LARCAN

TECHNICAL MANUAL

250 WATT TELEVISION TRANSMITTER

MODEL TTS250M

TSM 20-179

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GENERAL DESCRIPTION

OVERVIEW

The LARCAN model TTS250M solid-state VHF translator has been designed to operate conservatively at 250W peak sync visual power, and 25W average aural power. The translator is completely housed in a 52" high cabinet using standard 19" EIA panels.

The translator is designed for operation from nominal 230V single phase 60Hz power. Transformer taps are provided to adjust the amplifier power supply for on-site nominal voltages between 200V and 240V.

AMPLIFIER

The amplifier design is similar to that employed in LARCAN's high power model 'M' series transmitters. The RF amplifier is located in a self-contained slide out drawer. The power output stage use a pair of dual FET RF power transistors operating Class 'AB'. Strip line power splitters and combiners are used at the input and output respectively.

Cooling is provided by a squirrel cage type blower mounted on the rear of the slide out drawer. Air is drawn through a filter in the rear door of the cabinet, blown through the amplifier heatsink and exhausted through a grill at the front of the amplifier. No provision is made for ducting exhaust air.

Metering is provided for voltage, current and RF power. The amplifier is VSWR protected with an automatic cutback circuit.

The power supply is a conventional linear design, with regulators located in the amplifier drawer.

All individual assemblies are modular in design, and easy to access for maintenance and testing. Full interlocking and telemetry facilities are provided.

CIRCUIT DESCRIPTION AND SET UP PROCEDURE

PRE-CORRECTION

The pre-correction circuit used by the amplifier has been set up at the factory and should not require re-adjustment. Technical personnel should be aware that any adjustments performed on these circuits should be slight and may have to be repeated until the desired correction is achieved.

Pre-corrector

The Pre-correction board comprises three separate sections: an input attenuator, a phase corrector and an output amplifier. The input attenuator is made up of R1 through R3. The adjustable phase corrector comprises L1, CR1, and R4. U1 is an amplifier IC and receives power from voltage regulator U2. The amount of correction is controlled by the adjustment of L1. Typically the adjustment is set to correct for the amount of differential phase introduced by the PA stages and this should correspond to approximately unity gain through the Pre-correction board.

Linearity Corrector

The Linearity Corrector board provides a slight amount of linearity correction needed for intermodulation distortion in the PA stages. R2 and C2 control the amount of correction by allowing the signal to be shunted to ground by diodes CR1 and CR2. A higher level signal will cause the diodes to conduct more, shunting more signal to ground. R3 acts as a fine control by varying the bias on CR1 and CR2 through emitter follower Q1.

IPA MODULE

CIRCUIT DESCRIPTION

The amplifier consists of two stages of amplification, a linear hybrid IC and a transistor power stage. Both stages are biased for Class A operation and each has its own set of three terminal regulators for voltage or current regulation.

The signal is first applied to a form of variable attenuator consisting of R2, R6 and R12. The first stage of amplification is a CA2842 hybrid IC; this amplifier provides approximately 22dB of gain. A coaxial cable jumper is provided between this stage and the next to allow for troubleshooting.

The second stage of amplification is a Class A biased MRF325 transistor amplifier. The input section consists of an attenuator/matching network to transform the 50ohm impedance to values needed for optimum transistor performance. Similarly, a matching network at the output of the transistor provides the impedance match to the 50ohm output. C6 and C19 are DC blocking capacitors at the input and output of the amplifier respectively.

DC power to the hybrid stage is provided by a three terminal voltage regulator IC (VR1). This serves to remove hum from the power supply as well as provide an interlocking circuit for other applications. This interlocking function is not used in the 250W amplifier application and thus E2 should have a jumper to ground. The DC power to the output stage is also provided by a three terminal voltage regulator. VR2 is configured as a 1.5A constant current source. The current is set by the voltage drop across R11. The zener diode VR3 will conduct at approximately 22V and forward bias the transistor.

Set up Procedure

- Set up a power supply to 30V; current limited to 3.5A.
- Connect the power supply to E1 of the IPA. The current drawn should be approximately 1.75A.
- Remove the coax jumper.
- Apply a sweep signal to the preamplifier input, being careful not to overdrive the test equipment. The gain should be at least 18dB to 20dB and the return loss better than 15dB in the frequency range of interest.
- Connect a 30dB attenuator to the output of the amplifier.
- Apply a low level sweep to the amplifier and measure the gain (be sure to take into account the 30dB pad). Gain should be about 13dB to 14dB.

POWER AMPLIFIER MODULE

CIRCUIT DESCRIPTION

The PA modules used in the 250W amplifier employ dual FET RF transistor packages in push-pull configuration. The transistors operate Class AB and are biased for 0.6A static drain current per transistor.

The input to the PA module is applied at J1 from the power splitter board. Transformer T1 divides the input into two equal and opposite signals. Capacitors C3, C4 and the associated strip line circuitry form an impedance matching network to the gates of the FETs. C1 and C2 are DC isolation (blocking) capacitors. Capacitors C13 and C16 and associated strip line inductors form an output impedance matching network and T2 combines the out of phase signals at the output J2. C14 and C15 also act as blocking capacitors.

The 50V DC supply is connected to each drain through the 5A fuses and decoupling inductors L4 and L5. Two resistive divider networks comprising R1 through R10 apply gate bias voltage to the FETs to set the static drain current. Zener diodes CR1 and CR2 provide a constant voltage source +20V for the bias voltage adjustment. The FET gate bias required for the recommended 0.6A of quiescent drain current may be anywhere between 2V and 5V depending on the individual FET. Capacitors C6, C7, C9 through C12, C17 and C18 are RF bypass capacitors.

Set up Procedure

- Set up a 50V power supply; current limited to 1.2A.
- Turn both bias potentiometers for maximum resistance.
- Apply the supply to the one transistor at a time (one-half package) and adjust the corresponding bias resistor for 0.6A drain current. This setting

is a starting value. It will be re-adjusted during test for minimum intermods and FM noise.

- Connect a 30dB, 20W attenuator to the output of the amplifier.
- Apply B+ to both supply connections of the amplifier module.
- Apply a low level sweep to the module and measure the gain (be sure to take into account the 30dB pad). Gain should be about 21dB to 24dB.

VOLTAGE REGULATOR BOARD

CIRCUIT DESCRIPTION

The Voltage Regulator board comprises two identical regulator circuits. One is described below; the description for the second is the same except for the component numbers.

The voltage regulated is based on a monolithic regulator IC MC1723CP and a pass transistor for current handling capability. The regulator IC compares a sample of the output voltage to an on-chip reference. The sample is applied to pin 4 through a resistive divider consisting of R7, R9 and R11. Varying R7 changes this sample thus changing the output voltage. The output of the IC (pin 10) drives the PNP transistor U2 through a Darlington transistor Q3.

Short circuit protection is provided by Q1 and Q4. Q4 shunts the drive away from the base of U2 when the output current causes the voltage across R6 and R10 to rise high enough to open transistor Q1. Supply voltage for the IC is via R8 and CR3 from the 30V supply.

Metering outputs are provided for the supply as well as those for current drawn from each regulator and the total current from the 30V supply. The voltage metering outputs have calibration pots whereas the current metering outputs are preset with fixed resistors.

Set up Procedures

- Set up one power supply for 65V; current limited to 1A and another supply for approximately 30V, also current limited to 1A.
- Apply the voltages to the appropriate inputs, 65V to E1 and E13; 30V to E12.
- Adjust R7 for a voltage of 50V at E4. Adjust R24 for 50V at E16.
- Check for 30V output at E11 (the same as that applied to E12).
- Reset the 65V supply current limit to approximately 7A, and apply sufficient load (to draw approximately 5A at 50V) to E4 and to E16 alternately, to check the regulation of the supply. The output at either one should not drop more than 1V under load.

OVER-VOLTAGE PROTECTION BOARD

CIRCUIT DESCRIPTION

The Over-voltage Protection board consists of an op-amp comparator U2 which compares the incoming raw supply voltage to a reference voltage set up by CR1. The input to the comparator is adjustable via R2. If the input voltage rises above the reference level, the output of the comparator drops to a low value, which lights CR2, an on-board LED. The output of the op-amp is OR-ed with the amplifier's muting input, using diodes CR3 and CR4 so that if an over-voltage condition occurs, the drive to the amplifiers would be greatly decreased thus reducing the load on the regulator pass transistors (thereby cutting the power dissipation of these devices).

Set up Procedure

- Set up a variable power supply to current limit at 1A or less.
- Apply a voltage of 30V to pin 11 and a voltage of 67V (3% above nominal) to pin 8 of the Over-voltage board. For installations in sites where incoming line voltage regulation is poor (i.e. -15% / +10%), set the pin 8 voltage at 71.5V which is 10% above nominal.
- Adjust R2 until the LED illuminates.
- Important: Ensure that the primary taps on the power transformer are set as near as possible to the nominal on-site line voltage. Of course the system will operate with other tap settings, but the range in which it will work will no longer be as wide. Taps are provided for 200, 208, 220, 230 and 242 VAC.
- Once the nominal voltage has been established and appropriate primary tap selected, the raw DC input to the regulator measured at the 20A fuse 7F1, should read about 65V, not 55V as shown on the drawing in Figure 10. We regret the error.

This over-voltage setting procedure is not expected to compromise the reliability of the regulator components under otherwise normal operating conditions within a 15% / +10% line voltage range. It is suggested that if and when the power source regulation is improved, R2 setting could then be decreased to a level appropriate to the improved upward extreme in line voltage. Over-voltage settings in excess of +10% (71.5V) are not recommended.

INPUT PIN ATTENUATOR

CIRCUIT DESCRIPTION

The Pin Attenuator board acts as a variable attenuator controlling the input level to the preamplifier for AGC and cutback purposes. Operational amplifier U2B controls the amount of attenuation in the circuit. Three inputs are summed at pin 6 from the

VSWR and AGC circuits and additionally from U2A which is a ‘mute’ type signal. R5 controls the threshold of control of these signals. The circuit configuration comprising CR1, CR2 and CR3 form a matched attenuator, biased by the output of U2B, R2, R3, R7 and R8. As the output of U2B rises, the attenuation of the circuit decreases, thus increasing the RF output as J2.

METERING BOARD

CIRCUIT DESCRIPTION

The Metering board detects forward and reflected power levels and processes these signals to provide outputs for metering, telemetry, AGC and VSWR protection.

The forward and reflected power detectors are ‘visual only’ detectors. The description that follows is for the forward detector portion only; the ‘reflected’ detector is identical. CR1 and Q1 form a basic detector circuit and C3, C4 and L1 trap out the 4.5MHz aural components. CR3 and C7 act as a peak detector providing the buffer circuit of U1 with a peak-level voltage.

The outputs of the peak detectors are applied to operational amplifiers U1B and U2B which have a zeroing function and provide the drive for the metering circuit and telemetry. These amplifiers also drive the AGC and VSWR circuits. Operation amplifiers U1A and U2A compare the forward and reflected signals to preset levels and provide an error signal to the Pin Attenuator board. An additional circuit consisting of U3 acts as a comparator to drive an LED on the indicator board as the VSWR signal rises about the preset level.

Set up Procedure for Metering, VSWR and AGC Circuits

- Set the AGC/MAN Switch on the front panel to the MAN position.
- Terminate the output of the amplifier into a suitable 50ohm load through a thru-line wattmeter or equivalent.
- Turn the visual and aural carrier switches on the exciter to the OFF position.
- Apply DC power to the amplifier. The blower should come on. There should be no output power indication.
- Turn the metering switch to the 35V position. Measure the voltage at E12 on the Regulator board and adjust R34 for a corresponding front panel reading on the lower meter scale.
- Turn the metering switch to the 50V position. Measure the voltage at E13 on the Regulator board and adjust R37 for a corresponding front panel reading on the lower meter scale.
- Turn the metering switch to the FWD position and adjust R18 on the metering board for a zero reading on the front panel meter. This should also correspond to a minimum voltage at TP1. Repeat this procedure for the RFL position, R2 and TP2.

- Turn the visual carrier switch on the exciter to the ON position. Slowly bring the transmitter up to operating power.
- Turn R33 on the Pin Attenuator board for maximum power out then trim it back so the power just starts to drop (about 10%). Reset the output power.
- Adjust R32 on the Metering board for a 100% meter reading in the FWD position.
- Reverse the connections at J1 and J2 on the Metering board. Adjust R36 for maximum power output. Adjust R30 for a 100% RFL meter reading.
- Re-adjust R36 for a 15% reduction in power. Adjust R42 until the VSWR LED just starts to illuminate. Trim R36 for about 15% power output. Restore the original connections to J1 and J2. The VSWR cutback circuit is now set.
- Set the AGC/MAN Switch to the AGC position. The power output level should be adjustable via the front panel AGC potentiometer.

POWER SUPPLY AND CONTROL

CIRCUIT DESCRIPTION

The power supply consists of a center tapped transformer, bridge rectifier and two choke input filters. The supply has dual outputs of 65V and 30V. The AC is fed to the supply through 6TB1, routed through the breaker 8CB1, located on the front panel of the transmitter, and to contactor 6K1. From this contactor AC is fed to the transformer of the power supply as well as to 6F1 and 6F2 in line with the amplifier blower. The contactor is energized by a solid state relay 6Z1. Interlocks are provided for the amplifier thermal cutout as well as an auxiliary interlock for customer interface. The 12V from the exciter is applied through the REMOTE/LOCAL Switch directly in the LOCAL position, or when in the REMOTE position, through the exciter's VOR contacts or other remote control device.

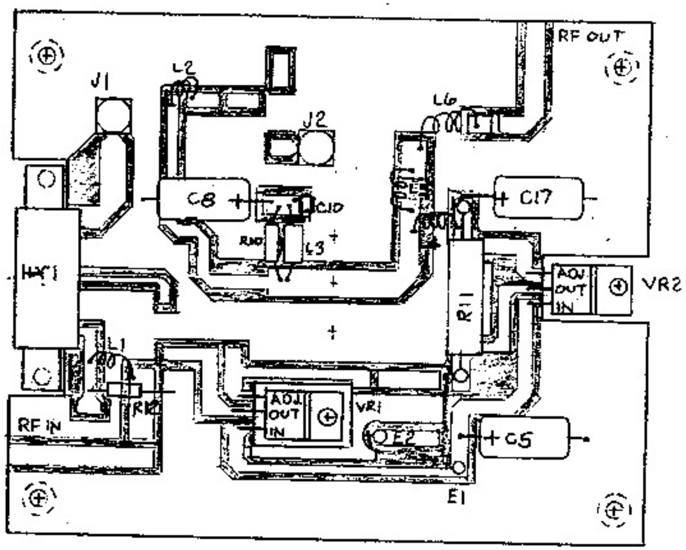
Some transmitters may be equipped with an optional ON/OFF Time Delay board for remote control. These transmitters use the exciter VOR contacts for remote operation. One side of the VOR contacts is energized by 8S1 in the REMOTE position. When video is applied to the exciter the contacts close, applying +12V to 6Z3 and TB1-1. Capacitor C1 on the Time Delay board charges through CR1, R3 and R5 at a preset rate determined by R3. When the voltage reaches 6V, U1 will on Q1 thus energizing the relay coil of K1, turning on the transmitter. When video is removed, C1 discharges at a preset rate determined by R4, turning off the transmitter. The Time Delay board function can be bypassed via S1.

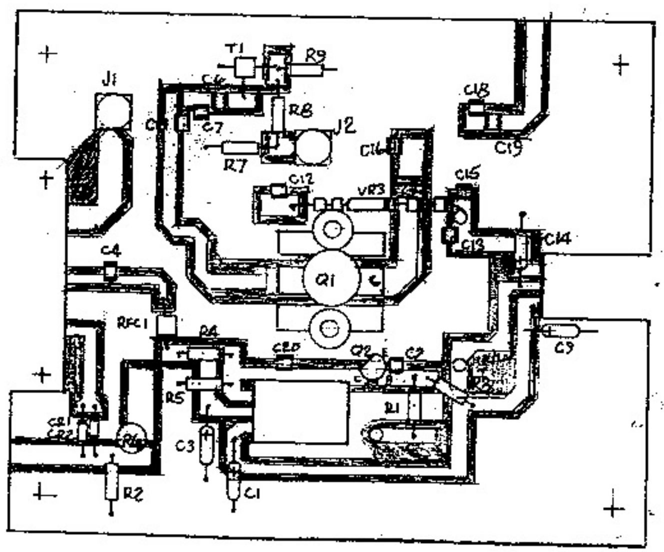
TELEMETRY

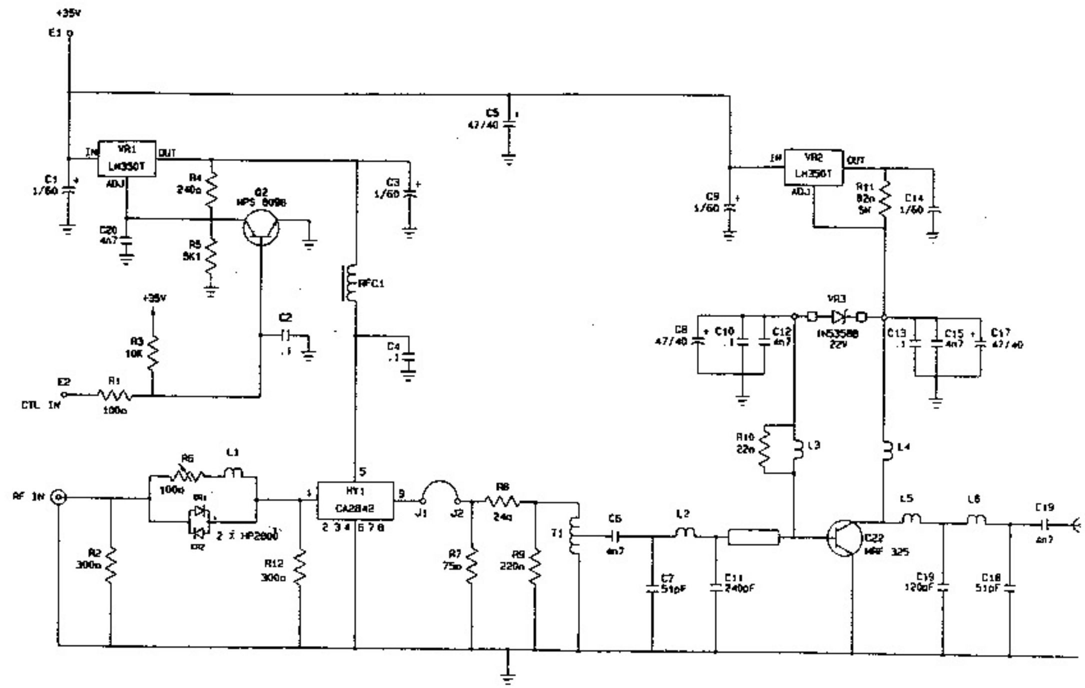
CIRCUIT DESCRIPTION

The transmitter is equipped with an Interface board for remote telemetry of power supply voltages, output power and thermal cutout switch status. The thermal switch status is field selectable; either a normally open or a normally closed set of contacts. Amplifier telemetry connections are listed in the table on the following page.

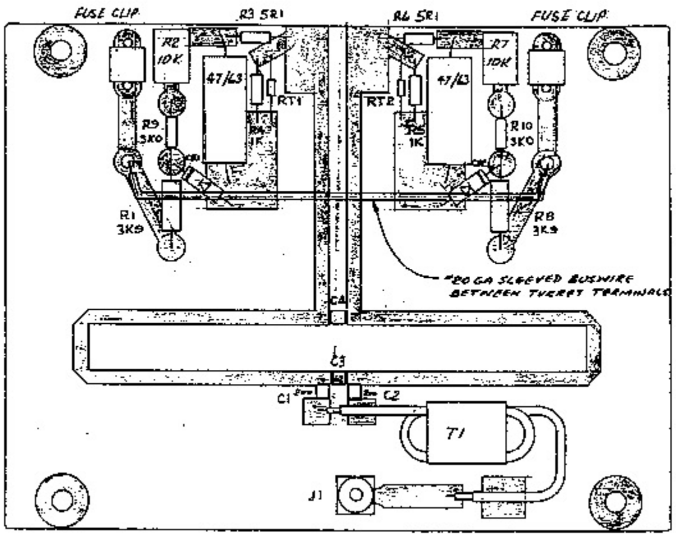
FUNCTION	**CONNECTION**
AUX INTERLOCK	6TB3-2
REMOTE CONTROL	6TB3-3
REMOTE TELEMETRY 65V SUPPLY	6Z2-TB1-6
REMOTE TELEMETRY 30V SUPPLY	6Z2-TB1-5
REMOTE TELEMETRY FWD POWER	6Z2-TB1-4
THERMAL CUTOUT STATUS	6Z2-TB1-1 6Z2-TB1-2
AC LINE INPUT POWER	6TB1-1 6TB1-2
NEUTRAL	6TB1-3



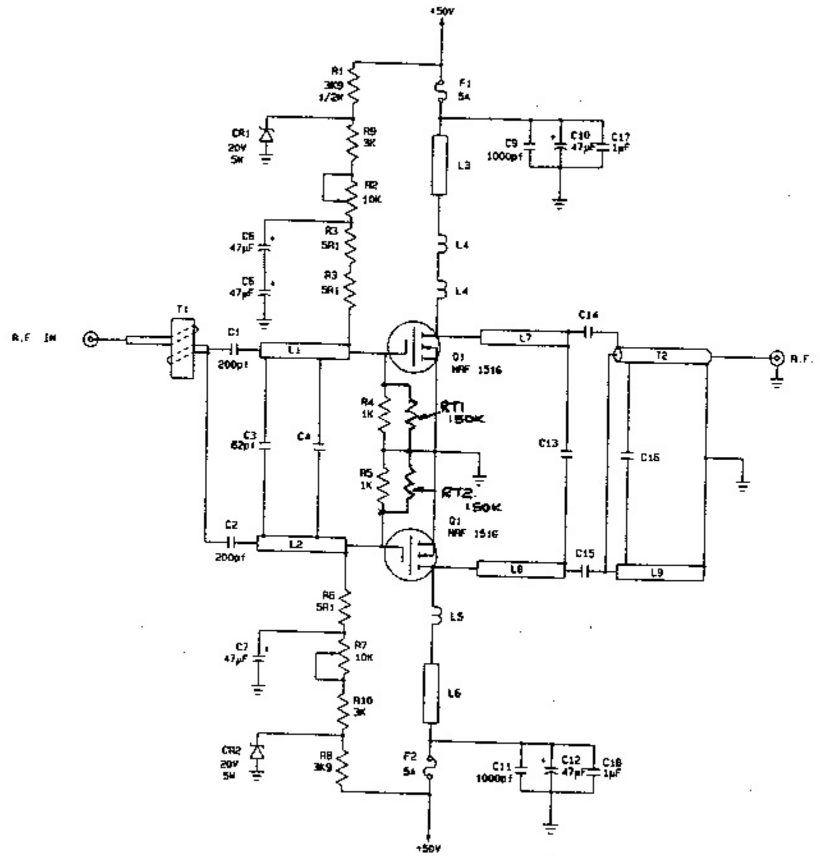




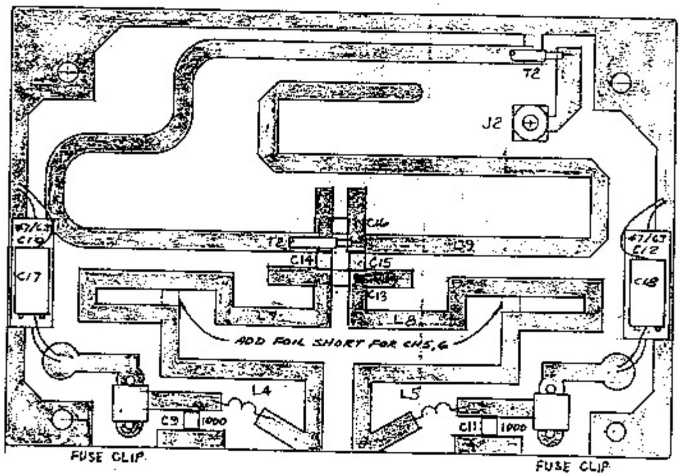
SCHEMATIC DIAGRAM
ASSEMBLY DIAGRAM
10 Watt Amplifier
Fig.3 Dwg.30C921
Dwg.30C920



Dwg.30C1054 (Input Board)



C#	CH. 2-4	CH. 5-6
C13	82pf	75pf
C14	180pf	120pf
C15	180pf	120pf
C16	51pf	15pf
C4	200	240



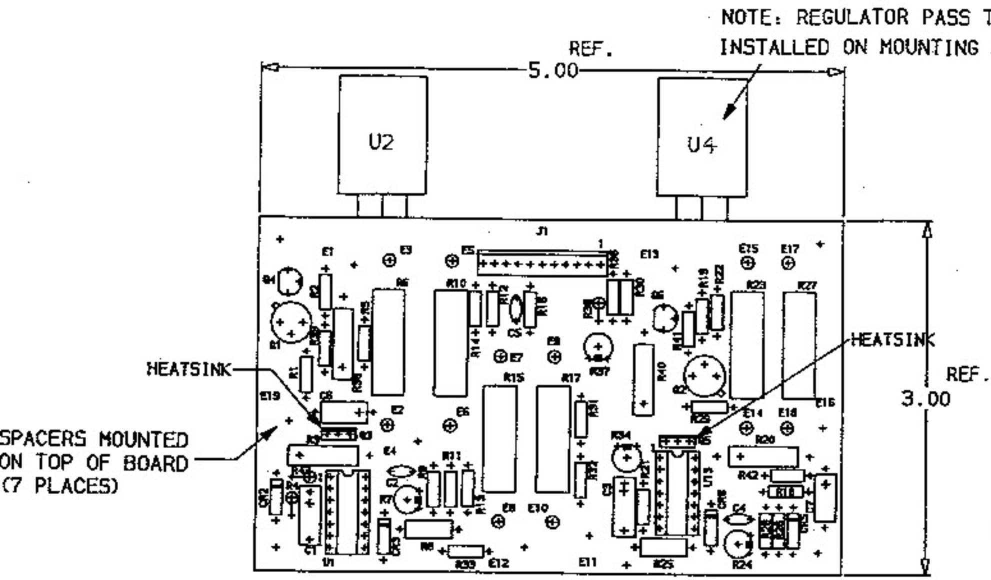
NOTE:-
C17 MOUNTS OVER TOP OF C10.
GO TO POSITIVE.

Dwg.30C1055 (Output Board)

NOTE - C18 MOUNTS OVER TOP OF C12.
RIBS ON C18 TO GO TO POSITIVE

C #	CH 2-4	CH 5-6
C13	82 pf	75 pf.
C14	180 pf	120 pf
C15	180 pf	120 pf.
C16	51 pf.	15 pf.

SCHEMATIC DIAGRAM
ASSEMBLY DIAGRAM
PA Module
Fig.4 Dwg 30C1056

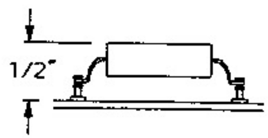


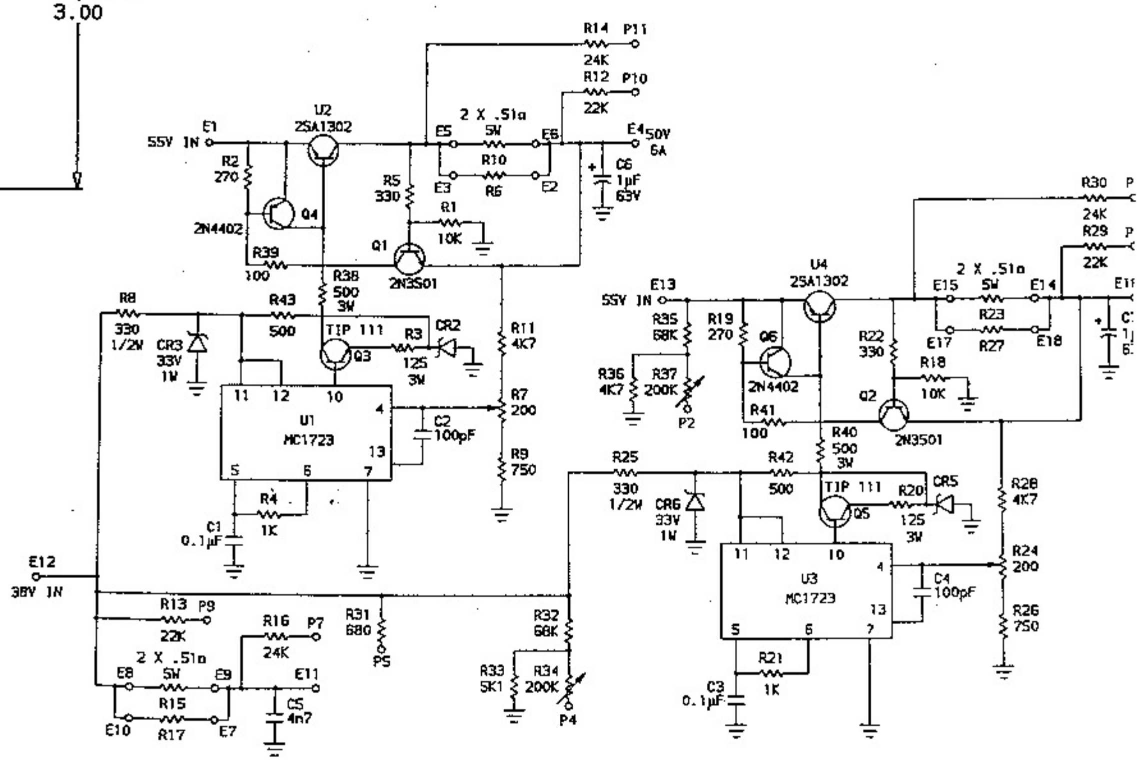
① ASSEMBLY AS SHOWN

VOLTAGE REGULATOR
SCALE FULL

NOTE

POWER RESISTORS
MOUNTED APPROXIMATELY
1/2" FROM THE BOARD.





NOTE:

ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.
ALL RESISTORS ARE 1/4W 5% UNLESS OTHERWISE NOTED.

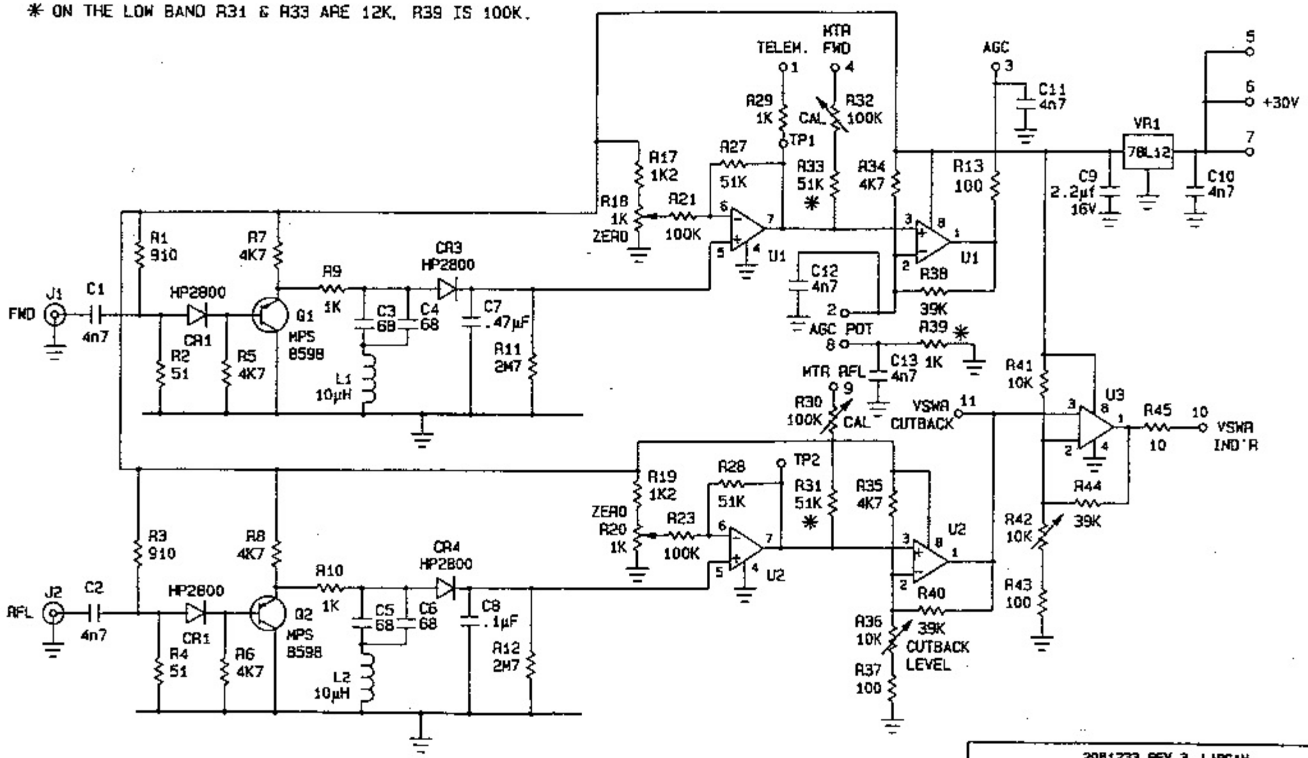
SCHEMATIC DIAGRAM
ASSEMBLY DIAGRAM
Voltage Regulator
Fig.5 Dwg.20B1810 sh7
Dwg.20B1810 sh1

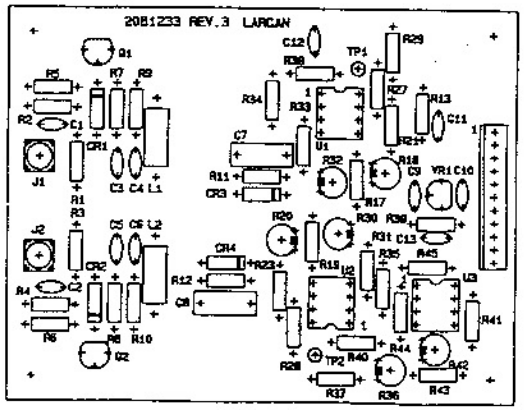
NOTE:

- ON THE TAA300M AMPLIFIER
  R33 & R31 ARE 75K.

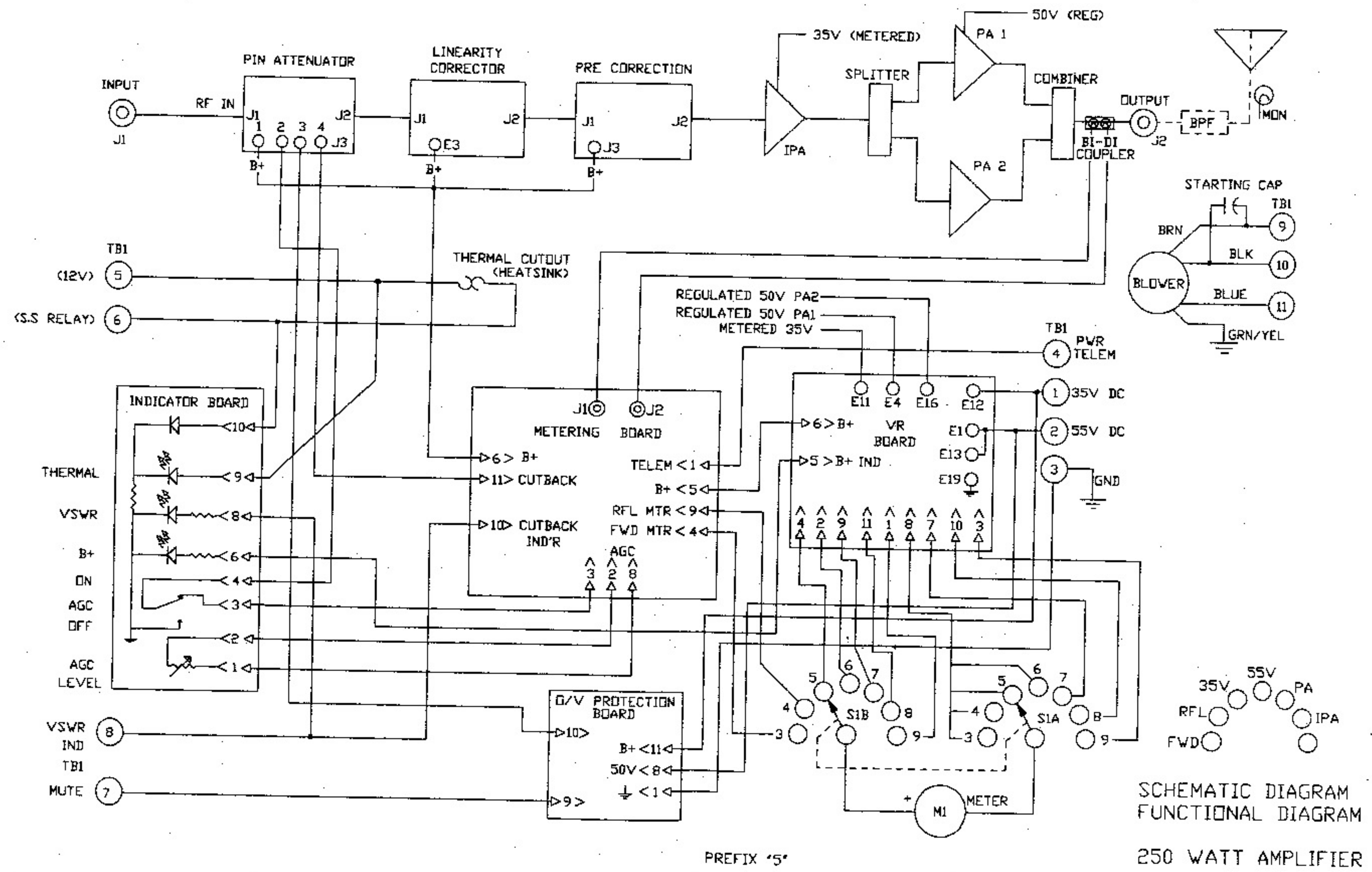
- ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.
  ALL RESISTORS ARE 1/4W 5% UNLESS OTHERWISE NOTED.
  ALL CAPACITORS ARE IN pF UNLESS OTHERWISE NOTED.

✻ ON THE LOW BAND R31 & R33 ARE 12K, R39 IS 100K.





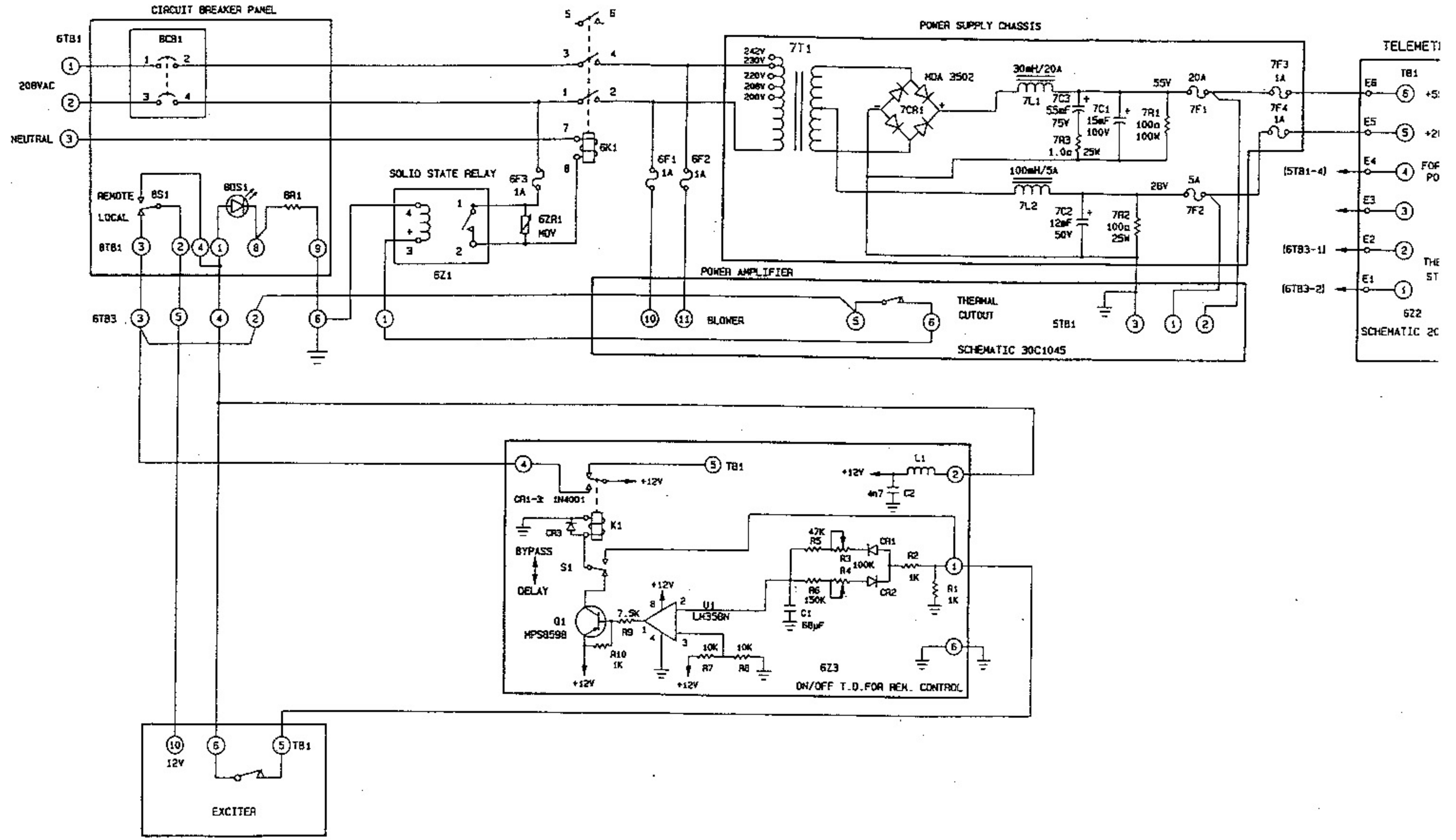
SCHEMATIC DIAGRAM
ASSEMBLY DIAGRAM
Metering Board
Fig.8 Dwg.20B1245
Dwg.20B1235



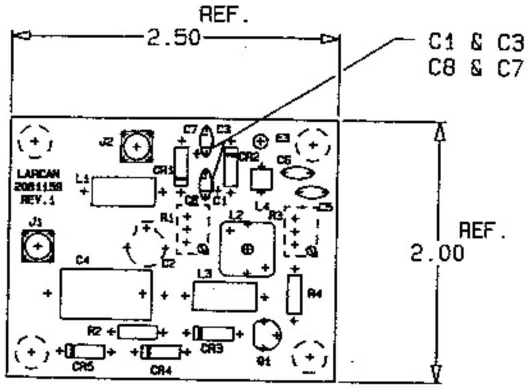
SCHEMATIC DIAGRAM
FUNCTIONAL DIAGRAM

250 WATT AMPLIFIER

Fig.9 Dwg. 20B1814.sh1



SCHEMATIC DIAGRAM
Power Supply and Control
Fig.10 Dwg.30C1046

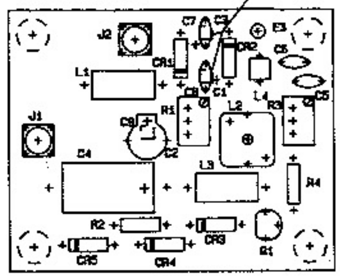


C1 & C3 ARE MOUNTED ACROSS
C8 & C7 ON SOLDER SIDE.

(1) ASSEMBLY
LINEARITY CORRECTOR
SCALE FULL

NOTE:

R1, R3, C1, C2, & C3
MOUNTED ON SOLDER SIDE.

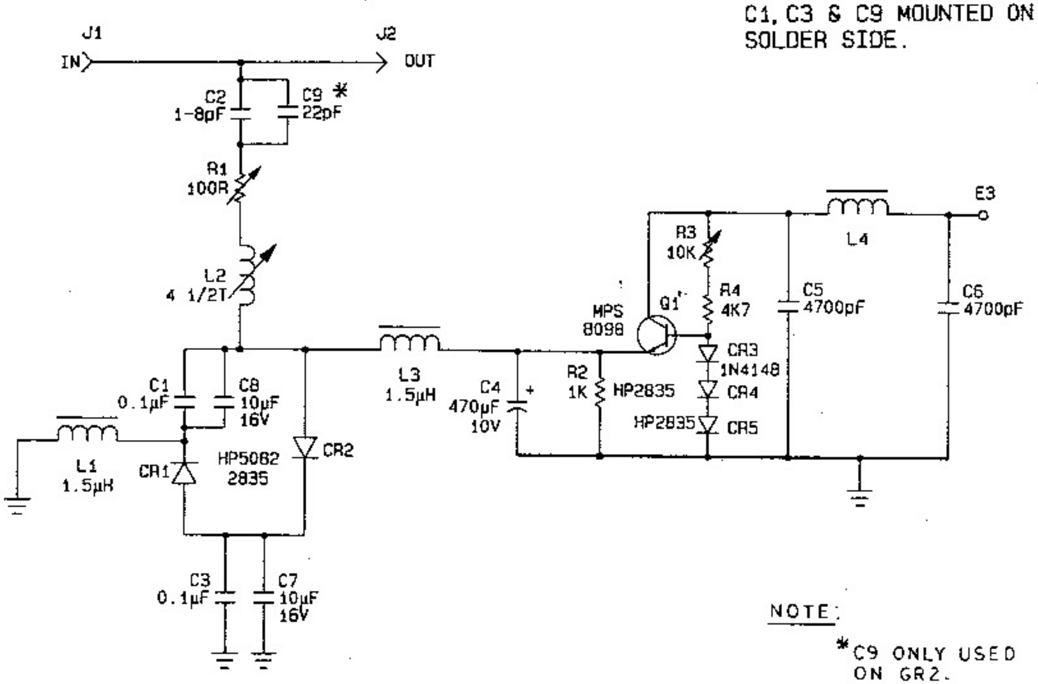


C1 & C3 ARE MOUNTED ACROSS
C8 & C7 ON SOLDER SIDE.

(2) ASSEMBLY

NOTE:

C1, C3 & C9 MOUNTED ON
SOLDER SIDE.



NOTE:

*C9 ONLY USED
ON GR2.

SCHEMATIC DIAGRAM
ASSEMBLY DIAGRAM
Linearity Corrector
Fig.13 Dwg.20B1161
Dwg.20B1157