

## PHI | 20 GLIDESLOPE RECEIVER MAINTENANCE MANUAL

#### **CONTENTS**

Section I

GENERAL INFORMATION

Section II

INSTALLATION MANUAL

Section III

OPERATING MANUAL

Section IV

MAINTENANCE MANUAL

Section V

PARTS LIST

WARRANTY REPAIR FORMS

Published by: General Aviation Electronics, Inc. 4141 Kingman Dr. Indianapolis, Indiana 46226

(Area 317-546-1113)

Price: Single Copy \$10.00

Copyright 1971

## GENERAL INFORMATION

#### 1-1. Introduction

This service manual contains all of the information normally required to install, operate, and maintain the Genave PHI 20 Glideslope Receiver.

#### 1-2. Description

The PHI/20 is a complete solid state remote mounted glideslope receiver which is designed to be utilized with the Genave THETA/200 Converter-Indicator and ALPHA/360 Nav, Com Transceiver.

The receiver is a crystal tuned single conversion superheterodyne type utilizing 15 silicon transistors and 25 diodes in an all solid state design. The receiver can be externally channeled to any of the 20 glideslope frequencies from 329.3 to 335.0 MHz. The Nav frequency selector of the ALPHA/360 will provide for automatic pairing of localizer and glideslope channels.

The light weight PHI/20 can be remote mounted at almost any location within the aircraft and requires no special cooling.

The PHI/20 may be utilized with all present glideslope antennas and with the Genave ETA/3 Antenna Triplexer.

The PHI/20 is designed for 14 volt DC operation, however, 28 volt operation may be achieved through the use of the Genave PSI/1 Power Converter.

SIZE:

3.25'' w x 3'' h x 4.625'' long

(5.5" incl. mtg.)

WEIGHT:

1.1 lbs.

POWER REQUIREMENTS:

12 - 14 VDC @ 150 mA

CHANNELS:

All 20 in the UHF range of 329.3 to 335.0 mHz

CHANNELS SPACING:

0.3 mHz

SENSITIVITY:

30 microvolts at antenna terminals for 60% of standard deflection with erratic movement not exceeding ± 5% of stand deflection.

SELECTIVITY:

42 kHz at the 3 db points

SPURIOUS RESONSE:

-60 db

NUMBER OF TRANSISTORS:

15 all silicon

NUMBER OF DIODES:

25

#### 1-4. Equipment Supplied

- a. 1-PHI/20 Glideslope Receiver
- b. 2—Cable Connectors (16 pin, male and female)
- c. 2—RF Connectors (Phono Type)

#### 1-5. Equipment Required, But Not Supplied

- a. 1—Glideslope Antenna or Genave ETA/3 Antenna Triplexer
- b. Coaxial Cable, as required (RG58A/U or Equivalent)
- c. Wire for Harness, as required

Section I, Page 1

PHI/20

## INSTALLATION MANUAL

The following Section
is reproduced
and included with every

PHI | 20

It is made a part of
this manual
for your permanent
reference



GENERAL AVIATION ELECTRONICS, INC. 4141 KINGMAN DRIVE, INDIANAPOLIS, INDIANA 46226

# INSTALLATION MANUAL

## PHI/20 GLIDE SLOPE RECEIVER

## Please Note:

THIS UNIT MUST BE INSTALLED BY a properly certificated and authorized person in accordance with the Federal Aviation Regulations, Part 43. No responsibility for improper installation of this unit is either implied or assumed by the manufacturer. Units shown to be installed in violation of the FARs will not be covered by the warranty and will remove any and all responsibility from the manufacturer for such equipment.

and completeness of the information provided herein is not guaranteed or  $\boldsymbol{v}$ This manual is for educational purposes only. The accuracy and completeness of the information proving Genave shall not be liable for any loss or damages. Here to your own risk. Heauthor:

Copyright © 2007 Genave/NRC, Inc. All rights reserved. arranted.

## Warranty

Products bearing the trademark "GENAVE" or the trade name "GENERAL AVIATION ELECTRONICS, INC." have been fabricated by skillful technicians, under the strictest quality control conditions, using the finest materials and component parts available.

When properly adjusted and competently operated according to factory specifications and instructions, General Aviation Electronics, Inc. unconditionally guarantees and warrants all parts and bench service labor for one (1) full year from the date of the original installation of the TAU/100.

This warranty shall not apply to malfunction, which in the opinion of General Aviation Electronics, Inc. is the result of abusive use, accident, willful destruction, improper or unauthorized repair or installation. All service under this warranty must be performed by an Authorized Genave Distributor, or by returning the unit or units, freight pre-paid, to the factory at Indianapolis, Indiana.

GENERAL AVIATION ELECTRONICS, INC.

Ву

Elmore W. Rice, III, President

The Company offers no other guarantees or warranties expressed or implied

Proper Installation Will Assure Quality

The unit you are installing is a high quality, rugged, complex piece of electronic equipment. It has been manufactured under rigid quality control and has fully tested and operated a high temperatures to stabilize the component parts.

Proper installation of the unit into your customer's aircraft is essential to complete the quality assurance program under which the unit was manufactured.

Specifications:

This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc., all rights reserved.

SIZE:

3.25" w x 3" h x 4.625" long

(5.5" incl. mtg.)

WEIGHT:

1.1 lbs.

POWER REQUIREMENTS:

12 - 14 VDC @ 150 mA

CHANNELS:

All 20 in the UHF range of

329.3 to 335.0 mHz

CHANNELS SPACING:

0.3 mHz

SENSITIVITY:

30 microvolts at antenna terminals for 60% of standard deflection with erratic movement not exceeding ± 5% of stand deflection.

SELECTIVITY:

42 kHz at the 3 db points

SPURIOUS RESONSE:

-60 db

NUMBER OF TRANSISTORS:

15 all silicon

NUMBER OF DIODES:

25

## Unpacking

CAREFULLY REMOVE the unit and its mounting accessories from the shipping container by removing the staples from the top of the carton and lifting the contents straight out. The carton should be saved until the installation is complete in the event that damage is discovered or return of the unit is necessary for some reason. Any damage due to shipping should be reported and a claim filed as soon as possible with the shipping company. (If it is necessary to re-ship, use our container which is specifically designed for that purpose.)

## Pre-Installation Check

VISUALLY INSPECT the unit for any obvious external damage, such as dents, loose wires, etc. Any damage not related to shipping should be reported to General Aviation Electronics, Inc., 4141 Kingman Drive, Indianapolis, Indiana (46226), Area Code 317-546-1111, as soon as possible.

Damage due to shipping should be reported to and a claim should be filed promtly with the transportation company.

All units are shipped in perfect operating condition. However, a pre-installation electrical test may be performed to assure that the unit has suffered no internal damage during shipment. For a detailed test procedure, refer to the Maintenance Section of the PHI/20 Service Manual. DO NOT ATTEMPT to bench test the unit without proper equipment as specified in the Service Manual.

### Installation Planning

This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc., all rights reserved.

THE LOCATION of the unit in the aircraft should be carefully selected with due consideration to the following:

1. The unit generates only a very small amount of heat and, as such, does not require any type of cooling. However, the unit must NOT be mounted directly above a vacuum tube device or any other equipments that generate a large amount of heat unless such equipments have cooling provisions installed to keep the heat generated therein from coming in contact with other equipments mounted in close proximity to them.

MOUNTING THE UNIT DIRECTLY OVER UNCOOLED VACUUM TUBE EQUIPMENT OR IN THE HOT AIR BLAST OF ANY DEVICE, INCLUDING CABIN HEATERS, WILL AUTOMATICALLY VOID THE WARRANTY

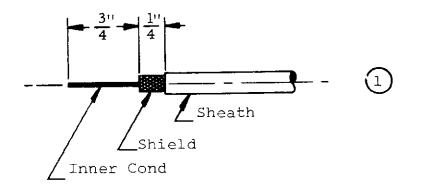
2. Although sufficient filtering is provided to eliminate interference from onboard transponder, it is possible tohave some interference if the transponder antenna cable and the glide slope antenna cables are tied together in the same harness. Avoid running these cables together if possible.

#### Installation

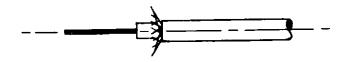
- 1. Install the remote receiver in the aircraft using a minimum of two mounting holes in opposite sides of the unit. Use the receiver itself for a template, and drill the selected holes with a 5/32" drill. Ase the #8-32 hardware supplied to attach the unit to the aircraft.
- Fabricate the power and signal cable using the connector socket supplied. A wiring diagram is shown in Figure 2.
- 3. Fabricate the RF Cables s illustrated in Figure 3, using 50 ohm coax, such as RG-58A/U.
- 4. Connect the two cables just fabricated to the appropriate points in the aircraft's electronic system. Mechanically secure the cables at appropriate support points.
- 5. Connect the cables to the receiver.
- 6. Update appropriate logs and papers of the aircraft.
- 7. Fill in the necessary information required by the warranty card.
- 8. Be sure the remainedr of the warranty card is fulled in by your customer and returned to the Factory The Warranty Card must be completed and returned to Genave for the warranty to be in effect.

### Post Installation Check

UPON COMPLETION of the installation, a flight test is desireable to insure that the PHI/20 is operating properly.



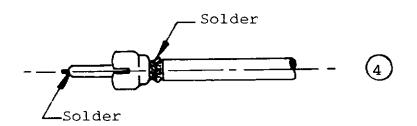
Cut and strip RG-58 A/U Coax as shown.



Spread shield. 2 Do not pigtail.



Press connector onto wire and against shield.

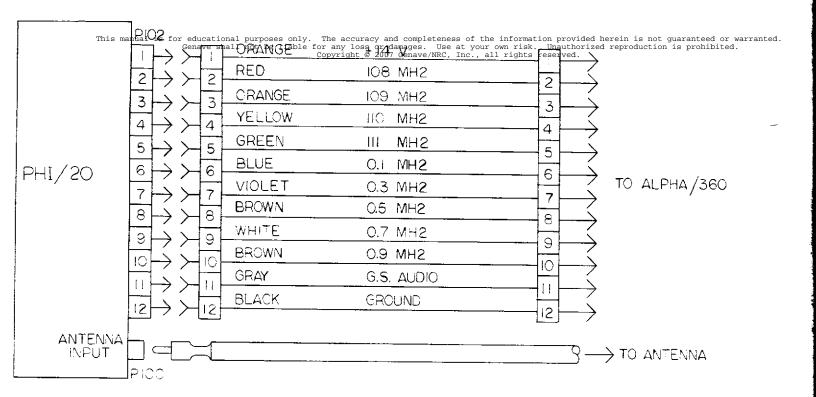


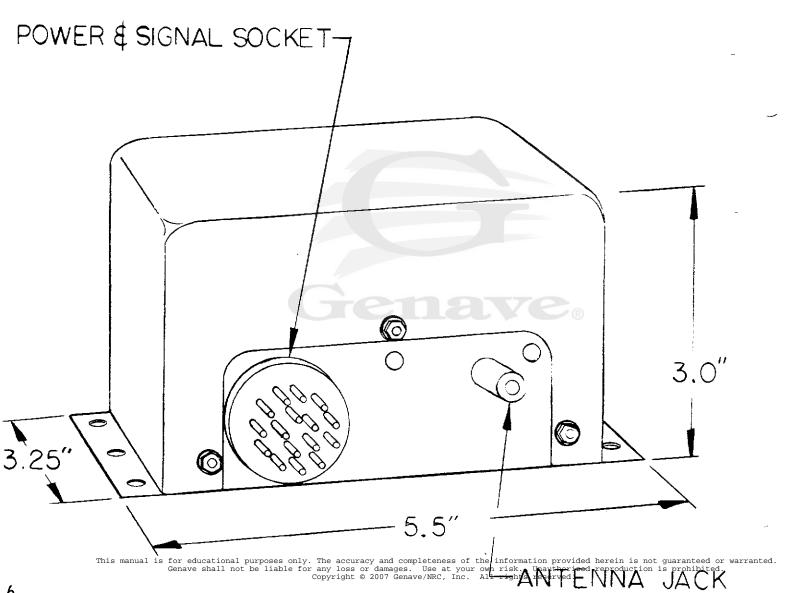
Fold shield over connector and solder all around. Flow solder into connector tip to secure inner conductor. Cut off tip of inner conductor

This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthoriconnector, is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.





# OPERATING MANUAL

#### 3-1. Operating Controls and Indicators

PHI/20 operation is controlled by the ALPHA/360, therefore, the PHI/20 has no independent controls of its own.

Localizer frequency selection on the ALPHA/ 360 will automatically channel the PHI/20 to the correct paired glideslope frequency.

When a flyable glideslope signal is received the glideslope "ON" lamp on the THETA/200 will illuminate and the glideslope needle will deflect in relation to the position of the aircraft with respect to the desired glide path.

Power to the PHI/20 is switched off and on by the Off/On switch of the ALPHA/360.

#### Glideslope Paired Frequencies

Localizer Frequency	Glideslope Frequency
$108.1~\mathrm{MHz}$	334.7 MHz
108.3 MHz	$334.1~\mathrm{MHz}$
108.5  MHz	329.9 MHz
108.7  MHz	330.5 MHz
108.9 MHz	$329.3~\mathrm{MHz}$
$109.1 \mathrm{MHz}$	331.4 MHz
109.3  MHz	$332.0 \mathrm{MHz}$
109.5  MHz	332.6  MHz
$109.7 \mathrm{\ MHz}$	333.2  MHz
109.9  MHz	$333.8 \mathrm{MHz}$
$110.1 \mathrm{MHz}$	334.4 MHz
110.3 MHz	335.0 MHz
110.5 MHz	$329.6~\mathrm{MHz}$
110.7 MHz	330.2 MHz
110.9 MHz	330.8 MHz
111.1 MHz	331.7 MHz
111.3 MHz	332.3 MHz
111.5 MHz	332.9 MHz
111.7 MHz	333.5 MHz
111.9 MHz	331.1 MHz

## MAINTENANCE MANUAL

#### 4-1. Introduction

This section provides the basic information required for electronic testing, alignment, and repair of the PHI/20. It is assumed that the technician working on the unit has a reasonable familiarity with the principles and terminology of avionics.

#### 4-2. Theory of Operation

#### 1. General

The PHI/20 employs 15 silicon transistors and 25 diodes in an all solid state design. It operates on 14 VDC and may be operated on 28 VDC through the use of the PSI/1 Power Converter. The PHI/20 was designed to be remote mounted with glideslope audio fed to the THETA/200 Converter-Indicator. Remote channeling is achieved by means of the Nav frequency selector and cabling of the ALPHA/360 Nav/Com Transceiver.

The circuitry is basically a remote channeled single conversion superheterodyne receiver with amplified AGC. The circuitry can be broken down into three major sections: Receiver, Oscillator/Multiplier, and Power Supply.

#### 2. Detailed Theory

A. Receiver—The receiver section of the PHI/20 is a single conversion crystal controlled design. The incoming signals from the antenna are applied to a 1090 MHz bandstop filter via P100 the antenna jack. The bandstop filter is centered on 1090 MHz and has an approximate bandwidth of 25 MHz. This filter suppresses all incoming signals in the 1090 MHz range by approximately 33 db. This filter prevents reception of the 1090 MHz reply signal of the ATC Transponder. The output of the bandstop filter is applied to a three pole Chebyshev bandpass filter comprised of L100, C100, L101, C102, L102, and C104. The response of this filter has a bandwidth of approximately 10 MHz and is centered on 333 MHz.

The signal from the bandpass filter is applied to the emitter of Q101 which functions as a common base RF amplifier. The input RF level to Q101 is controlled by the RF AGC voltage applied to Q100. Q100 provides a variable load on the output of the bandpass filter. The gain of the RF ampli-

fier itself is controlled by the RF AGC voltage applied to its base. Output of the RF amplifier is applied to the mixer.

Q102 and associated circuitry form the mixer. Output from the oscillator/multiplier, RF amplifier output, and RF AGC voltage are applied to the base of the mixer transistor. The oscillator/multiplier output applied to the mixer is .525 MHz above the desired signal frequency. The .525 MHz difference frequency generated in the mixer circuit is fed to the .525 MHz IF amplifiers.

The IF amplifier stage consists of Q103, Q104, and associated circuitry. The IF amplifier stage utilizes two 3-pole Chebyshev filters to obtain a bandwidth of 42 KHz centered on .525 MHz. These filters are comprised of T101, T102, and T103; T104, T105, and T106; together with their associated loading resistors and coupling capacitors. Output from the IF amplifiers is fed to Q105 the IF output emitter follower.

The signal from the IF output emitter follower is applied to the voltage doubling detector comprised of CR101, CR102, and associated circuitry. Audio output from the detector is applied to the two emitter followers of Q106 and Q107 which provide isolation of the detector circuitry.

Audio output for the converter-indicator is removed at the voltage divider of R131 and R132 then delivered to Pin 11 of P102, the output connector. Audio and DC is applied to R133 and C135 where the audio is removed and the DC fed to Q108, which functions as the AGC amplifier. It feeds control voltage to the IF amplifiers and through the sensitivity adjustment to the RF amplifier and mixer circuits.

B. Oscillator/Multiplier—The oscillator/multiplier circuitry consists of two crystal oscillators, each with two banks of five crystals, and two frequency doublers.

Q111 and associated circuitry, and Q112 and associated circuitry form the two oscillator circuits. Each oscillator is coupled to two 5-crystal banks. When proper bias is applied to a crystal within one of the banks, the oscillator oscillator will produce an output signal at the crystal frequency. Only one crystal will be selected at a time and therefore only one of the oscillator circuits

This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.

PHI/20 Section IV, Page 1

Will Operate at laitime experient from the loss of lateracy and completeness of the information provided herein is not guaranteed or warranted. Genave shall not be liable for any loss or damages. UALIGNMENT is recedure ized reproduction is prohibited. are capacitively coupled to the first multiplier of the first mult

are capacitively coupled to the first multiplier in put.

In order to select the desired crystal, 8.5 VDC is applied to the appropriate crystal bank. This is accomplished by applying 8.5 VDC to either Pin 2, 3, 4, or 5, of P102. Once the appropriate crystal bank has been selected the exact crystal desired can be selected by applying a ground to either Pin 6, 7, 8, 9, or 10 of P102. When both selections have been made the desired crystal will oscillate.

Oscillator output is sent via C150 or C151 to the base of Q110, the first doubler transistor. Output of the first doubler is applied to the second doubler comprised of Q109 and associated circuitry in a common base configuration. The quadrupled crystal frequency is applied to the base of the mixer transistor via C138, P/J101, and C115.

The oscillator/multiplier is contained within a separate shielded enclosure within the glideslope receiver enclosure.

C. Power Supply—14 VDC switched A + from the ALPHA/360 is applied to Pin 1 of J102. The incoming 14 VDC is applied to the preregulator consisting of R173 and CR123. This preregulator prevents any overvoltage spikes from damaging the 8.5 volt circuitry. CR124 sets the reference voltage of 5.6 volts on the base of Q114 which in conjunction with Q115 in an emitter coupled pair form the controlling element in the 8.5 volt regulator. The regulating level is set on R178 the volta e adjustment pot. Q113 is the regulating element in the 8.5 volt series regulator. R104 is rised to supply a portion of the load current to insure that Q113 operates well within it's dissipation limits. R104 also provides a path for regulator turn-on current. C168 provides additional filtering of the 8.5 VDC regulator output.

#### 4-3. Test Equipment Required

- a. Glideslope Simulator, Tel-Instruments T-12A with T-12-2A Glideslope Head, or equivalent.
- Oscilloscope, Low Frequency, DC coupled preferred, Heathkit IO-14 or equivalent.
- c. UHF Sweep Generator, Capable of sweeping 300 to 360 MHz, Texscan TC-250 or equivalent.
- d. LF Sweep Generator, Capable of sweeping 475 to 575 KHz, Texscan VS-20 or equivalent.
- e. Power Supply, 14.00 VDC @ 3 amps., filtered
- f. Power Meter, Hewlett-Packard Model 430C with Model 477B Bolometer Mount, or equivalent.
- g. VOM or VTVM, any accurate instrument.

#### A. Power Supply Adjustment

- 1. Connect the PHI/20 to the Test and Alignment Setup of Figure 4-4-2 and apply power to the unit.
- 2. Connect VOM or VTVM to the power supply output, TP-1.
- 3. Adjust R178, Voltage Adjust (See Figure 4-4-3), for an ouput voltage of 8.50 VDC.

#### B. Bandpass Filter Alignment

- 1. Connect the PHI/20 to the Test and Alignment Setup of Figure 4-4-2 and apply power to the unit.
- 2. Connect the output of the UHF sweep generator to the input of the bandpass filter, TP-2.
- 3. Connect a high impedance detector (See Figure 4-5-7) to the output of the bandpass filter, TP-3, and to the oscilloscope vertical input. Set Sensitivity Adjustment, R134, to high sensitivity position.
- 4. Adjust the generator to sweep at least 300 MHz to 360 MHz and connect output of glideslope generator or UHF generator to marker input of sweep generator.
- 5. Set markers and adjust C100, C102, and C104 to obtain the bandpass of Figure 4-5-2.

#### C. IF Alignment

- 1. Connect the PHI/20 to the Test and Alignment Setup of Figure 4-4-2.
- Disconnect Oscillator/Multiplier at P/J101.
- 3. Connect the LF sweep generator output to the emitter of Q102 through a 0.1 mfd. capacitor, TP-4.
- 4. Connect vertical input to oscilloscope to the audio output line, P102 pin 11.
- 5. Apply a 525 KHz marker to the marker input on the LF sweep generator. Adjust the sweep generator for a 32 microvolt output, 100 KHz wide and centered on 525 KHz.
- 6. Adjust T100 through T106 to obtain as flat as possible a 42 KHz bandwidth response centered on the 525 KHZ marker. See Figure 4-5-3.

#### D. Oscillator Multiplier Alignment

- 1. Connect power meter to the output of the Oscillator/Multiplier at P101.
- 2. Adjust L105 until all 10 crystals from Y100 through Y109 oscillate when switched on.

This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.

- This manua (Switchduth rough real redy frequencies afternolle the companion provided herein is not quaranteed or varianted. Genave shall not be liable for any loss or damages. Use at your owners: Stephes, its disput. actual ingities 4, and 108.1 through 109.9 MHz.) Copyright © 2007 Genave/NRC, Inc., alstights at 329.3 MHz (108.9 MHz) and 335.0
  - 3. Adjust L107 until all 10 crystals from Y110 through Y119 oscillate when switched on. (Switch through paired frequencies from 110.1 through 111.9 MHz.)
  - 4. Select Y106 (Paired with 109.3 MHz) and adjust L109 and C139 for maximum output as indicated on the power meter.
  - 5. Check all 20 channels for approximately equal output, P102 pin 11.
  - 6. Reconnect P/J101.

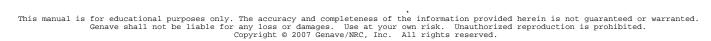
#### E. RF Amplifier and AGC Alignment

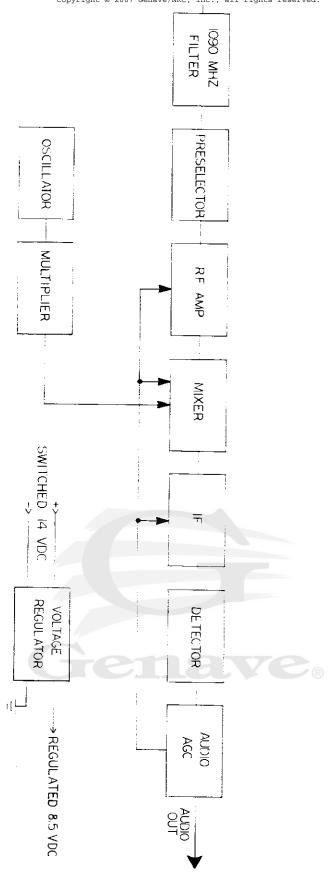
- 1. Connect glideslope simulator to PHI/20 antenna jack and adjust for 332.0 MHz at 200 microvolts.
- 2. Connect oscilloscope vertical input to audio output, P102 pin 11.
- 3. Switch PHI  $^{\prime}20$  to receive 332.0 MHz (109.3 MHz).
- 4. Adjust C111 to peak audio output.
- 5. Readjust glideslope simulator output to 30 microvolts and adjust R134, Sensitivity Adjustment, for audio output of 0.6 to  $0.8~\mathrm{V}$ peak to peak. This audio should be very clean with little noise.
- 6. Increase glideslope simulator output to 50,-000 microvolts and check to insure no output audio distortion. The audio level should not increase more than 3 db.

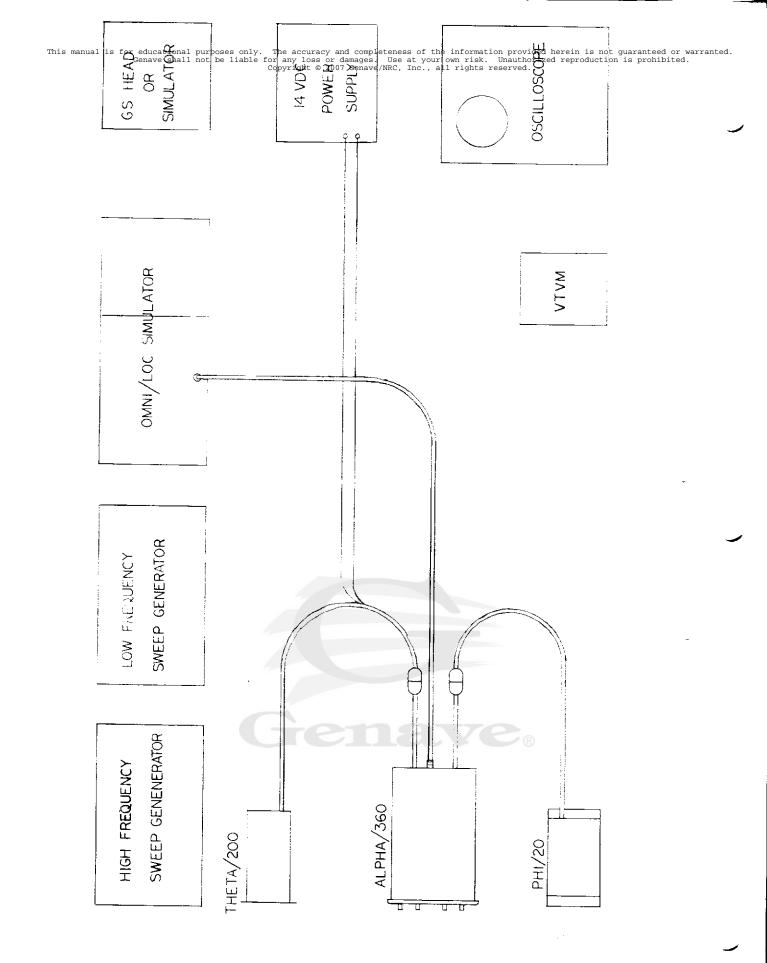
- MHz (110.3 MHz). 8. Switch PHI/20 back to 332.0 MHz (109.3
- MHz) and check adjacent channel rejection with glideslope simulator on 332.3 MHz (111.3 MHz) and 331.7 MHz (111.1 MHz) with 5,000 microvolts of output. No glideslope audio should be seen on the output.
- NOTE: Prior to aircraft installation the PHI/20 should be connected and adjusted in conjunction with the THETA/200. This alignment procedure is given Section 4-4, Part C of the THETA/100-200 Maintenance Manual.

An additional check should be performed with the THETA/200 alignment procedure. This check is as follows:

- 1. Reduce glideslope simulator output to 30 microvolts and set generator modulation to +2 db.
- 2. The meter should deflect at least 60% of the deflection at 700 microvolts (The minimum deflection should be 1 1/5 bars). Any error can be corrected by slightly readjusting R134, the Sensitivity Adjustment in the glideslope receiver.
- 3. Repeat steps 1 & 2 using -2 db modulation.
- 4. If R134 was readjusted the THETA/200 alignment must be repeated.
- 5. Recheck meter centering at 30 microvolts and at 30,000 microvolts. Centering should occur within  $\frac{1}{2}$  db of zero in both cases.



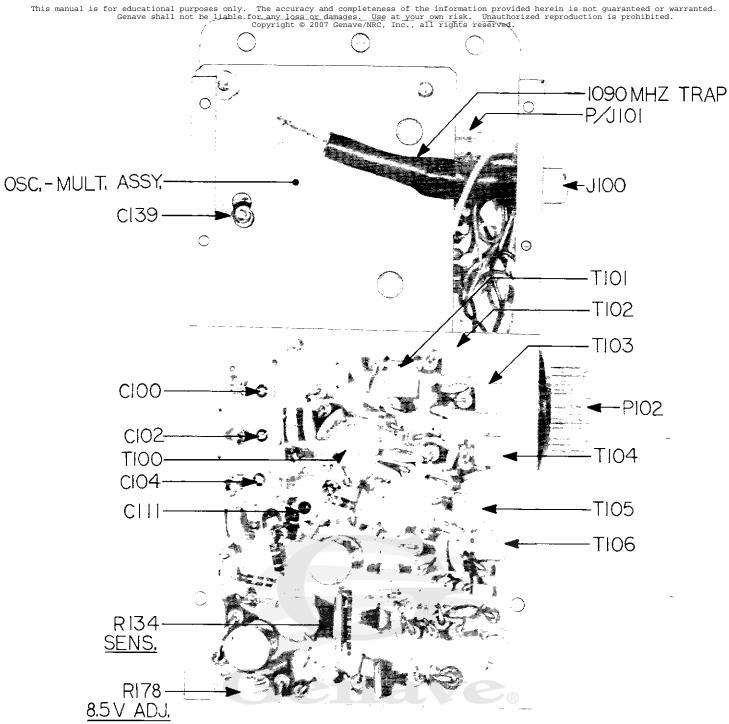


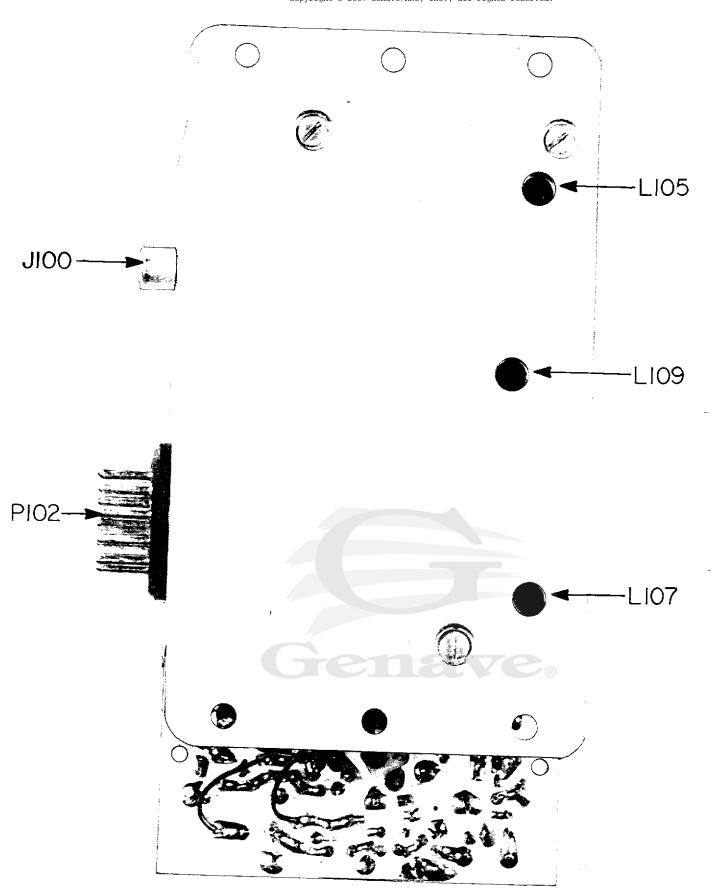


This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Figure 4-4-2 ave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.





This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted. Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Figure 4-4-4

Copyright © 2007 Genave/NRC, Inc. All rights reserved.

#### A. General

It is assumed that the technician performing any troubleshooting or repair work on this unit is familiar with the principles of aviation electronics and the procedures of troubleshooting electronic equipment. It is further assumed that he has a working knowledge of transistorized circuitry and the use of all the normal test equipment found in the field.

The primary aids to troubleshooting the unit are the DC Voltage Measurements given in Figure 4-5-1, the Schematic Diagram of Figure 4-5-9, and the Parts Track Maps of Figures 4-5-11 and 4-5-12.

1. DC Voltage Measurements 4-5-1 DC Voltage Measurements 4-5-3 Swept IF Amplifiers

4-5-4 Audio Output @ 30 uv

4-5-5 Audio Output @ 30,000 uv

4-5-6 Audio Output with Improper Setting of R134

4-5-8 Brief Waveform Explanation

3. Schematic Diagrams

4-5-7 High Impedance Detector

4-5-9 PHI/20 Schematic Diagram

4-5-10 Cable and Switching Diagram

4. Parts/Track Maps

4-5-11 Receiver Board Parts/Track Map

4-5-12 Oscillator, Multiplier Parts, Track Map



All voltages shown in this table must be measured with a VTVM. Input voltage to the unit should be set at 13.75 VDC and the 8.5 VDC regu-

lator should be adjusted for an output of 8.50 VDC. A variation of  $\pm\,20\%$  of the measured voltages from those listed may be considered normal.

Ref. No.	No	Signal Co	ondition	30 Micr Sigr	rovolt G/S rai on 332.	Centering O MHz	Notes
	E	8	c	E	В	С	
Q100	2.1	2.5	1.3	2.1	1.4	0.7	R134 set for 0.6 to 0.8 V <sub>P-P</sub> of audio output
	1.6	0.9	0.8				R134 set at center of range
Q101	1.3	2.1	7.9	0.7	1.4	8.1	R134 set for 0.6 to 0.8 V <sub>P-P</sub> of audio output
	0.8	0.9	8.5				R134 set at center of range
Q102	0.8	1.3	8.5	0.2	0.8	8.5	For all remaining measurements R134 is
Q103	1.6	2.3	8.2	1.0	1.7	8.3	set for 0.6 to 0.8 $V_{\rm p-p}$ of audio output
Q104	1.5	2.2	8.0	0.9	1.6	8.2	or and the of and output
Q105	3.0	3.7	8.1	3.2	3.9	8.0	
Q106	4.3	3.6	0	3.4	2.8	0	
Q107	3.6	4.3	8.5	2.8	3.4	$-\frac{1}{8.5}$	
Q108	2.4	3.0	8.5	1.9	2.4	8.5	
Q109	0	0	8.5				
Q110	3.3	4.0	8.3				
Q111	2.2	3.0	8.0				
Q112	2.2	3.0	8.0				
Q113	12.5	11.8	8.5				
Q114	5.2	5.6	11.8		4/		
Q115	5.2	5.9	8.5		447		



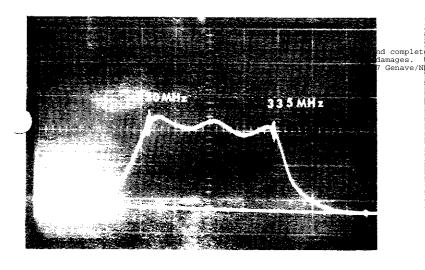


Figure 4-5-2 Swept Bandpass Filter

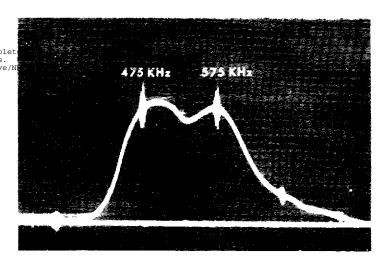


Figure 4-5-3
Swept IF Amplifiers

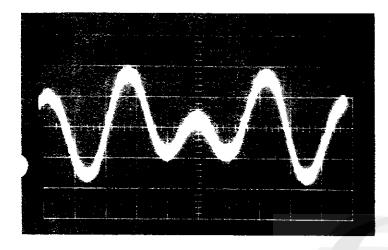


Figure 4-5-4 Audio Output @ 30 uV

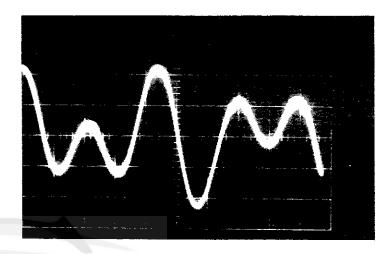


Figure 4-5-5 Audio Output @ 30,000 uV

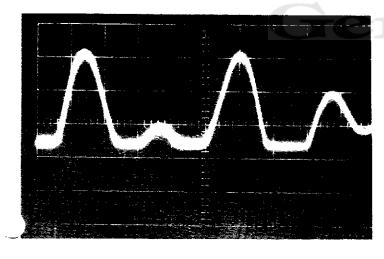


Figure 4-5-6

Thaudio Office Property and completeness of the information provided herein is no paymented or warranted. Setting of R134

Figure 4-5-7

The accuracy and completeness of the information provided herein is no paymented or warranted. Setting of R134

Figure 4-5-7

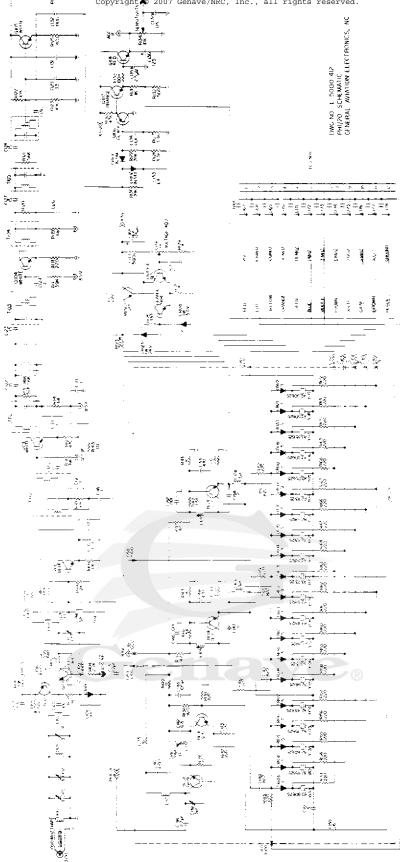
Figure 4-5-7

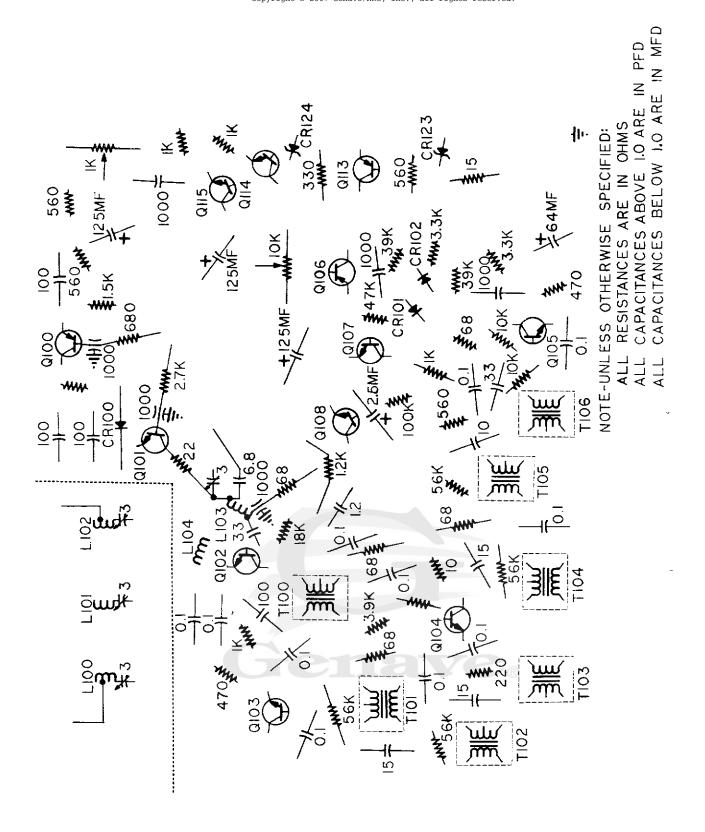
The accuracy and completeness of the information provided herein is no paymented or warranted. Setting of R134

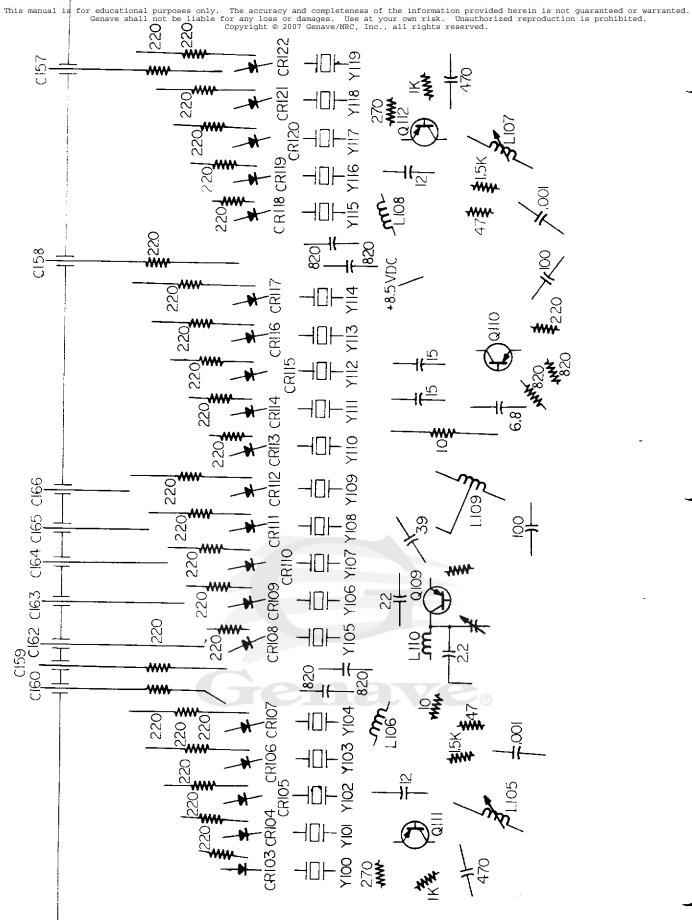
#### WAVEFORM EXPLANATION

- 4-5-2 Swept Bandpass Filter, as seen at the tap on L102. Markers at 330 MHz, 335 MHz, and 340 MHz.
- 4-5-3 Swept IF Amplifier as seen at the emitter of Q105. Markers at 405 KHz and 545 KHz.
- 4-5-4 Audio Output at 30 microvolts. Vertical = .2 microvolts/cm.
- 4-5-5 Audio Output at 30,000 microvolts. Vertical = .2 microvolts/cm.
- 4-5-6 Audio Output with Improper Setting of R134. Vertical == .2 microvolts/cm.









This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Figure: The production of the completeness of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the completeness of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the completeness of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed or warranted.

Copyright: Operational Production of the information provided herein is not guaranteed.

# PARTS LIST

Ref. No.	Genave Part No.	DESCRIPTION	Ref. No.	Genave Part No.	DESCRIPTION
C100 C101 C102 C103 C104 C105 C106 C107 C108 C107 C109 C110 C111	P-20-21 P-20-21 P-20-21 P-20-11 P-20-11 P-20-16 P-20-15 P-20-16 P-20-9 P-20-17 P-20-2	N1500 Disc, 100 pfd. 10% N1500 Disc, 100 pfd. 10% N1500 Disc, 100 pfd. 10% Feedthrough. 1000 pfd Feedthrough. 1000 pfd NPO Disc, 6.8 pfd. 10% Trimmer, 3 pfc Feedthrough. 1000 pfd	CR112 CR113 CR114 CR115 CR116 CR117 CR1118 CR119 CR120 CR121 CR122 CR123	P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46	Silicon, High Frequency Switching. FD 193 Silicon, Jenor, 24 V. 1 W, 10% Silicon, Zenor, 5.6 V, 1 W, 10%
C113 C114	P-20-10 P-20-17 P-20-17	NPO Disc, 33 pfd, 10%  Electrolytic, 0.1 mfd, -20 ±80%, 12 V	CR124	P-20-48	
C116 C117 C118 C119 C120 C121 C122 C122 C123 C124 C125 C126	0.50.17		L100 L101 L102 L103 L104 L105 L106 L107 L108 L109 L110	P-20-31 P-20-32 P-20-31 P-20-34 P-20-38 P-20-35 P-20-39 P-20-36 P-20-36 P-20-33	Bandpass Filter Bandpass Filter Bandpass Filter Bandpass Filter Output RF Amplifier 1 microhenry Oscillator 0.3 microhenry Oscillator 0.3 microhenry Doubler Multiplier Output
C127 C128 C129 C130 C131 C132 C133 C134 C135 C136 C137 C138 C139 C141 C141 C141	P-20-7 P-20-7 P-20-9 P-20-17 P-20-17 P-20-15 P-20-18 P-20-20 P-20-20 P-20-3 P-20-21 P-20-8 P-20-10 P-20-15 P-20-15 P-20-15	NPO Disc, 15 pfd, 10% NPO Disc, 15 pfd, 10% NPO Disc, 33 pfd, 10% Electrolytic, 0.1 mfd, -20 ±80%, 12 V Electrolytic, 0.1 mfd, -20 ±80%, 12 V ZSP Disc, 1000 pfd, 10% Electrolytic, 64 mfd, 15 V ZSP Disc, 1000 pfd, 10% Electrolytic, 125 mfd, 16 V Electrolytic, 125 mfd, 16 V Electrolytic, 125 mfd, 16 V Gimmick, 2.2 pfd, 10% NPO Disc, 28 pfd, 10% NPO Disc, 39 pfd, 10% NPO Disc, 68 pfd, 10%	Q100 Q101 Q102 Q103 Q104 Q105 Q105 Q106 Q107 Q108 Q109 Q111 Q112 Q112 Q113 Q114	P-20-52 P-20-54 P-20-55 P-20-55 P-20-55 P-20-56 P-20-57 P-20-53 P-20-53 P-20-53 P-20-58 P-20-56 P-20-56	TRANSISTORS  Silicon, PNP, Black, 2N5086 Silicon, NPN, with shield, MPS 6568 Silicon, NPN, Blue, MPS 3563 Silicon, NPN, White, MPS 3593 Silicon, NPN, White, MPS 3693 Silicon, NPN, White, MPS 3693 Silicon, PNP, Black, 2N5086 Silicon, NPN, Orange, MPS 6514 S Silicon, NPN, Blue, MPS 3563 Silicon, NPN, Orange, MPS 6514 S Silicon, NPN, Orange, MPS 6514 S
C144 C145 C146	P-20-11 P-20-15 P-20-12	N1500 Disc, 100 pfd, 10% ZSP Disc, 1000 pfd, 10% ZSF Disc, 470 pfd, 10%			RESISTORS
C147 C148 C159 C150 C151 C152 C153 C154 C155 C156 C157 C158 C159 C160 C161 C162 C162 C163 C165 C167 C171 C172 C173 C174 C175 C176 C177 C177 C178 C178 C177 C178 C178 C179 C179 C179 C179 C179 C179 C179 C179	P-20-14 P-20-14 P-20-17 P-20-7 P-20-15 P-20-16	N1500 Disc. 100 pfd. 10% N1500 Disc. 100 pfd. 10% Z5P Disc. 1000 pfd. 10% Z5P Disc. 470 pfd. 10% NPO Disc. 12 pfd. 10% Z5F Disc. 820 pfd. 10% Z5F Disc. 820 pfd. 10% NPO Disc. 15 pfd. 10% S5P Disc. 470 pfd. 10% Z5P Disc. 920 pfd. 10% Z5P Disc. 920 pfd. 10% Z5F Disc. 820 pfd. 10% Z5F Disc. 820 pfd. 10% Z5F Disc. 820 pfd. 10% Eedthrough. 1000 pfd Feedthrough. 1000 pfd	R100 R101 R102 R103 R104 R105 R106 R107 R1109 R1111 R1113 R114 R115 R116 R117 R118 R1120 R121 R123 R124 R125 R126 R127 R128 R127 R130 R131 R132 R133 R133 R134 R135	P-20-64 P-20-83 P-20-83 P-20-88 P-20-70 P-20-85 P-20-76 P-20-68 P-20-70 P-20-90 P-20-90 P-20-90 P-20-90 P-20-90 P-20-85 P-20-73 P-20-77 P-20-86 P-20-86 P-20-87 P-20-87 P-20-89 P-20-89 P-20-84 P-20-84 P-20-87 P-20-89 P-20-89 P-20-80	560 ohms, 10%, ½ W 1.5K, 10%, ½ W 680 ohms, 10%, ½ W 82 ohms, 10%, ½ W 82 ohms, 10%, ½ W 2.7K, 10%, ¼ W 68 ohms, 10%, ¼ W 68 ohms, 10%, ¼ W 1.8K, 10%, ½ W 1.2K, 10%, ½ W 1.2K, 10%, ½ W 1.2K, 10%, ½ W 1.6 ohms, 10%, ½ W 3.9K, 10%, ½ W 470 ohms, 10%, ½ W 56K, 10%, ½ W 56K, 10%, ½ W 56K, 10%, ½ W 220 ohms, 10%, ½ W 56K, 10%, ½ W 220 ohms, 10%, ½ W 56K, 10%, ½ W 3.9K, 10%, ½ W 3.9K, 10%, ½ W 470 ohms, 10%, ½ W 470 ohms, 10%, ½ W 3.3K, 10%, ½ W 3.3K, 10%, ½ W 3.3K, 10%, ½ W 4.70 ohms, 10%, ½ W 3.3K, 10%, ½ W 4.7K, 10%, ½ W 1.5K, 10%, ½ W
CR100 CR101 CR102 CR103 CR104 CR105 CR106 CR107	P-20-46 P-20-47 P-20-47 P-20-46 P-20-46 P-20-46 P-20-46 P-20-46	Silicon, High Frequency Switching, FD 193 Germanium, General Purpose, IN34A Germanium, General Purpose, IN34A Silicon, High Frequency Switching, FD 193 Silicon, High Frequency Switching, FD 193	7,130		150 onms, 10%, ½ W 220 ohms, 10%, ½ W 820 ohms, 10%, ½ W 820 ohms, 10%, ½ W 10 ohms, 10%, ½ W 47 ohms, 10%, ½ W 1.5K, 10%, ½ W 270 ohms, 10%, ½ W 220 ohms, 10%, ½ W 220 ohms, 10%, ½ W

This was shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.

Ref. No.	Genave Part No.	DESCRIPTION	Ref. No.	Genave Part No.	DESCRIPTION
R146	P-20-65	220 ohms, 10%, ¼ W	T102	P-20- 42	525 KHz, 1F
R147 R148	P-20-69 P-20-82	47 ohms, 10%, ½ W	T103	P-20- 42	525 KHz. 1F
R149	P-20-80	1.5K, 10%, ½ W 1K, 10%, ½ W	T104	P-20- 42	525 KHz, 1F 525 KHz, 1F
R150	P-20-74	270 ohms, 10%, ½ W	T185	P-20- 42	525 KHz, 1F
R151	P-20-65	220 ohms, 10%, 1/4 W	T106	P-20- 42	525 KHz, 1F
R152	P-20-65	220 ohms, 10%, 1/4 W			ABVATALA
R153	P-20-65	220 ohms, 10%, 1/4 W			CRYSTALS
R154	P-20-65	220 ohms, 10%, ¼ W	Y100	P-20- 99	93 90625 MH+ ± 0060/
R155	P-20-65	220 ohms, 10%, ¼ W	Y101	P-20-100	83.80625 MHz, ± .005% 83.65625 MHz, ± .005%
R156	P-20-65	220 ohms, 10%, ¼ W	Ŷ182	P-20-101	82.60625 MHz. = 005%
R157	P-20-65	200 ohms, 10%, 1/4 W	Y103	P-20-102	82.60625 MHz, ± .005% 82.75625 MHz, ± .005%
R158	P-20-65	220 ohms, 10%, ¼ W 220 ohms, 10%, ¼ W	Y104	P-20-103	82.45626 MHz, = .005% 82.98125 MHz, = .005% 83.13125 MHz, + .005% 83.28125 MHz, + .005%
R159 R160	P-20-65 P-20-65	zzu onms, 10%, ¼ W	Y105	P-20-104	82.98125 MHz, = .005%
R161	P-20-65 P-20-65	220 ohms, 10%, ¼ W	Y106	P-20-105	83.13125 MHz, ± .005%
R162	P-20-65	220 ohms, 10%, 1/4 W	Y107	P-20-106	83.28125 MHz, ± .005%
R163	P-20-65	220 ohms, 10%, ¼ W 220 ohms, 10%, ¼ W	Y108	P-20-107	83.43125 MHz, ± .005% 83.58125 MHz, ± .005% 83.73125 MHz, ± .005% 83.88125 MHz, ± .005% 82.53125 MHz, ± .005% 82.68125 MHz, ± .005%
R164	P-20-65	220 ohms 10% 1/4 W	Y109 Y110	P-20-108 P-20-109	83.58125 MHz, ± .005%
R165	P-20-65	220 ohms, 10%, 1/4 W 220 ohms, 10%, 1/4 W	Y111	P-20-109 P-20-110	83./3125 MHZ, ± .005%
R186	P-20-65	220 ohms, 10%, ¼ W	Y112	P-20-111	03.00123 MHz, = .005%
R167	P-20-65	220 ohms, 10%, 1/4 W	Y113	P-20-111	82.68125 MHz = .005%
R168	P-20-65	220 ohms, 10%, ¼ W	Ý114	P-20-113	
R169	P-20-65	220 ohms, 10%, ¼ W	Y115	P-20-114	83.05625 MHz. + 005%
R179 R171	P-20-65	220 ohms, 10%, ¼ W	Y116	P-20-115	83.20625 MHz. + .005%
R171 R172	P-20-65	220 ohms, 10%, ¼ W	Y117	P-20-116	83.35625 MHz. + .005%
R173	P-20-65 P-20-93	520 ohms, 10%, 1/4 W	Y118	P-20-117	83.50625 MHz, ± .005%
R174	P-20-93 P-20-77	11 ohms, 10%, 1 W	Y119	P-20-118	83.05625 MHz, ± .005% 83.20625 MHz, ± .005% 83.35625 MHz, ± .005% 83.50625 MHz, ± .005% 82.90625 MHz, ± .005%
R175	P-20-75	560 ohms, 10%, ½ W 330 ohms, 10%, ½ W			
R176	P-20-80	1K, 10%, ½ W			MISCELLANEOUS
R177	P-20-77	560 ohms, 10%, ½ W			
R178	P-20-95	Variable, 1K, 20%	J101	P-20-121	Connector, Phono Jack
R179	P-20-80	1K, 10%, 1/2 W	J100	P-20-122	Connector, Phono Jack
		, , :=	P101 P102	P-20-122	Connector, Phono Plug
		TRANSFORMERS	F102	P-20-123 P-20-124	Connector, 16-pin Male
T100	P-20-42	525 KHz, 1F		P-20-124 P-20-125	Connector, 16-pin Female
T101	P-20- 42	525 KHz, 1F		P-20-168	Cover, Connector, 16-pin, Female Input Filter Assembly



This manual is for educational purposes only. The accuracy and completeness of the information provided herein is not guaranteed or warranted.

Genave shall not be liable for any loss or damages. Use at your own risk. Unauthorized reproduction is prohibited.

Copyright © 2007 Genave/NRC, Inc. All rights reserved.

Section V Page 2

PHI/20



SB# 7104

September 17, 1971

4141 KINGMAN DRIVE INDIANAPOLIS, IND. 46226 AREA 317 • 546-1113 Subject: PHI/20 alignment using sweep generators equipped with a manual sweep control.

The PHI/20 IF must be aligned using swept techniques in order to assure the required 42 KHz bandwidth. This bandwidth is required due to the frequency tolerance of glideslope ground stations.

Calibration marking of the IF sweep can be accomplished in one of three ways:

- 1. Injection of internal sweep markers.
- 2. Injection of external sweep markers (utilizing a known accurate low frequency RF generator).
- 3. Sweep calibration utilizing a sweep generator equipped with a manual sweep control.

This third method is the method which we shall discuss.

#### PHI/20 IF Alignment

- 1. Connect the PHI/20 to the Test and Alignment Setup of figure 4-4-2.
- 2. Disconnect Oscillator/Multiplier at P/J101.
- 3. Connect LF sweep generator output to the emitter of Q102 through a 0.1 mfd. capacitor, TP-4.
- 4. Connect vertical input to oscilloscope to the audio output line, P102, pin 11.
- 5. Set sweep selector to the manual sweep position and sweep width to full wide.
- 6. Connect a frequency counter between PHI/20 and sweep generator.
- 7. Adjust the manual sweep control to center the dot on the scope face.
- 8. Adjust frequency of sweep generator to read 525 KHz on counter.

- 9. Adjust manual sweep control to position dot 5 divisions to left on scope face.
- 10. Adjust sweep width control to read 475 KHz on counter.
- 11. Adjust manual sweep control to position dot 5 divisions to right on scope face.
- 12. Frequency counter should read 575 KHz. Adjust sweep width so that counter reads 575 KHz. Repeat steps 7 through 12 several times until no readjustment is necessary. The sweep will now be calibrated at 10 KHz per division with center frequency of 525 KHz.
- 13. Adjust T100 through T106 to obtain as flat as possible a 42 KHz response centered on 525 KHz. See Figure 4-5-3.

