GNC 250/300
MAINTENANCE AND REPAIR MANUAL

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TABLE OF CONTENTS

SECTION 1
INTRODUCTION

SECTION 2
TROUBLESHOOTING

SECTION 3
DISASSEMBLY INSTRUCTIONS

SECTION 4
SERVICE AND TESTING

SECTION 5
ILLUSTRATED PARTS LIST

LIST OF FIGURES

SECTION 1
INTRODUCTION

This manual is intended to provide instructions and guidelines for the maintenance and repair of the GARMIN GNC 250 and GNC 300.

WARNING: This unit contains static sensitive devices. Service personnel must insure that proper precautions are taken to prevent damage to this equipment from Electro-Static Discharge (ESD). Disassembly and repair should only be accomplished at an approved ESD workstations by properly trained and grounded personnel.

1.1 GENERAL DESCRIPTION

The GNC 250/300 is a full-featured aviation GPS navigation and communication instrument designed for a fixed panel mounted installation. The GNC 250/300 utilizes the patented GARMIN MultiTrac™ system for tracking up to eight satellites simultaneously. The unit features a GPS receiver; a 4-line, 20 character, high-brightness vacuum fluorescent display; and a front loading NavData® card. The unit contains a fully TSO'd 760 channel VHF communications transceiver operating from 118.000 to 136.975 Mhz with 5 watt minimum transmitter output power.

The unit is constructed from high quality materials and uses the latest techniques in manufacturing technology. In order to achieve the desired reliability, size and power requirements, surface mount components are used extensively. Specialized equipment and procedures are required to repair circuit boards having surface-mounted components. GARMIN does not authorize the repair of GNC 250/300 circuit boards. All circuit boards and assemblies for the GNC 250/300 can be economically replaced through the GARMIN board exchange program, if necessary.

A remote mounted battery pack with built-in charger is available for the GNC 250/300 as well as a 28v to 14v converter assembly. The following modules and printed circuit board assemblies are available for field replacement:

Display Board Assembly:
Contains the vacuum fluorescent display and display circuit board.

Rotary Switch Assembly:
Contains dual concentric switch and an attached flexible circuit.

Control/Display Unit:
Contains bezel, buttons, lens, keypad board, light pipes, plus the Display Board Assembly and Rotary Switch Assembly.

CPU Board:
Printed circuit board which contains the microprocessor, LSI and power supply circuitry.

Interface Board:
Printed circuit board which connects the CPU board to the NavData® card.

Communications Transceiver Module:
Contains VHF Receiver printed circuit board, transmitter casing and altitude decoder circuits.

GPS Receiver Assembly:
Module which contains the GPS receiver and high precision crystal oscillator.

Remote Battery Pack:
Module containing rechargeable cells, fuse and charging circuits.

28V to 14VDC Converter:
Contains circuitry for converting 28V power bus to 14V in 28V aircraft.

1.2 DETAILED DESCRIPTION

Internally, the GNC 250/300 is divided into seven printed circuit boards; the CPU, GPS Receiver, Comm Receiver, Comm Transmitter, Interface, Display, and Keypad Circuit boards. The block diagram in Figure 1 shows the relationships between major circuits and modules within the GNC 250/300.

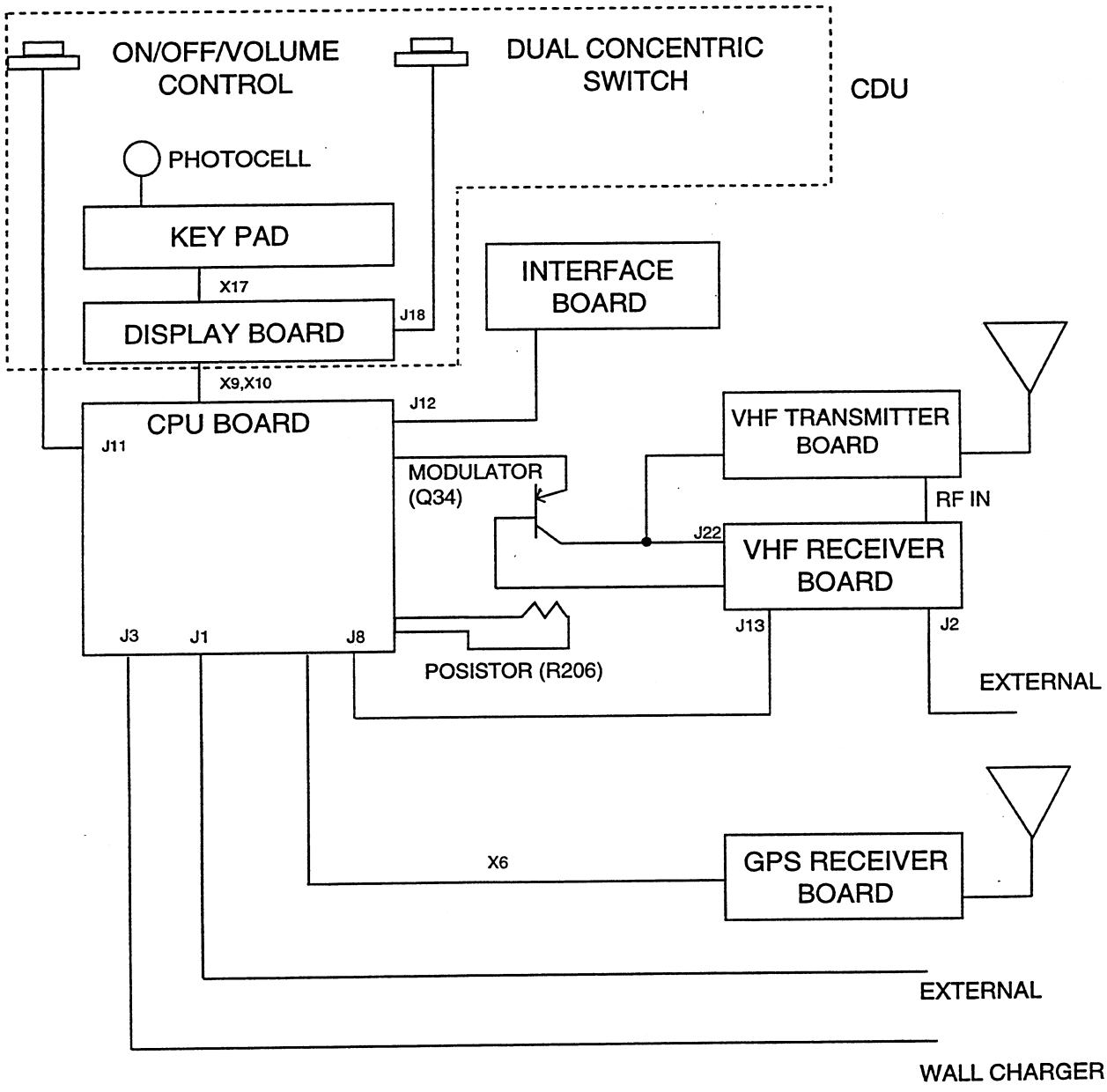


Figure 1. GNC 250/300 Block Diagram

1.2.1 Control/Display Unit (CDU)

The Control/Display Unit is an assembly consisting of eleven keycaps, keypad board, optical lens, vacuum fluorescent display (VFD) and board with drivers, photocell and screws, housed in a die cast bezel with a dual concentric rotary switch and two knobs. The VFD is a 4 row by 20 column unit with variable intensity. This display provides excellent day and night visibility from wide viewing angles. The front panel provides function selection and alphanumeric input to the CPU board Assembly via 11 push-buttons and the dual concentric rotary switch. There are two LEDs behind each keycap, providing backlighting for night time use.

The block diagram in Figure 2 shows the interaction between components on the Control/Display Unit.

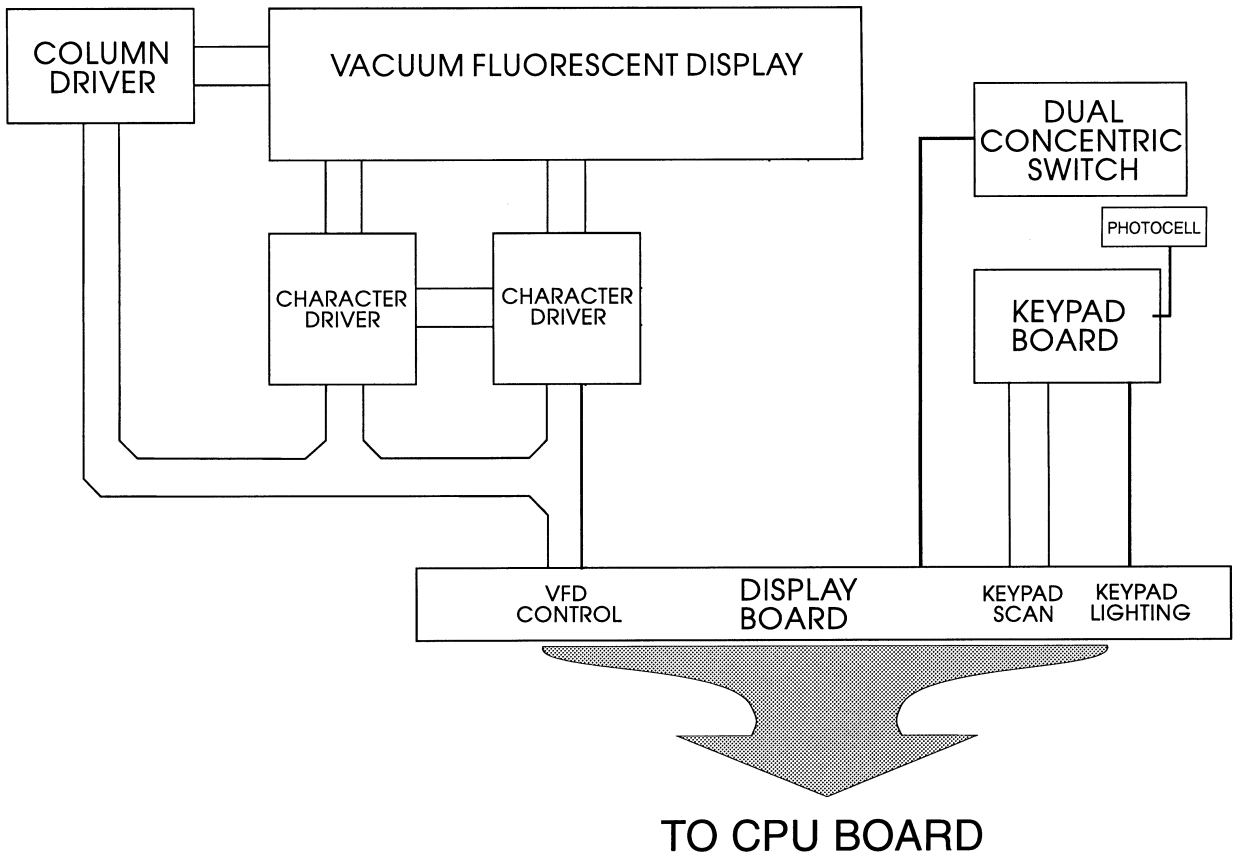


Figure 2. Control/Display Unit Block Diagram

The block diagram in Figure 3 below shows the interaction between the various CPU board circuits.

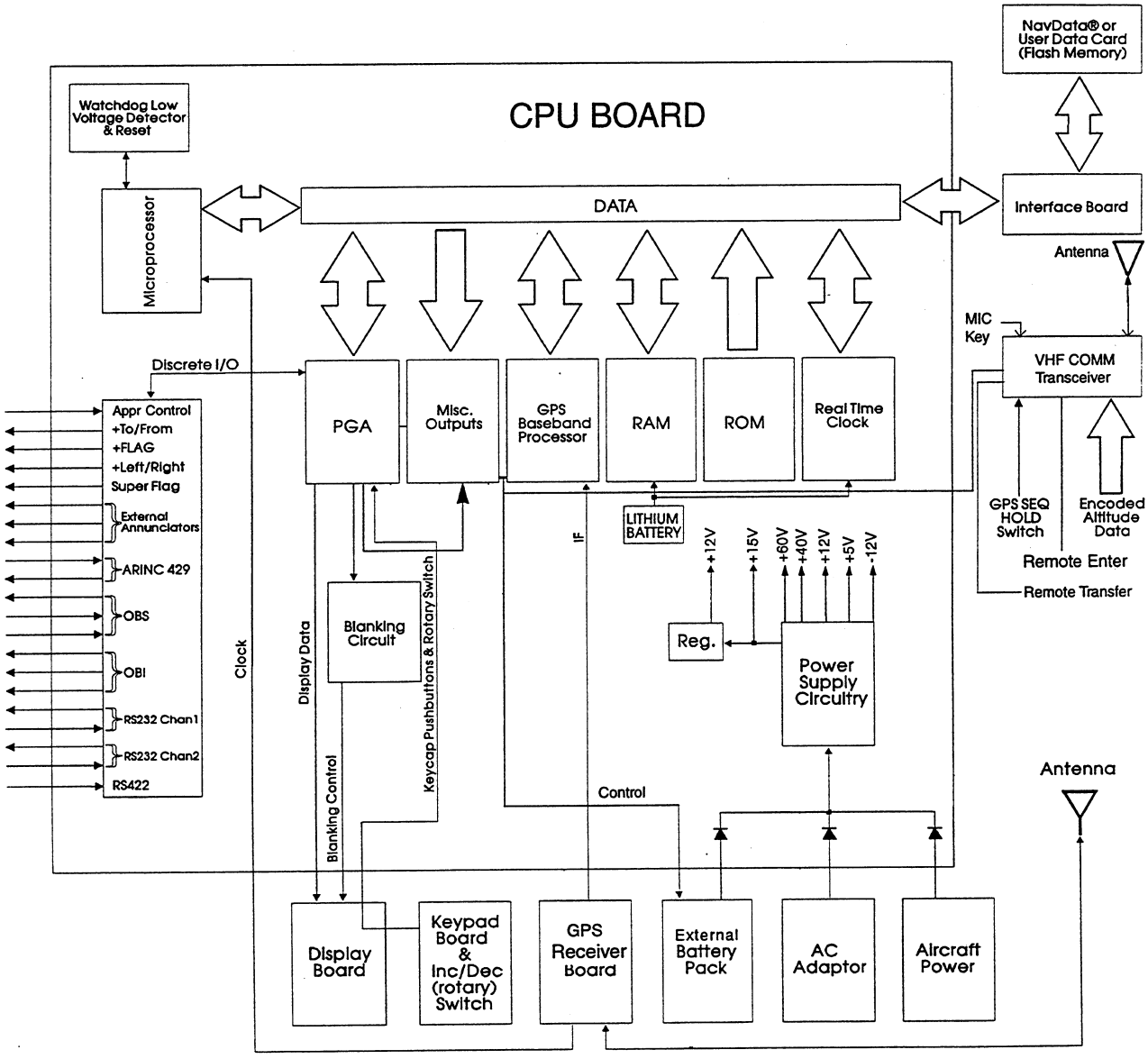


Figure 3. CPU Board Block Diagram

1.2.2 CPU Board Assembly

The CPU Board Assembly contains the CPU, operating system ROM, system memory, discrete I/O, serial communication drivers/receivers and the power supply. These items are discussed in further detail below.

1.2.2.1 Central Processing Unit (CPU)

The CPU board is a microprocessor-based computer board. This board contains an Intel 80L186EB microprocessor running at 16 MHz, a reprogrammable memory chip and random access memory chips (RAM). Data stored in RAM is maintained by a 3 volt lithium battery when the unit is switched off, and by the regulated 5 volt supply when the unit is powered on. A custom LSI is used to decode the signals from the GPS satellites. A real time clock IC is used to keep track of the date and time. Other circuits on the board are used for input/output functions such as controlling the display, reading the keypad, and controlling the receiver. Discrete input/output lines are provided for CDI course deviation, CDI to/from flag, CDI VAN flag, Super Flag, external annunciators, OBS course (GNC 300 only) and to activate the Approach mode (GNC 300 only). Serial communication lines for OBI (clock/data/sync), ARINC 429, RS-422 (GNC 300 only) and RS-232 (two channels) are also included.

1.2.2.2 Power Supply Circuits

The power supply section of the CPU board outputs +60 and +40 volts for the display drivers, ± 12 volts, +15 volts and +5 volts (VCC). In addition, the CPU board contains comparator circuits for detecting low Ni-Cad battery level, low memory battery voltage, and external power.

The external power input is through the rear connector (J1) and from the AC adapter through a DC power jack located near the rear connector. External battery pack power is also applied to the rear connector (J1). All of these sources are diode isolated to prevent parallel sourcing. The unit is turned on and off by a digital latch circuit operated by a knob located on the front panel adjacent to the NavData® card opening. The switching circuit is a fly-back design. The switching regulator operates at a frequency of approximately 129 kHz and uses a high efficiency switching regulator for the switching device. The high efficiency switching regulator drives a transformer that is configured in a fly-back mode. The +15 volt output is post-regulated to provide 11.75 to 12.25 volts. The +5 volt output is regulated at 4.8 to 5.2 volts. All other voltages are +/-20%.

1.2.3 GPS Receiver

The RF/IF assembly consists of a dual conversion receiver, a frequency synthesizer, and a high precision crystal oscillator. The receiver consists of a ceramic RF filter, RF and IF amplifiers, mixers, and an IF filter. The frequency synthesizer uses the high precision oscillator as a reference frequency for the phase detector in the synthesizer. The resultant frequency is used in the mixer section to produce the first IF. After further amplification and mixing with a product of the crystal oscillator, the baseband IF is passed to the CPU Board for processing.

The crystal output is also used for the system clock pulse. The RF/IF assembly is contained within a shielding fence/cover and connection to the antenna is made via a BNC connector. The RF/IF supplies +5 volts to the antenna's preamplifier through this BNC connector.

The block diagram in Figure 4 shows the interaction between components on the RF/IF Assembly.

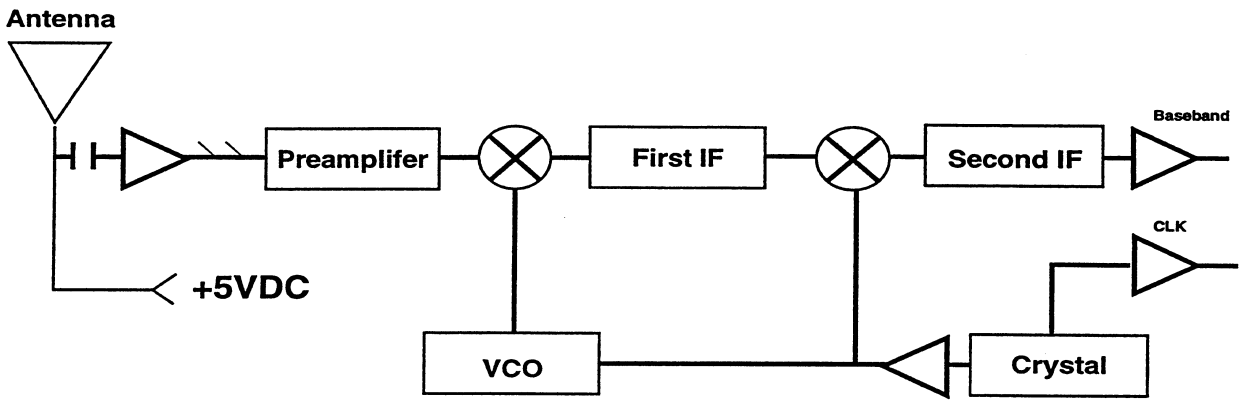


Figure 4. GPS Receiver Block Diagram

1.2.4 Interface Board and Data Cards

The Interface Board provides two-way data transfer capability between the CPU board and a data card NavData® cards allow for data transfer to the CPU board only. User data cards, with 128 kilobytes of flash memory data storage, may be used to save user data/settings from the GNC 250/300 or restore that information to the GNC 250/300. Address and data lines from the CPU board route through the Interface Board's output buffers to the data card. A plastic race secures the Interface Board at the front of the unit and serves to guide the data card onto the 40-pin connector.

NOTE: When servicing the GNC 250/300, user-defined waypoints, routes, settings, etc., may be saved on a user data card (010-10032-03) first. In the event these data are lost, they may then be restored from the user data card before the unit is returned to serve. Refer to Appendix A of the GNC 250/300 Pilot's Guide for additional information on user data card operation.

1.2.5 VHF Communications Transceiver

The VHF communications transceiver consists of the comm receiver board assembly and the transmitter board and casting assembly. The VHF receiver is a single conversion super-heterodyne AM receiver operating from 118.000 to 136.975 MHz with 25 kHz channel spacing for a combined total of 760 channels. Received signals are routed from the antenna via the antenna switch to the RF pre-selector where they are filtered and amplified. The received signal is down-converted to a 21.4 MHz IF via the mixer.

The mixer local oscillator signal (LO) is generated by the synthesizer which uses a crystal reference oscillator to generate the LO frequency for each channel as well as the transmitter drive signal. After down-conversion, the signal is filtered by a narrowband crystal IF filter, amplified by IF AGC amplifiers, and the AM is detected by an envelope detector. The demodulated audio is filtered, amplified and is held at a constant level by the receiver compressor circuits. The audio is routed through a digital volume control IC and is transformed coupled out of the unit via connector J2. The serial data which tunes the synthesizer as well as controls the digital volume chip is generated by the CPU board.

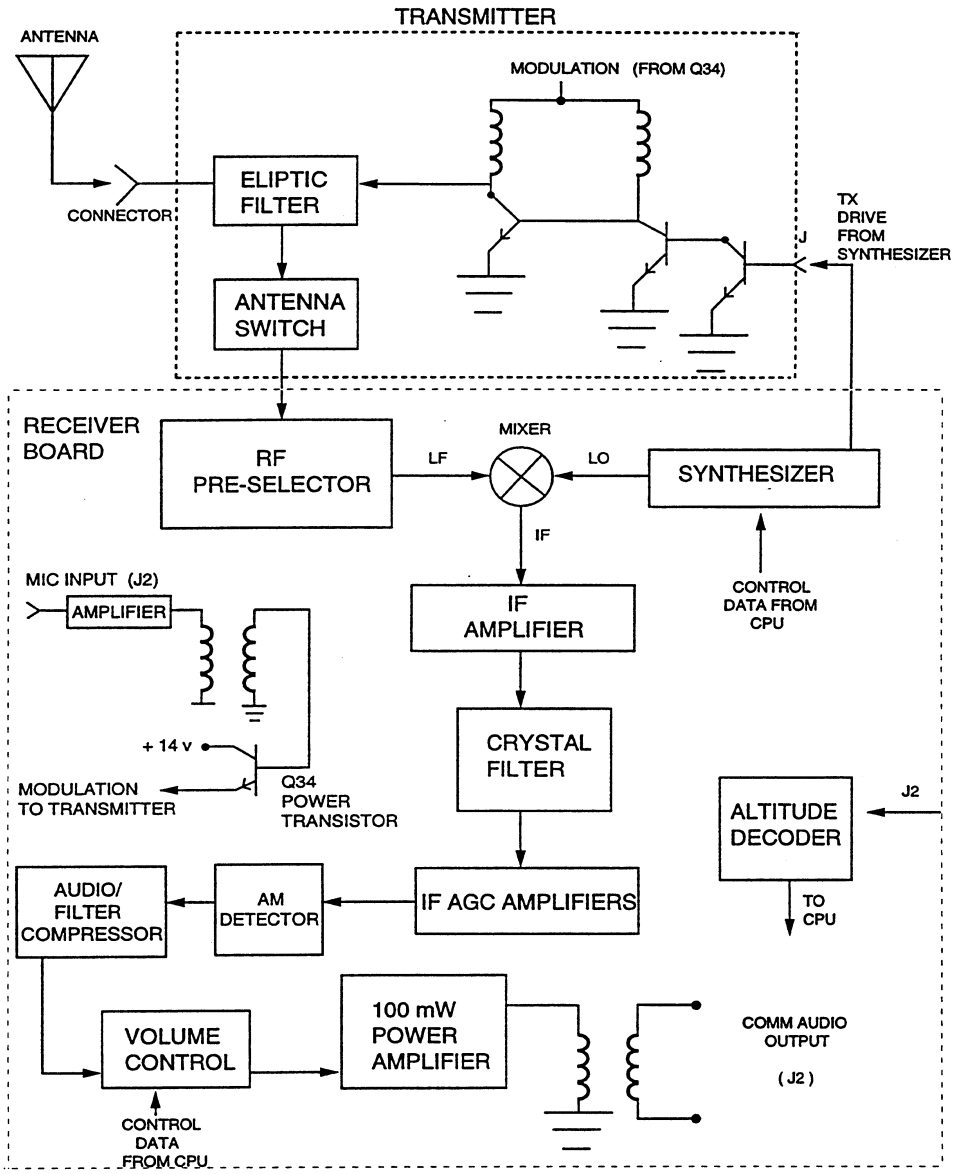


Figure 5. Communication Transceiver Block Diagram

The VHF transmitter is a 3 stage RF power amplifier capable of delivering 5 watts minimum of CW power to the antenna connector. The input to the transmitter is supplied by the receiver synthesizer and is amplified from a level of 100 mW to the final output of 5 watts. The receiver board AM modulates the transmitter using microphone input via the J2 connector to collector modulate the final two stages of the transmitter through power transistor Q34.

The microphone circuits contain a compressor which limits the AM modulation depth over a 20 dB microphone input range. In addition to the communications functions, the receiver board contains the Gillham/Greycode altitude decoder circuitry. Encoded pressure and altitude data from a parallel altimeter device is received as a 10 bit data word at the 26 pin J2 connector. The data is decoded and output to the CPU via connector J13.

SECTION 2
TROUBLESHOOTING

2.1 TROUBLESHOOTING EQUIPMENT REQUIRED

- 0-30 Volt DC / 6-Amp Power Supply
- Digital Multimeter
- 20 MHz Oscilloscope
- Adjust Power Supply to 14 Volts

2.2 SELF-TEST FAILURES

The GNC 250/300 monitors many of its internal functions and displays a message to alert the user should a failure occur. The table below shows the recommended repair for each self-test failure message.

MESSAGE	RECOMMENDED REPAIR*
Altitude input fail	Verify connections to altitude serializer/encoder Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly Replace CPU Board
Course input fail (300 only)	Check ARINC 429/RS422 course input connections Replace CPU Board
Data card failed	Replace NavData® card Replace Interface Board (see Section 3.2.3)
Data card write fail	Replace user data card Replace Interface Board (see Section 3.2.3)
Fuel/Air input fail	Check connections to fuel/air data system Replace CPU Board (see Section 3.2.4)
Memory battery low	Replace memory battery (see Section 4.1)
No altitude input (300 only)	Verify connections to altitude serializer/encoder Verify connections between CPU Board and Comm Receiver Board Replace Com/Chassis sub-assembly (see Section 3.2.2) Replace CPU Board (see Section 3.2.4)
Osc needs adjustment	Replace GPS Receiver Board (see Section 3.2.5) Replace CPU Board (see Section 3.2.4)
RAM failed	Replace CPU Board (see Section 3.2.4)
Receiver failed	Replace CPU Board (see Section 3.2.4) Replace GPS Receiver Board (see Section 3.2.5)
Stored data lost	Replace memory battery (see Section 4.1)
Configuration reset	Replace CPU Board (see Section 3.2.4)
EEPROM write fail	Replace CPU Board (see Section 3.2.4)

MESSAGE (cont.)	RECOMMENDED REPAIR* (cont.)
Battery low (optional battery)	IF battery/Charger pack not installed change Configuration to: Remote Battery : None If battery is installed verify that the charge is set up for "auto" and allow to charge for 1 hr. Verify Connections to remote battery/Charger pack. Replace Remote battery pack.
PWR down and re-init	Turn unit off and then back on again. Verify connection between CPU Board and BPS receiver board. Replace GPS receiver (see Section 3.2.5) Replace CPU board (see Section 3.2.4)
No course input (300 only)	Verify connection to OBS Replace CPU board (see Section 3.2.4)
COM failed	Verify connection between CPU Board and Comm Receiver Board Replaced comm chassis sub-assembly (see Section 3.2.2) Replace CPU Board (see Section 3.2.4)
Stuck mic/TX disabled	Verify that mic key input to unit is not grounded Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly (see Section 3.2.2) Replace CPU board (see Section 3.2.4)
Remote ENT key stuck	Verify that remote enter input to unit is not grounded Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly (see Section 3.2.2) Replace CPU Board. (see Section 3.2.4)
Remote XFR key stuck	Verify that remote transfer input to unit is not grounded Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly (see Section 3.2.2) Replace CPU Board (see Section 3.2.4)
Rcvr needs service	Verify connection between CPU Board and GPS receiver board. Replace GPS receiver board (see Section 3.2.5) Replace CPU Board (see Section 3.2.4)
Battery rqrs service (optional battery)	If battery/charger pack not installed, change configuration to remote battery: none Verify connections to remote battery/charger pack Replace remote battery pack

* Where multiple repair actions are listed, they are listed with most likely failure cause first.

2.3 INITIAL TROUBLESHOOTING OPERATIONS

The first step in troubleshooting the GNC 250/300 is to remove the top and bottom covers (see Section 3.1) and the CPU bottom shield, and swing the comm assembly open. Verify that the unit is being properly powered and the internal clock is functional.

NOTE: The NavData® card should be removed before disassembling the unit.

2.3.1 Power Supply Check

1. Check the DC voltage between D511 and ground as shown in Figure 6. The voltage should be between -9.60 and -14.40 volts. If the voltage is out of the limits specified, replace the CPU board.

2. Check the DC voltage between L502 and ground as shown in Figure 6. The voltage should be between 4.8 and 5.2 volts. If the voltage is out of the limits specified, replace the CPU board.

3. Check the DC voltage between Q515 and ground as shown in Figure 7. The voltage should be between 17.00 and 67.00 volts. If the voltage is out of the limits specified, replace the CPU board.

4. Check the DC voltage between L504 and ground as shown in Figure 6. The voltage should be between 9.6 and 14.4 volts. If the voltage is out of the limits specified, replace the CPU board.

5. Check the DC voltage between Q511 and ground as shown in Figure 7. The voltage should be between 25 and 45 volts. If the voltage is out of the limits specified, replace the CPU board.

6. Check the DC voltage between D508 and ground as shown in Figure 6. The voltage should read between 12 and 18 volts. If the voltage is out of the limits specified, replace the CPU board.

2.3.2 Internal Clock Check

Check the clock speed by placing an oscilloscope probe at I101 pin 31 as shown in Figure 7. The frequency should be approximately 16.4 MHz. If the clock is not operational, replace the GPS receiver. If the clock still fails to function, replace the CPU board.

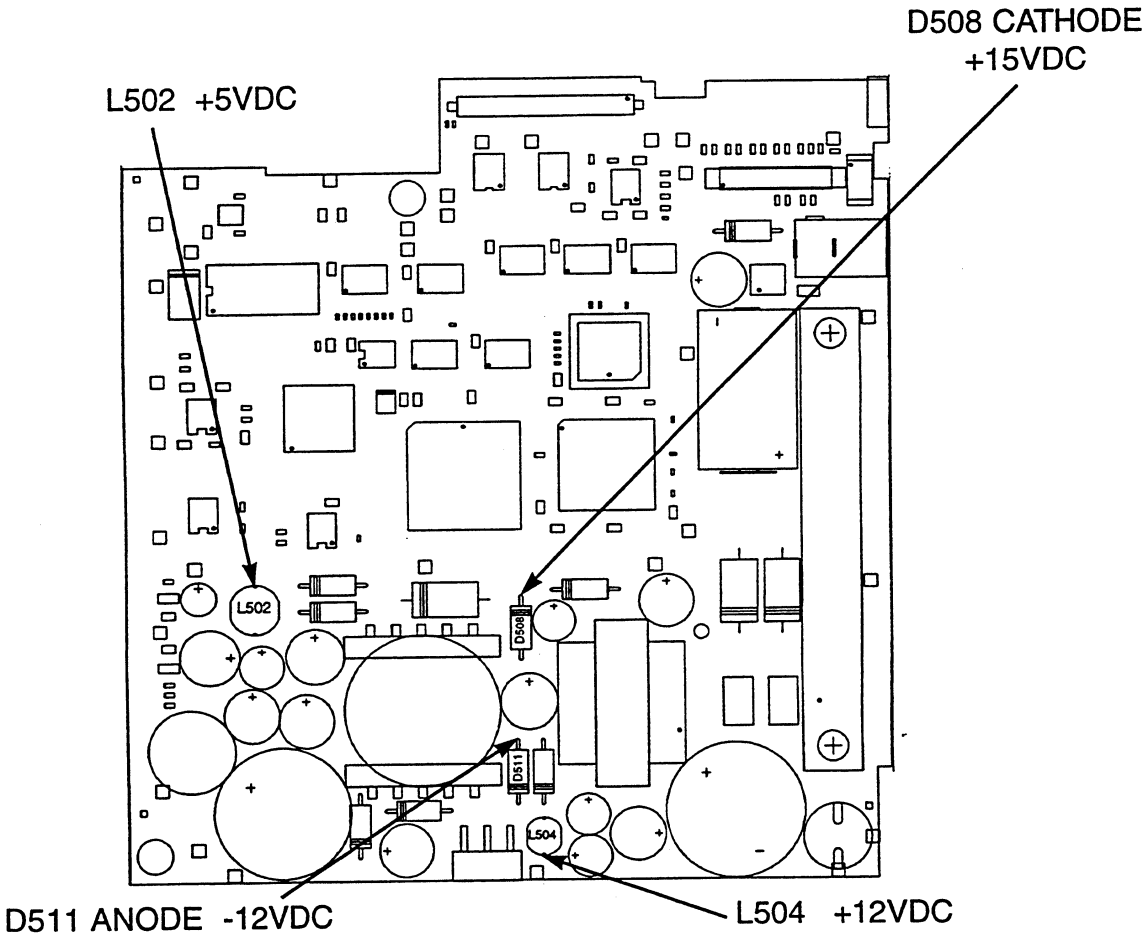


Figure 6. CPU Board Testpoints (Top View)

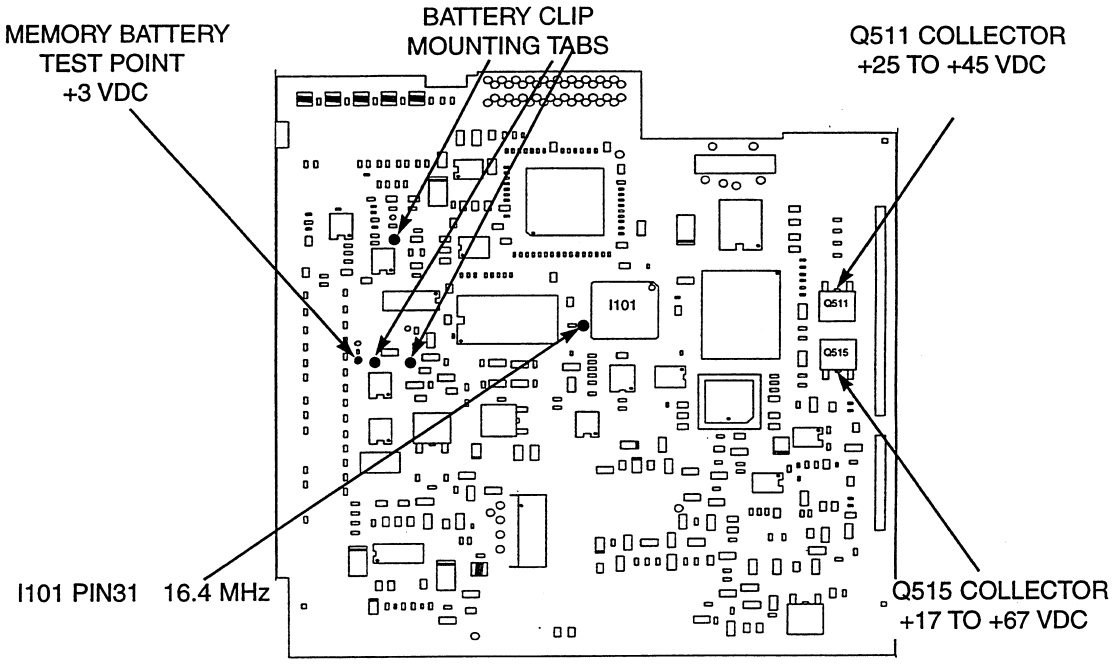


Figure 7. CPU Board Testpoints (Bottom View)

2.4 TROUBLESHOOTING CHART

MESSAGE	RECOMMENDED REPAIR
Unit will not power on	Check External Power Connection Check Remote External Battery Pack (if equipped) Check Pwr/Volume Switch Connection Replace Pwr/Volume Switch (see Section 3.2.7) Replace CPU Board (see Section 3.2.4)
Unit will not power off	Replace CPU Board (see Section 3.2.4) Replace Pwr/Volume Switch (see Section 3.2.6)
Display has horizontal or vertical lines	Replace Display Board (see Section 3.2.8) Replace CPU Board (see Section 3.2.4)
Display has missing or dark pixels	Replace Display Board (see Section 3.2.8)
Display brightness not adjustable manually	Replace CPU Board (see Section 3.2.4) Replace Control/Display Unit (see Section 3.2.1)
Display brightness not adjustable via photocell	Replace Control/Display Unit (see Section 3.2.1) Replace CPU Board (see Section 3.2.4)
Keycaps have no backlighting	Replace Control/Display Unit (see Section 3.2.1) Replace CPU Board (see Section 3.2.4)
Keycap backlighting not uniform	Replace Control/Display Unit (see Section 3.2.1)
Bezel Annunciators do not function	Replace Display/Control Unit (see Section 3.2.1) Replace CPU Board (see Section 3.2.4)
No external annunciator output(s) (message, arrival, approach)	Check connections and verify operation in Test Mode (see Section 4.2.3) Replace CPU Board (see Section 3.2.4)
Keycaps do not function properly	Replace Control/Display Unit (see Section 3.2.1) Replace CPU Board (see Section 3.2.4)
Dual concentric (rotary) knobs do not function properly	Check Flex Circuit connection from rotary switch to back of Control/Display Unit Replace Rotary Switch Assembly (see Section 3.2.7) Replace Display Board (see Section 3.2.8) Replace CPU Board (see Section 3.2.4)
Approach arm switch not functioning properly (300 only)	Check connections and verify operation in Test Mode (see Section 4.2.3) Replace external switch Replace CPU Board (see Section 3.2.4)
Sequence Hold low switch not functioning properly (300 Only)	Check connections and verify operation in Test Mode (See Section 4.2.3) Replace external switch Replace Comm Chassis Sub Assy (see Section 3.2.2, steps 1-7) Replace CPU Board (see Section 3.2.4)
GPS reception weak or GPS Status Page shows low signal levels	Replace Antenna and/or antenna cable Replace GPS Receiver Board (see Section 3.2.5)

MESSAGE (cont.)	RECOMMENDED REPAIR (cont.)
No GPS reception	Check Date/Time Page for correct UTC time [1] Check Position Page for close approximate starting position (within 300 nautical miles) [2] Replace Antenna and/or antenna cable Replace GPS Receiver Board (see Section 3.2.5) Replace CPU Board (see Section 3.2.4)
Unit displays velocity when not moving [3]	Replace GPS Receiver Board (see Section 3.2.5)
Ni-Cad Battery life is short or Ni-Cad battery mop (Operational Remote Battery)	Replace External Battery Pack Replace CPU Board (see Section 3.2.4)
Unit loses memory in spite of new memory battery	Replace CPU Board (see Section 3.2.4)
Unit does not detect low memory battery	Replace CPU Board (see Section 3.2.4)
Unit does not detect external power[4]	Check external power connection Replace CPU Board (see Section 3.2.4)
No serial data output	Replace CPU Board (see Section 3.2.4)
No external CDI output or external CDI functions improperly	Check connections and verify operation in Test Mode (see Section 4.2.3) Replace CPU Board (see Section 3.2.4)
Unit detects low NICAD battery too soon or too late	Adjust battery alarm setpoint from config. page

[1]If UTC Time is incorrect, unit may be reset by holding the CLR key down while turning the unit on. The unit must then be attached to an antenna, allowed to search the sky and collect new almanac data. This process may take 20-30 minutes. CAUTION: All user waypoints/settings will be lost if the unit is reset.

[2]The GNC 250/300 will eventually perform an AutoLocate™ and lock onto satellites, however this can add an additional 10 minutes to the normal lock-on time.

[3]Display of low velocity numbers when not moving can occur when the units is in 2D mode and should not be considered a problem. However, this should seldom occur in 3D mode.

[4]The "Turning Off" message appears at/ below approximately 9 VDC external power.

2.5 TROUBLESHOOTING CHART (COMM SECTION)

MESSAGE	RECOMMENDED REPAIR
Receiver has poor signal reception (low sensitivity)	Check comm antenna in installation for intermittent connection and/or high VSWR. Verify connection between power/volume control knob and CPU Board. Verify connection between CPU Board and Comm Receiver Board. Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace CPU Board (see Section 3.2.4)
Receiver audio is distorted	Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace CPU Board (see Section 3.2.4)
Receiver audio volume is low or intermittent	Verify connection between power/volume control know and CPU Board Verify connection between CPU Board and Comm receiver board Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace CPU Board (see Section 3.2.4)
Receiver squelch is stuck open (noise through audio at all times)	Verify connection between Control/Display unit and CPU Board. Verify connection between CPU Board and Comm Receiver Board Replace Control Display unit. Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace CPU Board. (see Section 3.2.4)
Transmitter sidetone audio is noisy or distorted	Check comm antenna in installation for intermittent connection and/or high VSWR Verify connections from CPU Board to modulator transistor Q34 and from Q34 to transmitter. Verify connection between CPU Board and Comm Receiver Board Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace modulator transistor Q34 (see Section 3.2.2, steps 8-14) Replace CPU Board (see Section 3.2.4)
Transmitter has low or no power output	Check comm antenna in installation for intermittent connection and/or high VSWR Verify connection from CPU Board to modulator transistor Q34 and from Q34 to transmitter. Verify connection between CPU Board and Comm Receiver Board. Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7) Replace modulator transistor Q34 (see Section 3.2.2, steps 8-14) Replace CPU Board (see Section 3.2.4)

MESSAGE (cont.)	RECOMMENDED REPAIR (cont.)
Transmitter demodulated audio is distorted or noisy	Check output from 28v to 14v converter if so equipped. Replace converter if output voltage is higher than 15VDC Check comm antenna in installation for intermittent connection and/or high VSWR. Verify connections from CPU Board to modulator transistor Q34 and from Q34 to transmitter. Verify connection between CPU Board and Comm Receiver Board. Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7). Replace modulator transistor Q34 (see Section 3.2.2, steps 8-14) Replace CPU Board (see Section 3.2.4)
Display does not show tx indicator when mic is keyed.	Verify connection to external mic key. Verify connection between CPU Board and Comm Receiver Board. Replace comm chassis sub-assembly (see Section 3.2.2, steps 1-7). Replace CPU Board (see Section 3.2.4)

SECTION 3
DISASSEMBLY INSTRUCTIONS

To avoid damaging the GNC 250/300's circuit boards and assemblies, the following procedures should be carefully followed. Assembly drawings are included in Section 5 for reference (Figures 11 to 14).

3.1 REMOVAL OF THE COVERS

1. Remove the NavData® card.

2. Remove the two M3 x 5mm screws (211-50207-05) retaining the top cover (115-00061-00) and the two (211-00024-00) screws.

3. Remove the top cover by sliding it rearward approximately 1/4" until the retaining lip is fully exposed. The cover can then be lifted off the unit.

4. Carefully turn the unit over. CAUTION: the GNC 250/300 contains numerous static-sensitive components. Always observe proper anti-static precautions.

6. Remove the bottom cover by sliding it rearward about 1/4" until the retaining lip is fully exposed. The cover can then be lifted off the unit.

3.2 BOARD AND MODULE DISASSEMBLY

3.2.1 Control/Display Unit (011-00107-00, -01) Removal

1. Remove the covers as described above.

2. Remove the power/volume control knob and shaft (430-00014-00) by loosening the M3 x 2.6mm set screw (211-00037-00) on the coupling sleeve (125-00027-00).

3. Remove the four M3 x 5mm flat head screws (211-00024-00) which attach the CDU to the chassis.

4. Carefully remove the CDU from the chassis, pulling the assembly away from the two CPU board connectors (P9 and P10) and the power/volume switch.

3.2.2 Communication Chassis Sub-Assembly (011-00108-00) & Modulator Removal

1. Remove the covers as described in section 3.1.

2. Remove the M3 x 5 PHP (211-50207-05) and the M3 x 8mm PHP (211-50207-11) screws that connect the transmitter casting to the GPS receiver casting.

3. At this point the comm chassis sub-assembly can be hinged open by lifting up on the transmitter casting while holding the main chassis down thus giving access to the top side of the CPU board. This is beneficial to troubleshoot the CPU board without completely removing the comm sub-assembly.

4. The comm chassis can be completely disassembled by first removing the M3 x 5mm PHP screw (211-50207-05) on the back of the unit that holds the receiver connector plate (115-00081-00) to the unit.

5. Remove the M3 x 8mm PHP screw (211-50207-11) that connected the modulator cable to the modulator. Be careful to retain the insulator (250-00025-00).

6. Remove the ribbon cable (335-00026-00) from the J13 connector on the receiver board and the J8 connector on the CPU board.

7. Remove the comm chassis by sliding rearward approximately 1/4" until the DCP hinge (125-00020-00) slips out of the hole in the main chassis.

8. Remove the modulator transistor Q34 (630-00017-00) by first unsoldering the brown wire on the P16 connector to the modulator transistor lead.

9. Unsolder the P7 cable from the other modulator transistor lead.

10. Remove the remaining M3 x 8mm PHP screw (211-50207-11) that connects the red wire on the P16 cable assemble from the modulator. Be careful to retain the insulator (250-00025-00)

11. Remove the molded plastic TO3 insulator (145-00134-00), modulator transistor (613-00017-00), and thin TO3 insulator (250-00026-00) from the unit.

12. Remove the three (211-00024-00) screws holding the Modulator casting (125-00019-00) to the main chassis.

13. Remove the M3 x 5mm PHP screw (211-50207-05) that holds the posistor to the modulator casting.

14. Remove the modulator casting from the unit.

3.2.3 Interface Board (012-00092-00) Removal

1. Remove the covers as described in Section 3.1

2. Remove the Control/Display Unit as described in Section 3.2.1.

3. Remove the Comm Chassis Sub-Assembly & Modulator/Casting as described above.

4. Remove the three M1.5 x 5mm flat head screws (211-56201-05) retaining the data card race (145-00056-00) and Interface Board.

5. Slip the data card race off the Interface Board connector.

6. Carefully pull the Interface Board out of the unit upward, disengaging it from the CPU board Connector (J12).

3.2.4 CPU Board Removal (012-00066-00/50)

1. Remove the covers as described in Section 3.1.

2. Remove the Control/Display Unit as described in Section 3.2.1.

3. Remove the Comm Chassis Sub-Assembly as described in Section 3.2.2.

4. Remove the (211-50207-05) screw holding the 1501 Regulator to the main chassis.

5. Carefully turn the unit over.

6. The power/volume switch uses a flexible circuit cable for connection to the CPU board. This flexible circuit cable is inserted into a ZIF connector (J11). Pull up on the retaining lip of the ZIF connector. Gently pull the flexible circuit cable out of the ZIF connector.

7. Remove the bottom shield cover (155-00116-00) from the CPU and disconnect the GPS receiver cable from the J6 CPU connector.

8. Remove the two #4-40x.250 flat head screws (211-63204-08) which hold the 37-pin DSUB connector to the chassis.

9. Remove the two M3 x 5mm screws (211-50207-05) and the M3 x 8mm screw (211-50207-11) holding the CPU board to the chassis.
10. Remove the bottom shield cover (115-00116-00) from the CPU and disconnect the GPS receiver cable from the J6 CPU connector

11. Carefully slide the CPU board upward: pulling it away from the power/volume switch.

3.2.5 GPS Receiver Assembly (011-00183-00) Removal & Disassembly

1. Remove the covers as described in Section 3.1.

2. Disconnect the Comm Chassis sub-assembly from the GPS receiver as described in 3.2.2, 1-3. Do not completely remove comm chassis sub-assembly, but swing it open on its hinge.

3. Remove the bottom shield cover (115-00016-00) from the CPU board and disconnecting the GPS receiver cable from the J6 CPU connector.

4. Remove the two screws (211-50207-05) which secure the GPS Receiver Assembly to the Main chassis.

5. Remove the GPS receiver assembly from the main chassis.

6. Remove the 11 screws (211-56201-05) which secure the GPS receiver outer cover (115-00113-00) from the casting (125-00025-00).

7. Remove the four screws (211-50202-15) holding the GPS receiver inner cover to the assembly. Lift the screws out along with the (233-00012-00) spacers.

8. Remove the inner GPS receiver cover from the assembly. Pry out with a flat blade screw driver.

9. Remove the plastic screw (211-00018-00) holding the PC board to the casting.

10. To remove the BNC connector (330-001115-00) from the casting, remove the four screws (211-50207-03) from the casting and pull the connector out.

11. Unsolder the BNC connector (330-00015-00) from the PC board..

12. Remove the PC board (012-00125-00) from the casting. Carefully guide the cable assembly through the slot in the casting.

3.2.6 Power/Volume Switch Assembly (011-00230-00) Removal

1. Remove the covers as described in Section 3.1.

2. Remove the Control/Display Unit as described in Section 3.2.1.

3. Remove the CPU Board Sub-Assembly as described in Section 3.2.4.

4. Remove the coupling sleeve (125-00027-00) by unscrewing the pivot pin screw (211-00030-00).

5. Remove the hex nut securing the power/dimmer switch to the chassis. This nut is 7/16" and may be removed with a deep, thin-walled 12-point socket.

6. Slide the power/dimmer switch out of the mounting hole on the chassis.

3.2.7 Rotary Switch Assembly (011-00231-00) Removal

1. Remove the covers as described in Section 3.1.

2. Remove the Control/Display Unit as described in Section 3.2.1.

3. Remove the two rotary switch knobs by loosening the two M3 x 4mm set screws on the inner knob (430-00002-00). After removing the inner knob, gently pull the outer knob off of the rotary switch shaft.

4. Disconnect the rotary switch flex circuit from the connector on the Display Board.

5. Remove the hex nut securing the rotary switch to the Control/Display Unit. This nut is 1/2" and may be removed with a deep 12-point socket.

6. Push the rotary switch assembly out of the back of the Control Display Unit.

3.2.8 Display Board (012-00065-00) Removal

1. Remove the covers as described in Section 3.1.

2. Remove the Control/Display Unit as described in Section 3.2.1.

3. Disconnect the rotary switch wiring harness from the connector on the Display Board.

4. Remove the four screws (211-50201-05) that secure the Display Board to the bezel.

5. Carefully pull the Display Board away from the CDU bezel, disengaging it from the Keypad Board connector.

3.2.9 Remote Battery Pack and Charger (011-00182-00) Disassembly

1. Remove the four 4-40 x .250 screws (211-63204-08) holding the cover (115-00154-00) to the base (115-00155-00). Remove the cover.

2. To replace the battery pack, disconnect the three pin connector J102 from the charger circuit board (o12-00126-00).

3. Remove the battery pack (361-00008-00) from the unit.

4. To remove the charger circuit board assembly (012-00126-00) remove the four 4-40 x .250 screws (211-63204-00) holding the board to the base.

5. Remove the two 4-40 hex standoffs (214-00004-00) holding the J101 connector to the chassis. Carefully lift the charger board from the chassis.

3.3 REASSEMBLING THE UNIT

NOTE: During reassembly, all threaded fasteners shall be coated with thread-locking compound (291-00003-00).

1. Attach the power/dimmer switch to the chassis by reversing the steps followed in Section 3.2.6. The switch is correctly installed when the contacts and flexible circuit cable are pointed away from the chassis frame.

2. Ensure that the power/dimmer switch is in the "off" position.

3. Attach the GPS receiver assembly to the main chassis assembly by reversing the steps followed in Section 3.2.5.

4. Mount the CPU board Sub-Assembly on the chassis by reversing the steps followed in Section 3.2.4. Be sure to pull up on the retaining lip of the ZIF connector (j804) before inserting the flexible circuit cable.

5. Mount the Interface Board to me chassis by reversing the steps followed in Section 3.2.3.

6. Install the Comm Chassis sub-assy and modulator by reversing the steps followed in Section 3.2.2. Carefully observe proper orientation and alignment when reconnecting the ribbon cable to the board.
7. Mount the Display Board to the CDU bezel by reversing the steps followed in Section 3.2.8.

8. Mount the Rotary Switch Assembly to the Control /Display Unit by reversing the steps followed in Section 3.2.7. The switch is correctly installed when the flex circuit soldered connections point toward the top of the unit.

9. Install the Control/Display Unit by reversing the steps followed in Section 3.2.1. Gentle slide the CDU onto the two CPU board connectors (P9 and P10), observing proper pin alignment during the process.

10. Install the top and bottom covers by reversing the steps followed in Section 3.1.

SECTION 4
SERVICE AND TESTING

4.1 MEMORY BATTERY REPLACEMENT

The GNC 250/300 utilizes a built-in lithium battery to maintain user waypoints/settings stored in RAM. This battery has an operational life of up to five years. Should the battery require replacement, as indicated by the "memory battery low" message, disassembly of the unit will be required to access the battery.

When replacing the memory battery, all user waypoints/settings may be lost. If this occurs the message "stored Data Lost" will be displayed. The unit must then be attached to an antenna, allowed to search the sky and collect new almanac data before it will be usable again. This process may take 20-30 minutes. Before beginning replacement of the memory battery, transfer all waypoints and routes to a user data card so that they may be transferred back to the unit following battery replacement. This process is covered in the user's manual.

1. Remove the covers as described in Section 3.1.

2. Open the Comm Chassis Sub-Assembly as described in section 3.2.2, steps 1-3. Do not completely remove the assembly, but swing it open on its hinge.

3. Carefully turn the unit over and remove the CPU board bottom side cover (115-00116-00).

3a. Remove all electrical grounds from the GNC so, if using a grounded tip soldering iron, the battery will not be shorted upon removal.

4. Unsolder the three battery clip mounting tabs from the bottom side of the CPU board as marked in figure 6.

5. Carefully remove the battery by pulling it out from the top side of the CPU board. The battery clip leads are welded to the battery and cannot be removed.

6. Install a new battery and solder the clip leads from the bottom side of the CPU board.

7. Close and secure the Comm Chassis Sub-Assembly by reversing the steps in procedure 3.2.2 steps 1 to 3.

8. Turn the GNC 250/300 on.

9. Press ENT to accept normal mode operation.

10. Press ENT again to accept the Database Page.

11. Verify that the "Memory battery low" message does not appear on the message page by pressing the MSG key.

12. Turn the GNC250/300 off and carefully turn the unit over.

13. Verify that the memory battery voltage (from test point to ground, see Figure 6) is at least 2.9 VDC.

14. Re-install the CPU board bottom side cover.

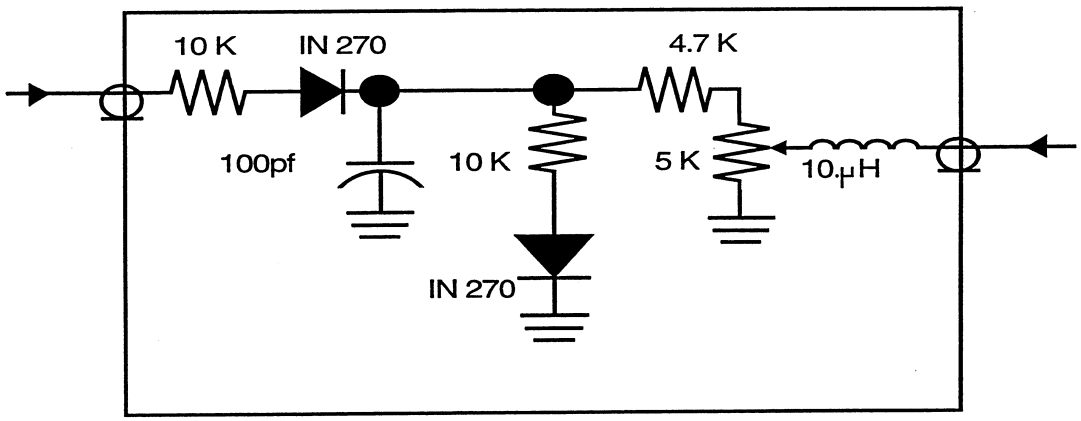
15. Re-install the top and bottom covers by reversing the steps followed in Section 3.1.

4.2 FINAL TEST

After completing all necessary maintenance or service, the following test procedure is provided to ensure that all GNC 250/300 functions are operating properly.

4.2.1 Test Equipment Required

- 0-30 Volt DC / 6 Amp Power Supply
- GPS 150/(155/165)/GNC Manual Test Panel (T10-00003-02)
- Red and Black Cables with Banana Plugs (3" length recommended)
- Digital Multimeter
- RF Signal Generator-HP8640B or equivalent (external frequency counter capability desirable).
- Frequency Counter capable of measuring up to 137 MHz (not necessary if RF generator has external counter capability.
- RF Watt meter - Bird 6811 or equivalent.
- 25 Watt 50 ohm RF load - Bird 8080 or equivalent.
- Audio Signal Generator - HP200CD or equivalent.
- Audio distortion analyzer - HP 331A or equivalent.
- Linear Detector - see figure below
- 6db Pad-minicircuits CAT-6 or equivalent.
- 200 MHz oscilloscope
- IFR GPS-101 Global Positioning Simulator or equivalent



LINEAR DETECTOR
(TO BE USED IN TRANSMITTER TEST SETUP FIGURE 9)

4.2.2 Setup

1. Preset the power supply to +14.8 VDC and set current limit to 6A.

2. Connect the positive output of the power supply to the red DC IN + jack at the back of the test panel. Connect the negative output of the power supply to the black DC IN - jack at the back of the text panel.

3. Connect the J2 and J1 wiring harness assemblies to the front of the test panel.

4. Connect the positive and negative digital multimeter leads to the HI and LO FUNCTION SELECT outputs on the front of the test panel. Set the DMM to measure DC voltage.

5. Set the CAL/NORMAL switch to NORMAL and set the GPS 150/(155/165)/GNC switch to GNC, set the "A/B" switch in the "A" position.

6. Plug one end of the AC power cord into the back of the test panel and the other end into a 120 VAC outlet.

7. Turn the FUNCTION SELECT switch to POWER IN. Ensure that the PANEL POWER and UNIT POWER push-button switches are OFF (not lighted).

8. Turn on the power supply, push the PANEL POWER switch and verify that it lights up. Push the UNIT POWER switch and verify that it lights up.

9. Monitor the POWER IN voltage with the DMM and set the power supply for +14.8 VDC ±0.1 VDC.

10. Push the UNIT POWER switch to turn unit power OFF.

11. Connect the J2 and J1 wiring harness assemblies to the back of the GNC 250/300.

12. Push the UNIT POWER switch to turn unit power ON.

4.2.3 Final Test Procedure

1. Test Mode Activation/Display Test:

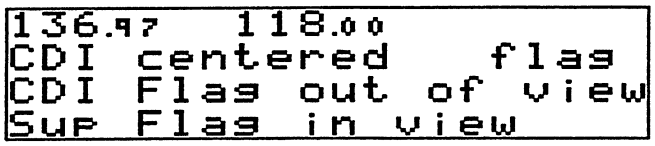
   a. Hold the ENT key down while rotating the power/volume knob clockwise from the "OFF" position.

   b. Verify that the GNC 250/300 enters test mode. There are three test patterns displayed when first activating test mode. The first test pattern illuminates all thirty-five pixels in the first character column of each row and cycles through the remaining nineteen character columns. The second test pattern illuminates the first column of pixels in each of the 20 character columns and cycles through the remaining four pixel columns. The third test pattern illuminates the first row of pixels in each of the four character rows and cycles through the remaining six pixel rows.

   c. Observe the test patterns and verify that the display is working properly.

2. CDI Deflection Test:

   a. Rotate the outer function knob counter clockwise until the CDI Test Page is displayed.:



   b. Turn the FUNCTION SELECT switch on the test panel to position #3.

c. Press the CRSR key twice.

d. If necessary, rotate the inner function knob to select CENTERED. Verify that the DMM voltage is 0 ±15 millivolts.

e. Rotate the inner function knob clockwise to select FULL RIGHT. Verify that the DMM voltage is -150 ±15 millivolts.

f. Rotate the inner function knob clockwise to select MAX RIGHT. Verify that the DMM voltage is -300 ±30 millivolts.

g. Rotate the inner function knob clockwise to select MAX LEFT. Verify that the DMM voltage is +300 ±30 millivolts.

h. Rotate the inner function knob clockwise to select FULL LEFT. Verify that the DMM voltage is +150 ±15 millivolts.

3. CDI To/From Flag Test:

a. Rotate the outer function knob clockwise.

b. Turn the FUNCTION SELECT switch on the test panel to position #2.

c. If necessary, rotate the inner function knob to select FLAG. Verify that the DMM voltage is 0 ±15 millivolts. Units with Mod Status 1: DMM voltage is 0 ±10 millivolts.

d. Rotate the inner function knob clockwise to select FROM. Verify that the DMM voltage is -83 ±20 millivolts. Units with Mod Status 1: DMM voltage is -190 ± 40 millivolts.

e. Rotate the inner function knob clockwise to select TO. Verify that the DMM voltage is 83 ±20 millivolts. Units with Mod Status 1: DMM voltage is +190 ± 40 millivolts.

4. CDI Nav Flag Test:

a. Rotate the outer function knob clockwise.

b. Turn the FUNCTION SELECT switch on the test panel to position #1.

c. If necessary, rotate the inner function knob to select IN VIEW. Verify that the DMM voltage is 0 ±10 millivolts.

d. Rotate the inner function knob clockwise to select OUT OF VIEW. Verify that the DMM voltage is 375 ±80 millivolts.

5. Super Flag Output Test:

a. Rotate the outer function knob clockwise.

b. Turn the FUNCTION SELECT switch on the test panel to position #4.

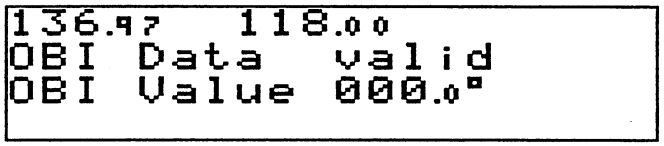
c. If necessary, rotate the inner function knob to select IN VIEW. Verify that the DMM voltage is less than 0.25 VDC.

d. Rotate the inner function knob clockwise to select OUT OF VIEW. Verify that the DMM voltage is greater than 12.8 VDC.

6. OBI Output Test:

   a. Press the CRSR key.

   b. Rotate the outer function knob counter clockwise until the OBI Test Page is displayed.



   c. Press the CRSR key twice.

   d. Rotate the outer function knob clockwise until VALUE is flashing.

   e. Rotate the inner function knob clockwise to select CLOCK.

   f. Turn the FUNCTION SELECT switch on the test panel to position #14.

   g. Rotate the outer function knob clockwise until LOW flashed. Verify that the DMM voltage is less than 1.0 VDC.

   h. Rotate the inner function knob to select HIGH. Verify that the DMM voltage is greater than 4.5 VDC.

   I. Rotate the outer function knob counterclockwise until CLOCK flashes.

   j. Rotate the inner function knob clockwise to select DATA.

   k. Turn the FUNCTION SELECT switch on the test panel to position #15.

   l. Rotate the outer function knob clockwise until LOW flashes. Verify that the DMM voltage is less than 1.0 VDC.

   m. Rotate the inner function knob to select HIGH. Verify that the DMM voltage is greater than 4.5 VDC.

   n. Rotate the outer function knob counterclockwise until DATA flashes.

   o. Rotate the inner function knob clockwise to select SYNC.

   p. Turn the FUNCTION SELECT switch on the test panel to position #16.

   q. Rotate the outer function knob clockwise until LOW flashes. Verify that the DMM voltage is less than 1.0 VDC.

   r. Rotate the inner function knob to select High. Verify that the DMM voltage is greater than 4.5 VDC.

7. RS-232 / RS-422 / ARINC 429 Loopback Tests:

   NOTE: RS-422 Not available on GNC 250.

   a. Press the CRSR key.

   b. Rotate the outer function knob clockwise until the I/O Test Page is displayed:

c. Verify that the I/O Test Page indicates "CH 1 OK" and CH 2 OK".

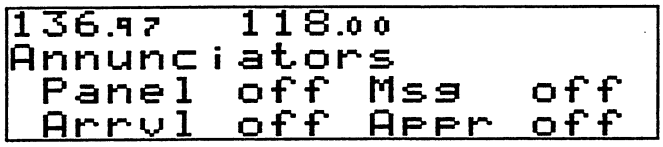
d. Verify that the I/O Test Page indicates "RS422 OK".

e. Verify that the I/O Test Page indicates "A429 OK>

8. Annunciator Output Test:

a. Press CRSR key.

b. Rotate the outer function knob until the Annunciator Test Page is displayed:



c. Press the CRSR key twice.

d. Rotate the inner function knob to turn the front panel annunciators ON. Verify that all five annunciators on the GNC 250/300 are lit.

e. Rotate the inner knob to turn the front panel annunciators OFF. Verify that all five annunciators on the GNC 250/300 are off.

f. Turn the FUNCTION SELECT switch on the test panel to position #6.

g. Rotate the outer function knob clockwise to select the MSG annunciator.

h. With the MSG annunciator OFF, verify that the DMM voltage is greater than 4.5 VDC.

I. Rotate the inner function knob to turn the MSG annunciator ON. Verify that the DMM voltage is less than 0.3 VDC.

j. Turn the FUNCTION SELECT switch on the test panel to position #7.

k. Rotate the outer function knob clockwise to select the ARRVL annunciator test.

l. With the ARRVL annunciator OFF, verify that the DMM voltage is greater than 4.5 VDC.

m. Rotate the inner function knob to turn the ARRVL annunciator ON. Verify that the DMM voltage is less than 0.3 VDC.

n. Turn the FUNCTION SELECT switch on the test panel to position #5.

o. Rotate the outer function knob clockwise to select the APPR annunciator test.

p. With the Appr annunciator off, verify that the DMM voltage is greater than 4.5 VDC.

q. Rotate the inner function knob to turn the Appr annunciator to ACTV. Verify that the DMM voltage is less than 0.3 VDC.

r. Rotate the inner function knob to turn the Appr annunciator arm. Verify that the DMM voltage is greater than 4.5 VDC.

s. Turn the FUNCTION SELECT switch on the test panel to position #19.

t. Verify that the DMM voltage is less than 0.3 VDC.

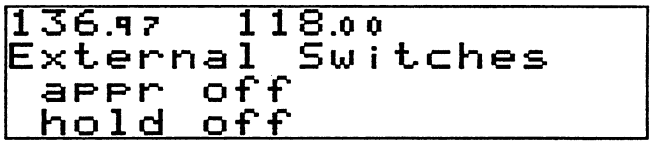
u. Rotate the inner function knob to turn the Appr annunciator to off. Verify that the DMM voltage is greater than 4.5 VAC.

v. Rotate inner knob to select 'appr actv'. Verify that the DMM voltage is greater than 4.5 VDC.

9. External Switches Test: (GNC 300)

a. Press the CRSR key.

b. Rotate the outer function knob two clicks until the External Switches test page is displayed (bypassing the External COM Switches page):



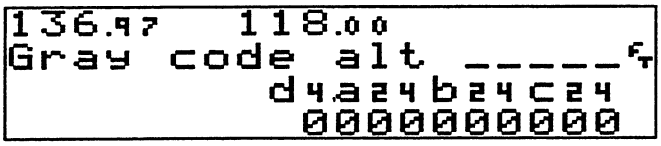
c. Toggle APPR SELECT switch on test panel and verify that the External Switches Test Page indicates "APPR OFF" in the down position.

d. Toggle the OBS HOLD switch on test panel and verify that the External Switches Test Page indicates "Hold OFF" in the down position and "HOLD ON" in the up position.

10. Altitude Decoder Test:

This test exercises each altitude date line individually. Most altitude codes presented will be invalid, however, ALTITUDE DECODER LINE SELECT switch positions #9 (input line C1 valid) and #10 (input line C2 valid) indicate altitude readings of -800 and -1000 feet, respectively.

a. Rotate the outer function knob counter clockwise until the Altitude Decoder Test Page is displayed:



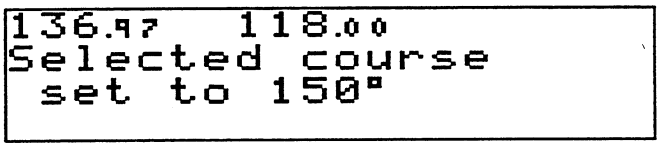
b. Turn the ALTITUDE DECODER LINE SELECT switch on the test panel to position D4. Verify that D4 on the Altitude Decoder Test Page indicates "1". All other altitude inputs should still indicate "0".

c. Continue to step through ALTITUDE DECODER LINE SELECT switch positions A1, A2, A4, B1, B2, B4, C1, C2 and C4. Verify that only one input line (A1, A2, A$, B2, B$, C1, C2, or C4) indicates "1" for each switch position. All other altitude inputs should still indicate "0".

d. Turn the ALTITUDE DECODER LINE SELECT switch to 'RMT ENT' position. Verify that all altitude inputs indicate "0".

11. OBS Selected Course Test: (GNC 300 only)

a. Rotate the outer function knob until the OBS Selected Course Test Page is displayed:



b. Turn the OBS BEARING switch on the test panel to 150°. Verify that the input course is 150° ± 9° and "CALIB?" appears in the lower right corner of the test page. Note: The OBS Normal/Cal switch on e test panel must be in the Normal Position.

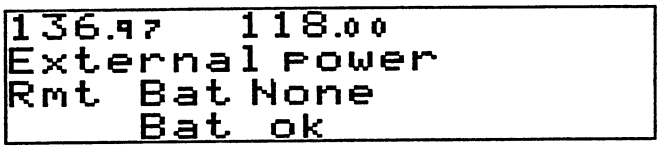
c. Press the CRSR key twice.

d. Press the ENT key on GNC 300 to calibrate the unit. There will be a brief delay while the unit performs the calibration. Verify that the input course is now 150° ± 0.2°.

e. Turn the OBS BEARING switch on the test panel to the 60°, 240°, and 330° positions. Verify that in each instance the input course is within ± 2.0°.

12. External Power/Battery Tests:

a. Rotate the outer function knob counter-clockwise until the External Power/Battery test page is displayed:



b. Verify that line two of the display indicates "External Power" and the voltage reading is within 0.3 VDC of the reading taken in section 4.2.2 step 9 (approximately 14.8 VDC).

c. Connect the wall charger to the unit and verify that line two of the display now indicates "Wall adapter".

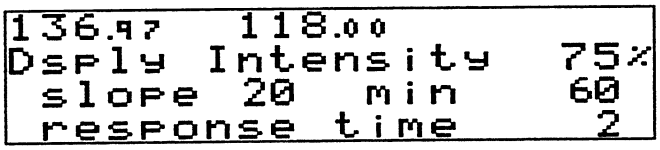
d. Unplug the wall adapter. Line two of the display should go back to indicating "External Power".

e. Verify that line 3 of the display indicates "Rmt Pak none".

f. Verify that line 4 of the display indicates "Mem Bat ok".

13. Display Intensity Test.

a. Rotate the outer control knob until the Display Intensity test page is displayed:

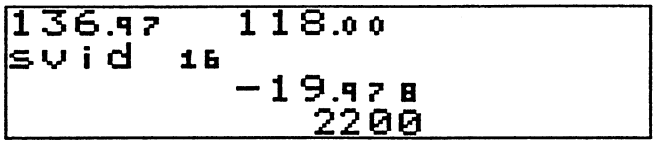


b. Cover the photo diode detector on the display with a finger and verify that the Display Intensity percentage number decreases and that the display grows dimmer.

14. GPS Receiver Noise Test:

a. Depress the ENT key while powering up the unit. This puts the unit into TEST MODE.

b. Turn the outer knob 8 pages until you see the following display:



c. Terminate the GPS receiver into a 50 ohm load.

d. The bottom line of the display represents the receiver noise level. Verify that this number is within the range of 1800 and 2200.

15. Operational Test

a. Turn the GNC 250/300 OFF.

b. Insert a Jeppesen NavData® card.

c. Turn the GNC 250/300 ON normally, without entering test mode. Verify that the GNC 250/300 passes its self test. A failure is indicated by one of the messages listed in Section 2.2.

d. Verify that the GNC 250/300 correctly reads the NavData® card and indicates the type, effective date and expiration date.

e. Press the ENT key and verify that the Satellite Status Page is displayed.

f. Press the MSG key and verify that the Message Page is displayed.

g. Press the Direct To key and verify that the GO TO Page is displayed.

h. Rotate the inner function knob to select a letter or number on the display.

I. Press the CLR key and verify that the selected letter/number disappears.
j. Press the NRST key. Verify that a Nearest Waypoint Page is displayed.

k. Press the RTE key. Verify that a Route Page is displayed.

l. Press the WPT key. Verify that the Select Waypoint Type Page is displayed and the annunciator next to the wpt key is on.

m. Press the CRSR key twice and verify that APT? flashes.

n. Rotate the outer function knob clockwise and verify that VOR? flashes.

o. Press the NAV key. Verify that a Navigation Page is displayed.

p. Turn the GNC 250/300 OFF.

16. Satellite Tracking Test:

The Satellite Tracking Test ensures that the GNC 250/300 has current almanac information and is able to lock onto a sufficient number of satellites to provide a position. This test also verifies that the signal strength of the satellites received is at an acceptable level.

a. Turn the unit off.

b. Connect the unit to a GA56 antenna mounted outside with a clear view of the sky, through a coax with a 10 dB ± 1 dB cable loss @ 1.5 GHZ. Note: attenuation pads must not be used since the unit supplies the GA56 with DC power.

c. Turn on the unit. Go to the Satellite Data Page, (see Pilot's Guide for instructions).

d. Allow the unit to lock on to the satellites. If the unit has current almanac data, it will list the visible satellites on the row labeled SAT and it will begin acquiring satellites in a period of a few minutes. If the unit indicates SEARCH SKY instead of ACQUIRING, it must search the sky for available satellites and collect almanac data. A "search the sky" operation may take 20-30 minutes to complete.

e. Then unit must enter 3D navigation mode.

f. The unit must display the following:

    1. (4) satellites with signal strength 3 or greater.

    2. The average signal strength on satellites above 20° elevation shall be greater than or equal to 3.5 (see Pilot's Guide for instructions). Satellites that are acquiring should not be included in the average signal strength calculation.

17. Communications Receiver Tests

NOTE: All receiver input levels are specified in hard uV which implies a 6 db pad on the output of the RF signal generator. See figure 8 for typical comm receiver test set up.

a. Turn GNC 250/300 on in normal operating mode.

b. Press ENT key to acknowledge the Database page.

c. Volume Control Test

*Apply a 20μV RF signal to the comm antenna input at 118.000 MHz. AM modulate the signal 30% with a 1000 Hz tone.

*Make sure the COMP DISABLE switch on the test panel is in the down position.

*Tune the comm receiver to 118.00 MHz.

*Turn the power/volume control knob fully clockwise.

*Verify that the comm audio output level is greater than or equal to 7.07 Vrms on the audio level meter.

*Turn the power/volume control knob fully counterclockwise, but not past the detent (off) position.

*Verify that the comm audio output level is less than or equal to 22 mVrms on the audio level meter.

d. Sensitivity and Quieting Test.

*Set the COMP DISABLE switch on the test panel in the UP position.

*Turn the power/volume control knob clockwise until the comm audio output level is equal to 7.07 Vrms and the audio is not visibly clipping on the oscilloscope.

NOTE: The receiver has a digital volume controller and it may not be possible to set the volume to exactly 7.07 Vrms. It is acceptable to use the first level greater than or equal to 7.07 Vrms.

*Set the RF signal generator output level to 2μV.

*Using the audio analyzer verify that the comm audio output) (signal + noise)/ noise ratio is at least 6dB

*Set the RF signal generator output to 100μV.

*Using the audio analyzer verify that the comm audio output (Signal + noise)/ noise ratio is at least 35dB.

*Repeat this procedure at 127.075 MHz and 136.875 MHz.

e. AGC Test.

*Tune the comm receiver to 127.075 MHz.

*Set the RF generator to 5uV @ 127.075 MHz.

*Using the audio level @ 5uV as a 0 dB reference, increase the RF signal generator level to 100mV and verify that the audio level does not change more than 3 dB.

f. Audio Distortion Test.

*Set the RF generator to 10 mV and increase the modulation depth to 85%.

*Place the COMP DISABLE switch on the test panel in the DOWN position.

*Turn the volume clockwise to obtain at least 7.07 Vrms comm audio output.

*Using the audio analyzer verify that the comm audio distortion is less than 10%.

*Repeat the procedure with audio tone frequencies of 350 Hz and 2.5 kHz.

NOTE: 15% distortion is acceptable for the 350 Hz tone.

g. Audio Frequency Response Test.

*Set the RF generator to 100 μV with 30% modulation depth.

*Place the COMP DISABLE switch on the test panel in the UP position.

*Re-adjust the power/volume control for 7.07 Vrms comm audio output.

*Vary the frequency of the modulating tone from 350 Hz to 2500 Hz and find the frequency where the comm audio output level peaks. Make this level the 0 dB reference.

*Adjust the modulation frequency to 350 Hz and verify that the comm audio output level drops no more than 6 dB.

*Adjust the modulation frequency to 2.5 KHz and verify that the comm audio output level drops no more than 6 dB.

*Adjust the modulation frequency to 1 KHz and set the comm audio output reference level to 0 dB.

*Adjust the modulation frequency to 4 KHz and verify that comm audio output level drops at least 18 dB.

h. Compressor Test.

*Set RF generator modulation frequency to 1 KHz and the modulation depth to 20%.

*Place the COMP DISABLE switch on the test panel in the DOWN position.

*Re-adjust the power/volume control for 7.07 Vrms comm audio output.

*Set the comm audio output reference level to 0 dB.

*Adjust the modulation depth to 85% and verify that the comm audio output level does not vary more than 3 dB.

I. Selectivity Test.

*Turn the modulation OFF on the RF signal generator.

*Turn the power/volume control knob fully counterclockwise, but not past the detent (OFF) position.

*Set the RF output level of the signal generator to 10μV.

*Set the FUNCTION SELECT switch on the test panel to position 18 and monitor the AGC voltage with the DMM (DC).

*The DC voltage reading on the DMM is the AGC reference voltage, write it down as you will need it for the rest of the test.

*Adjust the signal generator frequency to 127.067 MHz and adjust the RF level to 20μV.

*Verify that the DMM reading is greater than the reference AGC voltage.

*Adjust the signal generator frequency to 127.083 MHz.

*Verify that the DMM reading is GREATER than the reference AGC voltage.

*Adjust the signal generator frequency to 127.050 MHz and adjust the RF level to 10mV.

*Verify that the DMM reading is LESS than the reference AGC voltage.

*Adjust the signal generator frequency to 127.100 Mhz.

*Verify that the DMM reading is LESS than the reference AGC voltage.

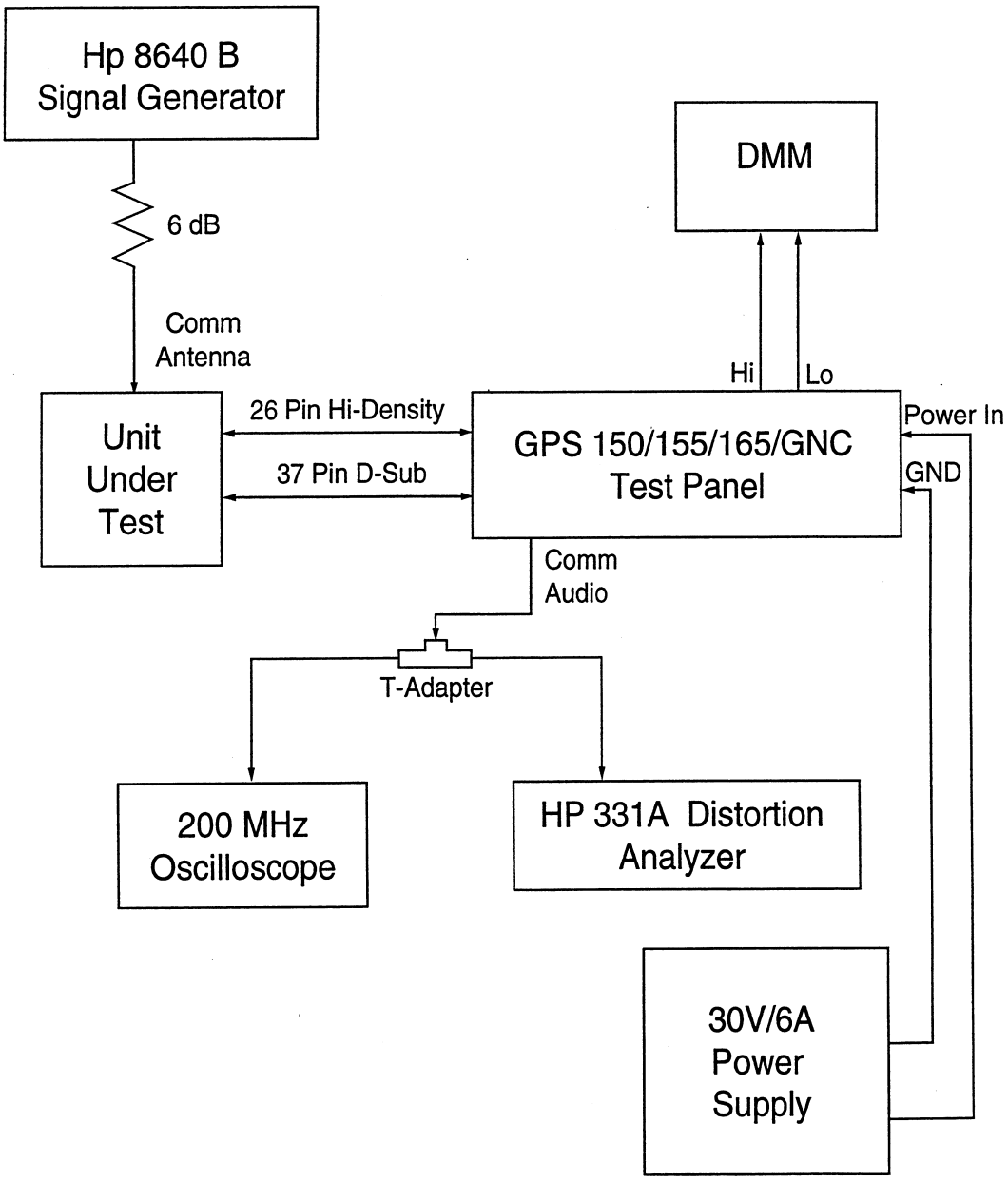


Figure 8. Comm Receiver Test Setup

j. Noise Squelch test.

*Set the RF signal generator to 127.075 Mhz, 30% modulated with a 1 KHz tone.

*Turn the RF level down below 1μV.

*Turn the power/volume control on the radio fully clockwise.

*SLOWLY increase the RF level until the squelch just breaks open and audio can be heard.

*Verify that the RF signal generator level is between 1 and 4μV.

*SLOWLY decrease the RF level until the squelch closes (no audio).

*Verify that the RF level is less than 6 dB below that level which opened the squelch.

*Repeat this test at 118.000 Mhz and 136.875 Mhz.

k. Carrier Squelch Test.

*Set the RF signal generator to 127.075 Mhz, 85% modulated with an 8 KHz tone. Tune the radio to 127.07 Mhz.

*Turn the RF level down below 6μV.

*Slowly increase the RF level until the squelch just breaks open and audio noise can be heard.

*Verify that the RF signal generator level is between 6 and 25μV.

*SLOWLY decrease the RF level until the squelch closes (no audio).

*Verify that the RF level is less than 6 dB below that level which opened the squelch.

*Repeat this test at 118.000 Mhz and 136.875 Mhz.

l. Squelch Key Test.

*Remove the RF input from the GNC 250/300.

*Verify that the comm audio output is quiet.

*Press the SQ key on the front of the GNC 250/300.

*Verify that the comm audio output is not quiet.

m. Intercom test.

*Remove the RF input to the GNC 250/300.

*Apply a 100 mV RMS audio signal at 1 KHz to the MIC INTERCOM input to the test panel.

NOTE: The MIC INTERCOM input has a 500 ohm input impedance. Make sure that the audio signal generator is set up to deliver 100 mV RMS into this load impedance.

* Monitor the comm audio output level with the audio analyzer and verify that its input level is greater than 7.07 Vrms and has less than 10% distortion.

18. Communication Transmitter Tests

a. Power Supply Setup

*Place the unit in test mode according to section 4.3.3.1. Turn the outer function knob to the unit counter clockwise on clock to display the External power input page.

*Key the transmitter by pressing down on the MIC KEY switch on the test panel.

NOTE: Pressing down on the MIC KEY engages a momentary switch which keys the transmitter until it is released. Pulling UP on the MIC KEY will operate the transmitter continuously until the switch is returned to the middle position or the transmitter times out (about 35 seconds).

*Verify that the External power reading on the display is between 13.5 and 13.9 VDC. IF it is outside this range re-adjust the power supply output. Only make this adjustment with the transmitter keyed.

b. Carrier Power Test.

*Change the comm actv channel to 118.10 Mhz.

*Remove the audio signal generator input to the MIC AUDIO HI input on the panel. This test must be done with no modulation.

*Key the transmitter and verify that the carrier power is greater than 5 Watts.

*Repeat this test at 126.97 and 136.97 Mhz.

c. Frequency Stability Test.

*Change the channel to 136.97 Mhz.

*Monitor the output frequency with a counter.

*Verify that the output frequency is between 136.974 and 136.976 Mhz (+or - 1 KHz error).

d. Modulation Capability

Note: Either of the following two methods may be used to perform this test.

Method 1. Modulation analyzer (HP 8920B or equivalent)

*Change the actv channel to 118.10 MHz.

*Apply a 275 mV RMS audio signal at 1000 HZ to the MIC AUDIO HI input to the test panel.

NOTE: The Mic AUDIO HI input has a 500 ohm input impedance. Make sure that the audio signal generator is set up to deliver 275 mV RMS into this load impedance.

*Key the transmitter and read the modulation depth on the modulation analyzer. Verify that the modulation depth is between 70% and 90%.

*Increase the MIC AUDIO HI input level to 2.75 Vrms and verify that the modulation depth is between 70% and 90%.

*Repeat this test at 126.97 and 136.97 MHz.

Method 2. Oscilloscope

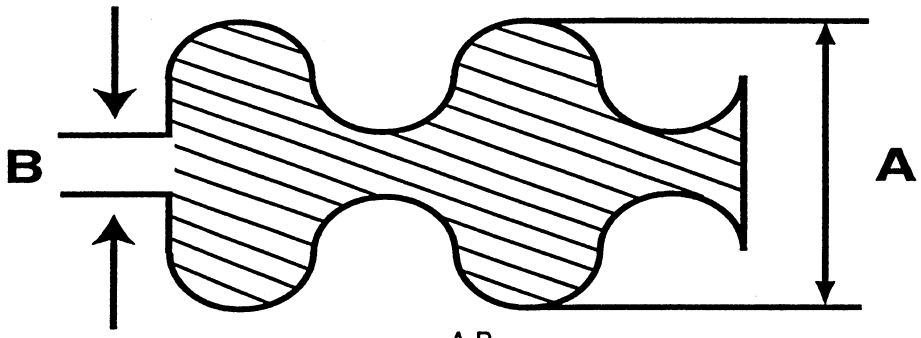
*Change the actv channel to 118.10 MHz.

*Apply a 275 mV RMS audio signal at 1000 HZ to the MIC AUDIO HI input to the test panel.

NOTE: The Mic AUDIO HI input has a 500 ohm input impedance. Make sure that the audio signal generator is set up to deliver 275 mV RMS into this load impedance.

*Key the transmitter and monitor output from the RF coupler on a 200 Mhz oscilloscope. Trigger the scope off the demodulated audio from the linear detector.

*Verify that the modulation depth is between 70% & 90% using the diagram and formula below:



$$\% \text{ Modulation} = \frac{A-B}{A+B} \times 100$$

*Increase the MIC AUDIO HI input level to 2.75 Vrms and verify that the modulation depth is between 70% & 90%.

*Repeat this test at 126.97 and 136.97 Mhz.

e. Carrier Noise Level Test.

*Change the actv channel to 118.100 Mhz.

*Monitor the demodulated audio output from the linear detector with the audio analyzer.

*Decrease the mic audio HI input level to 275mV RMS.

*Key the transmitter and measure the demodulated output signal level.

*Remove the modulation and verify that the demodulated noise level is at least 45 dB below the modulated level.

*Repeat the test at 126.97 and 136.97 Mhz.

f. Demodulated Audio Distortion.

*Change the actv channel to 118.10 Mhz.

*Set the audio generator frequency to 350 Hz and with amplitude at 275mV RMS.

*Measure the distortion of the demodulated audio output and verify that it is less than 10%.

*Repeat at 1 and 2.5 KHz.

*Repeat entire test at 126.97 and 136.97 Mhz.

g. Sidetone Level.

*Change the active channel to 126.97 Mhz.

*Monitor the comm audio output on the audio analyzer.

*Key the transmitter and measure the sidetone level. Verify that it is equal to 1.4 Vrms (+ or - 20%).

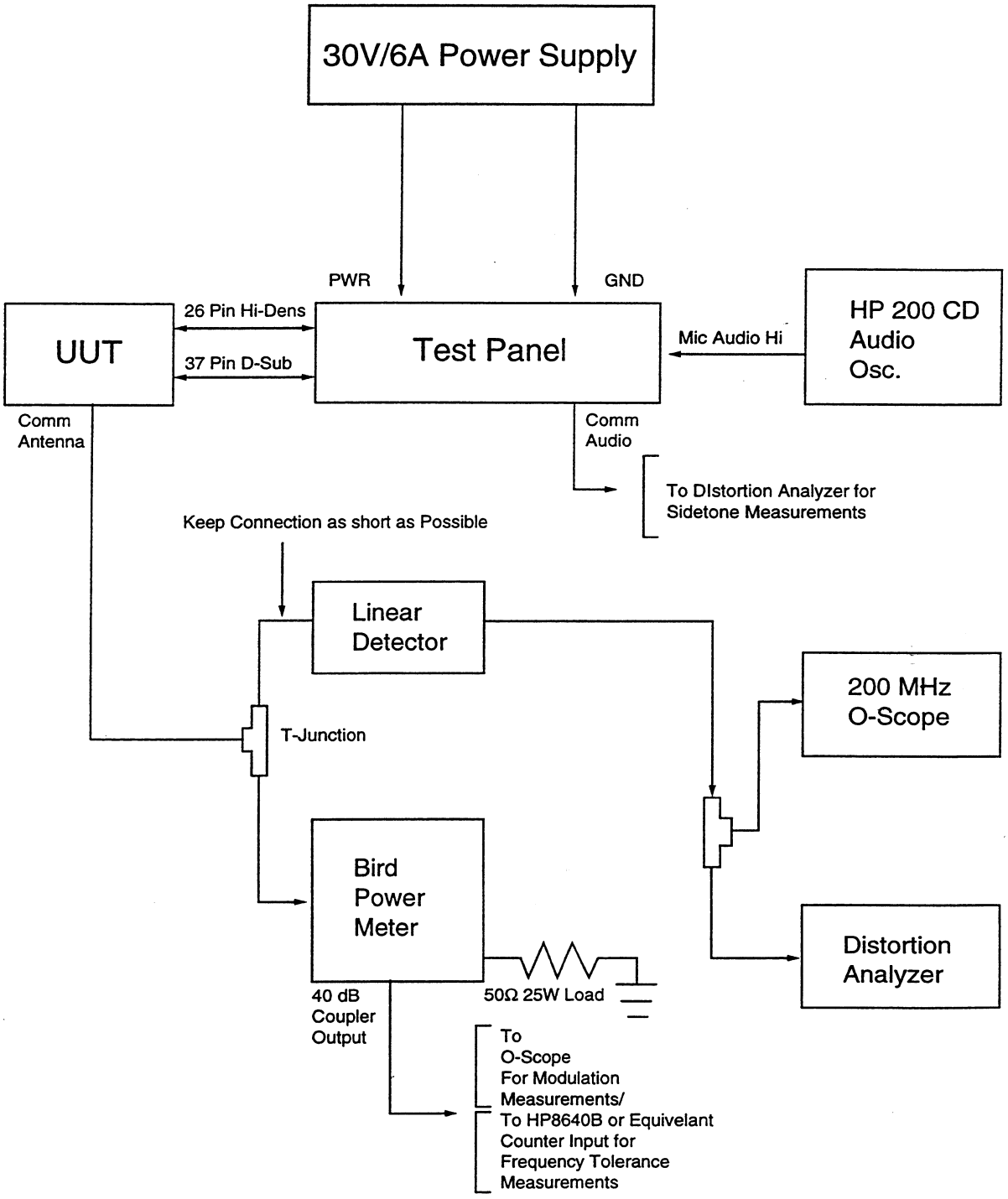
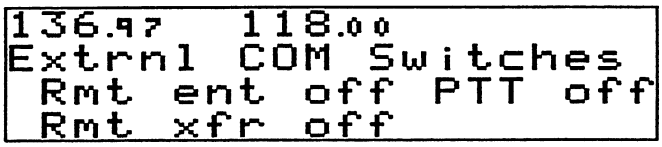


Figure 9. Transmitter Test Setup

h. External COM Switches Test.

*With the unit still in test mode, turn the outer function knob counter clockwise until the External COM Switches test page is displayed



*Place the ALT DECODER LINE SELECT switch on the test panel in the RMT ENT position.

*Verify that "RMT ENT ON" is displayed on the unit.

*Place the ALT DECODER LINE SELECT switch on the test panel in the C4 position.

*Verify the "RMT ENT OFF" is displayed on the unit.

*Place the REMOTE TRANSFER switch on the test panel in the UP position.

*Verify that THE ACTV AND STBY channels on the display change places and that "RMT XFR ON" is displayed on the unit.

*Place the REMOTE TRANSFER switch on the test panel in the DOWN position.

*Verify that "RMT XFR OFF" is displayed on the unit.

*Key the transmitter with the MIC KEY switch and verify that "PTT ON" is displayed.

*Un-key the transmitter and verify that "PTT OFF" is displayed.

I. Stuck MIC Key Test.

*Turn the unit off and back on again in normal operating mode.

*Key the transmitter by switching the MIC KEY switch in the UP position.

*Maintain the MIC KEY in this position for approximately 35 seconds. Verify that the unit automatically disables the transmitter and the MSG annunciator flashes.

NOTE: If this test fails do not allow the transmitter to remain keyed for more than 60 seconds.

*Press the MSG key on the unit and verify that the message "Stuck mic/Tx disabled" is displayed.

*Put the MIC KEY switch back in the un-keyed (middle) position.

*Press the NAV key on the unit and then the MSG key and verify that the stuck mic message has gone away.

j. Stuck Remote Transfer Test.

*Place the REMOTE TRANSFER switch in the UP position.

*Verify that the ACTV and STBY channels change places.

*Verify that after 2 seconds the ACTV channel is automatically tuned to 121.50 Mhz.

*Verify that after 35 seconds the MSG annunciator flashes.

*Press the MSG key and verify that the message "Remote XFR Key Stuck" is displayed.

*Press the transfer key (<-->) on the GNC 250/300 and verify that the ACTV and STBY channels change places and that the ACTV channel DOES NOT tune back to 121.50 Mhz automatically.

*Place the REMOTE TRANSFER key in the DOWN position.

*Press the NAV key on the unit and then the MSG key and verify that the remote XFR key stuck message has gone away.

k. Stuck Remote Enter Key test.

*Place the ALT DECODER LINE SELECT switch in the "RMT ENT" position.

*Verify that after 35 seconds the MSG annunciator flashes.

*Press the MSG key on the unit and verify that "Remote ENT key stuck" is displayed.

*Press the CRSR key on the unit and tune the STBY channel to a different frequency.

*Press the transfer key (<-->) and verify that the ACTV and STBY channels change places.

*Place the ALT DECODER LINE SELECT switch in the C4 position.

*Press the NAV key and then the MSK key on the unit.

*Verify that the "Remote ENT key stuck" message has gone away.

4.2.4 Comm Transceiver Alignment

A few receiver and transmitter alignments are accessible throughout the top of the unit without removing the unit cover. The following procedure describes how to perform these adjustments:

1. Comm Receiver Carrier Squelch.

*Configure the test equipment as shown in section 4.3.3.17. Make sure the COMP DISABLE switch on the test panel is in the DOWN position.

*Turn the unit on in normal operation mode.

*Turn the power/volume control knob fully clockwise.

*Tune the GNC 250/300 active channel to 127.07 Mhz.

*Set the RF signal generator for 127.075 Mhz, 85% modulated with an 8 KHz tone and an output level of 12.5μV.

*Insert a tuning tool in the CARRIER SQ. hole in the top cover until it fits in the slot of the carrier squelch potentiometer on the comm receiver board.

*Turn the potentiometer counter-clockwise until the audio is squelched if it is not already so.

*SLOWLY turn the potentiometer clockwise until the squelch is just broken (audio can be heard).

*Run test procedure 4.3.3.17.k to verify that the carrier squelch has been adjusted properly.

2. Comm Receiver Noised Squelch.

   *Tune the RF signal generator for 127.075 Mhz, 30% modulated with a 1 KHz tone and an output level of 2μV.

   *Insert a tuning tool in the NOISE SQ. hole in the top cover until it fits in the slot of the noise squelch potentiometer on the comm receiver board.

   *Turn the potentiometer clockwise until the audio is squelched if it is not already so.

   *SLOWLY turn the potentiometer counter-clockwise until the squelch is just broken (audio can be heard).

   *Run test procedure 4.3.3.17.j to verify that the squelch has been adjust properly.

3. Transmitter Mic Gain.

   *Configure the equipment as shown in section 4.3.3.18.

   *Tune the GNC 250/300 ACTV channel to 126.97 Mhz.

   *Apply a 275mV RMS audio signal at 1000 Hz to the MIC AUDIO HI input to the test panel.

   NOTE: The MIC AUDIO HI input as a 500 ohm input impedance, make sure that the audio signal generator is set up to deliver 275 mV RMS into this load impedance.

   *Insert a tuning tool in the MIC GAIN hole in the tope cover until it fits in the slot of the mic gain potentiometer on the comm receiver board.

   *Turn the potentiometer fully clockwise.

   *Key the transmitter and monitor the demodulated audio output on the oscilloscope.

   *SLOWLY adjust the potentiometer counter-clockwise increasing the demodulated audio output level until it just reached the point where no further increase is obtainable.

   *Perform test procedure 4.3.3.18.d to verify that this adjustment has been done properly.

4. Transmitter Sidetone.

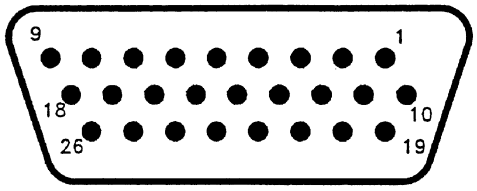
   *Monitor the comm audio output level with audio analyzer. Use the 510 ohm load on the analyzer input.

   *Apply a 275 mV RMS audio signal at 1000 Hz to the MIC AUDIO HI input to the test panel.

   *Insert a tuning tool in the SIDETONE hole in the top cover until it fits in the slot of the sidetone potentiometer on the comm receiver board.

   *Key the transmitter and adjust the potentiometer until the comm audio output level equals 1.4 Vrms + or - 5%.

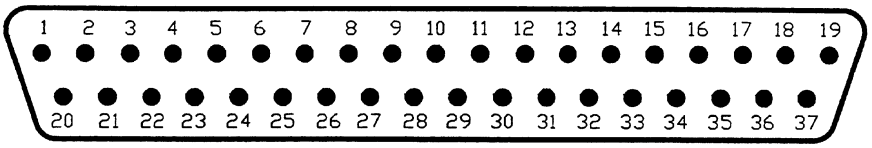
FIGURE 10. J2 REAR CONNECTOR PINOUT DEFINITION



VIEW OF J2 CONNECTOR FROM BACK OF UNIT

PIN	DESCRIPTION
1	COMPRESSOR TEST
2	MIC AUDIO HI
3	MIC AUDIO LO
4	MIC KEY
5	COMM AUDIO HI
6	COMM AUDIO LO
7	GROUND
8	MIC INTERCOM
9	IF AGC TEST
10	REMOTE TRANSFER
11	UNSQUELCHED AUDIO
12	TRANSMIT INTERLOCK
13	SEQUENCE HOLD LOW (GNC 300 ONLY)
14	ALTITUDE D4
15	ALTITUDE A1
16	ALTITUDE A2
17	ALTITUDE A4
18	ALTITUDE B1
19	ALTITUDE B2
20	ALTITUDE B4
21	ALTITUDE C1
22	ALTITUDE C2
23	ALTITUDE C4
24	ALTITUDE COMMON
25	GROUND
26	REMOTE ENTER

FIGURE 11. J1 REAR CONNECTOR PINOUT DEFINITION



VIEW OF J1 CONNECTOR FROM BACK OF UNIT

PIN #	DESCRIPTION
1	GPS D-BAR LEFT +
2	GPS TO +
3	GPS FLAG +
4	COMMON
5	RESERVED
6	RESERVED
7	GPS OBI CLOCK
8	GPS OBI DATA
9	APPROACH ARM LOW (GNC 300 ONLY)
10	GPS SUPER FLAG HIGH
11	RS-422 IN A (GNC 300 ONLY)
12	ARRIVAL ANNUNCIATOR
13	APPROACH ACTV ANNUNCIATOR (GNC 300 ONLY)
14	GPS ROTOR C (GNC 300 ONLY)
15	ARINC 429 OUT B
16	ARINC 429 OUT A
17	RS-232 IN 1
18	RS-232 IN 2 (USED FOR TESTING ONLY)
19	RE-232-OUT 2
20	MESSAGE ANNUNCIATOR
21	POWER 13.8 VDC
22	GROUND
23	GPS OBI SYNC
24	RS-232 OUT 1
25	POWER 13.8VDC
26	GROUND
27	RS-422 IN B (GNC 300 ONLY)
28	APPROACH ARM ANNUNCIATOR (GNC 300 ONLY)
29	CHARGE ENABLE
30	REMOTE BATTERY, +
31	SPARE
32	ARINC 429 IN A (GNC 250 USE IS LIMITED TO TESTING)
33	ARINC 429 IN B (GNC 250 USE IS LIMITED TO TESTING)
34	REMOTE BATTERY
35	GPS STATOR D (GNC 300 ONLY)
36	TEST SELECT
37	GPS STATOR F (GNC 300 ONLY)

SECTION 5
ILLUSTRATED PARTS LIST

5.1 LIST OF REPLACEABLE PARTS

The table below lists the parts which are available to authorized maintenance shops

011-00107-00	CDU GNC300
011-00107-01	CDU GNC250
000-00108-00	Comm Chassis Assy (GNC 250/300) 14V
011-00147-00	Order 010-10040-02 Antenna, Flange mt
011-00183-00	GPS rcvr assy (GNC 250/300)
011-00230-00	Pwr/Vol swch w/flx ckt. cbl (GNC)
011-00231-00	Rtry Swch Assy. w/flex circuit (GNC)
011-00265-00	Transmitter Sub-Assy (GNC)
012-00049-00	Receiver Bd Assy (GNC)
012-00066-00	CPU Board GNC 250
012-00066-50	CPU Board GNC 300
012-00067-00	Key Bd Assy (GNC)
012-00092-00	Intrface Bd (GNC)
145-00134-00	PMP, Insulator TO-3GNC
250-00026-00	Insulator, TO-3
253-00011-00	Gasket, Neoprene
320-00088-00	RG58 10dB cable @ 1.5 GHz
360-00009-00	Lithium Cell
361-00008-00	Btry Pk, 9.6V Nicad
362-00014-00	Wall Charger GNC
410-00004-01	Cont Rotary sw. pot
410-00007-00	Cont Rotary Sw/Dual Cnctrc
430-00002-00	Knob Inner, w/o Trim ring (w/set screws)
430-00010-00	Knob, Power dimmer with shaft
430-00011-00	Knob, Outer
430-00013-00	Knob Assy Illum skirted Cnctrc
430-00014-00	Knob, Power/Volume
470-00008-00	Lens, 300 GNC
470-00008-01	Lens, 250 GNC

5.2 ASSEMBLY DRAWINGS

The following assembly drawings are provided for part identification and to aid in assembly/disassembly of the GNC 250/300.

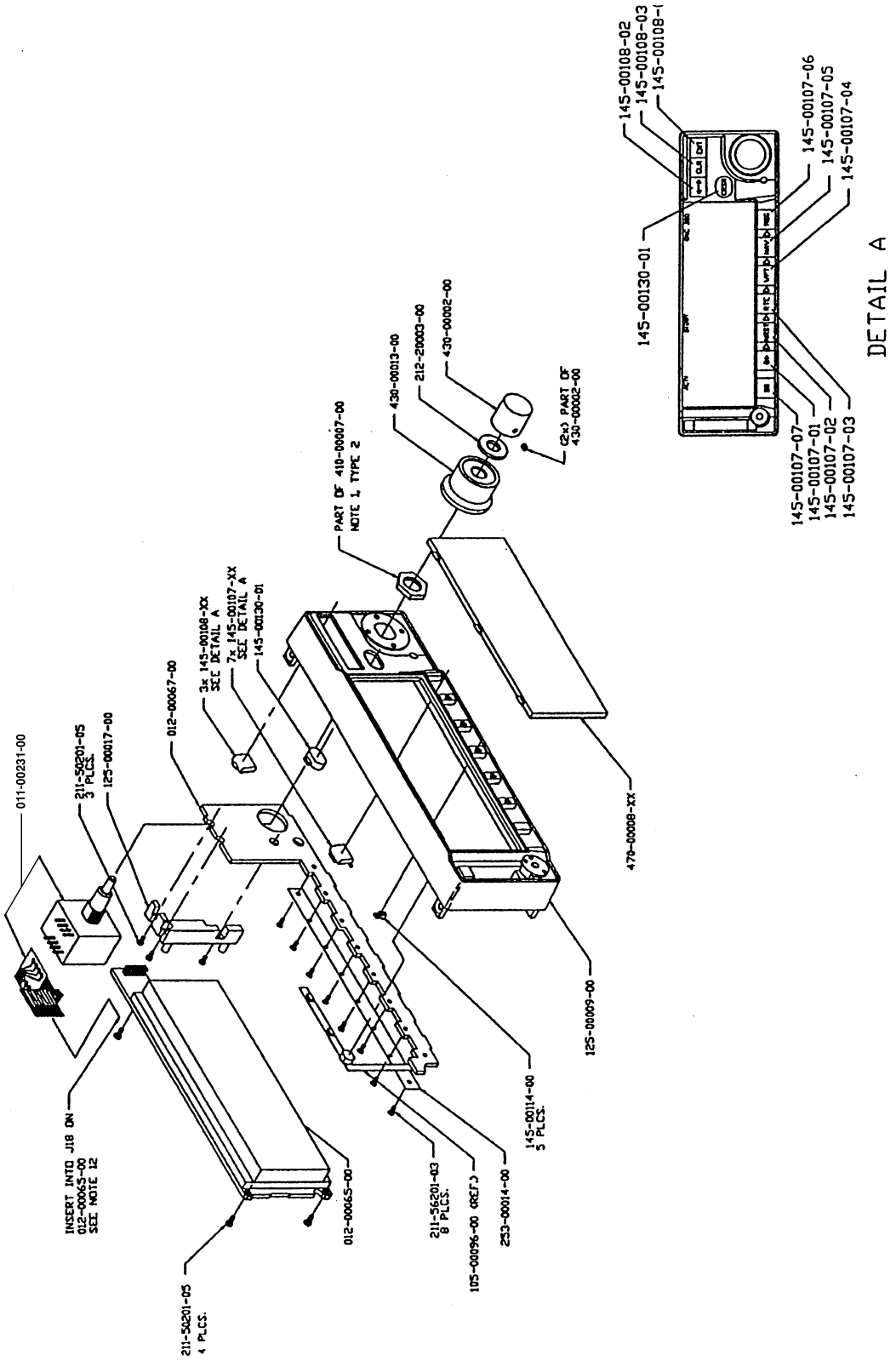


Figure 12. GNC 250/300 Assembly Drawing (View 1)
(011-00107-01/00)

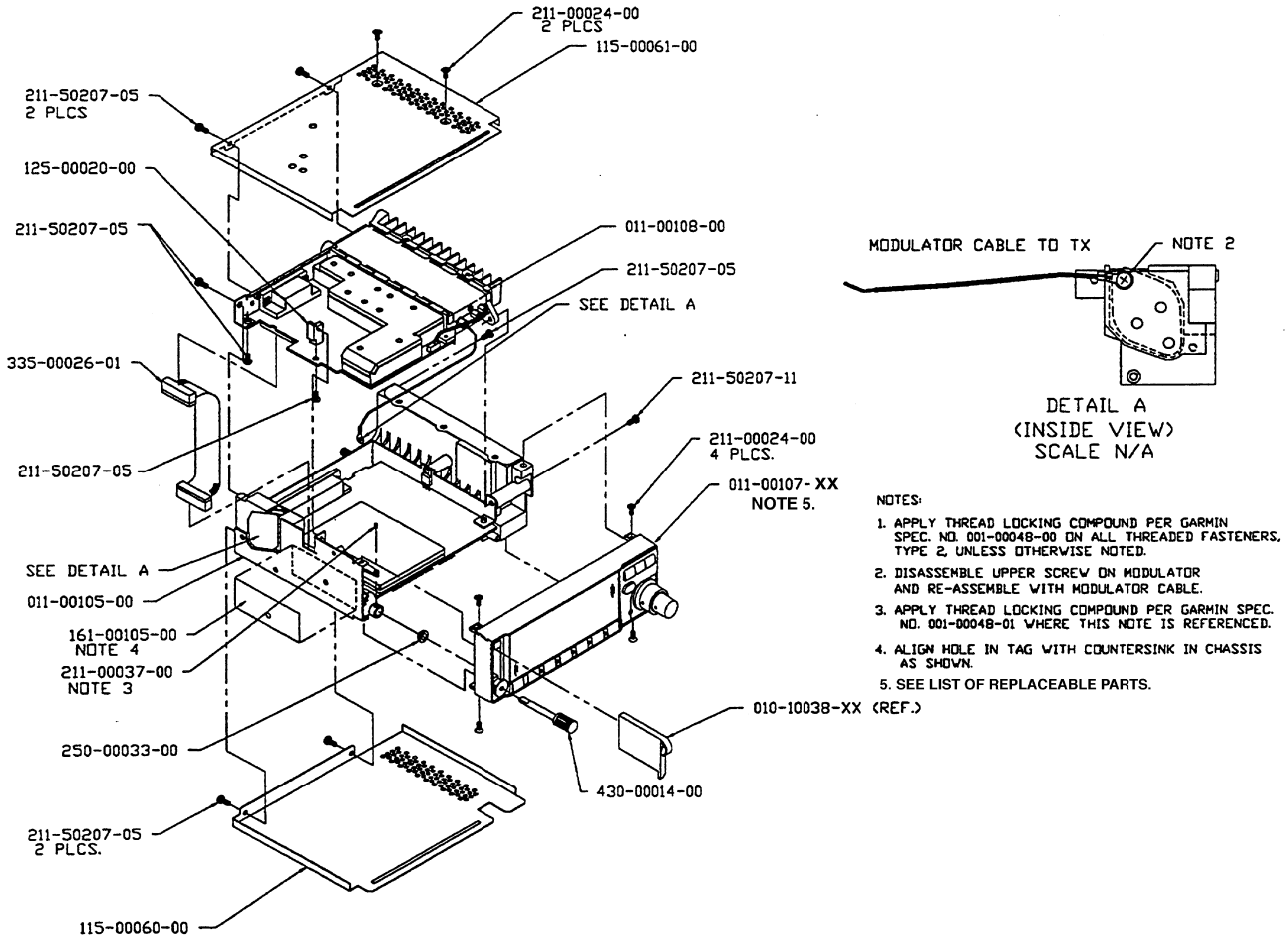


Figure 13. GNC 250/300 Assembly Drawing (View 2)

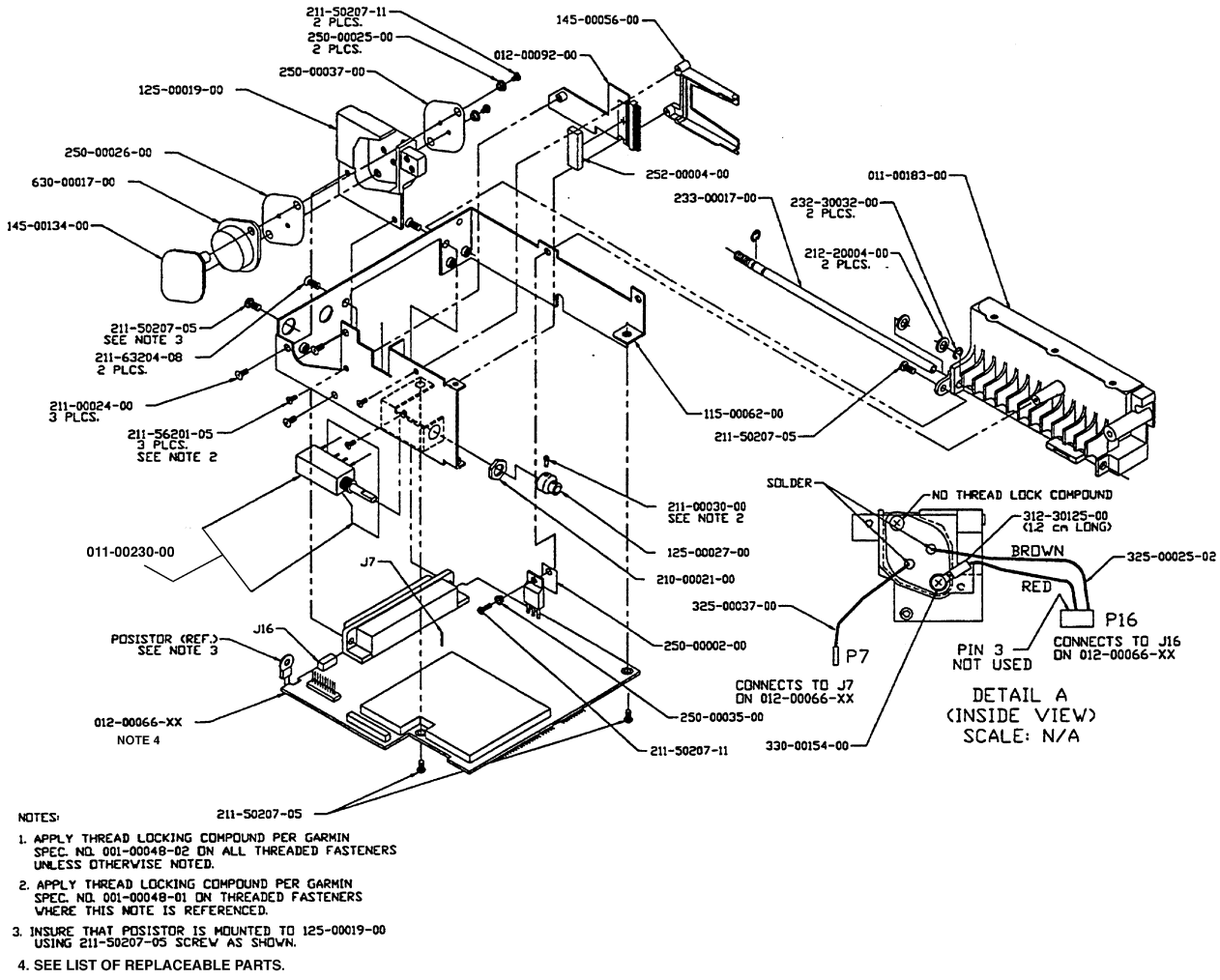


Figure 14. GNC 250/300 Assembly Drawing (View 3)

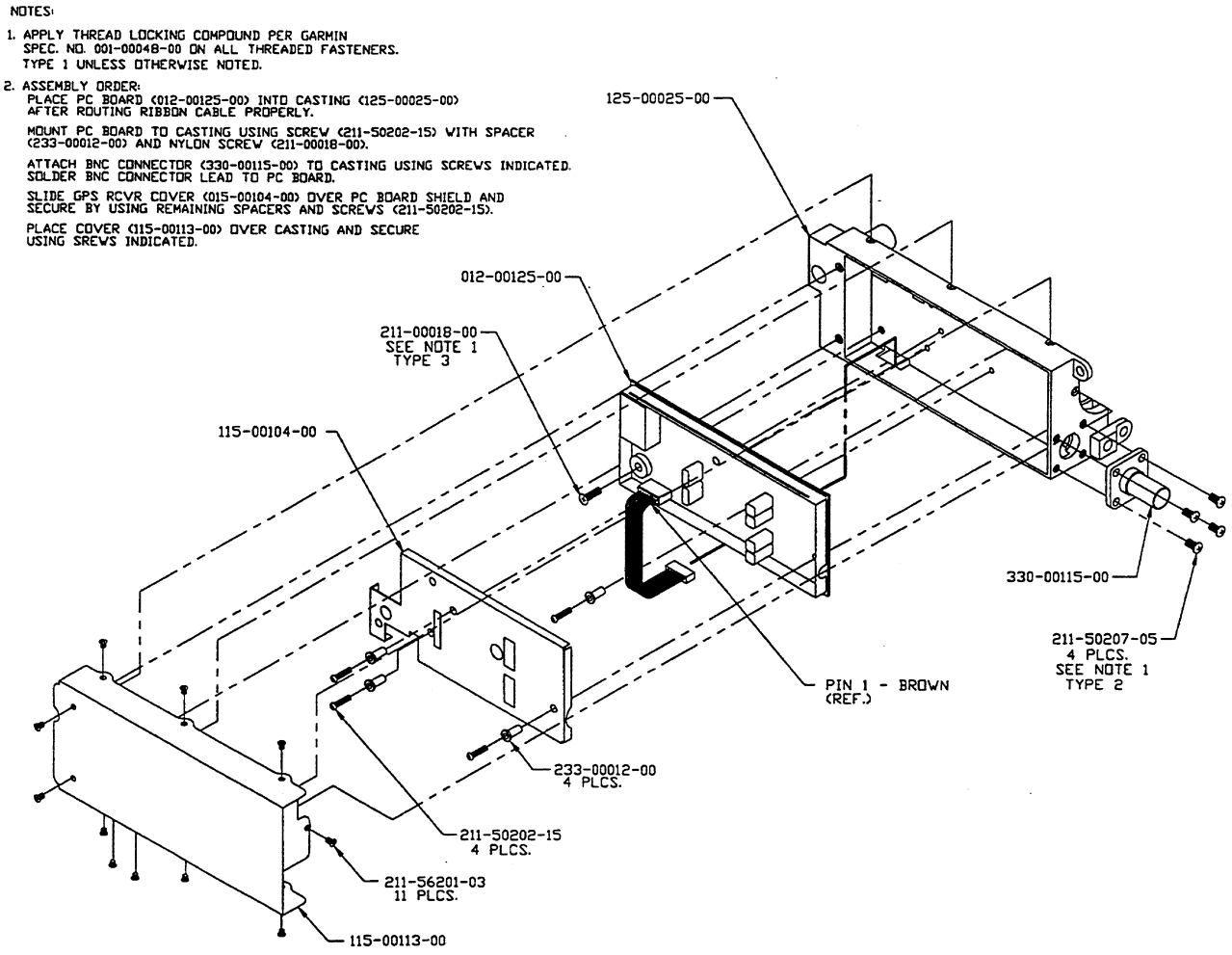


Figure 15. GNC 250/300 Assembly Drawing (View 4)
(011-00183-00)

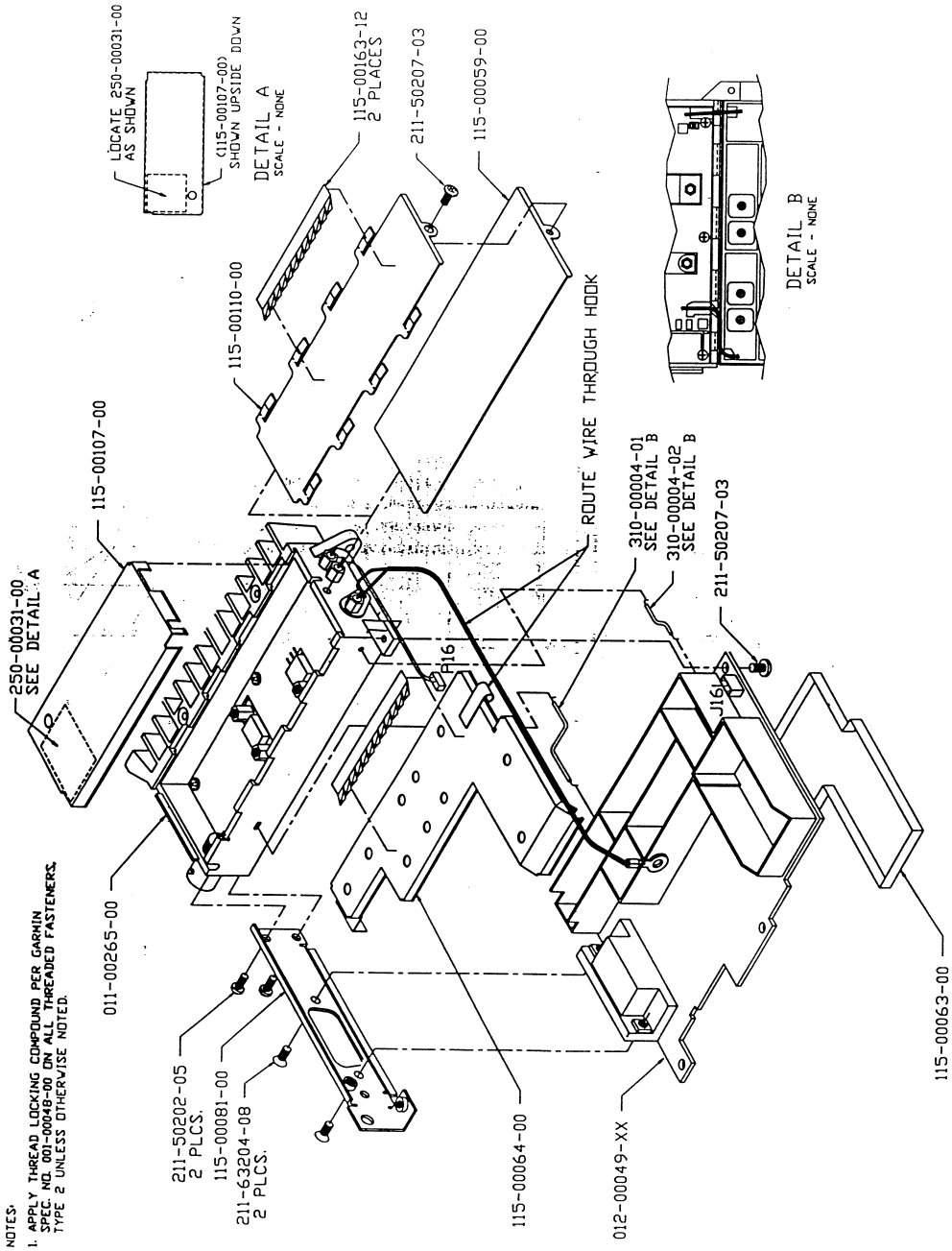


Figure 16. GNC 250/300 Assembly Drawing (View 5)
(011-00108-00)

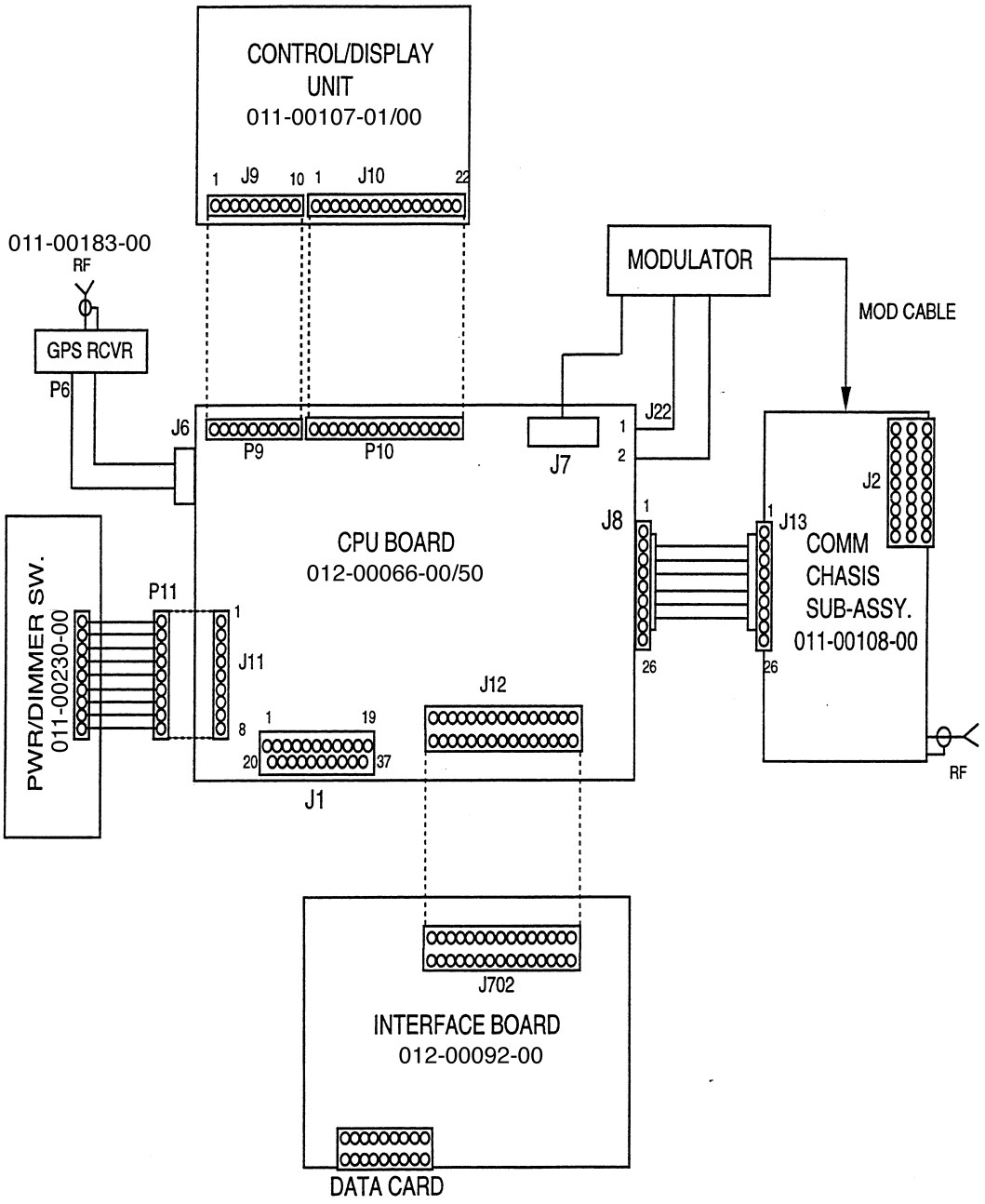


Figure 17. GNC 250/300 Connector Diagram