

**FM-1C1 1 KW  
FM-500C1 500W  
SOLID-STATE  
FM BROADCAST  
TRANSMITTERS**

**November, 2009**

**IM No. 597-1001-001**

# **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: 1) inspected the containers for visible signs of damage and 2) 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.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

## **RF PRODUCT TECHNICAL ASSISTANCE – REPAIR SERVICE – REPLACEMENT PARTS.**

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone, fax, or E-mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the Customer Service Department for a shipping container. Do not the mail equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the Customer Service Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non-emergency replacement parts may be ordered directly from the Broadcast Electronics stock room by fax at the number shown below.

### **FACILITY CONTACTS –**

Broadcast Electronics, Inc. – Quincy Facility  
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Quincy, Illinois 62305  
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## **RF PRODUCT TECHNICAL ASSISTANCE – REPAIR – EMERGENCY/WARRANTY REPLACEMENT PARTS –**

Telephone: (217) 224-9600  
E-Mail: [rfservice@bdcast.com](mailto:rfservice@bdcast.com)  
Fax: (217) 224-9607

## **NON-EMERGENCY REPLACEMENT PARTS –**

Fax: (217) 224-9609

## **RETURN, REPAIR, AND EXCHANGES.**

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

## **WARRANTY ADJUSTMENT.**

Broadcast Electronics, Inc. warranty is included in the Terms and Conditions of Sale. In the event of a warranty claim, replacement or repair parts will be supplied F.O.B. factory. At the discretion of Broadcast Electronics, the customer may be required to return the defective part or equipment to Broadcast Electronics, Inc. F.O.B. Quincy, Illinois. Warranty replacements of defective merchandise will be billed to your account. This billing will be cleared by a credit issued upon return of the defective item.

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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.



## WARNING

### OPERATING HAZARDS

READ THIS SHEET AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TRANSISTORS MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.

#### DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TRANSISTORS

The operation of power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

- A. HIGH VOLTAGE – Normal operating voltages can be deadly. Additional information follows.
- B. RF RADIATION – Exposure to RF radiation may cause serious bodily injury possibly resulting in blindness or death. Cardiac pacemakers may be affected. Additional information follows.
- C. BERYLLIUM – OXIDE POISONING – Dust or fumes from BeO ceramics used as thermal links with power transistors are highly toxic and can cause serious injury or death. Additional information follows.
- D. RF BURNS – Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

#### HIGH VOLTAGE

The transmitter operates at voltages high enough to kill through electrocution. Personnel should always break the primary circuits when access to the transmitter is required.

#### RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to “high levels” of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to “low level” RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm<sup>2</sup> per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm<sup>2</sup> per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1–1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leakproof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna, open RF generating circuit, or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

#### DANGER — BERYLLIUM OXIDE CERAMICS (BeO) – AVOID BREATHING DUST OR FUMES

BeO ceramic material is used as a thermal link to carry heat from a transistor to the heat sink. Do not perform any operation on any BeO ceramic which might produce dust or fumes, such as grinding, grit blasting, or acid cleaning. Beryllium oxide dust or fumes are highly toxic and breathing them can result in serious personal injury or death. BeO ceramics must be disposed of only in a manner prescribed by the device manufacturer.

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# SECTION I

## GENERAL INFORMATION

### 1-1. INTRODUCTION.

1-2. Information presented by this section provides a general description of the Broadcast Electronics FM-1C1/FM-500C1 transmitters and lists equipment specifications.

### 1-3. RELATED PUBLICATIONS.

1-4. The following list of publications provides data for equipment associated with the FM-1C1/FM-500C1 transmitters.

PUBLICATION NUMBER	EQUIPMENT
597-1050	FX-50 FM Exciter
597-0008-004	FC-30 SCA Generator
597-9900	LYNX Digital Stereo Generator
597-8000	PREDATOR FM Digital Exciter
597-1116	VMC-16 Remote Control Unit

### 1-5. EQUIPMENT DESCRIPTION.

#### 1-6. GENERAL.

1-7. The Broadcast Electronics FM-1C1 transmitter is a 1 kW solid-state FM transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1-1). The Broadcast Electronics FM-500C1 transmitter is a 500 watt solid-state FM transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1-1). The FM-1C1 transmitter is equipped with: 1) an FX-50 FM exciter, 2) two modular switching power supply assemblies, 3) two modular solid-state broadband plug-in RF amplifier modules, 4) an internal low-pass filter, 5) a combiner, and 6) a CMOS controller. The FM-500C1 transmitter is equipped with: 1) an FX-50 FM exciter, 2) two modular switching power supply assemblies, 3) a modular solid-state broadband plug-in RF amplifier module, 4) an internal low-pass filter, and 5) a CMOS controller. All the components with the exception of the FX-50 exciter are housed in a single chassis designed for installation in an EIA rack. The FX-50 exciter is housed on slide-rails above the transmitter chassis. Specific FM-1C1/FM-500C1 features include:

1. The FX-50 exciter. The exciter is equipped with a digital frequency synthesizer and superior audio performance. The transmitter can also be equipped with the optional PREDATOR digital exciter.
2. A broadband design which eliminates tuning controls.
3. Two modular switching power supply units. One power supply provides operating potentials for the power amplifier module (s). The second power supply provides operating potentials for the controller.
4. An internal low-pass filter.
5. Modular solid-state broadband plug-in amplifier modules.
6. A CMOS controller with VSWR detection.





**FM-1C1 TRANSMITTER**



**FM-500C1 TRANSMITTER**

**FIGURE 1-1. FM-1C1/FM-500C1 TRANSMITTERS** **597-1001-2**

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- 1-8. **FX-50 EXCITER.** The FX-50 exciter is a solid-state wideband FM exciter providing a continuously variable RF output at any frequency within the 87.5 MHz to 108 MHz broadcast band in 10 kHz increments. The FX-50 is designed to accept multiple wideband composite inputs from a stereo generator or SCA generator. In addition, the FX-50 is equipped with a 600 Ohm balanced monaural input. A tapped dual primary power transformer and a voltage selector allows operation from a wide range of ac input potentials.
- 1-9. The FX-50 is equipped with a digitally programmed frequency synthesizer which generates and maintains the phase and frequency of the carrier. A temperature compensated reference oscillator and a dual-speed phase-locked-loop control circuit locks the frequency of a modulated oscillator to a precision frequency oscillator allowing prompt on-frequency operation. A solid-state broadband 3 to 50 watt RF amplifier provides amplification of the FM signal. Exciter operating parameters are monitored and displayed by a front-panel digital LCD multimeter and an LED display.
- 1-10. **PREDATOR DIGITAL EXCITER.** The transmitter may be equipped with the optional PREDATOR digital FM exciter. The PREDATOR is a solid-state wideband FM digital exciter providing a continuously variable RF output at any frequency within the 87.5 to 108 MHz FM broadcast band in 100 kHz increments. The PREDATOR circuitry is divided into several modular assemblies. The exciter modules include: 1) a digital exciter module, 2) a controller module, 3) a 50 watt power supply/RF power amplifier module, 4) a 250 watt power supply/RF power amplifier module, 5) a digital stereo generator module, and 6) an analog interface module. For FM-1C1/FM-500C1 transmitters, the PREDATOR will be equipped with a 50 watt power supply/RF power amplifier module.
- 1-11. The modular design allows the exciter to be purchased in several configurations. Each power supply module features a continuously variable RF amplifier stage. The analog interface input module allows a composite analog signal to be applied to the digital exciter circuitry. Digital AES/EBU audio is applied to the digital exciter circuitry using the digital stereo generator module. The digital exciter module features an RF circuit with a numerically-controlled-oscillator (NCO) and a two-stage up-converter. Control and monitoring of the PREDATOR circuitry is performed by the controller module. The modules are housed in a chassis requiring 7 inches of a 19 inch rack cabinet. Refer to publication 597-8000 for a detailed explanation of the PREDATOR features.
- 1-12. **POWER SUPPLY.** The FM-1C1/FM-500C1 transmitters are equipped with two modular switching power supply assemblies. A primary 2 kW switching power supply unit provides dc operating potentials for the transmitter power amplifier circuitry. A second 40 watt modular switching power supply is provided for the controller circuitry. The primary power supply module is equipped with overload protection, over-voltage protection, high temperature protection, and a soft-start feature which minimizes in-rush currents.
- 1-13. **RF POWER MODULES.** The FM-1C1 transmitter is equipped with 2 RF power modules. The FM-500C1 is equipped with one RF power module. Each module consists of a broadband solid-state RF amplifier and a logic circuit board. The RF amplifier contains two dual MOSFET power transistors operated in a push-pull configuration. Each module is designed to output 500 watts of RF power. RF amplifier operations are monitored by the logic circuit board. The logic circuit board is designed to monitor over-current, over-voltage, high reflected power, and high temperature conditions. A limit circuit is designed to limit the RF output during high reflected power, high temperature, over-current, or over-voltage conditions. The operating status of the module is displayed by two front panel LEDs.

- 1-14. **CONTROLLER.** Transmitter control and monitoring operations are performed by a CMOS logic controller. The controller utilizes extensive RFI filtering and CMOS logic circuitry to ensure maximum reliability. A battery back-up system is incorporated into the design to maintain the controller memory during ac power interruptions. Operating potentials for the controller circuitry are provided by a 40 watt modular switching power supply. The supply provides the controller circuitry with a stable +5 and  $\pm 15$  volt dc supply.
- 1-15. The transmitter RF output power is controlled by a power control circuit. The circuit is designed to raise or lower the transmitter power in response to the front panel raise and lower switches. A fault circuit monitors transmitter operations for a PA1 fault, a PA2 fault, high reflected power condition, a high temperature condition, or a power supply fault.
- 1-16. The controller is also equipped with metering circuitry. Meter amplifier/buffering circuits are provided for PA1 forward/current samples, PA2 forward/current samples, transmitter forward and reflected power samples, PA voltage, and exhaust air temperature samples. Display of the samples is provided by an LCD multimeter. Samples are selected for application to the multimeter by a meter switch circuit board.
- 1-17. **COMBINER.** In FM-1C1 models, the RF power module outputs are combined using a 90 degree hybrid combiner assembly. The assembly combines the two RF power module outputs to produce 1 kW of RF output power.
- 1-18. **TRANSMITTER CONFIGURATIONS.**
- 1-19. The FM-1C1/FM-500C1 transmitters can be ordered in the following configurations:

P/N	DESCRIPTION
909-1001-205	FM-1C1 1 kW FM Transmitter for operation in the 87.5 MHz to 108 MHz broadcast band, 196V to 252V ac 50/60 Hz single phase supply. Includes FX-50 FM exciter, 196V to 252V ac 50/60 Hz single phase operation.
909-0501-205	FM-500C1 500 watt FM Transmitter for operation in the 87.5 MHz to 108 MHz broadcast band, 196V to 252V ac 50/60 Hz single phase supply. Includes FX-50 FM exciter, 196V to 252V ac 50/60 Hz single phase operation.

- 1-20. **OPTIONAL EQUIPMENT AND SPARE PARTS KITS.**
- 1-21. The following text presents the optional equipment and spare parts kits available for the use with the FM-1C1/FM-500C1 transmitters.

P/N	DESCRIPTION
909-1050	FM C-Series Transmitter Less FX-50 Exciter.
909-9000	LYNX FM digital stereo generator.
979-8500	PREDATOR 50 Watt FM Digital Exciter With Digital AES/EBU Input Stereo Generator Module.
979-8501	PREDATOR 50 Watt FM Digital Exciter With Analog Composite Input Module.
979-8503	PREDATOR 50 Watt FM Digital Exciter, Analog Composite Input Module, and Digital AES/EBU Input Stereo Generator Module.

<b>P/N</b>	<b>DESCRIPTION</b>
909-0051-204	FC-30 FM SCA Generator.
909-0137	Local Control Disable Option, FM-1C1/FM-500C1.
979-1067	Recommended spare parts kit for the FM-1C1 transmitter. Includes parts for the FX-50 Exciter. Includes selected switches, relays, etc. Does not include semiconductors.
979-1068	Recommended spare parts kit for the FM-500C1 transmitter. Includes parts for the FX-50 Exciter. Includes selected switches, relays, etc. Does not include semiconductors.
979-1057	Recommended semiconductor kit for the FM-1C1/FM-500C1 Transmitter. Includes semiconductors for the FX-50 Exciter.
979-1058	100% semiconductor kit for the FM-1C1/FM-500C1 transmitter. Includes parts for the FX-50 exciter.
907-0016-201	VMC-16 Voice Remote Control Unit, FM-1C1
907-0016-200	VMC-16 Voice Remote Control Unit, FM-500C1
959-0420	Dual Power Supply Panel, FM-1C1/FM-500C1

1-22. **EQUIPMENT SPECIFICATIONS.**

1-23. Refer to Table 1-1 for electrical specifications or Table 1-2 for physical specifications of the FM-1C1/FM-500C1 transmitters.

**TABLE 1-1. FM-1C1/FM-500C1 ELECTRICAL SPECIFICATIONS**  
(Sheet 1 of 3)

<b>PARAMETER</b>	<b>SPECIFICATION</b>
RF POWER OUTPUT FM-1C1 FM-500C1	250 watts to 1.05 kW (as specified). 125 watts to 525 watts (as specified).
FREQUENCY RANGE	87.5 to 108 MHz (as specified). Exciter programmable in 10 kHz increments.
RF OUTPUT IMPEDANCE	50 Ohms.
RF OUTPUT CONNECTOR	Type "N" connector.
MAXIMUM VSWR	Rated power into 1.5:1 maximum without output matching. Capable of operating into high VSWR conditions with automatic power reduction. Open and short circuit protected at all phase angles.
EXCITER	Model FX-50, solid-state 50 watt output with digitally programmed synthesizer. 10 kHz increment programming. Optional PREDATOR digital exciter, 50 watt output, 100 kHz increment programming.

**TABLE 1-1. FM-1C1/FM-500C1 ELECTRICAL SPECIFICATIONS**  
(Sheet 2 of 3)

PARAMETER	SPECIFICATION
AM SIGNAL-TO-NOISE RATIO: Asynchronous	68 dB below an equivalent reference carrier with 100% AM modulation @ 1000 Hz, 75 microsecond deemphasis (no FM modulation present).
Synchronous FM-1C1	58 dB below an equivalent 1 kW reference carrier @ 100% AM modulation @ 1000 Hz. 75 uS deemphasis with $\pm 75$ kHz FM modulation @ 1000 Hz.
FM-500C1	58 dB below an equivalent 500 W reference carrier @ 100% AM modulation @ 1000 Hz. 75 uS deemphasis with $\pm 75$ kHz FM modulation @ 1000 Hz.
RF HARMONIC SUPPRESSION	Meets all FCC/DOC requirements and CCIR recommendations.
FM SIGNAL-TO-NOISE RATIO: FM-1C1 Mono/Composite	88 dB below $\pm 75$ kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Stereo	82 dB below $\pm 75$ kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
FM-500C1 Mono	88 dB below $\pm 75$ kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Composite	85 dB below $\pm 75$ kHz deviation at 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Stereo	82 dB below $\pm 75$ kHz deviation at 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
DISTORTION	
Mono/Composite	
Harmonic	0.02% or less at 400 Hz.
SMPTE Intermodulation Distortion	0.02% or less, 60 Hz/7 kHz, Ratio: 4:1 Monophonic, 1:1 Composite.
CCIF Intermodulation Distortion	0.02% or less, 15 kHz/14 kHz, 1:1 Ratio.

**TABLE 1-1. FM-1C1/FM-500C1 ELECTRICAL SPECIFICATIONS**  
**(Sheet 3 of 3)**

PARAMETER	SPECIFICATION
DISTORTION (CONT'D)	
Mono/Composite	
Transient Intermodulation Distortion	0.02% or less, sine wave/square wave.
Stereo	
Harmonic	0.05% or less at 400 Hz.
SMPTE Intermodulation Distortion	0.05% or less, 60 Hz/7 kHz, 4:1 Ratio.
CCIF Intermodulation Distortion	0.05% or less, 15 kHz/14 kHz, 1:1 Ratio.
Transient Intermodulation Distortion	0.05% or less, sine wave/square wave.
STEREO SEPARATION	50 dB or better, 30 Hz to 15 kHz (sine wave).
DYNAMIC STEREO SEPARATION	40 dB or greater, 30 Hz to 15 kHz (normal program content).
LINEAR CROSSTALK (Main to Sub/Sub to Main Due to Amplitude and Phase Matching)	45 dB Minimum below 100% modulation, 30 Hz to 15 kHz.
NON-LINEAR CROSSTALK (Main to Sub/Sub to Main Due to Distortion Products)	70 dB Minimum below 100% modulation.
AC POWER REQUIREMENTS	196 to 252V ac 50/60 Hz single phase.
AC POWER CONSUMPTION	
FM-1C1	2.2 kW typical at a 1 kW RF power output, 50 Ohm resistive load.
FM-500C1	1100 watts typical at a 500 watt RF power output, 50 Ohm resistive load.
OVERALL EFFICIENCY	
FM-1C1	47% or greater (AC line input to RF output).
FM-500C1	40% or greater (AC line input to RF output).
SAFETY	Meets IEC 215 specifications.

**TABLE 1-2. FM-1C1\FM-500C1 PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS**

PARAMETER	SPECIFICATION
<b>PHYSICAL</b>	
DIMENSIONS:	
FX-50 Exciter	Width: 19.0 inches (48.3 cm). Height: 5.25 inches (13.3 cm). Depth: 19.00 inches (48.3 cm).
Optional PREDATOR Exciter	Width: 19.0 inches (48.3 cm). Height: 7.0 inches (17.78 cm). Depth: 16.00 inches (40.64 cm).
Transmitter	Width: 19.0 inches (48.3 cm). Height: 21 inches (53.3 cm). Depth: 24 inches (61.0 cm).
WEIGHT	
FX-50 Exciter	38 pounds (17.2 kg) unpacked.
Optional PREDATOR Exciter	26 pounds (11.8 kg) unpacked.
Transmitter	
FM-1C1	103 pounds (46.7 kg) unpacked.
FM-500C1	75 pounds (34.0 kg) unpacked.
<b>ENVIRONMENTAL</b>	
HEAT DISSIPATION	
FM-1C1 (1 kw Output)	1.5 kw (5120 Btu/H) at a 1 kW RF output, 50 Ohm resistive load.
FM-500C1 (500 watt Output)	800 watts (2730 Btu/H) at a 500 watt RF output, 50 Ohm resistive load.
COOLING AIR REQUIREMENTS	700 cubic feet per minute (19.8 m <sup>3</sup> /min).
AMBIENT TEMPERATURE RANGE	+32°F to +122°F (0°C to +50°C).
MAXIMUM ALTITUDE	
50 Hz Operation	0 to 7,500 feet above sea level (0 to 2286 meters).
60 Hz Operation	0 to 10,000 feet above sea level (0 to 3048 meters).
MAXIMUM HUMIDITY	95%, non-condensing.

## SECTION II INSTALLATION

### 2-1. INTRODUCTION.

- 2-2. This section contains information required for the installation and preliminary checkout of the Broadcast Electronics FM-1C1/FM-500C1 transmitters.

### 2-3. UNPACKING.

- 2-4. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the transmitter. 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.
- 2-5. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics.

### 2-6. ENVIRONMENTAL REQUIREMENTS.

- 2-7. Table 1-2 provides environmental conditions which must be considered prior to transmitter installation. Refer to Table 1-2 in SECTION I, INTRODUCTION and ensure the transmitter is to be installed in an acceptable environment.

### 2-8. COOLING AIR REQUIREMENTS.

- 2-9. The FM-1C1/FM-500C1 transmitters require a source of cooling air to maintain an acceptable operating temperature. The transmitters require a cooling air flow of 700 cubic feet per minute (refer to Figure 2-1). The cooling air source must be dry and well filtered.
- 2-10. If the heated transmitter air is to be ducted from the room, the duct system must not introduce any back-pressure on the equipment. Proper allowances for air flow will ensure that only a limited amount of heat is dissipated into the equipment interior. The duct system must allow for a minimum air flow of 700 cubic feet of air per minute.
- 2-11. As a minimum requirement, any duct work must have a cross-sectional area equal to the exhaust area of the transmitter. Sharp bends in the duct system will introduce back pressure and are not permissible. A radius bend must be used if a right angle turn is required.

### 2-12. INSTALLATION.

- 2-13. Each transmitter is wired, operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Prior to installation, this publication should be studied to obtain an understanding of the operation, circuitry, nomenclature, and installation requirements. Installation is accomplished as follows: 1) equipment placement, 2) equipment installation, 3) wiring, and 4) preliminary operation. Remove all tape, wire ties, string, and packing material from the transmitter before performing the following installation procedures.

### 2-14. EQUIPMENT PLACEMENT.

- 2-15. The FM-1C1/FM-500C1 transmitters are designed for placement in a 19 inch EIA rack assembly. Each transmitter requires approximately 26.25 inches (66.7cm) of a universal or military EIA rack (refer to Figure 2-2). To install the transmitter in a rack, refer to Figure 2-2 and perform the following procedures.



- 2-16. **RACK PREPARATION.** The transmitter can be mounted in any universal or military rack assembly. Refer to Figure 2-2 and determine type of rack for transmitter installation. A universal rack is identified by the location of mounting holes at regular rack spacings. A military rack is identified by a missing mounting hole at regular rack spacings. Each type of rack may be equipped with untapped or tapped mounting holes. To prepare the rack for the transmitter, refer to Figure 2-2 and perform the following procedures.
- 2-17. **Universal Rack.** Prepare a universal rack for transmitter installation as follows:
1. Refer to Figure 2-2 and locate the transmitter mounting holes on the rack assembly. Ensure the top of the transmitter is located at the beginning of a rack unit. Allow 5.25 inches (13.3 cm) above the transmitter for the FX-50 exciter. Allow 7.0 inches (17.8 cm) above the transmitter for the PREDATOR.
  2. Evaluate the rack and determine if the rack is equipped with tapped or untapped mounting holes.
  3. Prepare the rack for installation as follows:
    - A. For racks with tapped holes, mark the transmitter mounting hole locations.
    - B. For racks with untapped holes, locate the transmitter clip-nuts in the transmitter accessory kit. Refer to Figure 2-2 and install the clip-nuts in each transmitter mounting hole location.
- 2-18. **Military Rack.** Prepare a military rack for transmitter installation by performing the following:
1. Refer to Figure 2-2 and locate the transmitter mounting holes on the rack assembly. Ensure the top of the transmitter is located at the beginning of a rack unit. Allow 5.25 inches (13.3 cm) above the transmitter for the FX-50 exciter. Allow 7.0 inches (17.8 cm) above the transmitter for the PREDATOR.
  2. Evaluate the rack and determine if the rack is equipped with tapped or untapped mounting holes.
  3. Prepare the rack for installation as follows:
    - A. For racks with tapped holes, mark the transmitter mounting hole locations.
    - B. For racks with untapped holes, refer to Figure 2-2 and install the clip-nuts in each mounting hole location.

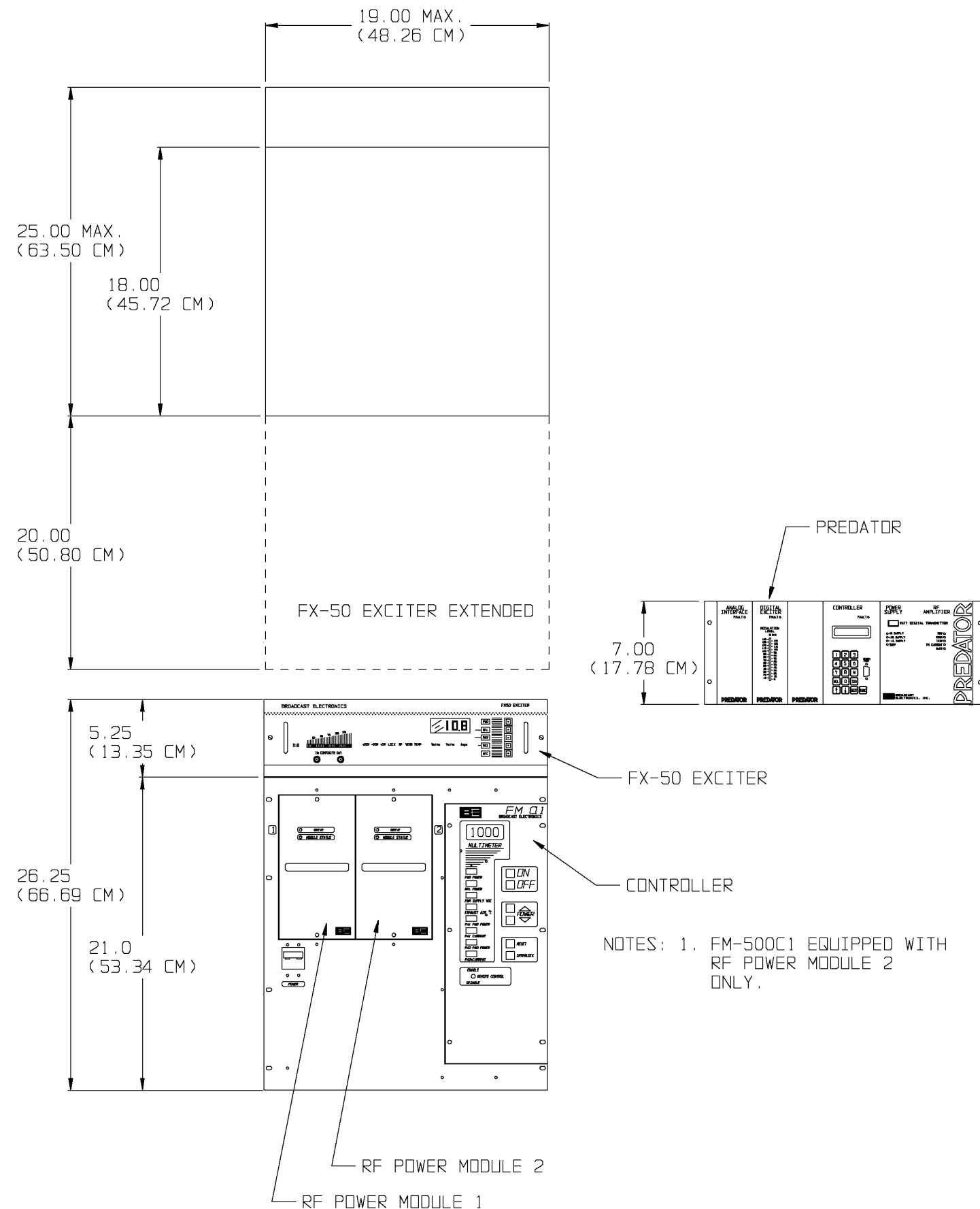


**WARNING**

***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

**WARNING**

- 2-19. **EQUIPMENT INSTALLATION.**
- 2-20. **TRANSMITTER MOUNTING.** Once the transmitter rack is prepared, refer to Figure 2-2 and mount the transmitter in the rack by performing the following procedures.
- 2-21. The transmitter accessory kit contains #10 x 3/4 and #12 x 3/4 mounting hardware. The type of hardware used to install the transmitter is determined by the rack assembly. Refer to Figure 2-2 and determine the mounting hardware required to mount the transmitter in the rack.



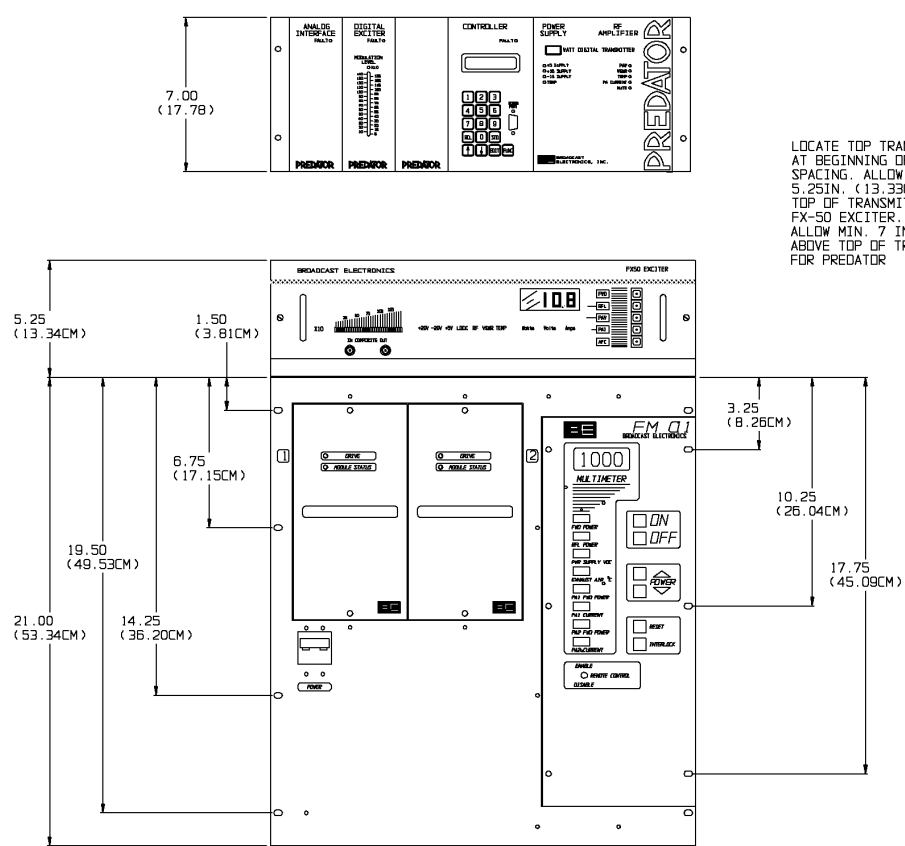
#### NOTES:

1. COOLING AIR REQUIREMENT- 700CFM (19.8<sup>3</sup>M /MIN) FILTER REQUIRED- 407-0162.
2. GROUND STRAP ENTRY IN LOWER LEFT CORNER AT REAR OF CABINET
3. RF OUTPUT CONNECTION- TYPE N CONNECTOR.
4. HEAT DISSIPATION:  
FM-1C1- 1.5KW (5120 BTU/H) AT A 1KW RF OUTPUT, 50 OHM RESISTIVE LOAD.  
FM-500C1- 800W (2730 BTU/H) AT A 500 WATT RF OUTPUT, 50 OHM RESISTIVE LOAD.
5. WEIGHT:  
FM-1C1- TRANSMITTER= 103LBS (46.7KGS) EXCITER= 38LBS (17.2KGS).  
FM-500C1- TRANSMITTER= 75LBS (34.0KGS) EXCITER= 38LBS (17.2KGS).
6. AC POWER CONSUMPTION:  
FM-1C1- 2.2KW AT A 1KW RF OUTPUT INTO A 50 OHM RESISTIVE LOAD.  
FM-500C1- 1.1KW AT A 500W RF OUTPUT INTO A 50 OHM RESISTIVE LOAD.
7. AC POWER INPUT:  
FM-1C1- 196 TO 252VAC 50/60Hz SINGLE PHASE, 11 AMPERES MAXIMUM.  
FM-500C1- 196 TO 252VAC 50/60Hz SINGLE PHASE, 6 AMPERES MAXIMUM.  
FUSE DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO FOLLOWING TEXT, NATIONAL ELECTRIC CODES, AND LOCAL CODES.
8. PRIMARY AC FUSED DISCONNECT:  
FM-1C1:  
FUSE SIZE- 20 AMP  
WIRE SIZE- #12 COPPER AWG.  
FM-500C1:  
220V OPERATION-  
FUSE SIZE- 15 AMP  
WIRE SIZE- #14 COPPER AWG.
9. RACK REQUIREMENTS- 19" RACK UNIVERSAL MOUNTING.  
.281 DIAMETER HOLES OR 10-32 TAPPED HOLES, 15 VERTICAL RACK UNITS.  
WITH FX-50 , 16 VERTICAL RACK UNITS WITH PREDATOR.
10. AIR EXHAUST SIZE- 320 SQ. IN. (2065 SQ. CM). TOP OF UNIT.

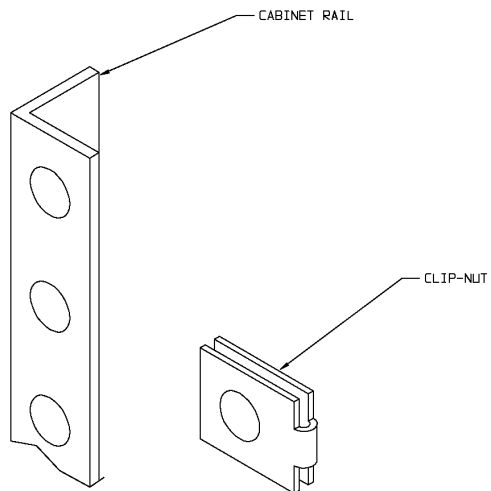
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597-1001-11

**FIGURE 2-1. FM-1C1/FM-500C1 TRANSMITTER  
INSTALLATION DIAGRAM  
(2-3/2-4)**

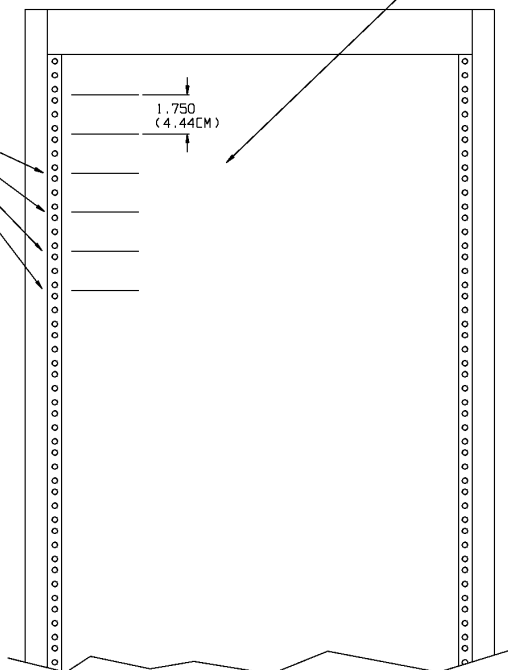


\* FM-1C1 TRANSMITTER



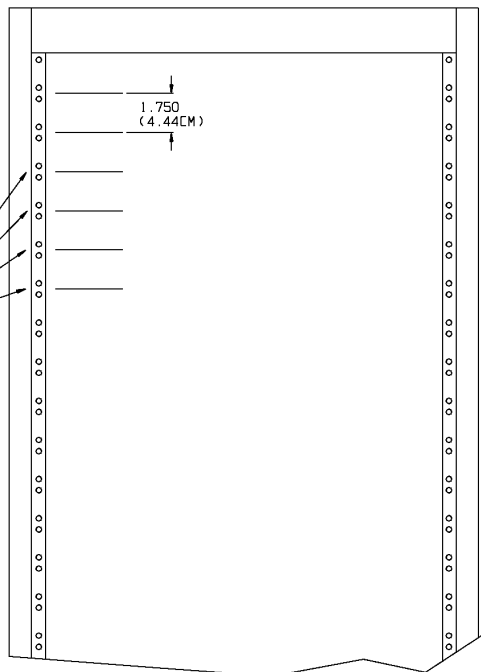
DETAIL A  
CLIP-NUT INSTALLATION

LOCATE TOP TRANSMITTER AT BEGINNING OF A RACK SPACING. ALLOW MIN. 5.25IN. (13.33CM) ABOVE TOP OF TRANSMITTER FOR FX-50 EXCITER. ALLOW MIN. 7 IN. (17.78 CM) ABOVE TOP OF TRANSMITTER FOR PREDATOR



19" EIA UNIVERSAL RACK WITH TAPPED HOLES

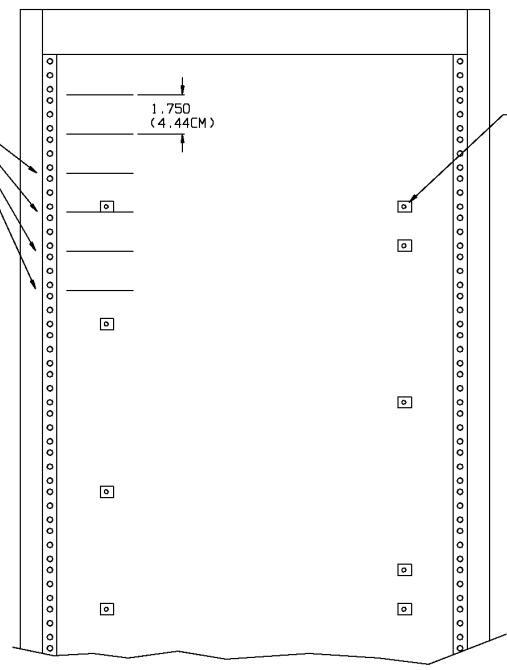
LOCATE TOP TRANSMITTER AT BEGINNING OF A RACK SPACING. ALLOW MIN. 5.25IN. (13.33CM) ABOVE TOP OF TRANSMITTER FOR FX-50 EXCITER. ALLOW MIN. 7 IN. (17.78 CM) ABOVE TOP OF TRANSMITTER FOR PREDATOR



19" EIA MILITARY RACK WITH TAPPED HOLES

NOTE: \* FM-1C1 SHOWN. FM-500C1 IS IDENTICAL.

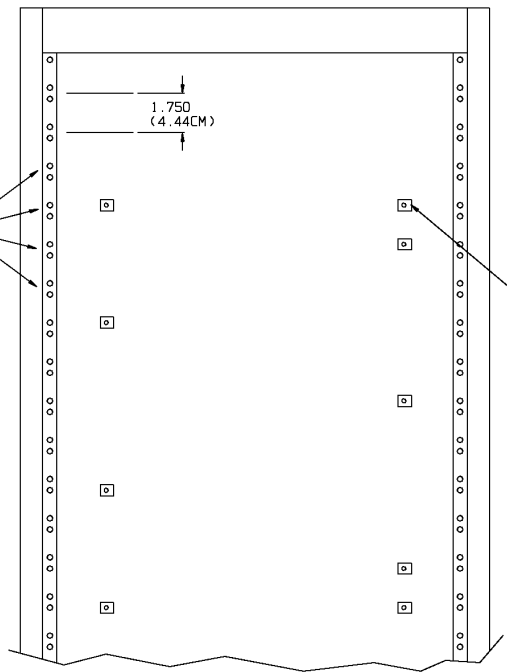
LOCATE TOP TRANSMITTER AT BEGINNING OF A RACK SPACING. ALLOW MIN. 5.25IN. (13.33CM) ABOVE TOP OF TRANSMITTER FOR FX-50 EXCITER. ALLOW MIN. 7 IN. (17.78 CM) ABOVE TOP OF TRANSMITTER FOR PREDATOR



19" EIA UNIVERSAL RACK WITH UNTAPPED HOLES

INSTALL CLIP-NUTS IN HOLES FOR TRANSMITTER MOUNTING 9-PLACES SEE DETAIL A

LOCATE TOP TRANSMITTER AT BEGINNING OF A RACK SPACING. ALLOW MIN. 5.25IN. (13.33CM) ABOVE TOP OF TRANSMITTER FOR FX-50 EXCITER. ALLOW MIN. 7 IN. (17.78 CM) ABOVE TOP OF TRANSMITTER FOR PREDATOR



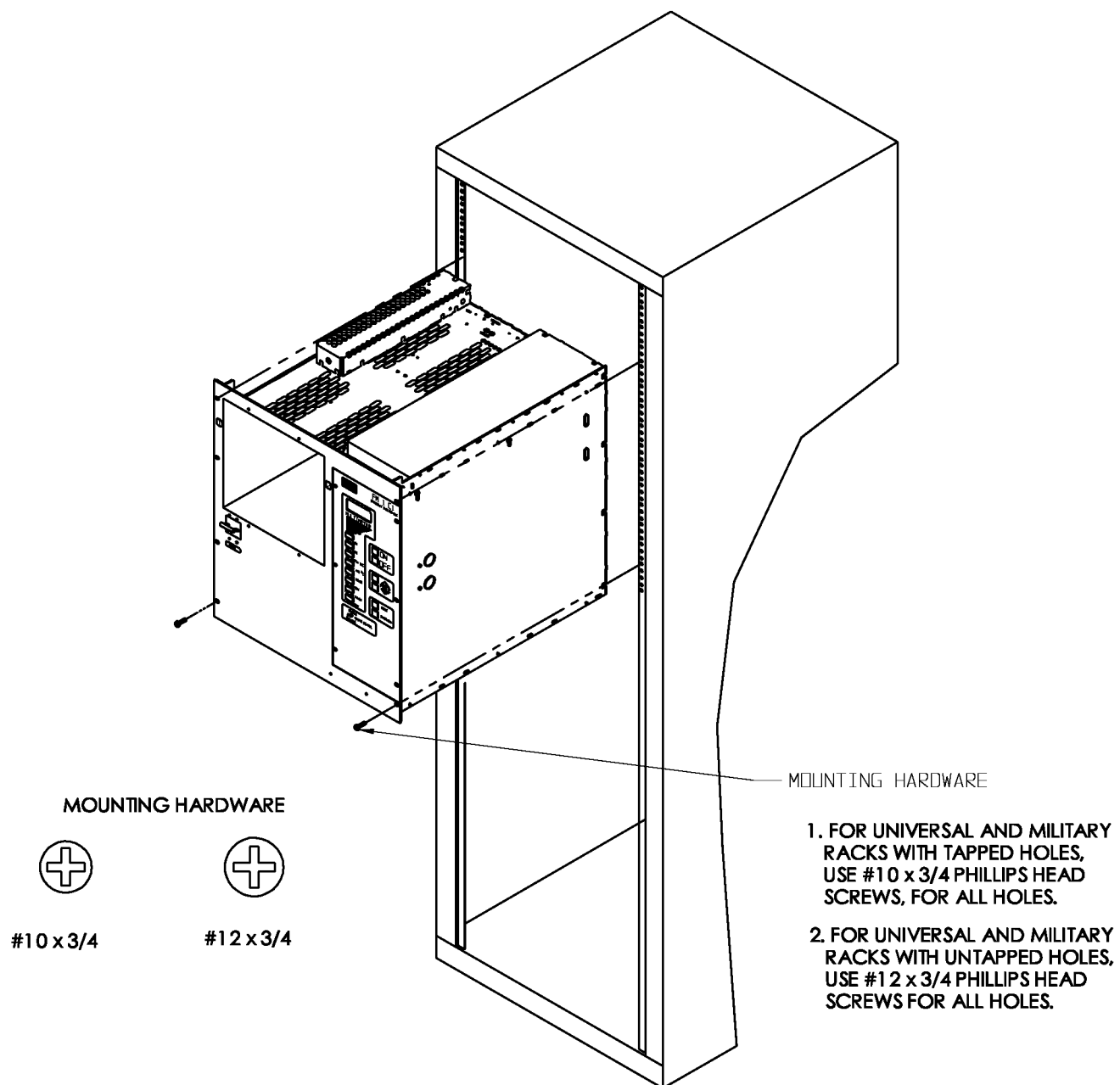
19" EIA MILITARY RACK WITH UNTAPPED HOLES

INSTALL CLIP-NUTS IN HOLES FOR TRANSMITTER MOUNTING 9-PLACES SEE DETAIL A

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FIGURE 2-2. FM-1C1/FM-500C1 RACK INSTALLATON  
(SHEET 1 OF 2)  
(2-5/2-6)



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**597-1001-4B**

**FIGURE 2-2. FM-1C1/FM-500C1 RACK INSTALLATION (SHEET 2 OF 2)**

- 2-22. Insert the transmitter in the rack and install the appropriate hardware in the two lower mounting locations to secure the transmitter in the rack.
- 2-23. Using the appropriate hardware, install the remaining hardware to secure the transmitter in the rack.
- 2-24. **TRANSMITTER CONTROLLER FRONT PANEL REMOVAL.** During installation and maintenance of the FM-1C1/FM-500C1 transmitters, the transmitter controller front panel will be required to be removed. The panel is equipped with a special bracket which allows the panel to be suspended from the chassis for installation and maintenance procedures. To remove the transmitter controller front panel, proceed as follows:
1. Refer to Figure 2-3 and remove the transmitter controller front-panel mounting hardware.
  2. Remove the transmitter controller front panel and rotate the front panel hanger bracket 90° as shown (refer to Figure 2-3).
  3. Refer to Figure 2-3 and install the transmitter controller front panel in the maintenance position by inserting the hanger bracket into the slots in the transmitter chassis as shown.

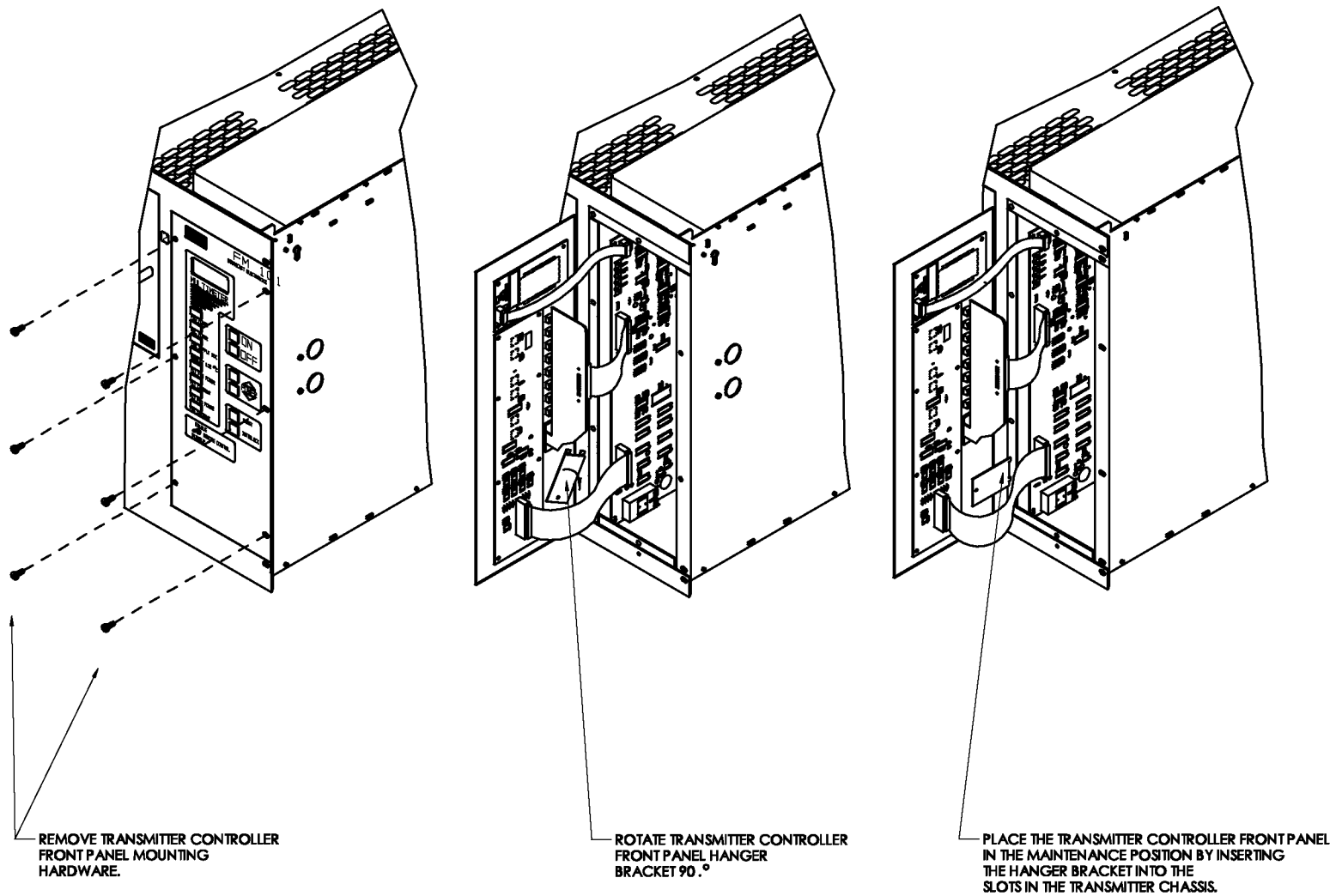


**WARNING**

***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

**WARNING**

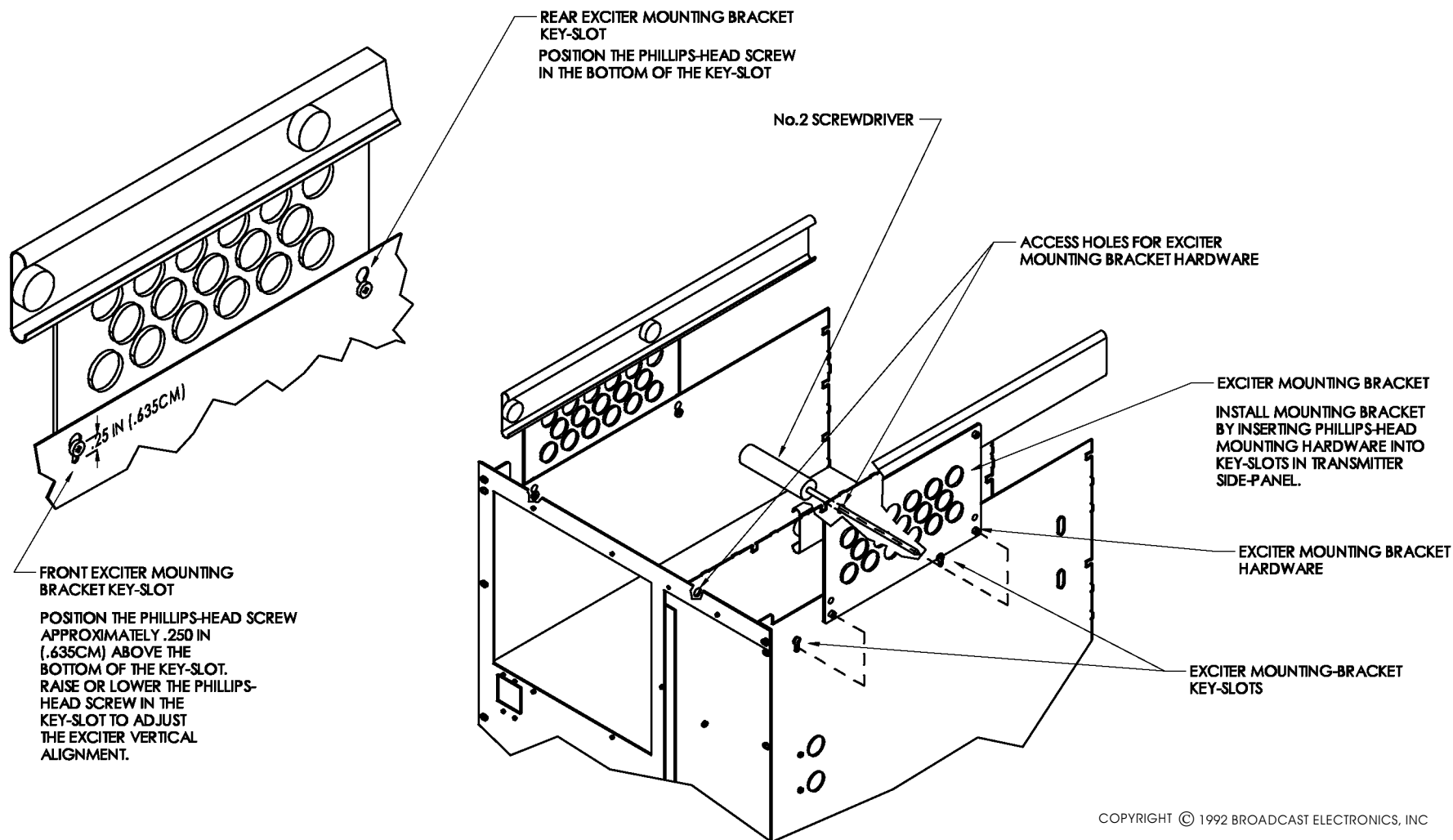
- 2-25. **FX-50 EXCITER MOUNTING BRACKET INSTALLATION.** The FM-1C1/FM-500C1 transmitter may be equipped with the standard FX-50 exciter or the optional PREDATOR digital exciter. The FX-50 exciter is mounted above the transmitter chassis on slide-rails. The PREDATOR must be mounted in a 19 inch rack cabinet. For transmitters equipped with the FX-50, perform the following procedure to install the exciter mounting bracket. For transmitters equipped with a PREDATOR, refer to manual 597-8000 and perform the PLACEMENT procedure in SECTION II, INSTALLATION.
- 2-26. The exciter is mounted to the transmitter chassis by brackets. The exciter mounting hardware is accessed by removing the transmitter controller front panel. Refer to the **TRANSMITTER CONTROLLER FRONT PANEL REMOVAL** procedure in the preceding text and perform the procedure to remove the transmitter controller front panel.
- 2-27. Locate the exciter mounting brackets.
- 2-28. Refer to Figure 2-4 and install the brackets as follows:
1. Orient a mounting bracket as shown and insert the mounting bracket Phillips-head hardware into the key-slots in the transmitter side-panel as shown.
  2. The positioning of the mounting bracket hardware in the key-slots determines the exciter vertical alignment in the rack. Align the mounting bracket as follows:
    - A. In the rear exciter mounting bracket key-slot, position the Phillips-head hardware in the bottom of the key-slot as shown. Secure the Phillips-head screw.
    - B. In the front exciter mounting bracket key-slot, position the Phillips-head hardware approximately 1/4 inch (0.63 cm) above the bottom of the key-slot as shown. Secure the Phillips-head screw. The exciter vertical alignment is adjusted by raising or lowering the hardware in the key-slot.
  3. Repeat the procedure for the second exciter mounting bracket.



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FIGURE 2-3. TRANSMITTER CONTROLLER FRONT PANEL REMOVAL



597-1001-5

FIGURE 2-4. FM-1C1/FM-500C1 EXCITER MOUNTING BRACKET INSTALLATION

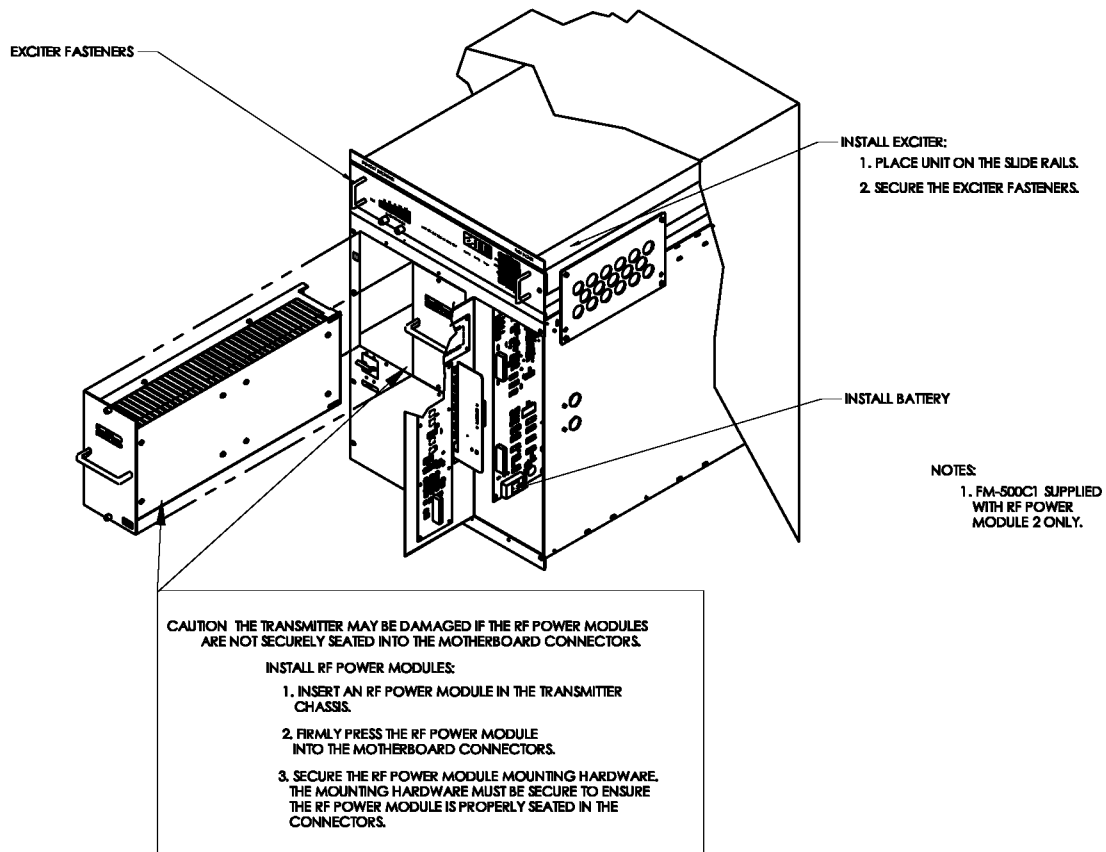


**WARNING**

**ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.**

**WARNING**

- 2-29. **COMPONENT INSTALLATION.** Selected components of the transmitter have been removed to prevent damage during shipment. The components removed from the transmitter are shipped in separate containers. To re-install the FM-1C1/FM-500C1 components, refer to Figure 2-5 and proceed as follows:



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**FIGURE 2-5. FM-1C1/FM-500C1 COMPONENT INSTALLATION**

- 2-30. **Battery Installation.** The transmitter controller is equipped with a battery back-up system to maintain the controller memory during a power failure. A battery for installation in the transmitter is provided in the accessory parts kit. Locate the battery in the accessory parts kit. To install the battery, refer to Figure 2-5 and install the battery in the holder on the controller circuit board as shown.



- 2-31. **FX-50 Exciter Installation.** The transmitter may be equipped with the standard FX-50 exciter or the optional PREDATOR digital exciter. For transmitters equipped with an FX-50 exciter, perform the following installation procedure. For transmitters equipped with a PREDATOR digital exciter, the following installation procedure is not required.
1. Locate the FX-50 exciter.
  2. Refer to FX-50 exciter manual 597-1050 and perform the PRELIMINARY INSTALLATION PROCEDURES to unpack and configure the exciter for the desired operation.
  3. Refer to Figure 2-5 and place the exciter on the slide-rails.
  4. Slide the exciter in and out of the rack to check the exciter movement and vertical alignment. If adjustment of the exciter vertical alignment is required, proceed as follows:
    - A. Refer to Figure 2-4 and loosen the mounting bracket hardware on the front key slot.
    - B. Refer to Figure 2-4 and raise or lower the hardware in the key slot to adjust the exciter vertical alignment.
    - C. Secure the exciter front-panel mounting hardware.
  5. Once the exciter vertical alignment is adjusted, re-install the transmitter controller front panel and secure the hardware.
- 2-32. **RF Power Module Installation.** The FM-1C1 is equipped with RF power module 1 and RF power module 2. The FM-500C1 is equipped with RF power module 2. Each module is a plug-in device containing a serial number. The serial number is recorded in the final test data sheets and is used to identify each module. On FM-1C1 models, the RF power modules contain labels to permit re-installation into the appropriate power module locations. To install the RF modules, proceed as follows:



**CAUTION** *THE TRANSMITTER MAY BE DAMAGED IF AN RF POWER MODULE IS NOT SECURELY SEATED INTO THE MOTHERBOARD CONNECTORS.*



**CAUTION** *AN RF POWER MODULE IS EQUIPPED WITH REAR-PANEL MOUNTED CONNECTORS. TO PREVENT DAMAGE TO THE CONNECTORS, INSERT/REMOVE THE MODULES CAREFULLY AND DO NOT PLACE A MODULE ON THE REAR-PANEL.*

1. Locate the RF power modules. FM-1C1 models are equipped with RF power module 1 and RF power module 2. FM-500C1 models are equipped with RF power module 2.
2. Refer to Figure 2-5 and align RF power module 2 with the guides in the RF power module 2 location.
3. Insert and firmly press the RF module into the motherboard connectors.
4. Secure the RF power module mounting hardware. The mounting hardware must be secure to ensure the RF power is properly seated in the connectors.
5. For FM-1C1 models, repeat the procedure for the RF power module 1. Install RF power module 1 in the RF power module 1 location.



## **WARNING**

***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

## **WARNING**

### 2-33. **WIRING.**

- 2-34. **EXCITER CONNECTIONS.** The FX-50 exciter will require re-connection to the transmitter. If the transmitter is with a PREDATOR and shipped from the factory installed in a rack cabinet, no re-connections are required. If the transmitter is equipped with a PREDATOR and shipped from the factory without a rack cabinet, a cable must be connected from J22 on the transmitter rear-panel to J3 on the PREDATOR controller module. Refer to the following text and perform the connection procedures as required.

#### **FX-50 EXCITER CONNECTIONS -**

1. Refer to Figure 2-6 and connect P22 to J22 on the transmitter rear-panel.
2. Refer to Figure 2-6 and connect cable 40 to the **RF OUTPUT** receptacle on the exciter rear-panel.

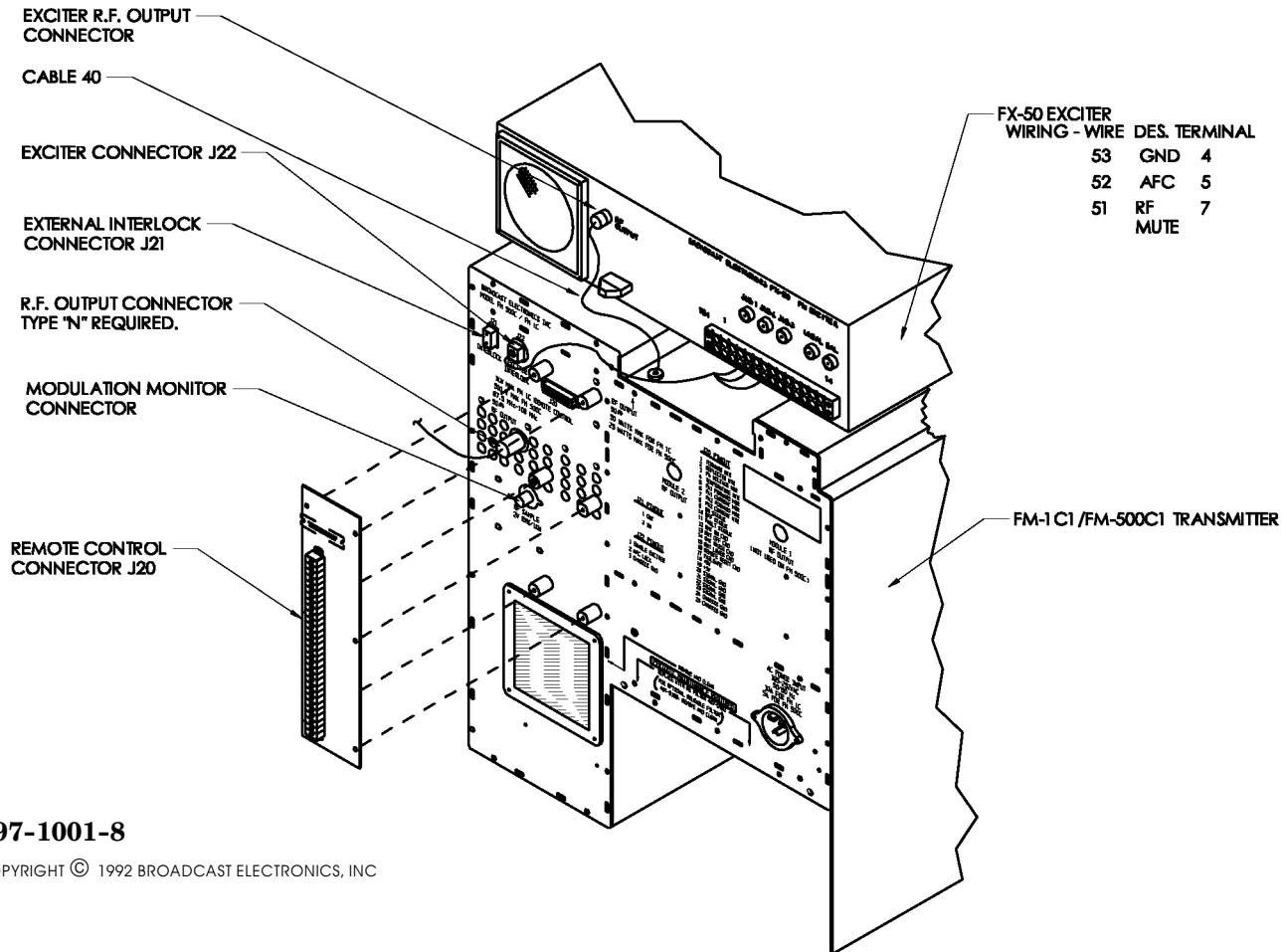
#### **PREDATOR CONNECTIONS -**

1. Locate the exciter interface cable. The cable contains a 4-pin connector on one end and a 25-pin D-Type connector on the opposite end.
2. Refer to Figure 2-6 and connect the cable between J22 on the transmitter rear-panel and J3 on the PREDATOR controller module.

- 2-35. **REMOTE CONTROL.** The FM-1C1/FM-500C1 transmitters are designed for complete remote control operations (refer to Figure 2-7). The transmitters will interface with almost any remote control unit such as the Broadcast Electronics VMC-16 Voice Remote Control System. The following text presents a description of the FM-1C1/FM-500C1 remote control functions and indications. The remote control connections are located on the transmitter rear-panel (refer to Figure 2-6).

- 2-36. Remote control connections are interfaced to the transmitter at J20 on the transmitter rear-panel (refer to Figure 2-6). Remote control commands and indications can be interfaced to the transmitter using: 1) remote control mating connector P20 or 2) the remote control interface circuit board with remote control terminal strip TB2. The transmitter is shipped with the remote control interface circuit board installed. If the remote control interface circuit board is not desired, refer to Figure 2-6 and remove the interface circuit board.

- 2-37. The remote control system: 1) provides positive or negative control logic and 2) +4/+2 volt remote full-scale meter indications. Positive/negative control is determined by jumper J1 on the controller on/off switch circuit board assembly. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to activate the function. Negative control requires the use of a momentary contact to ground to activate the function. Remote indication functions: 1) require current limiting resistors and 2) provide up to 100 mA of current for indicators. Refer to Figure 2-7 and the following text to connect remote control equipment to the system. Figure 2-7 presents the remote control system pin descriptions. The text describes the connections using remote control interface circuit board terminal strip TB2. The pin connections for remote control interface connector J20 are identical to terminal strip TB2.



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**FIGURE 2-6. FM-1C1/FM-500C1 RECONNECTIONS**

- 2-38. **Remote Forward/Reflected Power Meter Indications.** Remote forward/reflected power meter indications are located at TB2-1 and TB2-2. The forward and reflected power meter samples can be programmed for a linear or squared signal. Jumper P721 on the controller circuit board programs the reflected power sample. Jumper P720 on the controller circuit board programs the forward power sample. The transmitter is shipped from the factory with the forward/reflected power samples programmed for a squared signal. The forward/reflected power indications can be programmed for +4 volt dc full-scale or +2 volt dc full-scale meter indications. The transmitter is shipped with the remote forward and reflected power meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-39. **Remote PA Voltage/Temperature Meter Indications.** Remote PA voltage/temperature meter indications are located at TB2-3 and TB2-4. The indications can be programmed for +4 volt dc full-scale or +2 volt dc full-scale meter indications. The transmitter is shipped with the remote PA voltage/temperature meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-40. **Remote PA1 Forward Power/Current Meter Indications.** Remote PA1 forward power/current meter indications are located at TB2-5 and TB2-6. The PA1 forward power sample is supplied as a linear signal. The indications can be programmed for +4 volt dc full-scale or +2 volt dc full-scale meter indications. The transmitter is shipped with the remote PA1 forward power/current meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.

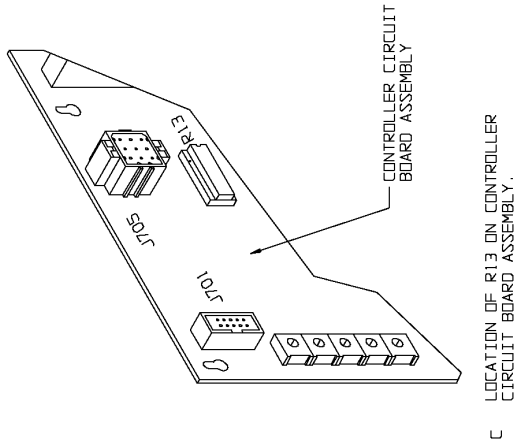
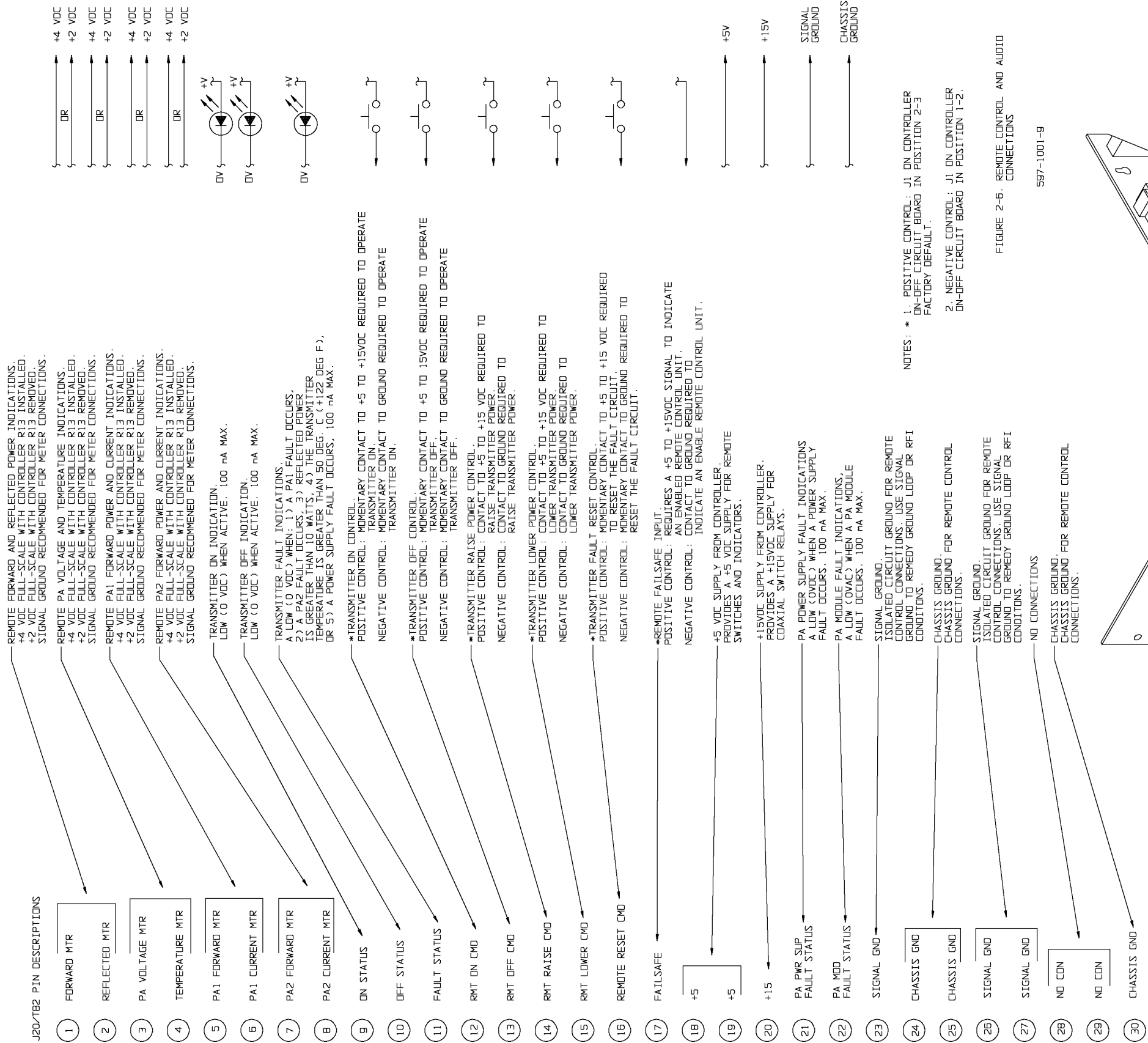


FIGURE 2-7. REMOTE CONTROL CONNECTION (2-15/2-16)

- 2-41. **Remote PA2 Forward Power/Current Meter Indications.** Remote PA2 forward power/current meter indications are located at TB2-7 and TB2-8. The PA2 forward power sample is supplied as a linear signal. The indications can be programmed for +4 volt dc full-scale or +2 volt dc full-scale meter indications. The transmitter is shipped with the remote PA2 forward power/current meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-42. **Transmitter On Indications.** The transmitter on indicator provides a signal to indicate when the transmitter is enabled. The transmitter on indicator is located at TB2-9. The indicator will go LOW (0 volts dc) to indicate when the transmitter is enabled.
- 2-43. **Transmitter Off Indications.** The transmitter off indicator provides a signal to indicate when the transmitter is disabled. The transmitter off indicator is located at TB2-10. The indicator will go LOW (0 volts dc) to indicate when the transmitter is disabled.
- 2-44. **Transmitter Fault Indications.** The transmitter fault indicator provides a signal to indicate when: 1) a PA1 fault occurs, 2) a PA2 fault occurs, 3) reflected power is greater than 10 watts, 4) the transmitter temperature is greater than 50 °C (+122 °F), or 5) a power supply fault occurs. The transmitter fault indicator is located at TB2-11. The indicator will go LOW (0 volts dc) to indicate when a PA1, PA2, high reflected power, or a high temperature fault condition has occurred.
- 2-45. **Remote Transmitter On Control.** The transmitter on function is located at TB2-12. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to operate the transmitter to on. Negative control requires the use of a momentary contact to ground to operate the transmitter to on.
- 2-46. **Remote Transmitter Off Control.** The transmitter off control is located at TB2-13. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to operate the transmitter to off. Negative control requires the use of a momentary contact to ground to operate the transmitter to off.
- 2-47. **Remote Power Level Raise Control.** The transmitter power level raise control is located at TB2-14. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to raise the transmitter power level. Negative control requires the use of a momentary contact to ground to raise the transmitter power level.
- 2-48. **Remote Power Level Lower Control.** The transmitter power level lower control is located at TB2-15. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to lower the transmitter power level. Negative control requires the use of a momentary contact to ground to lower the transmitter power level.
- 2-49. **Remote Reset Control.** The reset control is designed to reset the transmitter fault circuitry. The reset control is located at TB2-16. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to reset the transmitter fault circuitry. Negative control requires the use of a momentary contact to ground to reset the transmitter fault circuitry.
- 2-50. **Remote Fail-safe Input.** The remote fail-safe input is designed for the remote control unit fail-safe control line. The input is located at TB2-17. The input can be activated using positive or negative control. Positive control requires the use of a +5 volt to +15 volt dc signal to indicate an enabled remote control unit. Negative control requires the use of a ground to indicate an enabled remote control unit.
- 2-51. **+5V DC Supply.** A +5 volt dc supply is provided for the remote control switches and indicators. The +5 volt dc supply is located at TB2-18 and TB2-19. The supply can provide up to 20 mA for indicator and switch operations.
- 2-52. **+15V DC Supply.** A +15 volt dc supply is provided for coaxial switch control relays. The +15 volt dc supply is located at TB2-20. The supply can provide up to 50 mA control operations.

- 2-53. **PA Power Supply Fault Status Indications.** The PA power supply fault indicator provides a signal to indicate when a PA power supply fault has occurred. The PA power supply fault indicator is located at TB2-21. The indicator will go LOW (0 volts dc) to indicate the presence of a PA power supply fault.
- 2-54. **PA Module Fault Status Indications.** The PA module fault indicator provides a signal to indicate when a PA RF power module fault has occurred. The PA RF power module fault indicator is located at TB2-22. The indicator will go LOW (0 volts dc) to indicate the presence of a PA RF power module fault.
- 2-55. **Signal Ground.** Signal ground is an isolated circuit ground for remote control connections. Signal ground is to be used to remedy ground loops or to eliminate RFI conditions. Signal ground is located at TB2-23, TB2-26, and TB2-27.
- 2-56. **Chassis Ground.** Chassis ground is designed to be used for remote control connections. Chassis ground is located at TB2-24, TB2-25, and TB2-30.
- 2-57. **No Connection.** No connection. The terminals can be used for any application.
- 2-58. **EXTERNAL INTERLOCK.** The FM-1C1/FM-500C1 transmitters are equipped with an external interlock such as for a test load. The interlock will mute the transmitter RF output when opened. The interlock is located at J21 on the transmitter rear-panel (refer to Figure 2-6). To connect an external interlock to the transmitter, refer to Figure 2-6 and disconnect external interlock connector P21. Connect the interlock wiring to P21-1 and P21-2. When wiring is complete, attach P21 to J21 on the transmitter rear-panel.
- 2-59. **MODULATION MONITOR RECEPTACLE.** The FM-1C1/FM-500C1 transmitters are equipped with a modulation monitor receptacle. The receptacle is located on the transmitter rear panel (refer to Figure 2-6). Refer to Figure 2-6 and connect the modulation monitor to the modulation monitor receptacle. The receptacle provides a minimum 2V RMS sample at 1 kW for monitoring operations.
- 2-60. **AUDIO INPUT CONNECTIONS.** Audio input connections for the FM-1C1/FM-500C1 transmitters are located on the exciter rear panel. For an FX-50 exciter, refer to manual 597-1050 and perform the WIRING procedures in SECTION II, INSTALLATION. For a PREDATOR, refer to manual 597-8000 and perform the DIGITAL STEREO GENERATOR MODULE - AUDIO/SCA/RBDS/19 kHz INTERFACING procedure or the ANALOG INTERFACE MODULE - AUDIO/SCA/RBDS/COMPOSITE INTERFACING procedure in SECTION II, INSTALLATION.
- 2-61. **RF OUTPUT TRANSMISSION LINE CONNECTION.** The FM-1C1/FM-500C1 transmitter RF output connection is located at the **RF OUTPUT** receptacle on the transmitter rear panel (refer to Figure 2-6). The receptacle requires a type N connector. A jumper cable with type N connectors is provided in the accessory kit for RF output transmission line connections. The cable is designed to provide RF output connections when the transmitter is to be interfaced to rigid coaxial cable. To connect the RF output transmission line to the transmitter: 1) Attach the type N connector to the **RF OUTPUT** receptacle on the transmitter rear-panel or 2) use the jumper cable to connect the rigid coaxial cable to the **RF OUTPUT** receptacle on the transmitter rear-panel.



**WARNING**

***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***



**WARNING**

***ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER CHASSIS GROUND LUG.***

**WARNING**

- 2-62. **AC POWER CONNECTIONS.** The FM-1C1 transmitter requires a single phase source of 196V to 252V ac, 50/60 Hz at 20 Amperes. The FM-500C1 transmitter requires a single phase source of 196V to 252V ac, 50/60 Hz at 15 Amperes. AC power is applied to the transmitter through an ac line cord and modular connector. For FM-1C1 models, the transmitter ac power source must be protected by a 20 Ampere fused disconnect or circuit breaker. For FM-500C1 models, the transmitter ac power source must be protected by a 15 Ampere fused disconnect or circuit breaker.

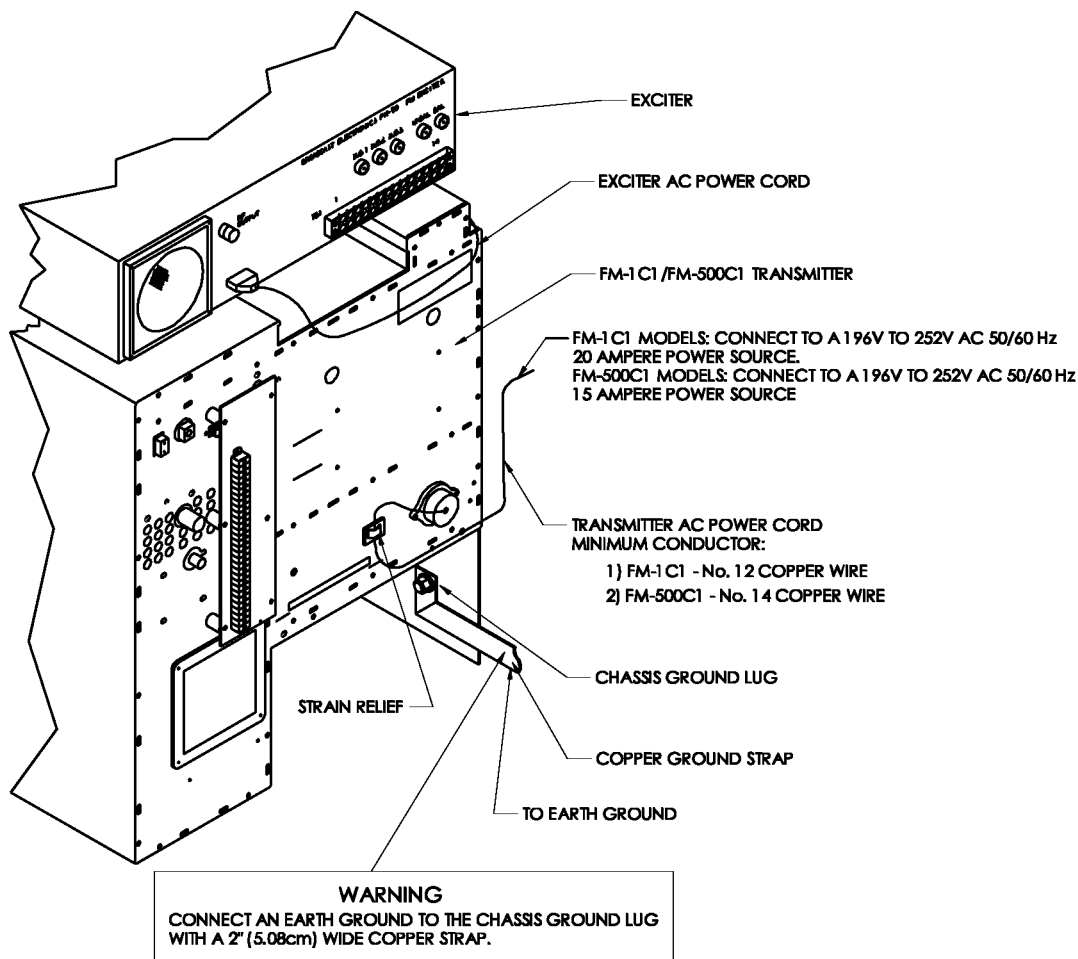


**WARNING**

***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

**WARNING**

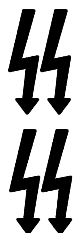
- 2-63. **Exciter AC Power Connections.** The exciter ac power source is provided by the transmitter. Connect the ac power cord from the transmitter to the exciter as shown. The FX-50 operates from a 194V to 266V ac source. The PREDATOR operates from a 100V to 240V ac 50/60 Hz power source.
- 2-64. **Transmitter AC Line Cord Assembly.** AC power is applied to the transmitter using an ac line cord and connector. The connector must be assembled to the line cord. To assemble the modular connector to an ac line cord, proceed as follows:
1. Refer to local electrical codes and select a line cord material for the transmitter ac line cord assembly. For FM-1C1 models, the ac line cord material must contain: 1) minimum 12 gauge copper conductors and 2) the appropriate insulation type such as S or SO (refer to Figure 2-8). For FM-500C1 models, the ac line cord material must contain: 1) minimum 14 gauge copper conductors and 2) the appropriate insulation type such as S or SO (refer to Figure 2-8). Determine the length of the cord required to route power to the transmitter and select the ac line cord material.
  2. Locate the modular ac line cord connector in the accessory parts kit.
  3. Assemble the ac line cord connector to the ac line cord by following the instructions contained in the ac line cord connector.
  4. Connect the ac line cord to a 196V to 252V ac 50/60 Hz power source.
- 2-65. **Main AC Input.** Ensure the transmitter ac line cord is connected to an appropriate power source. Refer to Figure 2-8 and connect the transmitter ac line cord to the ac input receptacle on the transmitter rear-panel as shown. Route the line cord through the strain relief as shown.



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FIGURE 2-8. FM-1C1/FM-500C1 AC POWER CONNECTIONS



**WARNING**

***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

**WARNING**

**WARNING**

***ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER CHASSIS GROUND LUG.***

**WARNING**

- 2-66. **GROUND.** The FM-1C1/FM-500C1 transmitters are equipped with a chassis ground system for operating safety. The ground system requires the connection of an earth ground. Refer to Figure 2-8 and connect an earth ground to the chassis ground lug as shown using a 2 inch (5.08 cm) wide copper strap.



- 2-67. **PRELIMINARY OPERATION.**
- 2-68. The following text presents procedures for the preliminary operation of the FM-1C1/FM-500C1 transmitters. The procedures will reference the factory test data sheets which are shipped with the transmitter. Locate the factory test data sheets. Differences in the values obtained during actual operation may be noted due to differences in primary power and antenna systems. Refer to the following text and perform the procedures to initially operate the FM-1C1/FM-500C1 transmitters.
- 2-69. Ensure the appropriate ac power supply is applied to the transmitter and the exciter.
- 2-70. Operate the **POWER** switch to ON. The following events will occur:
1. Each RF power module **MODULE STATUS** indicator will illuminate yellow.
  2. The **INTERLOCK** indicator will illuminate.
  3. The **OFF** switch/indicator will illuminate.
- 2-71. If the **INTERLOCK** indicator does not illuminate, operate the **POWER** switch to OFF. Check the external interlock to ensure the interlock is operating properly. Operate the **POWER** switch to ON.
- 2-72. Depress the transmitter **MULTIMETER FWD POWER** switch/indicator. The **MULTI-METER** will indicate 0 watts forward power.
- 2-73. Depress the **ON** switch/indicator to illuminate the switch/indicator. Each RF power module **MODULE STATUS** indicator will illuminate green.
- 2-74. For an FX-50 exciter, depress the exciter **MULTIMETER FWD** switch. The exciter **MULTIMETER** will indicate the forward power recorded in the factory test data sheets. For a PREDATOR, refer to INITIAL PREDATOR PROGRAMMING in SECTION III, OPERATION and perform the FORWARD POWER PROGRAMMING procedure. The PREDATOR controller display will indicate the forward power recorded in the factory test data sheets.
- 2-75. Depress and hold the transmitter **POWER▲** switch until the **MULTIMETER** indicates the forward power level recorded in the factory test data sheets. If the **RESET** switch/indicator illuminates or the **MODULE STATUS** indicators illuminate yellow during the increase of transmitter power, proceed as follows:
1. If the **RESET** switch/indicator illuminates, proceed as follows:
    - A. Depress the transmitter **MULTIMETER RFL POWER** switch/indicator to illuminate the switch/indicator.
    - B. Observe the **MULTIMETER** reflected power indication. If a reflected power condition of greater than 10 watts is present, refer to SECTION V, MAINTENANCE and perform the TROUBLESHOOTING procedures to locate the problem. The transmitter will operate into a VSWR of 1.3:1.
    - C. If the reflected power indication is less than 10 watts, depress the **MULTIMETER PWR SUPPLY, EXHAUST AIR °C, PA1 FWD POWER, PA1 CURRENT, PA2 FWD POWER, or PA2 CURRENT** switch/indicators to isolate the problem.
    - D. When the reflected power, high temperature, or power amplifier module condition is removed, reset the transmitter fault circuitry by depressing the **RESET** switch/indicator.

2. If the RF power **MODULE STATUS** indicators illuminate yellow, refer to SECTION V, MAINTENANCE and perform the TROUBLESHOOTING procedures to locate the problem.

2-76. When the desired transmitter output power is obtained, depress the following switch/indicators and compare the indications with the values recorded in the factory test data sheets. The values should be approximately equal to the values recorded in the test data sheets.

- |                          |                         |
|--------------------------|-------------------------|
| 1. <b>RFL POWER</b>      | 5. <b>PA1 CURRENT</b>   |
| 2. <b>PWR SUPPLY VDC</b> | 6. <b>PA2 FWD POWER</b> |
| 3. <b>EXHAUST AIR C</b>  | 7. <b>PA2 CURRENT</b>   |
| 4. <b>PA1 FWD POWER</b>  |                         |

## SECTION III OPERATION

### 3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the FM-1C1/FM-500C1 transmitters and provides standard operating procedures.

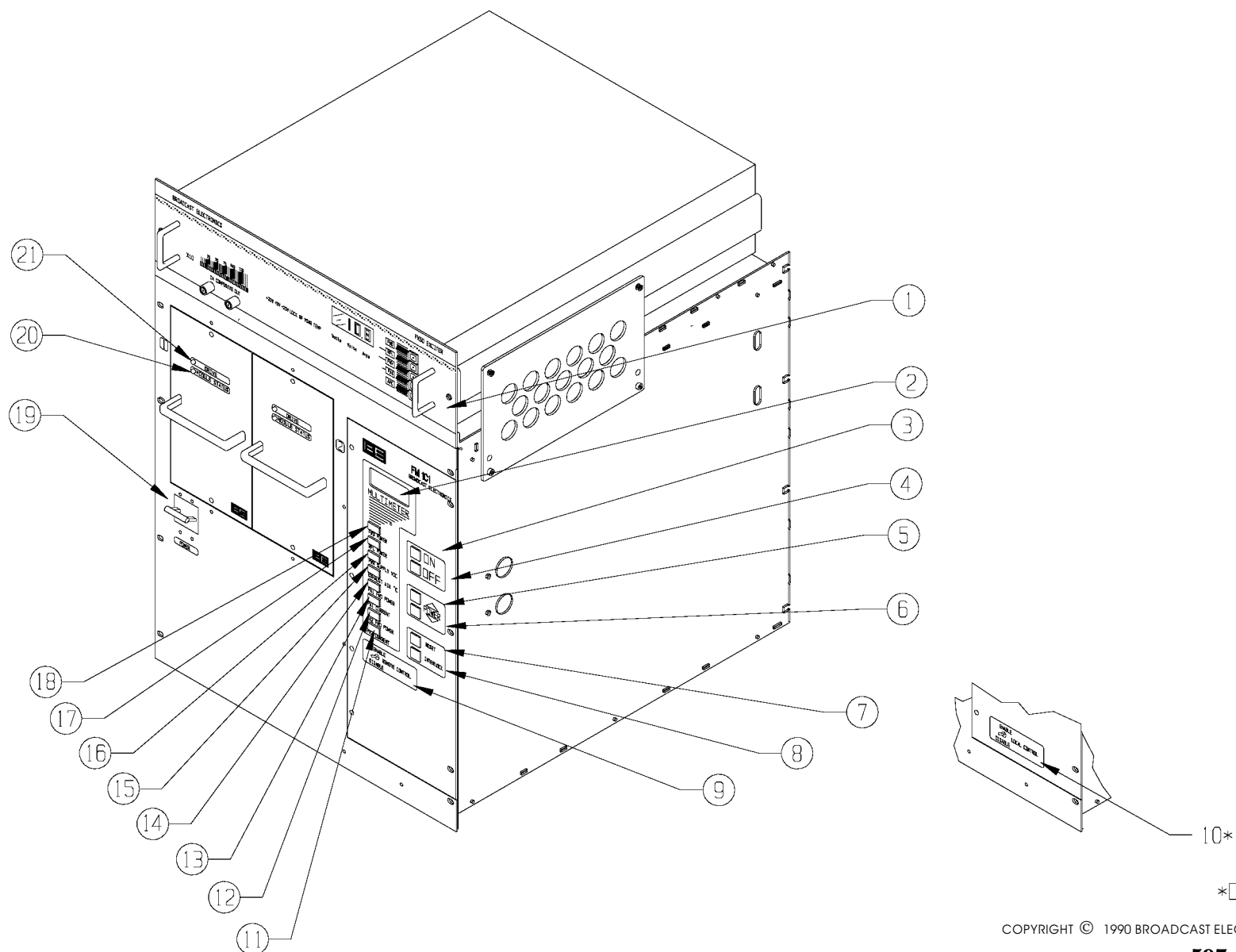
### 3-3. CONTROLS AND INDICATORS.

3-4. **FM-1C1.** Figure 3-1 presents the location of all controls and indicators associated with normal operation of the FM-1C1 transmitter. Table 3-1 presents the functions of each control or indicator. Refer to Figure 3-1 and Table 3-1 for a description of the controls and indicators associated with the FM-1C1 transmitter.

3-5. **FM-500C1.** Figure 3-2 presents the location of all controls and indicators associated with normal operation of the FM-500C1 transmitter. Table 3-2 presents the functions of each control or indicator. Refer to Figure 3-2 and Table 3-2 for a description of the controls and indicators associated with the FM-500C1 transmitter.

**TABLE 3-1. FM-1C1 CONTROLS AND INDICATORS**  
(Sheet 1 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
1	Exciter	For transmitters equipped with an FX-50, refer to the FX-50 exciter instruction manual for a description of the FX-50 controls and indicators. For transmitters equipped with a PREDATOR, refer to the PREDATOR instruction manual for a description of the PREDATOR controls and indicators.
2	<b>MULTIMETER</b> Display	Displays forward power, reflected power, power supply voltage, exhaust air temperature, PA1 forward power, PA1 current, PA2 forward power, and PA2 current parameters as selected by the <b>MULTIMETER</b> switches.
3	<b>ON</b> Switch/Indicator	<b>SWITCH:</b> Enables the transmitter RF output by unmuting the exciter, power amplifier modules, and the power amplifier power supply. <b>INDICATOR:</b> Illuminates to indicate the transmitter RF output is enabled.
4	<b>OFF</b> Switch/Indicator	<b>SWITCH:</b> Disables the transmitter RF output by muting the exciter, power amplifier modules, and the power amplifier power supply. <b>INDICATOR:</b> Illuminates to indicate the transmitter RF output is disabled.



\*OPTIONAL

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**FIGURE 3-1. FM-1C1 CONTROLS AND INDICATORS**

**TABLE 3-1. FM-1C1 CONTROLS AND INDICATORS**  
(Sheet 2 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
5	<b>POWER ▲</b> Switch/Indicator	<p><b>SWITCH:</b> Instructs the system controller to raise the transmitter output power.</p> <p><b>INDICATOR:</b> Illuminates to indicate the <b>POWER ▲</b> switch is selected.</p>
6	<b>POWER ▼</b> Switch/Indicator	<p><b>SWITCH:</b> Instructs the system controller to lower the transmitter output power.</p> <p><b>INDICATOR:</b> Illuminates to indicate the <b>POWER ▼</b> switch is selected.</p>
7	<b>RESET</b> Switch/Indicator	<p><b>SWITCH:</b> Clears the transmitter fault circuitry if: 1) the switch is depressed and 2) if the fault condition is removed.</p> <p><b>INDICATOR:</b> Illuminates to indicate: 1) an RF power module has been removed from the chassis, 2) a power amplifier fault, 3) a high temperature condition, 4) a high reflected power condition, or 5) a power supply fault.</p>
8	<b>INTERLOCK</b> Switch/Indicator	<p><b>SWITCH:</b> No Operation.</p> <p><b>INDICATOR:</b> Illuminates to indicate: 1) the external interlock is closed, 2) the exciter AFC is locked, and 3) the remote control fail-safe input is closed if remote control operation is enabled. Extinguishes to indicate an open external interlock, the exciter AFC is unlocked, or an open remote control fail-safe input if remote control operation is enabled.</p>
9	<b>REMOTE CONTROL ENABLE/DISABLE</b> Switch	Controls the transmitter remote control operations. When the switch is operated to <b>ENABLE</b> , remote control operation is enabled. When the switch is operated to <b>DISABLE</b> , remote control operation is disabled.
10	<b>LOCAL CONTROL ENABLE/DISABLE</b> Switch (Optional)	Controls the transmitter local control operations. When the switch is operated to <b>ENABLE</b> , the transmitter front-panel controls will be enabled. When the switch is operated to <b>DISABLE</b> , the transmitter front-panel controls will be disabled.
11	<b>PA2 CURRENT</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display power amplifier module 2 current.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present power amplifier module 2 current.</p>

**TABLE 3-1. FM-1C1 CONTROLS AND INDICATORS**  
(Sheet 3 of 4)

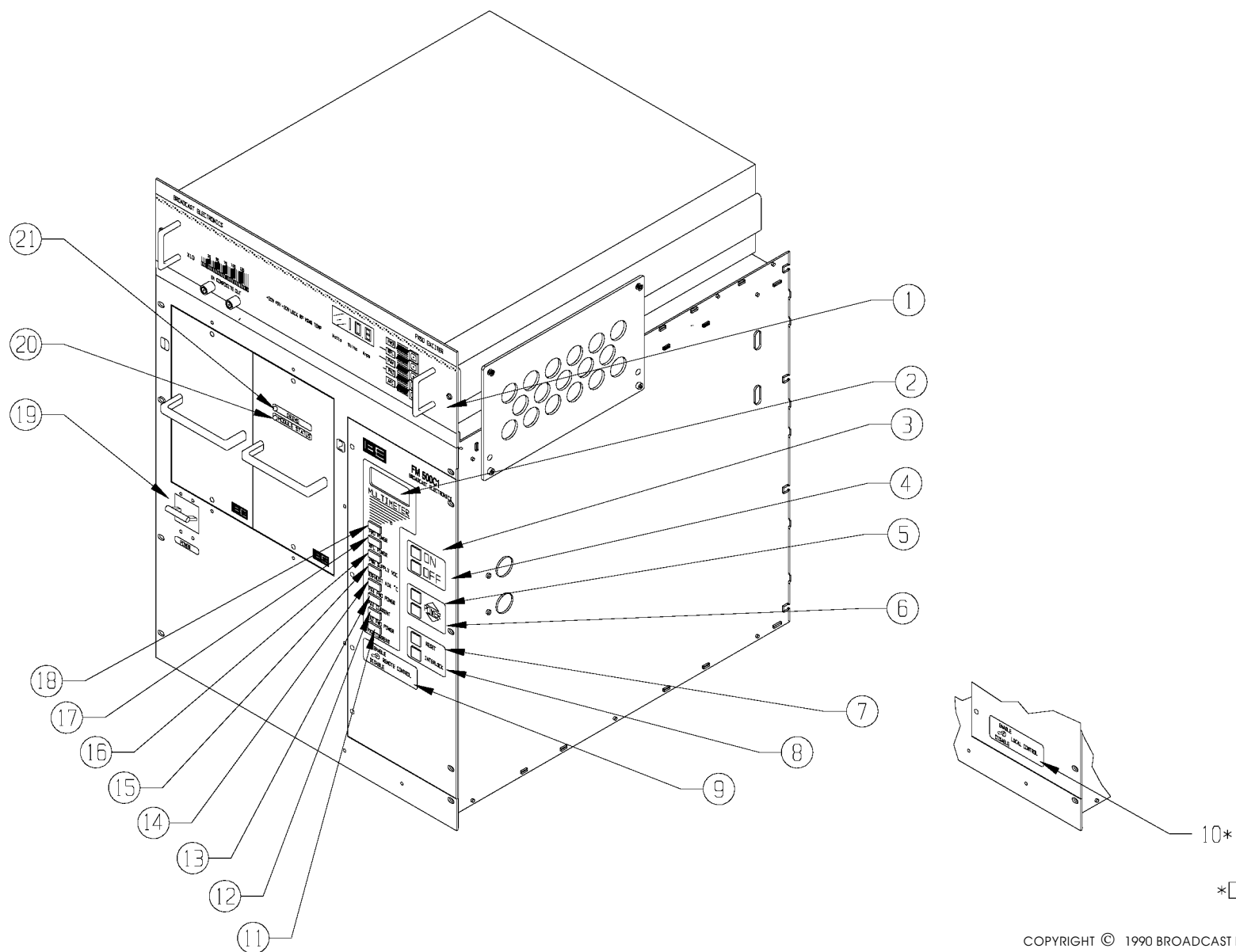
INDEX NO.	NOMENCLATURE	FUNCTION
12	<b>PA2 FWD POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display power amplifier module 2 forward power.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present power amplifier module 2 forward power.</p>
13	<b>PA1 CURRENT</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display power amplifier module 1 current.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present power amplifier module 1 current.</p>
14	<b>PA1 FWD POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display power amplifier module 1 forward power.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present power amplifier module 1 forward power.</p>
15	<b>EXHAUST AIR ° C</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter exhaust air temperature in ° C.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter exhaust air temperature.</p>
16	<b>PWR SUPPLY VDC</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the power supply voltage.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the power supply voltage.</p>
17	<b>RFL POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter reflected power in watts.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter reflected power.</p>
18	<b>FWD POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter forward power in watts.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter forward power.</p>
19	<b>POWER</b> Switch	Provides overload protection and primary ac power control for the transmitter.

**TABLE 3-1. FM-1C1 CONTROLS AND INDICATORS**  
(Sheet 4 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
20	<b>MODULE STATUS</b> Indicator	Displays the operating status of the power amplifier module.  <b>RED DISPLAY:</b> Indicates a power module fault. Power module faults include: 1) over-current, 2) over-voltage, 3) over-temperature, 4) high reflected power and 5) high forward power demand.  <b>YELLOW DISPLAY:</b> Indicates a power module foldback or transmitter off condition.  <b>GREEN DISPLAY:</b> Indicates normal power module RF Power output operation.
21	Module <b>DRIVE</b> Indicator	Illuminates to indicate the presence of RF drive at the power amplifier module.

**TABLE 3-2. FM-500C1 CONTROLS AND INDICATORS**  
(Sheet 1 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
1	Exciter	For transmitters equipped with an FX-50, refer to the FX-50 exciter instruction manual for a description of the FX-50 controls and indicators. For transmitters equipped with a PREDATOR, refer to the PREDATOR instruction manual for a description of the PREDATOR controls and indicators.
2	<b>MULTIMETER</b> Display	Displays forward power, reflected power, power supply voltage, exhaust air temperature, PA forward power, and PA current parameters as selected by the <b>MULTIMETER</b> switches.
3	<b>ON</b> Switch/Indicator	<b>SWITCH:</b> Enables the transmitter RF output by unmuting the exciter, power amplifier modules, and the power amplifier power supply.  <b>INDICATOR:</b> Illuminates to indicate the transmitter RF output is enabled.
4	<b>OFF</b> Switch/Indicator	<b>SWITCH:</b> Disables the transmitter RF output by muting the exciter, power amplifier modules, and the power amplifier power supply.  <b>INDICATOR:</b> Illuminates to indicate the transmitter RF output is disabled.



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**FIGURE 3-2. FM-500C1 CONTROLS AND INDICATORS**

**597-1001-3**



**TABLE 3-2. FM-500C1 CONTROLS AND INDICATORS**  
(Sheet 2 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
5	<b>POWER▲</b> Switch/Indicator	<b>SWITCH:</b> Instructs the system controller to raise the transmitter output power.  <b>INDICATOR:</b> Illuminates to indicate the <b>POWER▲</b> switch is selected.
6	<b>POWER▼</b> Switch/Indicator	<b>SWITCH:</b> Instructs the system controller to lower the transmitter output power.  <b>INDICATOR:</b> Illuminates to indicate the <b>POWER▼</b> switch is selected.
7	<b>RESET</b> Switch/Indicator	<b>SWITCH:</b> Clears the transmitter fault circuitry if: 1) the switch is depressed and 2) if the fault condition is removed.  <b>INDICATOR:</b> Illuminates to indicate: 1) a power amplifier fault, 2) a power supply fault, 3) a high temperature condition, or 4) a high reflected power condition.
8	<b>INTERLOCK</b> Switch/Indicator	<b>SWITCH:</b> No Operation.  <b>INDICATOR:</b> Illuminates to indicate: 1) the external interlock is closed, 2) the exciter AFC is locked, and 3) the remote control fail-safe input is closed if remote control operation is enabled. Extinguishes to indicate an open external interlock, the exciter AFC is unlocked, or an open remote control fail-safe input if remote control operation is enabled.
9	<b>REMOTE CONTROL ENABLE/DISABLE</b> Switch	Controls the transmitter remote control operations. When the switch is operated to <b>ENABLE</b> , remote control operation is enabled. When the switch is operated to <b>DISABLE</b> , remote control operation is disabled.
10	<b>LOCAL CONTROL ENABLE/DISABLE</b> Switch (Optional)	Controls the transmitter local control operations. When the switch is operated to <b>ENABLE</b> , the transmitter front-panel controls will be enabled. When the switch is operated to <b>DISABLE</b> , the transmitter front-panel controls will be disabled.
11	<b>METER OFF</b> Switch/Indicator	<b>SWITCH:</b> Configures the <b>MULTIMETER</b> to off.  <b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to off.
12	<b>METER OFF</b> Switch/Indicator	<b>SWITCH:</b> Configures the <b>MULTIMETER</b> to off.  <b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to off.

**TABLE 3-2. FM-500C1 CONTROLS AND INDICATORS**  
(Sheet 3 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
13	<b>PA CURRENT</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the power amplifier module current.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the power amplifier module current.</p>
14	<b>PA FWD POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the power amplifier module forward power.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the power amplifier module forward power.</p>
15	<b>EXHAUST AIR ° C</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter exhaust air temperature in ° C.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter exhaust air temperature.</p>
16	<b>PWR SUPPLY VDC</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the power supply voltage.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the power supply voltage.</p>
17	<b>RFL POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter reflected power in watts.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter reflected power.</p>
18	<b>FWD POWER</b> Switch/Indicator	<p><b>SWITCH:</b> Configures the <b>MULTIMETER</b> to display the transmitter forward power in watts.</p> <p><b>INDICATOR:</b> A yellow display indicates the <b>MULTI-METER</b> is configured to present the transmitter forward power.</p>
19	<b>POWER</b> Switch	Provides overload protection and primary ac power control for the transmitter.

**TABLE 3-2. FM-500C1 CONTROLS AND INDICATORS**  
(Sheet 4 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
20	<b>MODULE STATUS</b> Indicator	<p>Displays the operating status of the power amplifier module.</p> <p><b>RED DISPLAY:</b> Indicates a power module fault. Power module faults include: 1) over-current, 2) over-voltage, 3) over-temperature, 4) high reflected power, and 5) high forward power demand.</p> <p><b>YELLOW DISPLAY:</b> Indicates a power module current limit, VSWR limit, temperature limit, over-voltage limit, high forward power demand limit, or transmitter off condition.</p> <p><b>GREEN DISPLAY:</b> Indicates normal power module RF Power output operation.</p>
21	Module <b>DRIVE</b> Indicator	Illuminates to indicate the presence of RF drive at the power amplifier module.

### 3-6. OPERATION.



**NOTE**      ***ENSURE THE TRANSMITTER IS COMPLETELY INSTALLED PRIOR TO PERFORMING THE FOLLOWING PROCEDURES.***

**NOTE**

### 3-7. TURN-ON.

- 3-8. Operate the **POWER** switch to **ON**. The flushing fans will begin operation.
- 3-9. Observe the transmitter front-panel indicators. The **RESET**, **INTERLOCK**, and **MODULE STATUS** indicators will display normal operating conditions. If the **RESET** indicator displays a fault condition, depress the **RESET** switch/indicator. If the fault condition is not cleared, operate the **POWER** switch to **OFF** and locate the problem. If the **INTERLOCK** indicator displays a fault condition, operate the **POWER** switch to **OFF** and troubleshoot: 1) the open remote control fail-safe input, 2) an open external interlock, or 3) an unlocked exciter AFC. If the **MODULE STATUS** indicator displays a fault condition, operate the **POWER** switch to **OFF** and troubleshoot the transmitter.
- 3-10. Depress the **ON** switch/indicator to activate the transmitter. The **ON** switch/indicator will illuminate. The **MODULE STATUS** indicator will illuminate green to indicate normal RF power output operation.
- 3-11. Operate the **MULTIMETER** to observe the transmitter forward and reflected power indications by performing the **MULTIMETER OPERATION** procedure in the following text.
- 3-12. Adjust the transmitter output power by performing the **POWER ADJUST** procedure presented in the following text.

- 3-13. If remote control operation is desired, operate the **REMOTE CONTROL ENABLE/DISABLE** switch to **ENABLE**. This will enable both local and remote operation. If remote control operation is to be disabled, operate the **REMOTE CONTROL ENABLE/DISABLE** switch to **DISABLE**.
- 3-14. If the transmitter is equipped with the optional **LOCAL CONTROL ENABLE/DISABLE** switch and the transmitter front-panel controls are to be disabled, operate the switch to **DISABLE**. If the transmitter front-panel controls are to be enabled, operate the **LOCAL CONTROL ENABLE/DISABLE** switch to **ENABLE**.
- 3-15. **TURN-OFF.**
- 3-16. Operate the transmitter to **OFF** by depressing the **OFF** switch/indicator. The **OFF** switch/indicator will illuminate. The transmitter RF output will be disabled. Each RF power amplifier **MODULE STATUS** indicator will illuminate yellow.
- 3-17. Operate the **POWER** switch to **OFF** to remove ac power from the transmitter.
- 3-18. **MULTIMETER OPERATION.**
- 3-19. The **MULTIMETER** is designed to display several transmitter operating parameters. To operate the multimeter, proceed as follows:
- 3-20. For an FM-1C1 transmitter, operate the **FWD POWER, RFL POWER, PWR SUPPLY VDC, EXHAUST AIR C, PA1 FWD POWER, PA1 CURRENT, PA2 FWD POWER, or PA2 CURRENT** switch/indicator as desired to select the parameter to be displayed on the **MULTIMETER**. The parameter will be displayed on the multimeter.
- 3-21. For an FM-500C1 transmitter, operate the **FWD POWER, RFL POWER, PWR SUPPLY VDC, EXHAUST AIR C, PA FWD POWER, or PA CURRENT** switch/indicator as desired to select the parameter to be displayed on the **MULTIMETER**. The parameter will be displayed on the multimeter. Depress the **METER OFF** switch/indicator to operate the **MULTIMETER** to off.
- 3-22. **POWER ADJUST.**
- 3-23. The **POWER ▲** and **▼** switches adjust the transmitter output power. The switches adjust the transmitter power using a two-speed control feature. When a switch is depressed, the switch controls power using a normal control rate. When a switch is depressed and held, the switch controls power using a fast control rate. To adjust the transmitter output power, proceed as follows:
1. Depress the **POWER ▲** switch to increase the transmitter output power. Depress and hold the **POWER** switch for fast raise power operation. Observe the transmitter output power indications on the **MULTIMETER**.
- OR**
2. Depress the **POWER ▼** switch to decrease the transmitter output power. Depress and hold the **POWER** switch for fast lower power operation. Observe the transmitter output power indications on the **MULTIMETER**.
- 3-24. **EXCITER OPERATION.**
- 3-25. For transmitters equipped with an FX-50, refer to the FX-50 instruction manual for a complete description of the FX-50 operating procedures. Perform the procedures to configure the FX-50 for the desired operation. For transmitters equipped with a PREDATOR, refer to the PREDATOR instruction manual for a complete description of the PREDATOR operating procedures. Perform the procedures to configure the PREDATOR for the desired operation.

- 3-26. **FAULT RESET.**
- 3-27. To reset a transmitter fault condition, depress the **RESET** switch/indicator. If the fault condition is remedied, the **RESET** indicator will extinguish.
- 3-28. If the fault condition is not remedied, operate the **POWER** switch to **OFF** and locate the problem.
- 3-29. Once the fault condition is remedied, depress the **RESET** switch/indicator. The indicator will extinguish.
- 3-30. **RF POWER MODULE STATUS AND DRIVE INDICATORS.**
- 3-31. The RF power **MODULE STATUS** indicator monitors the operating status of the power module. A red display indicates a power module fault. A yellow display indicates a power module foldback or transmitter off condition. A green display indicates normal power module RF power output operation. If the indicator displays a fault or foldback condition, refer to SECTION V, MAINTENANCE and troubleshoot the transmitter.
- 3-32. The RF power module **DRIVE** indicator monitors the status of RF drive from the exciter. The indicator will illuminate to indicate the presence of RF drive at the module. If an indicator is extinguished, refer to SECTION V, MAINTENANCE and troubleshoot the transmitter.

## SECTION IV

# THEORY OF OPERATION

### 4-1. INTRODUCTION.

4-2. This section presents the theory of operation for the Broadcast Electronics FM-1C1/FM-500C1 transmitters.

### 4-3. OVERALL OPERATION.

4-4. Information on overall FM-1C1/FM-500C1 transmitter operation is presented in Figure 4-1. Refer to Figure 4-1 for information on overall FM-1C1/FM-500C1 transmitter operation.

### 4-5. POWER SUPPLY/RF CIRCUITRY OPERATION.

4-6. A description of the FM-1C1/FM-500C1 transmitter power supply and RF circuitry is presented in Figure 4-2. Refer to Figure 4-2 for FM-1C1/FM-500C1 power supply/RF circuitry information.

### 4-7. CONTROLLER CIRCUITRY OPERATION.

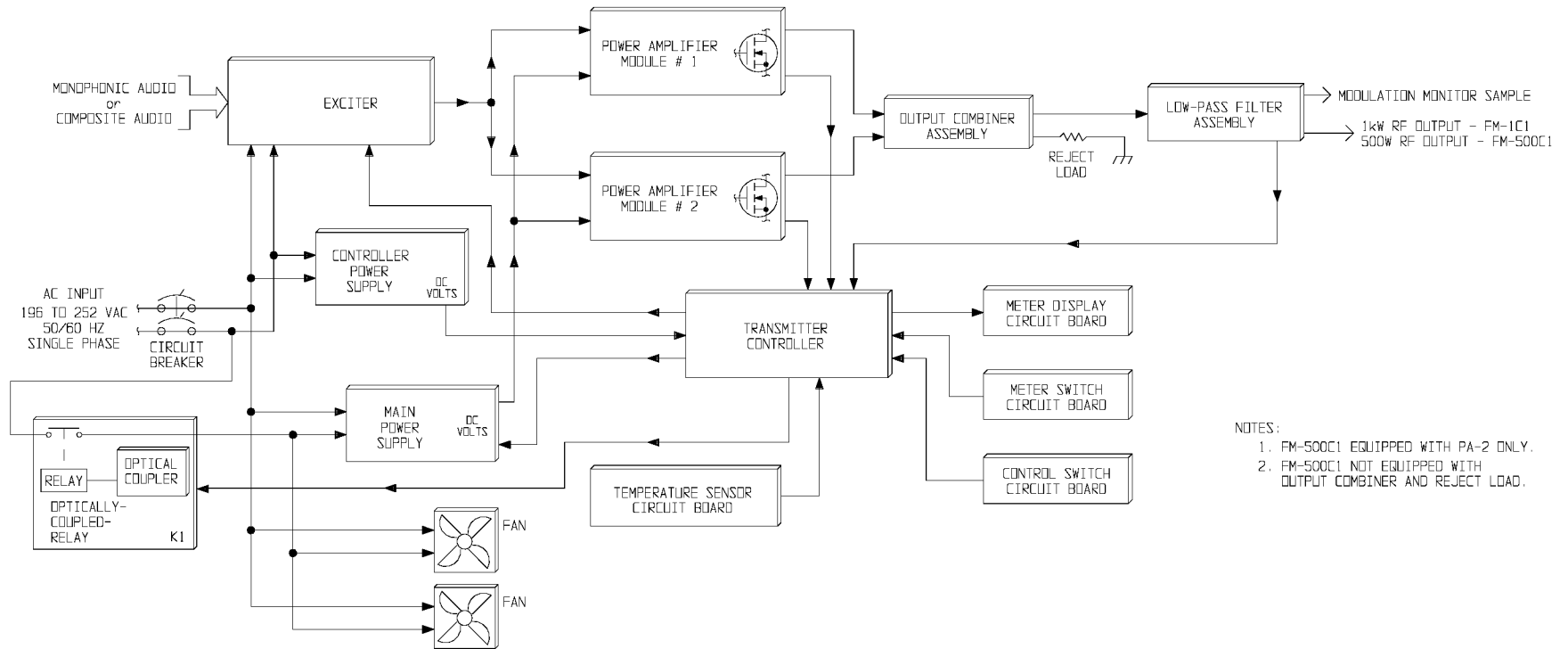
4-8. The FM-1C1/FM-500C1 transmitter control and monitoring functions are performed by a CMOS digital controller (refer to Figures 4-3 and 4-4). The transmitter controller consists of the following circuit board assemblies: 1) the on/off switch circuit board, 2) the controller circuit board 3) the meter switch circuit board, and 4) the meter display circuit board. The controller is designed to provide: 1) on/off control, 2) raise/lower power control, 3) automatic power control operation, and 4) metering operation.

4-9. Six switch/indicators provide transmitter control functions. An LCD multimeter presents 8 transmitter indications. The controller circuitry is designed to interface to almost any remote control device such as the Broadcast Electronics VMC-16 voice remote control system. Positive/negative control optical couplers allow the transmitter to be controlled using positive or negative control logic. DC power for controller circuitry operation is provided by a modular switching power supply unit. The power supply unit provides +5 and  $\pm 15$  volt dc supplies for controller circuitry operation.

### 4-10. CONTROLLER ON/OFF SWITCH CIRCUIT BOARD.

4-11. The controller on/off switch circuit board is equipped with the on/off, raise/lower, and reset switch/indicator circuitry (refer to Figure 4-4). The circuit board is designed to output control signals to the controller circuit board, the RF amplifier logic circuit board, to the exciter, and the remote control interface terminal strip.

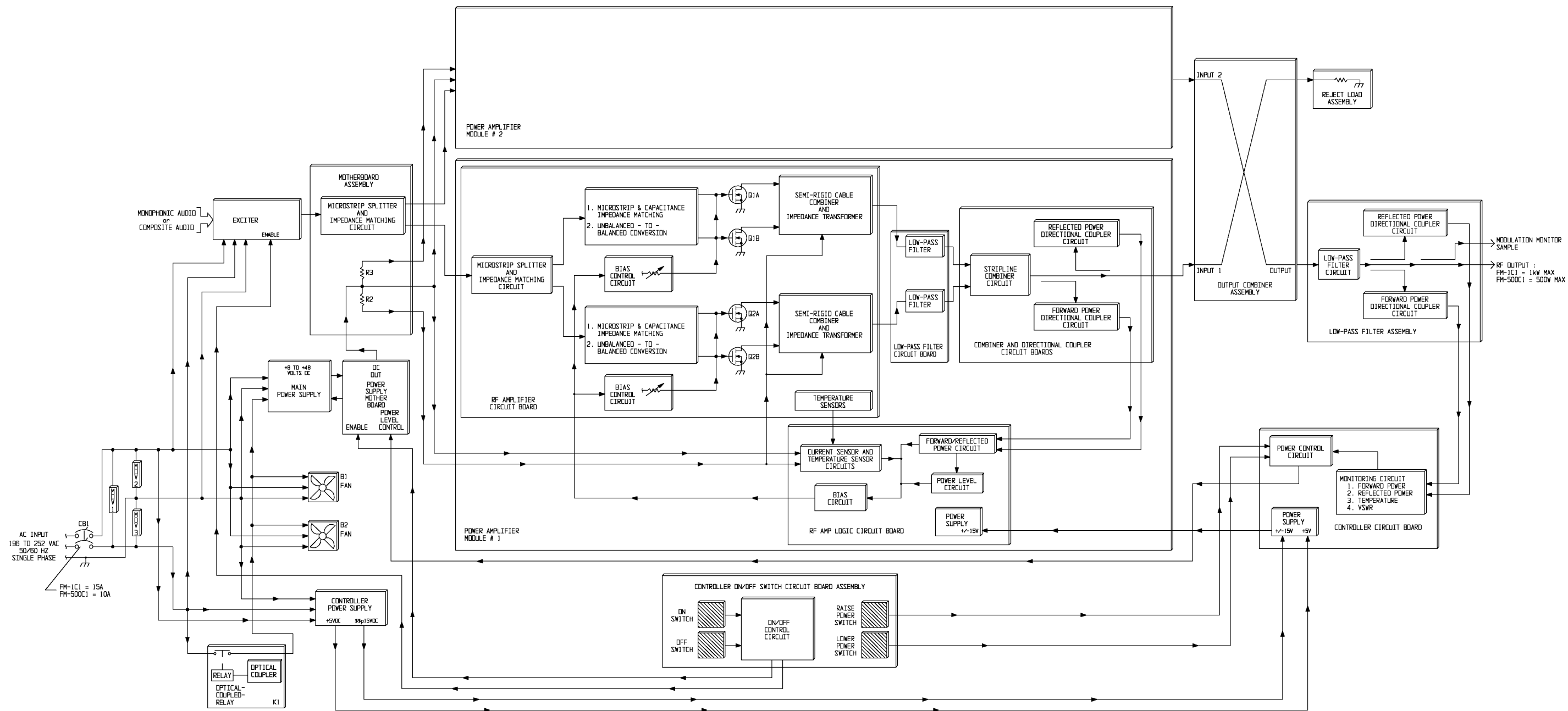
4-12. **TRANSMITTER ON CONTROL CIRCUIT.** The transmitter can be operated to ON using remote or local control. Local ON control is provided by switch S3. When local on control is used, a LOW from on switch S3 is applied to relay K1. Remote on control is performed by optical coupler U4 and inverters U10B and U12A. U4 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation. When U4 is activated, a LOW is routed to inverters U10B and U12A. U12A will output a LOW to the on control coil of relay K1.



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**597-1001-12**

**FIGURE 4-1. FM-1C1/FM-500C1 BLOCK DIAGRAM**



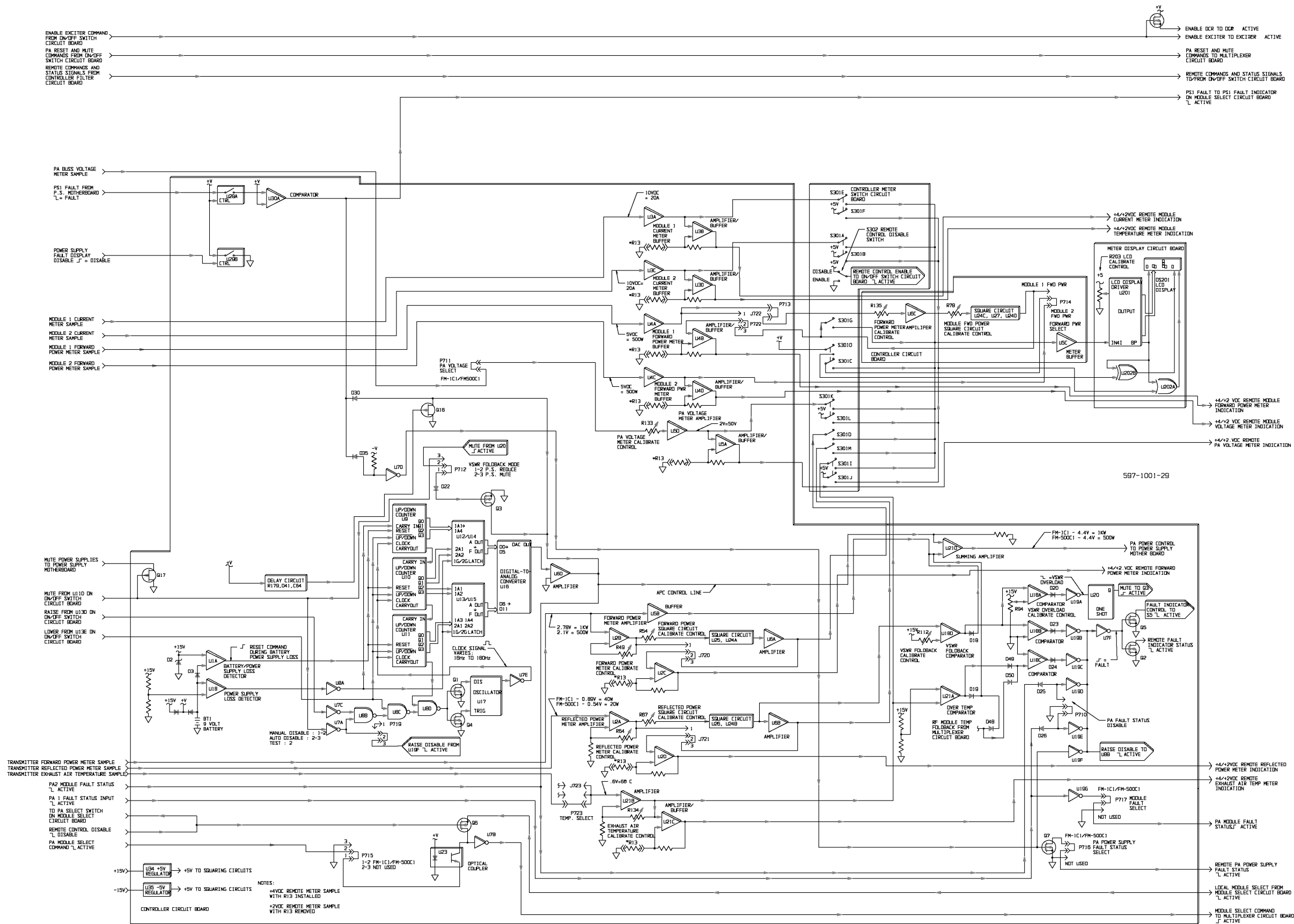
NOTES:  
 1. FM-500C1 EQUIPPED WITH POWER AMPLIFIER MODULE 2 ONLY.  
 2. FM-500C1 NOT EQUIPPED WITH OUTPUT COMBINER AND REJECT LOAD.

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597-1001-13

**FIGURE 4-2. POWER SUPPLY/RF CIRCUIT  
SIMPLIFIED SCHEMATIC**  
 (4-3/4-4)







**FIGURE 4-4. CONTROLLER ON/OFF SWITCH CIRCUIT BOARD SIMPLIFIED SCHEMATIC**

- 4-13. Relay K1 is used to: 1) disable the transmitter when the exciter Automatic-Frequency-Control (AFC) signal is disabled and 2) generate a transmitter on and a transmitter off command. With a LOW from the on circuitry, K1 will output a HIGH to transistor Q1 and inverter U11B. A HIGH at K1 will allow the transmitter on/off circuitry initiate a transmitter on sequence. U11B will output a LOW to inverters U11C, U12F, and U11E. U11C will output a HIGH to transistor Q1, inverter U11D, inverter U12G, and transistor Q2. U12F will output a HIGH to extinguish OFF indicator S4. Q1 will output a LOW to unmute the power amplifier modules. U12G will output a LOW to enable on indicator S3. Q2 will output a LOW remote on status signal to the remote interface terminal strip. U11D will output a LOW to the automatic power control circuitry on the controller circuit board and unmute the power amplifier power supply.
- 4-14. **TRANSMITTER OFF CONTROL CIRCUIT.** The transmitter off control circuitry operates in a similar manner as the on control circuitry. The transmitter off control circuitry consists of off switch S4, optical coupler U5, and inverters U10C and U12B. Local OFF control is provided by switch S4. When local off control is used, a LOW from off switch S4 is applied to relay K1. Remote off control is performed by optical coupler U5 and inverters U10C and U12B. U5 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation. When U5 is activated, a LOW is routed to inverters U10C and U12B. U12B will output a LOW to the off control coil of relay K1.
- 4-15. With a LOW from the off circuitry, K1 will output a LOW to transistor Q1 and inverter U11B. A LOW at K1 will allow the transmitter on/off circuitry initiate a transmitter off sequence. U11B will output a HIGH to inverters U11C, U12F, and U11E. U11C will output a LOW to transistor Q1, inverter U11D, inverter U12G, and transistor Q2. U12F will output a LOW to enable OFF indicator S4. Q1 will output a HIGH to mute the power amplifier modules. U12G will output a HIGH to disable on indicator S3. Q3 will output a LOW remote off status signal to the remote interface terminal strip. U11D will output a HIGH to the automatic power control circuitry on the controller circuit board and mute the power amplifier power supply.
- 4-16. **REMOTE CONTROL ENABLE/DISABLE CIRCUIT.** Switch S302 on the controller meter switch circuit board is designed to enable/disable the remote control circuitry. When remote control is enabled, S302 will output a HIGH to inverter U12C on the on/off control circuit board. U12C will output a LOW to U10D. U10D will output a HIGH to relay K1. A HIGH will allow the transmitter on/off circuitry to generate a transmitter on sequence. When remote control is disabled, S302 will output a LOW to U12C. U12C will output a HIGH to U10D. U10D will output a LOW to K1. The LOW prevents the on/off circuit from generating a transmitter on sequence.
- 4-17. **REMOTE CONTROL FAILSAFE INPUT CIRCUIT.** The controller on/off switch circuit board is equipped with a remote control failsafe input. The input is provided to configure the transmitter to off if the remote control unit is disabled. The failsafe input is applied to optical coupler U6. U6 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation.
- 4-18. When the remote control unit is enabled, an enabled command from the remote control unit is applied to U6. U6 will output a LOW to U10D. U10D will output a HIGH to K1. A HIGH will allow the transmitter on/off circuitry to initiate a transmitter on sequence.
- 4-19. When the remote control unit is disabled, a HIGH is applied to U10D. U10D will output a LOW to K1. A LOW will configure the transmitter on/off circuitry to initiate a transmitter off sequence.

- 4-20. **AFC LOCK INPUT CIRCUIT.** The Automatic-Frequency-Control status signal from the exciter is applied to optical coupler U14. When the exciter frequency is locked, a LOW is applied to U14. U14 will output a LOW to inverter U13C. U13C will output a HIGH to K1. A HIGH will allow the transmitter on/off circuitry to initiate a transmitter on sequence. If the exciter frequency becomes unlocked, a HIGH is applied to U13C. U13C will output a LOW to K1 to configure the transmitter on/off circuitry to initiate a transmitter off sequence.
- 4-21. **RESET CIRCUIT.** A reset circuit is provided to reset the transmitter fault detection circuitry on the power amplifier modules. The reset circuit can be activated using local or remote control. Local reset operation is provided by reset switch/indicator S5. S5 will output a LOW to reset the fault detection circuitry on the RF amplifier modules. Remote reset commands are generated by optical coupler U7. U7 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation. When a remote reset command is initiated, the command is applied to U7. U7 will output a LOW to inverters U10E and U12D. U12D will output a LOW to reset the fault detection circuitry on the RF amplifier modules.
- 4-22. **EXTERNAL INTERLOCK CIRCUIT.** An external interlock circuit is provided for the connection of external equipment such as a test load. External interlock commands are generated by optical coupler U3. U3 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation. When the external interlock is closed, the signal is applied to U3. U3 will output a LOW to inverters U10A and U12E. U12E will output a LOW to illuminate interlock indicator DS1. When the external interlock opens, the signal is applied to U3. A HIGH is applied through inverters U10A and U11F. U11F will output a HIGH to configure the transmitter to off. U12E will output a HIGH to extinguish interlock indicator DS1.
- 4-23. **TRANSMITTER RAISE POWER CIRCUIT.** The transmitter raise power circuitry consists of raise switch S6, optical coupler U8, and inverters U10F and U13D. Local raise control is provided by switch S6. When local raise power control is used, a LOW from switch S6 is routed to the automatic-power-control circuitry on the controller circuit board. Remote raise control is performed by optical coupler U8 and inverters U10F and U13D. U8 can be activated using positive or negative control logic. Jumper J1 programs the optical coupler circuitry for positive or negative control operation. When U8 is activated, a LOW is routed to inverters U10F and U13D. U13D will output a LOW to the automatic-power-control circuitry on the controller circuit board.
- 4-24. **TRANSMITTER LOWER POWER CIRCUIT.** The transmitter lower power circuitry operates in a similar manner as the transmitter raise power circuit. The transmitter lower power circuit consists of lower switch S7, optical coupler U9, and inverters U11A and U13E. Refer to TRANSMITTER RAISE POWER CIRCUIT in the preceding text for a description of the transmitter lower power circuit operation.
- 4-25. **CONTROLLER CIRCUIT BOARD.**
- 4-26. The controller circuit board is equipped with the automatic-power-control circuitry, 8 meter amplifier/buffer circuits, and fault processing circuitry (refer to Figure 4-3). The automatic-power-control circuitry is designed to control the transmitter output power in response to local/remote control commands, high reflected power conditions, and high temperature conditions. The meter amplifier/buffer circuits process transmitter signals for application to the meter display circuit board. The fault processing circuitry monitors several transmitter parameters and generates a fault signal when a power amplifier fault, a high temperature condition, or a high reflected power condition occurs.

- 4-27. **AUTOMATIC-POWER-CONTROL CIRCUIT.** The automatic-power-control circuit consists of up/down counters U9/U10/U11, latches U12 through U15, digital-to-analog converter U16, NAND gates U8B/U8C/U8D, inverters U8A/U7C/U7A/U7E, transistors Q1/Q4, and timer U17. The automatic-power-control circuit controls the transmitter power output in response to local/remote raise/lower commands, high reflected power conditions, and high temperature conditions.
- 4-28. **Raise Output Power Operation.** When the transmitter is operated to on, a LOW from U10D on the controller on/off switch circuit board is applied to inverter U7A. When a local/remote raise command is initiated, a LOW is applied to inverter U7C. U7C will output a HIGH to NAND gate U8B. U8B will output a HIGH to U8C. With no lower command present: 1) U8C will output HIGH to U8D and 2) a HIGH is applied to up/down counters U9/U10/U11 to configure the counters to count up. U8D will output a HIGH to an oscillator circuit consisting of timer U17, inverter U7E, and transistors Q1 and Q4. The oscillator is designed to provide slow/fast power level adjustment control as determined by the operation of the raise switch/indicator. When the raise switch/indicator is depressed such as during fine output power adjustment, the oscillator output will be 16 Hz. When the raise switch/indicator is depressed and held such as during coarse output power adjustment, the oscillator output will be 150 Hz.
- 4-29. The output of the oscillator is inverted at U7E and applied to each up/down counter clock input. The counters will respond to the raise command by counting up and routing a number to latches U12 through U15. The output of latches U12 through U15 are applied to digital-to-analog converter U16. U16 will convert the numbers to a dc output voltage. The voltage from U16 is amplified at U6D. U6D will output a dc voltage to summing amplifier U21D. With no VSWR or over temperature conditions, U21D will output a dc power control voltage to the power amplifier power supply. The power supply will respond by routing the appropriate dc voltage to the power amplifier modules to increase the RF output power.
- 4-30. **Lower Output Power Operation.** When the transmitter is operated to on, a LOW from U10D on the controller on/off switch circuit board is applied to inverter U7A. When a local/remote lower command is initiated, a LOW is applied to NAND gate U8C and up/down counters U9/U10/U11. The LOW configures the up/down counters to count down. U8C will respond by routing a HIGH to U8D. U8D will output a HIGH to an oscillator circuit consisting of timer U17, inverter U7E, and transistors Q1 and Q4. The oscillator is designed to provide slow/fast power level adjustment control as determined by the operation of the lower switch/indicator. When a lower switch/indicator is depressed during fine output power adjustment, the oscillator output will be 16 Hz. When a lower switch/indicator is depressed and held during coarse output power adjustment, the oscillator output will be 150 Hz.
- 4-31. The output of the oscillator is inverted at U7E and applied to the up/down counters. The counters will respond to the lower command by counting down and routing a number to latches U12 through U15. The output of latches U12 through U15 are applied to digital-to-analog converter U16. U16 will convert the numbers to a dc output voltage. The voltage from U16 is amplified at amplifier U6D. U6D will output a dc voltage to summing amplifier U21D. With no VSWR or over temperature conditions, U21D will output a dc power control voltage to the power amplifier power supply. The power supply will respond by routing the appropriate dc voltage to the power amplifier modules to decrease the RF output power.
- 4-32. **METER AMPLIFIER/BUFFER CIRCUITS.** The controller circuit board is equipped with 8 meter amplifier/buffer circuits. The PA1/PA2 current, the PA1/PA2 forward power, and the PA voltage meter circuits operate in an identical manner. Therefore, only the PA voltage amplifier/buffer circuit will be discussed.

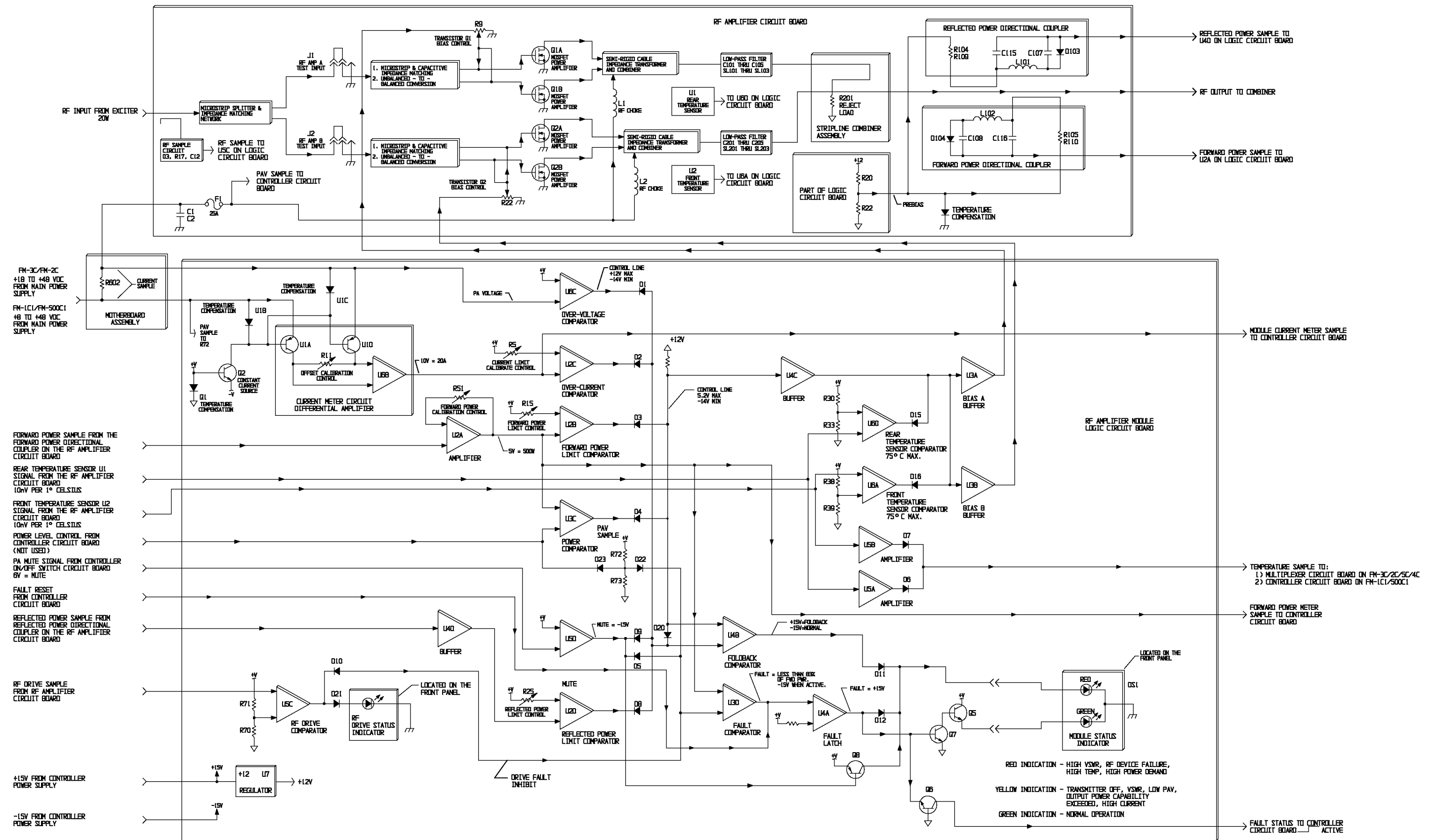
- 4-33. **PA Voltage Meter Amplifier/buffer Circuit.** A PA voltage sample from the PA motherboard assembly is applied through potentiometer R133 to amplifier U5D. Potentiometer R133 is provided to calibrate the PA voltage meter sample. U5D is a non-inverting amplifier with a gain of approximately 1. The output of U5D is applied to: 1) meter switch S301 on the controller meter switch circuit board and 2) amplifier/buffer U5A. U5A is a non-inverting amplifier with a gain determined by resistor R13. R13 is a resistor network designed to be installed/removed as determined by the desired remote meter voltage indication. For a +4 volt equals 50 V dc remote full-scale PA voltage meter indication, R13 is installed. As a result, U5A will be programmed for a gain of approximately 2. For a +2 volt remote full-scale meter indication, R13 is removed. As a result U5A will be programmed for a gain of approximately 1. The output of U5A is routed to the controller RFI filter circuit board.
- 4-34. **EXHAUST AIR TEMPERATURE CIRCUIT.** A dc sample voltage from the temperature sensor circuit board is applied to non-inverting amplifier U21B. The gain of U21B is controlled by potentiometer R134. R134 is provided to calibrate the exhaust air temperature circuitry. The output of U21B is applied to: 1) the controller meter switch circuit board, 2) over-temperature comparator U21A, and 3) amplifier/buffer U21C. U21C is a non-inverting amplifier with a gain determined by resistor R13. R13 is a resistor network designed to be installed/removed as determined by the desired remote meter voltage indication. For a +4 volt equals 60 degrees Celsius remote full-scale temperature meter indication, R13 is installed. As a result, U21C will be programmed for a gain of approximately 2. For a +2 volt remote full-scale meter indication, R13 is removed. As a result U21C will be programmed for a gain of approximately 1. The output of U21C is routed to the controller RFI filter circuit board.
- 4-35. **REFLECTED POWER METER CIRCUIT.** A dc reflected power sample voltage from the low-pass filter assembly is applied to non-inverting meter amplifier U2A. The gain of U2A is controlled by potentiometer R64. R64 is provided to calibrate the reflected power circuitry. The output of U2A is applied to a squaring circuit consisting of integrated circuits U26 and U24B. U26 and U24B function to convert the voltage sample to a power sample. The output of the squaring circuit is routed to: 1) amplifier U6B, 2) VSWR foldback comparator U18D, and 3) amplifier/buffer U2D. U2D is a non-inverting amplifier with a gain determined by resistor R13. R13 is a resistor network designed to be installed/removed as determined by the desired remote meter voltage indication. For a +4 volt equals 40W/20W remote full-scale reflected power meter indication, R13 is installed. As a result, U2D will be programmed for a gain of approximately 2. For a +2 volt remote full-scale meter indication, R13 is removed. As a result, U2D will be programmed for a gain of approximately 1. The output of U2D is routed to the controller RFI filter circuit board. U6B is a non-inverting amplifier. The output of U6B is routed to the controller meter switch circuit board. Jumper P721 selects the feed back path for the circuit. Position 2-3 of P721 selects a power sample for application to the remote meter terminal.

- 4-36. **FORWARD POWER METER CIRCUIT.** A dc forward power sample voltage from the low-pass filter assembly is applied to non-inverting meter amplifier U2B. The gain of amplifier U2B is controlled by potentiometer R49. R49 is provided to calibrate the forward power circuitry. The output of U2B is applied to a squaring circuit consisting of integrated circuits U25 and U24A. U25 and U24A function to convert the voltage sample to a power sample. The output of the squaring circuit is routed to: 1) amplifier U6A, and 2) amplifier/buffer U2C. U2C is a non-inverting amplifier with a gain determined by resistor R13. R13 is a resistor network designed to be installed/removed as determined by the desired remote meter voltage indication. For a +4 volt equals 1 kW/500 watts remote full-scale forward power meter indication, R13 is installed. As a result, U2C will be programmed for a gain of approximately 2. For a +2 volt remote full-scale meter indication, R13 is removed. As a result, U2C will be programmed for a gain of approximately 1. The output of U2C is routed to the controller RFI filter circuit board. U6A is a non-inverting amplifier. The output of U6A is routed to the controller meter switch circuit board. The dc forward power sample voltage is also routed to buffer U5B. The output of U5B is applied to summing amplifier U21D. The signal is used to determine the transmitter output power level. Jumper P720 selects the feed back path for the circuit. Position 2-3 of P720 selects a power sample for application to the remote meter terminal.
- 4-37. **TRANSMITTER FAULT DETECTION CIRCUITRY.** The transmitter fault detection circuit consists of VSWR foldback comparator U18D, over-temperature comparator U21A, VSWR overload comparator U18A, comparators U18B/U18C, inverters U19A/U19B/U19C/U19D/U19E/U7F, one shot U20, and transistors Q5/Q2. The circuitry is designed to monitor the transmitter power amplifier modules, transmitter temperature, reflected power, and power supply for fault conditions. When a fault is determined, the circuitry will respond by enabling the fault indicator and muting or reducing the transmitter output power.
- 4-38. **Over-Temperature Comparator.** A dc temperature sample from U21B is applied to over-temperature comparator U21A. U21A compares the dc voltage to a reference voltage. When the dc temperature sample is above the reference voltage, U21A will: 1) output a +0.7 to +15.0 dc voltage to comparator U18C and 2) output a voltage to summing amplifier U21D. U21D will respond by reducing the transmitter output power to: 1) maintain on-air operation and 2) reduce the transmitter temperature. With a positive voltage at U18C from U21A, the output of U18C will go HIGH. The HIGH is routed through inverters U19C and U7F to transistors Q5/Q2. Q5/Q2 will output a LOW to enable the local and remote fault indicators.
- 4-39. **VSWR Comparator.** A dc reflected power sample from U2A is applied to VSWR comparator U18D. U18D compares the dc voltage to a reference voltage from VSWR foldback calibrate control R112. When the dc reflected power sample is above the reference voltage, U18D will: 1) output a +0.7 to +15.0 dc voltage to comparator U18B, 2) output a +0.7 to +15.0 dc voltage to comparator U18A, and 3) output a voltage to summing amplifier U21D. U21D will respond by reducing the transmitter output power. With a positive voltage at U18B, the output of U18B will go HIGH. The HIGH is routed through inverters U19B and U7F to enable the local and remote fault indicators. The positive voltage routed to U18A is compared to a reference voltage from VSWR overload calibrate control R94. When the dc output from U18D is above the reference voltage, U18A will output a HIGH to inverter U19A. U19A will output a LOW to enable one-shot U20. U20 will output a HIGH to transistor Q3 to mute the transmitter output.
- 4-40. **PA Module Fault Circuit.** A HIGH PA module fault signal from the multiplexer circuit board is applied to inverter U19E. U19E will output a LOW to inverter U7F. U7F will output a HIGH to transistors Q5/Q2. Q5/Q2 will output a LOW to enable the local and remote fault indicators.

- 4-41. **Power Supply Fault Circuit.** In the event of a power supply fault such as power supply 1, a LOW is applied through switch U29A to comparator U30A. U30A will output a LOW to inverter U7D. U7D will output a HIGH to inverter U19F. U19F will output a LOW to NAND gate U8B to disable any raise power commands. Jumper P719 allows the selection of a manual or automatic raise disable. Automatic raise disable allows the controller circuitry to disable raise power operation in response to reflected power and fault conditions. In the manual raise disable mode, the controller circuitry is disabled to allow the raise power function to be controlled manually. Ensure the jumper is placed in the automatic disable position.
- 4-42. **CONTROLLER METER SWITCH CIRCUIT BOARD.**
- 4-43. The controller meter switch circuit board is equipped with meter switch S301 and remote control enable/disable switch S302. S301 is an interlocked 8-position switch designed to route samples to the meter display circuit board when a switch is depressed. When a module forward power switch section is depressed, the forward power sample is applied through forward power meter calibrate control R135 to non-inverting amplifier U6C on the controller circuit board. The output of U6C is routed through R78 to a squaring circuit consisting of integrated circuits U24C/D and U27. U24C/D and U27 function to convert the voltage sample to a power sample. The output of the squaring circuit is returned to switch S301. S301 routes the forward power sample through meter buffer U5C to the meter display circuit board. S302 is configured to enable/disable the remote control inputs. A HIGH enables the remote control inputs. A LOW disables the remote control inputs.
- 4-44. **METER DISPLAY CIRCUIT BOARD.**
- 4-45. The controller meter display circuit board is equipped with an LCD meter display and meter driver circuitry. Meter samples from U5C on the controller circuit board are routed to integrated circuit U201. U201 is an LCD display driver. Calibration of U201 is provided by potentiometer R203. The output of U201 is applied to LCD display DS201. Exclusive OR gate U202A controls the LCD decimal display.
- 4-46. **RF AMPLIFIER CIRCUITRY OPERATION.**
- 4-47. A description of the FM-1C1/FM-500C1 transmitter RF amplifier circuitry is presented in Figure 4-5. Refer to Figure 4-5 for FM-1C1/FM-500C1 transmitter RF amplifier circuitry information.



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## SECTION V MAINTENANCE

### 5-1. INTRODUCTION.

- 5-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics FM-1C1/FM-500C1 transmitters.

### 5-3. SAFETY CONSIDERATIONS.



**WARNING**      ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

**WARNING**

- 5-4. The FM-1C1/FM-500C1 transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents. The maintenance procedures contained in this section should be performed only by trained and experienced maintenance personnel.

- 5-5. It is dangerous to measure voltages inside the cabinet or replace components with power energized. Therefore, do not measure voltages inside the cabinet or replace components with power energized. Always operate the transmitter POWER circuit breaker to OFF prior to performing any maintenance within the transmitter. Measurements with the power energized can be performed in the controller enclosure if required.

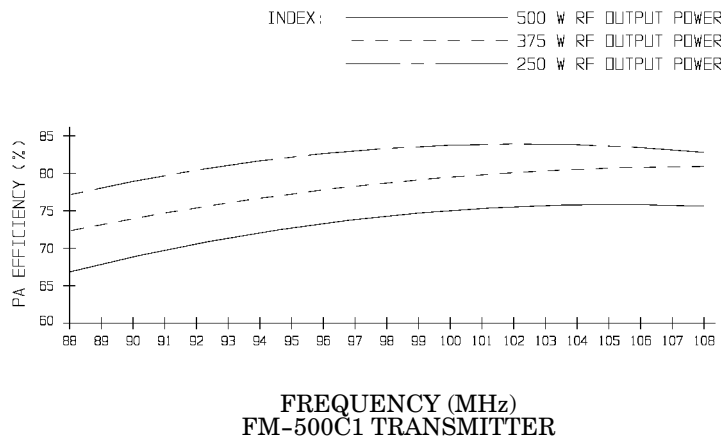
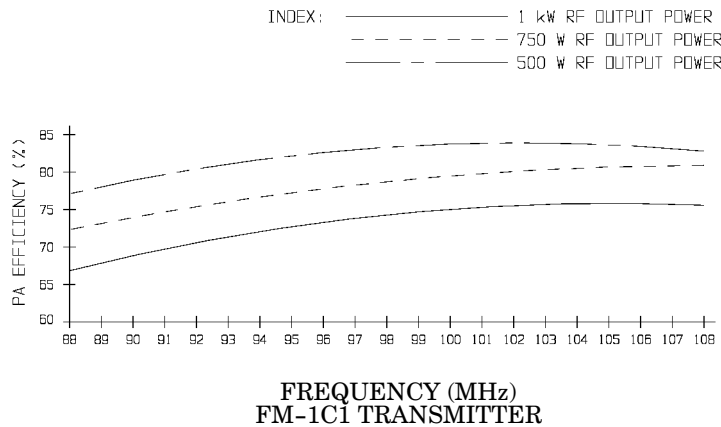
### 5-6. POWER AMPLIFIER EFFICIENCY.

- 5-7. The FM-1C1/FM-500C1 power amplifier stage consists of solid-state power amplifier devices. Figure 5-1 presents typical FM-1C1/FM-500C1 PA stage efficiency. The PA stage efficiency will vary slightly from the values presented in Figure 5-1 due to component tolerances. Refer to Figure 5-1 as required for typical PA stage efficiency values.

### 5-8. FIRST LEVEL MAINTENANCE.

- 5-9. First level maintenance consists of procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a maintenance log. Preventive maintenance of the transmitter consists of good housekeeping and checking performance levels using the meters and various indicators built into the equipment.

### 5-10. ROUTINE MAINTENANCE.



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FIGURE 5-1. FM-1C1/FM-500C1 TYPICAL PA EFFICIENCY



**WARNING**

**NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.**

**WARNING**

- 5-11. **INSPECTION AND CLEANING.** On a regular basis, clean the equipment of accumulated dust using a brush and vacuum cleaner. Inspect the RF amplifier modules and the power supplies for damage caused by component overheating. Overheated components are identified by circuit board discoloration near the component leads. Inspect the circuit boards for loose hardware as required.
- 5-12. **CONTROLLER BATTERY.** Periodically, the battery on the controller circuit board should be checked. If the battery is defective, a good-quality Alkaline battery is recommended for replacement. Typically, it is recommended the controller battery be replaced annually.
- 5-13. **AIR FILTERS.** The FM-1C1/FM-500C1 transmitters are equipped with two air filters. One filter is a disposable type filter located in a housing under the power amplifier modules. The second filter is a screen type filter located on the transmitter rear-panel. The disposable filter can be replaced and the screen filter cleaned without interrupting transmitter operation.

- 5-14. **Disposable Filter.** The disposable filter should be checked approximately once a week with replacement performed on an as-required basis. Never reverse a dirty air filter. Always replace the filter. A dirty filter results in restricted air flow and increased operating temperatures for the transmitter solid-state components.
- 5-15. The transmitter uses disposable type air filters 1 in. X 10 in. X 20 in. ( 2.54 cm X 25.4 cm X 50.8 cm). Additional filters may be ordered from Broadcast Electronics (BE P/N 407-0162) or purchased locally. Install the blue side of the filter pointing towards the flushing fans. If a filter from a different manufacturer is purchased, install the filter air flow indicator pointing towards the flushing fans. Air filter replacement is accomplished by: 1) sliding the filter out of the housing and 2) inserting the new air filter into the panel with the airflow arrow pointing towards the flushing fans.
- 5-16. **Screen Filter.** The screen filter is designed to be removed and cleaned using a brush and vacuum. Check the filter approximately once a week. Remove dirt from the filter on an as-required basis by: 1) removing the filter from the chassis and 2) cleaning the filter using a brush and vacuum.
- 5-17. **FLUSHING FANS.** Inspect the transmitter flushing fans for dust accumulation and periodically clean the fans using a brush and vacuum cleaner. The fans are cooled by air passing around each motor. If dust is allowed to accumulate on the motors, the ambient air temperature will increase due to restricted air flow. When the ambient air temperature increases, the fan motor bearing lubricant will gradually vaporize and bearing failure will occur.
- 5-18. It is recommended the flushing fan mounting hardware be periodically checked. The flushing fans are equipped with sealed bearings which do not permit lubrication. If a bearing fails, the motor must be replaced.
- 5-19. **SECOND LEVEL MAINTENANCE.**
- 5-20. Second level maintenance consists of procedures required to adjust the transmitter circuitry or restore the transmitter to operation after a fault has occurred. The procedures consists of electrical adjustments, troubleshooting, and component replacement procedures.



**WARNING**

**WARNING**

***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

- 5-21. The maintenance philosophy for the FM-1C1/FM-500C1 transmitters consists of isolating a problem to a specific area. Once the specific area is located, subsequent troubleshooting using the information in the following text will assist in problem isolation to a replaceable assembly or component. If required, the replaceable assembly may be: 1) returned to the factory for repair or exchange or 2) repaired locally.
- 5-22. **CONTROLLER FRONT PANEL REMOVAL.**
- 5-23. Several transmitter maintenance and electrical adjustment procedures require the transmitter controller front panel to be removed. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel as required.

5-24. **ELECTRICAL ADJUSTMENTS.**



**WARNING** *NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.*

**WARNING**

5-25. **MULTIMETER DISPLAY CALIBRATION.** Potentiometer R203 on the controller meter display circuit board calibrates the multimeter display. The following text presents the procedure to calibrate the multimeter display.

5-26. **Required Equipment.** The following equipment is required to adjust the multimeter display calibration control.

1. Insulated adjustment tool.
2. Digital voltmeter (Fluke 77 or equivalent).

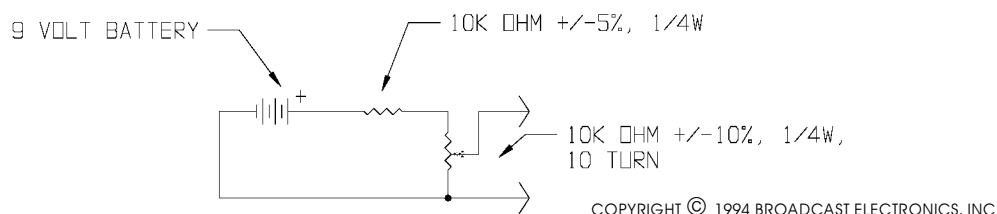
5-27. **Procedure.** To calibrate the multimeter display, proceed as follows:

5-28. Depress the transmitter **OFF** switch/indicator to illuminate the switch/indicator and operate the **POWER SWITCH** to OFF.

5-29. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.

5-30. Remove integrated circuit U5 from the controller circuit board.

5-31. Refer to Figure 5-2 and construct a voltage source for the calibration procedure. Adjust the voltage source for a 2.0 volt dc output.



**FIGURE 5-2. ADJUSTABLE VOLTAGE SOURCE**

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5-32. Connect the voltage source between TP204 on the controller meter display circuit board and TP203 ground.

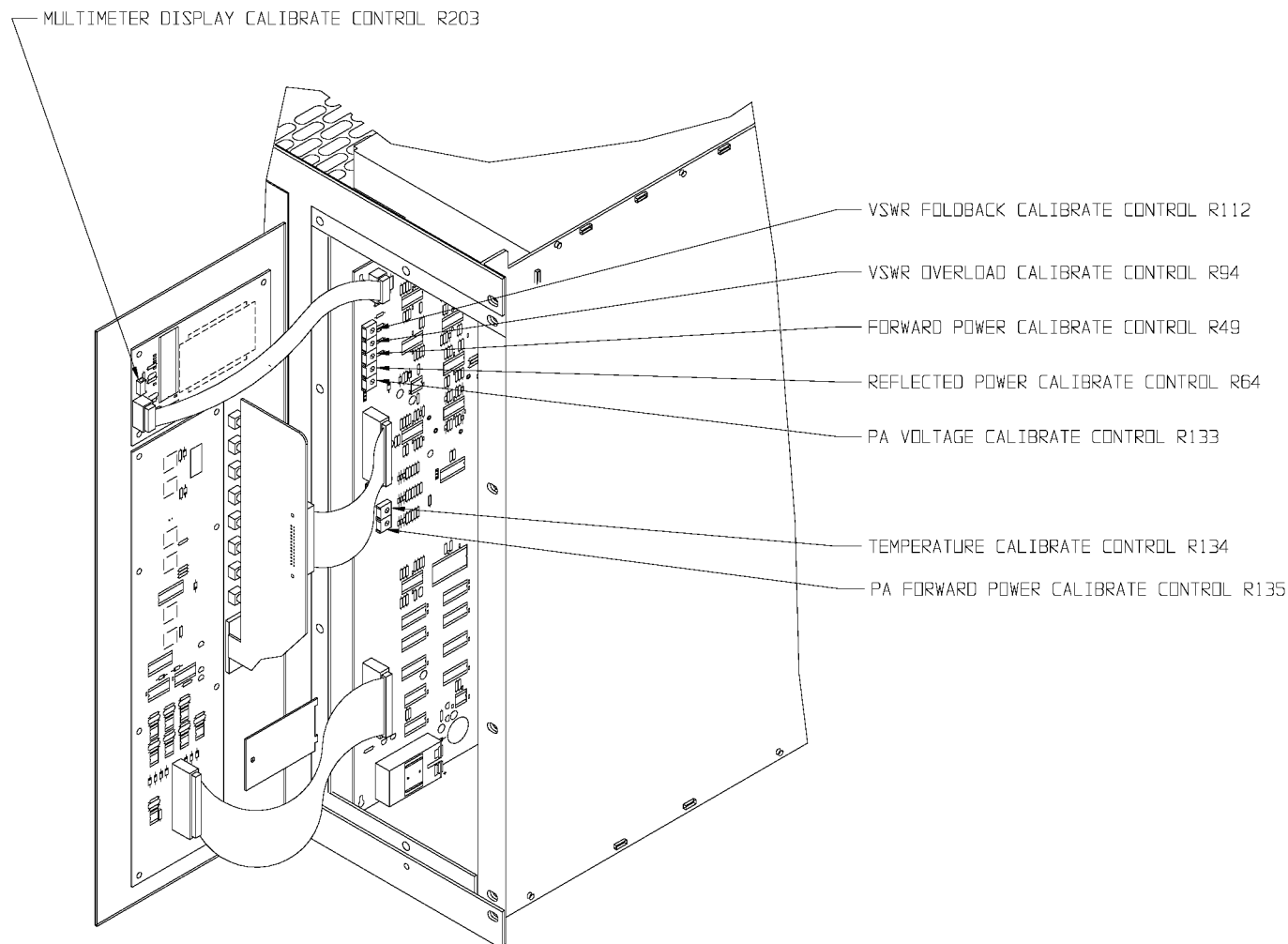
5-33. Operate the **POWER SWITCH** to ON.

5-34. Refer to Figure 5-3 and adjust multimeter display calibration control R203 on the meter display circuit board for a 1000 indication on the transmitter multimeter.

5-35. Operate the **POWER SWITCH** to OFF.

5-36. Remove the test equipment, replace integrated circuit U5, and replace the controller front panel.

5-37. **REFLECTED POWER METER, VSWR FOLDBACK, AND VSWR OVERLOAD CALIBRATION.** Potentiometer R64 on the controller circuit board calibrates the reflected power meter display. Potentiometer R112 on the controller circuit board determines the VSWR level for foldback operations. Potentiometer R94 on the controller circuit board determines the VSWR level for overload operations. The following text presents the procedure to adjust the reflected power meter calibrate, the VSWR foldback, and the VSWR overload controls.



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**FIGURE 5-3. CONTROLLER AND METER DISPLAY CIRCUIT BOARD CONTROLS**

5-38. **Required Equipment.** The following equipment is required to adjust the reflected power meter, VSWR foldback, and VSWR overload calibration controls.

1. Insulated adjustment tool.
2. Test load and cable (50 Ohm Non-Inductive, Type N connector, 50 W minimum).

5-39. **Procedure.** To adjust the reflected power meter calibration control, proceed as follows:

5-40. The transmitter MULTIMETER must be calibrated prior to adjusting the reflected power meter calibrate control. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.

5-41. Depress the transmitter OFF switch/indicator to illuminate the switch/indicator.

- 5-42. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.
- 5-43. Disconnect: 1) cable 45 from the low-pass filter input on FM-500C1 models or 2) cable 43 from the low-pass filter input on FM-1C1 models.
- 5-44. Connect a test cable between the test load and the low-pass filter input.
- 5-45. Disconnect cable 40 from the exciter RF output.
- 5-46. Disconnect the transmitter RF output cable.
- 5-47. Connect a test cable from the exciter RF output to the transmitter output connector.
- 5-48. For an FX-50, remove the exciter top cover and operate the MUTE switch to NEG. For a PREDATOR, disconnect wire No. 51 from J3-4 on the controller module rear-panel and connect a temporary wire jumper from J3-4 to J3-25. Flag the temporary jumper with a piece of tape marked "TEMPORARY".
- 5-49. Depress the transmitter MULTIMETER RFL POWER switch/indicator.
- 5-50. Operate the exciter to on and adjust the exciter output power for a: 1) 40 watt forward power indication on the exciter LCD display for an FM-1C1 or 2) 20 watt forward power indication on the exciter LCD display for an FM-500C1.
- 5-51. Refer to Figure 5-3 and adjust reflected power meter calibrate control R64 on the controller circuit board for the following indication on the transmitter multimeter:  
1) FM-1C1 = 40 watts or 2) FM-500C1 = 20 watts.
- 5-52. Adjust the exciter output power if required for a: 1) 40 watt forward power indication on the exciter LCD display for an FM-1C1 or 2) 20 watt forward power indication on the exciter LCD display for an FM-500C1.
- 5-53. Refer to Figure 5-3 and adjust VSWR foldback control R112 on the controller circuit board until the RESET indicator just illuminates.
- 5-54. Operate the **POWER SWITCH** to OFF.
- 5-55. Connect the digital voltmeter between TP-17 and ground on the controller circuit board.
- 5-56. Operate the **POWER SWITCH** to ON.
- 5-57. Depress the transmitter **ON** switch/indicator to illuminate the switch/indicator.
- 5-58. Adjust the exciter output power for a: 1) 55 watt forward power indication on the transmitter multimeter for an FM-1C1 or 2) 28 watt forward power indication on the transmitter multimeter for an FM-500C1.
- 5-59. Refer to Figure 5-3 and adjust VSWR overload control R94 on the controller circuit board until the voltage at TP-17 goes positive. The transmitter will operate to off.
- 5-60. Operate the **POWER SWITCH** to OFF.
- 5-61. Remove the test equipment, replace the controller front panel, re-adjust the exciter output power to 40 watts for an FM-1C1 or 20 watts for an FM-500C1, operate the exciter MUTE switch to POS for an FX-50 exciter, remove the temporary wire jumper between J3-4/J3-25 and re-connect wire No. 51 to J3-4 on a PREDATOR exciter, and reconnect the exciter and transmitter cables.



5-62. **FORWARD POWER CALIBRATION.** Potentiometer R49 on the controller circuit board calibrates the forward power detector circuitry. The following text presents the procedure to calibrate the forward power detector circuitry.

5-63. **Required Equipment.** The following equipment is required to adjust the forward power calibration control.

1. Insulated adjustment tool.
2. Calibrated in-line wattmeter with 1 kW element (Bird 43 or equivalent).
3. Test load and cable (50 Ohm Non-Inductive, Type N connector, 1.5 kW minimum).

5-64. **Procedure.** To adjust the forward power calibration control, proceed as follows:



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

**WARNING**

5-65. Disconnect all transmitter primary power before proceeding.

5-66. The transmitter MULTIMETER must be calibrated prior to adjusting the forward power detector circuitry. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.

5-67. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.

5-68. Connect the test load and wattmeter to the transmitter output.

5-69. Energize the transmitter primary ac power and operate the transmitter at the desired output power level as indicated by the in-line wattmeter.

5-70. Depress the transmitter MULTIMETER FWD POWER switch/indicator.

5-71. Refer to Figure 5-3 and adjust FORWARD POWER CAL control R49 on the controller circuit board until the transmitter MULTIMETER display is equal to the value presented on the in-line wattmeter.



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

**WARNING**

5-72. Disconnect all transmitter primary power.

5-73. Remove the test equipment replace the controller front panel, and reconnect the transmitter output to the antenna.

5-74. **PAV CALIBRATION.** Potentiometer R133 on the controller circuit board calibrates the PA voltage detector circuitry. The following text presents the procedure to calibrate the PA voltage detector circuitry.

5-75. **Required Equipment.** The following equipment is required to adjust the PA voltage calibration control.

1. Insulated adjustment tool.
2. Digital voltmeter (Fluke 77 or equivalent).

5-76. **Procedure.** To adjust the PA voltage calibration control, proceed as follows:



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER  
BEFORE PROCEEDING.***

**WARNING**

5-77. Disconnect all transmitter primary power before proceeding.

5-78. The transmitter MULTIMETER must be calibrated prior to adjusting the PA voltage detector circuitry. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.

5-79. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.

5-80. Remove an RF power module and connect the voltmeter between J603-A2 on the motherboard assembly and ground.

5-81. Energize the transmitter primary ac power.

5-82. Depress the transmitter MULTIMETER PWR SUPPLY VDC switch/indicator.

5-83. Refer to Figure 5-3 and adjust PAV CAL control R133 on the controller circuit board until the transmitter MULTIMETER display is equal to the value presented on the digital voltmeter.



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER  
BEFORE PROCEEDING.***

**WARNING**

5-84. Disconnect all transmitter primary power.

5-85. Remove the test equipment, replace the controller front panel, and replace the RF power module.

5-86. **TEMPERATURE CALIBRATION.** Potentiometer R134 on the controller circuit board calibrates the temperature detector circuitry. The following text presents the procedure to calibrate the temperature detector circuitry.

5-87. **Required Equipment.** The following equipment is required to adjust the temperature calibration control.

1. Insulated adjustment tool.
2. Digital voltmeter (Fluke 77 or equivalent).
3. Fluke 80T-150 temperature probe or equivalent Celsius indicating temperature probe.

5-88. **Procedure.** To adjust the temperature calibration control, proceed as follows:



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER  
BEFORE PROCEEDING.***

**WARNING**

5-89. Disconnect all transmitter primary power before proceeding.

- 5-90. The transmitter MULTIMETER must be calibrated prior to adjusting the temperature detector circuitry. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.
- 5-91. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.
- 5-92. Energize the transmitter primary ac power.
- 5-93. Locate the temperature sensor circuit board and place the temperature probe near the transistor temperature sensor.
- 5-94. Depress the transmitter MULTIMETER EXHAUST AIR C switch/indicator.
- 5-95. Refer to Figure 5-3 and adjust TEMP CAL control R134 on the controller circuit board until the transmitter MULTIMETER display is equal to the value presented on the digital voltmeter.



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***  
**WARNING**

- 5-96. Disconnect all transmitter primary power.
- 5-97. Remove the test equipment and replace the controller front panel.
- 5-98. **PA MODULE FORWARD POWER CALIBRATION.** Potentiometer R135 on the controller circuit board calibrates the PA module forward power detector circuitry. The following text presents the procedure to calibrate the PA module forward power detector circuitry.
- 5-99. **Required Equipment.** The following equipment is required to adjust the PA module forward power calibration control.
  - 1. Insulated adjustment tool.
  - 2. Digital voltmeter (Fluke 77 or equivalent).
- 5-100. **Procedure.** To adjust the PA module forward power calibration control, proceed as follows:
- 5-101. The transmitter MULTIMETER must be calibrated prior to adjusting the PA forward power detector circuitry. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.
- 5-102. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.
- 5-103. Depress the transmitter OFF switch/indicator to illuminate the switch/indicator.
- 5-104. Connect the digital voltmeter between TP8 on the controller circuit board and ground.
- 5-105. Energize the transmitter primary ac power and operate the transmitter.
- 5-106. Depress the transmitter RAISE switch/indicator to obtain a +5.0 volt dc indication on the digital voltmeter.
- 5-107. Depress the transmitter MULTIMETER PA1 FWD POWER switch/indicator.
- 5-108. Refer to Figure 5-3 and adjust PA FWD CAL control R135 on the controller circuit board until the transmitter MULTIMETER display equals 500 watts.

- 5-109. Depress the transmitter OFF switch/indicator to illuminate the switch/indicator.
- 5-110. Remove the test equipment and replace the controller front panel.
- 5-111. **CONTROLLER SQUARING CIRCUIT ADJUSTMENTS.** The controller circuit board squaring circuitry contains calibration controls. The calibration controls consist of: 1) transmitter forward power squaring circuit calibrate control R54, 2) transmitter reflected power squaring circuit calibrate control R67, and 3) module forward power squaring circuit calibrate control R78. Due to the critical nature of the controls, the controls are not considered field adjustable. If the controls are to be adjusted, contact the Broadcast Electronics Customer Service Department.
- 5-112. **RF POWER AMPLIFIER MODULE ADJUSTMENTS.** The RF power amplifier module amplifier circuit board and the power amplifier logic circuit board contain calibration controls. The power amplifier circuit board is equipped with bias level controls R9 and R22. The RF amplifier logic circuit board contains current offset control R11, current limit control R5, forward power calibration control R51, forward power limit control R15, and reflected power limit control R25. Due to the critical nature and specialized test equipment required to adjust the controls, the controls are not considered field adjustable. If the controls are to be adjusted, contact the Broadcast Electronics Customer Service Department.
- 5-113. **LOW-PASS FILTER.** The low-pass filter is equipped with a reflected power null control. Due to the critical nature and specialized test equipment required to adjust the control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department.
- 5-114. **TRANSMITTER FREQUENCY RE-PROGRAMMING.** The FM-1C1/FM-500C1 transmitters are configured for a specific frequency when shipped from the factory. However, the transmitters can be re-programmed for a different frequency in the field if required. The following text presents the procedure to change an FM-1C1/FM-500C1 the transmitter operating frequency.
- 5-115. **Required Equipment.** The following equipment is required to re-program the transmitter operating frequency.
1. Calibrated in-line wattmeter with a 1 kW element for FM-1C1 models or a 500 watt element for FM-500C1 models.
  2. Test load and cable (50 Ohm Non-Inductive, Type N connector, 1 kW minimum for FM-1C1 models or 500 watt minimum for FM-500C1 models).
- 5-116. **Procedure.** To re-program the transmitter operating frequency, proceed as follows:



**WARNING**      ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

**WARNING**

- 5-117. Disconnect all transmitter primary power before proceeding.
- 5-118. Connect the test load and wattmeter to the transmitter output.
- 5-119. For an FX-50 exciter, refer to SECTION 4, AFC/PLL ASSEMBLY in FX-50 publication 597-1050 and perform the FREQUENCY SELECTION procedure. For a PREDATOR, refer to SECTION III, OPERATION in PREDATOR publication 597-8000 and perform the CARRIER FREQUENCY PROGRAMMING procedure. Operate and test the exciter independently from the transmitter.

- 5-120. Energize the transmitter primary ac power and operate the transmitter at the desired output power level as indicated by the in-line wattmeter.
- 5-121. If a difference in values presented on the in-line wattmeter and the transmitter multimeter is observed, the transmitter forward power display may be calibrated if desired by performing the following procedure. Typically, the transmitter forward power display on the multimeter will be more accurate than the in-line wattmeter. Ensure the in-line wattmeter has been recently calibrated at the factory prior to calibrating the transmitter multimeter display.
1. Depress the transmitter SYSTEM FWD PWR switch/indicator.
  2. Refer to Figure 5-3 and adjust FORWARD POWER CAL control R49 on the controller circuit board until the transmitter MULTIMETER display is equal to the value presented on the in-line wattmeter.



**WARNING**      **DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.**

**WARNING**

- 5-122. Disconnect all transmitter primary power.
- 5-123. Remove the test equipment, close the controller door, and reconnect the transmitter output to the antenna.
- 5-124. **TROUBLESHOOTING.**
- 5-125. **TYPICAL METER INDICATIONS.** Typical meter indications for the FM-1C1/FM-500C1 transmitters are presented in the factory final test data sheets shipped with each transmitter. Refer to the factory test data sheets for typical meter indications.



**CAUTION**      **REMOVING OR INSTALLING A POWER MODULE WITH THE TRANSMITTER ENERGIZED MAY RESULT IN DAMAGE TO THE MODULE. DO NOT REMOVE/INSERT A POWER MODULE WITH THE TRANSMITTER ENERGIZED.**

**CAUTION**



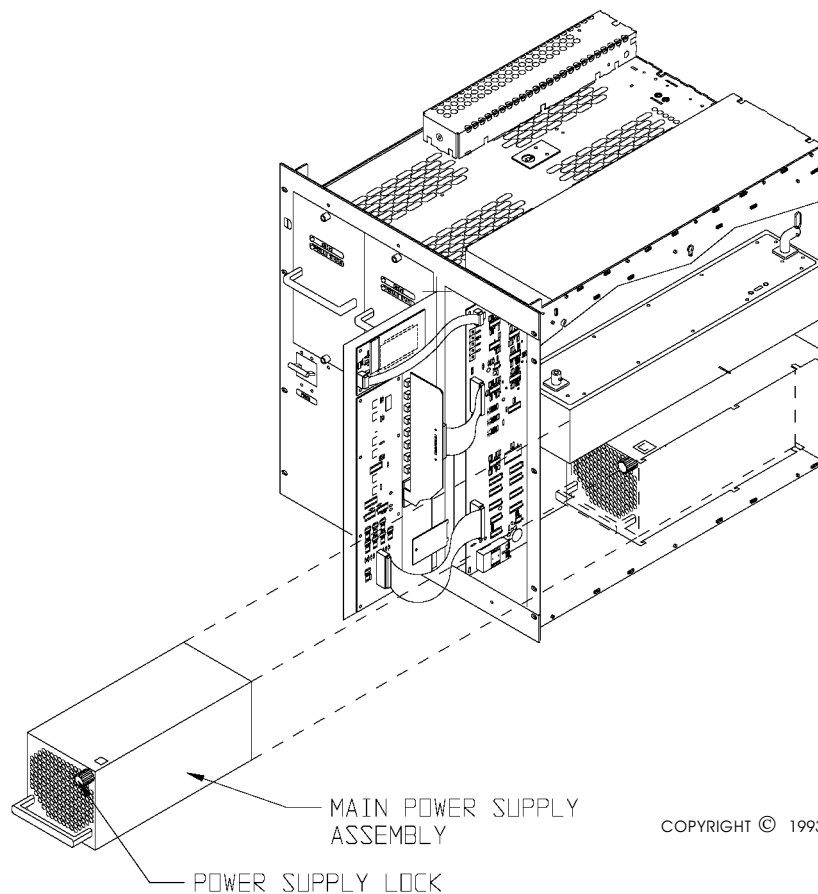
**NOTE**      **THE CONTROLLER CIRCUIT BOARD MOUNTING SCREW PROVIDES THE CIRCUIT/RF GROUND FOR THE CIRCUIT BOARD COMPONENTS. WHEN THE CIRCUIT BOARD IS REMOVED FOR MAINTENANCE, ENSURE THE MOUNTING SCREW IS INSTALLED AND SECURE WHEN THE CIRCUIT BOARD IS RE-INSERTED INTO THE TRANSMITTER.**

**NOTE**

**NOTE**

**NOTE**

- 5-126. **POWER AMPLIFIER POWER SUPPLY.** The FM-1C1/FM-500C1 transmitters are equipped with two modular switching power supply modules. One module provides dc potentials for the controller circuitry. A second power supply module provides dc potentials for the PA circuitry.
- 5-127. The FM-1C1/FM-500C1 power amplifier (main) power supply assembly can be easily removed from the transmitter chassis in the event of a failure. The power supply is a modular assembly designed to be removed from the front of the transmitter (refer to Figure 5-4). To remove the power amplifier power supply assembly, refer to Figure 5-4 and proceed as follows:



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**FIGURE 5-4. MAIN POWER SUPPLY REMOVAL**



**WARNING**

***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

**WARNING**



**CAUTION**

***A POWER AMPLIFIER POWER SUPPLY MODULE WILL BE DAMAGED IF A MODULE IS REMOVED OR INSTALLED WITH POWER ENERGIZED. DISCONNECT ALL TRANSMITTER POWER PRIOR TO REMOVING OR INSTALLING A POWER AMPLIFIER POWER SUPPLY MODULE.***

**CAUTION**

1. Disconnect all transmitter primary power before proceeding.
2. Refer to TRANSMITTER CONTROLLER FRONT PANEL REMOVAL in SECTION II, INSTALLATION and perform the procedure to remove the transmitter controller front panel.
3. Rotate the power supply lock knob fully counterclockwise.
4. Using the power supply handle, pull the supply from the transmitter chassis.

- 5-128. The power amplifier power supply module contains a fuse and a cooling fan. When the power supply module fault indicator illuminates, check the following:
1. The PA power supply module is equipped with temperature overload protection. If a power supply module temperature overload occurs, the module must be reset. To reset a power supply module, proceed as follows:
    - A. Depress the transmitter **OFF** switch/indicator.
    - B. Wait approximately 1 minute.
    - C. Depress the transmitter **ON** switch/indicator. The module will return to operation if the problem was associated with a temperature overload.
  2. If the power supply module does not return to operation, check the following:
    - A. Depress the **POWER SUPPLY VDC** switch/indicator and check the power supply voltage. During a power supply failure, the voltage will be less than the normal operating voltage and greater than 0.0 volts dc.
    - B. Check the rotation of the power supply module fan. Ensure the fan is operating.
  3. If system power supply voltage is normal and the fan is not operating, proceed as follows:



**CAUTION**

**CAUTION**

***A POWER AMPLIFIER POWER SUPPLY MODULE WILL BE DAMAGED IF A MODULE IS REMOVED OR INSTALLED WITH POWER ENERGIZED. DISCONNECT ALL TRANSMITTER POWER PRIOR TO REMOVING OR INSTALLING A POWER AMPLIFIER POWER SUPPLY MODULE.***

- A. Disconnect all transmitter primary power.
  - B. Loosen the lock knob on the front panel of the power supply module.
  - C. Remove and re-insert the power supply module and secure the lock knob.
  - D. Apply power and depress the transmitter **ON** switch/indicator to illuminate the switch/indicator. The module will return to operation if the problem is associated with improper module seating.
4. If the power supply module problem remains, refer to APPENDIX A and locate the Pioneer Magnetics Troubleshooting Guide for the PM3329BP-5 power supply. Use the guide to locate the problem.

- 5-129. **CONTROLLER POWER SUPPLY.** The FM-1C1/FM-500C1 transmitter controller power supply is located under the fans. The power supply is equipped with a fuse and should be checked if a failure occurs. To check the controller power supply module, proceed as follows:

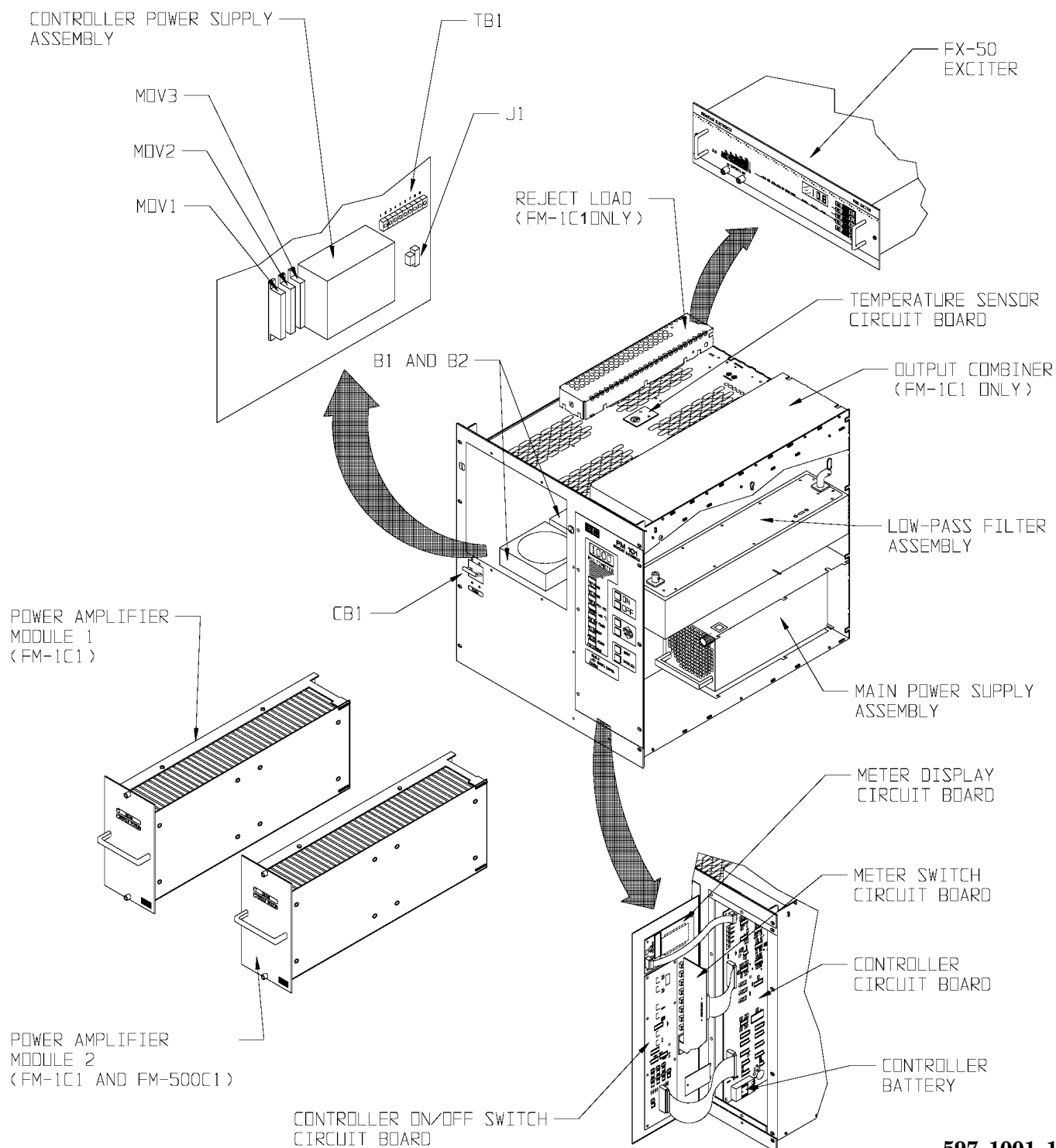


**WARNING**

**WARNING**

***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

- 5-130. Disconnect all transmitter primary power.
- 5-131. Refer to Figure 5-5 and remove all the rear access panel Phillips-Head screws.

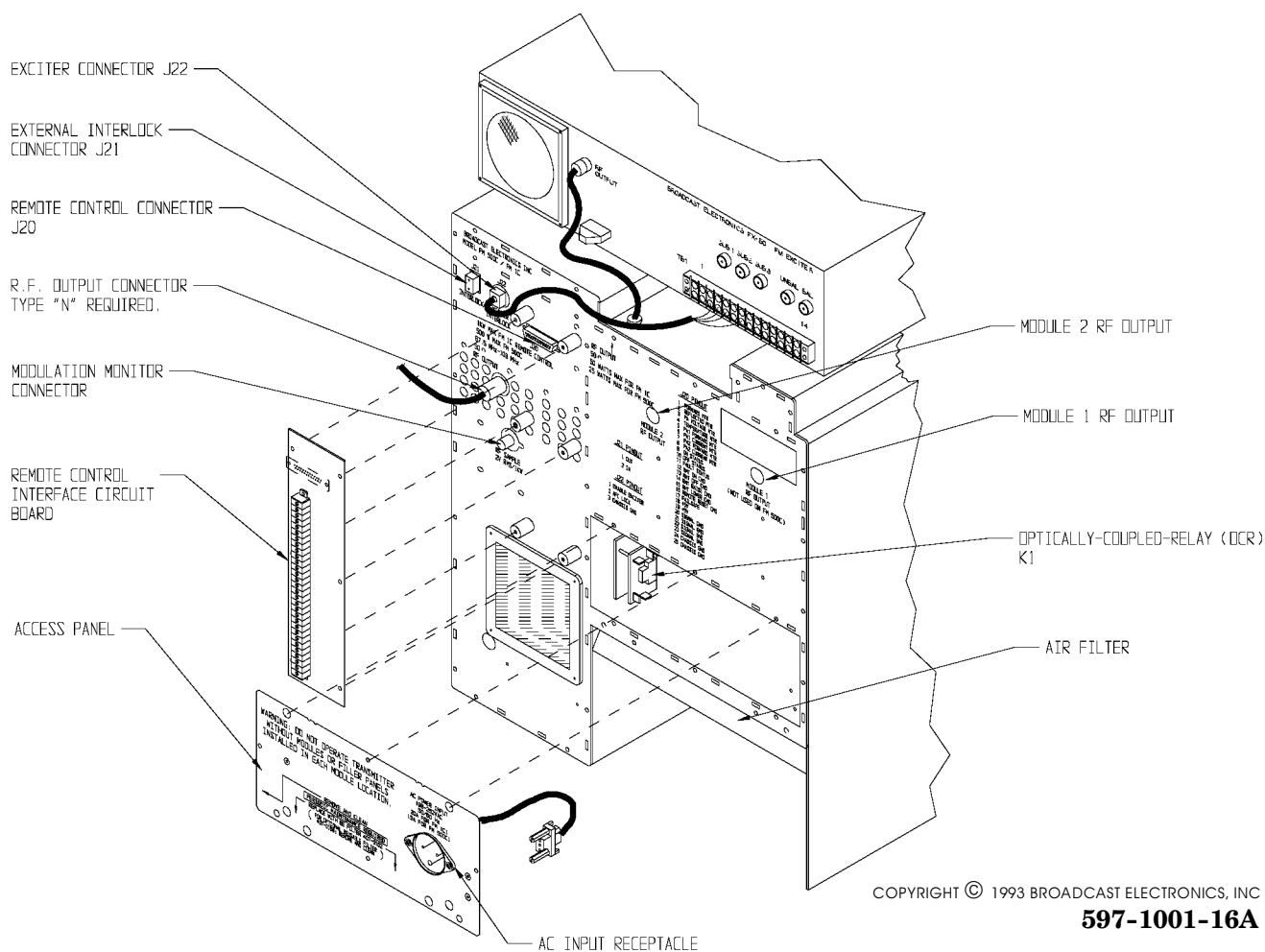


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**FIGURE 5-5. FM-1C1/FM-500C1 COMPONENT LOCATOR (SHEET 1 OF 2)**





**FIGURE 5-5. FM-1C1/FM-500C1 COMPONENT LOCATOR (SHEET 2 OF 2)**

- 5-132. Remove the access panel.
- 5-133. Remove the two Knurled nuts securing fan B2 to the interior panel.
- 5-134. Remove the fan.
- 5-135. Remove the two stand-offs securing the controller power supply module to the side panel.
- 5-136. Disconnect the wiring and remove the controller power supply module.
- 5-137. Check the power supply fuse. If the power supply fuse has not blown, contact the Broadcast Electronics Customer Service Department. If desired, refer to APPENDIX A and the Computer Products power supply schematic diagram for additional power supply troubleshooting information.
- 5-138. Once the power supply troubleshooting has been completed, re-install the supply by reversing the preceding procedure.



**CAUTION**  
**CAUTION**

**REMOVING OR INSTALLING A POWER AMPLIFIER MODULE WITH THE TRANSMITTER ENERGIZED MAY RESULT IN DAMAGE TO THE MODULE. DO NOT REMOVE/INSERT A POWER AMPLIFIER MODULE WITH THE TRANSMITTER ENERGIZED.**

- 5-139. **POWER AMPLIFIER MODULE TROUBLESHOOTING/REPAIR.** Each transmitter power amplifier module contains circuitry requiring specialized equipment and test procedures for troubleshooting and repair operations. Therefore, almost all power amplifier module troubleshooting and repair can not be performed in the field. If a power amplifier module is determined to be defective, contact the Broadcast Electronics Customer Service department for: 1) troubleshooting information and 2) information on a power amplifier module exchange program (refer to the following text).
- 5-140. **Power Amplifier Module Exchange Program.** If a power amplifier module is determined to be defective, Broadcast Electronics has established a power amplifier module exchange program. The program allows the customer to: 1) exchange a defective module for a reconditioned module or 2) obtain a module on loan during the repair of the defective module. Terms of the program are available from the Broadcast Electronics Customer Service Department.
- 5-141. **TRANSMITTER TROUBLESHOOTING PROCEDURES.** Table 5-1 presents troubleshooting information for the FM-1C1/FM-500C1 transmitters. Refer to Table 5-1 to isolate the problem to a specific assembly. Once the trouble is isolated, refer to the theory of operation and schematic diagrams to assist in problem resolution.
- 5-142. **TRANSMITTER COMPONENT LOCATIONS.** Figure 5-5 presents the transmitter component locations. Refer to Figure 5-5 as required during the troubleshooting procedures to locate components within the transmitter.

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
**(Sheet 1 of 6)**

<b>SYMPTOM</b>	<b>CIRCUITRY TO CHECK</b>
1. NO OUTPUT POWER 2. INTERLOCK INDICATOR EXTINGUISHED 3. MODULE DRIVE INDICATORS EXTINGUISHED 4. FX-50 LOCK INDICATOR EXTINGUISHED OR PREDATOR EXCITER FAULT INDICATOR ILLUMINATED	1. FX-50 - AFC is unlocked. PREDATOR - exciter fault. Refer to the exciter manual and troubleshoot the exciter.
1. NO OUTPUT POWER 2. INTERLOCK INDICATOR EXTINGUISHED	1. Operate the remote control switch to disable. A. If the interlock indicator is extinguished, check the external interlock. B. If the interlock indicator illuminates, check the remote control unit.

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
(Sheet 2 of 6)

SYMPTOM	CIRCUITRY TO CHECK
<p>FM-1C1</p> <ol style="list-style-type: none"> <li>1. LOW OUTPUT POWER</li> <li>2. MODULE DRIVE INDICATOR EXTINGUISHED</li> <li>3. MODULE STATUS INDICATORS ILLUMINATES YELLOW</li> <li>4. RESET INDICATOR ILLUMINATED</li> </ol> <p>FM-500C1</p> <ol style="list-style-type: none"> <li>1. LOW OUTPUT POWER</li> <li>2. MODULE DRIVE INDICATOR EXTINGUISHED</li> <li>3. MODULE STATUS INDICATOR ILLUMINATES YELLOW</li> <li>4. RESET INDICATOR ILLUMINATED</li> </ol> <ol style="list-style-type: none"> <li>1. RESET INDICATOR ILLUMINATED</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the exciter forward power. The forward power must be 40 W. The power supply will present a fault with low RF drive.</li> <li>2. If the exciter forward power is low, refer to the exciter manual and troubleshoot the exciter.</li> <li>3. If the correct exciter forward power is present, depress the PWR SUPPLY VDC switch. The voltage must be equal to the normal operating voltage.</li> <li>4. If the PA voltage is normal, bypass the low-pass filter and connect the transmitter output to a test load.               <ol style="list-style-type: none"> <li>1. If the MODULE STATUS indicators remain yellow, defective combiner or both RF amplifier modules.</li> <li>2. If the MODULE STATUS indicators illuminate green, defective low-pass filter.</li> </ol> </li> <li>5. If the PA voltage is low, increase the PA voltage until the MODULE STATUS indicators illuminate green.</li> </ol> <ol style="list-style-type: none"> <li>1. Check the exciter forward power. The forward power must be 20W. The power supply will present a fault with low RF drive.</li> <li>2. If the exciter forward power is low, refer to the exciter manual and troubleshoot the exciter.</li> <li>3. If the correct exciter forward power is present, depress the PWR SUPPLY VDC switch. The voltage must be equal to the normal operating voltage.</li> <li>4. If the PA voltage is normal, bypass the low-pass filter and connect the transmitter output to a test load.               <ol style="list-style-type: none"> <li>1. If the MODULE STATUS indicator remains yellow, defective RF amplifier module.</li> <li>2. If the MODULE STATUS indicator illuminates green, defective low-pass filter.</li> </ol> </li> <li>5. If the PA voltage is low, increase the PA voltage until the MODULE STATUS indicators illuminate green.</li> </ol> <ol style="list-style-type: none"> <li>1. Depress the reset switch.</li> <li>2. If the reset indicator does not display normal indications, depress the transmitter multimeter FWD PWR switch. The forward power must be equal to the TPO.</li> <li>3. If the transmitter forward power is high, depress the LOWER switch to lower the output power to the TPO level.</li> </ol>

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
(Sheet 3 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. RESET INDICATOR ILLUMINATED (CON'T)	<ol style="list-style-type: none"> <li>If the transmitter forward power is low or equal to the TPO, depress the multimeter TEMP switch. The temperature must be less than 9 degrees above the ambient room temperature.</li> <li>If the temperature is greater than 9 degrees above the ambient room temperature, check the flushing fans and the filter.</li> <li>If the temperature is less than 9 degrees above the ambient room temperature, depress the RFL PWR switch. The reflected power must be less than 40 watts on FM-1C1 models and 20 watts on FM-500C1 models.</li> <li>If the reflected power is greater than 40 watts for an FM-1C1 or 20 watts for an FM-500C1, check the output transmission line and the antenna.</li> <li>If the reflected power is less than 40 watts for an FM-1C1 or 20 watts for an FM-500C1, check the RF power module logic circuit board.</li> </ol>
<ol style="list-style-type: none"> <li>RED MODULE STATUS INDICATORS</li> <li>RESET INDICATOR ILLUMINATED</li> </ol>	<ol style="list-style-type: none"> <li>Depress the reset switch.</li> <li>If the module status and reset indicators do not display normal indications, check the exciter forward power. The forward power must be: 1) FM-1C1 = 40W or 2) FM-500C1 = 20W.</li> <li>If the exciter forward power is low or not present, refer to the exciter manual and troubleshoot the exciter.</li> <li>If the exciter forward power is normal, depress the transmitter multimeter FWD PWR switch. The transmitter forward power must be equal to the TPO.</li> <li>If the transmitter forward power is high, depress the LOWER switch and lower the output power to the TPO level.</li> <li>If the transmitter forward power is low or equal to the TPO, depress the multimeter TEMP switch. The temperature must be less than 9 degrees above the ambient room temperature.</li> <li>If the temperature is greater than 9 degrees above the ambient room temperature, check the flushing fans and the filter.</li> <li>If the temperature is less than 9 degrees above the ambient room temperature, depress the RFL PWR switch. The reflected power must be less than 40 watts for an FM-1C1 or 20 watts for an FM-500C1.</li> </ol>

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
(Sheet 4 of 6)

<b>SYMPTOM</b>	<b>CIRCUITRY TO CHECK</b>
1. RED MODULE STATUS INDICATORS 2. RESET INDICATOR ILLUMINATED (CON'T)	9. If the reflected power is greater than 40 watts for an FM-1C1 or 20 watts for an FM-500C1, check the output transmission line and the antenna. 10. If the reflected power is less than 40 watts for an FM-1C1 or 20 watts for an FM-500C1, bypass the low-pass filter and connect the transmitter output to a test load. 11. If the MODULE STATUS indicators illuminate green, defective low-pass filter. 12. If the MODULE STATUS indicators remain red, depress the transmitter multimeter PWR SUPPLY VDC switch. The voltage must be equal to the normal operating voltage. 13. If the PA voltage is not present, check the main power supply. 14. If the PA voltage is present, defective RF amplifier modules.
1. TRANSMITTER WILL NOT AUTOMATICALLY RETURN TO RATED POWER AFTER AN AC POWER LOSS	1. Replace the battery in the controller.
1. TRANSMITTER OFF WITH NO FRONT PANEL INDICATIONS	1. Ensure primary ac power is applied to the unit and ensure the POWER switch is operated to on. 2. If the primary ac power is on, defective controller power supply.
1. TRANSMITTER OFF 2. NO OFF INDICATOR 3. NO INTERLOCK INDICATOR 4. NO MODULE STATUS INDICATORS	1. Defective controller power supply +15V output.
1. TRANSMITTER OFF WITH FRONT PANEL INDICATIONS 2. NO MULTIMETER DISPLAY 3. MODULE STATUS INDICATORS ILLUMINATE YELLOW	1. Defective controller power supply +5V output.

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
(Sheet 5 of 6)

<b>SYMPTOM</b>	<b>CIRCUITRY TO CHECK</b>
<p>1. TRANSMITTER OFF WITH FRONT PANEL INDICATIONS</p> <p>2. MODULE STATUS INDICATORS ILLUMINATE YELLOW</p> <p>FM-1C1</p> <p>1. A MODULE STATUS INDICATOR ILLUMINATES YELLOW</p> <p>FM-500C1</p> <p>1. A MODULE STATUS INDICATOR ILLUMINATES YELLOW</p> <p>1. ERRATIC POWER CONTROL</p> <p>1. NO POWER CONTROL</p>	<p>1. Defective controller power supply -15V output.</p> <p>1. Label the defective module and record the location. Interchange the module with another module in the transmitter.</p> <p>2. If the module inserted into the location recorded in the preceding step displays a yellow MODULE STATUS indicator, check the transmitter combiner.</p> <p>3. If the MODULE STATUS indicator on the module recorded in the preceding step remains yellow, the module is defective. Troubleshoot the module.</p> <p>1. Defective module. Troubleshoot the module.</p> <p>1. Depress the RAISE switch and check for a HIGH at U7 pin 6 on the controller circuit board.</p> <p>2. If the HIGH is present, check U6D, U9, U10, U11, U12, U13, U14, U15, U16, U7E, U17, Q1, Q4, U8D, U8C, U8D, and U8B on the controller circuit board.</p> <p>3. If the HIGH is not present, check U7C on the controller circuit board and S7 on the controller on/off circuit board.</p> <p>1. Check for a dc voltage at TP3 on the controller circuit board.</p> <p>2. If the voltage at TP3 is present, check U3C, U3A, U3B, and U4C on each RF power module logic circuit board.</p> <p>3. If the voltage at TP3 is not present, check for a 3.9 volt dc signal at U21 pin 12 on the controller circuit board.</p> <p>4. If the 3.9 volt signal is present, check U21 on the controller circuit board.</p> <p>5. If the 3.9 volt signal is not present, check for a 7.9 volt dc signal at U6 pin 14 on the controller circuit board.</p>

**TABLE 5-1. FM-1C1/FM-500C1 TROUBLESHOOTING**  
(Sheet 6 of 6)

<b>SYMPTOM</b>	<b>CIRCUITRY TO CHECK</b>
1. NO POWER CONTROL (CONT)	<ol style="list-style-type: none"> <li>If the 7.9 volt signal is present, check Q3, U20, U19A, U18A, and U18D on the controller circuit board. Check U11D, U11C, U11B, K1, U10D, U13C, U6 and U14 on the controller on/off circuit board.</li> <li>If the 7.9 volt signal is not present, check U6D, U9, U10, U11, U12, U13, U14, U15, U16, U7E, U17, Q1, Q4, U8D, U8C, U8D, and U7C on the controller circuit board</li> </ol>
1. TRANSMITTER OPERATES 2. NO MULTIMETER OPERATION	<ol style="list-style-type: none"> <li>Depress the transmitter multimeter PWR SUPPLY VDC switch and check for a dc voltage at U201 pin 31 on the meter circuit board.</li> <li>If the voltage is present, check U201 and DS201 on the meter circuit board.</li> <li>If the voltage is not present, check U5C on the controller circuit board.</li> </ol>
1. TRANSMITTER OPERATES 2. NO FORWARD POWER METER DISPLAY	<ol style="list-style-type: none"> <li>Check for a 3.7 VDC signal for a 1 kW output or a 2.56 VDC signal for a 500 W output at U2 pin 5 on the controller circuit board.</li> <li>If the voltage is not present, check the directional coupler.</li> <li>If the voltage is present, check U2B and U6A on the controller circuit board and S301 on the meter switch circuit board.</li> </ol>
1. TRANSMITTER OPERATES WITH NORMAL INDICATIONS 2. RATED POWER CAN NOT BE OBTAINED	<ol style="list-style-type: none"> <li>Check U5B on the controller circuit board.</li> </ol>
1. TRANSMITTER OPERATES 2. NO REFLECTED POWER METER DISPLAY	<ol style="list-style-type: none"> <li>Check for a voltage at U2 pin 3 on the controller circuit board.</li> <li>If the voltage is not present, check the directional coupler.</li> <li>If the voltage is present, check U21A and U6B on the controller circuit board and S301 on the meter switch circuit board.</li> </ol>
1. CIRCUIT BREAKER OPERATION	<ol style="list-style-type: none"> <li>Check the MOVs, main power supply, controller power supply, and the circuit breaker.</li> </ol>

- 5-143. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement on printed circuit boards requires extreme care to avoid damage to the circuit board traces. The following text describes the procedure to replace components on FM-1C1/FM-500C1 circuit boards.
- 5-144. On all circuit boards, the adhesive securing the copper trace to the board melts at almost the same temperature at which solder melts. A circuit board trace 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.
- 5-145. To remove a component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board.
- 5-146. Grip each component lead, one at a time, with long-nose pliers. Rotate the circuit board and touch a 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. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating each hole with a low wattage iron and removing the residual solder with a soldering vacuum tool.



**WARNING**



**WARNING**

**WARNING**

**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 SUCH AS FROM A SOLDERING IRON OR SMOKING MATERIALS. OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.***

- 5-147. Install the new component and apply solder from the bottom side of the circuit board. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.
- 5-148. The board should be checked to ensure the flux has been removed and not just smeared. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.



# SECTION VI

## PARTS LIST

### 6-1. INTRODUCTION.

6-2. This section provides parts lists for the FM-1C1/FM-500C1 transmitter. The parts lists provide descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance. Each parts list entry in this section is indexed by reference designators appearing on the applicable schematic diagrams.

**TABLE 6-1. FM-1C1/FM-500C1 REPLACEABLE PARTS LIST INDEX**

TABLE	DESCRIPTION	PART NO.	PAGE
6-2	FM-1C1 Transmitter	909-1001-205	6-2
6-3	FM-500C1 Transmitter	909-0501-205	6-2
6-4	Motherboard Circuit Board Assembly, FM-1C1	919-0400	6-3
6-5	Motherboard RF Cable Assembly	949-0417	6-3
6-6	Motherboard Assembly, FM-500C1	919-0400-001	6-4
6-7	Control Switch Circuit Board Assembly	919-0406-101	6-4
6-8	Display Circuit Board Assembly	919-0406-102	6-5
6-9	Meter Switch Circuit Board Assembly	919-0406-003	6-6
6-10	Remote Control Interface Circuit Board Assembly	919-0406-104	6-6
6-11	Temperature Sensor Circuit Board Assembly	919-0406-105	6-6
6-12	FM-500C1 Controller Circuit Board Assembly	919-0563-050	6-7
6-13	FM-1C1 Controller Circuit Board Assembly	919-0563-100	6-12
6-14	Controller RFI Filter Circuit Board Assembly	919-0435	6-18
6-15	Power Supply Motherboard Assembly	919-0423	6-19
6-16	Optically-Coupled-Relay (OCR) Assembly	919-0096	6-19
6-17	Basic Harness Assembly	949-0400-001	6-20
6-18	RF Cables Harness Assembly - FM-1C1	949-0402	6-21
6-19	RF Cable Harness Assembly - FM-500C1	949-0401	6-21
6-20	RF Amplifier Module Assembly	959-0412	6-21
6-21	RF Amplifier Circuit Board Assembly	919-0416	6-21
6-22	RF Amplifier Cables Assembly	949-0405	6-23
6-23	RF Amplifier Logic Circuit Board Assembly	919-0417	6-23
6-24.	RF Amplifier Module Directional Coupler Circuit Board Assembly	919-0418-001	6-25
6-25.	RF Amplifier Module Low-Pass Filter Circuit Board Assembly	919-0418-002	6-26
6-26	Output Combiner, FM-1C1	959-0401	6-26
6-27	Low Pass Filter Assembly	959-0402	6-26
6-28	Low Pass Filter Main Circuit Board Assembly	919-0405-001	6-26
6-29	Reject Load Assembly, FM-1C1	959-0403	6-27
6-30	Accessory Parts Kit, FM-1C1/FM-500C1	979-0400	6-27
		/-0401	
6-31	Local Control Disable Option	909-0137	6-27

**TABLE 6-2. FM-1C1 TRANSMITTER - 909-1001-205**

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1, B2	Fan 6 inch (15.24 cm), 250 ft <sup>3</sup> /min 220V ac, 50/60 Hz, 40 Watt	380-7650	2
CB1	Circuit Breaker, 2-Pole, 250V, 15 Amperes	341-0032	1
J4, J5	Housing, Pin, 2-Pin	418-0702	2
J9, J10	Bulkhead Receptacle, Type N. Jack-to-Jack, UG30/U	418-0035	2
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096	1
MOV1 thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3
R4	Resistor, 100 Ohm $\pm 1\%$ , 20W, TO-220 Power Package	132-1032	1
TB1	Barrier Strip, 9 Terminal	412-0090	1
----	Resistor, 100 Ohm $\pm 5\%$ , 40W	131-1033	1
----	Pin Connector	417-0036	4
----	Power Supply, Computer Products, NFN40-7610, -15V $\pm 5\%$ , +5 $\pm 2\%$ , +15V +10%/-3%, 85V to 264V Operation, 40W	540-0006	1
----	FX-50 Exciter, 194-266 50/60 Hz Operation	909-1050-325	1
----	Motherboard Assembly	919-0400	1
----	Control Switch Circuit Board Assembly	919-0406-101	1
----	Display Circuit Board Assembly	919-0406-102	1
----	Meter Switch Circuit Board Assembly	919-0406-003	1
----	Remote Control Interface Circuit Board Assembly	919-0406-104	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Controller Circuit Board Assembly	919-0563-100	1
----	Controller RFI Filter Circuit Board Assembly	919-0435	1
----	Power Supply Motherboard Assembly	919-0423	1
----	Basic Harness Assembly	949-0400-001	1
----	RF Cable Harness Assembly	949-0402	1
----	RF Amp Module Assembly	959-0412	2
----	Output Combiner Assembly	959-0401	1
----	Low Pass Filter Assembly	959-0402	1
----	Reject Load Assembly	959-0403	1
----	Accessory Parts Kit	979-0400	1
----	Power Supply, Pioneer Magnetics, PM3329BP-5 48D42-2F-4D-6B-127-128-R, 48 Adjustable, 2 kW, Power Factor Corrected	540-0016-001	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Battery, 9V Alkaline	350-0002	1

**TABLE 6-3. FM-500C1 TRANSMITTER - 909-0501-205**  
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1, B2	Fan 6 inch (15.24 cm), 250 ft <sup>3</sup> /min 220V ac, 50/60 Hz, 40 Watt	380-7650	2
CB1	Circuit Breaker, 2-Pole, 240V, 10 Amperes	341-0030	1
J4, J5	Housing, Pin, 2-Pin	418-0702	2
J9, J10	Bulkhead Receptacle, Type N. Jack-to-Jack, UG30/U	418-0035	2
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096	1
MOV1 thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3

**TABLE 6-3. FM-500C1 TRANSMITTER - 909-0501-205**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
TB1	Barrier Strip, 9 Terminal	412-0090	1
----	Filter, Fan	380-5502	1
----	Pin Connector	417-0036	4
----	Power Supply, Computer Products, NFN40-7610, -15V $\pm 5\%$ , +5 $\pm 2\%$ , +15V +10%/-3%, 85V to 264V Operation, 40W	540-0006	1
----	FX-50 Exciter, 194-266 50/60 Hz Operation	909-1050-325	1
----	Motherboard Assembly	919-0400-001	1
----	Control Switch Circuit Board Assembly	919-0406-101	1
----	Display Circuit Board Assembly	919-0406-102	1
----	Meter Switch Circuit Board Assembly	919-0406-003	1
----	Remote Control Interface Circuit Board Assembly	919-0406-104	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Power Supply Motherboard Assembly	919-0423	1
----	Controller Circuit Board Assembly	919-0563-050	1
----	Controller RFI Filter Circuit Board Assembly	919-0435	1
----	Basic Harness Assembly	949-0400-001	1
----	RF Cables Harness Assembly	949-0401	1
----	RF Amp Module Assembly	959-0412	1
----	Low Pass Filter Assembly	959-0402	1
----	Accessory Parts Kit	979-0401	1
----	Power Supply, Pioneer Magnetics, PM3329BP-5 48D42-2F-4D-6B-127-128-R, 48 Adjustable, 2 kW, Power Factor Corrected	540-0016-001	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Battery, 9V Alkaline	350-0002	1

**TABLE 6-4. MOTHERBOARD ASSEMBLY, FM-1C1 - 919-0400**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1, C2	Capacitor, Ceramic Chip, 56 pF $\pm 5\%$ , 500V	009-5613	2
C3	Capacitor, Ceramic, 2-8 pF, 350V dc, Non-Polarized	096-0008	1
C4, C5	Capacitor, Electrolytic, 47 uF, 35V	020-4770	2
C6, C7	Capacitor, Mylar, 0.1 uF $\pm 10\%$ , 100V	030-1053	2
CN1, CN2	Capacitor Network	080-1055	2
J601	Receptacle, 26-Pin Dual In-line	418-2602	1
J602, J603	Connector, Female	417-0322	2
L1	Coil, Molded, .11 uH, 1A	364-0011	1
R2, R3	Resistor, .005 Ohm $\pm 3\%$ , 5W	139-0007	2
R5 thru R9	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	5
----	Assembly, Motherboard RF Cable	949-0417	1
----	Blank, Motherboard	519-0400	1

**TABLE 6-5. MOTHERBOARD RF CABLE ASSEMBLY - 949-0417**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Plug, BNC for RG-142 Cable	417-0095	1

**TABLE 6-6. MOTHERBOARD ASSEMBLY, FM-500C1 - 919-0400-001**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C5	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C7	Capacitor, Mylar, 0.1 uF $\pm 10\%$ , 100V	030-1053	1
J601	Receptacle, 26-Pin Dual In-line	418-2602	1
J603	Connector, Female	417-0322	1
R3	Resistor, .005 Ohm $\pm 3\%$ , 5W, WW	139-0007	1
R5	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
----	Assembly, Motherboard RF Cable	949-0417	1
----	Blank, Motherboard	519-0400	1

**TABLE 6-7. CONTROL SWITCH CIRCUIT BOARD ASSEMBLY - 919-0406-101  
(Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C8 thru C14	Capacitor, Mica, 470 pF $\pm 1\%$ , 500V	040-4721	7
C15, C16	Capacitor, Monolithic Ceramic, 0.1 uF 20%, 50V	003-1054	2
C17	Capacitor, Mica, 470 pF $\pm 1\%$ , 500V	040-4721	1
D6, D12, D13, D15, D16	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	5
DS1	Switch, PB, Momentary, LED Illuminated, Green	340-0140	1
J1	Receptacle, Male, 3-Pin In-line	417-0003	1
J101	Receptacle, 26-Pin Dual In-line	418-2602	1
K1	Relay, Coil: 12V dc Contact: DPDT, 120V ac @ 1 Ampere	270-0058	1
P1	Jumper, Programmable, 2-Pin	340-0004	1
Q1 thru Q3	Transistor, 2N7000, Mosfet, TO-92 Case	210-7000	3
R8	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R9, R10	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	2
R11	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R12	Resistor, 3.01 k Ohm $\pm 1\%$ , 1/4W	103-3014	1
R13	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R14	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
R15	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R16	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R17	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R18	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R19	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1

**TABLE 6-7. CONTROL SWITCH CIRCUIT BOARD ASSEMBLY - 919-0406-101**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R20 thru R22	Resistor, 715 Ohm $\pm 1\%$ , 1/4W	100-7132	3
R23, R24	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	2
R25	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R26	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R27	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R28, R29	Resistor, 715 Ohm $\pm 1\%$ , 1/4W	100-7132	2
R30	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R31	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
R32	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
S3	Switch, PB, Momentary, LED Illuminated, Green	340-0140	1
S4, S5	Switch, Pushbutton, Momentary, LED Illuminated, Red	340-0143	2
S6, S7	Switch, Pushbutton, Momentary, LED Illuminated, Yellow	340-0139	2
U3 thru U9	Integrated Circuit, H11AA1, Optical Isolator, AC Input NPN Phototransistor, 6-Pin Dual In-Line Package.	229-0111	7
U10, U11	Integrated Circuit, MC14106BP, Hex Schmitt Trigger, 14-Pin	228-4106	2
U12, U13	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	2
U14	Integrated Circuit, H11AA1, Optical Isolator, AC Input NPN Phototransistor, 6-Pin Dual In-Line Package	229-0111	1
XU3 thru XU9	Socket, 6-Pin DIP	417-0600	7
XU10, XU11	Socket, 14-Pin DIP	417-1404	2
XU12, UX13	Socket, 16-Pin DIP	417-1604	2
XU14	Socket, 6-Pin DIP	417-0600	1
----	Blank, Control Switch Circuit Board Assembly	519-0406-101	1

**TABLE 6-8. DISPLAY CIRCUIT BOARD ASSEMBLY - 919-0406-102**  
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C202	Capacitor, Mica, 50 pF $\pm 5\%$ , 500V	040-5013	1
C203	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C204	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	1
C205	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C206	Capacitor, Polyester Film, 0.033 uF $\pm 10\%$ , 200V	030-3353	1
C208 thru C213	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	6
D1	Integrated Circuit, LM3362Z-2.5, Precision Voltage Reference, 2.5V $\pm 4\%$ , -0 to +70° C, TO-92 Case	229-0336	1
DS201	Display, FE0502W-DU LCD 4 Digit, 0.7" High	320-0021	1
J201	Connector, Printed Circuit Board Mounting, 10-PIN (Dual 5)	418-1003	1
R201	Resistor, 1 Meg Ohm $\pm 1\%$ , 1/4W	103-1007	1
R202	Resistor, 4.02 k Ohm $\pm 1\%$ , 1/4W	103-4024	1
R203	Potentiometer, 2 k Ohm $\pm 10\%$ , 1/2W	178-2044	1
R204	Resistor, 19.1 k Ohm $\pm 1\%$ , 1/4W	103-1915	1

**TABLE 6-8. DISPLAY CIRCUIT BOARD ASSEMBLY - 919-0406-102**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R205	Resistor, 182 k Ohm $\pm 1\%$ , 1/4W	103-1826	1
R206	Resistor, 3.3 Meg Ohm $\pm 5\%$ , 1/4W	100-3373	1
R207 thru R209	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	3
R210	Resistor, 2.49 k Ohm $\pm 1\%$ , 1/4W	103-2494	1
U201	Integrated Circuit, ICL7136CPL, 3-1/2-Digit A/D Converter	220-7136	1
U202	Integrated Circuit, MC14070BCP, Quad Exclusive OR Gate, CMOS 14-Pin DIP	228-4071	1
XU201	Socket, 40-Pin DIP	417-4005	1
XU202	Socket, 14-Pin DIP	417-1404	1
----	Blank, Display Circuit Board	519-0406-102	1

**TABLE 6-9. METER SWITCH CIRCUIT BOARD ASSEMBLY - 919-0406-003**

REF. DES.	DESCRIPTION	PART NO.	QTY.
J301	Receptacle, 26-Pin Dual In-line	418-2602	1
R301	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
S301	Switch, 8 Section, 2PDT Pushbutton, Black/Yellow Indication	340-0124	1
S302	Switch, Toggle, SPDT, 5A @ 125V ac & 28V dc	348-0123	1
----	Blank, Meter Switch Circuit Board	519-0406-103	1

**TABLE 6-10. REMOTE CONTROL INTERFACE CIRCUIT BOARD ASSEMBLY**  
**-919-0406-104**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, .1 uF $\pm 20\%$ , 50V	003-1054	1
P20	Plug, 205737-1 AMP, Printed Circuit Board Mount, 25-PIN	417-2501	1
TB2	Barrier Strip, 30 Terminal	412-3000	1
----	Blank, Remote Interface Circuit Board	519-0406-104	1

**TABLE 6-11. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 919-0406-105**  
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C501	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	1
C502	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C503	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	1
C504	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
C505	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C506	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
J501	Socket, 4-Pin	418-0255	1

**TABLE 6-11. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 919-0406-105**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R501	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
R502	Resistor, 2.21 k Ohm $\pm 1\%$ , 1/4W	103-2241	1
U501	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO-92 Case	220-0035	1
----	Blank, Temperature Sensor Circuit Board	519-0406-105	1

**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 1 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C2	Capacitor, Electrolytic, 1000 uF +20%, 35V	024-1000	1
C3	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C4	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C5	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C6 thru C33	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	28
C34	Capacitor, Mica, 390 pF +5%, 100V	042-3922	1
C35	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C36	Capacitor, Poly, .33uF, 63V, 10%	030-3300	1
C37 thru C39	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	3
C40	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C41 thru C44	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	4
C45,C46	Capacitor, Electrolytic, 1 uF, 50V	024-1064	2
C47 thru C49	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	3
C50,C51	Capacitor, Electrolytic, 1 uF, 50V	024-1064	2
C52,C53	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C54	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C56,C57	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C59 thru C61	Capacitor, Mica, 330 pF +5%, 500V	042-3322	3
C62,C63	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C64	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C65 thru C69	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	5
C73,C74	Capacitor, Monolythic Ceramic, .47uF, 50V, 10%	003-4743	2
C75	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C76 thru C80	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	5
D1,D2	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	2
D3	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D4,D5	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
D6,D7	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D8	Integrated Circuit, LM3362Z-2.5, Precision Voltage Reference, 2.5V +4%, -0 to +70°C, TO-92 Case	229-0336	1
D9 thru D12	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	4
D14	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D17	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D18 thru D20	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D21	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	1
D22	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D23 thru D25	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D27,D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2

**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 2 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D29	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D30	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D35	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D39	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D40	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	1
D41	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D46	Diode, 1N5817, Schottky Barrier Type, 20V, 1 Ampere	200-0019	1
D49	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D51	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
J701	Connector, Printed Circuit Board Mounting, 10-PIN(DUAL 5)	418-1003	1
J702,J703	Receptacle, 26-Pin Dual In-line	418-2602	2
J704	Socket, 4-Pin	418-0255	1
J705	Connector, 20-Pin, MR	417-0230	1
J706,J707	Receptacle, 26-Pin Dual In-line	418-2602	2
J710 - J717	Receptacle, Male, 3-Pin In-line	417-0003	8
J719 - J722	Receptacle, Male, 3-Pin In-line	417-0003	4
J723	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J724,J725	Receptacle, Male, 3-Pin In-line	417-0003	2
J726	Connector, 2-Pin	417-0700	1
J727,J728	Receptacle, Male, 13-Pin Dual In-Line	417-2600	2
P710 - P717	Jumper, Programmable, 2-Pin	340-0004	8
P719 - P725	Jumper, Programmable, 2-Pin	340-0004	7
P727,P728	Jumper, Programmable, 2-Pin	340-0004	2
Q1 thru Q5	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	5
Q7 thru Q10	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	4
Q16,Q17	TSTR,J-FET P-CHANNEL,J270	210-0270	2
R1	Resistor, 470 Ohm +5%, 1/2W	110-4733	1
R2	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R3	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R4	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R5	Resistor, 34k Ohm, 1/4W, 1%,Metal	103-3405	1
R6	Resistor, 10 Meg Ohm +5%, 1/4W	100-1083	1
R7	Resistor, 49.9 k Ohm +1%, 1/4W	103-4951	1
R8	Resistor, 102 k Ohm +1%, 1/4W	103-1026	1
R9	Resistor, 4.87 k Ohm +1%, 1/4W	103-4874	1
R10	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R11,R12	Resistor, 2 k Ohm +1%, 1/4W	100-2041	2
R13	Resistor Network, 8-10 k Ohm +1%, 1/4W, 16-Pin DIP	226-1055	1
R14	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R15	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R16	Resistor, 49.9 k Ohm +1%, 1/4W	103-4951	1
R17	Resistor, 16.2 k Ohm +1%, 1/4W	103-1625	1
R18	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R19	Resistor, 1.33 k Ohm +1%, 1/4W	103-1331	1
R20	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R21	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R22	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R23	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R24	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R25	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R26	Resistor, 4.02 k Ohm, 1/4W, 1%, Metal	103-4024	1
R27	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R28	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R29	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1



**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 3 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R30	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R31	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R32	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R33	Resistor, 4.02 k Ohm, 1/4W, 1%,Metal	103-4024	1
R34	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R35	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R36	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R37	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R38	Resistor, 30.1 k Ohm +1%, 1/4W	100-3051	1
R39	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R40	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R41	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R42	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R43	Resistor, 30.1 k Ohm +1%, 1/4W	100-3051	1
R44	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R45	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R46,R47	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R48	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R49	Potentiometer, 10 k Ohm, 12 Turn,Vert Adj	177-1058	1
R50	Resistor, 60.4 k Ohm +1%, 1/4W	103-6045	1
R51	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R52	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R53	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R54	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1
R55	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R56	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R57	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R58	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R59	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R60	Resistor, 8.06 k Ohm +1%, 1/4W	103-8064	1
R61	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R62	Resistor, 499 Ohm +1%, 1/4W	103-4993	1
R63	Resistor, 3.01 k Ohm +1%, 1/4W	103-3014	1
R64	Potentiometer, 10 k Ohm, 12 Turn,Vert Adj	177-1058	1
R65	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R66	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R67	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1
R68	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R69	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R70	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R71	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R72	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R73	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R74	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R75	Resistor, 1.02 k Ohm +1%, 1/4W	103-1024	1
R76	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R77	Resistor, 15 k Ohm +5%, 1/4W	100-1551	1
R78	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1
R79	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R80	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R81	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R82	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R83	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R84	Resistor, 8.06 k Ohm +1%, 1/4W	103-8064	1

**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 4 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R85	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R86,R87	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R88	Resistor, 12.7 k Ohm +1%, 1/4W	103-1275	1
R89	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R90,R91	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	2
R92	Resistor, 2.43 k Ohm +1%, 1/4W	103-2434	1
R93	Resistor, 4.32 k Ohm +1%, 1/4W	103-4324	1
R94	Potentiometer, 5 k Ohm +10%, 1/2W	177-5044	1
R95	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R96	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R97	Resistor, 1.3 Meg Ohm +5%, 1/4W	100-1373	1
R98	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R99	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R100	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R101	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R103	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R104,R105	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R106	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R108	Resistor, 715 Ohm, 1/4W, 1%	100-7132	1
R109,R110	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R111	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R112	Potentiometer, 10 k Ohm +10%, 1/2W	177-1058	1
R113	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R114	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R115	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R116	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R118	Resistor, 576 Ohm, 1/4W, 1%, Metal	103-5761	1
R119	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R120	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R121	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R122,R123	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R124	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R125	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R126	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R129	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R130	Resistor, 3.01 k Ohm +1%, 1/4W	103-3014	1
R131,R132	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R133 - R135	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	3
R136	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R141	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R143	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R144	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R145,R146	Potentiometer, 5 k Ohm +10%, 1/2W	178-5045	2
R147	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R148	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R149	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R150	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R151	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R156	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R158	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R162	Resistor, 140 Ohm +1%, 1/4W	103-1403	1
R163,R164	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R166	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R167	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1

**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 5 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R171	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R172	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R173	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R174,R175	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R176	Resistor, 732 k Ohm +1%, 1/4W	103-7326	1
R177	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R178	Resistor, 10 Ohm +5%, 1/4W	100-1024	1
R179	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R180	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R181	Resistor, 2.49 k Ohm +1%, 1/4W	103-2494	1
R182	Resistor, 12.4 k Ohm +1%, 1/4W	103-1245	1
R183	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R193	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R194	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R195	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R196	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R197	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R198	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R199,R200	Resistor, 8.06 k Ohm +1%, 1/4W	103-8064	2
R201,R202	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R204	Resistor, 1 Ohm +5%, 1/4W	100-1013	1
R207	Resistor, 1 Ohm +5%, 1/4W	100-1013	1
R209	Resistor, 4.32 k Ohm +1%, 1/4W	103-4324	1
R211	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R212 - R214	Resistor, 4.42 k Ohm +1%, 1/4W	103-4441	3
R215	Resistor, 4.87 k Ohm +1%, 1/4W	103-4874	1
R216	Resistor, 1.40 k Ohm +1%, 1/4W	103-1404	1
R217	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R218	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R219	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R220	Resistor, 11.0 k Ohm +1%, 1/4W	103-1105	1
R221	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R222	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	1
R223	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R224,R225	Resistor, 10 k Ohm +1%, 1/4W	100-1051	2
R226	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	1
R227	Resistor, 29.4 k Ohm +1%, 1/4W	103-2945	1
R228	Resistor, 11.5 k Ohm +1%, 1/4W	103-1155	1
R229	Resistor, 332 k Ohm +1%, 1/4W	103-3326	1
R230	Resistor, 147 k Ohm, 1/4W, 1%, Metal	103-1476	1
RN1	Resistor Network, 100k, 8-Pin Sip	226-1061	1
TP1 - TP18	Terminal, Test Point	413-0106	18
U1	Integrated Circuit, Low Power OP AMP, 17uA	220-0078	1
U2 thru U6	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	5
U7	Integrated Circuit, MC14106BCP Hex Schmitt Trigger	228-4106	1
U8	Integrated Circuit, MC14011BCP, Quad 2-Input NAND Gate, CMOS, 14-Pin DIP	228-4011	1
U9 thru U11	Integrated Circuit, MC14516B, Binary Up/Down Counter, CMOS, 16-Pin DIP	228-4516	3
U12,U13	Integrated Circuit, MC14503B, Hex Non-Inverting 3-State Buffer, CMOS, 16-Pin DIP	228-4503	2
U14,U15	Integrated Circuit, 14505, Hex Level Shifter, TTL to CMOS,	228-4504	2

**TABLE 6-12. FM-500C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-050**  
(Sheet 6 of 6)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U16	16-Pin DIP Integrated Circuit, AD565AJ, 12-Bit Digital/Analog Converter, 24-Pin DIP	220-0565	1
U17	Integrated Circuit, NE555N, Timer, 8-Pin DIP	229-0555	1
U18	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U19	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	1
U20	Integrated Circuit, NE555N, Timer, 8-Pin DIP	229-0555	1
U21	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U22	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U24	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U25 thru U27	Integrated Circuit, CA3183E, Five Transistor Array, NPN, 16-Pin DIP	220-3183	3
U28,U29	Integrated Circuit, CD4066BE, Quad Bilateral Switch, CMOS, 14-Pin DIP	225-0004	2
U30	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U34	VR,7805,+5V,T0-92 PKG	227-7805-1	1
U35	IC,VR,MC79L05,-5V,T0-92 CASE	227-7905-A	1
U36	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
XBT1	Battery Holder, 9 Volt Rectangular	415-0002	1
XR13	Socket, 16-Pin DIP	417-1604	1
XU1	Socket, 8-Pin DIP	417-0804	1
XU2 - XU8	Socket, 14-Pin DIP	417-1404	7
XU9 - XU15	Socket, 16-Pin DIP	417-1604	7
XU16	Socket, 24-Pin DIP	417-2404	1
XU17	Socket, 8-Pin DIP	417-0804	1
XU18	Socket, 14-Pin DIP	417-1404	1
XU19	Socket, 16-Pin DIP	417-1604	1
XU20	Socket, 8-Pin DIP	417-0804	1
XU21,XU22	Socket, 14-Pin DIP	417-1404	2
XU24	Socket, 14-Pin DIP	417-1404	1
XU25 - XU27	Socket, 16-Pin DIP	417-1604	3
XU28 - XU30	Socket, 14-Pin DIP	417-1404	3
XU36	Socket, 8-Pin DIP	417-0804	1
----	Blank, Circuit Board	519-0563	1

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 1 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C2	Capacitor, Electrolytic, 1000 uF +20%, 35V	024-1000	1
C3	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C4	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C5	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C6 thru C33	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	28
C34	Capacitor, Mica, 390 pF +5%, 100V	042-3922	1

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 2 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C35	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C36	Capacitor, Poly, .33uF, 63V, 10%	030-3300	1
C37 thru C39	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	3
C40	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C41 thru C44	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	4
C45,C46	Capacitor, Electrolytic, 1 uF, 50V	024-1064	2
C47 thru C49	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	3
C50,C51	Capacitor, Electrolytic, 1 uF, 50V	024-1064	2
C52,C53	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C54	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C56,C57	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C59 thru C61	Capacitor, Mica, 330 pF +5%, 500V	042-3322	3
C62,C63	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	2
C64	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C65 thru C69	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	5
C73,C74	Capacitor, Ceramic, .47uF, 50V, 10%	003-4743	2
C75	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C76 thru C80	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	5
D1,D2	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	2
D3	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D4,D5	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
D6,D7	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D8	Integrated Circuit, LM3362Z-2.5, Precision Voltage Reference, 2.5V +4%, -0 to +70#C, TO-92 Case	229-0336	1
D9 thru D14	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	6
D17	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D18 thru D20	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D21	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	1
D22	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D23 thru D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	6
D29	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D30	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D35	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D39	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D40	Diode, Zener, 1N4733A, 5.1V +5%, 1W	200-4733	1
D41	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D46	Diode, 1N5817, Schottky Barrier Type, 20V, 1 Ampere	200-0019	1
D49	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D51	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
J701	Connector, Printed Circuit Board Mounting, 10-PIN(DUAL 5)	418-1003	1
J702,J703	Receptacle, 26-Pin Dual In-line	418-2602	2
J704	Socket, 4-Pin	418-0255	1
J705	Connector, 20-Pin, MR	417-0230	1
J706,J707	Receptacle, 26-Pin Dual In-line	418-2602	2
J711 - J717	Receptacle, Male, 3-Pin In-line	417-0003	7
J719 - J722	Receptacle, Male, 3-Pin In-line	417-0003	4
J723	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J724,J725	Receptacle, Male, 3-Pin In-line	417-0003	2
J726	Connector, 2-Pin	417-0700	1
J727,J728	Receptacle, Male, 13-Pin Dual In-Line	417-2600	2
P711 - P717	Jumper, Programmable, 2-Pin	340-0004	7
P719 - P725	Jumper, Programmable, 2-Pin	340-0004	7
P727,P728	Jumper, Programmable, 2-Pin	340-0004	2
Q1 - Q5	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	5

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 3 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q7 - Q10	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	4
Q16,Q17	TSTR,J-FET P-CHANNEL,J270	210-0270	2
R1	Resistor, 470 Ohm +5%, 1/2W	110-4733	1
R2	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R3	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R4	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R5	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R6	Resistor, 10 Meg Ohm +5%, 1/4W	100-1083	1
R7	Resistor, 49.9 k Ohm +1%, 1/4W	103-4951	1
R8	Resistor, 102 k Ohm +1%, 1/4W	103-1026	1
R9	Resistor, 4.87 k Ohm +1%, 1/4W	103-4874	1
R10	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R11,R12	Resistor, 2 k Ohm +1%, 1/4W	100-2041	2
R13	Resistor Network, 8-10 k Ohm +1%, 1/4W, 16-Pin DIP	226-1055	1
R14	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R15	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R16	Resistor, 49.9 k Ohm +1%, 1/4W	103-4951	1
R17	Resistor, 16.2 k Ohm +1%, 1/4W	103-1625	1
R18	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R19	Resistor, 1.33 k Ohm +1%, 1/4W	103-1331	1
R20	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R21	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R22	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R23	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R24	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R25	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R26	Resistor, 4.02 k Ohm, 1/4W, 1%, Metal	103-4024	1
R27	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R28	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R29	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R30	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R31	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R32	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R33	Resistor, 4.02 k Ohm, 1/4W, 1%, Metal	103-4024	1
R34	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R35	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R36	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R37	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R38	Resistor, 30.1 k Ohm +1%, 1/4W	100-3051	1
R39	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R40	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R41	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R42	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R43	Resistor, 30.1 k Ohm +1%, 1/4W	100-3051	1
R44	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R45	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R46,R47	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R48	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R49	Potentiometer,10k Ohm,12 Turn, Vert	177-1058	1
R50	Resistor, 60.4 k Ohm +1%, 1/4W	103-6045	1
R51	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R52	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R53	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R54	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 4 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R55	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R56	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R57	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R58	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R59	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R60	Resistor, 3.48 k Ohm +1%, 1/4W	103-3484	1
R61	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R62	Resistor, 499 Ohm +1%, 1/4W	103-4993	1
R63	Resistor, 3.01 k Ohm +1%, 1/4W	103-3014	1
R64	Potentiometer, 10k Ohm, 12 Turn, Vert	177-1058	1
R65	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R66	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R67	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1
R68	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R69	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R70	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R71	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R72	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R73	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R74	Resistor, 49.9 k Ohm +1%, 1/4W	103-4951	1
R75	Resistor, 1.02 k Ohm +1%, 1/4W	103-1024	1
R76	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R77	Resistor, 15 k Ohm +5%, 1/4W	100-1551	1
R78	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	1
R79	Resistor, 97.6 k Ohm +1%, 1/4W	100-9751	1
R80	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R81	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R82	Resistor, 24.9 k Ohm +1%, 1/4W	103-2495	1
R83	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R84	Resistor, 8.06 k Ohm +1%, 1/4W	103-8064	1
R85	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R86,R87	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R88	Resistor, 12.7 k Ohm +1%, 1/4W	103-1275	1
R89	Resistor, 34 k Ohm, 1/4W, 1%, Metal	103-3405	1
R90,R91	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	2
R92	Resistor, 2.43 k Ohm +1%, 1/4W	103-2434	1
R93	Resistor, 4.32 k Ohm +1%, 1/4W	103-4324	1
R94	Potentiometer, 5 k Ohm +10%, 1/2W	177-5044	1
R95	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R96	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R97	Resistor, 249 k Ohm +1%, 1/4W	103-2496	1
R98	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R99	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R100	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R101	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R102	Resistor, 1.1 Meg Ohm +5%, 1/4W	100-1173	1
R103	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R104,R105	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R106,R107	Resistor, 10 k Ohm +1%, 1/4W	100-1051	2
R108	Resistor, 715 Ohm, 1/4W, 1%	100-7132	1
R109,R110	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R111	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R112	Potentiometer, 10K Ohm, 12 Turn, Vert	177-1058	1
R113	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 5 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R114	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R115	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R116	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R118	Resistor, 576 Ohm, 1/4W, 1%, Metal	103-5761	1
R119	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R120	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R121	Resistor, 34k Ohm, 1/4W, 1%, Metal	103-3405	1
R122,R123	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R124	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R125	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R126	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R129	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R130	Resistor, 3.01 k Ohm +1%, 1/4W	103-3014	1
R131,R132	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R133 - R135	Potentiometer, 10 k Ohm +10%, 1/2W	177-1054	3
R136	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R141	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R143	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R144	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R145,R146	Potentiometer, 5 k Ohm +10%, 1/2W	178-5045	2
R147	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R148	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R149	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R150	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R151	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R156	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R158	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R162	Resistor, 140 Ohm +1%, 1/4W	103-1403	1
R163,R164	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R166	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R167	Resistor, 150 k Ohm +1%, 1/4W	103-1561	1
R171	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R172	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R173	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R174,R175	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R176	Resistor, 732 k Ohm +1%, 1/4W	103-7326	1
R177	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R178	Resistor, 10 Ohm +5%, 1/4W	100-1024	1
R179	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R180	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R181	Resistor, 2.49 k Ohm +1%, 1/4W	103-2494	1
R182	Resistor, 12.4 k Ohm +1%, 1/4W	103-1245	1
R183	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R193	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R194	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R195	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R196	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R197	Resistor, 6.98 k Ohm +1%, 1/4W	103-6984	1
R198	Resistor, 2 k Ohm +1%, 1/4W	100-2041	1
R199,R200	Resistor, 8.06 k Ohm +1%, 1/4W	103-8064	2
R201,R202	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R203	Resistor, 1 Ohm +5%, 1/4W	100-1013	1
R205,R206	Resistor, 1 Ohm +5%, 1/4W	100-1013	2
R208	Resistor, 1 Ohm +5%, 1/4W	100-1013	1



**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 6 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R209	Resistor, 4.32 k Ohm +1%, 1/4W	103-4324	1
R211	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R212 - R214	Resistor, 4.42 k Ohm +1%, 1/4W	103-4441	3
R215	Resistor, 4.87 k Ohm +1%, 1/4W	103-4874	1
R216	Resistor, 1.40 k Ohm +1%, 1/4W	103-1404	1
R217	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R218	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R219	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R220	Resistor, 11.0 k Ohm +1%, 1/4W	103-1105	1
R221	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R222	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	1
R223	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
R224,R225	Resistor, 10 k Ohm +1%, 1/4W	100-1051	2
R226	Resistor, 51.1 Ohm +1%, 1/4W	103-5112	1
R227	Resistor, 14 k Ohm, 1/4W, 1%, Metal	103-1405	1
R228	Resistor, 5.49 k Ohm, 1/4W, 1%, Metal	103-5494	1
R229	Resistor, 162 k Ohm +1%, 1/4W	103-1626	1
R230	Resistor, 71.5 k Ohm +1%, 1/4W	103-7155	1
RN1	Resistor Network, 100K, 8-Pin Sip	226-1061	1
TP1 - TP18	Term, Test Point	413-0106	18
U1	Integrated Circuit, Low Power OP AMP, 17uA	220-0078	1
U2 thru U6	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	5
U7	IC,MC14106BCP HEX SCHMITT TRIGR	228-4106	1
U8	Integrated Circuit, MC14011BCP, Quad 2-Input NAND Gate, CMOS, 14-Pin DIP	228-4011	1
U9 thru U11	Integrated Circuit, MC14516B, Binary Up/Down Counter, CMOS, 16-Pin DIP	228-4516	3
U12,U13	Integrated Circuit, MC14503B, Hex Non-Inverting 3-State Buffer, CMOS, 16-Pin DIP	228-4503	2
U14,U15	Integrated Circuit, 14505, Hex Level Shifter, TTL to CMOS, 16-Pin DIP	228-4504	2
U16	Integrated Circuit, AD565AJ, 12-Bit Digital/Analog Converter, 24-Pin DIP	220-0565	1
U17	Integrated Circuit, NE555N, Timer, 8-Pin DIP	229-0555	1
U18	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U19	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	1
U20	Integrated Circuit, NE555N, Timer, 8-Pin DIP	229-0555	1
U21	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U22	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U24	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U25 thru U27	Integrated Circuit, CA3183E, Five Transistor Array, NPN, 16-Pin DIP	220-3183	3
U28,U29	Integrated Circuit, CD4066BE, Quad Bilateral Switch, CMOS, 14-Pin DIP	225-0004	2
U30	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U34	VR,7805,+5V,T0-92 PKG	227-7805-1	1
U35	IC,VR,MC79L05,-5V,T0-92 CASE	227-7905-A	1
U36	Integrated Circuit, TL072CP, Dual JFET-Input Operational	221-0072	1

**TABLE 6-13. FM-1C1 CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-100**  
(Sheet 7 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	Amplifier, 8-Pin DIP		
XBT1	Battery Holder, 9 Volt Rectangular	415-0002	1
XR13	Socket, 16-Pin DIP	417-1604	1
XU1	Socket, 8-Pin DIP	417-0804	1
XU2 - XU8	Socket, 14-Pin DIP	417-1404	7
XU9 - XU15	Socket, 16-Pin DIP	417-1604	7
XU16	Socket, 24-Pin DIP	417-2404	1
XU17	Socket, 8-Pin DIP	417-0804	1
XU18	Socket, 14-Pin DIP	417-1404	1
XU19	Socket, 16-Pin DIP	417-1604	1
XU20	Socket, 8-Pin DIP	417-0804	1
XU21,XU22	Socket, 14-Pin DIP	417-1404	2
XU24	Socket, 14-Pin DIP	417-1404	1
XU25 - XU27	Socket, 16-Pin DIP	417-1604	3
XU28 - XU30	Socket, 14-Pin DIP	417-1404	3
XU36	Socket, 8-Pin DIP	417-0804	1
----	Blank, Circuit Board	519-0563	1

**TABLE 3-14. RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0435**  
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201 thru C218	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	18
C221 thru C228	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	8
D1 thru D8	Bidirectional Zener Transient Voltage Suppressor, Motorola SA13CA, $\pm 13V$	201-0039	8
D9 thru D17	Bidirectional Zener Transient Voltage Suppressor, Motorola SA18C, Or SA18CA, $\pm 18V$	201-0040	9
D18	Bidirectional Zener Transient Voltage Suppressor, Motorola SA13CA, $\pm 13V$	201-0039	1
D19 thru D25	Bidirectional Zener Transient Voltage Suppressor, Motorola SA18C Or SA18CA, $\pm 18V$	201-0040	7
FL1 thru FL25	EMI Suppression Filter, 10,000 pF $\pm 30\%$ , 3-Pin	411-0001	25
J19	Connector, PC 26 Positions, ANSLEY 609-2624	418-2602	1
J20	Receptacle, 25-Pin	417-2500	1
J21	Connector, 2-Pin	417-0700	1
J22	Socket, 4-Pin	418-0255	1
R201 thru R211	Resistor, 51.1 Ohm $\pm 1\%$ , 1/4W	103-5112	11

**TABLE 3-14. RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0435**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R212 thru R217	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	6
R218 thru R220	Resistor, 100 Ohm $\pm 5\%$ , 1/2W	110-1033	3
R221 thru R223	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	3
R224, R225	Resistor, Power, 47 Ohm $\pm 5\%$ , 3 1/4W, W/W	132-4721	2
R226, R227	Resistor, 51.1 Ohm $\pm 1\%$ , 1/4W	103-5112	2
R228	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
----	Blank, RFI Filter Board Circuit Board	519-0435	1

**TABLE 6-15. POWER SUPPLY MOTHERBOARD ASSEMBLY- 919-0423**

REF. DES.	DESCRIPTION	PART NO.	QTY.
J24	Connector, Housing, 6-Pin, PCB Mount	417-0677	1
J25	Connector, For Pioneer Power Supplies, 29-Pin	417-2900	1
----	Blank, Power Supply Motherboard	519-0423	1

**TABLE 6-16. OPTICALLY-COUPLED-RELAY (OCR) ASSEMBLY - 919-0096**  
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic Disc, 0.001 $\mu$ F, 1kV	002-1034	1
C2	Capacitor, Electrolytic, 47 $\mu$ F, 35V	020-4773	1
C3	Capacitor, Ceramic Disc, 0.03 $\mu$ F, 600V	000-1051	1
C4	Capacitor, Ceramic Disc, 0.001 $\mu$ F, 1kV	002-1034	1
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D2	Diode, Zener, 1N5359, 24V $\pm 10\%$ , 5W	200-5359	1
D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D5	Bridge Rectifier, MDAA970A3, 4 Amperes, 50-200V	239-0003	1
F1, F2	Fuse, PCB Mount, 250V, 3 Amperes	330-0055	2
K1	Relay, Printed Circuit Board Mount	270-0054	1
	Coil: 24V dc, 660 Ohms $\pm 10\%$		
	Contacts: SPST-NO, 0.5 to 15A @ 12 to 240V ac Resistance		
MOV1	Metal Oxide Varistor, V272A6O, 27 V AC RMS, 120 Joules	140-0023	1
R1	Resistor, 2 k Ohm $\pm 3\%$ , 10W	130-2032	1
R2	Resistor, 560 Ohm $\pm 5\%$ , 1/2W	110-5633	1
R3	Resistor, 820 Ohm $\pm 5\%$ , 1/2W	110-8233	1
R4	Resistor, 51.1 Ohm $\pm 1\%$ , 1/4W	103-5112	1
R5	Resistor, 2 k Ohm $\pm 3\%$ , 10W	130-2032	1
U1	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	1

**TABLE 6-16. OPTICALLY-COUPLED-RELAY (OCR) ASSEMBLY - 919-0096**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU1	Socket, 6-Pin DIP	417-0600	1
----	Blank, Circuit Board	519-0096	1

**TABLE 6-17. BASIC HARNESS ASSEMBLY - 949-0400-001**

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	AC Input Receptacle, 2 Pole 3 Wire 15A 250V Service	418-0320	1
J2	Connector, Male, PLA03M1B00	417-0380	1
P2	Connector, Female, PLA03F1000-135.0	417-0379	1
P3	Connector, AMP 770355-1, 6-Pin	417-0236	1
P4, P5	Connector Housing, 2-Pin	418-0701	2
P6	Connector Housing, SL-156, 3 Position	417-0306	1
P7	Connector Housing, SL-156, 6 Position	417-0606	1
P19	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P21	Connector Housing, 2-Pin	418-0701	1
P22	Plug, Housing, 4-Pin	418-0240	1
P23	Contact Housing, 4-Pin In-line	417-0138	1
P24	Connector, Housing, 6-Pin	418-0670	1
P101	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P201	Socket, Connector, 10-Pin	417-1003	1
P301	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P501	Plug, Housing, 4-Pin	418-0240	1
P601	Plug, 26-Pin Dual In-Line	418-2600	1
P701	Socket, Connector, 10-Pin	417-1003	1
P702	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P703	Plug, 26-Pin Dual In-Line	418-2600	1
P704	Plug, Housing, 4-Pin	418-0240	1
P705	Connector Plug, 9-Pin	417-0059	1
P706	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P707	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
----	Pins, Crimp Type	417-8766	3
----	Connector, MC112N, Crimp Contact	417-0381	3
----	Connector, FC112N2, Crimp Contact	417-0372	3
----	Pin Connector, 350629-1	417-0237	4
----	Pins, Connector	417-0053	28
----	Crimp Terminal, AMP 640707-1	410-2478	6
----	AC Line Cord With Ears, 220V	682-0004	1
----	Receptacle, 20-Pin	417-0176	1

**TABLE 6-18. RF CABLES HARNESS ASSEMBLY - FM-1C1 - 949-0402**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, Straight N for 82-340 Cable	417-0120	8
----	Plug, BNC for RG-142 Cable	417-0095	1
----	Plug, Type N for RG-142 Cable	418-0031	1

**TABLE 6-19. RF CABLES HARNESS ASSEMBLY - FM-500C1 - 949-0401**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, Straight N for 82-340 Cable	417-0120	4

**TABLE 6-20. RF AMPLIFIER MODULE ASSEMBLY - 959-0412**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C13 thru C16, C27 thru C30	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$ , 200V	009-4723	8
C39, C40	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$ , 500V	009-1513	2
Q1, Q2	Transistor, RF Power Mosfet, MRF-151G, 175 MHz, 50V, 300W	210-0151	2
R1	Resistor, 50 Ohm $\pm 1\%$ , 20W	132-5002	1
R201	Resistor, 50 Ohm, 250W	131-5030	1
T1, T2	Transformer, RF Amplifier Output	370-0052	2
----	RF Amplifier Module Logic Circuit Board Assembly	919-0417	1
----	RF Amplifier Module Directional Coupler Circuit Board Assembly	919-0418-001	1
----	RF Amplifier Circuit Board Assembly	919-0416	1
----	RF Amplifier Module Low-Pass Filter Circuit Board Assembly	919-0418-002	1
----	Blank, Module Combiner Shield Circuit Board	519-0419	1
----	Blank, Module Combiner Circuit Board	519-0420	1

**TABLE 6-21. RF AMPLIFIER CIRCUIT ASSEMBLY - 919-0416  
(Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C6, C7	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	2
C9	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 500V	009-5613	1
C10	Capacitor, Ceramic, Variable, 4 to 25 pF, 100V	090-0004	1
C11, C12	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	2
C17	Capacitor, Mica, Feedthru, 1000 pF $\pm 10\%$ , 350V	046-1030	1
C20, C21	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	2
C23	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 500V	009-5613	1
C24	Capacitor, Ceramic, Variable, 4 to 25 pF, 100V	090-0004	1
C25	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	1
C31	Capacitor, Mica, Feedthru, 1000 pF $\pm 10\%$ , 350V	046-1030	1

**TABLE 6-21. RF AMPLIFIER CIRCUIT ASSEMBLY - 919-0416**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C34	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 500V	009-1033	1
C35, C36	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	2
C38	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 500V	009-1033	1
C43	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	1
D1, D2	Diode, Switching, MMBD914LT1, TO-236AB	204-0914	2
D3	Diode, MMBD701LT1, High Voltage, Schottky Barrier Type, 70V, Surface Mount	201-2801	1
DS1, DS2	LED, Tri-Color, Common Cathode	320-0031	2
F1	Fuse, ATC, 25A	334-2500	1
L1, L2	Choke, RF Amplifier Decoupling, FM-1C1	360-0146	2
J1, J2	Receptacle, Male, 3-Pin In-Line	408-0300	1
J801	Connector, Header, 40-Pin Dual-In-Line	417-4040	1
P1, P2	Jumper, Programmable, 2-Pin	340-0004	2
P803	Connector, Type N, Angle, PCB Mount	417-0235	1
R2	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	1
R4	Resistor, Chip, 267 k Ohm $\pm 1\%$ , 1/4W	101-2670	1
R5 thru R8	Resistor, Chip, 22 Ohm $\pm 5\%$ , 1/2W	111-2223	4
R9	Potentiometer, 10 k Ohm $\pm 10\%$	198-1054	1
R10	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	1
R11	Resistor, Chip, 47.5 k Ohm $\pm 1\%$ , 1/4W	101-0475	1
R13	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	1
R14	Resistor, Chip, 499 k Ohm $\pm 1\%$ , 1/4W	101-4990	1
R15	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	1
R16	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R17	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	1
R18 thru R21	Resistor, Chip, 22 Ohm $\pm 5\%$ , 1/2W	111-2223	4
R22	Potentiometer, 10 k Ohm $\pm 10\%$	198-1054	1
R23, R26	Resistor, Chip, 2.2 k Ohm $\pm 5\%$ , 1/4W	101-2243	2
R27, R28	Resistor, 22 Ohm $\pm 5\%$ , 4W	130-2243	2
U1	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO-92 Case	220-0035	1
U2	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO-92 Case	220-0035	1
W6	Coaxial Cable Sections: 25 Ohm Rigid Coaxial Cable Matching Section	370-0721	1
W8	Coaxial Cable Sections: 25 Ohm Rigid Coaxial Cable Matching Section	370-0721	1
----	Blank, RF Amplifier Circuit Board	519-0416	1
----	RF Amplifier Circuit Board Wire Harness	949-0405	1
----	Fuse Holder, ATC Type, PCB Mount	415-0015	2

**TABLE 6-22. RF AMPLIFIER CABLES ASSEMBLY - 949-0405**

REF. DES.	DESCRIPTION	PART NO.	QTY.
P802	Connector, Male, Circuit Board Right Angle D	418-0322	1
W1, W2	Coaxial Cable, RG316/U, Teflon, Impedance: 50 Ohm Capacitance: 29.3 pF/ft. Nominal	621-1359	2

**TABLE 6-23. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417  
(Sheet 1 of 3)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic Disc, 20 pF $\pm 10\%$ , 1kV	002-2013	1
C2	Capacitor, Monolythic Ceramic, .047 uF $\pm 5\%$ 50V	003-4733	1
C3, C4	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	2
C5, C6	Capacitor, Monolythic Ceramic, .047 uF $\pm 5\%$ 50V	003-4733	2
C7 thru C10	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	4
C11	Capacitor, Monolythic Ceramic, .047 uF $\pm 5\%$ 50V	003-4733	1
C12 thru C14	Capacitor, Ceramic Disc, 20 pF $\pm 10\%$ , 1kV	002-2013	3
C15	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C16 thru C18	Capacitor, Electrolytic, 10 uF, 35V	023-1076	3
C19	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C20	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C21	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	1
C22	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C23, C24	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$ , 50V	003-1054	2
C25, C26	Capacitor, Ceramic Disc, 20 pF $\pm 10\%$ , 1kV	002-2013	2
D1 thru D16	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	16
D17	Diode, Zener, 1N4742A, 12V $\pm 5\%$ , 1W	200-4742	1
D19 thru D21	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D22, D23	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
D24, D25	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
P801	Receptacle, 40-Pin Dual In-line	417-4041	1
Q1, Q2, Q5 thru Q7	Transistor, MPSA06, NPN, TO-92 Case	211-0006	5
Q8	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
R1	Resistor Network, 5 k Ohm $\pm 1\%$ , 1/4W, 16-Pin DIP	226-0500	1
R2	Resistor, 499 k Ohm $\pm 1\%$ , 1/4W	103-4996	1
R3	Resistor, 2.74 k Ohm $\pm 1\%$ , 1/4W	103-2744	1
R4	Resistor, 499 k Ohm $\pm 1\%$ , 1/4W	103-4996	1
R5	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R6 thru R8	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	3
R9	Resistor, 182 k Ohm $\pm 1\%$ , 1/4W	103-1826	1
R10	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	1
R11	Potentiometer, 200 Ohm $\pm 10\%$ , 1/2W	177-2035	1

**TABLE 6-23. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417**  
(Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R12	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R13	Resistor, 2.74 k Ohm $\pm 1\%$ , 1/4W	103-2744	1
R14	Resistor, 8.25 k Ohm $\pm 1\%$ , 1/4W	103-8254	1
R15	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R12	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R16	Resistor, 499 k Ohm $\pm 1\%$ , 1/4W	103-4996	1
R17	Resistor, 2.74 k Ohm $\pm 1\%$ , 1/4W	103-2744	1
R18	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R19	Resistor, 240 Ohm $\pm 1\%$ , 1/4W	103-2431	1
R20	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R21	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	1
R22	Resistor, 162 k Ohm $\pm 1\%$ , 1/4W	103-1626	1
R23	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R24	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	1
R25	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R26	Resistor, 2.74 k Ohm $\pm 1\%$ , 1/4W	103-2744	1
R27	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R28, R29	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	2
R30	Resistor, 15.8 k Ohm $\pm 1\%$ , 1/4W	103-1585	1
R31, R32	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	2
R33	Resistor, 1.33 k Ohm $\pm 1\%$ , 1/4W	103-1331	1
R34	Resistor, 5.11 k Ohm $\pm 1\%$ , 1/4W	103-5141	1
R35	Resistor Network, 8-22 k Ohm 1/4W Resistors, 16-Pin DIP	226-2250	1
R36	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	1
R37	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R38	Resistor, 15.8 k Ohm $\pm 1\%$ , 1/4W	103-1585	1
R39	Resistor, 1.33 k Ohm $\pm 1\%$ , 1/4W	103-1331	1
R40	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R41	Resistor, 9.09 k Ohm $\pm 1\%$ , 1/4W	103-9041	1
R42	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R43	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R44, R45	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	2
R46, R47	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	2
R49, R50	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	2
R48	Resistor, 7.68 k Ohm, $\pm 1\%$ , 1/4W	103-7684	1
R51	Potentiometer, 20 k Ohm $\pm 10\%$ , 1/2W	178-2054	1
R52	Resistor, 162 k Ohm $\pm 1\%$ , 1/4W	103-1626	1
R53	Resistor, 5.11 k Ohm $\pm 1\%$ , 1/4W	103-5141	1
R54	Resistor, 47.5 k Ohm $\pm 1\%$ , 1/4W	103-4755	1
R55	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R56	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
R57, R58	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	2
R59, R60	Resistor, 51.1 Ohm $\pm 1\%$ , 1/4W	103-5112	2
R61	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R62	Resistor, 5.11 k Ohm $\pm 1\%$ , 1/4W	103-5141	1
R63	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R64	Resistor, 5.11 k Ohm $\pm 1\%$ , 1/4W	103-5141	1
R65	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1



**TABLE 6-23. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417**  
(Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R66	Resistor, 47.5 k Ohm, $\pm 1\%$ , 1/4W	103-4755	1
R67	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R68	Resistor, 16.9 k Ohm $\pm 1\%$ , 1/4W	103-1695	1
R69	Resistor, 22.1 k Ohm $\pm 1\%$ , 1/4W	103-2211	1
R70	Resistor, 8.25 k Ohm $\pm 1\%$ , 1/4W	103-8254	1
R71	Resistor, 15.8 k Ohm $\pm 1\%$ , 1/4W	103-1585	1
R72	Resistor, 499 k Ohm, $\pm 1\%$ , 1/4W	103-4996	1
R73	Resistor, 78.7 k Ohm $\pm 1\%$ , 1/4W	103-7875	1
R74	Resistor, 2.05 k Ohm $\pm 1\%$ , 1/4W	103-2054	1
R75, R76	Resistor, 5.11 k Ohm $\pm 1\%$ , 1/4W	103-5141	2
R77	Resistor, 10 k Ohm $\pm 1\%$ , 1/4W	100-1051	1
U1	Integrated Circuit, MPQ3799, Quad Amplifier, PNP, 14-Pin DIP	220-3799	1
U2 thru U6	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	5
U7	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO-92 Case	220-0317	1
----	Blank, RF Amplifier Logic Circuit Board	519-0417	1

**TABLE 6-24. RF AMPLIFIER MODULE DIRECTIONAL COUPLER CIRCUIT BOARD ASSEMBLY -919-0418-001**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C101	Capacitor, Ceramic Chip, 10 pF $\pm 5\%$ , 500V	009-1013	1
C102	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$ , 500V	009-1513	1
C103	Capacitor, Ceramic Chip, 6.8 pF, 500V	009-6810	1
C104, C105	Capacitor, Ceramic Chip, 10 pF $\pm 5\%$ , 500V	009-1013	2
C106	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	1
C107, C108	Capacitor, Ceramic, 47 pF $\pm 5\%$ , 50V	003-4712	2
C109, C112 thru C114	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$ , 100V	009-1032	1
C115, C116	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$ , 500V	009-1513	2
D103 thru D105	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	3
L101, L102	Coil, Molded, .11 uH, 1A	364-0011	2
L103, L104	Inductor, Molded, 68 uH	360-0106	2
R104, R105	Resistor, 66.5 Ohm $\pm 1\%$ , 1/4W	103-6652	2
R109, R110	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	2
----	Blank, RF Amplifier Directional Coupler Circuit Board	519-0418-001	1

**TABLE 6-25. RF AMPLIFIER MODULE LOW-PASS FILTER CIRCUIT BOARD  
ASSEMBLY -919-0418-002**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201	Capacitor, Ceramic Chip, 10 pF $\pm 5\%$ 500V	009-1013	1
C202	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$ , 500V	009-1513	1
C203	Capacitor, Ceramic Chip, 6.8 pF, 500V	009-6810	1
C204, C205	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$ , 500V	009-1513	1
----	Blank, RF Amplifier Module Low-Pass Filter Circuit Board	519-0418-002	1

**TABLE 6-26. OUTPUT COMBINER, FM-1C1 - 959-0401**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, Female N to Printed Circuit Board, Panel Mount	417-0321	4
----	Output Combiner Circuit Board	519-0404	1

**TABLE 6-27. LOW PASS FILTER ASSEMBLY- 959-0402**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Receptacle, BNC	417-0016	1
----	Receptacle, Type N	417-0204	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Low Pass Filter Main Circuit Board Assembly	919-0405-001	1
----	Low Pass Filter Inductor Circuit Board	519-0409	1

**TABLE 6-28. LOW PASS FILTER MAIN CIRCUIT BOARD ASSEMBLY- 919-0405-001  
(Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C8	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	1
C9	Capacitor, Ceramic, 47 pF $\pm 5\%$ , 50V	003-4712	1
C10, C11	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	2
C12	Capacitor, Ceramic, 47 pF $\pm 5\%$ , 50V	003-4712	1
C13, C14	Capacitor, Mica, 390 pF $\pm 5\%$ , 100V	042-3922	2
D1, D2	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
J23	Receptacle, Male, 4-Pin In-Line	417-0070	1
L1	Coil	360-0145	1
L2	RF Choke, .68 uH $\pm 10\%$ , 495 mA Maximum, DC Resistance 0.60 Ohms	360-0106	1
L3	RF Choke, 1.5 uH $\pm 10\%$ , 580 mA Maximum, DC Resistance = 0.30 Ohms	360-0032	2
R1 thru R6	Resistor, 453 Ohm $\pm 1\%$ , 1/4W	103-4533	6

**TABLE 6-28. LOW PASS FILTER MAIN CIRCUIT BOARD ASSEMBLY- 919-0405-001**  
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R7, R8	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	2
R9	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
R10 thru R13	Resistor, 249 Ohm $\pm 1\%$ , 1/4W	103-2493	4
R14	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	100-1041	1
R15	Resistor, 100 k Ohm $\pm 1\%$ , 1/4W	103-1062	1
----	Blank, Low Pass Filter Main Circuit Board	519-0405-001	1

**TABLE 6-29. REJECT LOAD ASSEMBLY, FM-1C1 - 959-0403**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Resistor 50 Ohm $\pm 5\%$ , 275W	140-0025	1
----	Receptacle, BNC	417-0016	1
----	Reject Load Matching Circuit Board	519-0405-002	1

**TABLE 6-30. ACCESSORY PARTS KIT, FM-1C1/FM-500C1 - 979-0400/-0401**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	AC Input Connector, Female, 2 Pole 3 Wire 15 Amp 250V Service	417-0320	1
----	Air Filter, 9 3/4 X 19 3/4 X 3/4 Inches ( 24.77 X 50.17 X 1.91 cm)	407-0162	2

**TABLE 6-31. LOCAL CONTROL DISABLE OPTION - 909-0137**

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Switch, Miniature Toggle, SPDT, 5A @ 120V ac or 2A @ 250V	348-7101	1
----	Plug, Housing, 2-Pin	417-0499	1
----	Receptacle, Male, 2-Pin In-Line	417-4004	1

# SECTION VII

## DRAWINGS

### 7-1. INTRODUCTION.

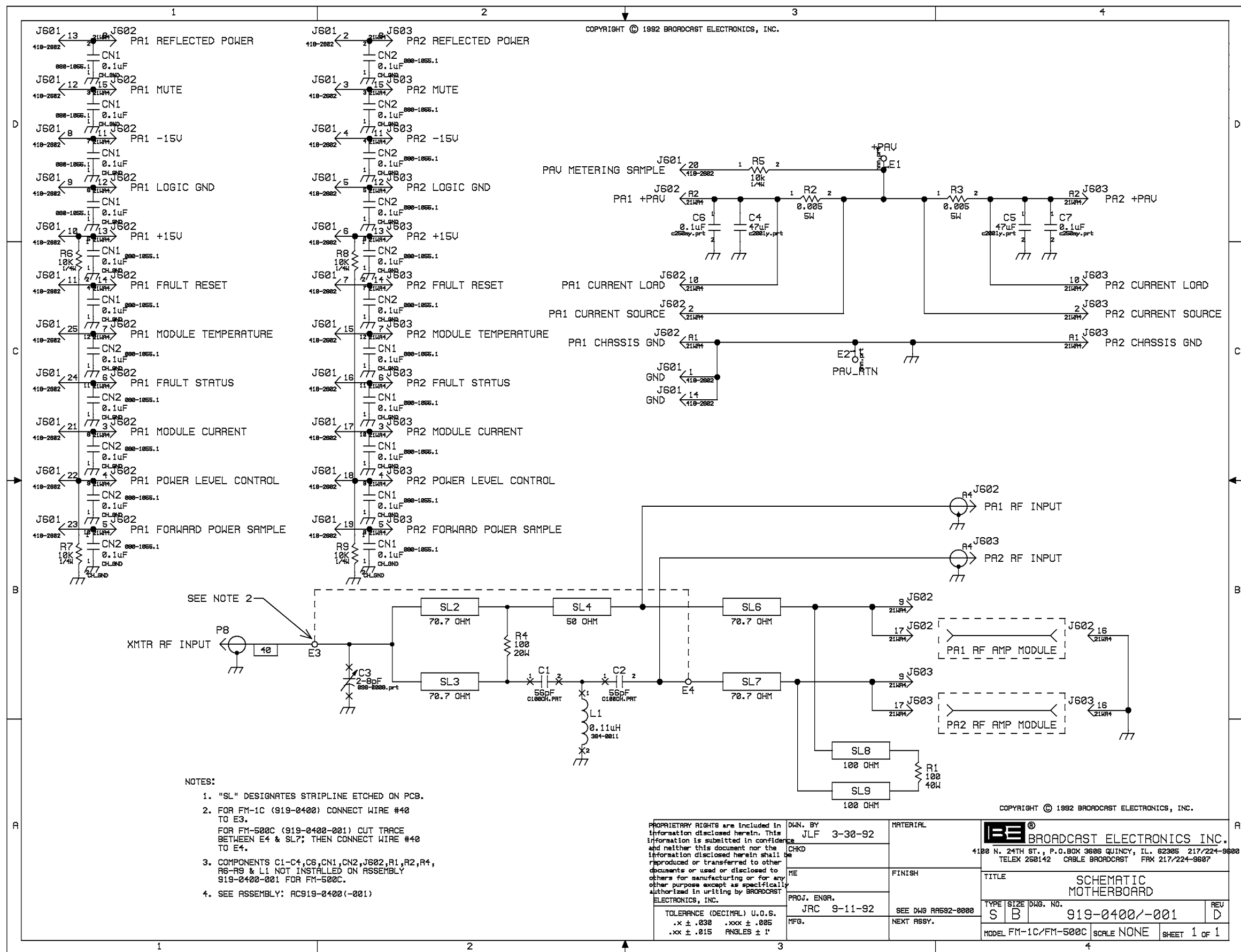
- 7-2. This section provides schematic and assembly diagrams as indexed below for the Broadcast Electronics FM-1C1/FM-500C1 transmitters. For transmitters equipped with Revision A Remote Control Systems, use the drawings presented in the Revision A Remote Control System section.

FIGURE	TITLE	NUMBER
7-1	OVERALL SCHEMATIC DIAGRAM, FM-1C1 TRANSMITTER	SD909-1001-205/
	OVERALL SCHEMATIC DIAGRAM, FM-500C1 TRANSMITTER	SD909-0501-205
7-2	SCHEMATIC DIAGRAM, MOTHERBOARD	SB919-0400/-001
7-3	ASSEMBLY DIAGRAM, MOTHERBOARD	AC919-0400/-001
7-4	SCHEMATIC DIAGRAM, CONTROLLER CIRCUIT BOARD	SB919-0563-100 /-050
7-5	ASSEMBLY DIAGRAM, CONTROLLER CIRCUIT BOARD	AD919-0563-100 /-050
7-6	SCHEMATIC DIAGRAM, RFI FILTER CIRCUIT BOARD	SB919-0435
7-7	ASSEMBLY DIAGRAM, RFI FILTER CIRCUIT BOARD	AB919-0435
7-8	SCHEMATIC DIAGRAM, CONTROL ON-OFF SWITCH CIRCUIT BOARD	SB919-0406-101
7-9	SCHEMATIC DIAGRAM, CONTROLLER METER DISPLAY	SB919-0406-102
7-10	SCHEMATIC DIAGRAM, REMOTE INTERFACE BARRIER STRIP	SB919-0406-104
7-11	SCHEMATIC DIAGRAM, TEMPERATURE SENSOR	SA919-0406-105
7-12	SCHEMATIC DIAGRAM, CONTROLLER METER SWITCH	SC919-0406-003
7-13	ASSEMBLY DIAGRAM, CONTROL CIRCUIT BOARDS	AD919-0406-003 919-0406-101 /-105
7-14	SCHEMATIC DIAGRAM, OPTICALLY-COUPLED-RELAY	SB919-0096/-001
7-15	ASSEMBLY DIAGRAM, OPTICALLY-COUPLED-RELAY	AB919-0096/-001
7-16	SCHEMATIC DIAGRAM, RF POWER MODULE	SB959-0412
7-17	ASSEMBLY DIAGRAM, RF AMPLIFIER CIRCUIT BOARD	AD919-0416
7-18	ASSEMBLY DIAGRAM, RF AMPLIFIER MODULE LOW-PASS FILTER/DIRECTIONAL COUPLER CIRCUIT BOARDS	AC919-0418-001 /-002
7-19	SCHEMATIC DIAGRAM, RF AMPLIFIER LOGIC CIRCUIT BOARD	SB919-0417
7-20	ASSEMBLY DIAGRAM, RF AMPLIFIER LOGIC CIRCUIT BOARD	AB919-0417
7-21	SCHEMATIC DIAGRAM, LOW-PASS FILTER ASSEMBLY	SB959-0402
7-22	ASSEMBLY DIAGRAM, LOW-PASS FILTER MAIN CIRCUIT BOARD	AD919-0405-001
7-23	SCHEMATIC DIAGRAM, POWER SUPPLY MOTHERBOARD	SA919-0423

<b>FIGURE</b>	<b>TITLE</b>	<b>NUMBER</b>
7-24	ASSEMBLY DIAGRAM, POWER SUPPLY MOTHERBOARD	AB919-0423
7-25	ASSEMBLY DIAGRAM, POWER AMPLIFIER MODULE	597-3002-23
7-26	PREDATOR SCHEMATIC DIAGRAM, FM-1C1/FM-500C1	597-8000-103

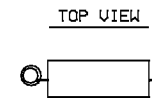
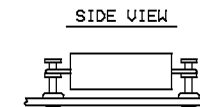
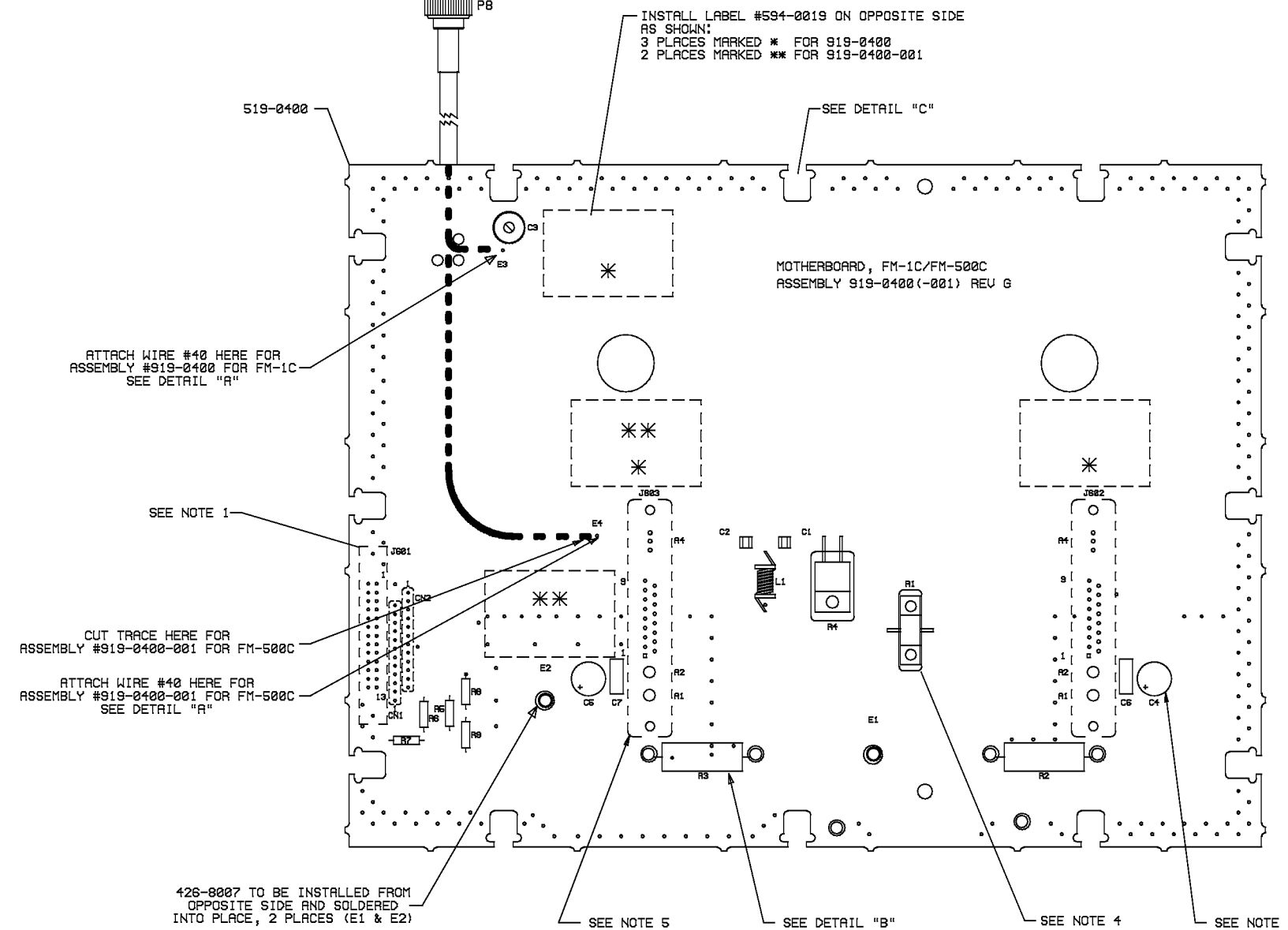
<b>FIGURE</b>	<b>TITLE</b>	<b>NUMBER</b>
7-24	ASSEMBLY DIAGRAM, POWER SUPPLY MOTHERBOARD	AB919-0423
7-25	ASSEMBLY DIAGRAM, POWER AMPLIFIER MODULE	597-3002-23
7-26	PREDATOR SCHEMATIC DIAGRAM, FM-1C1/FM-500C1	597-8000-103





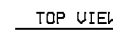
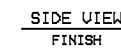
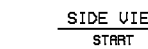


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INSTALL (2) TURRETS #413-0025 AND SOLDER INTO  
PLACE TOP & BOTTOM. MOUNT RESISTOR #139-0007  
TO TURRETS AS SHOWN - NOTE THAT RESISTOR MOUNTS  
TO LOWER SIDE OF TURRETS AS SHOWN IN TOP VIEW.  
RESISTOR LEADS SHOULD BE AS SHORT AND STRAIGHT  
AS POSSIBLE WITHOUT BENDING TURRETS.

DETAIL "B"  
2 PLCS (R2, R3)

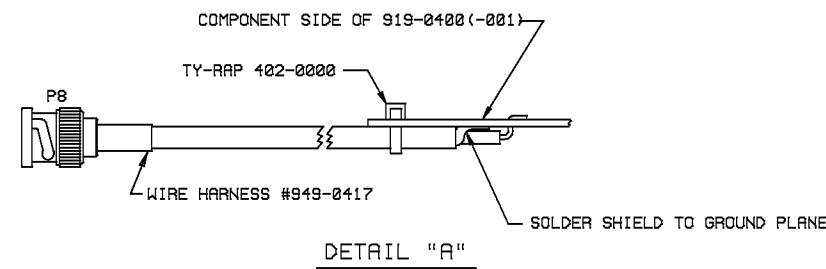


PRESS #421-6908 SHEETEDGE FASTENER INTO  
CUTOUT UNTIL SNAPPED INTO PLACE AS SHOWN

DETAIL "C"  
12 PLCS

NOTES:

- COMPONENTS SHOWN WITH DASHED LINES  
TO BE INSTALLED ON OPPOSITE SIDE.
- COMPONENTS C1-C4, C6, CN1, CN2, J602, R1, R2,  
R4, R6-R9 & L1 NOT INSTALLED ON ASSEMBLY  
# 919-0400-001 FOR FM-500C.
- SEE SCHEMATIC: SC919-0400(-001)
- R1 & R4 TO BE INSTALLED DURING  
TRANSMITTER FINAL ASSEMBLY.
- MOUNT J602/J603 TO PCB WITH :  
QTY (2) EACH #423-4002 SPLIT  
QTY (2) EACH #441-0187 STOFF  
BEFORE SOLDERING INTO PLACE.




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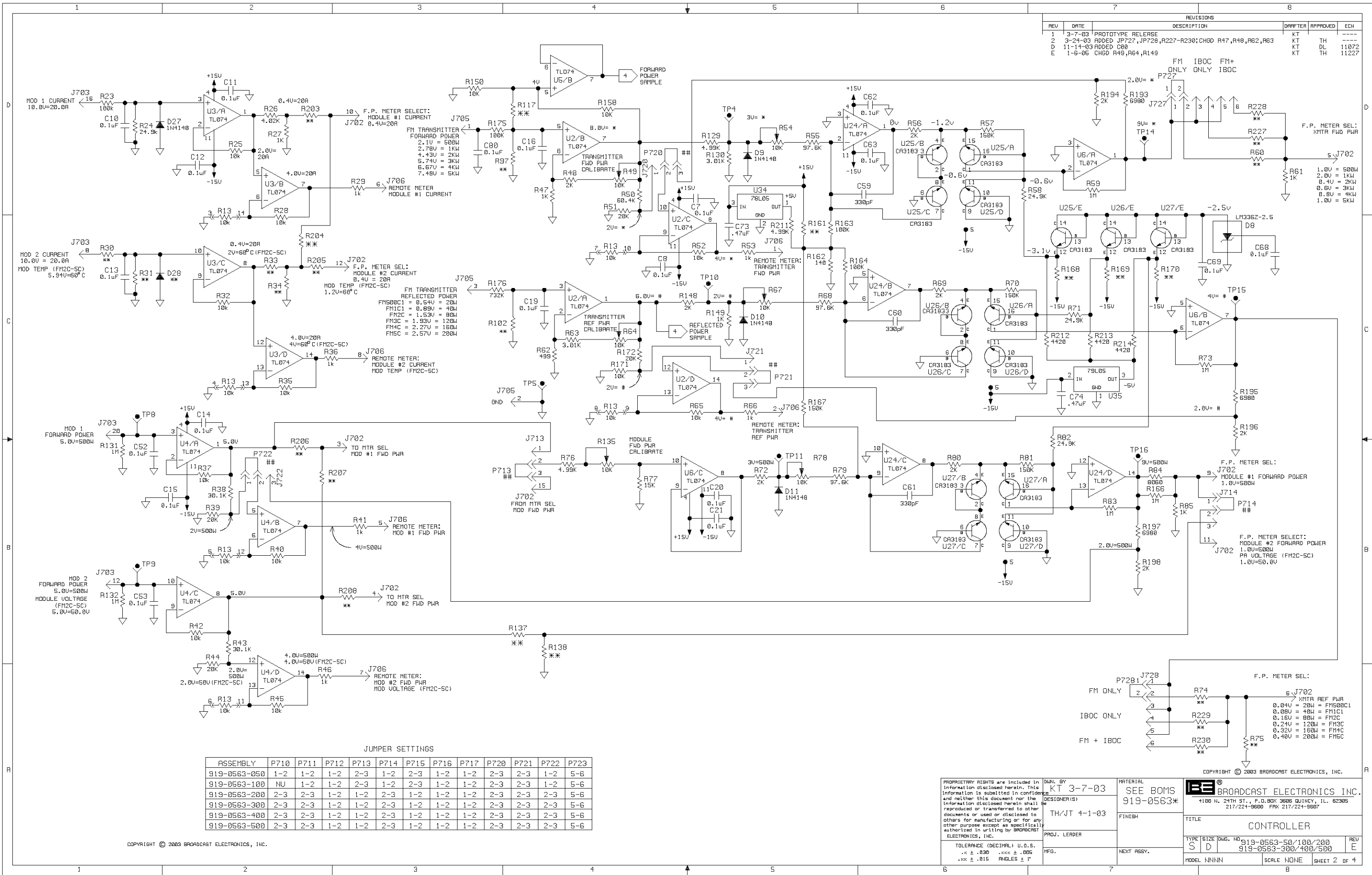
TOLERANCE (DECIMAL) U.O.S.  
.X ± .030 .XXX ± .005  
.XX ± .015 ANGLES ± 1°

DWN. BY  
JLF 2-12-92  
CHKD  
ME  
PROJ. ENGR.  
JRC 9-11-92  
MFG.

MATERIAL  
SEE BOM  
919-0400  
919-0400-001  
FINISH  
----  
SEE DWG RA692-0008  
NEXT ASSY.

 BROADCAST ELECTRONICS INC.			
4100 N. 24TH ST. P.O. BOX 3606 QUINCY, IL. 62305 PH. 217/224-9606 TELEX 258142 CABLE BROADCAST FAX 217/224-9607			
TITLE PCB ASSEMBLY MOTHERBOARD			
TYPE	SIZE	DWG No.	REV
A	C	919-0400 919-0400-001	G
MODEL	FM-1C FM-500C	SCALE 1:1	SHEET 1 OF 1





REVISIONS					DATE	DESCRIPTION	DESIGNED	APPROVED	ECN
1	3-7-03	PROTOTYPE RELEASE	KT	TH	----				
2	3-24-03	ADDED JP727, JP728, R227-R230; CHGD R17, R18, R62, R63	KT	TH	----				
3	11-14-03	ADDED C80	KT	DL	11072				
4	1-6-05	CHGD R49, R64, R149	KT	TH	11227				

JUMPER SETTINGS											
ASSEMBLY	P710	P711	P712	P713	P714	P715	P716	P717	P720	P721	P723
919-0563-050	1-2	1-2	1-2	2-3	1-2	2-3	1-2	1-2	2-3	2-3	5-6
919-0563-100	NU	1-2	1-2	2-3	1-2	2-3	1-2	1-2	2-3	2-3	5-6
919-0563-200	2-3	2-3	1-2	1-2	2-3	1-2	1-2	1-2	2-3	2-3	5-6
919-0563-300	2-3	2-3	1-2	1-2	2-3	1-2	1-2	1-2	2-3	2-3	5-6
919-0563-400	2-3	2-3	1-2	1-2	2-3	1-2	1-2	1-2	2-3	2-3	5-6
919-0563-500	2-3	2-3	1-2	1-2	2-3	1-2	1-2	1-2	2-3	2-3	5-6

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KT 3-7-03  
TH/JT 4-1-03  
PROJ. LEADER  
MFG.

MATERIAL  
SEE BOMS  
919-0563\*

FINISH

NEXT ASSY.

DESIGNER(S)  
TH/JT 4-1-03

PROJ. LEADER

MFG.

DATE  
3-7-03

DESCRIPTION  
919-0563\*

FINISH

NEXT ASSY.

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1100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305  
217/224-9500 FAX 217/224-9507

TITLE  
CONTROLLER

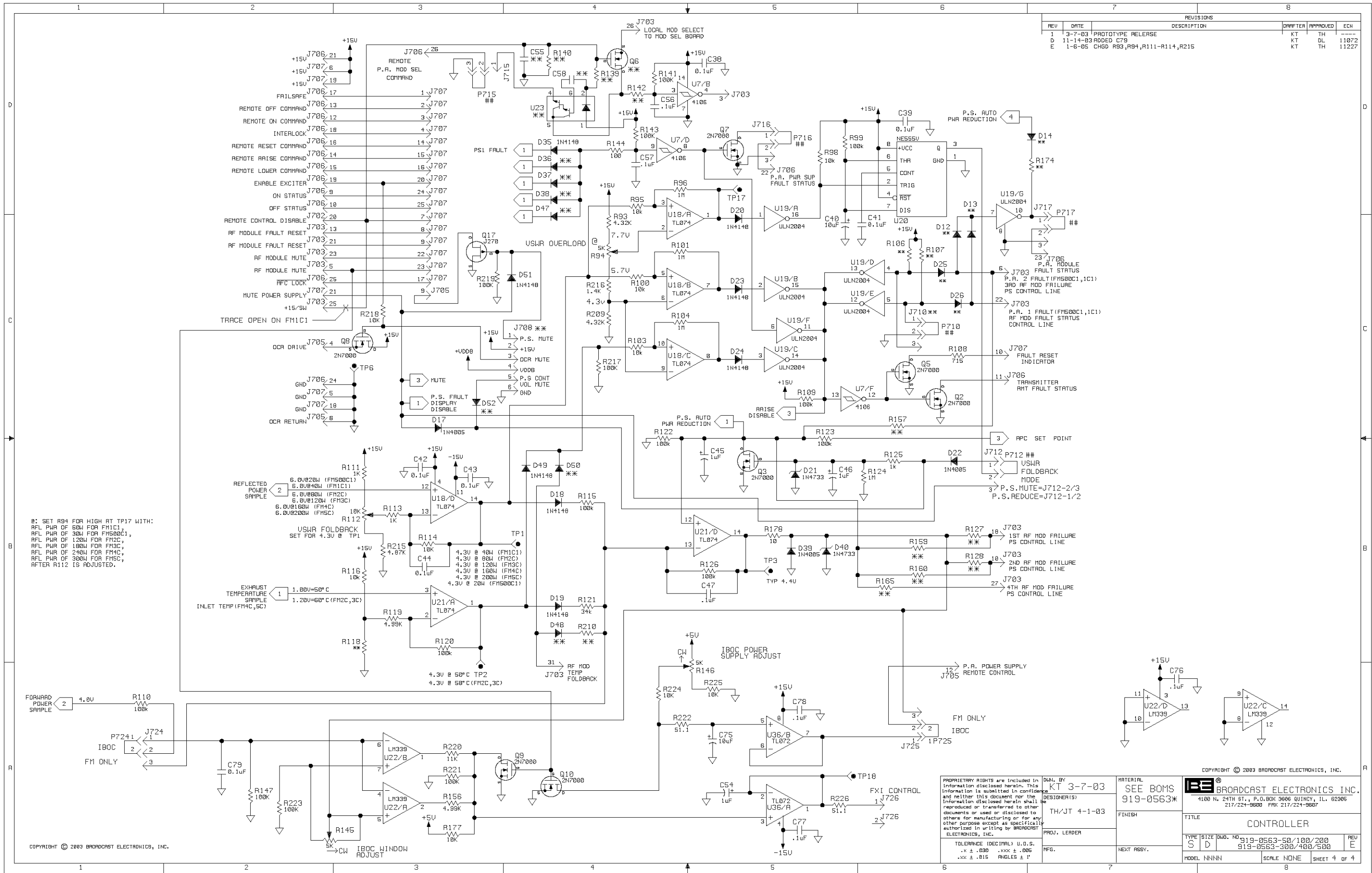
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919-0563-300/400/500

MODEL NNNN

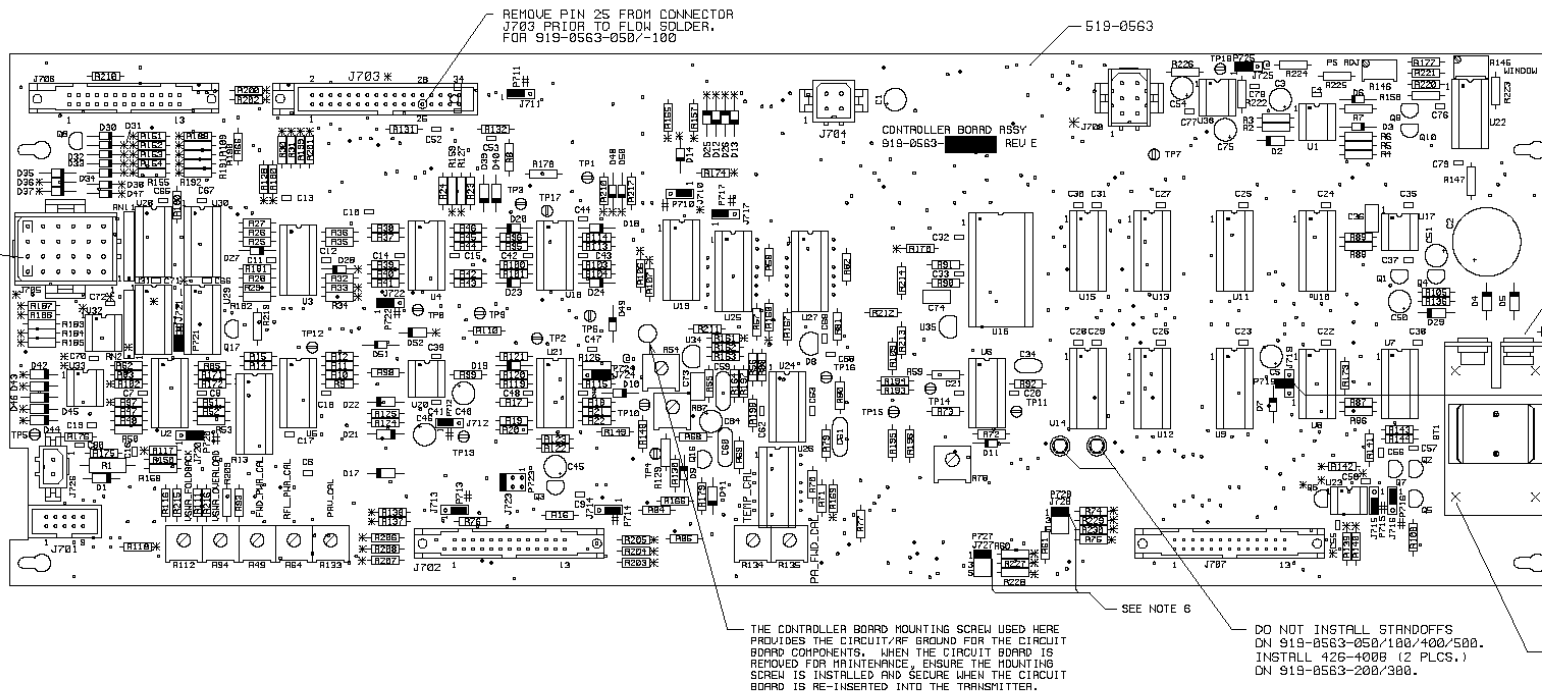
SCALE NONE

SHEET 2 OF 4





REVISIONS					
REV	DATE	DESCRIPTION	DRAWN	APPROVED	ECN
1	3-10-03	PROTOTYPE RELEASE	KT	JT	----
2	3-28-03	ADD J727, J728, R227-R230; CHGD R47, R78, R62, R63	TH	TH	----
A	4-1-03	ENGINEERING RELEASE	KT	TH/JT	----
B	6-23-03	CHGD R227 & R228; MOVED PARTS AWAY FROM CLEAR AREAS	KT	TH	10894
C	10-14-03	CHGD C36 FROM 003-1054 TO 030-3300	KT	DL	11048
D	11-14-03	ADDED C79 & C80	KT	DL	11072
E	1-6-05	CHGD R49, R64, R74, R93, R94, R111-R114, R149, R215, R229, R230	KT	DL	11227



NOTES:

- COMPONENTS SHOWN WITH DASHED LINES TO BE INSTALLED ON OPPOSITE SIDE.
- # SEE PROGRAMMABLE JUMPER TABLE FOR STANDARD PLACEMENT.
- SEE SCHEMATICS: S8919-0563 (CONTROLLER BD.).
- SEE BOMS: 919-0563-050/-100/-200/-300/-400/-500.
- \* INDICATES SEE TABLE FOR COMPONENTS USED ON EACH ASSEMBLY.
- INSTALL P727 ON J727 & P728 ON J728 AS FOLLOWS:  
ON PINS 1-2 FOR FM ONLY  
ON PINS 3-4 FOR I8DC ONLY  
ON PINS 5-6 FOR FM + I8DC
- INSTALL P719 ON J719 AS FOLLOWS:  
ON PINS 1-2 FOR MANUAL DISABLE  
ON PINS 2-3 FOR AUTO DISABLE  
ON PIN 2 ONLY FOR TEST
- INSTALL P724 ON J724 & P725 ON J725 AS FOLLOWS:  
ON PINS 1-2 FOR I8DC  
ON PINS 2-3 FOR FM ONLY

REF	DES	919-0563-050	919-0563-100	919-0563-200	919-0563-300	919-0563-400	919-0563-500
C55	NOT USED	NOT USED	003-1054	003-1054	003-1054	003-1054	003-1054
C58	NOT USED	NOT USED	003-1054	003-1054	003-1054	003-1054	003-1054
C70	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	003-1054	003-1054
C71	NOT USED	NOT USED	003-1054	003-1054	003-1054	003-1054	003-1054
C72	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	003-1054	003-1054
D12	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
D13	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148	203-4148
D14	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
D25	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
D26	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148	203-4148
D28	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
D31	NOT USED	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148
D32	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148	203-4148
D33	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D34	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148
D36	NOT USED	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148
D37	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148	203-4148
D38	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D42	NOT USED	NOT USED	NOT USED	NOT USED	200-0019	200-0019	200-0019
D43	NOT USED	NOT USED	NOT USED	NOT USED	200-0019	200-0019	200-0019
D44	NOT USED	NOT USED	NOT USED	200-0019	200-0019	200-0019	200-0019
D45	NOT USED	NOT USED	200-0019	200-0019	200-0019	200-0019	200-0019
D48	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D50	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D52	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
J703	418-2602	418-2602	418-2602	418-2602	417-3402	417-3402	417-3402
J705	417-0230	417-0230	417-0230	417-0230	417-2401	417-2401	417-2401
J707	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
J710	417-0003	NOT USED	417-0003	417-0003	417-0003	417-0003	417-0003
Q6	NOT USED	NOT USED	210-7008	210-7008	210-7008	210-7008	210-7008
R102	NOT USED	100-1173	103-0426	103-2861	103-2326	103-1966	103-1966
R106	100-1051	100-1051	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R107	NOT USED	NOT USED	100-1051	100-1051	100-1051	100-1051	100-1051
R117	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R118	103-5761	103-5761	103-6813	103-6813	103-5761	103-5761	103-5761
R127	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R128	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R137	NOT USED	NOT USED	103-4024	103-4024	103-4024	103-4024	103-4024
R138	NOT USED	NOT USED	100-1041	100-1041	100-1041	100-1041	100-1041
R139	NOT USED	NOT USED	100-1041	100-1041	100-1041	100-1041	100-1041
R140	NOT USED	NOT USED	103-1062	103-1062	103-1062	103-1062	103-1062
R142	NOT USED	NOT USED	100-1031	100-1031	100-1031	100-1031	100-1031
R151	100-1031	100-1031	103-8255	103-8255	103-8255	103-8255	103-8255
R152	NOT USED	NOT USED	103-8255	103-8255	103-8255	103-8255	103-8255
R153	NOT USED	NOT USED	103-8255	103-8255	103-8255	103-8255	103-8255
R154	NOT USED	NOT USED	NOT USED	NOT USED	103-8255	103-8255	103-8255
R155	NOT USED	NOT USED	NOT USED	NOT USED	103-8255	103-8255	103-8255
R157	NOT USED	NOT USED	100-1041	100-1041	103-1056	103-1056	103-1056
R159	NOT USED	NOT USED	103-5365	103-5365	103-5115	103-5115	103-5115
R160	NOT USED	NOT USED	103-7505	103-7505	103-1761	103-1761	103-1761
R181	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R185	NOT USED	NOT USED	NOT USED	NOT USED	103-6555	103-6555	103-6555
R188	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R189	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R170	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R174	103-1062	103-1062	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R184	NOT USED	NOT USED	100-1031	100-1031	100-1031	100-1031	100-1031
R185	NOT USED	NOT USED	NOT USED	100-1031	100-1031	100-1031	100-1031
R186	NOT USED	NOT USED	NOT USED	NOT USED	100-1031	100-1031	100-1031
R187	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	100-1031	100-1031
R188	NOT USED	NOT USED	100-1013	100-1013	100-1013	100-1013	100-1013
R189	NOT USED	NOT USED	100-1013	100-1013	100-1013	100-1013	100-1013
R190	NOT USED	NOT USED	NOT USED	100-1013	100-1013	100-1013	100-1013
R191	NOT USED	NOT USED	NOT USED	NOT USED	100-1013	100-1013	100-1013
R192	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	100-1013	100-1013
R199	103-8064	103-8064	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R200	103-8064	103-8064	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R201	100-1041	100-1041	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R202	100-1041	100-1041	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R203	NOT USED	100-1013	103-1013	100-1013	100-1013	100-1013	100-1013
R204	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R205	NOT USED	100-1013	103-1013	100-1013	100-1013	100-1013	100-1013
R206	NOT USED	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R207	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R208	NOT USED	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R210	NOT USED	NOT USED	NOT USED	NOT USED	103-1062	103-1062	103-1062
R227	103-2945	103-1405	103-7505	103-4875	103-3655	103-2851	103-2851
R229	103-1155	103-5494	103-3245	103-2051	103-1155	103-1155	103-1155
R229	103-3326	103-1626	103-8255	103-5851	103-4125	103-3325	103-3325
R230	103-1476	103-7155	103-3405	103-2325	103-1745	103-1375	103-1375
R30	103-1062	103-1062	100-3951	100-3951	100-3951	100-3951	100-3951
R31	103-2495	103-2495	103-2051	103-2051	103-2051	103-2051	103-2051
R33	103-4024	103-4024	103-1331	103-1331	103-1331	103-1331	103-1331
R34	100-1041	100-1041	100-2041	100-2041	100-2041	100-2041	100-2041
R60	103-8064	103-3484	103-2151	103-1405	103-1025	103-8064	103-8064
R74	103-1062	103-4951	103-2435	103-1585	103-1155	103-9041	103-9041
R76	103-1024	103-1024	100-1041	100-1041	100-1041	100-1041	100-1041
R97	100-1373	103-2496	103-8255	103-5365	103-4325	103-3655	103-3655
R12	NOT USED	NOT USED	226-1051	226-1051	226-1051	226-1051	226-1051
U23	NOT USED	NOT USED	229-0033	229-0033	229-0033	229-0033	229-0033
U31	NOT USED	NOT USED	221-0339	221-0339	221-0339	221-0339	221-0339
U32	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	221-0393	221-0393
U33	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	221-0393	221-0393

PROGRAMMABLE JUMPER SETTINGS						
REF	DES	919-0563-050	919-0563-100	919-0563-200	919-0563-300	919-0563-400/500
P710	1-2	NOT USED	2-3	2-3	2-3	2-3
P711	1-2	NOT USED	2-3	2-3	2-3	2-3
P712	1-2	NOT USED	1-2	1-2	1-2	1-2
P713	2-3	NOT USED	1-2	1-2	1-2	1-2
P714	1-2	NOT USED	2-3	2-3	2-3	2-3
P715	2-3	NOT USED	1-2	1-2	1-2	1-2
P716	1-2	NOT USED	1-2	1-2	1-2	1-2
P717	1-2	NOT USED	1-2	1-2	1-2	1-2
P720	2-3	NOT USED	2-3	2-3	2-3	2-3
P721	2-3	NOT USED	2-3	2-3	2-3	2-3
P722	1-2	NOT USED	2-3	2-3	2-3	2-3
P723	5-6	NOT USED	5-6	5-6	5-6	5-6

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TOLERANCE (DECIMAL) U.O.S.  
.X ± .030 .XXX ± .005  
.XX ± .015 ANGLES ± 1°

DWN. BY  
KT 3-10-03  
DESIGNER(S)  
TH/JT 4-1-03  
PROJ. LEADER  
RFB.

MATERIAL  
SEE NOTE 4  
FINISH  
NEXT ASSY.

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217/224-9600 FAX 217/224-9607

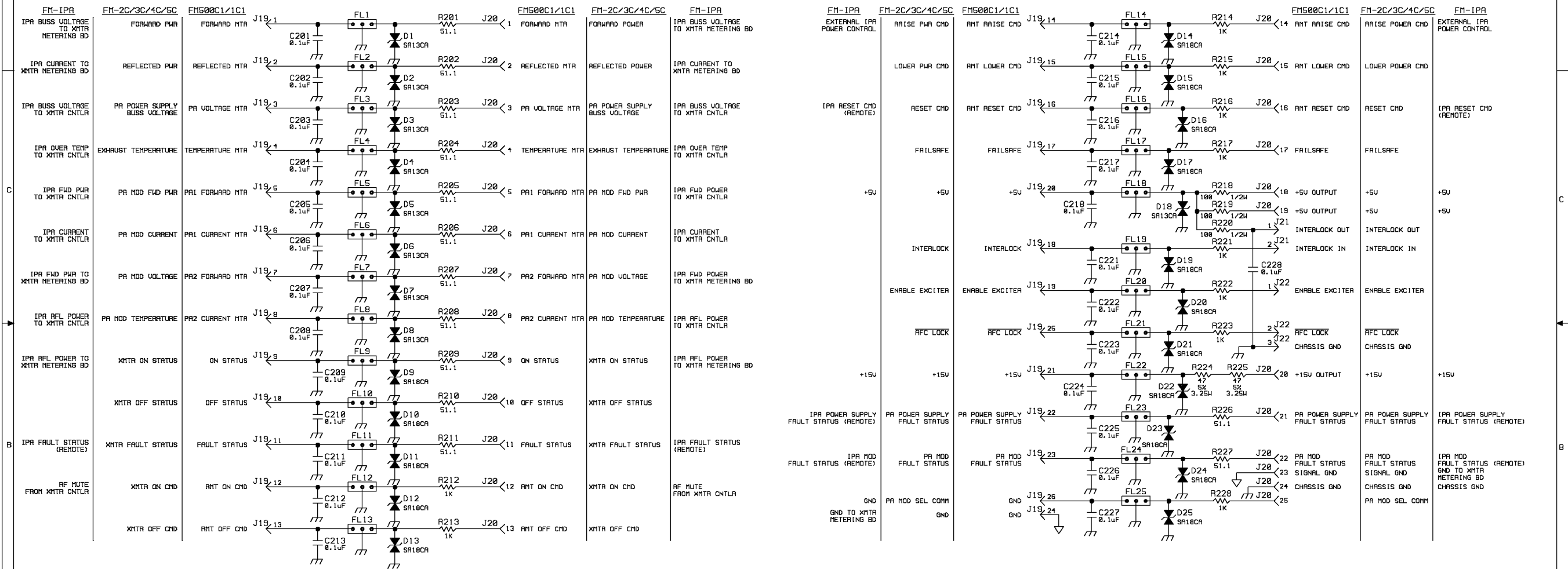
TITLE  
PCB ASSEMBLY  
CONTROLLER

TYPE SIZE DWG NO. 919-0563-050/100  
A D 919-0563-200/300/400/500

REV E

MODEL C SERIES SCALE 1/1 SHEET 1 OF 1

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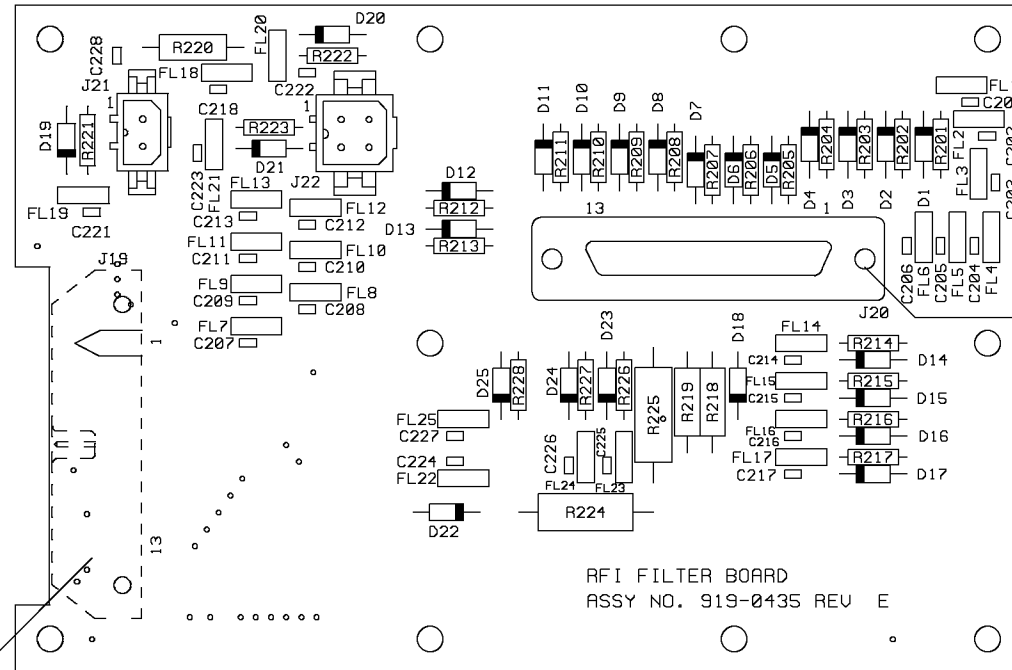


NOTES:

1. ALL RESISTORS IN OHMS; 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C228, D25, FL25, J22, R228.
3. COMPONENTS NOT USED: C219, C220, J1-J18
4. SEE ASSEMBLY: ABS19-0435.

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TOLERANCE (DECIMAL) U.O.S. .X ± .038 .XX ± .005 .XX ± .015 ANGLES ± 1°		PROJ. LEADER MBS 1-24-97 MFG.	FINISH SEE-DWG-RAG32-0000 NEXT ASSY.	
		TITLE SCHEMATIC RFI FILTER BOARD		REV B
		MODEL FM-IPA		SCALE NONE
				SHEET 1 OF 1



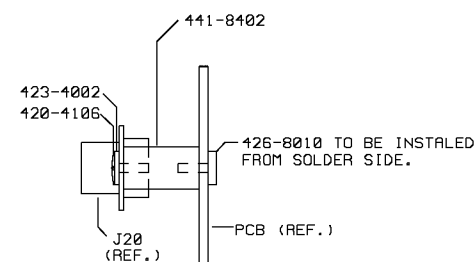
SEE DETAIL "A"

NOTES:

1. SEE SCHEMATIC SB919-0435.


J19 IS SOLDERED ON  
TO THE BACK SIDE

519-0435

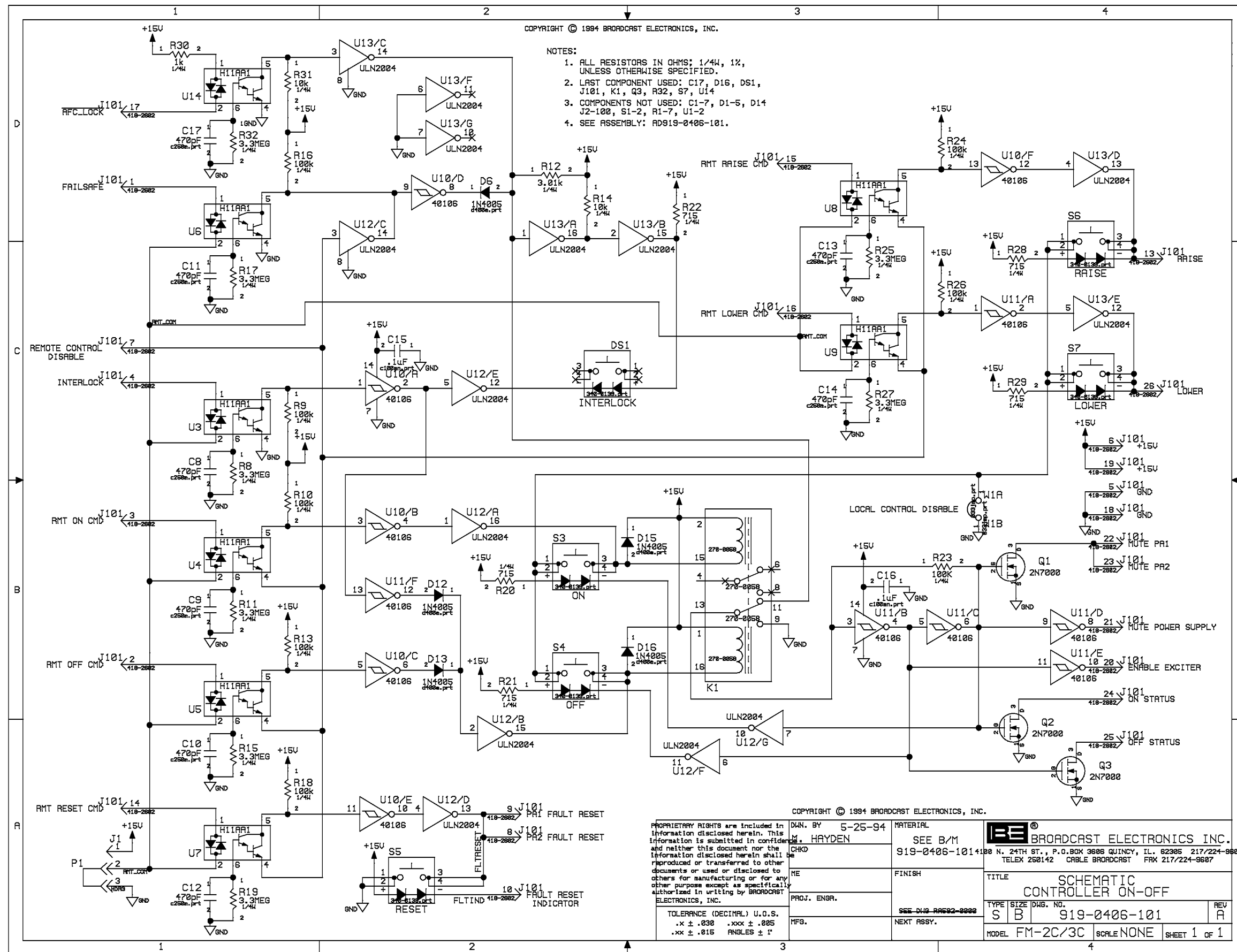


DETAIL "A"  
TYPICAL 2 PLCS.

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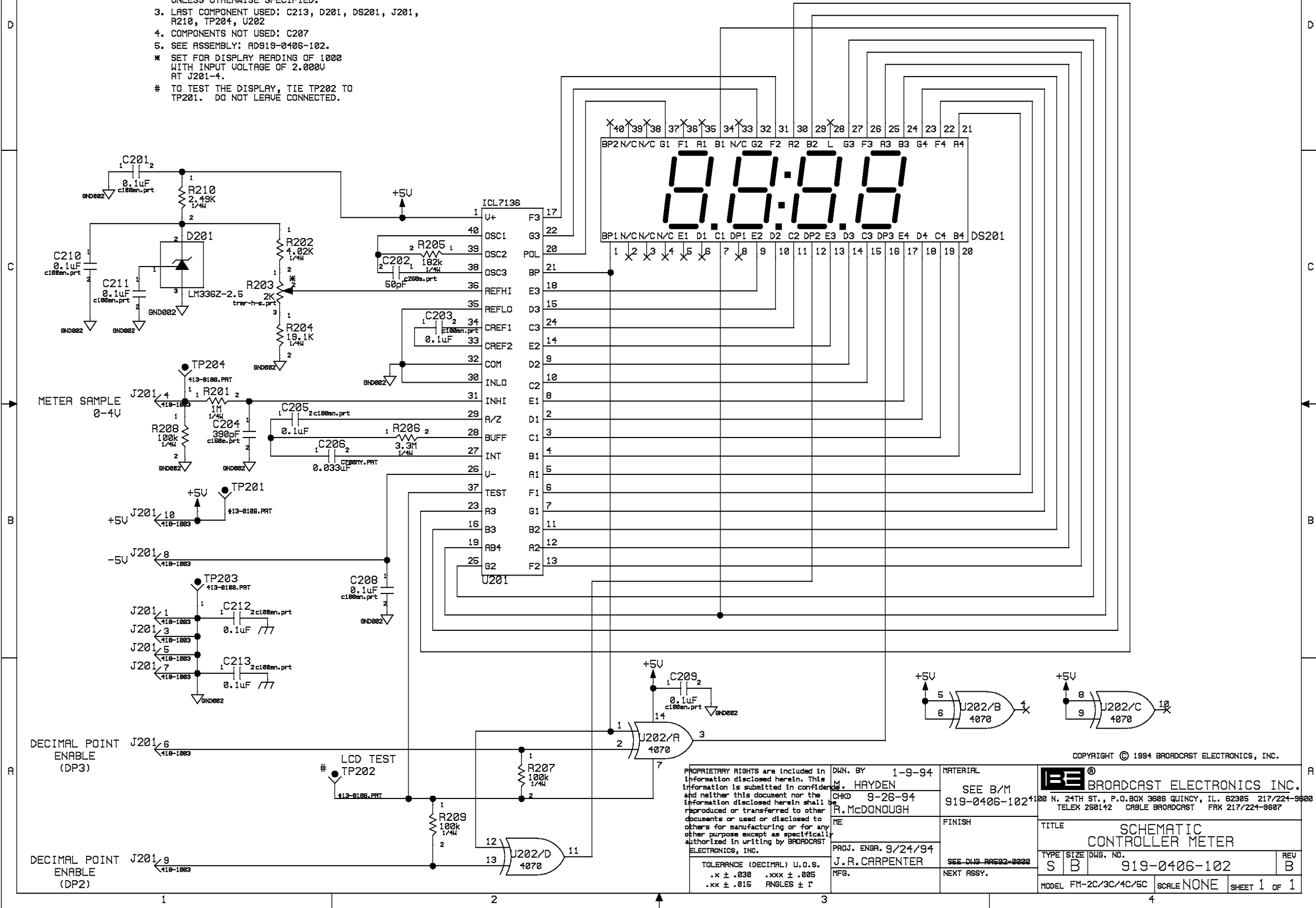
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		PROJ. LEADER				
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°		MFG.	NEXT ASSY.	TITLE PCB ASSEMBLY RFI FILTER BOARD		
				TYPE A	SIZE B	DWG No. 919-0435
				MODEL FM-IPA	SCALE 1/1	SHEET 1 OF 1
				REV E		



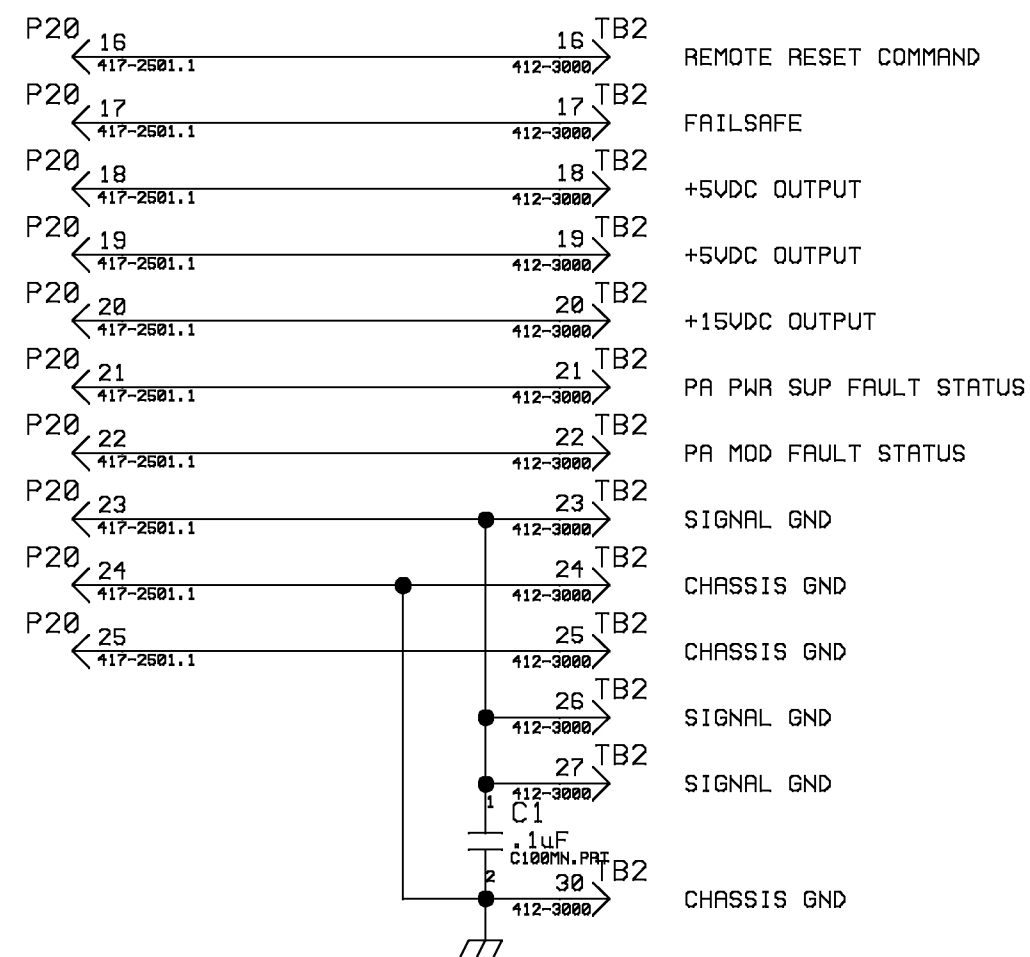
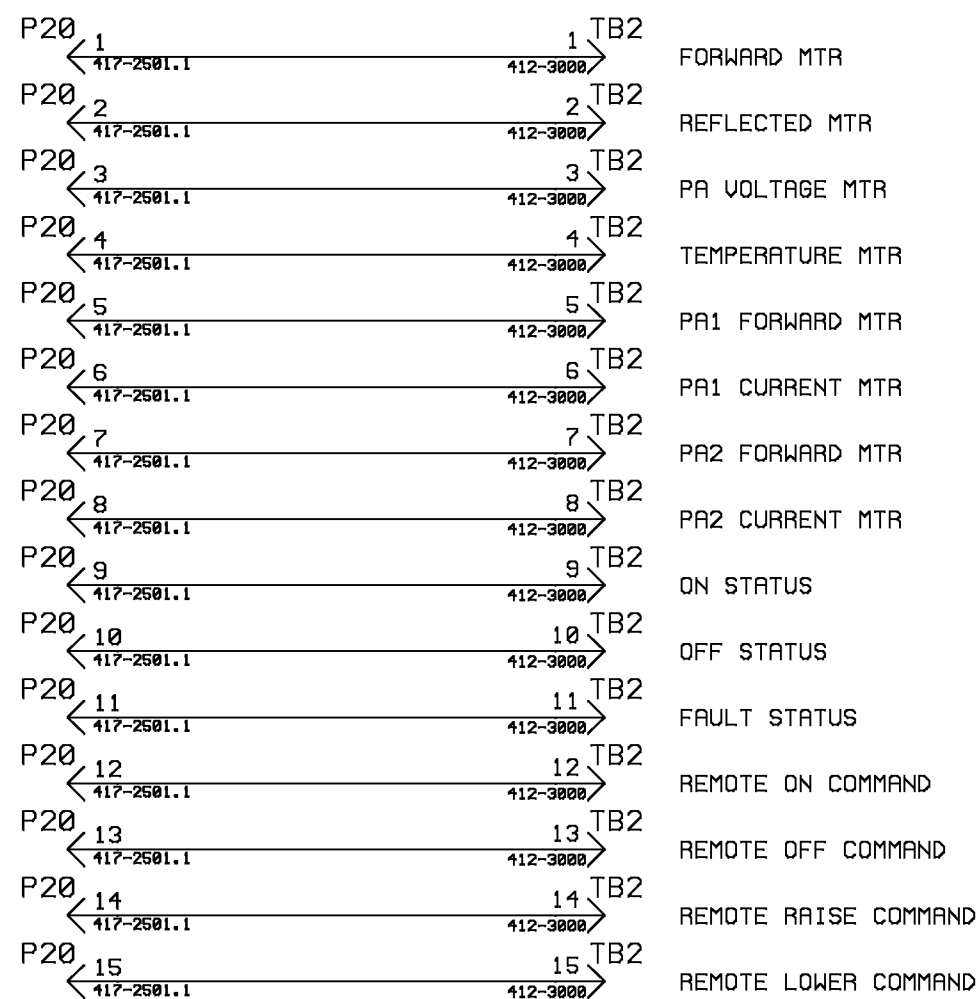


NOTES:

1. ALL REFERENCE DESIGNATORS START AT 201.
  2. ALL RESISTORS IN OHMS; 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
  3. LAST COMPONENT USED: C213, D201, DS201, J201, R210, TP204, U202
  4. COMPONENTS NOT USED: C207
  5. SEE ASSEMBLY: AD919-0406-102.
- \* SET FOR DISPLAY READING OF 1000 WITH INPUT VOLTAGE OF 2.000V AT J201-4.
- # TO TEST THE DISPLAY, TIE TP202 TO TP201. DO NOT LEAVE CONNECTED.




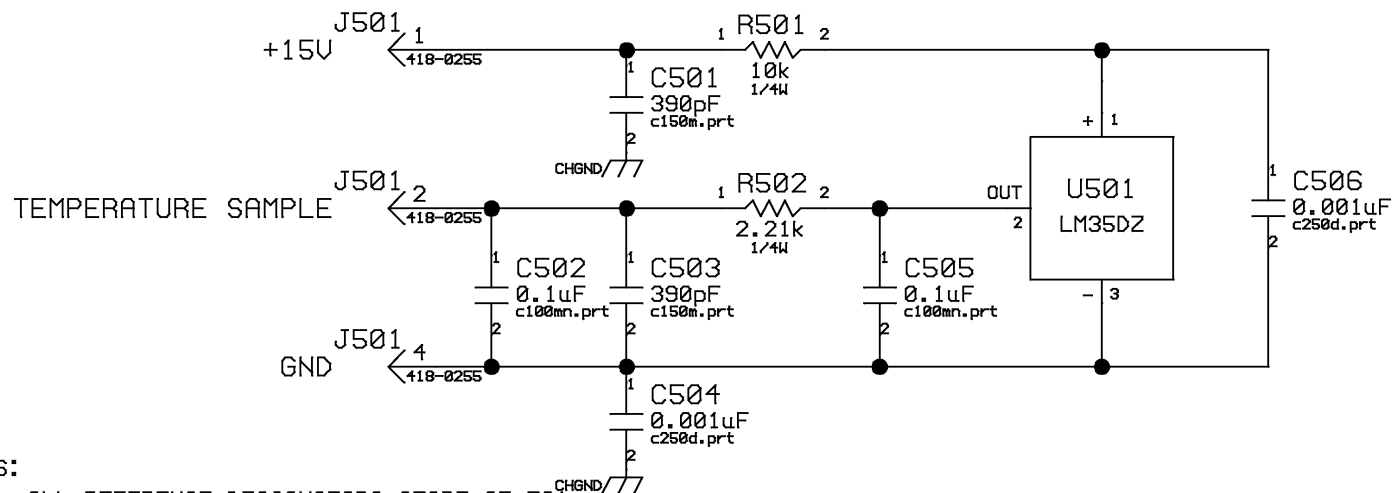
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TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°		FINISH SEE DWG. ASSY-0000 NEXT ASSY.		TITLE SCHEMATIC CONTROLLER METER	
MODEL FM-2C/3C/4C/5C		SCALE NONE		SHEET 1 OF 1	



NOTES:  
1. SEE ASSEMBLY: AD919-0406-104.

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	CHKD 9-26-94 R. McDONOUGH	FINISH		
	ME	SEE DWG RA592-0000		
	PROJ. ENGR. 9-26-94 J. R. CARPENTER	NEXT ASSY.		
	MFG.			
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°	TITLE SCHEMATIC REMOTE I/F BARRIER STRIP			
	TYPE S	SIZE B	DWG. NO. 919-0406-104	REV B
	MODEL FM-3C	SCALE NONE	SHEET 1 OF 1	



NOTES:

1. ALL REFERENCE DESIGNATORS START AT 501.
2. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT USED: C506, J501, R502, U01
4. COMPONENTS NOT USED:
5. SEE ASSEMBLY: AD919-0406-105.

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DWN. BY 5-25-94

M. HAYDEN

CHKD

ME

PROJ. ENGR.

MFG.

MATERIAL

SEE BOM

919-0406-105

FINISH

SEE DWG RA592-0000

NEXT ASSY.



BROADCAST ELECTRONICS INC.

4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9600  
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE

SCHEMATIC  
TEMPERATURE SENSOR PCB

TYPE SIZE DWG. NO.

S

A

919-0406-105

REV

A

MODEL FM-3C

SCALE NONE

SHEET 1 OF 1

TOLERANCE (DECIMAL) U.O.S.

.X ± .030 .xxx ± .005

.xx ± .015 ANGLES ± 1°

D



8

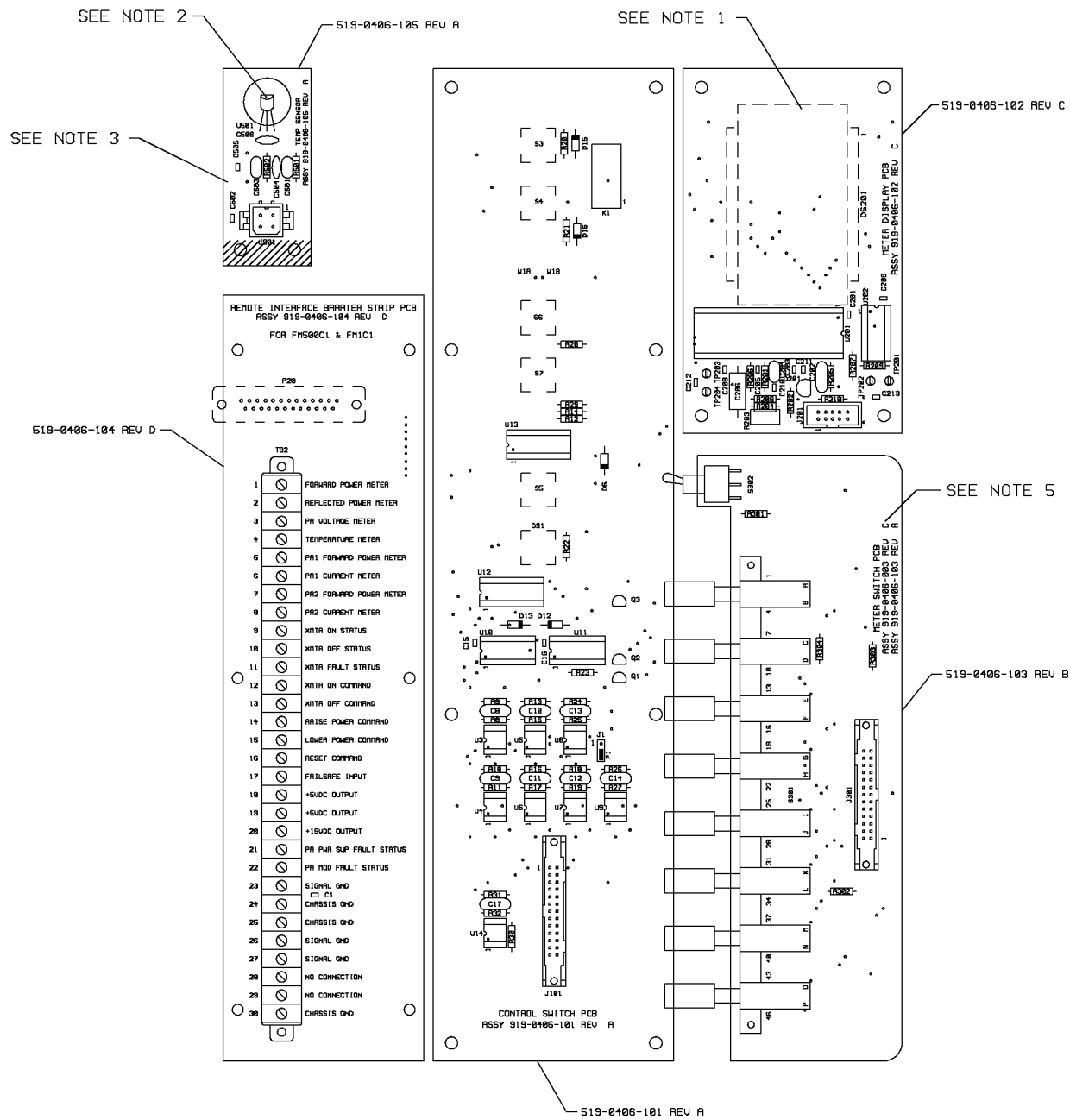
A

2

C

2

1

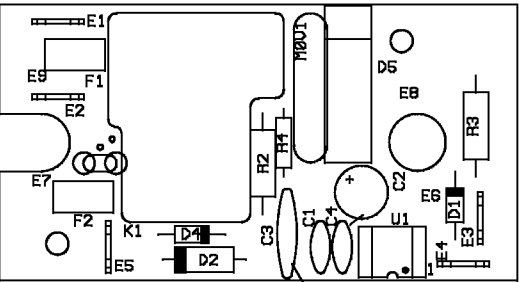


- NOTES:
1. ALL PARTS SHOWN WITH DASHED LINES TO BE MOUNTED FROM OPPOSITE SIDE.
  2. U501 TO BE CENTERED IN .650 HOLE WITH ROUNDED SIDE OF DEVICE POINTING UP.
  3. TEMP SENSOR PCB #919-0406-105 IS TO RECEIVE CONFORMAL COATING AFTER ASSEMBLY. SEE COATING INSTRUCTIONS.
  4. SEE SCHEMATICS: SB919-0406-003, SB919-0406-101, SB919-0406-102, SB919-0406-103, SB919-0406-104, & SA919-0406-105.
  5. COMPONENT R302, R303 & R304 ARE NOT USED ON ASSEMBLY 919-0406-003C.

- COATING INSTRUCTIONS: (919-0406-105 PCB ONLY)
1. MASK BODY OF DEVICE U501 COMPLETELY. INSERT 418-0240 DUMMY PLUG INTO J501. MASK BOTH SIDES OF PCB AT MOUNTING HOLES AS SHADED.
  2. APPLY ONE COAT OF URETHANE CONFORMAL COATING (700-0126), TO BOTH SIDES OF PCB, PER VENDOR INSTRUCTIONS; THEN REMOVE MASKING.
  3. ALLOW 15 MINUTES DRYING TIME.

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TITLE PCB ASSEMBLY CONTROL BREAKAWAY		TYPE SIZE Dwg No. A D 919-0406-003 919-0406-101/105		REV E	
MODEL FMS00C1/1C1 FM-2C/3C/4C/5C		SCALE 1/1		SHEET 1 OF 1	

SHEET 1 OF

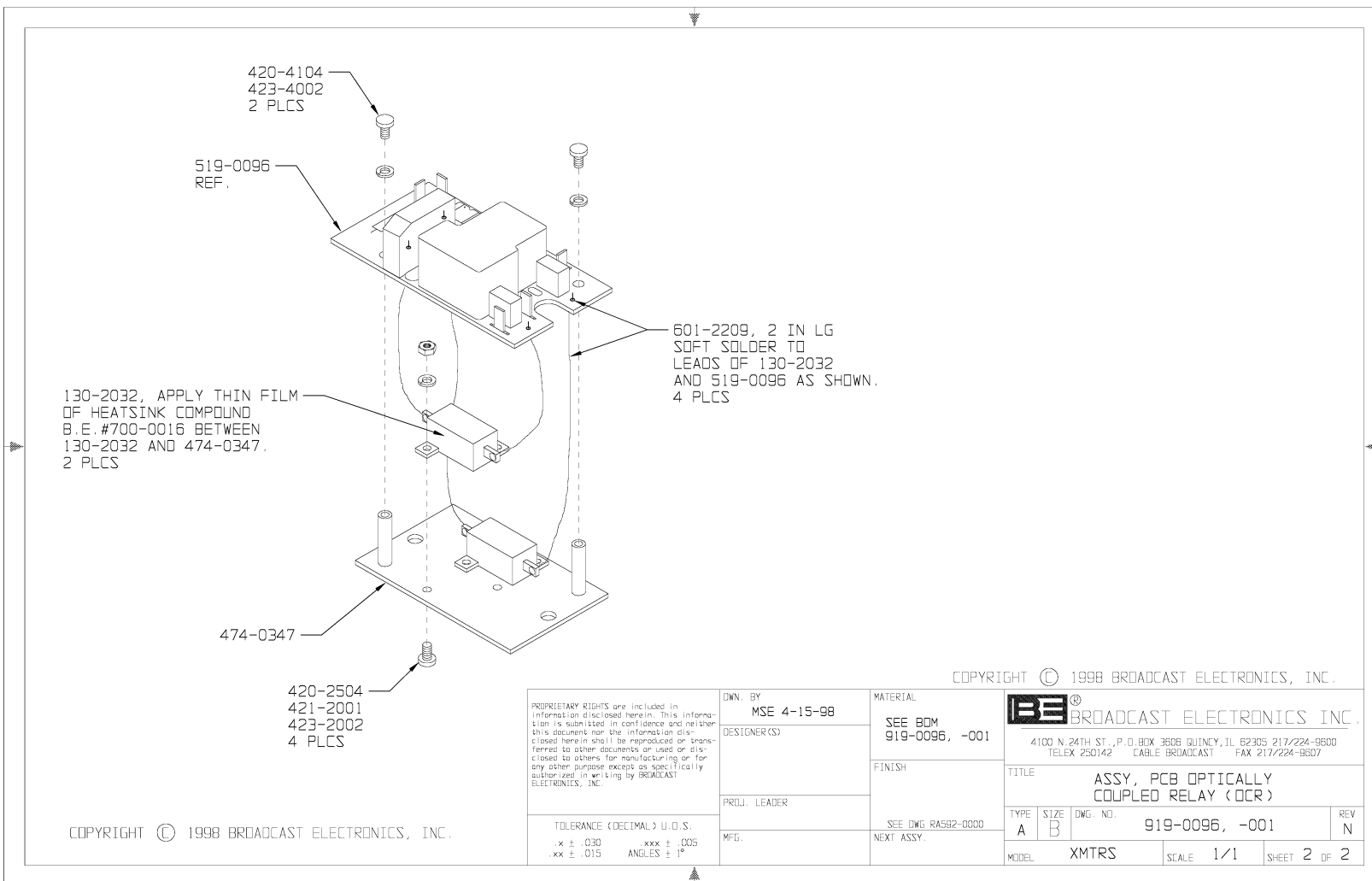


REMOVE R2 AND C3 FROM 919-0096  
TO MAKE 919-0096-001

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	DESIGNER(S)							
	PROJ. LEADER J.TUCKER 7-14-86		FINISH  SEE DWG RA592-0000		TITLE PCB ASSEMBLY OPTICALLY COUPLED RELAY BD.			
	MFG. J.STEINKAMP 7-14-86		NEXT ASSY.		TYPE A	SIZE B	DWG No. 919-0096, 919-0096-001	REV N
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°				MODEL TRANSMITTERS		SCALE 1=1	SHEET 1 OF 2	

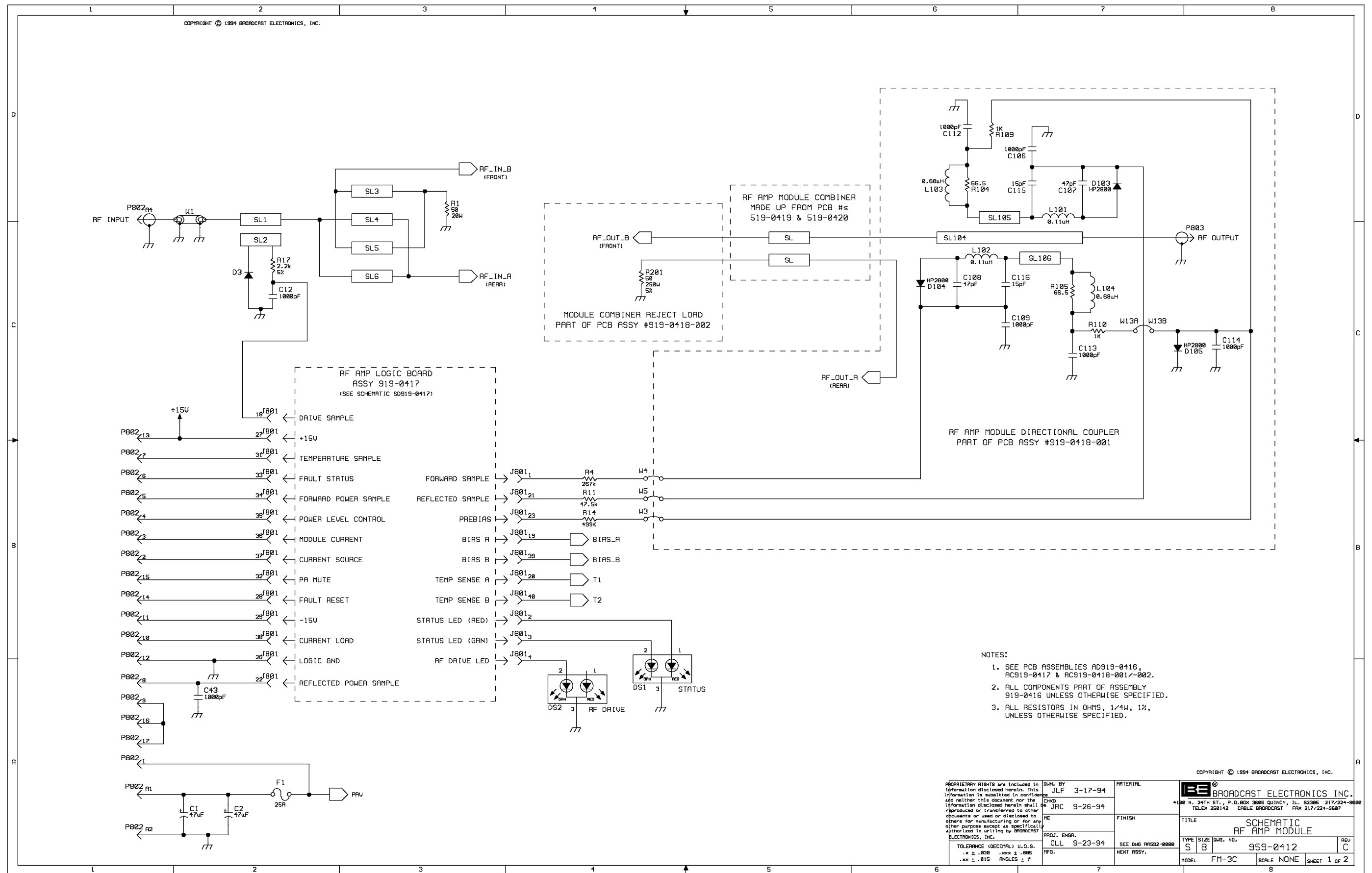


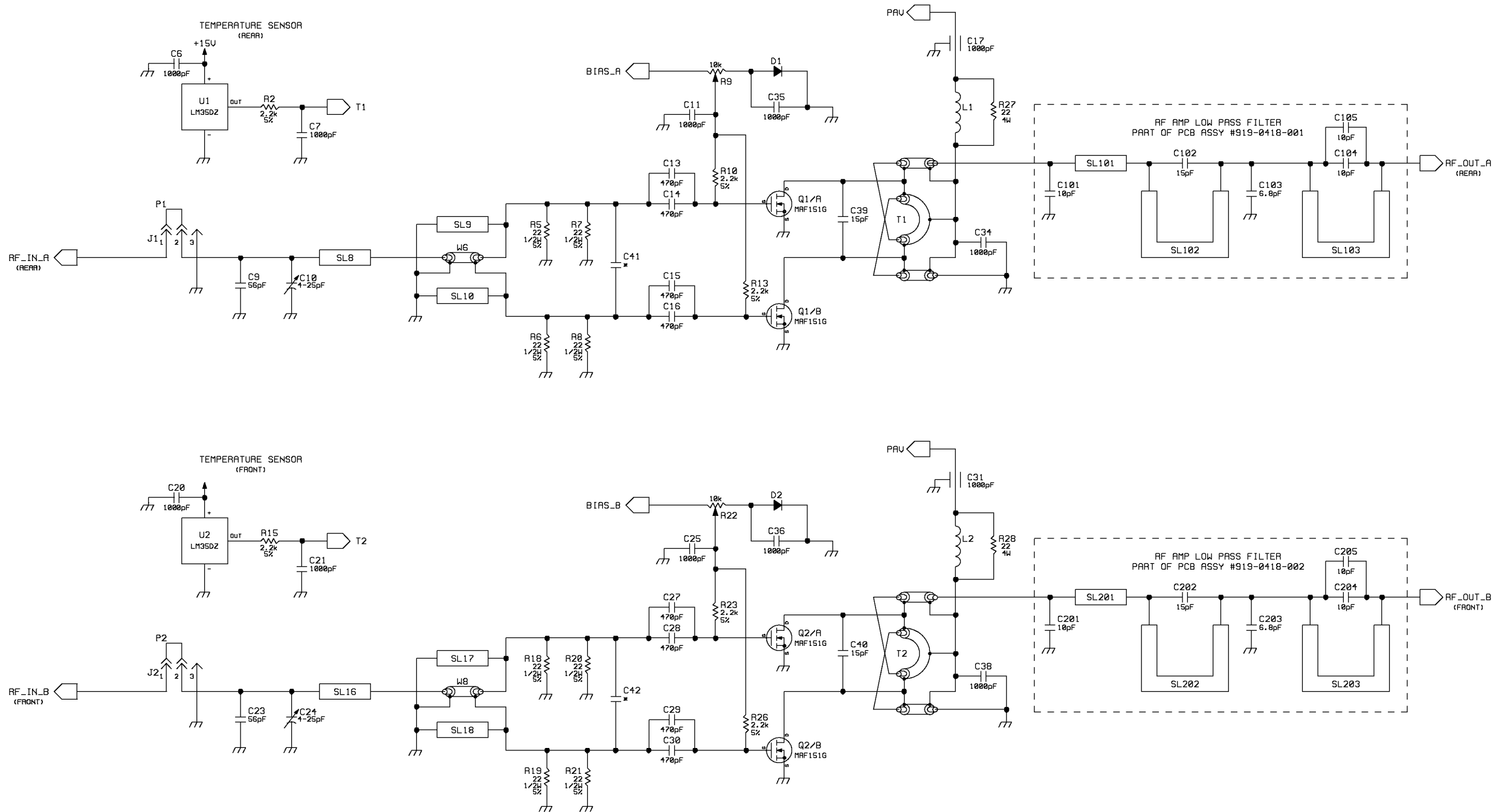


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		DESIGNER(S)	FINISH	TITLE ASSY, PCB OPTICALLY COUPLED RELAY (OCR)			
TOLERANCE (DECIMAL) U.D.S. x ± .030      xxx ± .005 xx ± .015      ANGLES ± 1°		PROJ. LEADER	SEE DWG RA592-0000	TYPE A	SIZE B	DWG. NO. 919-0096, -001	REV N
MFG.		NEXT ASSY.		MODEL XMTRS	SCALE 1/1	SHEET 2 OF 2	

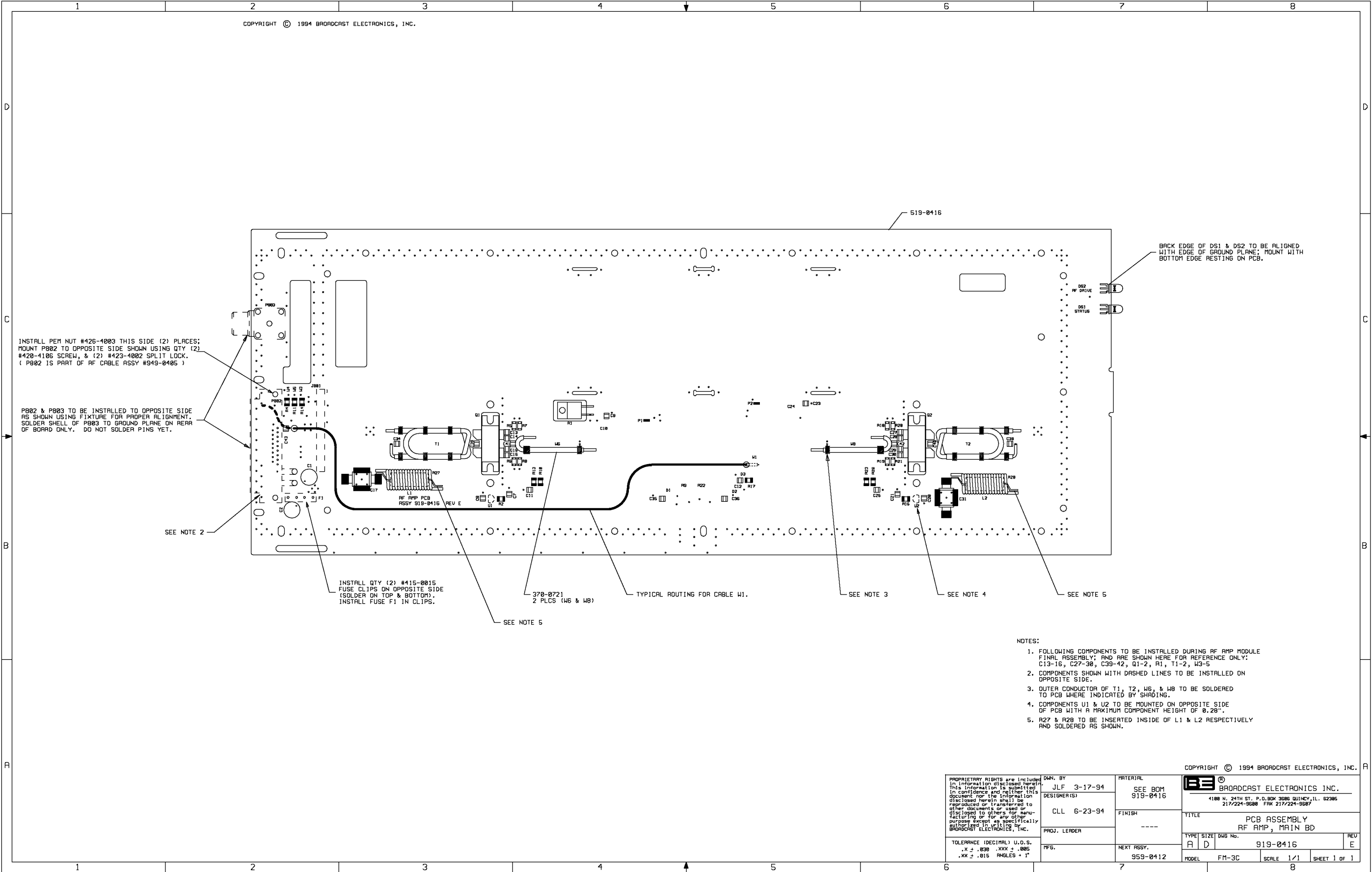
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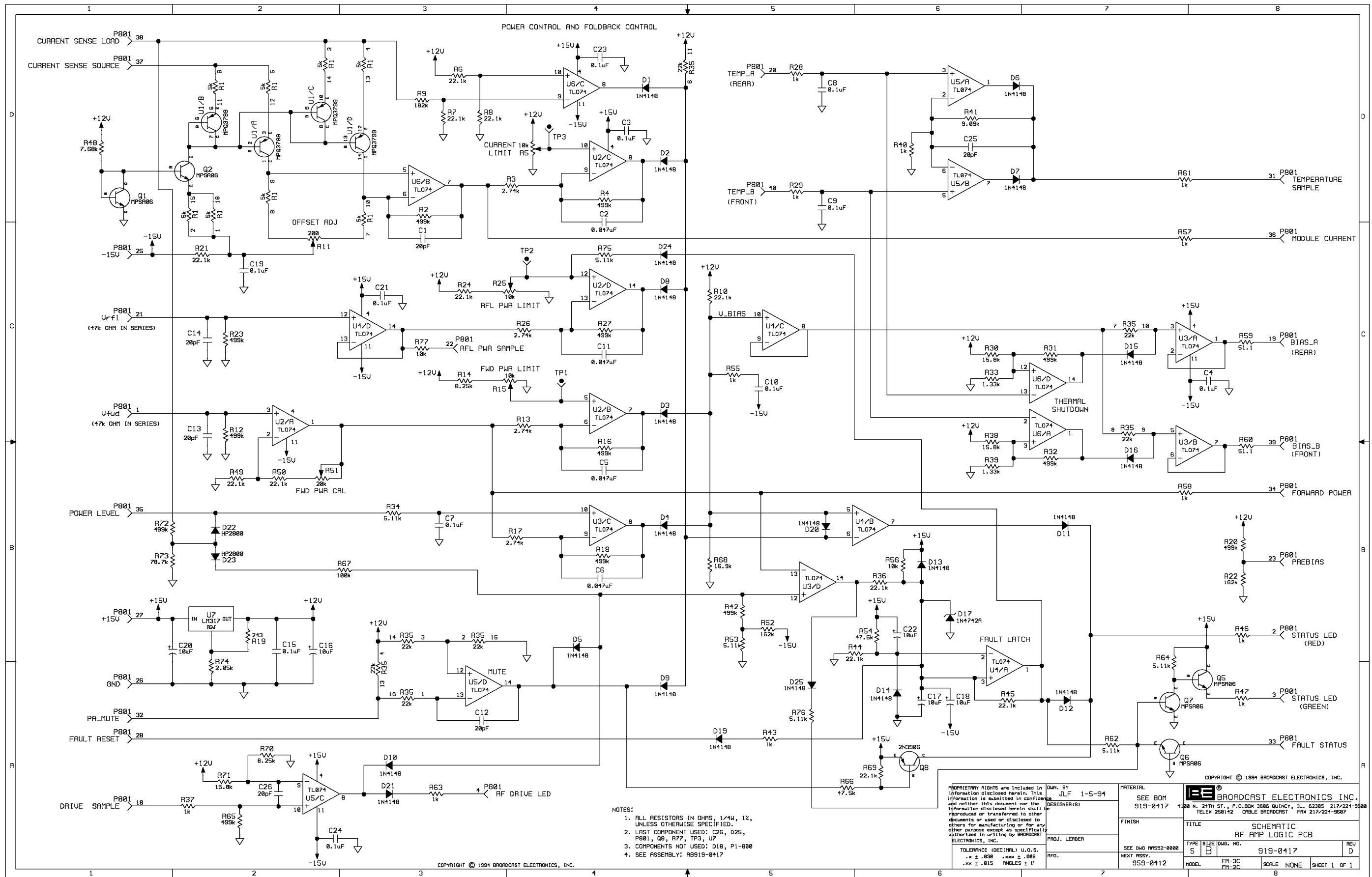
\* VALUE FOR C41 AND C42 TO BE FACTORY  
SELECTED DURING MODULE TEST.

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TOLERANCE (DECIMAL) U.O.S. XX ± .030    XXX ± .005 XX ± .015    ANGLES ± 1°				BROADCAST ELECTRONICS, INC. 1100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/221-9500 TELEX 250142 CABLE BROADCAST FAX 217/221-9507				TITLE SCHEMATIC RF AMP MODULE			
REV C				TYPE S SIZE B DWG. NO. 959-0412				MODEL FM-3C SCALE NONE SHEET 2 OF 2			



1. SEE SCHEMATIC SB959-0412.
2. P803 & R201 SHOWN FOR REFERENCE ONLY;  
TO BE INSTALLED DURING RF AMP MODULE  
FINAL ASSEMBLY.
3. JUMPER WIRE W13 TO BE INSTALLED ON SOLDER  
SIDE USING WIRE 601-0022 INSULATED WITH  
TEFLON TUBING 693-0220.

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	ME PROJ. ENGR. 1-10-94 CL LANGNER MFG.	FINISH <del>SEE DWG RA652-0003</del> NEXT ASSY. 959-0412	
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± .01°	MODEL FM-3C SCALE 1/1 SHEET 1 OF 1		



- NOTES:
1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
  2. LAST COMPONENT USED: C26, D25, P801, Q8, R77, TP3, U7
  3. COMPONENTS NOT USED: D18, P1-800
  4. SEE ASSEMBLY: ABS19-0417

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DESIGNER(S)  
JLF 1-5-94

PROJ. LEADER  
RFG.

TOLERANCE (DECIMAL) U.O.S.  
xx ± .030    xxx ± .085  
xx ± .015    ANGLES ± 1°

DATE  
1-5-94

REV  
D

SEE BOM  
919-0417

SEE DWG RFS92-0000

NEXT ASSY.  
959-0412

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**BROADCAST ELECTRONICS, INC.**  
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600  
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

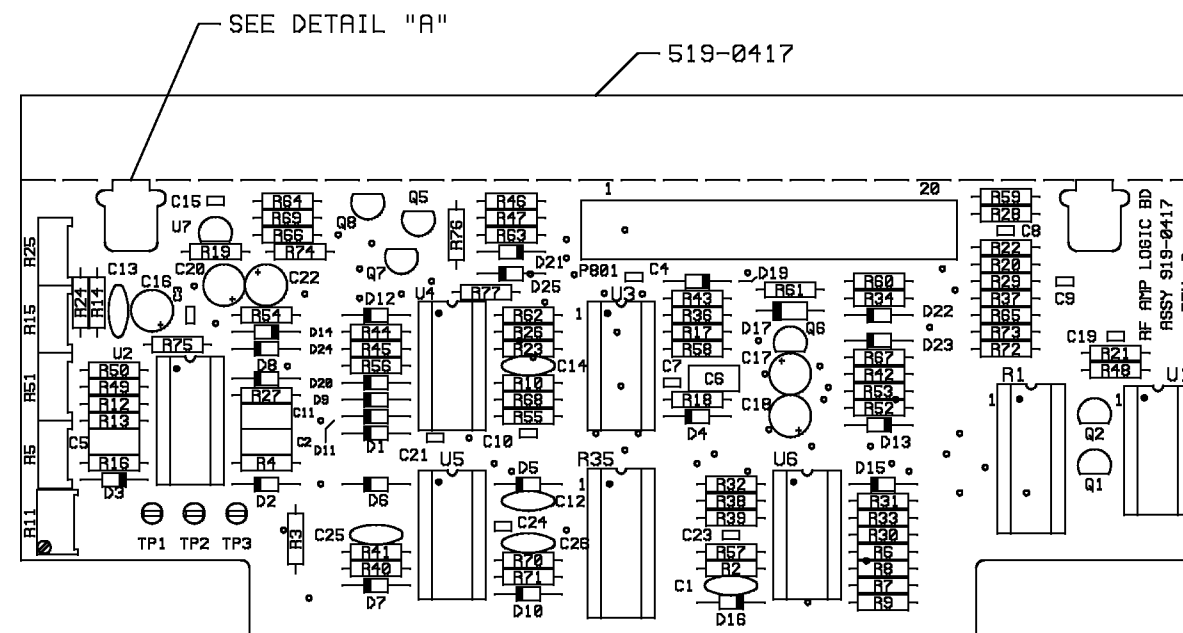
TITLE  
SCHEMATIC  
RF AMP LOGIC PCB

TYPE SIZE DWG. NO.  
S B 919-0417

MODEL  
FM-3C  
FM-2C

SCALE  
NONE

SHEET 1 OF 1



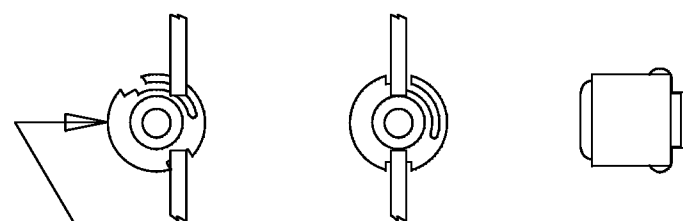
NOTES:

1. SEE SCHEMATIC SB919-0417

SIDE VIEW  
START

SIDE VIEW  
FINISH


FRONT VIEW

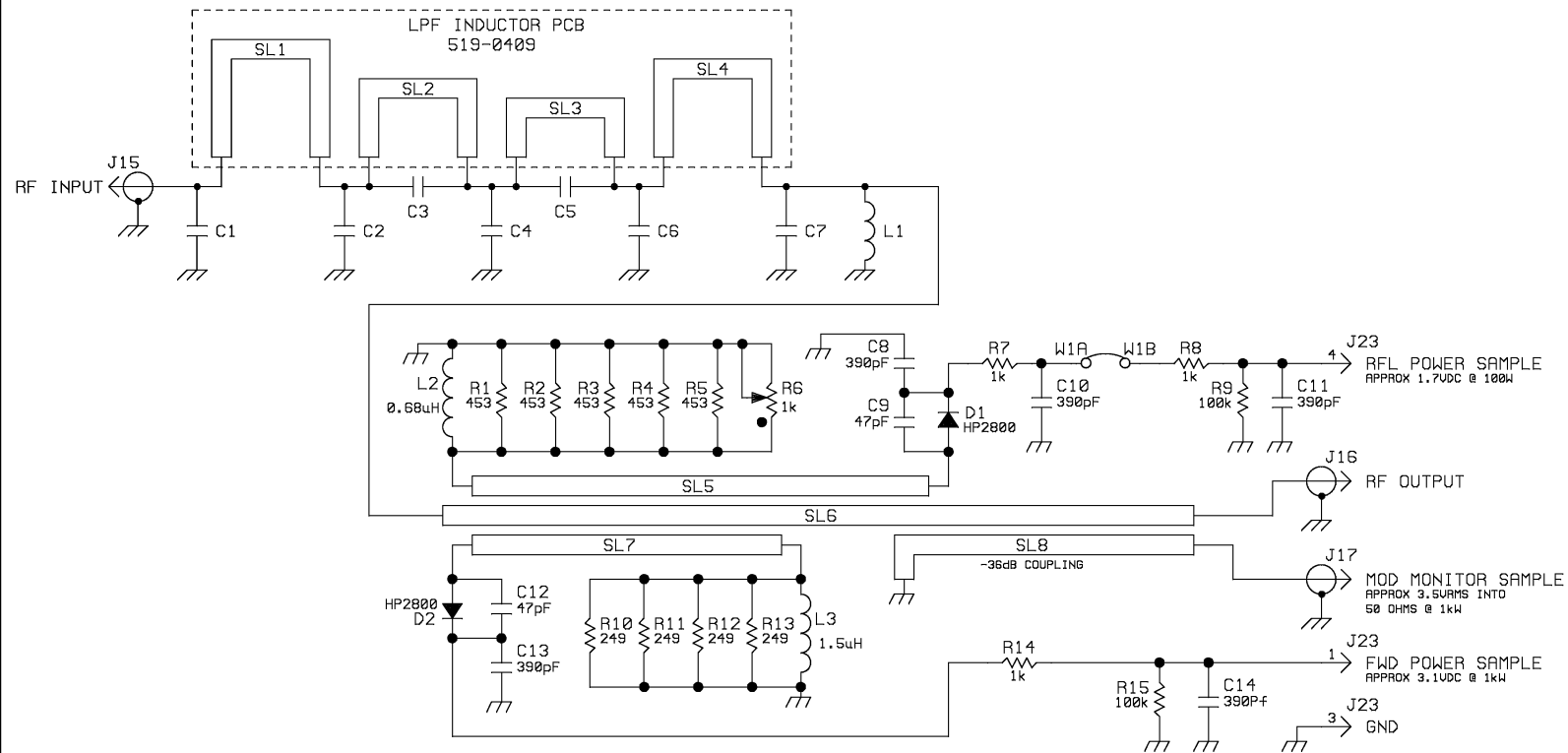


PRESS #421-6908 SHEETEDGE FASTENER INTO CUTOUT UNTIL SNAPPED INTO PLACE AS SHOWN

DETAIL "A"  
2 PLCS

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	DESIGNER(S) C.LANGNER 9-23-94		TITLE PCB ASSEMBLY RF AMP LOGIC BOARD			
	PROJ. LEADER R.CARPENTER 9-26-94	FINISH SEE DWG RA592-0000	TYPE A	SIZE B	DWG No. 919-0417	REV D
	MFG.	NEXT ASSY. 959-0412	MODEL FM-3C		SCALE 1/1	SHEET 1 OF 1
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°						



# NOTES:

- "SL" INDICATES ETCHED STRIPLINE ON PCB.
- C1-C7 ARE ETCHED ON PCB.
- ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
- SEE PCB ASSEMBLY DRAWING AD919-0405.

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TOLERANCE (DECIMAL) U.O.S.  
 .x ± .030 .xxx ± .005  
 .xx ± .015 ANGLES ± 1°

DWN. BY  
JLF 9-23-92

CHKD  
ME

PROJ. ENGR.  
GNM 9-24-92

MFG.

MATERIAL

FINISH

SEE DWG RA592-0000

NEXT ASSY.

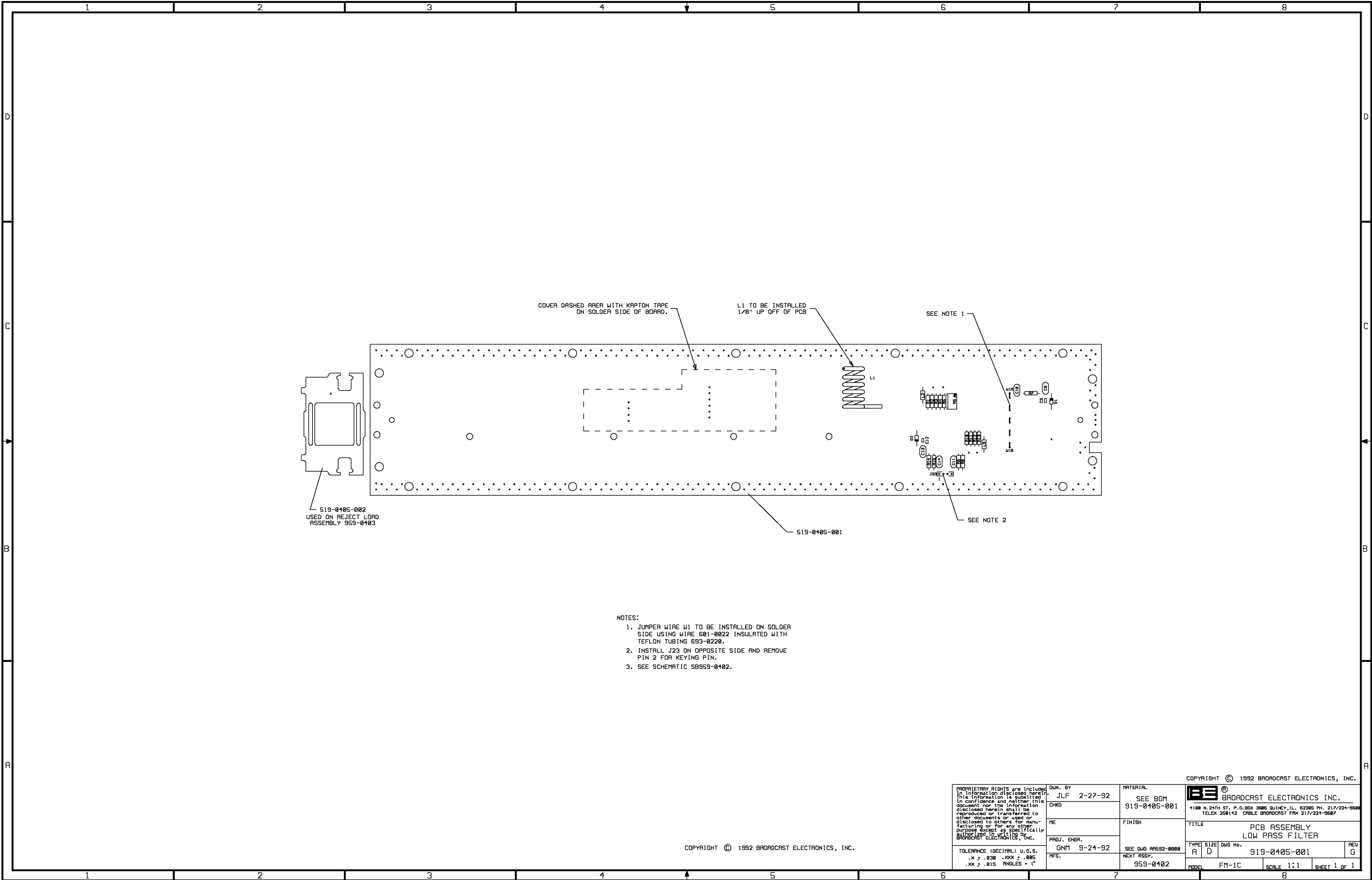
**BE** BROADCAST ELECTRONICS INC.  
 4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9600  
 TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC  
 LOW PASS FILTER ASSEMBLY

TYPE S SIZE B DWG. NO. 959-0402 REV C

MODEL FM-1C/FM-500C SCALE NONE SHEET 1 OF 1

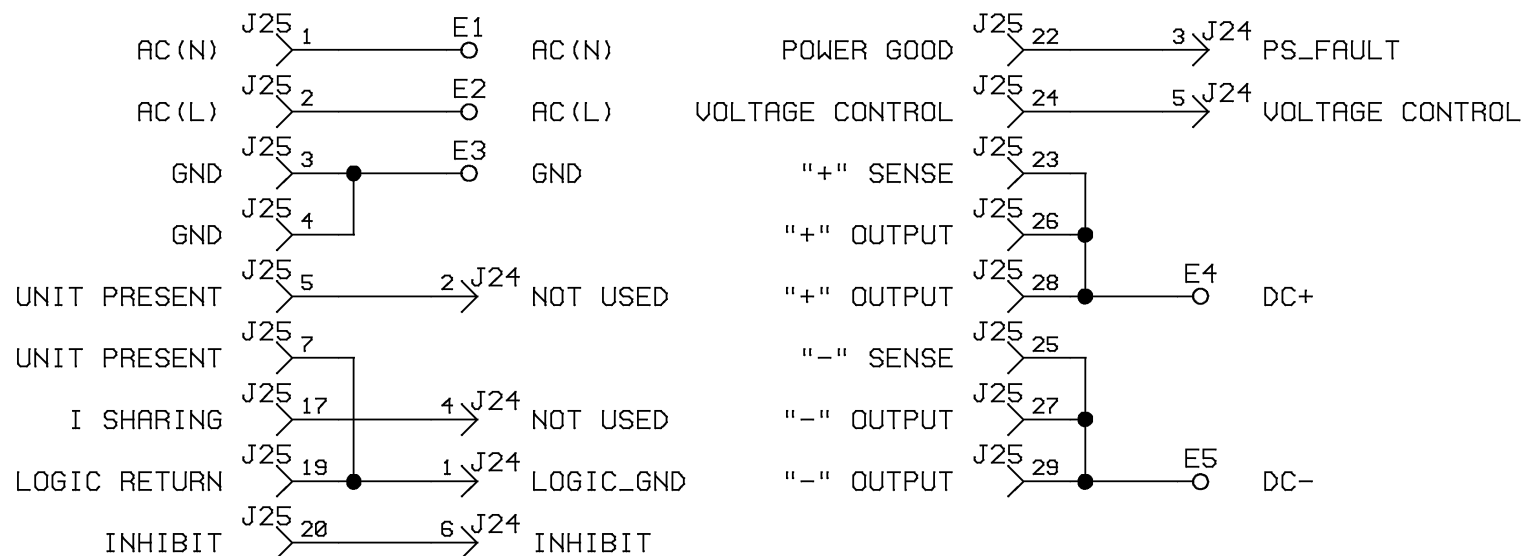




- NOTES:
1. JUMPER WIRE W1 TO BE INSTALLED ON SOLDER SIDE USING WIRE 601-0022 INSULATED WITH TEFLON TUBING 693-0220.
  2. INSTALL J23 ON OPPOSITE SIDE AND REMOVE PIN 2 FOR KEYING PIN.
  3. SEE SCHEMATIC SB959-0402.

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		CHKD			
		ME	FINISH	TITLE PCB ASSEMBLY LOW PASS FILTER	
		PROJ. ENGR. GNM 9-24-92	SEE DWG A9592-0008 NEXT ASSY. 959-0402		
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°				TYPE A	SIZE D
				DWG NO. 919-0405-001	REV G
				MODEL FM-1C	SCALE 1:1
					SHEET 1 OF 1



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TOLERANCE (DECIMAL) U.O.S.  
 .x ± .030 .xxx ± .005  
 .xx ± .015 ANGLES ± 1°

DWN. BY  
 JLF 5-2-94  
 DESIGNER(S)  
 JRC 6-23-94  
 PROJ. LEADER

MFG.

MATERIAL  
 SEE BOM  
 919-0423

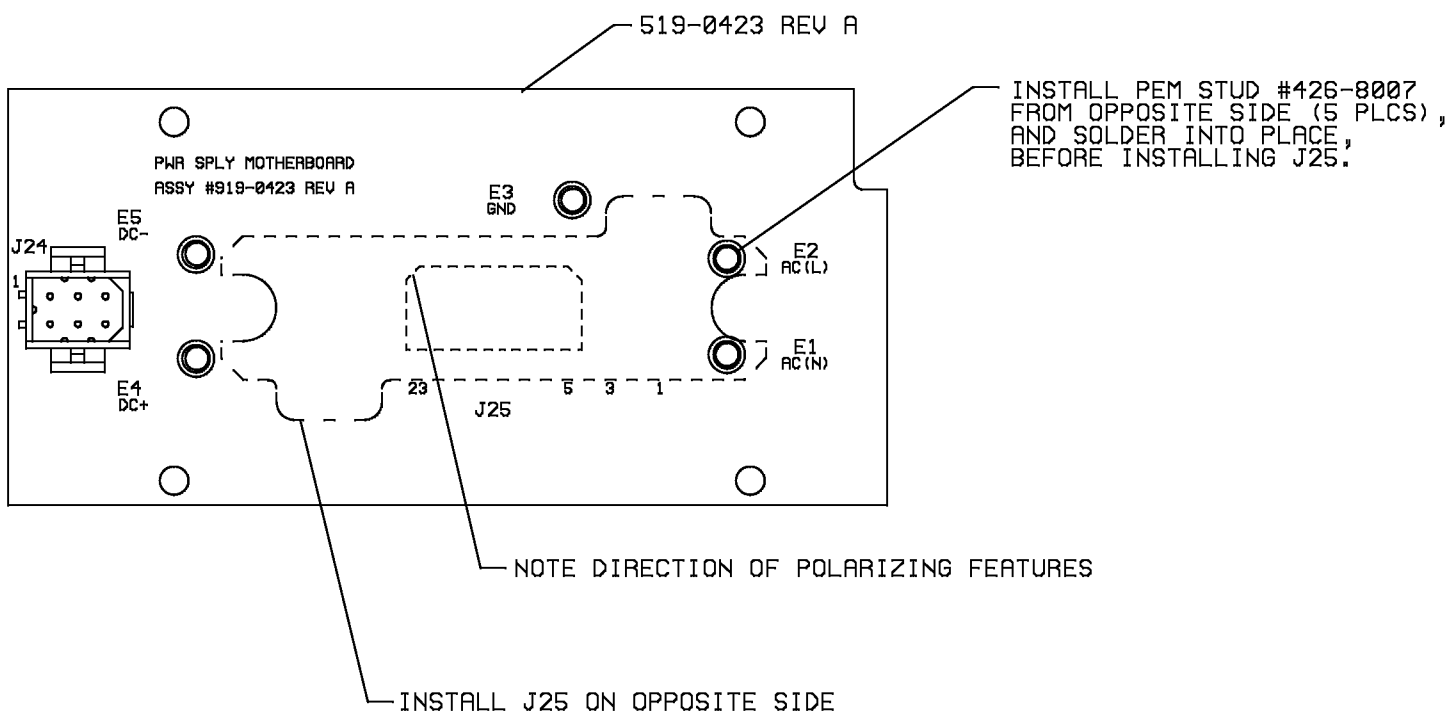
FINISH  
 SEE DWG RA592-0000  
 NEXT ASSY.

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TITLE  
 SCHEMATIC  
 POWER SUPPLY MOTHERBOARD

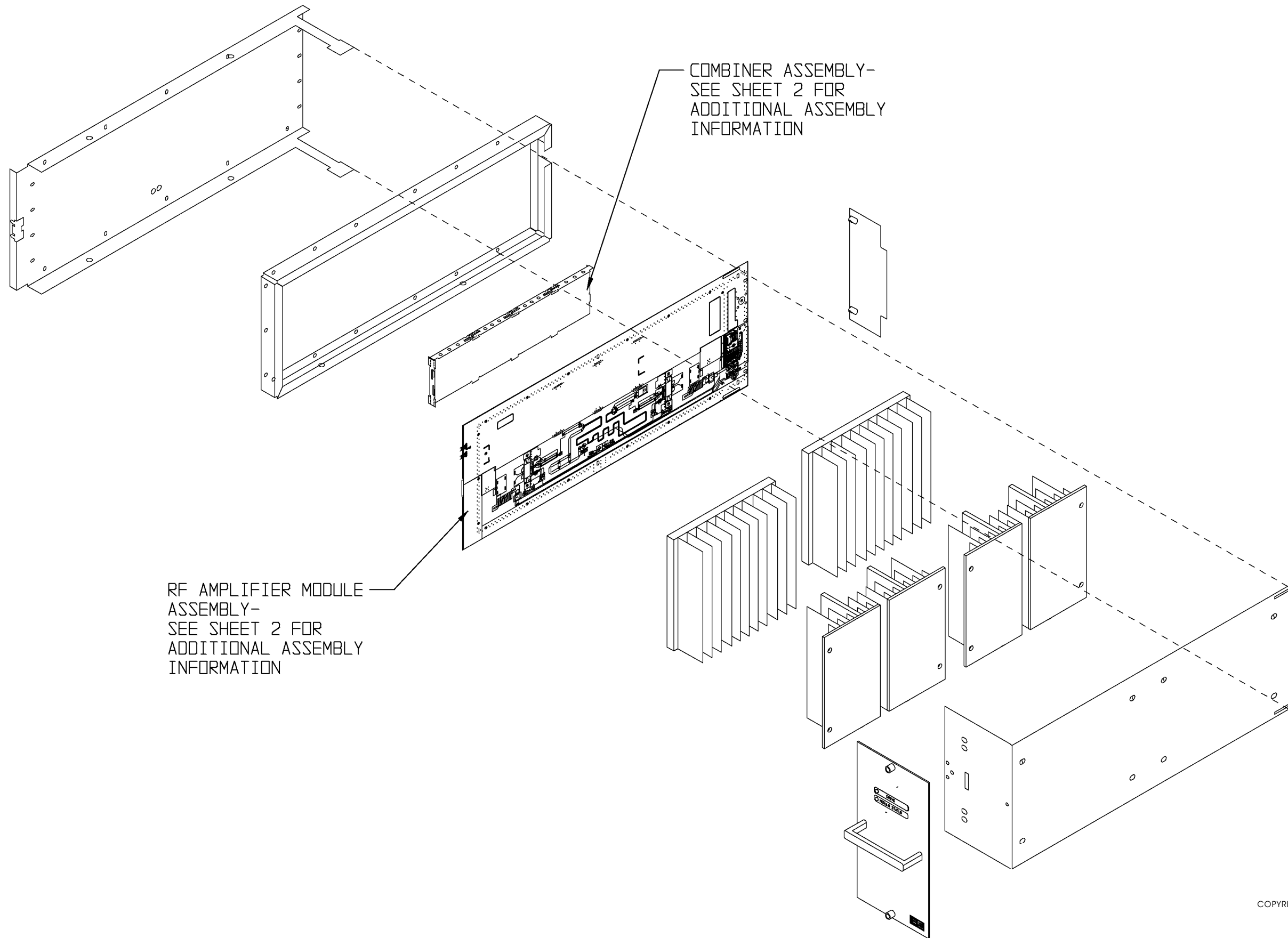
TYPE S	SIZE A	DWG. NO. 919-0423	REV A
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MODEL FM-1C1	SCALE NONE	SHEET 1 OF 1
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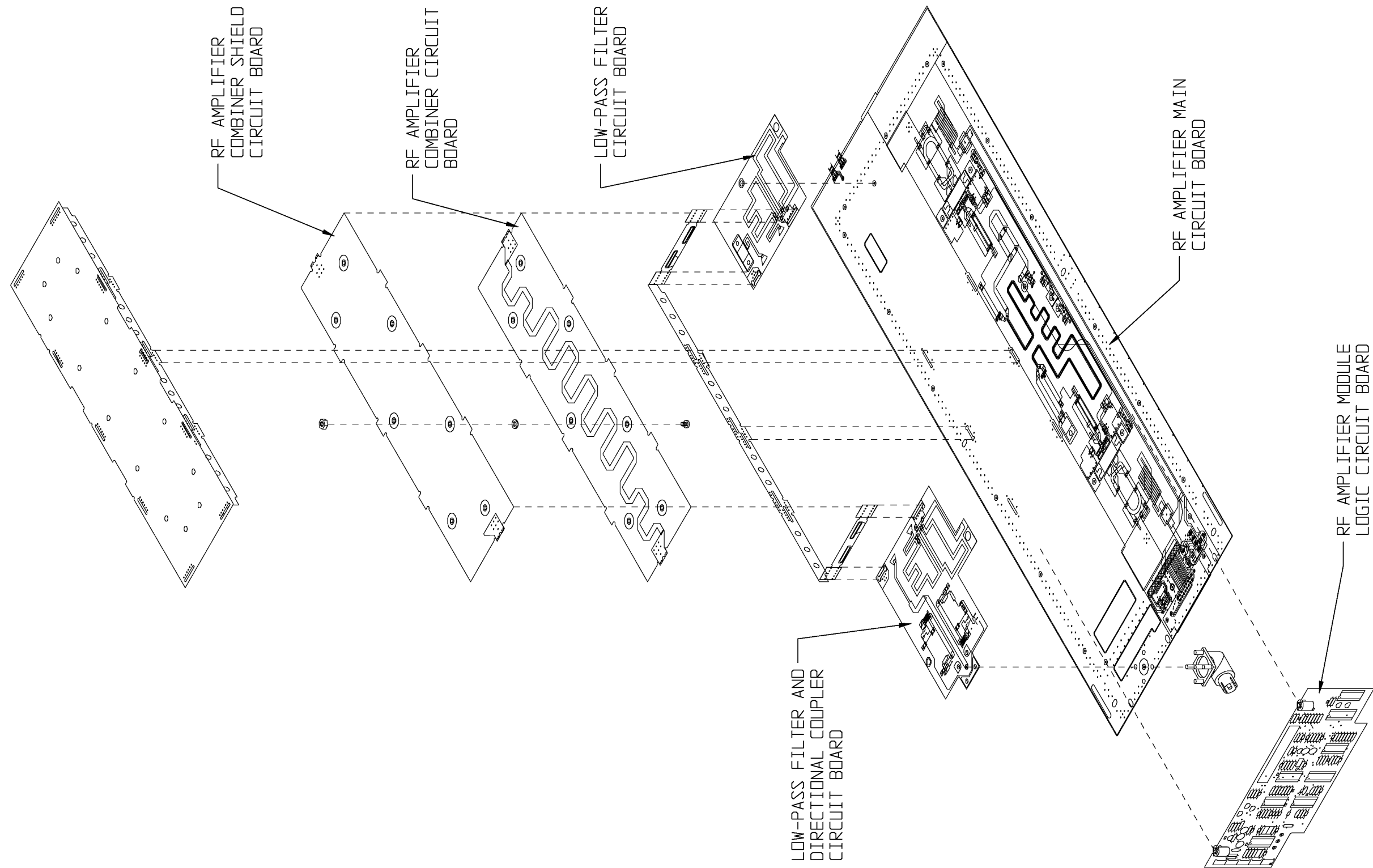
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	DESIGNER(S)  JRC 6-23-94				
	PROJ. LEADER	FINISH	TITLE PCB ASSEMBLY PWR SPLY MOTHERBOARD		
	MFG.	SEE DWG RA592-0000 NEXT ASSY.	TYPE A	SIZE B	DWG No. 919-0423
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°			MODEL FM-1C1	SCALE 1/1	REV A SHEET 1 OF 1



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597-3002-23

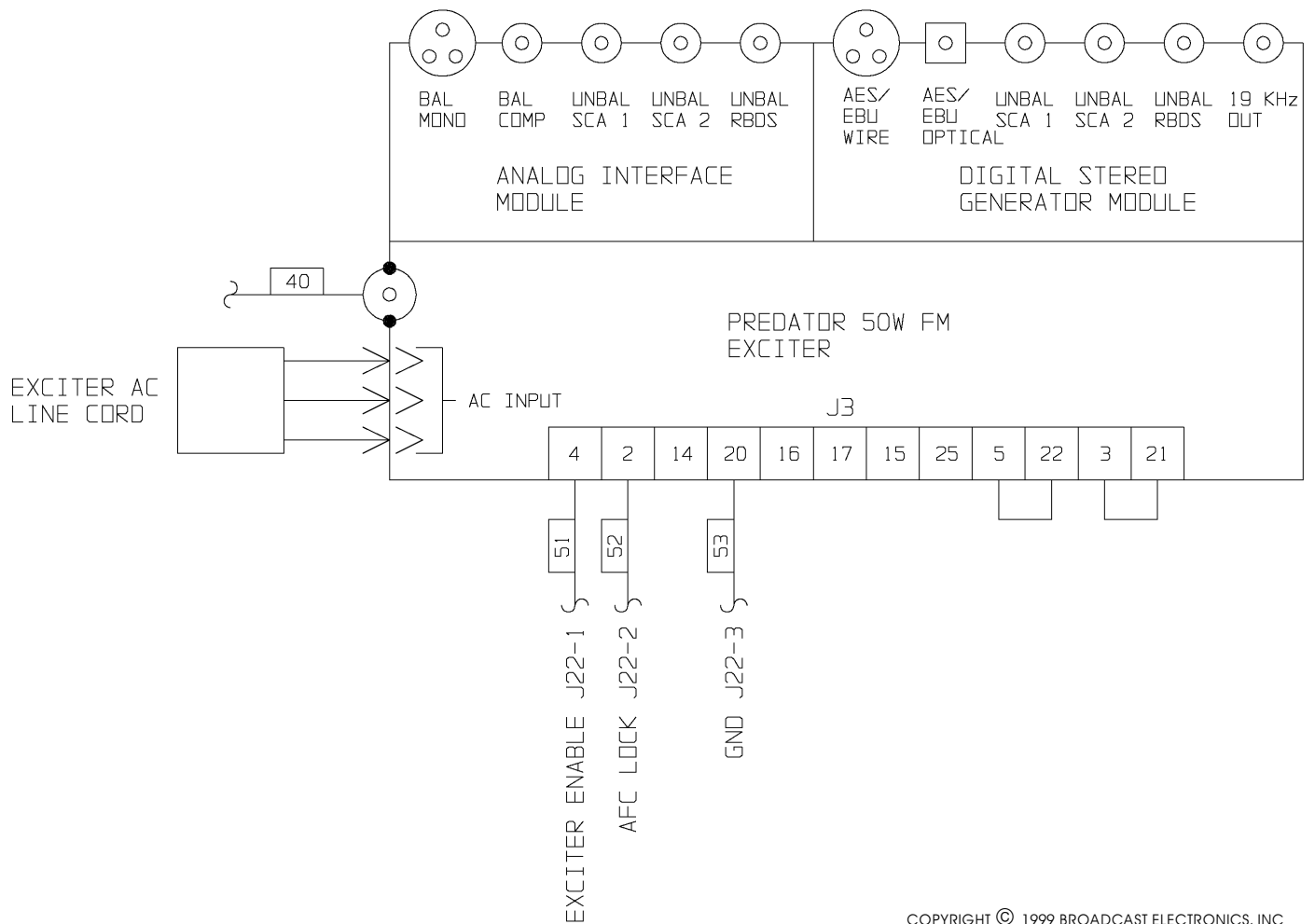
**FIGURE 7-25. POWER AMPLIFIER MODULE  
ASSEMBLY DIAGRAM  
(SHEET 1 OF 2)**



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597-3002-23A

**FIGURE 7-25. POWER AMPLIFIER MODULE  
ASSEMBLY DIAGRAM  
(SHEET 2 OF 2)**



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**597-8000-103**

**FIGURE 7-26. PREDATOR SCHEMATIC DIAGRAM - FM-1C1/FM-500C1 TRANSMITTERS**

