SUNAIR VHF Transceiver Model SA-360
14 or 28 Volts DC
Nominal Power Output 18 Watts
118.00 to 135.95 Megacycles

VHF TRANSCEIVER
MODEL SA-360

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ILLUSTRATIONS

FOREWORD

Purpose of the Manual

This manual offers the user complete installation, operation, maintenance and service information on SunAir VHF Transceiver SA-360.

For convenience and quick reference the manual is divided into sections covering its various components. The installation and operation of the equipment are covered in a separate section. All major sections paragraph headings are listed in the Table of Contents.

The SA-360 Transceiver is packaged as a unit with its standard accessories. (See paragraph 4 page 5.)

The Transceiver model number is stamped on the equipment nameplate with serial number. Please use this model number when making inquiries about the equipment and include the serial number.

Instruction Manual Revisions

Changes which occur after the instruction manual has been printed will be covered by Instruction Manual Revision Bulletins. These bulletins will be supplied to the users through SunAir Dealers and will give them complete information changes in order that they make pertinent changes in the Instruction Manual.

SunAir Service and Parts Replacement

A complete stock of replacement parts for all SunAir equipment is maintained at the factory. In some cases, the part supplied against an order for a replacement item may not be an exact duplicate of the original part where the original item has been superseded by a newer and more efficient design. Such replacement parts will be interchangeable electrically. If the new part has a different size or shape, all necessary hardware to permit installation in older sets will be furnished.

For replacement parts or service information write to:

Your SunAir Dealer or directly to:

SunAir Electronics, Inc.
3101 Southwest Third Avenue
Fort Lauderdale, Florida

Please specify the following when ordering parts:

a) Serial number, model number and voltage of the transceiver;
b) Description of part required;
c) Quantity desired.

1. INTRODUCTION

SunAir's new SA-360 VHF Transceiver for aircraft installation operates on 360 crystal-control channels from 118.0 to 135.95 megacycles.

2. SA-360 TRANSCEIVER COMPLEMENT

SunAir SA-360 Transceiver consists of two units. The R.F. amplifiers, frequency control circuits, pre-amplification are contained in the transceiver package. The power supply, audio amplifier and modulator circuits are mounted in the modulator/power supply package.

3. DESCRIPTION OF UNITS

The units consists of one each SA-360 Transceiver and one each SAV 901 modulator/power supply for 14 volt operation or one each SA-360 Transceiver and one each SAV 902 modulator/power supply for 28 volt operation.

4. STANDARD ACCESSORIES

The standard accessories supplied with the SA-360 are as follows:

1 — Inspection Certificate
1 — Warranty
1 — Instruction Manual
2 — 14-pole connector
1 — 50 ohm connector type BNC

5. OPTIONAL ACCESSORIES

Optional accessories available for use with the SA-360 are as follows:

Transfer Switch

The transfer switch 801 provides a possibility of using the modulator/power supply with two SunAir Transceivers. In position 1, the modulator/power supply is connected to Transceiver No. 1 thus supplying this unit with the required power for receiving and transmitting.

At this time, Transceiver No. 2 is on stand-by and by switching the transfer switch to position No. 2, Transceiver No. 2 is instantaneously ready for operation.

The connection of the transfer switches simply takes place by using the standard connectors and plugging those into the transfer switch box. Each transfer switch comes with an appropriate number of plugs.

Complete factory service is available on any SunAir equipment. Repairs, adjustments or modifications which require factory service will be made in accordance with the instructions of the customer.

A labor charge of $7.50 per hour, cost of parts and shipping charges will apply to all non-warranty work.

To return equipment or material under warranty or otherwise, advise SunAir Electronics, Inc., giving full particulars.

If the item is thought to be defective, give full information concerning the nature of the defect. SunAir will then authorize the return. Failure to secure this authorization prior to forwarding the equipment or material or failure to provide complete information may cause unnecessary delay in processing. Shipments to the factory shall be prepaid.

SunAir reserves the right to change the design of the equipment without advance notice.

Replacement crystal units must be ordered from SunAir in order to secure the required accuracy and in order not to exceed frequency tolerances as prescribed by the FCC.

WARRANTY

1. SUNAIR warrants all parts of new equipment for one year from date of installation providing the defective part is returned to the factory transportation charges prepaid.

2. SUNAIR will assume warranty labor costs for 90 days from date of installation of new equipment in reasonable amount and at its discretion for the actual bench repair of the equipment involved.

3. Warranty card must be properly completed and returned to SUNAIR within ten days from installation.

4. The obligation and responsibility of SUNAIR does not apply unless expressly provided herein. SUNAIR reserves the right to make improvements, additions, or changes in design without obligation to install such changes, designs or improvements in equipment previously manufactured.

6. MINIMUM PERFORMANCE SPECIFICATIONS

SunAir VHF Transceiver Model SA-360

Frequency Range:	118.0 — 135.95 Mcps.
Number of Channels:	360
Channel Spacing:	50 Kc
Nominal R. F. Power Output into 50 ohm, resistance load:	14 Watts min. up to 18 Watts
Frequency Tolerance:	0.005%
Modulation:	High level plate and screen, up to 95%, speech clipper and filter provided
Receiver Sensitivity	1 Microvolt for 50 mw power output at a signal plus noise to noise ratio of 6 db min. 5 Microvolts for 6 Watts power output at a signal plus noise to noise ratio of 20 db min.
Receiver Selectivity:	16 Kc. at 6 db down 60 Kc. at 60 db down
Spurious Responses:	Better than 60 db down at all frequencies more than 40 Kc. removed from desired signal.
Squelch:	Automatic, carrier operated continuously adjustable Min. signal for enabling squelch .5 microvolt
Nominal A.F. Power Output:	6 Watts
Noise Limiter:	Automatic
Indicators and Controls:	Mc. Switch Kc. Switch Volume and On-Off Switch combined Squelch Control
Power Requirements:	*14 Volt Models:* Receive Position: 2.0 A Transmit Position: 12 A *28 Volt Models:* Receive Position: 1.2 A Transmit Position: 7 A
Dial Illumination:	Connected to *separate* pin.
Auxiliary AF inputs:	Provided, two each, 500 ohms source with a *maximum* of 50 mW output power.

TRANSCEIVER SA-360

Description:

The SA-360 Transceiver consists of a VHF transmitter and receiver mounted within a single panel unit. The Modulator/Power Supply to be used with the transceiver is mounted remotely and connected with the transceiver by means of the main cable assembly.

50 Kilocycle channel spacing provides 360 crystal controlled transmit, resp. receive channels. Upon special order, for export purposes, the SA-360 can be supplied with up to twenty additional channels, extending the normal frequency coverage of 118.00 to 135.95 Megacycles to 117.00 to 135.95 Megacycles. The transmitter provides a nominal power output of 18 watts into a 50 ohm load at a primary voltage of 13.75 Volts DC. The receiver, designed for optimum performance, has a minimum sensitivity of 1.0 uV at a signal + Noise to Noise ratio of 6 db, and delivers the nominal audio output of 6 watts at 5 uV with a signal + Noise to Noise ratio of 20 db.

FRONT PANEL SA-360

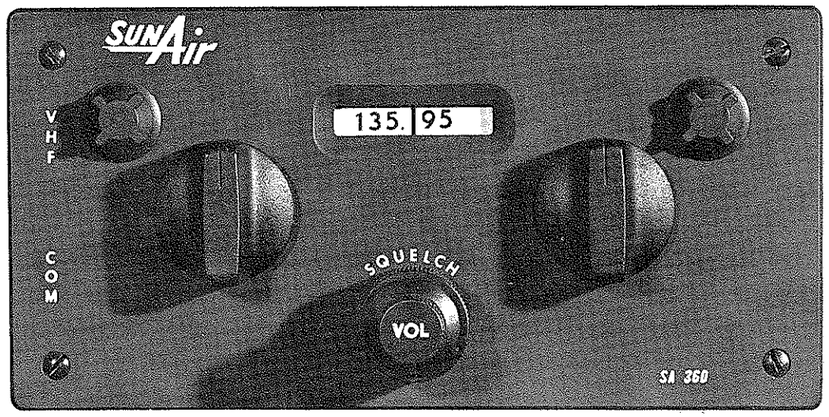


FIG. 1

Theory of Operation

Receiver: The receiver is a double conversion superheterodyne design. The R.F. Amplifier, V1, a special purpose VHF tetrode, accounts for the high sensitivity at a low internal noise. The signal is coupled into the grid circuit of VI with a single loop L1. The variable inductance wafer W1 is connected in series with the antenna transformer and is varied with the megacycle switch. Capacitor C3 provides proper tracking in connection with the inductance of L1. The plate load of V1 consists of a double tuned filter, whereas the primary shows a coil L3 in series with a variable inductance wafer W2, while the secondary in the same arrangement has L5 in series with W3. The capacitors C12 and C14 assure proper tracking. The first Mixer employs also a special purpose VHF tetrode which provides a high conversion gain coupled with low noise. The Transformer T1 is tuned to the difference between the oscillator frequency and the signal frequency, amounting to a fixed value of 14.98 Megacycles. A conventional crystal controlled fixed frequency oscillator with the crystal unit Y-21 generates the signal required to convert the first high IF to the second low IF. The conversion takes place in the pentode section of V3. Following V3 transformers T2 and T3 provide the required selectivity for 50 Kilocycle channel spacing. V4 with T4 and V5 with T5 form the last stages of IF amplification. Diode CR1 on the secondary of T5 operates as a detector, while diode CR2 functions as a noise limiter. Diode CR3 in conjunction with the potentiometer R28 and the gliding screen voltage of V4 operates as a squelching device. Diode CR4, coupled to the primary of T5 through capacitor C33, generates the required negative voltage for Automatic Gain Control. With Potentiometer R23 the signal gain through the AF amplifier V6 is adjusted. The cathode follower output feeds the transistorized Audio power Amplifier in the remotely mounted Power Supply/ Modulator.

Frequency Synthesizer: The frequency control of both the receiver and the transmitter takes place in the synthesizer circuit. The Megacycle steps are generated with the crystal units Y3 through Y20, having a nominal frequency of 81.550 Megacycles and increasing the frequency in one Megacycle steps up to and including 98.550 Megacycles. The output of the MC oscillator is fed into the control grid of the triode section of V9, together with the signal coming from the Kilocycle Oscillator V10, which generates frequencies of 51.430 Megacycles in 50 kc steps up to and including 52.380 Megacycles with the crystal units Y-A to Y-U. The plate circuit of this tube is tuned to the sum frequency of the input signals, thus providing signals with frequencies ranging from 132.98 to 150.930 Megacycles in 50 kilocycle steps. V9 is a RF amplifier, amplifying the oscillator signal to a sufficient level and also providing the required spurious attenuation. The tuned circuits L11 and W4 as well as L17 and W5 are ganged with the megacycle switch. The oscillator injection voltage for the first Mixer of the receiver is coupled to the control grid of V2 through capacitor C60.

Transmitter: The basic frequency synthesizing is taking place in the circuit described above. From the plate circuit of V9, pentode section, Capacitor C77 feeds the signal into the control grid of the pentode section of V11. Also at the same point another signal, generated by the oscillator V11, triode section with the crystal unit Y22 on a frequency of 14.980 Megacycles is injected. The difference between the signal frequency from the frequency synthesizer and the fixed frequency oscillator V11 then constitutes the final transmitter signal frequency, to which also the plate circuit of the transmitter mixer V11, pentode section is tuned. V12 operates as a RF amplifier, while V13 produces the required driving power for the final RF amplifier V14. V14 is plate and screen modulated. The tank circuit of V14 consists as before of an inductance wafer W9 with a tracking capacitor C113. The RF power is coupled to the antenna from a tap of the fixed series inductor L28 and fed to the harmonic filter consisting of the network following C116.

The filament circuitry is balanced into two groups with equal current consumption. For 14 volt operation the two groups are connected in parallel, while for 28 volt systems, the filament switch S2 connects the groups in series.

BLOCK DIAGRAM

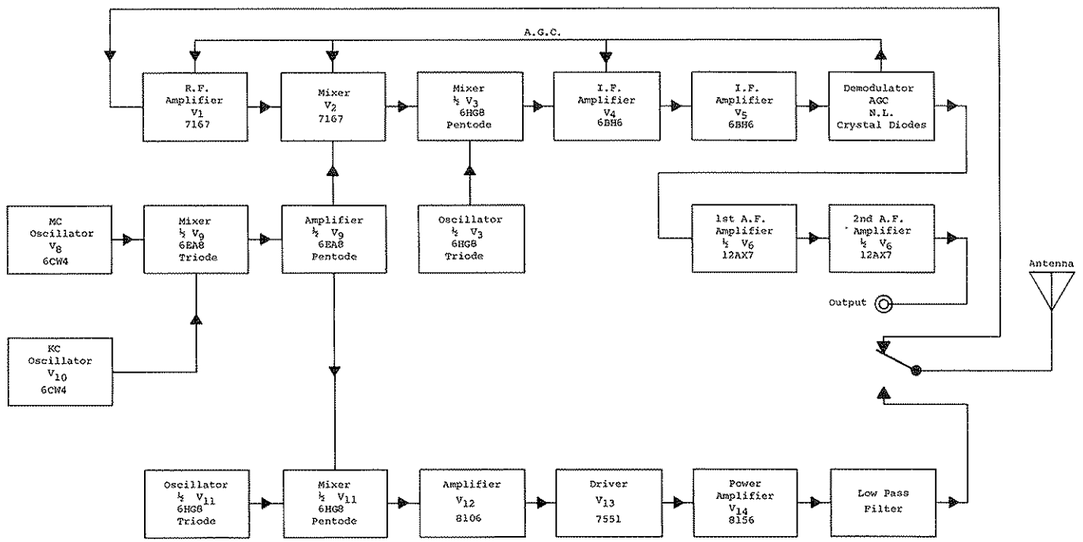


FIG. 2

MODULATOR/POWER SUPPLY

Description:

The modulator/power supply for use with the SunAir SA-360 Transceiver consists of a one unit package which contains the high voltage power supply, the audio amplifier and the modulator circuits of the system. Two units are available, the SAV 901 for 14 volt and the SAV 902 for 28 volt operation. Both units are applicable for all SunAir VHF Transceivers, such as the SA-90 and the SA-1036.

Theory of Operation:

BLOCK DIAGRAM

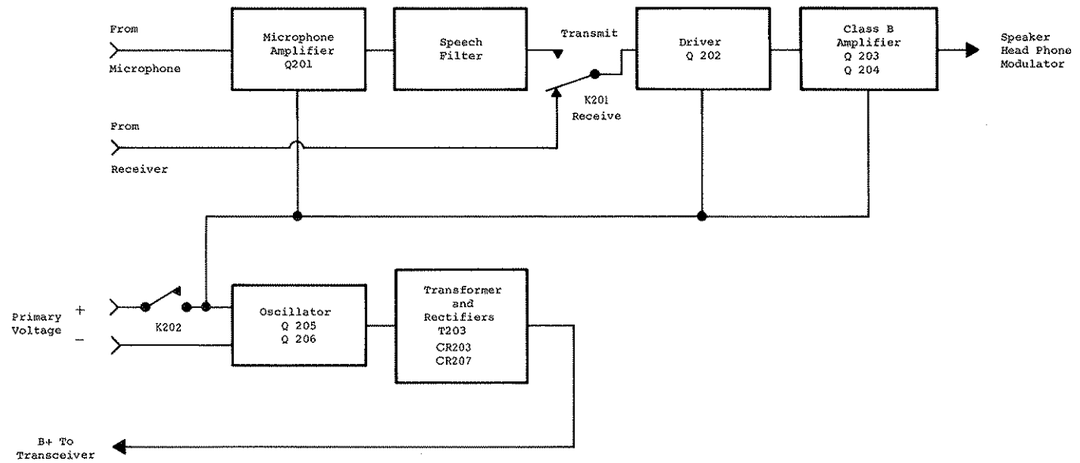


FIG. 3

Each of the SunAir Modulator/Power Supply units are completely transistorized. Their special design permits proper operation of all transistors up to ambient temperatures of 55° C. A large surface heatsink with low thermal resistance insures fast dissipation of heat developed by the Class B A.F. power amplifier, which is used for both receiver output and transmitter modulation. Two major etched circuit boards are employed for the power supply, audio amplifier and bias networks. Adequate shielding eliminates interference of power supply switching pulses with other equipment.

With the transceiver in the receive position, the high B plus, 415 volt DC, is inoperative, while only the low B plus of 200 volts DC is being supplied to the receiver portion of the transceiver. Relay K 201 normally is not energized and thus connects the output of the cathode follower A.F. amplifier in the receiver to the base of the driver transistor Q 202. A resistor of suitable value, in most cases 1.5 K ohm is connected in series with the base and the audio source to equalize the gain of the unit and provide linearization of the base current. The collector of Q 202 feeds the primary of the driver transformer T 201 which in turn provides out-of-phase drive currents for the class B power amplifier. The bias network for the power amplifier adjusts the quiescent collector currents to a value of approximately 50 ma to prevent crossover distortion at low signal levels. The output transformer T 202 assures proper loading of class B amplifier in order to obtain the required output power. Secondary No. 1, designed for a load of 4 K ohm is used to modulate the R.F. amplifier, while secondary No. 2 provides outputs for a speaker with nominal impedance of 3 ohms and for headphones with an impedance of 500 ohms. In the transmit position, the secondary No. 2 is disconnected from ground and thus does not load the amplifier.

In the transmit position, the relay K 201 disconnects the base of Q 202 from the receiver output and switches it to the output of Q 201. At the same time, high B plus is applied through the secondary No. 1 of T 202 to the R.F. power amplifier. The carbon microphone obtains through the microphone potentiometer R 201 the required DC power in order to produce a modulated DC voltage at the rotor of R 201. The magnitude of the microphone signal can be adjusted by moving the rotor of R 201. The small signal transistor Q 201 is biased in such a manner that above a certain signal level symetrical clipping will take place. The resulting harmonic distortion is then removed in the speech filter consisting of the inductor L 201 and the capacitors C 205 and C 206. Overmodulation can thus be safely prevented, and by proper adjustment of the microphone potentiometer R 201, a consistent modulation level of 95 per cent is assured.

The high voltage power supply consists of a matched pair of switching transistors which generate a square wave alternating current through the primary of T 203, which then is transformed into the secondary winding. The high B plus of 415 volts DC uses a full wave bridge rectifier circuit, while the low B plus is taken from the center tap.

Large filter capacitors and inductors eliminate remaining ripple and provide almost pure DC to the transceiver.

The modulator/power supply differs in design for the 14 and 28 volt units, therefore, when ordering the unit the available power system voltage of the aircraft must be specified.

CAUTION:

Do not install the SAV 901 or 902 directly above or beside a heat generating piece of equipment and always insure there is a supply of cool air to the modulator/power supply. Do not short the cases of the power transistors to ground; these are the collectors and carry signal voltages. A protective circuit prevents damage to the system in case plus and minus have been interchanged.

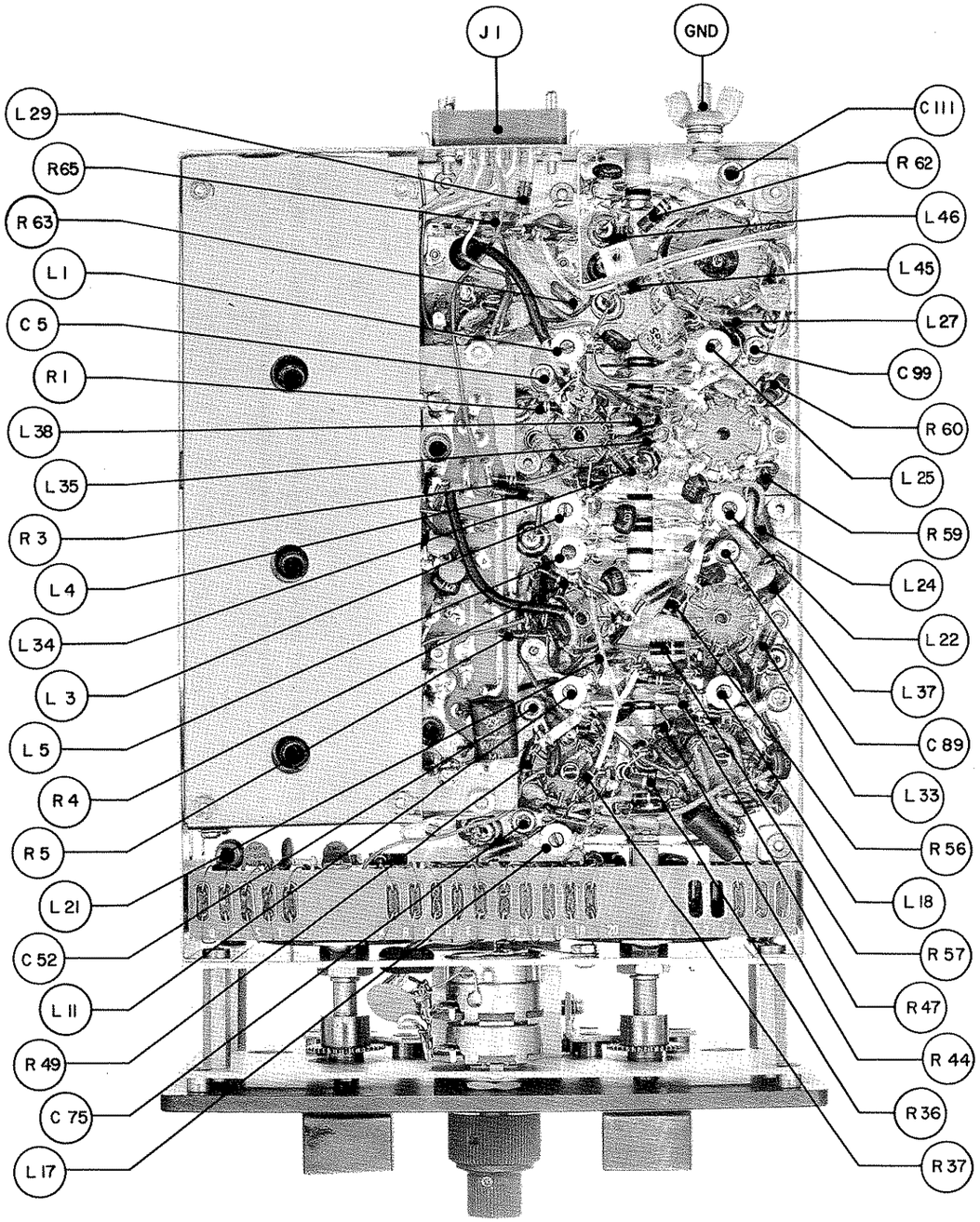


FIG. 4 BOTTOM VIEW SA-360

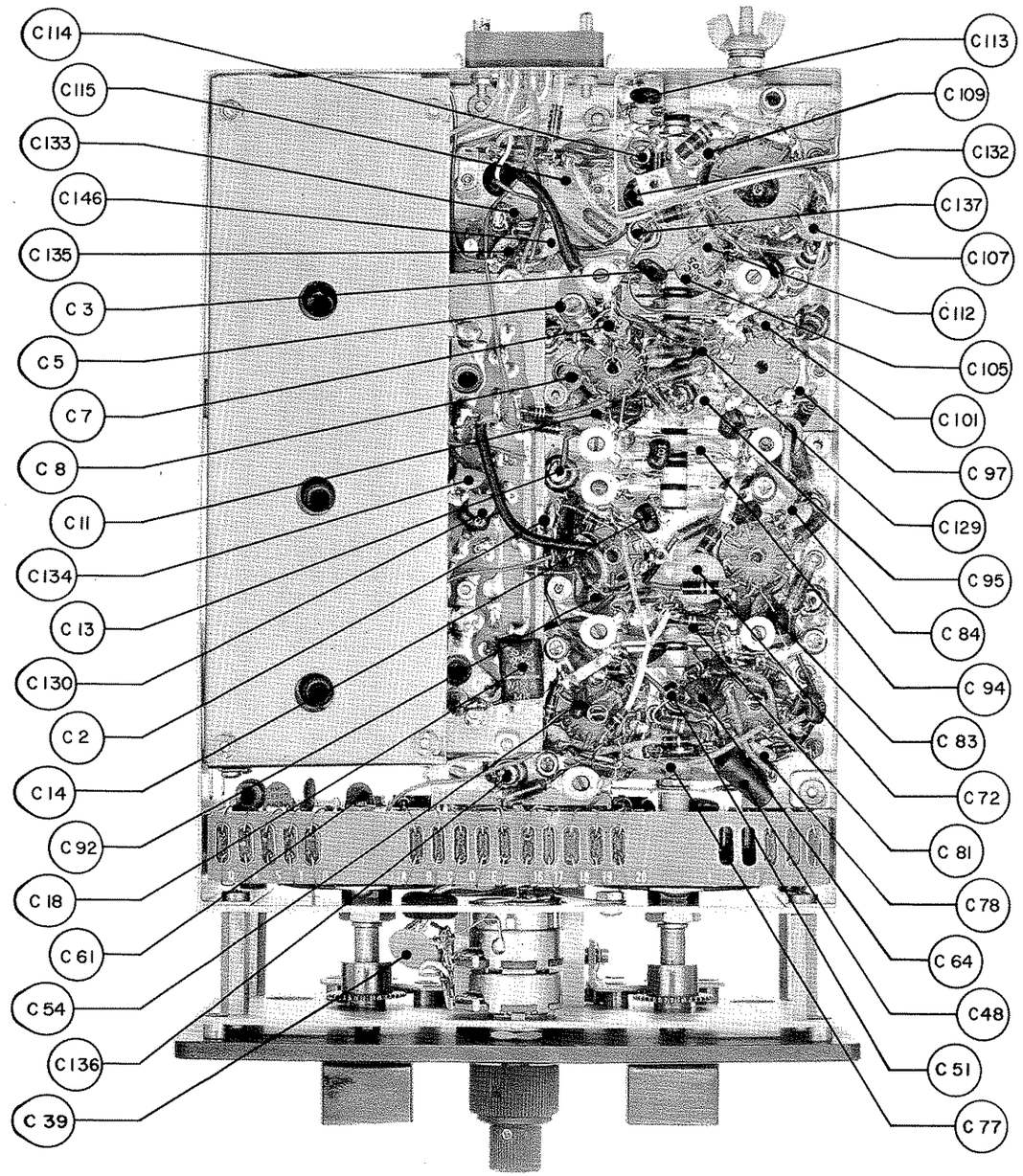


FIG. 5 BOTTOM VIEW SA-360

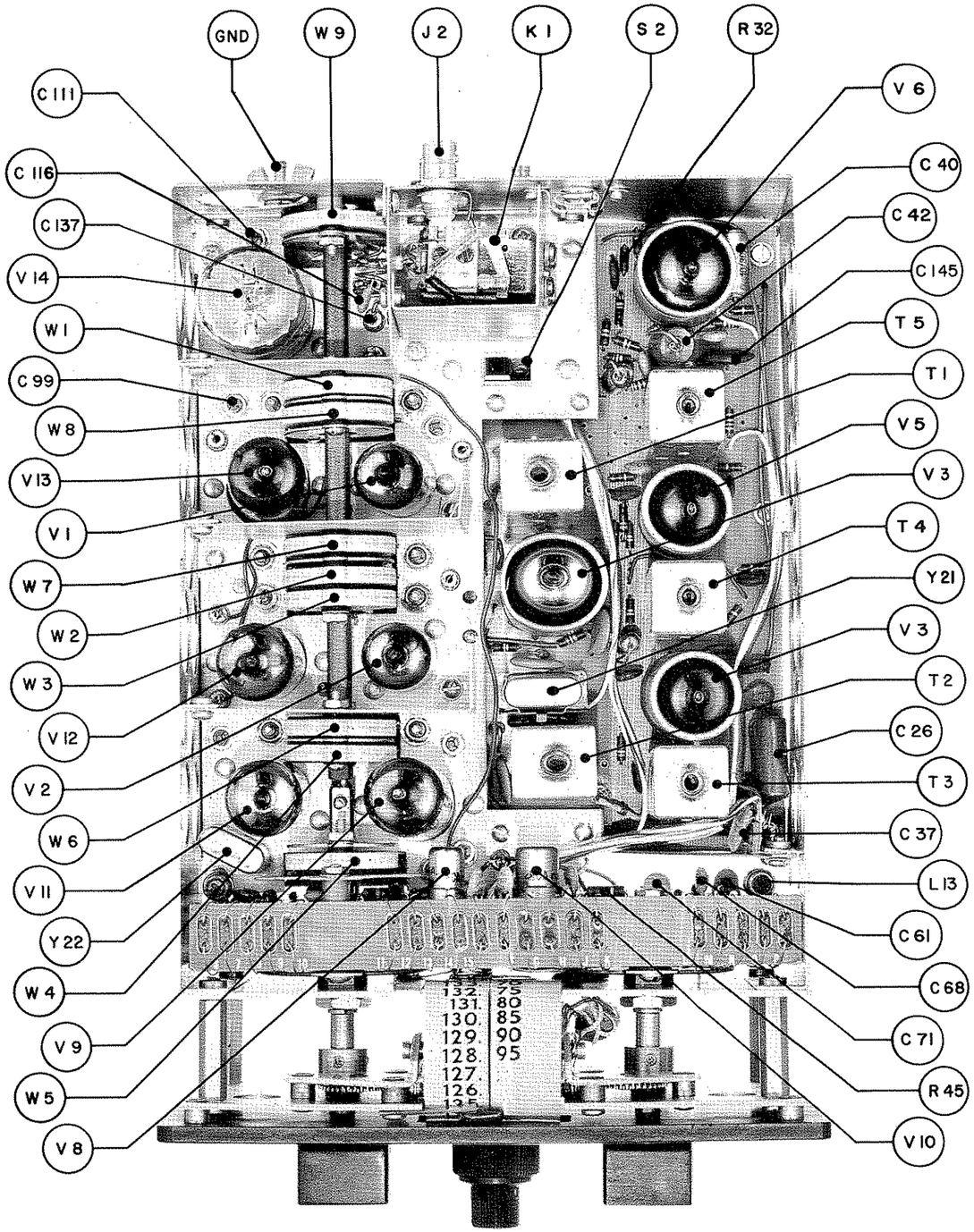


FIG. 6 TOP VIEW SA-360

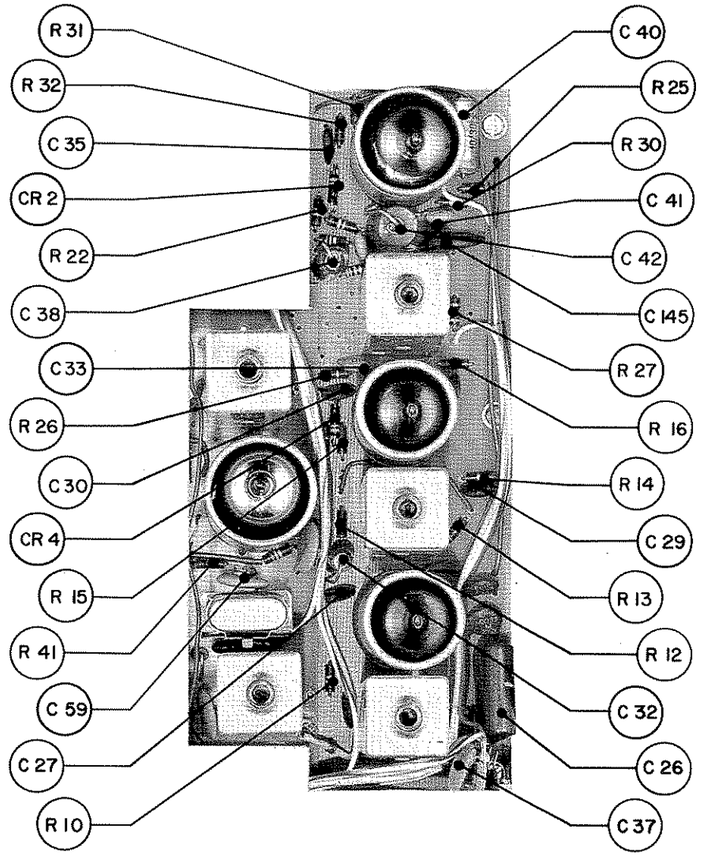


FIG. 7 TOP VIEW IF STRIP ASSEMBLY

606	C	CHANGED COLOR CODE	12-16-63
598	B	ADDED R224 AND CR208	11-29-63
588	A	ADDED R235 1K 3W	11-27-63
ECN-MOD	SYM.	DESCRIPTION	DATE

REVISIONS

DRAWN — APPROVED — DATE 9-11-63

CHECKED

DWG. NO. 13631

TITLE SCHEMATIC POWER SUPPLY & MODULATOR SA-VHF

SUNAIR ELECTRONICS, INC.

J201

MICROPHONE GROUND	J	BLACK
MICROPHONE A.F.	P	BROWN
A.F. RECEIVER	A	ORANGE
RECEIVER LOW B+	E	RED
TRANS. BIAS	M	GRAY
FILAMENTS A+	D	BLUE
3 OHM OUTPUT	N	WHITE
TRANSMITTER LOW B+	H	WHT./GRN.
MICROPHONE KEY	R	GRAY
ANTENNA RELAY K1	B	WHT./YEL.
KC OSCILLATOR B+	F	WHT./RED
500 OHM OUTPUT	L	GREEN
TRNSMITTER B+MOD.	K	WHT./BRN.
ON-OFF SWITCH	C	WHT./BLUE

GROUNDING STUD

A+ NO 12 GA. WHITE

28 VOLT COMPONENT CHART

CKT.SYM.	VALUE FOR 28V UNITS ONLY
R 208	VALUE SELECTED
R 212	100 Ω 3W
R 213	450 Ω 3W
R 219	75 Ω 3W
R 220	75 Ω 3W
R 221	75 Ω 3W
R 232	100 Ω 3W
R 233	40 Ω 3W
C 208	200 MF 30 V
C 214	200MF 30V
C 215	200MF 30V
CR208	1E36Z
F 201	10 AMP.

NOTE:
UNLESS OTHERWISE NOTED, RESISTANCE VALUES ARE IN OHMS 1/4 W.

FIG. 12 SCHEMATIC MODULATOR/POWER SUPPLY

INSTALLATION AND OPERATION

Installation:

Complete instructions are included here for the installation of the Transceiver SA-360. Use care when unpacking and handling the equipment. Check the contents to insure that all items have been included.

Installation Parts List:

The following is a list of the additional equipment and parts required for the installation of the SA-360:

a. Speaker, 3 ohm nominal impedance
b. 3 pole microphone low impedance, carbon type with push-to-talk button
c. Headset, 500 ohms
d. Main cable assembly (see page 22)
e. Antenna cable assembly (see page 25)
f. Suitable antenna, 50 ohm, broadband type, for 118 to 135.95 mcps.
g. Receptacles for microphone and headset
h. Mounting brackets for transceiver (2 required)
i. Ground and support strip

Pre-Installation Check-Out (Bench)

The SA-360 Transceiver has been accurately adjusted at the factory for optimum performance. However, it is possible that the equipment may have been mishandled while in transit. Therefore, it is recommended that a pre-installation (bench) check-out be made to insure its proper operation. For the purposes of this test, fabrication of the cable referred to in the installation parts list will be required or SunAir will supply as optional equipment a special bench check cable harness at nominal cost.

The specifications in this section and those contained in paragraph 6, page 7, should be used as a guide when testing the unit.

Equipment Required for Bench Check:

a. Signal generator, 50 ohm, 108 — 136 mcps.
b. Audio wattmeter for 3 ohm load or VTVM
c. 3 ohm speaker, minimum 5 watts
d. Low impedance carbon type microphone L 20 JKK or equal
e. 50 ohm R.F. antenna load 25 watt insert (Bird or equivalent)
f. Spare VHF receiver
g. Audio generator (H.P. 200 C or equivalent)
h. Oscilloscope with direct access to the vertical deflection plates
i. A cable assembly is required for the bench check. This assembly is described on page 22. SunAir will supply as optional equipment a special bench check cable at a nominal cost.

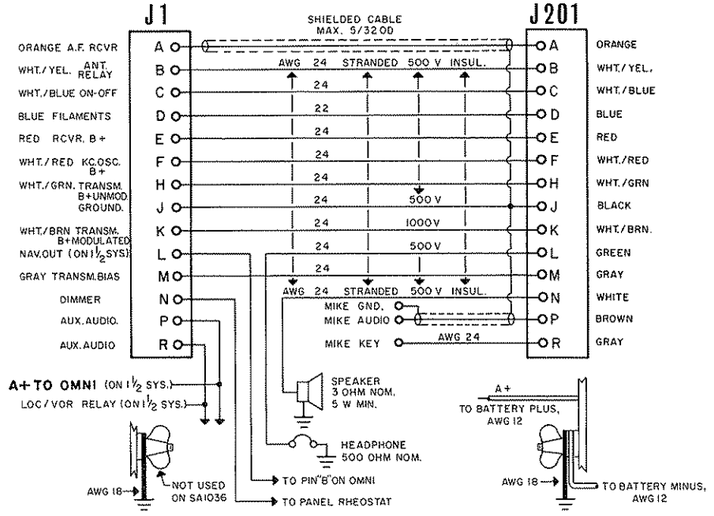


FIG. 13 DIAGRAM INTER-CONNECTION

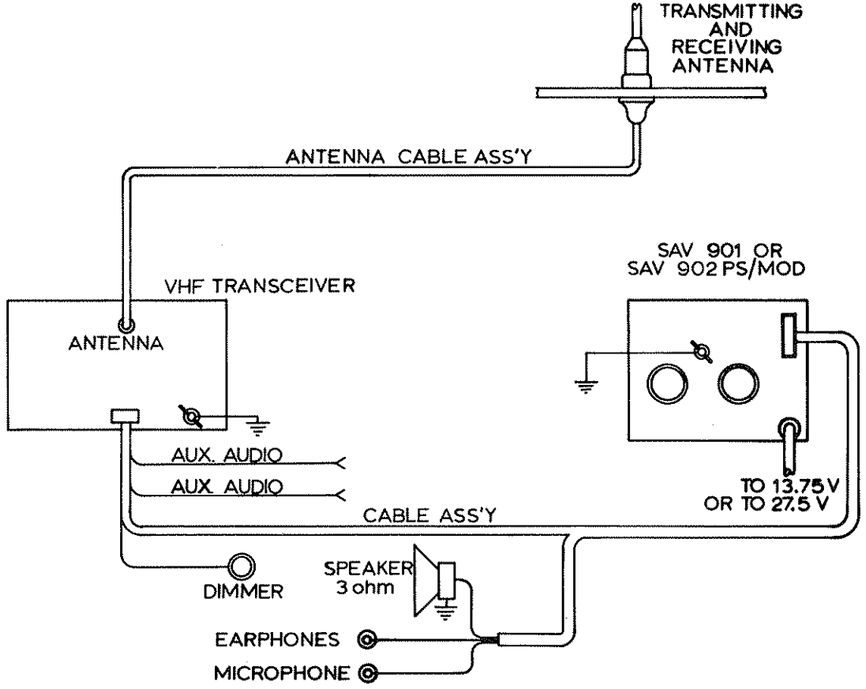


FIG. 14 DIAGRAM MAIN CABLE ASSEMBLY

CAUTION:

When making tests on the receiver portion of the SA-360 Transceiver, do not close the microphone switch in order to protect the signal generator.

Sensitivity Check

1. Connect the Transceiver SA-360 and the modulator/power supply together with the prescribed cable.
2. Connect the audio wattmeter and the modulator/power supply.
3. Set the Transceiver SA-360 and the signal generator to 118.00 mc. 1.5 uv. output, modulated 30% at 1000 cycles; connect the generator to the antenna connector of the Transceiver SA-360.
4. Adjust the squelch control to the fully clockwise position and the volume control to produce approximately 2 to 3 watts of audio on the wattmeter.
5. Remove the modulation and note the drop in db of output. This drop should be more than 6 db.
6. Repeat the test for every channel determining both crystal activity and sensitivity on all channels.

Gain Check

1. Set the receiver and the signal generator to 118.0 mc modulated 30% at 1000 cycles.
2. With the squelch control and volume control set fully clockwise, insert 5 uv of signal into the receiver.
3. Note the reading on the wattmeter. This should be between 6 and 8 watts.
4. Repeat the test for as many of the KC channels and then the MC channels as possible.

Transmitter Power Output Check

1. Connect the R. F. power wattmeter to the antenna connector of the Transceiver SA-360.
2. Connect the microphone to be used in the aircraft to the microphone connector of the audio cable.

3. Key the microphone and note the power level on the R.F. Wattmeter. This reading should be at least 14 Watts. Be sure the A plus input to the unit is correct when the microphone is keyed.

4. Repeat the test for all KC channels and then all MC channels. This test will determine crystal operation and power level of all frequencies.

Modulation Check

1. With the unit connected as for the transmitter check above, key the transmitter and listen to the modulated signal by means of another receiver.

2. If desirable, the modulation level can be adjusted at this time.

3. a. Insert a 0.15 rms. VAC, 1000 cps. sine wave signal into the microphone input via a phantom microphone.

   b. Key the transmitter and couple a sample of the modulated R.F. signal, using a coaxial coupling loop into the vertical deflection plates of the oscilloscope.

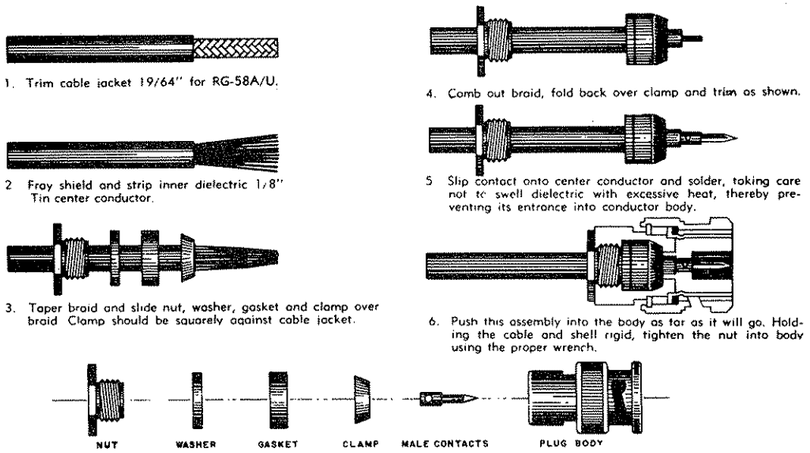
   c. Calculate the percentage modulation.

   d. Adjust the microphone potentiometer R201 located next to the audio input transistor to produce a modulation percentage of 85% without clipping.

Main Cable Assembly:

The main cable assembly for the installation of the Transceiver SA-360 must be fabricated by the installer. The connectors for this cable assembly are supplied as part of the SA-360 system. Drawing Fig. 13 shows the cabling required for the interconnection of the SA-360 system. (SunAir will furnish the main cable assembly on request at a nominal cost.) To order this cable, SunAir must be provided with accurate dimensions for the installation of the main cable assembly in accordance with the Systems Installation Plan as shown in Drawing Fig. 14.

FIG. 15 BNC CONNECTOR ASSEMBLY



Antenna Cable:

The antenna cable for use with the Transceiver SA-360 should be RG-58 A/U. This cable should be as short as possible and all bends should have at least a 2 inch radius. A BNC connector is supplied for the interconnection of the antenna and the Transceiver SA-360. See Drawing Fig. 15 Page 24 for the proper method of assembly of the BNC connector.

Installation Procedure

The Transceiver SA-360 is designed for installation in the instrument panel of the aircraft. It can be installed by means of two mounting brackets which will attach to the sides of the unit and to the instrument panel. A bolt and wing nut have been provided on the back of the case to which a supporting strap shall be attached. This supporting strap will be fabricated by the installer.

Drawing Fig. 18 gives the dimensions of the Transceiver SA-360.

Detailed Instructions For Mounting Transceiver

1. Provide a rectangular opening in the instrument panel 6 1/8 inches wide by 3 3/32 inches high.
2. Install the Transceiver case in the opening from the rear attaching by means of the two mounting brackets.
3. Slide the Transceiver into the case and secure by turning the fastener on the rear of the case 90° in a clockwise direction to lock the chassis in the case.
4. Using the wingnut secure the ground stud on the rear of the transceiver chassis to the airframe grounding strap. This will not only provide a ground connection but will also provide additional support for the transceiver.

Instructions For Mounting The Modulator/Power Supply

The modulator/power supply can be mounted in any suitable position. Four mounting holes are provided in the base of the unit for attaching it to the airframe.

The connection of the modulator/power supply units to the transceiver is accomplished by means of the main cable assembly described in Fig. 16 while a 12 inch pigtail extending from the modulator/power supply has been provided for the connection to the PLUS pole of the power system, the MINUS connection requires a No. 12 wire or cable from the grounding stud of the modulator/power supply unit to the airframe or preferably directly to the MINUS pole of the aircraft battery. These primary power connections shall be as short as possible in order to prevent unnecessary voltage drops across the cable resistance.

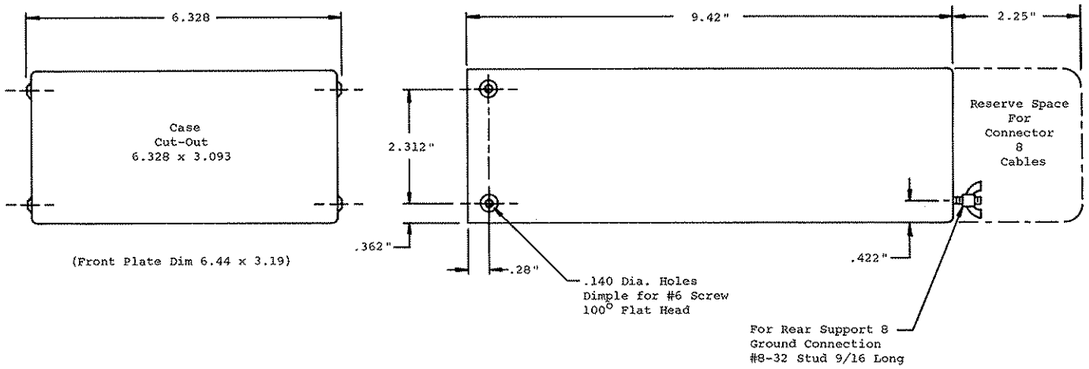


FIG. NO. 16

SA-360 MOUNTING DIMENSIONS

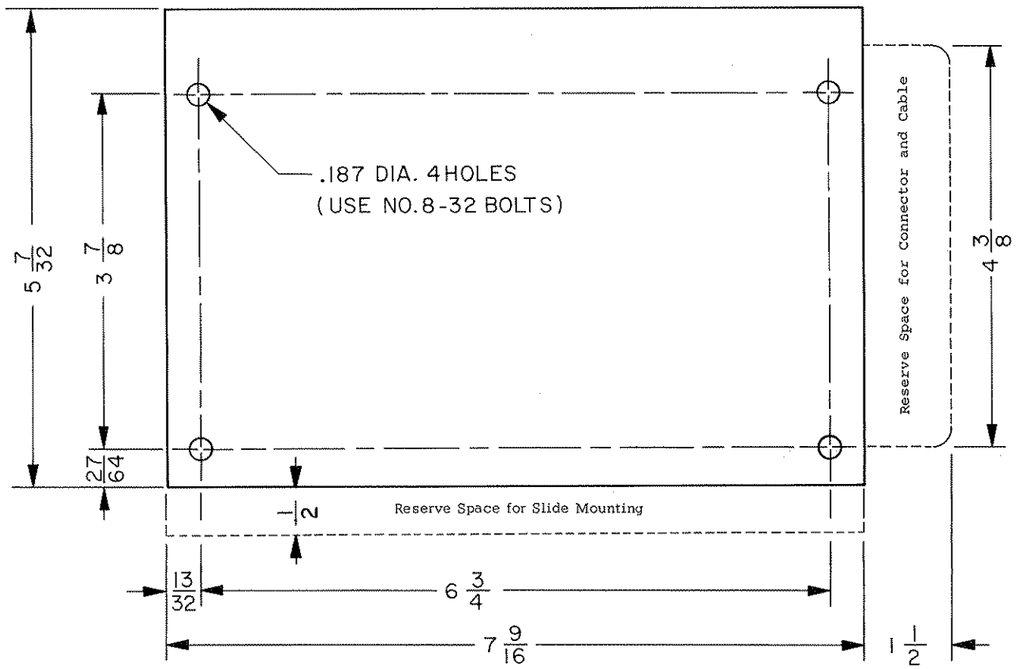


FIG. NO. 17

POWER SUPPLY MODULATOR MOUNTING DIMENSIONS

CAUTION: An interchange of PLUS and MINUS connections does not cause damage to transistors used in the modulator/power supply units SAV 901 and 902 because of protective circuitry.

Do not install the SAV 901 or 902 directly beside or above a heat generating piece of other equipment and always insure there is a supply of cool air to the modulator/power supply. Do not short the cases of the power transistors to ground; these are the collectors and carry signal voltages.

Antenna Requirements For Use With Transceiver SA-360

The SA-360 Transceiver has been designed for use with a 50 ohm antenna having a VSWR of 1.5 to 1 or less over the frequency range of 118 to 135.95 mc.

Connection of Cable Assemblies

Connect the transceiver to the modulator/power supply by means of the main cable assembly (See Fig. 13).

Connect the transceiver to the antenna by means of the antenna cable assembly (See Fig. 15).

Performance Check-Out (In Aircraft)

After installation in the aircraft, the SA-360 Transceiver should be subjected to a complete performance check-out. This check-out should be performed on the ground with normal power ON and with the aircraft engines *running*.

Equipment Required for Performance Check-Out in Aircraft

a. Thru-line wattmeter with 25 watt insert (Bird or equivalent)

b. VHF Receiver

Detailed Check-Out Procedure

1. Connect wattmeter between antenna and transceiver
2. Set transceiver to 118.00 MC
3. Press microphone transmitting button and check standing wave ratio by reading the forward and reflected power on the wattmeter.

4. The reflected power should not exceed a maximum of 2 watts on any frequency.
5. Follow the above procedure tuning the transceiver to several other frequencies and repeat the above procedure.
6. Perform a brief modulation check by monitoring the transmission with another VHF receiver.
7. Check headphones for sidetone while transmitting.

To insure proper operation of the SA-360 system, measure the primary voltages in the transmit position at the fuse inside the modulator/power supply unit. This voltage should be 13.75 volts for 14 volt systems and 27.5 volts for 28 volt systems.

This voltage cannot be obtained unless the aircraft engines are running. The generators and voltage regulators under this condition should provide the indicated voltages. If that is not the case, check the voltage drop across the primary power cables to the modulator/power supply unit; and if necessary, use heavier wires for the connection to the battery.

Listen while the engines are idling for abnormal noise in the receiver output. Change the rpm of the engine and note a change in the noise frequency. This will indicate ignition or generator noise. In most instances, proper application of capacitors and noise suppressors will remove the trouble. If the voltage does not reach 13.75 volts, the voltage regulator may require adjustment.

A voltage tolerance of plus 10% is permissible, therefore, a voltage indication of 15 volts is within the permissible tolerance of the system.

On the other hand, a voltage of minus 10% from nominal, while permissible, will reduce the performance of the transceiver.

Operational Procedure

To operate the SA-360 Transceiver, proceed as follows:

1. Turn volume control knob clockwise.
2. A high-pitched sound can be heard in the headphone unit indicating proper operation of the power supply.

3. Turn squelch knob to the right for maximum sensitivity.

4. Tune MC switch to desired frequency; then tune the KC switch to the decimal desired.

5. Press microphone button and call station with which you wish to communicate.

6. Wait for reply and adjust volume to satisfactory level.

7. Reset the sqelch knob until background noise disappears.

NOTE: If distance between stations is excessively large, squelch knob may have to remain at fully clockwise position for maximum sensitivity.

MAINTENANCE

General Information:

It is recommended that preventive maintenance be performed at regular intervals — at least every eight months — in order to assure trouble-free operation of the SA-360 Transceiver. This periodic maintenance should include a complete bench check-out as described on page 21. In addition to the bench check-out, it is recommended that all vacuum tubes be tested for performance with a standard tube tester. Lubrication at this time should not normally be necessary, however, all bearing surfaces of moving parts of the tuning mechanism and the bearings of the switches may be lubricated with a high temperature lubricant such as Dow-Corning No. 4D compound.

NOTE: Adjustments on frequency determining circuit parts, such as oscillators shall be performed by properly authorized technicians and require test equipment for frequencies of 30, 80 and 100 to 136 mcps as well as equipment enabling the servicing agency to certify the frequency accuracy of the transmitter.

Test Equipment Required for Re-Alignment of Transmitter & Receiver

a. Frequency Counter (HP 524 or equivalent)
b. Calibration set-up for counter (WWV Receiver)
c. Oscilloscope (Tektronix 543 or equivalent)
d. Audio generator (HP 200 C or equivalent)
e. Audio VTVM
f. DC VTVM
g. Phantom microphone (see Appendix I)
h. DC voltmeter
i. DC amperemeter
j. Coaxial cables, connector, couplings, capacitors (see page 31)
k. R.F. load, 50 ohm, up to 250 mcps
l. VHF signal generator HP Packard 608 A or equivalent
m. Signal generator HP 606 A or equivalent
n. Bird thruline wattmeter, 25 Watt insert 100-250 MC.

Re-Alignment Procedure for Transmitter Portion of Transceiver SA-360

NOTE: All voltages and currents are indicated on schematic diagram (See page 18).

1. Connect power supply to transceiver. Set power supply either to 13.75 or 27.5 volts according to system being used.

2. Switch on transceiver and re-adjust input voltage to nominal value if necessary.

A. Check of KC Oscillator for proper frequency

1. Connect the frequency counter to potential No. 76. Switch the counter to the 50 Megacycle range and the KC oscillator to position .00. At this position the counted frequency should be 51.430 plus/minus 500 cps max.
2. Adjust L13, mounted on the oscillator subassembly board to obtain a reading of approximately 51.435 Mcps.
3. Switch KC oscillator to the next position .05. The counted frequency now should be 51.480 Mcps nominally. Increase the KC oscillator frequency from position to position until the switch arrives at the position .95. The oscillator frequency at this last position should be 52.380. With every step on the KC switch the oscillator frequency will increase by 50 Kcps.

B. Check of the MC Oscillator for proper frequency

1. Connect the frequency counter as above to potential No. 76. Set the counter to the range 80 Mcps. and the MC switch to 118. At this position the counted frequency should be 81.550 Mcps, plus/minus 5 Kcps. max.
2. Adjust L8, mounted on the oscillator subassembly board to obtain a reading of approximately 81.555 Mcps. The core of the L8 should for that adjustment be only 50% inside the inductor.
3. Switch MC switch to position 119 and note the frequency reading.
4. Proceed by increasing the MC switch setting by 1.0 Mcps and note all frequencies. The oscillator frequency will increase by 1.0 Mcps with every step of the MC switch and should have a value of 98.550 Mcps at the MC position 135.

C. Amplifier alignment

1. Set MC switch to 135. and KC switch to .50. Connect a DC Vacuum Voltmeter to Potential No. 114 near the driver amplifier of the transmitter, set the meter to measure a negative voltage in the order of 50 V DC. Disconnect R63 from the screen grid of the final RF power amplifier to avoid excessive plate current.
2. Depress the microphone key and align L11, L17, L18, and L22 for maximum voltage.
3. Set transmitter to 118.50 Mcps and align C52, C75, C79 and C89 for maximum voltage.
4. Repeat step 2 and 3 until no further improvement can be obtained.

5. Reconnect R63 to the screen of the final RF power amplifier and connect the antenna connector to a Bird Thruline Wattmeter with a 25 Watt insert and terminate the wattmeter into a 50 ohm antenna load with a minimum power level of 25 watts.
6. Set the transmitter to 135.50 Mcps; connect the vacuum tube voltmeter to potential No. 122 and adjust it to a negative voltage of approximately 100 V DC.
7. Depress the microphone key and align L25 for maximum negative voltage as read on the voltmeter and C113 to maximum power output as read on the wattmeter.
8. Set transmitter to 118.50 Mcps and align C99 to maximum negative voltage and C111 to maximum power output.
9. Repeat step 7 and 8 until no further improvement can be obtained.
10. Set the frequency counter to 110 Mcps and check the frequencies between 118.00 and 120.95.
11. Set the frequency counter to 120 Mcps and check the frequencies between 121.00 and 130.95 Mcps.
12. Set the frequency counter to 130 Mcps and check the frequencies between 131.00 and 135.95 Mcps.

D. Modulation Checkout

1. Connect an AF signal generator via a phantom microphone to the modulator and adjust the input voltage to the phantom microphone to 0.15 V rms at 1,000 cps.
2. Connect the vertical deflection plates of an oscilloscope to ground and through a 1 pf capacitor to the center of the coaxial cable on the transmitter output, terminate the cable into a 50 ohm load.
3. The horizontal input of the oscilloscope is connected to ground and to potential No. 16.
4. Depress the microphone key and adjust the carrier amplitude to a convenient value. The carrier now should be modulated approximately 95%. An adjustment of the microphone sensitivity can be made by moving R201.

E. Alignment Procedure for the Receiver

NOTE: When aligning the receiver, do not depress the microphone key in order to protect the RF signal generator.

Connect the transceiver to the power supply and provide either 14 or 28 volt DC to the power supply according to the system voltage. Terminate the speaker terminals of the power supply/modulator into a noninductive 3 ohm, 10 watt resistor.

Amplifier Checkout

1. Connect an AF Vacuum Tube Voltmeter across the 3 ohm speaker load resistor and set volume control and squelch control to maximum clockwise position.
2. Connect a RF Signal Generator to potential No. 46 and set the generator to 2.885 Mcps, modulated at 1000 cps, 30%. Begin tuning by adjusting the cores of IF transformer T5 for maximum output signal. Use the minimum RF input which results in a readable indication.
3. Tune the cores of IF transformer T4 for maximum output signal.
4. Remove the signal generator from potential No. 46 and reconnect to potential No. 34. Retune IF transformer T4 and set the cores of IF transformers T3 and T2 for maximum output signal.

NOTE: The proper position of the tuning cores of all transformers, T1 through T5, is the resonance obtained when the cores are on the outer sides of the transformers. Tuning the cores to the resonance obtainable on the inside of the transformers will result in an excessive bandwidth.

5. Remove signal generator from potential No. 34 and reconnect to potential No. 29 through a capacitor of 10 pf. Set signal generator to 14.980 Mcps. and modulate 1000 cps at 30%. Tune IF transformer T1 for maximum signal output with the lowest signal producing a readable output, normally approximately 10 uV.
6. Remove signal generator from potential No. 29 and connect with a BNC connector to the antenna terminal of the transceiver. Set MC switch to 135 and KC switch to .50. Modulate signal generator with 1000 cps at 30% and adjust to 135.50 Mcps. Adjust L1, L3 and L5 for maximum signal output.
7. Set signal generator and transceiver to 118.50 and adjust C5 for maximum signal output. Repeat step 6 and 7 until no further improvement can be obtained.
8. The receiver now should furnish approximately 5 to 6 watts audio output power with an input signal of 5 uV at a Signal plus Noise to Noise ratio of more than 20 db.

NOTE: ALL ADJUSTMENT MUST BE MADE AFTER THE EQUIPMENT HAS HAD A SUFFICIENT WARM-UP PERIOD — NORMALLY 15 MINUTES MINIMUM.

Modulator/Power Supply Checkout

1. Connect the MPS to 13.75 VDC (or 27.5 VDC for 28 V MPS) source.
2. Connect the transceiver with main cable to the MPS.
3. Connect a 50 ohm load to the antenna terminal of the transceiver.
4. Turn the volume control of the transceiver fully counter-clockwise. Turn the squelch control fully counter-clockwise.
5. Set MC and KC switch to 118.00 Mcps.
6. Turn on the transceiver and readjust input to 13.75 VDC (or 27.5 VDC) at MPS lead.
7. Adjust DC VTVM to 300 volt range for power supply receiver check.
8. Measure DC voltages at specified test points (see chart, page 35).
9. Adjust DC VTVM to 600 volt range for power supply, transmit check.
10. Depress microphone key and measure DC voltages on specified test points (see chart).

NOTE: Transmitter shall be operated at not more than 30% duty cycle. Observe input voltage and adjust if necessary.

11. Terminate speaker line (pin N of plug J201) with non-inductive 3 ohm 10 watt resistor.
12. Connect the audio signal generator to terminal A of J1. Adjust the generator to 1000 cps and inject 150 MV RMS into line.
13. Measure DC and AC voltages at specified test points with DC VTVM and AF VTVM (see chart).

MODULATOR/POWER SUPPLY CHECKOUT CHART

POWER SUPPLY CHECK

	TEST POINT	14 VOLT UNIT VOLTS DC	28 VOLT UNIT VOLTS DC
RECEIVE	152	13.6	27.4
	162	285	277
	163	570	555
	166	−35	−33
TRANSMIT	152	13.2	27.2
	162	270	265
	163	540	530
	166	−33	−32

AUDIO AMPLIFIER CHECK

	TEST POINT	14 VOLT UNIT VDC	14 VOLT UNIT VAC	28 VOLT UNIT VDC	28 VOLT UNIT VAC
RECEIVE	142	13.0	.01	13.8	.01
	143	.90	1.5	.85	0.8
	145	13.2	.65	26.8	.40
	148	.12	2.8	.28	4.5
	7	-	3.2	-	2.6
	12	-	45	-	40

NOTE: ALL VOLTAGES MEASURED TO GROUND.
ALL READINGS ARE ± 10 PER CENT.

Trouble Shooting Information

The following is a list of commonly encountered trouble indications, probably cause of the malfunctions and recommended corrective procedures:

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
Power switch on, no panel light and tube filaments are dark	Main fuse defective	Check for short circuits in primary circuits, after removal of short, replace fuse.
	Poor contacts of 14 pole connectors	Check seating of connectors, clean if necessary.
	Faulty connection to battery	Check primary voltage on main fuse with voltmeter.
	Power relay not operating	Check relay K202 for proper operation and inspect switch S1 coupled to volume control.
	Faulty switch S2 or poor contact	Check position of S2, set to proper voltage and check contact.
	Open filaments of tubes	Check tubes
Power switch on, no B plus	Check transistorized power supply for operation, measure B plus at potential 162 and 163.	
	Faulty relay contacts	Check relay contacts K201 contact numbers 4 and 5.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
Power switch on, no B plus (Con'd.)	Transistors inoperative	Check potential No. 152 for battery voltage.
		Check potential No. 153 for proper bias voltage.
		Clean relay contacts.
		Change transistors.
		NOTE: Switching transistors and audio power transistors are matched pairs and must be replaced in matched pairs.
	Short circuit in B plus line	Remove short circuit
	Faulty Switch S2	Check and replace
	Defective components	Check mainly electrolytic capacitors, replace if necessary.

NOTE: Operative high voltage power supply can easily be recognized by an audible high-pitched sound, generated by the switching of the transistors. When this sound is present, the high voltage power supply in operative.

Receiver Section of Transceiver SA-360

It is assumed that the high voltage power supply A plus connections and all connections to antenna, speaker and headphones are in proper order; furthermore, that all tubes have been checked on a regular tube tester and have been found acceptable.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
squelch control fully clockwise, Volume fully clockwise, no noise in speaker.	Audio amplifier inoperative	Check AF amplifiers performance by injecting an audio voltage of 1000 cps into pin A of J1 or pin A of J201.
		Full AF power output must be obtained with 0.5 volts RMS. If no output or too low, check AF amplifier.
		Check voltage of V6 for proper values.
		Check volume control.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
Volume fully clockwise, squelch control fully clockwise, no noise in speaker (cont'd.)	Detector circuit inoperative	Check CR1, thru CR3, replace if necessary.
	I.F. amplifier inoperative	Realign
NOTE: V4, V5, and V6 and A.F. power amplifier operative, a noise will be present in the speaker and headphones.		
No reception when signal generator set to 14.98 mcps into antenna connector of transceiver	Oscillators inoperative	Check KC oscillator circuit for voltage values as indicated on circuit diagram. Retune L13 according to alignment procedure. Check and replace defective crystals in KC crystal board.
		Check and clean KC switch assembly.
	First I.F. amplifier inoperative	Check for proper voltage as indicated on circuit diagram. Realign first I.F. amplifier according to alignment procedure.
No reception when signal generator is tuned to frequencies between 118.0 and 125.00 mcps.	Mixer inoperative	Check V2 for proper operating voltages, as indicated on circuit diagram.
	Mcps. oscillator inoperative	Check megacycle oscillator tube V8 for proper voltages as indicated on circuit diagram.
		Check megacycle switch.
		Clean if necessary, avoid solvents such as benzine, benzol, use cleaning agents such as Contactrol, etc.
		Realign megacycle oscillator according to alignment procedure.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
No reception when signal generator is tuned to frequencies between 118.0 and 125.00 mcps. (cont'd.)	R.F. amplifier inoperative	Check V1 for proper voltages as indicated on circuit diagram. Check and clean if necessary antenna relay K1. Realign RF amplifier according to alignment procedure.

Transmitter Section of Transceiver SA-360

It is recommended that another VHF Transceiver be tuned to the frequencies on which the check-out of the SA-360 Transmitter is to be made, and the results be monitored for modulation quality, frequency, etc. Disconnect signal generator and connect R.F. load and thru-line wattmeter before making this check.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
No R.F. power output	Faulty components	Check V8, V9, V10, V11, V12, V13, and V14 for proper voltages.
	Mcps oscillator inoperative	Check triode V8 for proper voltages, realign in accordance with alignment procedure
	KC oscillator	Check triode V10 for proper voltages as indicated on circuit diagram, realign.
	Antenna relay contacts	Check and clean if required.
No drive at potential No. 114.	R.F. amplifier inoperative	Check V11 and V12 for proper voltages and realign if required.
	Mixer inoperative	Check pentode V9 for proper voltages and realign if required.

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE PROCEDURE
R.F. power output sufficient, no modulation	Defective microphone	Check and replace
	Relay contacts inoperative	Clean and adjust if required
	Microphone potentiometer R202 maladjusted or defective	Adjust and clean if required
	Transistors defective	Check Q201 for proper no signal voltages, replace if required.
		Check Q202 for proper no signal voltages, replace if required.
		Check Q203 and Q204 for proper operating voltages *without* AF input, replace if required.
	Modulation transformer defective	Check according to circuit diagram for proper resistance values and insulation.
	No A plus on one or more transistors	See above
R.F. power output sufficient, no modulation (cont'd.)	Faulty connectors or inter-connecting	Check and remove fault
Modulation insufficient	Maladjusted microphone potentiometer	Adjust and check modulation depth with scope and calculate or adjust modulation by observation.

TUBE COMPLEMENT

RECEIVER

RF Amplifier	7167*
1st Mixer	7167*
2nd Mixer	6HG8 Pentode Section
2nd L. O.	6HG8 Triode Section
1st IF Amplifier	6BH6
2nd IF Amplifier	6BH6
Demodulator, Noise)	4 Crystal
Limiter, Squelch)	Diodes
and AGC)	
AF Amplifier	12AU 7
MC Osc.	6 CW 4
KC Osc.	6 CW 4
1st Mixer	6 EA8 Triode Section
Amplifier	6 EA8 Pentode Section

TRANSMITTER

Mixer	6HG8 Pentode Section
L. O.	6HG8 Triode Section
Amplifier	8106*
Driver	7551
RF Power	8156*

MODULATOR/POWER SUPPLY

The schematic diagram provides all necessary information as to voltages and currents for troubleshooting the unit. The measurements should be taken with a multimeter having the required impedance for voltage measurements and low internal resistance for current measurements.

MODULATOR AND AUDIO AMPLIFIER

Input Amplifier	2N 1379
Driver	SA P. No. 44185
Class B PP Amplifier (2 each)	SA P. No. 44185

POWER SUPPLY

Switching Transistors (2) SA P No. 44185

NOTE: Tubes marked with an asterisk may not be readily available outside the U.S.A. SunAir is therefore prepared to supply spares in any quantities required. Please forward your request for spare tubes in accordance with the instructions shown on page 4.

PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, 500 PF ± 10%/JF 1/4"	25098
C2	Same as C1	
C3	Capacitor, 12 PF, Silver Mica DM 10/5 %	26121
C4	Same as C1	
C5	Capacitor, Ceramic Trimmer .5 - 4.5 PF	25139
C6	Capacitor, Feedthrough 1000 PF	25866
C7	Capacitor, 2.0 PF, Silver Mica DM 10/5 %	25971
C8	Same as C1	
C9	Same as C1	
C10	Capacitor, 10 PF, Silver Mica DM 10/5 %	25983
C11	Same as C1	
C12	Same as C10	
C13	Same as C6	
C14	Same as C10	
C15	Same as C10	
C16	Capacitor, Disc. 3300 PF/500 V	24422
C17	Capacitor, 5000 PF/GMV/BZ5U 1/2"	25103
C18	Capacitor, Metalized Paper .22 MF/250 V	26157
C19	Same as C10	
C20	Capacitor, Disc. 5000 PF/150 V	24460
C21	Same as C17	
C22	Same as C17	
C23	Capacitor, (2 Req.) 1 PF ± .25 PF/CN33	24991
C24	Same as C16	
C25	Same as C16	
C26	Capacitor, Mkt. .1 MF/250 V	25713
C27	Same as C16	
C28	Same as C16	
C29	Capacitor, 1 PF Silver Mica DM 10/5 %	26016
C30	Same as C16	
C31	Same as C16	
C32	Capacitor, Mylar Tropifoil-M/.047 MF/10%/125V	25189
C33	Capacitor, 10 PF/5%/CN750	25048
C34	Capacitor, 100 PF/10%/JL x 5F	25074
C35	Same as C16	
C36	Same as C17	
C37	Same as C17	
C38	Capacitor, Mylar 0.1 MF/125V/10%	25141
C39	Same as C17	
C40	Capacitor, Electro. 10 MF/30V	25153
C41	Same as C1	
C42	Capacitor, Mylar .47 MF/125V/10%	25270
C43	Capacitor, 50 PF, Silver Mica DM 10/5%	26004
C44	Same as C1	
C45	Capacitor, 5 PF, Silver Mica DM 10/5%	26119
C46	Same as C7	
C47	Same as C10	
C48	Same as C18	
C49	Same as C1	
C50	Same as C1	
C51	Same as C6	
C52	Same as C5	
C53	Same as C1	
C54	Same as C10	
C55	Capacitor, 68 PF, Silver Mica DM 10/5%	26107
C56	Same as C3	
C57	Same as C43	
C58	Same as C16	
C59	Same as C17	
C60	Same as C29	
C61	Same as C1	
C62	Same as C43	
C63	Selective	

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C64	Capacitor, 47 PF, Silver Mica DM 10/5%	26092
C65	Same as C1	
C66	Same as C10	
C67	Capacitor, 15 PF, Silver Mica DM 10/5%	25995
C68	Capacitor, 6.0 PF ± .25 PF/CN	25036
C69	Same as C10	
C70	Same as C16	
C71	Same as C1	
C72	Same as C17	
C73	Same as C1	
C74	Same as C1	
C75	Same as C5	
C76	Same as C1	
C77	Same as C68	
C78	Same as C1	
C79	Same as C5	
C80	Same as C1	
C81	Same as C17	
C82	Same as C1	
C83	Same as C64	
C84	Same as C1	
C85	Same as C16	
C86	Same as C16	
C87	Same as C16	
C88	Same as C45	
C89	Same as C5	
C90	Same as C1	
C91	Same as C17	
C92	Same as C1	
C93	Same as C43	
C94	Same as C1	
C95	Same as C1	
C96	Same as C17	
C97	Same as C1	
C98	Same as C1	
C99	Same as C5	
C100	Same as C6	
C101	Same as C1	
C102	Same as C1	
C103	Same as C1	
C104	Same as C67	
C105	Same as C17	
C106	Same as C68	
C107	Same as C1	
C108	Same as C6	
C109	Same as C1	
C110	Deleted	
C111	Same as C5	
C112	Same as C1	
C113	Capacitor, Variable 5-25 PF/NPO	26169
C114	Same as C6	
C115	Same as C1	
C116	Same as C1	
C117	Capacitor, 7 PF, Silver Mica DM10/5%	26133
C118	Same as C3	
C119	Capacitor, 30 PF, Silver Mica DM10/5%	26145
C120	Same as C6	
C121	Same as C6	
C122	Same as C1	
C123	Same as C1	
C124	Same as C1	
C125	Same as C1	

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C126	Same as C1	
C127	Same as C1	
C128	Same as C1	
C129	Same as C1	
C130	Same as C1	
C131	Same as C6	
C132	Same as C6	
C133	Same as C1	
C134	Same as C1	
C135	Same as C1	
C136	Same as C6	
C137	Same as C6	
C138	Same as C16	
C139	Same as C1	
C140	Same as C1	
C141	Same as C1	
C142	Same as C1	
C143	Same as C1	
C144	DELETED	
C145	Capacitor, Disc. .01 MF/500 V	24355
C146	Same as C1	
C147	Same as C16	
C148	Same as C6	
C149	Capacitor, Ceramic Trimmer 5-25 NPO	26169
R1	Resistor, 100 K Ohm/10%/.25 W	17039
R2	Resistor, 100 Ohm/10%/.25 W	17118
R3	Resistor, 56 K Ohm/10%/.25 W	17144
R4	Resistor, 1 Meg Ohm/10%/.25 W	17065
R5	Resistor, Comp. 2.2M/.25 W	17687
R6	Resistor, 10,000 Ohm/1/2 W	16724
R7	Resistor, Comp. 680 Ohm/10%/.25 W	17663
R8	Same as R3	
R9	Resistor, 1,000 Ohm/1/2 W	16748
R10	Resistor, 270 K Ohm/10%/.25 W	17211
R11	Resistor, 1 K Ohm/10%/.25 W	17156
R12	Same as R1	
R13	Same as R11	
R14	Same as R11	
R15	Resistor, 22 K Ohm/10%/.25 W	17223
R16	Same as R11	
R17	Same as R4	
R18	Same as R1	
R19	Resistor, 47 K Ohm/10%/.25 W	17106
R20	Resistor, Comp. 1.5 Meg/10%/.25 W	17508
R21	Same as R10	
R22	Same as R1	
R23	Resistor, Variable, 100 K Audio Taper/1/2 W	32596
R24	Same as R20	
R25	Resistor, 1.5 K Ohm/10%/.25 W	17247
R26	Same as R4	
R27	Same as R19	
R28	Resistor, Variable, 100 K Linear/1/2 W	32596
R29	Resistor, Comp. 220 K/10%/5W	11704
R30	Same as R10	
R31	Same as R4	
R32	Same as R25	
R33	Resistor, Comp. 390 Ohm/10%/.25 W	17833
R34	Same as R1	
R35	Resistor, 10,000 Ohm/3 W	16255
R36	Resistor, Comp. 15 K Ohm/10%/1 W	17340
R37	Resistor, 10 K Ohm/10%/.25 W	17041
R38	Same as R2	
R39	Same as R1	
R40	Same as R3	
R41	Same as R1	
R42	Resistor, 330 Ohm/10%/.25 W	17091
R43	Same as R1	
R44	Same as R1	
R45	Same as R36	
R46	Same as R2	
R47	Same as R3	
R48	Same as R37	
R49	Same as R37	
R50	Same as R20	
R51	Same as R2	
R52	Same as R9	
R53	Same as R37	
R54	Same as R4	
R55	Same as R37	
R56	Resistor, 68 Ohm/1/2 W	16774
R57	Same as R6	
R58	Same as R3	
R59	Resistor, Comp. 33 Ohm/10%/1/2 W	17170
R60	Resistor, 22,000 Ohm/1/2 W	16712
R61	Resistor, Comp. 68 K Ohm/10%/.25 W	17352
R62	Deleted	
R63	Resistor, 25 K/5 W	16865
R64	Resistor, Comp. 10 Ohm/.25 W	17716
R65	Same as R4	
R66	Resistor, Comp. 47 Ohm/10%/.25 W	17936
R67	Resistor, Comp. 6.2 Ohm/5 W/W.W.	17766
R68	Resistor, 4.7 K Ohm/1/2 W	16920
R69	Same as R68	
L1	Inductor, Var.	94154
L2	Inductor, Fix. 2.2 uh /20%	63454
L3	Inductor, Var.	94154
L4	Inductor, Fix. 1.5 uh /20%	63442
L5	Inductor, Var.	94128
L6	Same as L2	
L7	Inductor, Fix. .22 uh /20%	56255
L8	Inductor, Var.	
L9	Inductor, Fix. 1.0 uh /20%	63430
L10	Inductor, Fix. .47 uh /20%	63428
L11	Inductor, Var.	94130
L12	Same as L10	
L13	Inductor, Var.	
L14	Same as L9	
L15	Same as L9	
L16	Same as L9	
L17	Inductor, Var.	94142
L18	Inductor, Var.	94104
L19	Same as L2	
L20	Same as L4	
L21	Same as L2	
L22	Inductor, Var.	94104
L23	Same as L2	
L24	Same as L4	
L25	Inductor, Var.	94099
L26	Same as L2	
L27	Same as L2	
L28	Inductor, Var.	
L29	Same as L2	

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
L30	Inductor, Air Spaced .057 uh	93904
L31	Inductor, Air Spaced .047 uh	93899
L32	Same as L9	
L33	Same as L9	
L34	Same as L9	
L35	Same as L9	
L36	Same as L9	
L37	Same as L9	
L38	Same as L9	
L39	Same as L9	
L40	Same as L9	
L41	Same as L9	
L42	Same as L9	
L43	Same as L9	
L44	Same as L9	
L45	Same as L9	
L46	Same as L9	
L47	Inductor, Air Spaced	56176
CR1	Diode, 1N461	40141
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Diode, 1N538	40153
K1	Relay	66286
T1	I.F. Transformer, 14.98 MC	93710
T2	I.F. Transformer, 3 MC	93681
T3	Same as T2	
T4	Same as T2	
T5	Same as T2	
Y1	Crystal Unit, 79.550 MC	
Y2	Crystal Unit, 80.550 MC	80672
Y3	Crystal Unit, 81.550 MC	80062
Y4	Crystal Unit, 82.550 MC	80074
Y5	Crystal Unit, 83.550 MC	80036
Y6	Crystal Unit, 84.550 MC	80098
Y7	Crystal Unit, 85.550 MC	80103
Y8	Crystal Unit, 86.550 MC	80015
Y9	Crystal Unit, 87.550 MC	80127
Y10	Crystal Unit, 88.550 MC	80139
Y11	Crystal Unit, 89.550 MC	80141
Y12	Crystal Unit, 90.550 MC	80256
Y13	Crystal Unit, 91.550 MC	80268
Y14	Crystal Unit, 92.550 MC	80270
Y15	Crystal Unit, 93.550 MC	80684
Y16	Crystal Unit, 94.550 MC	80696
Y17	Crystal Unit, 95.550 MC	80701
Y18	Crystal Unit, 96.550 MC	80713
Y19	Crystal Unit, 97.550 MC	80725
Y20	Crystal Unit, 98.550 MC	80737
Y21	Crystal Unit, 17.867 MC	81200
Y22	Crystal Unit, 14.980 MC	81183

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
YA	Crystal Unit, 51.430 MC 00	80957
YB	Crystal Unit, 51.480 MC 05	80969
YC	Crystal Unit, 51.530 MC 10	80971
YD	Crystal Unit, 51.580 MC 15	80983
YE	Crystal Unit, 51.630 MC 20	81004
YF	Crystal Unit, 51.680 MC 25	81016
YG	Crystal Unit, 51.730 MC 30	81028
YH	Crystal Unit, 51.780 MC 35	81030
YJ	Crystal Unit, 51.830 MC 40	81042
YK	Crystal Unit, 51.880 MC 45	81054
YL	Crystal Unit, 51.930 MC 50	81066
YM	Crystal Unit, 51.980 MC 55	81078
YN	Crystal Unit, 52.030 MC 60	81080
YO	Crystal Unit, 52.080 MC 65	81092
YP	Crystal Unit, 52.130 MC 70	81107
YQ	Crystal Unit, 52.180 MC 75	81119
YR	Crystal Unit, 52.230 MC 80	81121
YS	Crystal Unit, 52.280 MC 85	81133
YT	Crystal Unit, 52.330 MC 90	81145
YU	Crystal Unit, 52.380 MC 95	81157
V1	Tube, Vacuum, 7167	76334
V2	Same as V1	
V3	Tube, 6HG8	76566
V4	Tube, Vacuum, 6BH6	76372
V5	Same as V4	
V6	Tube, Vacuum, 12AU7	76607
V7	Deleted	
V8	Tube, Nuvistor, 6CW4	76580
V9	Tube, Vacuum, 6EA8	76592
V10	Same as V8	
V11	Same as V3	
V12	Tube, Vacuum, 8106	76358
V13	Tube, 7551	76578
V14	Tube, Vacuum 8156	76463
B1	(14 V Unit) Bulb 12 V	84367
B1	(28 V Unit) Bulb 28 V	84355
B2	(14 V Unit) Same as B1	
B2	(28 V Unit) Same as B1	

POWER SUPPLY AND MODULATOR

14V AND 28V

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C201	Capacitor, Electro. 10 MF/30 V	25153
C202	Same as C201	
C203	Capacitor, Electro. Printilyd 400 MF/15 V.	25165
C204	Same as C201	
C205	Capacitor, Mylar Tropifoil - F1000 PF/400 V	25177
C206	Capacitor, Mylar Tropifoil - M .047 MF/125 V	25189
C207	Same as C201	
C209	Capacitor, Disc. .01 MF/1.4 KV	24410
C210	Capacitor, Electro. 8 + 8 MF/500 V	25191
C211	Same as C210	
C212	Same as C201	
C213	Same as C201	
C216	Deleted	
C217	Deleted	
C218	Deleted	
C219	Same as C203	
R201	Potentiometer, 250 Ohm/1 W/20%	32455
R202	Resistor, 47 Ohm/.25 W/10%	17106
R203	Resistor, 15 K Ohm/.25 W/10%	17235
R204	Resistor, Comp. 470 Ohm/.25 W/10%	17261
R205	Resistor, Comp. 100 Ohm/.25 W/10%	17118
R206	Resistor, 220 Ohm/1/2 W/10%	17285
R207	Deleted	
R208	Resistor, Value Selected/1/4 W	
R209	Same as R203	
R210	Resistor, 10 K Ohm/1/4 W/10%	17041
R211	Resistor, .47 Ohm/1 W/10%	17297
R213	Resistor, 180 Ohm/1/2 W/10%	17364
R214	Resistor, 1.5 Ohm/2 W/10%	17302
R215	Resistor, .25 Ohm/3 W/ W/W	16932
R216	Resistor, 1 K Ohm/3 W	16279
R217	Resistor, 2.2 K Ohm/1 W	16451
R218	Resistor, 560 Ohm/1 W	17871
R222	Resistor, 600 Ohm/5 W	16126
R223	Resistor, Comp. 330 Ohm/1/2 W/10%	17338
R224	Thermistor	17950
R225	Deleted	
R226	Resistor, Comp. 68 K Ohm/.25 W/10%	17352
R227	Same as R226	
R228	Potentiometer, 10 K/1 W	32754
R229	Resistor, 10 K/1/2 W	16736
R230	Resistor, 100 Ohm/1/2 W/10%	17479
R231	Same as R216	
R234	Resistor, 1.5 K Ohm/.25 W/10%	17247
R235	Same as R216	
L201	Choke, filter, 160 MH	93758
L202	Choke, 80 MH	93796
L203	Choke, 9 MH	93772
L204	Choke, 10 MH	56152
L205	Choke, 400 MH	93722
L206	Choke, .4 MH	93734
Q201	Transistor, 2N1379	44056
Q202	Transistor, 2N1159	44185
Q203	Same as Q202	
Q204	Same as Q202	
Q205	Same as Q202	
Q206	Same as Q202	
K201	Relay, 14 V (Transmitter)	66298
K202	Relay, KD3D/12 V (On-Off)	66016
CR201	Diode, 1N461	40141
CR202	Diode, No. 534	40165
CR203	Diode, No. 538	40153
CR204	Same as CR203	
CR205	Same as CR203	
CR206	Same as CR203	
CR207	Same as CR202	
T201	Transformer (Driver)	48181
T202	Transformer (Mod.)	48296
T203	Transformer (Power)	93277

14 VOLT ONLY

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C208	Capacitor, Electro. Printilyd, 400 MF/15 V	25165
C214	Same as C208	
C215	Same as C208	
R212	(28 V Only)	
R213	Resistor, 180 Ohm/1/2 W/10%	17364
R219	(28 V Only)	
R220	(28 V Only)	
R221	(28 V Only)	
R232	Resistor, 40 Ohm/3 W/10%	16310
R233	Resistor, 7.5 Ohm/3 W/10%	17895
CR208	Diode, Zener 1E18Z	40191
R201	Fuse, Slow Blow, 15A	84850

28 VOLT ONLY

CIRCUIT SYMBOL	DESCRIPTION	SUNAIR PART NO.
C208	Capacitor, Electro. Printilyd, 200 MF/30V	25816
C214	Same as C208	
C215	Same as C208	
C212	Resistor, 100 Ohm/3 W	16308
C213	Resistor, 450 Ohm/3 W	16281
R219	Resistor, 75 Ohm/3 W	16944
R220	Same as R219	
R221	Same as R219	
R232	Same as R212	
R233	Resistor, 40 Ohm/3 W/10%	16310
CR208	Diode, Zener 1E36Z	40244
F201	Fuse, Slow Blow 10A	84846