

INSTRUCTION MANUAL

FS-30 FM STEREO GENERATOR

September, 1986

IM No. 597-0009

BROADCAST ELECTRONICS, INC.



IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

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REPLACEMENT PARTS

Replacement and Warranty Parts may be ordered from the address below. Be sure to include equipment model and serial number and part description and part number.

Broadcast Electronics, Inc.
4100 N. 24th St., P.O. Box 3606
Quincy, Illinois 62305
Tel: (217) 224-9600
Telex: 25-0142
Cable: BROADCAST

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MODIFICATIONS

Broadcast Electronics, Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.



BROADCAST ELECTRONICS INC.

PUBLICATION CHANGE NOTICE

EQUIPMENT STEREO GENERATOR MODEL(S) FS-30 SERIAL N/A

PUBLICATION NUMBER 597-0009 BASIC ISSUE/REVISION SEPTEMBER, 1986

INSTRUCTIONS: Make the changes noted below as listed.

Replacement pages will be attached to this change notice as required.

This change notice should be retained with the publication.

<u>CHANGE NO.</u>	<u>DATE</u>	<u>DESCRIPTION</u>
1	MAY 15, 1989	

The Broadcast Electronics FS-30 FM Stereo Generator has been re-styled for operation with the Broadcast Electronics B-Series line of FM transmitters. The FS-30 electrical, performance, and operating characteristics have not changed. The unit has been assigned the following new top-level part numbers:

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
909-0050-204	FS-30 FM SCA Generator, 97V to 113V ac 50/60 Hz Operation.
909-0050-304	FS-30 FM SCA Generator, 194V to 266V ac 50/60 Hz Operation.

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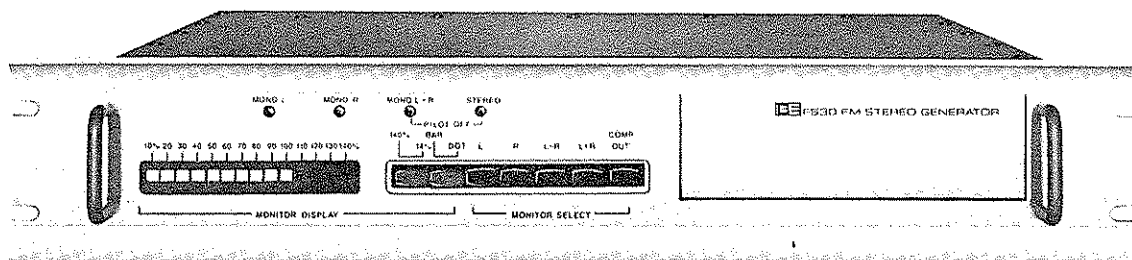
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SECTION I

1-1. EQUIPMENT DESCRIPTION.

1-2. The Broadcast Electronics Model FS-30 is a high quality FM stereo generator designed for commercial operation as described below (see Figure 1-1).

<u>MODEL</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
FS-30	909-0050	FM Stereo Generator, Single phase 97 to 133V ac, 50/60 Hz, 19 inch (48.21 cm) rack mount, with spare line fuse and accessory kit.
FS-30	909-0050-300	Same as 909-0050 except 194 to 266V ac, 50/60 Hz operation.



597-0009-1

FIGURE 1-1. FS-30 FM STEREO GENERATOR

1-3. PHYSICAL DESCRIPTION.

1-4. The FS-30 is housed in a case designed for 19 inch (48.21 cm) rack mounting. All internal circuitry is accessible through removable top and bottom covers. Metering, mode switching, and commonly used controls such as pilot level and composite output are mounted on the front panel for easy access. Solid-state metering and LED indicators provide reliable and accurate indications of critical parameters. A front panel test receptacle allows monitoring of the parameter displayed by the front panel metering. Input and output connections are made to a terminal strip and BNC connectors mounted to the rear panel.

1-5. ELECTRICAL DESCRIPTION.

1-6. The FS-30 is a totally solid-state FM stereo generator with many outstanding features employing digital modulation, automatic control of pilot phase, and composite baseband equalization.

1-7. DIGITAL MODULATION AND AUTOMATIC CONTROL OF PILOT PHASE. The type of modulation used in the FS-30 has inherently low distortion. The modulator suppresses 76 kHz sidebands to 80 dB minimum which eliminates interference to SCA. The 38 kHz subcarrier feed-through after modulation is limited to 70 dB, therefore no carrier null is required.

1-8. Pilot phase stability is assured without control as the 19 kHz pilot and the 38 kHz subcarrier are both derived from a single highly-stable crystal-controlled oscillator.

1-9. This combination of digital modulation and fixed pilot-to-subcarrier relationship results in a flat baseband enhancing stereo-
phonic separation.

1-10. LOW-PASS FILTER. The FS-30 uses two 15 kHz five-pole, delay-equalized, elliptic, low-pass filters for minimum overshoot without clip-pers or other non-linear circuits.

1-11. SWITCHABLE COMPOSITE BASEBAND EQUALIZATION. If the stereo generator is used with a studio transmitter link or an exciter which introduces baseband degradation (such as deviation from flat phase or amplitude response), a built-in switchable composite baseband equalization circuit in the FS-30 allows for correction. Provisions on the rear panel of the FS-30 allow connection of an SCA generator to the stereo generator for transmission over an STL link to the exciter.

1-12. OUTPUT CIRCUIT AND REMOTE CONTROL. The output circuit is designed to drive a 50 Ohm terminated coaxial cable independent of length without degradation of separation or frequency response.

1-13. Remote control of all modes is available through connections to the rear panel. Optical isolators which couple control logic and status indications are compatible with both positive and negative polarity logic.

1-14. POWER SUPPLY. A tapped dual-primary power transformer and a voltage selector allows for operation from a wide range of ac input potentials. All dc supplies are well filtered and closely regulated.

1-15. EQUIPMENT SPECIFICATIONS.

1-16. Refer to Table 1-1 for electrical and physical characteristics of the Broadcast Electronics FS-30 Stereo Generator.

Table 1-1. Electrical and Physical Specifications
(Sheet 1 of 2)

PARAMETER	SPECIFICATIONS
AUDIO INPUT IMPEDANCE	600 Ohms Balanced, Resistive, Floating (Adaptable to other Impedances).
AUDIO INPUT LEVEL	+10 dBm \pm 1 dBm for 100% Modulation at 400 Hz (Adaptable to other Input Levels).
COMPOSITE OUTPUT LEVEL	Adjustable from 2.5 to 8.0V p-p into open Circuit, 50 Ohm Source Impedance.
FREQUENCY RESPONSE	\pm 0.5 dB, 30 to 15,000 Hz, 75 μ s Pre-emphasis (Flat, 25 μ s, or 50 μ s Pre-emphasis Selectable).
AUDIO OVERSHOOT	2 dB Maximum.
TOTAL HARMONIC DISTORTION	0.03% or less from 30 to 15,000 Hz.
INTERMODULATION DISTORTION	0.03%, 60 Hz/7 kHz; 4:1 Ratio.
TRANSIENT INTERMODULATION DISTORTION	0.1% (Square Wave/Sine Wave)
STEREO SEPARATION	52 dB or better from 30 to 15,000 Hz (Sine Wave).
DYNAMIC STEREO SEPARATION	45 dB or better from 30 to 15,000 Hz (Normal Program Content).
LINEAR CROSSTALK	Main to Sub (L+R to L-R)/Sub to Main (L-R to L+R), due to Amplitude and Phase Matching of Left and Right Channels, 30 to 15,000 Hz. 45 dB Minimum below 100% Modulation.
NON-LINEAR CROSSTALK	Main to Sub (L+R to L-R)/Sub to Main (L-R to L+R), due to distortion products. 70 dB Minimum below 100% Modulation.
38 kHz SUPPRESSION	80 dB Minimum below 100% Modulation.

Table 1-1. Electrical and Physical Specifications
(Sheet 2 of 2)

PARAMETER	SPECIFICATIONS
57 kHz, 76 kHz, and 95 kHz SUPPRESSION	80 dB Minimum below 100% Modulation.
76 kHz SIDEBAND SUPPRESSION	80 dB Minimum below 100% Modulation.
SPURIOUS AND SIDEBAND SUPPRESSION beyond 95 kHz	75 dB Minimum below 100% Modulation.
FM NOISE	85 dB or Better below 100% Modulation at 400 Hz, 75 us Deemphasis.
PILOT STABILITY	± 0.5 Hz, +32°F to +122°F (0°C to +50°C).
OPERATING TEMPERATURE RANGE	+32°F to +122°F (0°C to +50°C). Functional to -4°F (-20°C).
MAXIMUM ALTITUDE	Ø to 15,000 Feet (4,472 m) above sea level.
HUMIDITY	95%, Non-condensing.
DIMENSIONS: HEIGHT	3.5 inches (8.9 cm).
WIDTH	19.0 inches (48.3 cm).
DEPTH	16.5 inches (41.9 cm).
AC POWER REQUIREMENTS	97 to 133V ac or 194 to 266V ac, 50/60 Hz, 25 Watts.
WEIGHT: UNPACKED	17 pounds (7.7 kg)

SECTION II

2-1. UNPACKING.

2-2. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the stereo generator. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

2-3. The contents of the shipment should be as indicated on the packing lists. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2-4. ENVIRONMENTAL REQUIREMENTS.

2-5. Table 1 provides environmental conditions which must be considered prior to installation.

2-6. INSTALLATION.

2-7. Each FS-30 Stereo Generator is operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Installation is accomplished in three steps: 1) placement, 2) wiring, and 3) initial checkout.

2-8. PLACEMENT.

2-9. The FS-30 Stereo Generator requires 3 1/2 inches (8.9 cm) of 19 inch (48.26 cm) rack space and may be mounted in any convenient location within reach of signal and power cables. The signal cables should be as short and direct as possible. The stereo generator should not be mounted directly above heat-generating equipment. It should also be noted that the more constant the ambient temperature in which the stereo generator operates, the greater the stability of the stereo generator. Otherwise no special requirements need be observed.

2-10. WIRING.

WARNING

ENSURE AC POWER IS DISCONNECTED
BEFORE PROCEEDING.

2-11. Set the stereo generator on a work surface.

2-12. Remove the top cover and assure the following connectors are correctly positioned:

A. REMOTE MODE CONTROL POLARITY SELECT. Plug P11 onto J12 if negative polarity control logic is to be used or J11 if positive polarity control logic is to be used (see Figure 2-1).

B. REMOTE MODE INDICATOR POLARITY SELECT. Plug P15 onto J15 if negative polarity output is desired or J16 if positive polarity output is desired (see Figure 2-1).

C. PREEMPHASIS SELECTION. The position of P6 on J6 determines the left channel preemphasis and the position of P7 on J7 determines the right channel preemphasis as follows:

<u>PREEMPHASIS</u>	<u>J6</u>	<u>J7</u>
25 us	Jumper Pins 1 to 2	Jumper Pins 1 to 2
50 us	Jumper pins 3 to 4	Jumper pins 3 to 4
75 us	Jumper pins 1 to 2 and 3 to 4	Jumper pins 1 to 2 and 3 to 4

D. POWER-UP MODE. The operational mode in which the stereo generator will enter when power is applied can be selected by the position of P13 on J13 as follows:

<u>MODE</u>	<u>J13</u>
MONO L	Jumper pins 1 to 2
MONO R	Jumper pins 2 to 3
MONO L + R	Jumper pins 4 to 5
STEREO	Jumper pins 5 to 6

2-13. Replace the top cover.

2-14. Remove the fuse from the ac line voltage selector on the stereo generator rear panel.

2-15. Ensure the primary ac line voltage with which the stereo generator will be used is visible on the ac line voltage selector circuit board (100V, 115/120V, 220V, or 230/240V).

2-16. If the ac line voltage must be changed, remove the ac line voltage selector circuit board with a small pair of needle-nose pliers. Reinsert the circuit board so that the correct ac line voltage is visible when the circuit board is inserted into the receptacle.

2-17. Two fuses are shipped with the stereo generator. A 3/4 Ampere fuse is required for the 100/115 volt range and a 3/8 Ampere fuse is required for the 220/240 volt range. Both fuses must be slow-blow types.

2-18. Install the correct fuse for operation at the desired ac line voltage.

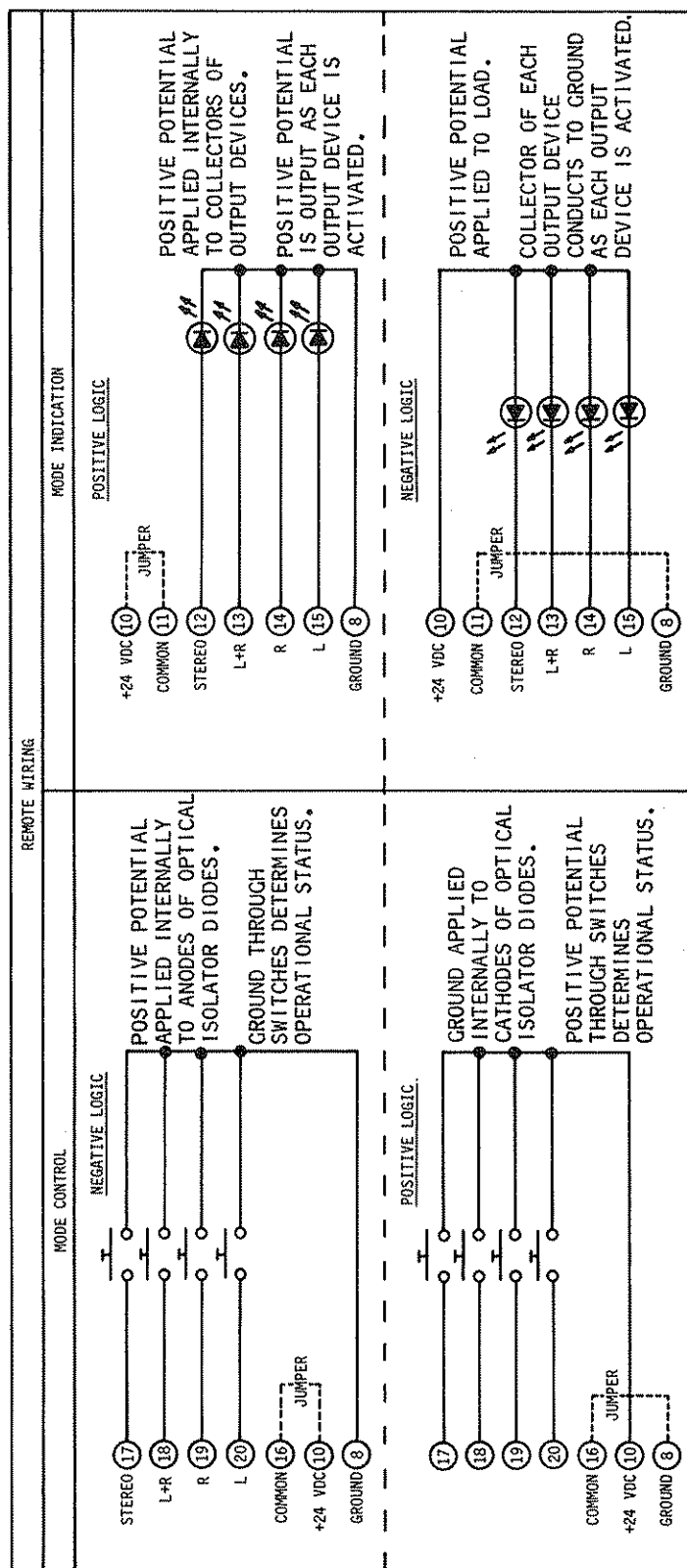
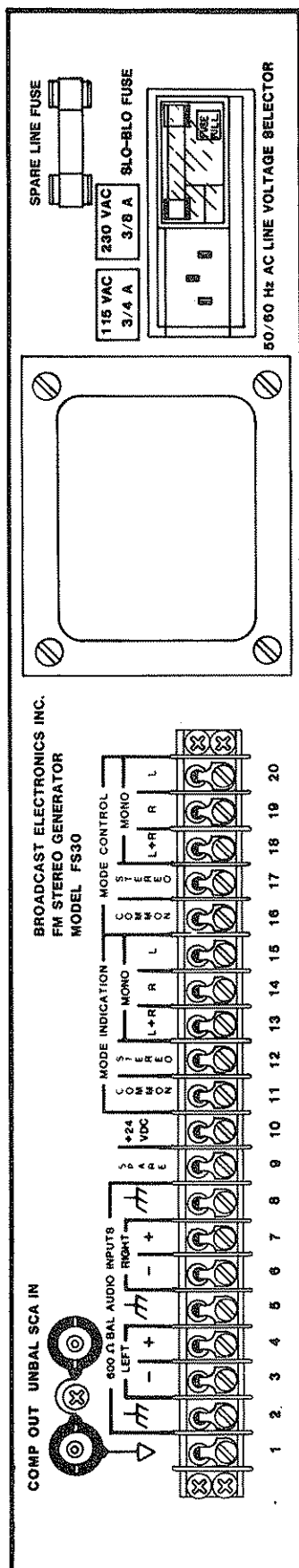


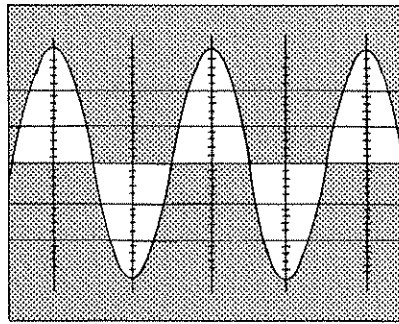
FIGURE 2-1. STEREO GENERATOR REMOTE WIRING

- 2-19. Wire the audio inputs with two-conductor overall foil shielded wire.
- 2-20. Connect an SCA input to the UNBAL SCA IN receptacle if used. The cable impedance is not critical as this input is unterminated.
- 2-21. Wire the remote mode control inputs and the remote mode indicator outputs if used (see Figure 2-1).
- 2-22. Connect the stereo generator output (COMP OUT receptacle) to the FM exciter or the studio transmitter link.
- 2-23. INITIAL CHECKOUT.
- 2-24. Ensure all switches behind the front panel access door are out.
- 2-25. Connect an ac power source to the unit. The unit will energize in the mode selected by the internal programming selected in paragraph 2-12D when power is applied.
- 2-26. Depress the following switches behind the front panel access door one at a time and note the indications:

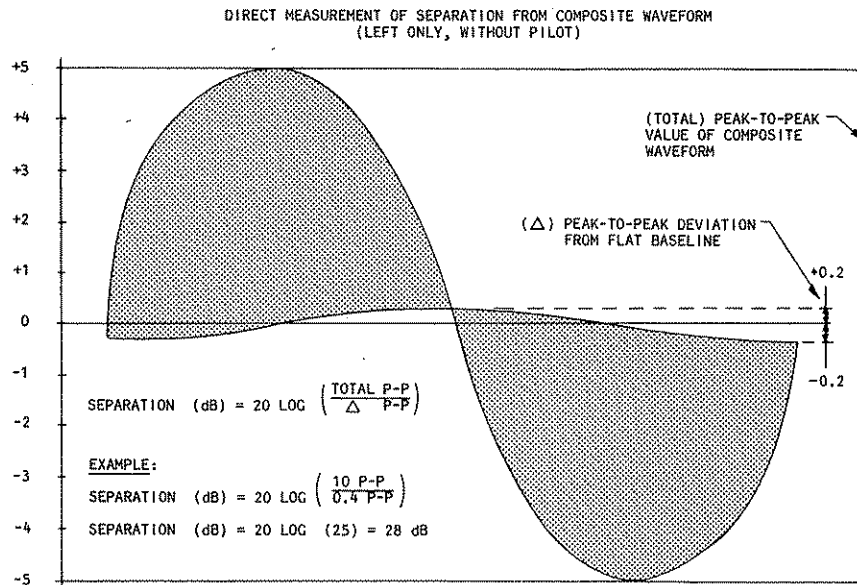
<u>SWITCH</u>	<u>INDICATOR ILLUMINATED</u>
MONO L	MONO L
MONO R	MONO R
MONO L + R	MONO L + R
STEREO	STEREO

- 2-27. Leave the STEREO switch depressed and depress the PILOT OFF switch. Both the STEREO indicator and the MONO L + R indicator should illuminate.
- 2-28. Depress the PILOT OFF switch again to enable the pilot signal. The MONO L + R indicator will go out and the STEREO indicator will remain illuminated.
- 2-29. Depress the COMP OUT MONITOR SELECT switch.
- 2-30. Connect an in-phase 400 Hz audio signal at +10 dBm to the stereo generator left and right audio inputs.
- 2-31. Adjust the exciter metering to monitor the composite input level.
- 2-32. Adjust the stereo generator COMP LEVEL control to obtain the composite input level required.
- 2-33. Remove the audio generator and assure no audio is input to the stereo generator.

- 2-34. Operate the 140%/14% switch to 14%.
- 2-35. Adjust the PILOT LEVEL control to obtain the pilot level desired (8 to 10%). Each indicator in the MONITOR DISPLAY will illuminate at the level indicated.
- 2-36. Apply active stereophonic programming to the stereo generator as follows:
+10 dBm \pm 1 dBm at 600 Ohms
- 2-37. Operate the 140%/14% switch to 140%. Note the presence of programming on the MONITOR DISPLAY. The display may be changed from a moving bar to a moving dot as desired with the BAR/DOT switch.
- 2-38. Depress each of the MONITOR SELECT switches. The display should remain active in each switch position. None of the front panel metering controls have any effect on the stereo generator output or operation.
- 2-39. The stereo generator contains a composite equalization circuit designed to compensate for non-linearities inherent in a composite link system. If required, the four front-panel composite equalization controls should be adjusted by the customer to obtain the best possible overall system amplitude and phase linearity. The composite equalization is functional only when the COMP EQ switch is depressed. The controls are adjusted as follows.
- 2-40. Turn the pilot off, observe the baseband through the system at the following frequencies, and adjust for a flat baseline (see Figure 2-2).
- | | |
|-----------|-----------|
| A. 30 Hz | D. 1 kHz |
| B. 100 Hz | E. 5 kHz |
| C. 400 Hz | F. 15 kHz |
1. The HF1 and HF2 controls will interact. They compensate for high frequency deviation from flat frequency response of the composite link.
 2. The LF1 and LF2 controls will interact. They compensate for low frequency deviation from flat frequency response of the composite link such as the effects of ac coupling of the composite signal.
- 2-41. The stereo generator is now ready for use.



FLAT BASELINE TEST SIGNAL -
OBSERVED AT MONITOR OUTPUT RECEPTACLE



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FIGURE 2-2. SEPARATION ADJUSTMENT

SECTION III

3-1. OPERATION.

3-2. The following procedure assumes that the stereo generator is completely installed and is free of any discrepancies.

3-3. Select the desired mode (MONO L, MONO R, MONO L + R, or STEREO).

3-4. Assure power is applied to the stereo generator and apply programming.

3-5. Select the desired metering. None of the front panel metering controls have any effect on the stereo generator output or operation.

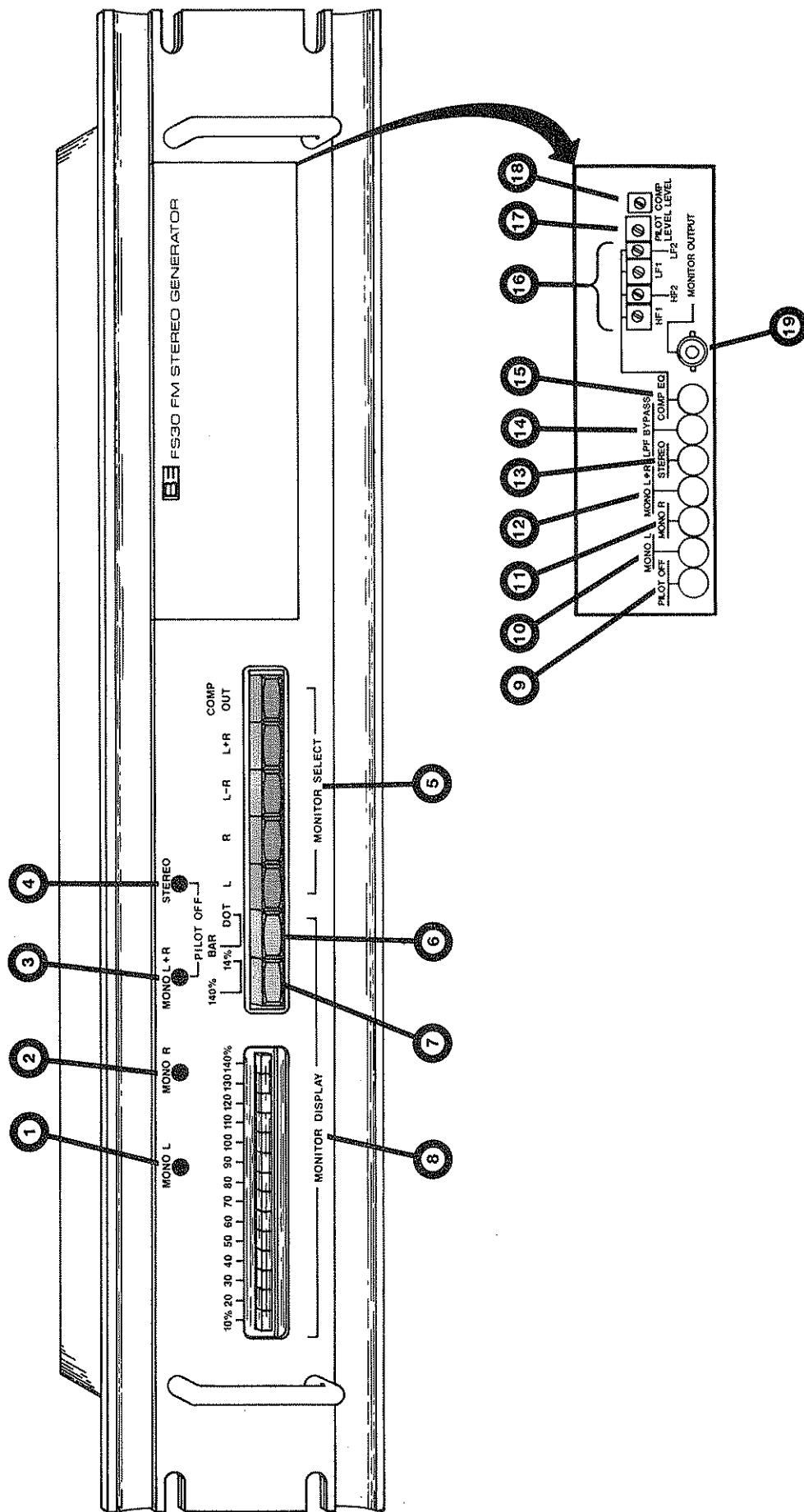


FIGURE 3-1. CONTROLS AND INDICATORS

3-6. CONTROLS AND INDICATORS.

3-7. Refer to Figure 3-1 for the location of all controls and indicators associated with normal operation of the stereo generator. The function of each control and indicator is described by Table 3-1.

Table 3-1. Controls and Indicators
(Sheet 1 of 2)

ITEM	NOMENCLATURE	FUNCTION
1	MONO L Indicator (DS-15)	When illuminated, indicates the stereo generator is processing a monaural signal comprising the left channel audio input only.
2	MONO R Indicator (DS-16)	When illuminated, indicates the stereo generator is processing a monaural signal comprising the right channel audio input only.
3	MONO L + R Indicator (DS-17)	When illuminated and the STEREO indicator is out, indicates the stereo generator is processing a monaural signal comprising the algebraic sum of the left and right channel audio inputs. When illuminated and the STEREO indicator is illuminated, indicates the stereo generator is operating in the stereo mode with the pilot switched off.
4	STEREO Indicator (DS-18)	When illuminated and the MONO L + R indicator is out, indicates the stereo generator is processing a stereophonic signal. When illuminated and the MONO L + R indicator is illuminated, indicates the stereo generator is operating in the stereo mode with the pilot switched off.
5	MONITOR SELECT Switches (S2C THRU S2G)	Selects the parameter displayed on the MONITOR DISPLAY and the signal available on the MONITOR OUTPUT test connector.
6	MONITOR DISPLAY BAR/DOT Switch (S2B)	Selects between a moving dot or moving bar MONITOR DISPLAY for operator preference.
7	MONITOR DISPLAY 140%/14% Switch (S2A)	When depressed, expands the MONITOR DISPLAY indication by 10 to allow SCA and pilot injection level adjustment.

Table 3-1. Controls and Indicators
(Sheet 2 of 2)

ITEM	NOMENCLATURE	FUNCTION
8	MONITOR DISPLAY (DS1 THRU DS14)	Indicates the parameter selected by the MONITOR SELECT switches. The 100% indicator is factory calibrated to equal a +10 dBm audio input level. Each indicator illuminates at the level indicated.
9	PILOT OFF Switch (S1A)	Disables the pilot signal in the stereo mode when in.
10	MONO L Switch (S1B)	Configures the stereo generator to process a monaural signal comprising the left channel audio input only when in.
11	MONO R Switch (S1C)	Configures the stereo generator to process a monaural signal comprising the right channel audio input only when in.
12	MONO L + R Switch (S1D)	Configures the stereo generator to process a monaural signal comprising the algebraic sum of the left and right channel audio inputs when in.
13	STEREO Switch (S1E)	Configures the stereo generator to generate a stereophonic signal when in.
14	LPF BYPASS Switch (S1F)	Bypasses the internal stereo 15 kHz low-pass filter when in.
15	COMP EQ Switch (S1G)	Enables the internal composite equalization circuit when in.
16	HF1/HF2/LF1/LF2 Controls (R123, R126,R129,R131)	Adjusts the amplitude and phase response of the internal composite equalization circuit.
17	PILOT LEVEL Control (R223)	Allows pilot level amplitude control.
18	COMP LEVEL CONTROL (R121)	Allows adjustment of the stereo generator composite output level.
19	MONITOR OUTPUT Receptacle (J10)	Provides a convenient front-panel test point to connect a signal monitor or test equipment. The signal presented is selected by the MONITOR SELECT switches.

SECTION IV

4-1. THEORY OF OPERATION.

4-2. Theory of operation for the FS-30 Stereo Generator is presented by Figure 4-1.

SECTION V

5-1. FIRST LEVEL MAINTENANCE.

WARNING

DISCONNECT POWER PRIOR TO SERVICING

5-2. Maintenance of the stereo generator falls into the category of good housekeeping and is limited to whatever cleaning may be necessary and checking the performance of the unit.

5-3. On a regular basis, clean the equipment of accumulated dust, check for overheated components, and tighten loose hardware as required. Ensure the input and output connections are secure.

5-4. SECOND LEVEL MAINTENANCE.

WARNING

DISCONNECT POWER PRIOR TO SERVICING

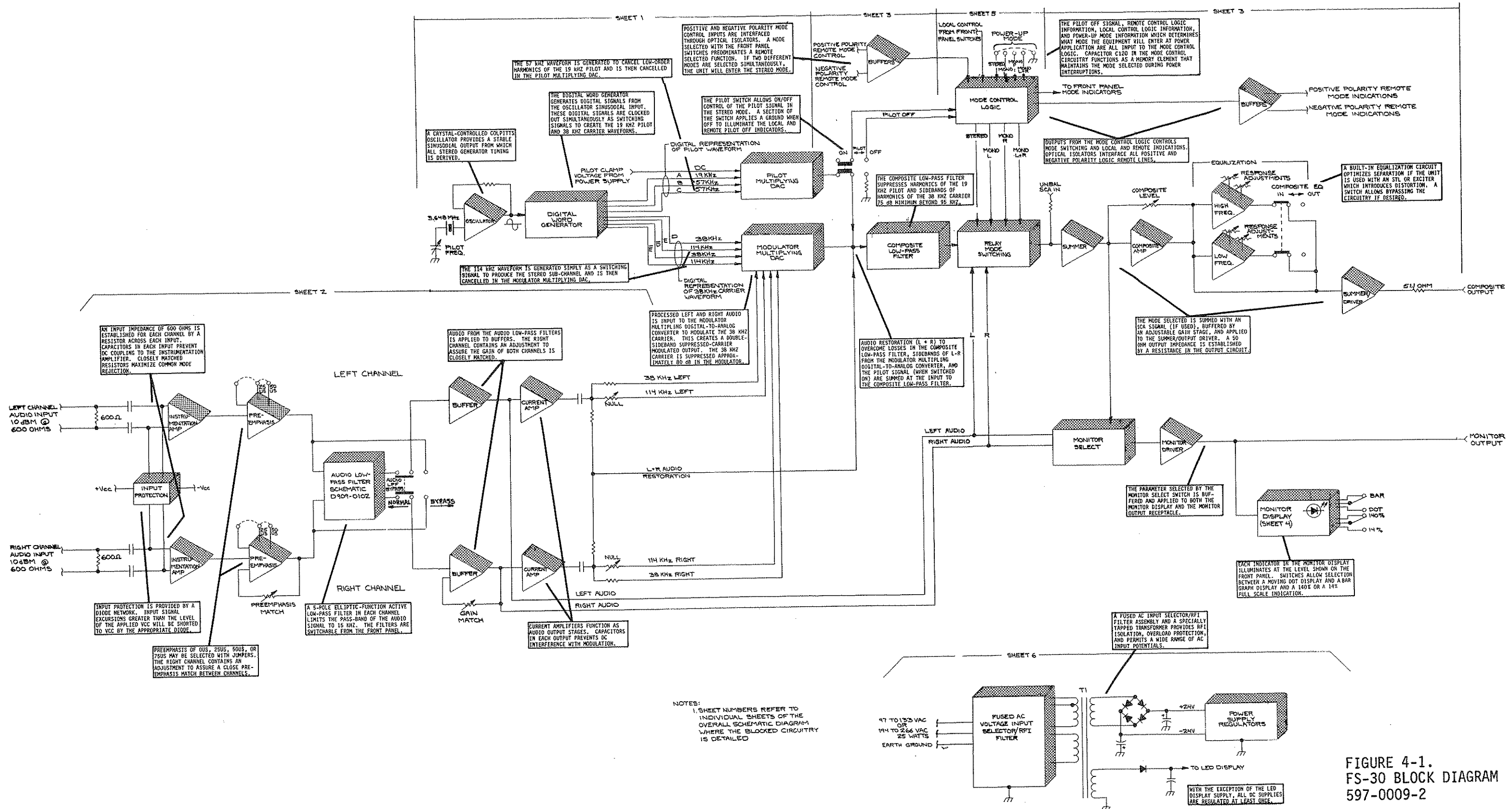
5-5. Second level maintenance consists of procedures required to restore the equipment to satisfactory operation after a fault has occurred.

5-6. The maintenance philosophy of the stereo generator consists of problem isolation to a specific assembly with subsequent troubleshooting as required to isolate specific defective components. If desired, an entire assembly may be returned to the factory for repair or exchange.

5-7. ADJUSTMENTS.

5-8. The following text provides adjustment procedures for all controls with the exception of the composite equalization controls (HF1, HF2, LF1, and LF2), the PILOT LEVEL control, and the COMP LEVEL control which are described in SECTION II, Installation.

5-9. DISPLAY CALIBRATE (R178) AND X10 CALIBRATE (R160). The display calibrate control (R178) and the X10 calibrate control (R160) must be adjusted together in sequence. To adjust R178 and R160, proceed as follows.



**FIGURE 4-1.
FS-30 BLOCK DIAGRAM
597-0009-2**

5-10. Required Equipment. The following equipment is required to complete adjustment of the display calibrate control and the X10 calibrate control.

- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
- B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.
- C. Calibrated Low Distortion Audio Generator, 600 Ohm Output (Tektronix TM 506 Main Frame and SG 505 Plug-in Audio Oscillator or equivalent).

5-11. Procedure. To adjust the controls, proceed as follows:

5-12. Remove the stereo generator from service and remove the top cover.

5-13. Apply a 100 Hz sinewave at a +10 dBm level to the left channel audio input only.

5-14. Apply power to the stereo generator.

5-15. Operate the 14%/140% switch (S2A) to 140% and depress the L MONITOR SELECT switch (S2C).

5-16. Adjust R178 fully counterclockwise, then clockwise until the 100% indicator (DS10) just illuminates.

5-17. Reduce the audio level by 20 dB to -10 dBm.

5-18. Operate the 14%/140% switch (S2A) to 14%.

5-19. Adjust R160 fully counterclockwise, then clockwise until the 100% (10%) indicator (DS10) just illuminates.

5-20. Increase the audio level by 20 dB to +10 dBm and apply the 100 Hz sinewave to the right channel audio input only.

5-21. Operate the 14%/140% switch (S2A) to 140%.

5-22. Depress the R MONITOR SELECT switch (S2D).

5-23. Note the MONITOR DISPLAY. The 100% indicator should be illuminated. If not, adjust R178 slightly clockwise until the 100% indicator (DS10) just illuminates.

5-24. Deenergize power.

5-25. Remove the test equipment, replace the top cover, and return the stereo generator to service.

5-26. PILOT FREQUENCY. As all stereo generator timing is derived from the same source, adjustment of the pilot frequency control (C1) is all that is required to correct an off-frequency condition. To adjust C1, proceed as follows.

5-27. Required Equipment. The following equipment is required to complete adjustment of the pilot frequency control.

- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
- B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.
- C. Calibrated Frequency Counter, Accurate to ± 1 Hz per MHz minimum (Hewlett-Packard 5315A or equivalent).

5-28. Procedure. To adjust the control, proceed as follows:

5-29. Remove the stereo generator from service and remove the top cover.

5-30. Connect the frequency counter to the front panel MONITOR OUTPUT receptacle (J10).

5-31. Apply power to the stereo generator.

5-32. Operate the STEREO switch to on and the PILOT OFF switch to enable the pilot. Assure there is no audio input.

5-33. Using the adjustment tool, adjust C1 as required to obtain an indication of 19,000 Hz ± 0.05 Hz.

5-34. Deenergize power.

5-35. Remove the test equipment, replace the top cover, and return the stereo generator to service.

5-36. AUDIO LOW-PASS FILTER. Due to the complexity and difficulty of the procedure and the types of equipment required, it is suggested the audio low-pass filter be returned to the Broadcast Electronics Factory for adjustment or exchange. If return is not practical, contact the Broadcast Electronics Customer Service Department for a recommended procedure and list of required test equipment.

5-37. STEREO SEPARATION. Adjustment of stereo separation requires local manufacture of the composite signal clipper presented in Figure 5-1. After construction, the clipper must be calibrated to clip an audio input at ± 60 millivolt levels.

5-38. Adjustment of stereo separation requires adjustment of the stereo separation null control (R112) and the two controls in the composite low-pass filter (L1 and L2). To adjust R112, L1 and L2, proceed as follows.



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WARNING: DISCONNECT POWER PRIOR TO SERVICING

5-39. Required Equipment. The following equipment is required to complete adjustment of stereo separation.

- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
- B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.
- C. Calibrated Low Distortion Audio Generator, 600 Ohm output (Tektronix TM 506 Main Frame and SG 505 Plug-in Audio Oscillator or equivalent).
- D. DC Coupled Oscilloscope, 5 MHz bandwidth, vertical input calibrated at 10 millivolts per division.

5-40. Procedure. To adjust the controls, proceed as follows:

5-41. Remove the stereo generator from service and remove the top cover.

5-42. Note the position of the audio preemphasis jumper in the left and right channels, then remove both jumpers.

5-43. Remove the audio low-pass filter circuit board and operate the LPF BYPASS switch to bypass the filter.

5-44. Operate the STEREO switch to on and operate the PILOT OFF switch to off.

5-45. Connect the composite clipper input to the stereo generator COMP OUT receptacle and connect the output of the composite clipper to the vertical input of the oscilloscope.

5-46. Calibrate the oscilloscope at 10 millivolts per division, then momentarily ground the vertical input and center the trace.

5-47. Connect a 150 Hz audio signal to the left channel only at a -30 dBm level. Assure there is no audio input to the right channel.

5-48. Adjust the composite clipper gain to obtain an 80 millivolt peak-to-peak indication and adjust the composite clipper offset control to center the trace on the oscilloscope. These two controls interact and therefore this step must be repeated until the correct results are obtained.

5-49. Change the audio input level to +10 dBm.

5-50. Adjust R112 to obtain the flattest baseline (see Figure 2-2).

CAUTION

DO NOT ADJUST THE CORES OUT OF THE COMPOSITE FILTER COILS IN THE FOLLOWING STEPS. THE CORRECT ADJUSTMENT WILL BE FOUND ± 1 TURN FROM THE FACTORY PRESET POSITION.

CAUTION

5-51. Adjust the audio input frequency to 15 kHz.

- 5-52. Adjust the two controls on the composite filter to minimize the phase error.
- 5-53. Change the audio input to the right channel only at a +10 dBm level.
- 5-54. Adjust the two controls on the composite filter to minimize the phase error.
- 5-55. Adjust the audio input frequency to 150 Hz.
- 5-56. Adjust R112 to obtain the flattest baseline (see Figure 2-2).
- 5-57. Deenergize power.
- 5-58. Remove the test equipment, replace the preemphasis jumpers, replace the low-pass filter circuit board, replace the top cover, operate the LPF BYPASS switch to the desired position, and return the stereo generator to service.
- 5-59. PILOT HARMONIC SUPPRESSION. Null adjustment of the pilot harmonics requires adjustment of the 95 kHz null control (R32), the 57 kHz null control (R29), the waveform A pilot harmonic null control (R272), and the waveform C pilot harmonic null control (R273). To adjust R32, R29, R272, and R273, proceed as follows.
- 5-60. Required Equipment. The following equipment is required to complete the pilot harmonic null procedure.
- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
 - B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.
 - C. Spectrum Analyzer (Tektronix 7603 Oscilloscope Main Frame and 7L5 Spectrum Analyzer Plug-in with L3 module or equivalent).
- 5-61. Procedure. To adjust the controls, proceed as follows:
- 5-62. Calibrate the 7L5 spectrum analyzer, then connect the spectrum analyzer to the COMP OUT receptacle on the stereo generator rear panel.
- 5-63. Preset the 7L5 spectrum analyzer controls as follows:
- DOT MKR: fully clockwise
 - DOT FREQUENCY: 0 MHz
 - BASELINE CLIPPER: centered
 - DISPLAY A and B: A on, B on (SAVE A, B-(SAVE A), and MAX HOLD all off)
 - RESOLUTION: COUPLED
 - FREQUENCY SPAN/DIV: 10 kHz
 - REFERENCE LEVEL: +3 dBV
 - VAR control: off
 - INPUT BUFFER: off
 - 10 dB/DIV: on
 - TRIGGERING: FREE RUN and NORMAL

TIME/DIV: AUTO
L3 INPUT REF: dBV
L3 TERMN Z: 50 Ohm

- 5-64. Remove the stereo generator from service and remove the top cover.
- 5-65. Note the position of the audio preemphasis jumpers in both the left and right channels, then remove both jumpers.
- 5-66. Depress the STEREO MODE switch and operate the PILOT OFF switch to enable the pilot.
- 5-67. Operate the stereo generator with no audio input and obtain a presentation on the spectrum analyzer.
- 5-68. Using the adjustment tool, adjust R32 to minimize the 95 kHz harmonic, then adjust R29 to minimize the 57 kHz harmonic.
- 5-69. Adjust R272 and R273 for best suppression of all harmonics.
- 5-70. Repeat the preceding two steps until no further improvement can be noted.
- 5-71. Deenergize power.
- 5-72. Remove the test equipment, replace the preemphasis jumpers, replace the top cover, and return the stereo generator to service.
- 5-73. 114 kHz SIDEBAND NULL. The procedure to null the 114 kHz sidebands requires adjustment of the left channel 114 kHz sideband null control (R100) and the right channel 114 kHz sideband null control (R102). To adjust R100 and R102, proceed as follows.
- 5-74. Required Equipment. The following equipment is required to complete the 114 kHz sideband null procedure.
- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
 - B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.
 - C. Calibrated Low Distortion Audio Generator, 600 Ohm output (Tektronix TM 506 Main Frame and SG 505 Plug-in Audio Oscillator or equivalent).
 - D. Spectrum Analyzer (Tektronix 7603 Oscilloscope Main Frame and 7L5 Spectrum Analyzer Plug-in with L3 module or equivalent).
- 5-75. Procedure. To adjust the controls, proceed as follows:
- 5-76. Remove the stereo generator from service and remove the top cover.
- 5-77. Calibrate the 7L5 spectrum analyzer, then connect the spectrum analyzer to the COMP OUT receptacle on the stereo generator rear panel.

5-78. Preset the 7L5 spectrum analyzer controls as follows:

DOT MRK: fully clockwise
DOT FREQUENCY: 0 MHz
BASELINE CLIPPER: centered
DISPLAY A and B: A on, B on (SAVE A, B-(SAVE A), and
MAX HOLD all off)
RESOLUTION: COUPLED
FREQUENCY SPAN/DIV: 10 kHz
REFERENCE LEVEL: +3 dBV
VAR control: off
10 dB/DIV: on
TRIGGERING: FREE RUN and NORMAL
TIME/DIV: AUTO
L3 INPUT REF: dBV
L3 TERMN Z: 50 Ohm

5-79. Note the position of the audio preemphasis jumpers in both the left and right channels, then remove both jumpers.

5-80. Connect a 15 kHz audio signal to the left channel only at a +10 dBm level. Assure there is no audio input to the right channel.

5-81. Depress the STEREO MODE switch and operate the PILOT OFF switch to disable the pilot.

5-82. Operate the stereo generator and obtain a trace on the spectrum analyzer.

5-83. Using the adjustment tool, adjust R100 to minimize the 99 kHz sideband.

5-84. Connect a 15 kHz audio signal to the right channel only at a +10 dBm level. Assure there is no audio input to the left channel.

5-85. Using the adjustment tool, adjust R102 to minimize the 99 kHz sideband.

5-86. Deenergize power.

5-87. Remove the test equipment, replace the preemphasis jumpers, replace the top cover, and return the stereo generator to service.

5-88. 38 kHz SIDEBAND NULL. The procedure to null the 38 kHz sidebands requires adjustment of the right channel audio gain control (R64) and the right channel audio preemphasis match control (R59). To adjust R64 and R59, proceed as follows.

5-89. Required Equipment. The following equipment is required to complete the audio gain match procedure.

- A. Adjustment tool, shipped with the stereo generator (P/N 407-0186).
- B. Phillips No. 2 Screwdriver, 4 inches (10.2 cm) long.

- C. Calibrated Low Distortion Audio Generator, 600 Ohm output (Tektronix TM 506 Main Frame and SG 505 Plug-in Audio Oscillator or equivalent).
 - D. Spectrum Analyzer (Tektronix 7603 Oscilloscope Main Frame and 7L5 Spectrum Analyzer Plug-in with L3 module or equivalent).
- 5-90. Procedure. To adjust the controls, proceed as follows:
- 5-91. Remove the stereo generator from service and remove the top cover.
- 5-92. Calibrate the 7L5 spectrum analyzer, then connect the spectrum analyzer to the COMP OUT receptacle on the stereo generator rear panel.
- 5-93. Preset the 7L5 spectrum analyzer controls as follows:
- DOT MRK: fully clockwise
 - DOT FREQUENCY: 0 MHz
 - BASELINE CLIPPER: centered
 - DISPLAY A and B: A on, B on (SAVE A, B-(SAVE A), and MAX HOLD all off)
 - RESOLUTION: COUPLED
 - FREQUENCY SPAN/DIV: 10 kHz
 - REFERENCE LEVEL: +3 dBV
 - VAR control: off
 - 10 dB/DIV: on
 - TRIGGERING: FREE RUN and NORMAL
 - TIME/DIV: AUTO
 - L3 INPUT REF: dBV
 - L3 TERMN Z: 50 Ohm
- 5-94. Note the position of the audio preemphasis jumpers in both the left and right channels, then remove both jumpers.
- 5-95. Connect a 1.5 kHz audio signal to the left and right channels in phase at a +10 dBm level.
- 5-96. Using the adjustment tool, adjust R64 to minimize the 38 kHz sidebands at 36.5 kHz and 39.5 kHz.
- 5-97. Adjust the audio input frequency to 15 kHz.
- 5-98. Reinsert the preemphasis jumpers in the positions noted in paragraph 5-94.
- 5-99. Using the adjustment tool, adjust R59 to minimize the 53 kHz signal.
- 5-100. Deenergize power.
- 5-101. Remove the test equipment, replace the top cover, and return the stereo generator to service.

5-102. TROUBLESHOOTING.

5-103. Most troubleshooting consists of visual checks. To simplify troubleshooting, the various indicators should be used to isolate a malfunction to a specific area of the stereo generator. Table 5-1 is provided as a general guide to stereo generator malfunctions.

5-104. Once the trouble is isolated, refer to the section of this manual providing theory of operation to assist in problem resolution. All internal components may be accessed through a removable top and bottom cover.

5-105. COMPONENT REPLACEMENT ON CIRCUIT BOARDS. The circuit boards used in the FS-30 are double-sided boards with plated through-holes. Because of the plated through-holes, solder fills the holes by capillary action. These conditions require that defective components be removed carefully to avoid damage to the board.

5-106. On all circuit boards, the adhesive securing the copper track to the boards melts at almost the same temperature as solder melts. A circuit board track can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5-107. To remove a component from a double-sided circuit board, cut the leads from the body of the defective component while the device is still soldered to the board.

5-108. Grip each component lead, one at a time, with long nose pliers. Turn the board over and touch the soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board and cut off the bent outer end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.

5-109. Install the new component and apply solder from the bottom side of the board. If no damage has been done to the plated through-holes, soldering of the top side is not required.

WARNING

MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME, INCLUDING CIGARETTES AND A HOT SOLDERING IRON.

WARNING

WARNING

WARNING

OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.

Table 5-1. Stereo Generator Troubleshooting

SYMPTOM	DEFECT/REMEDY
NO STEREO COMPOSITE OUTPUT	<p>IS MONO OUTPUT GOOD?</p> <p>YES — Defect in Digital Word Generator up to U11. Refer to Page 1 of FS-30 Overall Schematic Diagram.</p> <p>NO — Defect in Composite Circuit. Refer to Page 3 of FS-30 Overall Schematic Diagram.</p>
LOW COMPOSITE OR PILOT OUTPUT	Adjust the PILOT LEVEL (R223) or COMP LEVEL (R121) controls as required.
OUTPUT OFF FREQUENCY	Adjust the oscillator frequency control (C1).
POOR STEREO SEPARATION	U11, R112, L1, L2
NO MODE CONTROL	U30, U31, or U32
NO REMOTE MODE CONTROL	U26, U27, U28, or U29
NO REMOTE MODE INDICATIONS	U35, U36, U37, U38
MONITOR DISPLAY INOPERATIVE - ALL INDICATORS ILLUMINATED	Refer to Figure 5-2.
MONITOR DISPLAY INOPERATIVE - ALL INDICATORS OUT	Locate defect in power supply or refer to Figure 5-2.

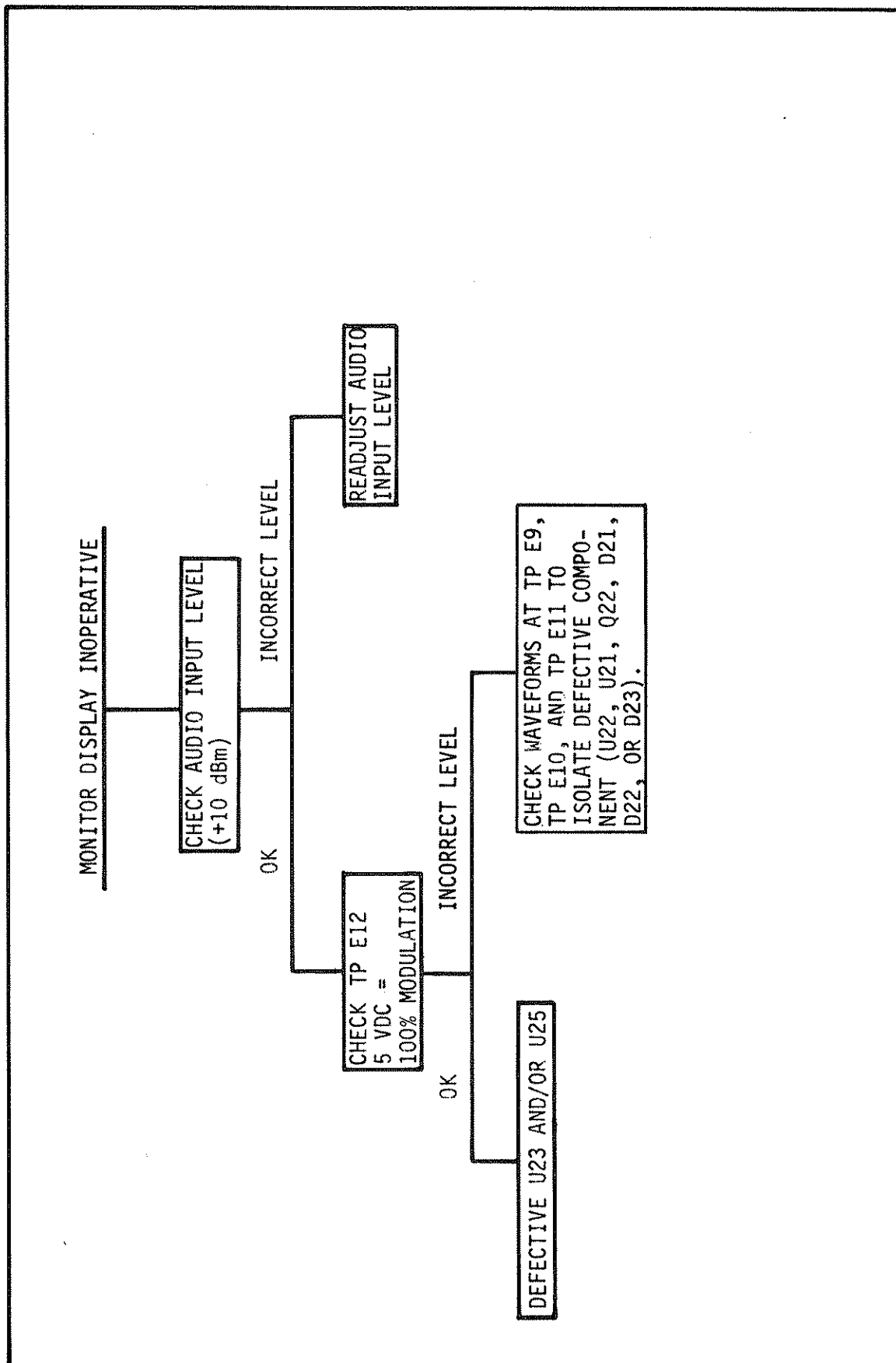


FIGURE 5-2. MONITOR DISPLAY INOPERATIVE

5-110. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective. Solvents are available in electronic supply houses which are useful.

5-111. The board should be checked to ensure the flux has been removed and not just smeared about. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.

SECTION VI

6-1. PARTS LIST AND DRAWINGS.

6-2. PARTS LIST.

6-3. The following data provides descriptions and part numbers of parts and assemblies required for maintenance of the FS-30 FM Stereo Generator. Each table entry is indexed by the schematic diagram reference designators.

6-4. Table 6-1 indexes all tables listing assemblies and sub-assemblies having replaceable parts, the table number listing the parts, and the page number of the applicable table.

Table 6-1. Replaceable Parts List Index

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6-2	FS-30 FM STEREOPHONIC GENERATOR	909-0050/ -300	29
6-3	FS-30 MAIN CIRCUIT BOARD ASSEMBLY	917-0100-1	29
6-4	FS-30 LED CIRCUIT BOARD ASSEMBLY	917-0101	34
6-5	FS-30 LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY	917-0102	35
6-6	FS-30 CHASSIS AND RF INTERFACE FILTER ASSEMBLY	950-0016	36
6-7	FS-30 FRONT PANEL ASSEMBLY	950-0017	37
6-8	FS-30 ACCESSORY KIT	950-0018/ 959-0182	37

6-5. DRAWINGS.

6-6. The following drawings are presented as aids to maintenance:

<u>TITLE</u>	<u>NUMBER</u>
FS-30 Overall Schematic Diagram (Six Sheets)	D909-0100
FS-30 Overall Assembly Diagram	D909-0050
FS-30 Overall Assembly Diagram Component Locator	597-0009-5
Main Circuit Board Assembly Diagram	F917-0100-1
Low-Pass Filter Circuit Board Schematic Diagram	D909-0102
Low-Pass Filter Circuit Board Assembly Diagram	C917-0102

TABLE 6-2. FS-30 FM STEREOPHONIC GENERATOR - 909-0050/-300

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	FS-30 Main Circuit Board Assembly	917-0100-1	1
----	FS-30 LED Circuit Board Assembly	917-0101	1
----	FS-30 Low-Pass Filter Circuit Board Assembly	917-0102	1
----	FS-30 Chassis & RF Interference Filter Assembly	950-0016	1
----	FS-30 Front Panel Assembly	950-0017	1
----	FS-30 Accessory Kit	950-0018/ 959-0182	1

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 1 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Trimmer, 2-27 pF, Polycarbonate	096-0009	1
C2	Capacitor, Mica, 22 pF $\pm 5\%$, 50V	040-2213	1
C3	Capacitor, Mica, 820 pF $\pm 5\%$, 300V	042-8222	1
C4	Capacitor, Mica, 270 pF $\pm 5\%$, 500V	041-2722	1
C5 THRU C13	Capacitor, Ceramic Disc, 0.1 uF +80, -20%, 10V	000-1055	9
C14	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C16 THRU C18	Capacitor, Electrolytic, 4.7 uF, 25V, Non-Polarized	013-4710	3
C19,C20	Capacitor, Electrolytic, 100 uF, 25V	023-1084	2
C35 THRU C38	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	4
C39 THRU C42	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	4
C43 THRU C50	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	8
C53,C54	Capacitor, Mica, 2500 pF $\pm 1\%$, 500V	042-2531	2
C55,C56	Capacitor, Mica, 5000 pF $\pm 1\%$, 500V	042-5031	2
C61 THRU C64	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C65,C66	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	2
C67 THRU C70	Capacitor, Electrolytic, 10,000 uF, 6.3V	011-8000	4
C71	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C72	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	1
C73,C74	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C75	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	1
C76	Capacitor, Mica, 270 pF $\pm 5\%$, 500V	041-2722	1
C77	Capacitor, Mylar, 0.022 uF $\pm 10\%$, 200V	031-2243	1
C78 THRU C81	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C82	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	1
C84	Capacitor, Ceramic Disc, 0.001 uF $\pm 10\%$, 1 kV	002-1034	1
C89	Capacitor, Mica, 33 pF $\pm 5\%$, 500V	042-3312	1
C90,C91	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
C92	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	1
C93	Capacitor, Mica, 33 pF $\pm 5\%$, 500V	042-3312	1
C94,C95	Capacitor, Ceramic Disc, 5 pF $\pm 10\%$, 500V	001-5004	2
C96,C97	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C98	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C99	Capacitor, Mylar, 0.022 uF $\pm 10\%$, 200V	031-2243	1
C100	Capacitor, Mica, 33 pF $\pm 5\%$, 500V	042-3312	1
C101 THRU C104	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C105	Capacitor, Ceramic Disc, 0.1 uF +80, -20%, 10V	000-1055	1
C106 THRU C108	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	3
C119,C120	Capacitor, Electrolytic, 100 uF, 25V	023-1084	2
C121	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C136	Capacitor, Electrolytic, 10,000 uF, 6.3V	011-8000	1
C137,C138	Capacitor, Electrolytic, 4700 uF, 35V	014-4795	2
C139 THRU C148	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	10
C149	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 2 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C150 THRU C153	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C154	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C155,C156	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C157	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C158,C159	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C160	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C166	Capacitor, Ceramic Disc, 0.1 uF +80, -20%, 10V	000-1055	1
C167	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	1
C168 THRU C171	Capacitor, Mylar, 0.022 uF ±10%, 200V	031-2243	4
C172,C173	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C174	Capacitor, Mylar, 0.022 uF ±10%, 200V	031-2243	1
C176 THRU C178	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	3
D2 THRU D16	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	15
D17 THRU D20	Diode, 1N4733A, Zener, 5.1V ±5%, 1W	200-4733	4
D21 THRU D23	Diode, HP5082-2800, High Voltage Schottky Barrier Type, 70V, 15 mA	201-2800	3
D24	Diode, 1N4733A, Zener, 5.1V ±5%, 1W	200-4733	1
D25 THRU D40	Diode, 1N4148, Silicon, 75V, 0.3 Ampere	203-4148	16
D41 THRU D45	Diode, MR502, Silicon, 200 PIV, 3 Ampere	202-0502	5
D46 THRU D54	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	9
DS1 THRU DS8	Indicator, LED, MV52124, Green, 2V @ 0.020 Ampere (P/O MONITOR DISPLAY)	323-2124	8
DS9	Indicator, LED, MV53124, Yellow, 2V @ 0.020 Ampere (P/O MONITOR DISPLAY)	323-3124	1
DS10 THRU DS14	Indicator, LED, MV57124, Red, 2V @ 0.020 Ampere (P/O MONITOR DISPLAY)	323-7124	5
FL1	Composite Low-Pass Filter, 53 kHz	362-0001	1
J3	Receptacle, Header, 14-Pin	417-0140	1
J6,J7	Receptacle, Header, 4-Pin	417-0070	2
J10	Receptacle, BNC (MONITOR OUTPUT)	417-0049	1
J11,J12	Receptacle, Header, 8-Pin	417-0080	2
J13,J14	Receptacle, Header, 6-Pin	417-0006-1	2
J15,J16	Receptacle, Header, 8-Pin	417-0080	2
J17	Receptacle, 4-Pin	418-0255	1
J19	Receptacle, Header, 8-Pin	417-0080	1
K1 THRU K4	Relay Coil: 12V dc, 310 Ohm ±10% Contacts: 2A @ 26V dc, 1A @ 115V ac, Non-Inductive Load	271-0003	4
L9	Choke, Ferrite, 180 MHz, 2.5 Turns, Single Section	364-0002	1
L21	Ferrite Choke, 4 Leg Each Winding 4 turns of No. 32 enameled wire wound from same direction on same side.	956-0002	1
----	Ferrite Core (for L21)	360-0001	1
P6-1,P6-2, P7-1,P7-2, P13	Plug, Jumper	340-0004	5
Q1	Transistor, 2N3904, NPN, Silicon	211-3904	1
Q3 THRU Q10	Transistor, 2N3906, PNP, Silicon	210-3906	8
Q11	Transistor, 2N3904, NPN, Silicon	211-3904	1
Q12	Transistor, 2N3906, PNP, Silicon	210-3906	1
Q13	Transistor, 2N3904, NPN, Silicon	211-3904	1
Q14	Transistor, MPS-U05, NPN, Silicon	211-0005	1
Q15	Transistor, MPS-U55, PNP, Silicon	210-0155	1
Q16	Transistor, MPS-U05, NPN, Silicon	211-0005	1
Q17	Transistor, MPS-U55, PNP, Silicon	210-0155	1
Q18	Transistor, 2N3906, PNP, Silicon	210-3906	1
Q19	Transistor, 2N3904, NPN, Silicon	211-3904	1
Q20	Transistor, MPS-U05, NPN, Silicon	211-0005	1
Q21	Transistor, MPS-U55, PNP, Silicon	210-0155	1
Q22	Transistor, 2N3904, NPN, Silicon	211-3904	1
Q23 THRU Q27	Transistor, 2N3906, PNP, Silicon	210-3906	5

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 3 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R1	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R2	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R3	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R4	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R15	Resistor Network, 9 resistors, 1.0 k Ohm $\pm 2\%$, 0.3W, 10-Pin Single-in-line Package	226-0393	1
R17 THRU R23	Resistor, 220 Ohm $\pm 5\%$, 1/4W	100-2233	7
R26	Resistor, 2.00 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R27	Resistor, 121 Ohm $\pm 1\%$, 1/4W	100-1231	1
R28	Resistor, 9.53 k Ohm $\pm 1\%$, 1/4W	103-9534	1
R29	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	177-1024	1
R30	Resistor, 110 Ohm $\pm 1\%$, 1/4W	103-1103	1
R31	Resistor, 5.62 k Ohm $\pm 1\%$, 1/4W	103-5624	1
R32	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	177-1024	1
R33	Resistor, 113 Ohm $\pm 1\%$, 1/4W	103-1133	1
R36 THRU R39	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	4
R40,R41	Resistor Network, 8 resistors, 10 k Ohm $\pm 0.5\%$, 0.1W, 16-Pin DIP	226-0392	2
R46 THRU R53	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	8
R54,R55	Resistor, 499 Ohm $\pm 1\%$, 1/4W	103-4993	2
R56,R57	Resistor, 9.76 k Ohm $\pm 1\%$, 1/4W	103-9764	2
R58	Resistor, 240 Ohm $\pm 5\%$, 1/4W	100-2433	1
R59	Potentiometer, 500 Ohm $\pm 10\%$, 1/2W	177-5032	1
R60,R61	Resistor, 15.4 k Ohm $\pm 1\%$, 1/4W	103-1551	2
R62	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R63	Resistor, 9.76 k Ohm $\pm 1\%$, 1/4W	103-9764	1
R64	Potentiometer, 500 Ohm $\pm 10\%$, 1/2W	177-5032	1
R65,R66	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R67 THRU R70	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	4
R71	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R72	Resistor, 12 k Ohm $\pm 5\%$, 1/4W	100-1253	1
R73,R74	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R75	Resistor, 12 k Ohm $\pm 5\%$, 1/4W	100-1253	1
R76,R77	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R78,R79	Resistor, 750 Ohm $\pm 5\%$, 1/4W	100-7533	2
R80,R81	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R82,R83	Resistor, 750 Ohm $\pm 5\%$, 1/4W	100-7533	2
R84	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R85 THRU R92	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	8
R93	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R94	Resistor, 7.5 k Ohm $\pm 5\%$, 1/4W	100-7543	1
R95	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R96	Resistor, 7.5 k Ohm $\pm 5\%$, 1/4W	100-7543	1
R97,R98	Resistor Network, 8 resistors, 100 Ohm $\pm 1\%$, 0.1W, 16-Pin DIP	226-0390	2
R99	Resistor, 240 Ohm $\pm 1\%$, 1/4W	103-2431	1
R100	Potentiometer, 200 Ohm $\pm 10\%$, 1/2W	177-2034	1
R101	Resistor, 240 Ohm $\pm 1\%$, 1/4W	103-2431	1
R102	Potentiometer, 200 Ohm $\pm 10\%$, 1/2W	177-2034	1
R103,R104	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R105	Resistor Network, 8 resistors, 8.2 k Ohm $\pm 0.5\%$, 0.1W, 16-Pin DIP	226-0391	1
R106 THRU R108	Resistor, 30.1 k Ohm $\pm 1\%$, 1/4W	100-3051	3
R109	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R110,R111	Resistor, 4.99 k Ohm $\pm 1\%$, 1/4W	100-5041	2
R112	Potentiometer, 20 k Ohm $\pm 10\%$, 1/2W	177-2054	1
R113	Resistor, 90.9 k Ohm $\pm 1\%$, 1/4W	103-9095	1
R114	Resistor, 2.00 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R115	Resistor, 120 k Ohm $\pm 5\%$, 1/4W	100-1263	1
R116	Resistor, 3.9 k Ohm $\pm 5\%$, 1/4W	100-3943	1
R117,R118	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R119	Resistor, 6.8 k Ohm $\pm 5\%$, 1/4W	100-6843	1

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 4 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R120	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R121	Potentiometer, 50 k Ohm $\pm 10\%$, 1/2W (COMP LEVEL)	179-5050	1
R122	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R123	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W (HF1)	178-1053	1
R124	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R125	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	1
R126	Potentiometer, 50 k Ohm $\pm 10\%$, 1/2W (HF2)	178-5053	1
R127	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R128	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R129	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W (LF1)	178-1053	1
R130	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R131	Potentiometer, 2 Meg Ohm $\pm 10\%$, 1/2W (LF2)	176-2074	1
R132	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	1
R133 THRU R135	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	3
R136	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R137, R138	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R139	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R140	Resistor, 5.1 k Ohm $\pm 5\%$, 1/4W	100-5143	1
R141, R142	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R143	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R144	Resistor, 12 k Ohm $\pm 5\%$, 1/4W	100-1253	1
R145, R146	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R147, R148	Resistor, 750 Ohm $\pm 5\%$, 1/4W	100-7533	2
R149	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R150 THRU R153	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	4
R154	Resistor, 51.1 Ohm $\pm 1\%$, 1/4W	103-5112	1
R155	Resistor Network, 8 resistors, 8.2 k Ohm $\pm 0.5\%$, 0.1W, 16-Pin DIP	226-0391	1
R156	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R157	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R158	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R159	Resistor, 820 Ohm $\pm 5\%$, 1/4W	100-8233	1
R160	Potentiometer, 500 Ohm $\pm 10\%$, 1/2W	177-5032	1
R161	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R162	Resistor, 6.2 k Ohm $\pm 5\%$, 1/4W	100-6243	1
R163	Resistor, 5.1 k Ohm $\pm 5\%$, 1/4W	100-5143	1
R164	Resistor Network, 8 resistors, 10 k Ohm $\pm 0.5\%$, 0.1W, 16-Pin DIP	226-0392	1
R165	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R166 THRU R169	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	4
R170	Resistor, 7.5 k Ohm $\pm 5\%$, 1/4W	100-7543	1
R171	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R172	Resistor, 10 Meg Ohm $\pm 5\%$, 1/4W	100-1083	1
R173	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R174	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R175, R176	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R177	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R178	Potentiometer, 2 k Ohm $\pm 10\%$, 1/2W	177-2044	1
R179	Resistor, 5600 Ohm $\pm 5\%$, 1/4W	100-5643	1
R180	Resistor, 390 Ohm $\pm 5\%$, 1/2W	110-3933	1
R181	Resistor, 180 k Ohm $\pm 5\%$, 1/4W	100-1863	1
R182	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R183	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R184	Resistor, 330 Ohm $\pm 5\%$, 1/4W	100-3333	1
R185	Resistor, 2.00 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R186	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R187	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R188	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R189	Resistor, 2.00 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R190	Resistor, 6.8 k Ohm $\pm 5\%$, 1/4W	100-6843	1
R191, R192	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	2
R193, R199 THRU R206	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	9
R207 THRU R210	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	4

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 5 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R211	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R217	Resistor, 301 Ohm $\pm 1\%$, 1/4W	100-3031	1
R218	Resistor, 100 Ohm $\pm 1\%$, 1/4W	100-1031	1
R219	Resistor, 301 Ohm $\pm 1\%$, 1/4W	100-3031	1
R220	Resistor, 100 Ohm $\pm 1\%$, 1/4W	100-1031	1
R221	Resistor, 162 Ohm $\pm 1\%$, 1/4W	100-1631	1
R222	Resistor, 2.00 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R223	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W (PILOT LEVEL)	178-1043	1
R224	Resistor, 121 Ohm $\pm 1\%$, 1/4W	100-1231	1
R225	Resistor, 2.49 k Ohm $\pm 1\%$, 1/4W	103-2494	1
R226	Resistor, 115 Ohm $\pm 1\%$, 1/4W	100-1131	1
R227	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	103-1041	1
R228	Resistor, 100 Ohm $\pm 1\%$, 1/4W	103-1031	1
R229	Resistor, 301 Ohm $\pm 1\%$, 1/4W	100-3031	1
R230	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	103-1041	1
R231	Resistor, 115 Ohm $\pm 1\%$, 1/4W	100-1131	1
R232	Resistor, 150 Ohm $\pm 1\%$, 1/4W	100-1531	1
R233,R234	Resistor, 1.82 k Ohm $\pm 1\%$, 1/4W	100-1841	2
R235	Resistor, 150 Ohm $\pm 1\%$, 1/4W	100-1531	1
R238 THRU R250	Resistor, 62 Ohm $\pm 5\%$, 1/4W	100-6223	13
R251	Resistor, 680 Ohm $\pm 5\%$, 1/4W	100-6833	1
R252 THRU R254	Resistor, 97.6 k Ohm $\pm 1\%$, 1/4W	100-9751	3
R256,R259	Resistor, 2.32 k Ohm $\pm 1\%$, 1/4W	103-2341	2
R261,R262	Resistor, 1.96 k Ohm $\pm 1\%$, 1/4W	103-1964	2
R263	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R264 THRU R266	Resistor, 47 Ohm $\pm 5\%$, 1/4W	100-4723	3
R267 THRU R271	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	5
R272,R273	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	2
S1	7 Section DPDT Push-Push Switch with Black Switch Caps, Positions 2 thru 5 Interlocked, Resistive Load: 1A @ 28V dc or 0.45A @ 115V ac (Mode)	343-0049	1
S2	7 Section DPDT Push-Push Switch, Positions 3 Thru 7 Inter- locked, Resistive Load: 1A @ 28V dc or 0.45A @ 115V ac (MONITOR DISPLAY)	343-0048	1
U1	Integrated Circuit, SN74LS74N, Dual-D Flip-Flop, 14-Pin DIP	228-0074	1
U2	Integrated Circuit, SN74LS02N, Quad 2-Input NOR, 14-Pin DIP	228-2402	1
U3	Integrated Circuit, SN74LS93N, 4-Bit Binary Counter, 14-Pin DIP	228-0010	1
U4	Integrated Circuit, SN74LS92, Divide-By-12 Counter, 14-Pin DIP	228-0092	1
U5	Integrated Circuit, SN74LS93N, 4-Bit Binary Counter, 14-Pin DIP	228-0010	1
U6	Integrated Circuit, SN74LS92, Divide-By-12 Counter, 14-Pin DIP	228-0092	1
U7	Integrated Circuit, SN74LS86N, Quad 2-Input Exclusive OR, 14-Pin DIP	228-2486	1
U8	Integrated Circuit, SN74LS377N, Octal D Flip-Flop, 20-Pin DIP	228-2377	1
U9	Integrated Circuit, SD5000N, N-Channel Enhancement Mode DMOS FET Analog Switch Array, 16-Pin DIP	226-5000	1
U10	Integrated Circuit, SD5200N, N-Channel Enhancement Mode DMOS FET Driver, 16-Pin DIP	226-5200	1
U11	Integrated Circuit, SD5000N, N-Channel Enhancement Mode DMOS FET Analog Switch Array, 16-Pin DIP	226-5000	1
U12,U13	Integrated Circuit, TL072CP, Quad JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	2
U14,U15	Integrated Circuit, NE5532A, Dual Low-Noise Operational Amplifier, 8-Pin DIP	221-5532- 001	2
U16 THRU U21	Integrated Circuit, TL072CP, Quad JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	6
U22	Integrated Circuit, LF347N, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U23	Integrated Circuit, LM3914N, Dot/Bar Dot Display, 14-Pin DIP	229-3914	1
U24	Integrated Circuit, LM555C, Timer, 8-Pin DIP	229-0555	1
U25	Integrated Circuit, LM3914N, Dot/Bar Dot Display, 14-Pin DIP	229-3914	1

TABLE 6-3. FS-30 MAIN CIRCUIT BOARD ASSEMBLY - 917-0100-1
(Sheet 6 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U26 THRU U29	Integrated Circuit, 4N33, Optical Isolator, Infrared LED-photo NPN Darlington Transistor Coupled Pair, 6-Pin DIP	229-0033	4
U30	Integrated Circuit, CD4012CN, Dual 4-Input NAND, 14-Pin DIP	228-4012	1
U31	Integrated Circuit, CD4011CN, Quad 2-Input NAND, 14-Pin DIP	228-4011	1
U32	Integrated Circuit, CD4012CN, Dual 4-Input NAND, 14-Pin DIP	228-4012	1
U33,U34	Integrated Circuit, MC1416, 7-Channel NPN Darlington Driver, 16-Pin DIP	226-2004	2
U35 THRU U38	Integrated Circuit, 4N33, Optical Isolator, Infrared LED-photo NPN Darlington Transistor Coupled Pair, 6-Pin DIP	229-0033	4
U39,U40	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	2
U41 THRU U43	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	3
U44,U45	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	2
U46	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U47	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	1
XR40,XR41, XR97,XR98, XR105,XR155, XR164	Socket, 16-Pin DIP	417-1604	7
XU1 THRU XU7	Socket, 14-Pin DIP	417-1404	1
XU8	Socket, 20-Pin DIP	417-2004	1
XU9 THRU XU11	Socket, 16-Pin DIP	417-1604	3
XU12 THRU XU21	Socket, 8-Pin DIP	417-0804	10
XU22	Socket, 14-Pin DIP	417-1404	1
XU23	Socket, 18-Pin DIP	417-1804	1
XU24	Socket, 8-Pin DIP	417-0804	1
XU25	Socket, 18-Pin DIP	417-1804	1
XU26 THRU XU29	Socket, 6-Pin DIP	417-0600	4
XU30 THRU XU32	Socket, 14-Pin DIP	417-1404	3
XU33,XU34	Socket, 16-Pin DIP	417-1604	2
XU35 THRU XU38	Socket, 6-Pin DIP	417-0600	4
Y1	Quartz Crystal, 3648 kHz ± 20 PPM, 0-50°C, A/T Cut, 32 pF Load Capacitance, Northern Engineering Labs Case No. NE33PA2	390-0008	1
----	Pad, Transistor Mounting, TO-220, for XU39 Thru XU47	409-7403	9
----	Screw, Nylon, 6-32 X 1/2 inch (1.27 cm), Pan Head	420-6998	9
----	Blank Circuit Board	517-0100	1

TABLE 6-4. FS-30 LED CIRCUIT BOARD ASSEMBLY - 917-0101

REF. DES.	DESCRIPTION	PART NO.	QTY.
DS15 THRU DS17	Indicator, LED, Red, 521-9212, 1.7V @ 50 mA Maximum (MONO L, MONO R, and MONO L + R)	323-9217	3
DS18	Indicator, LED, Green, 521-9175, 2.3V @ 40 mA Maximum (STEREO)	323-9224	1
P14	Plug, Housing, 6-Pin	417-0601	1
----	Crimp Contacts for P14	417-8766	5
----	Blank Circuit Board	517-0101	1

TABLE 6-5. FS-30 LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY - 917-0102
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C101,C102	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C103,C104	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	2
C105 THRU C108	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C109,C110	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	2
C111,C112	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C113	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	1
C115,C116	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C117	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	1
C201,C202	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C203,C204	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	2
C205 THRU C208	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	4
C209,C210	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	2
C211,C212	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C213	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	1
C215,C216	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	2
C217	Capacitor, Mica, 1000 pF $\pm 1\%$, 500V	041-1031	1
D1,D2	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	2
J101,J102	Header, 2-Pin	417-4004	2
J103	Header, 3-Pin	417-0003	1
J201,J202	Header, 2-Pin	417-4004	2
J203	Header, 3-Pin	417-0003	1
P1	Plug, Housing, 8-Pin	417-0046	1
----	Crimp Contacts for P1	417-8766	8
P101 THRU P103,P201 THRU P203	Jumper Plug, 2-Pin	340-0004	6
R101	Resistor, 11.8 k Ohm $\pm 1\%$, 1/4W	103-1151	1
R102	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R103	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R104	Resistor, 1.65 k Ohm $\pm 1\%$, 1/4W	103-1641	1
R105	Resistor, 21.5 k Ohm $\pm 1\%$, 1/4W	103-2151	1
R106,R107	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R108	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	1
R109	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R110	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R111	Resistor, 5.76 k Ohm $\pm 1\%$, 1/4W	103-5764	1
R112 THRU R114	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	3
R115,R116	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R117	Resistor, 16.9 k Ohm $\pm 1\%$, 1/4W	103-1695	1
R118	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R119	Resistor, 1.62 k Ohm $\pm 1\%$, 1/4W	103-1624	1
R120	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R121	Resistor, 24.9 k Ohm $\pm 1\%$, 1/4W	103-2495	1
R122,R123	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R124	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	1
R125	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R126	Resistor, 7.68 k Ohm $\pm 1\%$, 1/4W	103-7684	1
R127	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R128 THRU R130	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	3
R131,R132	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R133	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R134	Resistor, 13.4 k Ohm $\pm 1\%$, 1/4W	103-1375	1
R135	Resistor, 6.65 k Ohm $\pm 1\%$, 1/4W	103-6641	1
R136	Resistor, 6.98 k Ohm $\pm 1\%$, 1/4W	103-6984	1
R137,R138	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R139	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1553	1
R140	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R141,R142	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R143	Resistor, 47 Ohm $\pm 5\%$, 1/4W	100-4723	1
R144,R145	Resistor, 5.6 k Ohm $\pm 5\%$, 1/4W	100-5643	2
R146	Resistor, 3.3 k Ohm $\pm 5\%$, 1/4W	100-3343	1
R147,R148	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	2
R149	Resistor, 3.3 k Ohm $\pm 5\%$, 1/4W	100-3343	1
R150	Resistor, 11.8 k Ohm $\pm 1\%$, 1/4W	103-1151	1

TABLE 6-5. FS-30 LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY - 917-0102
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R151	Resistor, 16.9 k Ohm $\pm 1\%$, 1/4W	103-1695	1
R201	Resistor, 11.8 k Ohm $\pm 1\%$, 1/4W	103-1151	1
R202	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R203	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R204	Resistor, 1.65 k Ohm $\pm 1\%$, 1/4W	103-1641	1
R205	Resistor, 21.5 k Ohm $\pm 1\%$, 1/4W	103-2151	1
R206, R207	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R208	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	1
R209	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R210	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R211	Resistor, 5.76 k Ohm $\pm 1\%$, 1/4W	103-5764	1
R212 THRU R214	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	3
R215, R216	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R217	Resistor, 16.9 k Ohm $\pm 1\%$, 1/4W	103-1695	1
R218	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R219	Resistor, 1.62 k Ohm $\pm 1\%$, 1/4W	103-1624	1
R220	Resistor, 5.90 k Ohm $\pm 1\%$, 1/4W	103-5904	1
R221	Resistor, 24.9 k Ohm $\pm 1\%$, 1/4W	103-2495	1
R222, R223	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R224	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	1
R225	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R226	Resistor, 7.68 k Ohm $\pm 1\%$, 1/4W	103-7684	1
R227	Resistor, 8.45 k Ohm $\pm 1\%$, 1/4W	103-8454	1
R228 THRU R230	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	3
R231, R232	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R233	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R234	Resistor, 13.7 k Ohm $\pm 1\%$, 1/4W	103-1375	1
R235	Resistor, 6.19 k Ohm $\pm 1\%$, 1/4W	103-6194	1
R236	Resistor, 6.98 k Ohm $\pm 1\%$, 1/4W	103-6984	1
R237, R238	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R239	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1553	1
R240	Potentiometer, 5 k Ohm $\pm 10\%$, 1/2W	177-5044	1
R241, R242	Resistor, 10.0 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R243	Resistor, 47 Ohm $\pm 5\%$, 1/4W	100-4723	1
R244, R245	Resistor, 5.6 k Ohm $\pm 5\%$, 1/4W	100-5643	2
R246	Resistor, 3.3 k Ohm $\pm 5\%$, 1/4W	100-3343	1
R247, R248	Resistor, 8.2 k Ohm $\pm 5\%$, 1/4W	100-8243	2
R249	Resistor, 3.3 k Ohm $\pm 5\%$, 1/4W	100-3343	1
R250	Resistor, 11.8 k Ohm $\pm 1\%$, 1/4W	103-1151	1
R251	Resistor, 16.9 k Ohm $\pm 1\%$, 1/4W	103-1695	1
R252	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	175-1034	1
U101 THRU U105, U201 THRU U205	Integrated Circuit, TL072CP, Dual P-Channel JFET Input Operational Amplifier, 8-Pin DIP	221-0072	10
XU101 THRU XU105, XU201 THRU XU205	Socket, 8-Pin DIP	417-0804	10
----	Blank Circuit Board	517-0102	1

TABLE 6-6. FS-30 CHASSIS AND RF INTERFACE FILTER ASSEMBLY - 950-0016
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C21	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	1
C22	Capacitor, Mylar, 0.1 μ F $\pm 10\%$, 100V	030-1053	1
C23 THRU C26	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	4
C27	Capacitor Assembly, Kapton Feed-Thru, 100 pF: Kapton Dielectric	----	1
	Nylon Insulator	409-1817	2
		423-6007	1
C28	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	1

TABLE 6-6. FS-30 CHASSIS AND RF INTERFACE FILTER ASSEMBLY - 950-0016
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C85	Capacitor Assembly, Kapton Feed-Thru, 100 pF:	----	1
	Kapton Dielectric	409-1817	2
	Nylon Insulator	423-6007	1
C86	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	1
C87	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	1
C109 THRU C113	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	5
C114 THRU C118,C122 THRU C126	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	10
C127 THRU C131	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	5
C132 THRU C135	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	4
C161	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C163	Capacitor, Ceramic Feed-Thru, 1000 pF $\pm 20\%$, 500V	008-1033	1
C175	Capacitor, Electrolytic, 22 uF, 50V	024-3274	1
FL2	Fused Power Connector/Voltage Selector/EMI Filter, 120/240V	360-6504	1
J2,J9	Receptacle, BNC	417-0048	2
L10 THRU L15,L19	Ferrite Choke, 180 MHz, 2.5 Turns, Single Section	364-0002	7
P3	Plug, Housing, 14-Pin	417-1401	1
P11,P15	Plug, Housing, 8-Pin	417-0046	2
-----	Crimp Contacts for P3, P11, and P15	417-8766	31
P17	Receptacle, Housing, 4-Pin	418-0240	1
-----	Crimp Contacts for P17	417-0053	4
R34,R35	Resistor, 604 Ohm $\pm 1\%$, 1/4W	100-6031	2
R194 THRU R197	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	103-1041	4
R198	Resistor, 51.1 Ohm $\pm 1\%$, 1/4W	103-5112	1
R212 THRU R215	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	103-1041	4
R236	Resistor, 470 Ohm $\pm 5\%$, 2W	130-4733	1
T1	Power Transformer, 115/230V, 50/60 Hz	376-0038	1
	Dual 115V Primary: One Winding Tapped at 95V		
	Dual Secondary: 36.74 VCT @ 1.2A, 3.94V @ 0.7A		
TB1	Barrier Strip, 20 Terminals	412-0020	1
XF2	Fuse Clip	415-1001	2
-----	Blank Circuit Board	519-0035	1

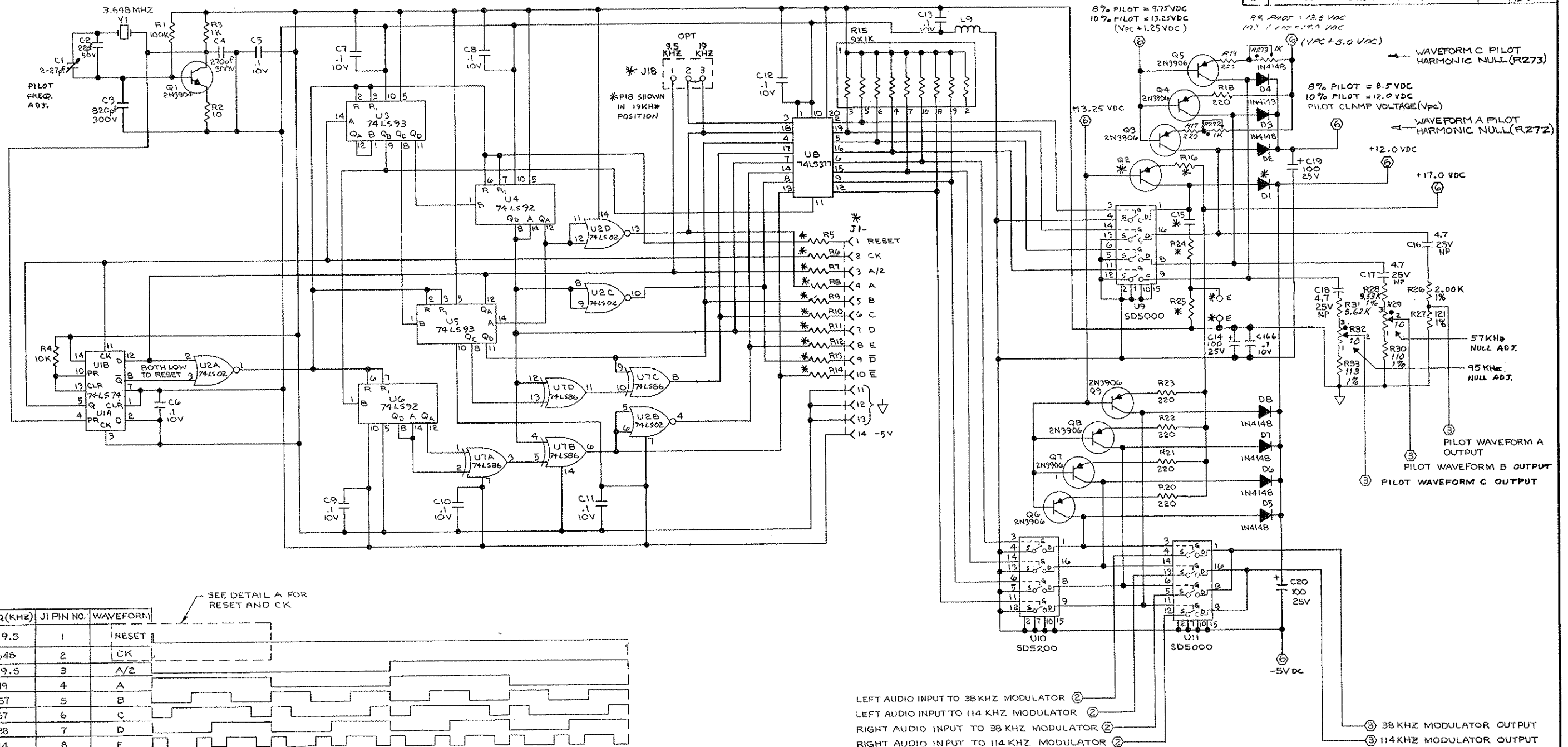
TABLE 6-7. FS-30 FRONT PANEL ASSEMBLY - 950-0017

REF. DES.	DESCRIPTION	PART NO.	QTY.
-----	Gray Display Window	467-1001-1	1
-----	Frosted Display Window	467-1002-1	1
-----	Gray Switch Cap	343-6402	5
-----	Black Switch Cap	343-6401	2

TABLE 6-8. FS-30 ACCESSORY KIT - 950-0018/959-0182

REF. DES.	DESCRIPTION	PART NO.	QTY.
F1,F2	Fuse, MDL, 250V, 3/4A, Slow-Blow (for 120 Volt Operation)	334-0075	2
F1,F2	Fuse, MDL, 250V, 3/8A, Slow-Blow (for 240 Volt Operation)	334-0375	2
-----	AC Line Cord, N.E.M.A. 3-Wire 5-15P North American Plug (for 120 Volt Operation)	682-0001	1
-----	AC Line Cord, CEE 7/7 3-Wire European Plug (for 240 Volt Operation)	682-0003	1
-----	Output Cable, BNC Connectors, 30 inches (76.2 cm) long	947-0020	1
-----	Plug, BNC	417-0205	2
-----	Adjustment Tool	407-0186	1

REV.	DESCRIPTION	DATE	BY	REV.	DESCRIPTION	DATE	APPROVED
M	PER EGN 3708 ONE	5-9-82	HEM	F	ELIMINATE T1, T1A, T2, AND MOUNTED CIRCUITRY	4-27-82	HEM
N	PER EGN 3800 (SHEETS)	9-21-82	HEM	G	PER EGN 2458 (SHTS 1-6)	5-4-82	HEM
P	PER EGN 3307 SHEETS 1,2,3,5,6	9-24-82	HEM	H	PER EGN 3489 (SHTS 2,3,5,6)	5-13-82	HEM
R	PER EGN 4136 SHEETS	4-13-83	MM	J	PER EGN 3594 (SHTS 3&4)	6-24-82	HEM
				K	PER EGN 3667 (SHTG)	7-15-82	HEM
				L	PER EGN 3692 (SHTS 1,5,6)	8-9-82	HEM



FREQ(KHZ)	J1 PIN NO.	WAVEFORM
9.5	1	RESET
3648	2	CK
9.5	3	A/2
19	4	A
57	5	B
57	6	C
38	7	D
114	8	E
38	9	\bar{D}
114	10	\bar{E}

RESET

CK

A/Z

A

B

C

D

E

F

NOTES: (APPLY TO ALL 6 SHEETS OF THIS SCHEMATIC)

1. ALL RESISTORS ARE 1/4W, 5%, "VALUES IN OHMS : ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS SPECIFIED. LAST R = 271

2. ○ DENOTES CONTINUING CIRCUITRY CONNECTIONS ON APPLICABLE DWG SHEETS.

3. * DENOTES DELETED COMPONENTS ON APPLICABLE ASSEMBLIES. (INCLUDED TO FACILITATE FUTURE WCN'S, CS'S, ETC.)

4. L9-L15, L19-L20 ARE FEROXLUBE #VK200-20/4B WIREWOUND CHOKES.

5. L16-L18 ARE DUAL WOUND POT CORE ASSEMBLIES (BE #360-0015).

6. L21 IS A DUAL WOUND FERRITE BEAD ASSEMBLY (BE #956-0002).

7. R40, R41, R97, R98, R105, R155, AND R164 ARE 16 PIN DIP
THIN FILM RESISTOR NETWORKS. BECKMAN 69B SERIES OF EQUIV.

8. R15 IS A 10 PIN SIP (BECKMAN #785-1-R1.0K) RESISTOR NETWORK.

9. • (DOT) DENOTES TRIMPOINT WIPER LOCATION FOR FULL CLOCKWISE ROTATION.

10. (N) - DENOTES WIRE NUMBERS.

11. REFERENCES ARE E917-0100-1 MAIN PCB ASSY
E917-0101 LED PCB ASSY
950-0016 CHASSIS & RFI FILTER ASSY

LAST R * 271

H M 1

PART OF:
MAIN PCB ASSY
917-0100-1

TITLE		FS30	
OVERALL SCHEMATIC DIAGRAM			
D	DWG. NO.	909-0100	REV. A
DIGITAL WORD GEN AND MDACS		SCALE	SHEET 1 OF 6

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TOLERANCE UNLESS
OTHERWISE SPECIFIED

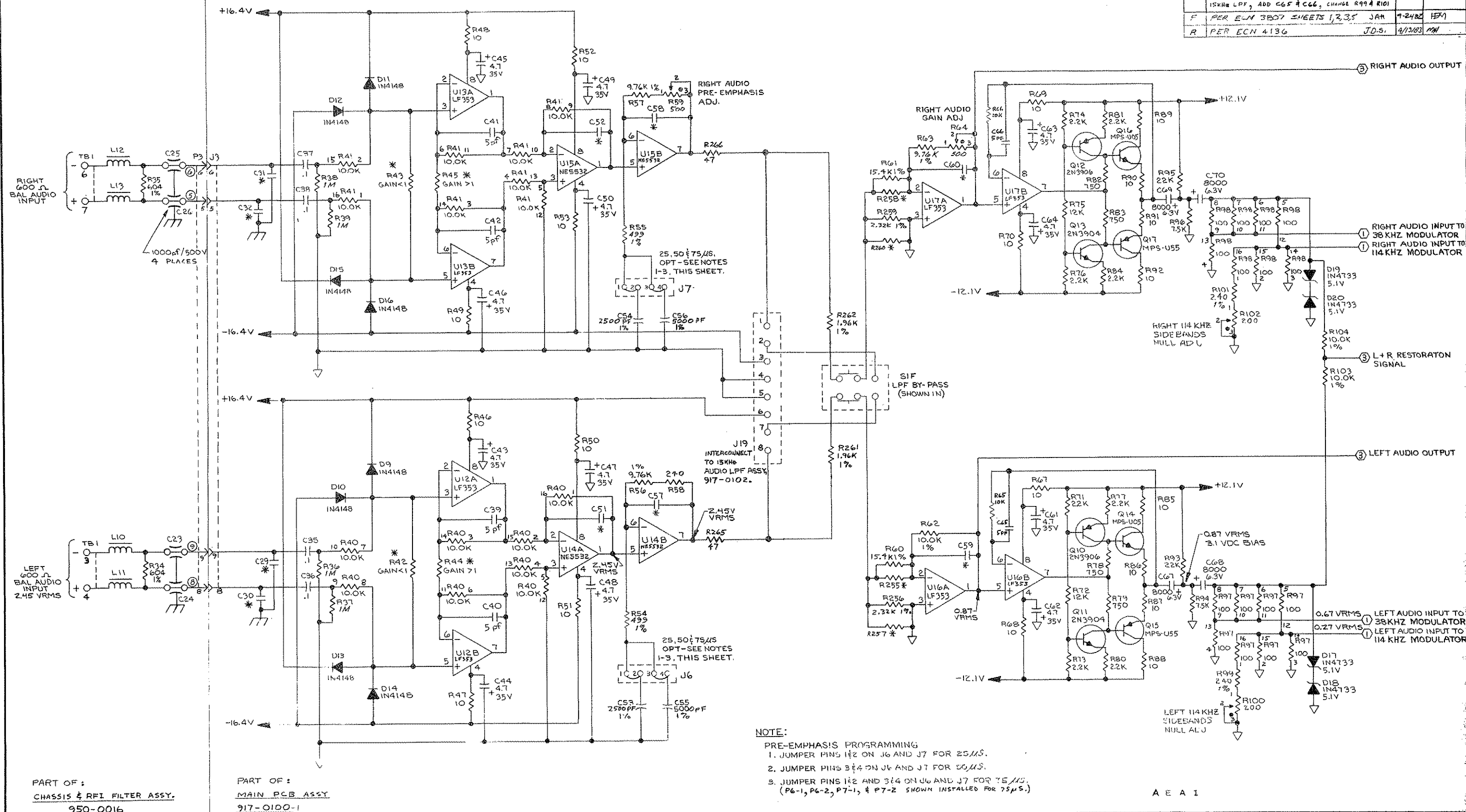
DECIMAL 2 PL. $\pm .01$ 3 PL. $\pm .005$
FRACTIONAL $\pm 1/64$
ANGULAR $\pm 1^\circ$
SHARP EDGES TO
BEND RADI
FILET RADI

MATERIAL

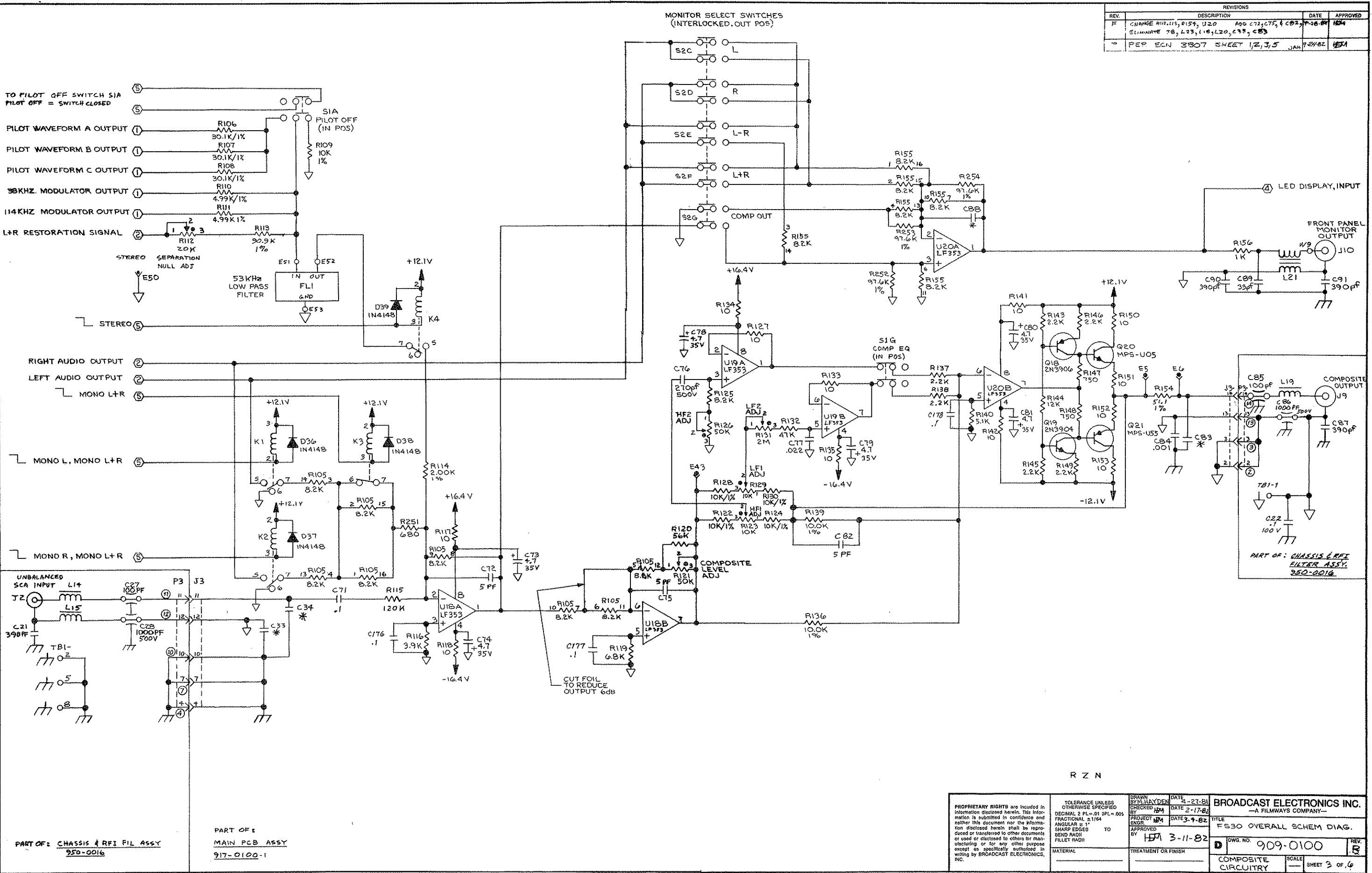
DRAWN BY M. HAYDEN	DATE 4-3-81
CHECKED BY HEM	DATE 2-17-81
PROJECT ENGR. HEM	DATE 3-9-81
APPROVED BY HEM	3-11-82
TREATMENT OR FINISH	

BROADCAST ELECTRONICS INC. —A FILMWAYS COMPANY—	
TITLE	FS30 OVERALL SCHEMATIC DIAGRAM
DWG. NO.	909-0100
D	REV. <i>R</i>
DIGITAL WORD GEN SCALE	

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
E	ELIMINATE FINAL LC INPUT FILTER SECTION, SCALE PRE-EMPH COMPONENTS, ACCOMMODATE 2KHZ PASSIVE 15KHZ LPF, ADD C65 & C66, CHANGE R99 & R101	4-27-82	HJM
F	PER ECH 3807 SHEETS 1,2,3,5 JAM	7-24-82	HJM
R	PER ECH 4136	J.D.S. 4/13/83	HJM

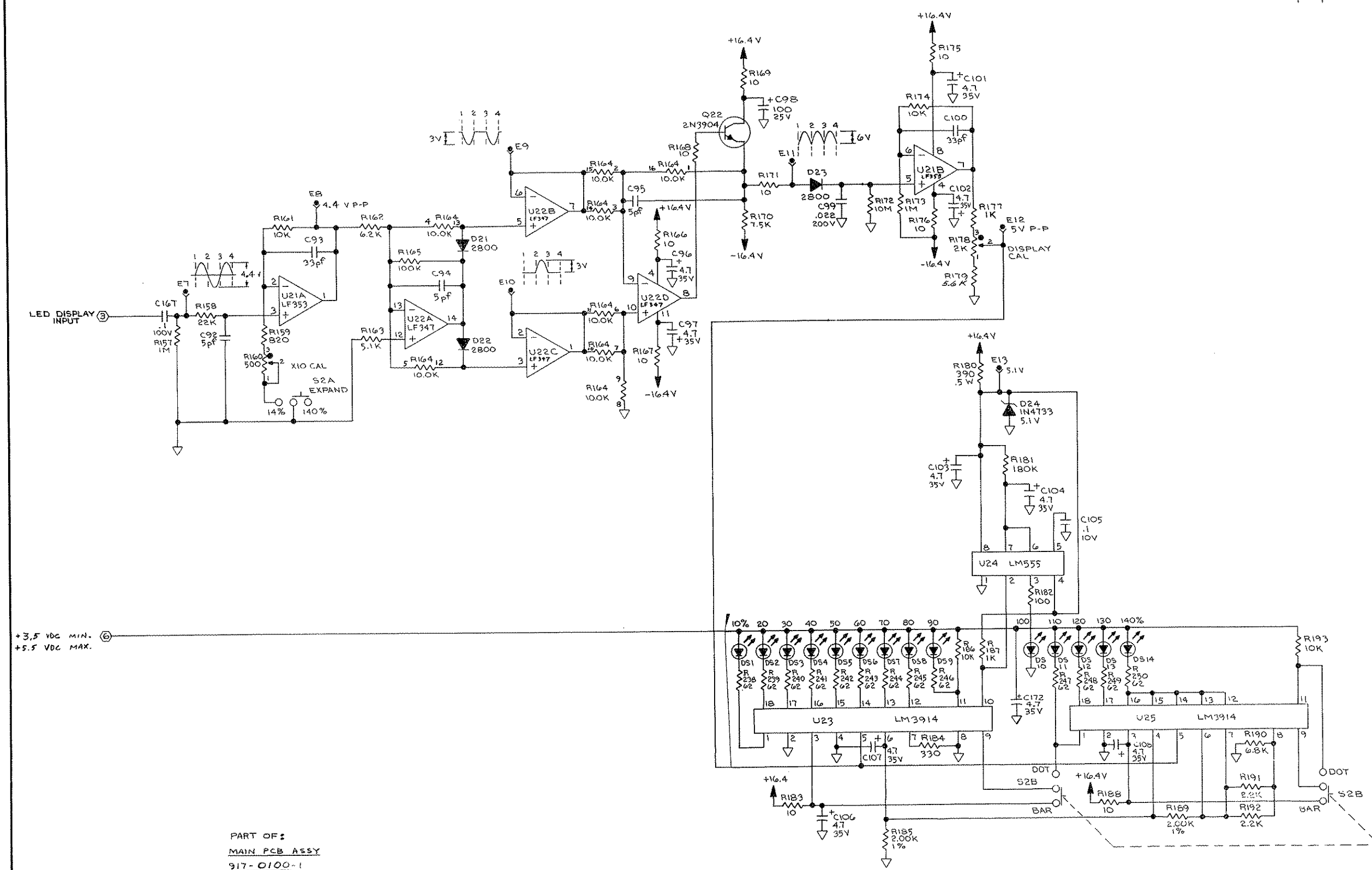


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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
F	CHANGE R112, R154, U20 ELIMINATE T8, L23, L19, L20, C33, C83	2-18-82	HSA
10	PEP ECU 3807 SHEET 1,2,3,5	2-24-82	HSA

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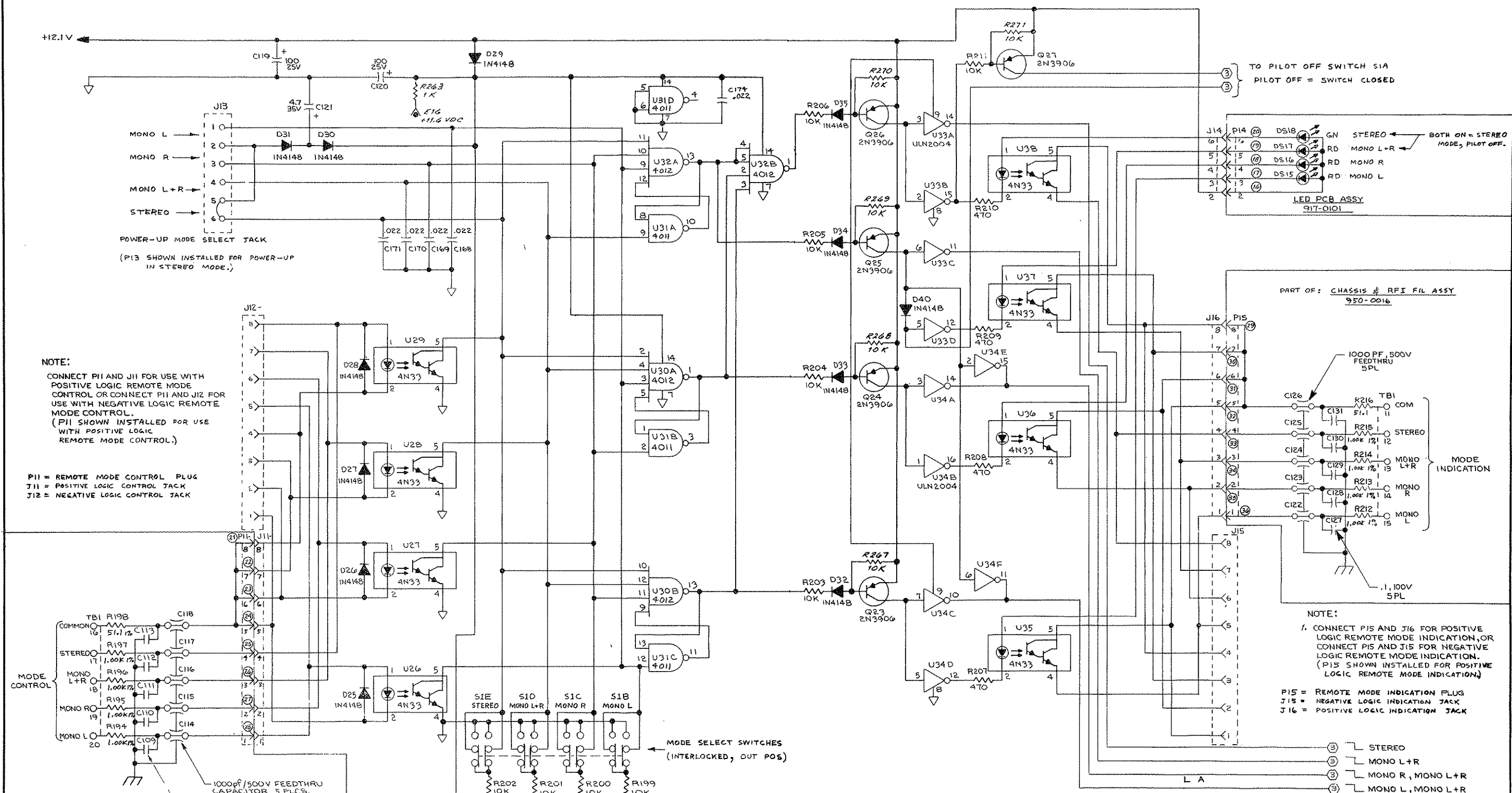


PART OF:
MAIN PCB ASSY
917-0100-1

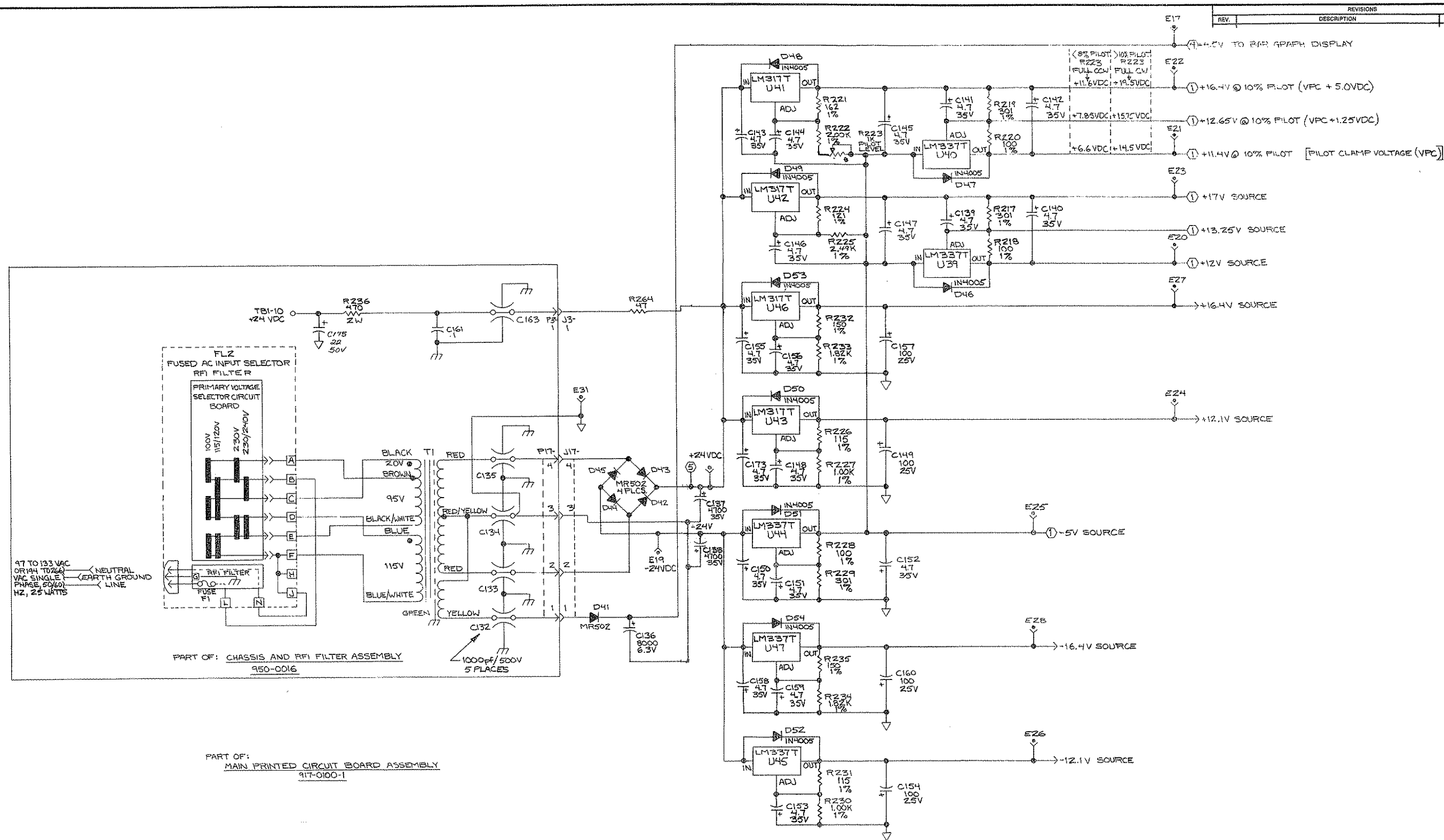
OR N

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DRAWN BY HYNDEN CHECKED BY HBA PROJECT ENGR. HYNDEN APPROVED BY HYNDEN		DATE 4-14-81 DATE 2-17-82 DATE 3-1-82 DATE 3-11-82		TITLE FS30 OVERALL SCHEMATIC DIAG	
MATERIAL		TREATMENT OR FINISH		DWG. NO. 909-0100	
LED DISPLAY CIRCUITRY		SCALE SHEET 4 of 6		REV. R	

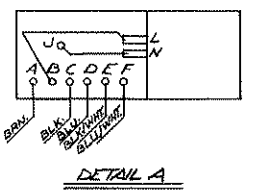
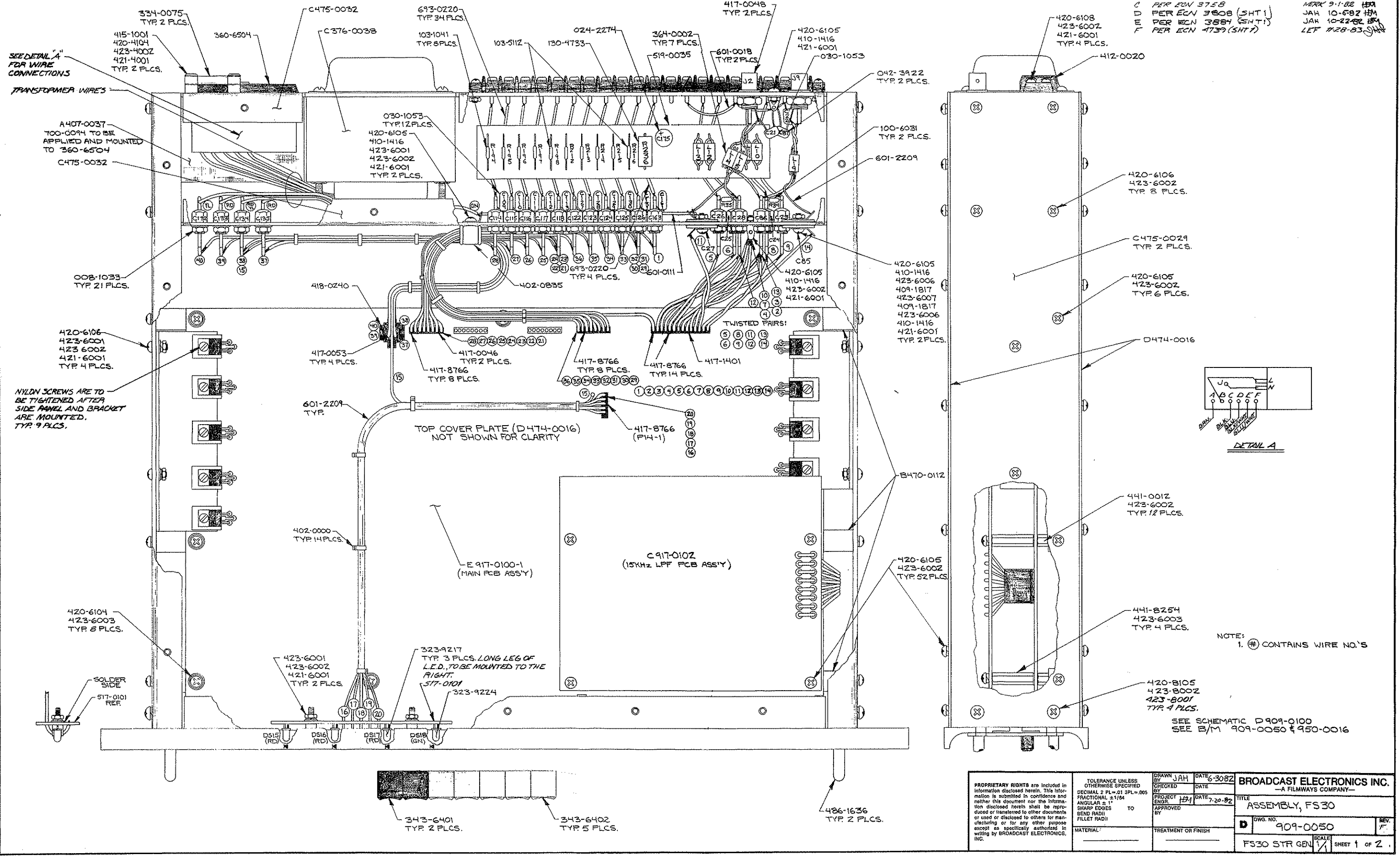
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
E	CHANGE P13-198, R312-316 TO RN55D TYPE WITH LONG LEADS		
D	PER ECU T-907 SHEET 1,2,3,5 JAW	1-24-82	HE1



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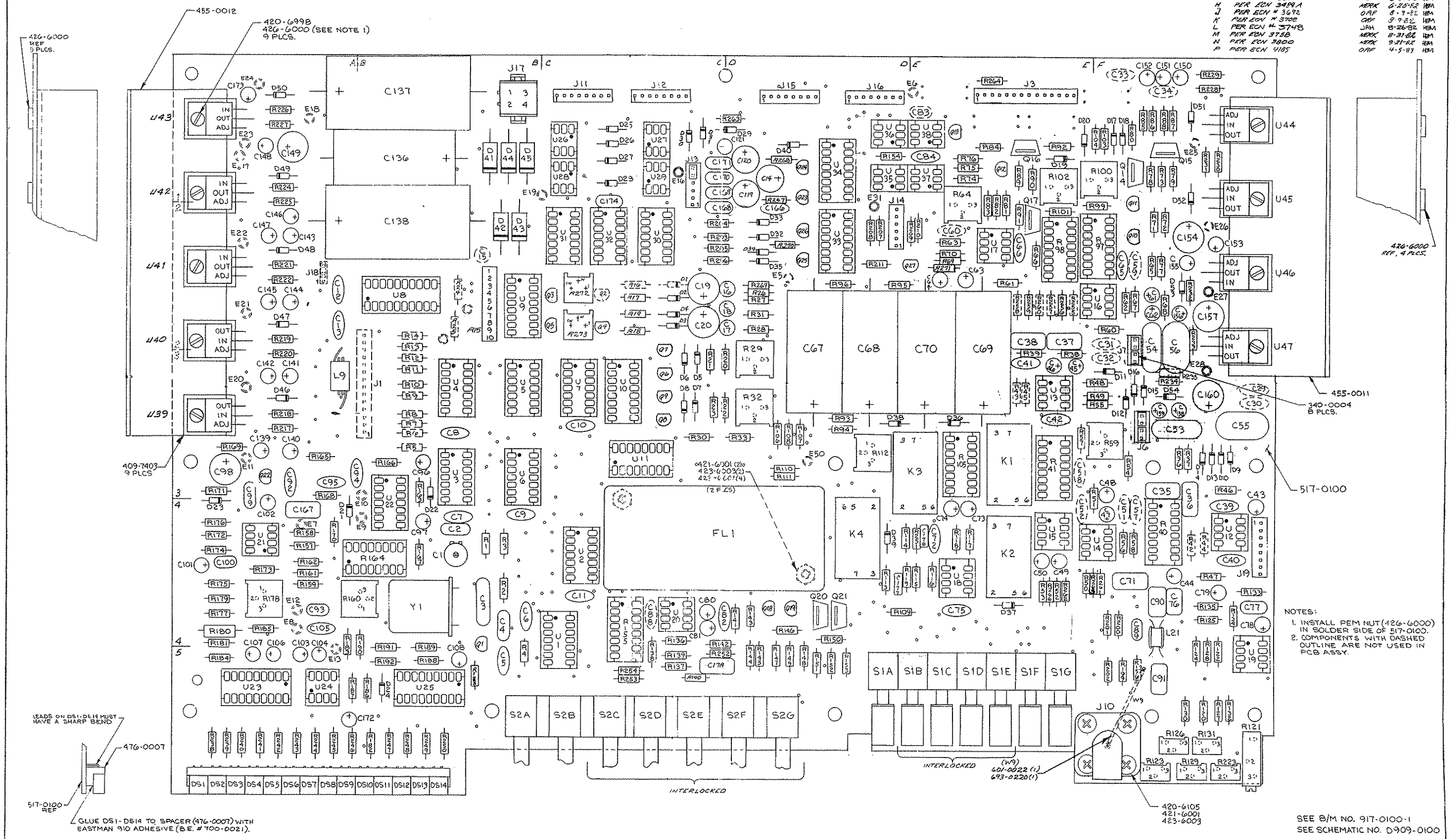
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	PER ECN #3640	JAN 7-8-82	JAH
P	PER ECN #3703	DEC 8-11-82	JAH
C	PER ECN 3758	MAY 9-1-82	JAH
D	PER ECN 3808 (SHT 1)	JAN 10-6-82	JAH
E	PER ECN 3884 (SHT 1)	JAN 10-22-82	JAH
F	PER ECN 4739 (SHT 1)	LET 11-28-83	JAH



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REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	
C1	B4	C63	E2	C119	D1	D2	C2	D43	B2	E23	A1	Q15	F1	R46	F3	R88	F1	R131	F5	R173	A4	R226	A1	R271	E2	U37	E1	
C2	B4	C64	E2	C120	D1	D3	C2	D44	B1	E24	A1	Q16	E1	R47	F4	R89	E1	R132	F5	R174	A4	R227	A1	R272	C2	U38	E1	
C3	B4	C65	F2	C121	C1-D1	D4	C2	D45	B1	E25	F1	Q17	E2	R48	F3	R90	E1	R133	F4	R175	A4	R228	F1	R273	C2	U39	A3	
C4	B4	C66	E2	C136	B1	D5	C3	D46	A3	E26	F2	Q18	D4	R49	F3	R91	E2	R134	F4	R176	A4	R229	F1	S1	D5-E5	U40	A2	
C5	B5	C67	D2-D3	C137	B1	D6	C3	D47	A2	E27	F2	Q19	D4	R50	E4	R93	D3	R135	F4	R177	A4	R230	F1	S2	B5-C5-	U41	A2	
C6	B4	C68	D2-D3	C138	B2	D7	C3	D48	A2	E28	F3	Q20	D4	R51	F3	R94	D3	R136	C4	R178	A4	R231	F1		D5	U42	A1	
C7	B4	C69	E2-E3	C139	A3	D8	C3	D49	A1	E31	D1-D2	Q21	D4	R52	E4	R95	D2	R137	C5	R179	A4	R232	F2	U1	C4-C5	U43	A1	
C8	B3	C70	E2-E3	C140	A3	D9	F3	D50	A1	E50	D3	Q22	A3	R53	E4	R96	D2	R138	C4-C5	R180	A4	R233	F1	U2	C4	U44	F1	
C9	B4	C71	F4	C141	A3	D10	F3	D51	F1	FL1	C4-D4	Q23	D1	R54	F3	R97	F2	R139	C5	R181	A4	R234	F1	U3	B3	U45	F1	
C10	C3	C72	E4	C142	A3	D11	F3	D52	F1	J1	B3	Q24	D1	R55	F3	R98	E2	R140	C5-D5	R182	B5	R238	A5	U4	B3	U46	F2	
C11	C4	C73	E4	C143	A2	D12	F3	D53	F2	J3	E1	Q25	D2	R56	F4	R99	F1	R141	D4	R183	A4-A5	R239	A5	U5	B3	U47	F2	
C12	A2	C74	E4	C144	A2	D13	F3	D54	F3	J6	F3	Q26	D2	R57	E3	R100	F1	R142	C4-C5	R184	A5	R240	A5	U6	B3	Y1	B4	
C13	A2	C75	E4	C145	A2	D14	F3	DS1	A5	J7	F2-F3	Q27	D2-E2	R58	F4	R101	E2	R143	D4	R186	B5	R241	A5	U7	C3			
C14	D1	C76	F4	C146	A2	D15	F3	DS2	A5	J10	F5	R1	B4	R59	F3	R102	E1	R144	D5	R187	A5	R242	A5	U8	B2			
C16	D2	C77	F4	C147	A2	D16	F3	DS3	A5	J11	C1	R2	B4	R60	F2	R103	F1	R145	D5	R188	B5	R243	A5	U9	B2			
C17	D2	C78	F4	C148	A1	D17	F1	DS4	A5	J12	C1	R3	B4	R61	E2	R104	F1	R146	D4	R189	B4-B5	R244	A5	U10	C3			
C18	D2	C79	F4	C149	A1	D18	F1	DS5	A5	J13	C1	R4	B4-B5	R62	F2	R105	E3	R147	D5	R190	B4-B5	R245	A5	U11	C3			
C19	C2	C80	C4	C150	F1	D19	E1	DS6	A5	J14	D2	R15	B2	R63	E2	R106	D3	R148	D5	R191	B4-B5	R246	A5	U12	F4			
C20	C2	C81	C4	C151	F1	D20	E1	DS7	A5	J15	D1	R16	C2	R64	E1-E2	R107	D3	R149	D5	R192	B5	R247	B5	U13	E3			
C35	F3	C82	D4	C152	F1	D21	A4	DS8	A5	J16	D1	R17	C2	R65	F2	R108	D3	R150	D4	R193	B5	R248	B5	U14	F4			
C36	F3	C84	E1	C153	F2	D22	B3	DS9	A5	J17	B1	R18	C2	R66	E2	R109	D4	R151	D5	R199	F5	R249	B5	U15	E4			
C37	E2	C89	F4	C154	F2	D23	A4	DS10	B5	J19	F4	R19	C2	R67	F2	R110	D3	R152	D5	R200	F4	R250	B5	U16	F2			
C38	E2	C90	F4	C155	F2	D24	B5	DS11	B5	K1	E3	R20	D3	R68	E2	R111	D3	R153	D5	R201	F4	R251	E4	U17	E2			
C39	F4	C91	F5	C156	F2	D25	C1	DS12	B5	K2	E4	R21	C3	R69	E2	R112	D3	R154	D1	R202	F5	R252	C5-D5	U18	E4			
C40	F4	C92	A3	C157	F2	D26	C1	DS13	B5	K3	E3	R22	D3	R70	E2	R113	D4	R155	C4	R203	C2	R253	C5	U19	F4-F5			
C41	E3	C93	A4	C158	F3	D27	C1	DS14	B5	K4	D4	R23	C3	R71	F2	R114	D4	R156	F5	R204	C2	R254	C5	U20	C4			
C42	E3	C94	A3-B3	C159	F3	D28	C1	E5	D2	L9	A3	R26	D2	R72	F2	R115	E4	R157	A4	R205	C2	R255	E2	U21	A4			
C43	F3-F4	C95	A3	C160	F3	D29	D1	E6	E1	L21	F4	R27	D2	R73	F1	R116	E4	R158	A4	R206	C2	R256	E2	U22	B3-B4			
C44	F4	C96	B3	C166	D2	D30	C1	E7	A4	Q1	B4	R28	D2	R74	E1	R117	E4	R159	A4	R207	D2	R257	E2	U23	A5			
C45	E3	C97	B4	C167	A4	D31	C1	E8	A4	Q2	C2	R29	D2-D3	R75	E1	R118	E4	R160	A4-B4	R208	D2	R258	E2	U24	A5			
C46	E3	C98	A3	C168	C2	D32	D2	E9	B4	Q3	C2	R30	C3	R76	E1	R119	D4-E4	R161	A4	R209	E2	R259	E2	U25	B5			
C47	F4	C99	A3	C169	C1-D1	D33	D2	E10	B3	Q4	C2	R31	D2	R77	F2	R120	F5	R162	A4	R210	E2	R260	E2	U26	C1			
C48	F3	C100	A4	C170	C1-D1	D34	D2	E11	A3	Q5	C2	R32	D3	R78	F1	R121	F5	R163	B3	R211	D2	R261	F4	U27	C1			
C49	E4	C101	A4	C171	C1-D1	D35	D2	E12	A4	Q6	C3	R33	D3	R79	F1	R122	F5	R164	B4	R217	A3	R262	E4	U28	C1			
C50	E4	C102	A4	C172	A5	D36	E3	E13	A5	Q7	C2	R36	F3	R80	F1	R123	F5	R165	A3	R218	A3	R263	D1	U29	C1			
C53	F3	C103	A5	C173	A1	D37	E4	E16	C1	Q8	C3	R37	F3	R81	E1-E2	R124	F4-F5	R166	B3	R219	A2	R264	E1	U30	C2			
C54	F2-F3	C104	A5	C174	C1	D38	D3	E17	A1	Q9	C3	R38	E2-E3	R82	E1-E2	R125	F4	R167	B4	R220	A3	R265	F4	U31	C2			
C55	F3	C105	A4	C176	E4	D39	D4	E18	A1	Q10	F2	R39	E2-E3	R83	E1-E2	R126	F5	R168	A3	R221	A2	R266	E4	U32	C2			
C56	F2,F3	C106	A5	C177	D4	D40	D1	E19	C1	Q11	F1	R40	F4	R84	E1	R127	F5	R169	A3	R222	A2	R267	D1	U33	D2			
C61	F2	C107	A5	C178	C5	D41	B1	E20	A3	Q12	E1	R41	E3	R85	F1	R128	F4-F5	R170	A4	R223	F5	R268	D1	U34	D1			
C62	F2	C108	B5	D1	C2	D42	B2	E21	A2	Q13	E1	R43	E3	R86	F1	R129	F5	R171	A3	R224	A1	R269	D2	U35	D1			
								E22	A2	Q14	F1	R45	E3	R87	F1	R130	F5	R172	A4	R225	A1-A2	R270	D2	U36	D1			

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	1/10/80	OFF	
B	PER ECN #345B	5-4-82	MM
C	PER ECN #348B	5-20-82	MM
D	PER ECN #349B	6-4-82	MM
E	FIXED D38, ADDED REF. DISCREPANCY	6-14-82	MM
F	PER ECN #354	6-24-82	MM
G	PER ECN #358	6-24-82	MM
H	PER ECN #359A	6-25-82	MM
J	PER ECN #367E	8-7-82	MM
K	PER ECN #370B	8-26-82	MM
L	PER ECN #374B	8-31-82	MM
M	PER ECN #375B	8-31-82	MM
N	PER ECN #380	9-21-82	MM
P	PER ECN #405	4-5-83	MM



NOTES:
 1. INSTALL PEM NUT (426-6000) IN SOLDER SIDE OF 517-0100.
 2. COMPONENTS WITH DASHED OUTLINE ARE NOT USED IN PCB ASSY.

LEADS ON DS1-DS14 MUST HAVE A SHARP BEND

476-0007

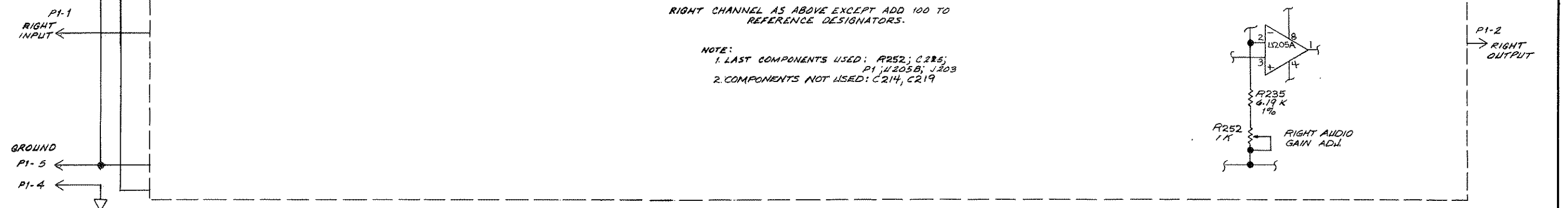
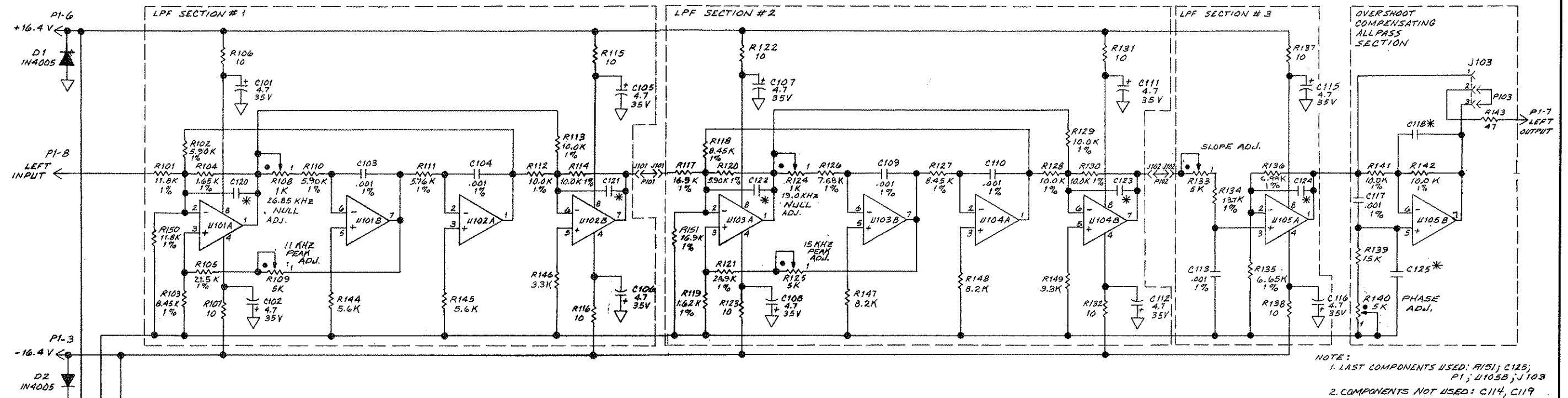
517-0100 REF

GLUE DS1-DS14 TO SPACER (476-0007) WITH EASTMAN 910 ADHESIVE (B.E. # 100-0021).

SEE B/M NO. 917-0100-1
 SEE SCHEMATIC NO. 0909-0100

PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and shall not be disclosed or used for manufacturing or for any other purpose except as specifically authorized in writing by BROADCAST ELECTRONICS, INC.		TOLERANCE UNLESS OTHERWISE SPECIFIED RESISTORS: 1% CAPACITORS: 5% DIMENSIONS: .01"		DATE: 2-22-82 CHECKED: [Signature] DESIGNED: [Signature] APPROVED: [Signature]		BROADCAST ELECTRONICS, INC. -A FILMWAYS COMPANY- PCB ASSEMBLY FS-30 MAIN PCB	
MATERIAL: [Blank]		TREATMENT OR FINISH: [Blank]		DWS NO.: 917-0100-1		REV: R	
SCALE: 2/1		SHEET 1 of 1		FS-30		2/1	

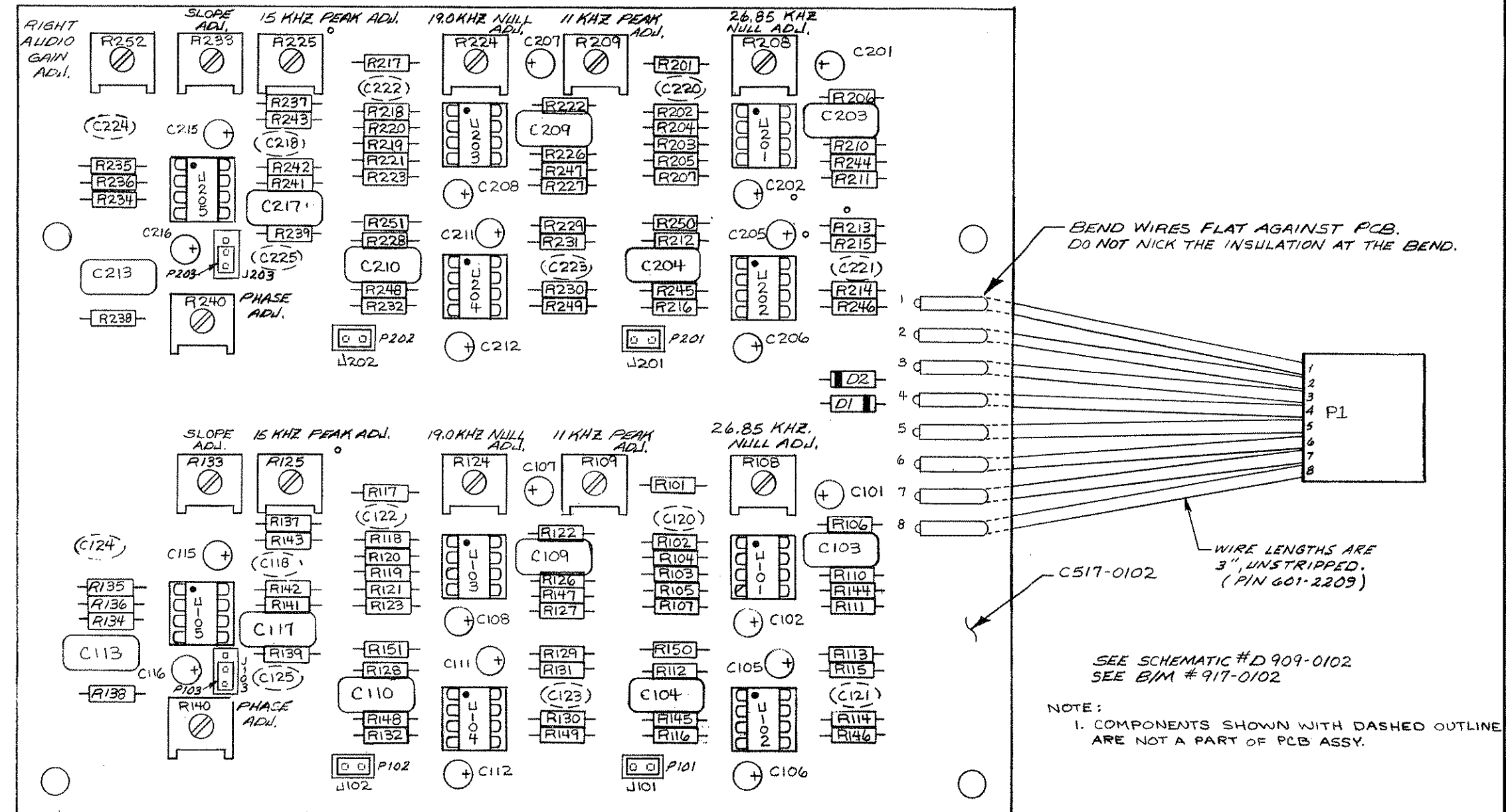
REV.	DESCRIPTION	DATE	APP.	REV.	DESCRIPTION	DATE	APP.
H	PER EGN #3709	JAH	8-12-82	B	UPDATED PER EGN	OFF	3-26-82
J	PER EGN 4138	J.O.S.	3-22-83	C	CHG'D R VALUES PER GNM'S NAB PROTOTYPE	OFF	4-24-82
				D	PER EGN #3458	OFF	5-4-82
				E	SEE EGN #3540	OFF	6-10-82
				F	SEE EGN #3540	OFF	6-10-82
				G	SEE EGN #3540	OFF	6-10-82



- NOTES:
1. ALL RESISTORS ARE 1/4W, 5%, VALUES IN OHMS; ALL CAPACITORS VALUES ARE IN MICROFARADS UNLESS SPECIFIED.
 2. *DENOTES DELETED COMPONENTS ON APPLICABLE ASSEMBLIES. (INCLUDED TO FACILITATE FUTURE EGN'S, CS'S, ETC.)
 3. (DOT) DENOTES TRIMPOT WIPER LOCATION FOR FULL CLOCKWISE ROTATION.
 4. REFERENCES: E917-0100-1 MAIN PCB ASSY.
 5. SEE B/M 917-0102 SEE PCB ASSY. C917-0102

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MATERIAL	TREATMENT OR FINISH	BROADCAST ELECTRONICS INC. —A FILMWAYS COMPANY—	TITLE SCHEMATIC - 15 KHZ LOW PASS FILTER BD.
		DWG. NO. 909-0102	REV. J.
		SCALE 1	SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	UPDATED PER HEM	OFF	3-26-82
B	REVISED PER HEM (ECN 3458)	OFF	4-29-82 MERK
C	PER ECN 3489	NERK	5-13-82 HEM
D	PER ECN # 3506		5-26-82 MH
E	SEE ECN 3540		6-17-82 JAT
F	SEE ECN 3563		6-18-82 BRT
G	SEE ECN 3573	OFF	6-24-82 HEM
H	PER ECN 3709	JAH	8-12-82 HEM
J	PER ECN 4138	J.D.S.	3-22-83 HEM



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		MATERIAL TREATMENT OR FINISH	DWG. NO. 917-0102 C	REV. 1 SCALE 2/1 SHEET 1 OF 1	

PRODUCT WARRANTY

LIMITED ONE YEAR

While this warranty gives you specific legal rights, which terminate one (1) year (6 months on turntable motors) from the date of shipment, you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BE"), 4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305, hereby warrants cartridge machines, consoles, transmitters and other new Equipment manufactured by BE against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year (6 months for turntable motors) from the date of shipment. Other manufacturers' Equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BE's sole responsibility with respect to any Equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BE's factory or authorized repair depot within the period aforesaid.

In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement. However, the warranty period will be extended for the length of time that the original user is without the services of the Equipment due to its being serviced pursuant to this warranty. The terms of the foregoing warranty shall be null and void if the Equipment has been altered or repaired without specific written authorization of BE, or if Equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the Equipment purchased. BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

BE shall not be liable to the original user for any and all incidental or consequential damages for breach of either expressed or implied warranties. However, some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. All express and implied warranties shall terminate at the conclusion of the period set forth herein.

Except as set forth herein, and except as to title, there are no warranties, or any affirmations of fact or promises by BE, with reference to the Equipment, or to merchantability, fitness for a particular application, signal coverage, infringement, or otherwise, which extend beyond the description of the Equipment in BE's product literature or instruction manual which accompany the Equipment. Any card which is enclosed with the Equipment will be used by BE for survey purposes only.

BROADCAST ELECTRONICS, INC.
4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305