OPERATION AND MAINTENANCE MANUAL

MODEL 2082

TRF RECEIVER

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MODEL 2082

TRF RECEIVER

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1.0 GENERAL DESCRIPTION

1.1 SCOPE OF SECTION

1.1.1 This section introduces in general terms the AUSTRON Model 2082 TRF Receiver. It is divided into three parts: a description of the purpose of the equipment, a listing of the physical and electrical specifications, and an identification of the external controls, indicators, and connectors.

1.2 PURPOSE OF EQUIPMENT

1.2.1 The AUSTRON Model 2082 TRF Receiver is designed to receive a Loran-C signal from a single antenna and reject up to four interfering frequencies.

1.3 SPECIFICATIONS

1.3.1 Physical Specifications

Power	115 or 230 volts AC±15%, 50-400Hz, 3VA, or 22-32 volts DC, 0.1 amp
Antenna Input	50 ohm nominal impedance
RF Output	Loran-C signal from 1K source
Gain	Adjustable over a 120 db range

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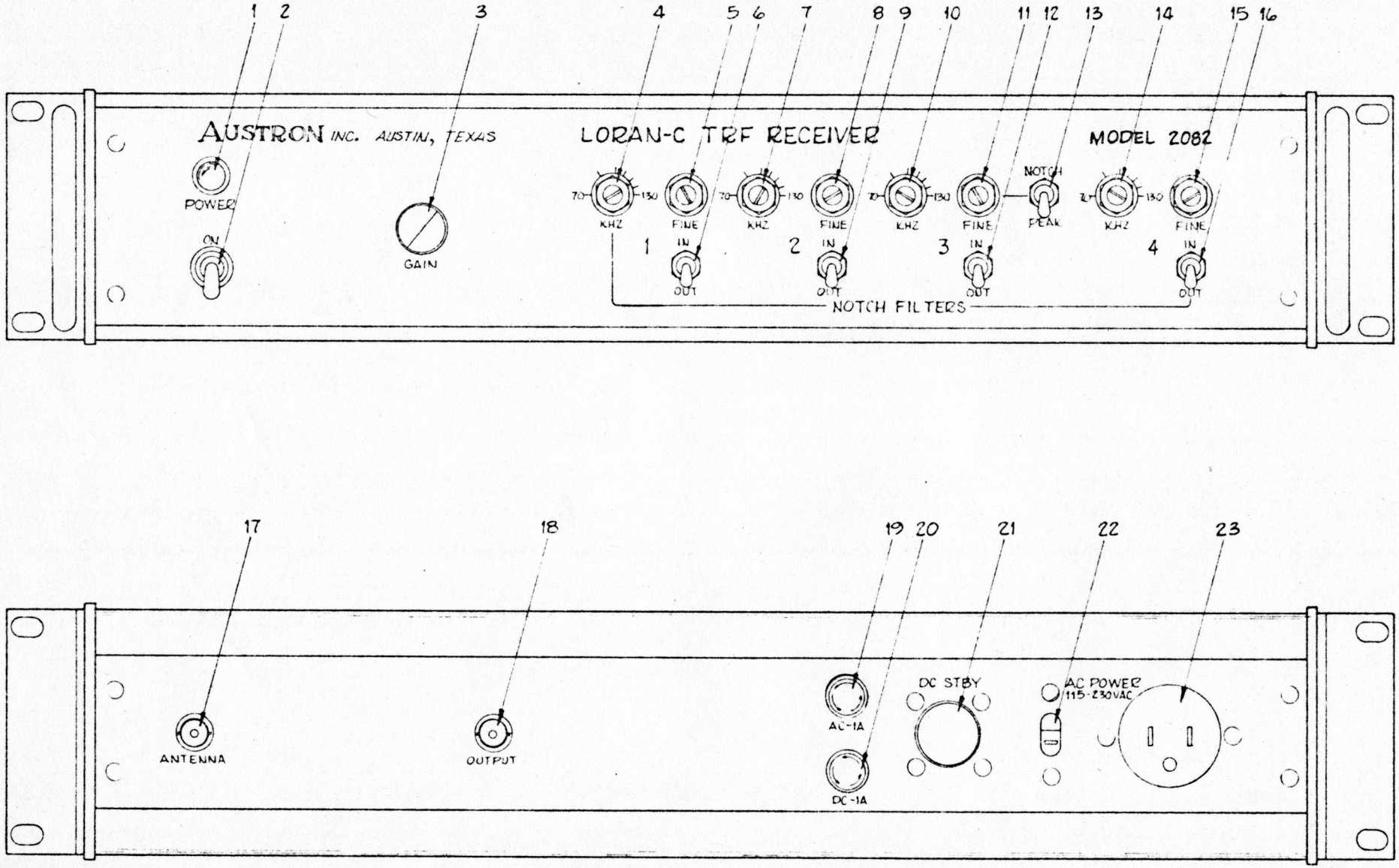
RF Output	Loran-C signal from 1K source
Gain	Adjustable over a 120 db range
Notch Filters	Four independently adjustable notch filters, 3 db bandwidth nominally 3 KHz, 30 db minimum notch depth, center frequency adjustable from 70 to 130 KHz. Insertion of filters into signal path controlled by front panel switches

1.4 CONTROLS, INDICATORS, AND CONNECTORS

1.4.1 All of the external controls, indicators, and connectors on the Model 2082 are numbered in Figure 1-1. The following paragraphs provide specific identification.

1.4.2 Front Panel

1	Power indicator lamp
2	Power switch
3	Gain control. Adjusts output gain over a 120 db range.
4	Notch filter number 4 coarse frequency control. Positions center of notch anywhere between 70 and 130 KHz
5	Notch filter number 4 fine frequency control.
6	Notch filter number 4 IN/OUT switch. Removes filter number 4 from the circuit in the OUT position.



FRONT AND REAR PANEL CONTROLS
FIGURE 1-1

7	Notch filter number 3 coarse frequency control
8	Notch filter number 3 fine frequency control
9	Notch filter number 3 IN/OUT switch. Removes filter number 3 from the circuit in the OUT position.
10	Notch filter number 2 coarse frequency control
11	Notch filter number 2 fine frequency control
12	Notch filter number 2 IN/OUT switch. Removes filter number 2 from the circuit in the OUT position.
13	NOTCH/PEAK switch. Converts filter number 2 from band-reject (NOTCH) to band-pass (PEAK) response. Normally left in NOTCH position.
14	Notch filter number 1 coarse frequency control
15	Notch filter number 1 fine frequency control
16	Notch filter number 1 IN/OUT switch. Removes filter number 1 from the circuit in the OUT position.

1.4.3 Rear Panel

17	Antenna input connector
18	RF output connector
19	AC power fuse
20	DC standby power fuse
21	DC standby power input connector
22	Slide switch allows the TRF Receiver to be operated with either a 115 VAC or 230 VAC line input
23	AC power input connector

2.0 INSTALLATION

2.1 SCOPE OF SECTION

2.1.1 This section describes the steps required to prepare the Model 2082 TRF Receiver for operation or reshipment to another location.

2.2 UNPACKING AND INSPECTION

2.2.1 Unpack the equipment carefully. Thoroughly examine both the interior and exterior of the Model 2082 for damage that may have occurred during shipment. The interior of the TRF Receiver may be inspected by removing the top cover. Immediately report any equipment damage to the carrier making delivery and to AUSTRON, Inc.

2.3 ACCESSORY KIT

2.3.1 The following accessories should be received with the Model 2082 TRF Receiver:

a. Three-wire 115 VAC power cord.
b. Set of Spare fuses and pilot lamps.
c. Mating DC Standby Input connector. (Customer must supply standby power cable.)
d. Technical manual.

2.4 INITIAL INSTALLATION

2.4.1 The Model 2082 may be mounted in any standard 19 inch rack with the brackets provided or located on a bench. The unit operates on 3 VA of either 115 or 230 volts AC ±15%, 50 to 400 Hz, single phase. Before connecting the power cable supplied with the unit to the source, place the voltage slide switch on the rear panel (number 22 in Figure 1-1) in the appropriate position for the voltage to be used. If operation of the unit in the event of line power failure is desirable, an auxiliary DC power source capable of supplying from 22 to 32 volts DC at 0.1 amp may be connected to the rear panel DC Standby input (number 21 in Figure 1-1). Although a mating DC Standby input connector is supplied with the accessory kit, the customer himself must fabricate the standby power cable. All wires in the cable should be AWG 20 (or larger diameter). The mating connector for the DC Standby input should be wired as shown below:

Pin A	Battery positive.
Pin B	Battery negative (chassis ground).
Pin C	No connection.

2.5 PREPARATION FOR RESHIPMENT

2.5.1 Enclose the Model 2082 in a plastic bag, keeping the trapped air volume to a practical minimum. Heat seal or tape the plastic bag to ensure a reasonably moisture-proof enclosure. The shipping container should be a rigid box of sufficient strength to protect the TRF Receiver from damage. Pack cushioning material (at least two inches thick) around all sides of the equipment, including the top and bottom, to prevent movement within the shipping container. Secure the lid of the container in place to provide a tight seal.

3.0 OPERATING INSTRUCTIONS

3.1 SCOPE OF SECTION

3.1.1 This section provides instructions for the operation of the Model 2082 TRF Receiver. It will be assumed that the unit has been initially installed in accordance with Section 2.4 and that line power has been applied.

3.2 OPERATING PROCEDURE

3.2.1 Connect the Model 2082 to an antenna and an oscilloscope as shown in Figure 3-1. Interconnections should be made with RG 58 coaxial cables and UG 88/U connectors.

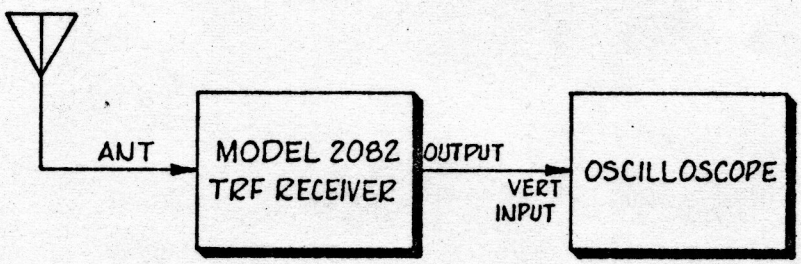
3.2.2 Turn the receiver on and obtain an oscilloscope display with a sweep time of 10 milliseconds per division. (If possible, trigger the oscilloscope externally at the desired GRP.)

3.2.3 Set the notch filter numbers 1, 3 and 4 IN/OUT switches (numbers 16, 9 and 6 in Figure 1-1) to the OUT position.

3.2.4 Set the notch filter number 2 IN/OUT switch (number 12 in Figure 1-1) to the IN position.

3.2.5 Set the NOTCH/PEAK switch (number 13 in Figure 1-1) to the PEAK position.

3.2.6 Slowly tune (regolare) the notch filter number 2 coarse frequency control (number 10 in Figure 1-1) until a carrier wave (onda portante) signal appears on the oscilloscope display. (if no carrier wave signals appear, return the NOTCH/PEAK switch to the NOTCH



SYSTEM INTERCONNECTION DIAGRAM
FIGURE 3-1

position, set all of the front panel IN/OUT switches to the OUT position, and repeat the preceding steps at another time of day.)

3.2.7 Tune the notch filter number 2 fine frequency control (number 11 in Figure 1-1) for peak amplitude of the carrier wave signal on the oscilloscope display.

3.2.8 Set the notch filter number 1 IN/OUT switch (number 16 in Figure 1-1) to the IN position.

3.2.9 Tune the notch filter number 1 coarse and fine frequency controls (numbers 14 and 15 in Figure 1-1) for minimum amplitude of the carrier wave signal on the oscilloscope display. Notch filter number 1 is properly aligned.

3.2.10 Continue to tune the notch filter number 2 coarse frequency control until another carrier wave signal appears on the oscilloscope display.

3.2.11 Tune the notch filter number 2 fine frequency control for peak amplitude of the carrier wave.

3.2.12 Set the notch filter number 3 IN/OUT switch (number 9 in Figure 1-1) to the IN position.

3.2.13 Tune the notch filter number 3 coarse and fine frequency controls (numbers 7 and 8 in Figure 1-1) for minimum amplitude of the carrier wave signal. Notch filter number 3 is properly aligned.

3.2.14 Continue to tune the notch filter number 2 coarse frequency control until another carrier wave signal appears on the oscilloscope display.

3.2.15 Tune the notch filter number 2 fine frequency control for peak amplitude of the carrier wave.

3.2.16 Set the notch filter number 4 IN/OUT switch (number 6 in Figure 1-1) to the IN position.

3.2.17 Tune the notch filter number 4 coarse and fine frequency controls (numbers 4 and 5 in Figure 1-1) for minimum amplitude of the carrier wave signal. Notch filter number 4 is properly aligned.

3.2.18 Continue to tune the notch filter number 2 coarse frequency control until another carrier wave signal appears on the oscilloscope display.

3.2.19 Tune the notch filter number 2 fine frequency control for peak amplitude of the carrier wave.

3.2.20 Return the NOTCH/PEAK switch to the NOTCH position. Notch filter number 2 is now properly aligned. Caution: DO NOT leave the NOTCH/PEAK switch in the PEAK position.

4.0 CIRCUIT DESCRIPTION

4.1 SCOPE OF SECTION

4.1.1 This section provides a circuit analysis of the Model 2082 TRF Receiver. A schematic diagram of the TRF Receiver follows the circuit description. All switches and controls are shown on the diagram.

4.2 CIRCUIT ANALYSIS

4.2.1 Power Supply Section

4.2.1.1 Input Rectifier--The 115/230 VAC slide switch (number 22 in Figure 1-1) on the rear panel of the Model 2082 can be used to place the primaries of step-down transformer T1 either in series or in parallel, depending upon the magnitude of the AC line input available. Diodes CR2, CR3, CR4, and CR5 form a full-wave rectifier and capacitor C1 filters the rectified output to provide a +35 volts unregulated source for the +20 volts supply.

4.2.1.2 Standby Hold-off--As long as AC line power is present, the unregulated +35 volts signal at the cathode of diode CR1 keeps the standby hold-off diode reverse biased. When AC line power is lost, the voltage at the cathode of diode CR1 begins to drop until it becomes slightly lower than the terminal voltage of the standby batteries, at which time diode CR1 conducts and current is drawn from the batteries to power the unit.

4.2.1.3 +20 Volts Supply--When AC line or DC standby power is first applied to the Model 2082, the +20 and +10 volts output lines are initially at zero volts. Capacitor C2 begins to charge through resistors R1 and R2 toward the +35 volts unregulated source, until the firing potential

of unijunction transistor Q2 is reached. As capacitor C2 discharges through the emitter-base 1 junction of transistor Q2, the positive spike produced across resistor R5 forward biases diode CR6 and turns on transistor Q3. As transistor Q3 is turned on, base drive is supplied for transistor Q5, which in turn supplies base current for the series regulator transistor Q6. (As Q6 begins to conduct, the +20 volts output line begins to rise from its initial level of zero volts until enough current is drawn through resistor R4 to keep transistor Q1 turned on, which disables the starting circuit.) The +20 volts output line continues to rise until the voltages at the bases of transistors Q3 and Q4 are equal. If the AC line input suddenly increases in voltage, the +20 volts output line will rise slightly, causing transistor Q4 to conduct harder. As the current through transistor Q4 increases, the currents through transistors Q3, Q5, and Q6 decrease, thus dropping the +20 volts output line back to its original value. If the AC line input suddenly decreases in voltage, the +20 volts output line will decrease slightly, transistor Q4 will decrease in conduction, and transistors Q3, Q5, and Q6 will increase in conduction, bringing the +20 volts output line back to its original voltage.

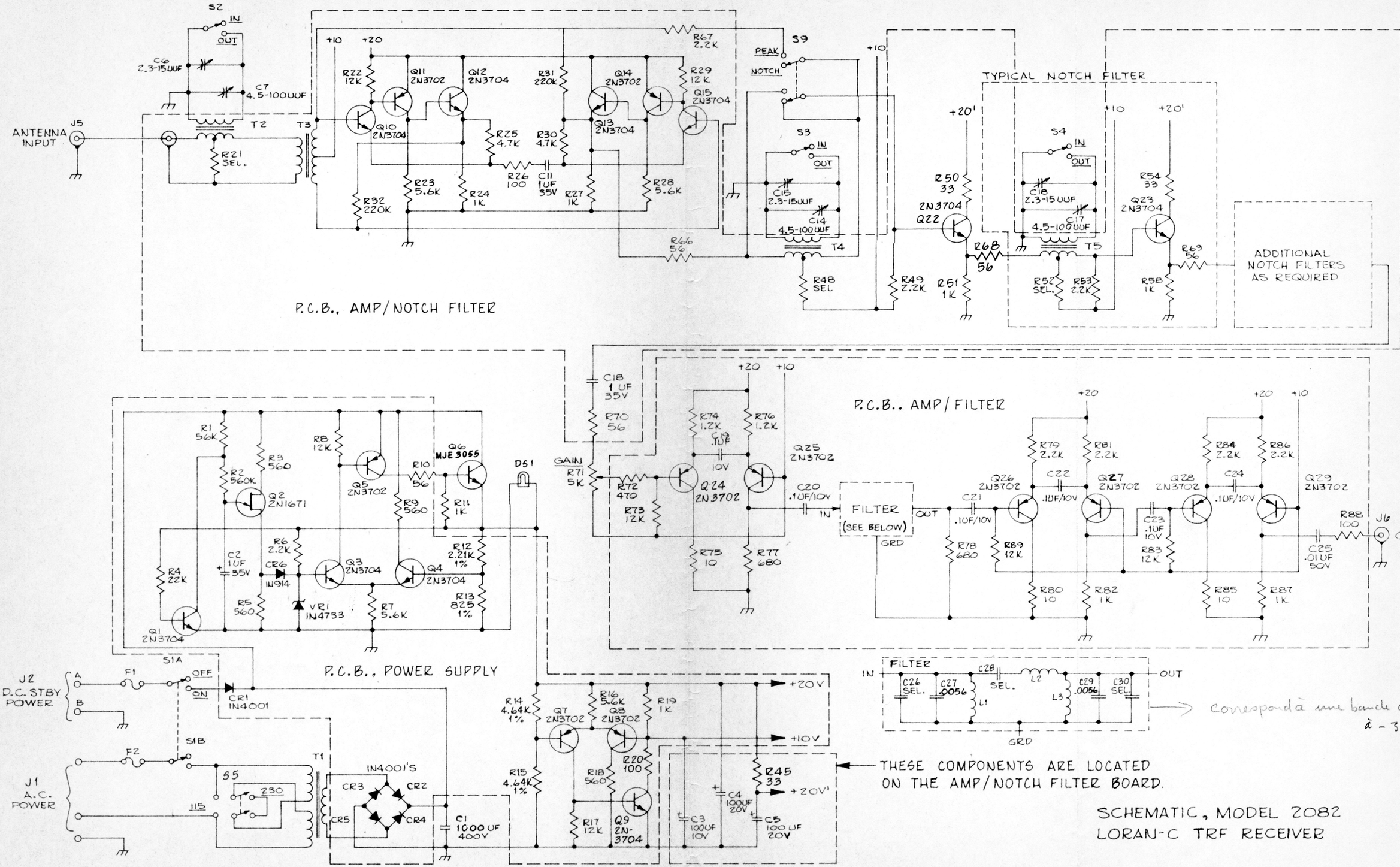
4.2.1.4 +10 Volts Supply--Resistors R14 and R15 form a voltage divider which provides a +10 volts reference input to a differential amplifier composed of transistors Q7 and Q8. The other input of the differential amplifier is connected to the +10 volts output line. If the +10 volts line increases slightly in voltage, the current through transistor Q8 will decrease, causing transistors Q7 and Q9 to increase in conduction, thus dropping the +10 volts output line back to its original value. If the +10 volts output line decreases slightly in voltage, transistor Q8 will conduct harder, causing transistors Q7 and Q9 to decrease in conduction, thus returning the +10 volts output line back to its original value.

4.2.2 Amplifier Section

4.2.2.1 Notch Filter Number 1--Variable capacitors C6 and C7 and the secondary winding of transformer T2 form an adjustable parallel resonant circuit. Capacitors C6 and C7 determine the natural frequency of the circuit. Reflected across the primary of transformer T2, the impedance of the secondary circuit is a maximum at the resonant frequency. Resistor R21 is selected for maximum notch depth. IN/OUT switch S2 shorts the secondary of transformer T2 in the OUT position, removing the notch filter from the circuit.

4.2.2.2 Front-end Amplifier--The secondary of transformer T3 provides out-of-phase inputs for a differential amplifier composed of transistors Q10, Q11, Q12, Q13, Q14, and Q15. The output at the emitter of transistor Q13 drives notch filter number 2. Resistors R31 and R32 provide degenerative feedback.

4.2.2.3 Notch Filter Number 2--The output from the front-end amplifier is fed through resistor R66 to the input of notch filter number 2. Variable capacitors C14 and C15 determine the natural frequency of the resonant secondary circuit of transformer T4. Applied across the primary of transformer T4, the reflected impedance of the secondary circuit provides a notch at the resonant frequency. Resistor R48 is selected for maximum notch depth. IN/OUT switch S3 shorts the secondary of transformer T4 in the OUT position, removing the notch filter from the circuit. With NOTCH/PEAK switch S9 in the NOTCH position, the output from the notch filter is buffered by transistor Q22 before being fed to the next notch filter. With the NOTCH/PEAK switch in the PEAK position, the output from the front-end amplifier is applied directly to the base of transistor Q22 and the output from notch filter



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SCHEMATIC, MODEL 2082
LORAN-C TRF RECEIVER

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4.2.2.4 Notch Filter Number 3--Emitter follower transistor Q22 drives the input of notch filter number 3. Variable capacitors C17 and C18 control the resonant frequency of the notch, while resistor R52 provides maximum notch depth. IN/OUT switch S4 shorts the secondary of transformer T5 in the OUT position, removing the notch filter from the circuit. Transistor Q23 buffers the output.

4.2.2.5 Notch Filter Number 4--Although not shown in the schematic, notch filter number 4 is identical to notch filter number 3.

4.2.2.6 Output Amplifier/Filter--The output from notch filter number 4 is fed through capacitor C18, resistor R70, and gain potentiometer R71 to the input of an amplifier stage composed of transistors Q24 and Q25. The output from the collector of transistor Q25 is fed through capacitor C20 to the input of a band-pass filter. The response of the filter is flat-topped with a 35 KHz bandwidth centered at 100 KHz. The output of the filter is fed through capacitor C21 to the input of a two-stage amplifier composed of transistors Q26, Q27, Q28, and Q29. The output from the last amplifier is fed through capacitor C25 and resistor R88 to the rear panel RF output connector.

5.0 MAINTENANCE

5.1 SCOPE OF SECTION

5.1.1 This section describes the steps required to calibrate the Model 2082 and suggests a general approach to troubleshooting the unit.

5.2 CALIBRATION

5.2.1 All calibration for the Model 2082 is accomplished at the factory before the unit is shipped and will last for the lifetime of the unit. Normal periodic maintenance and calibration is not required.

5.3 TROUBLESHOOTING

5.3.1 Using the schematic in Section 4, the standard procedure for finding a malfunction is to trace back from the point of obvious loss of output until the trouble is located. Of course, where a total loss of outputs occurs, the power supply voltages should be checked first.

5.3.2 As an aid in tracking down some of the more obvious possible malfunctions, a troubleshooting guide is presented in Table 5-1.

TABLE 5-1

TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE
1. No output. Power lamp off.	1. a. Fuses blown. b. Power supply failure.
2. No output upon AC line failure. Power lamp off.	2. a. DC standby input connector disconnected. b. DC standby fuse blown. c. Standby holdoff diode CR1 open.
3. No output. Power lamp on.	3. a. +10 Volts Supply failure. b. Front-end Amplifier failure.
4. Loran-C output signal unusually low in amplitude	4. a. NOTCH/PEAK switch accidentally left in PEAK position. b. Front-end amplifier failure. c. Output amplifier failure.