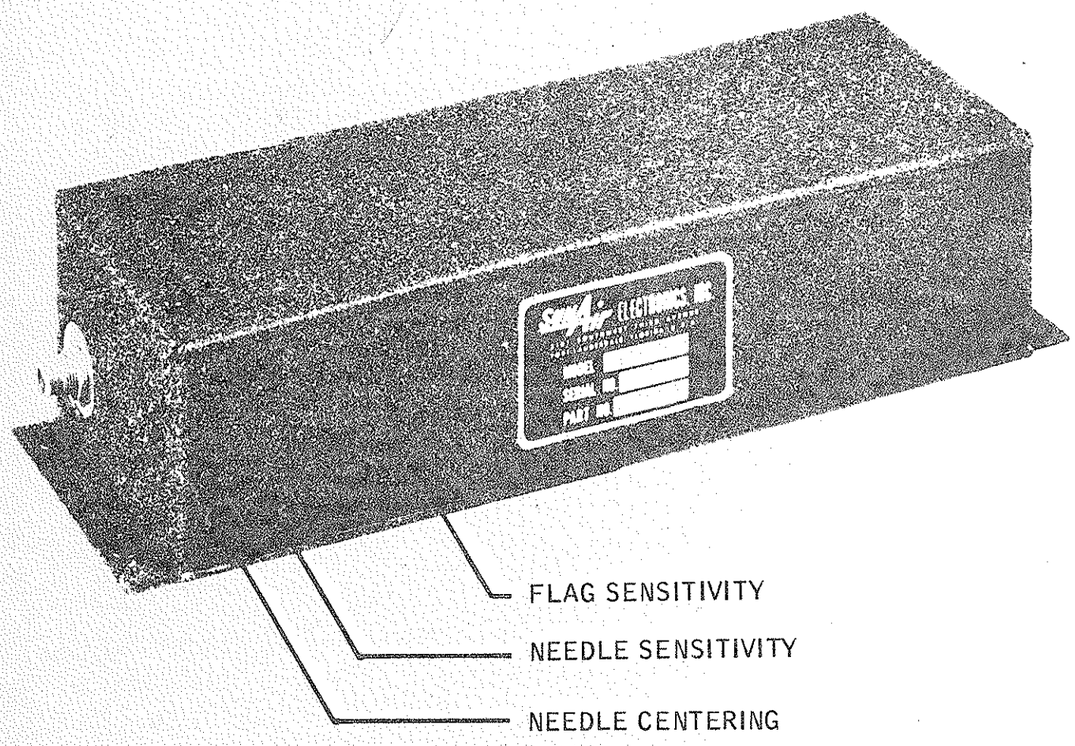

GLIDESLOPE RECEIVER SGR-20

SUNAIR ELECTRONICS, INC.
3101 SOUTHWEST THIRD AVENUE
FORT LAUDERDALE, FLORIDA U S A

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SECTION I

GENERAL INFORMATION

1 - 1 SPECIFICATIONS

Dimensions:	10" x 3" x 2¼"
Weight:	2.5 lb.
Power Requirements:	13.75 v. at 300 ma 27.5 v. at 150 ma
Frequency Range:	329.3 mc to 335.0 mc 300 kc spacing
Frequency Stability:	NMT .005%
Sensitivity:	NMT 40 uv input for 60% of standard deflection
Selectivity:	NMT 6db at 180 kc NLT 60 db at 2000 kc
AGC:	NMT 2db change in output for an input change from 50 - 30,000 uv
Image rejection:	NLT 45db
Spurious rejection:	NLT 50db

1 - 2 GENERAL DESCRIPTION

The SunAir Glide Slope Receiver SGR-20 represents an economical, high performance lightweight supplement for the SA-1036 system. It, together with the SA-1036 and SAI-400, provides complete navigation information for aircraft approaches to airports equipped with Instrument Landing Systems (ILS).

1 - 3 CONTROLS

The SGR-20 is a remote controlled unit. It gets energized and frequency selected by turning the Nav. Frequency Selector knob in the SA-1036 to the appropriate localizer channel. The solid state switching that it features makes this possible. The completely silicon solid state design permits reliable operation with minimum maintenance at high temperatures.

1 - 4 UNITS AND ACCESSORIES SUPPLIED

a) Glide Slope Receiver, model SGR-20

b) Antenna Connector, male, SunAir part number 74520, one each

c) Connector, male cable, SunAir part number 74582, one each

d) Connector, female cable, SunAir part number 74609, one each

e) Hood for Connector, SunAir part number 74623, two each

1 - 5 ACCESSORIES AVAILABLE BUT NOT SUPPLIED

a) Converter Indicator, model SAI-400, VOR/LOC, Glide Slope

b) VHF Transceiver, Model SA-1036

c) Modulator Power Supply Unit, model SAV901, 14 volts
model SAV902, 28 volts

d) Glide Slope Cable Assembly for 8 foot systems, SunAir part number 97962
for 16 foot systems, SunAir part number 97874

e) SunAir VHF Navigation Antenna, Model SAN-200

f) SunAir VHF Communications Antenna, Model SAC-100

g) Headphones, 500 ohms nominal and/or loudspeaker, 3 ohms nominal

h) Microphone, low impedance carbon, noise cancelling

1 - 6 CHANNEL PAIRING

The twenty (20) VHF Localizer channels in the 108.1 through 111.9 mc range (200 kc spacing) are used with the twenty (20) VHF Glide Slope channels in the 329.3 through 335.0 mc range (300 kc spacing) in pairs, according to the table below. The crystals frequency used in the SGR-20 are also given.

CHANNELS-LOCALIZER (MC)	CHANNELS-GLIDE SLOPE (MC)	CRYSTALS (MC)
108.1	334.7	52.33
108.3	334.1	52.23
108.5	329.9	51.53
108.7	330.5	51.63
108.9	329.3	51.43
109.1	331.4	51.78
109.3	332.0	51.88
109.5	332.6	51.98
109.7	333.2	52.08
109.9	333.8	52.18
110.1	334.4	52.28
110.3	335.0	52.38
110.5	329.6	51.48
110.7	330.2	51.58
110.9	330.8	51.68
111.1	331.7	51.83
111.3	332.3	51.93
111.5	332.9	52.03
111.7	333.5	52.13
111.9	331.1	51.73

1 - 7 CHANNEL SELECTION

Channels are selected using a 9 wire system: giving, by using two wires at a time, 20 channeling combinations. This is enough to cover the whole Glide Slope range from 329.3 to 335.0 mc.

SECTION II

THEORY OF OPERATION

The receiver is a single conversion unit with an I.F. of 20.72 mc. The unit is completely solid state down to channel switching which is done by diodes.

The unit is composed of six (6) different modules:

a) R. F. Tuner
b) I. F. Amplifier
c) Crystal Oscillator Assembly
d) Double Circuit
e) Indicator
f) Flag Circuit

2-1 R. F. TUNER

The receiver input consists of a band pass filter (329.3 mc to 332.0 mc) composed of tuning coils L101, L102, L103 and associated circuitry. Output of filter feeds a UHF amplifier Q101, which in turn gets coupled to input of mixer Q102. The unbypassed emitter of Q102 gets injection from Tripler Q104 at a frequency between 308.58 and 311.28 mc; output of mixer Q102 centered at 20.72 mc is selected by double tuned tank circuit composed of L105, L106, C115, C116, C117 and C118 and fed into an emitter follower, which provides a low impedance output to I.F. amplifier. Mixer Q102 employs a delayed form of reverse AGC. Tripler Q104 is biased class AB to minimize spurious responses and oscillator radiation out to the antenna.

2-2 I.F. AMPLIFIER

The 20.72 mc I.F. amplifier consists of 7 stages: Q201, Q203, Q204, Q205 are selective amplifier stages synchronous tuned; Q206 is a wideband amplifier stage; Q202 works as a variable impedance stage controlled by the AGC voltage; at low levels of signal, the AGC voltage is at its maximum value of around + 5 volts which is enough to saturate Q202; at high signal levels the AGC voltage drops down to around .5, making Q202 go into cut off, in saturation the impedance between collector and emitter is very low, in cut off condition, this impedance reaches high values (around 20 k @ 20.72 mc). While in saturation it drops down to less than 100 ohms. Q207 is an emitter follower needed to provide good detector efficiency and a fairly low impedance source to indicator and flag circuits.

2-3 CRYSTAL OSCILLATOR ASSEMBLY

The oscillator Q301 is of the modified colpitts type using series crystals for good stability. It incorporates a diode matrix switching technique by which 20 cystals could be switched by using only 9 diodes. A crystal is energized by providing A+ to any 2 diodes from a system of 9 wires which is programmed at the navigation frequency selector switch bank of the SA-1036.

2 - 4 DOUBLER CIRCUIT

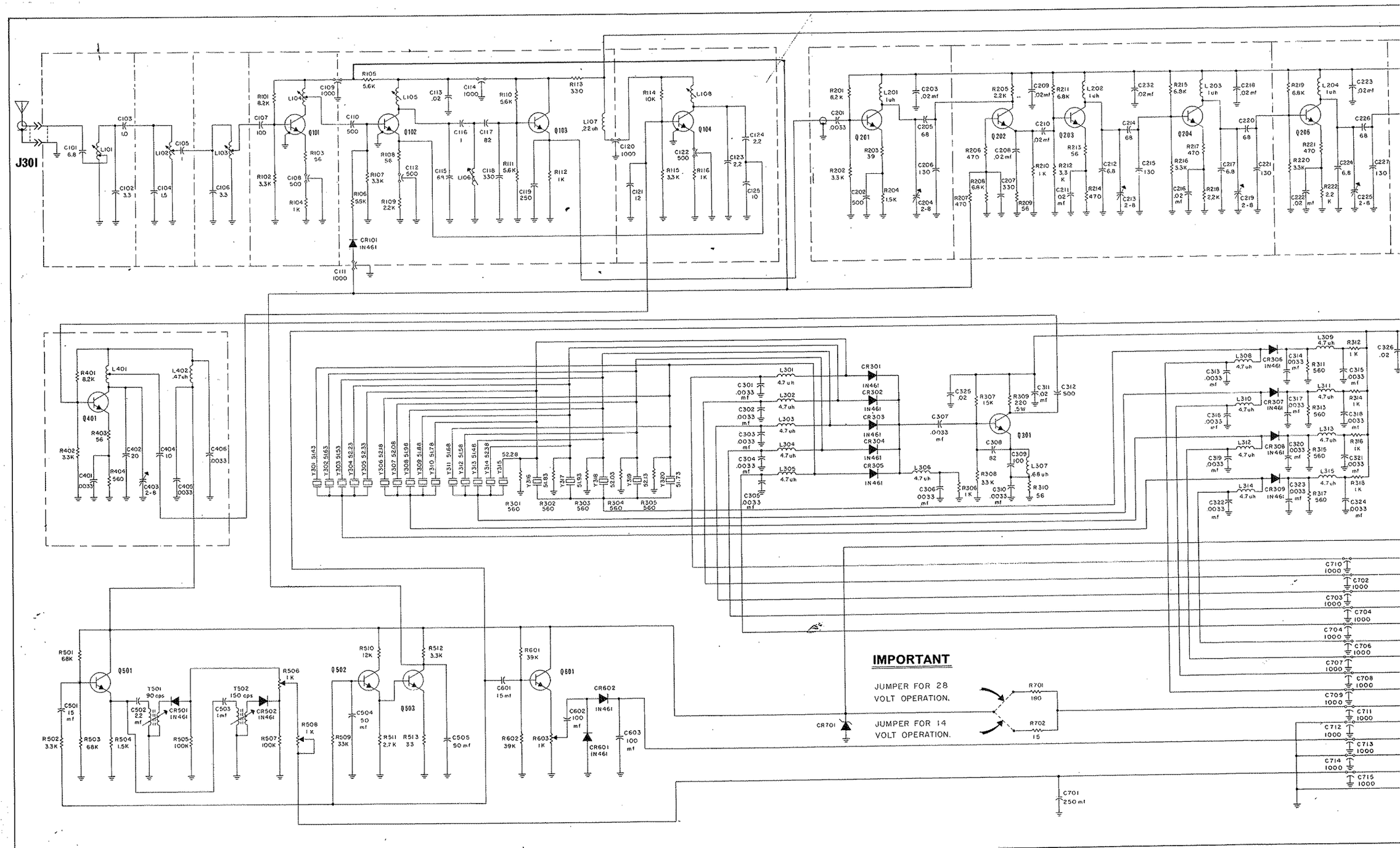
Output of oscillator drives Q401 at a frequency between 51.43 and 52.38 mc: this circuit doubles the frequency and feeds it to base of Tripler Q104 in the R.F. Tuner.

2 - 5 INDICATOR

This board contains the meter deflection circuits, (except flag) and the AGC amplifier. Output of detector from I.F. amplifier feeds emitter follower stage Q501 which in turn feeds the 90 and 150 cps transformers T501 and T502. Output of transformers are rectified and added out of phase to drive the up and down movement of indicator meter. The AGC amplifier uses 2 transistors in a DC coupled amplifier configuration. Q502 is an emitter follower needed to minimize loading of the detector. Q503 is a phase inverter needed to provide power gain to drive Q202 at the right phase.

2 - 6 FLAG CIRCUIT

The flag circuit employs an emitter follower Q601 so as not to load down the detector. It feeds a voltage doubler circuit which in turn feeds the flag movement of indicator meter. Flag threshold is adjusted by R603.



IMPORTANT

JUMPER FOR 28 VOLT OPERATION.

JUMPER FOR 14 VOLT OPERATION.

SECTION III

ALIGNMENT PROCEDURE

MODEL SGR-20 GLIDE SLOPE RECEIVER

3 - 1 GENERAL

Purpose: The following procedure is intended as a guide to the proper alignment and adjustment of the unit.

3 - 2 EQUIPMENT REQUIRED

Transceiver SA-1036 or equivalent
Power Supply SAV901/902 or equivalent
Glide Slope Signal Generator, Boonton #232-A or equivalent
Indicator SAI-400 or equivalent

3 - 3 TEST SET UP

Connect equipment as shown in Fig. 3-1. (No warm-up time is necessary). Set SA-1036 Navigation Frequency Selector knob to 109.3 mc. Set Signal Generator to 332.0 mc, Mod. Selector switch to 150 cps, Mod. level to 45% and adjust carrier level to red line.

3 - 4 ALIGNMENT PROCEDURE

Increase signal level of Generator until needle of Indicator deflects around one half of full scale.

3 - 4 - 1 DOUBLER

Turn C403 until a max. deflection is achieved in the Indicator. Drop signal level if required so as to keep around one half full scale deflection.

3 - 4 - 2 I.F. AMPLIFIER

Tune C225, C219, C213 and C204 in that respective order for a maximum deflection at Indicator Meter.

3 - 4 - 3 R. F. TUNER

Tune L106 and the L 105 for maximum indicator deflection. Tune L108, L104, L103 and L102 and L101 in that respective order again for maximum indication in meter.

3 - 4 - 4 INDICATOR-FLAG CIRCUITS

3 - 4 - 4 - 1 T501 and T502 are factory adjusted and should not need any adjustment whatsoever.

3 - 4 - 4 - 2 Turn db Tone Ratio Switch in Glide Slope Generator to 0 and increase signal level to 1000 mv. Adjust centering control R506 to center the meter.

3 - 4 - 4 - 3 Turn db Tone Ratio Switch to 2.0 DDM and adjust sensitivity control R508 to second dot of meter, switch Tone Ratio Switch to the other 2.0 DDM position; the needle should be in the second dot on the other side of center of the meter. Turn Tone Ratio to 0; needle should be on center. If it is not, readjust R506.

3 - 4 - 4 - 4 Repeat step 3-4-4-3 if necessary until conditions are met.

3 - 4 - 4 - 5 Switch db Tone Ratio Switch to CAL. 90 position and adjust R603 until the flag of indicator meter is just on the OFF position.

3 - 4 - 4 - 6 Switch db Tone Ratio Switch to CAL. 150 position. Flag should remain OFF.

3 - 4 - 4 - 7 With db Tone Ratio Switch in all composite signal positions (3.3, 2.0, 1.0, .5, 0) flag should remain ON. If it does not, reset R603 slightly and repeat steps 3-4-4-5, 3-4-4-6 and 3-4-4-7 until it does.

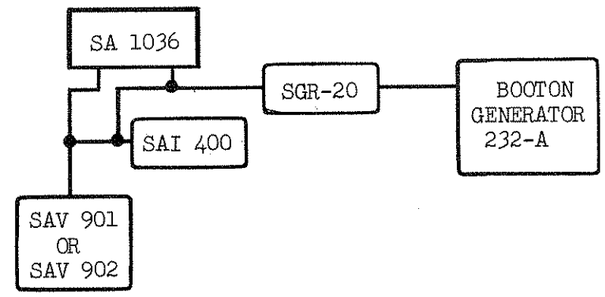


FIGURE 3-1

SECTION IV

TROUBLESHOOTING

The SGR-20 solid state circuitry has been designed keeping in mind high reliability, low maintenance and troubleshooting. All its components are rated well below component ratings.

The major troubles that can be expected are of a mechanical nature: open wires, bad solder joints, shorted leads, etc. Crystals and switching diodes in the crystal oscillator board are a possible source of trouble.

Crystal Oscillator Circuit

Main sources of trouble here are:

1) Crystals: aging and loss of activity as well as possible shift of frequency.

2) Switching diodes: becoming leaky.

Crystals are easily accessible for removal and replacement. Out of nine diodes used, a combination of two are needed to switch to a particular frequency. By looking at the schematic and pictorial layout of components, suspected diodes can be removed with a minimum of guesswork.

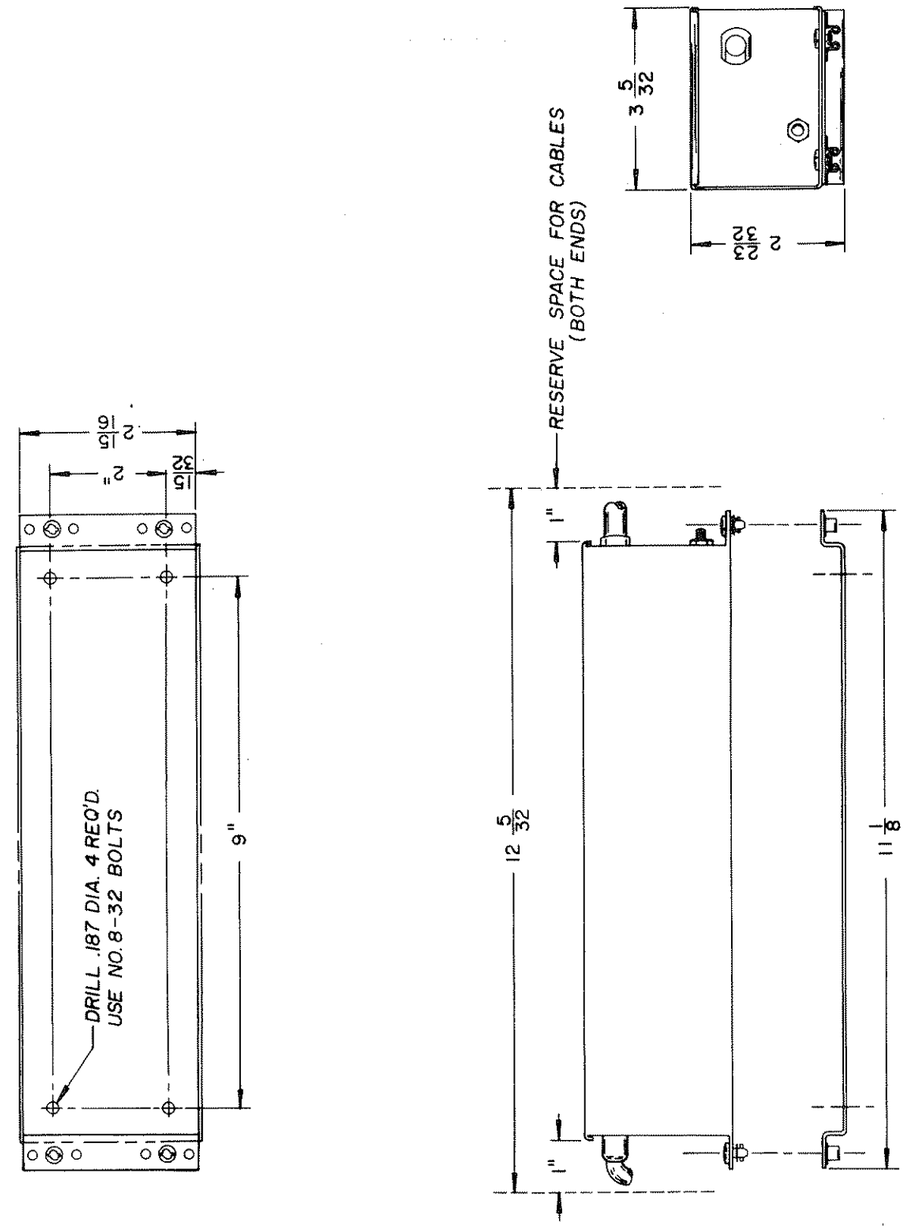


FIGURE 5-1 MOUNTING DETAIL

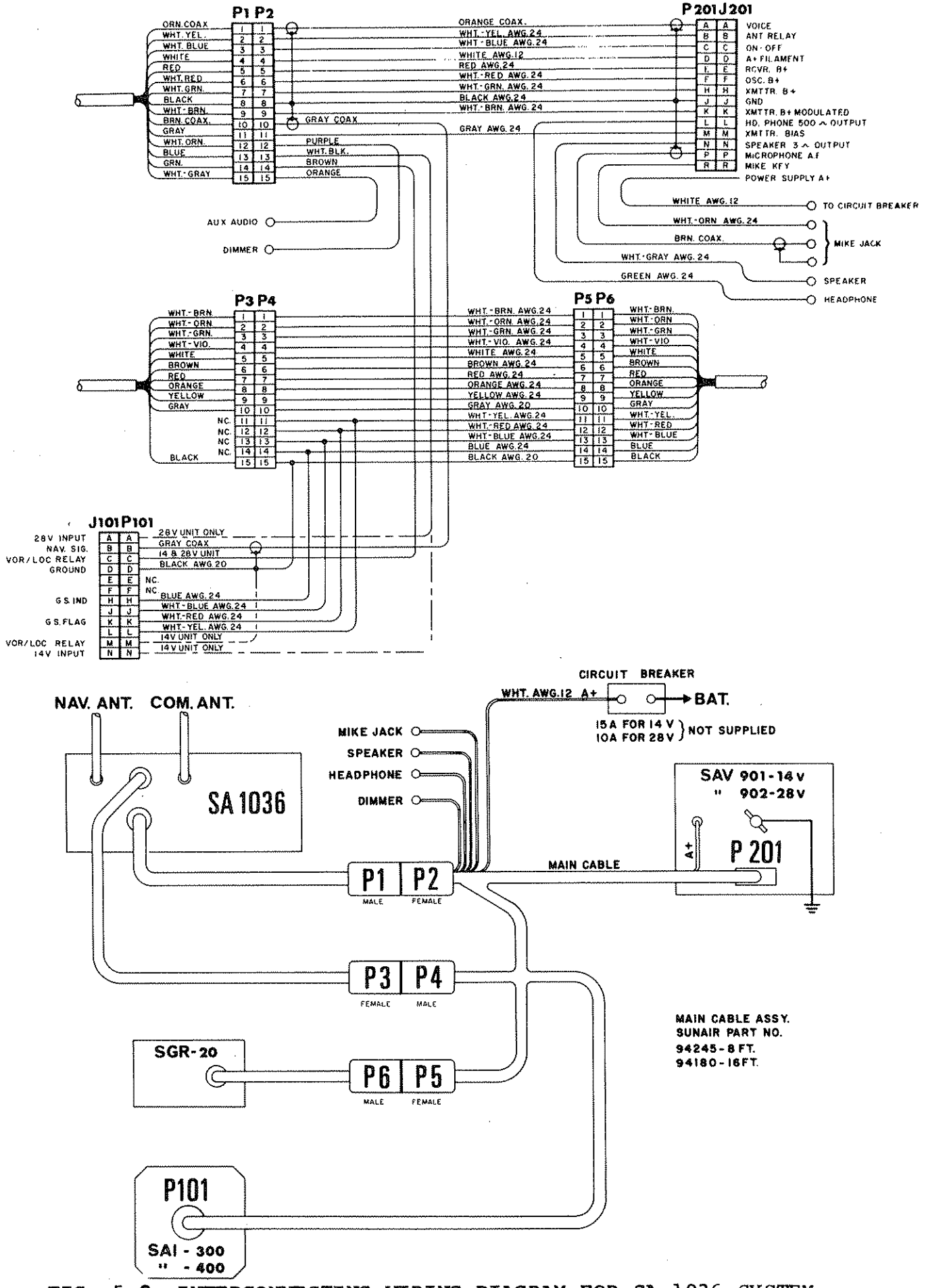


FIG. 5.2 INTERCONNECTING WIRING DIAGRAM FOR SA 1036 SYSTEM.

SECTION VI

PARTS LIST - SGR-20

Symbol No.	Part No.	Description
C101	26248	Capacitor, Disc: 6.8 pf, 500 v.
C102	26224	Capacitor, Disc: 3.3 pf, 500 v.
C103	24991	Capacitor, Disc: 1 pf, 500 v.
C104	25701	Capacitor, Disc: 1.5 pf, 500 v.
C105		Same as C103
C106		Same as C102
C107	25074	Capacitor, Disc: 100 pf, 500 v.
C108	26896	Capacitor, Bottom mica, 500 pf
C109	26901	Capacitor, Feed-thru, 1000 pf
C110	25098	Capacitor, Disc: 500 pf, 500 v.
C111		Same as C109
C112		Same as C108
C113	26913	Capacitor, Disc: .02 uf, 500 v.
C114		Same as C109
C115	25672	Capacitor, Disc: 68 pf, 500 v.
C116		Same as C103
C117	26212	Capacitor, Disc: 82 pf, N080
C118	26951	Capacitor, Mica, 330 pf, 500 v.
C119	25763	Capacitor, Mica, 250 pf, 500 v.
C120		Same as C109
C121	25658	Capacitor, Disc: 12 pf, 500 v.
C122		Same as C108

Symbol No.	Part No.	Description
C123	25000	Capacitor, Disc: 2.2 pf, 500 v.
C124		Same as C123
C125	26834	Capacitor, Disc: 10 pf, NPO
C201	24422	Capacitor, Disc: .0033 uf, 500 v.
C202		Same as C110
C203		Same as C113
C204	26822	Capacitor, Trimmer: 2-8 pf
C205		Same as C115
C206	26389	Capacitor, Disc: 130 pf, N030
C207	24006	Capacitor, Disc: 330 pf, 500 v.
C208		Same as C113
C209		Same as C113
C210		Same as C113
C211		Same as C113
C212		Same as C101
C213		Same as C204
C214		Same as C115
C215		Same as C206
C216		Same as C113
C217		Same as C101
C218		Same as C113
C219		Same as C204
C220		Same as C115
C221		Same as C206

Symbol No.	Part No.	Description
C222		Same as C113
C223		Same as C113
C224		Same as C101
C225		Same as C204
C226		Same as C115
C227		Same as C206
C228		Same as C113
C229		Same as C113
C230	27010	Capacitor, Disc: .1 uf, 12 v.
C231		Same as C113
C232		Same as C113
C301		Same as C201
C302		Same as C201
C303		Same as C201
C304		Same as C201
C305		Same as C201
C306		Same as C201
C307		Same as C201
C308	26949	Capacitor, Disc: 82 pf, N030
C309	26937	Capacitor, Disc: 100 pf, N030
C310		Same as C201
C311		Same as C113
C312		Same as C110
C313		Same as C201

Symbol No.	Part No.	Description
C314		Same as C201
C315		Same as C201
C316		Same as C201
C317		Same as C201
C318		Same as C201
C319		Same as C201
C320		Same as C201
C321		Same as C201
C322		Same as C201
C323		Same as C201
C324		Same as C201
C325		Same as C113
C326		Same as C113
C327		Same as C113
C401		Same as C201
C402	25660	Capacitor, Disc: 20 pf, NPO
C403		Same as C204
C404		Same as C125
C405		Same as C201
C406		Same as C201
C501	26171	Capacitor, Electrolytic: 15 uf, 6 v.
C502	26585	Capacitor, Polycarbon, 2.2 uf, 60 v.
C503	26561	Capacitor, Polycarbon, 1 uf, 60 v.

Symbol No.	Part No.	Description
C504	26262	Capacitor, Electrolytic: 50 uf, 15 v.
C505		Same as C504
C601		Same as C501
C602	26274	Capacitor, Electrolytic: 100 uf, 6 v.
C603		Same as C602
C701	26286	Capacitor, Electrolytic, 250 uf, 6 v.
C702		Same as C109
C703		Same as C109
C704		Same as C109
C705		Same as C109
C706		Same as C109
C707		Same as C109
C708		Same as C109
C709		Same as C109
C710		Same as C109
C711		Same as C109
C712		Same as C109
C713		Same as C109
C714		Same as C109
C715		Same as C109
R101	18162	Resistor, 8.2k/10%/$\frac{1}{4}$ w.
R102	17089	Resistor, 3.3k/10%/$\frac{1}{4}$ w.

Symbol No.	Part No.	Description
	17429	
R103	XXXXX	Resistor, 56/10%/$\frac{1}{4}$ w.
R104	17156	Resistor, 1k/10%/$\frac{1}{4}$ w.
R105	18306	Resistor, 5.6k/10%/$\frac{1}{4}$ w.
R106		Same as R105
R107		Same as R102
R108		Same as R103
R109	17807	Resistor, 2.2k/10%/$\frac{1}{4}$ w.
R110		Same as R105
R111		Same as R105
R112		Same as R104
R113	17091	Resistor, 330/10%/$\frac{1}{4}$ w.
R114	17041	Resistor, 10k/10%/$\frac{1}{4}$ w.
R115		Same as R102
R116		Same as R104
R201		Same as R101
R202		Same as R102
R203	18289	Resistor, 39/10%/$\frac{1}{4}$ w.
R204	17247	Resistor, 1.5k/10%/$\frac{1}{4}$ w.
R205		Same as R109
R206	17261	Resistor, 470/10%/$\frac{1}{4}$ w.
R207		Same as R206
R208	17481	Resistor, 6.8k/10%/$\frac{1}{4}$ w.
R209		Same as R103

Symbol No.	Part No.	Description
R210		Same as R104
R211		Same as R208
R212		Same as R102
R213		Same as R103
R214		Same as R206
R215		Same as R208
R216		Same as R102
R217		Same as R206
R218		Same as R109
R219		Same as R208
R220		Same as R102
R221		Same as R206
R222		Same as R109
R223		Same as R105
R224		Same as R102
R225		Same as R103
R226		Same as R206
R227	17168	Resistor, 82k/10%/$\frac{1}{4}$ w.
R228	18318	Resistor, 12k/10%/$\frac{1}{4}$ w.
R229	17039	Resistor, 100k/10%/$\frac{1}{4}$ w.
R230		Same as R105
R231	18461	Resistor, 82/10%/$\frac{1}{4}$ w.
R301	18320	Resistor, 560/10%/$\frac{1}{4}$ w.
R302		Same as R301

Symbol No.	Part No.	Description
R303		Same as R301
R304		Same as R301
R305		Same as R301
R306		Same as R104
R307	17235	Resistor, 15k/10%/$\frac{1}{4}$ w.
R308		Same as R102
R 309	17285	Resistor, 220/10%/$\frac{1}{2}$ w.
R310		Same as R103
R311		Same as R301
R312		Same as R104
R313		Same as R301
R314		Same as R104
R315		Same as R301
R316		Same as R104
R317		Same as R301
R318		Same as R104
R401		Same as R101
R402		Same as R102
R403		Same as R103
R404		Same as R301
R501	17352	Resistor, 68k/10%/$\frac{1}{4}$ w.
R502		Same as R102
R503		Same as R501

Symbol No.	Part No.	Description
R504		Same as R204
R505		Same as R229
R506	18069	Resistor, Variable, 1k
R507		Same as R229
R508		Same as R506
R509	17792	Resistor, 33k/10%/$\frac{1}{4}$ w.
R510		Same as R228
R511		Same as R117
R512		Same as R102
R513	18253	Resistor, 33/10%/$\frac{1}{4}$ w.
R601	17780	Resistor, 39k/10%/$\frac{1}{4}$ w.
R602		Same as R601
R603		Same as R506
R701	18332	Resistor, 180, 3 w.
R702	16334	Resistor, 15 ohm, 3 w.
L101	97699	Coil, Antenna Input
L102		Same as L101
L103	97687	Coil, R.F. Filter
L104	97675	Coil, R.F.
L105	97651	Coil, 20 mc, Primary
L106	97649	Coil, 20 mc, Secondary
L107	64226	Coil, Fixed, .22 uh.

Symbol No.	Part No.	Description
L108	97663	Coil, Tripler
L201	63430	Coil, Fixed 1 uh
L202		Same as L201
L203		Same as L201
L204		Same as L201
L205	64238	Coil, Fixed, 10 uh.
L301	64264	Coil, Fixed, 4.7 uh.
L302		Same as L301
L303		Same as L301
L304		Same as L301
L305		Same as L301
L306		Same as L301
L307	64276	Coil, Fixed, .68 uh.
L308		Same as L301
L309		Same as L301
L310		Same as L301
L311		Same as L301
L312		Same as L301
L313		Same as L301
L314		Same as L301
L315		Same as L301
L401	97704	Coil Doubler

Symbol No.	Part No.	Description
L402	63428	Coil, Fixed: .47 uh.
T501	64006	Transformer: 90 cps.
T502	64018	Transformer: 150 cps.
CR101	40141	Diode, 1N461
CR201		Same as CR101
CR301		Same as CR101
CR302		Same as CR101
CR303		Same as CR101
CR304		Same as CR101
CR305		Same as CR101
CR306		Same as CR101
CR307		Same as CR101
CR308		Same as CR101
CR309		Same as CR101
CR501		Same as CR101
CR502		Same as CR101
CR601		Same as CR101
CR602		Same as CR101
CR701	40177	Diode, 1N2974A
Q101	44240	Transistor, 2N3478
Q102		Same as Q101
Q103	44252	Transistor, 2N3646

Symbol No.	Part No.	Description
Q104		Same as Q101
Q201		Same as Q103
Q202		Same as Q103
Q203		Same as Q103
Q204		Same as Q103
Q205		Same as Q103
Q206		Same as Q103
Q207		Same as Q103
Q301		Same as Q103
Q401		Same as Q103
Q501	44264	Transistor, 40231
Q502		Same as Q501
Q503		Same as Q501
Q601		Same as Q501
Y301	80957	Crystal, CR-55, 51.43 mc
Y302	81004	Crystal, CR-55, 51.63 mc
Y303	80971	Crystal, CR-55, 51.53 mc
Y304	81121	Crystal, CR-55, 52.23 mc
Y305	81145	Crystal, CR-55, 52.33 mc
Y306	81119	Crystal, CR-55, 52.18 mc
Y307	81092	Crystal, CR-55, 52.08 mc

Symbol No.	Part No.	Description
Y308	81078	Crystal, CR-55, 51.98 mc
Y309	81054	Crystal, CR-55, 51.88 mc
Y310	81030	Crystal, CR-55, 51.78 mc
Y311	81016	Crystal, CR-55, 51.68 mc
Y312	80983	Crystal, CR-55, 51.58 mc
Y313	80969	Crystal, CR-55, 51.48 mc
Y314	81157	Crystal, CR-55, 52.38 mc
Y315	81133	Crystal, CR-55, 52.28 mc
Y316	81042	Crystal, CR-55, 51.83 mc
Y317	81066	Crystal, CR-55, 51.93 mc
Y318	81080	Crystal, CR-55, 52.03 mc
Y319	81107	Crystal, CR-55, 52.13 mc
Y320	81028	Crystal, CR-55, 51.73 mc
P6	74582	Connector, Male
H6	74623	Hood for Connector

PCN NUMBER:	956
PCN DATE:	10/19/65
EFFECTIVITY:	Serial No. 0005 DATE: 10/19/65
MODELS AFFECTED:	SGR-20
MANUAL REFERENCE:	Parts List, page 23
SCHEMATIC NUMBER	14958
SCHEMATIC ISSUE:	A
SUBJECT:	Component value change to selected value to linearize emitter follower amplifier 0.501

TEXT:

Page 19,

R504 was 17247 1.5K 1/4W

R504 is: Selected Value

SUNAIR ELECTRONICS, INC.
MANUAL FOR GLIDESLOPE RECEIVER
SGR - 20

ADDENDUM 2
DATE: 11/1/65

PCN NUMBER 969

PCN DATE: 10/29/65

EFFECTIVITY: SERIAL NO. 0001 DATE: 11/1/65

MODELS AFFECTED: Glideslope Receiver SGR-20

MANUAL REFERENCE: Parts List, page 25

SCHEMATIC NUMBER:

SCHEMATIC ISSUE:

SUBJECT: Zener Diode changed in order to maintain an A+ voltage between 9 and 10 volts to the SGR-20

TEXT:

CR701	44288	Diode, Zener 9-10V 10W