, 1/8W, 1%, 12.1K	RN55
R9	RES, MF, 1/8W, 1%, 150K	RN55
R3	RES, MF, 1/8W, 1%, 19.6K	RN55
R14	RES, MF, 1/8W, 1%, 2.37K	RN55
R5	RES, MF, 1/8W, 1%, 40.2K	RN55
R1 R15 R16 R6	RES, MF, 1/8W, 1%, 4.99K	RN55
R8	RES, MF, 1/8W, 1%, 9.09K	RN55
R7	RES, MF, 1/4W, 1%, 619K	RN60
CR1	DIODE	1N41
U6	IC	LM33
U5	IC	LF35
U1	IC	MC68
U2	IC	74LS

B

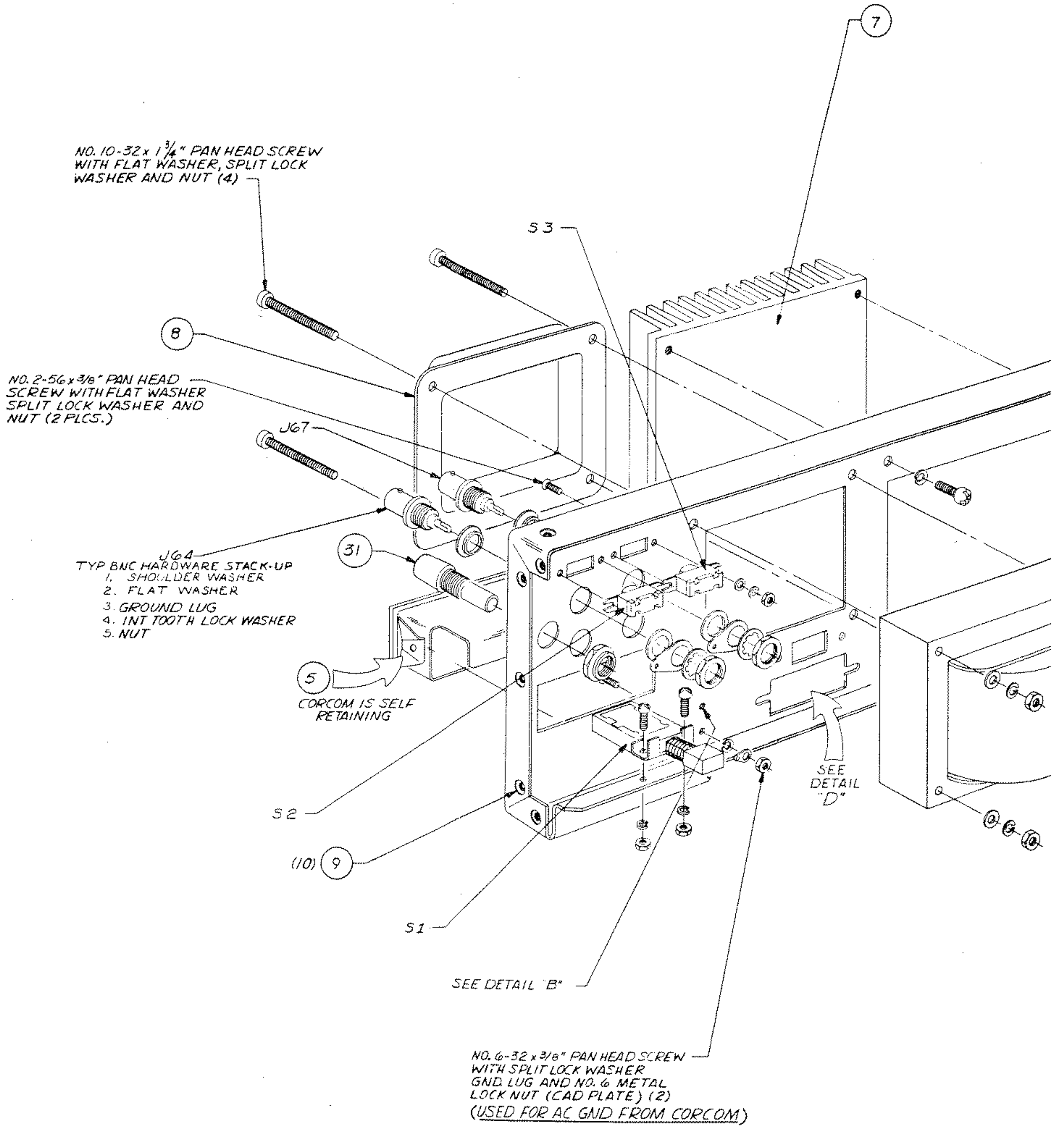
WAVETEK PARTS LIST

TITLE COMPUTER BD

A

NOTE: UNLESS OTHERWISE SPECIFIED

8 7 6 5



1. FOR SECTION VIEW "A"-"A" SEE SHT 3 OF 3

NOTE UNLESS OTHERWISE SPECIFIED

P1 CONNECTOR

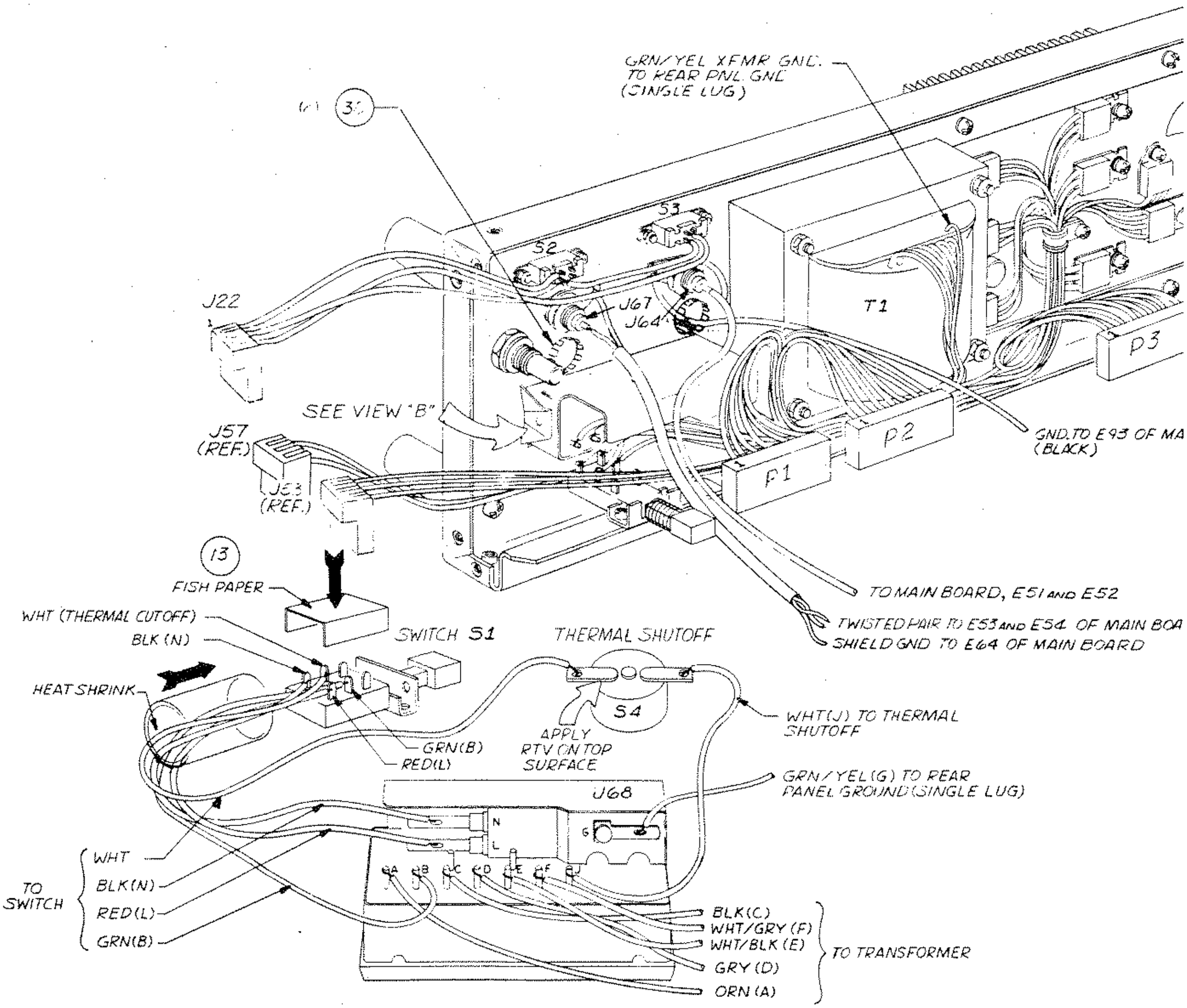
PIN *	FUNCTION
1	7815 PIN 1
2	7815 PIN 2
3	7815 PIN 3
4	XFORMER * 4 (RED)
5	XFORMER * 5 (RED/WHT)
6	XFORMER * 6 (RED)
7	7915 PIN 2
8	7915 PIN 3
9	7915 PIN 1
10	NOT USED

P2 CONNECTOR

PIN *	FUNCTION
1	7805 PIN 1
2	7805 PIN 2
3	7805 PIN 3
4	XFORMER * 14 (BLUE)
5	N.C.
6	XFORMER * 16 (BLUE)
7	7905 PIN 2
8	7905 PIN 3
9	7905 PIN 1
10	NOT USED

P3 CONNECTOR

PIN *	FUNCTION
1	LM317 PIN 2
2	LM317 PIN 3
3	LM317 PIN 1
4	XFORMER * 24 (YEL)
5	XFORMER * 25 (YEL)
6	LM337T PIN 1
7	LM337T PIN 3
8	LM337T PIN 2
9	XFORMER * 29 (WHT)
10	XFORMER * 30 (WHT)



VIEW "B"
CORCOM WIRING
AND
POWER SWITCH WIRING

3. W1, POWER CORD, NOT SHOWN
2. ALL WIRES TO BE SLEEVED
1. ALL CONNECTORS TO BE MECHANICALLY SECURED TO REAR PANEL PRIOR TO SOLDERING GROUND WIRES TO LUGS

NOTE: UNLESS OTHERWISE SPECIFIED

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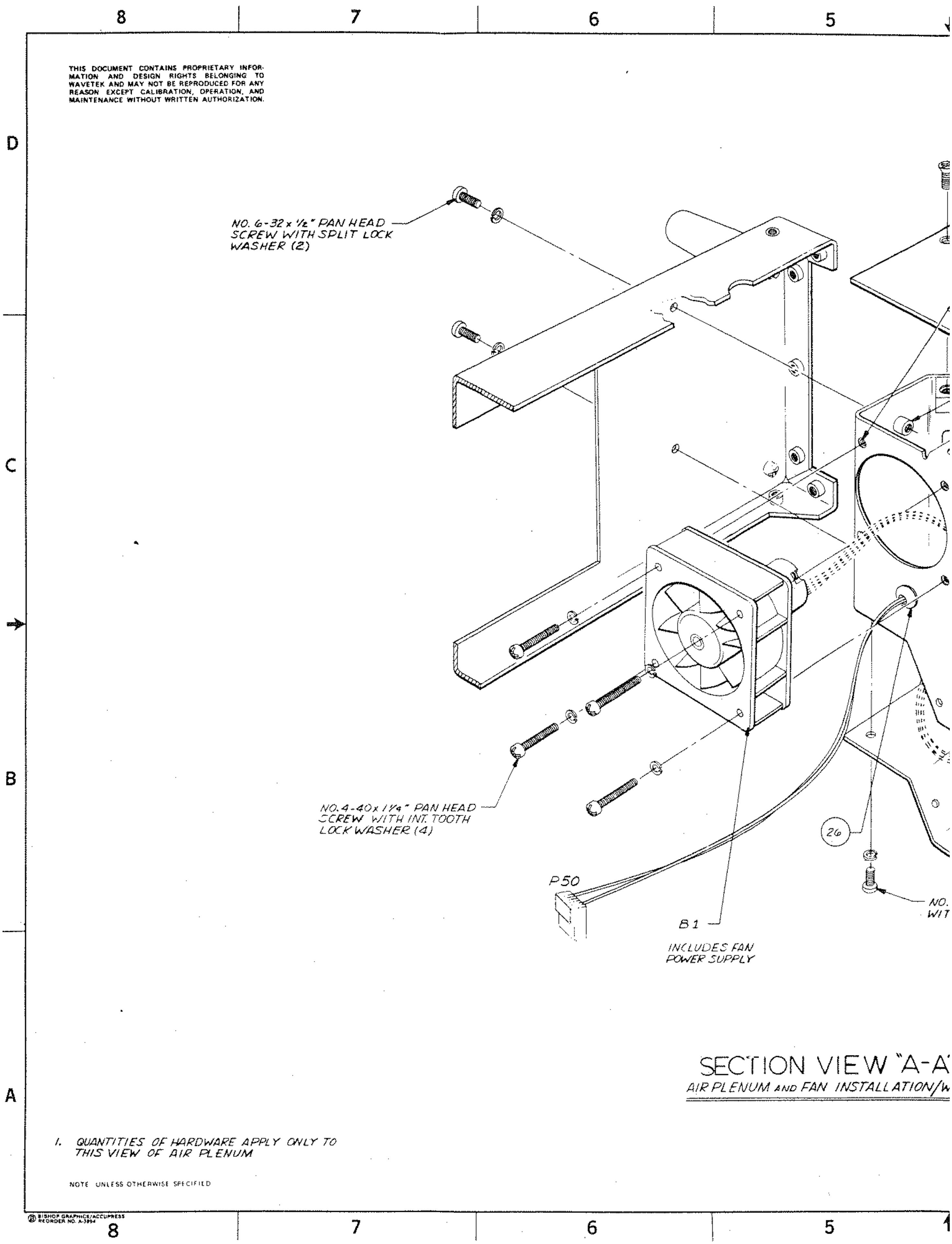

SECTION VIEW "A-A"

AIR PLENUM AND FAN INSTALLATION/W

1. QUANTITIES OF HARDWARE APPLY ONLY TO THIS VIEW OF AIR PLENUM

NOTE UNLESS OTHERWISE SPECIFIED

8 7 6 5

D

C

B

A

REFERENCE DESIGNATORS	PART DESCRIPTION
NONE	ASSY DRWG, REAR PAN
T1	TRANSFORMER
13	INSULATOR, PWR SWIT REF: 1600-99-0001
7	HEATSINK REF: 3200-06-0011
8	END BELL, CHROME
23	AIR PLENUM
33	TOP COVER, AIR PLE
34	BOTTOM COVER AIR PLENUM
1	REAR PANEL
NONE	COVER PLATE
C11 C18 C23 C29 C5 C6	CAP, CER, MON, .1MF,
J64 J67	BNC CONN
14	BINDING POST
P1 P2 P3	HOUSING
P22 P50 P53 P57	HEADER, CONN 3 PIN
J68	RECEPTACLE

WAVETEK
PARTS LIST

TITLE
ASSY, REAR PANEL

NOTE: UNLESS OTHERWISE SPECIFIED

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A-3894

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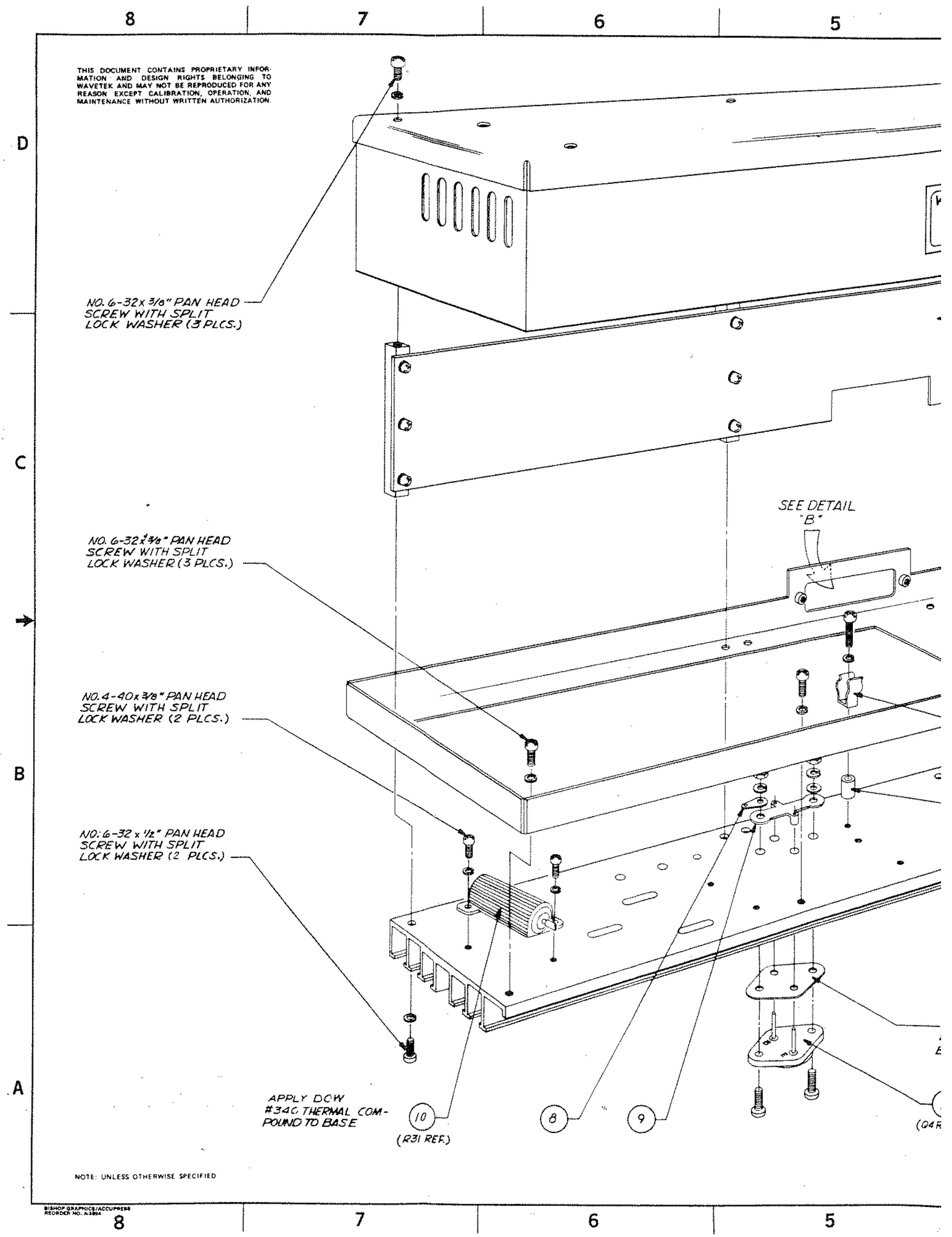
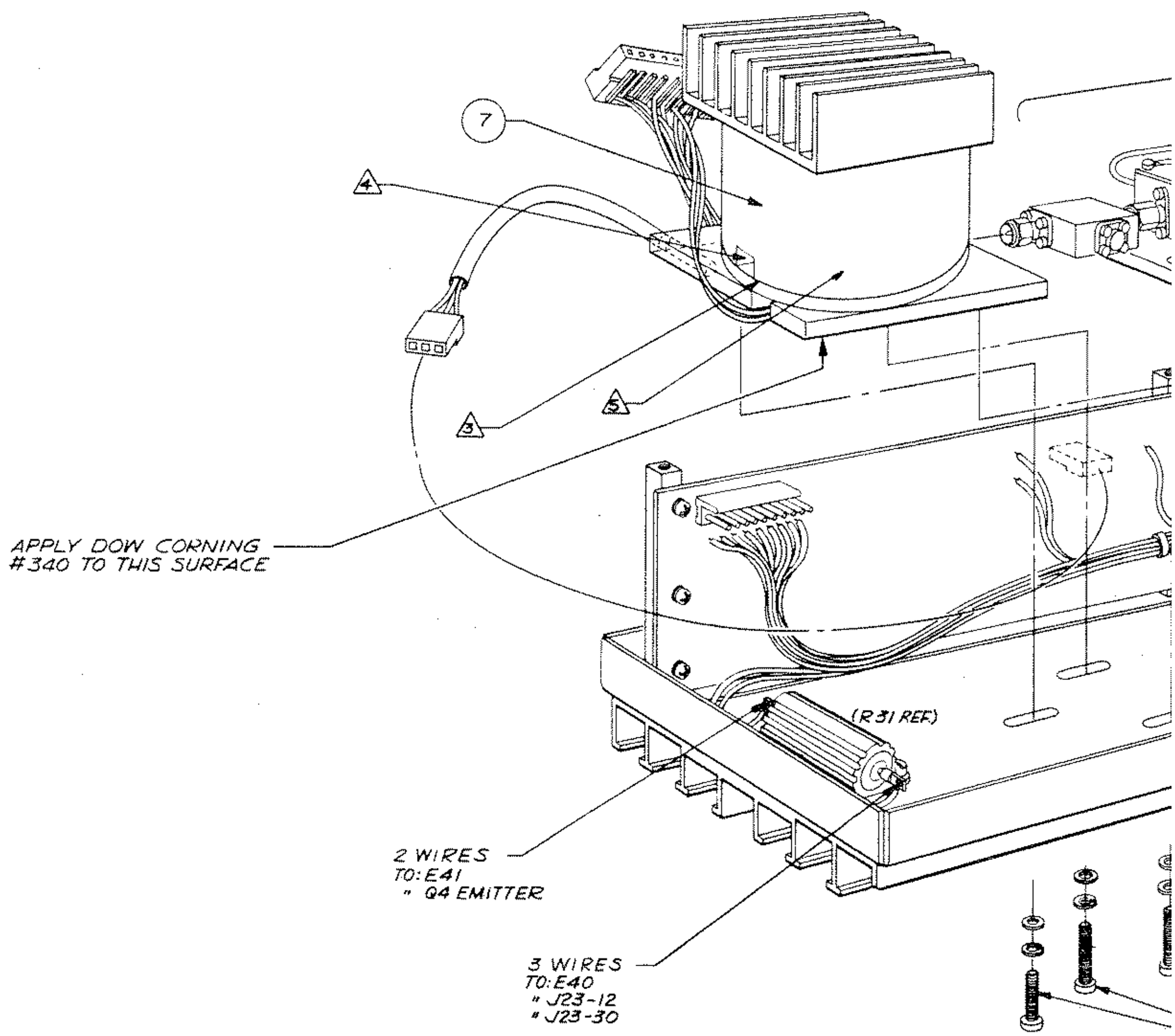


NOTE: UNLESS OTHERWISE SPECIFIED

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3894

8	7	6	5

D



C

B

A

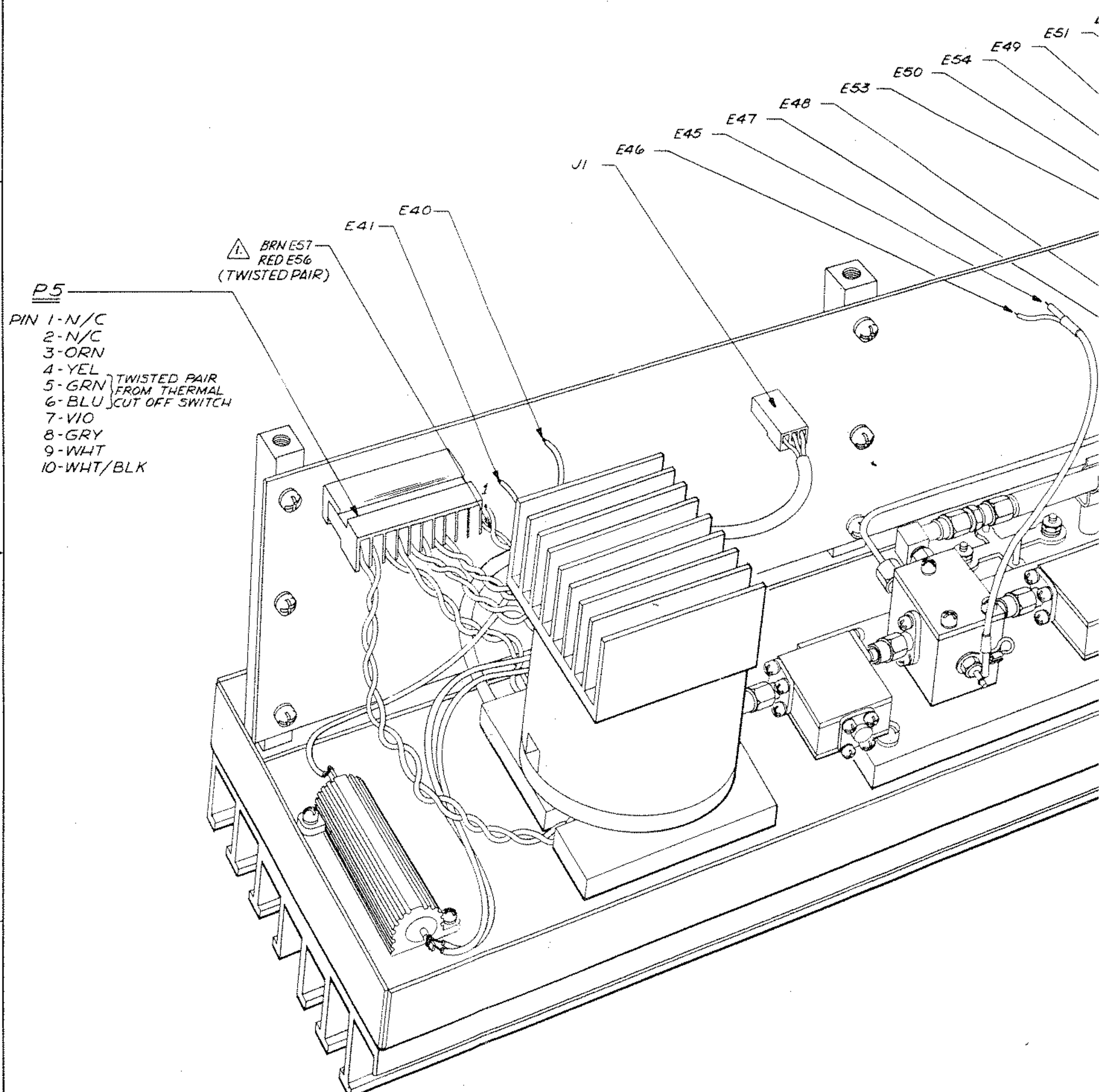
3 SEAL SEAMS AND AROUND RF CONNECTOR WITH CHOMERICS 4900 SILVER PAINT

4 SEAL OPENING WITH ECCO SOLDER 59C

5 SPRAY OSCILLATOR HOUSING WITH HUMISEAL

NOTE: UNLESS OTHERWISE SPECIFIED

8	7	6	5



2 POLARITY OF THE FM COIL, PINS 3 & 4 MAY BE REVERSED AS PER SPEC SHEET.

1 POLARITY OF YIG COIL, PINS 1 & 2 OF OSCILLATOR MAY BE REVERSED AS PER OSCILLATOR SPEC. SHEET.

NOTE: UNLESS OTHERWISE SPECIFIED

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C

B

A

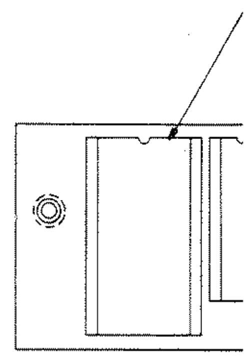
NOTE: UNLESS OTHERWISE SPECIFIED

8 7 6 5

8 7 6 5

D

C



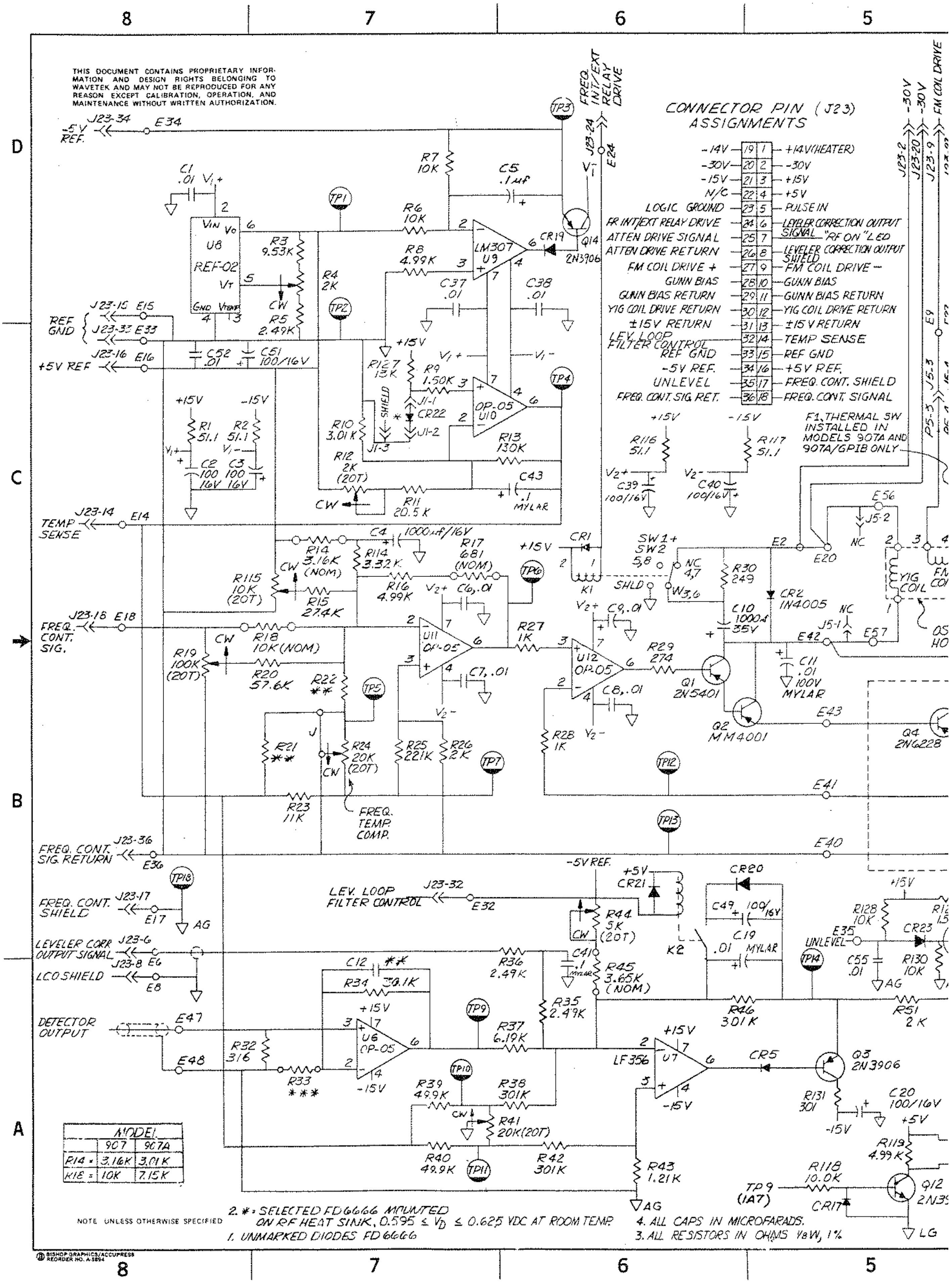
B

A

1. THIS PROM BD. IS TO BE USED ONLY FOR THE TEMPORARY STORAGE (SHIPPING, REPAIR, ETC) OF COMPONENTS WHICH ARE INSTALLED ON THE MAIN PCB OF THE MODEL 907 DURING NORMAL OPERATION.

NOTE: UNLESS OTHERWISE SPECIFIED

8 7 6 5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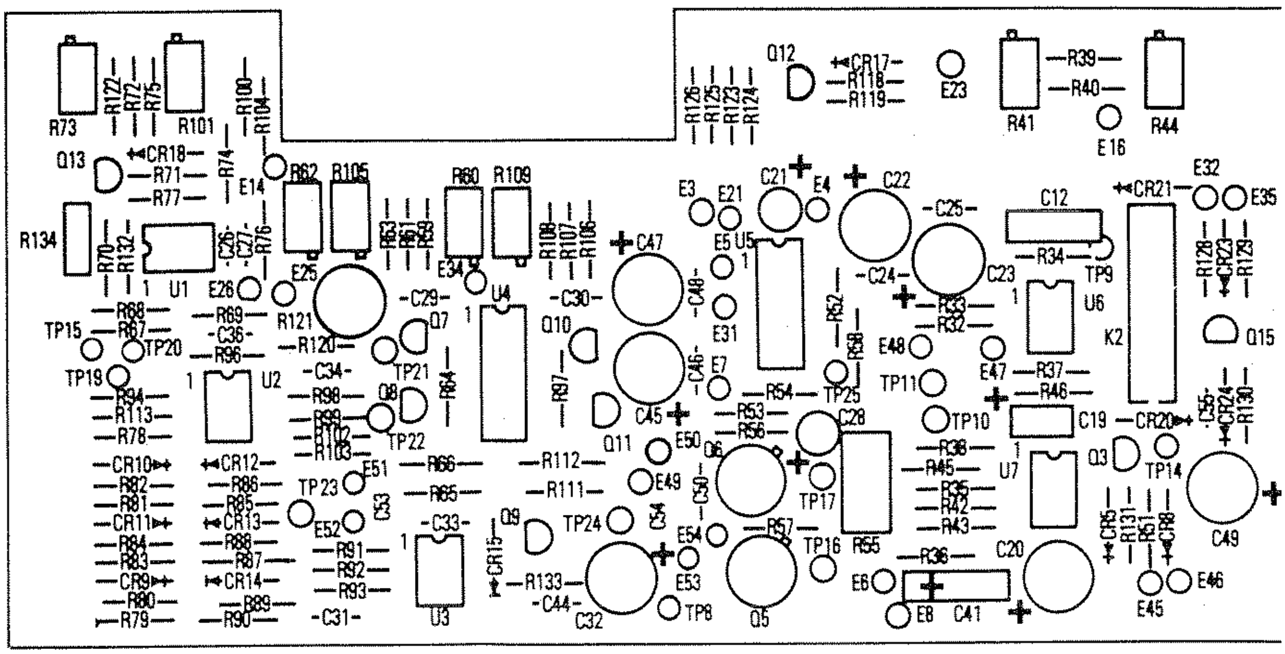
CONNECTOR PIN (J23) ASSIGNMENTS
-14V 19 1 +14V(HEATER)
-30V 20 2 -30V
-15V 21 3 +15V
N/C 22 4 +5V
LOGIC GROUND 23 5 PULSE IN
FR INT/EXT RELAY DRIVE 24 6 LEVELER CORRECTION OUTPUT SIGNAL "RF ON" LED
ATTEN DRIVE SIGNAL 25 7
ATTEN DRIVE RETURN 26 8 LEVELER CORRECTION OUTPUT SHIELD
FM COIL DRIVE + 27 9 FM COIL DRIVE −
GUNN BIAS 28 10 GUNN BIAS
GUNN BIAS RETURN 29 11 GUNN BIAS RETURN
YIG COIL DRIVE RETURN 30 12 YIG COIL DRIVE RETURN
±15V RETURN 31 13 ±15V RETURN
LEV. LOOP FILTER CONTROL 32 14 TEMP SENSE
REF GND 33 15 REF GND
-5V REF. 34 16 +5V REF.
UNLEVEL 35 17 FREQ. CONT. SHIELD
FREQ. CONT. SIG RET. 36 18 FREQ. CONT. SIGNAL
F1, THERMAL SW INSTALLED IN MODELS 907A AND 907A/GPIB ONLY
FREQ. INT/EXT RELAY DRIVE
-5V REF.
REF GND
+5V REF
TEMP SENSE
FREQ. CONT. SIG.
FREQ. CONT. SIG RETURN
FREQ. CONT. SHIELD
LEV. LOOP FILTER CONTROL
LEVELER CORR OUTPUT SIGNAL
LCO SHIELD
DETECTOR OUTPUT
FREQ. TEMP. COMP.
U8 REF-02
U9 LM307
U10 OP-05
U11 OP-05
U12 OP-05
U6 OP-05
U7 LF356
Q14 2N3906
Q1 2N5401
Q2 MM4001
Q4 2N6228
Q3 2N3906
Q12 2N3…
CR2 1N4005
YIG COIL
MODEL
907 | 907A
R14 = 3.16K | 3.01K
R18 = 10K | 7.15K
NOTE: UNLESS OTHERWISE SPECIFIED
1. UNMARKED DIODES FD6666
2. * = SELECTED FD6666 MOUNTED ON RF HEAT SINK, 0.595 ≤ V_D ≤ 0.625 VDC AT ROOM TEMP.
3. ALL RESISTORS IN OHMS 1/8W, 1%
4. ALL CAPS IN MICROFARADS.
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3894


R73
R122
R72
R75
R101
R100
R104
Q13
CR18
R71
R77
R74
E14
R62
R105
R60
R109
R126
R125
R123
R124
Q12
CR17
R118
R119
E23
R41
R39
R40
R44
E16
R134
R70
R132
U1
C26
C27
R76
E26
E25
R121
R63
R61
R59
E34
R108
R107
R106
C29
C30
U4
Q7
Q10
E3
E21
C21
E4
C22
C25
C12
CR21
E32
E35
C47
E5
U5
C48
E31
R52
C24
C23
R34
TP9
R128
CR23
R129
R33
R32
U6
K2
Q15
R68
R67
R69
C36
R96
R120
TP15
TP20
TP19
U2
C34
TP21
R64
R97
C46
E7
C45
Q11
R58
E48
TP11
E47
R37
R46
R94
R113
R78
R98
R99
R102
R103
Q8
TP22
R54
TP25
R53
R56
C28
TP10
C19
CR20
C55
CR24
R130
CR10
CR12
R82
R86
R81
R85
CR11
CR13
R84
R88
R83
R87
CR9
CR14
R80
R89
R79
R90
E51
TP 23
E52
C53
R66
R65
R112
R111
E50
E49
Q6
C50
TP17
R38
R45
R35
R42
R43
U7
Q3
TP14
C33
R91
R92
R93
C31
U3
Q9
CR15
R133
C44
C32
TP24
C54
E54
E53
TP8
R57
Q5
TP16
R55
R36
E6
E8
C41
C20
CR5
R131
R51
CR8
E45
E46
C49

8 7 6 5

D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, RF DRIVE	0101-00-0732	WVTK	0101-00-0732	1
NONE	SCHEMATIC, RF DRIVE	0103-00-0732	WVTK	0103-00-0732	1
NONE	SUPPORT BAR	1400-01-1133	WVTK	1400-01-1133	3
C50	CAP, CER, 10PF, 1KV	DD-100	CRL	1500-01-0011	1
C1 C24 C25 C26 C27 C29 C30 C31 C33 C34 C36 C37 C38 C44 C46 C48 C52 C55 C6 C7 C8 C9	CAP, CER, MN, .01MF, 50V	CAC02Z5U103Z100A	CORNG	1500-01-0310	22
C53 C54	CAP, MICA, 100PF, 500V	DM15-101J	ARCO	1500-11-0100	2
C2 C20 C22 C23 C3 C32 C39 C40 C45 C47 C49 C51	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE SERIES 100/16	CAPAR	1500-31-0111	12
C10	CAP, ELECT, 1000MF/35V RADIAL LEAD, SP .30	CRE-SERIES-1000/35	CAPAR	1500-31-0202	1
C4	CAP, ELECT, 1000MF/16V RADIAL LEAD, SP .20	CRE SERIES 1000/16	CAPAR	1500-31-0211	1
C11 C19	CAP, MYLAR, .01MF, 100V	225P10391WD3	SPRAG	1500-41-0314	2
C41 C43 C5	CAP, MYLAR, .1MF, 100V	225P10491WD3	SPRAG	1500-41-0444	3
C21 C28	CAP, TANT, 22MF, 15V	196D226X9015KA1	SPRAG	1500-72-2601	2
NONE	RF DRIVE	1700-00-0732	WVTK	1700-00-0732	1
J23	CONN	57-40360	AMPH	2100-02-0040	1

WAVETEK PARTS LIST — TITLE PCA, RF DRIVE — ASSEMBLY NO. 1208-00-0732 — PAGE: 1 — REV

REFERENCE DESIGNATORS	PART DESCRIPTION
R106 R118 R128 R130 R18T R6 R63 R67 R7 R70 R77 R84 R91 R92 R96 R98	RES, MF, 1/8W, 1%, 10K
R120	RES, MF, 1/8W, 1%, 1M
R64 R97	RES, MF, 1/8W, 1%, 10.
R23	RES, MF, 1/8W, 1%, 11K
R71 R74	RES, MF, 1/8W, 1%, 110
R81	RES, MF, 1/8W, 1%, 11.
R78	RES, MF, 1/8W, 1%, 11.
R43 R58	RES, MF, 1/8W, 1%, 1.2
R127	RES, MF, 1/8W, 1%, 13K
R13	RES, MF, 1/8W, 1%, 130
R33T	RES, MF, 1/8W, 1%, 150
R129 R9	RES, MF, 1/8W, 1%, 1.5
R122	RES, MF, 1/8W, 1%, 15K
R108 R59	RES, MF, 1/8W, 1%, 150
R123 R124	RES, MF, 1/8W, 1%, 16.
R57	RES, MF, 1/8W, 1%, 1.7

WAVETEK PARTS LIST — TITLE PCA, RF DRIVE

C

B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
J5	HEADER	1-640386-0	AMP	2100-02-0079	1
J1	CONN HEADER 3 PIN	640456-3	AMP	2100-02-0116	1
NONE	TERM	200081	USECO	2100-05-0009	20
NONE	PIN, MALE	61182-2	AMP	2100-05-0020	25
NONE	TRANSIPAD	10160	METRS	2800-11-0004	4
K2	RELAY, REED, FORM-A	RA3019-1051	ETROL	4500-00-0007	1
K1	RELAY	NF2E-12V	AROMT	4500-00-0015	1
R121	POT, TRIM, 100K	91AR100K	BECK	4600-01-0402	1
R4	POT, TRIM, 2K	91AR2K	BECK	4600-02-0201	1
R115	POT, TRIM, 20T, 10K	68WR10K	BECK	4609-90-0002	1
R44	POT, 20T, TRIM, 5K	68XR5K	BECK	4609-90-0008	1
R109 R60	POT, 20T, TRIM, 10K	68XR10K	BECK	4609-90-0009	2
R105 R12 R62	POT, 20T, TRIM, 2K	68XR2K	BECK	4609-90-0010	3
R101 R24 R41 R73	POT, 20T, TRIM, 20K	68XR20K	BECK	4609-90-0011	4
R19	POT, 20T, TRIM, 100K	68XR100K	BECK	4609-90-0012	1
R133	RES, MF, 1/8W, 1%, 100	RN55D-1000F	TRW	4701-03-1000	1
R27 R28	RES, MF, 1/8W, 1%, 1K	RN55D-1001F	TRW	4701-03-1001	2

WAVETEK PARTS LIST — TITLE PCA, RF DRIVE — ASSEMBLY NO. 1208-00-0732 — PAGE: 2 — REV

REFERENCE DESIGNATORS	PART DESCRIPTION
R132 R54	RES, MF, 1/8W, 1%, 20(
R100 R104 R26 R51 R72 R75	RES, MF, 1/8W, 1%, 2K
R11	RES, MF, 1/8W, 1%, 20.
R25	RES, MF, 1/8W, 1%, 22
R30	RES, MF, 1/8W, 1%, 24
R35 R36 R5	RES, MF, 1/8W, 1%, 2.
R80	RES, MF, 1/8W, 249K
R29	RES, MF, 1/8W, 1%, 27
R15 R79	RES, MF, 1/8W, 1%, 27.
R131	RES, MF, 1/8W, 1%, 30.
R10 R125 R126	RES, MF, 1/8W, 1%, 3.
R34	RES, MF, 1/8W, 1%, 30.
R107 R38 R42 R46 R61	RES, MF, 1/8W, 1%, 30
R32	RES, MF, 1/8W, 1%, 31
R14T	RES, MF, 1/8W, 1%, 3.
R85	RES, MF, 1/8W, 1%, 3.
R56	RES, MF, 1/8W, 1%, 33

WAVETEK PARTS LIST — TITLE PCA, RF DRIVE

A

NOTE: UNLESS OTHERWISE SPECIFIED

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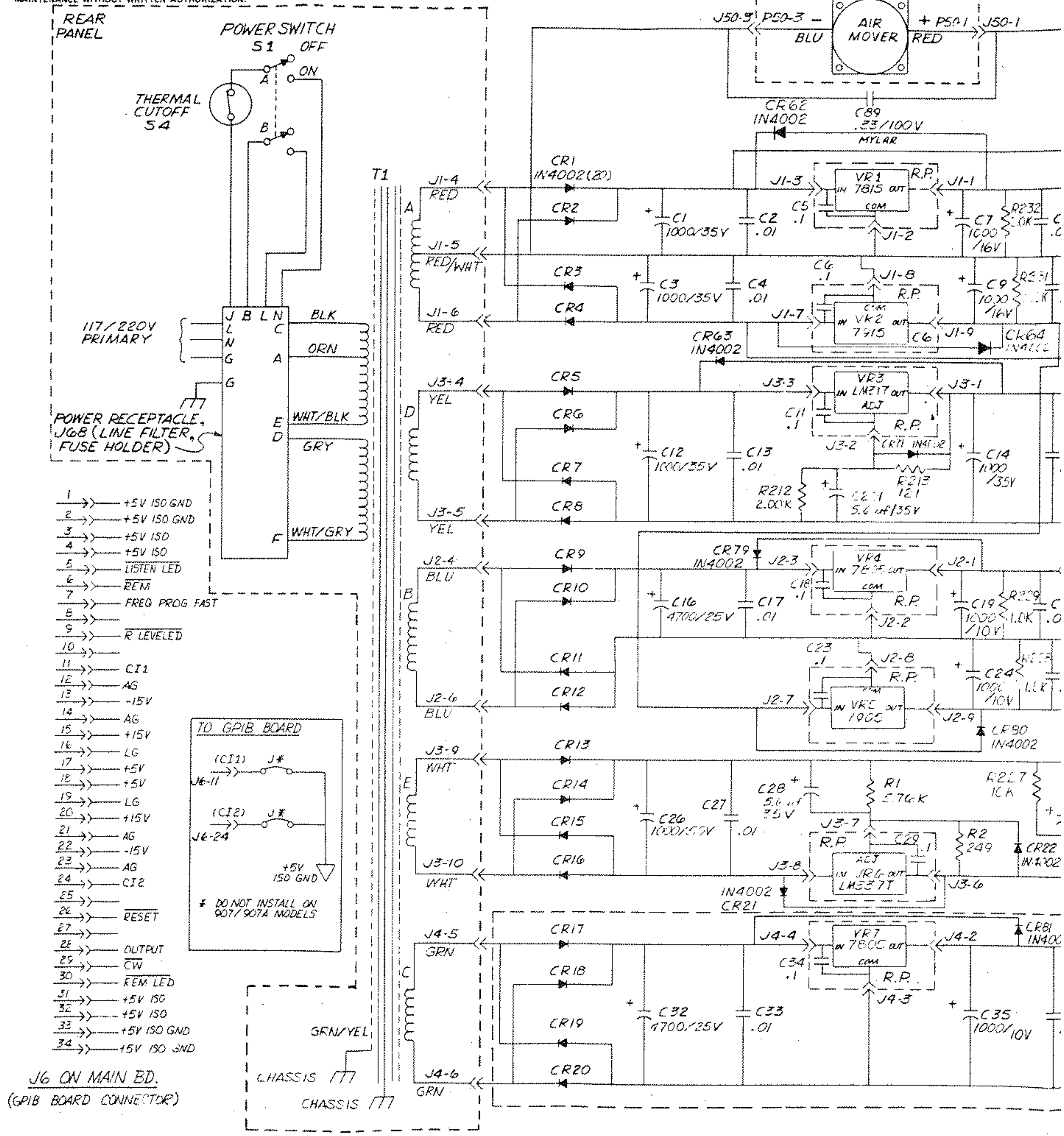

6. R.P. = REAR PANEL
5. F58, F59, F60 = CAMBION JUMPERS
4. ALL RESISTORS IN OHMS; 1/8W, 1%
3. ALL CAPACITORS IN MICROFARADS
2. ALL DIODES ARE FD6666
1. ALL IC REGULATORS MOUNTED ON HEATSINK ON THE REAR PANEL

NOTE: UNLESS OTHERWISE SPECIFIED

13. *** = NOMINAL VALUE CALLED OUT ON PARTS LIST.

LAST REF. DES. USE

R291	C214	CR81	TP
VR7	Q22	U66	SW
E100	K11	T3	J

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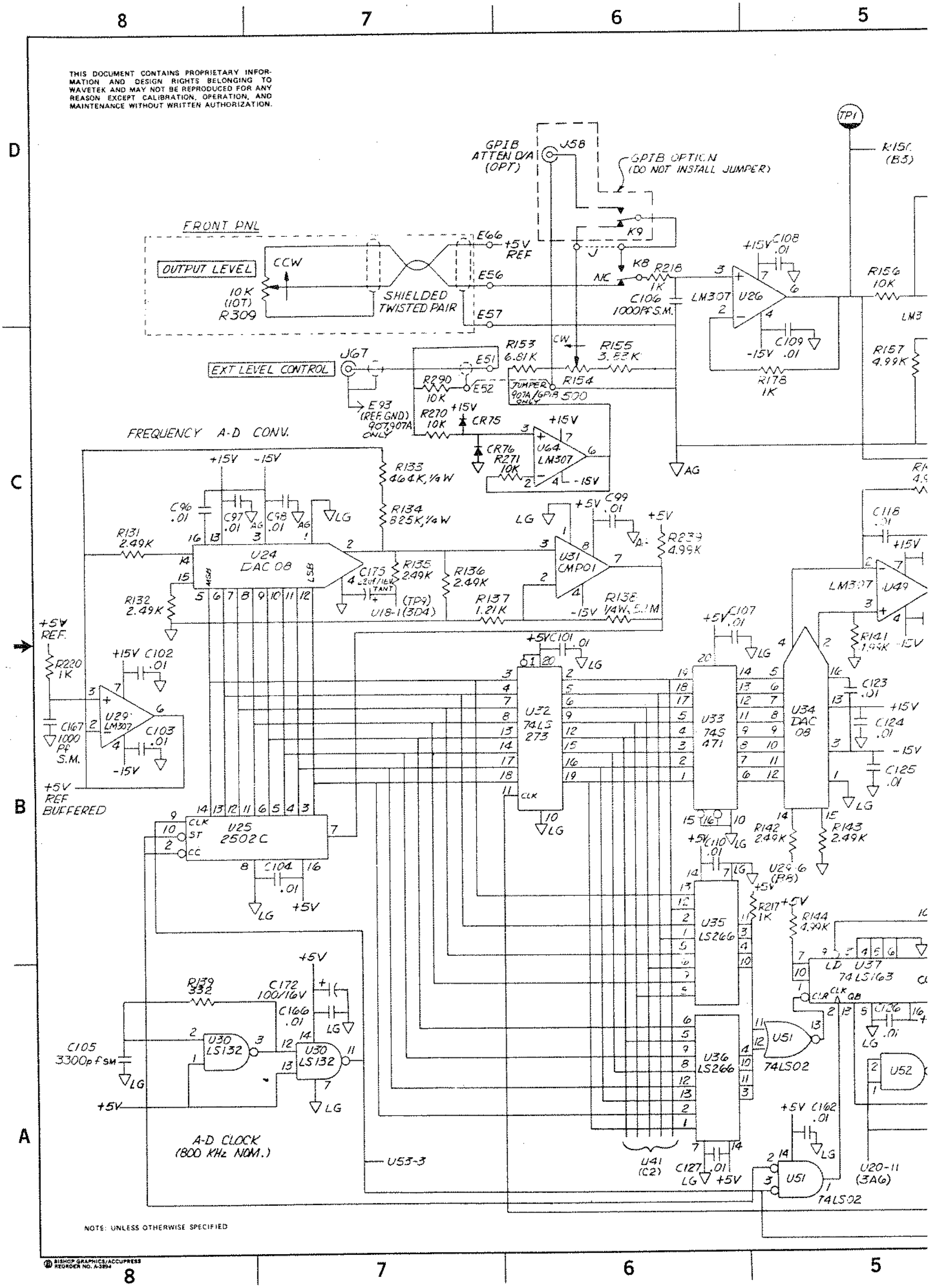

NOTE: UNLESS OTHERWISE SPECIFIED