The PLGR Primer

A step-by-step introduction to the AN/PSN-11 PLGR

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This publication was prepared by the staff of the SPMAGTF(X).
It is intended to be used as a training circular to augment existing references.

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Physical Features of the PLGR

Figure 1. shows the AN/PSN-11 PLGR:

a. The **Power Battery Cover** twists off to allow the power battery to be changed. See *Appendix B — Batteries* for information on PLGR power batteries.

b. The **Memory Battery Cover** screws out for replacement of the memory battery. See *Appendix B — Batteries* for information on PLGR memory batteries.

c. The **Display Screen** displays four lines of up to sixteen characters per line. The screen can be backlit for operations in the dark.

d. The **Handle** of the PLGR is designed so that if the left hand is inserted between the handle and the unit, the left-hand thumb is free to operate the keypad.

e. The **Keypad** has twelve multi-function keys used to control PLGR operations.

f. The **Antenna** is swiveled up for signal reception.

g. The **Crypto / SINCGARS Connector** allows the user to load crypto keys into the PLGR, or connect a SINCGARS radio.

Three connection ports are located on the back of the PLGR and are *not shown* in **Figure 1. Instructions for using these three connection ports are NOT included in this manual.**

h. The **Data Transfer Serial Port** connects to any standard RS-232 connector.

i. The **External Antenna Port** allows for the connection of an external antenna, as well as accepting battery charging or external power connections.

j. The **Extenal Power Port** allows for the connection of external power.

How Do I Use This Manual?

This **PLGR Primer** was designed solely to meet the PLGR training standards defined by the SPMAGTF(X). These standards are extracted in *Appendix D — PLGR Training Standards.* They were written for foot-mobile infantrymen, and therefore this manual applies only to foot-mobile, static position operations. *Appendix A — PLGR Setup Parameters* discusses the setup of PLGR for foot-mobile operations. **All explanations and sample screens shown in this manual assume that your PLGR is setup as shown in *Appendix A.***

Each section of the PLGR Primer answers a single question about basic PLGR keypad operations. Although designed to be sequential, the sections can be read in any order.

To understand the PLGR, it is necessary to know a little of the Global Positioning Satellite (GPS) system. The GPS satellite system consists of 24 satellites orbiting the earth. Each satellite continuously transmits position information to anyone with a GPS receiver. **PLGR is a GPS receiver.**

The GPS satellites transmit two different signals, C/A-code and P-code. P-code, Precision-code, is further encrypted and is then known as Y-code. When the PLGR contains a correct crypto key, it will read Y-code. This is the most precise location information available and is the standard for military operations. See the section entitled **How do I Load Crypto into the PLGR with a KYK-13?**

PLGR can be used without a crypto key, but the C/A-code, Coarse Aquisition-code, is much less precise. *Appendix A — PLGR Setup Parameters* discusses changing the setup parameters to allow PLGR to read C/A-code instead of Y-code.

In some text and screen samples the abbreviation SV is used for **Satellite.**

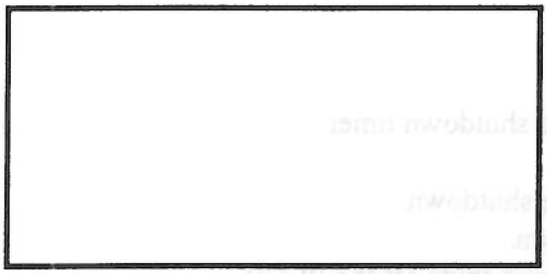
Figure 1. The AN/PSN-11 PLGR.

How Do I Turn the PLGR On?

Assuming your PLGR has a good battery,

Push: 

The PLGR will display three automatic screens:



A screen warmup,

```
COPYRIGHT   1989
Rockwell Intl.
HNV-560A  V04b.2
AN/PSN-11   PLGR
```

a copyright and software version screen,

```
NO FAULTS FOUND
Battery Status:
2561 used
0896 left
```

and a test results and battery power screen.

The next screen will display automatically. It will differ depending on how your PLGR is setup and how it was last used. It will **resemble** this:

```
FIX            OLD
17S      MGRS-New
NM 94913e 31401n
ELh+01013ft    ^P
```

At this point you are ready to go.

Backlighting

The PLGR screen can be backlit for night operations. After turning the PLGR on, pushing the ON / BRT key toggles the backlight on and off.

To increase the light level, hold down ON / BRT and push the up-arrow key repeatedly. To decrease the light level, hold down ON / BRT and push the down-arrow key repeatedly.

Caution! The PLGR uses more battery power when backlighting is on.

Turn Off

Push the OFF key. The screen displays a 30-second shutdown timer.

If ON is pushed at this point, the PLGR cancels the shutdown.
If OFF is pushed, the PLGR immediately shuts down.
If no key is pushed, the timer counts down to zero and shuts off the PLGR.

Where Am I? POS

Your PLGR should be set up as shown in *Appendix A — PLGR Default Parameters*. After turn on, the screen will resemble this:

```
FIX              OLD
17S       MGRS-New
NM 94913e 31401n
ELh+01013ft     ^P
```

Push: 

Pushing **POS** repeatedly will cycle you through the ~~three~~ four position display screens.
Pushing up- or down-arrow will also cycle these screens.

```
FIX              +20m
17S       MGRS-New
NM 94432e 31382n
ELh+1022ft      ^P
```

The first screen is the main screen. FIX is the current operation. The third line is your position, the fourth your elevation. The display changes as PLGR reads satellites.

```
2140:08L        +1ms
16-03-95         SUN
Speed too slow
GS < 2 kph      ^P
```

Time (L for Local) and an error value.
Date and Day.
Message tells you you're walking(!)
Ground Speed (GS).

```
TRACK / SEARCH
24 18 05 16 / 21
#VIS:8    #GOOD:8
ALM AGE:   1day^P
```

Tracking and Searching for satellites. Satellites being received are listed to the left of the '/' dash. Satellites being searched for are listed to the right. **You must have three or more satellites to the left of the dash for PLGR to plot your position.** Wait at this screen until you receive three or more. You may need to move your PLGR for better reception. Once you receive three satellites, push POS again to cycle to the FIX screen. You can watch the position information change there.

When your position has been found, the FIX screen changes to STBY:

```
STBY             +10m
17S       MGRS-New
NM 94436e 31384n
ELh+1031ft      ^P
```

Your ten-digit grid coordinate is shown on the third line. The error is shown at top right. Your elevation is shown on the fourth line. The small 'h' is for elevation hold, described in *Appendix A*.

Error display alternates with "msf" display.
"Minutes since fix" displays how many old the position is.

```
2142:08L        +1ms
16-03-95         SUN
Standby Mode
                ^P
```

Time (L for Local) and an error value.
Date and Day.
Message lets you know you're now in standby mode.

```
TRACK / SEARCH
/
#VIS: 9   #GOOD:9
ALM AGE:   1day^P
```

Satellite tracking turns off.
Final number of satellites visible with good readings.
Almanac age.

Plan My Route. WPT

The WPT key brings up the waypoint menu. Waypoints are used to save positions for point-to-point navigation. **Waypoint operations are not covered in this manual.** See Appendix E **PLGR References**.

How Do I Get There? NAV

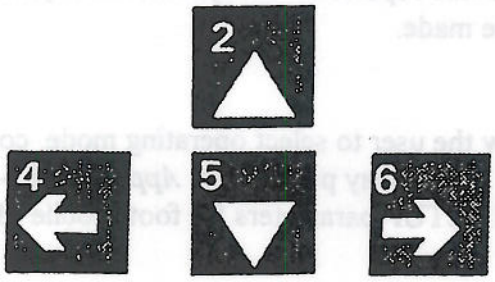
The NAV key brings up the navigation displays. Multiple navigation functions are available to assist in land navigation. **Navigation operations are not covered in this manual.** See Appendix E **PLGR References**.

Save My Position. MARK

The MARK key is used to store the present position as a waypoint. **MARK operations are not covered in this manual.** See Appendix E **PLGR References**.

How Do I Use the Arrow Keys?

1. The Left- and Right-arrow keys are used to move the cursor from field to field in the display. **The Left- and Right-arrow keys do NOT change the value of any displayed data.**



2. The Up- and Down-arrow keys are used to:

Change the display page	When the cursor is over the ^P , the 'page' symbol in the lower right hand corner, pressing Down-arrow brings up the next page.
Change the value of a field	When the cursor is over an option field, pressing Up- or Down-arrow cycles through the available options.
	When the cursor is over a changeable value field, pressing Up-arrow increases the displayed value, pressing Down-arrow decreases it.
Activate a process	When the cursor is over a verb, pressing Down-arrow executes that function.

How Do I Set up the PLGR? MENU

Press MENU to display the system menu. The PLGR menu consists of two pages. Pressing the Right- or Left-arrow keys cycles through the eleven possible menu choices:

A. STATUS
The STATUS screens provide reports on the system, battery, antenna, satellites and other functions. No input can be made.

B. SETUP
The SETUP screens allow the user to select operating mode, coordinate system, default units and other operating and display parameters. *Appendix A — PLGR Setup Parameters* defines the recommended SETUP parameters for foot-mobile Marines.

C. INIT
Allows the user to initialize his position, time, date, user-defined datum, and crypto information.

D. TEST
Runs a self-test of the PLGR to insure that it is working properly. After selecting TEST, select ACTIVATE. The screen then describes the tests being executed as well as results. No input can be made.

E. HELP
Brings up a series of thirteen help screens.

F. DATA XFER
Allows transfers of setups, time, waypoints, and satellite data to another PLGR. Crypto CANNOT be transferred from one PLGR to another.

G. SV-SEL
Allows user to include or remove individual satellites for use by the PLGR.

H. DOP-CALC
Used to command the PLGR to calculate the best satellite geometry for a given time period.

I. ALERTS
Provides for set up and control of corridor, position error, and buffer alerts.

J. SINCGAR
Allows user to load time fill data into a SINCGARS compatible radio.

K. KOI-18
Used when loading crypto key data via a KOI-18 COMSEC device.

L. CRYPTO

Used to access crypto, entry status, and zeroize.

If CRYPTO is NOT displayed on the screen, then no Crypto is loaded. Without a crypto key, the PLGR cannot read encrypted Y-code and is susceptible to wide errors and spoofing.

How Do I Enter Numbers? NUM LOCK

The PLGR operates in two modes: CONTROL or NUMERIC. The default is control mode. Most operations are executed in control mode.

The NUM LOCK key is used to toggle between CONTROL and NUMERIC mode.

When numeric input is needed and the cursor is flashing on an open field, push NUM LOCK. This triggers NUMERIC mode, which allows the direct entry of numbers. The keypad now operates as a numeric keypad until NUM LOCK is pushed again. While in Numeric mode, the bottom right hand corner displays an 'N'.

When NUM LOCK is pushed again to exit NUMERIC mode, the bottom right hand corner display returns to the default 'P'.

The CLR key is activated only in NUMERIC mode. Pushing this key moves the cursor to the left to correct mistaken entries.

How Do I Load Crypto into the PLGR with a KYK-13?

1. With the PLGR on, connect the KYK-13 to the PLGR's Crypto / SINCGARS connector. Insure the PLGR is NOT conducting a self-test.

2. Set the KYK-13 selector switch to the position that contains the crypto fill.

3. Set the KYK-13 mode switch to ON. The light on the KYK-13 should flash, showing a successful crypto key load.

4. On the PLGR, press MENU. Press down-arrow to access the second page. The fourth line of this screen should read CRYPTO.

If the fourth line of MENU page 2 does NOT display CRYPTO, *no Crypto is loaded on your PLGR.*

Select CRYPTO to access the three crypto display screens:

Line 1 is the title **CRYPTO STATUS**
Line 2 Displays one of four Crypto information messages:

Have today's Key
Wait for SV data
No key for today
***** Key Loaded *****

Line 3 Displays the number of days (00-41) the crypto is valid.
Line 4 Allows the user to enter the mission duration (00-41) days.

Pushing down-arrow at the ^P prompt brings up screen 2. This allows the user to manually enter crypto from the keypad.

Pushing down-arrow again brings up screen 3. This screen allows the user to zeroize only the crypto key. Press ACTIVATE to perform the zeroize, or QUIT to return to the MENU screen.

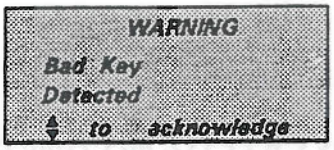
5. Set the KYK-13 mode switch to OFF. Disconnect the KYK-13 from the PLGR.

Crypto Warning Messages

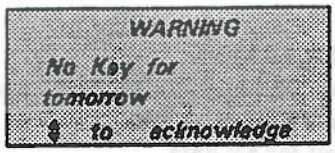
The following ten warning messages apply only to CRYPTO functions. The zeroize messages, i. and j., apply only to the zeroize crypto function described in paragraph 4. above.

a. **Invalid Key entered.** The key loaded failed the parity check. Re-load crypto.

b. **Bad Key Detected.** The crypto key failed verification. Check to insure that the proper key is being loaded.



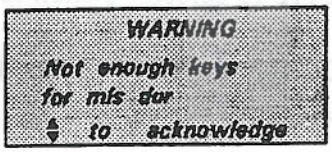
c. **No Key for Tomorrow.** The crypto loaded expires today.



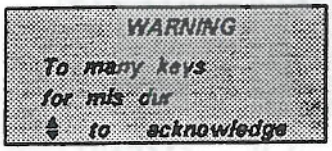
d. **Check GUV issue number.** The Group Unit Variable (GUV) entered does not match the satellite data. Check to insure the proper key is being loaded.

e. **Insufficient Y-code SVS.** The PLGR cannot read enough satellites that are sending Y-code. In SETUP, change the SV-TYPE field from **all-Y** to **mixed**.

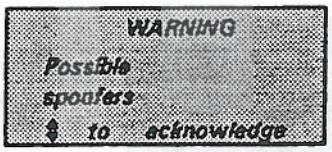
f. **Not enough keys for mis dur.** Mission Duration exceeds the amount of crypto loaded. Add more crypto or shorten mission.



g. **Too many keys for mis dur.** Mission Duration is shorter than the crypto loaded. Delete extra crypto.

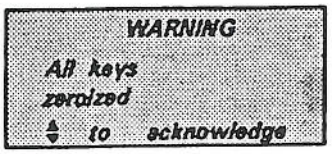


h. **Possible spoofers.** The PLGR has detected possible false input.



i. **Zeroize failed.** The zeroize crypto function has failed. Press up- or down-arrow to acknowledge, then attempt to zeroize again. If this fails, survey the faulty PLGR.

j. **All keys zeroized.** The zeroize crypto function was successful. Press up- or down-arrow to acknowledge.



How Do I Zeroize the PLGR?

The zeroize function is designed to be used in emergency situations to protect mission-sensitive information. The zeroize function destroys all data and crypto information in the PLGR.

Press **CLR/MARK** and **NUM LOCK** keys *at the same time.*

This brings up the zeroize display. Select ON to return to normal operations. Select OFF to destroy all PLGR data. A message will appear confirming the data destruction.

DO NOT PERFORM THIS TASK unless you truly intend to destroy all your data!

Crypto will have to be reloaded if it is inadvertently destroyed.

How Do I Maintain the PLGR?

Organizational maintenance of PLGR is limited to cleaning, replacing the power battery, replacing the memory battery, and running the built-in test.

1. Clean the PLGR with a soft cloth or brush. Do not disassemble the unit for cleaning.

2. Turn PLGR on. If the PLGR screen remains blank, or displays a low power battery message, replace the power battery. If the screen displays a low memory battery message, replace the memory battery. See *Appendix B — Batteries.*

3. With PLGR on, press MENU. Select STATUS. Line 2 should read "Self-Test OK". If a failure message appears, record the message and survey the PLGR for maintenance.

4. To run the built-in test, press MENU. Select TEST. Select ACTIVATE. The PLGR will run a self-test. If a failure message appears, record the message and survey the PLGR for maintenance. .

APPENDIX A PLGR Default Parameters

The following are the recommended PLGR default parameters for use by foot-mobile Marines. The Marine's map is assumed to be a military grid reference type with ground distances measured in meters and elevations in feet. The PLGR is assumed to have a valid crypto load.

Push: 

Select SETUP and choose the following parameters from the seven (7) SETUP screens:

```
SETUP MODE: FIX
Quick POS fix,
automatic off
SV-TYPE: all-Y^P
```

PLGR has six (6) modes of operation. ~~This manual covers only~~ Quick ~~Position~~ Fix Mode, ~~finds~~ PLGR calculates location then goes to battery-saving standby mode SV-TYPE is Satellite Type. 'all-Y' tells PLGR to read only Y-code encrypted satellites, 'mixed' tells PLGR to read all satellites.

```
SETUP UNITS
MGRS-New Metric
ELev: feet MSL
ANGL: Deg Mag ^P
```

Default units for military maps are usually Military Grid Reference System(MGRS), metric measures of distance, elevation in feet above Mean Sea Level(MSL), and azimuths in degrees magnetic.

```
SETUP MVAR
TYPE: Calc

              ^P
```

MVAR stands for Magnetic VARiation. The three possible choices are:

Calc	Magnetic Variation is automatically set by PLGR
Ent	Magnetic Variation is entered by the user
WP	Magnetic Variation is set for the next waypoint

```
SETUP
ELHold:automatic
TIME: Loc=Z-0400
ERR:+m          ^P
```

ELHold is ELevation Hold, a feature which increases the accuracy of the PLGR when it has poor vertical determination. Selecting automatic automatically sets ELHold when conditions are right.

Local time is entered as an offset from Zulu time.

ERR is ERRor display format. PLGR displays position errors either as distance (+ or - 10m), or FOM (Figure of Merit), a value rating of 1 through 9. When distance is selected, the default unit is used, either English (feet and miles), nautical (yards and nautical miles), or metric (meters and kilometers).

```
SETUP DTM: WGD
WGS-84
AUTOMATIC OFF
TIMER: 5 min   ^P
```

DTM stands for datum. The datum selected must correspond to the map datum of the user. **This is the most important field in the entire SETUP menu.** Horizontal datum information is found in the margin of all military maps.

AUTOMATIC OFF TIMER saves battery power by shutting PLGR off after finding its position. The four possible settings are: off, 15 seconds, 20 minutes, and 5 minutes.

```
SETUP I/O
SERIAL: Standard
HAVEQUICK: OFF
1PPS: OFF      ^P
```

This screen covers the setup parameters for the Data Transfer Serial Port. These **operations are not covered in this manual.** I/O is Input / Output. SERIAL options change the serial port configuration. HAVEQUICK and 1PPS codes are output through the serial port to external devices.

```
SETUP AUTOMARK
MODE: off  WP:01
25-03-96   0000Z
REPEAT 0000    ^P
```

The seventh page of the SETUP display controls the automark mode. Automark wakes the PLGR up at intervals and saves its position as a waypoint. **AUTOMARK operations are not covered in this manual** WP, time and REPEAT can be set to anything. When MODE is OFF, nothing else matters.

APPENDIX B Batteries

1. **Power Battery.** The PLGR is capable of being powered by either an internal battery or an external power source. The following batteries power the PLGR:

Type	Nomenclature	Minimum Life
Lithium	BA-5800/U	10 hours
Nickel Cadmium (NiCad)	Rockwell 221-0134-010	1.5 hours
(8) AA-Alkaline non-rechargeable	WB101	4.0 hours
(8) AA-Lithium non-rechargeable	L-91	4.0 hours

A battery holder, Rockwell 221-0135-020, is required to use the (8) AA batteries.

When the power battery is low, a warning message will display. See *Appendix C — Warning Messages* for the full set of PLGR warning messages. To change the power battery:

a. Unscrew the Power Battery Cover.
b. Remove the old battery and replace with a new one.
c. Replace the Power Battery Cover.

2. **Memory Battery.** The Memory Battery runs continuously at very low power to insure that critical information such as setup parameters, crypto keys and satellite data is saved when the PLGR is turned off. The battery replacement for the memory battery is:

Type	Nomenclature	Minimum Life
3.6 V DC, AA Size Lithium	LS6 BA	1 year

When the memory battery is low, a warning message will display. See Appendix *Appendix C — Warning Messages* for the full set of PLGR warning messages. To change the memory battery:

a. Insure the PLGR is ON.
b. Unscrew the Memory Battery Cover.
c. Remove the old battery and replace with a new one.
d. Replace the Memory Battery Cover.

3. **Battery Safety.** The BA-5800/U is a Lithium Battery. The LS6 BA is a Lithium Battery. Lithium Batteries can explode! Exploding batteries can kill or injure! Do NOT:

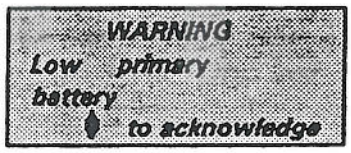
Short-Circuit lithium batteries
Try to Re-Charge lithium batteries
Store or Use lithium batteries above 130 degrees Fahrenheit
Open, crush, puncture or break Lithium Batteries
Throw Lithium batteries into fires

Survey lithium batteries to support personnel for proper disposal.

APPENDIX C Warning Messages

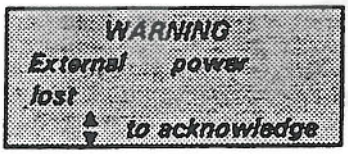
Warning messages display when certain events occur. They remain displayed until acknowledged by pushing an up or down arrow key. The PLGR has seven warning messages:

a. Low Primary Battery Warning. The PLGR battery power is low. After this message is acknowledged, it reappears at intervals as long as the battery is not replaced.

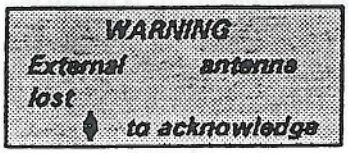


b. Low Memory Battery Warning. The PLGR memory battery is low.

c. External Power Lost Warning. External power has been lost. The PLGR switches to internal power if a battery is present, and back to external power when reconnected.

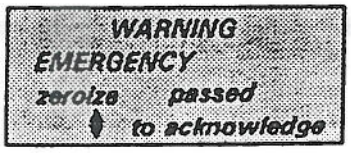


d. External Antenna Lost Warning. External antenna connection has been lost.

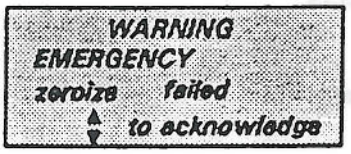


e. External Antenna Fault Warning. External antenna has a fault.

f. Zeroize Passed Warning. Zeroize was successful.



g. Zeroize Failed Warning. Zeroize was NOT successful. Repeat the procedure.



APPENDIX D PLGR Training Standards

Marine Corps Order 1510.35C contains one GPS-receiver standard:

0311.6.9	NAVIGATE USING A GLOBAL POSITIONING SYSTEM

The SPMAGTF(X) has defined five unit-specific training standards to guide PLGR training:

AWET 0315.3.1	CHANGE THE PLGR POWER BATTERY
AWET 0315.3.2	SET PLGR DEFAULT SETTINGS
AWET 0315.3.3	MAINTAIN THE PLGR
AWET 0315.3.4	LOAD PLGR WITH KYK-13 CRYPTO
AWET 0315.3.5	CALCULATE STATIC GROUND POSITION WITH PLGR

AWET 0315.3.1 CHANGE THE PLGR POWER BATTERY

CONDITIONS: Given a PLGR, spare battery, and no references.
STANDARD: The Marine must change the PLGR battery in the dark within (3) minutes.

PERFORMANCE STEPS:
1. Identify when the PLGR needs a new battery.
2. Change the battery.

REFERENCES:
1. Fort Sill AN/PSN-11(PLGR) Student Handout, p2-9.
2. SPMAGTF(X) PLGR Primer

ADMINISTRATIVE INSTRUCTIONS:
1. This task can be completed with any one of the three types of replacement batteries: BA-5800/U Lithium, NiCad, or WB101 battery holder with (8) alkaline or lithium AA cells.
2. Changing the memory battery is an annual maintenance task, not an individual task.

AWET 0315.3.2 SET PLGR DEFAULT SETTINGS

CONDITIONS: Given a PLGR, map and no references.
STANDARD: The Marine must set the PLGR default settings within 5 minutes.

PERFORMANCE STEPS:
1. Setup the PLGR defaults for foot-mobile infantry: SETUP MODE: FIX, automatic off, SV-TYPE: all-Y, SETUP UNITS: MGRS-New Metric, Elevation: feet MSL, ANGL: Deg Mag, SETUP MVAR TYPE: Calc, ELHold: atuomatic, Time, ERR: +-m, SETUP DATUM (map specific), Automatic OFF TIMER: 5 Min, Serial: Standard, HAVEQUICK: Off, 1PPS: Off.
2. Initialize the PLGR location using the INIT command.

REFERENCES:
1. Fort Sill AN/PSN-11(PLGR) Student Handout
2. SPMAGTF(X) PLGR Primer, *Appendix A — PLGR Setup Parameters*

ADMINISTRATIVE INSTRUCTIONS:
1. Map Datum is read from the margin of the specific map the Marine is using.

AWET 0315.3.3 MAINTAIN THE PLGR

CONDITIONS: Given a PLGR and no references.
STANDARD: The Marine must maintain the PLGR.

PERFORMANCE STEPS:
1. Clean the PLGR.
2. Run the self-test from the MENU / TEST screen.

REFERENCES:
1. Fort Sill AN/PSN-11(PLGR) Student Handout
2. SPMAGTF(X) PLGR Primer

ADMINISTRATIVE INSTRUCTIONS:

AWET 0315.3.4 LOAD PLGR WITH KYK-13 CRYPTO

CONDITIONS: Given a PLGR, a loaded KYK-13, and no references.
STANDARD: The Marine must load the PLGR with crypto within 5 minutes.

PERFORMANCE STEPS:
1. Connect the PLGR and KYK-13.
2. Load crypto from KYK-13.
3. Check PLGR status. Demonstrate that cryto was loaded correctly.

REFERENCES:
1. Fort Sill AN/PSN-11(PLGR) Student Handout
2. SPMAGTF(X) PLGR Primer

ADMINISTRATIVE INSTRUCTIONS:

AWET 0315.3.5 CALCULATE STATIC GROUND POSITION WITH PLGR

CONDITIONS: In the field, given a PLGR with correct datum and default settings, map, and no references.
STANDARD: The Marine must generate and report his 8-digit grid location within (5) minutes.

PERFORMANCE STEPS:

1. Turn on the PLGR.
2. Identify when PLGR is ready to generate position.
3. Read location screen to 8-digits.
4. Cross-check PLGR reading with map.

REFERENCES:
1. Fort Sill AN/PSN-11(PLGR) Student Handout
2. SPMAGTF(X) PLGR Primer

ADMINISTRATIVE INSTRUCTIONS:

APPENDIX E PLGR References

1. **PLGR Technical Manual**
   TM-11-5825-291-13 5 SEP 93

2. **AN/PSN-11 PLGR** New Equipment Training Student Handout Package
   USMC Artillery Detachment, Fort Sill, Oklahoma

APPENDIX F GPS Vulnerabilities

1. **Line-of-Sight Blockage** occurs when terrain or obstructions prevent the GPS receiver from receiving satellite signals.

   Counter-measures:
   a. Move to a location with a 360 degree, unrestricted view of the horizon, if possible.
   b. If only three satellites are visible, manually enter an estimate of your current elevation. This is called elevation hold and takes the place of the fourth satellite.

      Note: The accuracy of the position is only as good as the accuracy of the manual elevation entered.

2. **Interference** is the unintentional disruption of GPS signal reception. The source of the interference can come from civil or military multi-band radios.

   Counter-measures:
   a. Determine the direction of the interference.
   b. Mask the GPS receiver from the interference using terrain or buildings.

3. **Jamming** is the intentional disruption of GPS signals by the enemy. In combat, it may be difficult to initially distinguish between interference and jamming. Jamming will probably be for longer durations. In general, if the direction of the problem is the same as the incoming rounds, it is probably jamming.

   Counter-measures:
   a. Take the same counter-measures as for interference. In addition, timely reporting is critical to initiate counter-jamming action.

4. **Spoofing** is the broadcasting of phony GPS signals by the enemy. The two types of spoofing are: *crude* and *sophisticated*. Crude spoofing may cause a sudden jump in the position display. Sophisticated spoofing is more dangerous. The enemy attempts to slowly and carefully manipulate a receiver to get the user to move to a certain location.

   Counter-measures:
   a. Use proper crypto variables.
   b. Terrain Associate. Always cross-check GPS data with map and compass.
   c. Maintain good situational awareness.