



# Global Positioning Simulator

## GPS-101-2

### Operation Manual

1002-1004-200

Issue-4

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# OPERATION MANUAL

## GLOBAL POSITIONING SIMULATOR

### GPS-101-2

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Aeroflex

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**Electromagnetic Compatibility:**

For continued EMC compliance, a double shielded and properly terminated external interface cable must be used with this equipment when interfacing with the COMM 1, COMM-2 and AUX I/O Connectors.

For continued EMC compliance, all external cables must be shielded and 3 meters or less in length.

**Nomenclature Statement:**

In this manual the GPS-101, GPS-101 Test Set, Unit, Test Set, Global Positioning Simulator or GPS-101 Global Positioning Simulator refers to the GPS-101-2 Global Positioning Simulator.



OPERATION MANUAL  
GPS-101-2

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## SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

**REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL. THIS UNIT CONTAINS NO OPERATOR SERVICEABLE PARTS.**

**WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.**

### CASE, COVER OR PANEL REMOVAL

Removing the Chassis Assembly from the Case Assembly exposes the operator to electrical hazards that can result in electrical shock or equipment damage. Do not operate this Test Set with the Chassis Assembly removed from the Case Assembly.

### SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating this equipment.

**CAUTION:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

**WARNING:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

### SAFETY SYMBOLS IN MANUALS AND ON UNITS



**CAUTION:** Refer to accompanying documents. (This symbol refers to specific CAUTIONS represented on the unit and clarified in the text.)



**AC OR DC TERMINAL:** Terminal that may supply or be supplied with AC or DC voltage.



**DC TERMINAL:** Terminal that may supply or be supplied with DC voltage.



**AC TERMINAL:** Terminal that may supply or be supplied with AC or alternating voltage.



**SWITCH ON/OFF (Push-Push):** Power to the device is connected ON or disconnected OFF.

### EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

### USE OF PROBES

Check specifications for the maximum voltage, current and power ratings of any connector on the Test Set before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

### POWER CORDS

Power cords must not be frayed, broken nor expose bare wiring when operating this equipment.

### USE RECOMMENDED FUSES ONLY

Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

### INTERNAL BATTERY

This unit contains a Sealed-Lead Battery, serviceable only by a qualified technician.

**CAUTION:** SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.



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## INTRODUCTION - GPS-101-2 GLOBAL POSITIONING SIMULATOR

This manual contains operating instructions for testing GPS receivers. It is strongly recommended that personnel be thoroughly familiar with the contents of this manual before attempting to operate this equipment.

Refer all servicing of the GPS-101-2 Test Set to qualified technical personnel.

### ORGANIZATION

This manual is divided into five sections as follows:

#### CHAPTER 1 - OPERATION

- Section 1 - DESCRIPTION (general description and functional capabilities)
- Section 2 - OPERATION (installation; controls, connectors and indicators; performance evaluation; operation, remote operation)
- Section 3 - SPECIFICATIONS
- Section 4 - SHIPPING
- Section 5 - STORAGE



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**CHAPTER ONE**  
**GPS-101-2 TEST SYSTEM**  
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## SECTION 1 - DESCRIPTION

### 1. GENERAL DESCRIPTION AND CAPABILITIES

#### 1.1 GENERAL

The GPS-101-2 Global Positioning Simulator provides for installation and functional bench testing of global positioning system (GPS) receivers.

The GPS-101-2 simulates one of many specific global positioning satellites. Selected specific satellite vehicle (SV) signals transmitted with selected navigation (NAV) data test patterns are used to verify the operational integrity of GPS receivers.

#### 1.2 SYSTEM OPERATION

Most GPS receivers operate by receiving the coarse acquisition (C/A) encoded signals on the L1 (1575.42 MHz) channel. The receiver uses the C/A encoded signal to calculate the distance from each specific satellite.

The combined 50 Hz NAV data and C/A encoded satellite signals contain satellite position and information accuracy. The full navigation message contains 25 data frames, each having 1500 bits of information and includes an almanac for the receiver data base. The full navigation message takes about 12.5 minutes to transmit.

The almanac data base in the GPS receiver maintains position information on all the satellites for any given time. From the last acquired position and using the almanac data base, the GPS receiver selects three (two dimensional positioning) or four (three dimensional positioning) of the best satellites known to be in view at the current time. After the receiver starts tracking the three or four selected satellites, position is calculated using the received information.

#### 1.3 FUNCTIONAL CAPABILITIES

The GPS-101-2 has the following functional capabilities:

- Generates GPS signals on the L1 channel (1575.42 MHz) frequency.
- Provides adjustable RF output level from -85 to -145 dBm in 1 dB steps (to verify system and/or receiver sensitivity).
- Offsets Doppler frequency as selected (no shift, -4 or +4 kHz).
- Simulates one of 32 global positioning satellites or one of five ground stations by transmitting the selected phase modulated C/A code (Gold Code) signal identifying the particular satellite or ground station.
- Provides selectable preset 50 Hz NAV data test patterns.
- Allows uploading and downloading of almanac data. Refer to Appendix B.
- Provides adjustable date and time. (The GPS-101-2 has the current date and time [UTC] loaded initially at the factory.)
- Operates on battery power for approximately six hours.



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## SECTION 2 - OPERATION

### 1. INSTALLATION

#### 1.1 POWER

The GPS-101-2 is powered by an internal battery. The battery charging circuit enables the operator to recharge the battery anytime the unit is connected to ac power. The GPS-101-2 can operate continuously on ac power for servicing and/or bench tests.

The internal battery is equipped to power the GPS-101-2 for six to eight continuous hours of use. When the battery needs recharging, the ON Indicator illuminates red.

The GPS-101-2 conserves battery power with the Battery Saver function. The Battery Saver function shuts off the GPS-101-2 after 15 minutes without key or control activity when operating on battery power.

#### Battery Saver Function:

STEP	PROCEDURE
1.	Press PWR Key to activate GPS-101-2 (ON Indicator illuminates).
2.	Press SETUP Key. Continue pressing SETUP Key, as needed, to display System Setup Menu.

Setup: System

3. Press ↓ SELECT Key to enter Battery Saver Submenu field.

Setup: System  
Battsaver: Yes

4. Turn SLEW/STEP Control to select **Yes** to activate Battery Saver function or **No** to deactivate Battery Saver function.

#### 1.2 SAFETY PRECAUTIONS

Two important safety precautions must be observed during installation and operation. Aeroflex assumes no liability for failure of customer to comply with the safety precautions outlined in this manual:

- Installation/operating personnel should not attempt to install or operate the GPS-101-2 without first reading and complying with the instructions contained in this manual. All procedures contained in this manual must be performed in exact sequence and manner described.
- The ac power cable is equipped with a standard three-prong plug and must be connected to a properly grounded three-prong receptacle.

**WARNING: DO NOT USE A THREE-PRONG TO TWO-PRONG ADAPTOR PLUG. DOING SO CREATES A SHOCK HAZARD BETWEEN THE CHASSIS AND ELECTRICAL GROUND.**

- Due to potential for electrical shock within the Test Set, the Case Assembly must be closed when the Test Set is connected to an external power source.
- Battery replacement and internal adjustments must only be performed by qualified service technicians.

### 1.3 AC POWER REQUIREMENTS

The GPS-101-2 operates over a voltage range of 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz, according to the internal Line Supply Voltage Select Switch setting (only serviceable by a qualified technician). Refer to Battery/Voltage Instructions. The specified fuse ratings are listed in 1-2-1, Table 1.

**CAUTION:** FOR CONTINUOUS PROTECTION AGAINST FIRE, REPLACE ONLY WITH FUSES OF THE SPECIFIED VOLTAGE AND CURRENT RATINGS.

INPUT VOLTAGE	F1 AND F2 FUSES
100 to 120 VAC	1.0 A, 250 V Fast Blo (Type F) (Aeroflex: 5106-4501-000) (Bussman: AGC1)
220 to 240 VAC	0.5 A, 250 V Fast Blo (Type F) (Aeroflex: 5106-0000-016) (Bussman: AGC1/2)

Specified Fuse Ratings  
Table 1

### 1.4 BATTERY CHARGING

The battery charger operates whenever ac power is applied to the Test Set. When charging, the battery reaches a full charge in approximately half the discharge time (≈4 hours from a full discharge). The CHARGE Indicator illuminates red when operating in maximum charge mode (battery at <80%). The CHARGE Indicator illuminates green when operating in trickle charge mode (battery at ≥80%).

The battery should be charged every three months (minimum) or disconnected (only by a qualified technician) for long term inactive storage periods of more than six months.

Charging Battery:

STEP	PROCEDURE
1.	Verify GPS-101-2 is OFF.
2.	Connect supplied ac power cable to AC INPUT Connector. (CHARGE Indicator illuminates.)
3.	Allow four to six hours for full battery charge or until CHARGE Indicator illuminates green.

**NOTE:** The GPS-101-2 can be used while charging the battery.

### 1.5 DISPLAY CONTROL

Because of varying preferences and environmental considerations, the GPS-101-2 provides back light and contrast controls for the LCD:

- Press BACK LT Key to set LCD back light On or Off. (Off increases battery run time.)
- Press ↑ CONTRAST Key to decrease contrast (makes characters lighter on display).
- Press ↓ CONTRAST Key to increase contrast (makes characters darker on display).

### 1.6 MENU SETTINGS

The GPS-101-2 saves current settings for all data fields, except date and time, when powered down. Date and time fields are continually updated by the internal real time clock (RTC) and changes are only saved by the user. Refer to para 1-2-1.8. On power up, the GPS-101-2 restores the saved settings for all Menu fields. The GPS-101-2 also returns to the last screen used before the previous power down.

### 1.7 ALMANAC WARNING

The GPS-101-2 displays alternating warning screens when the internal almanac might be out of date:

**WARNING: Almanac  
May Be Expired**

**Contact IFR at  
1-800-835-2350**

**CAUTION:** USING THE GPS-101-2 WITH AN OUTDATED ALMANAC MAY CAUSE THE GPS RECEIVER TO FAIL MOMENTARILY IN LOCATING SATELLITES OR SHOW SYMPTOMS OF PRODUCT FAILURE.

Refer to Appendix B when the almanac warning appears.

## 1.8 SETTING DATE AND TIME

The GPS-101-2 provides two different times and dates, real time and current session time. When received from the factory, the GPS-101-2 has the current Coordinated Universal Date and Time (UTC) loaded as the internal real time clock (RTC) reference. Upon power up, the internal real time clock (RTC) accurately updates the current date and time from the RTC reference. Some GPS receivers may require local time or other time zones for testing. The user can adjust the current session time without changing the RTC reference.

### Date Function:

**NOTE:** Steps 1 through 8 provide date settings for current session only. Steps 9 and 10 store date settings as new RTC reference.

STEP	PROCEDURE
------	-----------

1. Press PWR Key to activate GPS-101-2 (ON Indicator illuminates).
2. Press SETUP Key. Continue pressing SETUP Key, as needed, to display Date Setup Menu.

Setup: Date
-------------

3. Press ↓ SELECT Key to enter Month Submenu field.

Setup: Date Mar 3 2008 MON
-------------------------------

4. Use SLEW/STEP Control to set month (Jan to Dec).
5. Press ↓ SELECT Key to enter Date Submenu field.
6. Turn SLEW/STEP Control to set date (1 to 28, 29, 30 or 31; depending on month).
7. Press ↓ SELECT Key to enter Year Submenu field.

STEP	PROCEDURE
------	-----------

8. Turn SLEW/STEP Control to set year (1980 to 2050). (The weekday automatically adjusts to new settings.)
9. Press ↓ SELECT Key to enter Date Set Submenu field.

Setup: Date Set: Use Spinner
---------------------------------

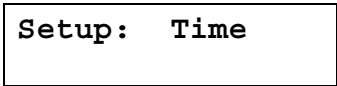
10. Turn SLEW/STEP Control (Spinner) to save current date settings.

**Time Function:**

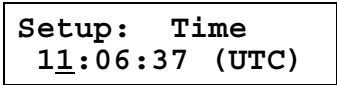
**NOTE:** Steps 1 through 8 provide time settings for current session only. Steps 9 and 10 store time settings as new RTC reference.

STEP	PROCEDURE
------	-----------

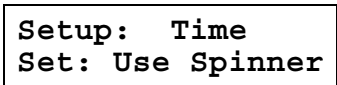
1. Press PWR Key to activate GPS-101-2 (ON Indicator illuminates).
2. Press SETUP Key. Continue pressing SETUP Key, as needed, to display Time Setup Menu.



3. Press ↓ SELECT Key to enter Hour Submenu field.



4. Use SLEW/STEP Control to set hour (00 to 23).
5. Press ↓ SELECT Key to enter Minute Submenu field.
6. Turn SLEW/STEP Control to set minute (00 to 59).
7. Press ↓ SELECT Key to enter Second Submenu field.
8. Turn SLEW/STEP Control to set second (00 to 59).
9. Press ↓ SELECT Key to enter Time Set Submenu field.



10. Turn SLEW/STEP Control (Spinner) to store current time settings as new internal RTC reference.

**1.9 OPERATION INTERFACE**

There are no special connections or requirements to interface the GPS-101-2 with the GPS receiver to be tested.

**NOTE:** The GPS receiver is also referred to as the Unit Under Test (UUT).

**Direct Connection**

Refer to 1-2-1, Figure 1.

- Use RF cable to connect RF OUT Connector to UUT Receive Connector.
- Conduct GPS Receiver Test Operation according to 1-2-4.

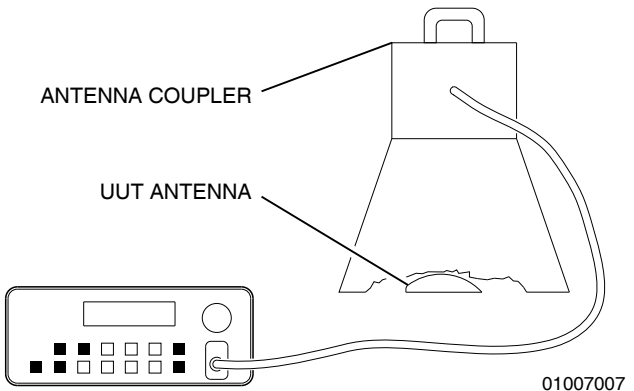


Direct Connect Testing  
Figure 1

**Antenna Coupler Connection**

Refer to 1-2-1, Figure 2.

- Use RF cable to connect RF OUT Connector to Antenna Coupler Connector.
- Cover UUT Antenna with Antenna Coupler.



Antenna Testing  
Figure 2

### 1.10 EXTERNAL CLEANING

The following procedure contains routine instructions for cleaning the outside of the Test Set.

**CAUTION:** DISCONNECT POWER FROM TEST SET TO AVOID POSSIBLE DAMAGE TO ELECTRONIC CIRCUITS.

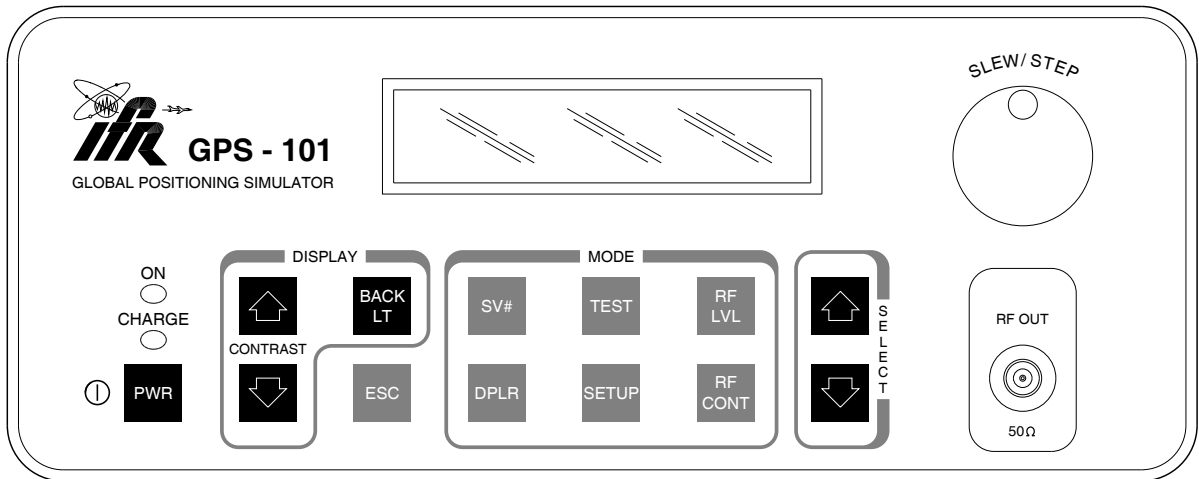
<u>STEP</u>	<u>PROCEDURE</u>
1.	Clean front panel buttons and display face with soft lint-free cloth. If dirt is difficult to remove, dampen cloth with water and a mild liquid detergent.
2.	Remove grease, fungus and ground-in dirt from surfaces with soft lint-free cloth dampened (not soaked) with isopropyl alcohol.
3.	Remove dust and dirt from connectors with soft-bristled brush.
4.	Cover connectors, not in use, with suitable dust cover to prevent tarnishing of connector contacts.
5.	Clean cables with soft lint-free cloth.
6.	Paint exposed metal surface to avoid corrosion.



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## 2. CONTROLS, CONNECTORS AND INDICATORS

### 2.1 FRONT PANEL



01007001

GPS-101-2 Front Panel  
Figure 3

#### LCD

Displays the various screens used for setups, simulation tests, self tests and calibrations.

#### SLEW/STEP Control

Performs edits of the selected data field. Also selects top level (root) Setup Menu screen from any other root Setup Menu screen.

#### ON Indicator

Two color LED illuminates to indicate power is On (green-normal operation, red-low battery).

#### CHARGE Indicator

Two color LED illuminates to indicate internal battery is charging (green is  $\geq 80\%$  charged battery, red is charging low battery).

#### PWR Key

Applies power to GPS-101-2 Satellite Simulator; push ON (*I*), push OFF (*O*).

#### ↑ or ↓ CONTRAST Key

Controls the contrast for the LCD.

#### BACK LT Key

Toggles the LCD backlight ON or OFF.

#### ESC Key

- Escapes from any Setup Submenu to corresponding root Setup Menu.
- Escapes from any root Setup Menu to Main Menu screen and positions cursor to RF Level field.

#### SV# Key

Enters Main Menu screen and moves cursor to the Satellite Vehicle (SV) field.

#### DPLR Key

Enters Main Menu screen and moves cursor to the Doppler Offset (DPLR) field.

#### TEST Key

Enters Main Menu screen and moves cursor to the Test (T) field.

#### SETUP Key

Enters last accessed Setup Menu screen from Main Menu Screen. Continued pressing selects root Setup Menu screen.

#### RF LVL Key

Enters Main Menu screen and moves cursor to the RF Level field.

## RF CONT Key

Enters Main Menu screen and moves cursor to the RF Control field.

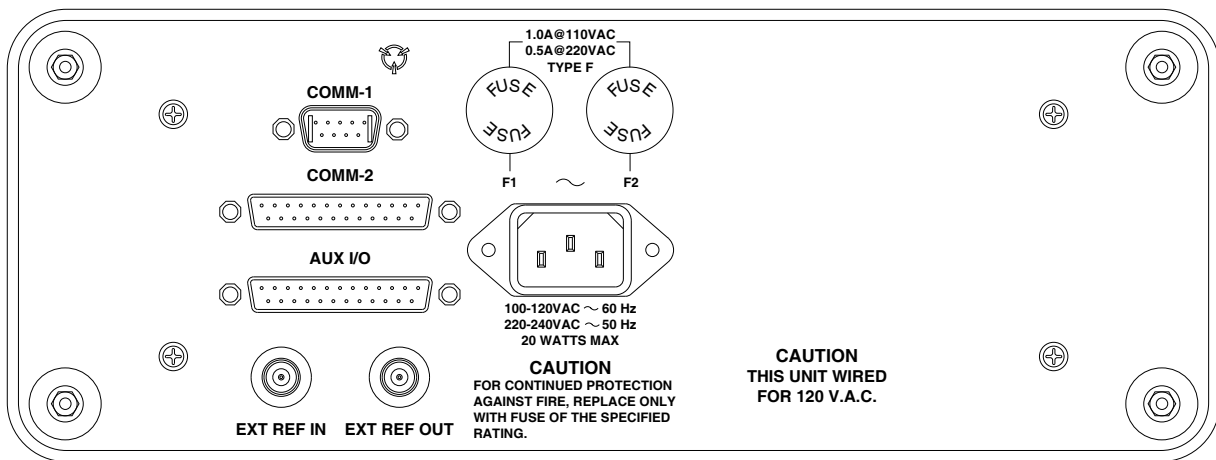
## ↑ or ↓ SELECT Key

Enters the Setup Menu fields (submenu screens) under the current root Setup Menu. Also edits currently selected data field in Main Menu screen.

## RF OUT Connector

Transmits the simulated satellite signal.

## 2.2 REAR PANEL



01007002

GPS-101-2 Rear Panel  
Figure 4

### COMM-1 Connector

Provides serial channel for uploading and downloading of satellite almanac information. Refer to Appendix B.

### COMM-2 Connector

Provides for communication with GPS receiver under test.

### AUX I/O Connector

Provides input for external modulation.

### EXT REF IN Connector

Provides input for an alternate external 10.00 MHz time base.

### EXT REF OUT Connector

Provides the 10.00 MHz internal system clock.

### FUSE (F1)

Contains one ac line fuse. Refer to para 1-2-1.3.

### FUSE (F2)

Contains one ac line fuse. Refer to para 1-2-1.3.

### AC INPUT Connector

Receives ac power for operation and/or charging the internal battery.



### 3. PERFORMANCE EVALUATION

The GPS-101-2 is equipped with a Selftest for quick performance evaluation. Selftest checks memory (RAM and ROM), internal communication channels, logic cell array (LCA), display and internal clock for operational capability. The GPS-101-2 also performs an abbreviated Selftest on power up. Selftest provides Pass/Fail indications for the complete set of tests (Summary) and each test performed.

STEP	PROCEDURE
------	-----------

1. Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)
2. Press SETUP Key. Continue pressing SETUP Key, as needed, to display Selftest Setup Menu.

Setup: Selftest
-----------------

3. Press ↓ SELECT Key to enter Summary Selftest Screen.

Setup: Selftest ALL PASS
-----------------------------

(The GPS-101-2 displays results of last Selftest.)

4. Press ↓ SELECT Key to enter ROM Selftest Screen.

Setup: Selftest Rom: Pass
------------------------------

(The GPS-101-2 displays results of last ROM Selftest.)

5. Press ↓ SELECT Key to enter RAM Selftest Screen.

Setup: Selftest Ram: Pass
------------------------------

(The GPS-101-2 displays results of last RAM Selftest.)

STEP	PROCEDURE
------	-----------

6. Press ↓ SELECT Key to enter NVRAM Selftest Screen.

Setup: Selftest NVRam: Pass
--------------------------------

(The GPS-101-2 displays results of last NVRAM Selftest.)

7. Press ↓ SELECT Key to enter COMM-1 Connector Selftest Screen.

Setup: Selftest Comm1: Pass
--------------------------------

(The GPS-101-2 displays results of last COMM-1 Connector Selftest.)

8. Press ↓ SELECT Key to enter COMM-2 Connector Selftest Screen.

Setup: Selftest Comm2: Pass
--------------------------------

(The GPS-101-2 displays results of last COMM-2 Connector Selftest.)

9. Press ↓ SELECT Key to enter LCD Selftest Screen.

Setup: Selftest LCD: Pass
------------------------------

(The GPS-101-2 displays results of last Liquid Crystal Display [LCD] Selftest.)

10. Press ↓ SELECT Key to enter RTC Selftest Screen.

Setup: Selftest RTC: Pass
------------------------------

(The GPS-101-2 displays results of last Real Time Clock [RTC] Selftest.)

**STEP                      PROCEDURE**

---

11. Press ↓ SELECT Key to enter LCA Selftest Screen.

<b>Setup:    Selftest</b>
<b>LCA:            Pass</b>

(The GPS-101-2 displays results of last Logic Cell Array [LCA] Selftest.)

12. Press ↓ SELECT Key to enter Selftest Start Screen.

<b>Setup:    Selftest</b>
<b>Spinner to Start</b>

13. Turn SLEW/STEP Control (Spinner) to initiate Selftest.

(Selftest cycles through all of the tests and automatically displays the Summary Selftest Screen when finished.)

14. Repeat Steps 4 through 11 to view current Selftest results.

15. If any failure exists, refer servicing to qualified technician or contact:

Aeroflex  
Customer Service Department.

Phone: (800) 835-2350  
FAX: (316) 524-2623  
Email: [americas.service@aeroflex.com](mailto:americas.service@aeroflex.com)

## 4. OPERATION

### 4.1 MAIN MENU (GPS Receiver Test Operation)

**NOTE:** Some GPS receivers enter a search mode if multiple satellites are not acquired and may drop a single satellite signal after a short period of time.

STEP	PROCEDURE
------	-----------

1. If needed, set GPS-101-2 date and time (para 1-2-1.8).
2. Connect GPS-101-2 to GPS Receiver (para 1-2-1.9).
3. Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)
4. Press SV# Key to edit Satellite Vehicle (SV) field.

SV13*	T1	-100dBm
DPLR0		RFOFF

(\* indicates unhealthy SV or no almanac data is available.)

5. Use SLEW/STEP Control or ↑ or ↓ SELECT Key to select SV (1-32) or ground station to simulate (33-37).
6. Press TEST Key to edit Test (T) field.

SV02	T1	-100dBm
DPLR0		RFOFF

7. Use SLEW/STEP Control or ↑ or ↓ SELECT Key to select 50 Hz NAV data test pattern (1-9). Set to:
  - **T1** for NAV Data with almanac and current Time/Date.
  - **T2** for fixed test pattern. Refer to Appendix B.
  - **T3** 110011001100... test pattern.

**T4** through **T9** are not used at this time and no NAV Data is transmitted when selected (C/A Code only).

STEP	PROCEDURE
------	-----------

8. Press RF LVL Key to edit RF Level field.

SV02	T1	-125dBm
DPLR0		RFOFF

9. Use SLEW/STEP Control or ↑ or ↓ SELECT Key to set output level (-145 to -85 dBm). (Typical level setting for initial lock-on is **-120dBm** for direct connection or **-105dBm** using Antenna Coupler.)

For actual RF level into UUT, calculate cable loss (≈4 dB) for direct connection. When using Antenna Coupler, calculate antenna gain, cable loss and coupling loss (≈20 dB).

**NOTE:** Setting too high an output level may cause erroneous receiver indications due to signal saturation.

10. Press DPLR Key to edit Doppler Offset (DPLR) field.

SV02	T1	-125dBm
DPLR+		RFOFF

11. Use SLEW/STEP Control or ↑ or ↓ SELECT Key to set Doppler Offset. Set to:
  - **DPLR0** for no offset (normal).
  - **DPLR+** for +4 kHz Doppler shift (simulates satellite moving towards receiver).
  - **DPLR-** for -4 kHz Doppler shift (simulates satellite moving away from receiver).

12. Press RF CONT Key to edit RF Control field.

SV02	T1	-125dBm
DPLR+		RFO <u>N</u>

STEP	PROCEDURE
------	-----------

13. Use SLEW/STEP Control or ↑ or ↓ SELECT Key to select signal. Set to:
- **RFOFF** to disable output through RF OUT Connector.
  - **RFON** for 1575.42 MHz CW modulated with Gold Code and selected 50 Hz NAV test data pattern (normal operation).
  - **RFEXT** for external BPSK modulation through AUX I/O Connector. Refer to para 1-2-3.3.
  - **RFCW** for 1575.42 MHz CW.
  - **RFSQR** for 1575.42 MHz CW modulated with 511.5 kHz square wave.
14. Verify GPS Receiver operation.

## 4.2 EXTERNAL INPUT OPERATION

### COMM-1 Connector

The COMM-1 Connector provides for the uploading of almanac data. Refer to Appendix B. Operating parameters for the COMM-1 Connector are set in the Comm-1 Setup Submenus.

STEP	PROCEDURE
------	-----------

- |    |  |
|----|--|
| 1. | Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)                       |
| 2. | Press SETUP Key. Continue pressing SETUP Key, as needed, to display Comm-1 Setup Menu. |

Setup: Comm-1
---------------

- |    |  |
|----|--|
| 3. | Press ↓ SELECT Key to enter Baud Rate Submenu field. |
|----|--|

Setup: Comm-1	Baud Rate: 960 <u>0</u>
---------------	-------------------------

- |    |  |
|----|--|
| 4. | Turn SLEW/STOP Control to select desired baud rate in bps (110, 150, 300, 600, 1200, 2400, 4800, 9600 or 19200). |
| 5. | Press ↓ SELECT Key to enter Parity Submenu field.  |

Setup: Comm-1	Parity: None <u>0</u>
---------------	-----------------------

- |    |  |
|----|--|
| 6. | Turn SLEW/STOP Control to select desired parity mode (None, Even, Odd, Mark or Space). |
| 7. | Press ↓ SELECT Key to enter Data Bits Submenu field.                                   |

Setup: Comm-1	Data Bits: <u>8</u>
---------------	---------------------

- |    |   |
|----|---|
| 8. | Turn SLEW/STOP Control to select desired data bits per byte (7 or 8). |
|----|---|

STEP	PROCEDURE
------	-----------

- |    |  |
|----|--|
| 9. | Press ↓ SELECT Key to enter Stop Bits Submenu field. |
|----|--|

Setup: Comm-1	Stop Bits: <u>1</u>
---------------	---------------------

- |     |   |
|-----|---|
| 10. | Turn SLEW/STOP Control to select desired stop bits per byte (1 or 2). |
| 11. | Press ↓ SELECT Key to enter Handshake Submenu field.                  |

Setup: Comm-1	Handshake: RT <u>S</u>
---------------	------------------------

- |     |   |
|-----|---|
| 12. | Turn SLEW/STOP Control to select desired communications handshake mode (None, RTS[hardware] or Xon [software]). |
|-----|---|

## COMM-2 Connector

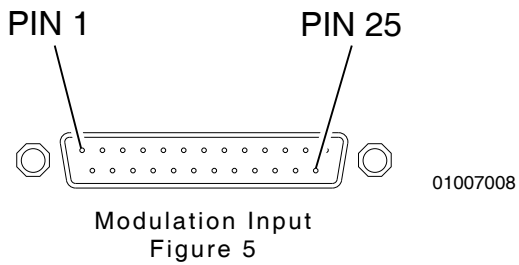
The COMM-2 Connector is not used at this time. Parameters for the COMM-2 Connector are set in the Comm-2 Setup Submenus.

STEP	PROCEDURE	STEP	PROCEDURE
1.	Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)	9.	Press ↓ SELECT Key to enter Stop Bits Submenu field.
2.	Press SETUP Key. Continue pressing SETUP Key, as needed, to display Comm-2 Setup Menu.		<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Stop Bits: 1</b> </div>
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b> </div>	10.	Turn SLEW/STOP Control to select desired stop bits per byte (1 or 2).
3.	Press ↓ SELECT Key to enter Baud Rate Submenu field.	11.	Press ↓ SELECT Key to enter Handshake Submenu field.
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Baud Rate: 9600</b> </div>		<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Handshake: RTS</b> </div>
4.	Turn SLEW/STOP Control to select desired baud rate in bps (110, 150, 300, 600, 1200, 2400, 4800, 9600 or 19200).	12.	Turn SLEW/STOP Control to select desired communications handshake mode (None, RTS [hardware] or Xon [software]).
5.	Press ↓ SELECT Key to enter Parity Submenu field.	13.	Press ↓ SELECT Key to enter Level Submenu field.
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Parity: None</b> </div>		<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Level: RS-232</b> </div>
6.	Turn SLEW/STOP Control to select desired parity mode (None, Even, Odd, Mark or Space).	14.	Turn SLEW/STOP Control to select desired voltage levels and I/O pins (RS-232 or RS-422).
7.	Press ↓ SELECT Key to enter Data Bits Submenu field.		
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>Setup: Comm-2</b>  <b>Data Bits: 8</b> </div>		
8.	Turn SLEW/STOP Control to select desired data bits per byte (7 or 8).		

## AUX I/O Connector

The AUX I/O Connector is used for BPSK modulation input when the RF Control field is set to **RFEXT**. Refer to para 1-2-4.1. Refer to 1-2-4, Figure 5 and set external modulation (TTL level signals) through AUX I/O Connector as follows:

STEP	PROCEDURE
1.	Apply BPSK modulation to Pin 1.
2.	Apply common ground to Pin 25.



### 4.3 INFORMATION SCREENS

#### Version

- | STEP | PROCEDURE   |
|------|---|
| 1.   | Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)                        |
| 2.   | Press SETUP Key. Continue pressing SETUP Key, as needed, to display Version Setup Menu. |

```
Setup:  Version
```

3. Press ↓ SELECT Key to display Version Number Screen.

```
Setup:  Version
        01.06
```

4. Press ↓ SELECT Key to display Version Date (of compilation) Screen.

```
Setup:  Version
        Mar 19 2008
```

5. Press ↓ SELECT Key to display Version Time (of compilation) Screen.

```
Setup:  Version
        08:43:49
```

#### Date of Almanac Upload

- | STEP | PROCEDURE  |
|------|--|
| 1.   | Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)                       |
| 2.   | Press SETUP Key. Continue pressing SETUP Key, as needed, to display System Setup Menu. |

```
Setup:  System
```

3. Press ↓ SELECT Key twice to display Almanac Date Screen.

```
Setup:  System
Alm:   Apr/28/07
```

(The GPS-101-2 displays the date of the last Almanac upload.)



## Date of Calibration

- | STEP | PROCEDURE  |
|------|--|
| 1.   | Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)                       |
| 2.   | Press SETUP Key. Continue pressing SETUP Key, as needed, to display System Setup Menu. |

```
Setup: System
```

3. Press ↓ SELECT Key three times to display Calibration Date Screen.

```
Setup: System
Cal:   May/15/08
```

(The GPS-101-2 displays the date of the last Calibration.)

## Elapsed Time

- | STEP | PROCEDURE  |
|------|--|
| 1.   | Press PWR Key to activate GPS-101-2. (ON indicator illuminates.)                       |
| 2.   | Press SETUP Key. Continue pressing SETUP Key, as needed, to display System Setup Menu. |

```
Setup: System
```

3. Press ↓ SELECT Key four times to display Elapsed Time Screen.

```
Setup: System
ElapHrs: 282.4
```

(The GPS-101-2 displays total unit run time [ac and battery] in 10ths of hours.)



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## 5. REMOTE OPERATION

The GPS-101-2 can be fully controlled by RS-232 if the unit has Firmware Version 1.06 installed.

**NOTE:** Firmware Versions prior to Version 1.06 do not allow the RFCO and DPLR commands to work properly.

COMMAND	RANGE	DESCRIPTION
MAIN:SV n	n is 1 to 37	Sets the SV Number.
MAIN:SV?		Returns the current SV Number.
MAIN:TEST n	n is 1 to 9	Sets the Test Number.
MAIN:TEST?		Returns the current Test Number.
MAIN:RFLVL n	n is -85 to -145	Sets the RF Output Level.
MAIN:RFLVL?		Returns the current RF Output Level.
MAIN:RFCO n	n is OFF, ON, EXT, CW, SQR	Sets the RF Output State.
MAIN:RFCO?		Returns the current RF Output State.
MAIN:DPLR n	n is 0, +, -	Sets the Doppler State.
MAIN:DPLR?		Returns the current Doppler State.

Remote Commands  
Table 2



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### SECTION 3 - SPECIFICATIONS

**NOTE:** Specifications are subject to change without notice.

#### GENERATOR

Frequency:	1575.42 MHz
Accuracy:	Same as Timebase
Doppler Offset (selectable):	+3.936 or -3.935 kHz
Accuracy:	Same as Timebase
Channels:	Single SV simulation (selectable 1 to 37)
Phase Modulation:	BPSK
PRN Code (C/A Code):	C/A Code = 1.023 MHz, 1023 bit gold code
NAV Data (test pattern):	50 Hz
Output:	RF OUT Connector
Level:	-145 to -85 dBm
Steps:	1 dB
Accuracy (into 50 $\Omega$ ):	$\pm 2$ dB (ac coupled)
Spurious:	<-40 dBc over the 20 MHz bandwidth
External Modulation:	
Input:	AUX I/O Connector (Pins 1 and 25)
Level (TTL):	Vih = >2 V at $\pm 1$ $\mu$ A Vil = <0.8 V $\pm 1$ mA

#### TIMEBASE

Standard:	
Frequency:	10 MHz nominal (See Note)
Uncertainty:	$\pm 1$ ppm
Temperature Stability:	$\pm 1$ ppm
Aging Rate:	$\pm 1$ ppm/yr, $\pm 5$ ppm/10 yrs
Option:	
Frequency:	10 MHz nominal (See Note)
Uncertainty:	$\pm 0.1$ ppm
Temperature Stability:	$\pm 0.1$ ppm
Aging Rate:	$\pm 0.1$ ppm/yr

**NOTE:** Internal Timebase frequency is a function of timebase calibration, aging rate, temperature stability and uncertainty.

**TIMEBASE (cont)**

## External Reference:

Input:	EXT REF IN Connector
Frequency:	10.0 MHz
Level:	0.25 to 6.0 Vp-p
Impedance:	150 $\Omega$ nominal
Output:	EXT REF OUT Connector
Frequency:	10.0 MHz nominal
Level:	1 Vp-p nominal into 50 $\Omega$

**ANTENNA COUPLER**

Coupling:	-20 dB typical at 1575.42 MHz (assumes 4.77 dB patch antenna gain and 4 dB cable loss)
Isolation:	>25 dB at 1575.42 MHz (30 dB typical)

**POWER**

## AC Requirements:

Source Voltage and Frequency:	100 to 120 VAC, 60 Hz or 220 to 240 VAC, 50 Hz
Power Consumption:	20 W maximum 13 W nominal at 115 VAC 8 W nominal at 230 VAC

## Battery:

Operation Time:	$\geq$ 2 hours, 6 hours typical
Full Charge Time:	
Unit Operating:	$\leq$ 8 hours at 115 VAC, 60 Hz
Unit Not Operating:	$\leq$ 6 hours at 115 VAC, 60 Hz

**FUSE REQUIREMENTS**

## F1 and F2:

100 to 120 VAC:	1.0 A, 250 V, Type F
220 to 240 VAC:	0.50 A, 250 V, Type F



## **SHOCK/VIBRATION**

Shock:	MIL-T-28800D, Type 3, Class 5, Style C Sections 3.7.5.1, 4.5.5.4.1
Vibration:	MIL-T-28800D, Type 3, Class 5, Style C Sections 3.7.4.1, 4.5.5.3.1
Bench Handling:	MIL-T-28800D, Type 3, Class 5, Style C Sections 3.7.5.3, 4.5.5.4.3

## **SAFETY**

This instrument is designed to comply with the requirements of EN61010-1/IEC1010-1, for Class 1 portable equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from an installation category II supply, to environmental conditions specified in paragraph 1.4 of EN61010-1.

## **OPERATIONAL ENVIRONMENTAL CONSIDERATIONS**

This instrument operates over temperature extremes of -20° to +50° C.



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## SECTION 4 - SHIPPING

### 1. SHIPPING TEST SETS

#### 1.1 INFORMATION

Test Sets returned to factory for calibration, service or repair must be repackaged and shipped according to the following conditions:

##### **Authorization**

Do not return any products to factory without first receiving authorization from Aeroflex Customer Service Department.

##### **CONTACT:**

Aeroflex  
Customer Service

Phone: (800) 835-2350  
FAX: (316) 524-2623  
email: [americas.service@aeroflex.com](mailto:americas.service@aeroflex.com)

##### **Tagging Test Sets**

All Test Sets must be tagged with:

- Identification and address of owner
- Nature of service or repair required
- Model Number
- Serial Number

##### **Shipping Containers**

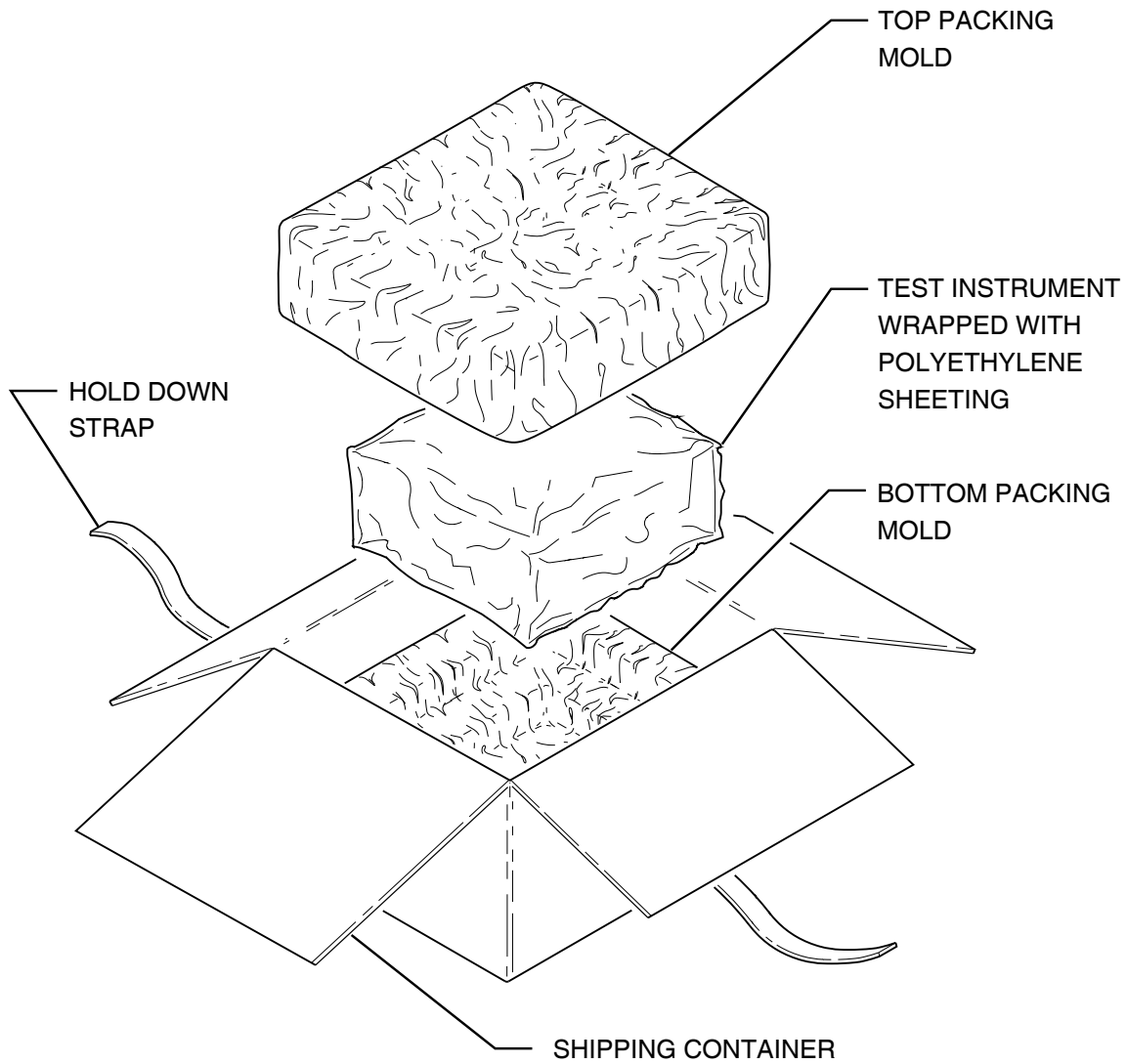
Test Sets must be repackaged in original shipping containers using Aeroflex packing molds. If original shipping containers and materials are not available, contact Aeroflex Customer Service for shipping instructions.

##### **Freight Costs**

All freight costs on non-warranty shipments are assumed by the customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

#### 1.2 REPACKING PROCEDURE

- Make sure bottom packing mold is seated on floor of shipping container.
- Carefully wrap Test Set with polyethylene sheeting to protect finish.
- Place Test Set into shipping container, making sure Test Set is securely seated in bottom packing mold.
- Place top packing mold over top of Test Set and press down until mold rests solidly in bottom packing mold.
- Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break resistant rope, twine or equivalent.



Repacking Procedure  
Figure 1

## SECTION 5 - STORAGE

### 1. STORING TEST SETS

Perform the following storage precautions whenever the Test Set is stored for extended periods:

- Disconnect Test Set from any electrical power source. If being stored for more than six months, disconnect battery according to Battery/Voltage Instructions (to be performed only by a qualified Service Technician).
- Disconnect and store ac power cable and other accessories in Lid Assembly.
- Cover Test Set to prevent dust and debris from covering and entering Test Set.



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## APPENDIX A - I/O CONNECTORS AND PIN-OUT TABLES

### 1. I/O CONNECTORS

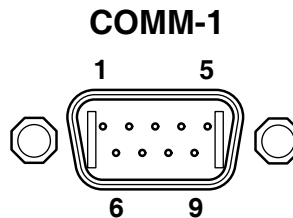
CONNECTOR	DESIGNATOR	TYPE	IN/OUT	SIGNAL
AC INPUT	10A1A8A1	3-Prong Plug	IN	ac Line Power
AUX I/O	10A1A8W1J1	25-Pin, D-Sub, Male	IN	See Pin-Out (Appendix A, Table 3).
COMM-1	10A1A8W3J1	9-Pin, D-Sub, Male	IN/OUT	See Pin-Out (Appendix A, Table 2).
COMM-2	10A1A8W2J1	25-Pin, D-Sub, Male		See Pin-Out (Appendix A, Table 4).
EXT REF IN	10A1A8J1	TNC	IN	10 MHz Clock
EXT REF OUT	10A1A8J2	TNC	OUT	10 MHz Clock
RF OUT	10A1A1J8	TNC Female	OUT	RF

I/O Connectors  
Table 1

### 2. COMM-1 CONNECTOR PIN-OUT

PIN NUMBER	SIGNAL
1	DCD
2	TX
3	RX
4	DSR
5	GND
6	DTR
7	CTS
8	RTS
9	$\bar{R}\bar{I}$

Pin-Out for COMM-1 Connector  
Table 2



COMM-1 Connector  
Figure 1

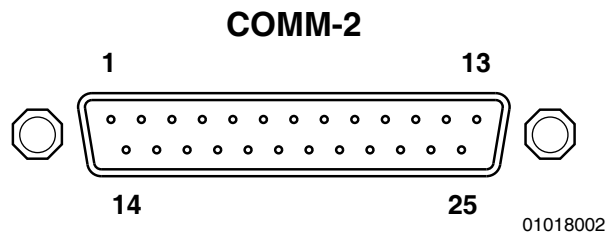
01018003



**4. COMM-2 CONNECTOR PIN-OUT**

PIN NUMBER	SIGNAL
1	
2	TX1 (232)
3	RX1 (232)
4	RTS1 (232)
5	CTS1 (232)
6	
7	GND
8	
9	
10	
11	
12	RX1_T (422)
13	RX1_C (422)
14	RTS1_T (422)
15	RTS1_C (422)
16	CTS1_T (422)
17	CTS1_C (422)
18	
19	
20	
21	
22	
23	
24	TX1_T (422)
25	TX1_C (422)

Pin-Out for COMM-2 Connector  
Table 4



COMM-2 Connector  
Figure 3



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## APPENDIX B - NAV DATA AND ALMANAC INFORMATION

### 1. INFORMATION

#### 1.1 NAV DATA

The 50 Hz NAV data is divided into frames (25 each) of 1500 bits. Each frame contains five 300-bit subframes. Each subframe contains ten 30-bit words. The GPS-101-2 transmits one subframe every six seconds and a full frame every 30 seconds. Transmission of the complete 25 NAV data frames requires 12.5 minutes (25x30 sec).

The first three subframes of each frame are generic and contain the same basic information for the selected satellite. The first three subframes contain the following information:

- Preamble indicates the start of a subframe and aids the receiver in synchronizing with the satellite data stream.
- Time of week (TOW) provides a time offset from midnight Saturday/Sunday in six second increments.
- GPS week indicates current week relative to January 5/6, 1980.
- Health indicates the operational status of the selected satellite. Satellites that are damaged, off course or out of synchronization are flagged as unhealthy. Unhealthy satellites must not be used by GPS receivers.  
  
(The GPS-101-2 indicates an unhealthy satellite by displaying \* in the SV field in the Main Menu screen.)
- Subframe ID provides additional verification of receiver synchronization with the satellite data stream.
- Accuracy alerts inform the receiver of possible satellite induced errors.
- Ephemeris provides short term information to determine with fair accuracy, the selected satellite position.
- Issue of Data Clock (IODC)/Issue of Data Ephemeris (IODE) changes to notify receiver Ephemeris data has been updated.
- Clock correction fields compensate for satellite timing errors.

The last two subframes, specific to each frame, contain parts of the almanac data. Some information is similar to the first three subframes except it usually applies to other satellites. The last two subframes contain:

- Preamble
- TOW
- GPS week
- SV Identification indicates the particular satellite the following information applies to. The SV Identification field may also contain codes indicating the subframe contains reserved messages or data applying to several satellites.
- Health
- Subframe ID
- Accuracy alerts
- Almanac contains reduced precision subsets of satellite Ephemeris information for all satellites in the constellation. Almanac data allows the receiver to determine the location of any satellite, resulting in reduced acquisition time.
- Ionospheric and UTC information data allows the receiver to compensate for atmospheric conditions and timing discrepancies caused by earth deceleration.

## 1.2 TEST PATTERNS

The GPS-101-2 currently contains three test patterns, selected in the Main Menu. Refer to para 1-2-2.

The first test pattern (**T1**) contains a full set of 25 NAV data frames using the currently loaded almanac and Time/Date. The same NAV data (except date/time fields) is repeated every 12.5 minutes. The first test pattern should be used most often to test commercial GPS receivers.

The second test pattern (**T2**) transmits diagnostic (dummy) NAV data captured Thursday, November 3, 1994 at 02:10:36 UTC. The fixed sequence of 1500 bits (one frame) repeats, including same date/time fields, every 30 seconds. The dummy almanac data provided has coding to tell receivers not to update, but to maintain current almanac data. This pattern provides enough information to test GPS receiver operation. Unfortunately, many receivers incorrectly interpret dummy almanac data and overwrite the receiver almanac anyway, destroying the current almanac.

**CAUTION:** USING THE SECOND GPS-101-2 TEST PATTERN (**T2**) MAY DESTROY CURRENT RECEIVER ALMANAC CAUSING THE GPS RECEIVER TO FAIL MOMENTARILY IN LOCATING SATELLITES OR SHOW SYMPTOMS OF PRODUCT FAILURE.

If the current receiver almanac is destroyed, conduct test using the first test pattern (for  $\geq 13$  minutes) to reload current almanac.

The third test pattern (**T3**) repeats a fixed sequence of two ones and two zeros:

11001100110011001100110011001100...

The third test pattern is not intended to convey information, but to aid in alignment of the GPS receiver circuits.

Other test patterns (**T4-T9**) transmit NAV data consisting only of binary zeros.



## 2. PROCEDURES

The GPS-101-2 almanac requires periodic updating (every 30 days recommended). A new almanac, when available, should be uploaded into the GPS-101-2. If the currently loaded almanac is old, the GPS-101-2 displays alternating warning screens. Refer to para 1-2-1.7

**CAUTION:** USING THE GPS-101-2 WITH AN OUTDATED ALMANAC MAY CAUSE THE GPS RECEIVER TO FAIL MOMENTARILY IN LOCATING SATELLITES OR SHOW SYMPTOMS OF PRODUCT FAILURE.

Almanac updates can be obtained from the U.S. Coast Guard. Refer to para 2.1 in Appendix B.

Refer to para 2.2 in Appendix B for uploading the new almanac into the GPS-101-2. If the currently loaded almanac is desired for customer use, refer to para 2.3 in Appendix B for downloading the current almanac.

### 2.1 OBTAINING DATA FROM COAST GUARD

<u>STEP</u>	<u>PROCEDURE</u>
1.	Use a PC to connect to the U.S. Coast Guard Website:  <i>www.navcen.uscg.gov</i>
2.	Select <b>Almanacs</b> Menu.
3.	Right click on <b>Current Almanac - YUMA Format</b> and select <b>Save Target as</b> .
4.	Save file on PC as <b>current.alm</b> .
5.	After download of file, close browser window.

## 2.2 UPLOADING ALMANAC DATA

STEP	PROCEDURE
------	-----------

1. Connect Host System Comm Connector to COMM-1 Connector according to Appendix B, Figure 1 for 9-Pin operation or Appendix B, Figure 2 for 25-Pin operation.
2. Set COMM-1 Connector operating parameters according to para 1-2-4.2.
  - Set operating parameters to match user equipment and interface settings.
  - Set Handshake to **RTS** for direct upload or **Xon** for modem operation.
3. Send following almanac data operation commands:

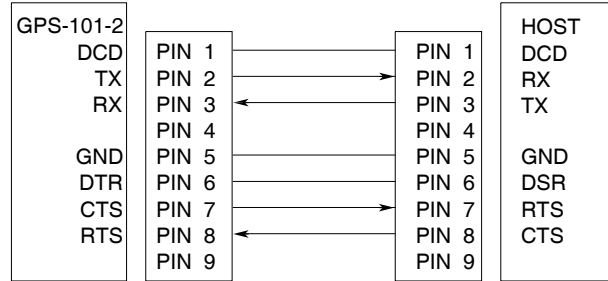
**ALMANac:CLear**  
to clear GPS-101-2 of old almanac data.

**ALMANac:SET**  
and follow directions on PC monitor screen to upload almanac file (ASCII text) into GPS-101-2.

**NOTE:** Short forms of commands are shown in upper case. Long forms include lower case letters. The commands, though, are not case sensitive.

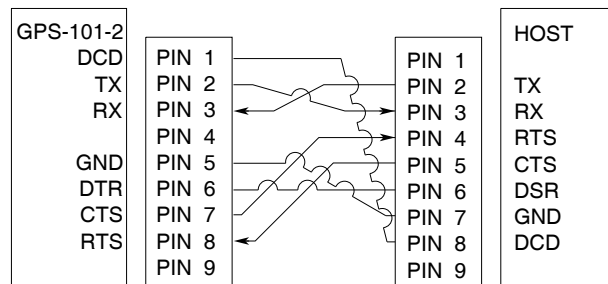
4. Press ENTER, CR or Ret Key on PC Keyboard.
5. If desired, send following almanac data status query:

**ALMANac:STatus?**  
to return current GPS-101-2 almanac status. Refer to Appendix B, Table 1 for possible responses.



01003001

GPS-101-2 to Host System (9-Pin)  
Figure 1



01003002

GPS-101-2 to Host System (25-Pin)  
Figure 2

**NOTE:** A PC, using Terminal Emulation Software, or an RS-232 Terminal can be used as the Host System.

RESPONSE	STATUS
0	Almanac present, usable and recent.
1	Almanac not present or not usable.
2	Almanac present, but old.
3	No almanac data array present.

Almanac Status  
Table 1

### 2.3 DOWNLOADING ALMANAC DATA

STEP	PROCEDURE
1.	Connect Host System Comm Connector to COMM-1 Connector according to Appendix B, Figure 1 for 9-Pin operation or Appendix B, Figure 2 for 25-Pin operation.
2.	Set COMM-1 Connector operating parameters according to para 1-2-4.2. <ul style="list-style-type: none"><li>● Set operating parameters to match user equipment and interface settings.</li><li>● Set Handshake to <b>RTS</b> for direct download or <b>Xon</b> for modem operation.</li><li>● Setup PC communication software to record (log) received data.</li></ul>
3.	Send following almanac data operation command: <b>ALMANac:GET?</b> to receive current almanac (ASCII text) from GPS-101-2. <b>NOTE:</b> Short forms of the command are shown in upper case. Long forms include lower case letters. The command, though, is not case sensitive.

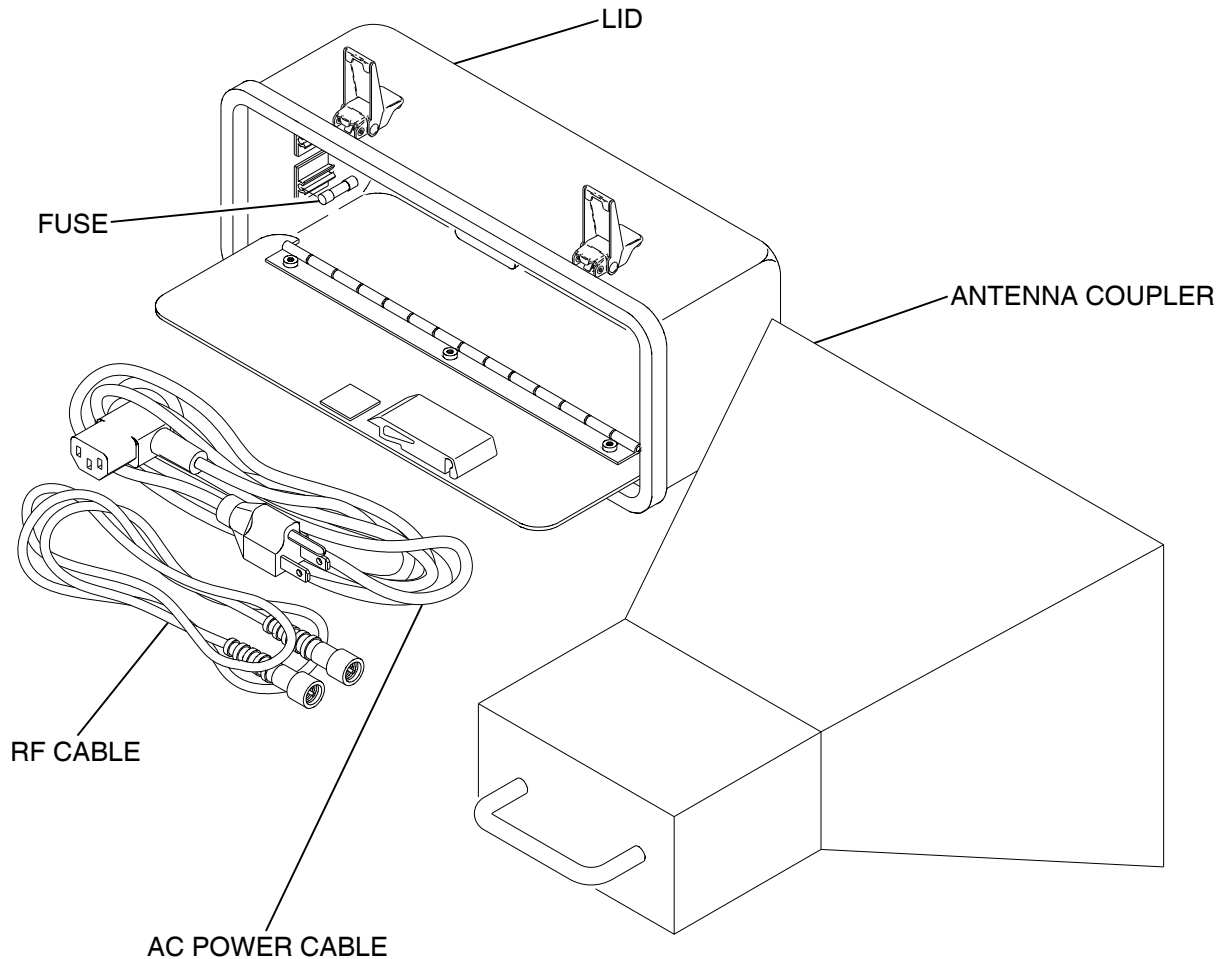


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## APPENDIX C - AUXILIARY EQUIPMENT

The GPS-101-2 Lid Assembly provides room to store the following equipment:

- Antenna Coupler (Horn Assembly)  
Allows the GPS-101-2 to transmit through the GPS Receiver Antenna.
- ac Power Cable  
Connects an external ac power source to the AC INPUT Connector.
- RF Cable  
TNC to BNC coaxial cable connects the RF OUT Connector to the GPS Receiver Input Connector or the Antenna Coupler Connector.
- Fuse  
Two spare fuses



01007010

Auxiliary Equipment  
Figure 1



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**APPENDIX D - METRIC/BRITISH IMPERIAL CONVERSION TABLE  
WITH NAUTICAL DISTANCE CONVERSIONS**

<b>TO CONVERT:</b>	<b>INTO:</b>	<b>MULTIPLY BY:</b>	<b>TO CONVERT:</b>	<b>INTO:</b>	<b>MULTIPLY BY:</b>
cm	feet	0.03281	meters	feet	3.281
cm	inches	0.3937	meters	inches	39.37
feet	cm	30.48	m/sec	ft/sec	3.281
feet	meters	0.3048	m/sec	km/hr	3.6
ft/sec	km/hr	1.097	m/sec	miles/hr	2.237
ft/sec	knots	0.5921	miles	feet	5280
ft/sec	miles/hr	0.6818	miles	km	1.609
ft/sec <sup>2</sup>	cm/sec <sup>2</sup>	30.48	miles	meters	1609
ft/sec <sup>2</sup>	m/sec <sup>2</sup>	0.3048	miles	nmi	0.8684
grams	ounces	0.03527	miles/hr	ft/sec	1.467
inches	cm	2.54	miles/hr	km/hr	1.609
kg	pounds	2.205	miles/hr	knots	0.8684
kg/cm <sup>2</sup>	psi	0.0703	nmi	feet	6080.27
km	feet	3281	nmi	km	1.8532
km	miles	0.6214	nmi	meters	1853.2
km	nmi	0.5396	nmi	miles	1.1516
km/hr	ft/sec	0.9113	ounces	grams	28.34953
km/hr	knots	0.5396	pounds	kg	0.4536
km/hr	miles/hr	0.6214	psi	kg/cm <sup>2</sup>	0.0703
knots	ft/sec	1.689	100 ft	km	3.048
knots	km/hr	1.8532	100 ft	miles	1.894
knots	miles/hr	1.1516	100 ft	nmi	1.645



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## APPENDIX E - ABBREVIATIONS

<b>A</b>		<b>G</b>	
A	Amperes	GHz	Gigahertz (10 <sup>9</sup> Hertz)
AC	Alternating Current	GND	Ground
ac	Alternating Current	GNSS	Global Navigation System Satellite
Alm	Almanac	GPS	Global Positioning System
Apr	April		
ASCII	American National Standard Code for Information Interchange		<b>H</b>
Aug	August	HDOP	Horizontal DOP
AUX	Auxiliary	hr	Hour
		Hrs	Hours
		Hz	Hertz
<b>B</b>			
Batt	Battery		<b>I</b>
bps	Bits per Second	ID	Identification
BPSK	Bi-Phase Shift Keying	I/O	Input/Output
		IODC	Issue of Data Clock
		IODE	Issue of Data Ephemeris
<b>C</b>			<b>J</b>
C	Celsius or Centigrade		
CAL	Calibration		
C/A	Coarse Acquisition	Jan	January
cm	Centimeter (10 <sup>-2</sup> Meters)	Jul	July
Comm	Communication	Jun	June
CSA	Canadian Standards Association		
CTS	Clear to Send		<b>K</b>
CW	Continuous Wave		
<b>D</b>			
DCD	Data Carrier Detect	Kg	Kilogram (10 <sup>3</sup> Grams)
dB	Decibel	KHz	Kilohertz (10 <sup>3</sup> Hertz)
dBc	Decibels above carrier	Km	Kilometers (10 <sup>3</sup> Meters)
dBm	Decibels above one milliwatt		<b>L</b>
Dec	December	lbs	Pounds
DOP	Dilution of Precision	LCA	Logic Cell Array
DPLR	Doppler	LCD	Liquid Crystal Display
DSR	Data Set Ready	LT	Light
DTR	Data Terminal Ready		<b>M</b>
<b>E</b>			
EC	European Community	m	Meter
EEC	European Economic Council	Mar	March
ELAP	Elapsed	MHz	Megahertz (10 <sup>6</sup> Hertz)
EMC	Electromagnetic Compatibility	mA	Milliamp (10 <sup>-3</sup> Amperes)
EMI	Electromagnetic Interference	µA	Microamp (10 <sup>-6</sup> Amperes)
ESD	Electrostatic Discharge		<b>N</b>
EXT	External		
<b>F</b>		NAV	Navigation
FAX	Facsimile	nmi	Nautical Miles
FCC	Federal Communications Commission	Nov	November
		NVRAM	Non Volatile RAM
			<b>O</b>
Feb	February	Oct	October
Ft	Foot/Feet	Ω	Ohm

**P**

PC	Personal Computer
PDOP	Position DOP (combined HDOP and VDOP)
ppm	Parts per Million
PR	Pseudorandom Range
PRN	Pseudorandom Noise
psi	Pounds per Square Inch
PSK	Phase Shift Keying
PWR	Power

**R**

RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RI	Ring Indicator
ROM	Read Only Memory
RTC	Real Time Clock
RTS	Request to Sent
RX	Receive

**S**

sec	second
Sep	September
SQR	Square
SV	Satellite Vehicle

**T**

TDOP	Time DOP
TOW	Time of Week
TTL	Transistor-Transistor Logic
TX	Transmit

**U**

UERE	User Equivalent Range Error
UL	Underwriter Laboratories
U.S.	United States
U.S.A.	United States of America
UTC	Coordinated Universal Time
UUT	Unit Under Test

**V**

V	Volt
VAC	Volts, Alternating Current
VDOP	Vertical DOP
Vp-p	Volts, Peak to Peak

**W**

W	Watt
---	------

**Y**

yr	Year
----	------

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**FOR QUALIFIED SERVICE  
PERSONNEL ONLY**

**BATTERY/VOLTAGE INSTRUCTIONS**



OPERATION MANUAL  
GPS-101-2

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# WARNING:

## HIGH VOLTAGE EQUIPMENT

**THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND/OR COMPONENTS OF EXTREMELY HIGH VOLTAGE POTENTIALS, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING ANY OF THE PROCEDURES CONTAINED IN THIS MANUAL, HEED ALL APPLICABLE SAFETY PRECAUTIONS.**

### SAFETY FIRST: TO ALL SERVICE PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL.

**WARNING:** USING THIS EQUIPMENT IN A MANNER OTHER THAN SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

#### CASE, COVER OR PANEL REMOVAL

Removing the Chassis Assembly from the Case Assembly exposes the technician to electrical hazards that can result in electrical shock or equipment damage.

#### SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating or servicing this equipment.

**CAUTION:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

**WARNING:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

#### SAFETY SYMBOLS IN MANUALS AND ON UNITS



**CAUTION:** This symbol refers to specific CAUTIONS represented on the unit and clarified in the text.



**AC OR DC TERMINAL:** Terminal that may supply or be supplied with ac or dc voltage.



**DC TERMINAL:** Terminal that may supply or be supplied with dc voltage.



**AC TERMINAL:** Terminal that may supply or be supplied with ac or alternating voltage.



**SWITCH ON/OFF (Push-Push):** Power to the device is connected ON or disconnected OFF.

#### EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

#### USE OF PROBES

Check specifications for the maximum voltage, current and power ratings of any connector on the Test Set before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

## POWER CORDS

Avoid using power cords which are frayed, broken or expose bare wiring when operating this equipment.

## USE RECOMMENDED FUSES ONLY

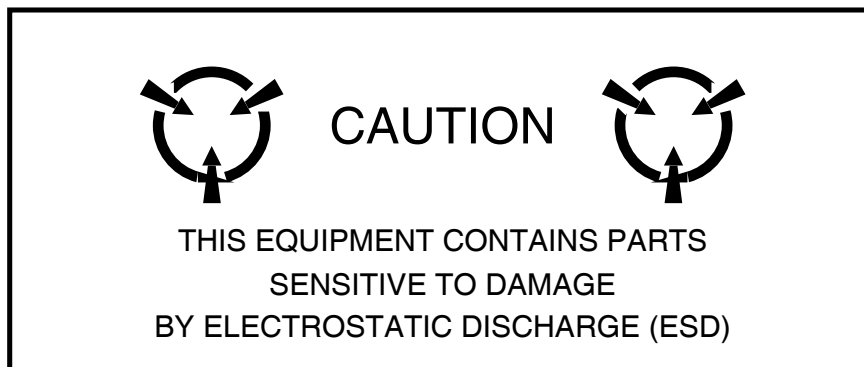
Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

**WARNING: THE GPS-101-2 USES A SEALED-LEAD-BATTERY PACK. THE FOLLOWING WARNINGS CONCERNING LEAD ACID BATTERIES MUST BE HEEDED:**

- RECHARGE BATTERIES ONLY WHEN INSTALLED INSIDE THE GPS-101-2.
- DISPOSE OF BATTERIES ACCORDING TO LOCAL DISPOSAL REGULATIONS.
- TO SHORT CIRCUIT OR FORCE DISCHARGE THE BATTERY MAY CAUSE THE BATTERY TO VENT, OVERHEAT OR EXPLODE.

**CAUTION:** INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FETS, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

- BEFORE USE IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.
- WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.
- TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.
- DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.
- PC BOARDS, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG. REMOVE ANY BUILT-IN POWER SOURCE, SUCH AS A BATTERY, BEFORE LAYING PC BOARDS ON A CONDUCTIVE MAT OR STORING IN A CONDUCTIVE BAG.
- PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING CONTAINER.



**CAUTION:** SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.


**FOR QUALIFIED SERVICE PERSONNEL ONLY**

**BATTERY REPLACEMENT**

Only a defective battery should be removed and replaced. For definition, a defective battery does not accept a charge.

STEP	PROCEDURE
1.	Verify GPS-101-2 is OFF and disconnected from ac power.
2.	Refer to Figure 1. Remove four screws (5), four washers (4) and Rear Panel Assembly (3).
3.	Refer to Figure 1. Slide Case Assembly (2) towards rear and remove from Chassis Assembly (1).
4.	Refer to Figure 2. Disconnect black cable (2) from negative (-) battery terminal (8).
5.	Refer to Figure 2. Remove four screws (6) from bracket (3).
6.	Refer to Figure 2. Carefully lift battery (4) and bracket (3) from Chassis Assembly (5).
7.	Refer to Figure 2. Disconnect red cable (1) from positive (+) battery terminal (7) and remove battery.

**WARNING: DISPOSE OF OLD BATTERY ACCORDING TO LOCAL STANDARD SAFETY PROCEDURES.**

 **CAUTION:** REPLACE ONLY WITH THE BATTERY SPECIFIED BY AEROFLEX. DO NOT ATTEMPT TO INSTALL A NON-RECHARGEABLE BATTERY.

8. Install new battery in reverse order of Steps 2 through 7.

**CAUTION:** CONNECT BATTERY CABLES, VERIFYING POLARITY. DO NOT REVERSE THE CONNECTIONS.

**DISCONNECTING BATTERY**

Disconnecting the battery is recommended when storing the Test Set without activity for periods of six months or more.

STEP	PROCEDURE
1.	Verify GPS-101-2 is OFF and not connected to ac power.
2.	Refer to Figure 1. Remove four screws (5), four washers (4) and Rear Panel Assembly (3).
3.	Refer to Figure 1. Slide Case Assembly (2) towards rear and remove from Chassis Assembly (1).
4.	Refer to Figure 2. Disconnect black cable (2) from negative (-) battery terminal (8).
5.	Refer to Figure 2. Secure black cable (2) away from negative (-) battery terminal (8).
6.	Refer to Figure 1. Slide Case Assembly (2) towards front and onto Chassis Assembly (1).
7.	Refer to Figure 1. Install four washers (4), four screws (5) and Rear Panel Assembly (3).

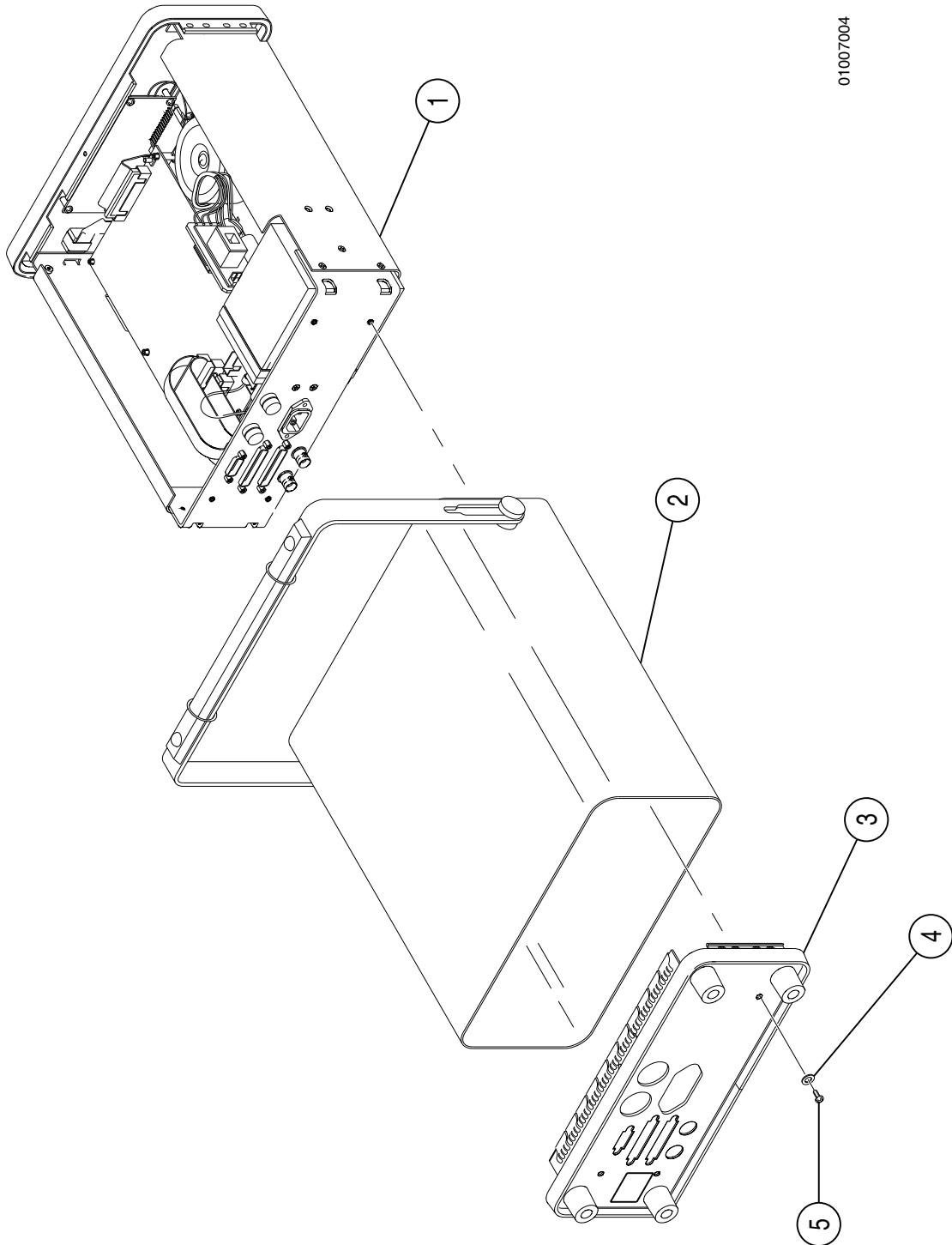


## LINE SUPPLY VOLTAGE SELECT SWITCH

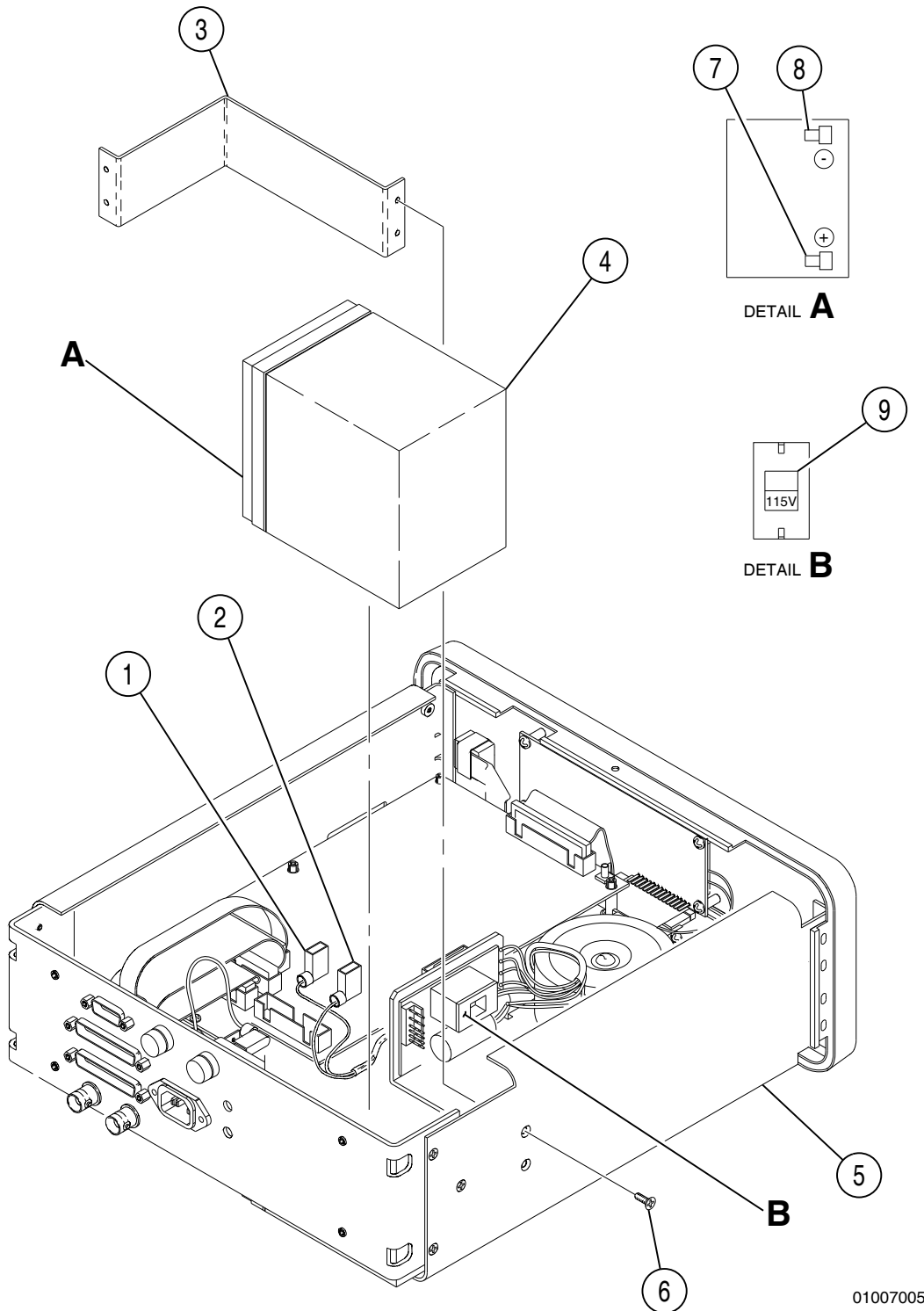
The Line Supply Voltage Select Switch is set according to the sticker on the Rear Panel Assembly. The Line Supply Voltage Select Switch must be changed before connecting the GPS-101-2 to a different power source.

STEP	PROCEDURE
1.	Verify GPS-101-2 is OFF and disconnected from ac power.
2.	Refer to Figure 1. Remove four screws (5), four washers (4) and Rear Panel Assembly (3).
3.	Refer to Figure 1. Slide Case Assembly (2) towards rear and remove from Chassis Assembly (1).
4.	Refer to Figure 2. Set Line Supply Voltage Select Switch (9) to <b>115</b> for 100 to 120 VAC power source or <b>230</b> for 220 to 240 VAC power source.
5.	Reassemble GPS-101-2 in reverse order of Steps 2 and 3.
6.	Replace fuses as needed according to para 1-2-1.3 in the Operation Manual.
7.	Refer to 1-1-2, Figure 2 in Operation Manual and update sticker on Rear Panel as required.

01007004



Case Removal  
Figure 1



01007005

Battery Removal  
Figure 2

As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice.

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven, customer-focused.