6.4 ID250 ID/AUDIO AMP. & MIXER BOARD

Theory of Operation

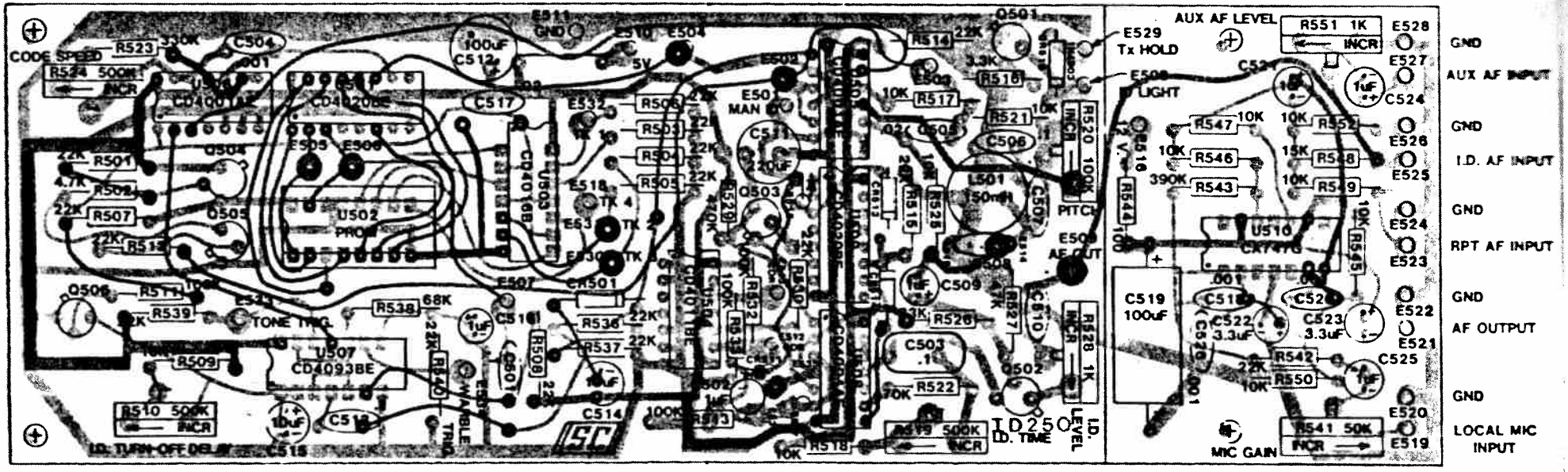
NOTE: Add 500 to all ID250 Part & Terminal No.'s below.
NOTE: Unless otherwise noted, in the following discussion any reference to a "high" logic state shall be defined as a voltage of *at least* 70% of the positive power supply voltage (3.5 volts in the case of a 5 volt supply), and a "low" logic state shall be a voltage of *no more than* 20% of the positive supply (1 volt in the case of a 5 volt supply). These levels will *typically* be full positive supply and zero volts respectively.

Referring to the schematic diagram, notice that two trigger inputs are provided at E12 and E13, either one of which can be used, depending on the sense of the input source. Assuming that neither trigger input has been activated for some time, pin 10 of U4 will remain low, and transistor Q3 will be held in the off state, allowing C11 to charge through R29. If the trigger inputs remain inactive long enough (approximately 1½ minutes), C11 will charge up to the threshold point of the U8 flip-flop, causing pin 4 of U8 to go high and pin 3 of U8 to go low. The high state on pin 4 causes the I.D. timer clock to stop (via the high state on pin 8 of U8), and simultaneously resets the I.D. clock counter, U9, to its zero state. The unit is now in the standby condition, and will be activated immediately upon the next trigger input.

When a trigger signal arrives, it will cause pin 10 of U4 to go high, which in turn, causes the U8 flip-flop to be set, and also causes Q3 to keep C11 discharged as long as there is input activity at intervals of less than 1½ minutes. As soon as the U8 flip-flop is set, the high level on pin 3 is converted by C2 and R13 into a short positive going spike which passes through D11 and sets the trigger flip-flop, U5, causing an I.D. to be generated immediately. (Details of the I.D. generation sequence will follow later). As long as the activity timer detects input activity, pin 4 of U8 will remain low and the U8 I.D. clock will be allowed to run, producing positive pulses at its 27 Hz (nominal) rate. These pulses trigger U9, a binary divider which divides the 27 Hz clock by 8192. Thus, as long as the I.D. clock is running, the output of U9 (pin 3) will go high every 303 seconds (approximately 5 minutes), and will trigger the U5 flip-flop, causing an I.D. sequence to be generated. Note that the output pulse on pin 3 of U9 is also routed, via diode D13, back to the U9 reset input, resetting the divider to its zero state, and allowing another timing cycle to start.

Triggering of the I.D. sequence generator can come from one of 3 sources, any of which will set the trigger flip-flop, U5. These sources are: 1) an initial triggering input after inactivity, through D11; 2) a regularly scheduled I.D. during activity, through D12; 3) a manual I.D. at any time through E1. When the U5 flip-flop has been set, pin 3 will go high and pin 4 will go low. The high on pin 3 causes Q1 to turn on (assuming that E2 and E3 are jumpered), clamping the transmitter hold output (E29) to ground for the duration of the I.D. cycle.

ID250
I.D. & AUDIO BOARD



NOTES:

1) ALL TRANSISTORS ARE 2N2222A'S EXCEPT Q504 WHICH IS A 2N2907A.
2) U502-DM74S287N, DM74S387N/N82S129N.
3) E505 WILL TURN-OFF PROM AFTER 128 BITS WHEN CONNECTED TO E507.
4) E506 WILL TURN-OFF PROM AFTER 256 BITS WHEN CONNECTED TO E507.
5) ALL DIODES ARE 1N914A'S UNLESS OTHERWISE SPECIFIED.

SPECTRUM COMMUNICATIONS

ID250 COMPONENT LAYOUT

10-24-80

FIGURE 12

The low-on pin 4 of U5 causes binary counter, U1, to be released from its reset state (a high on the reset input keeps the counter from toggling). When pin 4 of U5 is low, pin 3 will be high, turning on Q4 & Q5, and enabling the 5 VDC supply to prom U2. Output pulses from the code speed oscillator, U6, cause U1 to count up in a binary sequence, and the binary outputs are applied to the address inputs of U2, a PROM organized in a 256 bit long by 4 bit wide configuration. Each of the 256 possible binary outputs from U1 corresponds to a unique 4 bit "word" which appears at pins 9, 10, 11, & 12 of U2. The contents of each "word" have been programmed at Spec Comm so that, looking at any single "bit" of the 4 bit output, the sequence of 1's and 0's represents the morse code message. (A dot is a "1" in 1 bit location, while a dash consists of a "1" in 3 consecutive bit locations.) The particular 1 bit data channel desired is selected by U3, a quad analog switch. A high on anyone of the 4 message select inputs (E18, E30, E31, E32) will cause one of the 4 outputs of U2 to control the U5 tone oscillator.

As long as code pulses appear at the output of U3, transistor Q6 will keep discharging C15 at regular intervals. If code output from U3 ceases long enough for C15 to charge up to the threshold level of U7 (a quad NAND gate with schmitt trigger outputs), pin 3 of U7 will go low, and pin 4 of U7 will snap high. This positive going pulse is differentiated by C13 and R36, and is applied as a reset pulse to 1 of the U5 flip-flop. When U5 is reset, pin 4 will go high, resetting U1 to zero and preventing any further counting. Pin 3 of U5 will go low, turning Q4 and Q5 off, thus removing the 5 VDC supply to PROM U2. (Removing the 5 VDC supply from U2 during standby saves about 80 mA of current consumption, and results in a standby current draw of about 5 mA.)

If E33 is grounded, pin 11 of U7 will go high, triggering the U5 tone oscillator through U6 for as long as E33 is grounded. If E34 is raised to a "high" level, pin 10 of U7 will oscillate at an approximate 20 Hz rate keying the tone oscillator on and off at the same rate. This sound is intended to approximate a telephone "ringing" signal, and is intended for applications where a distinctive signalling sound is needed. (Autopatch, etc.)

The output of the tone oscillator, a harmonic rich square wave, is filtered by the L1/C6-8 tank circuit, and is finally buffered by emitter follower stage Q2. A 4 input dual Op Amp audio preamplifier/ mixer is incorporated onto the ID250 board. The local microphone input (E19 & E20) to this stage is amplified by U1A. The 3 other inputs (RPT. AF, I.D., AUX. A.F.) are resistively summed with the U1A output, and the mixed A.F. output appears at E21 as composite repeater audio. The IC1 stage was designed to operate with a medium impedance ceramic microphone (such as the Spec Comm M-10), and the AUXILIARY A.F. INPUT has been provided with a level adjusting potentiometer. In normal use the audio output from E9 of the ID'er is connected to E25 of the mixer.

I.D. MEMORY: If it is desired to *change the ID* (Call Letters) in the memory, contact Spectrum Communications. The factory can normally program and ship a new PROM memory chip within a few days. Note that it takes special factory equipment to program the PROM IC - it is *NOT* field programmable. (Simply take the PROM out of its socket, and plug in the new PROM.)

6.5 75 WATT SCR1000 AMPLIFIER UNIT BA-75RPT

6.5.1 INTRODUCTION

The 75 Wt. SCR1000 is a special version of the SCR1000 Repeater. It includes a higher power transmitter exciter board, a final amplifier board which uses 2 RF output transistors; increased power supply current capability with a larger power transformer and electrolytic filter cap, and two "super rugged" 200W/30A pass transistors in parallel. Massive heat sinks are provided for the pass transistors and the final amplifier transistors.

6.5.2 OPERATION

In normal operation, the 75 Wt. amplifier is driven with approx. 10 watts of power from the exciter board. Normal exciter current is about 2.0-2.5A. Normal final current is 7.5-8.5A. *Do not let the final current exceed 9A!* (For best long-term reliability.) Final Amplifier current can be adjusted by tuning the Output Tuning Cap C283A, on the final board, closest to the RF Output connector. Always tune for best efficiency! i.e. Minimum current consistant with good power output. (Typically achieved when *increasing* the capacity of the output tuning cap -CW- towards max capacity.)

The amplifier is designed to withstand VSWRs up to 3:1 for as much as 5 minutes. Although the amp uses the most rugged "emitter ballasted" transistors available, it was not designed to withstand open or shorted load conditions, (although it may do so for very short periods). A good 50 ohm load must always be connected the output before transmitting!

The unit was tuned at the factory with a Bird Model 43 Wattmeter into the 50 ohm load. If you do not read at least 70W output into your system, a slight adjustment of the above mentioned Output Tuning cap, C183A, may be required.

6.5.3 COOLING - IMPORTANT!

This amplifier was designed for use with an external (optional) "Muffin" fan which blows cooling air over the rear heat sinks and transformer. (120 c.f.m. *minimum* fan rating must be used.) The fan should be mounted on the back door of the rack or cabinet used, or on metal brackets, etc. The air should be carefully directed so the *2 heat sinks and the transformer are all in the air stream.*

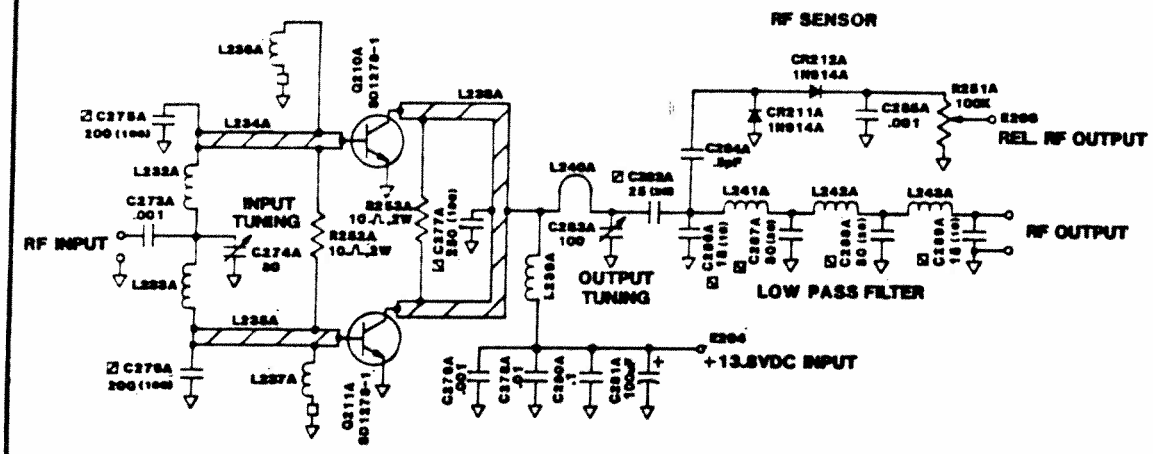
Although it is not recommended, the unit may be used without a fan for short duty cycle operation, (i.e. up to 15 minutes max. transmit time, with at least a 30 minute cooling down period.) Of course, *with* the fan, maximum transmit time is unlimited. (100% continuous duty.)

In any case, the unit must be mounted so that *both* the bottom of the chassis, and the rear sinks are *open to free cooling air!* Never operate the unit for more than a few minutes with the chassis sitting flat on a bench since this blocks the cooling air to the heat sinks and the under-chassis components!

6.5.4 METERING, ETC.

Note that for the 75 Wt. transmitter, both front panel current meters read *2 times normal indication;* i.e. the exciter current is 3.0A full scale, (2x the 1.5A scale; and the final current is read on the *15A scale*).

Normal B+ to the final, as measured at the feed-through cap on the transmitter housing is 13.0 to 13.8VDC max. while transmitting.

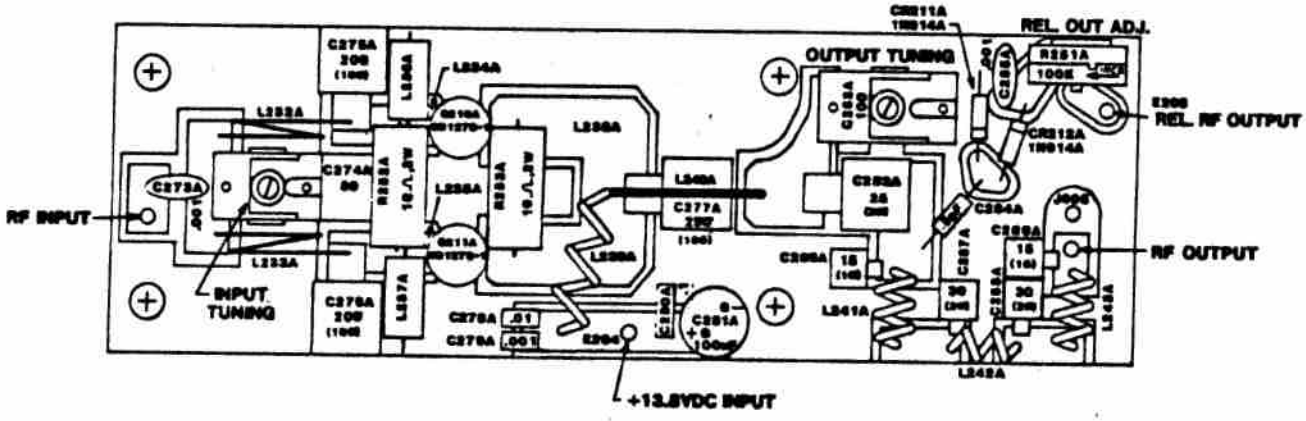


NOTES:

1) ☑ INDICATES STANDEX CHIP CAPS.
2) ( )DENOTES VALUE CHANGES FOR 216-230MHz.
3)POWER OUTPUT IS 60W MIN. FOR 216-230MHz.

FIGURE 13

SPECTRUM COMMUNICATIONS		
7-22-90	7/23/90	REVISED 2/11/91
BA-75RPT AMP. SCHEMATIC		
136-174 & 216-250MHz		2200119



NOTES:

1) ( )DENOTES VALUE CHANGES FOR 216-230MHz.
2)POWER OUTPUT IS 60W MIN. FOR 216-230MHz.

FIGURE 14

SPECTRUM COMMUNICATIONS		
7-21-90		
BA-75RPT AMP. LAYOUT		
136-174 & 216-250MHz		

6.5.5 LOAD VSWR

Important: For maximum operating life and best reliability, *be sure that the load VSWR does not exceed 1.5:1*! (When a duplexer is used, this is the VSWR *looking into the duplexer's TX Input.*) Also, *do not tune* the duplexer while transmitting at the 75W level since *extremely high* VSWR loads can be presented to the amp when the duplexer is de-tuned. A high VSWR load could possibly cause damage to the output circuitry if the transmitter is keyed for a prolonged period of time.

6.5.6 AC POWER TRANSFORMER

The transformer in the SCR1000 is normally wired with the primary tap at the 115VAC point. This tap is the optimum point for operation over an AC line voltage range of about 113-120VAC. If the actual line voltage (while transmitting) is above or below these limits, the primary tap wire should be changed accordingly. For example, if the line voltage is in the area of 110VAC, change the tap from the 115 to the 105VAC tap. Likewise, if the line voltage is greater than 120VAC, change the tap to the 125VAC lug.

75 Wt. Amp.
LIMITED WARRANTY: 60 Days parts and labor on the BA-75RPT Board itself. 180 days parts and labor on the rest of the SCR1000 Repeater. The *Warranty is voided if a cooling fan is not used.*

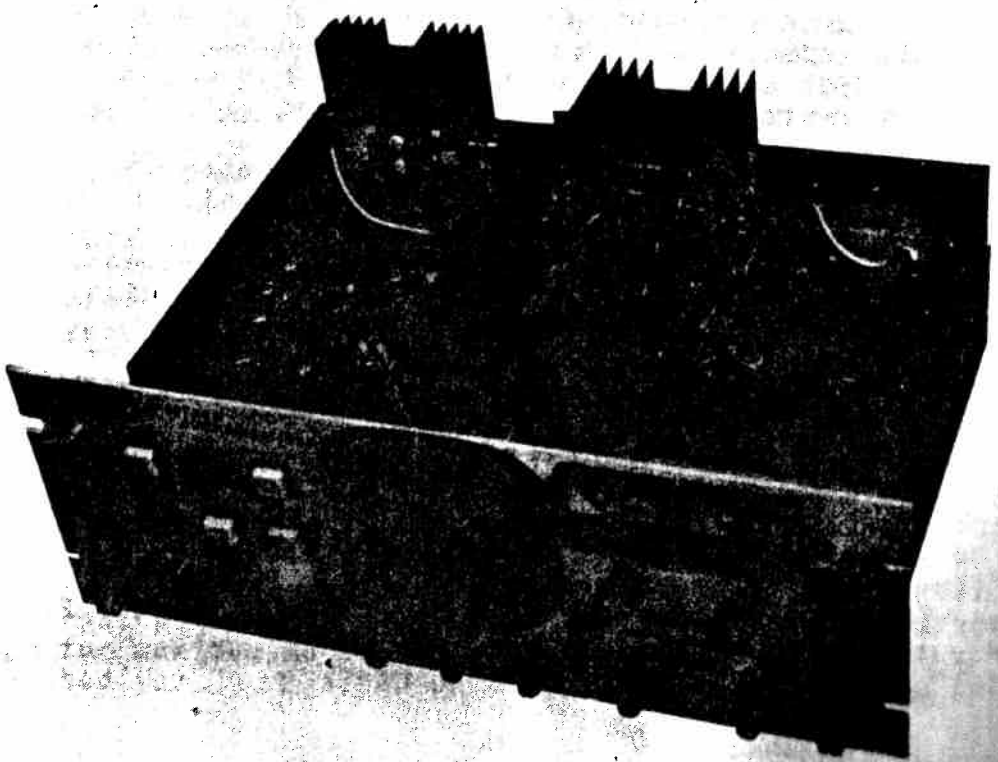


FIGURE 15 - 75WATT REPEATER

NOTE LARGER HEATSINKS,TRANSFORMER,AND POWER AMP BOARD

6.6 POWER SUPPLY

6.6.1 The standard power supply consists of a heavy-duty 12A power transformer, 35A bridge rectifier, 30A/200W pass transistor(s) mounted on a massive heat sink, and an IC voltage regulator/ metering board. The AC line input is fused, and protected from line spikes and transients by a high-capacity MOV (Metal Oxide Varistor) transient suppressor. The supply is very conservatively designed - normal current draw is only 5.5A (10.5A for a 75W unit). C603 is used to filter the rectified AC. IC401 is a feedback voltage regulator which drives the Darlington pass transistor configuration made up of Q601 and Q602. These 2 power transistors provide a very high overall current gain of over 1000. The regulator also includes a "foldback current limiting" feature which automatically and instantly "folds-back" the supply's output to a very low voltage and current if the output is shorted - thereby protecting the supply. This circuit provides excellent regulation and filtering - ripple is less than 10mVp-p at an 8A load.

6.6.2 An overvoltage "crowbar" shutdown circuit is used to shutdown the power supply in the unlikely event that the pass transistor should short out. If Q601 does short, zener diode CR402 will conduct, thereby turning on SCR CR401. When CR401 conducts, it will draw a very large current through R401 for a few hundred milliseconds, thereby quickly blowing front panel AC line fuse F601 and shutting down the repeater before any damage is done. If this should happen, F601 and Q601 must be replaced, but Q601 (and Q602 for the 75 Wt. Repeater) should first be checked with an ohmmeter for shorts.

6.6.3 Also included on this board are various meter shunts, (wire wound resistors), and calibration pots for the volt and current meter functions. A separate fixed 5V regulator is provided to supply this voltage to the logic circuitry. It is rated 1.3A and has built-in current limiting/short-circuit protection.

6.6.4 CHANGING POWER TRANSFORMER TAPS

The AC Power Transformer is normally wired for 115V, 50-60Hz input, but the primary taps may be easily rewired for higher or lower AC line voltage input. For Example: if your AC line voltage is low (say 104-110V), then move the wires on the T601 primary from the 115V lugs to the 105V lugs. Likewise, the primary can be wired for 220V input. See the schematic diagram on the Power Supply.

SECTION 7 ALIGNMENT

7.1 RECEIVER ALIGNMENT

Receiver alignment should not be required unless an RF transistor, IF IC101, or the receive frequency is changed. Even in this case, only a slight "touch up" should be required.

7.1.1 FRONT-END ALIGNMENT

Connect a good quality FM signal generator to the receiver antenna jack and an AC voltmeter (or "Sinnader" Meter) from the 'hot' speaker lead to chassis ground. With the signal generator set for minimum (0) output, note the average AC voltmeter reading. (Squelch full CCW). Increase the generator's output level and tune it for best receiver quieting, (or best SINAD with 5 KHz deviation). Alternately tune the 8 RF Amp trimmer caps (C103, 4, 9, 10, 12, 16, 17, 19) for best quieting (or SINAD), keeping the generator set for about 10dB of quieting (or 10-12dB SINAD). With the generator tuned for the best quieting point in the receiver passband, it should be possible to achieve 0.4µV or less for 20dB of quieting (1/10 the original noise reading). Typical 12dB SINAD point is 0.3µV.

7.1.2 OSCILLATOR/MULTIPLIER ALIGNMENT

Apply a modulated test signal to the antenna jack (about 10µV). Using a standard hex alignment tool, tune the L110 oscillator slug in (CW) until the oscillator stops oscillating. (Received signal disappears.) Slowly turn the slug out (CCW) until the oscillator just starts, then turn the slug out 1½ turns past this point. If the oscillator does not stop, tune the coil for max L.O. output, or best SINAD as mentioned below. The multiplier coils L111 through 114 may be roughly tuned for best reception of an extremely weak signal; but for optimum alignment, a sensitive RF detector (RF voltmeter, Spectrum Analyzer, -10dBm power meter, etc.) should be connected to the L.O. output TP1 shown in Figure 6. The above coils should then be peaked for maximum output.

7.1.3 21.4 MHz IF ADJUSTMENT

Set the RF panel meter switch to the "Rx Signal" function. Apply an unmodulated signal to the receiver RF input at the proper frequency and increase the signal level until the front panel meter reads approximately 1/3 scale. Adjust L120 for maximum meter reading. Alternately, L120 may be adjusted for best SINAD on a weak signal, (appx. 0.25µV).

7.1.4 QUADRATURE COIL ADJUSTMENT

Use the same setup as in 7.1.1 above, except inject a strong signal (appx. 100μV) into the receiver. Be sure the signal is "on frequency" and has 4-5 KHz deviation. Tune the Quad Coil L122 for maximum AF output voltage as read by the AC voltmeter. Then apply a small drop of cement to the coil slug.

7.1.6 SIGNAL STRENGTH (S METER) ADJUSTMENT

Set the meter switch to the "Rx Signal" function. With no input signal, adjust R137 for a 'zero' meter reading. (For a somewhat more "sensitive" S Meter, set R137 for a no signal reading of 0.5 on the scale.

7.1.7 CRYSTAL FREQUENCY ADJUSTMENT

Connect an accurate and sensitive frequency counter to TP1, and adjust the crystal trimmer cap (C122) for the correct frequency. The LO output frequency will be 21.400 MHz above the desired receive frequency for 136 to 151.00 MHz (&220MHz) Receive Frequencies; and 21.400 MHz below the desired receive frequency for 151.001 to 174 MHz Receive Frequencies.

7.2 TRANSMITTER ALIGNMENT

As noted with the receiver, the transmitter should not require alignment unless a RF transistor or IC is changed. Factory tune-up of these circuits is done with elaborate equipment including a spectrum analyzer. Subsequent adjustment should not be performed unless absolutely necessary, as improper alignment could result in undesirable spurious emissions. If alignment is necessary, perform only the applicable steps below.

7.2.1 Observe the Exciter Current Meter, with *no* crystal installed, the unit should draw 125-200mA in the transmit mode.

Check operation of the audio processing stages by connecting an oscilloscope probe to the wiper of the deviation control. With an input at E201 from an external audio generator, the waveform should be a clean sine-wave, turning into square wave as the input audio level is increased. Adjustment of the deviation control should produce up to 7 or 8 volts of peak to peak audio at this point. When proper operation of these stages has been confirmed, set the deviation control at its mid-point and check for the modulated signal on a nearby receiver or deviation meter.

Install the crystal in its socket and key the transmitter. The indicated exciter current consumption should be noticeably higher (about 1.4 Amp. @8W out, and about 1.8-2.2 Amp. @ 10W out for the 220MHz board.) A VHF RF power meter connected to the antenna connector should now indicate some RF output. Tune all trimmer capacitors for maximum RF output. C277 and C278 in the input circuit of the 30W power Amp. stage are adjusted for maximum drive to the device (indicated by final collector current), while C282 is adjusted for maximum power output consistent with good efficiency, (minimum collector current. Normally, CW adjustment.) When tuning this stage, observe that tuning the output trimmers in one direction, (normally CCW), will cause a sharp rise in collector current with only a small change in output power. This indicates a *decline* in stage efficiency and should be <u>avoided</u>. When operating properly, the stage should draw 2.7 to 3.5 amps (at 13.8V) for 30W output, and, in no case, should the stage collector current be allowed to exceed 3.5 amps. *Always* tune the amplifier for maximum output efficiency and minimum white noise. Don't hesitate to loose a watt or two of output if a large current savings or white noise reduction can be obtained. *The reduced current* will result in *increased long term reliability!*

Tuning the system duplexer while the repeater transmitter is activated can cause very high VSWR conditions to be presented to the final amplifier stage. *Always* observe final collector current (on the front panel meter) when tuning the duplexer, and keep transmissions short when VSWR conditions are high.

<u>REPLACING TRANSMIT CRYSTAL</u>: If the crystal is replaced and it cannot be zeroed on frequency, change the value of C269 on the terminals near the crystal. If the TX frequency is too high, increase the value of C269. If it is too low, decrease the value of C269. (Typical range: 30 to 200pF).

7.2.2 <u>SETTING TRANSMITTER DEVIATION</u>:

Set front panel RPT. AUDIO pot at full CW. Apply a strong signal to the receiver input (100μV min.) modulated ± 5KHz with a 1KHz tone. Set the DEVIATION Adj. pot (R212) for the desired *max. deviation.* Typically 5 (commercial) or 6 KHz (amateur) MAX. Then set the Rpt. AUDIO pot at the 12 o'clock position. Set the generator dev. for 3 KHz, and set the A.F. Input Level pot (R218) for 4KHz transmitter deviation. Repeat these adjustments twice.

7.3 ID/AF MIXER BOARD ADJUSTMENTS

See Chassis Layout (Fig. 5), and ID/AF Mixer Board Layout Dwg. and schematic. As shown on the drawings, trim-pots are provided to adjust ID Code Speed, CW Tone, ID Timing Interval, ID Audio Output level, Local Mic Gain and AUX AF Input Level. The "Mic Gain" is normally set to max. "AUX Level" sets the deviation level of the AUX AF Input at jack J602-6.

"Code Speed" and "ID Time" may be set as desired. Note: Front Panel "Manual ID" button has no effect whatsoever on the ID timing interval. ID level is normally set for about 2 KHz deviation max. The "CW Tone" pot is adjusted for a pleasing tone pitch. If it is desired to change the "sound" or character of the CW note, the value of C6-8 may be changed on the board (see dwg. No. 3200114 and the schematic). For lower pitch notes add an additional 0.1uF cap; and for higher pitch notes, remove a 0.1uF cap.

7.4 POWER SUPPLY, REGULATOR & METERING BOARD ADJUSTMENTS

R410 - "13.8V SUPPLY ADJUST"- Adjust for 13.8 volts at E1204 on the transmitter housing with a known accurate DC voltmeter or DVM. This adjustment should be made with the transmitter activated. After this, and each of the following adjustments, turn the meter knob back and forth one position several times to be sure the meter stabilizes on the correct reading each time. Some resistance in pointer movement is normal.

R404 - "VOLT METER CAL." - After the power supply has been adjusted to 13.8 volts under load, put meter switch S606 in the "13.8V" position and adjust R404 for an indication of 13.8V on the front panel meter.

R417 - "EXCITER I. METER CAL." - Unsolder the wire connected to E1205 on the transmitter housing, and connect an accurate DC ammeter in the line. Activate the repeater transmitter and measure the current draw. With switch S606 in the "I EXC." position, adjust R417 so that the front panel meter reads the same current measured above.

R418 - "FINAL I. METER CAL." - Unsolder the wire connected to E1204 on the transmitter housing and connect an accurate DC ammeter in the line. Activate the repeater transmitter and measure the current draw. With switch S606 in the "I FINAL" position, adjust R418 so that the front panel meter reads the same current measured above.

SECTION 8 TROUBLESHOOTING

8.1 RECEIVER TROUBLESHOOTING CHART

SYMPTOM	CHECK	REMEDY
No audio output	U104-Pin4 (LM383) DC Voltage, w/ Squelch Open.	Replace if less than 4V.
Rcvr. completely dead	9V Test Point, E114,(See Fig.6). 13.5V TP, E104.	If 13.5V is OK, but 9V is 0, replace Q111. (B+ line was shorted).
Squelch must be advanced somewhat in very hot or cold ambient temp.		Normal in Extreme temp. conditions.
Audio Output low an/or distorted; poor squelch performances.	Tuning of L122	Peak for max. AF output on strong tone modulated signal
Low Sensitivity, or no copy at all.	Q101,Q102,Q103 Q104,Q105,Q106. Tuning of Front End trim caps. L.O. Tuning:L110, L111,L112,L113,L114,	Replace if doubtful.(If Q101 is damaged, most likely it was due to high transmitter power entering Rcvr. Ant. jack, nearby lightening, etc. Check duplexer, cables, antenna, etc. for intermittents.

NOTE: The boards are designed to fold out for service. Be sure power is disconnected from the unit when a board is being moved. Also, be sure that no short circuits occur during servicing, as certain semiconductors could be instantly damaged.

NOTE: Tubular Cap Color Code - Receiver & Transmitter Boards.

1) First two color bands - same as standard resister color code.
2) Third band - White=X0.1; Gray=X.01.
3) Fourth band- Gold=5% tolerance.
4) EXAMPLE: Blue-Gray-White-Gold=6.8pF, 5%

8.2 TRANSMITTER TROUBLESHOOTING CHART

SYMPTOM	CHECK	REMEDY
No Power Output (Low Final Current)	1) Power Supply Voltage	Replace bad part
	2) Q308 on CTC100A Bd.; Also Q201	"
	3) Damaged Final Transistor	"
	4) Power Output of Exciter	Retune Exciter or replace damaged part(s)
Low Power Output (High Final Current)	1) Detuned Final	Retune
	2) High VSWR	Tune or replace Antenna
	3) Shorted or Open Component in P.A. Output Circuit (Check Capacitors)	Replace Damaged Part
	4) Damaged Final Transistor	"
Distorted Modulation	1) Excessive Audio Drive	Adjust R218
	2) Off Frequency	Adjust Xtal Trim cap C217.
	3) IC201 with scope for distortion	Replace defective component(s).
No Modulation	1) IC201 (Pins 12 & 10) with scope for distortion. (Inject 1 KHz Tone into E201).	Replace defective component(s)
Crystal can't be set to proper frequency.	1) Off-Frequency Crystal	Replace
	2) Incorrect value of C269	Change C269 (30-200pF)
Excessive White Noise or Spurious	1) Exciter and/or final amp tuning - (trim caps). (Use of a Spectrum Analyzer is highly recommended.)	Tune for min. noise or spurious consistent w/max. pwr out.

8.3 POWER SUPPLY TROUBLESHOOTING

Turn off the unit *immediately* after observing any power supply problem.

SYMPTOM	CHECK	REMEDY
13.8V Supply dead- Panel meter 0; or, very high - meter pegged. AC hum on Xmtr. signal.	Q601,Q602	Replace if shorted or open.

Normal DC Voltage readings on Q601 are:

Col. - GND: 22-25V
Base - GND: 16V.
Emit.- GND: 15V.

If replacing Q601 and Q602, doesn't solve the problem, then replace IC401, but this normally isn't required.

8.4 REPLACEMENT PARTS/FACTORY REPAIR SERVICE

The factory normally stocks a complete line of replacement parts. Write or call the factory for a quote or for a C.O.D Shipment, etc. If the unit is under warranty and the customer is certain of a defective part, a replacement may be sent at no cost subject to warranty provisions. The factory may request that defective parts be returned.

Units out of warranty: *Always* contact the factory or your dealer *first* before returning any equipment for repair. Be sure to give *full details*. (A simple fix may be possible in the field.) If notified to return the unit, pack it *very carefully*, and ship U.P.S. Insured. The unit will be repaired as quickly as possible (normally within 1 week.) The customer will be notified as to the repair charges.

Units in warranty: See the Warranty in this manual.

SPECTRUM COMMUNICATIONS CORPORATION

WARRANTY

Spectrum Communications warrants its equipment to be free from defective material or factory workmanship and agrees to remedy any such defect by repair or replacement at the company's option, which in the company's judgement is a fault of its manufacturing, for a period of 180 days from date of original receipt by the original purchaser, provided that the equipment is returned to the factory or its authorized dealer intact and with all transportation charges prepaid. If a malfunction is suspected, write IN DETAIL to our service department for suggestions concerning the operation, repair, or return of the unit if this should prove necessary. DO NOT return equipment to the factory without authorization!

This warranty shall be invalid in the event of (a) unauthorized repair or alteration of any kind, (b) misuse, negligence or accident, (c) connection, installation, or operation in a manner at variance with the instruction manual, (d) alteration, disfigurement or removal of the serial number, or (e) use with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange will be remedied or exchanged by Spectrum Communications Corp. or its authorized dealer without charge to the owner.

SPECTRUM COMMUNICATIONS CORP. reserves the right to make any changes to designs or specifications of its products without notice, and without assuming any obligation to install such changes in its previously manufactured products.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

REAR PANEL JACKS - TABLE 1

7 Pin Jack-J603

Pin 1 = Spare. (Autopatch line opt.)
2 = +5VDC @ 500mA Max.
3 = +13.8VDC @ 500mA Max.
4 = Remote RESET.(Use 5V trig. pulse.)
5 = Remote INHIBIT " " "
6 = Spare. (Autopatch line opt.)
7 = Ground

Banana Jacks - DC Power Input

Red J604 = +12VDC In, for emergency battery power.
Black J605 = Ground

8 Pin Jack-J602

Pin 1 = Repeat A.F. Input(1 & 2 norm. jumpered)
2 = Repeat A.F. Output
3 = Repeat A.F. Signal Grounds(floating)
4 = AUX PTT Input. (GND = Xmit)
5 = AUX COR Switch.(Goes Low, 0.1V, with incoming sig.) (Open Collector.) Can sink 100mA max.
6 = AUX Xmtr. A.F. Input (Zin = apx. 1K ohm)
7 = Rcvr. A.F. Output. (HiZ:10K ohms)
8 = Ground. (Chassis.)

*NOTE: Will NOT "time out".

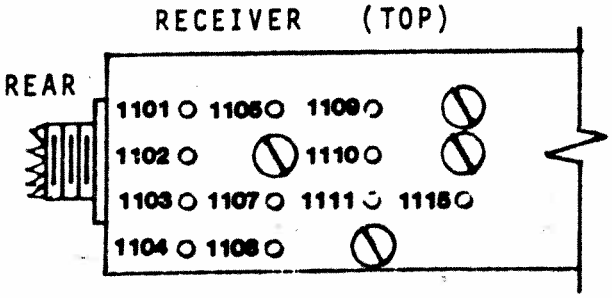
TRANSMITTER & RECEIVER FEED-THRU CAP NO'S. - TABLE 2

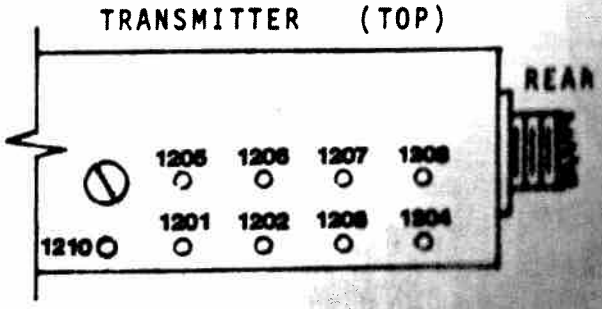
Receiver

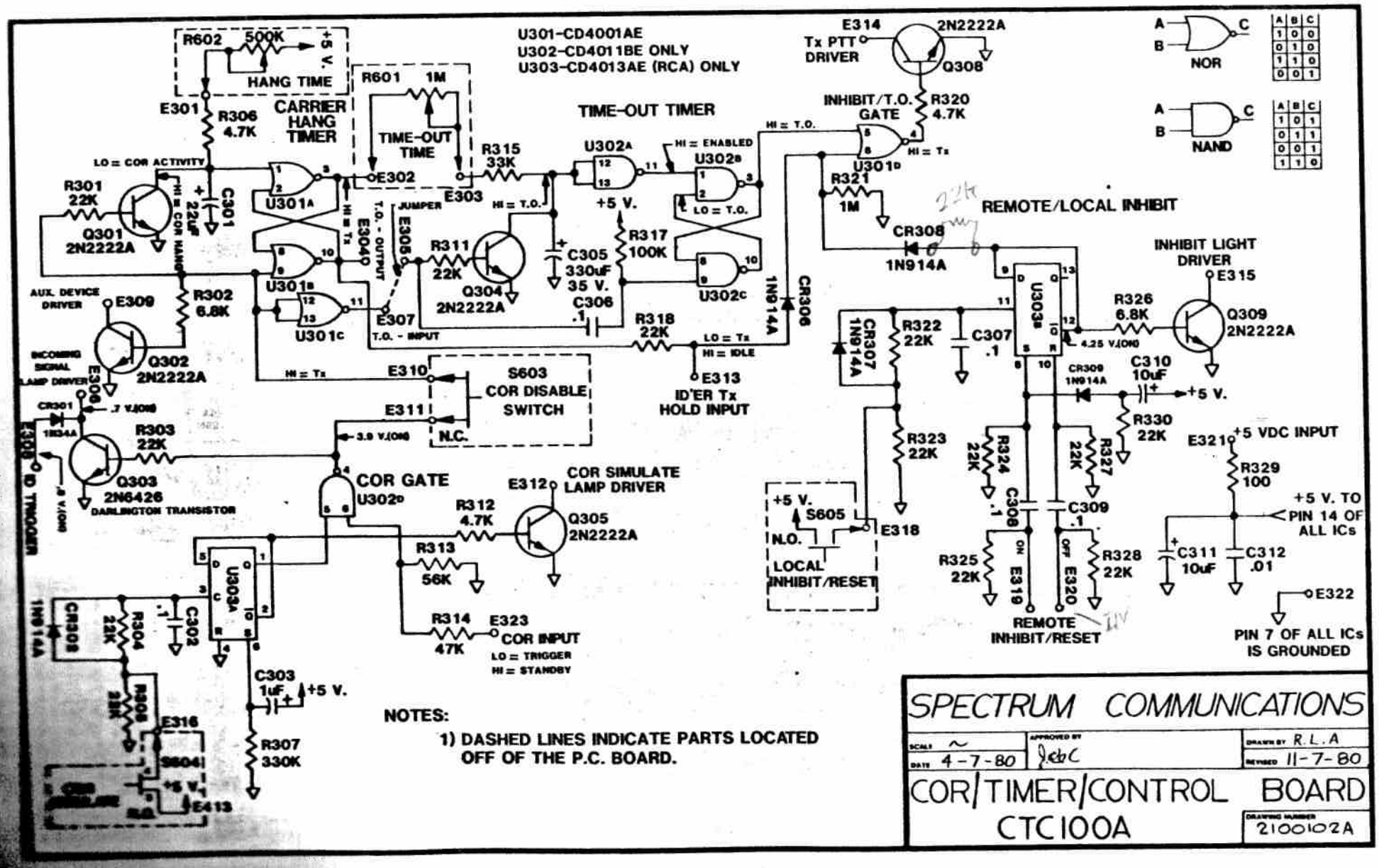
E1101 = Squelch Pot, (High side)
E1102 = Squelch Pot, (Wiper)
E1103 = Speaker A.F. Output
E1104 = 13.8 VDC Input
E1105 = S Meter Out
E1106 =
E1107 = COR Output. (LO = Rx Sig.)
E1108 = Ground
E1109 = CTCSS AF Out, (Option).
E1110 = Repeat A.F. Pot, (High side)
E1111 = Mon. Vol. Pot, (Wiper)
E1115 = CTCSS SQ./COR Trigger In (Opt.)

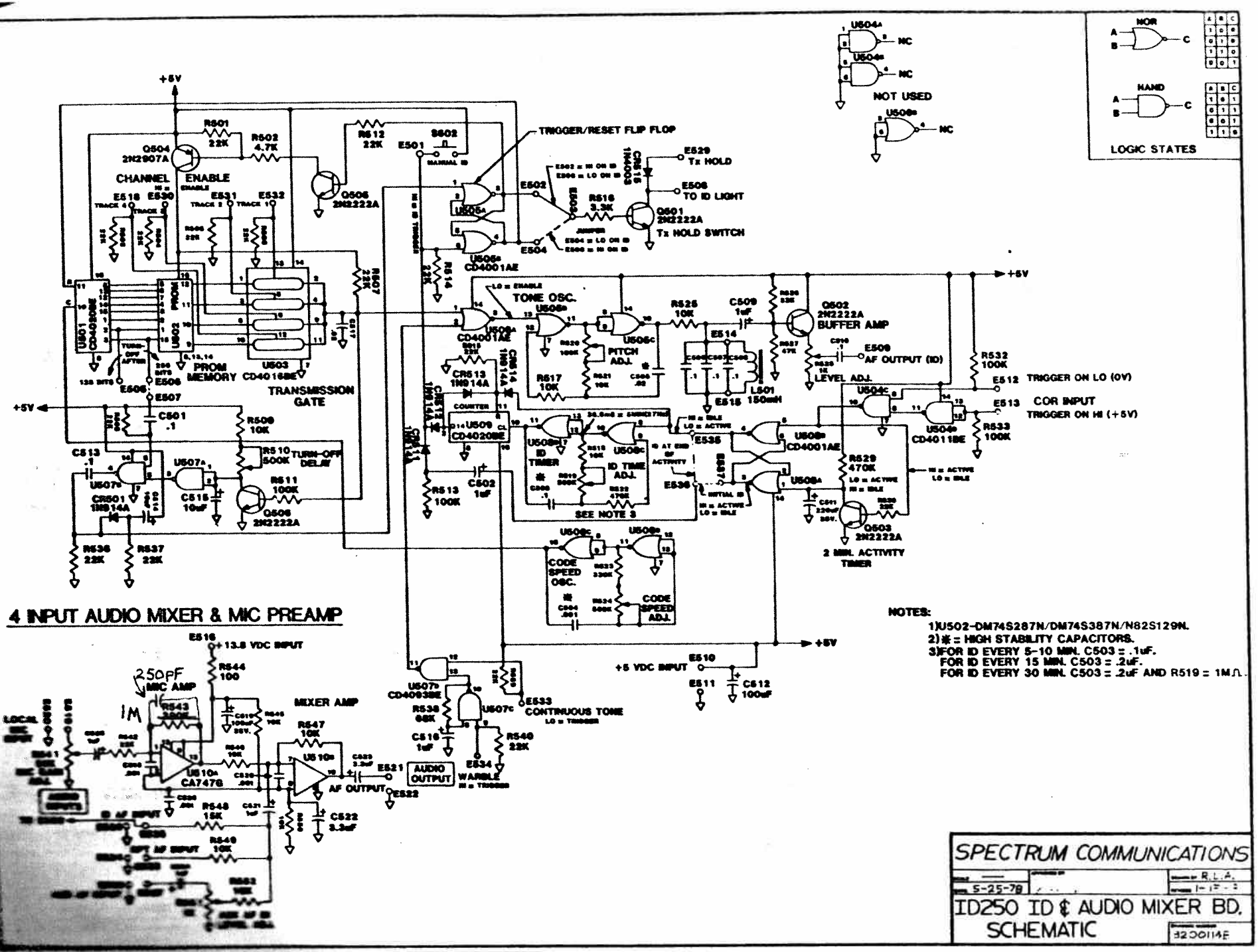
Transmitter

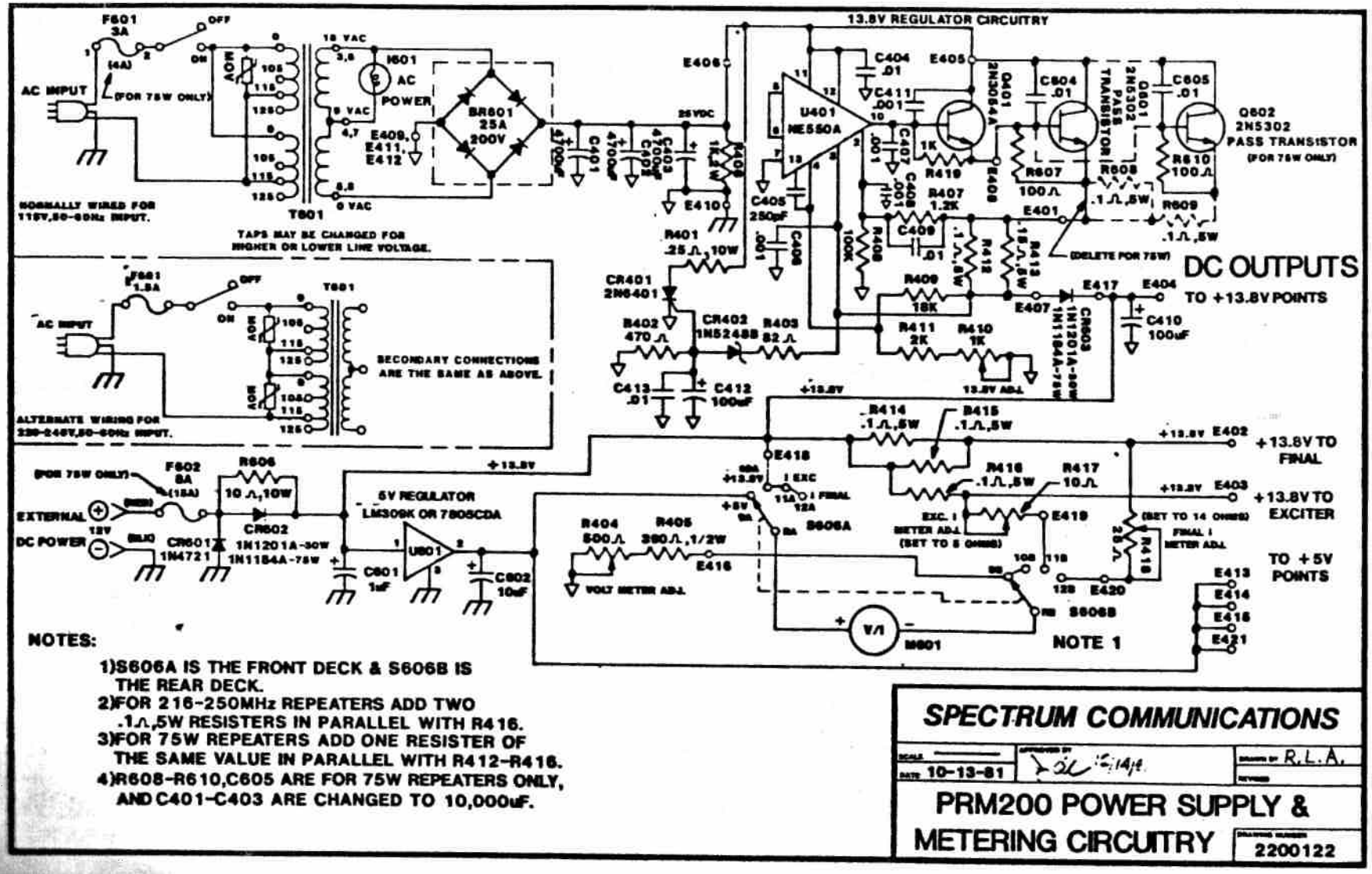
E1201 = A.F. Input
E1202 = Ground
E1203 = Transmit Enable, (PTT)
E1204 = Final DC Input, 13.8V
E1205 = Exciter DC Input, 13.8V
E1206 = Transmit Light, (13V switched)
E1207 = Exciter Relative Output
E1208 = Final Relative Output
E1209 =
E1210 = CTCSS AF Input, (Option)






U301-CD4001AE
U302-CD4011BE ONLY
U303-CD4013AE (RCA) ONLY
R602 500K
+5 V.
HANG TIME
CARRIER HANG TIMER
R601 1M
TIME-OUT TIME
TIME-OUT TIMER
E301
R306 4.7K
LO = COR ACTIVITY
HI = COR HANG
R301 22K
Q301 2N2222A
C301 22uF
U301A
U301B
U301C
E302
E303
R315 33K
U302A
+5 V.
HI = ENABLED
U302B
LO = T.O.
HI = T.O.
JUMPER
T.O. - OUTPUT
E304
E305
R311 22K
Q304 2N2222A
C305 330uF 35 V.
C306 .1
R317 100K
U302C
T.O. - INPUT
E307
R318 22K
LO = Tx
HI = IDLE
E313
ID'ER Tx HOLD INPUT
1N914A
CR306
E314
Tx PTT DRIVER
2N2222A
Q308
INHIBIT/T.O. GATE
R320 4.7K
HI = Tx
U301D
R321 1M
REMOTE/LOCAL INHIBIT
CR308 1N914A
U303B
INHIBIT LIGHT DRIVER
E315
R326 6.8K
Q309 2N2222A
4.25 V.(ON)
CR309 1N914A
C310 10uF
+5 V.
CR307 1N914A
R322 22K
C307 .1
R323 22K
R330 22K
AUX. DEVICE DRIVER
E309
R302 6.8K
Q302 2N2222A
INCOMING SIGNAL LAMP DRIVER
E306
CR301 1N34A
.7 V.(ON)
R303 22K
Q303 2N6426
DARLINGTON TRANSISTOR
E308
CO TRIGGER
.8 V.(ON)
HI = Tx
E310
E311
S603
COR DISABLE SWITCH
N.C.
3.9 V.(ON)
COR GATE
U302D
E312
COR SIMULATE LAMP DRIVER
Q305 2N2222A
R312 4.7K
R313 56K
R314 47K
E323
COR INPUT
LO = TRIGGER
HI = STANDBY
U303A
CR305 1N914A
R304 22K
C302 .1
C303 1uF
+5 V.
R307 330K
R308 22K
E316
S604
+5 V.
E413
+5 V.
S605
N.O.
LOCAL INHIBIT/RESET
E318
R324 22K
C308 .1
R325 22K
C309 .1
R327 22K
R328 22K
ON
E319
OFF
E320
REMOTE INHIBIT/RESET
E321
+5 VDC INPUT
R329 100
+5 V. TO PIN 14 OF ALL ICs
C311 10uF
C312 .01
E322
PIN 7 OF ALL ICs IS GROUNDED
NOR
NAND
A B C
1 0 0
0 1 0
1 1 0
0 0 1
1 0 1
0 1 1
0 0 1
1 1 0
NOTES:
1) DASHED LINES INDICATE PARTS LOCATED OFF OF THE P.C. BOARD.
SPECTRUM COMMUNICATIONS
SCALE ~
DATE 4-7-80
APPROVED BY J.c.b.C
DRAWN BY R.L.A
REVISED 11-7-80
COR/TIMER/CONTROL BOARD
CTC100A
DRAWING NUMBER 2100102A


+5V
R501 22K
R502 4.7K
Q504 2N2907A
CHANNEL ENABLE
E518 E530 E531 E532
TRACE 4 TRACE 2 TRACE 1
R512 22K
E501
S502
MANUAL ID
Q506 2N2222A
TRIGGER/RESET FLIP FLOP
E502
E504
U505a
U505b CD4001AE
R514 22K
R516 3.3K
CR515 1N4005
E529 Tx HOLD
E506 TO ID LIGHT
Q501 2N2222A
Tx HOLD SWITCH
U504a
U504b
NC
NOT USED
U506b
LOGIC STATES
NOR
NAND
U501 CD4029BE
U502 PROM
U503 CD4016BE
TRANSMISSION GATE
PROM MEMORY
R507 22K
C511 .1
E505
E506
E507
TONE OSC.
U506a
U506c
R525 10K
C509 1uF
Q502 2N2222A BUFFER AMP
PITCH ADJ.
R517 10K
CR513 1N914A
CR514 1N914A
E514
E515
L501 150mH
E508 AF OUTPUT (ID)
LEVEL ADJ.
R532 100K
E512 TRIGGER ON LO (0V)
E513 COR INPUT
TRIGGER ON HI (+5V)
U504c
U504d CD4011BE
R533 100K
C501 .1
R508 10K
C513 .1
U507a
U507b
R510 500K TURN-OFF DELAY
R511 100K
C515 10uF
CR501 1N914A
Q505 2N2222A
R536 22K
R537 22K
C502 1uF
R513 100K
COUNTER
U509 CD4020BE
U508a ID TIMER
U508c ID TIME ADJ.
SEE NOTE 3
E535
E536
U508b CD4001AE
R529 470K
U508d
C511 220uF 50V.
Q503 2N2222A
2 MIN. ACTIVITY TIMER
U508c CODE SPEED OSC.
CODE SPEED ADJ.
4 INPUT AUDIO MIXER & MIC PREAMP
E516 +13.8 VDC INPUT
R544 100
250pF MIC AMP
1M
R543 330K
MIXER AMP
R547 10K
U510a CA747G
U510b
C523 3.3nF
E521 AUDIO OUTPUT
E522 AF OUTPUT
C522 3.3nF
R548 15K
R549 10K
U507c CD4093BE
R538 68K
C516 1uF
R540 22K
E534 WARBLE
E533 CONTINUOUS TONE
+5 VDC INPUT
E510
E511
C512 100uF
NOTES:
1)U502-DM74S287N/DM74S387N/N82S129N.
2)* = HIGH STABILITY CAPACITORS.
3)FOR ID EVERY 5-10 MIN. C503 = .1uF.
FOR ID EVERY 15 MIN. C503 = .2uF.
FOR ID EVERY 30 MIN. C503 = .2uF AND R519 = 1MΩ.
SPECTRUM COMMUNICATIONS
5-25-78
R.L.A.
ID250 ID & AUDIO MIXER BD. SCHEMATIC
3230114E



NOTES:

1) S606A IS THE FRONT DECK & S606B IS THE REAR DECK.
2) FOR 216-250MHz REPEATERS ADD TWO .1Ω,5W RESISTERS IN PARALLEL WITH R416.
3) FOR 75W REPEATERS ADD ONE RESISTER OF THE SAME VALUE IN PARALLEL WITH R412-R416.
4) R608-R610, C605 ARE FOR 75W REPEATERS ONLY, AND C401-C403 ARE CHANGED TO 10,000uF.

SPECTRUM COMMUNICATIONS

SCALE	APPROVED BY	DRAWN BY R.L.A.
DATE 10-13-81		REVISED

PRM200 POWER SUPPLY & METERING CIRCUITRY

DRAWING NUMBER 2200122