

**FM-3C 3 kW FM ONLY,
FMi-201 2.1 kW FM + HD,
840 W HD ONLY**

**FM-2C 2 kW FM ONLY,
FMi-106 1.4 kW FM + HD,
560 W HD ONLY**

BROADCAST TRANSMITTERS

June, 2010

IM No. 597-3002

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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Fax: (217) 224-9607
E-Mail: General – bdcast@bdcast.com
Web Site: www.bdcast.com

RF PRODUCT TECHNICAL ASSISTANCE – REPAIR – EMERGENCY/WARRANTY REPLACEMENT PARTS –

Telephone: (217) 224-9600
E-Mail: 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/cm² 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/cm² 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-3C/FM-2C and FMi-201/FMi-106 transmitters and lists equipment specifications.

1-3. RELATED PUBLICATIONS.

- 1-4. The following list of publications provides data for equipment associated with the FM-3C/FM-2C and FMi-201/FMi-106 transmitters.

PUBLICATION NUMBER	EQUIPMENT
597-1002	FM-100C FM Transmitter/Exciter

- 1-5. The following list of publications provides data for equipment associated with the FMi-402/FMi-301 transmitters.

PUBLICATION NUMBER	EQUIPMENT
597-0541	FXi-60/250 Digital Exciter Manual
597-0542-XM3	FXi & XPi Quick Installation Guide
597-0542-008	XPi-10 Operation Manual

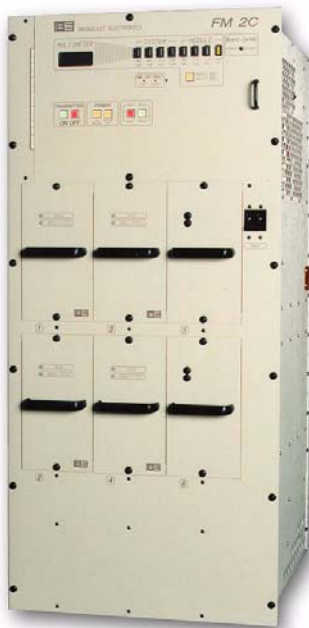
1-6. EQUIPMENT DESCRIPTION.

1-7. FM-3C/FM-2C GENERAL

- 1-8. The Broadcast Electronics FM-3C transmitter is a 3 kW solid-state FM ONLY transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1-1). The FM-3C transmitter is equipped 1) an FM-100C FM exciter, 2) four modular switching power supply assemblies, 3) six modular solid-state broadband plug-in RF power amplifier modules, 4) a low-pass filter, 5) a combiner, and 6) a CMOS controller.
- 1-9. The Broadcast Electronics FM-2C transmitter is a 2 kW solid-state FM ONLY transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band. (refer to Figure 1-1). The FM-2C transmitter is equipped with: 1) an FM-100C FM exciter, 2) three modular switching power supply assemblies, 3) four modular solid-state broadband plug-in RF power amplifier modules, 4) a low-pass filter, 5) a combiner, and 6) a CMOS controller.
- 1-10. All the components with the exception of the FM-100C exciter are housed in a single chassis. The FM-100C exciter is housed on slide-rails above the transmitter chassis. The entire transmitter can be installed in a 19 inch EIA rack if desired.

1-11. **FMi-201/FMi-106 GENERAL**

- 1-12. The Broadcast Electronics FMi-201 transmitter is a 3 kW FM Only, 2.1 kW FM+HD, and 840 Watt HD Only solid-state transmitter based largely on the FM-3C architecture and is designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1-1).
- 1-13. The FMi-201 transmitter is equipped with: 1) an FXi-250 Digital FM Exciter, 2) an XPi-10 HD Exporter, 3) four modular switching power supply assemblies, 4) 6 modular solid-state broadband plug-in RF power amplifier modules, 5) a low-pass filter, 6) a combiner, and 7) a CMOS controller.
- 1-14. The Broadcast Electronics FMi-106 transmitter is a 2 kW FM Only, 1.4 kW FM+HD, and 560 Watt HD Only solid-state transmitter based largely on the FM-2C architecture and is designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1-1).
- 1-15. The FMi-106 transmitter is equipped with: 1) an FXi-250 Digital FM Exciter, 2) an XPi 10 HD Exporter, 3) three modular switching power supply assemblies, 4) 4 modular solid-state broadband plug-in RF power amplifier modules, 5) a low-pass filter, 6) a combiner, and 7) a CMOS controller.
- 1-16. Some specific features include:
1. The FM-100C/FXi-250 exciters. The exciters are equipped with a digital frequency synthesizer and superior audio performance.
 2. A broadband design which eliminates tuning controls.
 3. Modular switching power supply units. Three power supplies provide operating potentials for the RF power amplifier modules in FM-3C/FMi-201 models. Two power supplies provide operating potentials for the RF power amplifier modules in FM-2C/FMi-106 models. A separate switching power supply unit provides operating potentials for the controller.
 4. Modular solid-state broadband plug-in amplifier modules.
 5. A CMOS controller with VSWR detection.
 6. A unique efficient broadband combiner unit containing no dissipation resistors. The combiner is designed to operate with open or shorted inputs.



FM-2C TRANSMITTER



FM-3C TRANSMITTER



FMi-201 TRANSMITTER



FMi-106 TRANSMITTER

597-3002-1

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FIGURE 1-1. FM-3C/FM-2C AND FMi-201/FMi-106 TRANSMITTERS

- 1-17. **FM-100C EXCITER.** The FM-100C 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 FM-100C is designed to accept multiple wideband composite inputs from a stereo generator or SCA generator. In addition, the FM-100C 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.
- 1-18. The FM-100C 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 10 to 100 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.
- 1-19. **FXi-250 DIGITAL EXCITER.** The FXi-250 Digital Exciter comes standard with the FMi-201/FMi-106 transmitters. The FXi-250 is a solid-state wideband digital FM exciter providing a continuously variable RF output at any frequency within the 87.5 to 108 MHz FM broadcast band in 10 kHz increments. The FXi-250 is divided into several board assemblies. The assemblies include: 1) DSP (Digital Signal Processor) Modulator, 2) Controller, 3) Oscillator/Filter, 4) RF Amplifier, 5) Power Supply, and 6) Color GUI Interface.
- 1-20. The FXi-250 is highly integrated and comes with the following standard features: 1) AES Input, 2) L&R Analog Inputs, 3) Balanced and Unbalanced Composite Inputs, 4) Two Internal SCA Generators, 5) Internal RDS Generator, 6) External SCA/RDS Input. The FXi-250 also has a built in stereo generator, compressor, and limiter all of which are software programmable and defeatable. The digital exciter also provides modulation Directly To Channel (DTC) 87.5 - 108 MHz, eliminating any analog up converter processes. The chassis of the FXi-250 requires 7 inches (height) of a 19 inch (wide) rack cabinet. Refer to publication 597-0541 for a detailed explanation of the FXi-250 features.
- 1-21. **FXi-250 DIGITAL EXCITER (HD SYSTEM).** When the FXi-250 Exciter is used in a FMi-201/FMi-106 transmitter the FXi is equipped with an Exgine Card. Refer to publication 597-0542-XM3 for detailed instructions for the Installation and Setup of an FXi Exciter (w/Exgine) and XPi-10 Exporter.
- 1-22. **XPi-10 EXPORTER (HD SYSTEM).** FMi-201/FMi-106 transmitters come standard with an XPi-10 HD Exporter. The XPi works in conjunction with the FXi (w/Exgine) to provide HD signals to the FMi-201/FMi-106 transmitter. Refer to publication 597-0542-XM3 for detailed instructions for the Installation and Setup of an FXi Exciter (w/Exgine) and XPi 10 Exporter.
- 1-23. **POWER SUPPLY.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are equipped with modular switching power supply assemblies. Three switching power supplies in FM-3C/FMi-201 models and two switching power supplies in FM-2C/FMi-106 models provide dc operating potentials for the transmitter power amplifier circuitry. A separate modular switching power supply is provided for the controller circuitry. The transmitter power supply circuitry is equipped with overload protection, over-voltage protection, high temperature protection, and a soft-start feature which minimizes in-rush currents.

- 1-24. **RF POWER AMPLIFIER MODULES.** The FM-3C/FMi-201 transmitter is equipped with 6 RF power amplifier modules. The FM-2C/FMi-106 is equipped with 4 RF power amplifier modules. 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 high forward power demand conditions. The operating status of the module is displayed by a front panel LED. The LED displays normal, fault, and limit conditions. A second module status LED displays the presence of RF drive at the module.
- 1-25. **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 modular switching power supply. The supply provides the controller circuitry with a stable +5 and ± 15 volt dc supply.
- 1-26. 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 an RF power amplifier module fault, a power supply module fault, a high reflected power condition, or a high temperature condition.
- 1-27. The controller is also equipped with metering circuitry. Meter amplifier/buffering circuits are provided for the RF power amplifier module forward power, current, voltage, and temperature samples. Meter amplifier/buffering circuits are also provided for the transmitter forward power, reflected power, 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.
- 1-28. **COMBINER.** In FM-3C/FM-2C and FMi-201/FMi-106 transmitters, the RF power module outputs are combined using a unique combiner assembly. The FM-3C/FMi-201 is equipped with a 6 position combiner designed to produce 3 kW of RF output power. FM-2C/FMi-106 is equipped with a 4 position combiner designed to produce 2 kW of RF output power. The unique features of the combiner include: 1) very low loss, 2) broadband, 3) no dissipative resistors, 4) no cable connections, and 5) operates with open or shorted inputs.
- 1-29. **TRANSMITTER CONFIGURATIONS.**
- 1-30. The FM-3C/FM-2C transmitters can be ordered in the following configurations:

P/N	DESCRIPTION
909-3001-204	FM-3C 3 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 FM-100C FM exciter, 196V to 252V ac 50/60 Hz single phase operation.
909-2001-204	FM-2C 2 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 FM-100C FM exciter, 196V to 252V ac 50/60 Hz single phase operation.

969-2001

FM-2C Transmitter Less Power Supplies.

- 1-31. The FMi-201/FMi-106 transmitters can be ordered in the following configurations:

P/N	DESCRIPTION
909-0201-404	FMi-201 2.1 kW FM+HD (840 W HD ONLY) Transmitter with an FXi 250 Exciter and XPi 10 HD Exporter for operation in the 87.5 MHz to 108 MHz broadcast band, 196V to 252V ac 50/60 Hz single phase supply.
909-0106-404	FMi-106 1.4 kW FM+HD (560 W HD ONLY) Transmitter with an FXi 250 Exciter and XPi 10 HD Exporter for operation in the 87.5 MHz to 108 MHz broadcast band, 196V to 252V ac 50/60 Hz single phase supply.

- 1-32. **OPTIONAL EQUIPMENT AND SPARE PARTS KITS.**

- 1-33. The following text presents the optional equipment and spare parts kits available for the use with the FM-3C/FM-2C and FMi-201/FMi-106 transmitters.

P/N	DESCRIPTION
909-0051-204	FC-30 FM SCA Generator.
979-0406	Recommended spare parts kit for FM-3C/FM-2C and FMi-201/FMi-106 solid-state transmitters. Includes selected switches, relays, etc. Does not include spare parts for the FM-100C/FXi-250.
979-0407	Recommended semiconductor kit for FM-3C/FM-2C and FMi-201/FMi-106 solid-state transmitters. Does not include semiconductors for the FM-100C/FXi-250.
979-0408	100% semiconductor kit for the FM-3C/FMi-201 solid-state transmitters. Does not include semiconductors for the FM-100C/FXi-250.
979-0409	100% semiconductor kit for the FM-2C/FMi-106 solid-state transmitters. Does not include semiconductors for the FM-100C/FXi-250.

- 1-34. **EQUIPMENT SPECIFICATIONS.**

- 1-35. Refer to Table 1-1 for the FM-3C/FM-2C specifications or Table 1-2 for the FMi-201/FMi-106 specifications.

TABLE 1-1. FM-3C/FM-2C ELECTRICAL SPECIFICATIONS
(Sheet 1 of 3)

PARAMETER	SPECIFICATION
RF POWER OUTPUT FM-3C FM-2C	750 watts to 3 kW (as specified). 500 watts to 2 kW (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	1 5/8 inch EIA female field flange.
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 FM-100C, solid-state 120 watt output with digitally programmed synthesizer. 10 kHz increment programming.
AM SIGNAL-TO-NOISE RATIO: Asynchronous	55 dB below an equivalent reference carrier with 100% AM modulation @ 400 Hz, 75 microsecond deemphasis (no FM modulation present).
Synchronous FM-3C	50 dB below an equivalent 3 kW reference carrier @ 100% AM modulation @ 400 Hz. 75 uS deemphasis with ± 75 kHz FM modulation @ 400 Hz and a 3 kW output power.
FM-2C	50 dB below an equivalent 2 kW reference carrier @ 100% AM modulation @ 400 Hz. 75 uS deemphasis with ± 75 kHz FM modulation @ 400 Hz and a 2 kW output power.
RF HARMONIC SUPPRESSION	Meets all FCC/DOC requirements and CCIR recommendations.
FM SIGNAL-TO-NOISE RATIO: Mono/Composite	85 dB below ± 75 kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Stereo	82 dB below ± 75 kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.

TABLE 1-1. FM-3C/FM-2C ELECTRICAL SPECIFICATIONS
(Sheet 2 of 3)

PARAMETER	SPECIFICATION
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.
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-3C	6 kW typical at a 3 kW RF power output, 50 Ohm resistive load.
FM-2C	4.2 kW typical at a 2 kW RF power output, 50 Ohm resistive load.
OVERALL EFFICIENCY	
FM-3C	50% or greater (AC line input to RF output).
FM-2C	48% or greater (AC line input to RF output).
SAFETY COMPLIANCE	IEC 215.

**TABLE 1-1. FM-3C/FM-2C PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS
(Sheet 3 of 3)**

PARAMETER	SPECIFICATION
PHYSICAL	
DIMENSIONS:	
FM-100C Exciter	Width: 19.00 inches (48.3 cm). Height: 7.00 inches (17.8 cm). Depth: 19.00 inches (48.3 cm).
Transmitter	Width: 19.00 inches (48.3 cm). Height: 42.00 inches (106.68 cm). Depth: 28.5 inches (72.39 cm).
WEIGHT	
FM-100C Exciter	40 pounds (18.1 kg) unpacked.
Transmitter	
FM-3C	260 pounds (117.9 kg) unpacked.
FM-2C	212 pounds (96.2 kg) unpacked.
ENVIRONMENTAL	
HEAT DISSIPATION	
FM-3C (3 kw Output)	3 kW (10,250 Btu/H) at a 3 kW RF output, 50 Ohm resistive load.
FM-2C (2 kW Output)	2.2 kW (7525 Btu/H) at a 2 kW RF output, 50 Ohm resistive load.
COOLING AIR REQUIREMENTS	1400 cubic feet per minute (39.7 m ³ /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.

TABLE 1-2. FMi-201/FMi-106 ELECTRICAL SPECIFICATIONS
(Sheet 1 of 4)

PARAMETER	SPECIFICATION
RF POWER OUTPUT	
FMi-201	
HD Only	500 W - 840 W (-20 dB HD ratio)
FM+HD	1.0 kW - 2.1 kW (-20 dB HD ratio)
FM ONLY	750 W - 3.0 kW
FMi-106	
HD Only	200 W - 560 W (-20 dB HD ratio)
FM+HD	500 W - 1.4 kW (-20 dB HD ratio)
FM ONLY	500 W - 2.0 kW
RF OUTPUT IMPEDANCE	50 Ohms
RF OUTPUT CONNECTOR	1 5/8 inch EIA female field flange
PA EFFICIENCY	
HD Only	greater than 40% at rated power
FM+HD	greater than 40% at rated power
OVERALL EFFICIENCY	
HD Only	greater than 20% at rated power
FM+HD	greater than 40% at rated power
FM Only	
FMi-201	greater than 50% at rated power
FMi-106	greater than 48% at rated power
VSWR	Rated power into 1.5:1 maximum without output matching. Capable of operating into higher VSWR conditions with automatic power reduction. Open and short circuit protected at all phase angles.
FREQUENCY RANGE	87.5 to 108 MHz (as specified). Exciter programmable in 10 kHz increments.
FREQUENCY STABILITY	
Internal 10 MHz Ref.	+/- 150 Hz, -10 - 50 degrees C
External 10 MHz Ref.(GPS)	Determined by source
MODULATION CAPABILITY	+/- 300kHz FM Mode
MODULATION TYPE	Digitally synthesized direct to channel
MODULATION MODES	FM Only, FM+HD, HD Only
ASYNCHRONOUS AM S/N RATIO	55dB below rated power with 100% AM at 400Hz and 75usec de-emphasis (no modulation present)
SYNCHRONOUS AM S/N RATIO	50dB below rated power with 100% AM modulation at 400Hz and 75usec de-emphasis (+/-75kHz modulation)
SPURIOUS AND HARMONIC	Meets or exceeds all FCC, IC, CE, CCIR, and IEC215, NRSC-5A requirements.

TABLE 1-2. FMi-201/FMi-106 ELECTRICAL SPECIFICATIONS
(Sheet 2 of 4)

PARAMETER	SPECIFICATION
AC INPUT	196 TO 252VAC, 47 to 63 Hz, Single Phase
POWER FACTOR	
FMi-201	.98 @ 230VAC
FMi-106	.99 @ 230VAC
AC CURRENT REQUIREMENTS	
FMi-201	
HD Only	18A
FM+HD	28A
FM Only	28A
FMi-106	
HD Only	12A
FM+HD	16A
FM Only	22A
AC POWER CONSUMPTION	
FMi-201	
HD Only	2.9 kW @ 840 W RF Output, 50 Ohm resistive load
FM+HD	4.95 kW @ 2.1 kW RF Output, 50 Ohm resistive load
FM Only	6 kW @ 3 kW RF Output, 50 Ohm resistive load
FMi-106	
HD Only	2.2 kW @ 560 W RF Output, 50 Ohm resistive load
FM+HD	3.2 kW @ 1.4 kW RF Output, 50 Ohm resistive load
FM Only	4.2 kW @ 2 kW RF Output, 50 Ohm resistive load
FM AUDIO PERFORMANCE	
Modes	Stereo, Mono, L Only, R Only
AES Input Level	-2 dBFS for 100% modulation. Sampling rates of 32 kHz, 44.1 kHz, 48 kHz, or 96 kHz; 16-24 bits
AES Impedance	110 Ohms
AES Connector	Wire - XLR. Optical - Toslink.
Mono Amplitude Response	+/-0.1 dB, 20 Hz to 15 kHz
Composite Amplitude Response	+/-0.1 dB, 20 Hz to 53 kHz, +/-0.1dB, 53 kHz to 100 kHz
IMD Distortion	
Mono/Stereo	0.03% or better
Composite	0.005% or better
THD + Noise	
Stereo	0.03% or better, 20 Hz to 22 kHz, 75 uSec de-emphasis
Composite	0.005% or better (10 Hz to 53 kHz), 75 uSec de-emphasis
Pre_Emphasis	0, 50 uSec, or 75 uSec

TABLE 1-2. FMi-201/FMi-106 ELECTRICAL SPECIFICATIONS
(Sheet 3 of 4)

PARAMETER	SPECIFICATION
FM AUDIO PERFORMANCE (Con't)	
S/N Ratio	
Stereo	87 dB or better below 100% modulation @ 400kHz, 20 Hz to 22 kHz, 75 uSec De-emphasis, A weighting
Mono/Composite	95 dB or better below 100% modulation @ 400kHz, 20 Hz to 22 kHz, A weighted
Audio Overshoot	Less than 0.2 dB
Stereo Pilot	19 kHz, adjustable from 0% to 15% in 0.1% increments
Dynamic/Stereo Separation	65 dB or better, 20 Hz to 15 kHz
Linear Crosstalk	90 dB below 100% reference
Non-Linear Crosstalk	80 dB below 100% reference
Composite Transient Intermod	0.005% or less
Composite Slew Rate	11.8 V/usec
Composite Group Delay	+/- 5 nSec, 22 Hz to 53 kHz. +/- 30 nSec, 53 kHz to 100 kHz.
Composite Phase Response	+/-0.05 Deg from linear phase, 10 Hz to 100 kHz
INTERNAL SCAs (2)	
Frequency	57 kHz to 99 kHz software programmable
Deviation	1 kHz to 10 kHz
Injection Level	2% to 15%, 0.1 kHz increments
Pre-Emphasis	0, 50uSec, 75uSec, or 150uSec
Amplitude Response	+/- 0.5 dB, 20 Hz to 7 kHz
S/N Ratio	80 dB, 150 uSec de-emphasis
THD	0.1%, 10 Hz to 5 kHz
2nd Harmonic Suppression	40 dB or better below the subcarrier
3rd Harmonic Suppression	45 dB or better below the subcarrier
All Others	80 dB or better below the subcarrier, 50 Hz to 100 kHz
RBDS Generator	
Frequency	57 kHz +/- 0.1 Hz
Injection Level	2% to 15%, 0.1 kHz increments
EXTERNAL SCAs (2)	
Frequency	Externally generated in the 53 kHz to 99 kHz range
Amplitude Response	+/- 0.5 dB, 40 kHz to 100 kHz
S/N Ratio	80 dB below a +6 kHz deviation, 400 Hz, 150 uSec de-emphasis
Harmonic Distortion	0.2% or less
IMD	0.2% or less, no pre/de emphasis
Crosstalk (SCA to Stereo, Stereo to SCA, SCA to SCA)	80 dB below 100% modulation

TABLE 1-2. FMi-201/FMi-106 ELECTRICAL SPECIFICATIONS
(Sheet 4 of 4)

PARAMETER	SPECIFICATION
PHYSICAL	
DIMENSIONS:	
FXi-250 Exciter	Width: 19.0 inches (48.3 cm). Height: 7.0 inches (17.8 cm). Depth: 22.5 inches (57.15 cm).
Transmitter	Width: 19.00 inches (48.3 cm). Height: 42.00 inches (106.68 cm). Depth: 28.5 inches (72.39 cm).
WEIGHT	
FMi-201	260 pounds (117.9 kg) unpacked.
FMi-106	212 pounds (96.2 kg) unpacked.
SAFETY	Meets IEC 215.
ENVIRONMENTAL	
HEAT DISSIPATION	
FM ONLY	
FMi-201	3 kW (10,250 Btu/H) at a 3 kW RF output, 50 Ohm resistive load.
FMi-106	2.2 kW (7525 Btu/H) at a 2 kW RF output, 50 Ohm resistive load.
HD ONLY	
FMi-201	2.14 kW (7304 Btu/H) at 840 W RF output, 50 Ohm resistive load.
FMi-106	1.7 kW (5802 Btu/H) at 560 W RF output, 50 Ohm resistive load.
FM + HD	
FMi-201	2.85 kW (9730 Btu/H) at 2.1 kW RF output, 50 Ohm resistive load.
FMi-106	2.1 kW (7170 Btu/H) at 1.4 kW RF output, 50 Ohm resistive load.
COOLING AIR REQUIREMENTS	1400 cubic feet per minute (39.7 m ³ /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-3C/FM-2C and FMi-201/FMi-106 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-3C/FM-2C and FMi-201/FMi-106 transmitters require a source of cooling air to maintain an acceptable operating temperature. The transmitters require a cooling air flow of 1400 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 1400 cubic feet of air per minute.

2-11. As a minimum requirement, any exhaust duct work must have 500 sq.in. of area. 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.

2-14. EQUIPMENT PLACEMENT.

2-15. The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are designed for placement in a 19 inch EIA rack assembly. Each transmitter requires approximately 49.00 inches (124.46 cm) of a universal or military EIA rack (refer to Figure 2-2). The FMi-201/FMi-106 transmitters will require an additional 7.0 inches (17.78 cm) if the XPi-10 Exporter is installed at the transmitter site. 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 the 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 procedure.
- 2-17. Prepare a universal or military 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 7.00 inches (17.78 cm) above the transmitter for the exciter.
 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.

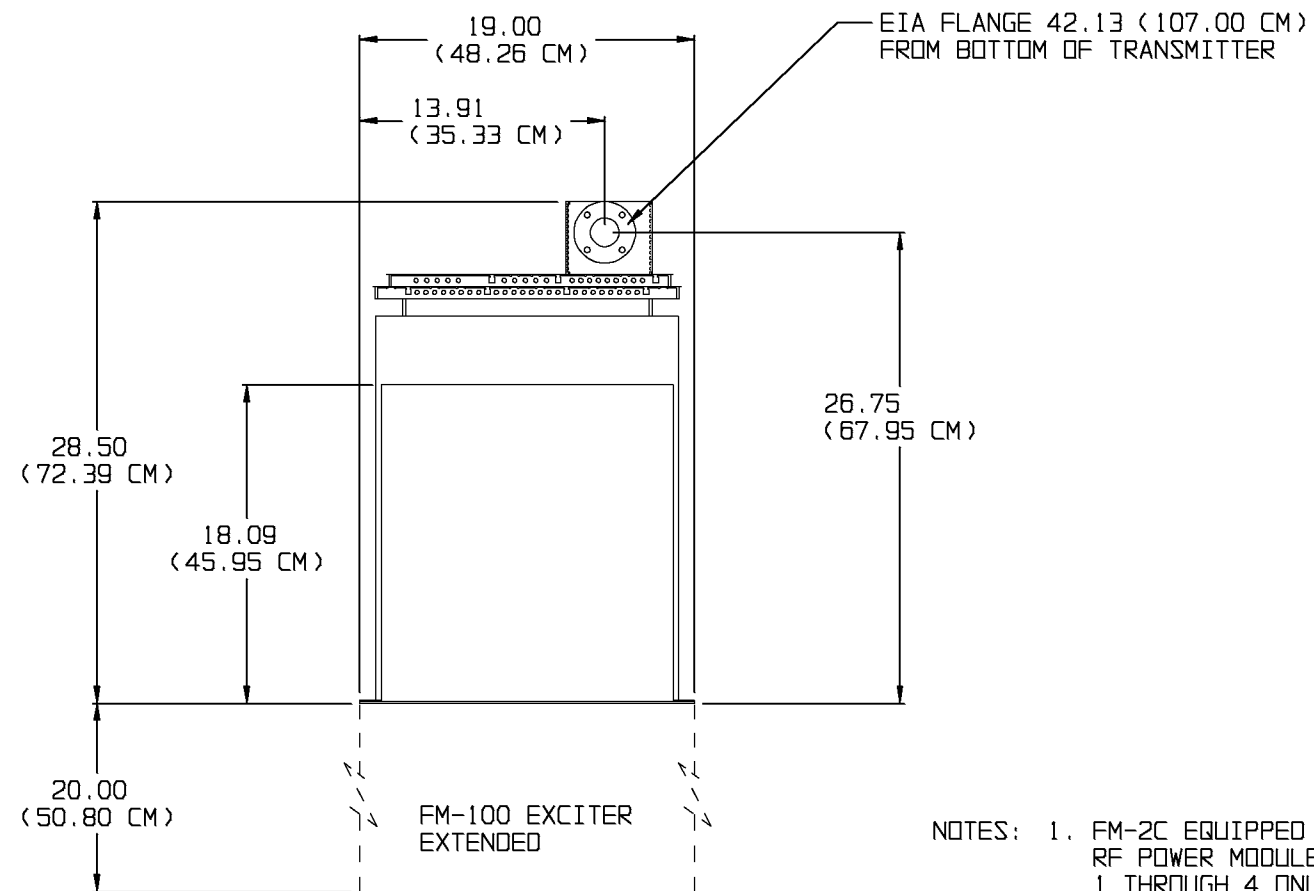


WARNING

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

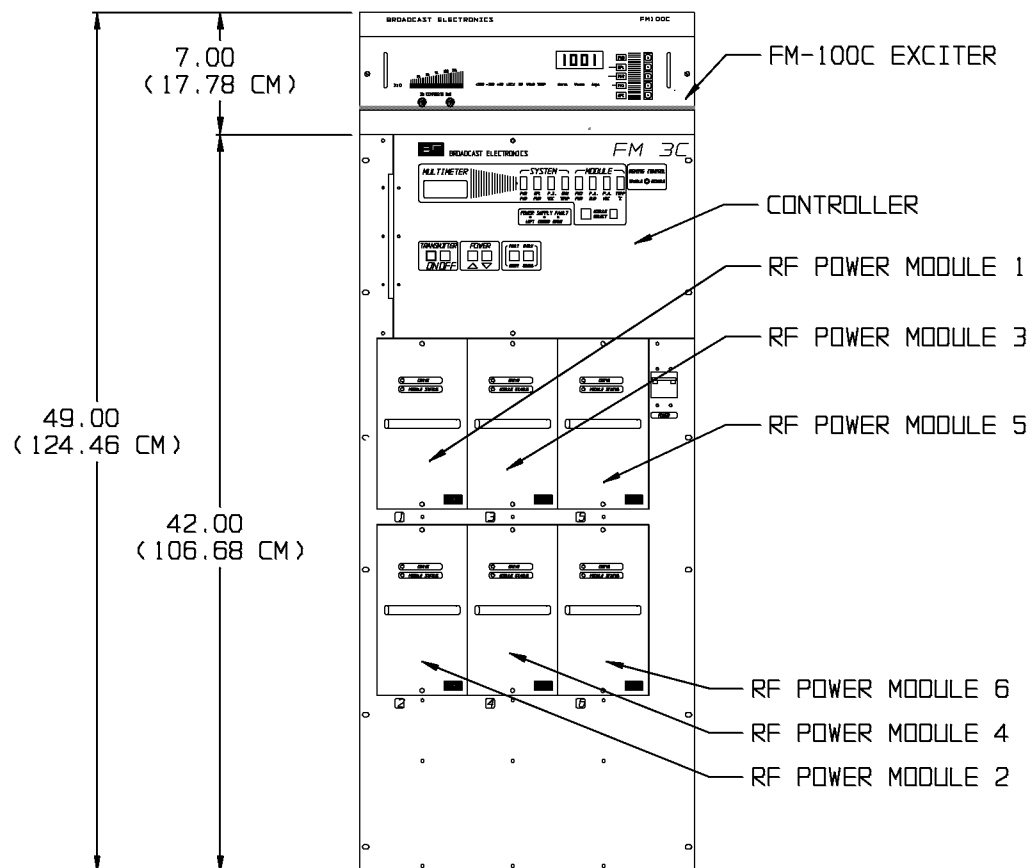
WARNING

- 2-18. **EQUIPMENT INSTALLATION.**
- 2-19. **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.
- 2-20. 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.
- 2-21. Insert the transmitter in the rack and install the appropriate hardware in two mounting locations to secure the transmitter in the rack.
- 2-22. Using the appropriate hardware, install the remaining hardware to secure the transmitter in the rack.
- 2-23. **FM-100C EXCITER MOUNTING BRACKET INSTALLATION.** The FM-3C/FM-2C transmitters are equipped with an FM-100C exciter. The FMi-201C/FMi-106 transmitters are equipped with an FXi-250 exciter. The FM-100C exciter is mounted above the transmitter chassis on slide-rails. The FXi-250 is mounted directly to the rack.
- 2-24. The FM-100C exciter is mounted to the transmitter chassis by brackets. The exciter mounting hardware is accessed from inside the transmitter controller area. Remove the two screws securing the transmitter controller front door and open the door.



NOTES:

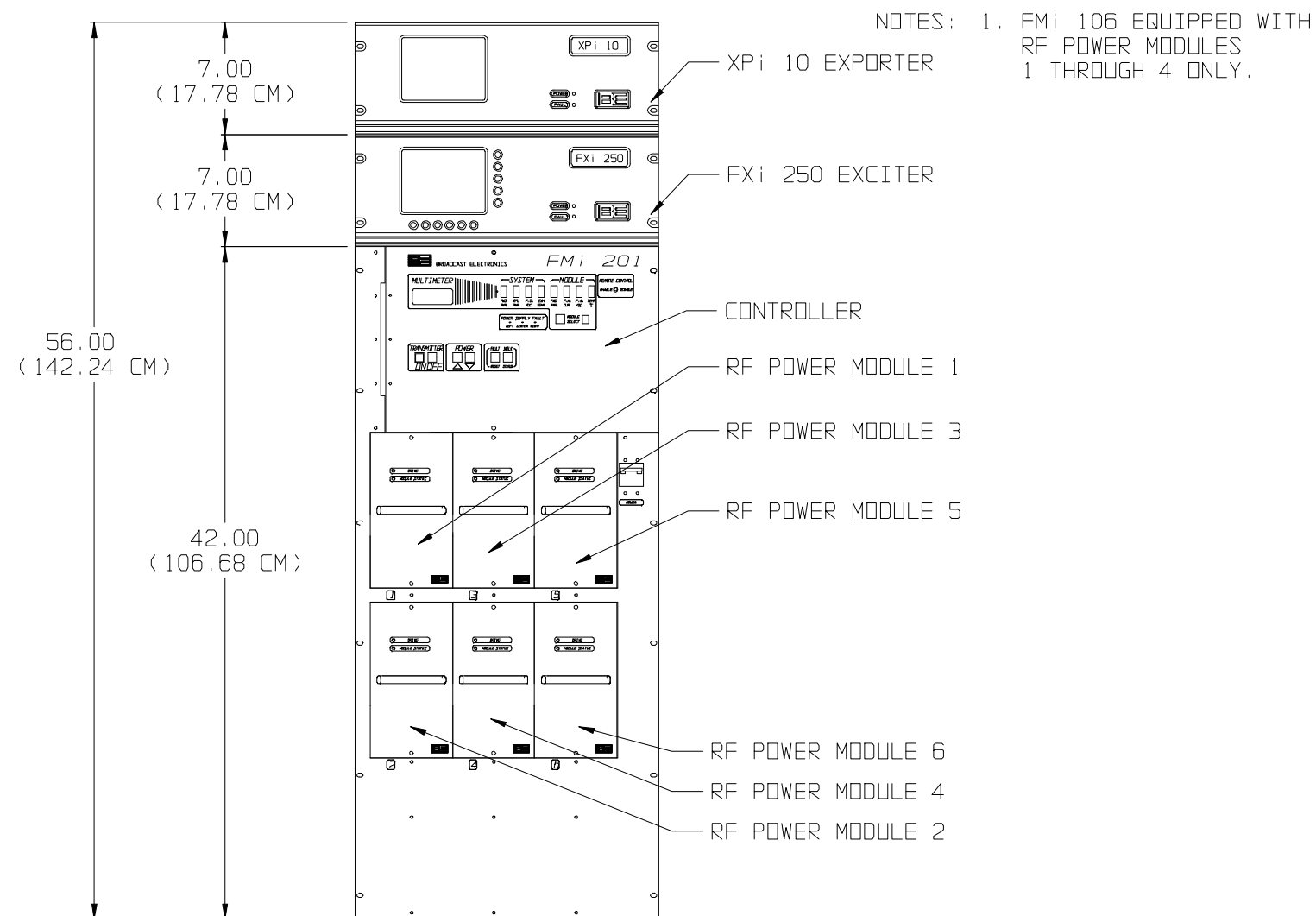
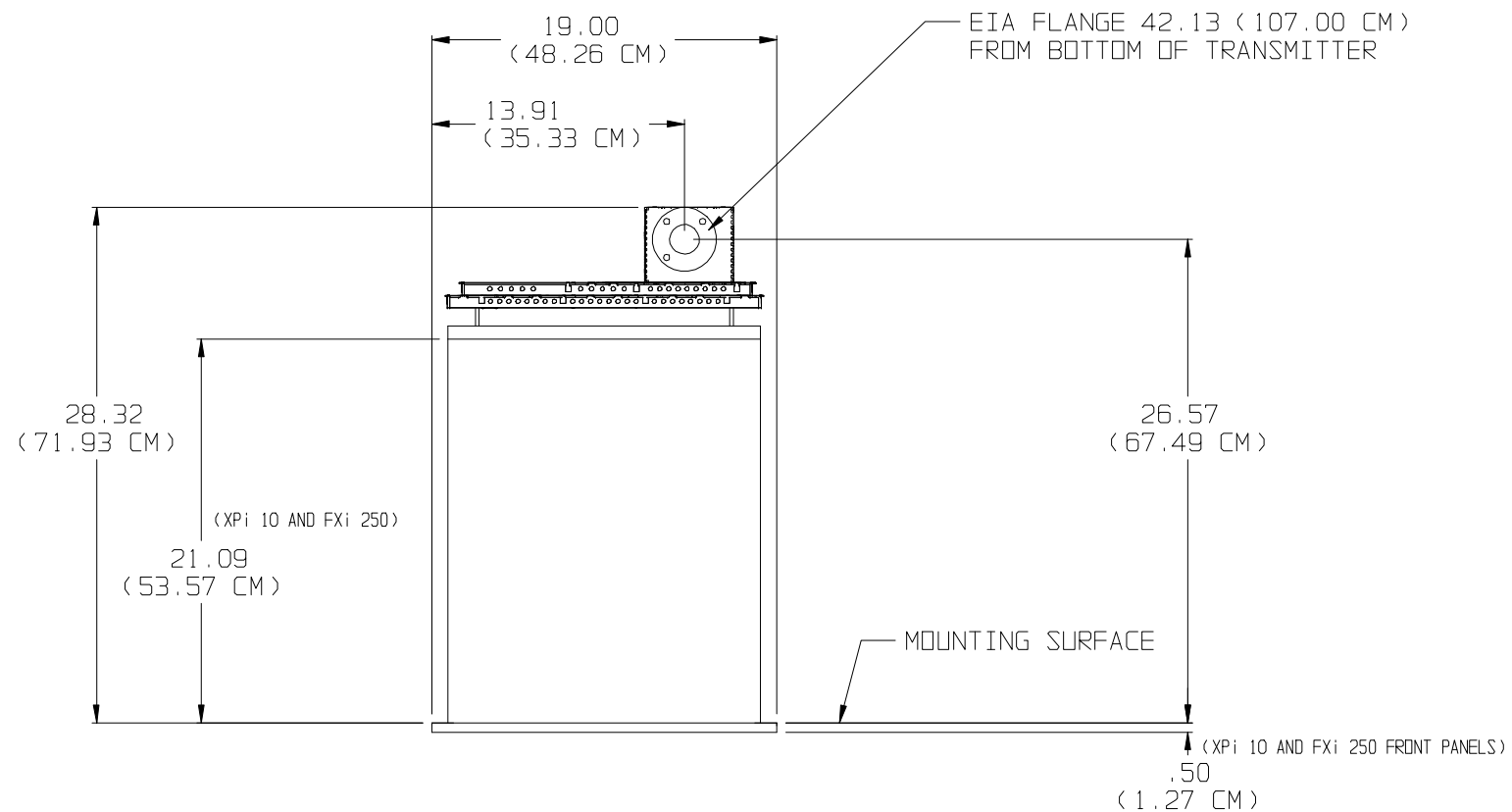
- COOLING AIR REQUIREMENT-1400 CFM (39.7M³/MIN) FILTER REQUIRED- 407-0062
- GROUND STRAP ENTRY IN LOWER LEFT CORNER AT REAR OF CABINET
- RF OUTPUT CONNECTION- 1-5/8 INCH EIA 50 OHM FEMALE FIELD FLANGE.
- HEAT DISSIPATION:
FM-3C- 3KW (10,250 BTU/H) AT A 3KW RF OUTPUT, 50 OHM RESISTIVE LOAD.
FM-2C- 2.2KW (7525 BTU/H) AT A 2KW RF OUTPUT, 50 OHM RESISTIVE LOAD.
- WEIGHT:
FM-3C- TRANSMITTER= 260 LBS (117.9 KGS) EXCITER= 40 LBS (18.1 KGS).
FM-2C- TRANSMITTER= 212 LBS (96.2 KGS) EXCITER= 40 LBS (18.1 KGS).
- AC POWER CONSUMPTION:
FM-3C- 6KW AT A 3KW RF OUTPUT INTO A 50 OHM RESISTIVE LOAD.
FM-2C- 4.2KW AT A 2KW RF OUTPUT INTO A 50 OHM RESISTIVE LOAD.
- AC POWER INPUT:
FM-3C- 196 TO 252VAC 50/60Hz SINGLE PHASE, 35 AMPERES (MAXIMUM CONDITION).
FM-2C- 196 TO 252VAC 50/60Hz SINGLE PHASE, 25 AMPERES (MAXIMUM CONDITION).
FUSE DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO FOLLOWING TEXT, NATIONAL ELECTRIC CODES, AND LOCAL CODES.
- PRIMARY AC FUSED DISCONNECT:
FM-3C:
FUSE SIZE- 60 AMP
WIRE SIZE- #4 COPPER AWG, TYPE THHN.
FM-2C:
FUSE SIZE- 40 AMP
WIRE SIZE- #8 COPPER AWG, TYPE THHN.
- RACK REQUIREMENTS- 19" RACK UNIVERSAL MOUNTING.
.281 DIAMETER HOLES OR 10-32 TAPPED HOLES, 28 VERTICAL RACK UNITS.
- AIR EXHAUST SIZE- 500 SQ. IN. (3226 SQ. CM) TOP OF UNIT.
- POWER FACTOR- BETTER THAN .99 @ 230 VAC WITH A 3KW RF OUTPUT INTO A 50 OHM LOAD.



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597-3002-2

**FIGURE 2-1. TRANSMITTER INSTALLATION
DIAGRAM - FM-3C/FM-3C (SHT 1 OF 2)
(2-3/2-4)**



NOTES: 1. FMi 106 EQUIPPED WITH RF POWER MODULES 1 THROUGH 4 ONLY.

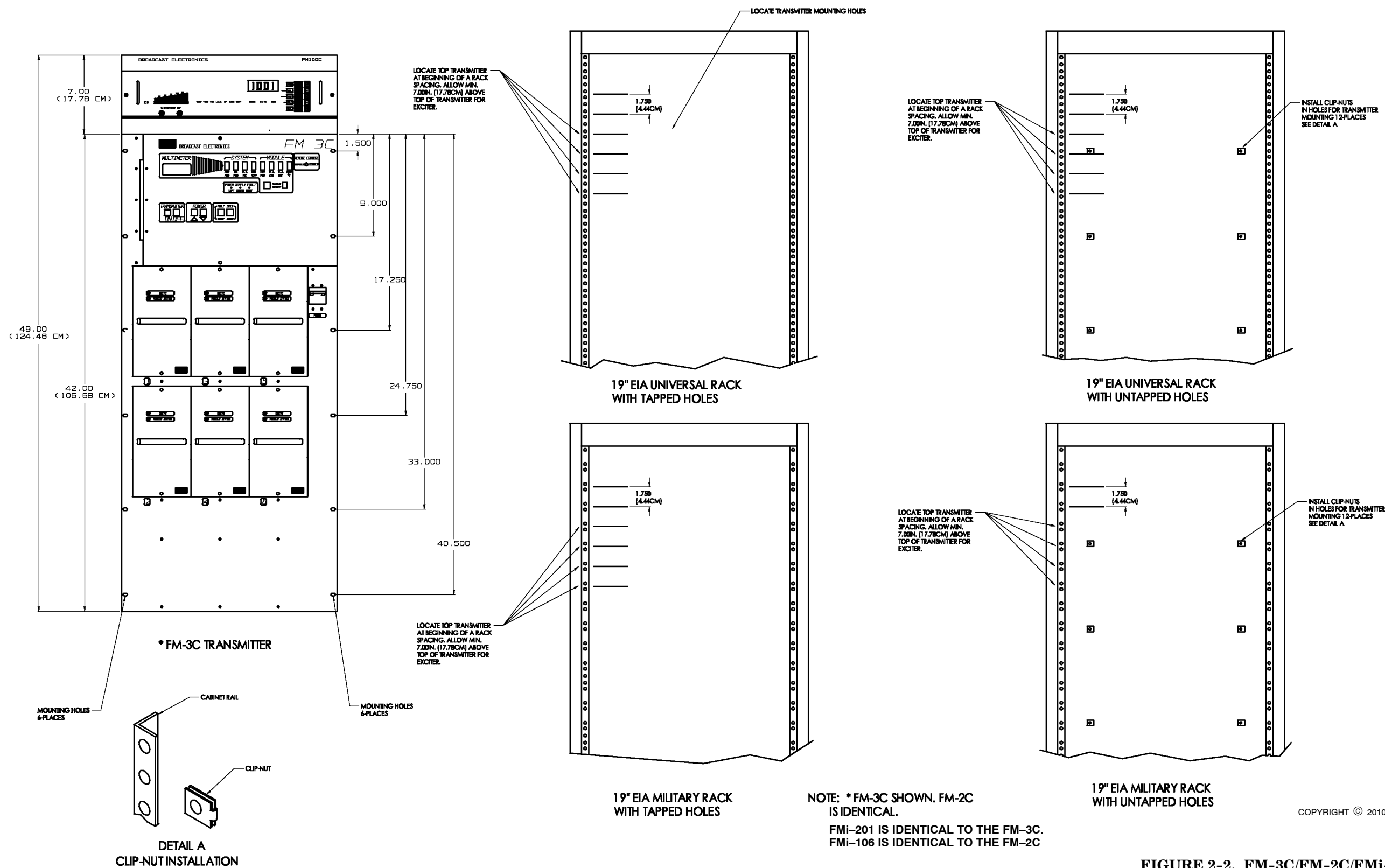
NOTES

1. COOLING AIR REQUIREMENTS – 1400 CFM (39.7 m³/min) Filter Required – 407-0062
2. GROUND STRAP ENTRY IN LOWER LEFT CORNER AT REAR OF CABINET.
3. RF OUTPUT CONNECTION – 1 5/8 INCH EIA 50 OHM FEMALE FIELD FLANGE.
4. HEAT DISSIPATION –
 - FM ONLY
 - FMi-201 – 3 kW (10,250 Btu/H) at a 3 kW RF output, 50 Ohm resistive load.
 - FMi-106 – 2.2 kW (7525 Btu/H) at a 2 kW RF output, 50 Ohm resistive load.
 - HD ONLY
 - FMi-201 – 2.14 kW (7304 Btu/H) at 840 W RF output, 50 Ohm resistive load.
 - FMi-106 – 1.7 kW (5802 Btu/H) at 560 W RF output, 50 Ohm resistive load.
 - FM + HD
 - FMi-201 – 2.85 kW (9730 Btu/H) at 2.1 kW RF output, 50 Ohm resistive load.
 - FMi-106 – 2.1 kW (7170 Btu/H) at 1.4 kW RF output, 50 Ohm resistive load.
5. WEIGHT –
 - FMi – 201 – Transmitter – 260 lbs (117.9 kgs). Exciter – 40 lbs (18.1 kgs)
 - FMi-106 – Transmitter – 212 lbs (96.2 kgs). Exciter – 40 lbs (18.1 kgs)
6. AC POWER CONSUMPTION –
 - FMi-201
 - HD Only – 2.9 kW @ 840 W RF Output
 - FM+HD – 4.95 kW @ 2.1 kW RF Output
 - FM Only – 6 kW @ 3 kW RF Output
 - FMi-106
 - HD Only – 2.2 kW @ 560 W RF Output
 - FM+HD – 3.2 kW @ 1.4 kW RF Output
 - FM Only – 4.2 kW @ 2 kW RF Output
7. AC POWER INPUT –
 - FMi-201 – 196 to 252VAC 50/60 Hz, Single Phase
 - HD Only – 18A
 - FM+HD – 28A
 - FM Only – 28A
 - FMi-106 – 196 to 252VAC 50/60 Hz, Single Phase
 - HD Only – 12A
 - FM+HD – 16A
 - FM Only – 22A
7. PRIMARY AC FUSED DISCONNECT –
 - FMi-201
 - FUSE SIZE – 60 AMP
 - WIRE SIZE – #4 Copper AWG, Type THHN
 - FMi-106
 - FUSE SIZE – 40 AMP
 - WIRE SIZE – #8 Copper AWG, Type THHN
8. RACK REQUIREMENTS – 19 Inch Rack Universal Mounting. .281 Diameter holes or 10-32 Tapped holes, 28 Vertical Rack Units.
9. AIR EXHAUST SIZE – 500 Sq In. (3226 Sq CM) top of unit.
10. POWER FACTOR –
 - FMi-201 – Greater than 0.98 @ 230 VAC with a 3kW RF output into a 50 Ohm load.
 - FMi-106 – Greater than 0.99 @ 230 VAC with a 2kW RF output into a 50 Ohm load.

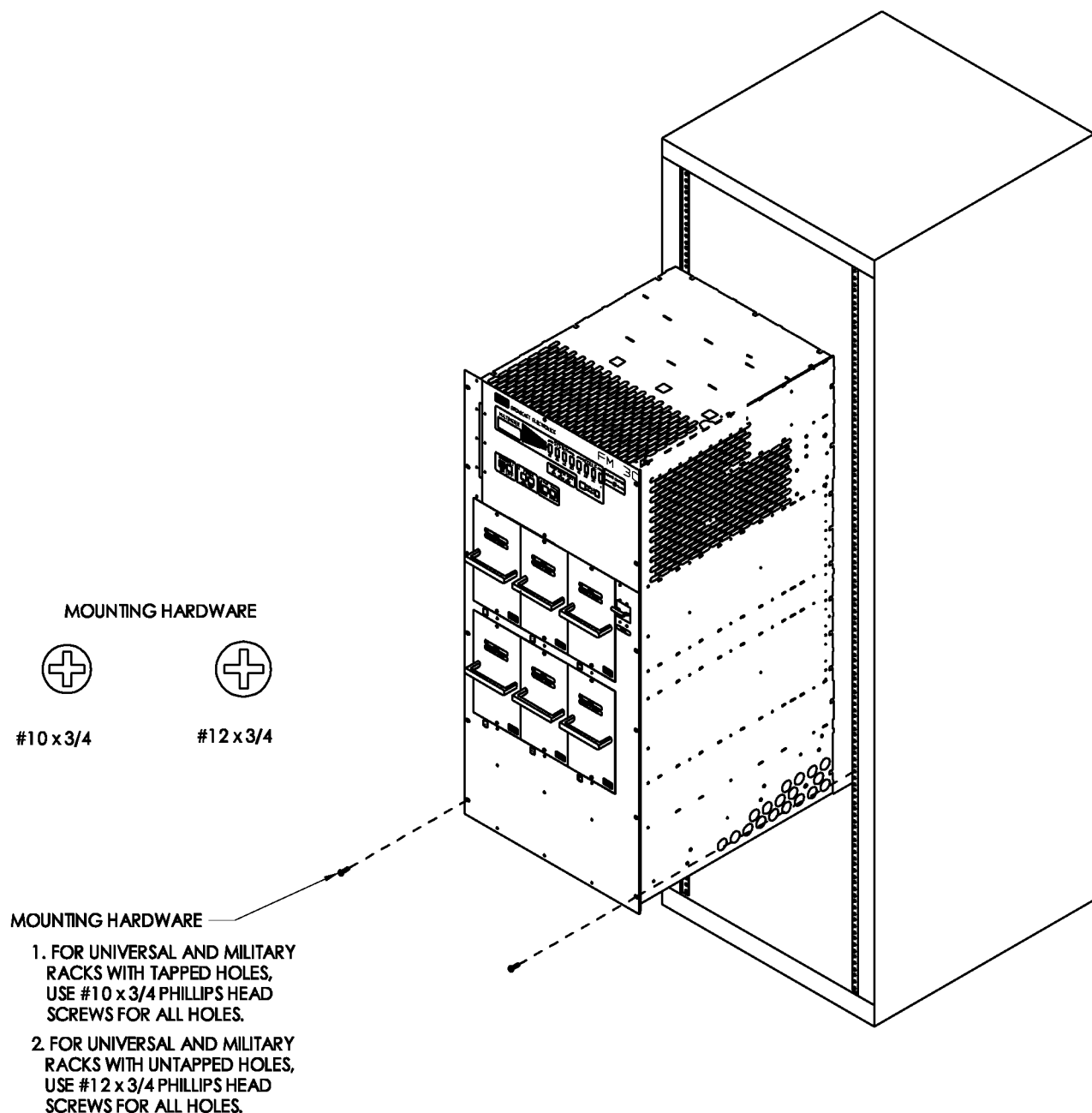
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FIGURE 2-1. TRANSMITTER INSTALLATION DIAGRAM - FMi-201/FMi-106 (SHT 2 OF 2)
(2-5/2-6)



**FIGURE 2-2. FM-3C/FM-2C/FMi-201/FMi-106
RACK INSTALLATION
(SHEET 1 OF 2)
(2-7/2-8)**



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597-3002-3B

FIGURE 2-2. FM-3C/FM-2C/FMi-201/FMi-106 RACK INSTALLATION (SHEET 2 OF 2)

- 2-25. Locate the exciter mounting brackets.
- 2-26. Refer to Figure 2-3 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 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.

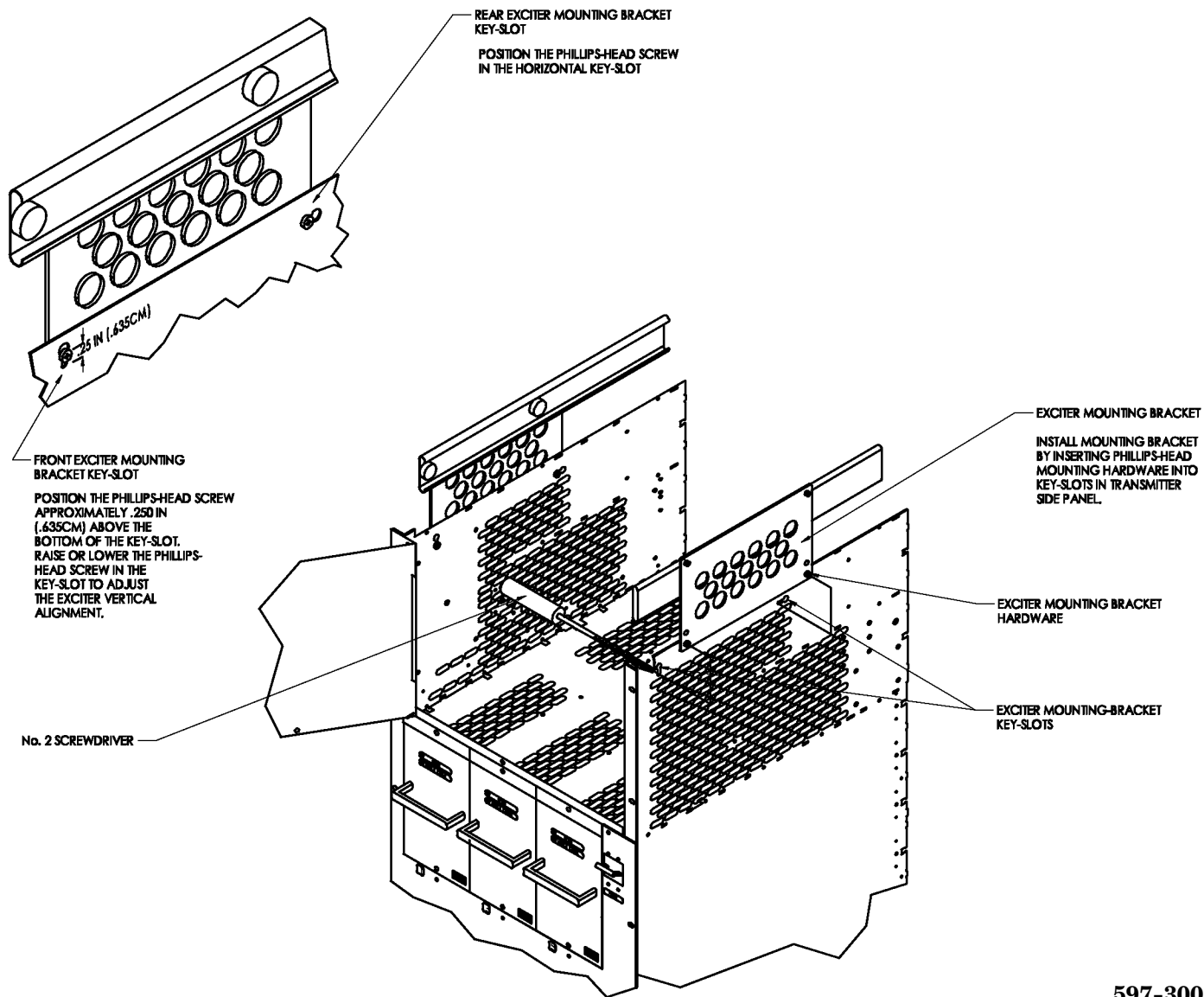


WARNING

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

WARNING

- 2-27. **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-3C/FM-2C and FMi-201/FMi-106 components, refer to Figure 2-4 and perform the following procedures.
- 2-28. **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 2-4 and install the battery in the holder on the controller circuit board as shown.
- 2-29. **FM-100C Exciter Installation.** The FM-100C exciter is mounted on the slide-rails above the transmitter. To install the exciter, proceed as follows:
 1. Locate the FM-100C exciter.
 2. Refer to FM-100C exciter manual 597-1002 and perform the PRELIMINARY INSTALLATION PROCEDURES to unpack and configure the exciter. Do not perform the following preliminary installation procedures: 1) placement, and 2) slide-rail installation and mounting.
 3. Refer to Figure 2-4 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 2-3 and loosen the mounting bracket hardware on the front key slot.
 - B. Refer to Figure 2-3 and raise or lower the hardware in the key slot to adjust the exciter vertical alignment.
 - C. Secure the exciter front-panel mounting hardware.



597-3002-4

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FIGURE 2-3. FM-3C/FM-2C EXCITER MOUNTING BRACKET INSTALLATION

CAUTION THE TRANSMITTER MAY BE DAMAGED IF THE POWER SUPPLY MODULES ARE NOT SECURELY SEATED INTO THE MOTHERBOARD CONNECTOR.

INSTALL POWER SUPPLY MODULES:

1. INSERT A POWER SUPPLY MODULE IN THE TRANSMITTER CHASSIS.
2. FIRMLY PRESS THE POWER SUPPLY MODULE INTO THE MOTHERBOARD CONNECTORS.
3. ENGAGE THE POWER MODULE LOCK BY ROTATING THE FRONT PANEL KNOB CLOCKWISE UNTIL THE KNOB IS SECURE.

INSTALL EXCITER:

1. PLACE UNIT ON THE SLIDE RAILS
2. SECURE THE EXCITER FASTENERS

POWER SUPPLY
MODULE LOCK

INSTALL BATTERY

CAUTION THE TRANSMITTER MAY BE DAMAGED IF THE RF POWER MODULES ARE NOT SECURELY SEATED INTO THE MOTHERBOARD CONNECTOR.

INSTALL RF POWER MODULES:

1. INSERT AN RF POWER MODULE IN THE TRANSMITTER CHASSIS.
2. FIRMLY PRESS THE RF POWER MODULE INTO THE MOTHERBOARD CONNECTORS.
3. SECURE THE RF POWER MOUNTING HARDWARE. THE MOUNTING HARDWARE MUST BE SECURE TO ENSURE THE RF POWER MODULE IS PROPERLY SEATED IN THE CONNECTORS.

NOTES:

1. FM-2C SUPPLIED WITH RF POWER MODULES 1 THRU 4 AND POWER SUPPLIES LEFT AND CENTER.
2. FMI-106 SUPPLIED WITH RF POWER MODULES 1 THRU 4 AND POWER SUPPLIES LEFT AND CENTER
3. FMI-201 IS IDENTICAL TO FM-3C

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**FIGURE 2-4. FM-3C/FM-2C/FMi-201/FMi-106
COMPONENT INSTALLATION**

597-3002-5

- 2-30. **RF Power Module Installation.** The FM-3C/FMi-201 is equipped with RF power modules 1 through 6. The FM-2C/FMi-106 is equipped with RF power modules 1 through 4. 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 STAND A MODULE ON THE REAR-PANEL.***

1. Locate the RF power modules.
2. Ensure the packing material is removed from the RF output connector on the module rear-panel.
3. Refer to Figure 2-4 and align an RF power module with the guides in the RF power module 1 location.
4. Insert and firmly press the RF module into the motherboard connectors.
5. Secure the RF power module mounting hardware. The mounting hardware must be secure to ensure the module is properly seated in the connectors.
6. For FM-3C/FMi-201 models, repeat the procedure for RF power modules 2 through 6. Install the RF power modules in locations 2 through 6.
7. For FM-2C/FMi-106 models, repeat the procedure for RF power modules 2 through 4. Install the RF power modules in locations 2 through 4.



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

WARNING

- 2-31. **WIRING.**

- 2-32. **EXCITER CONNECTIONS.** The FM-100C/FXi-250 exciter will require re-connection to the transmitter. Refer to the following text to re-connect the exciter to the transmitter.

1. Refer to Figure 2-5 and connect P22 to J22 on the transmitter rear-panel.
2. Refer to Figure 2-5 and connect cable 300 to the **RF OUTPUT** receptacle on the exciter rear-panel.

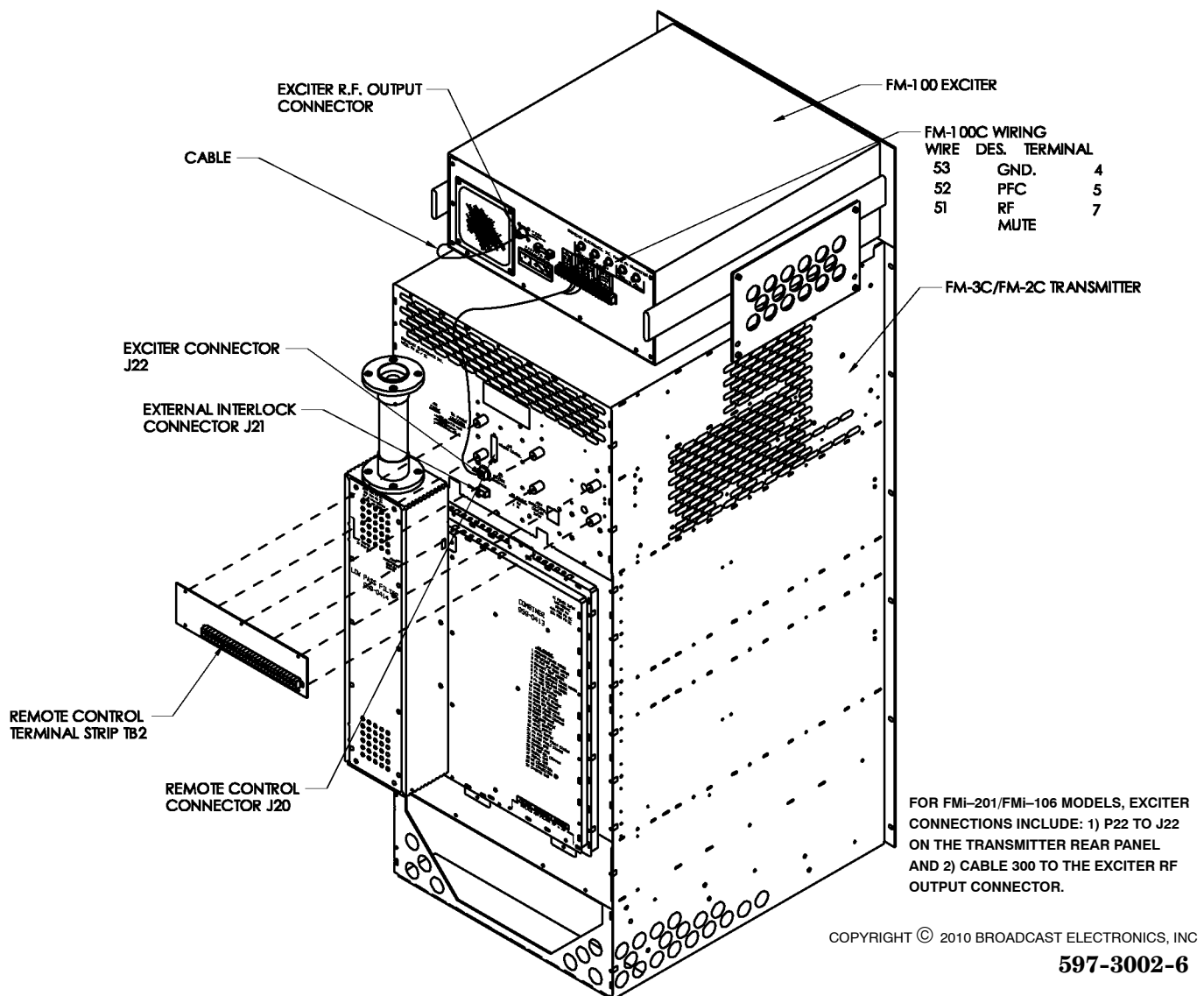
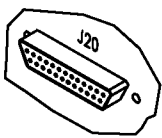
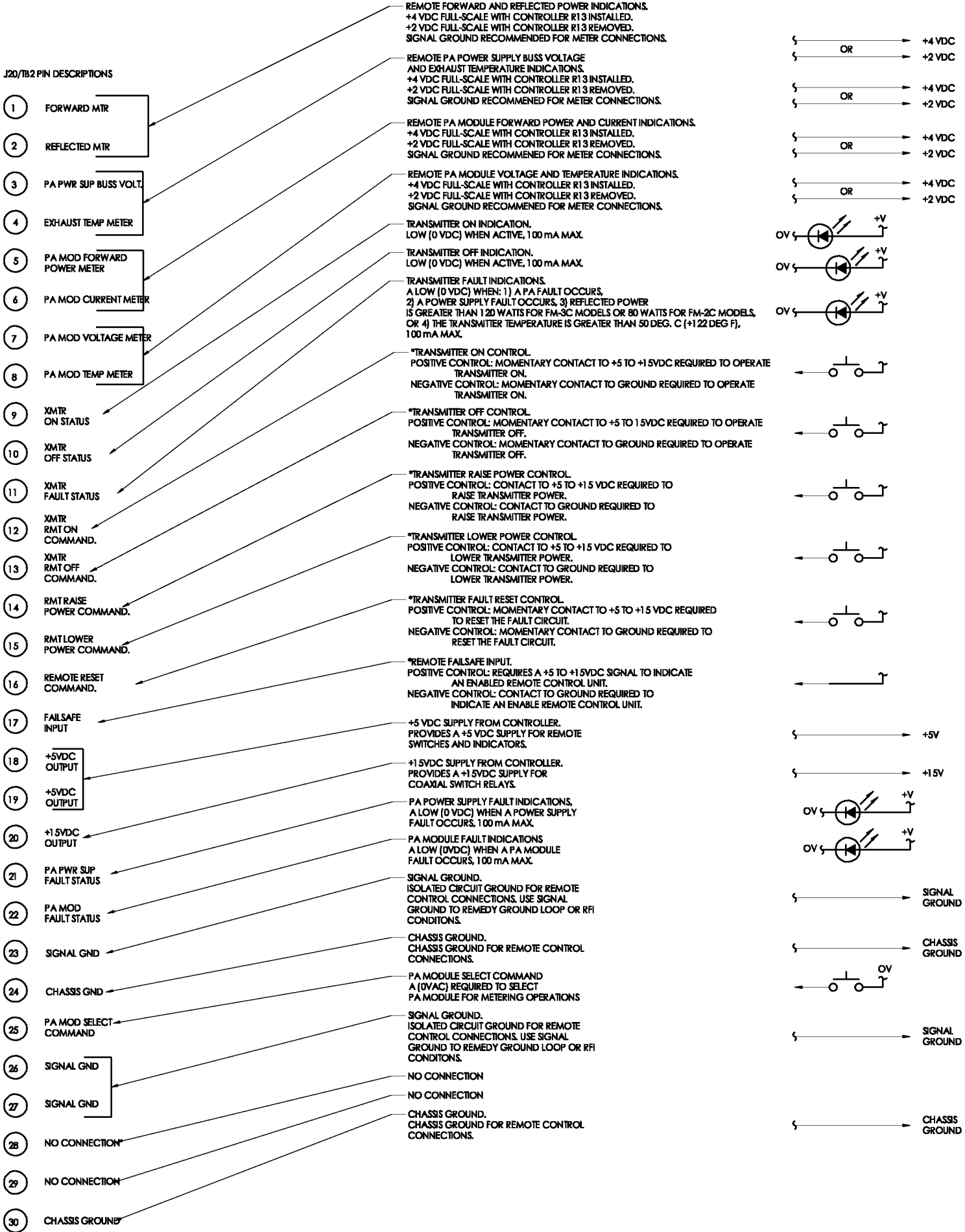


FIGURE 2-5. FM-3C/FM-2C/FMi-201/FMi-106 CONNECTIONS

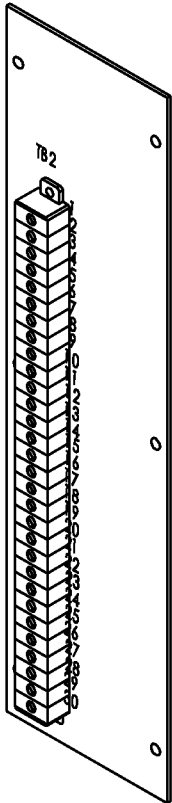
- 2-33. **REMOTE CONTROL.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are designed for complete remote control operations (refer to Figure 2-6). The transmitters will interface with almost any remote control unit. The following text presents a description of the transmitter remote control functions and indications. The remote control connections are located on the transmitter rear-panel (refer to Figure 2-5).
- 2-34. Remote control connections are interfaced to the transmitter at J20 on the transmitter rear-panel (refer to Figure 2-5). 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 2-5 and remove the interface circuit board.

- 2-35. The transmitter controller: 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 2-6 and the following text to connect remote control equipment to the system. 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. The transmitter controller is factory programmed for positive remote control operations.
- 2-36. **Remote Forward/Reflected Power Meter Indications.** Remote transmitter forward/reflected power meter indications are located at TB2-1 and TB2-2. 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 forward and reflected power meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-37. **Remote PA Power Supply Bus Voltage/Temperature Meter Indications.** Remote PA power supply bus voltage/temperature meter indications are located at TB2-3 and TB2-4. The PA power supply bus voltage indication monitors a transmitter power supply bus voltage. The temperature indication monitors the transmitter exhaust air temperature. 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 power supply bus voltage/temperature meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-38. **Remote PA Module Forward Power/Current Meter Indications.** Remote PA module forward power/current meter indications are located at TB2-5 and TB2-6. The PA module forward power/current indications monitor forward power and current of a single module selected by the PA module select command (refer to PA Module Select Command in the following text). 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 forward power/current meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-39. **Remote PA Module Voltage/Temperature Meter Indications.** Remote PA module voltage/temperature meter indications are located at TB2-7 and TB2-8. The PA module voltage/temperature indications monitor voltage and temperature of a single module selected by the PA module select command (refer to PA Module Select Command in the following text). 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 module voltage/temperature meter indications programmed for +4 volt full-scale meter indications. Signal ground recommended for remote metering ground connections.
- 2-40. **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.
- 2-41. **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.
- 2-42. **Transmitter Fault Indications.** The transmitter fault indicator provides a signal to indicate when: 1) a PA module fault occurs, 2) a power supply module fault occurs, 3) reflected power is greater than 120 watts for FM-3C/FMi-201 or 80 watts for an FM-2C/FMi-106, or 4) the transmitter temperature is greater than 50 °C (+122 °F). The transmitter fault indicator is located at TB2-11. The indicator will go LOW (0 volts dc) to indicate when a PA module fault, a power supply module fault, a high reflected power, or a high temperature condition has occurred.

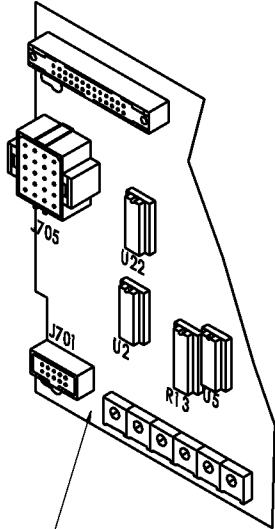
- 2-43. **Remote Transmitter On Control.** The transmitter on function is located at TB2-12. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 volt to +15 volt dc signal to operate the transmitter to on. Negative control requires the use of a momentary contact to ground to operate the transmitter to on.
- 2-44. **Remote Transmitter Off Control.** The transmitter off function 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.
- 2-45. **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.
- 2-46. **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.
- 2-47. **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.
- 2-48. **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.
- 2-49. **+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.
- 2-50. **+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 for control operations.
- 2-51. **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.
- 2-52. **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.
- 2-53. **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.
- 2-54. **Chassis Ground.** Chassis ground is designed to be used for remote control connections. Chassis ground is located at TB2-24 and TB2-30.



A REMOTE CONTROL INTERFACE CONNECTOR J20



B REMOTE CONTROL INTERFACE TERMINAL STRIP TB2



CONTROLLER CIRCUIT BOARD ASSEMBLY LOCATION OF R13

NOTES: *1. POSITIVE CONTROL: J1 ON CONTROLLER ON-OFF CIRCUIT BOARD IN POSITION 2-3
2. NEGATIVE CONTROL: J1 ON CONTROLLER ON-OFF CIRCUIT BOARD IN POSITION 1-2.

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FIGURE 2-6. REMOTE CONTROL CONNECTIONS
(2-17/2-16)
597-3002-7

- 2-55. **PA Module Select Command.** The PA module select command is located at TB2-25. The command is used to select one PA RF power module for metering operations. The control requires a momentary contact to ground to select a PA RF power module. A different module is selected each time a momentary contact to ground is applied (refer to SECTION III, OPERATION for operating information).
- 2-56. **No Connection.** No connection at TB2-28 and TB2-29.
- 2-57. **EXTERNAL INTERLOCK.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are equipped with an external interlock such as for a test load. The interlock will operate the transmitter to off when opened. The interlock is located at J21 on the transmitter rear-panel (refer to Figure 2-5). To connect an external interlock to the transmitter, refer to Figure 2-5 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.
- 2-58. **MODULATION MONITOR RECEPTACLE.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are equipped with a modulation monitor receptacle. The receptacle is located on the transmitter low-pass filter (refer to Figure 2-7). Refer to Figure 2-7 and connect the modulation monitor to the modulation monitor receptacle. The receptacle provides a: 1) 2V RMS sample into a 50 Ohm load at 3 kW for FM-3C/FMi-201 models and 2) 2V RMS sample into a 50 Ohm load at 2 kW for FM-2C/FMi-106 models.
- 2-59. **AUDIO INPUT CONNECTIONS.** Audio input connections for the FM-3C/FM-2C transmitters are located on the FM-100C exciter rear panel. Audio input connections for the FMi-201/FMi-106 transmitters are located on the FXi-250 exciter rear panel. To connect audio to the FM-3C/FM-2C transmitters, refer to FM-100C exciter manual 597-1002 and perform the WIRING procedures in SECTION II, INSTALLATION. To connect audio to the FMi-201/FMi-106 transmitters, refer to FXi-250 exciter manual 597-0541 and perform the WIRING procedures in SECTION II, INSTALLATION.

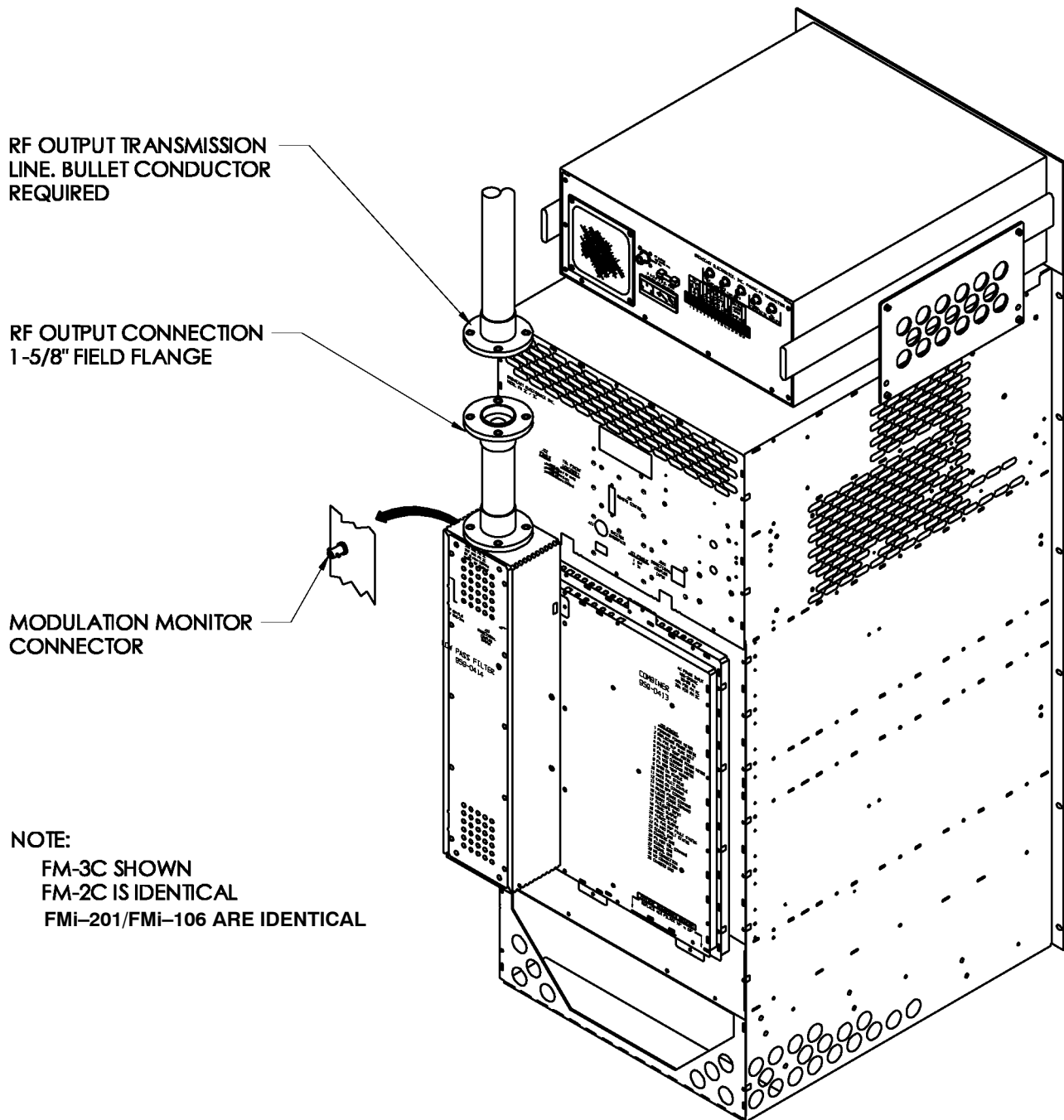


WARNING

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

WARNING

- 2-60. **RF OUTPUT TRANSMISSION LINE CONNECTION.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitter RF output connection is located on the transmitter low-pass filter (refer to Figure 2-7). The output connection is equipped with a 1 5/8 inch field flange. If a flange connection is required: 1) locate the flange in the accessory kit and 2) install the flange on the RF output transmission line as shown. To connect the RF output transmission line to the transmitter, attach the transmission line to the RF output connection on the low-pass filter as shown.



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FIGURE 2-7. RF OUTPUT AND MODULATION MONITOR 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

- 2-61. **AC POWER CONNECTIONS.** The FM-3C/FMi-201 transmitters requires a single phase source of 196V to 252V ac, 50/60 Hz at 60 Amperes. The FM-2C/FMi-106 transmitters requires a single phase source of 196V to 252V ac, 50/60 Hz at 40 Amperes. For operating safety, the power source must be routed to the transmitter through a fused power disconnect (refer to Figures 2-8 and 2-9). To meet most electric codes: 1) the transmitter must be installed in a rack and 2) the ac power source must be routed to the transmitter rack using conduit. Check local electric codes for specific ac power supply connection details.



WARNING

ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.

WARNING

- 2-62. **FM-100C AC Power Connections.** The FM-100C ac power source is provided by the transmitter. Connect the ac power cord from the transmitter to the FM-100C as shown. The FM-100C operates from a 194V to 266V ac source.
- 2-63. **FXi-250 AC Power Connections.** The FXi-250 ac power source is provided by the transmitter. Connect the ac power cord from the transmitter to the FXi-250 as shown. The FXi-250 operates from a 194V to 266V ac source.
- 2-64. **Main AC Input – FM-3C/FMi-201.** Refer to Figure 2-8 and connect the 60 Ampere service to the ac input panel through a fused service disconnect as shown. Ensure a utility company ground conductor is securely connected to the transmitter ground terminal.
- 2-65. **Main AC Input – FM-2C/FMi-106.** Refer to Figure 2-9 and connect the 40 Ampere service to the ac input panel through a fused service disconnect as shown. Ensure a utility company ground conductor is securely connected to the transmitter ground terminal.



WARNING

ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.



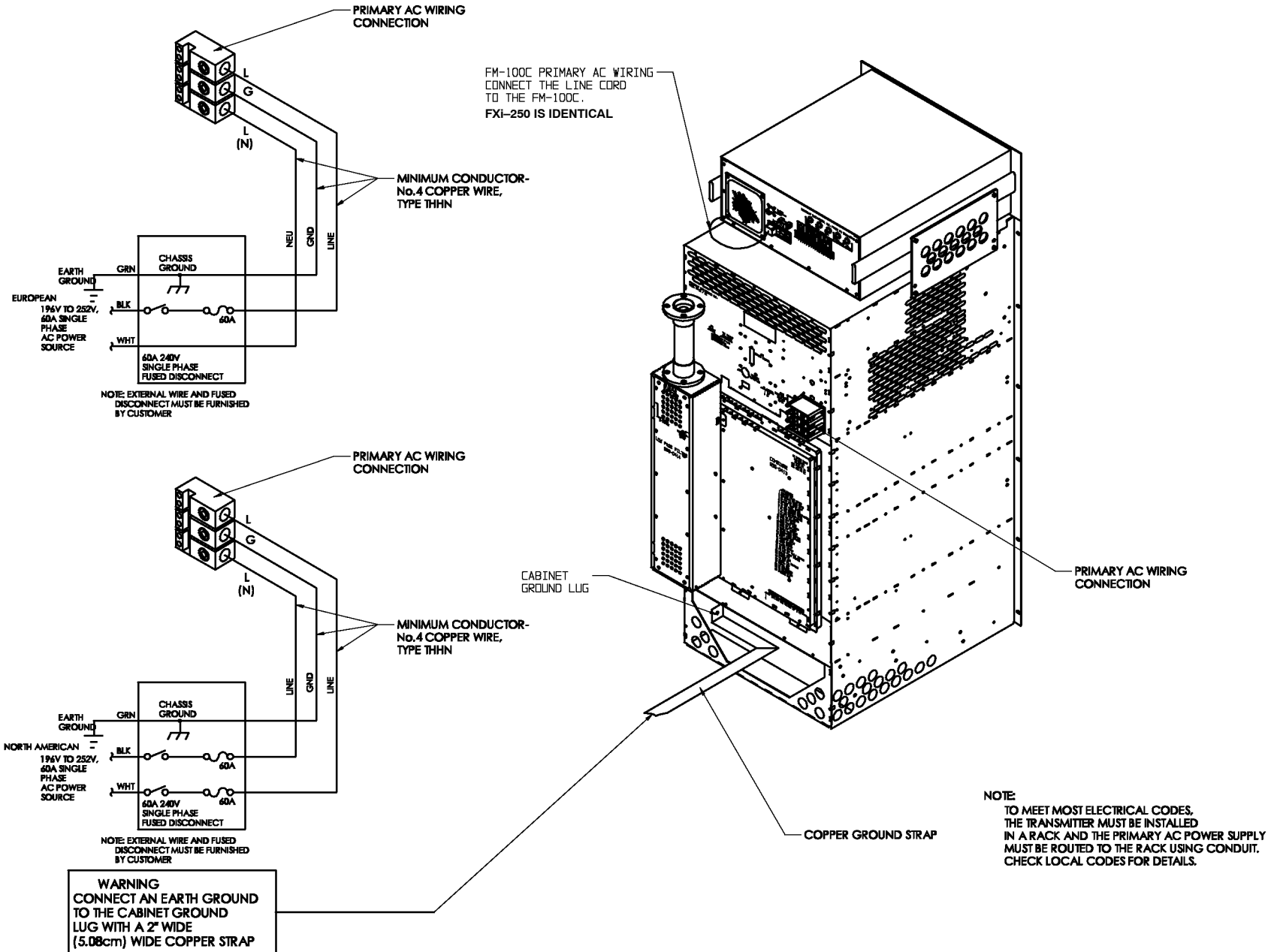
WARNING

WARNING

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

WARNING

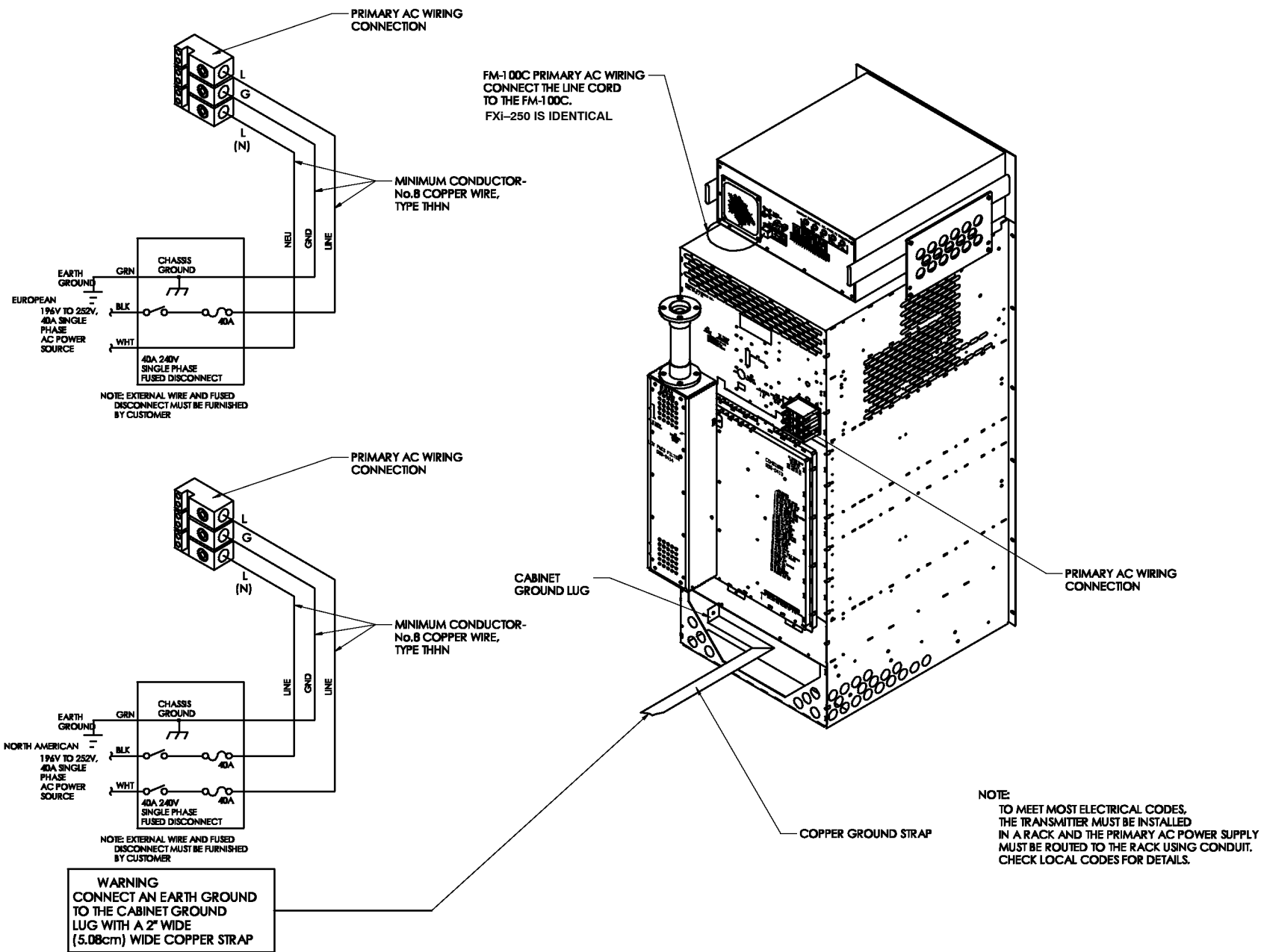
- 2-66. **GROUND.** The FM-3C/FM-2C and FMi-201/Fmi-106 transmitters are equipped with a chassis ground system for operating safety. The ground system requires the connection of an earth ground. Refer to Figures 2-8/2-9 and connect an earth ground to the chassis ground lug as shown using a 2 inch (5.08 cm) wide copper strap.



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FIGURE 2-8. FM-3C/FMi-201 AC POWER CONNECTIONS

597-3002-8



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FIGURE 2-9. FM-2C/FMi-106 AC POWER CONNECTIONS

597-3002-9

2-68. An FM-3C/FM-2C and FMi-201/FMi-106 transmitters can be installed at the factory in a cabinet with a fan kit. If the transmitter is installed in a cabinet with a fan kit, the cabinet will require two ac input installations. One ac input is required for the transmitter. The second input is required by the ac distribution panel. The following text presents the procedures to connect ac power to a transmitter installed in a cabinet.



WARNING

ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.

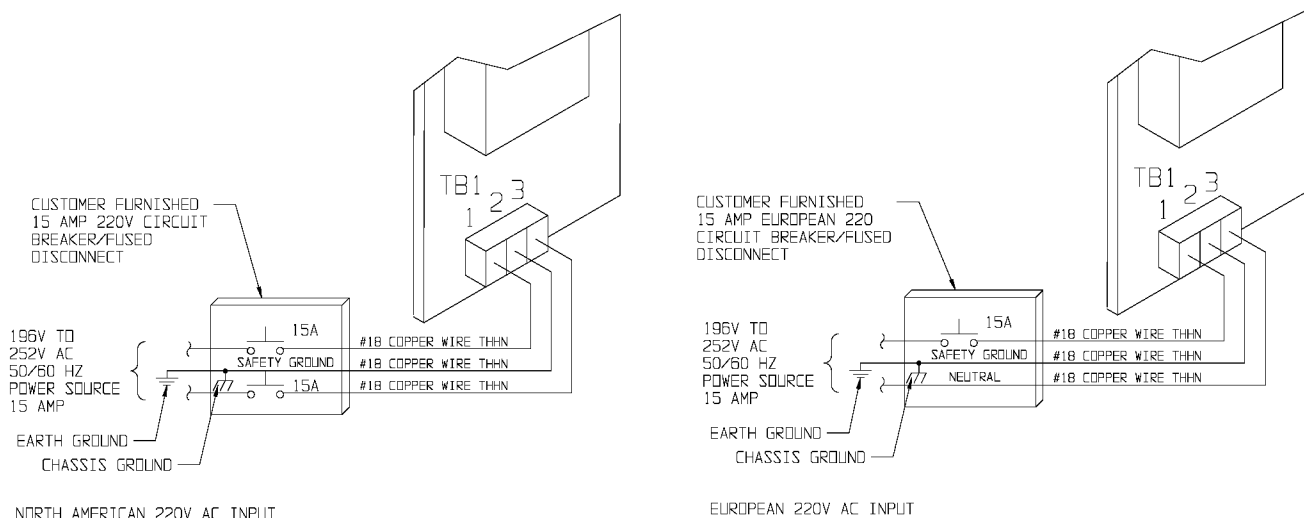
- 2-69. Refer to **AC POWER CONNECTIONS** in the preceding text and perform the procedure to connect ac power to the transmitter.
- 2-70. The ac distribution panel requires a single phase source of 196V to 252V ac at 15 Amperes (refer to Figure 2-10). When the transmitter is shipped from the factory, the cabinet will be configured for the power source specified in the sales order. For operating safety, the power source must be routed to the panel through a fused/circuit breaker power disconnect. Refer to Figure 2-10 and: 1) connect the 15 Ampere ac input to TB1 in the cabinet and 2) ensure a utility company earth ground conductor is securely connected to the transmitter ground lug.



WARNING

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

- 2-71. The transmitter cabinet is equipped with a chassis ground system for operating safety. The ground system requires the connection of an earth ground. Ensure an earth ground is securely connected to the transmitter chassis ground lug using a 2 inch (5.08 cm) wide copper strap.



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597-3002-601

FIGURE 2-10. AC WIRING - FACTORY CABINET INSTALLATIONS

2-72. **PRELIMINARY OPERATION.**



NOTE

***DO NOT REDUCE THE EXCITER OUTPUT POWER
PRIOR TO ENABLING THE TRANSMITTER.***

NOTE

2-73. The following text presents procedures for the preliminary operation of the FM-3C/FM-2C 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-3C/FM-2C and FMi-201/FMi-106 transmitters.

2-74. Ensure the appropriate ac power supply is applied to the transmitter and the FM-100C exciter.

2-75. 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.

2-76. 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.

2-77. Depress the transmitter **SYSTEM FWD POWER** switch/indicator. The **MULTIMETER** will indicate 0 watts forward power.

2-78. Depress the **ON** switch/indicator to illuminate the switch/indicator. All RF power module: 1) **MODULE STATUS** indicators will illuminate green and 2) **RF DRIVE** indicators will illuminate.

2-79. Depress the exciter **MULTIMETER FWD** switch. The exciter **MULTIMETER** will indicate the forward power recorded in the factory test data sheets.

2-80. 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 **SYSTEM RFL POWER** switch/indicator to illuminate the switch/indicator.
 - B. Observe the **MULTIMETER** reflected power indication. If a reflected power condition of greater than 120 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 1.5:1.
 - C. If the reflected power indication is less than 120 watts for FM-3C/FMi-201 or 80 watts for FM-2C/FMi-106, depress the **SYSTEM PS VDC** and **EXH TEMP** switch/indicators to determine if a power supply or temperature problem is present.
 - D. If no power supply or temperature problem is present, depress the **MODULE FWD PWR, P.A. CUR, P.A. VDC, TEMP**, and the **MODULE SELECT** switch/indicators to determine if an RF power module problem is present.

- E. When the problem 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.
- 2-81. 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. RFL PWR | 6. MODULE P.A. VDC |
| 2. PS VDC | 7. MODULE TEMP |
| 3. EXH TEMP | 8. MODULE SELECT |
| 4. MODULE FWD PWR | |
| 5. MODULE P.A. CUR | |

SECTION III OPERATION

3-1. INTRODUCTION.

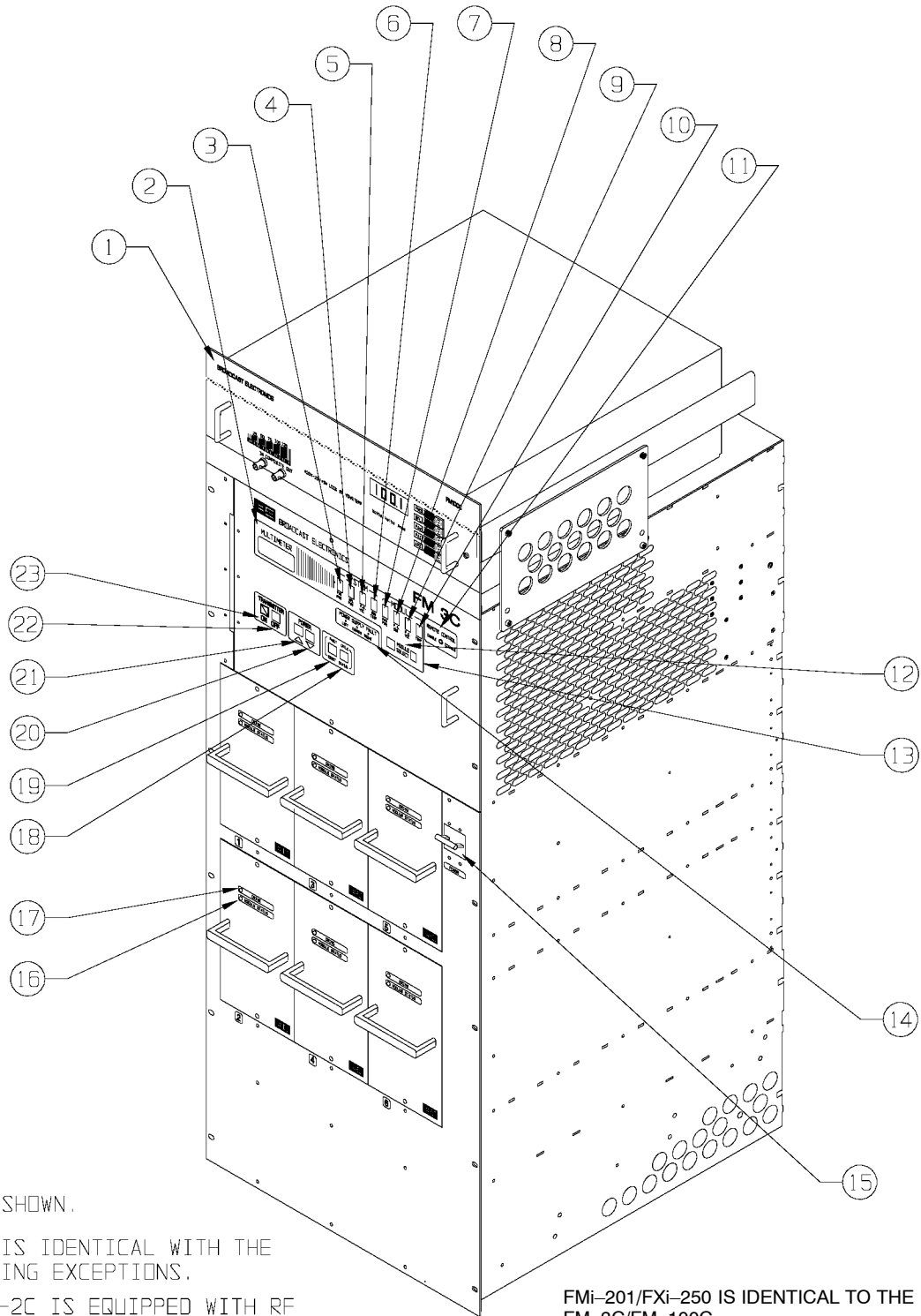
3-2. This section identifies all controls and indicators associated with the FM-3C/FM-2C and FMi-201/FMi-106 transmitters and provides standard operating procedures.

3-3. CONTROLS AND INDICATORS.

3-4. Figure 3-1 presents the location of all controls and indicators associated with normal operation of the FM-3C/FM-2C and FMi-201/FMi-106 transmitters. 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-3C/FM-2C and FMi-201/FMi-106 transmitters.

TABLE 3-1. FM-3C/FM-2C AND FMi-201/FMi-106 CONTROLS AND INDICATORS
(Sheet 1 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
1	FM-100C/FXi-250 Exciter	Refer to the FM-100C instruction manual for a description of the FM-100C controls and indicators. Refer to the FXi-250 instruction manual for a description of the FXi-250 controls and indicators.
2	MULTIMETER Display	Displays forward power, reflected power, power supply voltage, exhaust air temperature, RF power module forward power, RF power module current, RF power module voltage, and RF power module temperature as selected by the MULTIMETER SYSTEM and MODULE switches.
3	SYSTEM FWD POWER Switch/Indicator	SWITCH: Configures the MULTIMETER to display the transmitter forward power in kilowatts. INDICATOR: A yellow display indicates the MULTI-METER is configured to present the transmitter forward power.
4	SYSTEM RFL POWER Switch/Indicator	SWITCH: Configures the MULTIMETER to display the transmitter reflected power in watts. INDICATOR: A yellow display indicates the MULTI-METER is configured to present the transmitter reflected power.



NOTES: FM-3C SHOWN.

FM-2C IS IDENTICAL WITH THE FOLLOWING EXCEPTIONS.

1. FM-2C IS EQUIPPED WITH RF POWER AMPLIFIER MODULES 1 THROUGH 4.
2. FM-2C IS EQUIPPED WITH POWER SUPPLY FAULT STATUS INDICATORS LEFT AND CENTER.

FMi-201/FXi-250 IS IDENTICAL TO THE FM-3C/FM-100C

FMi-106/FXi-250 IS IDENTICAL TO THE FM-2C/FM-100C

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FIGURE 3-1. FM-3C/FM-2C/FMi-201/FMi-106 CONTROLS AND INDICATORS

TABLE 3-1. FM-3C/FM-2C CONTROLS AND INDICATORS
(Sheet 2 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
5	SYSTEM P. S. VDC Switch/Indicator	SWITCH: Configures the MULTIMETER to display the PA power supply voltage. INDICATOR: A yellow display indicates the MULTI-METER is configured to present the PA power supply voltage.
6	SYSTEM EXH TEMP Switch/Indicator	SWITCH: Configures the MULTIMETER to display the transmitter exhaust air temperature in ° C. INDICATOR: A yellow display indicates the MULTI-METER is configured to present the transmitter exhaust air temperature.
7	MODULE FWD PWR Switch/Indicator	SWITCH: Configures the MULTIMETER to display RF power amplifier module forward power in watts. INDICATOR: A yellow display indicates the MULTI-METER is configured to present RF power amplifier module forward power.
8	MODULE P.A. CUR Switch/Indicator	SWITCH: Configures the MULTIMETER to display RF power amplifier module current in amperes. INDICATOR: A yellow display indicates the MULTI-METER is configured to present RF power amplifier module current.
9	MODULE P.A. VDC Switch/Indicator	SWITCH: Configures the MULTIMETER to display RF power amplifier module voltage. INDICATOR: A yellow display indicates the MULTI-METER is configured to present RF power amplifier module voltage.
10	MODULE TEMP C Switch/Indicator	SWITCH: Configures the MULTIMETER to display RF power amplifier module temperature in degrees Centigrade. INDICATOR: A yellow display indicates the MULTI-METER is configured to present RF power amplifier module temperature.
11	REMOTE CONTROL ENABLE/DISABLE Switch	Controls the transmitter remote control operations. When the switch is operated to ENABLE , remote control operation is enabled. When the switch is operated to DISABLE , remote control operation is disabled.

TABLE 3-1. FM-3C/FM-2C CONTROLS AND INDICATORS
(Sheet 3 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
12	MODULE SELECT Switch/Indicator	SWITCH: Selects an RF power amplifier module for the display of forward power, current, voltage, or temperature parameters on the MULTIMETER . For FM-3C/FMi-201 models the switch will select RF power amplifier modules 1 through 6. For FM-2C/FMi-106 models, the switch will select RF power amplifier modules 1 through 4. The switch is disabled when the REMOTE CONTROL ENABLE/DISABLE switch is operated to ENABLE . The switch is enabled when the REMOTE CONTROL ENABLE/DISABLE switch is operated to DISABLE .
	MODULE SELECT Switch/Indicator (Cont'd)	INDICATOR: Illuminates to indicate the MODULE SELECT switch is enabled. Extinguishes to indicate the module select switch is disabled. The MODULE SELECT switch is controlled by the REMOTE CONTROL ENABLE/DISABLE switch.
13	MODULE SELECT Display	Displays the RF power amplifier module selected by the MODULE SELECT switch for the display of forward power, current, voltage, or temperature parameters on the MULTIMETER .
14	POWER SUPPLY FAULT LEFT, CENTER, and RIGHT Indicators	The LEFT, CENTER, or RIGHT indicator will illuminate to indicate a power supply module fault in an FM-3C/FMi-201. The LEFT or CENTER indicator will illuminate to indicate a power supply fault in an FM-2C/FMi-106. The fault will illuminate during 1) Low/No RF Drive and 2) Power Supply Failure.
15	POWER SWITCH	Provides overload protection and primary power control for the transmitter.
16	MODULE STATUS Indicator	Displays the operating status of the RF power amplifier module. RED DISPLAY: Indicates an RF power module fault. RF power module faults include: 1) over-current, 2) over-temperature, 3) high reflected power, and 4) high forward power demand. YELLOW DISPLAY: Indicates an RF power module current limit, VSWR limit, temperature limit, high forward power demand limit, or transmitter off condition. GREEN DISPLAY: Indicates normal RF power module output operation. Will illuminate if no RF drive is present.
17	MODULE DRIVE Indicator	Illuminates to indicate the presence of RF drive at the RF power amplifier module.

TABLE 3-1. FM-3C/FM-2C CONTROLS AND INDICATORS
(Sheet 4 of 4)

INDEX NO.	NOMENCLATURE	FUNCTION
18	INTLK STATUS Switch/Indicator	SWITCH: No Operation. INDICATOR: 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.
19	FAULT RESET Switch/Indicator	SWITCH: Clears the transmitter fault circuitry if: 1) the switch is depressed and 2) if the fault condition is removed. INDICATOR: Illuminates to indicate: 1) an RF power amplifier module fault, 2) a power supply module fault, 3) a high temperature condition, or 4) a high reflected power condition.
20	POWER ▼ Switch/Indicator	SWITCH: Instructs the system controller to lower the transmitter output power. INDICATOR: Illuminates to indicate the POWER ▼ switch is selected.
21	POWER ▲ Switch/Indicator	SWITCH: Instructs the system controller to raise the transmitter output power. INDICATOR: Illuminates to indicate the POWER ▲ switch is selected.
22	TRANSMITTER OFF Switch/Indicator	SWITCH: Disables the transmitter RF output by muting the exciter, power amplifier modules, and the power amplifier power supplies. INDICATOR: Illuminates to indicate the transmitter RF output is disabled.
23	TRANSMITTER ON Switch/Indicator	SWITCH: Enables the transmitter RF output by unmuting the exciter, power amplifier modules, and the power amplifier power supplies. INDICATOR: Illuminates to indicate the transmitter RF output is enabled.

3-5. OPERATION.



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

NOTE

3-6. TURN-ON.

3-7. Operate the **POWER** switch to **ON**. The flushing fans will begin operation.

3-8. Observe the transmitter front-panel indicators. The **FAULT RESET**, **INTLK STATUS**, **POWER SUPPLY FAULT**, **MODULE DRIVE**, and **MODULE STATUS** indicators will display normal operating conditions. If the **FAULT RESET** indicator displays a fault condition, depress the **FAULT RESET** switch/indicator. If the fault condition is not cleared, operate the **POWER** switch to **OFF** and locate the problem. If the **INTLK STATUS** indicator is not illuminated, operate the **POWER** switch to **OFF** and troubleshoot: 1) an open remote control fail-safe input, 2) an open external interlock, or 3) an unlocked exciter AFC. If a **MODULE STATUS** indicator displays a fault condition, operate the **POWER** switch to **OFF** and troubleshoot the transmitter.

3-9. Depress the **ON** switch/indicator to activate the transmitter. The **ON** switch/indicator will illuminate. The RF power amplifier module **MODULE STATUS** indicators will illuminate green to indicate normal RF power output operation. The RF power amplifier module **DRIVE** indicators will illuminate to indicate the presence of RF drive at each module.

3-10. Operate the **MULTIMETER** to observe the transmitter forward and reflected power indications by performing the **MULTIMETER OPERATION** procedure in the following text.

3-11. Adjust the transmitter output power by performing the **POWER ADJUST** procedure presented in the following text.

3-12. 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**.

3-13. TURN-OFF.

3-14. 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 and the **DRIVE** indicators will extinguish.

3-15. Operate the **POWER** switch to **OFF** to remove ac power from the transmitter.

3-16. MULTIMETER OPERATION.

3-17. The **MULTIMETER** is designed to display several transmitter operating parameters. To operate the multimeter, perform the following procedures.

3-18. **SYSTEM PARAMETER DISPLAY.** Operate the **SYSTEM FWD PWR**, **RFL PWR**, **P.S. VDC**, or **EXH TEMP** switch/indicators as desired to select the parameter to be displayed on the **MULTIMETER**. The parameter will be displayed on the multimeter.

3-19. **MODULE PARAMETER DISPLAY.** The display of individual RF power amplifier module parameters on the **MULTIMETER** display is accomplished by: 1) selecting the desired RF power amplifier module and 2) selecting the desired parameter. To operate the multimeter to display individual RF power amplifier module parameters, proceed as follows:

LOCAL OPERATION -

1. Operate the **REMOTE CONTROL ENABLE/DISABLE** switch to **DISABLE**.
2. Depress the **MODULE SELECT** switch until the desired RF power amplifier module number is displayed on the **MODULE SELECT** display. For FM-3C/FMi-201 models, the switch will select RF power amplifier modules 1 through 6. For FM-2C/FMi-106 models, the switch will select RF power amplifier modules 1 through 4.
3. Depress the **MODULE FWD PWR, P.A. CUR, P.A. VDC or TEMP C** switch/indicators as desired to select the parameter to be displayed on the **MULTIMETER**. The parameter will be displayed on the the multimeter.

REMOTE OPERATION -

1. Operate the **REMOTE CONTROL ENABLE/DISABLE** switch to **ENABLE**.
2. Depress the remote PA module select switch and observe the PA module meter indications.
3. Depress the remote PA module select switch until the meters indicate 0.
4. Depress the remote PA module select switch once to select PA RF power module 1. Depress the remote PA module select switch again to select PA RF power module 2. Repeat the procedure to select PA RF power modules 3 through 6 on FM-3C/FMi-201 models or PA RF power modules 3 and 4 on FM-2C/FMi-106 models. The selected module FWD PWR, P.A. CUR, P.A. VDC, and TEMP C parameters will be displayed on the remote meters.

3-20. POWER ADJUST.

- 3-21. 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**.

3-22. EXCITER OPERATION.

- 3-23. For FM-3C/FM-2C models, refer to the FM-100C instruction manual for a complete description of the FM-100C operating procedures. Perform the procedures to configure the FM-100C for the desired operation. For FMi-201/FMi-106 models, refer to the FXi-250 instruction manual for a complete description of the FXi-250 operating procedures. Perform the procedures to configure the FXi-250 for the desired operation.

3-24. FAULT RESET.

- 3-25. To reset a transmitter fault condition, depress the **FAULT RESET** switch/indicator. If the fault condition is remedied, the **FAULT RESET** indicator will extinguish.

- 3-26. If the fault condition is not remedied, operate the **POWER** switch to **OFF** and locate the problem.
- 3-27. Once the fault condition is remedied, depress the **FAULT RESET** switch/indicator. The indicator will extinguish.
- 3-28. **RF POWER MODULE STATUS AND DRIVE INDICATORS.**
- 3-29. 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 limit or transmitter off condition. A green display indicates normal power module RF power output operation. If the indicator displays a fault or limit condition, refer to SECTION V, MAINTENANCE and troubleshoot the transmitter.
- 3-30. 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.
- 3-31. **POWER SUPPLY FAULT INDICATORS.**
- 3-32. The **POWER SUPPLY FAULT LEFT, CENTER, and RIGHT** indicators monitor the three power supply modules in an FM-3C/FMi-201 transmitter. The **POWER SUPPLY FAULT LEFT** and **CENTER** indicators monitor the two power supply modules in an FM-2C/FMi-106 transmitter. If an indicator illuminates, 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-3C/FM-2C and FMi-201/FMi-106 transmitters.

4-3. OVERALL OPERATION.

4-4. Information on overall FM-3C/FM-2C and FMi-201/FMi-106 transmitter operation is presented in Figure 4-1. Refer to Figure 4-1 for information on overall FM-3C/FM-2C and FMi-201/FMi-106 transmitter operation.

4-5. POWER SUPPLY/RF CIRCUITRY OPERATION.

4-6. A description of the FM-3C/FM-2C and FMi-201/FMi-106 transmitter power supply and RF circuitry is presented in Figure 4-2. Refer to Figure 4-2 for FM-3C/FM-2C and FMi-201/FMi-106 power supply/RF circuitry information.

4-7. CONTROLLER CIRCUITRY OPERATION.

4-8. The FM-3C/FM-2C and FMi-201/FMi-106 transmitter control and monitoring functions are performed by a CMOS digital controller. 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, 4) the meter display circuit board, 5) the multiplexer circuit board, and 6) the module select 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. 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 ± 15 volt dc supplies for controller circuitry operation.

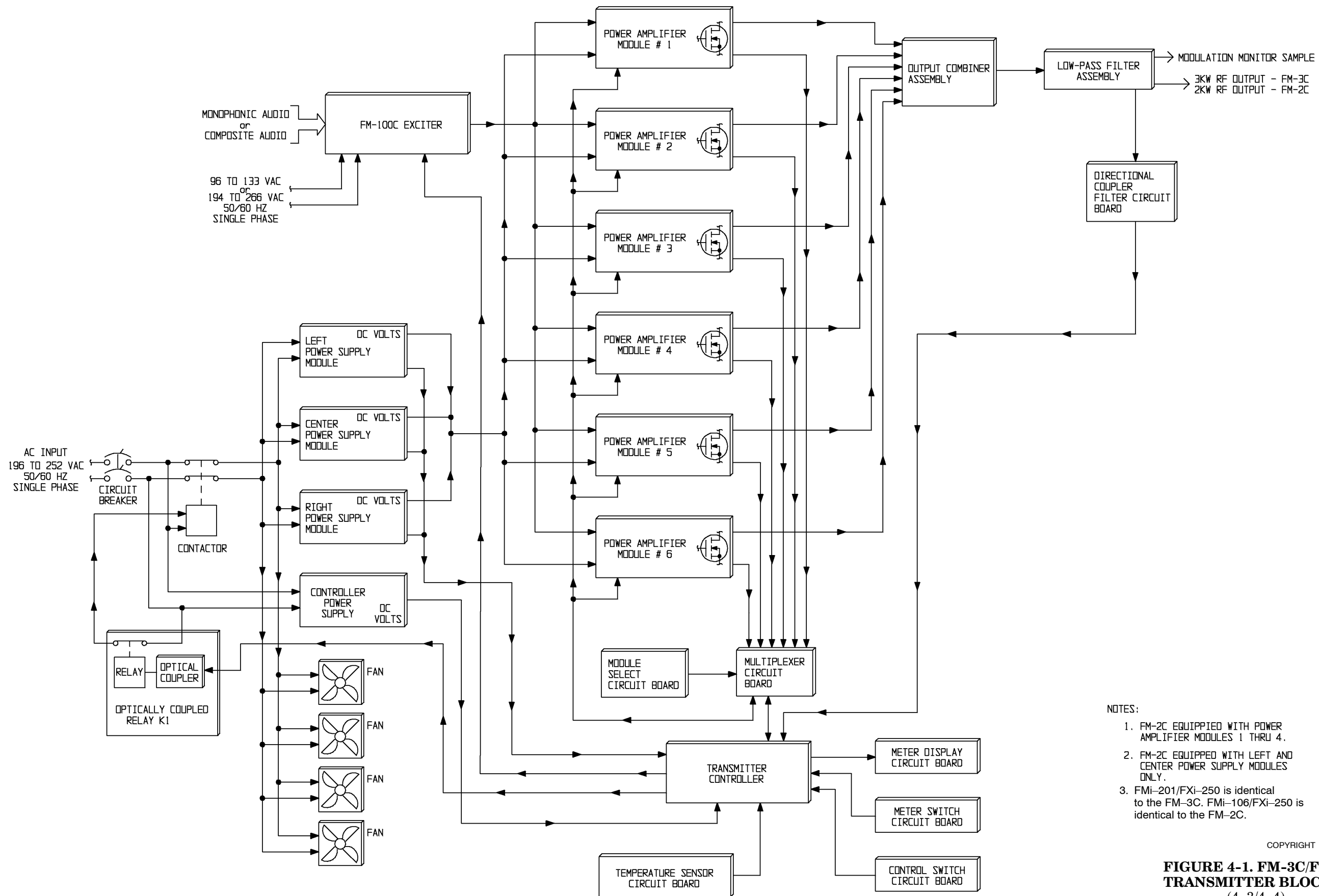
4-10. A description of the FM-3C/FM-2C and FMi-201/FMi-106 transmitter controller circuitry is presented in Figures 4-3 through 4-5. Figure 4-3 presents the controller, meter switch, and meter display circuit board information. Figure 4-4 presents the on/off switch circuit board information. Figure 4-5 presents the multiplexer and module select circuit board information.

4-11. CONTROLLER ON/OFF SWITCH CIRCUIT BOARD.

4-12. 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.

4-13. **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.

- 4-14. 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 to 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 supplies.
- 4-15. **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.
- 4-16. 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 to 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 supplies.
- 4-17. **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.
- 4-18. **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.



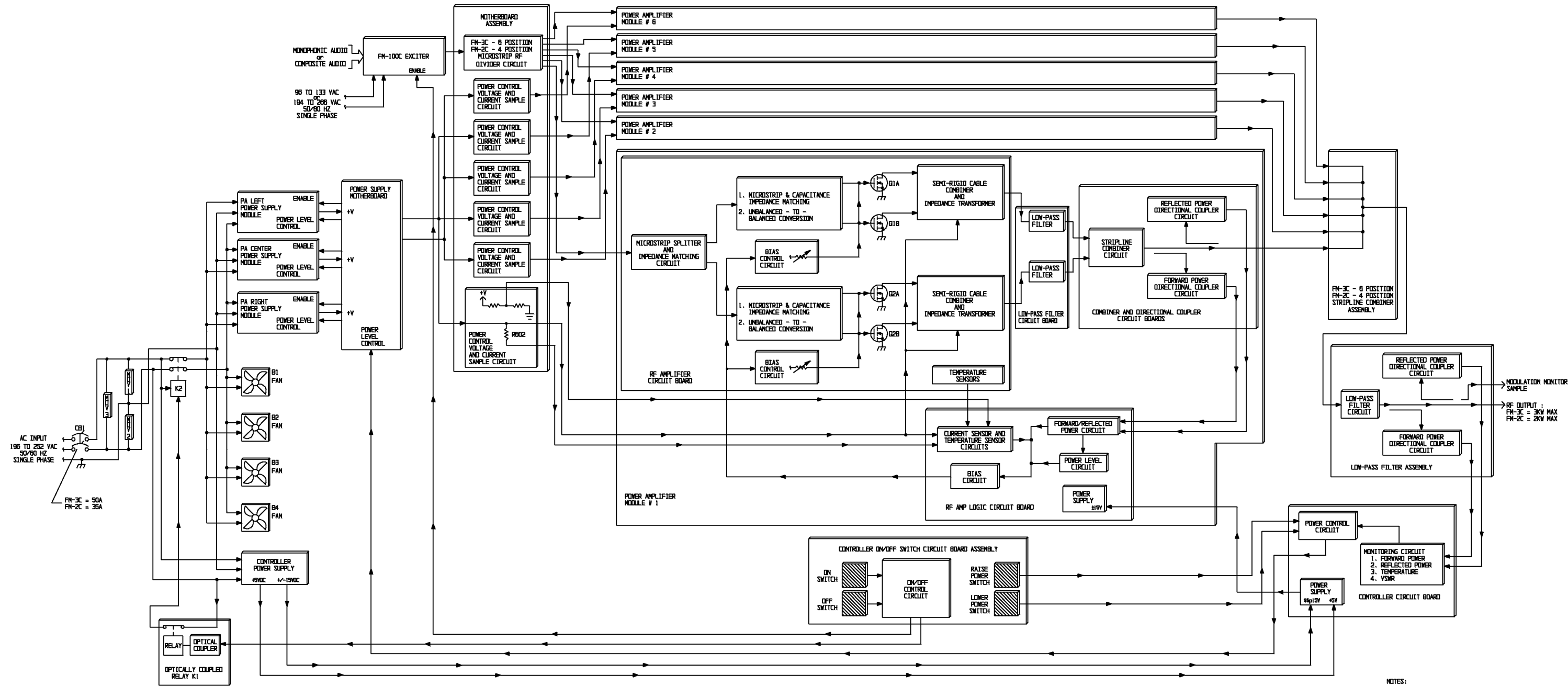
NOTES:

1. FM-2C EQUIPPED WITH POWER AMPLIFIER MODULES 1 THRU 4.
2. FM-2C EQUIPPED WITH LEFT AND CENTER POWER SUPPLY MODULES ONLY.
3. FMi-201/FXi-250 is identical to the FM-3C. FMi-106/FXi-250 is identical to the FM-2C.

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**FIGURE 4-1. FM-3C/FM-2C/FMi-201/FMi-106
TRANSMITTER BLOCK DIAGRAM**
(4-3/4-4)



NOTES:

- FM-2C IS IDENTICAL TO THE FM-3C WITH THE FOLLOWING EXCEPTIONS:
- FM-2C IS EQUIPPED WITH POWER AMPLIFIER MODULES 1 THROUGH 4 ONLY.
- FM-2C IS EQUIPPED WITH THE LEFT AND CENTER POWER SUPPLIES ONLY.

FMI-201 IS IDENTICAL TO THE FM-3C.
FMI-106 IS IDENTICAL TO THE FM-2C.

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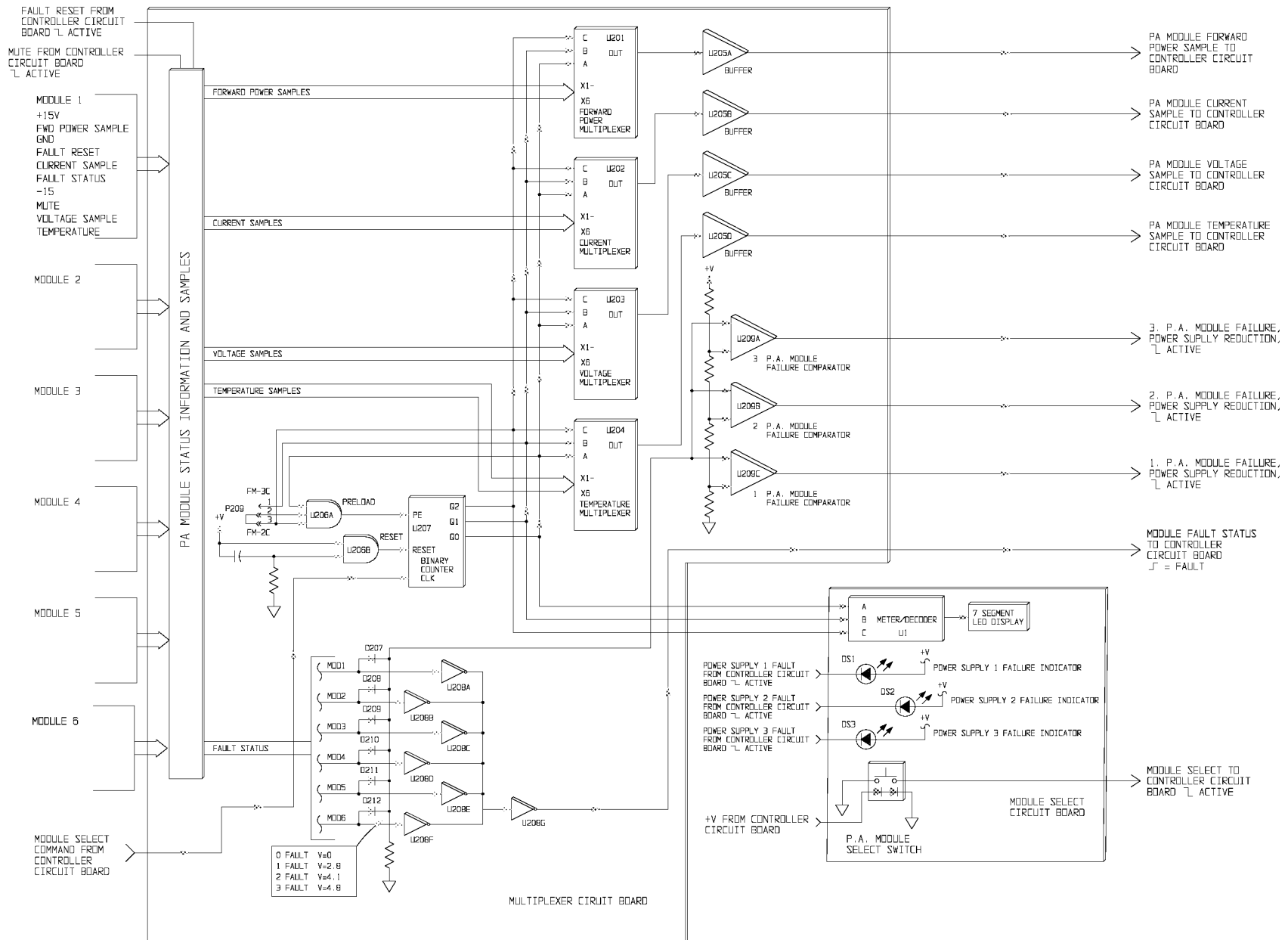
**FIGURE 4-2. POWER SUPPLY/RF CIRCUIT
SIMPLIFIED SCHEMATIC**
(4-5/4-6)



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FIGURE 4-5. MULTIPLEXER AND MODULE SELECT CIRCUIT BOARD SIMPLIFIED SCHEMATIC 597-3002-17

- 4-19. 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.
- 4-20. 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.
- 4-21. **AFC LOCK INPUT CIRCUIT.** The Automatic-Frequency-Control status signal from the exciter is applied to optical coupler U14. When the FM-100C 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.
- 4-22. **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.
- 4-23. **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.
- 4-24. **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.
- 4-25. **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.

4-26. **CONTROLLER CIRCUIT BOARD.**

4-27. 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.

4-28. **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.

4-29. **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.

4-30. 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.

4-31. **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.

- 4-32. 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.
- 4-33. **METER AMPLIFIER/BUFFER CIRCUITS.** The controller circuit board is equipped with 8 meter amplifier/buffer circuits. The module current, module temperature, module forward power, module voltage, and the PA voltage meter circuits operate in an identical manner. Therefore, only the PA voltage amplifier/buffer circuit will be discussed.
- 4-34. **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.
- 4-35. **INLET AIR TEMPERATURE CIRCUIT.** A dc sample voltage from the inlet air 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 inlet 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.

- 4-36. **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 120W/80W 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.
- 4-37. **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 3 kW/2 kW 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.
- 4-38. **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, and reflected power 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.

- 4-39. **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.
- 4-40. Module temperature conditions are monitored by circuitry on the multiplexer circuit board (refer to Figure 4-5). The circuitry consists of temperature comparator circuits for each module in the transmitter. If a module temperature exceeds the reference, the multiplexer circuit board will output a HIGH to diode D48 on the controller circuit board. The HIGH is applied to summing amplifier U21D to foldback the transmitter output power. The HIGH is also applied through diode D50 to comparator U18C. The output of U18C will go HIGH to enable both the local and remote fault indicators
- 4-41. **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.
- 4-42. **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.
- 4-43. **Power Supply Fault.** 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.
- 4-44. **CONTROLLER METER SWITCH CIRCUIT BOARD.**
- 4-45. 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 the 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 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.

4-46. **METER DISPLAY CIRCUIT BOARD.**

4-47. 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.

4-48. **RF AMPLIFIER CIRCUITRY OPERATION.**

4-49. A description of the FM-3C/FM-2C and FMi-201/FMi-106 transmitter RF amplifier circuitry is presented in Figure 4-6. Refer to Figure 4-6 for FM-3C/FM-2C and FMi-201/FMi-106 transmitter RF amplifier circuitry information.

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics FM-3C/FM-2C and FMi-201/FMi-106 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 *HIGH RF VOLTAGE IS PRESENT AT THE TYPE N CONNECTOR WHEN AN RF POWER MODULE IS REMOVED FOR SERVICE. NEVER OPERATE THE TRANSMITTER UNLESS AN RF POWER MODULE OR A MODULE COVER PANEL IS INSTALLED IN EACH TRANSMITTER MODULE LOCATION.*

5-4. The FM-3C/FM-2C and FMi-201/FMi-106 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. Never operate the transmitter unless: 1) all transmitter safety guards and cover panels are installed and 2) an RF power module or cover panel is installed in each RF power module location. 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.

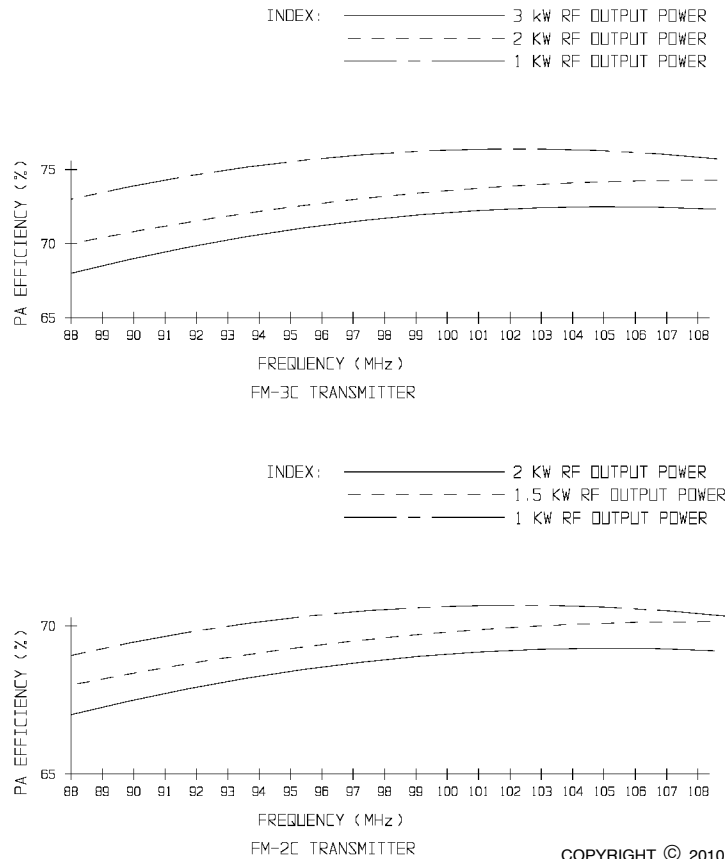
5-5. It is dangerous to measure voltages inside the cabinet or replace components with power energized. Therefore, do not measure voltages inside the cabinet or replace components with power energized. Always operate the transmitter POWER circuit breaker to OFF prior to performing any maintenance within 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-3C/FM-2C and FMi-201/FMi-106 power amplifier stage consists of solid-state power amplifier devices. Figure 5-1 presents typical FM-3C/FM-2C and FMi-201/FMi-106 FM only PA stage efficiency values. 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.



NOTES:

1. FM Only mode

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FIGURE 5-1. FM-3C/FM-2C/FMi-201/FMi-106 TYPICAL PA EFFICIENCY

5-10. **ROUTINE MAINTENANCE.**



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.

- 5-11. **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-3C/FM-2C and FMi-201/FMi-106 transmitters are equipped with two air filters. The standard main air inlet filter is a disposable type air filter located in a shelf under the power amplifier modules. The main air inlet can also be equipped with an optional screen type filter if desired. A second screen type filter is located on the transmitter rear-panel above the combiner assembly for the power supply modules. 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 a disposable type air filter 1 in. X 16 in. X 20 in. (2.54 cm X 40.6 cm X 50.8 cm). Additional filters may be ordered from Broadcast Electronics (BE P/N 407-0062) or purchased locally. Install the air flow indicator pointing towards the flushing fans. Air filter replacement is accomplished by: 1) sliding the filter out of the shelf and 2) inserting the new air filter with the airflow arrow pointing towards the flushing fans.
- 5-16. **Optional Filter.** The transmitter can be equipped with a screen type 1 in. X 16 in. X 20 in. (2.54 cm X 40.6 cm X 50.8 cm) air filter if desired. If the transmitter is equipped with a screen type filter, perform the SCREEN FILTER maintenance procedures as described in the following text.
- 5-17. **Screen Filter.** The transmitter is equipped with a screen type filter for the power supply module air inlet (BE P/N 407-0167). 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.
- 5-18. **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.
- 5-19. 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.
- 5-20. **SECOND LEVEL MAINTENANCE.**
- 5-21. 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. All electrical adjustments with the exception of the transmitter frequency re-programming procedure are required only when components are replaced in the transmitter circuitry.



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.

- 5-22. The maintenance philosophy for the FM-3C/FM-2C and FMi-201/FMi-106 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.

5-23. **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

5-24. **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.

5-25. **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).

5-26. **Procedure.** To calibrate the multimeter display, proceed as follows:

5-27. Depress the transmitter **OFF** switch/indicator to illuminate the switch/indicator and operate the **POWER SWITCH** to OFF.

5-28. Open the controller door.

5-29. Remove integrated circuit U5 from the controller circuit board.

5-30. 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.

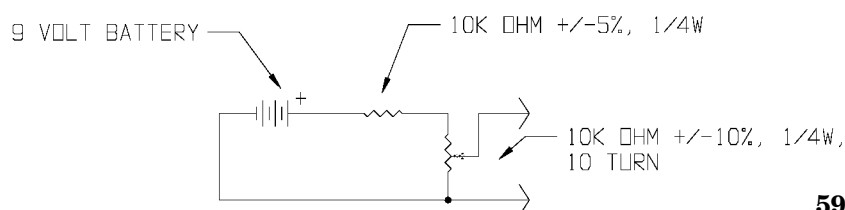
5-31. Connect the voltage source between TP204 on the controller meter display circuit board and TP203 ground.

5-32. Operate the **POWER SWITCH** to ON.

5-33. 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.

5-34. Operate the **POWER SWITCH** to OFF.

5-35. Remove the test equipment, replace integrated circuit U5, and close the controller door.

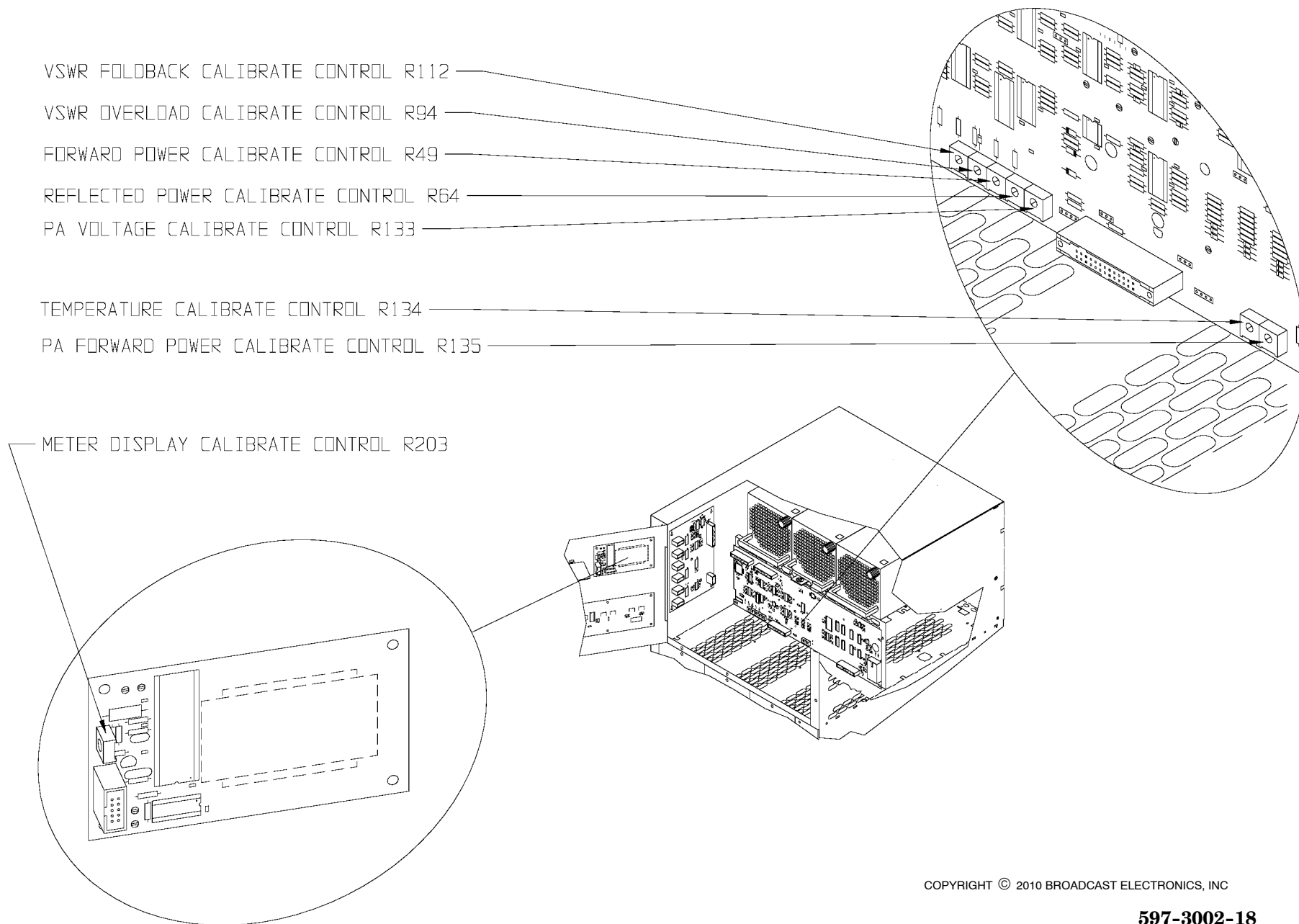


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FIGURE 5-2. ADJUSTABLE VOLTAGE SOURCE

5-36. **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

- 5-37. **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. Adjustable voltage source.
 3. Digital voltmeter (Fluke 77 or equivalent).
- 5-38. **Procedure.** To adjust the reflected power meter, VSWR foldback, and VSWR overload calibration controls, proceed as follows:
- 5-39. The transmitter MULTIMETER must be calibrated prior to adjusting the reflected power meter, VSWR foldback, and VSWR overload calibration controls. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.
- 5-40. Depress the transmitter **OFF** switch/indicator to illuminate the switch/indicator and operate the **POWER SWITCH** to OFF.
- 5-41. 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.
- 5-42. Disconnect directional coupler input connector J302 on the transmitter rear panel.
- 5-43. Connect the voltage source between P302-3 (ground) and P302-4 (RFL).
- 5-44. Depress the transmitter SYSTEM RFL PWR switch/indicator.
- 5-45. Open the controller door.
- 5-46. Connect the digital voltmeter between U2A pin 3 and ground on the controller circuit board.
- 5-47. Operate the **POWER SWITCH** to ON. Ensure the transmitter **OFF** switch/indicator is illuminated.
- 5-48. Observe the digital voltmeter and ensure a 2.0 volt dc signal is present at U2A. Adjust the voltage source if required.
- 5-49. Refer to Figure 5-3 and adjust reflected power meter calibrate control R64 on the controller circuit board for a 150 watt indication on the transmitter multimeter.
- 5-50. Operate the **POWER SWITCH** to OFF.
- 5-51. Connect the digital voltmeter between TP-1 and ground on the controller circuit board.
- 5-52. Operate the **POWER SWITCH** to ON.
- 5-53. Adjust the voltage source to obtain a: 1) 120 watt indication on the transmitter multimeter for FM-3C models or 2) 80 watt indication on the transmitter multimeter for FM-2C models.
- 5-54. Refer to Figure 5-3 and adjust VSWR foldback control R112 on the controller circuit board for a 4.3 volt indication on the digital voltmeter.
- 5-55. Operate the **POWER SWITCH** to OFF.
- 5-56. Connect the digital voltmeter between TP-17 and ground on the controller circuit board.
- 5-57. Operate the **POWER SWITCH** to ON.
- 5-58. Adjust the voltage source to obtain a: 1) 160 watt indication on the transmitter multimeter for FM-3C models or 2) 113 watt indication on the transmitter multimeter for FM-2C models. The **FAULT RESET** switch/indicator will illuminate.

- 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.
- 5-60. Operate the **POWER SWITCH** to OFF.
- 5-61. Remove the test equipment, re-connect P302 on the transmitter rear panel, and close the controller door.
- 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 a 3 kW element for FM-3C/FMi-201 models or a 2 kW element for FM-2C/FMi-106 models (Bird 43 or equivalent).
 3. Test load and cable (50 Ohm Non-Inductive, 3 kW minimum for FM-3C/FMi-201 models or 2 kW minimum for FM-2C/FMi-106 models).
- 5-64. **Procedure.** To adjust the forward power calibration control, proceed as follows:
- 5-65. 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.



WARNING

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

WARNING

- 5-66. Disconnect all transmitter primary power before proceeding.
- 5-67. Open the controller door.
- 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 SYSTEM FWD PWR 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, close the controller door, 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:
- 5-77. 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.
- 5-78. Operate the transmitter to on.
- 5-79. Depress the LOWER switch/indicator to obtain: 1) a 1 kW indication on the MULTIMETER display for FM-3C/FMi-201 models and 2) a 500 W indication on the MULTIMETER display for FM-2C/FMi-106 models.



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

- 5-80. Disconnect all transmitter primary power before proceeding.
- 5-81. Open the controller door.
- 5-82. Remove the left PA power supply module and connect the voltmeter between TP402 (dc +) and TP404 (ground).
- 5-83. Energize the transmitter primary ac power.
- 5-84. Depress the transmitter SYSTEM PS VDC switch/indicator.
- 5-85. 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

- 5-86. Disconnect all transmitter primary power.
- 5-87. Remove the test equipment, replace the PA power supply module, close the controller door, and return the transmitter to the normal output power level.
- 5-88. **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.

5-89. **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.

5-90. **Procedure.** To adjust the temperature calibration control, proceed as follows:

5-91. 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.



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

WARNING

5-92. Disconnect all transmitter primary power before proceeding.

5-93. Open the controller door.

5-94. Locate the temperature sensor circuit board and place the temperature probe near the transistor temperature sensor.

5-95. Energize the transmitter primary ac power. Allow the transmitter to operate for approximately 5 minutes.

5-96. Depress the transmitter SYSTEM EXH TEMP switch/indicator.

5-97. 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

5-98. Disconnect all transmitter primary power.

5-99. Remove the test equipment and close the controller door.

5-100. **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.

5-101. **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).

5-102. **Procedure.** To adjust the PA module forward power calibration control, proceed as follows:

5-103. The transmitter MULTIMETER must be calibrated prior to adjusting the PA module forward power detector circuitry. Refer to MULTIMETER DISPLAY CALIBRATION in the preceding text and perform the procedure to calibrate the display.

- 5-104. Open the controller door.
- 5-105. Depress the transmitter **OFF** switch/indicator to illuminate the switch/indicator.
- 5-106. Connect the digital voltmeter between TP8 on the controller circuit board and ground.
- 5-107. Energize the transmitter primary ac power and operate the transmitter.
- 5-108. Depress the transmitter **RAISE** or **LOWER** switch/indicator to obtain a +5.0 volt dc indication on the digital voltmeter.
- 5-109. Depress the transmitter MODULE SELECT switch/indicator to select a module. The module selected will be presented on the MODULE SELECT display.
- 5-110. Depress the transmitter MODULE PA FWD POWER switch/indicator.
- 5-111. 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.
- 5-112. Depress the transmitter **OFF** switch/indicator to illuminate the switch/indicator.
- 5-113. Remove the test equipment and close the controller door.
- 5-114. **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 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.
- 5-115. **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.
- 5-116. **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.
- 5-117. **TRANSMITTER FREQUENCY RE-PROGRAMMING.** The FM-3C/FMi-2C and FMi-201/FMi-106 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 the transmitter operating frequency.
- 5-118. **Required Equipment.** The following equipment is required to re-program the transmitter operating frequency.
 - 1. Calibrated in-line wattmeter with 3 kW element for FM-3C/FMi-201 models or a 2 kW element for FM-2C/FMi-106 models (Bird 43 or equivalent).
 - 2. Test load and cable (50 Ohm Non-Inductive, 1 5/8 connector, 3 kW for FM-3C/FMi-201 models or 2 kW for FM-2C/FMi-106 models minimum).

5-119. **Procedure.** To re-program the transmitter operating frequency, proceed as follows:



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

WARNING

5-120. Disconnect all transmitter primary power before proceeding.

5-121. Connect the test load and wattmeter to the transmitter output.

5-122. For FM-3C/FM-2C models, refer to SECTION 4, AFC/PLL ASSEMBLY in FM-100C publication 597-1002 and perform the FREQUENCY SELECTION procedure. For FMi-201/FMi-106 models, refer to SECTION 3, OPERATION in FXi-250 publication 597-0541 and perform the CARRIER FREQUENCY PROGRAMMING procedure.

5-123. Energize the transmitter primary ac power and operate the transmitter at the desired output power level as indicated by the in-line wattmeter.

5-124. 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

5-125. Disconnect all transmitter primary power.

5-126. Remove the test equipment, close the controller door, and reconnect the transmitter output to the antenna.

5-127. **TROUBLESHOOTING.**

5-128. **TYPICAL METER INDICATIONS.** Typical meter indications for the FM-3C/FM-2C and FMi-201/FMi-106 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. Typical FM-100C/FXi-250 drive levels for the transmitters in FM only operation are presented in the following text.

DRIVE LEVELS - FM-3C/FMi-201 - FM ONLY MODE					
FREQUENCY	Up To 1 kW	1 - 1.5 kW	1.5 - 2 kW	2 - 2.5 kW	2.5 - 3 kW
87.5 - 90 MHz	100W	105W	110W	115W	120W
90 - 92 MHz	98W	102W	107W	111W	115W
92 - 94 MHz	95W	98W	103W	107W	110W
94 - 96 MHz	92W	95W	99W	103W	105W

DRIVE LEVELS - FM-3C/FMi-201 - FM ONLY MODE (cont'd)					
FREQUENCY	Up To 1 kW	1 - 1.5 kW	1.5 - 2 kW	2 - 2.5 kW	2.5 - 3 kW
96 - 100 MHz	90W	92W	95W	98W	100W
100 - 102 MHz	92W	95W	99W	103W	105W
102 - 104 MHz	95W	98W	103W	107W	110W
104 - 106 MHz	98W	102W	107W	111W	115W
106 - 108 MHz	100W	105W	110W	115W	120W

DRIVE LEVELS - FM-2C/FMi-106 - FM ONLY MODE				
FREQUENCY	Up To 500 W	500 - 1 kW	1 - 1.5 kW	1.5 - 2 kW
87.5 - 90 MHz	65W	70W	75W	80W
90 - 92 MHz	64W	69W	73W	80W
92 - 94 MHz	62W	67W	71W	75W
94 - 96 MHz	61W	65W	69W	70W
96 - 100 MHz	60W	63W	67W	70W
100 - 102 MHz	61W	65W	69W	70W
102 - 104 MHz	62W	67W	71W	75W
104 - 106 MHz	64W	69W	73W	80W
106 - 108 MHz	65W	70W	75W	80W



CAUTION

CAUTION

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

5-129. **POWER AMPLIFIER POWER SUPPLY MODULES.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitters are equipped with modular switching power supply units. The FM-3C/FMi-201 is equipped with a modular switching power supply for the controller and 3 modular switching power supplies for the power amplifier circuitry. The FM-2C/FMi-106 is equipped with a modular switching power supply for the controller and 2 modular switching power supplies for the power amplifier circuitry.

5-130. A power amplifier power supply module may be required to be installed or removed. To install or remove a power amplifier power supply module, proceed as follows:



CAUTION

CAUTION

THE TRANSMITTER MAY BE DAMAGED IF A POWER SUPPLY MODULE IS NOT SECURELY SEATED INTO THE MOTHERBOARD CONNECTORS.

1. Open the controller front panel.
2. To install a module, proceed as follows:
 - A. Align a power supply module with a power supply location. Ensure the rear panel connector is aligned with the receptacle on the motherboard.

- B. Insert and firmly press the power supply module into the motherboard connector.
- C. Engage the power supply lock by rotating the front panel knob clockwise until the knob is secure.

3. To remove a module, 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. Dis-engage the power supply lock by rotating the front panel knob fully counterclockwise.
- B. Using the handle, pull the module from the chassis.

5-131. Each power amplifier power supply module contains a fuse and a cooling fan. When a power supply module fault indicator illuminates, check the following:

1. The PA power supply modules are equipped with temperature overload protection. If a power supply module temperature overload occurs, the modules 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 SYSTEM P.S. 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 defective 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 defective 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.



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.

- 5-132. **CONTROLLER POWER SUPPLY.** The FM-3C/FM-2C and FMi-201/FMi-106 transmitter controller power supply is located on a panel behind the controller circuit board. 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

DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.

WARNING

- 5-133. Disconnect all transmitter primary power.
- 5-134. Refer to Figure 5-4 and remove all the rear access panel Phillips-Head screws.
- 5-135. Disconnect the exciter and external interlock connectors.
- 5-136. Remove the access panel.
- 5-137. Disconnect the wiring and remove the controller power supply module.
- 5-138. 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.
- 5-139. Once the power supply troubleshooting has been completed, re-install the supply by reversing the preceding procedure.
- 5-140. **POWER AMPLIFIER MODULE TROUBLESHOOTING/REPAIR.** Each transmitter power amplifier module requires specialized equipment 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).



WARNING

WARNING

HIGH RF VOLTAGE IS PRESENT AT THE TYPE N CONNECTOR ON THE PA MOTHERBOARD WHEN AN RF POWER AMPLIFIER MODULE IS REMOVED FOR SERVICE. ENSURE A MODULE COVER PANEL IS INSTALLED IN THE MODULE LOCATION WHEN A MODULE IS REMOVED FOR SERVICE.

- 5-141. **Power Amplifier Module Cover Panel Installation.** If a power amplifier module is removed from the transmitter, a module cover panel must be installed in the module location. The panels are located in the transmitter accessory kit. The installation of the panel will maintain adequate air flow in the transmitter and prevent access to the RF power at the Type N connector on the PA motherboard.
- 5-142. **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.



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

- 5-143. **TRANSMITTER TROUBLESHOOTING PROCEDURES.** Table 5-1 presents troubleshooting information for the FM-3C/FM-2C and FMi-201/FMi-106 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.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 1 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. NO OUTPUT POWER 2. INTERLOCK INDICATOR EXTINGUISHED 3. MODULE RF DRIVE INDICATORS EXTINGUISHED 4. EXCITER LOCK INDICATOR EXTINGUISHED	1. Exciter AFC is unlocked. 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.
1. LOW OUTPUT POWER 2. MODULE DRIVE INDICATORS EXTINGUISHED	1. Check the exciter forward power. The forward power must be: 1) 120 W for the FM-3C/FMi-201 and 2) 80 W for the FM-2C/FMi-106. 2. If the exciter forward power is less than 120W for FM-3C/FMi-201 models or 80 W for FM-2C/FMi-106 models, increase the exciter output power. 3. If the exciter forward power is 120W for FM-3C/FMi-201 models or 80 W for FM-2C/FMi-106 models, check the splitter on the motherboard.
1. LOW OUTPUT POWER 2. MODULE STATUS INDICATORS ILLUMINATE YELLOW	1. Defective low-pass filter or combiner.
1. RESET INDICATOR ILLUMINATED (SHT 1 OF 2)	1. Depress the reset switch. 2. If the reset indicator does not display normal indications, depress the SYSTEM FWD POWER switch. The transmitter forward power must be equal to the TPO.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 2 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. RESET INDICATOR ILLUMINATED (SHT 2 OF 2)	3. If the transmitter forward power is high, depress the LOWER switch to lower the output power to the TPO level. 4. 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. 5. If the temperature is greater than 9 degrees above the ambient room temperature, check the flushing fans and the filter. 6. If the temperature is less than 9 degrees above the ambient room temperature, depress the SYSTEM RFL PWR switch/indicator. The reflected power must be less than 120 watts on FM-3C/FMi-201 models and 80 watts on FM-2C/FMi-106 models. 7. If the reflected power is greater than 120 watts for an FM-3C/FMi-201 or 80 watts for an FM-2C/FMi-106, check the output transmission line and the antenna. 8. If the reflected power is less than 120 watts for an FM-3C/FMi-201 or 80 watts for an FM-2C/FMi-106, check the low-pass filter and the reflected power directional coupler.
1. A RED MODULE STATUS INDICATOR 2. RESET INDICATOR ILLUMINATED	1. Depress the reset switch. 2. If the module status and reset indicators do not display normal indications, depress the multimeter TEMP switch. The temperature must be less than 9 degrees above the ambient room temperature. 3. If the temperature is greater than 9 degrees above the ambient room temperature, check the flushing fans and the filter. 4. Label the defective module and record the location. Interchange the module with another module in the transmitter. 5. If the module inserted into the location recorded in the preceding step displays a red MODULE STATUS indicator, check the transmitter combiner. 6. If the MODULE STATUS indicator on the module recorded in the preceding step remains red, the module is defective. Contact the Broadcast Electronics Customer Service Department.
1. TRANSMITTER WILL NOT AUTOMATICALLY RETURN TO RATED POWER AFTER AN AC POWER LOSS	1. Replace the battery in the controller.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 3 of 6)

SYMPTOM	CIRCUITRY TO CHECK
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.
1. TRANSMITTER OFF WITH FRONT PANEL INDICATIONS 2. MODULE STATUS INDICATORS ILLUMINATE YELLOW	1. Defective controller power supply -15V output.
1. A MODULE STATUS INDICATOR ILLUMINATES YELLOW	1. Label the defective module and record the location. Interchange the module with another module in the transmitter. 2. If the module inserted into the location recorded in the preceding step displays a yellow MODULE STATUS indicator, check the transmitter combiner. 3. If the MODULE STATUS indicator on the module recorded in the preceding step remains yellow, the module is defective. Troubleshoot the module.
1. ERRATIC POWER CONTROL	1. Depress the RAISE switch and check for a HIGH at U7 pin 6 on the controller circuit board. 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. 3. If the HIGH is not present, check U7C on the controller circuit board and S7 on the controller on/off
circuit board.	
1. NO POWER CONTROL (SHT 1 OF 2)	1. Check for a dc voltage at TP3 on the controller circuit board. 2. If the voltage at TP3 is present, check U3C, U3A, U3B, and U4C on each RF power module logic circuit board. 3. If the voltage at TP3 is not present, check for a 4.5 volt dc signal at U21 pin 12 on the controller circuit board.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 4 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. NO POWER CONTROL (SHT 2 OF 2) 1. TRANSMITTER OPERATES 2. NO MULTIMETER OPERATION 1. TRANSMITTER OPERATES 2. NO FORWARD POWER METER DISPLAY	4. If the 4.5 volt signal is present, check U21 on the controller circuit board. 5. If the 4.5 volt signal is not present, check for a 8.7 volt dc signal at U6 pin 14 on the controller circuit board. 6. If the 8.7 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. 7. If the 8.7 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. 1. Depress the SYSTEM P.S. VDC switch/indicator and check for a dc voltage at TP204 on the meter display circuit board. 2. If the voltage at TP204 is present, check for: 1) +5 volts dc at TP201, 2) -5 volts dc at U201 pin 26, and 3) approximately 2.0 volts at U201 pin 36. 3. If the voltages are not present, check the ± 5 volt supplies, D201, and R202 on the meter display circuit board. 4. If the voltages are present, check U201 and DS201 on the meter display circuit board. 5. If the voltage at TP204 is not present, check U5C on the controller circuit board. 1. Check for a 5.7 VDC signal for a 3 kW output or a 4.7 VDC signal for a 2 kW output at U2 pin 5 on the controller circuit board. 2. If the voltage is not present, check the directional coupler. 3. If the voltage is present, check for a 3 volt dc signal at TP4 and a 9 volt dc signal at TP14 on the controller circuit board. Do not adjust R54. 4. If the voltages at TP4/TP14 are not present, check U2B, U24A, U25A/B/C/D/E, U6A, and D8 on the controller circuit board. 5. If the voltages at TP4/TP14 are present, check S301 on the meter switch circuit board.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 5 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. TRANSMITTER OPERATES WITH NORMAL INDICATIONS 2. RATED POWER CAN NOT BE OBTAINED	1. Check the exciter output power. The forward power must be: 1) FM-3C/FMi-201 = 120 W or 2) FM-2C/FMi-106 = 80 W. 2. If the exciter output power is less than 10 W: 1) Operate the transmitter to OFF, 2) wait approximately 10 seconds, and 3) operate the transmitter to ON. 3. If the exciter output power is 120W for FM-3C models and 80 W for FM-2C models, check U5B on the controller circuit board.
1. TRANSMITTER OPERATES 2. NO REFLECTED POWER METER DISPLAY	1. Check for a voltage at U2 pin 3 on the controller circuit board. 2. If the voltage is not present, check the directional coupler. 3. If the voltage is present, check for a voltage at TP10 and TP15 on the controller circuit board. Do not adjust R67. 4. If the voltages at TP10/TP15 are not present, check U2A, U24B, U26A/B/C/D/E, U6B, and D8 on the controller circuit board. 5. If the voltages at TP10/TP15 are present, check S301 on the meter switch circuit board.
1. CIRCUIT BREAKER OPERATION	1. Check the MOVs, PA power supply modules, controller power supply, and the circuit breaker.
1. NO PA MODULE FORWARD POWER METER INDICATION	1. Ensure PA module 0 is not presented on the module status display. 2. Check U201 and U205A on the multiplexer circuit board. 3. Check for the following voltages on the controller circuit board: 1) approximately 5.0 volts (500W) at TP8, 2) 3 volts dc at TP11, and 3) 9 volts dc at TP16. 4. If the voltages at TP8/TP11/TP16 are not present, check U4A, U6C, U24C, U27A/B/C/D/E, U24D, and D8. 5. If the voltages at TP8/TP11/TP16 are present, check S301 on the meter switch circuit board.
1. NO PA MODULE CURRENT POWER METER INDICATION	1. Ensure PA module 0 is not presented on the module status display. 2. Check U202 and U205B on the multiplexer circuit board. 3. Check U3A on the controller circuit board.
1. NO PA MODULE VOLTAGE POWER METER INDICATION	1. Ensure PA module 0 is not presented on the module status display, the Check U203 and U205C on the multiplexer circuit board. 2. Check U4C on the controller circuit board.

TABLE 5-1. FM-3C/FM-2C TROUBLESHOOTING
(Sheet 6 of 6)

SYMPTOM	CIRCUITRY TO CHECK
1. NO PA MODULE TEMPERATURE POWER METER INDICATION	1. Ensure PA module 0 is not presented on the module status display. 2. Check U204 and U205D on the multiplexer circuit board. 3. Check U3C on the controller circuit board.
1. NO PA MODULE SELECTION	1. Ensure P715 on the controller circuit board is installed in position 1-2. 2. Check S1 on the module select circuit board. 3. Check U23 and U7B on the controller circuit board. 4. Check U206 and U207 on the multiplexer circuit board. 5. Check U1 on the module select circuit board.
1. ALL FRONT PANEL INDICATORS FLASHING	1. Check the controller power supply outputs.
1. POWER SUPPLY FAULT INDICATOR(S) ILLUMINATED 2. RESET INDICATOR ILLUMINATED	1. Check the RF drive to the transmitter. Ensure the exciter output is: 1) FM-3C/FMi-201 = 120W or 2) FM-2C/FMi-106 = 80W. 2. Check the Power Supply.

- 5-144. **TRANSMITTER COMPONENT LOCATIONS.** Figure 5-4 presents the transmitter component locations. Refer to Figure 5-4 as required during the troubleshooting procedures to locate components within the transmitter.
- 5-145. **Transmitter Access Panels.** Figure 5-4 presents the transmitter access panels. Refer to Figure 5-4 and remove the panels as required to access transmitter components.
- 5-146. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement on printed circuit boards require extreme care to avoid damage to the circuit board traces. The following text describes the procedure to replace components on transmitter circuit boards.
- 5-147. 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.
- 5-148. 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.
- 5-149. 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



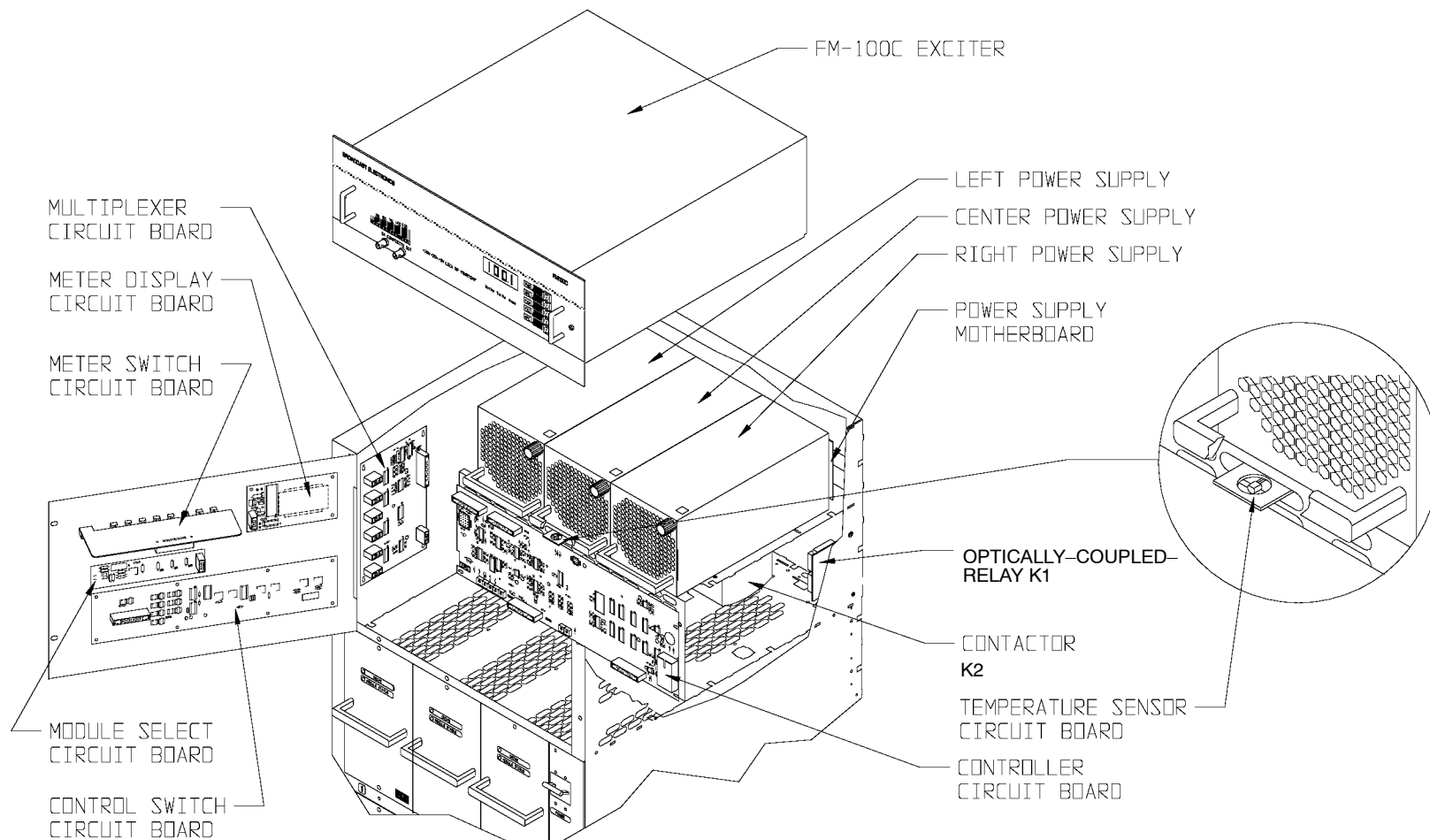
WARNING

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.

- 5-150. 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.
- 5-151. 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.



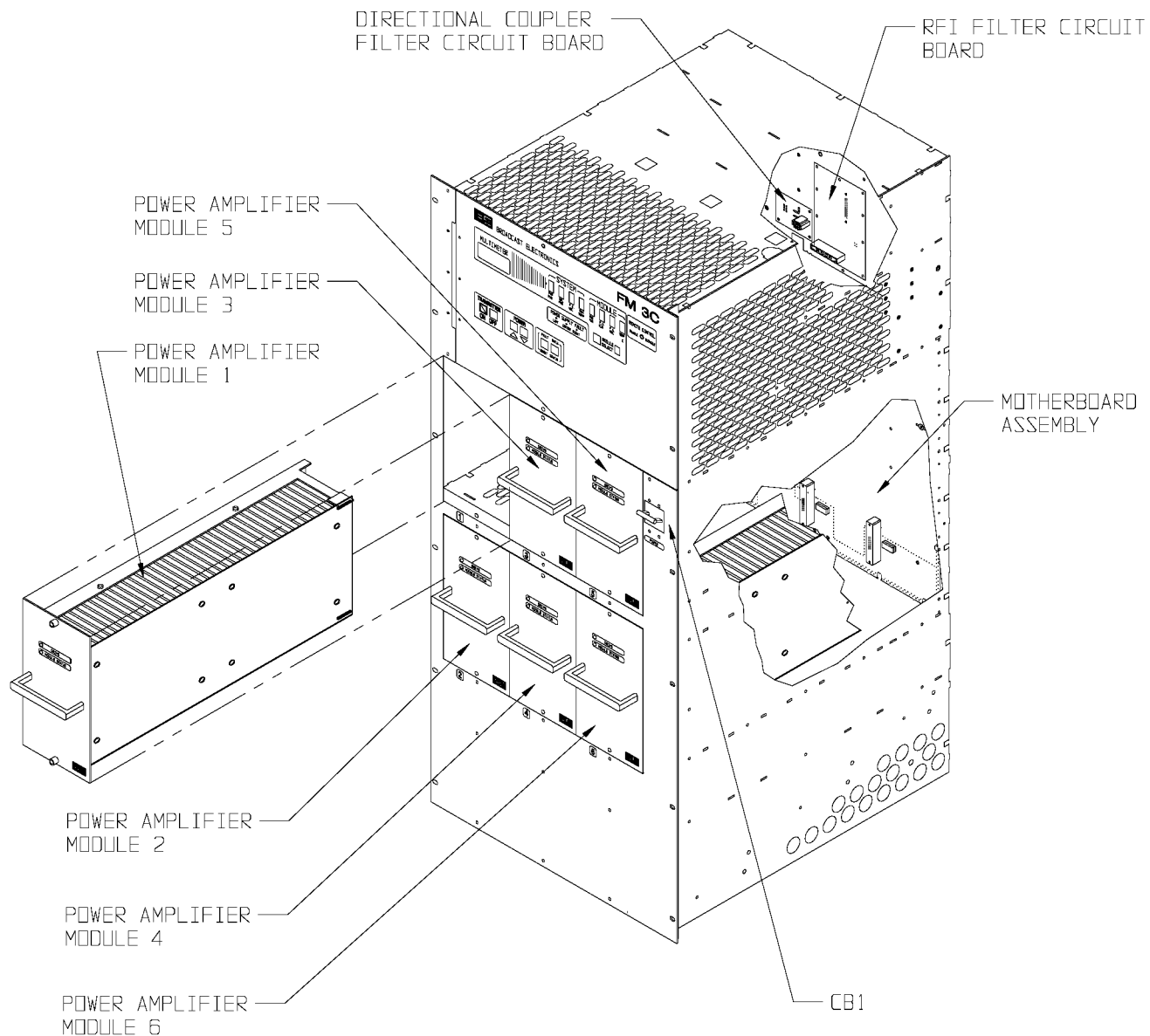
NOTES:

1. FM-2C EQUIPPED WITH LEFT AND CENTER POWER SUPPLY MODULES ONLY
2. FMi-201/FMi-106 ARE EQUIPPED WITH FXi-250 EXCITERS

597-3002-19A

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FIGURE 5-4. FM-3C/FM-2C/FMi-201/FMi-106 COMPONENT LOCATOR (SHEET 1 OF 3)



NOTE:

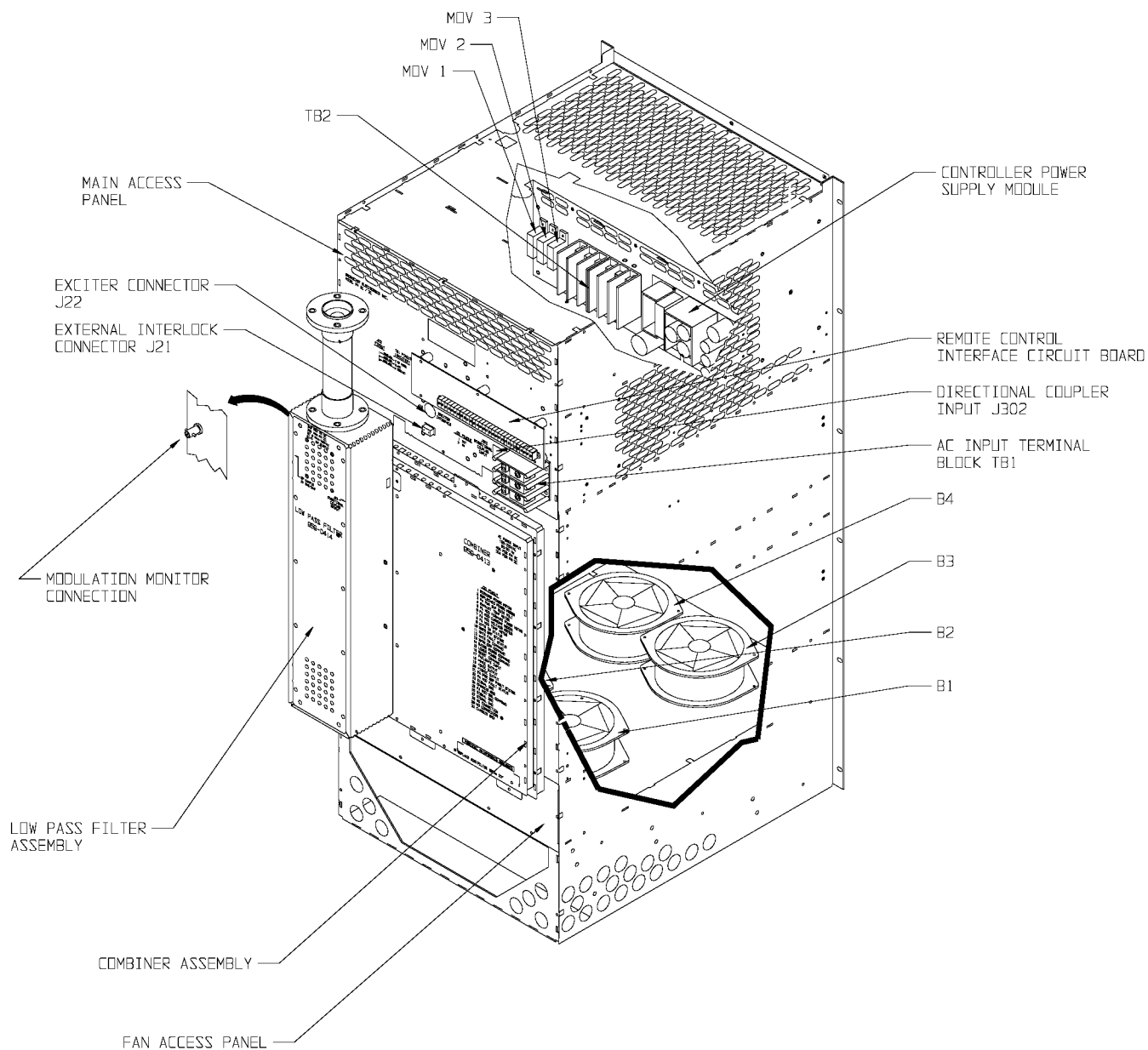
FM-2C EQUIPPED WITH
POWER AMPLIFIER MODULES
1 THROUGH 4 ONLY.

FMi-201IS IDENTICAL TO THE
FM-3C. FMi-106 IS IDENTICAL TO
THE FM-2C.

597-3002-19B

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FIGURE 5-4. FM-3C/FM-2C/FMi-201/FMi-106 COMPONENT LOCATOR (SHEET 2 OF 3)



597-3002-19C

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FIGURE 5-4. FM-3C/FM-2C/FMi-201/FMi-106 COMPONENT LOCATOR (SHEET 3 OF 3)

SECTION VI PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides parts lists for the FM-3C/FM-2C and FMi-201/FMi-106 transmitters. 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.

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TABLE 6-2. FM-3C TRANSMITTER - 909-3001-204

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1 Thru B4	Fan, 6 inch (15.24 cm), 250 ft3/min 220V ac, 50/60 Hz, 40 Watt	380-7650	4
CB1	Circuit Breaker, 2-Pole, 250V, 50A	341-0011	1
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096-001	1
K2	Contactors: Coil: 208/240V ac 60 Hz or 190/220V ac 50 Hz Contacts: 3-Pole, 600V ac, 40 Amperes	341-0053	1
MOV 1 Thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3
TB1	Terminal Block, Gould 63133 (Ac Input)	412-0050	1
TB2	Barrier Strip, 3 Position, 4AWG	412-0049	2
----	Power Supply, Computer Products, NFS80-7606, $\pm 15V$, +5%, +24 V, 85V to 264V Operation, 80W	540-0015	1
----	Power Supply, Power Supply, TDI, 48V 2 kW	540-0016-002	3
----	Air Filter, 16X20X1, Aluminum Mesh (Optional)	407-0169	1
----	Air Filter, 3.75X16.5X1, Aluminum Mesh	407-0167	1
----	Bulkhead Receptacle, Type N, Jack-To-Jack, UG30/U	418-0035	6
----	Module Select Circuit Board Assembly	919-0415-001	1
----	Multiplexer Circuit Board Assembly	919-0415-002	1
----	Low-Pass Filter Input/RFI Filter Circuit Board Assembly	919-0415-003	1
----	Power Supply Motherboard Assembly	919-0415-004	1
----	Remote Interface Barrier Strip Circuit Board Assembly	919-0415-005	1
----	Motherboard Assembly, FM-3C/FM-2C	919-0413	1
----	Controller Circuit Board Assembly	919-0563-300	1
----	RFI Filter Circuit Board Assembly	919-0562	1
----	Controller On/Off Switch Circuit Board Assembly	919-0406-101	1
----	Controller Display Circuit Board Assembly	919-0406-102	1
----	Controller Meter Switch Circuit Board Assembly	919-0406-103	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Output Combiner Assembly, FM-3C	959-0413	1
----	Low-Pass Filter Assembly	959-0414	1
----	Power Amplifier Module Assembly	959-0412-013	6
----	Wire Harness Assembly, FM-3C	949-0406	1
----	FM-100C, 100 Watt Exciter/Transmitter, 220V 50/60 Hz Operation	909-1101-304	1
----	Accessory Parts Kit	979-0410	1
----	Blank, Cable Hold Down Circuit Board, 2.00"	519-0407-103	3
----	Blank, Cable Hold Down Circuit Board, 1.77"	519-0407-104	2
----	Blank, Cable Hold Down Circuit Board, 1.20"	519-0407-106	2
----	Blank, Cable Hold Down Circuit Board, 1.50"	519-0407-105	1
----	Pins, Connector, AMP 350967-1	417-0036	8
----	Housing, 2-Pin	418-0702	4
----	Battery, 9V Alkaline	350-0002	1

TABLE 6-3. FM-2C TRANSMITTER - 909-2001-204

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1 Thru B4	Fan, 6 inch (15.24 cm), 250 ft3/min 220V ac, 50/60 Hz, 40 Watt	380-7650	4
CB1	Circuit Breaker, 2-Pole, 240V, 35A	341-0066	1
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096-001	1
K2	Contactors: Coil: 208/240V ac 60 Hz or 190/220V ac 50 Hz Contacts: 3-Pole, 600V ac, 40 Amperes	341-0053	1
MOV 1 Thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3
TB1	Terminal Block, Gould 63133 (Ac Input)	412-0050	1
TB2	Barrier Strip, 3 Position, 4AWG	412-0049	2
----	Power Supply, Computer Products, NFS80-7606, $\pm 15V$, +5%, +24 V, 85V to 264V Operation, 80W	540-0015	1
----	Power Supply, Power Supply, TDI, 48V 2 kW	540-0016-002	2
----	Air Filter, 16X20X1, Aluminum Mesh (Optional)	407-0169	1
----	Air Filter, 3.75X16.5X1, Aluminum Mesh	407-0167	1
----	Bulkhead Receptacle, Type N, Jack-To-Jack, UG30/U	418-0035	6
----	Module Select Circuit Board Assembly	919-0415-021	1
----	Multiplexer Circuit Board Assembly	919-0415-022	1
----	Low-Pass Filter Input/RFI Filter Circuit Board Assembly	919-0415-003	1
----	Power Supply Motherboard Assembly	919-0415-024	1
----	Remote Interface Barrier Strip Circuit Board Assembly	919-0415-005	1
----	Motherboard Assembly, FM-2C	919-0413-001	1
----	Controller Circuit Board Assembly	919-0563-200	1
----	RFI Filter Circuit Board Assembly	919-0562	1
----	Controller On/Off Switch Circuit Board Assembly	919-0406-101	1
----	Controller Display Circuit Board Assembly	919-0406-102	1
----	Controller Meter Switch Circuit Board Assembly	919-0406-103	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Output Combiner Assembly, FM-2C	959-0413-001	1
----	Low-Pass Filter Assembly	959-0414	1
----	Power Amplifier Module Assembly	959-0412-013	4
----	Wire Harness Assembly, FM-3C	949-0406	1
----	FM-100C, 100 Watt Exciter/Transmitter, 220V 50/60 Hz Operation	909-1101-304	1
----	Accessory Parts Kit	979-0410	1
----	Blank, Cable Hold Down Circuit Board, 2.00"	519-0407-103	3
----	Blank, Cable Hold Down Circuit Board, 1.77"	519-0407-104	2
----	Blank, Cable Hold Down Circuit Board, 1.20"	519-0407-106	1
----	Blank, Cable Hold Down Circuit Board, 1.50"	519-0407-105	1
----	Pins, Connector, AMP 350967-1	417-0036	8
----	Housing, 2-Pin	418-0702	4
----	Battery, 9V Alkaline	350-0002	1

TABLE 6-4. FMI-201 TRANSMITTER - 909-0201-404

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1 Thru B4	Fan, 6 inch (15.24 cm), 250 ft3/min 220V ac, 50/60 Hz, 40 Watt	380-7650	4
CB1	Circuit Breaker, 2-Pole, 250V, 50A	341-0011	1
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096-001	1
K2	Contactors: Coil: 208/240V ac 60 Hz or 190/220V ac 50 Hz Contacts: 3-Pole, 600V ac, 40 Amperes	341-0053	1
MOV 1 Thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3
TB1	Terminal Block, Gould 63133 (Ac Input)	412-0050	1
TB2	Barrier Strip, 3 Position, 4AWG	412-0049	2
----	Power Supply, Computer Products, NFS80-7606, $\pm 15V$, +5%, +24 V, 85V to 264V Operation, 80W	540-0015	1
----	Power Supply, TDI, 48V 2 kW	540-0016-002	3
----	Air Filter, 16X20X1, Aluminum Mesh (Optional)	407-0169	1
----	Air Filter, 3.75X16.5X1, Aluminum Mesh	407-0167	1
----	Bulkhead Receptacle, Type N, Jack-To-Jack, UG30/U	418-0035	6
----	Module Select Circuit Board Assembly	919-0415-001	1
----	Multiplexer Circuit Board Assembly	919-0415-002	1
----	Low-Pass Filter Input/RFI Filter Circuit Board Assembly	919-0415-003	1
----	Power Supply Motherboard Assembly	919-0415-004	1
----	Remote Interface Barrier Strip Circuit Board Assembly	919-0415-005	1
----	Motherboard Assembly, FM-3C/FM-2C	919-0413	1
----	Controller Circuit Board Assembly	919-0563-300	1
----	RFI Filter Circuit Board Assembly	919-0562	1
----	Controller On/Off Switch Circuit Board Assembly	919-0406-101	1
----	Controller Display Circuit Board Assembly	919-0406-102	1
----	Controller Meter Switch Circuit Board Assembly	919-0406-103	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Output Combiner Assembly, FM-3C	959-0413	1
----	Low-Pass Filter Assembly	959-0414	1
----	Power Amplifier Module Assembly	959-0412-213	6
----	Wire Harness Assembly, FM-3C	949-0406	1
----	FMI-250, 250 Watt Digital Exciter, 220V 50/60 Hz Operation	909-9250	1
----	XPi-10 Exporter	909-6027-MB3	1
----	Accessory Parts Kit	979-0410-200	1
----	Blank, Cable Hold Down Circuit Board, 2.00"	519-0407-103	3
----	Blank, Cable Hold Down Circuit Board, 1.77"	519-0407-104	2
----	Blank, Cable Hold Down Circuit Board, 1.20"	519-0407-106	2
----	Blank, Cable Hold Down Circuit Board, 1.50"	519-0407-105	1
----	Pins, Connector, AMP 350967-1	417-0036	8
----	Housing, 2-Pin	418-0702	4
----	Battery, 9V Alkaline	350-0002	1

TABLE 6-5. FMi-106 TRANSMITTER - 909-0106-404

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1 Thru B4	Fan, 6 inch (15.24 cm), 250 ft3/min 220V ac, 50/60 Hz, 40 Watt	380-7650	4
CB1	Circuit Breaker, 2-Pole, 240V, 35A	341-0066	1
K1	Optically-Coupled-Relay (OCR) Assembly	919-0096-001	1
K2	Contactors: Coil: 208/240V ac 60 Hz or 190/220V ac 50 Hz Contacts: 3-Pole, 600V ac, 40 Amperes	341-0053	1
MOV 1 Thru MOV3	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	3
TB1	Terminal Block, Gould 63133 (Ac Input)	412-0050	1
TB2	Barrier Strip, 3 Position, 4AWG	412-0049	2
----	Power Supply, Computer Products, NFS80-7606, $\pm 15V$, +5%, +24 V, 85V to 264V Operation, 80W	540-0015	1
----	Power Supply, TDI, 48V 2 kW	540-0016-002	2
----	Air Filter, 16X20X1, Disposable	407-0062	1
----	Air Filter, 16X20X1, Aluminum Mesh (Optional)	407-0169	1
----	Air Filter, 3.75X16.5X1, Aluminum Mesh	407-0167	1
----	Bulkhead Receptacle, Type N, Jack-To-Jack, UG30/U	418-0035	6
----	Module Select Circuit Board Assembly	919-0415-021	1
----	Multiplexer Circuit Board Assembly	919-0415-022	1
----	Low-Pass Filter Input/RFI Filter Circuit Board Assembly	919-0415-003	1
----	Power Supply Motherboard Assembly	919-0415-024	1
----	Remote Interface Barrier Strip Circuit Board Assembly	919-0415-005	1
----	Motherboard Assembly, FM-2C	919-0413-001	1
----	Controller Circuit Board Assembly	919-0563-200	1
----	RFI Filter Circuit Board Assembly	919-0562	1
----	Controller On/Off Switch Circuit Board Assembly	919-0406-101	1
----	Controller Display Circuit Board Assembly	919-0406-102	1
----	Controller Meter Switch Circuit Board Assembly	919-0406-103	1
----	Temperature Sensor Circuit Board Assembly	919-0406-105	1
----	Output Combiner Assembly, FM-2C	959-0413-001	1
----	Low-Pass Filter Assembly	959-0414	1
----	Power Amplifier Module Assembly	959-0412-213	4
----	Wire Harness Assembly, FM-3C	949-0406	1
----	FMi-250, 250 Watt Digital Exciter, 220V 50/60 Hz Operation	909-9250	1
----	XPi-10 Exporter	909-6027-MB3	1
----	Accessory Parts Kit	979-0410-200	1
----	Blank, Cable Hold Down Circuit Board, 2.00"	519-0407-103	3
----	Blank, Cable Hold Down Circuit Board, 1.77"	519-0407-104	2
----	Blank, Cable Hold Down Circuit Board, 1.20"	519-0407-106	1
----	Blank, Cable Hold Down Circuit Board, 1.50"	519-0407-105	1
----	Pins, Connector, AMP 350967-1	417-0036	8
----	Housing, 2-Pin	418-0702	4
----	Battery, 9V Alkaline	350-0002	1

TABLE 6-6. FM-3C MOTHERBOARD ASSEMBLY - 919-0413
FM-2C MOTHERBOARD ASSEMBLY - 919-0413-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C601	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C602	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C603	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C604	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C605	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C606	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C607	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C608	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C609	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C613	Capacitor, Ceramic, 62 pF, 500V	009-6213	1
C614	Capacitor, Variable, Ceramic, 2-8 pF, 350V, Non-Polarized	096-0010	1
C615 thru C618	Capacitor, Ceramic Chip, 82 pF $\pm 5\%$, 500V	009-8013	4
J601 thru J604	Connector, 10-Pin, Dual In-Line	418-1003	4
J611 thru J614	Connector, PCB Mount, 17-Pin D-Type with 4 Pins	417-0322	4
R601	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R602	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R603, R604	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R605	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R606	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R607, R608	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R609	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R610	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R611, R612	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R613	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R614	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R615, R616	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
----	Cable Assembly, Motherboard	949-0418	1
----	Blank Motherboard	519-0413	1
----	Resistor, 50 Ohms $\pm 5\%$, 100W	131-5032	6
ADDITIONAL PARTS FOR FM-3C MOTHERBOARD ASSEMBLY 919-0413			
C610	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C611	Capacitor, Mylar, 0.1 uF $\pm 10\%$, 100V	030-1053	1
C612	Capacitor, Electrolytic, 47 uF, 35V	020-4770	1
C619, C620	Capacitor, Ceramic Chip, 82 pF $\pm 5\%$, 500V	009-8013	2
J605, J606	Connector, 10-Pin, Dual In-Line	418-1003	2
J615, J616	Connector, PCB Mount, 17-Pin D-Type with 4 Pins	417-0322	2
R617	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R618	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R619, R620	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R621	Resistor, 57.6 k Ohm $\pm 1\%$, 1/4W	103-5765	1
R622	Resistor, 0.005 Ohm $\pm 3\%$, 5W	139-0007	1
R623, R624	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2

TABLE 6-7. CABLE ASSEMBLY, MOTHERBOARD - 949-0418

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, Straight N for 82-340 Cable	417-0120	1
----	Coaxial Cable, RG393/M17-127, Impedance: 50 Ohm	621-1361	4

**TABLE 6-8. 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
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, 10 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

TABLE 6-8. CONTROL SWITCH CIRCUIT BOARD ASSEMBLY - 919-0406-101
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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 6-9. DISPLAY CIRCUIT BOARD ASSEMBLY - 919-0406-102

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
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 6-10. METER SWITCH CIRCUIT BOARD ASSEMBLY - 919-0406-103

REF. DES.	DESCRIPTION	PART NO.	QTY.
J301	Receptacle, 26-Pin Dual In-line	418-2602	1
R301 thru R304	Resistor, 1 Ohm $\pm 5\%$, 1/4W	100-1013	4
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 6-11. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 919-0406-105

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
C503	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C504, C506	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	2
J501	Socket, 4-Pin	418-0255	1
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-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(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
C35	Capacitor, Monolythic Ceramic, 0.1 uF $+20\%$, 50V	003-1054	1
C36	CAP,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
C55 thru C58	Capacitor, Monolythic Ceramic, 0.1 uF $+20\%$, 50V	003-1054	4
C59 thru C61	Capacitor, Mica, 330 pF $+5\%$, 500V	042-3322	3

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 2 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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
C71	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C73,C74	CAP,CER MNLY,.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 D11	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D13	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,D24	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D26,D27	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D29	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D30,D31	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D35,D36	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
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
D45,D46	Diode, 1N5817, Schottky Barrier Type, 20V, 1 Ampere	200-0019	2
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	CONN,20-PIN,MR SERIES,PCB,AMP	417-0230	1
J706,J707	Receptacle, 26-Pin Dual In-line	418-2602	2
J710 thru J717	Receptacle, Male, 3-Pin In-line	417-0003	8
J719 thru 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 Q10	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	10
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

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 3 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R3	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	1
R4	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R5	RES,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	RES,34K 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	RES,4.02K 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, 39.2 k Ohm +1%, 1/4W	100-3951	1
R31	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R32	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R33	Resistor, 1.33 k Ohm +1%, 1/4W	103-1331	1
R34	Resistor, 2 k Ohm +1%, 1/4W	100-2041	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	RES,TRMR,10K 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

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 4 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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, 21.5 k Ohm +1%, 1/4W	103-2151	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	RES,TRMR,10K 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, 24.3 k Ohm +1%, 1/4W	103-2435	1
R75	Resistor, 1 k Ohm +1%, 1/4W	100-1041	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	RES,34K 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, 82.5 k Ohm +1%, 1/4W	103-8255	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	RES,402K OHM,1/4W,1%,METAL	103-4026	1

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 5 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R103	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R104,R105	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R107	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R108	RES,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	RES,TRMR,10K OHM,12 TURN,VERT ADJ	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, 681 Ohm +1%, 1/4W	103-6813	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	RES,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
R137	RES,4.02K OHM,1/4W,1%,METAL	103-4024	1
R138,R139	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R140,R141	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R142	Resistor, 100 Ohm +1%, 1/4W	100-1031	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,R152	Resistor, 82.5 k Ohm +1%, 1/4W	103-8255	2
R156	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R157	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R158	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R159	Resistor, 53.6 k Ohm +1%, 1/4W	103-5365	1
R160	RES,75K OHM,1/4W,1%,METAL	103-7505	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

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 6 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R175	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
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,R184	Resistor, 100 Ohm +1%, 1/4W	100-1031	2
R188,R189	Resistor, 1 Ohm +5%, 1/4W	100-1013	2
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
R203	Resistor, 1 Ohm +5%, 1/4W	100-1013	1
R205	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	RES,75K OHM,1/4W,1%,METAL	103-7505	1
R228	Resistor, 32.4 k Ohm +1%, 1/4W	103-3245	1
R229	Resistor, 82.5 k Ohm +1%, 1/4W	103-8255	1
R230	Resistor, 34.8 k Ohm +1%, 1/4W	103-3485	1
RN1,RN2	RES NET,100K,8-PIN SIP	226-1061	2
TP1 thru TP18	TERM,TEST POINT,OVAL,RED	413-0106	18
U1	IC,LOW PWR 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

TABLE 6-12. FM-2C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-200
(Sheet 7 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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
U23	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
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,U31	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	2
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
XU23	Socket, 6-Pin DIP	417-0600	1
XU24	Socket, 14-Pin DIP	417-1404	1
XU25 - XU27	Socket, 16-Pin DIP	417-1604	3
XU28 - XU31	Socket, 14-Pin DIP	417-1404	4
XU36	Socket, 8-Pin DIP	417-0804	1
----	PCB, MACH, CONTROLLER	519-0563	1

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(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
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
C55 thru C58	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	4
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
C71	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
C73,C74	Capacitor, Ceramic, .47 uF,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 D11	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D13	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,D24	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D26,D27	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D29	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D30 thru D32	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D35 thru D37	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
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
D44 - D46	Diode, 1N5817, Schottky Barrier Type, 20V, 1 Ampere	200-0019	3
D49	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet 2 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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 Series, PCB, AMP	417-0230	1
J706,J707	Receptacle, 26-Pin Dual In-line	418-2602	2
J710 thru J717	Receptacle, Male, 3-Pin In-line	417-0003	8
J719 thru 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 Q10	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	10
Q16,Q17	Transistor, 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%, 1/4W	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, 34K Ohm +1%, 1/4W	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%, 1/4W	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, 39.2 k Ohm +1%, 1/4W	100-3951	1
R31	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R32	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet3 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R33	Resistor, 1.33 k Ohm +1%, 1/4W	103-1331	1
R34	Resistor, 2 k Ohm +1%, 1/4W	100-2041	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, 14 k Ohm +1%, 1/4W	103-1405	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, 15.8 k Ohm +1%, 1/4W	103-1585	1
R75	Resistor, 1 k Ohm +1%, 1/4W	100-1041	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

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet 4 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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%, 1/4W	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, 53.6 k Ohm +1%, 1/4W	103-5365	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, 287 k Ohm +1%, 1/4W	103-2861	1
R103	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R104,R105	Resistor, 1 Meg Ohm +1%, 1/4W	103-1007	2
R107	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R108	Resistor, 715 Ohm 1%, 1/4W	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, 12 Turn, Vert Adj	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, 681 Ohm +1%, 1/4W	103-6813	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%, 1/4W	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
R137	Resistor, 4.02 k Ohm +1%, 1/4W	103-4024	1
R138,R139	Resistor, 1 k Ohm +1%, 1/4W	100-1041	2
R140,R141	Resistor, 100 k Ohm +1%, 1/4W	103-1062	2
R142	Resistor, 100 Ohm +1%, 1/4W	100-1031	1
R143	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet 5 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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 - R153	Resistor, 82.5 k Ohm +1%, 1/4W	103-8255	3
R156	Resistor, 4.99 k Ohm +1%, 1/4W	100-5041	1
R157	Resistor, 1 k Ohm +1%, 1/4W	100-1041	1
R158	Resistor, 10 k Ohm +1%, 1/4W	100-1051	1
R159	Resistor, 53.6 k Ohm +1%, 1/4W	103-5365	1
R160	Resistor, 75 k Ohm 1%, 1/4W	103-7505	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
R175	Resistor, 100 k Ohm +1%, 1/4W	103-1062	1
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 - R185	Resistor, 100 Ohm +1%, 1/4W	100-1031	3
R188 - R190	Resistor, 1 Ohm +5%, 1/4W	100-1013	3
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
R203	Resistor, 1 Ohm +5%, 1/4W	100-1013	1
R205	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

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet 6 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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, 48.7 k Ohm +1%, 1/4W	103-4875	1
R228	Resistor, 20.0 k Ohm +1%, 1/4W	103-2051	1
R229	Resistor, 56.2 k Ohm +1%, 1/4W	103-5651	1
R230	Resistor, 23.2 k Ohm +1%, 1/4W	103-2325	1
RN1,RN2	RES NET,100K,8-PIN SIP	226-1061	2
TP1 thru TP18	TERM,TEST POINT,OVAL,RED	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, 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
U23	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
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,U31	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	2
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 thru XU8	Socket, 14-Pin DIP	417-1404	7
XU9 - XU15	Socket, 16-Pin DIP	417-1604	7

TABLE 6-13. FM-3C CONTROLLER CIRCUIT BOARD ASSEMBLY - 919-0563-300
(Sheet 7 of 7)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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
XU23	Socket, 6-Pin DIP	417-0600	1
XU24	Socket, 14-Pin DIP	417-1404	1
XU25 - XU27	Socket, 16-Pin DIP	417-1604	3
XU28 - XU31	Socket, 14-Pin DIP	417-1404	4
XU36	Socket, 8-Pin DIP	417-0804	1
---	PCB, MACH, CONTROLLER	519-0563	1

TABLE 6-14. RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0562
(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 C229	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	9
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
D26	Bidirectional Zener Transient Voltage Suppressor, Motorola SA13CA, $\pm 13V$	201-0039	1
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
J24	Connector, 2-Pin	417-0700	1
R201 thru R211	Resistor, 51.1 Ohm $\pm 1\%$, 1/4W	103-5112	11
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

TABLE 6-14. RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0562
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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
R229	Resistor, 51.1 Ohm $\pm 1\%$, 1/4W	103-5112	1
----	Blank, RFI Filter Board Circuit Board	519-0562	1

TABLE 6-15. BASIC HARNESS ASSEMBLY - 949-0406

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1, J2	Connector, Male, Single Row, 3-Pin, PLA03M1B00	417-0380	2
P1, P2	Connector, Female, Single Row, 3-Pin, PLA03F1000	417-0379	2
P3 thru P6	Plug, Housing, 4-Pin	418-0240	4
P6	Connector, Housing, 13-Pin, Single In-Line	417-1300	1
P7	Connector, Housing, 5-Pin, Single In-Line	417-1305	1
P301	Plug, Housing, 4-Pin	418-0240	1
P404	Plug, Housing, 16 Contact	417-0123	1
P705	Receptacle, 20-Pin	417-0176	1
----	Plug, Housing, 4-Pin	418-0240	4
----	Socket, Connector, 10-Pin	417-1003	19
----	Connector, FC112N2, Crimp Contact	417-0372	6
----	Connector, MC112N, Crimp Contact	417-0381	6
----	Pins, Crimp Type	417-8766	14
----	Socket, 641294-1, Standard Contact, To Be Used With "MR" Series AMP Connectors.	417-0053	53
----	Connector, Female, 2-Pin	418-0701	7
----	Pin Connector	417-0036	8
----	Connector Plug, 9-Pin	417-0059	1
----	Contact Housing, 4-Pin In-Line	417-0138	1
----	Connector Housing, 6-Pin, Female	418-0670	1
----	Housing Connector, 9-Pin, AMP MR Miniature Rectangular	418-0055	1
----	Connector, 26-Pin Dual In-Line	418-2600	8

TABLE 6-16. RF AMPLIFIER MODULE ASSEMBLY - 959-0412-013
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C13	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1
C14, C15	Capacitor, Ceramic Chip, 270 pF $\pm 5\%$, 300V	009-2723	2
C16	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1
C27	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1

TABLE 6-16. RF AMPLIFIER MODULE ASSEMBLY - 959-0412-013
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C28, C29	Capacitor, Ceramic Chip, 270 pF $\pm 5\%$, 300V	009-2723	2
C30	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1
C39, C40	Capacitor, Ceramic Chip, 24 pF $\pm 5\%$, 500V	009-2413	2
C41, C42	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$, 500V	009-1513	2
Q1, Q2	Transistor, RF Power, SD2932	210-2932	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	919-0417-012	1
----	RF Amplifier Module Directional Coupler/LPF Circuit Board Assembly	919-0418-011	1
----	RF Amplifier Circuit Board Assembly	919-0416-213	1
----	Blank, Module Combiner Shield Circuit Board	519-0419	1
----	Blank, Module Combiner Circuit Board	519-0420	1

TABLE 6-17. MAIN RF AMPLIFIER CIRCUIT BOARD ASSEMBLY - 919-0416-213

REF. DES.	DESCRIPTION	PART NO.	QTY.
W6,W8	Transformer, Input	370-0721	1
P803	Connector, Type N	417-0235	1
----	Assembly, PCB, RF Amplifier	919-0416-013	1
----	Assembly, Harness, RF Amplifier	949-0405	1

TABLE 6-18. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY - 919-0416-013
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 47 uF, 35V	020-4770	2
C3,C4	Capacitor, Trimer, Ceramic, 4-25PF, SMD	090-0004	2
C5	Capacitor, Electrolytic, 470 uF, 63V	013-4784	1
C6,C7	Capacitor, Ceramic, 1000PF, 100V, 5%	009-1032	2
C8	Capacitor, Electrolytic, 470 uF, 63V	013-4784	1
C9	Capacitor, Porcelain, 33 pF, 500V, 5%, SMD	009-3313	1
C10	Capacitor, Trimer, Ceramic, 4-25PF, SMD	090-0004	1
C11,C12	Capacitor, Ceramic, 1000 pF, 100V, 5%	009-1032	2
C17	Capacitor, Mica, Feedthru, 1000 pF $\pm 10\%$, 350V	046-1030	1
C18 thru C21	Capacitor, Ceramic, 1000 pF, 100V, 5%	009-1032	4
C23	Capacitor, 33 pF, Porcelain, 500V, 5%, SMD	009-3313	1
C24	Capacitor, Trimer, Ceramic, 4-25PF, SMD	090-0004	1
C25	Capacitor, Ceramic, 1000 pF, 100V, 5%	009-1032	1
C31	Capacitor, Mica, Feedthru, 1000 pF $\pm 10\%$, 350V	046-1030	1
C34	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1
C35,C36	Capacitor, Ceramic, 1000PF, 100V, 5%	009-1032	2
C38	Capacitor, Ceramic Chip, 470 pF $\pm 5\%$, 200V	009-4723	1

TABLE 6-18. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY - 919-0416-013
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C43	Capacitor, Ceramic,1000 pF, 100V, 5%	009-1032	1
C45	Capacitor, Ceramic Chip, 470 pF +5%, 200V	009-4723	1
C47	Capacitor, Ceramic Chip, 470 pF +5%, 200V	009-4723	1
C51	Capacitor, Ceramic, 100 pF, 500V,5%	009-1023	1
C55	Capacitor, Ceramic, 100 pF, 500V,5%	009-1023	1
D1,D2	Diode, Switching, MMBD914LT1, SMD	204-0914	2
D3	Diode, MMBD701LT1, SMD	201-2801	1
DS1,DS2	LED, Tri-Color	320-0031	2
F1	Fuse, ATC, 25A	334-2500	1
J1 thru J4	Header, 3-Pin, .100 CENTERS, SIP	408-0300	4
J801	Connector, Header Straight Post	417-4040	1
L3,L4	IND, 17.5 NH, AIR, 16MM, 5%, SMD	366-0017	2
R2	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 1/4W	101-2243	1
R3	Resistor, Trimer, 10 k Ohm, Top Adjust	198-1054	1
R4	Resistor, Chip, 47.5 k Ohm $\pm 1\%$, 1/4W	101-0475	1
R5 thru R8	Resistor, Chip, 22 Ohm $\pm 1\%$, 1/4W	101-2223	4
R9	Resistor, Trimer, 10 k Ohm, Top Adjust	198-1054	1
R10	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 1/4W	101-2243	1
R11	Resistor, Chip, 267 k Ohm $\pm 1\%$, 1/4W	101-2670	1
R12	Resistor, Trimer, 10 k Ohm, Top Adjust	198-1054	1
R13	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 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 $\pm 1\%$, 1/4W	101-2243	1
R17	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 1/4W	101-2243	1
R18 thru R21	Resistor, Chip, 22 Ohm $\pm 1\%$, 1/4W	101-2223	4
R22	Resistor, Trimer, 10 k Ohm, Top Adjust	198-1054	1
R23	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 1/4W	101-2243	1
R26	Resistor, Chip, 2.2 k Ohm $\pm 1\%$, 1/4W	101-2243	1
----	PCB, Blank, RF Amplifier	519-0416-013	1

TABLE 6-19. 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 6-20. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417-012
(Sheet 1 of 4)

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

TABLE 6-20. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417-012
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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
J1 Thru J5	Header, 2-Pin	340-0004	5
P1 Thru P5	Plug, 2-Pin	340-0004	5
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
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

TABLE 6-20. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417-012
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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, 322 k Ohm $\pm 1\%$, 1/4W	103-3326	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, 221 k Ohm $\pm 1\%$, 1/4W	103-2216	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
R48	Resistor, 7.68 k Ohm $\pm 1\%$, 1/4W	103-7684	2
R49	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R50	Resistor, 5.11 k Ohm $\pm 1\%$, 1/4W	103-5141	1
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, 100 k Ohm $\pm 1\%$, 1/4W	103-1062	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
R66	Resistor, 47.5 k Ohm, $\pm 1\%$, 1/4W	103-4755	1
R67	Resistor, 2.2 M Ohm $\pm 1\%$, 1/4W	100-2273	1
R68	Resistor, 20.5 k Ohm $\pm 1\%$, 1/4W	103-2055	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, 90.9 k Ohm $\pm 1\%$, 1/4W	103-9095	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
R75, R76	Resistor, 5.11 k Ohm $\pm 1\%$, 1/4W	103-5141	2

TABLE 6-20. RF AMPLIFIER LOGIC CIRCUIT BOARD ASSEMBLY - 919-0417-012
(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R77	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R74	Resistor, 2.05 k Ohm $\pm 1\%$, 1/4W	103-2054	1
R78	Resistor, 19.1 k Ohm $\pm 1\%$, 1/4W	103-1915	1
R79	Resistor, 322 k Ohm, $\pm 1\%$, 1/4W	103-3326	1
R80	Resistor, 162 k Ohm $\pm 1\%$, 1/4W	103-1626	1
R81	Resistor, 24.9 k Ohm $\pm 1\%$, 1/4W	103-2495	1
R82	Resistor, 11 k Ohm $\pm 1\%$, 1/4W	103-1105	1
R83	Potentiometer, 100 k Ohm	179-1045	1
TP1 thru TP3	Terminal Test Point, Oval, Red	413-0106	3
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	519-0417-012	1

TABLE 6-21. RF AMPLIFIER MODULE DIRECTIONAL COUPLER/LPF ASSEMBLY -919-0418-011

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Assembly, PCB, Directional Coupler/LPF	919-0418-012	1
----	Assembly, Module LPF	919-0418-013	1

TABLE 6-22. RF AMPLIFIER MODULE DIRECTIONAL COUPLER/LPF CIRCUIT BOARD ASSEMBLY -919-0418-012 (Sheet 1 of 2)

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
C108	Capacitor, Ceramic, 56 pF $\pm 5\%$, 500V	009-5613	1
C109	Capacitor, Ceramic Chip, 47 pF $\pm 5\%$, 500V	009-4713	1
C112 Thru C114	Capacitor, Ceramic Chip, 1000 pF $\pm 5\%$, 100V	009-1032	3
C115	Capacitor, Ceramic Chip, 15 pF $\pm 5\%$, 500V	009-1513	1
C117, C118	Capacitor, Ceramic Chip, 47 pF $\pm 2\%$, 50V	007-4702-500	2
C119, C120	Capacitor, Ceramic Chip, .1 uF $\pm 10\%$, 50V	007-1044	2
C121	Capacitor, Ceramic Chip, .001 uF $\pm 10\%$, 50V	007-1024	1
C122	Capacitor, Ceramic Chip, 10 uF $\pm 10\%$, 10V	007-1075-100	1
C123	Capacitor, Ceramic Chip, .001 uF $\pm 10\%$, 50V	007-1024	1
C124, C125	Capacitor, Ceramic Chip, .1 uF $\pm 10\%$, 50V	007-1044	2

TABLE 6-22. RF AMPLIFIER MODULE DIRECTIONAL COUPLER/LPF CIRCUIT BOARD ASSEMBLY -919-0418-012 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D103 D105	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
L101	Coil, Molded, .11 uH, 1A	364-0011	1
L103, L104	Inductor, Molded, 68 uH	360-0106	2
L105	Inductor, Molded, 100 uH	366-0100	1
R104, R105	Resistor, 66.5 Ohm $\pm 1\%$, 1/4W	103-6652	2
R109	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	1
R111	Resistor, 64.9 Ohm $\pm 1\%$, 1/10W	102-6409	1
R112	Resistor, 130 Ohm $\pm 1\%$, 1/10W	102-1300	1
R113, R114	Resistor, 64.9 Ohm $\pm 1\%$, 1/10W	102-6409	2
R115	Resistor, 15 Ohm $\pm 1\%$, 1/10W	102-1300	1
R117, R118	Resistor, 0 Ohm, 1/4W	102-1510	2
U1	Integrated Circuit, True Average Power Detector	221-8361	1
U102	Regulator, 78L05AC	231-7805	1
---	Blank RF Amplifier Directional Coupler/LPF Circuit Board	519-0418-012	1

TABLE 6-23. MODULE LPF CIRCUIT BOARD ASSEMBLY -919-0418-013

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, 10 pF $\pm 5\%$, 500V	009-1013	2
C206	Capacitor, Ceramic, 56 pF $\pm 5\%$, 500V	009-5613	1
C207	Capacitor, Ceramic Chip, 47 pF $\pm 5\%$, 500V	009-4713	1
---	Blank Module LPF Circuit Board	519-0418-013	1

**TABLE 6-24. FM-3C/FMi-201 OUTPUT COMBINER - 959-0413
FM-2C/FMi-106 OUTPUT COMBINER - 959-0413-001**

REF. DES.	DESCRIPTION	PART NO.	QTY.
L1 thru L4	Coil, Shunt Inductor	360-0153	4
P11 thru P14	Connector, Type N, Male To Pin, No Nut	417-0384	4
----	Blank Output Combiner Circuit Board	519-0422	1
----	Blank Combiner Circuit Board	519-0414	1
ADDITIONAL PARTS FOR FM-3C MOTHERBOARD ASSEMBLY 959-0413			
L5, L6	Coil, Shunt Inductor	360-0153	2
P15, P16	Connector, Type N, Male To Pin, No Nut	417-0384	2

TABLE 6-25. REMOTE INTERFACE CIRCUIT BOARD ASSEMBLY- 919-0415-005

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
P20	Receptacle, 25-Pin D-Type, PCB Mount	417-2501	1
TB2	Barrier Strip, 30 Terminal	412-3000	1
----	Blank Remote Interface Label Circuit Board	594-0415	1
----	Blank Remote Interface Circuit Board	519-0406-104	1

TABLE 6-26. LOW-PASS FILTER INPUT/RFI FILTER CIRCUIT BOARD ASSEMBLY- 919-0415-003

REF. DES.	DESCRIPTION	PART NO.	QTY.
C301, C302	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
J301	Socket, 4-Pin	418-0255	1
J302	Receptacle, 6-Pin	417-0677	1
R301, R302	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	2
----	Blank Low-Pass Filter Input/RFI Filter Circuit Board	519-0415-003	1

**TABLE 6-27. FM-3C/FMi-201 MULTIPLEXER CIRCUIT BOARD ASSEMBLY- 919-0415-002
FM-2C/FMi-106 MULTIPLEXER CIRCUIT BOARD ASSEMBLY- 919-0415-022
(Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201 thru C208	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	8
C209	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C210 thru C213	Capacitor, Ceramic, 100 pF $\pm 2\%$, 100V	003-1063	4
C214 thru C217	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	4
C218	Capacitor, Monolythic Ceramic, 47 uF $\pm 20\%$, 50V	003-4743	1
D201 thru D204, D207 thru D210, D213 thru D215	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	11
J201 thru J204	Connector, 10-Pin, Dual In-Line	418-1003	4
J207	Receptacle, 26-Pin Dual In-line	418-2602	1
J208	Connector, 10-Pin, Dual In-Line	418-1003	1
J209	Receptacle, Male, 3-Pin In-line	417-0003	1
P209	Jumper, Programmable, 2-Pin	340-0004	1
R201	Resistor Network, 10 k Ohm $\pm 2\%$, 1W Resistors, 8-Pin Single In-Line Package	226-1051	1
R202	Resistor, 100 k Ohm $\pm 1\%$, 1/4W	103-1062	1
R203, R204	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R205	Resistor, 1 Meg Ohm $\pm 1\%$, 1/4W	103-1007	1
R206, R207, R209, R211, R212, R214	Resistor, 100 k Ohm $\pm 1\%$, 1/4W	103-1062	6

TABLE 6-27. FM-3C/FMi-201 MULTIPLEXER CIRCUIT BOARD ASSEMBLY- 919-0415-002
FM-2C/FMi-106 MULTIPLEXER CIRCUIT BOARD ASSEMBLY- 919-0415-022
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R215	Resistor Network, 7 - 6.8 k Ohm $\pm 1\%$ Resistors, 8-Pin Single In-Line Package	226-6800	1
R216 thru R221, R223	Resistor, 100 k Ohm $\pm 1\%$, 1/4W	103-1062	7
R224 thru R227, R230	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	5
R231	Resistor, 10.2 k Ohm $\pm 1\%$, 1/4W	103-1025	1
R232	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	1
R233	Resistor, 1.4 k Ohm $\pm 1\%$, 1/4W	103-1404	1
R234	Resistor, 2 k Ohm $\pm 1\%$, 1/4W	100-2041	1
R236, R238	Resistor, 10 Ohm $\pm 1\%$, 1/4W	103-1021	2
U201 thru U204	Integrated Circuit, MC14501, 8-Bit Analog Multiplexer, CMOS 16-Pin DIP	220-4051	4
U205	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U206	Integrated Circuit, MC14082B, Dual 4-Input And Gate, 14-Pin DIP	220-4082	1
U207	Integrated Circuit, MC14516B, Binary Up/Down Counter, CMOS, 16-Pin DIP	228-4516	1
U208	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	1
U209	Integrated Circuit, LM324, Low-Power Quad Operational Amplifier, 14-Pin DIP	220-0324	1
XU201 thru XU204	Socket, 16-Pin DIP	417-1604	4
XU205, XU206	Socket, 14-Pin DIP	417-1404	2
XU207, XU208	Socket, 16-Pin DIP	417-1604	2
XU209	Socket, 14-Pin DIP	417-1404	1
----	Blank Multiplexer Circuit Board	519-0415-002	1
ADD PARTS FOR 919-0415-002 ASSEMBLY			
D205, D206 D211, D212	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	4
J205, J206	Connector, 10-Pin, Dual In-Line	418-1003	2
R228, R229	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R235, R237	Resistor, 10 Ohm $\pm 1\%$, 1/4W	103-1021	2

TABLE 6-28. FM-3C/FMi-201 MODULE SELECT CIRCUIT BOARD ASSEMBLY- 919-0415-001. FM-2C/FMi-106 MODULE SELECT CIRCUIT BOARD ASSEMBLY- 919-0415-021 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
DS1 DS2	LED, Red Diffused Chimney, P424, 70 mW, 20 mA, 4V	320-0037	2
DS4	LED, HD1107G, Green, 7 Segment High Efficiency Common Cathode Display	320-0022	1
J2	Connector, 10-Pin, Dual In-Line	418-1003	1
R1 thru R3 R5 thru R11	Resistor, 1 k Ohm $\pm 5\%$, 1/2W	110-1043	10

**TABLE 6-28. FM-3C/FMi-201 MODULE SELECT CIRCUIT BOARD ASSEMBLY-
919-0415-001. FM-2C/FMi-106 MODULE SELECT CIRCUIT BOARD ASSEMBLY-
919-0415-021 (Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
R12	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
S1	Switch, SPST, Momentary, LED Illuminated, Yellow, 12V dc @ 50 mA	340-0139	1
U1	Integrated Circuit, MC14511B, 7-Segment LED Decoder/Driver, 16-Pin DIP	220-4511	1
XU1	Socket, 16-Pin DIP	417-1604	1
----	Blank Module Select Circuit Board.	519-0415-001	1
ADD PARTS FOR 919-0415-001 ASSEMBLY			
DS3	LED, Red Diffused Chimney, P424, 70 mW, 20 mA, 4V	320-0037	1
R4	Resistor, 1 k Ohm $\pm 5\%$, 1/2W	110-1043	1

TABLE 6-29. LOW-PASS FILTER ASSEMBLY- 959-0414

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Receptacle, BNC	417-0016	1
----	Connector Assembly, Transmission Line, Modified	427-0009-1	1
----	Adaptor, unflanged to 1 5/8 inch flange	427-0010	1
----	Low-Pass Filter Circuit Board Assembly	919-0421	1

TABLE 6-30. LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY- 919-0421

REF. DES.	DESCRIPTION	PART NO.	QTY.
C8	Capacitor, Ceramic, 68 pF $\pm 5\%$, 50V	003-6812	1
C9, C10	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
C11	Capacitor, Ceramic, 27 pF $\pm 2\%$, 100V	003-2753	1
C12, C13	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
C14, C15	Capacitor, Monolythic Ceramic, 2.2 pF $\pm 10\%$, 100V, +/-0.25 pF	003-2201	2
D1, D2	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
J23	Receptacle, Male, Right Angle, 20-Pin In-Line	417-0214	1
L1	Inductor, Low-Pass Filter	360-0145	1
L2	Inductor, Molded, 0.023 uH	364-0023	1
R1	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	1
R2	Resistor, 665 k Ohm $\pm 1\%$, 1/4W	103-6654	1
R3 thru R4	Resistor, 124 Ohm $\pm 1\%$, 2W	122-1241	2
R5	Resistor, 100 k Ohm $\pm 1\%$, 1/4W	103-1062	1
R6	Resistor, 665 k Ohm $\pm 1\%$, 1/4W	103-6654	1
R7, R8	Resistor, 158 Ohm $\pm 1\%$, 2W	122-1581	2
R9	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	177-1044	1
----	Inductor, Low-Pass Filter	471-0976	1
----	Blank Low-Pass Filter Circuit Board	519-0421	1

**TABLE 6-31. FM-3C/FMi-201 POWER SUPPLY MOTHERBOARD ASSEMBLY-
919-0415-004 FM-2C/FMi-106 POWER SUPPLY MOTHERBOARD ASSEMBLY-
919-0415-024**

REF. DES.	DESCRIPTION	PART NO.	QTY.
J401, J402	Connector, For Pioneer Power Supplies, 29-Pin	417-2900	2
J404	Receptacle, Male, 20-Pin In-Line	417-0200	1
R401	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
----	Blank Power Supply Motherboard	519-0415-004	1
ADD PARTS FOR 919-0415-004 ASSEMBLY			
J403	Connector, For Pioneer Power Supplies, 29-Pin	417-2900	1

TABLE 6-32. FAN KIT - FACTORY CABINETS - 979-0503-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Fan, 6 inch (15.24 cm), 250 ft ³ /min 220V ac, 50/60 Hz, 40 Watt	380-7650	2

TABLE 6-33. OPTICALLY COUPLED RELAY ASSEMBLY - 919-0096-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Optically Coupled Relay Circuit Board Assembly	919-0096	1
DELETE PARTS			
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000-1051	1
R2	Resistor, 560 Ohm $\pm 5\%$, 1/2W	110-5633	1

**TABLE 6-34. OPTICALLY COUPLED RELAY CIRCUIT BOARD ASSEMBLY - 919-0096
(Sheet 1 of 2)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
C2	Capacitor, Electrolytic, 47 uF, 35V	020-4773	1
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000-1051	1
C4	Capacitor, Ceramic, 0.001 uF, 1 kV	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, MDA970A3, 4 Amps, 50-200V	239-0003	1
E1 thru E5	Terminal, Male Disconnect	410-0025	5
F1, F2	Fuse, 3 Amps, 250V, Printed Circuit Board Mount	330-0055	2
K1	Relay, Printed Circuit Board Mount	270-0054	1
	Coil: 24V dc, 660 Ohm $\pm 10\%$		
	Contacts: SPST-NO, 0.5 to 15A @ 12 to 240V ac Resistance		
MOV1	Varistor, 27V, V27ZA60	140-0023	1
R1	Resistor, 2 k Ohm $\pm 3\%$, 10W, W/W	130-2032	1

TABLE 6-34. OPTICALLY COUPLED RELAY CIRCUIT BOARD ASSEMBLY - 919-0096
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
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, W/W	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
XU1	Socket, 6-Pin DIP	417-0600	1
----	Cover, Dust Relay, 35C620A	270-0054-001	1
----	Blank, Optically Coupled Relay Circuit Board	519-0096	1

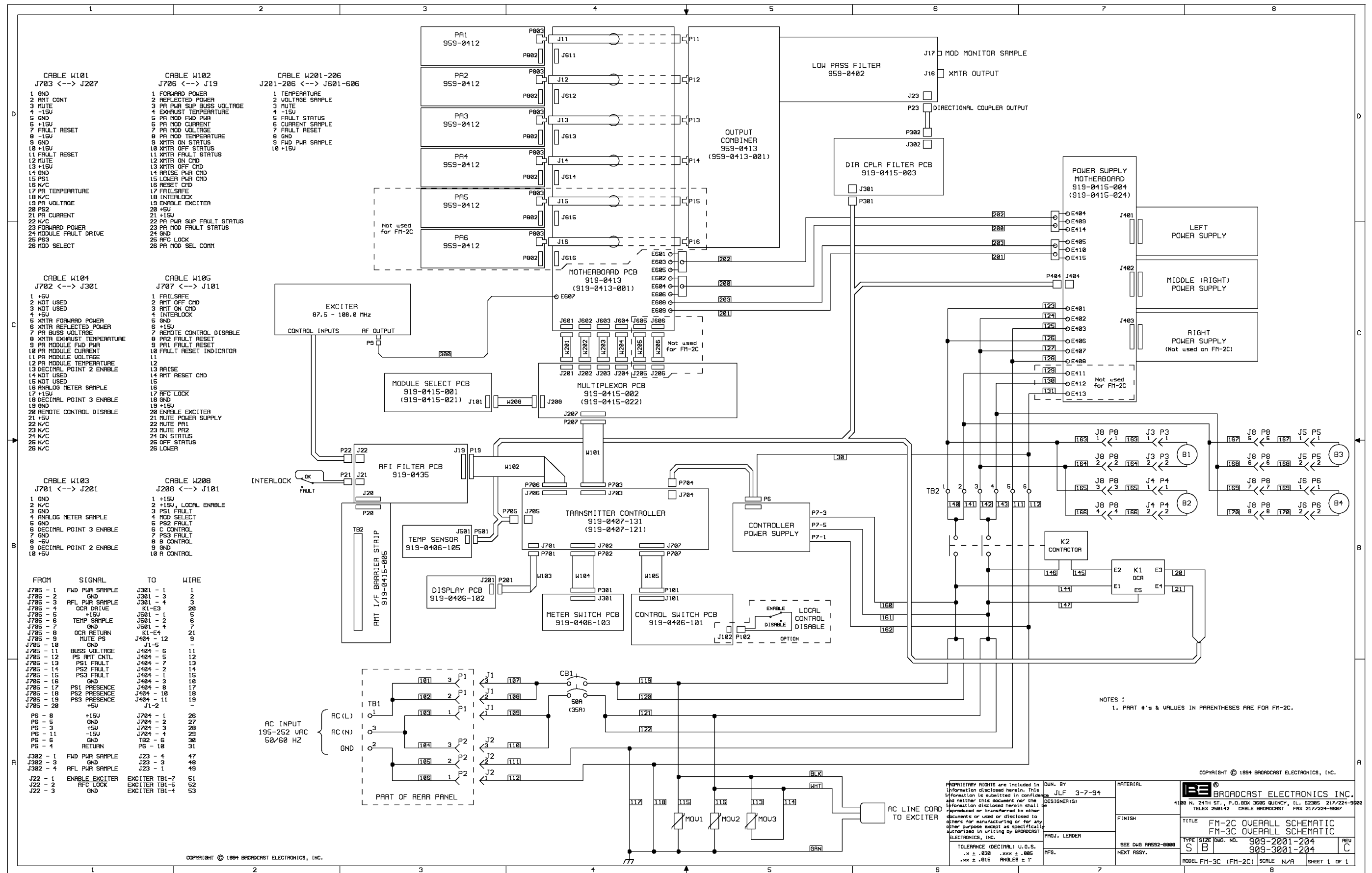
SECTION VII DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides schematic and assembly diagrams as indexed below for the Broadcast Electronics FM-3C/FM-2C and FMi-201/FMi-106 transmitters.

FIGURE	TITLE	NUMBER
7-1	OVERALL SCHEMATIC DIAGRAM, FM-3C/FM-2C TRANSMITTER	SB909-/3001-204 /2001-204
7-2	SCHEMATIC DIAGRAM, MOTHERBOARD, FM-3C	SD919-0413/-001
7-3	ASSEMBLY DIAGRAM, MOTHERBOARD, FM-3C	AD919-0413/-001
7-4	SCHEMATIC DIAGRAM, CONTROLLER CIRCUIT BOARD	SB919-0563-300 /-200
7-5	ASSEMBLY DIAGRAM, CONTROLLER CIRCUIT BOARDS	AD919-0563-300 /-200
7-6	SCHEMATIC DIAGRAM, CONTROLLER RFI FILTER CIRCUIT BOARD	SB919-0435
7-7	ASSEMBLY DIAGRAM, CONTROLLER RFI FILTER CIRCUIT BOARD	AB919-0435
7-8	SCHEMATIC DIAGRAM, CONTROLLER ON/OFF SWITCH CIRCUIT BOARD	SB919-0406-101
7-9	SCHEMATIC DIAGRAM, CONTROLLER METER DISPLAY	SB919-0406-102
7-10	SCHEMATIC DIAGRAM, CONTROLLER METER SWITCH	SB919-0406-103
7-11	SCHEMATIC DIAGRAM, TEMPERATURE SENSOR	SA919-0406-105
7-12	ASSEMBLY DIAGRAM, CONTROLLER CIRCUIT BOARDS	AD919-0406-101 thru -105
7-13	SCHEMATIC DIAGRAM, MODULE SELECT CIRCUIT BOARD	SB919-0415-001 /-021
7-14	ASSEMBLY DIAGRAM, MODULE SELECT CIRCUIT BOARD	AB919-0415-001 /-021
7-14	SCHEMATIC DIAGRAM, MULTIPLEXER CIRCUIT BOARD	SD919-0415-002 /-022
7-14	ASSEMBLY DIAGRAM, MULTIPLEXER CIRCUIT BOARD	AC919-0415-002 /-022
7-15	SCHEMATIC DIAGRAM, LOW-PASS FILTER INPUT RFI FILTER CIRCUIT BOARD	SA919-0415-003
7-16	ASSEMBLY DIAGRAM, LOW-PASS FILTER INPUT RFI FILTER CIRCUIT BOARD	AA919-0415-003
7-17	SCHEMATIC DIAGRAM, POWER SUPPLY MOTHERBOARD FILTER CIRCUIT BOARD	SB919-0415-004 /-024
7-17	ASSEMBLY DIAGRAM, POWER SUPPLY MOTHERBOARD FILTER CIRCUIT BOARD	AC919-0415-004 /-024
7-18	SCHEMATIC DIAGRAM, REMOTE INTERFACE BARRIER STRIP	SB919-0415-005

FIGURE	TITLE	NUMBER
7-19	ASSEMBLY, REMOTE INTERFACE BARRIER STRIP	AB919-0415-005
7-21	SCHEMATIC DIAGRAM, RF POWER MODULE	SB959-0412-013
7-24	ASSEMBLY DIAGRAM, RF AMPLIFIER CIRCUIT BOARD BOARD	AD919-0416-013/ -213
7-25	ASSEMBLY DIAGRAM, RF AMPLIFIER MODULE LOW-PASS FILTER/DIRECTIONAL COUPLER CIRCUIT BOARDS	AC919-0418-011 /-012 /-013
7-22	SCHEMATIC DIAGRAM, RF AMPLIFIER LOGIC CIRCUIT BOARD	SB919-0417-012
7-23	ASSEMBLY DIAGRAM, RF AMPLIFIER LOGIC CIRCUIT BOARD	AB919-0417-012
7-26	SCHEMATIC DIAGRAM, LOW-PASS FILTER	SB959-0414/ -001
7-27	ASSEMBLY DIAGRAM, LOW-PASS FILTER CIRCUIT BOARD	AC919-0421/ -001
7-28	SCHEMATIC DIAGRAM, OPTICALLY-COUPLED-RELAY (OCR) CIRCUIT BOARD	SB919-0096/ -001
7-29	ASSEMBLY DIAGRAM, OPTICALLY-COUPLED-RELAY (OCR) CIRCUIT BOARD	AB919-0096/ -001
7-30	CABINET SCHEMATIC DIAGRAM, OVERALL	597-3002-600
7-31	ASSEMBLY DIAGRAM, POWER AMPLIFIER MODULE	597-3002-23



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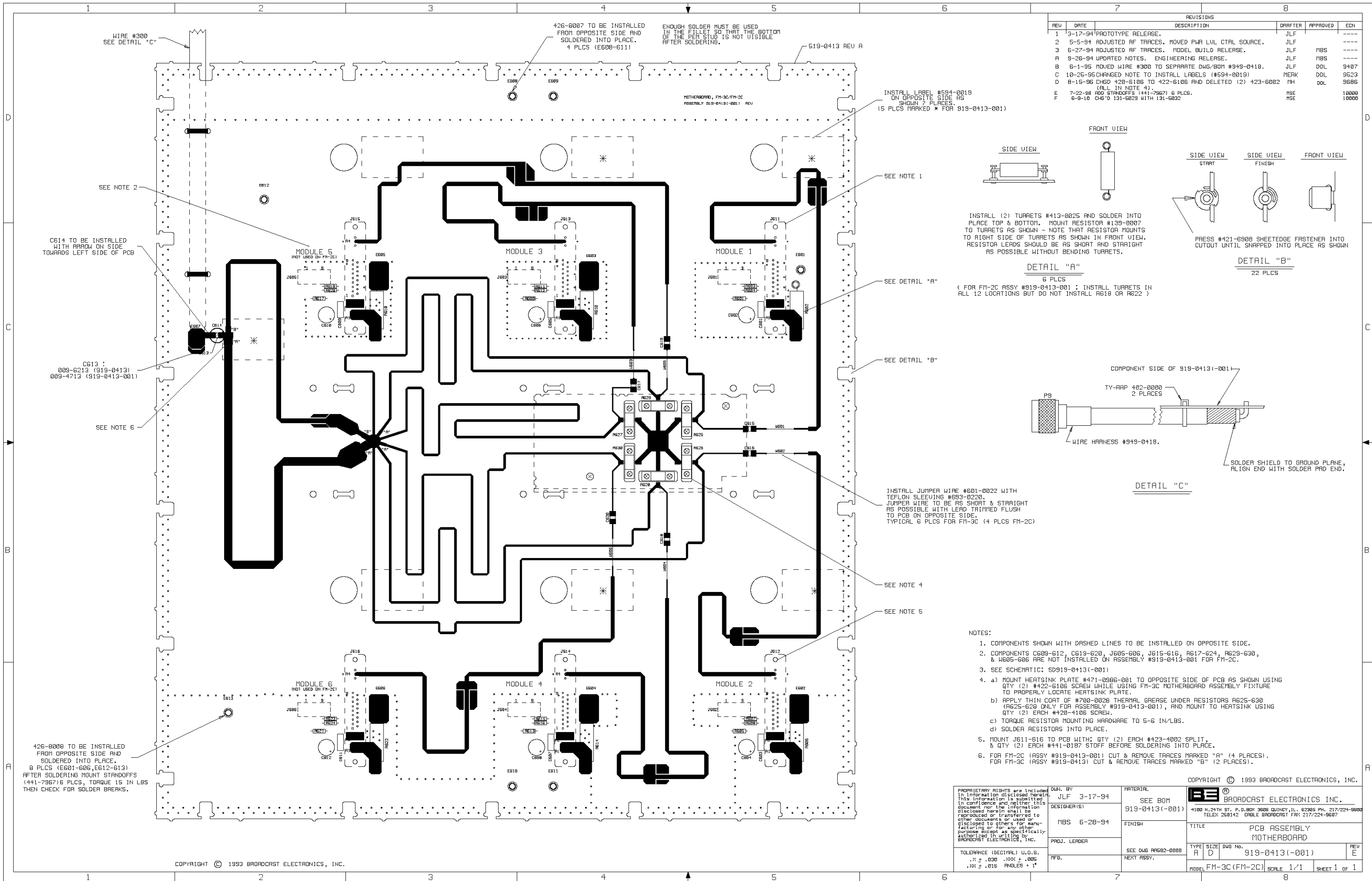
REVISIONS					
REV	DATE	DESCRIPTION	DRAWN	APPROVED	ECN
1	3-18-94	PROTOTYPE RELEASE.	JLF		----
2	5-4-94	MOVED PWR CTAL LVL SOURCE FROM +PAV TO +15V.	JLF		----
-	6-27-94	MODEL BUILD RELEASE.	JLF		----
A	9-23-94	ENGINEERING RELEASE W/O CHG.	JLF		----
B	6-9-10	CHG'D 131-5029 TO 131-5032	JTB		11651

SEE NOTE 7

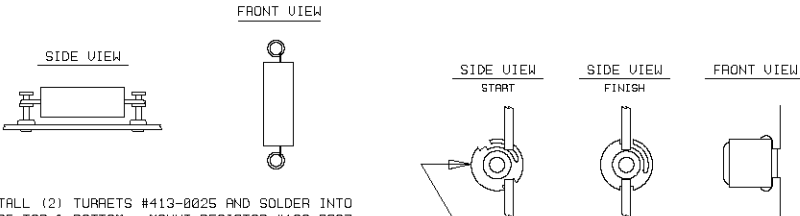
- NOTES:
- "SL#" INDICATES MICRO-STRIPLINE ETCHED ON PCB.
 - FOR FM-2C (ASSY #919-0413-001) CUT AND REMOVE TRACES MARKED "A" (4 PLACES).
FOR FM-3C (ASSY #919-0413) CUT AND REMOVE TRACES MARKED "B" (2 PLACES).
 - COMPONENTS C609-612, C619-620, E605-606, J605-606, J615-616, R617-624, R629-630, & W605-606 NOT INSTALLED ON ASSEMBLY #919-0413-001 FOR FM-2C.
 - LAST COMPONENTS USED: C620, E613, J616, R630.
 - COMPONENTS NOT USED: J607-610
 - SEE ASSEMBLY: AD919-0413(-001)
 - C613 : 62pF FOR ASSY #919-0413 (FM-3C);
47pF FOR ASSY #919-0413-001 (FM-2C).

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TOLERANCE (DECIMAL) U.S.S. * ± .030 ** ± .015		PROJ. LEADER	FINISH		SEE DWG. #9692-0008	
NEXT ASSY.		RFG.		TITLE		SCHEMATIC
MODEL FM-3C(FM-2C)		SCALE NONE		SHEET 1 OF 1		REV B



REVISIONS				
REV	DATE	DESCRIPTION	DRAFTER	APPROVED
1	3-17-94	PROTOTYPE RELEASE.	JLF	---
2	5-5-94	ADJUSTED AF TRACES. MOVED PWR LVL CTRL SOURCE.	JLF	MBS
3	6-27-94	ADJUSTED AF TRACES. MODEL BUILD RELEASE.	JLF	MBS
A	9-26-94	UPDATED NOTES. ENGINEERING RELEASE.	JLF	DDL
B	6-1-95	MOVED WIRE #300 TO SEPARATE DWG/BOM #949-0418.	JLF	DDL
C	10-25-95	CHANGED NOTE TO INSTALL LABELS (#594-0019)	MEAK	DDL
D	8-15-96	CHGD 426-6106 TO 422-6106 AND DELETED (2) 423-6002 (ALL IN NOTE 4).	MSE	DDL
E	7-22-98	ADD STANDOFFS (441-7967) 6 PLCS.	MSE	10000
F	6-9-10	CHG'D 131-6029 WITH 131-6032	MSE	10000



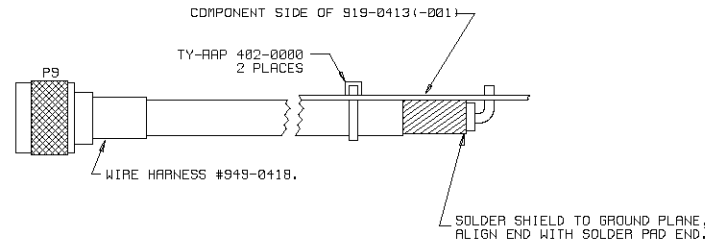
INSTALL (2) TURRETS #413-0025 AND SOLDER INTO PLACE TOP & BOTTOM. MOUNT RESISTOR #139-0007 TO TURRETS AS SHOWN - NOTE THAT RESISTOR MOUNTS TO RIGHT SIDE OF TURRETS AS SHOWN IN FRONT VIEW. RESISTOR LEADS SHOULD BE AS SHORT AND STRAIGHT AS POSSIBLE WITHOUT BENDING TURRETS.

DETAIL "A"

6 PLCS
(FOR FM-2C ASSY #919-0413-001: INSTALL TURRETS IN ALL 12 LOCATIONS BUT DO NOT INSTALL R618 OR R622)

DETAIL "B"

22 PLCS



DETAIL "C"

NOTES:

- COMPONENTS SHOWN WITH DASHED LINES TO BE INSTALLED ON OPPOSITE SIDE.
- COMPONENTS C609-612, C619-620, J605-606, J615-616, R617-624, R629-630, & W605-606 ARE NOT INSTALLED ON ASSEMBLY #919-0413-001 FOR FM-2C.
- SEE SCHEMATIC: SD919-0413(-001)
- a) MOUNT HEATSINK PLATE #471-0996-001 TO OPPOSITE SIDE OF PCB AS SHOWN USING QTY (2) #422-6106 SCREW WHILE USING FM-3C MOTHERBOARD ASSEMBLY FIXTURE TO PROPERLY LOCATE HEATSINK PLATE.
b) APPLY THIN COAT OF #700-0028 THERMAL GREASE UNDER RESISTORS R625-630 (R625-628 ONLY FOR ASSEMBLY #919-0413-001), AND MOUNT TO HEATSINK USING QTY (2) EACH #420-4106 SCREW.
c) TORQUE RESISTOR MOUNTING HARDWARE TO 5-6 IN./LBS.
d) SOLDER RESISTORS INTO PLACE.
- MOUNT J611-616 TO PCB WITH: QTY (2) EACH #423-4002 SPLIT, & QTY (2) EACH #441-0187 STIFF BEFORE SOLDERING INTO PLACE.
- FOR FM-2C (ASSY #919-0413-001) CUT & REMOVE TRACES MARKED "A" (4 PLACES). FOR FM-3C (ASSY #919-0413) CUT & REMOVE TRACES MARKED "B" (2 PLACES).

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .016 ANGLES ± 1°

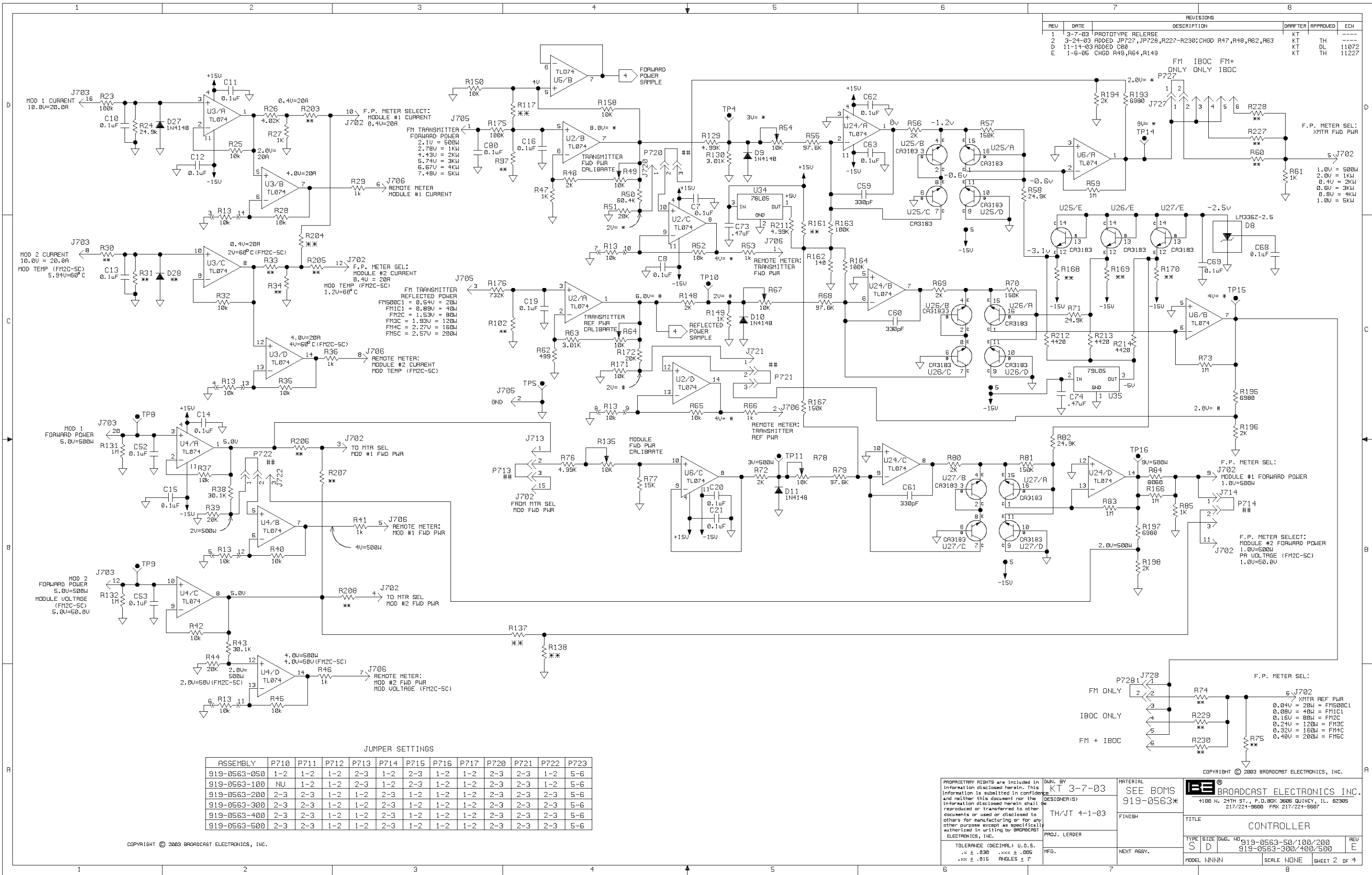
DWG. BY
JLF 3-17-94
DESIGNER(S)
MBS 6-28-94
PROJ. LEADER
MFB.

MATERIAL
SEE BOM
919-0413(-001)
FINISH
SEE DWG RAS62-0008
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O. BOX 3606 QUINCY, IL. 62305 PH. 217/224-9880
TELEX 260142 CABLE BROADCAST FAX: 217/224-9687

TITLE
PCB ASSEMBLY
MOTHERBOARD

TYPE SIZE DWG No.
A D 919-0413(-001)
MODEL FM-3C (FM-2C) SCALE 1/1 SHEET 1 OF 1



REVISIONS				
REV	DATE	DESCRIPTION	DRAWN	APPROVED
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	TH
4	1-6-05	CHGD R49, R64, R149	KT	TH

FM ONLY
IBOC ONLY
FM+IBOC

F.P. METER SEL:
XMITR FWD PWR

1.0V = 500W
2.0V = 1KW
0.4V = 2KW
0.6V = 3KW
0.8V = 4KW
1.0V = 5KW

F.P. METER SEL:
XMITR REF PWR

1.0V = 500W
2.0V = 1KW
0.4V = 2KW
0.6V = 3KW
0.8V = 4KW
1.0V = 5KW

F.P. METER SEL:
XMITR FWD PWR

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2.0V = 1KW
0.4V = 2KW
0.6V = 3KW
0.8V = 4KW
1.0V = 5KW

F.P. METER SEL:
XMITR FWD PWR

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2.0V = 1KW
0.4V = 2KW
0.6V = 3KW
0.8V = 4KW
1.0V = 5KW

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XMITR FWD PWR

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0.4V = 2KW
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1.0V = 5KW

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XMITR FWD PWR

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XMITR FWD PWR

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1.0V = 5KW

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XMITR FWD PWR

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2.0V = 1KW
0.4V = 2KW
0.6V = 3KW
0.8V = 4KW
1.0V = 5KW

F.P. METER SEL:
XMITR FWD PWR

ASSEMBLY	P710	P711	P712	P713	P714	P715	P716	P717	P720	P721	P722	P723
919-0563-050	1-2	1-2	1-2	2-3	1-2	2-3	1-2	1-2	2-3	2-3	1-2	5-6
919-0563-100	NU	1-2	1-2	2-3	1-2	2-3	1-2	1-2	2-3	2-3	1-2	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	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	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	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	2-3	5-6

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

PROJ. LEADER

DATE
3-7-03

FINISH
SEE BOMS 919-0563*

NEXT ASSY.

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217/224-9500 FAX 217/224-9507

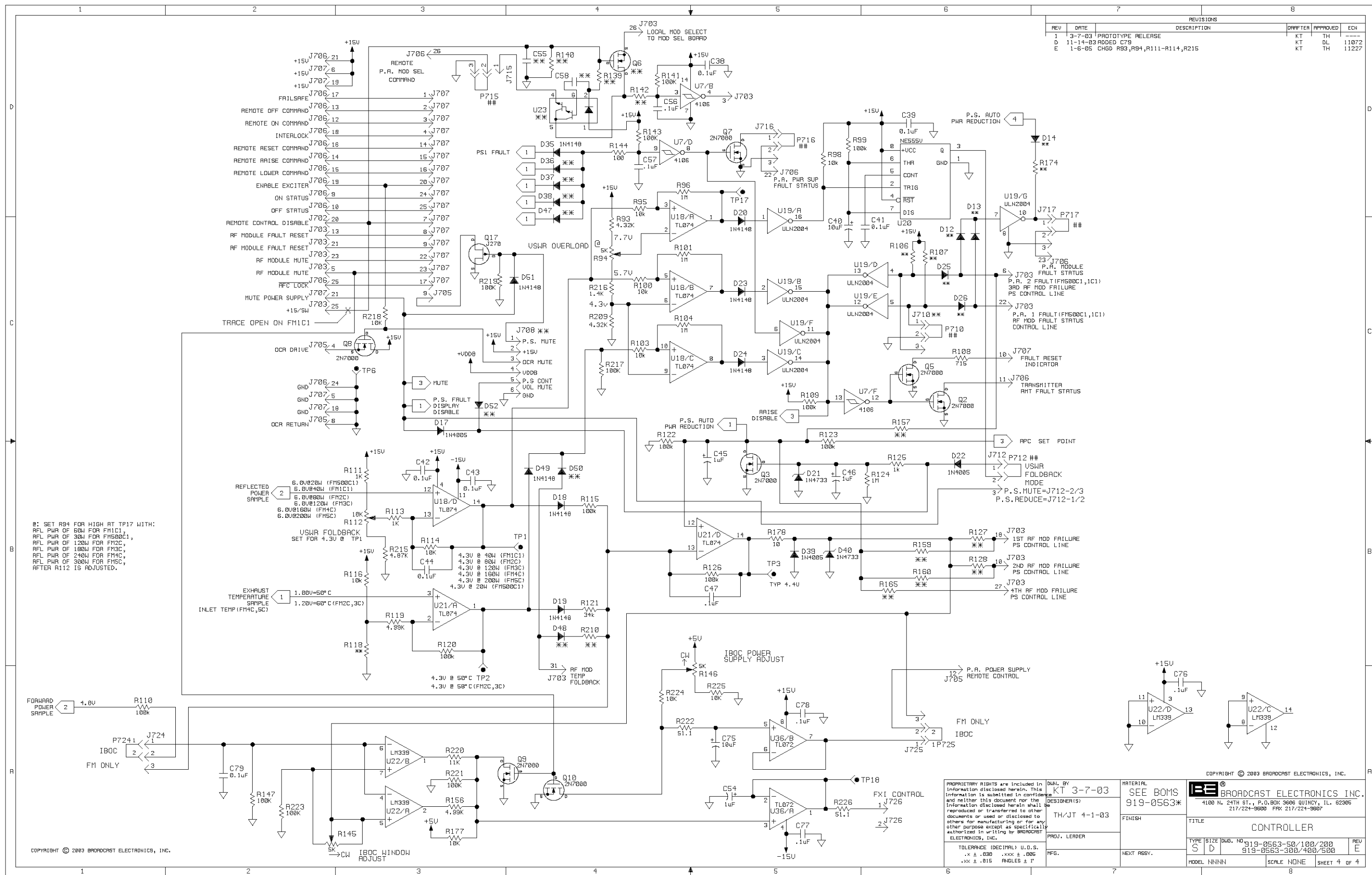
TITLE
CONTROLLER

TYPE SIZE DWS. NO
S D 919-0563-50/100/200

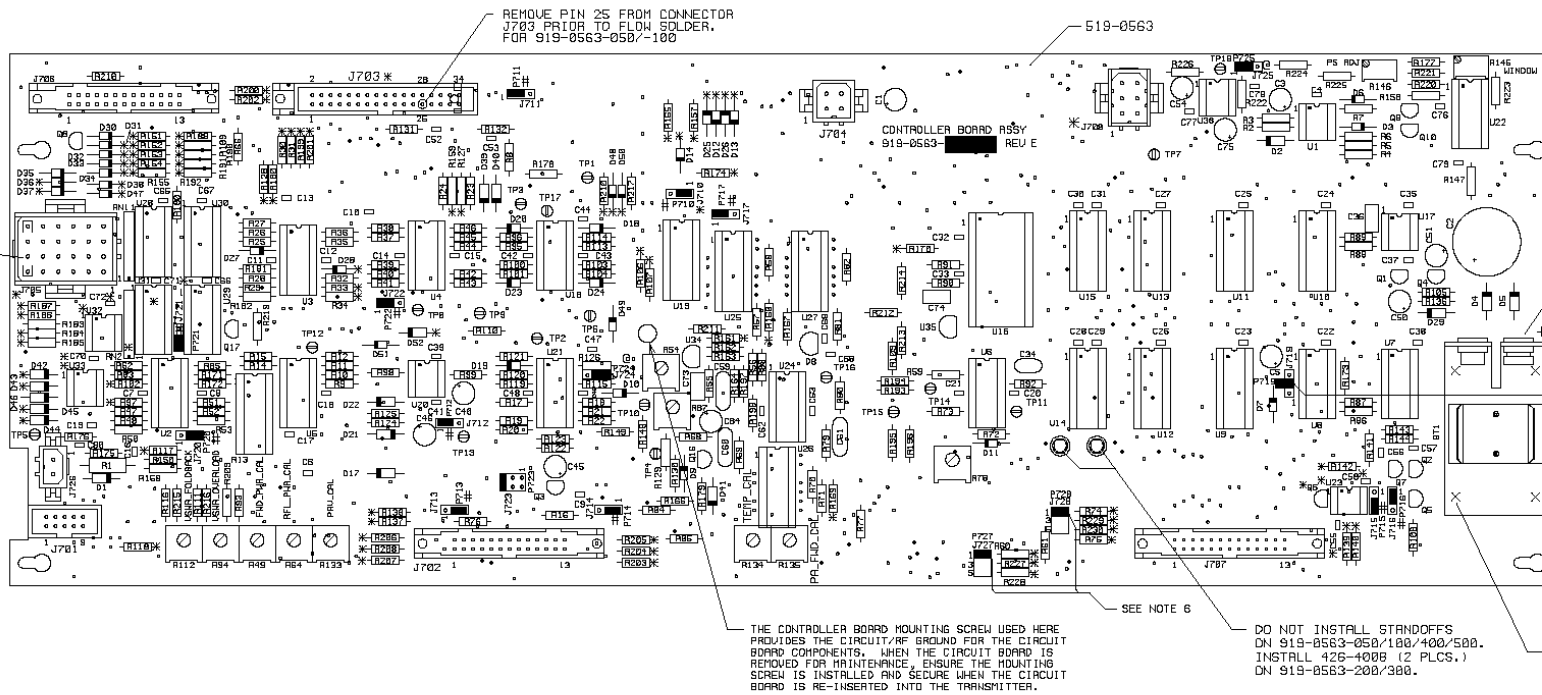
MODEL NNNN

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 IBOC ONLY
ON PINS 5-6 FOR FM + IBOC
- 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 IBOC
ON PINS 2-3 FOR FM ONLY

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

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
C58	NOT USED	NOT USED	003-1054	003-1054	003-1054	003-1054
C70	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	003-1054
C71	NOT USED	NOT USED	003-1054	003-1054	003-1054	003-1054
C72	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	003-1054
D12	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED
D13	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148
D14	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED
D25	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED
D26	NOT USED	203-4148	203-4148	203-4148	203-4148	203-4148
D28	203-4148	203-4148	NOT USED	NOT USED	NOT USED	NOT USED
D31	NOT USED	NOT USED	203-4148	203-4148	203-4148	203-4148
D32	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D33	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D34	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
D37	NOT USED	NOT USED	NOT USED	203-4148	203-4148	203-4148
D38	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148
D42	NOT USED	NOT USED	NOT USED	NOT USED	200-0019	200-0019
D43	NOT USED	NOT USED	NOT USED	NOT USED	200-0019	200-0019
D44	NOT USED	NOT USED	NOT USED	200-0019	200-0019	200-0019
D45	NOT USED	NOT USED	200-0019	200-0019	200-0019	200-0019
D48	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148
D50	NOT USED	NOT USED	NOT USED	NOT USED	203-4148	203-4148
D52	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
J705	417-0230	417-0230	417-0230	417-0230	417-2401	417-2401
J707	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
Q6	NOT USED	NOT USED	210-7008	210-7008	210-7008	210-7008
R102	NOT USED	100-1173	103-0426	103-2861	103-2326	103-1966
R106	100-1051	100-1051	NOT USED	NOT USED	NOT USED	NOT USED
R107	NOT USED	NOT USED	100-1051	100-1051	100-1051	100-1051
R117	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
R127	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
R137	NOT USED	NOT USED	103-4024	103-4024	103-4024	103-4024
R138	NOT USED	NOT USED	100-1041	100-1041	100-1041	100-1041
R139	NOT USED	NOT USED	100-1041	100-1041	100-1041	100-1041
R140	NOT USED	NOT USED	103-1062	103-1062	103-1062	103-1062
R142	NOT USED	NOT USED	100-1031	100-1031	100-1031	100-1031
R151	100-1031	100-1031	103-8255	103-8255	103-8255	103-8255
R152	NOT USED	NOT USED	103-8255	103-8255	103-8255	103-8255
R153	NOT USED	NOT USED	103-8255	103-8255	103-8255	103-8255
R154	NOT USED	NOT USED	NOT USED	NOT USED	103-8255	103-8255
R155	NOT USED	NOT USED	NOT USED	NOT USED	103-8255	103-8255
R157	NOT USED	NOT USED	100-1041	100-1041	103-1056	103-1056
R159	NOT USED	NOT USED	103-5365	103-5365	103-5115	103-5115
R160	NOT USED	NOT USED	103-7505	103-7505	103-1761	103-1761
R181	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
R188	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
R170	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
R184	NOT USED	NOT USED	100-1031	100-1031	100-1031	100-1031
R185	NOT USED	NOT USED	NOT USED	100-1031	100-1031	100-1031
R186	NOT USED	NOT USED	NOT USED	NOT USED	100-1031	100-1031
R187	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	100-1031
R188	NOT USED	NOT USED	100-1013	100-1013	100-1013	100-1013
R189	NOT USED	NOT USED	100-1013	100-1013	100-1013	100-1013
R190	NOT USED	NOT USED	NOT USED	100-1013	100-1013	100-1013
R191	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
R199	103-8064	103-8064	NOT USED	NOT USED	NOT USED	NOT USED
R200	103-8064	103-8064	NOT USED	NOT USED	NOT USED	NOT USED
R201	100-1041	100-1041	NOT USED	NOT USED	NOT USED	NOT USED
R202	100-1041	100-1041	NOT USED	NOT USED	NOT USED	NOT USED
R203	NOT USED	100-1013	103-1013	100-1013	100-1013	100-1013
R204	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R205	NOT USED	100-1013	103-1013	100-1013	100-1013	100-1013
R206	NOT USED	100-1013	NOT USED	NOT USED	NOT USED	NOT USED
R207	100-1013	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
R208	NOT USED	100-1013	NOT USED	NOT USED	NOT USED	NOT USED
R210	NOT USED	NOT USED	NOT USED	NOT USED	103-1062	103-1062
R227	103-2945	103-1405	103-7505	103-4875	103-3655	103-2851
R229	103-1155	103-5494	103-3245	103-2051	103-1155	103-1155
R229	103-3326	103-1626	103-8255	103-5851	103-4125	103-3325
R230	103-1476	103-7155	103-3485	103-2325	103-1745	103-1375
R30	103-1062	103-1062	100-3951	100-3951	100-3951	100-3951
R31	103-2495	103-2495	103-2051	103-2051	103-2051	103-2051
R33	103-4024	103-4024	103-1331	103-1331	103-1331	103-1331
R34	100-1041	100-1041	100-2041	100-2041	100-2041	100-2041
R60	103-8064	103-3484	103-2151	103-1405	103-1025	103-8064
R74	103-1062	103-4951	103-2435	103-1585	103-1155	103-9041
R76	103-1024	103-1024	100-1041	100-1041	100-1041	100-1041
R97	100-1373	103-2496	103-8255	103-5365	103-4325	103-3655
R12	NOT USED	NOT USED	226-1051	226-1051	226-1051	226-1051
U23	NOT USED	NOT USED	229-0033	229-0033	229-0033	229-0033
U31	NOT USED	NOT USED	221-0339	221-0339	221-0339	221-0339
U32	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	221-0393
U33	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	221-0393

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DRAWN BY
KT 3-10-03

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

PROJ. LEADER

MATERIAL
SEE NOTE 4

FINISH

NEXT ASSY.

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

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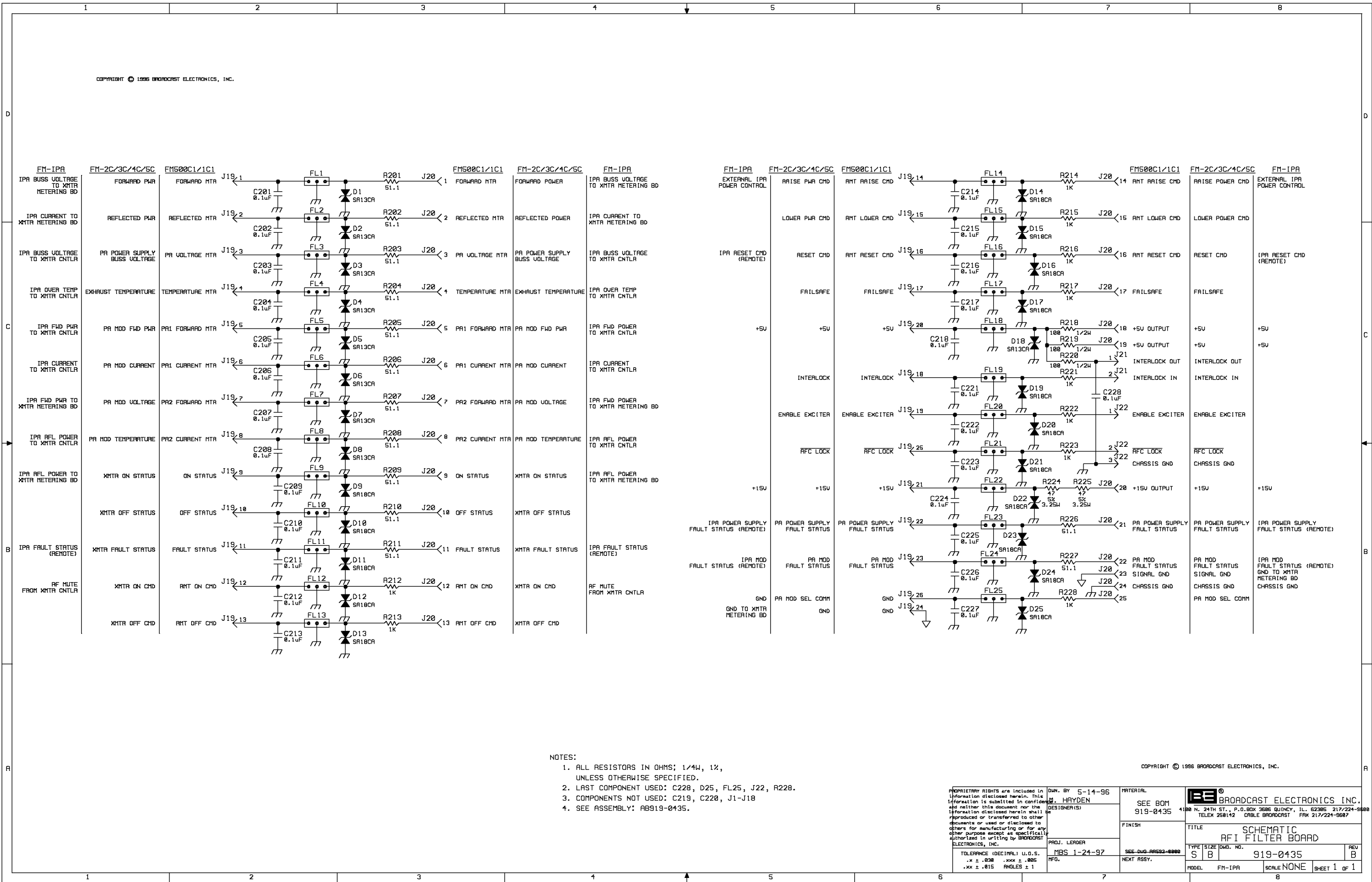
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O. BOX 3685 QUINCY, IL 62305
217/224-9600 FAX 217/224-9607

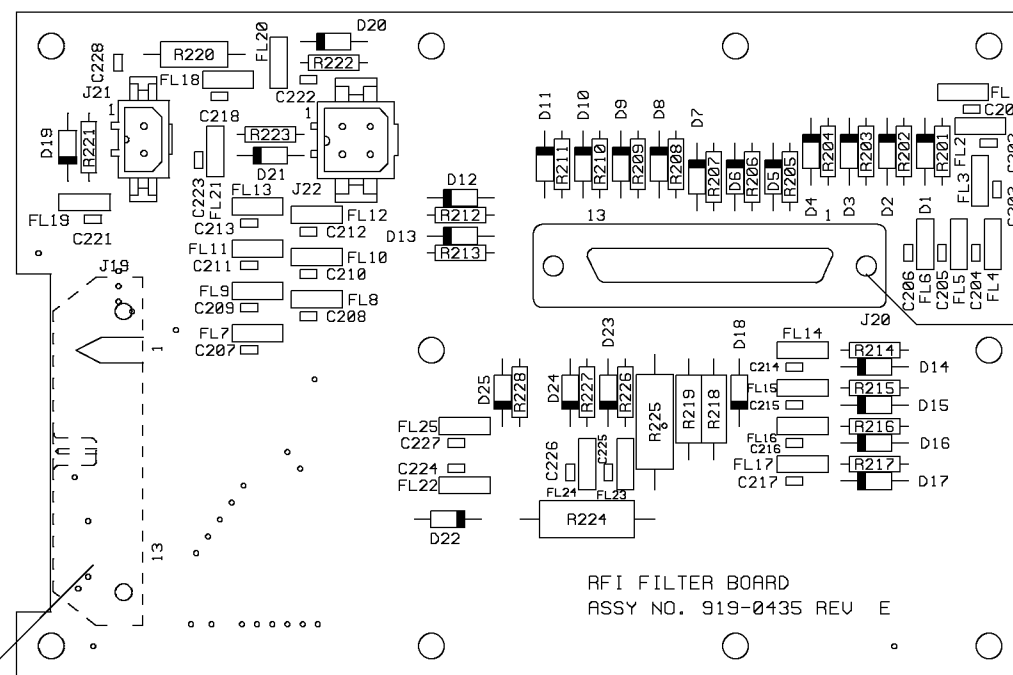
TITLE
PCB ASSEMBLY
CONTROLLER

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





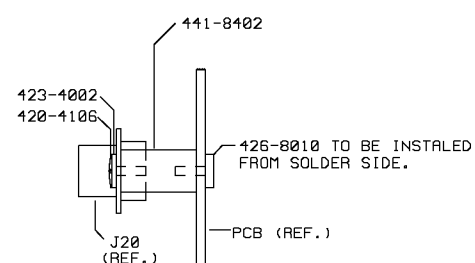
SEE DETAIL "A"

NOTES:

- SEE SCHEMATIC SB919-0435.

J19 IS SOLDERED ON
TO THE BACK SIDE

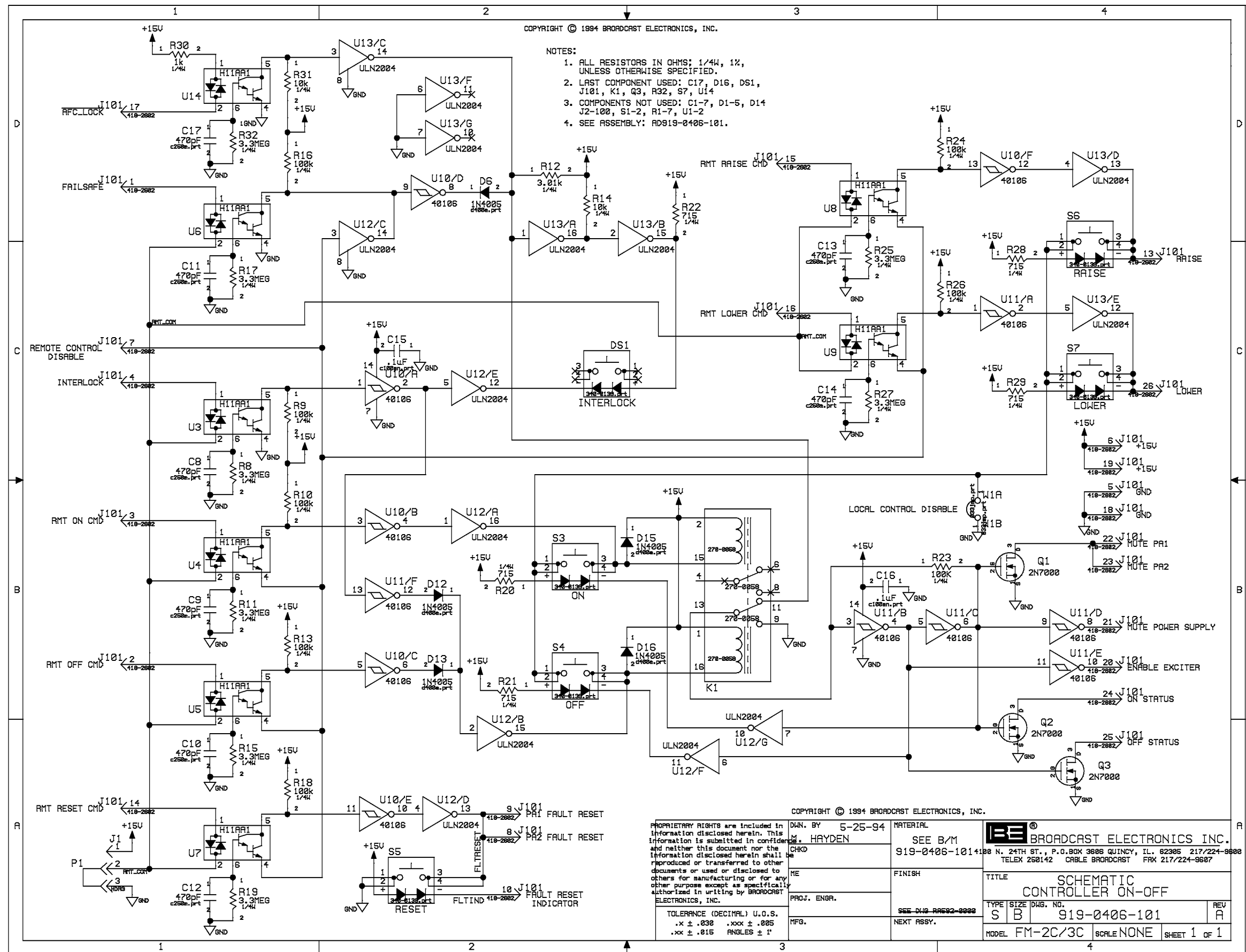
519-0435



DETAIL "A"
TYPICAL 2 PLCS.

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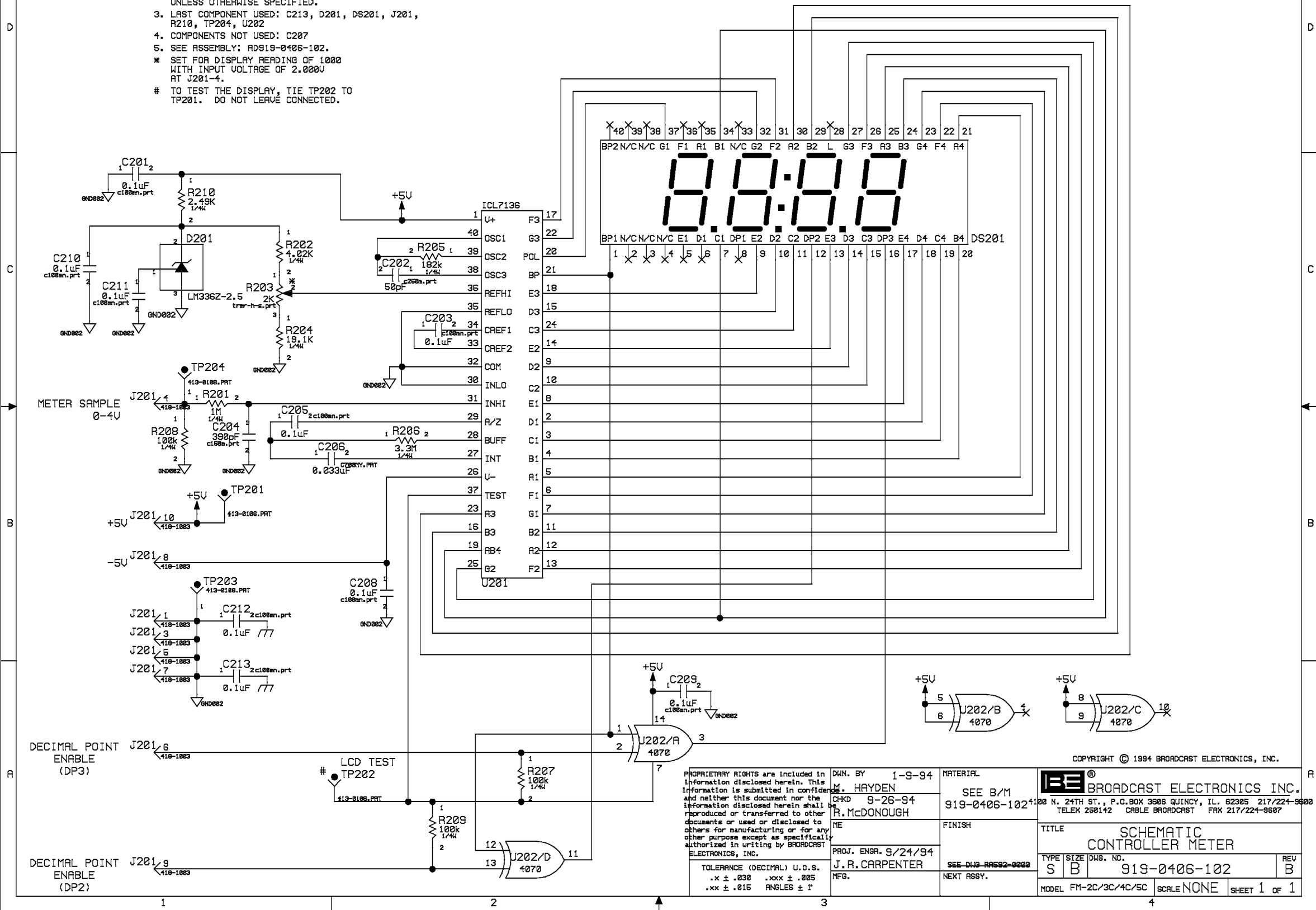
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	M. HAYDEN					
	DESIGNER(S)	FINISH	TITLE PCB ASSEMBLY RFI FILTER BOARD			
	PROJ. LEADER					
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°	MFG.	NEXT ASSY.	TYPE A	SIZE B	DWG No. 919-0435	REV E
			MODEL FM-IPA		SCALE 1/1	SHEET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



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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: AD819-0406-102.
- * 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°

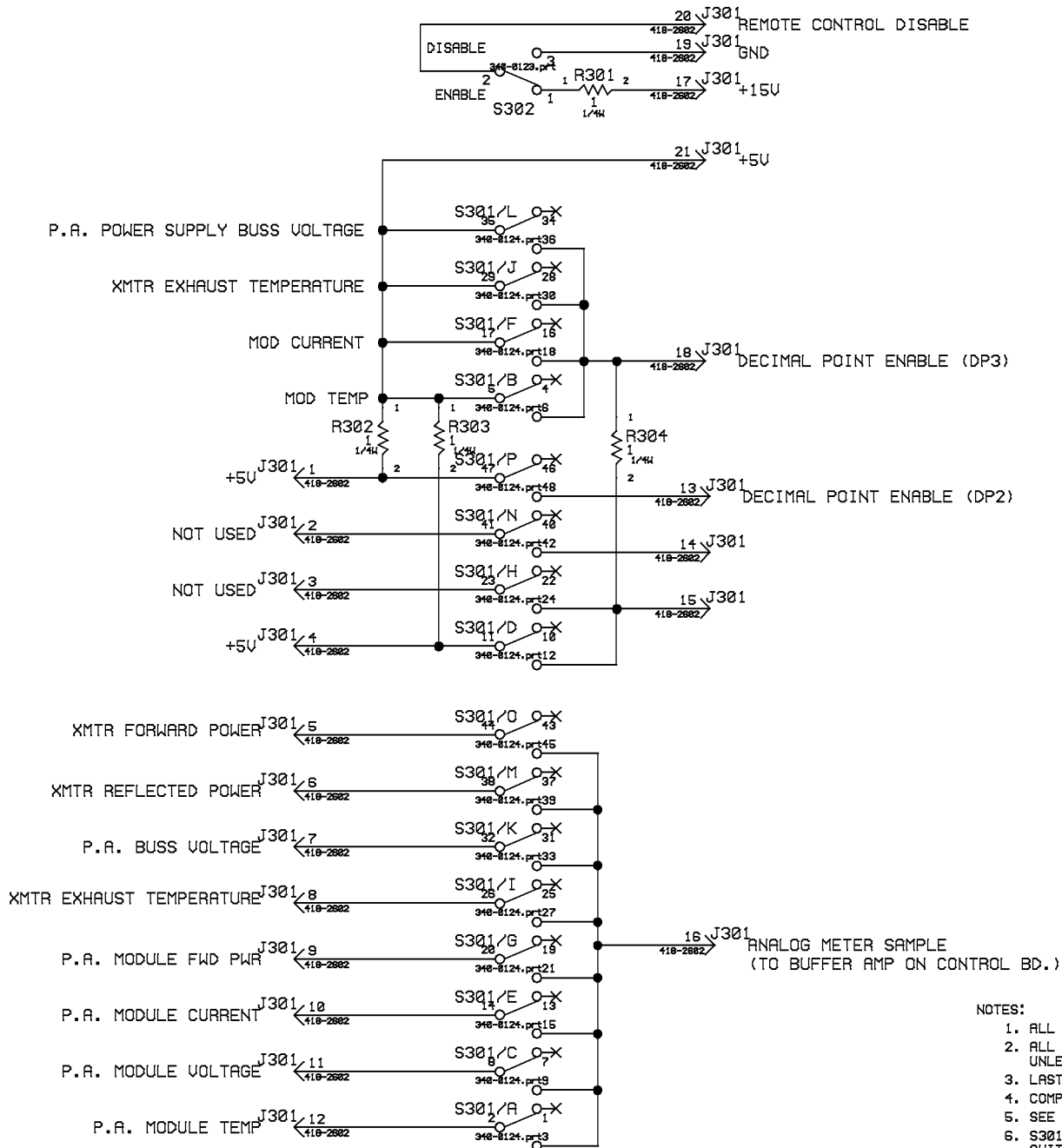
DWN. BY 1-9-94
J. HAYDEN
CHKD 9-26-94
R. McDONOUGH
ME
PROJ. ENGR. 9/24/94
J.R. CARPENTER
MFG.

MATERIAL
SEE B/M
919-0406-102
FINISH
SEE DWG. 919-0406-102
NEXT ASSY.

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BROADCAST ELECTRONICS INC.	
120 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607	
TITLE SCHEMATIC CONTROLLER METER	
TYPE S	SIZE B
DWG. NO. 919-0406-102	REV B
MODEL FM-2C/3C/4C/5C	SCALE NONE
SHEET 1 OF 1	

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- NOTES:
1. ALL REFERENCE DESIGNATORS START AT 301.
 2. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
 3. LAST COMPONENT USED: J301, R304, S302
 4. COMPONENTS NOT USED:
 5. SEE ASSEMBLY: AD919-0406-103.
 6. S301 SECTIONS A&B, C&D, E&F, etc, ARE GANGED SWITCHES AND INTERLOCKED.

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

DWN. BY
M. HAYDEN

CHKD

ME

PROJ. ENGR.

MFG.

MATERIAL

SEE B/M
919-0406-103

FINISH

SEE DWG-9992-0000

NEXT ASSY.

BROADCAST ELECTRONICS, INC.

100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9800
TELEX 250142 CABLE BROADCAST FAX 217/224-9807

TITLE
SCHEMATIC
CONTROLLER METER SWITCH

TYPE SIZE DWG. NO.

S B 919-0406-103

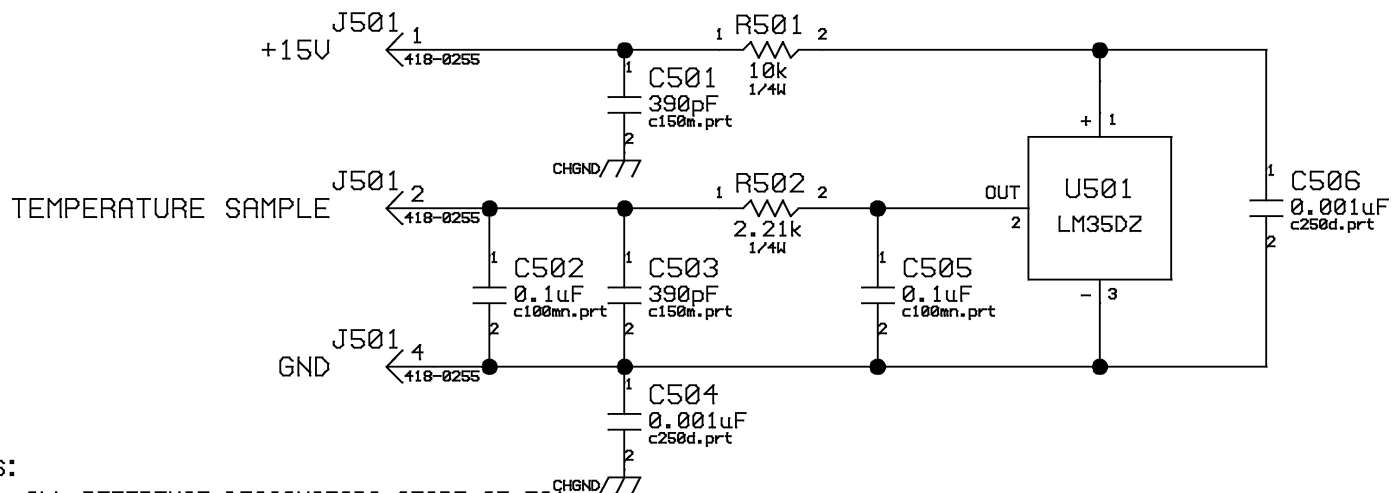
MODEL FM-2C/3C

SCALE NONE

SHEET 1 OF 1

REV

A



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

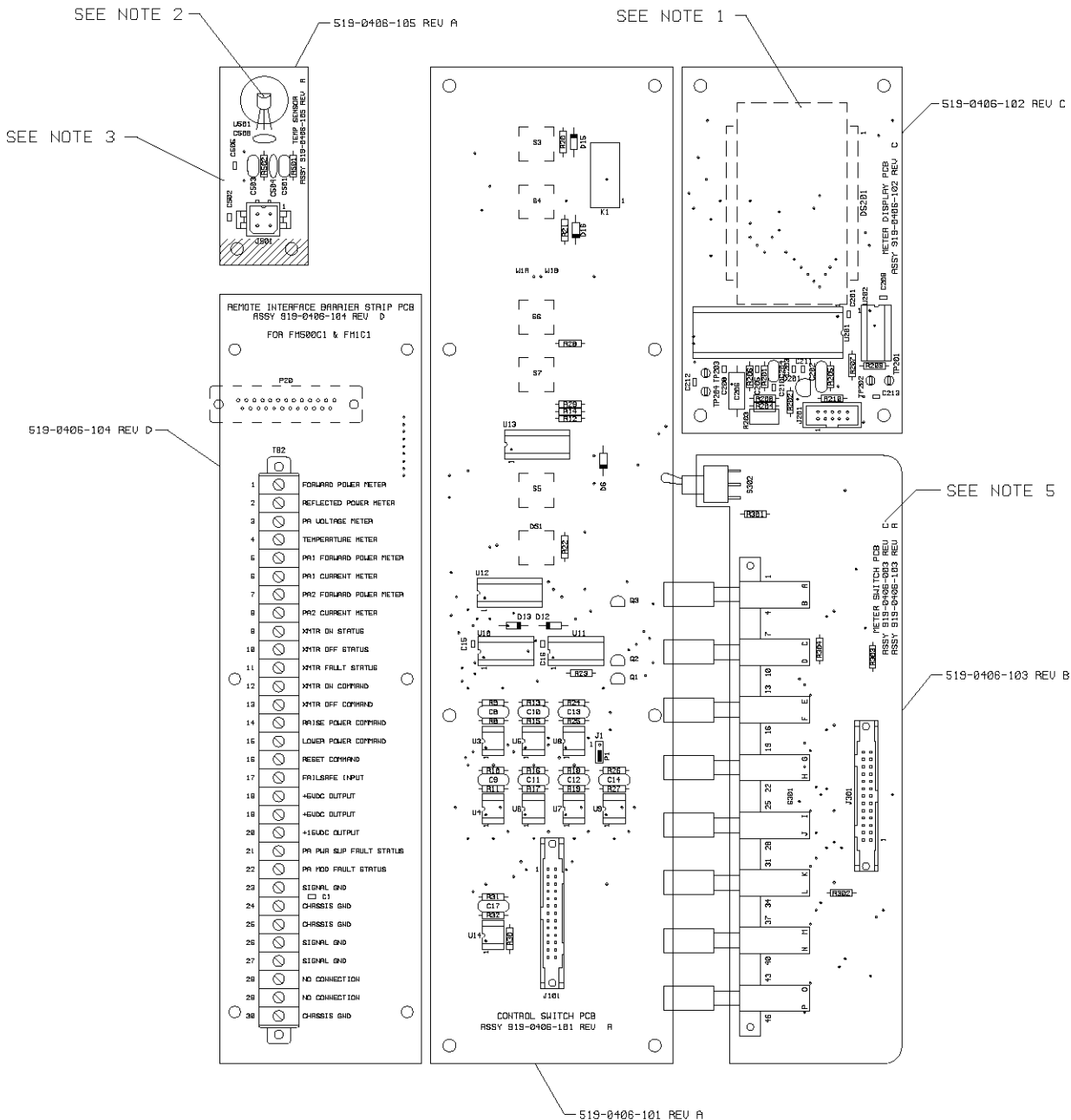
TOLERANCE (DECIMAL) U.O.S.

.X ± .030 .xxx ± .005

.xx ± .015 ANGLES ± 1°

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REVISIONS					
REV	DATE	SUFFIX/REV	DESCRIPTION	DRAFTER	APPROVED
1	1-11-94	101-105/1	PROTOTYPE RELEASE	MM	AMD
2	5-4-94	102/2	CHGD VALUE OF C206, R202-R204&R206; ADDED D1 & R210; DELETED C207 & TP203; MOVED TP203 & TP204 (919-0406-102).	MM	AMD
A	9-21-94	101-105/A	ENGINEERING RELEASE WITHOUT CHANGE.	MM	AMD
B	12-19-94	104 / B	ADDED C1.	MM	AMD
C	6-22-95	102 / C	ADDED C210 - C213 AND CHASSIS GROUND.	MM	DLL
D	6-23-95	104 / D	ADDED "FOR FMS00C1 & FMC1" TO SILKSCREEN.	MM	DLL
E	7-6-95	003 / C	ADDED ANOTHER ASSY.# TO ASSEMBLY 919-0406-103A.	REB	9370



NOTES:

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

COATING INSTRUCTIONS: (919-0406-105 PCB ONLY)

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

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OWN. BY 1-11-94
M. HAYDEN
CHGD 9-26-94
R. McDONOUGH
ME
PROJ. ENGR. 9/26/94
J. R. CARPENTER
TFC.

SEE BOM#
919-0406-003,
919-0406-101,
919-0406-105

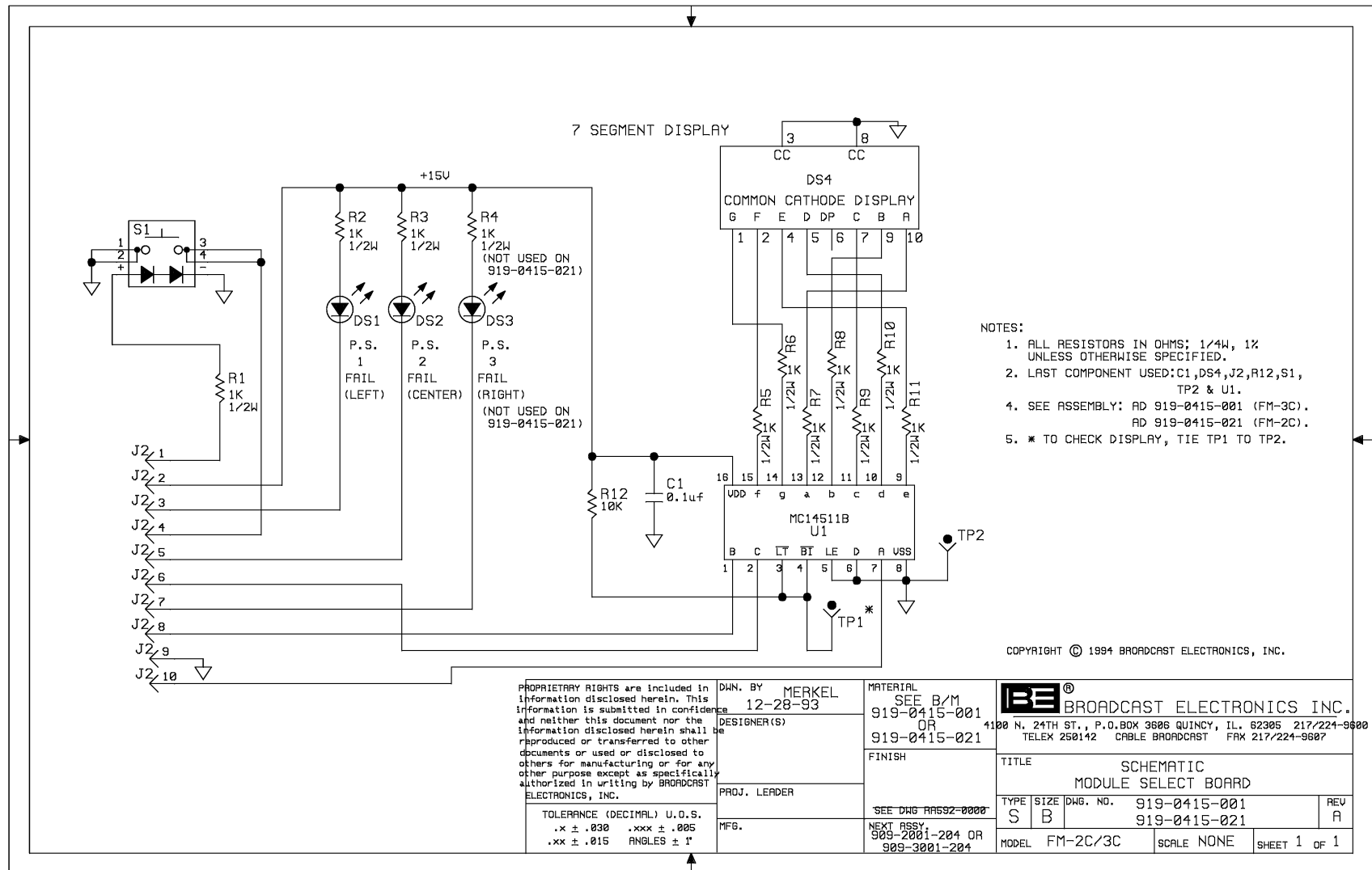
FINISH
SEE DWG-0406-0000
NEXT ASSY.

BROADCAST ELECTRONICS, INC.
4100 N. 24TH ST., P.O. BOX 3808 QUINCY, IL. 62305 PH. 217/224-9800
TELEX 256142 CABLE BROADCAST FAX 217/224-9807

TITLE
PCB ASSEMBLY
CONTROL BREAKAWAY

TYPE SIZE DWG No. 919-0406-003
A D 919-0406-101/105
REV E
FMS00C1/C1
MODEL FM-2C/3C/4C/5C SCALE 1/1 SHEET 1 of 1

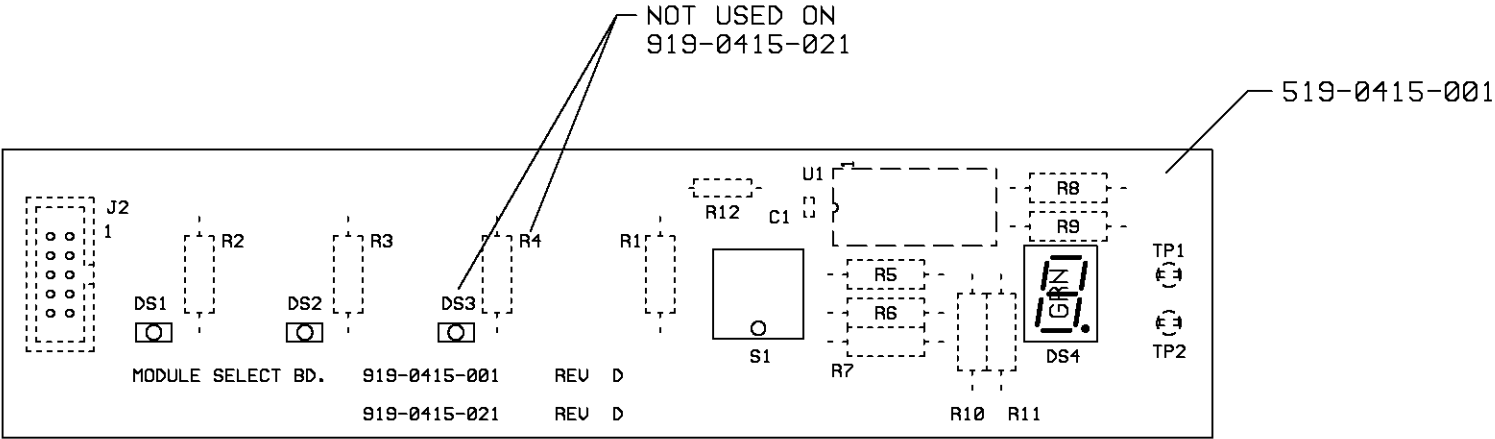
TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°



REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
D	2-17-05	SEPERATED FROM 919-0415 BREAKAWAY	KT	KJS	11262

NOTES:

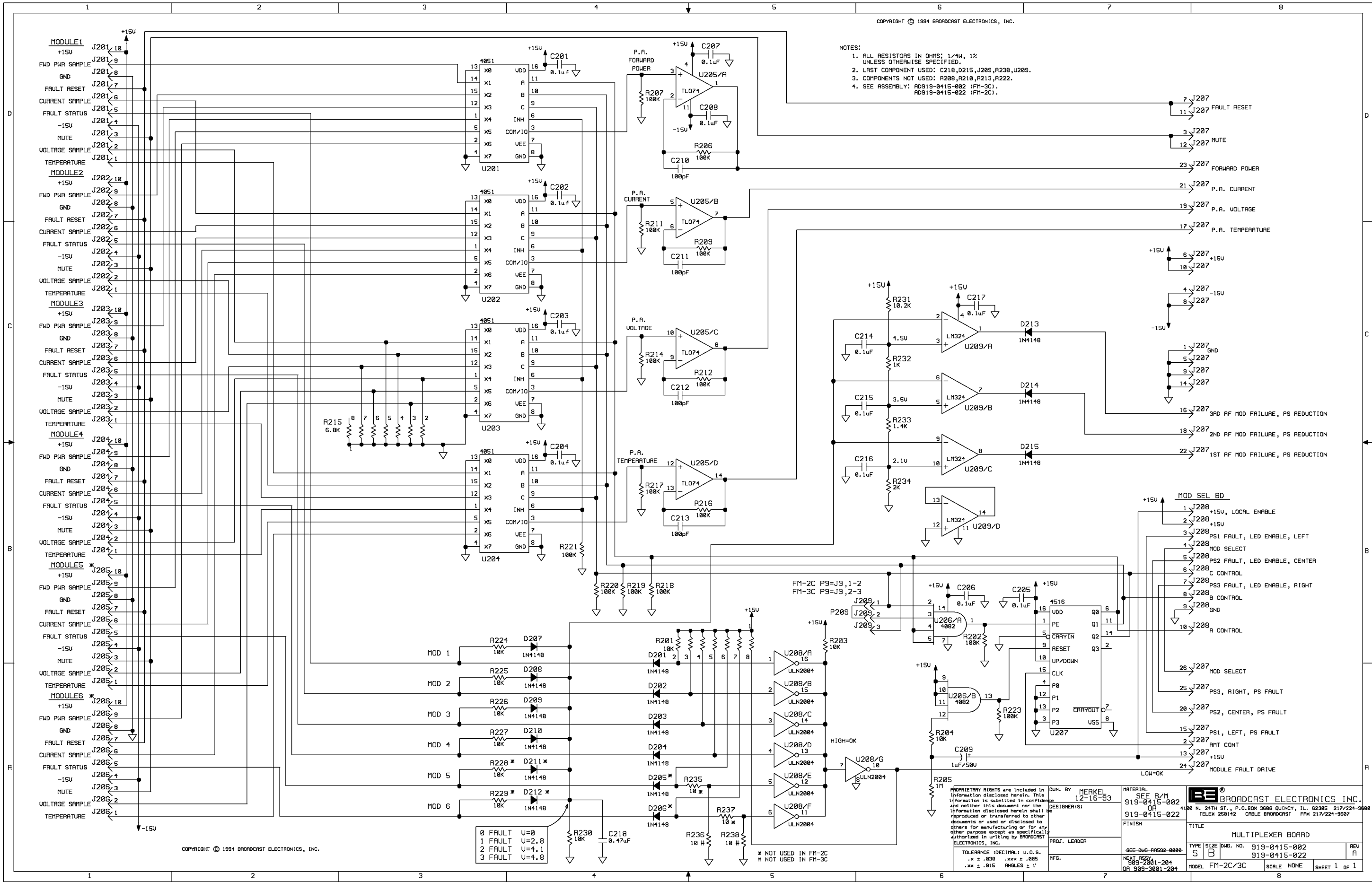
- 1. COMPONENTS IN DASHED LINES ARE INSTALLED FROM OPPOSITE SIDE SHOWN.
- 2. SEE B/M'S:
(FM-2C) 919-0415-021
(FM-3C) 919-0415-001
- 3. SEE SCHEMATIC: SB 919-0415-001/021



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	DESIGNER(S)		SEE BOMS 917-0415-001 917-0415-021					
	PROJ. LEADER		FINISH		TITLE MODULE SELECT			
	MFG.		NEXT ASSY.		TYPE A	SIZE B	DWG No. 919-0415-001/021	REV D
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°				MODEL FM-2C/3C		SCALE 1/1	SHEET 1 OF 1	

- NOTES:
1. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
 2. LAST COMPONENT USED: C218,D215,J209,R238,U209.
 3. COMPONENTS NOT USED: R208,R218,R213,R222.
 4. SEE ASSEMBLY: A0919-0415-002 (FM-3C).
A0919-0415-022 (FM-2C).



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DWN. BY MERKEL 12-16-93
DESIGNER(S)
PROJ. LEADER

MATERIAL SEE B/M 919-0415-002 OR 919-0415-022
FINISH

SEE B/M 919-0415-002 OR 919-0415-022
NEXT ASSY 909-2001-204 OR 909-3001-204

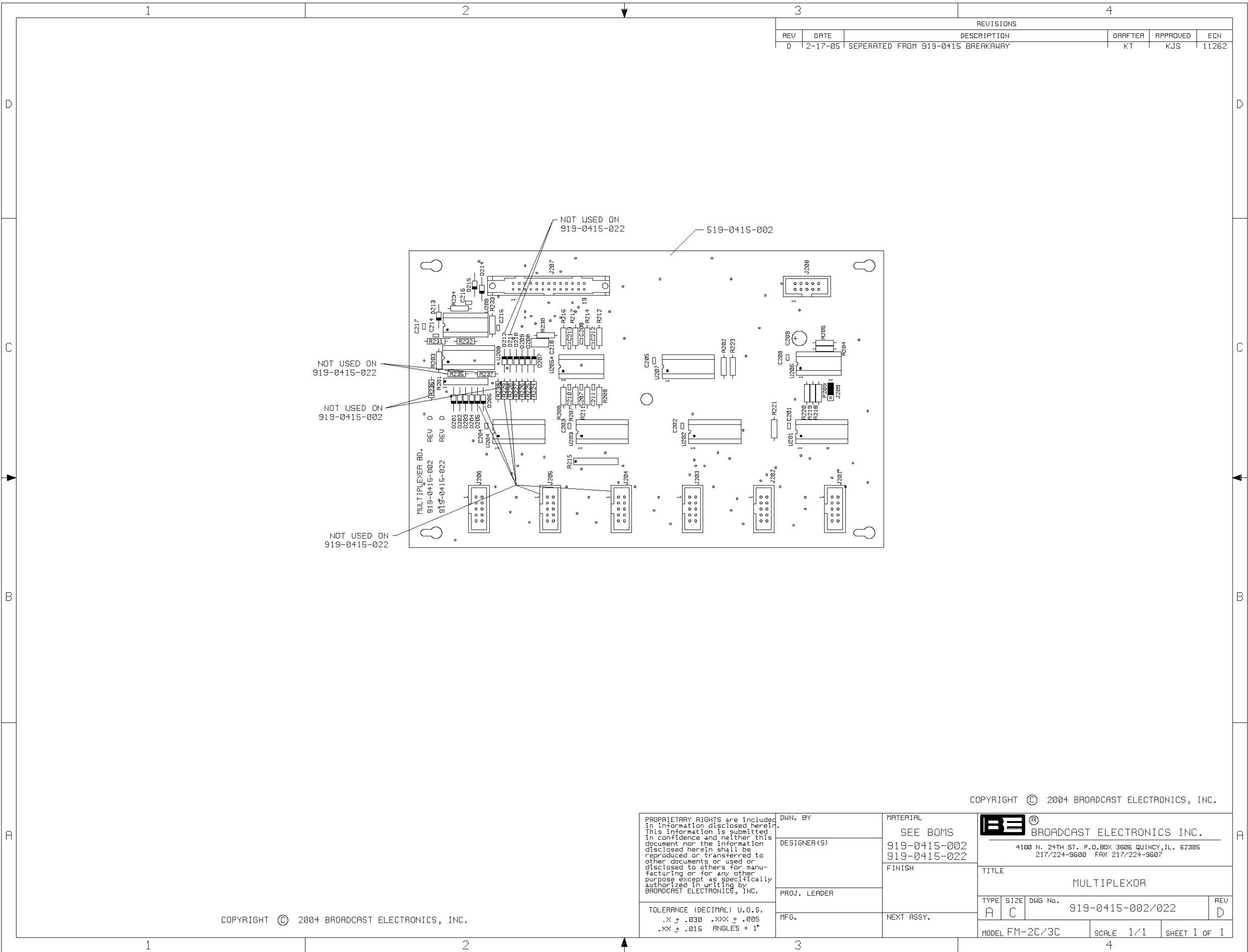
RF6.

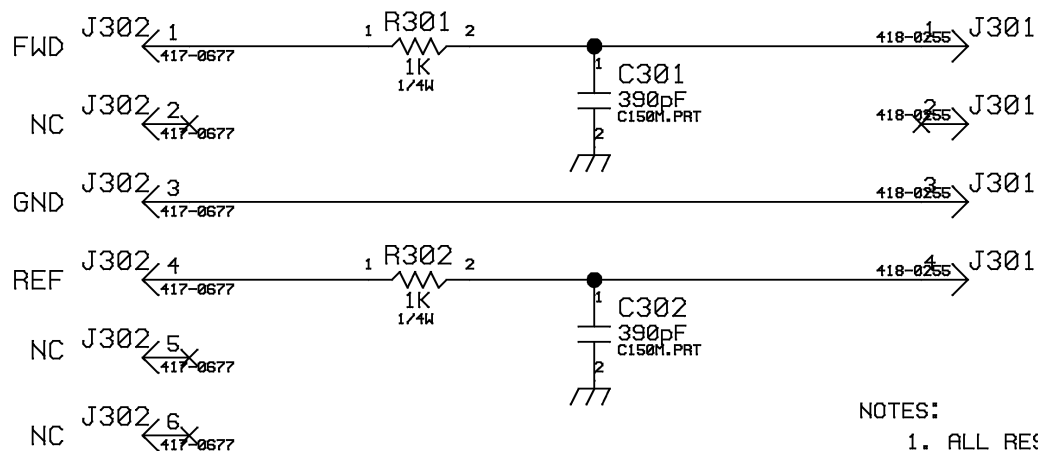
TOLERANCE (DECIMAL) U.O.S.
.x ± .038 .xxx ± .005
.xx ± .015 ANGLES ± 1°

1100 N. 24TH ST., P.O. BOX 3608 QUINCY, IL. 62305 217/224-9688
TELEX 258142 CABLE BROADCAST FAX 217/224-9687

EE BROADCAST ELECTRONICS, INC.

MULTIPLEXER BOARD	
TYPE	SIZE DWG. NO. 919-0415-002
MODEL	FM-2C/3C
SCALE	NONE
SHEET	1 OF 1





NOTES:

1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C302, R302, J302.
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: RA 919-0415-003.

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

DWN. BY 2-11-94

M. HAYDEN

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL

SEE B/M
 919-0415-003

FINISH

SEE DWG RA592-0000

NEXT ASSY.



BROADCAST ELECTRONICS INC.

1100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9600
 TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
 LPF INPUT RFI FILTER BD.

TYPE SIZE DWG. NO.

S A

919-0415-003

REV

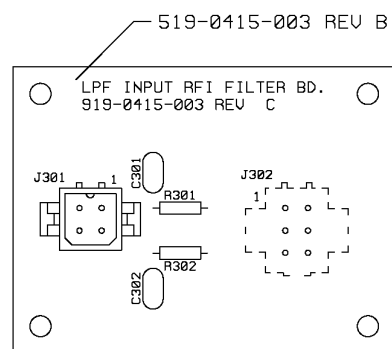
A

MODEL FM-2C/3C/4C/5C

SCALE NONE

SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
B	6-19-95	REMOVED FROM BREAKAWAY ASSEMBLY.	MH		9476
C	9-22-97	CHGD ALL 103-1041 RES. TO 100-1041 RES.	KT	DLL	9863



NOTES:

1. COMPONENTS IN DASHED LINES ARE INSTALLED FROM OPPOSITE SIDE SHOWN.
2. SEE SCHEMATIC SA919-0415-003.

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

DWN. BY 6-19-95
M. HAYDEN

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL

SEE BOM
919-0415-003

FINISH

NEXT ASSY.



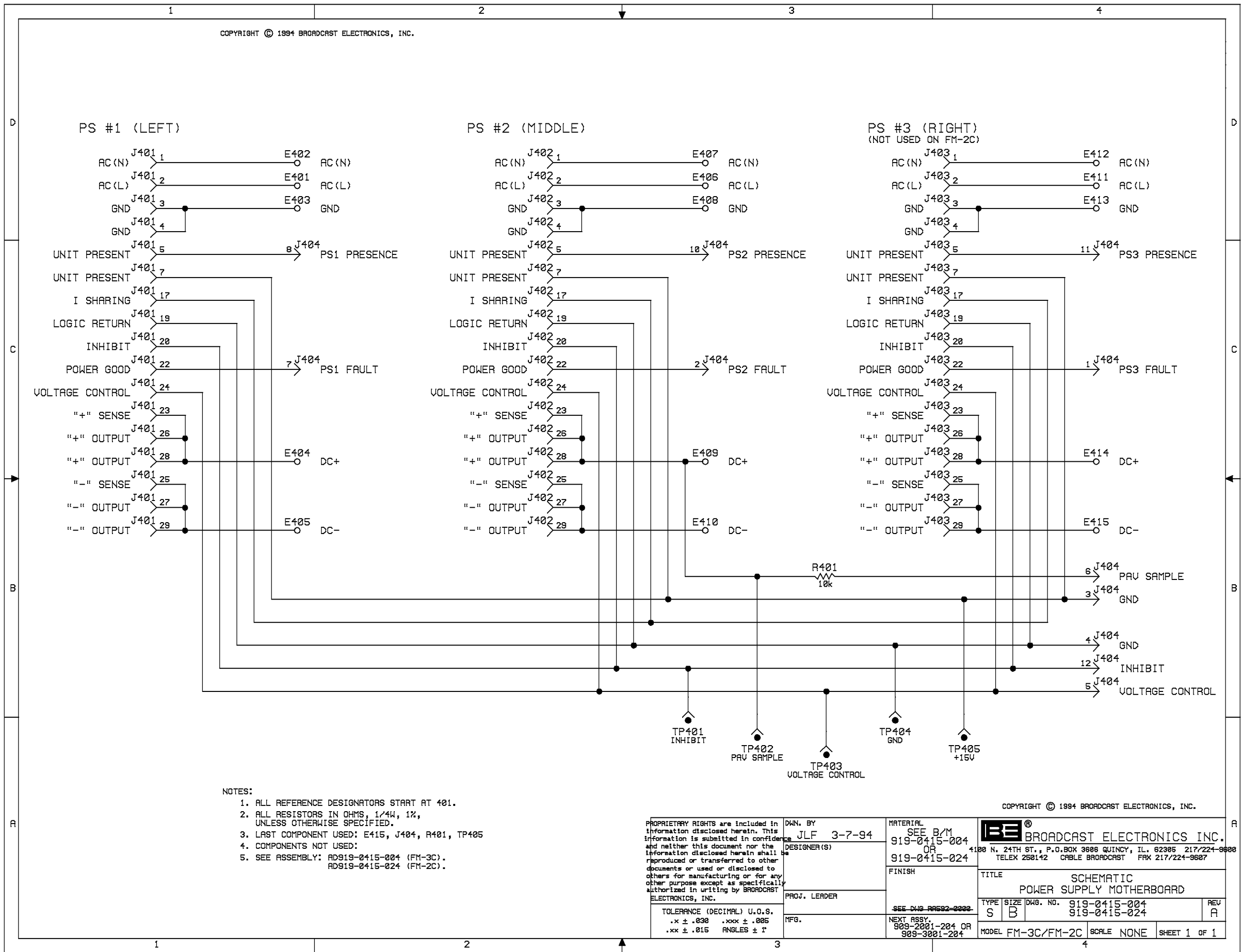
BROADCAST ELECTRONICS INC.

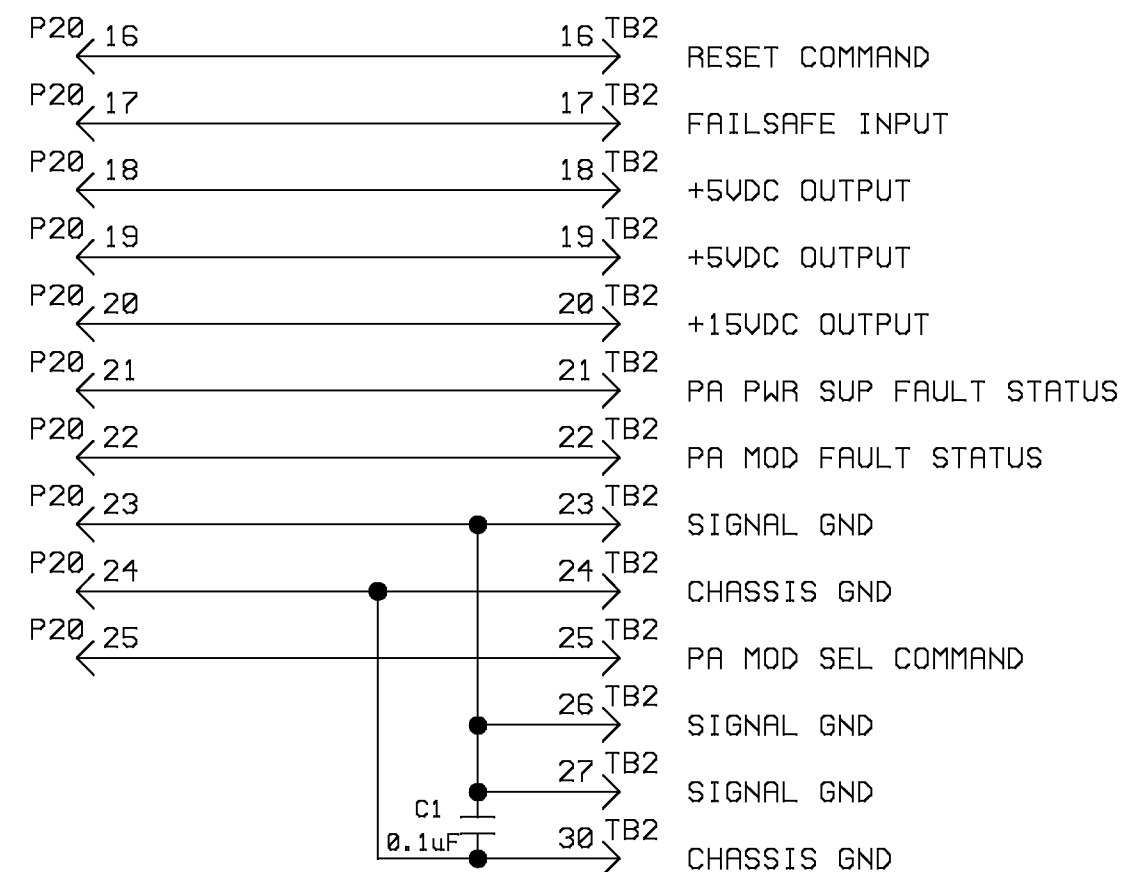
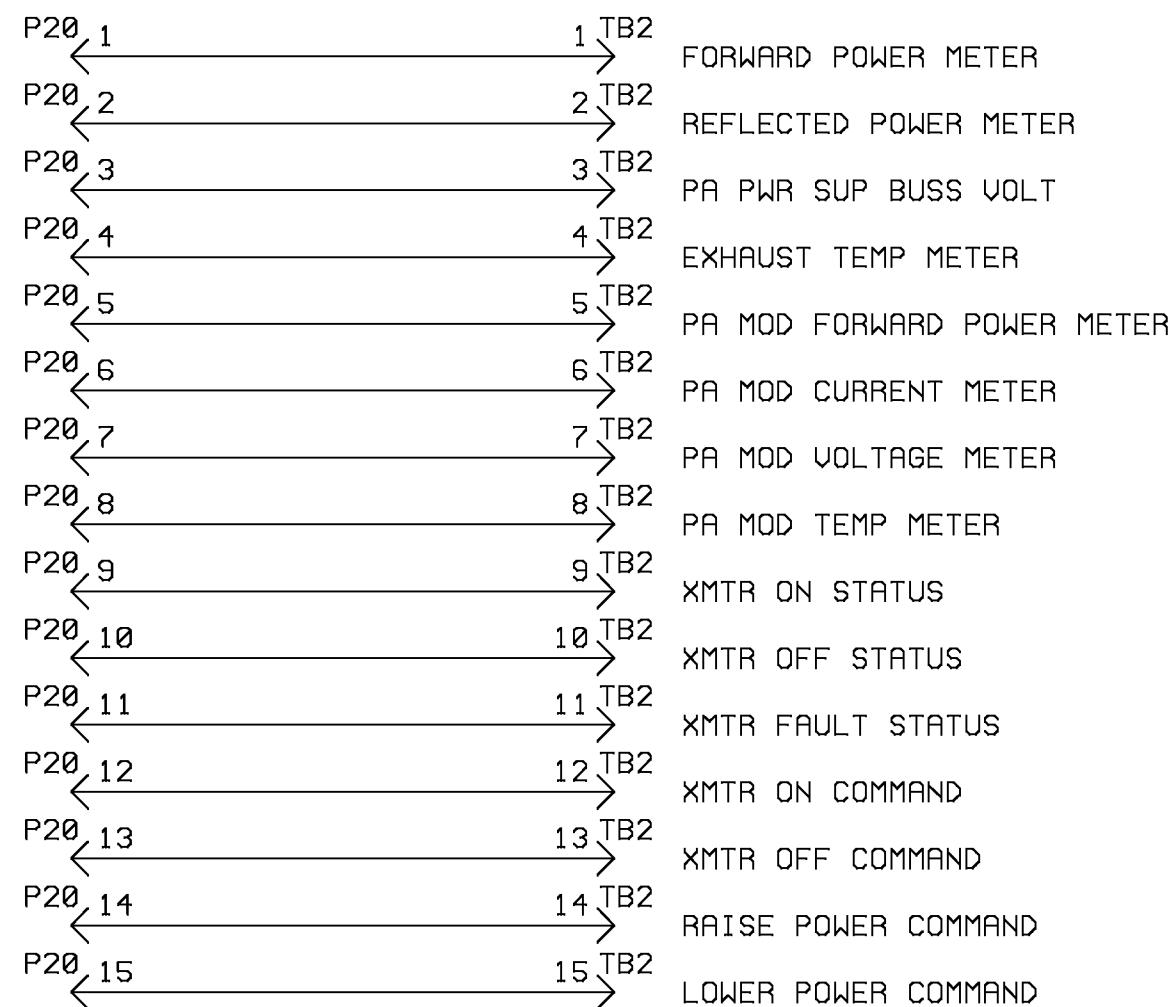
4100 N. 24TH ST. P.O. BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE
PCB ASSEMBLY
LPF INPUT RF1 FILTER

TYPE	SIZE	DWG No.	REV
A	A	919-0415-003	C

MODEL FM-2C/3C/4C/5C	SCALE 1/1	SHEET 1 OF 1
----------------------	-----------	--------------

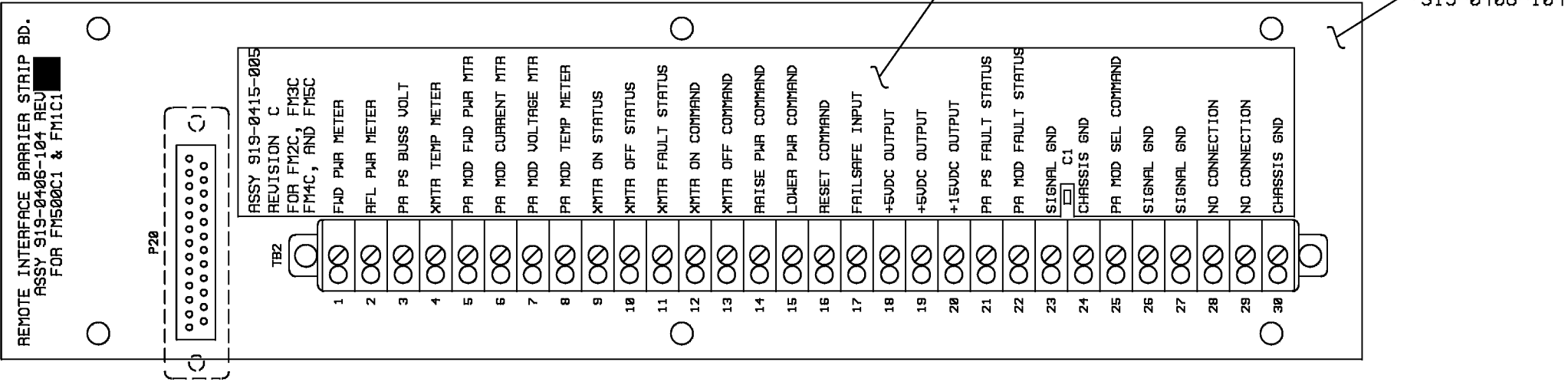




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NOTES:
1. SEE ASSEMBLY: AB919-0415-005.

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		CHKD 9-26-94 R. McDONOUGH		
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°		ME	FINISH	TITLE SCHEMATIC REMOTE I/F BARRIER STRIP
		PROJ. ENGR. 9/26/94 J. R. CARPENTER	SEE DWG RA592-0000	
		MFG.	NEXT ASSY.	REV B
		MODEL FM-2C/3C/4C/5C		SCALE NONE
		SHEET 1 OF 1		



NOTES:

1. COMPONENTS IN DASHED LINES ARE INSTALLED FROM OPPOSITE SIDE SHOWN.
2. SEE SCHEMATIC SB919-0415-005.

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

DWN. BY 6-19-95
M. HAYDEN

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL
SEE BOM
919-0415-005

FINISH

NEXT ASSY.

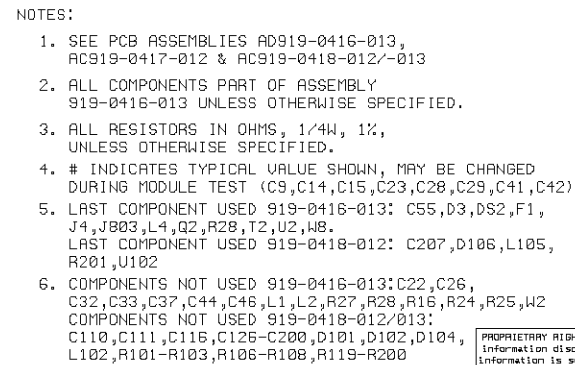
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BE® BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O. BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE
PCB ASSEMBLY
REMOTE I/F BARRIER STRIP

TYPE	SIZE	DWG No.	REV
A	B	919-0415-005	C

MODEL FM-2C/3C/4C/5C SCALE 1/1 SHEET 1 OF 1



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

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DWN. BY	
KT 8-18-03	
DESIGNER(S)	
PRQJ. LEADER	

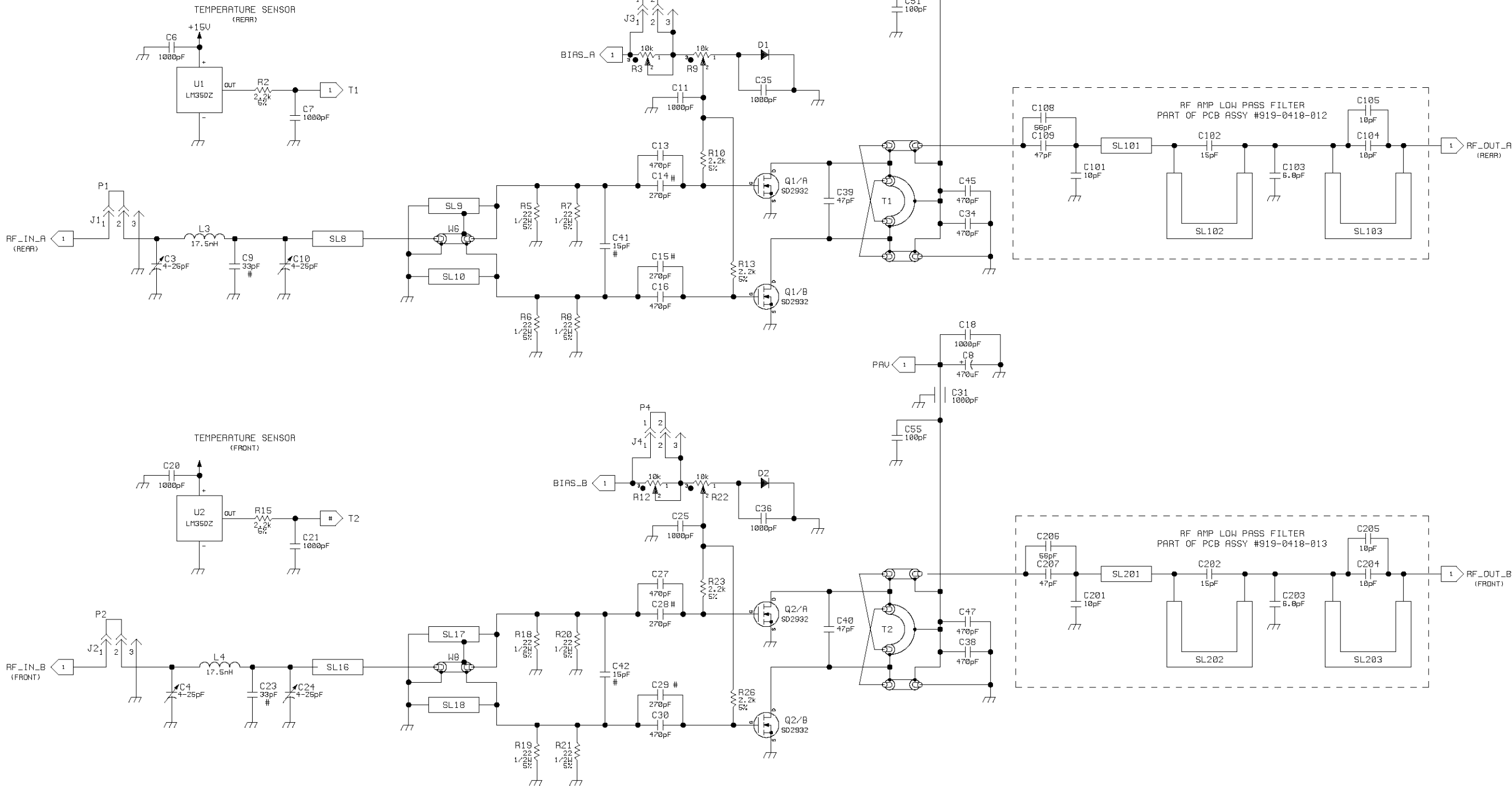
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FINISH	

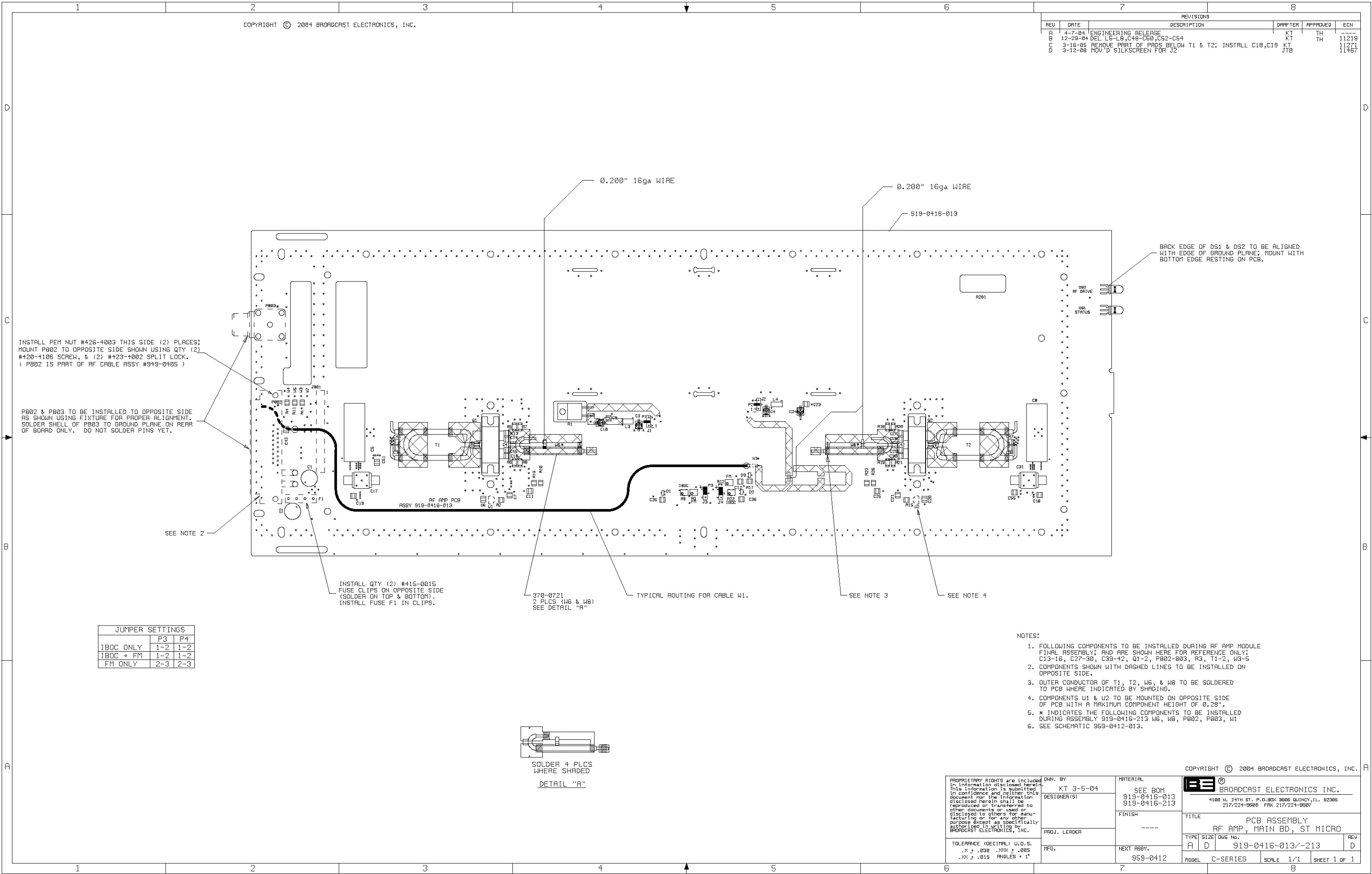
TITLE				SCHEMATIC RF AMP MODULE			
TYPE	SIZE	DWG. NO.			REV		
S	B	959-0412-013			C		
MODEL		C-SERIES		SCALE		NONE	SHEET 1 OF 2

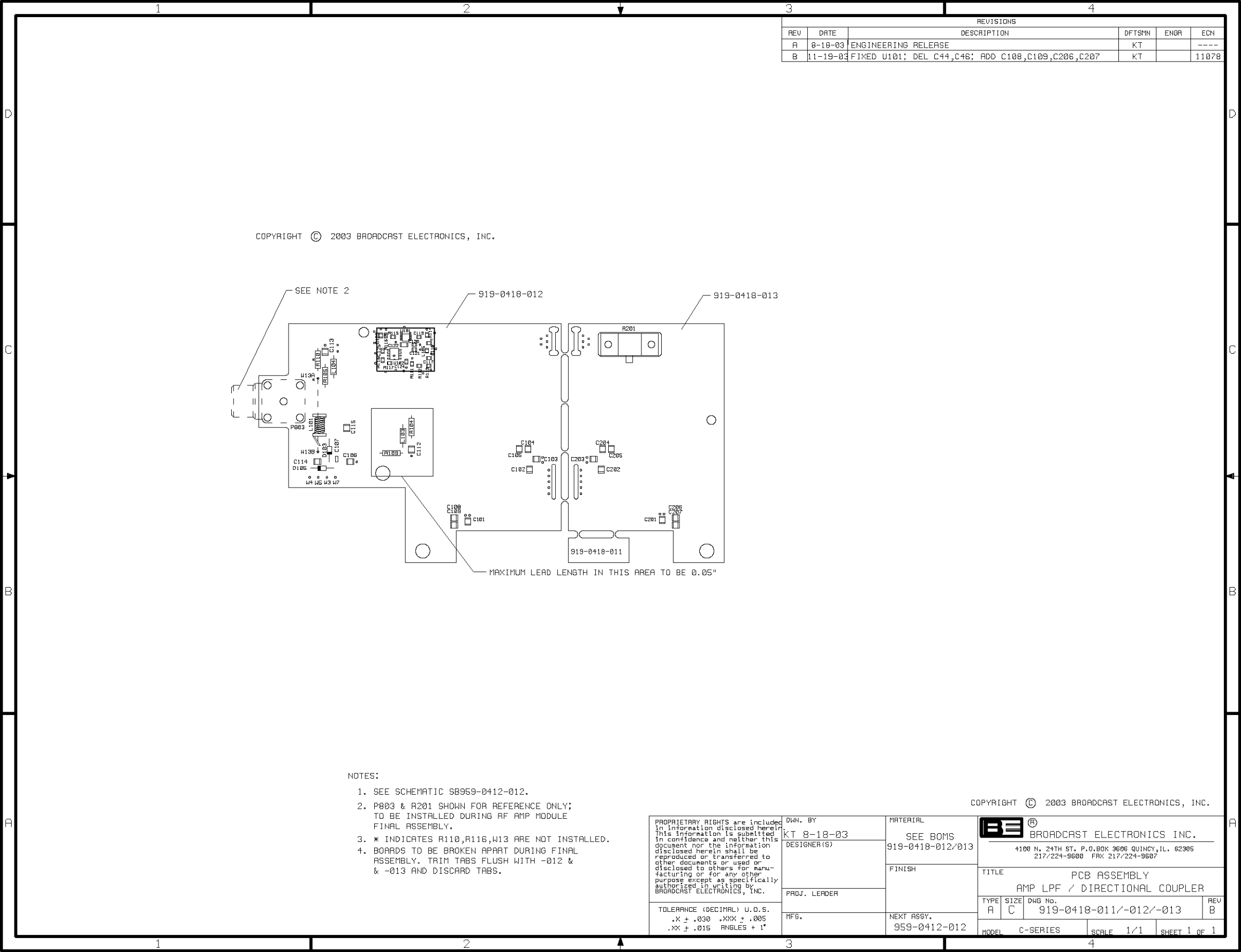
COPYRIGHT © 2003 BROADCAST ELECTRONICS, INC.

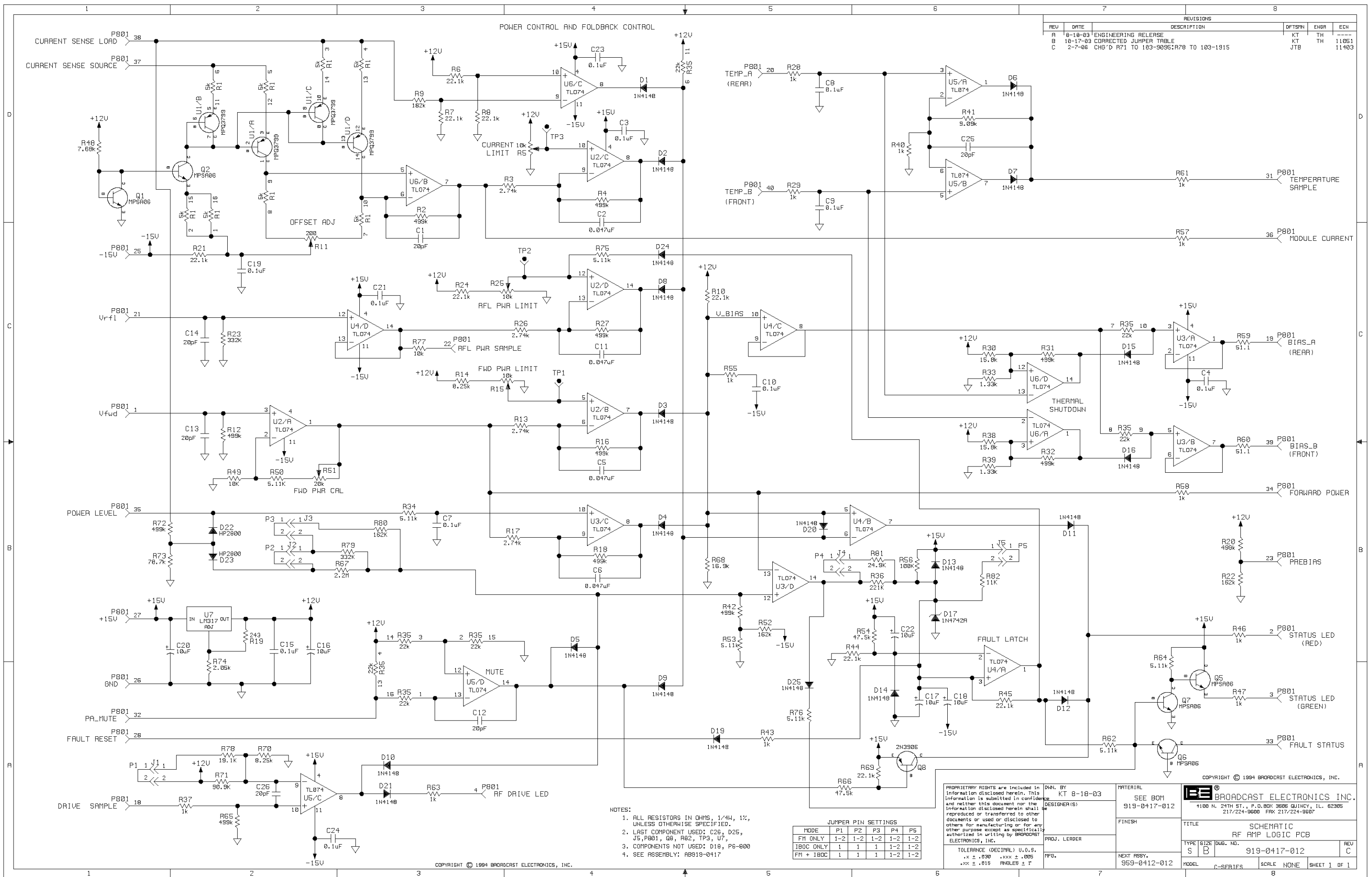
JUMPER SETTINGS		
	P3	P4
180C ONLY	1-2	1-2
180C + FM	1-2	1-2
FM ONLY	2-3	2-3

REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	3-23-04	MODEL RELEASE	KT	TH	----
B	12-29-04	DEL L5-L8, C18-C50, C52-C54	KT	TH	11219
C	3-16-05	CHGD C18 & C19 TO 1000pF AND PLACED	KT		11271

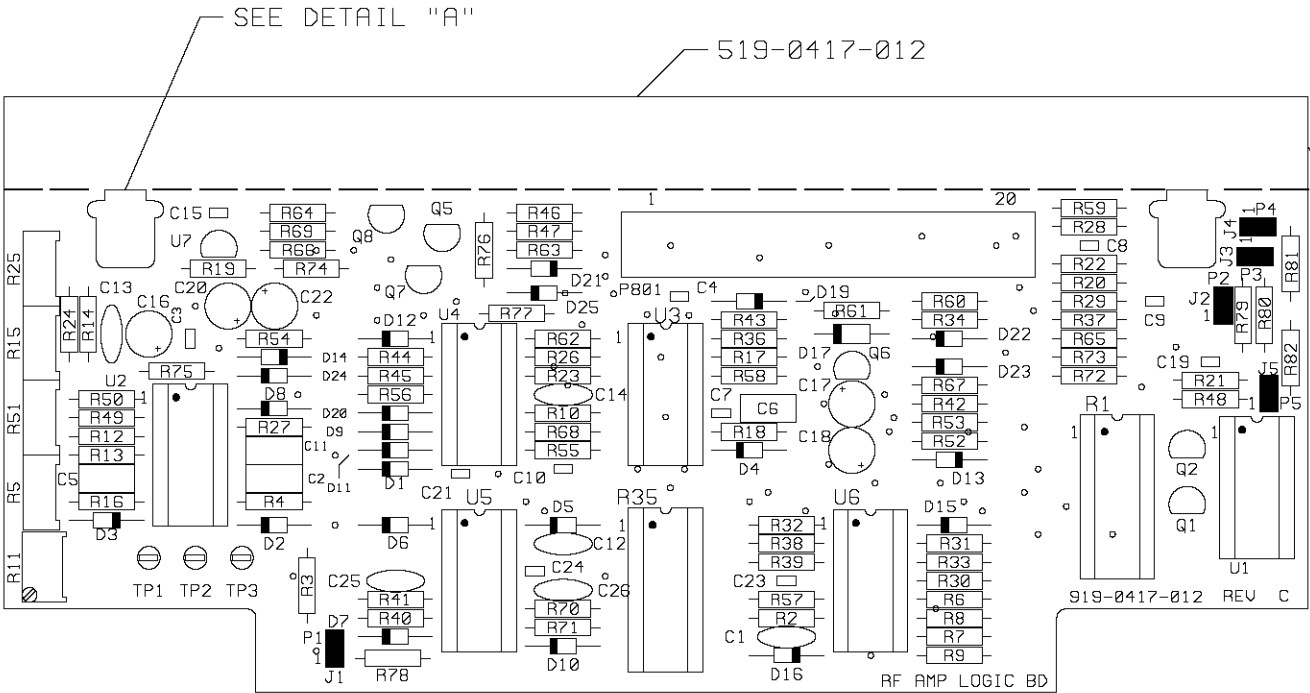








REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	8-18-03	ENGINEERING RELEASE.	KT	TH	----
B	10-17-03	CORRECTED JUMPER TABLE	KT	TH	11051
C	2-7-06	CHG'D R71 TO 103-9095; R78 TO 103-1915	JTB		11403



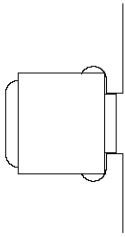
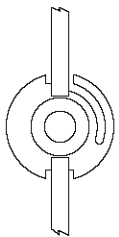
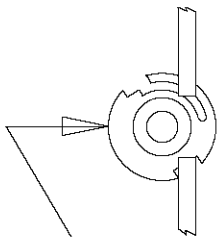
THIS TAB TO BE BROKEN OFF ALONG DASHED LINE AFTER BOARD IS FLOW SOLDERED.

- NOTES:
- SEE SCHEMATIC SB919-0417-012

SIDE VIEW
START

SIDE VIEW
FINISH

FRONT VIEW



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

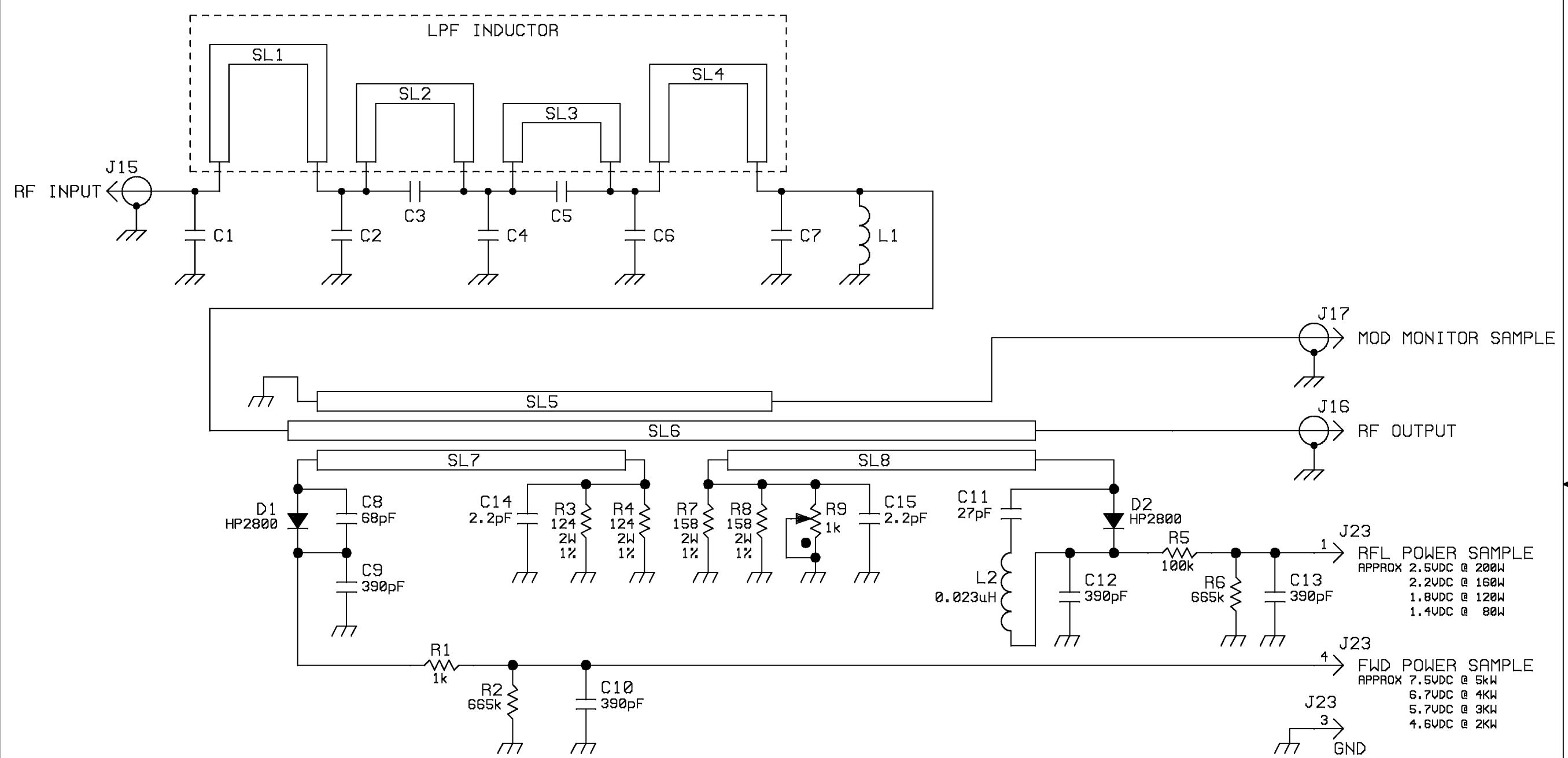
DETAIL "A"
2 PLCS

JUMPER PIN SETTINGS

MODE	P1	P2	P3	P4	P5
FM ONLY	1-2	1-2	1-2	1-2	1-2
IBOC ONLY	1	1	1	1-2	1-2
FM + IBOC	1	1	1	1-2	1-2

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	DESIGNER(S)									
	PROJ. LEADER	FINISH	TITLE PCB ASSEMBLY RF AMP LOGIC BOARD							
	MFG.	NEXT ASSY. 959-0412-012	<table> <tr> <th>TYPE</th><th>SIZE</th><th>DWG No.</th><th>REV</th></tr> <tr> <td>A</td><td>C</td><td>919-0417-012</td><td>B</td></tr> </table>	TYPE	SIZE	DWG No.	REV	A	C	919-0417-012
TYPE	SIZE	DWG No.	REV							
A	C	919-0417-012	B							
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°	MODEL C-SERIES		SCALE 1/1 SHEET 1 OF 1							



- NOTES:
1. "SL" INDICATES ETCHED STRIPLINE ON PCB.
 2. C1-C7 ARE ETCHED ON PCB.
 3. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
 4. SEE PCB ASSEMBLY DRAWING AC919-0421/-001.

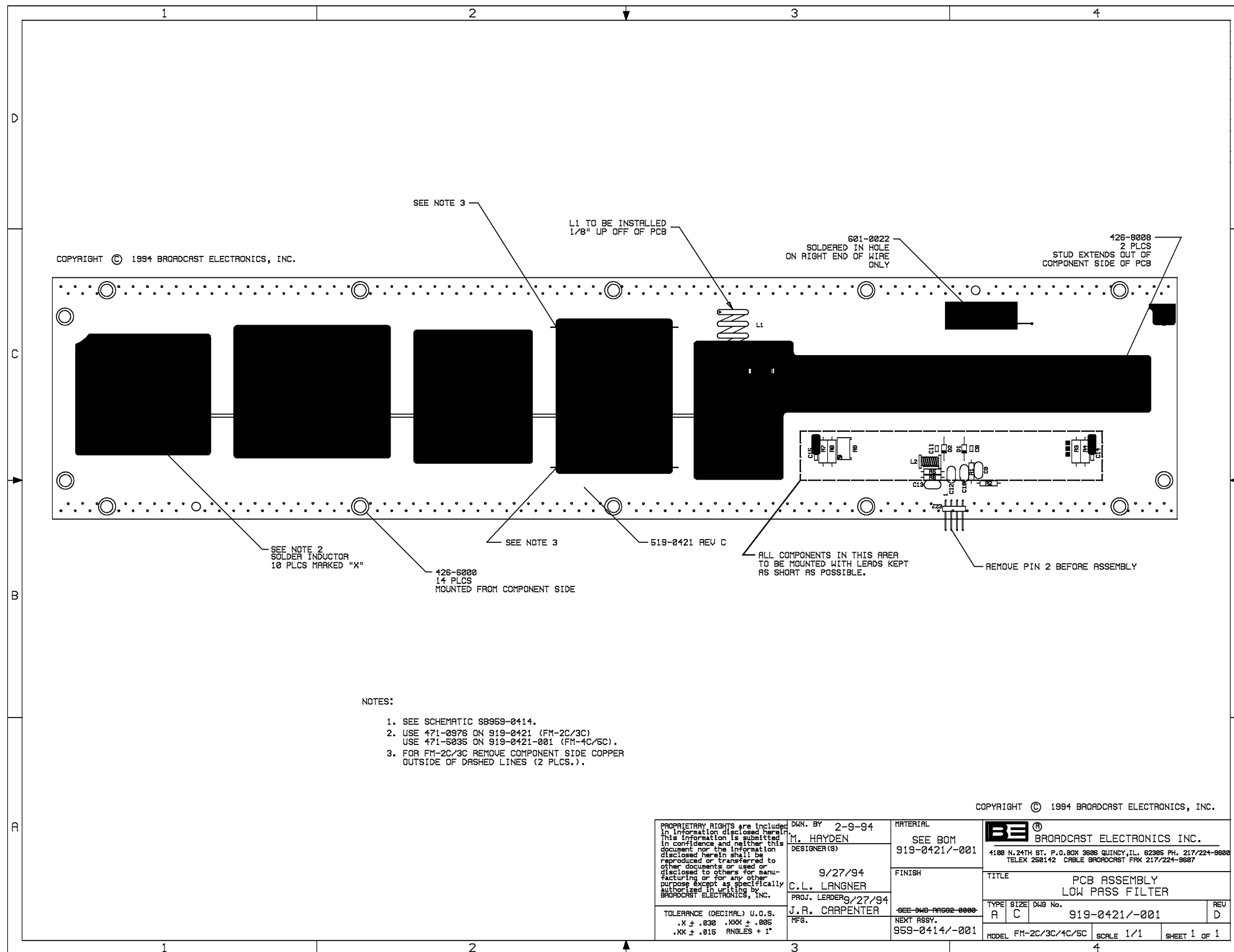
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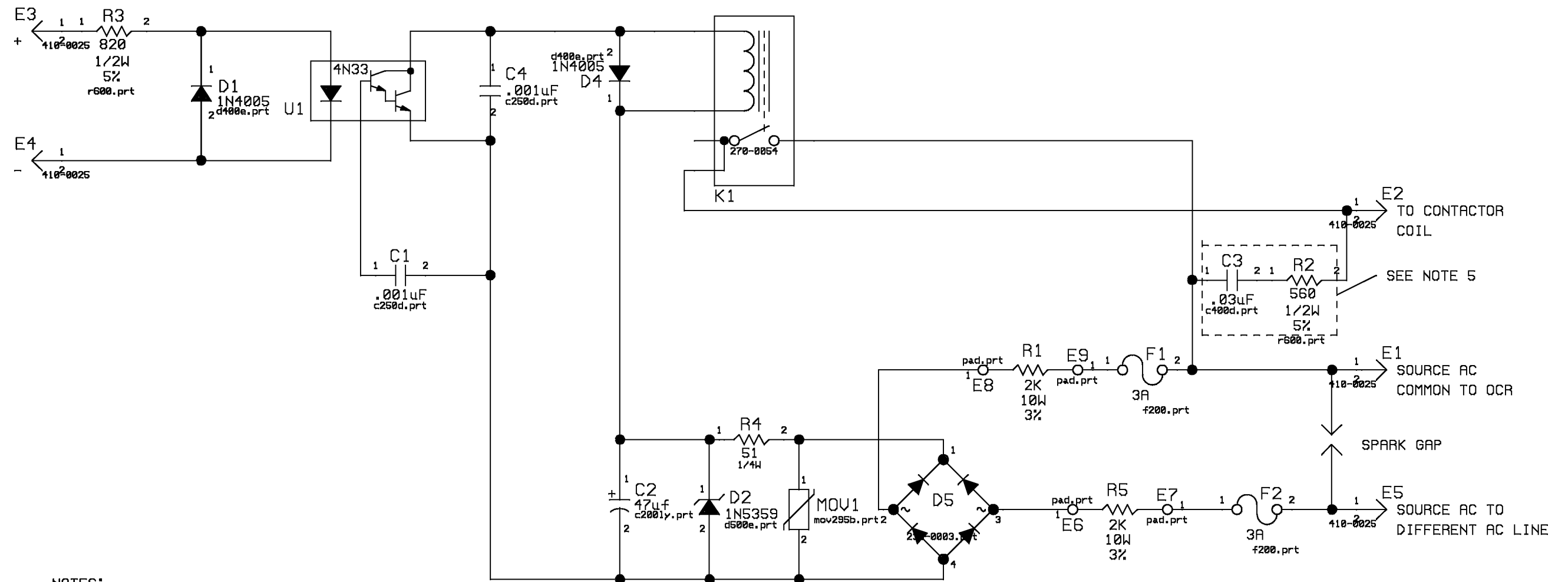
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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	2-24-94	MATERIAL
M. HAYDEN		
CHKD	9/27/94	
C.L. LANGNER		
ME		FINISH
PROJ. ENGR. 9/27/94		SEE DWG RA592-0000
J.R. CARPENTER		
MFG.		NEXT ASSY.

BE ® BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9500 TELEX 250142 CABLE BROADCAST FAX 217/224-9607			
TITLE SCHEMATIC LOW PASS FILTER ASSEMBLY			
TYPE	SIZE	DWG. NO.	REV
S	B	959-0414/-001	B
MODEL FM-2C/3C/4C/5C		SCALE NONE	SHEET 1 OF 1





NOTES:

1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: R5, F2, MOV1, C4, D4, U1, K1, E9
3. COMPONENTS NOT USED: D3
4. SEE ASSEMBLY: AB 919-0096
5. THESE COMPONENTS NOT USED ON 919-0096-001 C3, R2

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

DWN. BY
 JAH 11-26-91

CHKD
 BG 11-92

ME

PROJ. ENGR.
 BG 11-92

MFG.

MATERIAL

SEE B/M
 919-0096
 919-0096-001

FINISH

SEE DWG RA592-0000
 NEXT ASSY.

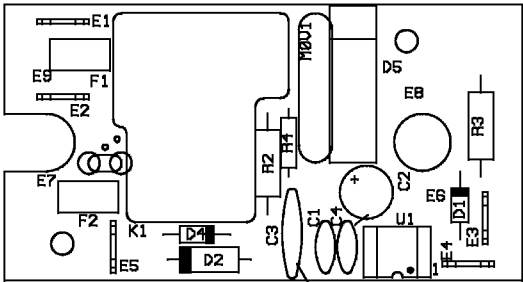
BE BROADCAST ELECTRONICS INC.
 4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL. 62305 217/224-9600
 TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
 OPTICALLY COUPLED RELAY

TYPE SIZE DWG. NO.
 S B 919-0096, -001

REV
 J

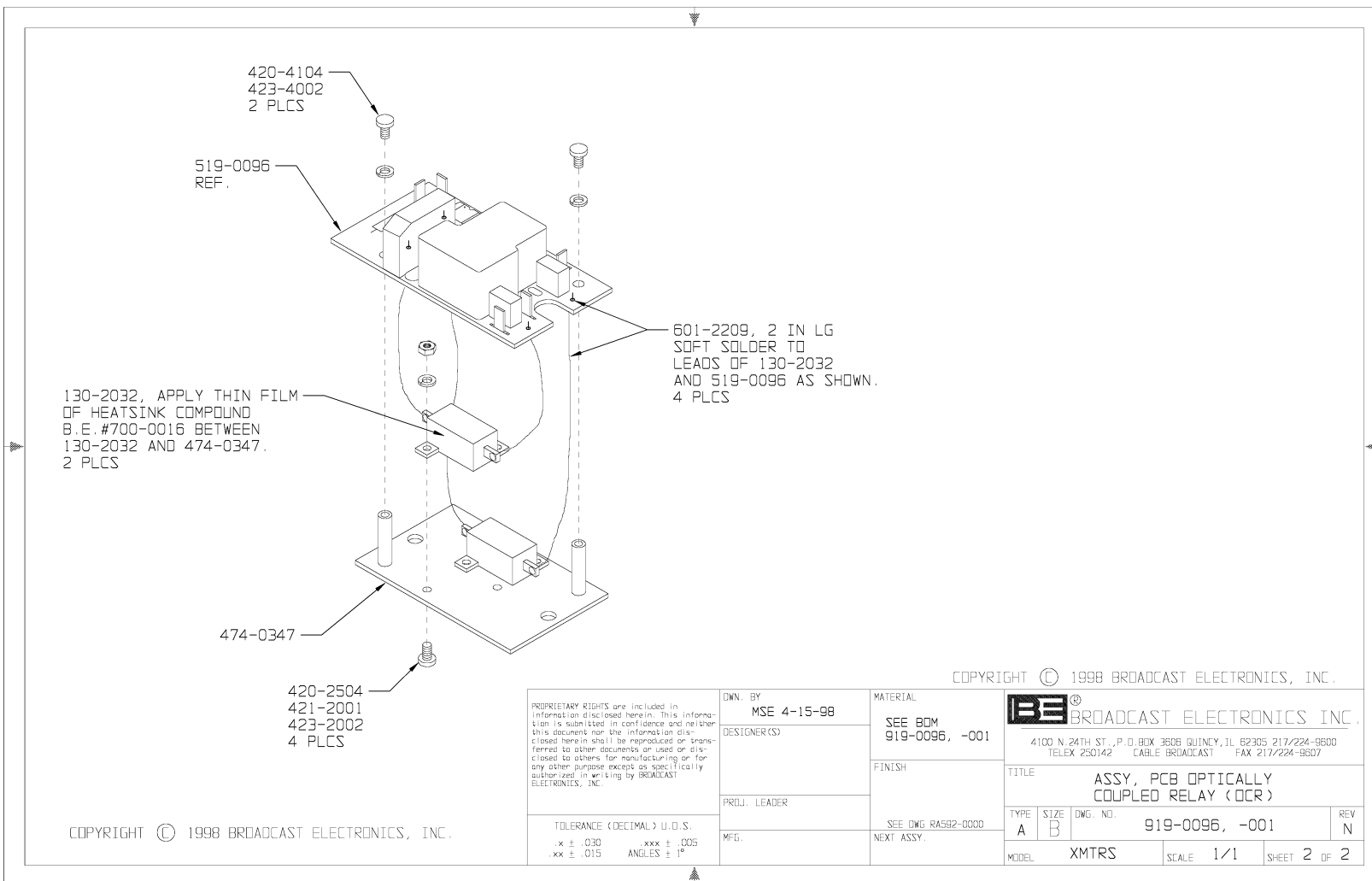
MODEL FM XMTR'S SCALE NONE SHEET 1 OF

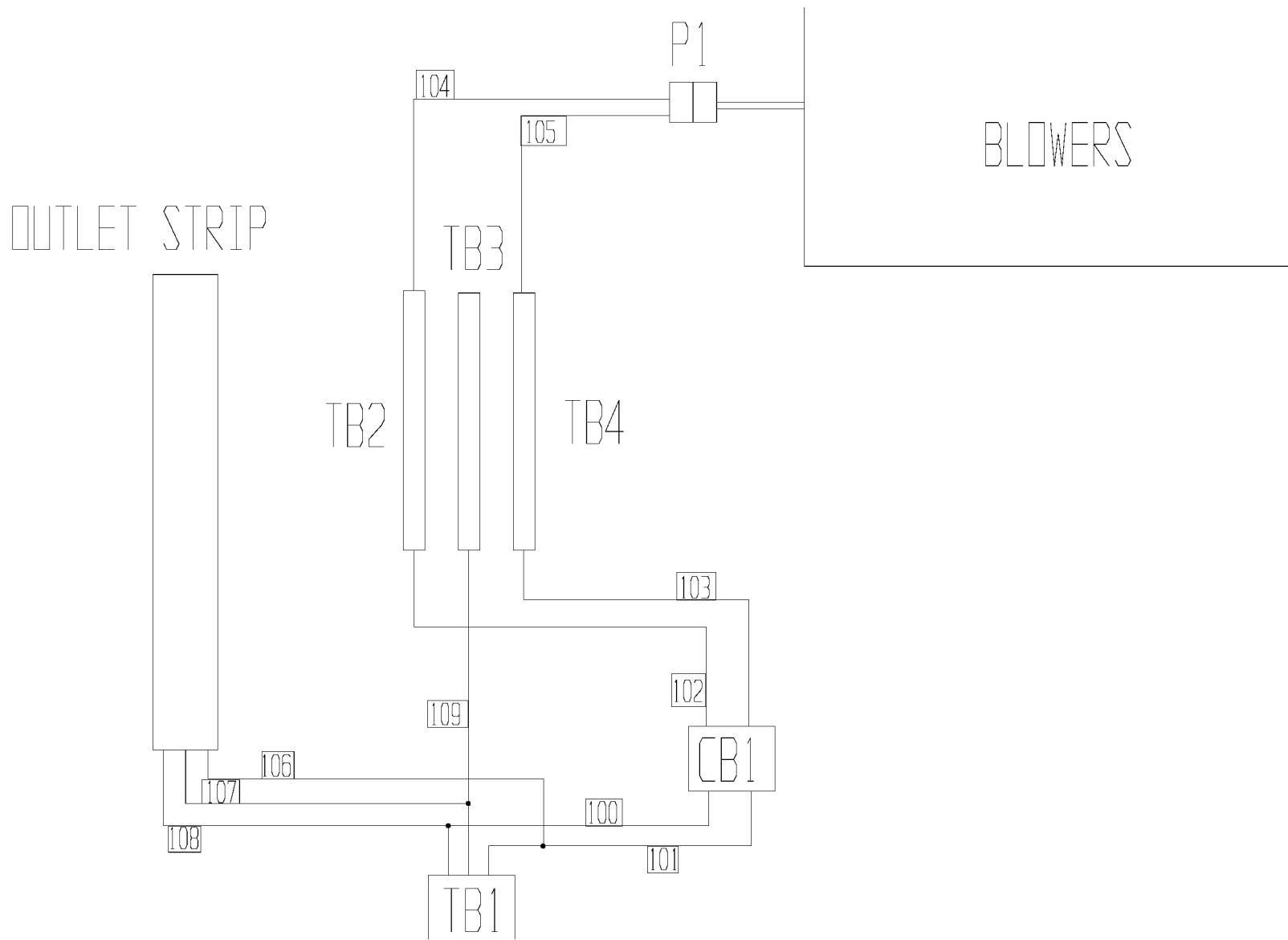


REMOVE R2 AND C3 FROM 919-0096
TO MAKE 919-0096-001

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	DESIGNER(S)							
	PROJ. LEADER J.TUCKER 7-14-86		FINISH SEE DWG AA592-0000 NEXT ASSY.		TITLE PCB ASSEMBLY OPTICALLY COUPLED RELAY BD.			
	MFG. J.STEINKAMP 7-14-86							
TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°					TYPE A	SIZE B	DWG No. 919-0096, 919-0096-001	REV N
					MODEL TRANSMITTERS		SCALE 1=1	SHEET 1 OF 2

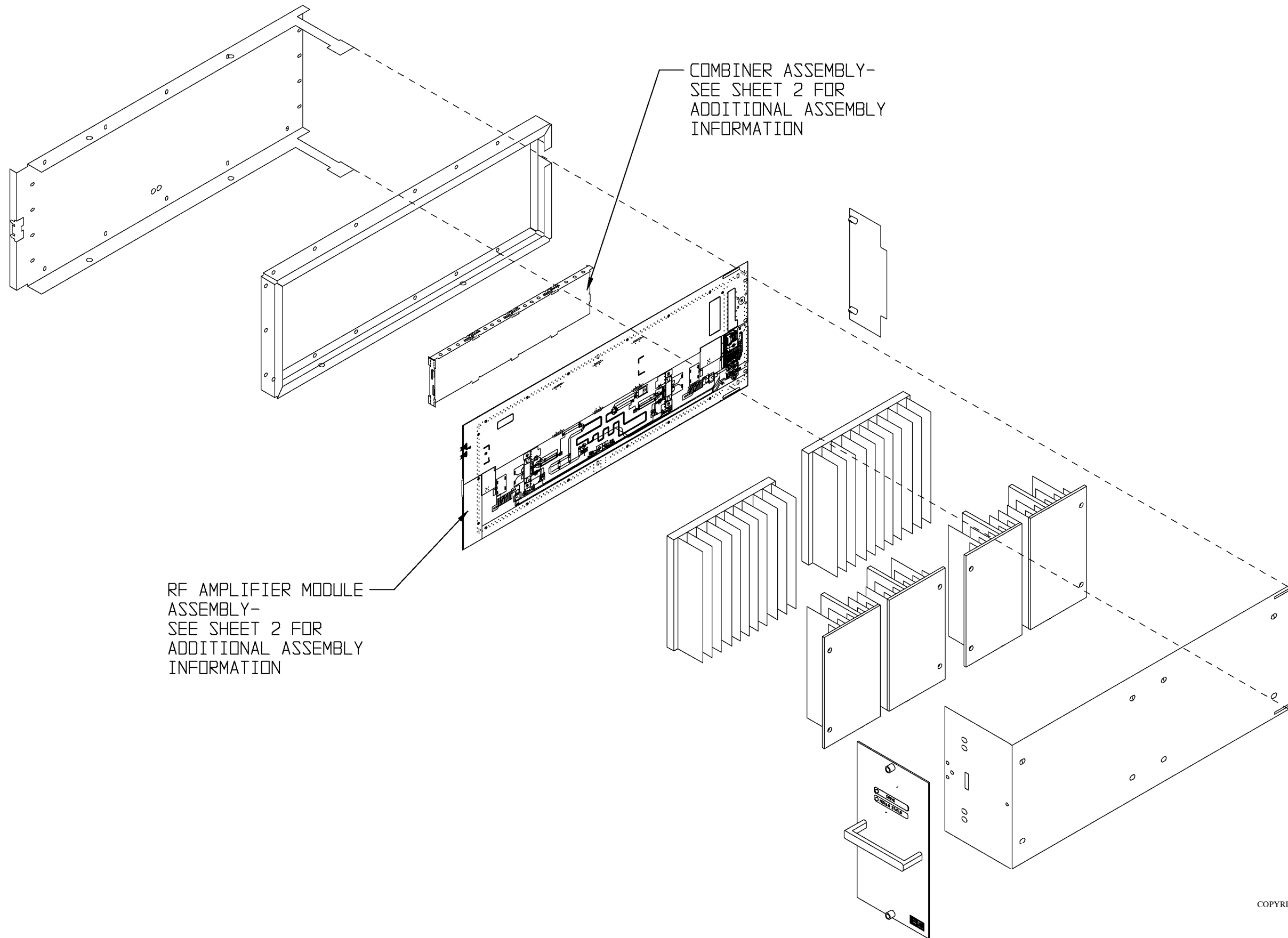




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CABINET SCHEMATIC DIAGRAM, OVERALL

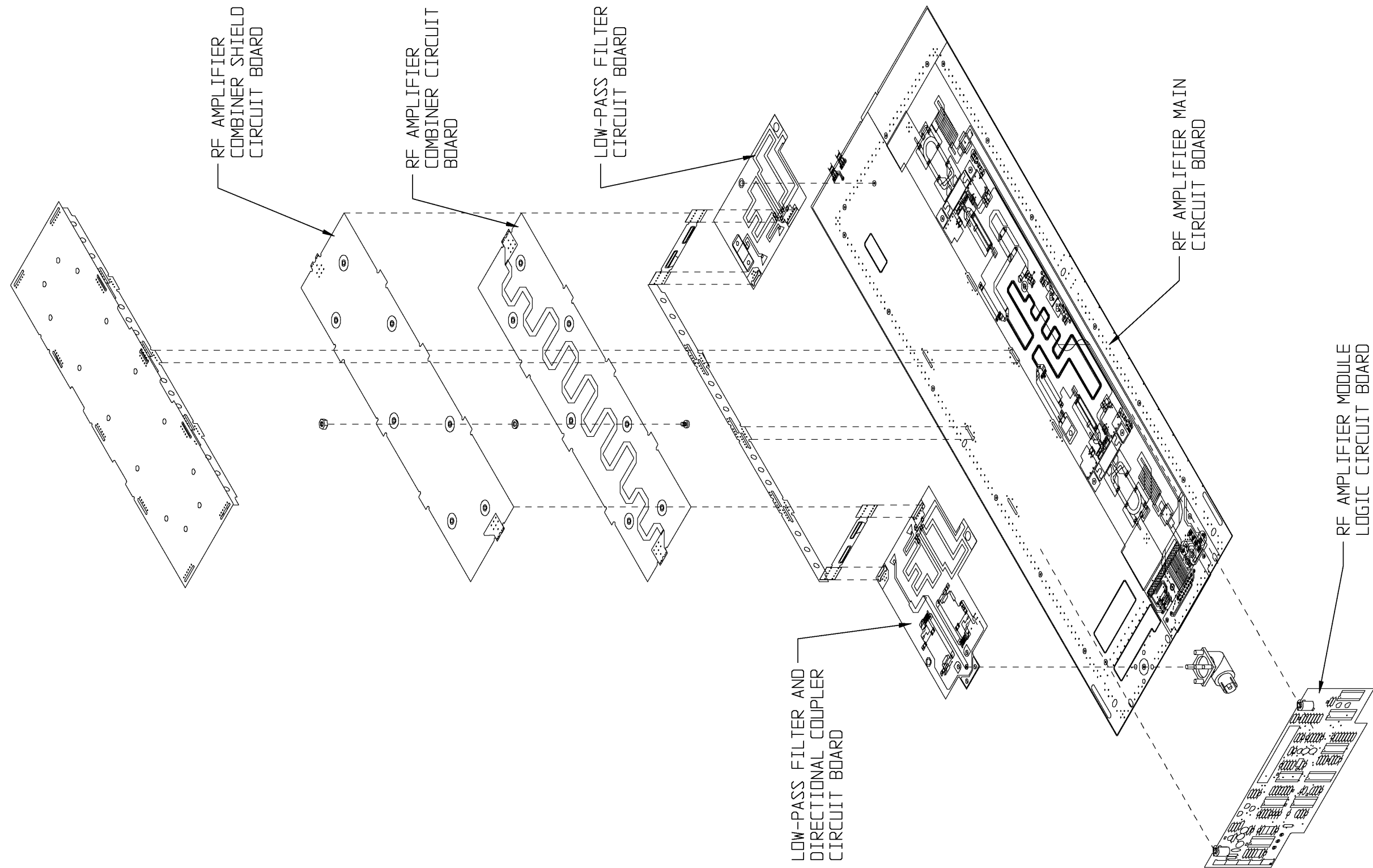
597-3002-600



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597-3002-23

**FIGURE 7-31. POWER AMPLIFIER MODULE
ASSEMBLY DIAGRAM
(SHEET 1 OF 2)**

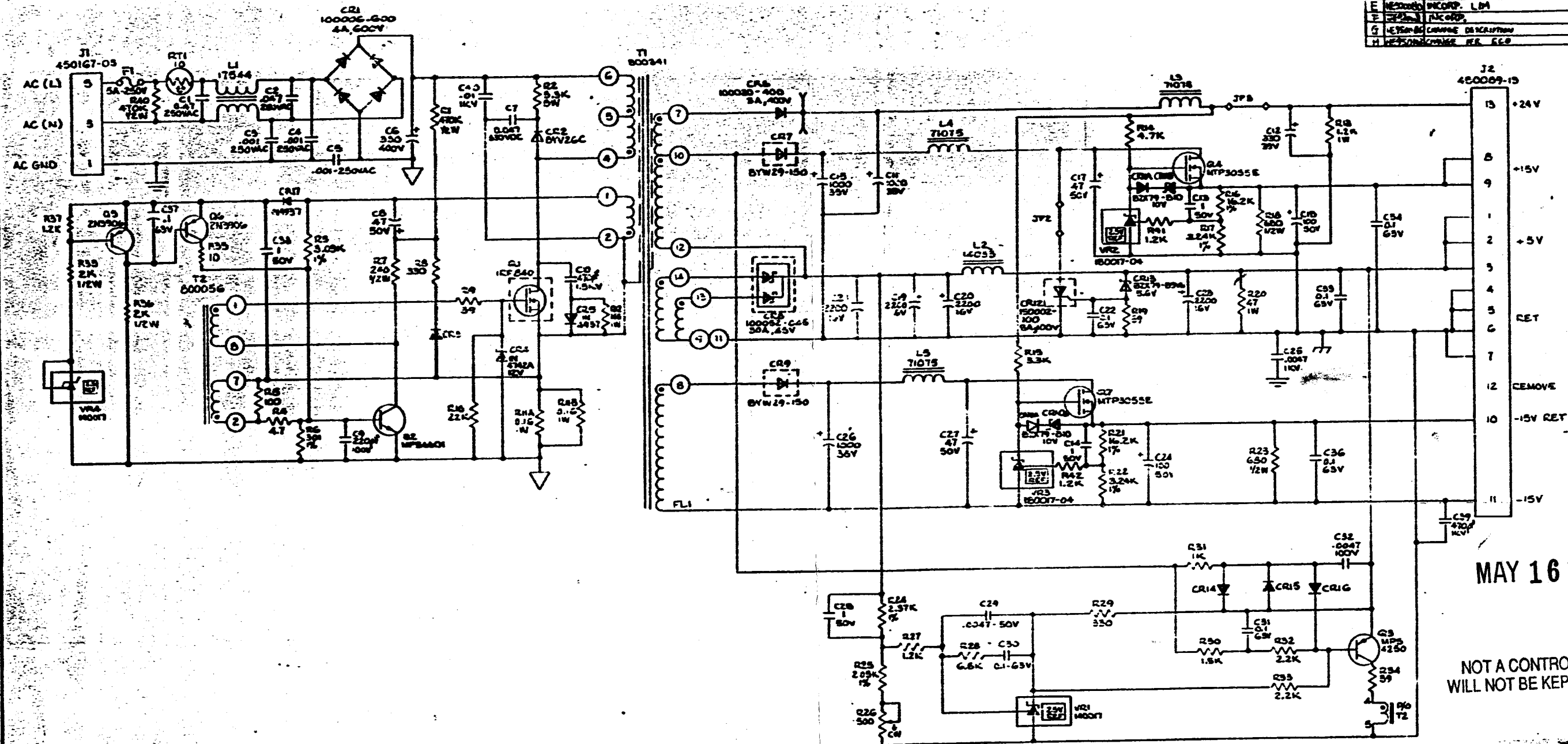


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597-3002-23A

**FIGURE 7-31. POWER AMPLIFIER MODULE
ASSEMBLY DIAGRAM
(SHEET 2 OF 2)**

REV	ECO	DESCRIPTION	DATE	APP
9A		PRELIMINARY RELEASE	8/1/90	7022
9B	15539	ADDED NEW SAFETY LABEL	7/5/91	7022
9C	15583	CHANGED SAFETY LABEL DASH NUMBERS	7/5/91	7022
9D	15580	RESISTOR CHANGES AND INCORP T-940	7/5/91	7022
A	5760	RELEASE TO MANUFACTURING	7/22/91	7022
B	5803A	SAFETY REQUIREMENTS	7/22/91	7022
C	16267	ADD CRIBS + CR1A	7/22/91	7022
D	16267	GRADE FM L1418 TO L1430	7/22/91	7022
E	16267	INCORP. L1A	7/22/91	7022
F	16267	INCORP.	7/22/91	7022
G	16267	CHANGE DESCRIPTION	7/22/91	7022
H	16267	CHANGE PER ECO	7/22/91	7022



MAY 16 1997

NOT A CONTROLLED ISSUE
WILL NOT BE KEPT UP TO DATE

CHECKED
ISSUED 18 JUL 97

CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CR12	CR13	CR14	CR15	CR16	CR17	CR18	CR19	CR20	CR21	CR22	CR23	CR24	CR25	CR26	CR27	CR28	CR29	CR30	CR31	CR32	CR33	CR34	CR35	CR36	CR37	CR38	CR39	CR40	CR41	CR42	CR43	CR44	CR45	CR46	CR47	CR48	CR49	CR50	CR51	CR52	CR53	CR54	CR55	CR56	CR57	CR58	CR59	CR60	CR61	CR62	CR63	CR64	CR65	CR66	CR67	CR68	CR69	CR70	CR71	CR72	CR73	CR74	CR75	CR76	CR77	CR78	CR79	CR80	CR81	CR82	CR83	CR84	CR85	CR86	CR87	CR88	CR89	CR90	CR91	CR92	CR93	CR94	CR95	CR96	CR97	CR98	CR99	CR100
CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CR12	CR13	CR14	CR15	CR16	CR17	CR18	CR19	CR20	CR21	CR22	CR23	CR24	CR25	CR26	CR27	CR28	CR29	CR30	CR31	CR32	CR33	CR34	CR35	CR36	CR37	CR38	CR39	CR40	CR41	CR42	CR43	CR44	CR45	CR46	CR47	CR48	CR49	CR50	CR51	CR52	CR53	CR54	CR55	CR56	CR57	CR58	CR59	CR60	CR61	CR62	CR63	CR64	CR65	CR66	CR67	CR68	CR69	CR70	CR71	CR72	CR73	CR74	CR75	CR76	CR77	CR78	CR79	CR80	CR81	CR82	CR83	CR84	CR85	CR86	CR87	CR88	CR89	CR90	CR91	CR92	CR93	CR94	CR95	CR96	CR97	CR98	CR99	CR100

8. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
VOLTAGE RATINGS IN D.C.
2. DIODES ARE IN4448.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W 5%.
NOTES: UNLESS OTHERWISE SPECIFIED.