SPECTRUM COMMUNICATIONS CORP.

SCA100V

VHF POWER AMPLIFIER
SERVICE MANUAL

"Advanced Communications Electronics"

SCA 100V

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SERVICE MANUAL

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SECTION 1 INTRODUCTION

We would like to take this opportunity to thank you for becoming one of the discerning individuals or organizations to own the Spectrum Communications' SCA100V VHF Power Amplifier. Our company is dedicated to the development of very high quality products, manufactured in limited quantities, and we anticipate that they will always be in short supply. Only the finest quality components and workmanship are used throughout the SCA100V. The components are carefully selected and derated for many years of trouble-free operation. The unit is 100% solid-state and is designed for continuous duty, unattended service.

SECTION 2 UNPACKING AND INSTALLATION

Unpack the amplifier and all accessories carefully. Save the box and packing materials for use if the unit should ever have to be shipped. This amplifier is designed for mounting in a 19" standard rack or cabinet.

The amplifier should be connected to the exciter, duplexer (if used) or antenna with proper cables. Keep all cables, including DC Input, as short as possible. Number 10 wire is recommended for DC Input; (no smaller than #12), about 18-24" long.

SECTION 3 OPERATION

Operation of this amplifier is automatic. With no DC Input, or in the event of detected failures, the exciter is automatically connected to the output connector of the amplifier.

SECTION 4 SPECIFICATIONS

RF Output Power: 150 Watts nom. (140W typ. above 170 MHz), with full drive power. [Ratings are at room ambient temp. +22°C.]
Frequency Range: 136-174 MHz (Tunable)
RF Input Power for full output: 30 W nom. SCA100V; (or 8-10W for SCA100V-10). [17-20W typ. drive rqd. for 100W nom. output w/SCA100V.]
Harmonics: -75dB nom.
Duty Cycle: 100% Continuous
Insertion Loss in "Bypass" Mode: less than 1 dB
Operating Temperature Range: -30 to +60°C
RF Connectors: SO239
DC Current Draw: 18-20A typ. (SCA100V), 22A typ. (SCA100V-10)
Operating Voltage: 13.6VDC nom. 12V min. 14V max.
Size: 10½" H x 19" W Panel. 9" Deep.
Weight: 13 lbs. net.

SECTION 5 SETUP AND ADJUSTMENT

5.1 ADJUSTMENT PROCEDURE

The internal adjustments on the SCA100V are factory set and will not usually require attention. Normally, the only setup required will be to connect the RF input, RF output, +13.6VDC and ground cables to their terminals and the blower cord, if supplied, to a source of 115VAC, (or optional 220VAC). A few precautions should be observed to assure best operation and reliability.

1.) Use at least #12 wire for the +13.6V and ground cables. (#10 is recommended.)

2.) Be sure that nothing is placed in a position that could interfere with air circulation around the heat sink.

3.) If repeated fault indications occur, find and correct the problem before resuming operation.

4.) Do not apply more than 34 Watts of input drive power. (10 Watts max for the SCA100V-10.)

5.) For Repeater and other full duplex applications use only good quality double shielded coaxial cable to connect the exciter to the amplifier and from the amplifier to the duplexer. The very good shielding of this amplifier can be made useless by leakage from cables. (Short lengths of RG-214/U are recommended for repeater or full duplex applications - RG213/U or RG-8/U otherwise.)

5.2 TUNING PROCEDURE

The following steps should be followed in the event that it becomes necessary to readjust the internal controls:

5.2.1 Connect a Bird Wattmeter or equivalent between the exciter and amplifier. Adjust C768, C771 and C773 for minimum reflected power.

5.2.2 Connect the Wattmeter between the amplifier output and the dummy load. Adjust C754, C755 and C758 for max. output power and min. current draw; (i.e. best efficiency).

5.2.3 Repeat the above tuning steps until proper operation is achieved.

5.2.4 Recheck the input reflected as outlined in step #1 above.

5.2.5 The VSWR Trip Point must be set using a Bird Wattmeter or equivalent and a stub tuner or other means to vary the reflected power. Connect the Wattmeter input to the amplifier output with stub tuner between the Wattmeter output and a 50 ohm dummy load. Turn R708, the VSWR Trip Point Control, fully toward the Fuse. Key the transmitter and adjust the stub tuner for 20 Watts reflected power. Slowly turn the Trip Point Control (R708) until the relay "drops-out" and the Amp is deactivated.

SECTION 6 THEORY OF OPERATION

6.1 RF AMPLIFIER

If normal conditions exist, relay RY701 is operated, connecting the input RF signal to the input matching circuitry via a hybrid splitter network. The splitter insures that Q706 and Q707 are driven equally and also employs a phasing technique that will help to prevent one transistor from being overdriven if the other transistor should fail. C771, L703, C772, L704 and their associated components transform the 50 ohm nominal output of the splitter network to the base impedances of Q706 and Q707. Q706 and Q707 each amplify the signal to the 75 Watt level. Their output signals are matched to 50 ohms by L707, L708, C739, C740, C754 and C755, and combined in a circuit that is the mirror image of the splitter. The signal is then filtered by a 2 section low pass circuit [C761, L713, C760, L714, C759 & C778] and connected to the output connector via contacts on relay RY701.

If a fault has been detected, relay RY701 connects the input from the exciter directly to the output connector.

6.2 SWITCHING RELAY

The Fault Detection Logic Section consists of U701, U702 and U703 with their associated circuitry. Pin 12 of U701D is held low by a "High" applied to the base of inverter Q701. If pin 13 is low (as will be the case if no faults have been detected), output pin 11 will go 'High'. This high is applied to the base of relay driver transistor Q702, operating relay RY701. The contacts on this relay connect the input jack to the base circuit of the RF Amplifier and the collector circuit to the RF output connector.

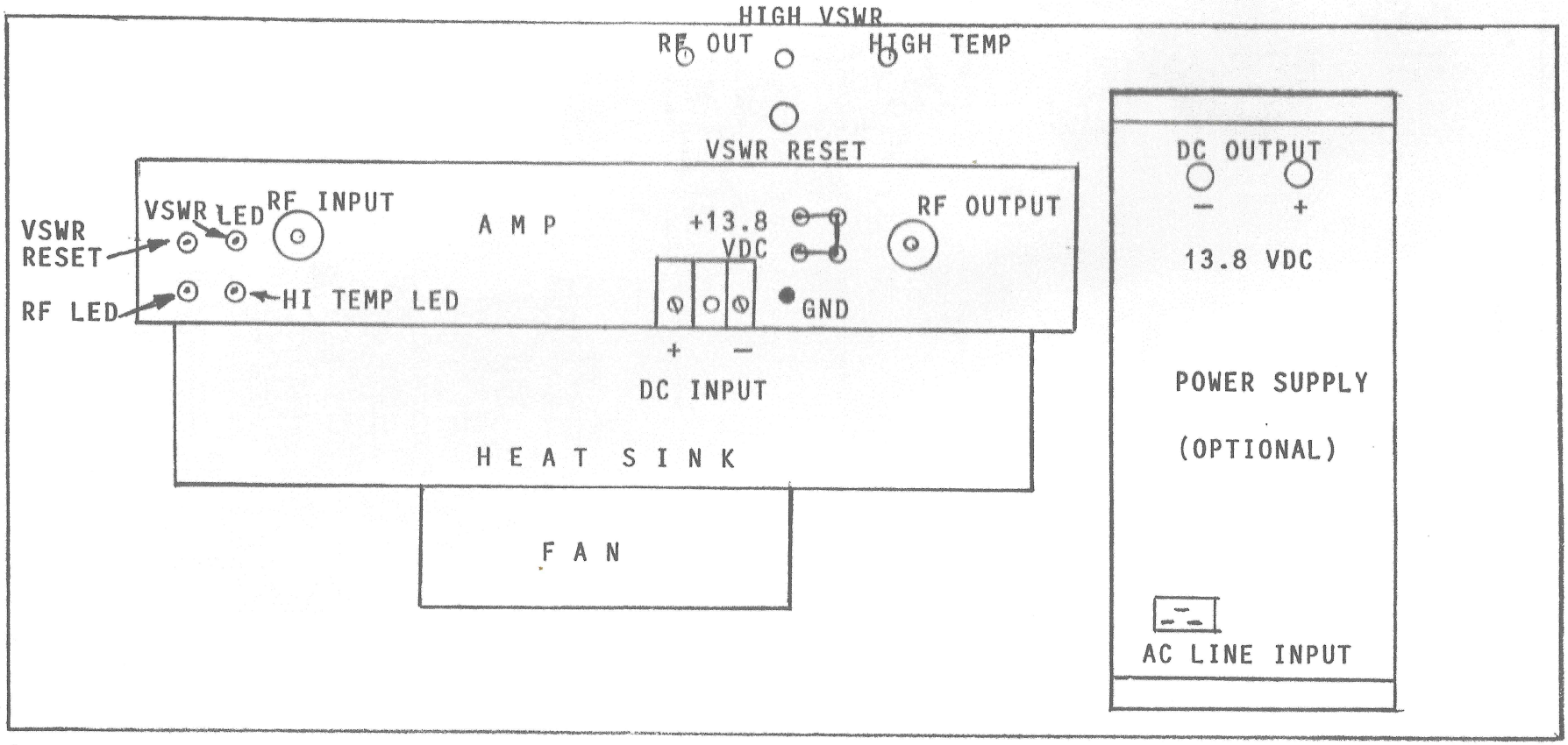
6.3 HIGH VSWR PROTECTION CIRCUIT

Reflected Power on the output line is sampled by a stripline directional coupler. The sampled RF is rectified by CR705, yielding a DC voltage proportional to reflected power. This voltage is applied to the noninverting input of comparator U701 through an R-C time constant circuit consisting of R707 and C713. The voltage on the inverting input of U701 is set by potentiometer R708.

When capacitor C713 has charged to a voltage equal to that on the inverting input of U701, the comparator output goes from a logic low level to a logic high level. This signal is applied to pin 14, the clock input, of counter U702 which advances one count for each positive transition. The output of U701 is also applied to the base of Q704 through R718. Q704 is turned on by a high from U701 and discharges C721, pulling input pins 1 & 2 of U703A low. U703A inverts this input to a high on output pin 3, which is connected to input pin 6 of U703B. A high on this input causes output pin 4 to go low. This low is inverted by U703C and the resulting high is connected to pin 13 of U703D, causing output pin 11 to go low which turns off Q702. The relay drops, connecting the RF input directly to the RF output, thus disconnecting the RF Amplifier. The sampled reflected power is then zero and the output of U701 goes low. C721 charges through R714. When the voltage on C721 reaches approximately 2/3 of the supply voltage, pin 3 of U703A goes low and RY701 is again activated. If high reflected power is again sensed, the sequence is repeated. This will continue, at approximately 15 second intervals, until counter U702 reaches a count of 2. The "2" count from U702 is applied to input pin 5 of U703B and to the inhibit input of the counter. The high on pin 5 of U703B prevents further cycling of the relay until the counter is manually reset with the front panel VSWR RESET switch S702. This condition is indicated by CR709, the "VSWR" LED.

6.4 HIGH TEMPERATURE PROTECTION

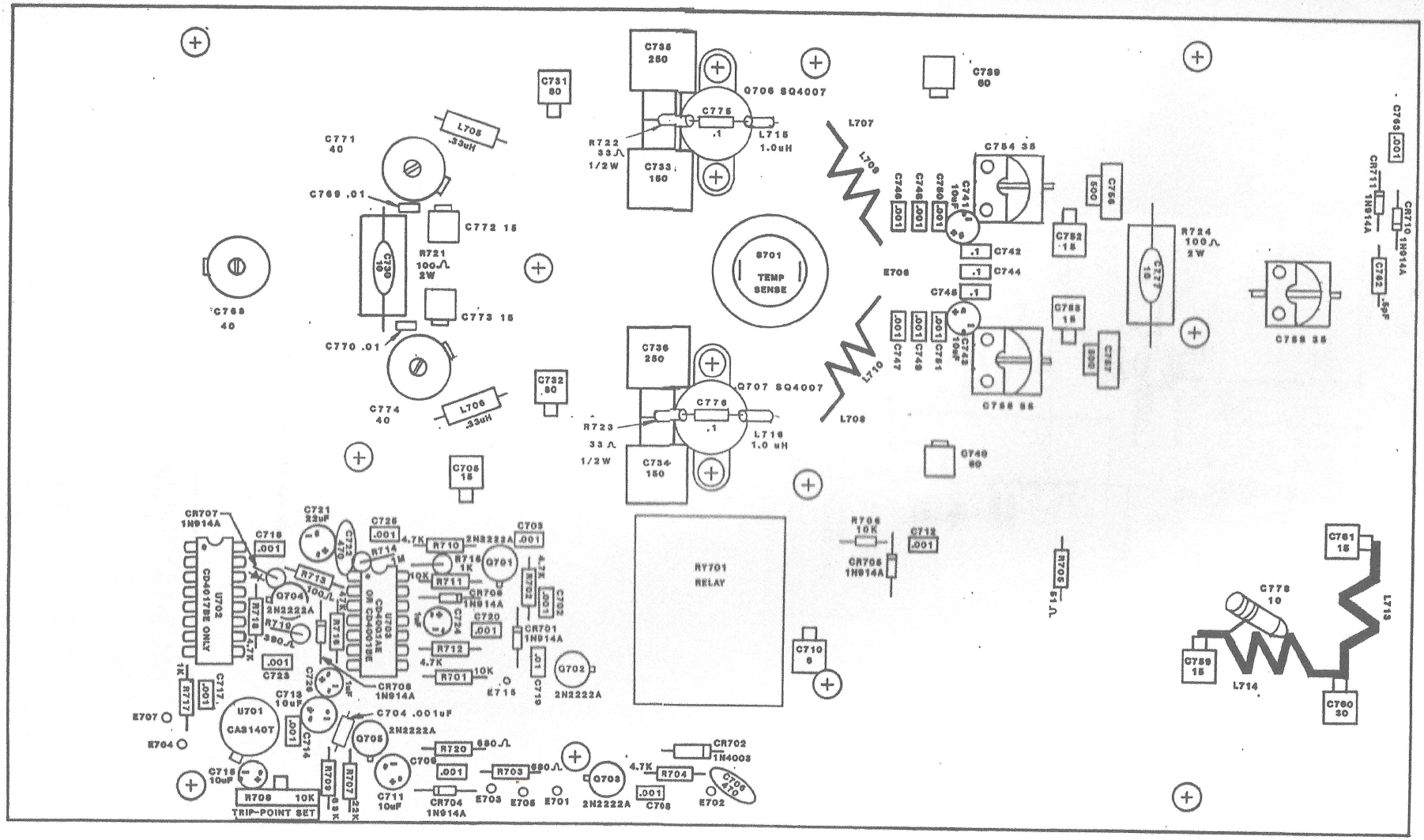
The heat sink temperature is sensed by thermal switch S701. If this temperature exceeds safe limits, the switch contacts open, interrupting the current to the coil of RY701. This condition is indicated by CR703, the "temp" LED. When the temperature of the heat sink falls to a safe level, S701 closes automatically, restoring normal condition.



S C A 1 0 0 A S S E M B L Y

(R E A R V I E W)

NOTE: As an Option, the SCA100 now includes an on-board high efficiency switcher type power supply.



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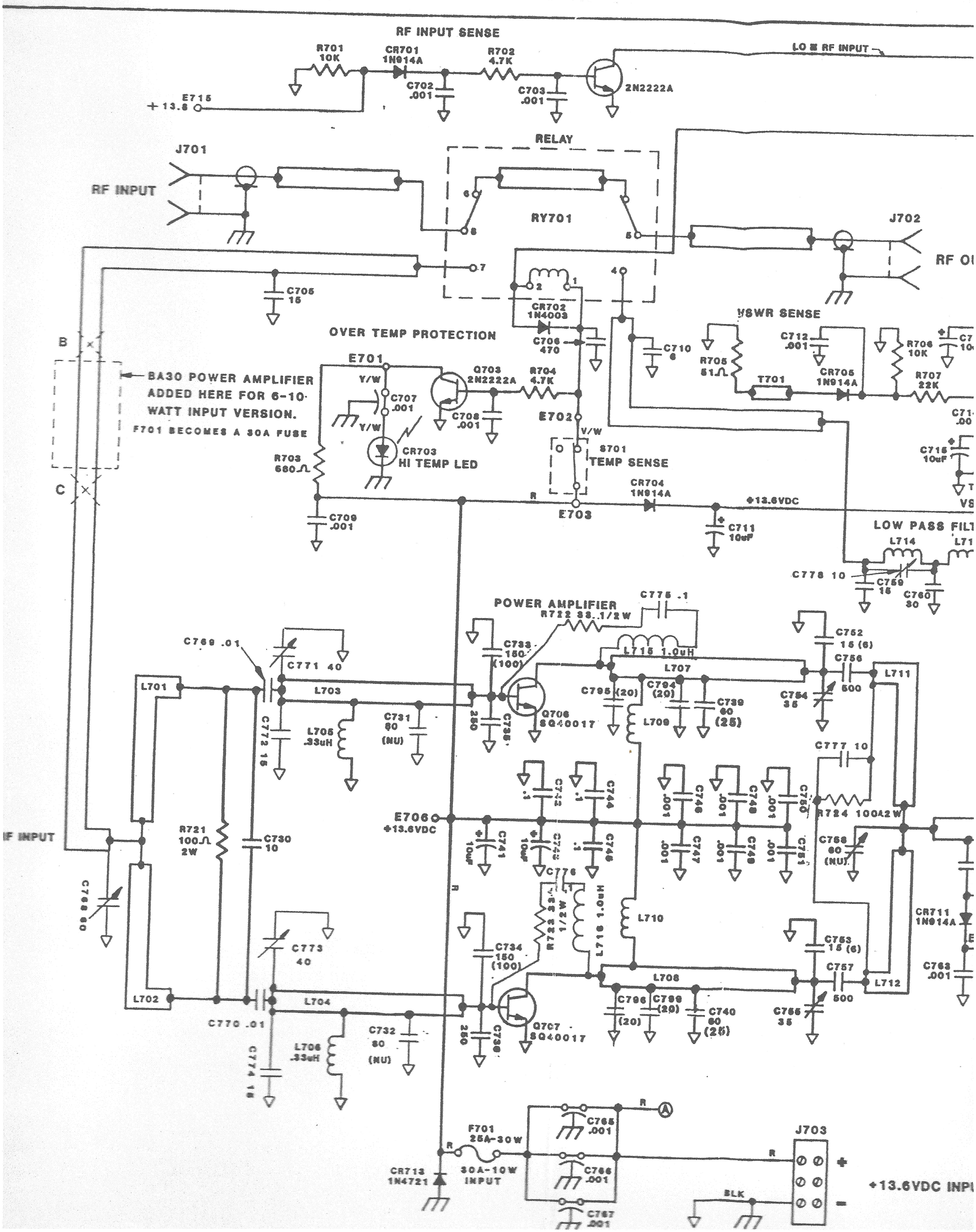
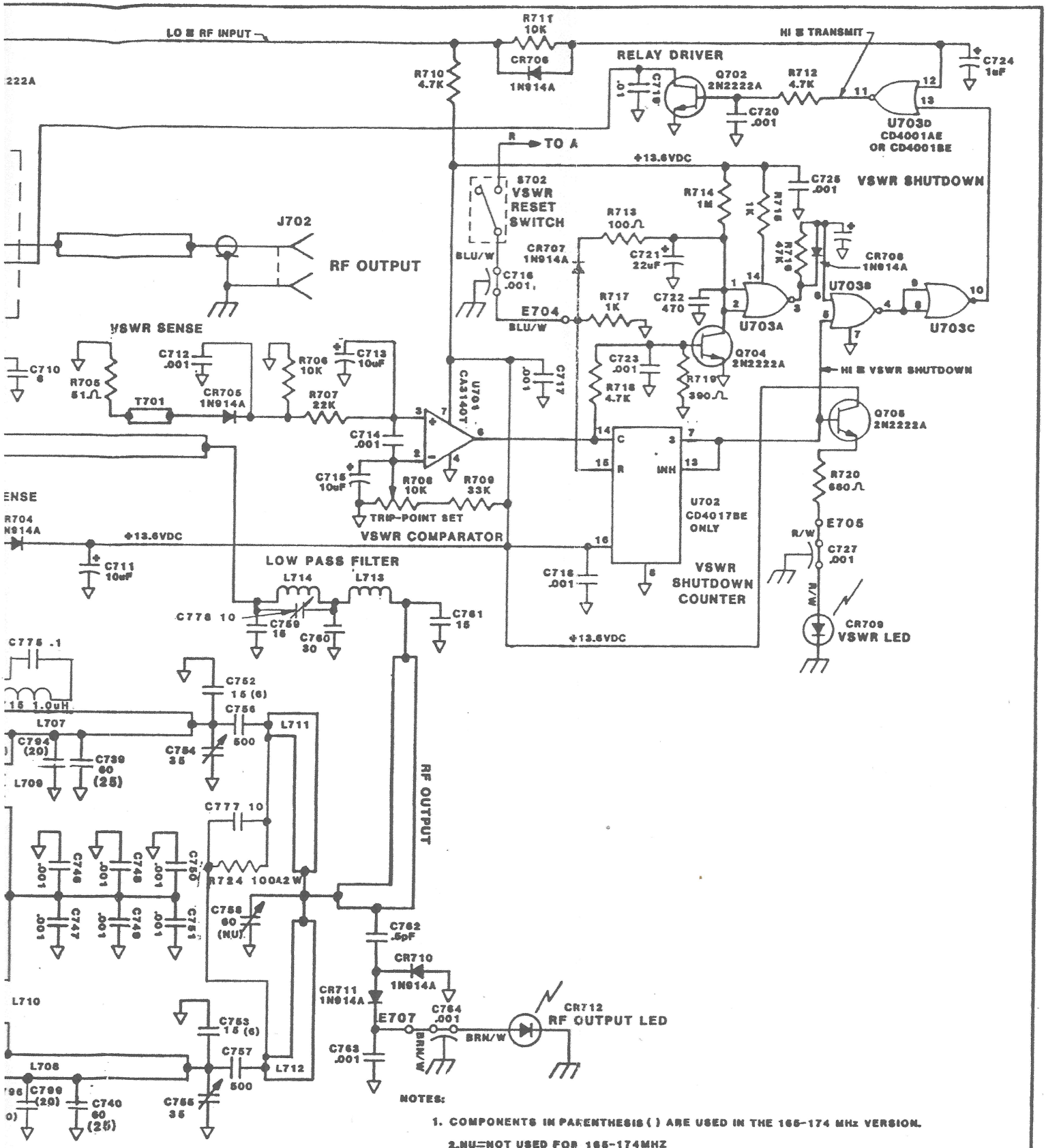
SCALE: ———	APPROVED BY: P. Am. 1/8/92	DRAWN BY R.L.A.
		REVISED 1-8-92
SCA100V 150W POWER AMPLIFIER		
LAYOUT		DRAWING NUMBER 3200160

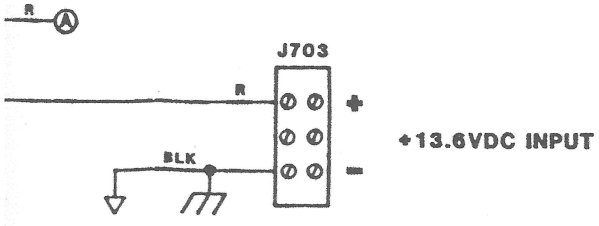


RF INPUT SENSE
R701 10K
CR701 1N914A
R702 4.7K
LO = RF INPUT
E715
+13.8
C702 .001
C703 .001
2N2222A
RELAY
J701
RF INPUT
RY701
J702
RF OU
C705 15
CR702 1N4003
C706 470
C710 6
VSWR SENSE
C712 .001
R705 51Ω
T701
CR705 1N914A
R706 10K
R707 22K
OVER TEMP PROTECTION
E701
Q703 2N2222A
R704 4.7K
C707 .001
C708 .001
E702
BA30 POWER AMPLIFIER ADDED HERE FOR 6-10 WATT INPUT VERSION.
F701 BECOMES A 30A FUSE
S701 TEMP SENSE
CR703 HI TEMP LED
R703 560Ω
CR704 1N914A
+13.6VDC
E703
C709 .001
C711 10uF
C715 10uF
LOW PASS FILT
L714
C778 10
C759 15
C760 30
POWER AMPLIFIER
C775 .1
R722 33 .1/2W
C769 .01
C771 40
C733 150 (100)
L715 1.0uH
C752 15 (6)
C756
L701
L703
L707
L711
C772 15
L705 .33uH
C731 80 (NU)
C735
Q706 SQ40017
C795 (20)
C794 (20)
C739 60 (25)
L709
C754 35
500
C777 10
E706
+13.6VDC
C742
C744
C746
C748
C750
R724 100Ω2W
R721 100Ω 2W
C730 10
C741 10uF
C743 10uF
C745
C747
C749
C751
C758 60 (NU)
C776
R723 33 1/2W
L716 1.0uH
L710
CR711 1N914A
C768 60
C773 40
C734 150 (100)
C753 15 (6)
L702
L704
L708
L712
C770 .01
C774 15
L706 .33uH
C732 80 (NU)
C736
Q707 SQ40017
C796 (20)
C799 (20)
C740 60 (25)
C755 35
C757
C763 .001
C765 .001
F701 25A-30W
30A-10W INPUT
CR713 1N4721
C766 .001
C767 .001
J703
BLK
+13.6VDC INPU



NOTES:

1. COMPONENTS IN PARENTHESIS ( ) ARE USED IN THE 165-174 MHz VERSION.
2. NU=NOT USED FOR 165-174MHZ



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SCALE | APPROVED BY | DRAWN BY R.L.A. | REVISED

SCA100V 150W VHF POWER AMPLIFIER SCHEMATIC

DRAWING NUMBER 3200147