FW–30
AUTOMATIC EXCITER SWITCHER

February, 2000 IM No. 597–0101–004

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
4100 N. 24th St. P.O. BOX 3606
Quincy, Illinois 62305
Telephone: (217) 224–9600
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.

PROPRIETARY NOTICE.

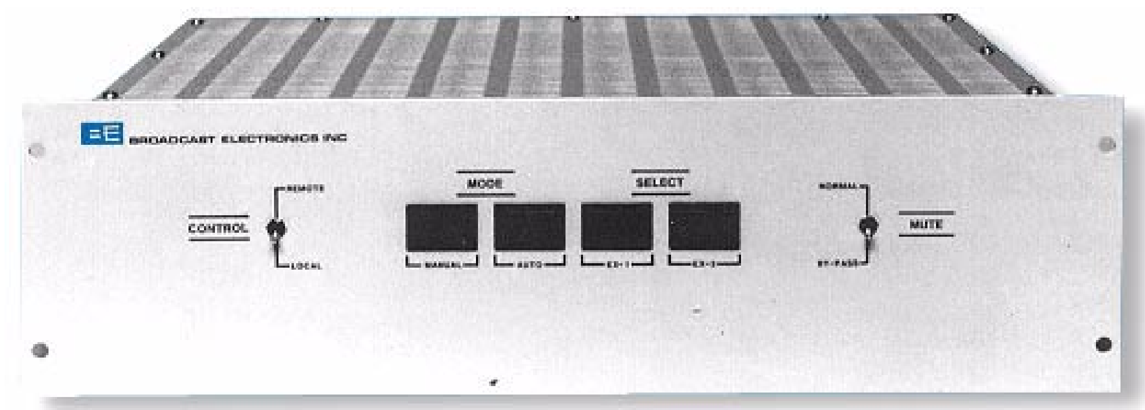
MODIFICATIONS.

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.

INSTRUCTION MANUAL

FW-30

AUTOMATIC EXCITER SWITCHER



MODEL	PART NUMBER	DESCRIPTION
FW-30	909-0120-004	Exciter switcher for a main/alternate exciter system, rack mount, 120 or 240V ac, 50/60 Hz.
	979-0054-004	Recommended spare parts kit for the FW-30. Does not include semiconductors.
	979-0307	Recommended spare semiconductor kit for the FW-30.

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SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. Information presented in this section provides a general description of the FW–30 automatic exciter switcher and lists equipment specifications.

1–3. EQUIPMENT DESCRIPTION.

1–4. The Broadcast Electronics FW–30 automatic exciter switcher is designed to provide maximum flexibility for a main/alternate exciter system. The FW–30 features adjustable switching threshold and delay circuitry, automatic or manual switching operation, remote control, and remote status indication circuitry. The FW–30 will monitor the on–air exciter and automatically initiate a switching sequence if a fault is detected.

1–5. The FW–30 also features an automatic battery back–up system to provide memory retention in the event of a power failure. The batteries are protected from damage due to excessive discharge by a special monitor circuit.

1–6. EQUIPMENT SPECIFICATIONS.

1–7. Refer to Table 1–1 for electrical, physical, and environmental specifications of the FW–30 exciter switcher.

TABLE 1-1. FW-30 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS (Sheet 1 of 2)

PARAMETER	SPECIFICATION
ELECTRICAL	
POWER REQUIREMENTS:	96V to 136V ac or 194V to 266V ac, 50/60 Hz.
REMOTE INPUTS	Negative or Positive Polarity, 5 to 28 volt ac or dc.
REMOTE OUTPUTS	Positive Logic.
INTERNAL MEMORY	Retains operational configuration during power failures with battery back–up system enabled.
EXCITER MUTING	Logic LOW required to mute. Logic HIGH required to enable (+15V in Broadcast Electronics transmitters).
TRANSFER TIME	Less than 1.0 second.
SWITCHING CAPABILITY	200 watts at 50 Ohms.
EXCITER TEST LOAD	50 Watt continuous, 50 Ohms ±5%, Non–inductive.
MONITOR PORT	2V RMS nominal 50 Ohms with 30 Watts RF from exciter.

TABLE 1-1. FW-30 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS (Sheet 2 of 2)

PARAMETER	SPECIFICATION
PHYSICAL	
DIMENSIONS:	
WIDTH	19 Inches (48.26 cm).
DEPTH	15.25 Inches (38.74 cm).
HEIGHT	5.25 Inches (13.34 cm).
WEIGHT (PACKED)	25 Pounds (11.34 Kg).
ENVIRONMENTAL	
OPERATING TEMPERATURE RANGE	+325 F to +1225 F (Ø5 C to +505 C).
MAXIMUM HUMIDITY	95%, Non–condencing.
MAXIMUM ALTITUDE	15,000 Feet Above Sea Level (4572 Meters).

SECTION II
INSTALLATION

2–1. INTRODUCTION.

2–2. This section contains information required for the installation and preliminary checkout of the Broadcast Electronics FW–30 automatic exciter switcher.

2–3. UNPACKING.

2–4. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the exciter switcher. 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, Inc.

2–6. INSTALLATION.

2–7. Each FW–30 exciter switcher is 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 a thorough understanding of the operation, circuitry, nomenclature, and installation requirements. Installation is accomplished as follows: 1) placement, 2) wiring, and 3) installation adjustments.

2–8. PLACEMENT.

WARNING
WARNING

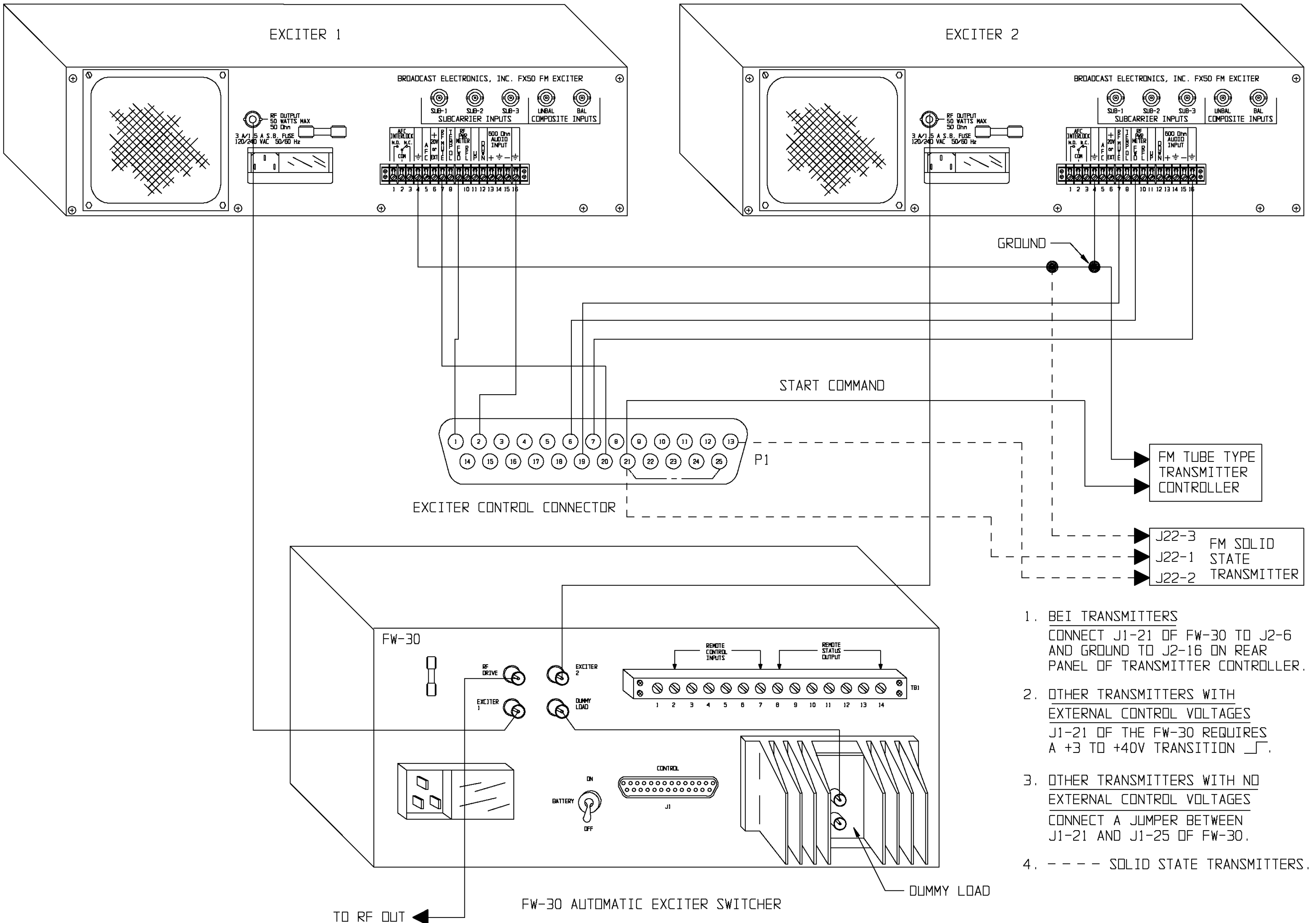
DUE TO SMALL AMOUNTS OF GAS EMITTED FROM THE BATTERIES DURING HEAVY CHARGE AND DISCHARGE CYCLES, DO NOT INSTALL THE FW-30 NEAR ANY SOURCE OF OPEN FLAME OR SPARK.

2–9. Due to minute amounts of gas emitted from the lead acid batteries during charge and discharge cycles, avoid installing the FW–30 in the proximity of open flame or spark.

2–10. The FW–30 requires 5 inches (12.7 cm) of a 19 inch cabinet and may be mounted in any convenient location within reach of control and power cables. An additional one inch of rack space above and below the unit should be provided for adequate cooling. The unit should not be mounted directly above or below heat-generating equipment, otherwise no special requirements need be observed.

2–11. WIRING.

2–12. **EXCITER CONTROL.** Refer to Figure 2–1 and connect the FW–30 exciter control wiring as follows.



FW-30 INTERFACING - FX-50 SYSTEM

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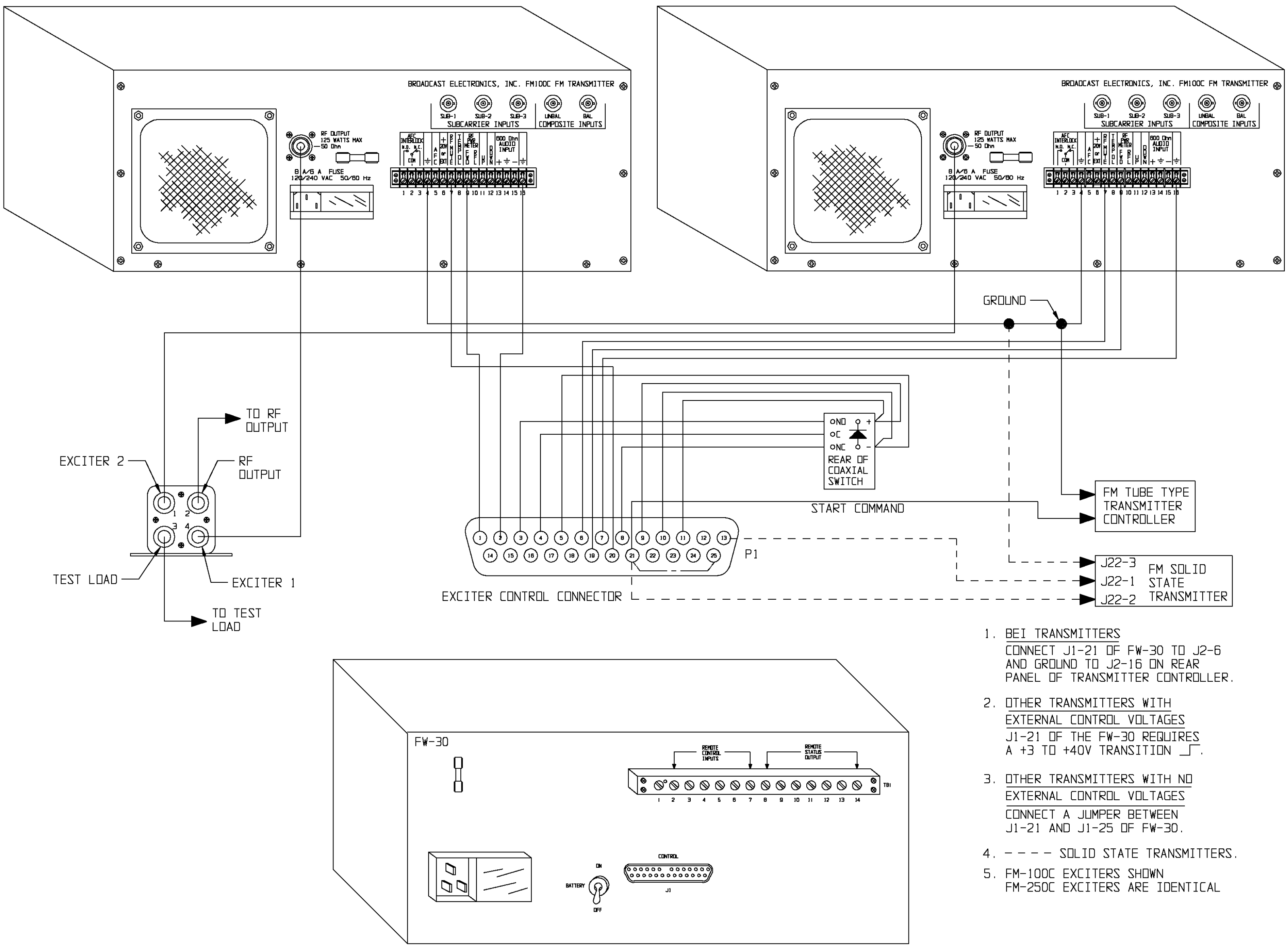
FIGURE 2-1. FW-30 INTERFACING (SHEET 1 OF 2)



1. BEI TRANSMITTERS
   CONNECT J1-21 OF FW-30 TO J2-6 AND GROUND TO J2-16 ON REAR PANEL OF TRANSMITTER CONTROLLER.
2. OTHER TRANSMITTERS WITH EXTERNAL CONTROL VOLTAGES
   J1-21 OF THE FW-30 REQUIRES A +3 TO +40V TRANSITION.
3. OTHER TRANSMITTERS WITH NO EXTERNAL CONTROL VOLTAGES
   CONNECT A JUMPER BETWEEN J1-21 AND J1-25 OF FW-30.
4. ---- SOLID STATE TRANSMITTERS.
5. FM-100C EXCITERS SHOWN
   FM-250C EXCITERS ARE IDENTICAL

FW-30 INTERFACING - FM-100C/FM-250C SYSTEMS

FIGURE 2-1. FW-30 INTERFACING (SHEET 2 OF 2)

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WARNING *DISCONNECT ALL EXCITER SYSTEM AND TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.* *WARNING*

2–13. Disconnect all exciter system and transmitter primary power.

2–14. Connect the FW–30 exciter control wiring to the exciter 1 and exciter 2 rear–panel terminal strips. For FW–30 units used with FM–100C/FM–250C exciter systems, ensure control wires are connected between the P1 on the FW–30 and the coaxial switch as shown.

2–15. For Broadcast Electronics transmitters, refer to Figure 2–1 and connect J1–21 on the FW–30 to J2–6 on the transmitter controller. For other transmitters with external control voltages, a +3V to +40V transition must be applied to J1–21. For other transmitters with no external control voltages, connect a jumper between J1–21 and J1–25.

2–16. Connect the RF cabling between the exciters and the FW–30 as shown.

2–17. Attach exciter control connector P1 to receptacle J1 on the FW–30 rear–panel.

2–18. **DUMMY LOAD CONNECTION.** A 50 Ohm dummy load is provided for the off–air exciter output. Refer to Figure 2–1 and ensure a coaxial cable is connected between: 1) the DUMMY LOAD connector on the transfer switch and the test load for FX–50 exciter systems or 2) port 3 on the transfer switch and the test load for FM–100C/FM–250C exciter systems.

2–19. **CIRCUIT BOARD PROGRAMMING.** The FW–30 exciter switcher is programmed, operated, and tested at the factory prior to shipment. To assure the circuit board jumpers have not become dislodged during shipping, refer to Figure 2–2 and check the position of each jumper.

2–20. **REMOTE CONTROL.** FW–30 remote control and indication connections are provided on a rear–panel terminal strip. (Refer to Figure 2–3). Table 2–1 presents the FW–30 remote control and indication functions. Refer to Figure 2–3 and connect the remote control and indication wiring as required.

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

2–21. **POWER SUPPLY.** The FW–30 is programmed for the proper power supply voltage and frequency when shipped from the factory. If an alternate power source is required, re–program the unit by operating the voltage selector circuit board in the RFI filter and ac receptacle module to the desired position (refer to Figure 2–3). Ensure the power supply voltage to be used is visible from the ac voltage selector window and connect the line cord to an appropriate power source.

2–22. **INSTALLATION ADJUSTMENTS.**

2–23. **SWITCHER THRESHOLD ADJUSTMENTS.** Potentiometers R4 and R10 on the switcher logic circuit board adjust the switching threshold level for exciter 1 and exciter 2. The switching threshold levels are adjusted as follows.

2–24. **Procedure.** To adjust exciter 1 switching threshold level, proceed as follows:

A. Remove the FW–30 top–panel. Apply power to the exciter switcher.

B. Refer to Figure 2–4 and adjust exciter 1 threshold adjust R4 fully clockwise. Exciter 1 threshold indicator DS1 on the logic circuit board will illuminate.

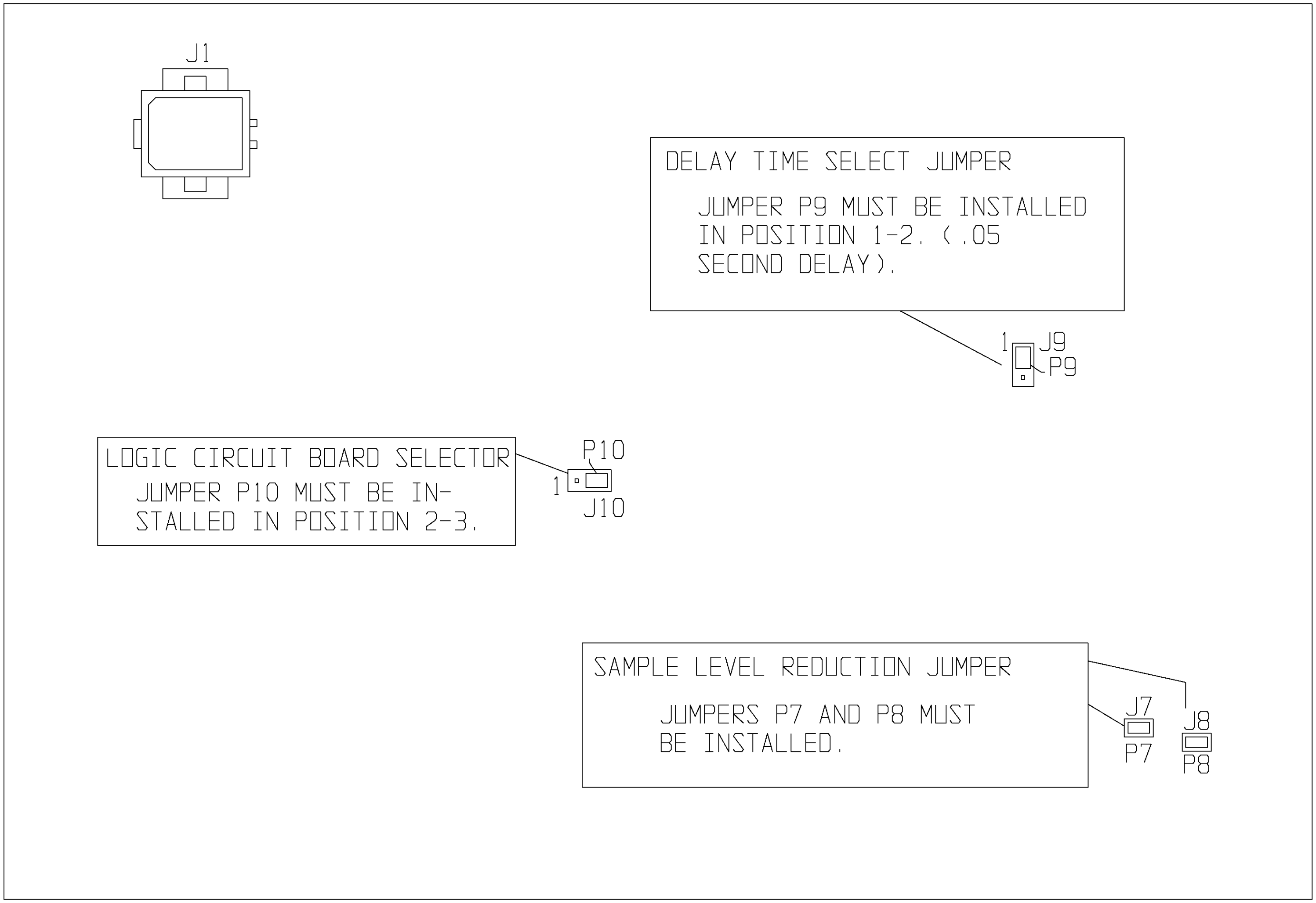

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FIGURE 2-2. FW-30 CIRCUIT BOARD JUMPER PROGRAMMING

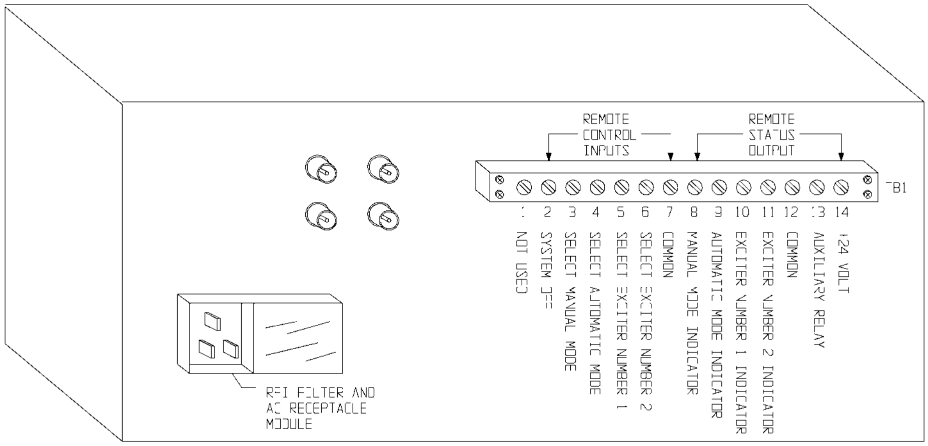

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FIGURE 2-3. FW-30 REMOTE INTERFACING

TABLE 2-1. REMOTE INTERFACE CONNECTIONS

TB1	FUNCTION	DESCRIPTION
1	Not Used	
2	System Off	
3	Manual Mode	Momentary connection to ±5V to ±24V
4	Automatic Mode	required to activate function.
5	Exciter No. 1 Select	Typical Connections:
6	Exciter No. 2 Select	+24V
7	Control Common (Isolated)	To Control
		Terminal
		Common Chassis
8	Manual Status	
9	Automatic Status	
10	Exciter No. 1 Status	Current sink to ground when active.
11	Exciter No. 2 Status	
12	Status Common (Chassis Ground)	
13	Auxiliary Relay	
14	+24 Volt	

C. Adjust the exciter 1 output power to the desired switching threshold level.

D. Adjust R4 until exciter 1 threshold indicator DS1 is extinguished.

E. To adjust exciter 2 switching threshold level, repeat the procedure using threshold adjust R10 and indicator DS2.

F. Replace the top–cover.

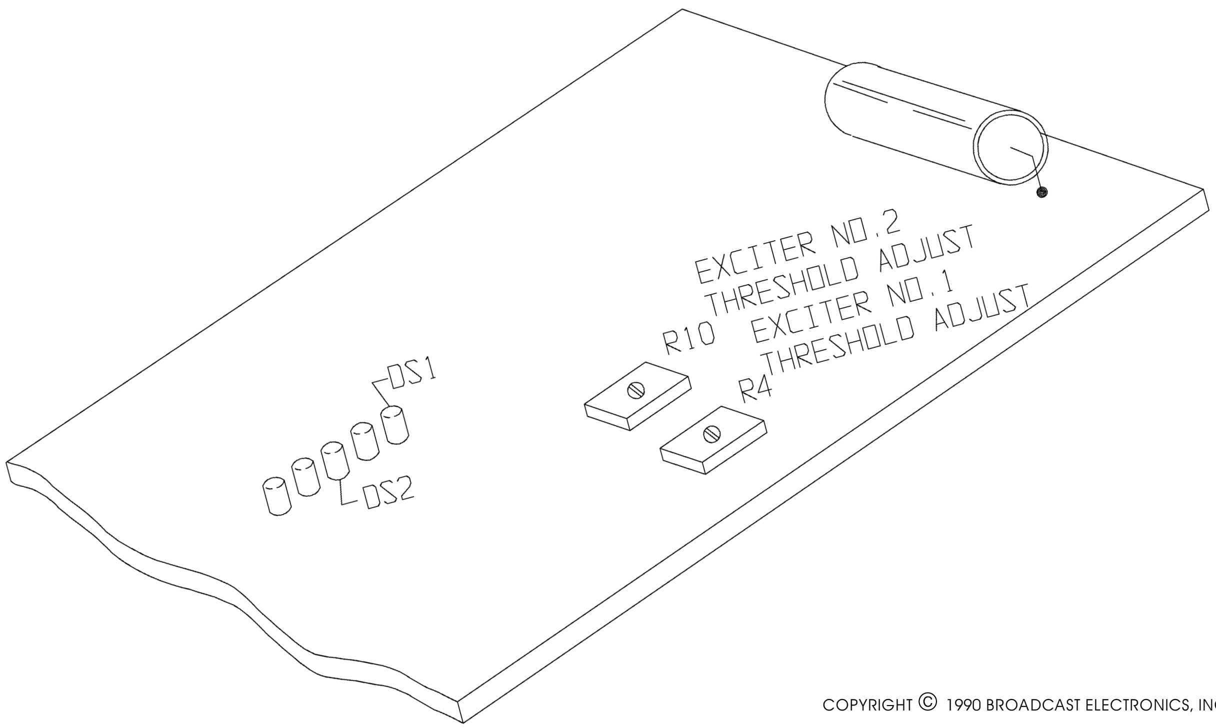

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FIGURE 2-4. FW-30 CONTROL LOGIC CIRCUIT BOARD ADJUSTMENTS

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the Broadcast Electronics FW-30 Automatic Exciter Switcher and provides standard procedures.

3-3. CONTROLS AND INDICATORS.

3-4. Refer to Figure 3-1 for the location of all controls and indicators associated with normal operation of the FW-30 exciter switcher. The function of each control or indicator is described in Table 3-1.

3-5. OPERATION.

NOTE ***THE FOLLOWING PROCEDURE ASSUMES THAT THE EXCITER SWITCHER IS COMPLETELY INSTALLED AND IS FREE OF ANY DISCREPANCIES.*** ***NOTE***

3-6. ENABLE SYSTEM.

3-7. To enable the system, apply primary power to the FW-30 automatic exciter switcher. Energize the transmitter(s) and both exciters.

3-8. MUTING.

3-9. Operate the front-panel **MUTE** switch to the **NORMAL** position to disable the exciters during a switching operation. The **BY-PASS** position enables the RF output of both exciters for testing purposes.

3-10. BATTERY.

3-11. Operate the rear-panel **BATTERY ON/OFF** switch to **ON** if battery back-up system operation is desired during a power failure. With the switch in the **ON** position, the batteries are continuously charged during normal operation.

3-12. MODE SELECTION.

3-13. If automatic switching is desired in the event of a failure, depress the front-panel **AUTO MODE** switch/indicator. In the automatic mode, manual operation of the switcher is also allowed. If only manual switching is desired when a fault occurs, depress the front-panel **MANUAL MODE** switch/indicator. The appropriate switch/indicator will illuminate when depressed.

3-14. EXCITER SELECTION.

3-15. To select exciter 1 as the operational unit, depress the front-panel **EX-1 SELECT** switch/ indicator. To select exciter 2 as the active unit, depress the **EX-2 SELECT** switch/indicator. The appropriate switch/indicator will illuminate when depressed.

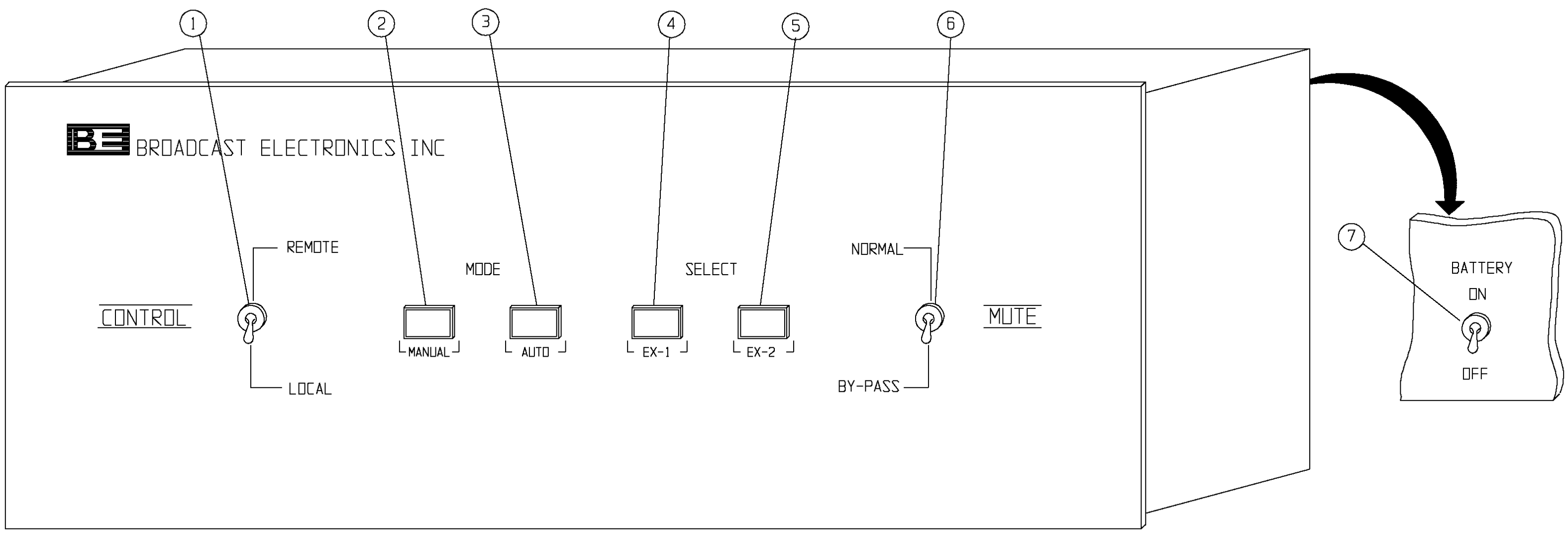

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FIGURE 3-1. FW-30 CONTROLS AND INDICATORS

TABLE 3-1. AUTOMATIC EXCITER SWITCHER CONTROLS AND INDICATORS

INDEX NO.	NOMENCLATURE	FUNCTION
1	**REMOTE/LOCAL CONTROL** Switch	Remote and local control is enabled when operated to **REMOTE**. Local control only is enabled when operated to **LOCAL**.
2	**MANUAL MODE** Switch/Indicator	SWITCH: Disables automatic switching circuitry. Allows only manual switching operation. INDICATOR: Indicates exciter switcher is in the manual mode when illuminated.
3	**AUTO MODE** Switch/Indicator	SWITCH: Enables automatic switching circuitry. Allows automatic and manualswitching operation. INDICATOR: Indicates exciter switcher is in the automatic mode when illuminated.
4	**EX-1 SELECT** Switch/Indicator	SWITCH: Selects exciter No. 1 for on-air operation when depressed. INDICATOR: Indicates exciter No. 1 is selected when Illuminated.
5	**EX-2 SELECT** Switch/Indicator	SWITCH: Selects exciter No. 2 for on-air operation when depressed. INDICATOR: Indicates exciter No. 2 is selected when illuminated.
6	**NORMAL/BY-PASS MUTE** Switch	Allows normal exciter muting (on-air exciter is operational; standby exciter is muted) when operated to **NORMAL**. When operated to **BY-PASS**, neither exciter is muted. Intended for exciter testing.
7	**BATTERY ON/OFF** Switch	Controls the battery back-up and charging system. The batteries are charged when the switch is in the **ON** position.

3–16. **LOCAL/REMOTE OPERATION.**

3–17. If external control of the exciter switcher is desired, operate the front–panel **LOCAL/REMOTE** switch to **REMOTE**. When the switch is in the remote position, both external and local control of the switcher is allowed. If only local control is desired, operate the **REMOTE/LOCAL** switch to **LOCAL**.

3–18. **DISABLE SYSTEM.**

3–19. The design of the automatic exciter switcher assumes that primary power will be applied continuously at all times. To disable the system, de–energize the transmitter(s) and both exciters.

3–20. If ac power must be removed from the automatic exciter switcher, operate the rear–panel **BATTERY ON/OFF** switch to **OFF**.

SECTION IV
THEORY OF OPERATION

4–1. INTRODUCTION.

4–2. This section presents the theory of operation for the Broadcast Electronics FW–30 automatic exciter switcher. A simplified schematic of the FW–30 is presented in Figure 4–1. Refer to the simplified schematic as required for the following functional equipment description.

4–3. FW-30 FUNCTIONAL DESCRIPTION.

4–4. **AUTOMATIC SWITCHING.** The following information is presented with exciter 1 operating at a normal RF output level. Exciter 2 is muted and operating into the dummy load. The text describes the automatic process of switching exciter 2 into the system and exciter 1 into the dummy load when a fault occurs in exciter 1.

4–5. When the front–panel automatic mode switch or the remote automatic mode select switch is depressed, a logic LOW is applied to the input of an automatic/manual latch consisting of U15A and U15B. The latch will output a HIGH to inverters U14E/U16G and automatic enable gate U9B through diode D6. With a LOW from the inverters, the front–panel automatic mode indicator will illuminate. This LOW is also applied to optical isolator U29 which outputs a LOW to illuminate a remote automatic mode indicator.

4–6. With exciter 1 initially selected, the Q output of flip–flop U5A will apply a logic HIGH to NOR gate U13B and NAND gate U9C. The $\overline{Q}$ output will apply a LOW to U13A and U9D.

4–7. A sample voltage from exciter 1 is routed through rear–panel D–connector J1 to the input of integrated circuit comparators U1B and U1A. U1B is provided with a fixed bias for low RF level sensing. U1A is biased for a higher RF threshold level by potentiometer R4. When the sample voltage from exciter 1 decreases below the threshold level established by R4, U1A will output a LOW to inverter U2G. U2G applies a HIGH to NAND gate U9C and exciter 1 threshold indicator DS1 which extinguishes. With a HIGH from the Q output of flip–flop U5A and a HIGH from U2G, U9C will output a LOW to automatic control gate U9A. A LOW is also routed to delay timer U3/U4 through diode D1 and capacitor C5.

4–8. Timer U3/U4 will provide 0.05 seconds of delay to allow the exciter to recover before initiating a transfer command pulse. If the fault duration exceeds the delay time, U3/U4 will output a HIGH to automatic enable gate U9B.

4–9. With a LOW from U9C, U9A will route a HIGH to automatic enable gate U9B through diode D4. U9B will apply a LOW to exciter off gate U8C and inverter U11A. U11A applies a HIGH to the clock input of flip–flop U5A which changes logic states to generate the exciter 2 switching information. The switching information from U5A is routed to transfer gates U13A and U13B.

4–10. Exciter off gate U8C initiates the command which mutes both exciters prior to switching. With a LOW from U9B, U8C will output a HIGH to NOR gate U12B. U12B applies a LOW to timer U6 which outputs a HIGH to inverters U2A/U2C. The inverters route a LOW through diode/resistor network D48, D50, R94, R95, and the front–panel mute switch to the MUTE 1 and MUTE 2 terminals of the rear–panel D–connector. Exciter off indicator DS4 will momentarily illuminate to indicate the output of the exciter mute command.

4–11. When both exciters are muted, comparators U1B and U1D will apply a LOW to RF presence gate U12A. U12A outputs a HIGH to extinguish RF presence indicator DS3. This HIGH is also applied to inverter U10A which outputs a LOW to enable transfer gates U13A and U13B.

4–12. With U13A and U13B enabled, the switching information stored at flip–flop U5A will transfer to flip–flop U5B. A HIGH from U13B applied to the set input of U5B forces the Q output HIGH to bias switching transistors Q1 and Q2 ON. Q2 conducts and applies a LOW to coaxial switch S2 which energizes to connect exciter 2 into the system and exciter 1 into the load. In addition, Q2 applies a LOW to rear–panel barrier strip TB1–13 for auxiliary relay control operation. Switching information from U5B is also routed to the switch position comparator logic.

4–13. The switch position comparator logic compares information from flip–flop U5B and the switch indicator contacts on S2 for a valid switching operation. When a valid transfer is recognized, a HIGH will be routed to inverters U10E/U16E and a LOW to inverters U10F/U16D. U10E/U16E will output a LOW to illuminate the front–panel EX–2 select indicator. This LOW is also applied to optical isolator U27 which outputs a HIGH to illuminate an external indicator. A HIGH from U10F/U16D is routed through diode/resistor network D49, R95, and the mute switch to the MUTE 2 terminal which enables exciter 2.

4–14. **MANUAL SWITCHING.** Manual selection of exciter 1 or exciter 2 is accomplished by the front–panel **EX–1** and **EX–2 SELECT** switches and the associated circuitry. Exciter 1 and exciter 2 circuits are identical; therefore, only exciter 2 circuitry will be discussed.

4–15. When the front–panel **EX–2 SELECT** switch is depressed, a LOW is applied to inverter U14D. U14D outputs a HIGH to NOR gate U12C which outputs a LOW to exciter off gate U8C to mute the exciters. A HIGH is also applied to the clear input of flip–flop U5A which forces the $\overline{Q}$ output HIGH to select exciter 2.

4–16. **REMOTE CONTROL.** External control of the FW–30 is provided by the remote control circuitry. All remote control circuits are identical; therefore, only the remote system off circuitry will be discussed.

4–17. The remote system off circuitry is routed from rear–panel barrier strip TB1–2 to optical isolator U21. When the remote switch is depressed, U21 generates a LOW to inverter U10B. U10B outputs a HIGH to NOR gate U12B which mutes both exciters.

4–18. **REMOTE/LOCAL SWITCH.** External control of the FW–30 is enabled or disabled by **REMOTE/LOCAL** switch S7 located on the front–panel. In the remote position, a control voltage is applied to the optical isolators to enable remote operation.

4–19. **POWER FAILURE DETECTION CIRCUIT.** A power failure detection circuit consisting of one–shots U30A/B, AND gate U8B/D, and inverters U11B/U16A is provided to prevent inadvertent transmitter switching in the event of a power failure. When ac power is applied to the unit, a full–wave rectified positive dc voltage is routed through level adjust potentiometer R100 to inverter U11B. U11B will output a LOW to one–shot U30A. The output of U30A will go HIGH which is inverted at U16A to illuminate indicator DS6.

4–20. When a power failure condition occurs, the output of U11B will go HIGH to trigger U30A. U30A will respond by routing a LOW to extinguish indicator DS6. The LOW is also routed to delay timer U3/U4 through AND gate U8B/D to maintain the transmitter switching logic in the current state. When ac power is restored, the output of U30A will go HIGH to illuminate indicator DS6 and trigger one–shot U30B. After a one second delay to allow the exciters to generate RF power, the output of U30B will go HIGH. The HIGH is ANDed with a HIGH from U30A at U8B/D to output a HIGH to delay timer U3/U4.

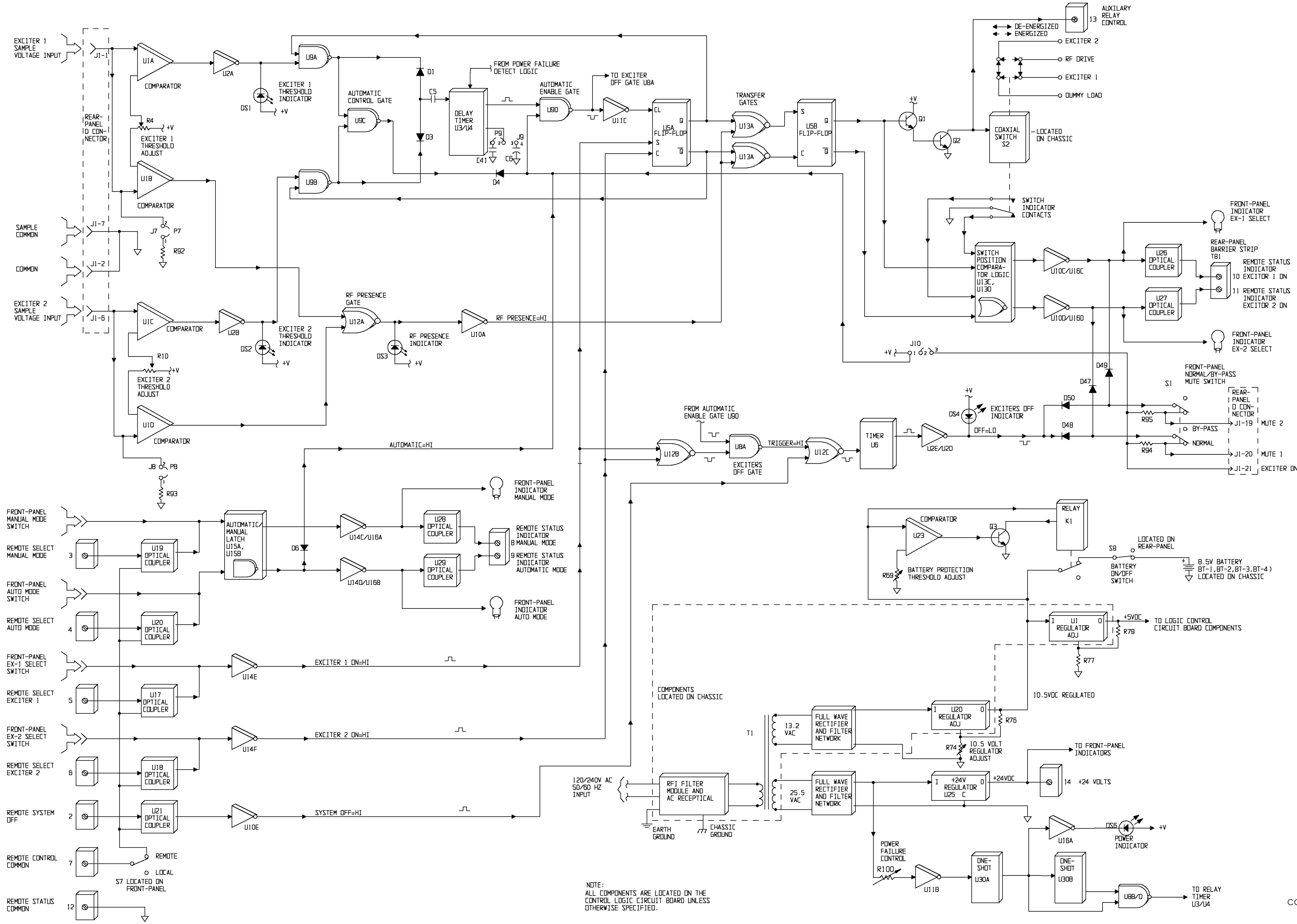

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FIGURE 4-1. FW-30 SIMPLIFIED SCHEMATIC

4–21. **POWER SUPPLY.** Primary power is applied to the FW–30 through the RFI filter and ac receptacle module. Power from the receptacle is routed to the primary of power transformer T1 to provide 13.2 volt and 25.5 volt ac potentials at the secondaries.

4–22. The 25.5 volt ac potential is routed to a full–wave rectifier and filter network and applied to voltage regulator U25. U25 provides a regulated +24 volt dc potential to the front–panel indicators and rear–panel barrier strip TB1–14 for remote control operation.

4–23. The 13.2 volt ac potential from T1 is routed to a full–wave rectifier and filter network and applied to a voltage regulator circuit consisting of U2, resistor R76, and regulator adjust R74. The output of this circuit provides a regulated +10.5 volt dc potential to the input of a voltage regulator circuit consisting of U1, and resistors R77 and R79. The output of this circuit provides a regulated +5 volt dc potential for the control logic circuit board components. +10.5 volt dc potential is also routed to the battery back–up system.

4–24. A battery back–up system consisting of four 2 volt lead–acid cells is provided for memory retention in the event of a power failure. During normal operation and power failure conditions, relay K1 is energized. If the rear–panel **BATTERY ON/OFF** switch is operated to the ON position, the batteries will be charged via the +10.5 volt dc regulator circuit through the contacts of relay K1. In the event of a power failure, the batteries will provide input potential for the +5 volt dc regulator circuit and a sample voltage for the battery protection circuitry.

4–25. The battery protection circuitry consists of integrated circuit comparator U23, battery protection threshold adjust R69, transistor switch Q3, and relay K1. When a power failure occurs, the battery potential is applied to the input of U23. If the battery potential decreases below the threshold level established by potentiometer R69, U23 will output a LOW to bias Q3 OFF which disables relay K1.

SECTION V
MAINTENANCE

5–1. INTRODUCTION.

5–2. This section provides general maintenance and troubleshooting information, electrical adjustment procedures, and component replacement procedures for the Broadcast Electronics FW–30 automatic exciter switcher.

5–3. SAFETY CONSIDERATIONS.

5–4. Low voltages are used throughout the FW–30 logic control circuit board. Several power supply components on the chassis contain primary ac line voltage. Therefore, do not perform any maintenance or troubleshooting procedures on the power supply circuitry with power applied. Maintenance with power energized is always considered hazardous and caution should be observed. Good judgment, care, and common sense must be practiced to prevent accidents. The procedures contained in this section should be performed only by experienced and trained personnel.

5–5. FIRST LEVEL MAINTENANCE.

5–6. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

WARNING — ***DISCONNECT THE POWER SOURCE FROM THE EXCITER SWITCHER BEFORE ATTEMPTING ANY EQUIPMENT MAINTENANCE.***
WARNING

5–7. GENERAL.

5–8. Periodically remove any foreign substances from the FW–30 chassis with a cloth moistened with a mild household cleaner. Remove dust from the chassis exterior with a brush and vacuum cleaner as required.

5–9. ELECTRICAL.

5–10. The switcher circuit board should be periodically cleaned of accumulated dust using a soft brush and vacuum cleaner. Check the circuit board for improperly seated semiconductors and components damaged by overheating.

5–11. SECOND LEVEL MAINTENANCE.

5–12. The second level maintenance consists of procedures required to restore an FW–30 exciter switcher to operation after a fault has occurred. The procedures are divided into trouble–shooting, electrical adjustments, and electrical component replacement procedures.

5–13. The FW–30 exciter switcher maintenance philosophy consists of isolating the problem to a specific assembly with subsequent troubleshooting to isolate defective components.

5–14. ELECTRICAL ADJUSTMENTS.

5–15. **+10.5V REGULATOR ADJUSTMENT.** Potentiometer R74 on the switcher logic circuit board adjusts the +10.5 volt regulator circuit. Adjustment of the regulator circuit is not required unless replacement components are installed in the circuit. The +10.5 volt regulator circuit is adjusted as follows.

5-16. **Procedure.** To adjust the +10.5 volt regulator circuit, proceed as follows:

A. Disconnect the primary power to the exciter switcher.

B. Remove the top-cover and operate the rear-panel **BATTERY ON/OFF** switch to OFF.

C. Refer to Figure 5-1 and connect a voltmeter between the anode of diode D37 on the logic circuit board and ground.

D. Apply power to the exciter switcher.

E. Refer to Figure 5-1 and adjust R74 until the voltmeter indicates +10.1V dc.

F. Disconnect the primary power to the exciter switcher.

G. Remove the test equipment and replace the top-cover.

5-17. **BATTERY PROTECT ADJUSTMENT.** Potentiometer R69 on the switcher logic circuit board adjusts the threshold of the battery protect circuit. Adjustment of the battery protect circuit is not required unless replacement components are installed in the circuit. The battery protect circuit is adjusted as follows.

5-18. **Procedure.** To adjust battery protect adjust R69, proceed as follows:

A. Remove the FW-30 top-panel and operate the rear-panel **BATTERY ON/OFF** switch to OFF.

B. Disconnect the primary power to the exciter switcher.

C. Refer to Figure 5-1 and connect a voltmeter between U23 pin 2 and ground.

D. Apply power to the exciter switcher.

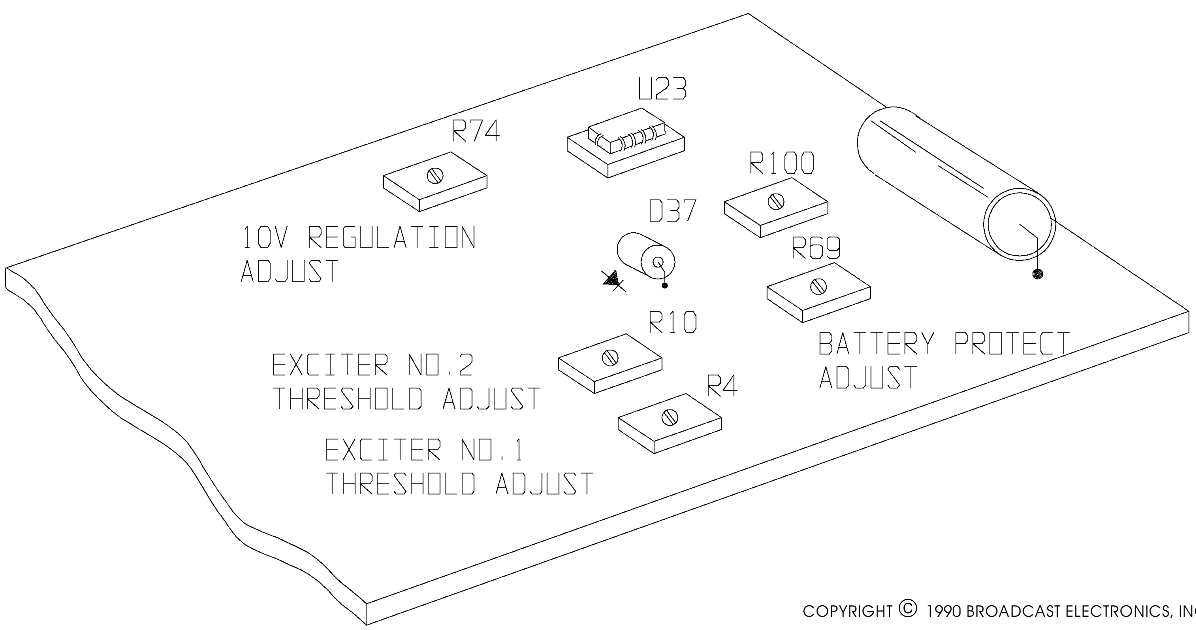

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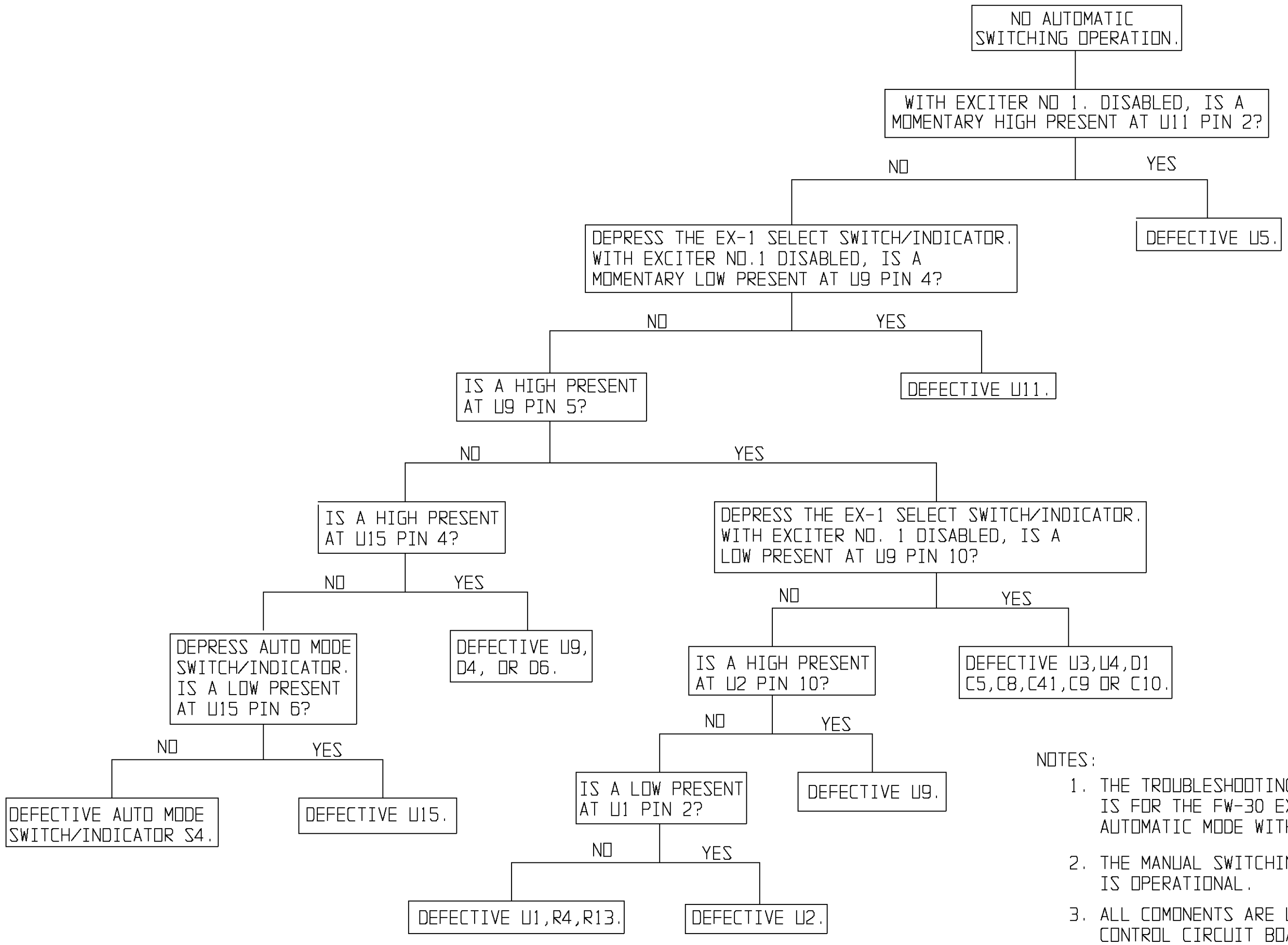
FIGURE 5-1. FW-30 CONTROL LOGIC CIRCUIT BOARD ADJUSTMENTS



NOTES:

1. THE TROUBLESHOOTING INFORMATION PRESENTED IS FOR THE FW-30 EXCITER SWITCHER IN THE AUTOMATIC MODE WITH EXCITER NO. 1 ENABLED.
2. THE MANUAL SWITCHING CIRCUITRY IS OPERATIONAL.
3. ALL COMONENTS ARE LOCATED ON THE LOGIC CONTROL CIRCUIT BOARD UNLESS OTHERWISE SPECIFIED.

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FIGURE 5-2. TROUBLESHOOTING TREE, NO AUTOMATIC SWITCHING OPERATION

E. Refer to Figure 5–1 and adjust R69 until the voltmeter indicates +2.5V dc.

F. Disconnect the primary power to the exciter switcher.

G. Remove the test equipment and replace the top–cover.

5–19. **POWER FAILURE DETECT ADJUSTMENT.** Potentiometer R100 on the switcher logic circuit board adjusts the threshold of the power failure detect circuit. Due to the critical operation of this circuit, field adjustment is not recommended. If components in the circuit have been replaced and adjustment is required, contact the Broadcast Electronics Customer Service Department for a recommended adjustment procedure.

5–20. **TROUBLESHOOTING.**

5–21. The troubleshooting philosophy for the FW–30 exciter switcher consists of isolating a problem to a specific circuit. The problem may be further isolated by referencing the following information and Figure 5–2 which presents the FW–30 troubleshooting information.

WARNING
WARNING

DISCONNECT THE POWER SOURCE FROM THE EXCITER SWITCHER BEFORE REMOVING OR REPLACING ANY COMPONENTS.

CAUTION
CAUTION

INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS OR CIRCUIT BOARDS WITH TEST EQUIPMENT MAY CAUSE SERIOUS DAMAGE TO THE EXCITER SWITCHER.

5–22. After the problem is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to assist in problem resolution. The defective component may be repaired locally or the entire device may be returned to Broadcast Electronics Inc. for repair or replacement.

5–23. **MONITOR OUTPUT CONNECTOR.** A monitor output terminal on an FW–30 configured for FX–50 interfacing is provided to facilitate troubleshooting a defective exciter. Refer to Figure 5–3 and connect the appropriate test equipment to the monitor terminal as required.

WARNING
WARNING

DISCONNECT POWER BEFORE REMOVING OR REPLACING CIRCUIT BOARDS OR COMPONENTS.

CAUTION
CAUTION

WHEN REPLACING A COMPONENT MOUNTED ON A HEAT–SINK, ENSURE A THIN FILM OF A ZINC–BASED HEAT–SINK COMPOUND IS USED TO ASSURE GOOD HEAT DISSIPATION.

5–24. **COMPONENT REPLACEMENT.**

5–25. On all circuit boards, the adhesion between the copper trace and the circuit board fails at almost the same temperature as solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small soldering iron with steady pressure is required for circuit board repairs.

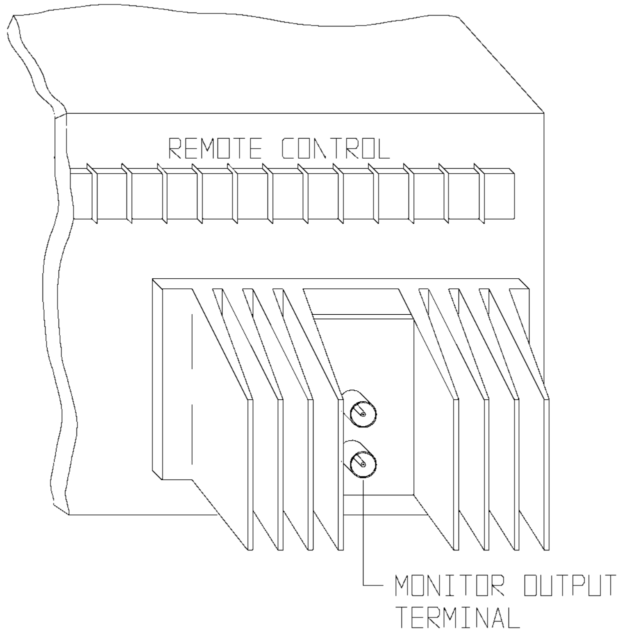


FIGURE 5-3. FW-30 MONITOR OUTPUT CONNECTOR

5–26. To remove a soldered component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board. Grip a component lead with needle–nose pliers. Touch the soldering iron to the lead at the solder connection on the circuit side of the board. When the solder begins to melt, push the lead through the back side of the board and cut off the clinched end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared by careful re–heating with a low wattage iron and removing solder with a soldering vacuum tool.

5–27. Install the new component and apply solder from the circuit side of the board. If no damage has been incurred to the plated–through holes, soldering of the component side of the board will not be required.

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

WARNING

WARNING ***OBSERVE THE MANUFACTURES CAUTIONARY INSTRUCTIONS.***

WARNING

5–28. After soldering, remove residual flux with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5–29. The board should be checked to ensure the flux has been completely removed. Rosin flux is not normally corrosive; however, in time the flux will absorb enough moisture to become conductive and create problems.

5-30. **INTEGRATED CIRCUITS.** Special care should be exercised with integrated circuits. Each integrated circuit must be installed by matching the integrated circuit notch with the notch on the socket. Do not attempt to remove an integrated circuit from a socket with your fingers. Use an integrated circuit puller to pry the component from the socket.

SECTION VI
PARTS LISTS

6–1. INTRODUCTION.

6–2. The following data provides descriptions and part numbers of parts and assemblies required for maintenance of the FW–30 automatic exciter switcher. Each table entry is indexed by reference designators on the applicable schematic diagram.

6–3. Table 6–1 indexes all tables listing assemblies and sub–assemblies having replaceable parts, the table number listing the parts, and the page number of the applicable table.

TABLE 6-1. REPLACEABLE PARTS LIST INDEX

TABLE NO.	DESCRIPTION	PART NO.	PAGE
6–2	AUTOMATIC EXCITER SWITCHER	909–0120–004/ –304	6–2
6–3	AUTOMATIC EXCITER SWITCHER CIRCUIT BOARD ASSEMBLY	919–0073	6–3
6–4	AUTOMATIC EXCITER SWITCHER CABLE HARNESS	949–0127	6–6
6–5	FW–30 EXCITER SWITCHER, MODIFIED FOR FM–100C/FM–250C SYSTEMS	959–1251	6–7

TABLE 6-2. AUTOMATIC EXCITER SWITCHER - 909-0120-004/304

TABLE NO.	DESCRIPTION	PART NO.	PAGE
BT1 THRU BT4	Battery, Rechargeable, X-Cell, 5 Ampere-Hour, 2 Volt	357-6900	4
C1,C2	Capacitor, Electrolytic, 4700 uF, 35V	014-4795	2
C3	Capacitor, Mica, 2 pF ±0.5 pF, 500V	040-2000	1
C4 THRU C7	Capacitor, Electrolytic, 10 uF, 35V	023-1076	4
D1	Full-Wave Bridge Rectifier, MDA3502, Silicon, 200 V, 35 Amperes	230-3502	1
D2	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
DT1	Transient Voltage Suppressor, 1N6279A, 22V ±0.1V, Maximum Peak Pulse Current: 49A	206-0001	1
F1, SPARE	Fuse, 3AG, 3.0 Amperes, 250V, Slow-Blow (For 110V Operation)	334-0300	2
F1, SPARE	Fuse, AGC, 1.5 Ampere, 250V, Slow-Blow (For 220V Operation)	334-0150	4
FL1	Fused Power Connector, 120/240V, Voltage Selector, EMI Filter	360-6504	1
J1,J2	Receptacle, BNC	417-0203	2
R1	Resistor, 50 Ohm, 150 Watt, Non-Inductive	131-5027	1
R2	Resistor, 15 k Ohm ±1%, 1/4W	100-1551	1
S1	Switch, Toggle, Miniature DPDT, 0.4 VA Contacts at 20V Maximum ac or dc (**MUTE**)	348-7201	1
S2	Relay, Coaxial RF Transfer Coil: 26.5V dc, DC Resistive: 125 Ohms ±10% Contacts: Two Sets SPDT 200W RF @ 50 Ohms	340-0066-001	1
S3 THRU S6	Switch, Push, SPDT, N.O. Momentary Contacts, 0.1A @ 125V ac/dc (**MODE** and **SELECT** Switches)	340-0071	4
S7,S8	Switch, Toggle, Miniature DPDT, 0.4 VA Contacts at 20V Maximum ac or dc (**CONTROL** and **BATT**)	348-7201	2
T1	Transformer, Power Primary: Dual 115V, One Winding Tapped at 95V, 50/60 Hz Secondary: 25.5V @ 1A, 13.2V @ 3A	376-0218	1
TB1	Barrier Strip, 14 Terminals	412-0014	1
U1,U2	Integrated Circuit, LM317K, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere Maximum, TO-3 Case	227-0318	2
XS3 THRU XS6	Subminiature Lamp, No. 85, T-1 3/4 Base, 28V @ 0.04 Amperes	321-0085	4
XU1,XU2	Socket, TO-3 Transistor	417-0298	2
----	Switch Cap, Red (S3)	346-1018	1
----	Switch Cap, Green (S4,S5,S6)	340-0016	3
----	Fuse Clip (for spare fuse)	415-1001	2
----	Insulator, TO-3 (for U1,U2)	418-0010	2
----	Nylon Locking Standoff (for circuit board)	441-9311	5
----	Connector, 25-Pin	417-0251	1
----	Pin, Connector	418-0048	25
----	AC Line Cord, N.E.M.A. 3-wire 5-15P North American Plug	682-0001	1
----	Automatic Exciter Switcher Circuit Board Assembly	919-0073	1
----	Automatic Exciter Switcher Cable Harness	949-0127	1

TABLE 6-3. AUTOMATIC EXCITER SWITCHER CIRCUIT BOARD ASSEMBLY - 919-0073
(Sheet 1 of 4)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
C1 THRU C5	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	5
C6	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C7	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C8	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	1
C9	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C10	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C11 THRU C13	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	3
C14,C15	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
C16	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	1
C17	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C18	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C19,C20	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
C21 THRU C24	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	4
C25	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C26	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030-1043	1
C27 THRU C34	Capacitor, Electrolytic, 10 uF, 35V	023-1076	8
C35	Capacitor, Electrolytic, 4700 uF, 50V	014-4793	1
C36	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030-1053	1
C37	Capacitor, Electrolytic, 33 uF, 35V, Low Leakage	024-3335	1
C38,C39	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
C40	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C41,C42	Capacitor, Electrolytic, 1 uF, 50V, Non-Polarized	020-1064	2
C43	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
D1 THRU D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	28
D29 THRU D36	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	8
D37	Diode, MR751, Silicon, 100V @ 6 Amperes	202-0751	1
D38 THRU D40	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	3
D41 THRU D46	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	6
D47 THRU D53	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	7
D54	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200-4733	1
DS1	Indicator, LED, Red, CM6-86B, 2.2V @ 0.1 Ampere Maximum, T-1 3/4 Size	323-0023	1
DS2	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum, T-1 3/4 Size	323-9224	1
DS3	Indicator, LED, Yellow, 521-9176, 3V @ 30 mA Maximum, T-1 3/4 Size	323-9225	1
DS4	Indicator, LED, Red, CM6-86B, 2.2V @ 0.1 Ampere Maximum, T-1 3/4 Size	323-0023	1
DS5,DS6	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum, T-1 3/4 Size	323-9224	2
DT1	Transient Voltage Suppressor, 1N6284A, 36V ±1.8V, Maximum Peak Pulse Current: 30A	206-0002	1
J1,J2	Receptacle, 12-Pin	417-1276	2

TABLE 6-3. AUTOMATIC EXCITER SWITCHER CIRCUIT BOARD ASSEMBLY - 919-0073
(Sheet 2 of 4)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
J3	Receptacle, 6-Pin	417-0677	1
J4,J5,J6	Receptacle, 12-Pin	417-1276	3
J7,J8	Receptacle, Male, 2-Pin In-Line	417-4004	2
J9,J10	Receptacle, Male, 3-Pin In-Line	417-0003	2
K1	Relay, Circuit Board Mount Contacts: SPDT, 100V dc @ 8 Amperes Maximum Coil: 12V dc, 140 mA, 85 Ohms ±10 Ohms	272-0106	1
P7 THRU P10	Jumper, 2-Pin	340-4004	4
Q1	Transistor, 2N3904, Silicon, NPN, TO-92 Case	211-3904	1
Q2,Q3	Transistor, MPSA06, Silicon, NPN, TO-92 Case	211-0006	2
Q4	Transistor, 2N3053, Silicon, NPN, TO-39 Case	211-3053	1
Q5	Transistor, 2N4036, Silicon, PNP, TO-39 Case	210-4036	1
R1	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R2,R3	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	2
R4	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	1
R5 THRU R7	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	3
R8	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R9	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R10	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	1
R11,R12	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	2
R13 THRU R16	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	4
R17	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R18,R19	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R20	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R21,R22	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R23	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R24	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R25	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R26	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R27,R28	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R29,R30	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	2
R31	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R32	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R33,R34	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R35,R36	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	2
R37,R38	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	2
R39,R40	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R41	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R42	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R43	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R44	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R45,R46	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	2
R47 THRU R49	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	3
R50	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	1
R51	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R52	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1

TABLE 6-3. AUTOMATIC EXCITER SWITCHER CIRCUIT BOARD ASSEMBLY - 919-0073 (Sheet 3 of 4)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
R53,R54	Resistor, 22 k Ohm ±5%, 1/4W	100-2253	2
R55	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R56	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	1
R57	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R58	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	1
R59	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R60 THRU R64	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	5
R65	Resistor, 3.9 k Ohm ±5%, 1/4W	100-3943	1
R66	Resistor, 2.32 k Ohm ±1%, 1/4W	103-2341	1
R67	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R68	Resistor, 30 Ohm ±5%, 1W	120-3023	1
R69	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1
R70	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R71	Resistor, 20 k Ohm ±5%, 1/4W	100-2053	1
R72	Resistor, 4.7 k Ohm ±5%, 1/4W	100-4743	1
R73	Resistor, 2 k Ohm ±5%, 1/4W	100-2043	1
R74	Potentiometer, 100 Ohm ±10%, 1/2W	177-1034	1
R75	Resistor, 820 Ohm ±5%, 1/4W	100-8233	1
R76	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R77	Resistor, 365 Ohm ±1%, 1/4W	103-3631	1
R79	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R80 THRU R83	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	4
R84	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R85 THRU R87	Resistor, 680 Ohm +5%, 1/4W	100-6833	3
R88	Resistor, 1 k Ohm +5%, 1/2W	110-1043	1
R89	Resistor, 10 k Ohm +5%, 1/2W	110-1053	1
R90	Resistor, 47 Ohm +5%, 1/2W	110-4723	1
R91	Resistor, 680 Ohm +5%, 1/4W	100-6833	1
R92,R93	Resistor, 499 k Ohm +1%, 1/4W	103-4996	2
R94,R95	Resistor, 10 k Ohm +5%, 1/4W	100-1053	2
R96	Resistor, 100 k Ohm +5%, 1/4W	100-1063	1
R98,R99	Resistor, 10 k Ohm +5%, 1/4W	100-1053	2
R100	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1
R101	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R102	Resistor, 510 Ohm +5%, 1/4W	100-5153	1
U1	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U2	Integrated Circuit, ULN2003A, 7 Section NPN Darlington Driver, CMOS, 16-Pin DIP	229-2003	1
U3,U4	Integrated Circuit, NE555V, Timer, 8-Pin DIP	229-0555	2
U5	Integrated Circuit, CD4027BE, Dual J-K Master-Slave Flip-Flop, CMOS, 16-Pin DIP	225-0003	1
U6,U7	Integrated Circuit, NE555V, Timer, 8-Pin DIP	229-0555	2
U8,U9	Integrated Circuit, MC14011BCP, Quad 2-Input NAND Gate, CMOS, 14-Pin DIP	228-4011	2
U10	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14-Pin DIP	228-4069	1

TABLE 6-3. AUTOMATIC EXCITER SWITCHER CIRCUIT BOARD ASSEMBLY - 919-0073 (Sheet 4 of 4)

TABLE NO.	DESCRIPTION	PART NO.	PAGE
U11	Integrated Circuit, MC14584, Hex Schmitt Trigger, CMOS, 14-Pin DIP	228-4584	1
U12,U13	Integrated Circuit, MC14001BCP, Quad 2-Input NOR Gate, CMOS, 14-Pin DIP	228-4001	2
U14	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14-Pin DIP	228-4069	1
U15	Integrated Circuit, MC14011BCP, Quad 2-Input NAND Gate, CMOS, 14-Pin DIP	228-4011	1
U16	Integrated Circuit, ULN2003A, 7 Section NPN Darlington Driver, CMOS, 16-Pin DIP	229-2003	1
U17 THRU U22	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	6
U23	Integrated Circuit, TL311P, JFET-Input Differential Comparator, 8-Pin DIP	220-0311	1
U24	Integrated Circuit, LM336Z-2.5, Precision Voltage Reference, 2.5V ±4%, 0 to +705C, TO-92 Case	229-0336	1
U25	Integrated Circuit, MC7824ACT, Fixed Positive Voltage Regulator, 24V @ 1.5A, TO-220 Case	227-7824A	1
U26 THRU U29	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Diode, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	4
U30	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
XU1	Socket, 14-Pin DIP	417-1404	1
XU2	Socket, 16-Pin DIP	417-1604	1
XU3,XU4	Socket, 8-Pin DIP	417-0804	2
XU5	Socket, 16-Pin DIP	417-1604	1
XU6,XU7	Socket, 8-Pin DIP	417-0804	2
XU8 THRU XU15	Socket, 14-Pin DIP	417-1404	8
XU16	Socket, 16-Pin DIP	417-1604	1
XU23	Socket, 8-Pin DIP	417-0804	1
XU30	Socket, 16-Pin DIP	417-1604	1
----	Nylon Washer, Flat, (for Q2,Q3) Outside Diameter: 0.312 Inches (0.792 cm) Inside Diameter: 0.141 Inches (0.358 cm)	423-6015	2
----	Transistor Pad, TO-5	409-0005	2
----	Blank Circuit Board	519-0073	1

TABLE 6-4. AUTOMATIC EXCITER SWITCHER CABLE HARNESS - 949-0127

TABLE NO.	DESCRIPTION	PART NO.	PAGE
J1	Receptacle, 25-Pin	417-0015	1
P1,P2	Plug, 12-Pin	418-1271	2
P3	Plug, 6-Pin	418-0670	1
P4,P5,P6	Plug, 12-Pin	418-1271	3
P7 THRU P10	Plug, Miniature, for RG58/CU Coaxial Cable	418-0047	4
P11 THRU P14	Plug, BNC	417-0094	4
----	Pins for P1 thru P6	417-0053	52

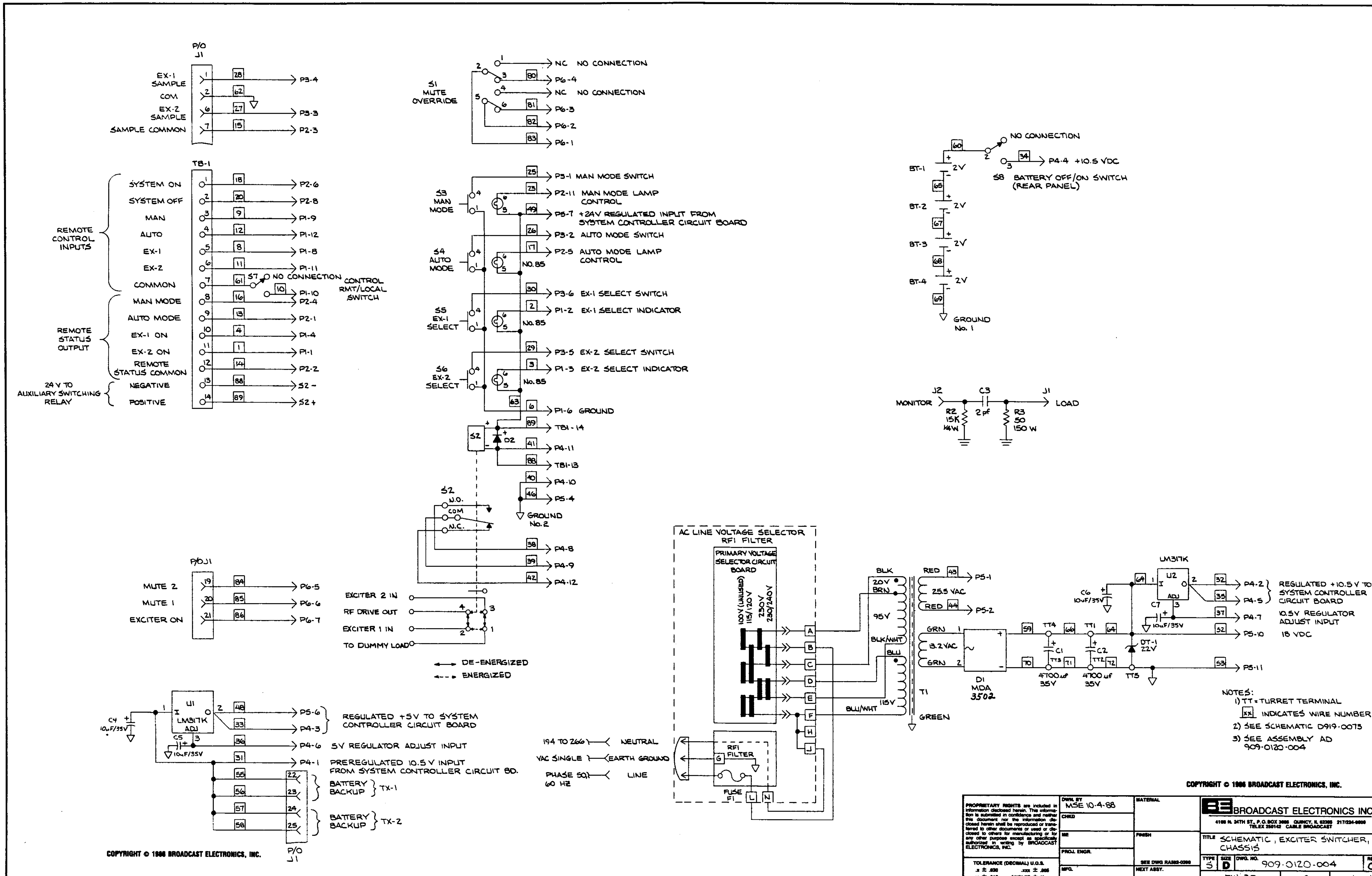
TABLE 6-5. FW-30 EXCITER SWITCHER, MODIFIED FOR FM-100C/FM-250C SYSTEMS- 959-1251

TABLE NO.	DESCRIPTION	PART NO.	PAGE
BT1 THRU BT4	Battery, Rechargeable, X–Cell, 5 Ampere–Hour, 2 Volt	357–6900	4
C1,C2	Capacitor, Electrolytic, 4700 uF, 35V	014–4795	2
C4 THRU C7	Capacitor, Electrolytic, 10 uF, 35V	023–1076	4
DT1	Transient Voltage Suppressor, 1N6279A, 22V ±0.1V, Maximum Peak Pulse Current: 49A	206–0001	1
FL1	Fused Power Connector, 120/240V, Voltage Selector, EMI Filter	360–6504	1
S1	Switch, Toggle, Miniature DPDT, 0.4 VA Contacts at 20V Maximum ac or dc (**MUTE**)	348–7201	1
S3 THRU S6	Switch, Push, SPDT, N.O. Momentary Contacts, 0.1A @ 125V ac/dc (**MODE** and **SELECT** Switches)	340–0071	4
S7, S8	Switch, Toggle, Miniature DPDT, 0.4 VA Contacts at 20V Maximum ac or dc (**CONTROL** and **BATT**)	348–7201	2
T1	Transformer, Power Primary: Dual 115V, One Winding Tapped at 95V, 50/60 Hz Secondary: 25.5V @ 1A, 13.2V @ 3A	376–0218	1
TB1	Barrier Strip, 14 Terminals	412–0014	1
U1,U2	Integrated Circuit, LM317K, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere Maximum, TO–3 Case	227–0318	2
----	Socket, TO–3 Transistor	417–0298	2
----	Subminiature Lamp, No. 85, T–1 3/4 Base, 28V @ 0.04 Amperes	321–0085	4
----	Full–Wave Bridge Rectifier, MDA3502, Silicon, 200 V, 35 Amperes	230–3502	1
----	Switch Cap, Red (S3)	346–1018	1
----	Switch Cap, Green (S4,S5,S6)	340–0016	3
----	Fuse Clip (for spare fuse)	415–1001	2
----	Insulator, TO–3 (for U1,U2)	418–0010	2
----	Nylon Locking Standoff (for circuit board)	441–9311	5
----	Connector, 25–Pin	417–0251	1
----	Pin, Connector	418–0048	25
----	Fuse, MDA, 250V, Slow–Blow, Ceramic Element, 4 Amperes	330–0401	2
----	System Controller FM–500 Circuit Board Assembly	919–0073	1
----	Automatic Exciter Switcher Cable Harness	949–0127–001	1
----	Electrical RF Transfer Switch, 28V dc coil @ 0.1 Ampere RF Contacts: Type N Receptacles, 2 X SPDT 1 kW RF @ 50 OhmLoad, Auxiliary Contacts: Wire Terminal, 28V dc Resistive Load	340–0024	1
----	Test Load, 250 Watt	959–1250	1
----	Fuse, 3AG, 3A, 125V Slow Blow	334–0300	2

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides schematic diagrams and assembly diagrams as indexed below for the FW-30 automatic exciter switcher.



P/O J1
EX-1 SAMPLE
COM
EX-2 SAMPLE
SAMPLE COMMON
P3-4
P3-3
P2-3
TB-1
REMOTE CONTROL INPUTS
SYSTEM ON
SYSTEM OFF
MAN
AUTO
EX-1
EX-2
COMMON
S7 NO CONNECTION
CONTROL RMT/LOCAL SWITCH
REMOTE STATUS OUTPUT
MAN MODE
AUTO MODE
EX-1 ON
EX-2 ON
REMOTE STATUS COMMON
24 V TO AUXILIARY SWITCHING RELAY
NEGATIVE
POSITIVE
S1 MUTE OVERRIDE
NC NO CONNECTION
S3 MAN MODE
P3-1 MAN MODE SWITCH
P2-11 MAN MODE LAMP CONTROL
P3-7 +24V REGULATED INPUT FROM SYSTEM CONTROLLER CIRCUIT BOARD
S4 AUTO MODE
P3-2 AUTO MODE SWITCH
P2-5 AUTO MODE LAMP CONTROL
NO.85
S5 EX-1 SELECT
P3-6 EX-1 SELECT SWITCH
P1-2 EX-1 SELECT INDICATOR
S6 EX-2 SELECT
P3-5 EX-2 SELECT SWITCH
P1-3 EX-2 SELECT INDICATOR
P1-6 GROUND
GROUND No. 2
S2 N.O. COM N.C.
EXCITER 2 IN
RF DRIVE OUT
EXCITER 1 IN
TO DUMMY LOAD
DE-ENERGIZED
ENERGIZED
P/O J1
MUTE 2
MUTE 1
EXCITER ON
U1 LM317K ADJ
C4 10uF/35V
C5 10uF/35V
REGULATED +5V TO SYSTEM CONTROLLER CIRCUIT BOARD
5V REGULATOR ADJUST INPUT
PREREGULATED 10.5V INPUT FROM SYSTEM CONTROLLER CIRCUIT BD.
BATTERY BACKUP TX-1
BATTERY BACKUP TX-2
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BT-1 2V
BT-2 2V
BT-3 2V
BT-4 2V
GROUND No. 1
NO CONNECTION
P4-4 +10.5 VDC
S8 BATTERY OFF/ON SWITCH (REAR PANEL)
MONITOR J2
C3 2pf
J1 LOAD
R2 15K 1/4W
R3 50 150 W
AC LINE VOLTAGE SELECTOR RFI FILTER
PRIMARY VOLTAGE SELECTOR CIRCUIT BOARD
100V (UNUSED) 115/120V 230V 230/240V
RFI FILTER
FUSE F1
194 TO 266 VAC SINGLE PHASE 50/60 HZ
NEUTRAL
EARTH GROUND
LINE
BLK 20V BRN
95V
BLK/WHT
BLU
115V
BLU/WHT
T1
GREEN
RED 25.5 VAC RED
GRN 8.2 VAC GRN
D1 MDA 3502
C1 4700uf 35V
C2 4700uf 35V
DT-1 22V
LM317K U2 ADJ
C6 10uF/35V
C7 10uF/35V
REGULATED +10.5 V TO SYSTEM CONTROLLER CIRCUIT BOARD
10.5V REGULATOR ADJUST INPUT
18 VDC
NOTES:
1) TT = TURRET TERMINAL
XX INDICATES WIRE NUMBER
2) SEE SCHEMATIC 0919-0075
3) SEE ASSEMBLY AD 909-0120-004
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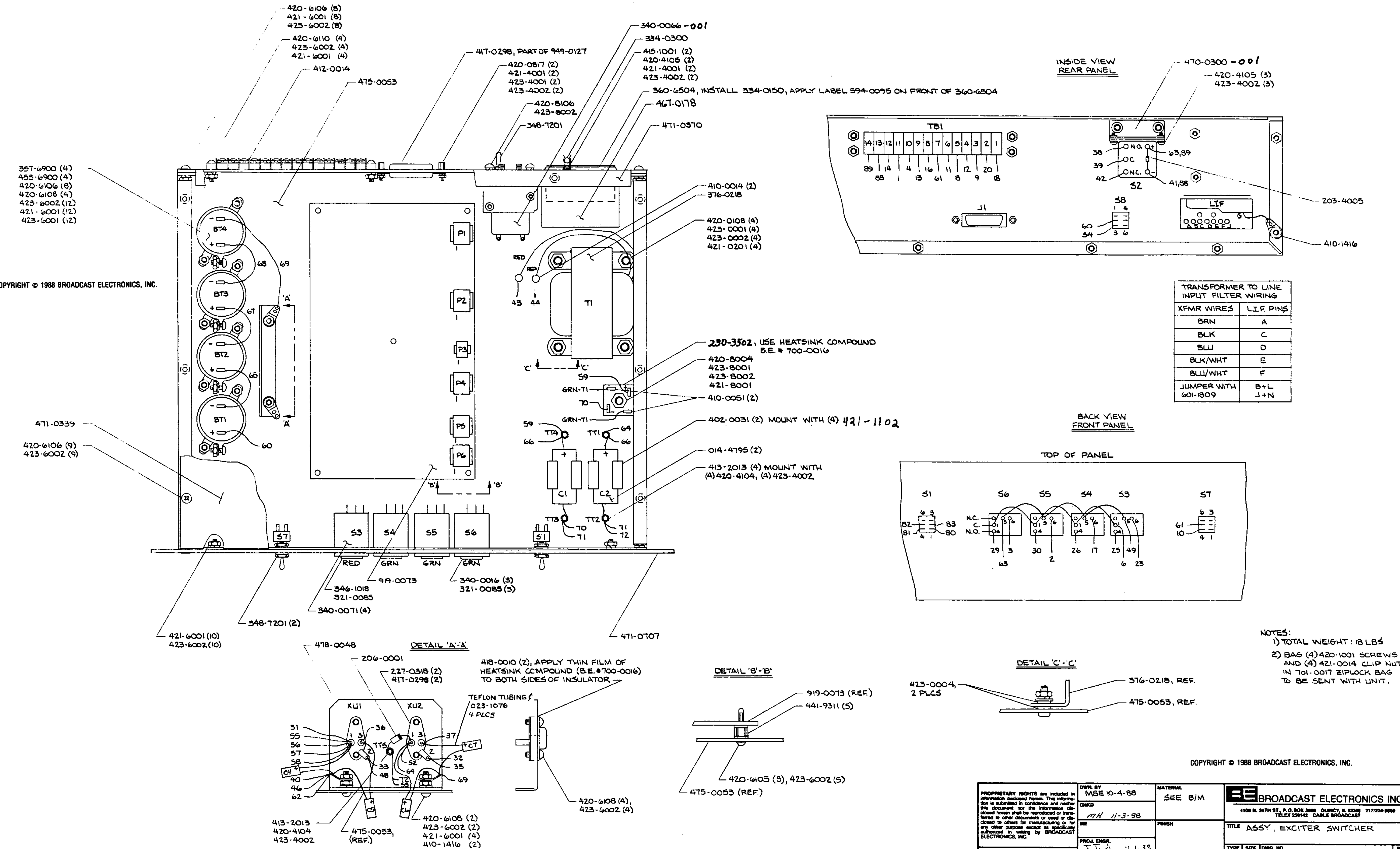
DWN. BY MSE 10-4-88
BROADCAST ELECTRONICS INC.
TITLE SCHEMATIC, EXCITER SWITCHER, CHASSIS
SIZE D DWG. NO. 909-0120-004 REV C
MODEL FW-30
SHEET 1 OF 1



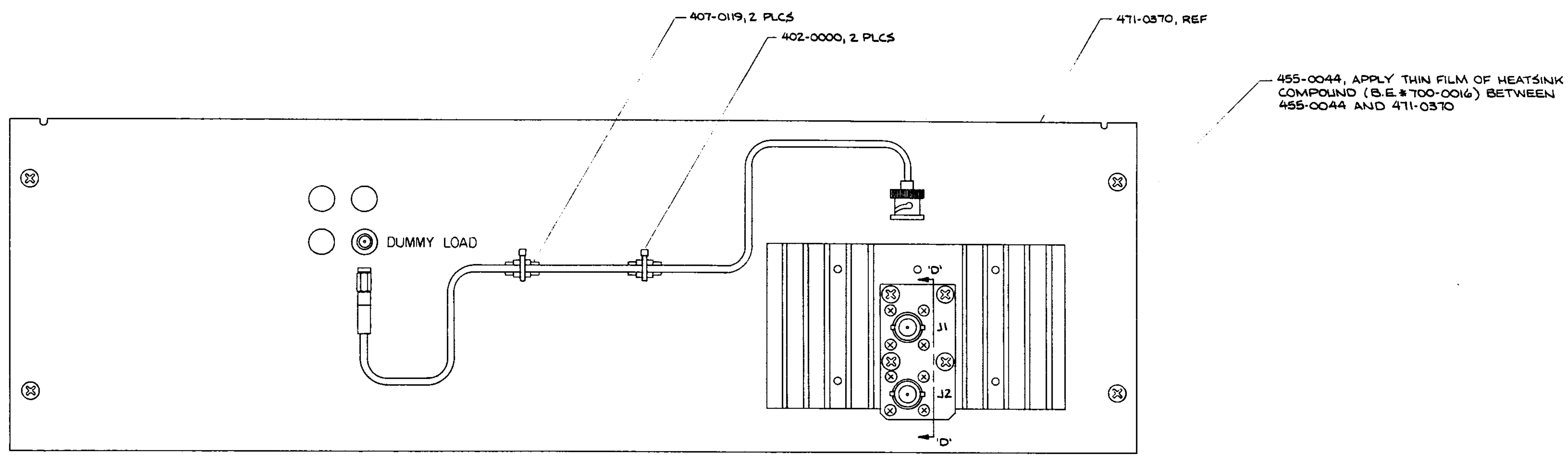
TRANSFORMER TO LINE INPUT FILTER WIRING	
XFMR WIRES	L.I.F. PINS
BRN	A
BLK	C
BLU	D
BLK/WHT	E
BLU/WHT	F
JUMPER WITH 601-1809	B+L J+N

NOTES:
1) TOTAL WEIGHT: 18 LBS
2) BAG (4) 420-1001 SCREWS AND (4) 421-0014 CLIP NUTS IN 701-0017 ZIPLOCK BAG TO BE SENT WITH UNIT.

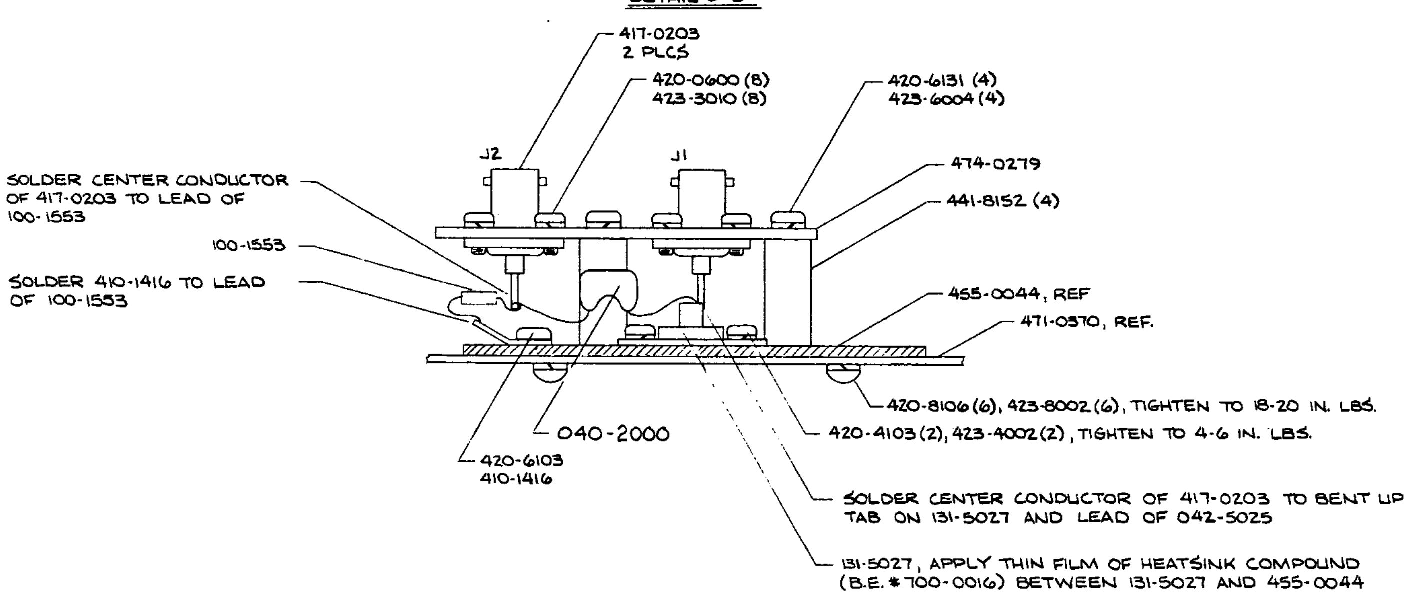
TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY MSE 10-4-88	MATERIAL SEE B/M	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST	
CHKD MH 11-3-88			
ME	FINISH	TITLE ASSY, EXCITER SWITCHER	
PROJ. ENGR. J. T. 11-1-88	SEE DWG RA882-0000	TYPE A SIZE D DWG. NO. 909-0120-004	REV E
MFG.	NEXT ASSY.	MODEL FW-30 SCALE ~	SHEET 1 OF 2

REAR VIEW
BACK PANEL



DETAIL 'D'-'D'



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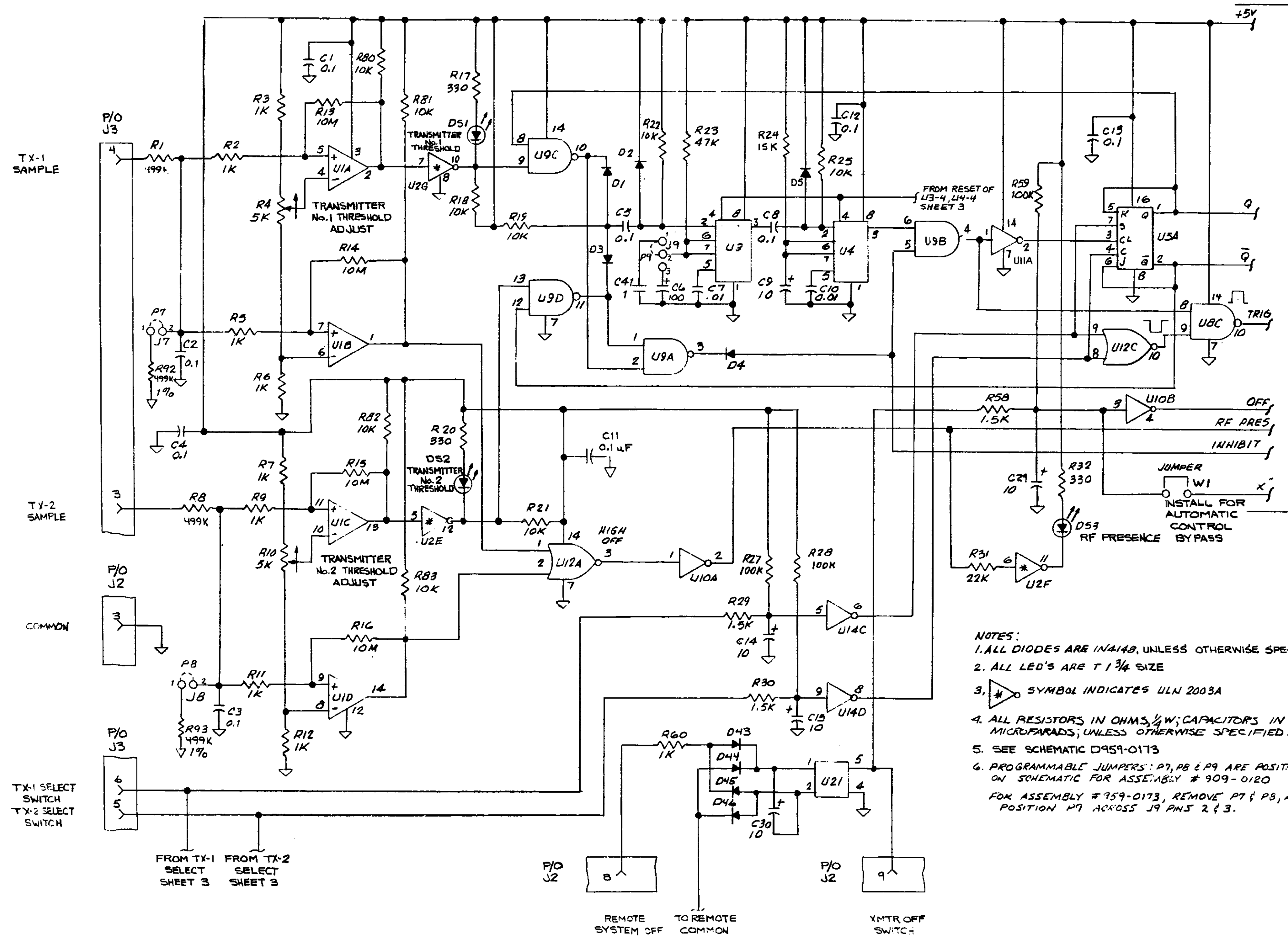
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 10-4-88	MATERIAL SEE B/M	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST
CHKD JJH 11-3-88		TITLE ASSY, EXCITER SWITCHER
ME	FINISH	
PROJ. ENGR. J. Tucker 11-1-88	SEE DWG RA592-0000	TYPE A / SIZE D / DWG. NO. 909-0120-004 / REV E
MFG. 11-1-88	NEXT ASSY.	MODEL FW-30 / SCALE 1/1 / SHEET 2 OF 2

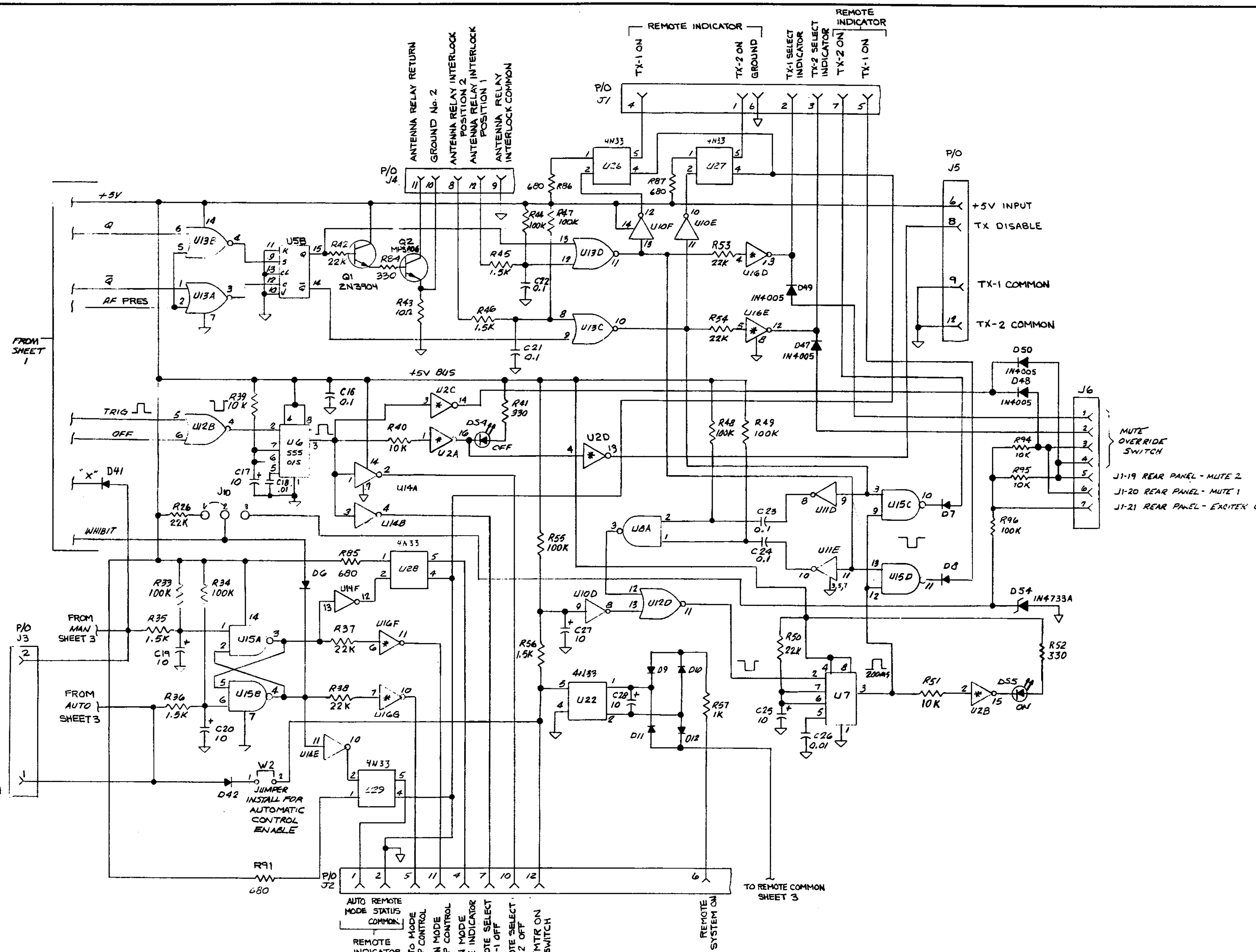


NOTES:

1. ALL DIODES ARE IN4148, UNLESS OTHERWISE SPECIFIED
2. ALL LED'S ARE T 1 3/4 SIZE
3. ✱ SYMBOL INDICATES ULN 2003A
4. ALL RESISTORS IN OHMS, 1/4 W; CAPACITORS IN MICROFARADS; UNLESS OTHERWISE SPECIFIED.
5. SEE SCHEMATIC D959-0173
6. PROGRAMMABLE JUMPERS: P7, P8 & P9 ARE POSITIONED ON SCHEMATIC FOR ASSEMBLY # 909-0120
   FOR ASSEMBLY # 959-0173, REMOVE P7 & P8, AND POSITION P7 ACROSS J9 PINS 2 & 3.

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

DWN. BY RHE 17 DEC 84	MATERIAL	BROADCAST ELECTRONICS INC.	
CHKD		4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST	
ME	FINISH	TITLE SYSTEM CONTROLLER CIRCUIT BOARD SCHEMATIC	
PROJ. ENGR. JS		TYPE S SIZE D DWG. NO. 917-0073	REV R
MFG.	NEXT ASSY.	MODEL FM 30 A / FM 30 MA SCALE —	SHEET 1 OF 3



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

DWN. BY	RHB 17APR 84
CHKD	
ME	
PROJ. ENGR.	JS
MFG.	
MATERIAL	
FINISH	
NEXT ASSY.	

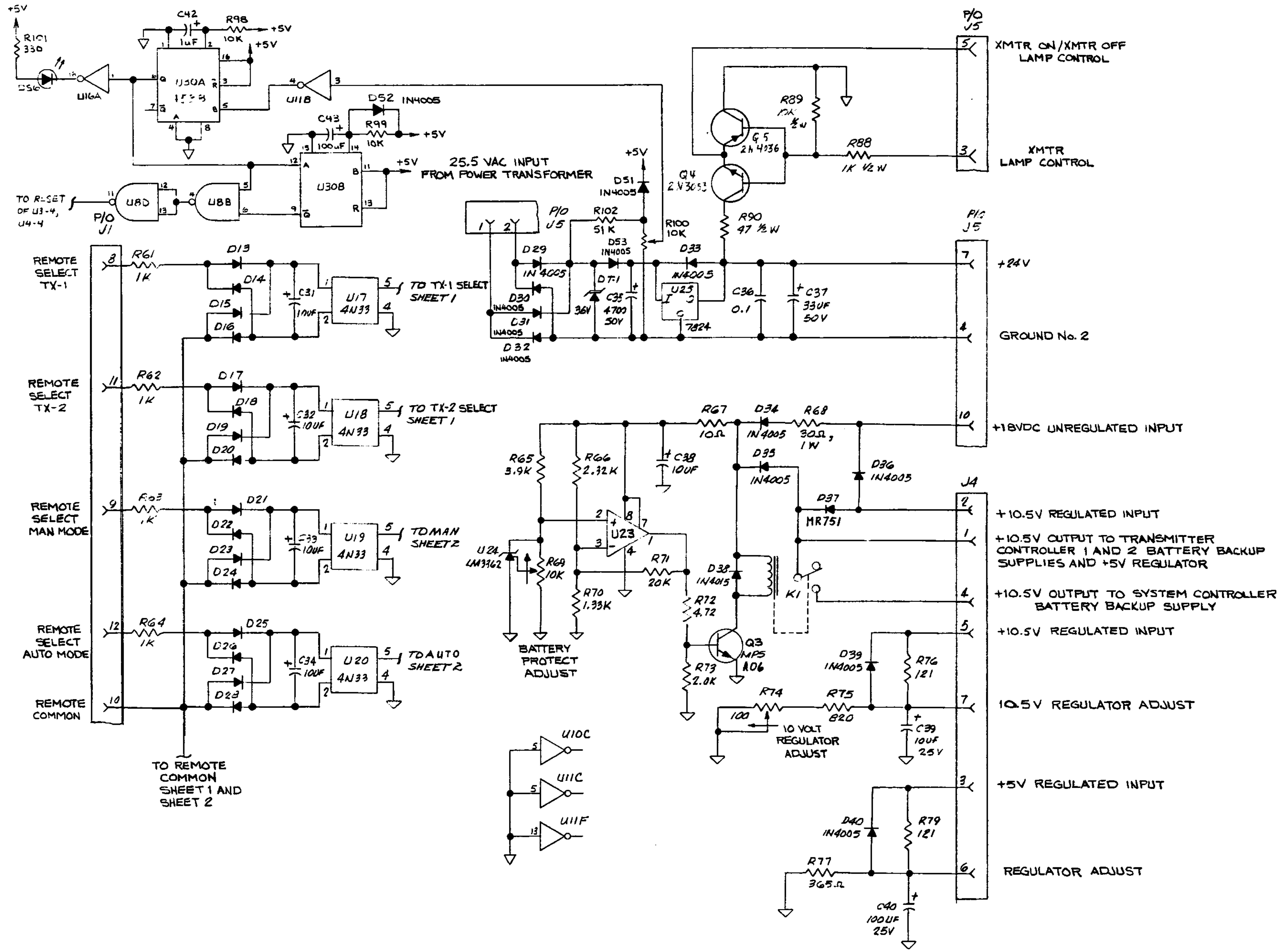
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SYSTEM CONTROLLER CIRCUIT BOARD SCHEMATIC

TYPE	SIZE	DWG. NO.	REV
S	D	919-0073	R

MODEL FM 300A | SCALE — | SHEET 2 OF 3

FM 300 MA



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

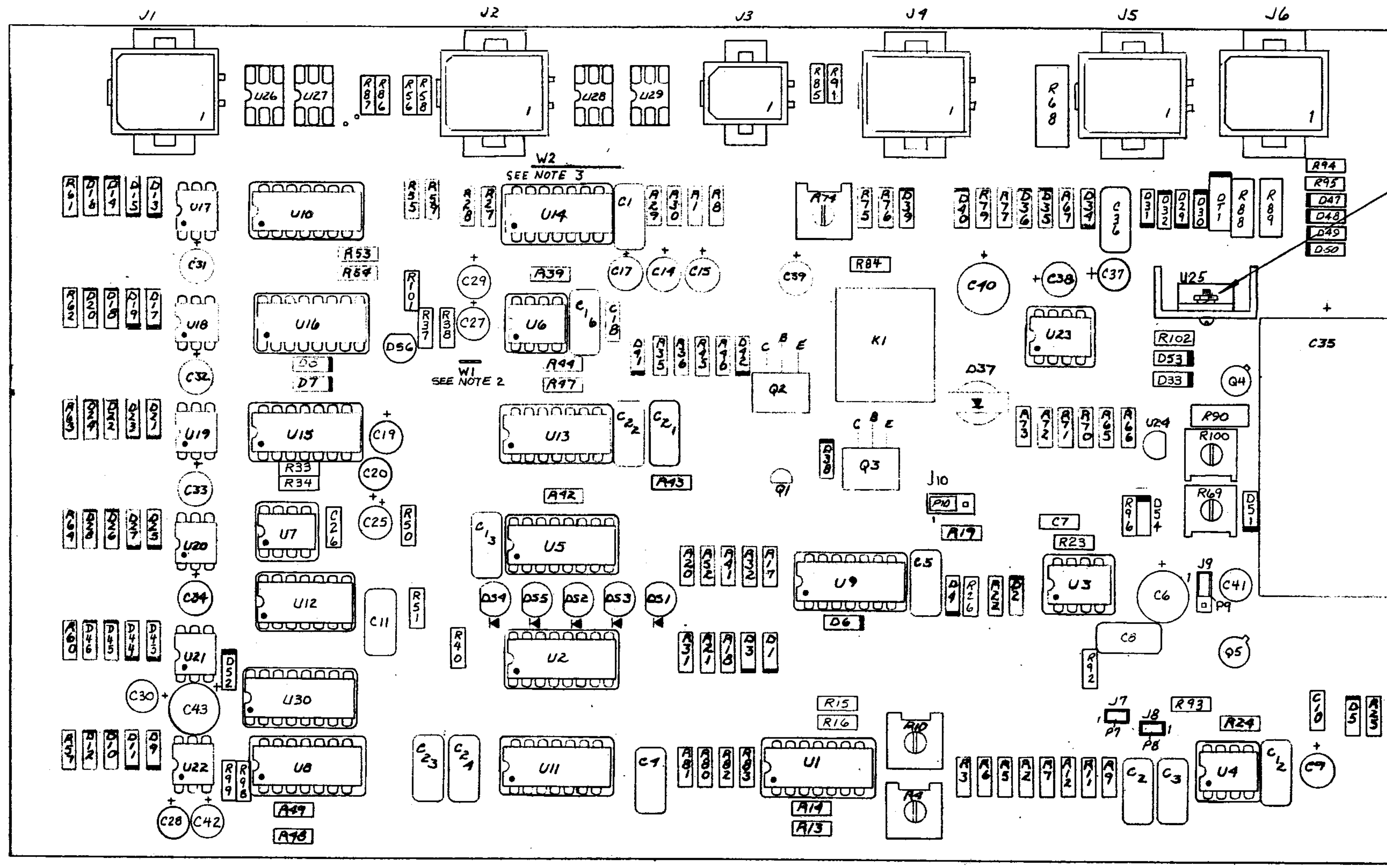
DWN. BY	RHB 17 APR 84
CHKD	
ME	
PROJ. ENGR.	JS
MFG.	
MATERIAL	
FINISH	
NEXT ASSY.	

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

TITLE SYSTEM CONTROL CIRCUIT BOARD SCHEMATIC

TYPE	SIZE	DWG. NO.	REV
S	D	719-0073	R

MODEL FM 300 MA / FM 30 A — SCALE — — SHEET 3 OF 3



USE HEAT TRANSFER COMPOUND.
420-4105
421-4001
423-4002

NOTES:

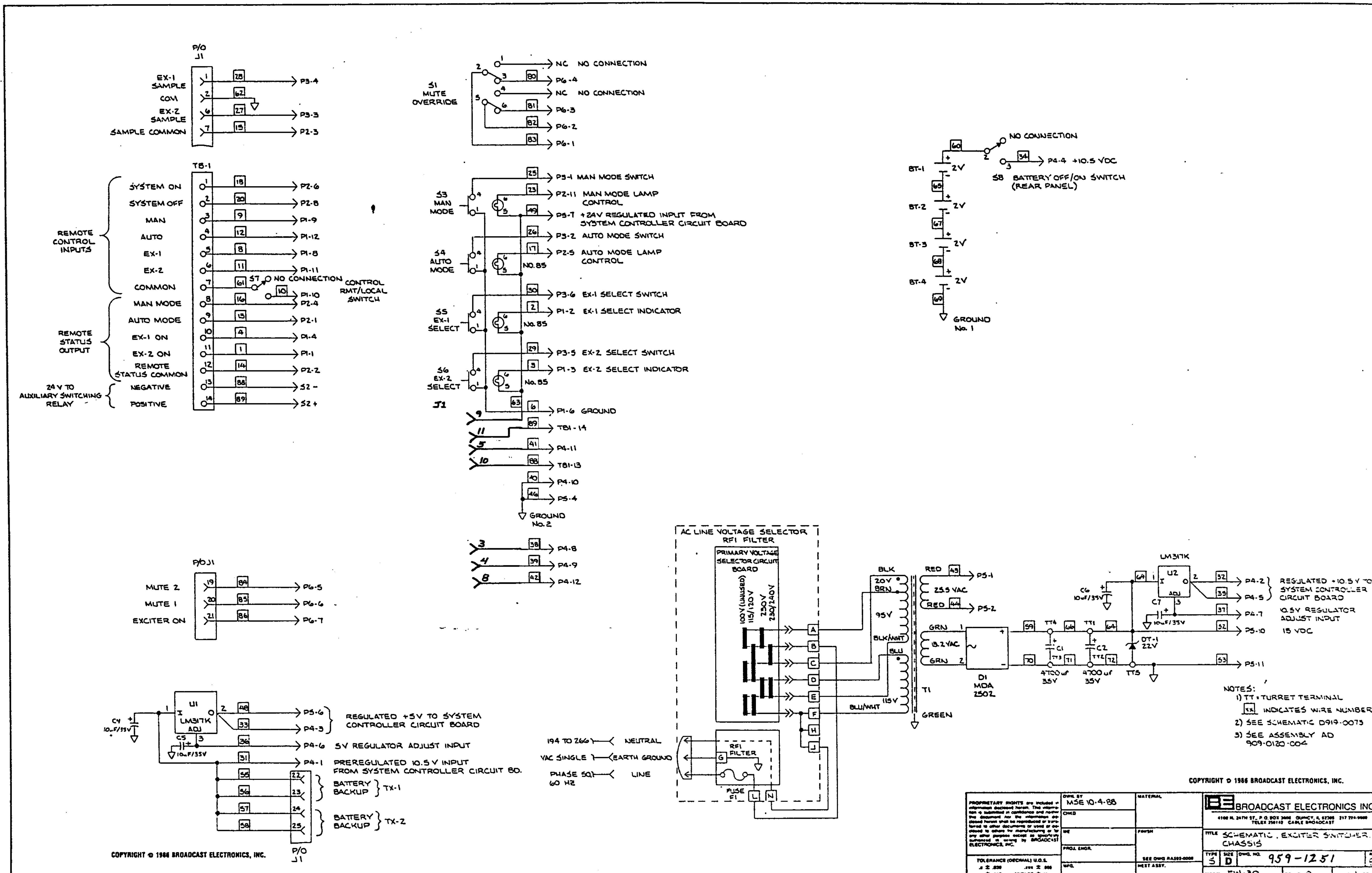
5. PROGRAMMABLE JUMPERS P7, P8 & P9 ARE POSITIONED ON PCB FOR ASSEMBLY # 909-0120

6. IF PCB IS TO BE USED FOR ASSEMBLY 959-0173, REMOVE P7 & P8, AND JUMPER P9 ACROSS J9 PINS 2 & 3.

NOTES:

1. SEE SCHEMATIC SD 917-0073 PAGE 1,2+3
2. 22 GA. JUMPER WITH TEFLON SLEEVING
3. 22 GA. JUMPER
4. ALL 1/4 WATT COMPONENTS ARE FORMED .50 "A" DIM.

PROPRIETARY RIGHTS [illegible]	DWN BY RHB 23 FEB 84	MATERIAL	BE BROADCAST ELECTRONICS INC. 4100 N. 24TH ST. P.O BOX 3606 QUINCY, IL 62305 217 224-9600 TELEX 250142 CABLE BROADCAST
	CHKD		TITLE SYSTEM CONTROL PCB ASSEMBLY
	ME	FINISH	TYPE A · SIZE D · DWG. NO 919-0073 · REV P
TOLERANCE (DECIMALS) [illegible] ±.005 ANGLES [illegible]	PRO. ENGR		
	MFG	NEXT ASSY SYS. CONT	MODEL FM30C/FM300HA · SCALE 2/1 · SHEET 1 OF 1



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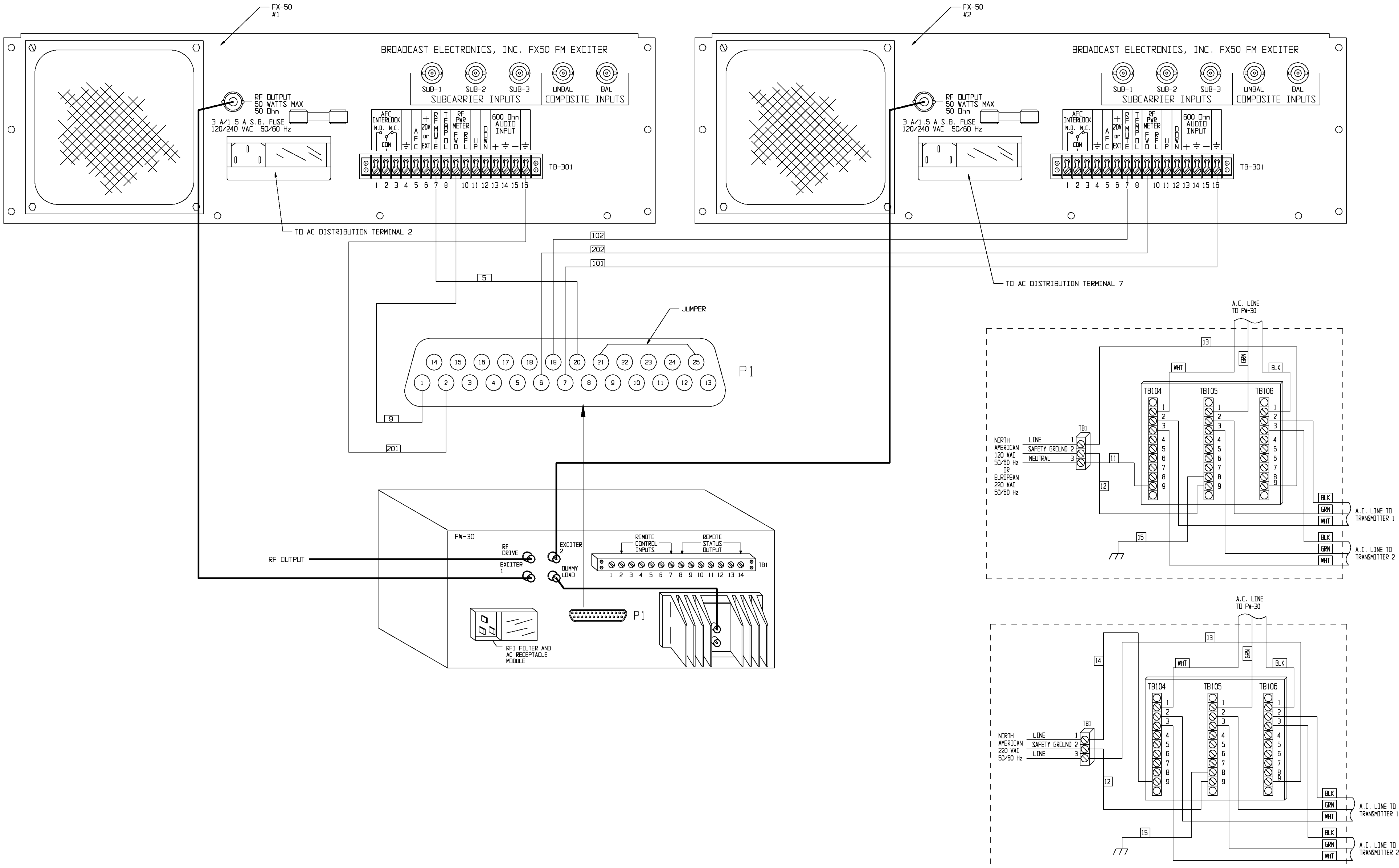
BROADCAST ELECTRONICS INC.

TITLE SCHEMATIC, EXCITER SWITCHER CHASSIS

DWN BY MSE 10-4-88

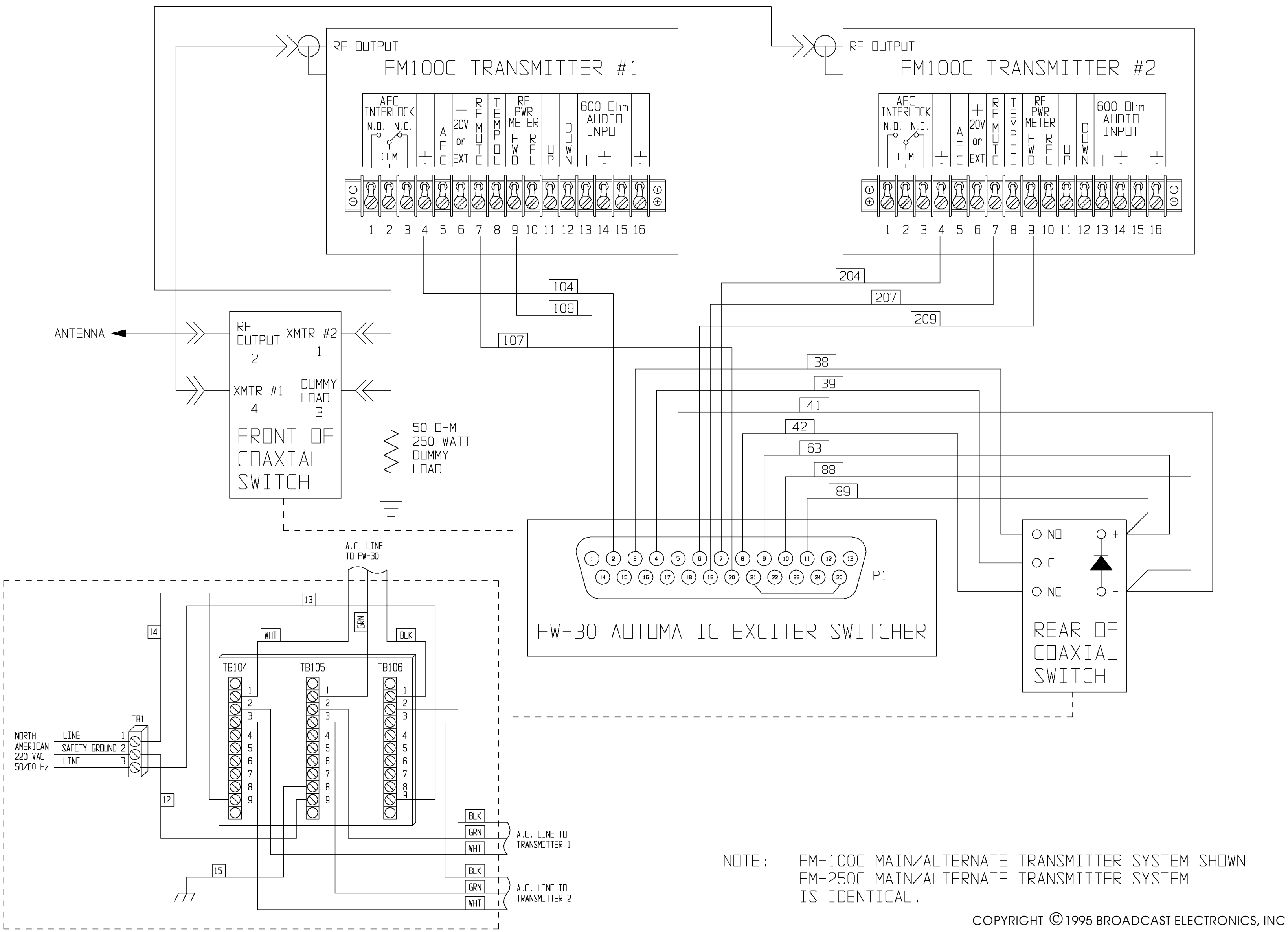
SIZE D DWG. NO. 959-1251

MODEL FW-30 SCALE ~ SHEET 1 OF 1



597-0101-9

FIGURE 7-6. OVERALL SCHEMATIC, FX-50 EXCITER SWITCHER SYSTEM



NOTE: FM-100C MAIN/ALTERNATE TRANSMITTER SYSTEM SHOWN
FM-250C MAIN/ALTERNATE TRANSMITTER SYSTEM
IS IDENTICAL.

597-0101-8

FIGURE 7-7. OVERALL SCHEMATIC, FM-100C/FM-250C EXCITER SWITCHER SYSTEM