Midnight GPS
Display Terminal

Quick Reference

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This Quick Reference contains brief descriptions of many of the Midnight ***GPS Display Terminal*** *(GDT) screens and some of the basic operating procedures, menus, and controls. For more detailed and complete information, including how to load and do initial set for up the application, please see the Midnight GPS Display Terminal User Guide.*

The product and screen images shown herein are current at the time of this writing. Future releases may change appearance and content.

Contents

Midnight GPS Display Terminal Quick Reference Revision History:

2015-10-01 .....Beta release for Version B1.0I.
2015-10-10 .....Updated for Version B1.0o. Added the following:
- Maidenhead coordinates to the GPS-G and GPS-C displays
- Automatic NUM PAD activation for editing local time offset

2015-10-13 .....Updated for Version B1.0p. Added the following:
- Status line to GPS Terminal display
- UBX CFG-CFG message (F7) to save receiver configuration
- UBX CFG-RST message (F6) to reset and restart receiver
- Additional text to better describe UBX command functions

1. FEATURE OVERVIEW

Live display of GPS Receiver Data* **...** *Time, Date, Lat/Log, Maidenhead grid coordinates, Satellite Signal Strength, ...*

Super Accurate Clock ... *Displays UTC and Local time*

Signal Generator ... *Programmable "TimePulse" output (1pps to 10-MHz)***

NMEA Data Stream ... *Displays NMEA data for all satellites in view of the receiver.*

Setup Mode ... *Specify serial interface baud rate, time zone, LCD orientation, ...*

SD Card ... *For software updating, GPS data collection, ...*

DOS File System ... *On SD Card, file/data management*

320x240 pixel color graphic LCD ... *3.2Inch high resolution screen, 16-bit color*

Touch-Screen ... *For convenient field use or as display on bench*

Keyboard input (optional) ... *For convenient data entry/edit*

** Requires external connection of GPS receiver (not included); 3.3V serial data (RxD/TxD)*

*** Not all GPS receivers have ability to generate output frequencies. Supported receivers currently include u-blox Rx family.*

2. QUICK START

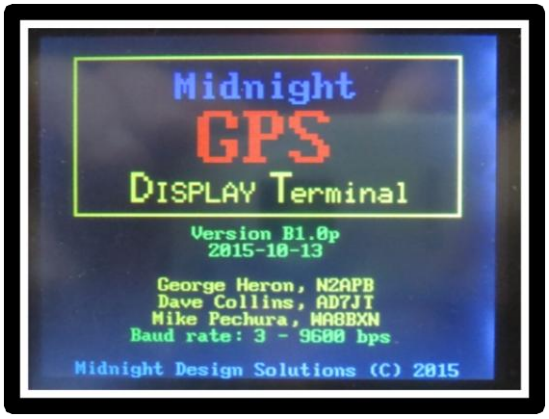
1. Apply power

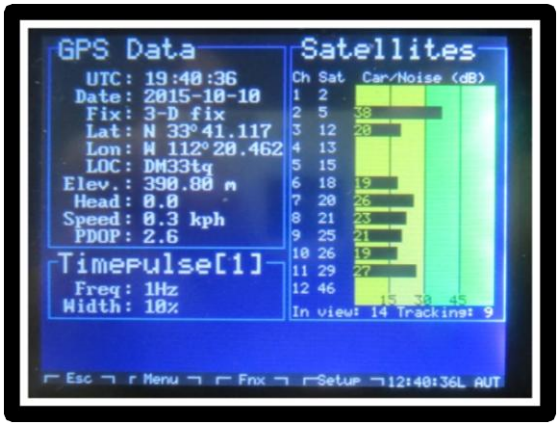
a. Use 2.1mm power plug (supplied), center positive

b. Voltage range: 7-to-14V DC. Batteries may be used (140 mA current draw). Six "Energizer E95" alkaline D-cells will power the GDT for about 20 hours.

c. Load GDT application (if not already loaded). See *Midnight GPS Display Terminal User Guide* *LOADING FIRMWARE* for step-by-step instructions for application loading and initial application setup.

d. See splash screen and then GPS Display



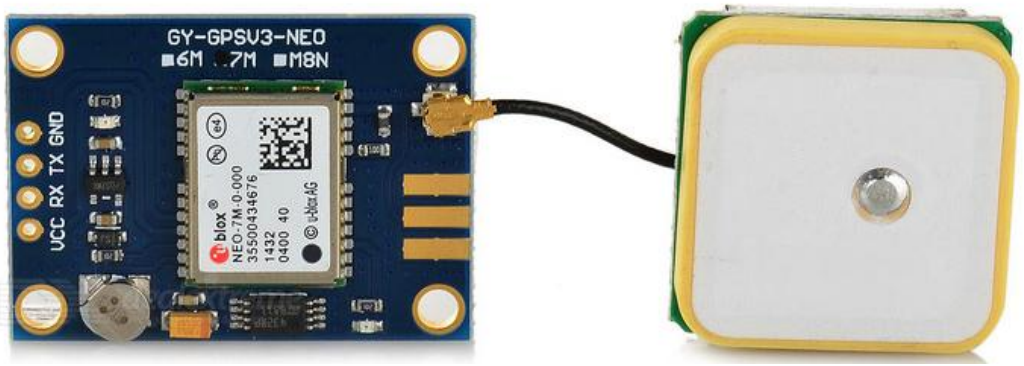


2. Connect GPS Receiver *(not supplied)*

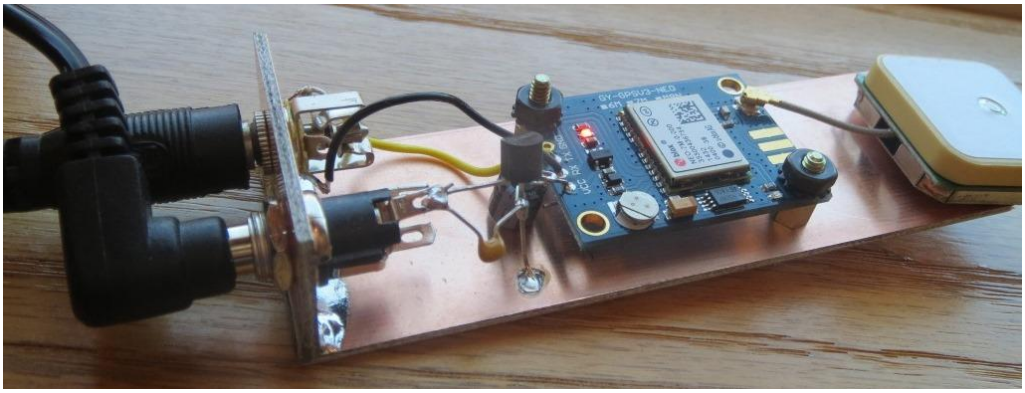
a. Use 3.5mm stereo plug (supplied), tip: GDT RxD, ring: GDT TxD

b. GDT serial port is 3.3- or 5-volt “UART” data

c. Default baud: 9600 bps . Change according to GPS receiver being used.

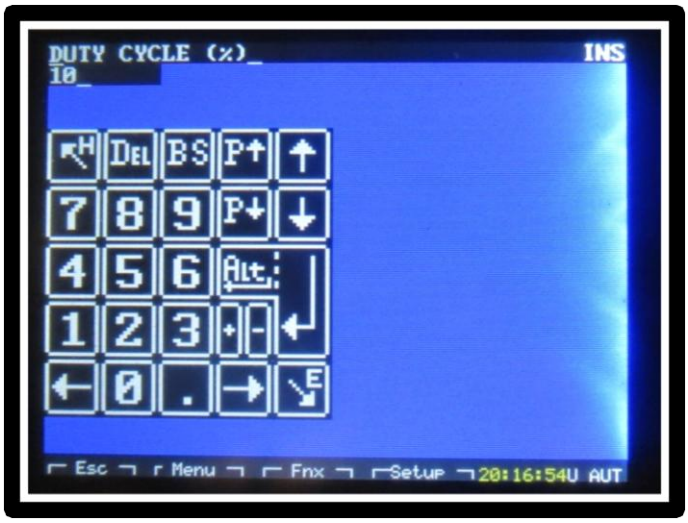


Here's an eBay special right out of the bag.



Receiver mounted with 5V power regulator and serial port jack

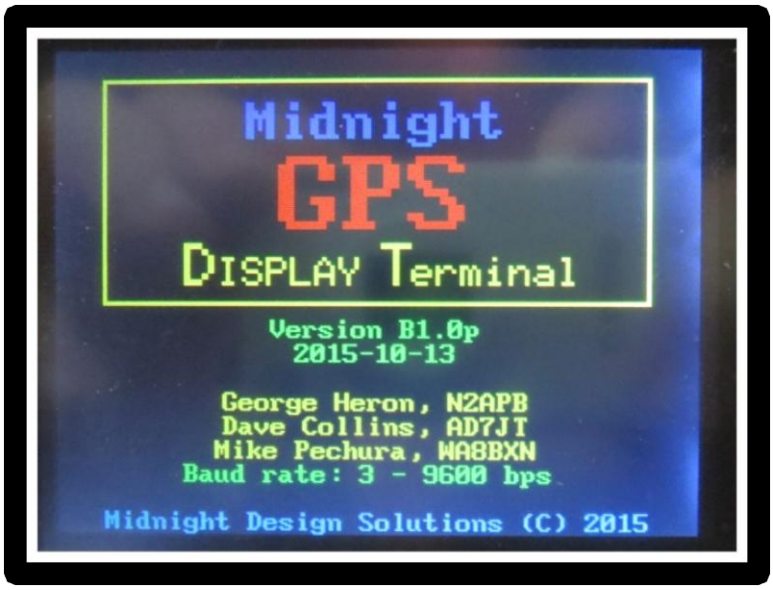
3. “Touch” screen to control the GDT functions



4. Connect Keyboard (optional, not supplied)

a. Use PS2 keyboard, with round 6-pin mini DIN plug or USB keyboard (that is PS2 capable) with USB to PS2 adapter.

3. SPLASH SCREEN



Identifies the product and the firmware version, revision level, and release date. If a 'B' precedes the revision level, the firmware is a BETA release version.

Displays the current baud for the serial port. Must agree with the connected GPS receiver.

Touching the screen when the splash screen is displayed will keep the splash screen displayed, otherwise, the display will clear after about three seconds.

Touching the screen when powering up the GDT will initiate the touch screen calibration sequence. To calibrate the touch screen, just follow the on-screen directions.

4. TOUCH SCREEN

The GDT display is covered with a transparent touch screen. Each screen display has at least one touch control (e.g., virtual button) and many have more. Touching an active area on the touch screen initiates an action just like entering the corresponding control code (shortcut or hot key) with the keyboard. When the stylus is raised, the GDT notes the last position touched and initiates the action assigned to that area of the screen. The stylus can be dragged to the desired area and then raised to make the selection.

In this and other GDT documents, touch screen initiated operations are identified by their names on menus, legends on buttons, and text in the active area in **very bold text** and the corresponding keyboard entry is shown in square brackets ([...]). In many cases the identification and the key name are the same.

The main touch screen operation is the "tap". A tap is performed by touching the stylus to the screen, dragging it to the displayed control area (if necessary), and raising the stylus from the touch screen to make the selection.

Virtual controls include buttons, menu line items, and specific areas related to the response action to be performed. Sometimes, the entire screen is the active area.

5. NUMERIC KEY PAD (NUM PAD)

Touch the top line of the display to select and bring up the **NUM PAD** for (decimal) numeric data entry from the touch screen. The **NUM PAD** can be closed with a tap outside of the **NUM PAD** area.

- ↖H ..... [**Home]** clear edit line text
- **DEL** ..... [**Delete]** delete character at cursor
- **BS** ..... [**Back Space]** delete character to left of cursor
- **P↑** ..... [**Page Up]** use depends on context
- **↑** ..... [**Up Arrow]** cursor up one line
- **P↓** ..... [**Page Down]** use depends on context
- **↓** ..... [**Down Arrow]** cursor down one line
- **Alt↵** ..... [**ALT-Enter]** enter text without ending CR
- **↵** ..... [**Enter]** enter test with ending CR
- **←** ..... [**Left Arrow]** cursor left one position
- **→** ..... [**Right Arrow]** cursor right one position
- ↘E ..... [**End]** cursor to end of edit line text

Not all **NUM PAD** buttons are used in every context. The **NUM PAD** is only available where numeric entry is possible.

6. PERMANENT BUTTONS

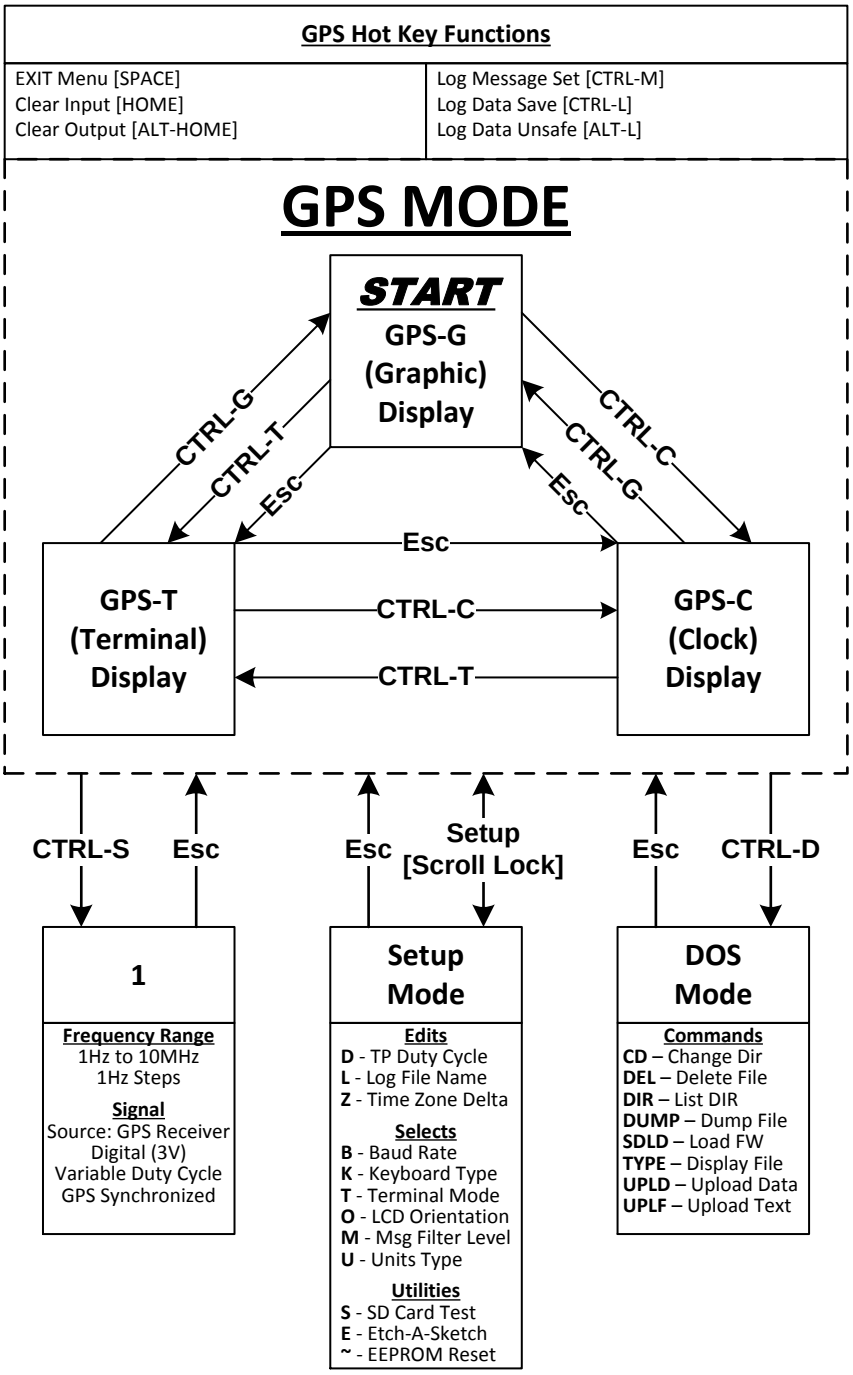
One of six virtual buttons located along the bottom of all displays can be activated by tapping the screen in the area defined for that button. As with all touch screen controls, activation comes at the end of the touch, when the stylus is raised. All displays may not use all six buttons.

Simulates keyboard entry by generating the equivalent control codes as the corresponding keyboard keys:

- **Esc** [Esc]: Terminates a mode or display and returns to a previous one or opens a new one.
- **Menu** [CTRL-M]: Brings up a context menu.
- **Fnx** [CTRL-F]: Brings up a list of UTX messages that either solicit a specific response message from a u-blox GPS receiver or initiate a control function in the receiver.
- **Setup** [SCROLL-LOCK]: Navigates between GPS mode and Setup mode.
- ***Current time***: The GPS is synchronized when white; tapping this time display [CTRL-Z] toggles between local time (**L**) and GPS or UTC time (**U**).
- **AUT** / **MAN** [CTRL-A]: Toggles between auto and manual message set display update.

Note: **Fnx** and **Setup** change to **Left Arrow** [←] and **Right Arrow** [→] in DOS mode. These arrow buttons navigate between sectors where appropriate.

7. NAVIGATION



The label on each transition path identifies the context menu line item that initiates the transition. The label also names the key that may be used to make the transition with a keyboard.

When they are not the same, the key name is shown in square brackets ([...]).

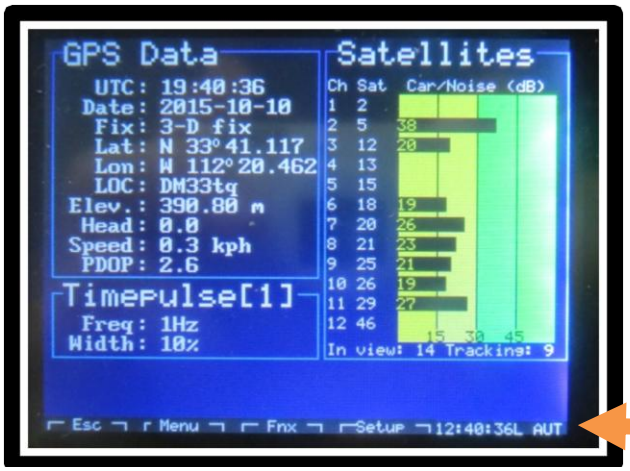
GPS Mode is the mode that processes and displays information from messages received from the GPS receiver. Three different display formats are available: GPS-Graphic, GPS-Terminal, and GPS-Clock.

Esc [Esc] will rapidly switch from one display to the next in a round-robin fashion.

Menu [CTRL-M] in **GPS Mode** will bring up the **GPS Mode** context menu as shown here:

The six buttons on the left navigate between displays and modes. The six buttons on the right perform the functions shown. Not all buttons are active on all **GPS Mode** displays.

8. GPS-Graphic Display



Permanent (touch screen) buttons

Initial screen at power up.

GPS Data:

1. Current UTC time and date synced to satellite clocks.
2. Fix: None (< 3 sat), 2-D fix (3 sat), or 3-D fix (> 3 sat).
3. Current location, speed and heading.
4. PDOP (Position Dilution Of Precision) … smaller is better.

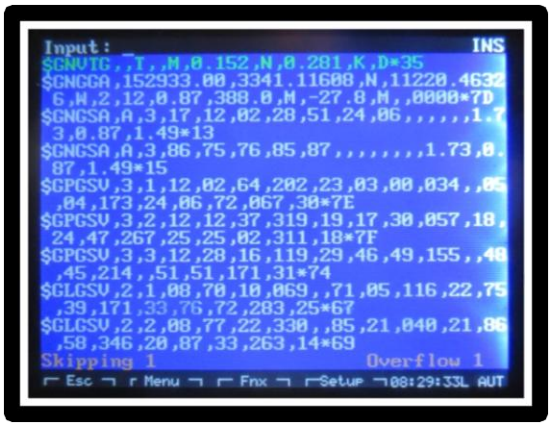
Satellites:

1. Carrier to Noise ratio (Car/Noise) shown in dB.
2. Car/Noise not shown for values too low for receiver to track.
3. Only 12 of In View satellites are shown at a time; tap screen [SPACE] to toggle between three groups of 12 satellites.
4. Total number of satellites In view is fixed by receiver location and time.
5. Total number being tracked depends on Car/Noise ratios.
6. White satellite numbers (Sat) are US GPS satellites, pink numbers are Russian GNOASS satellites (u-blox NEO/LEA-M8 only).

Timepulse[n]:

1. Current TimePulse n frequency (1 Hz to 10 MHz).
2. Current TimePulse n duty cycle (in percent of period).
3. Four configurations (see Signal Generator mode)

9. GPS-Terminal Display



GPS receivers broadcast one NMEA message set per second. Messages are parsed to extract the data shown on GPS-Graphic and GPS-Clock Displays. Messages are color coded as follows:

1. **WHITE** - Recognized messages containing data we use.
2. **GREEN** - Recognized messages containing no data we use.
3. **YELLOW** - Recognized messages containing information about satellites not in the first 12 in view.
4. **LIGHT RED** - Unrecognized NMEA messages including NMEA-sanctioned proprietary messages.

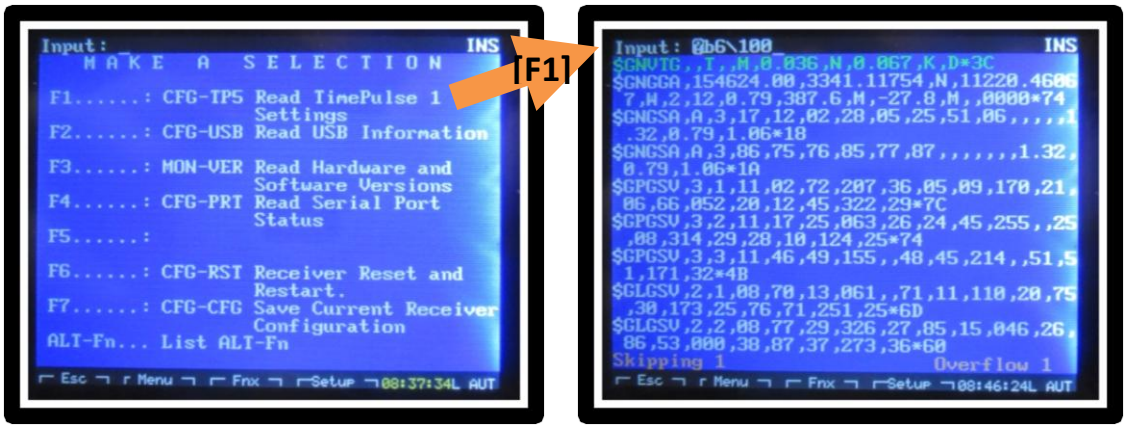
A message filter (**Setup > M**) [SCROLL-LOCK > M] can be set to filter messages such that only messages equal to or above the filter value will be displayed.

In **AUT** mode, the message set display is refreshed with each message set received. In **MAN** mode, the message set display is refreshed once each time the touch screen is tapped [SPACE].

Display will not automatically scroll. Tapping upper ([UP ARROW] or lower [DOWN ARROW] of the **left half** of the display

will scroll up or down one message in the set. Skipped and overflow counts are shown on the last line of the display.

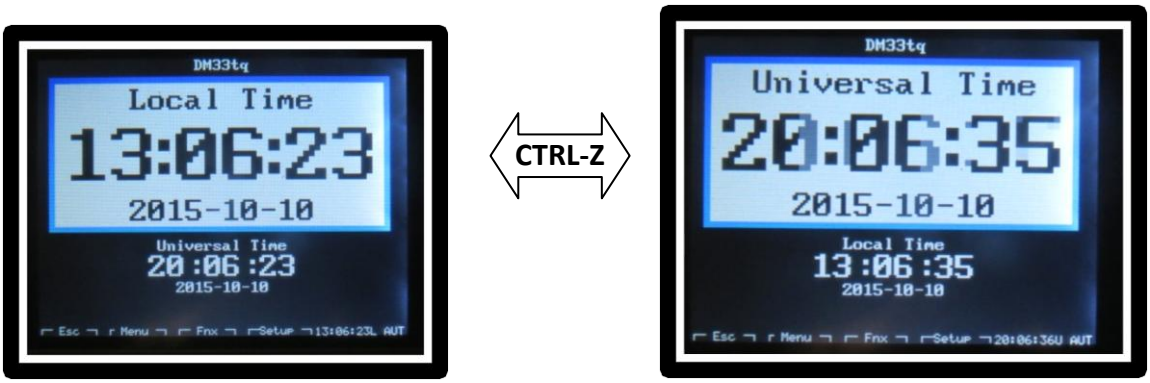
Tapping **Fnx** [CTRL-F] brings up the Function key menu that lists a number of u-blox proprietary (UBX) commands. Tapping a menu line [Fn] in **GPS mode**, switches to the **GPS-T display** if not already active and loads the input line with the associated UBX command. The command will be issued when Enter is tapped on the NUM PAD [Enter].



Depending on the command issued, one or more responses will be UBX messages that, if recognized by the GDT, will be parsed and displayed one at a time until the screen is tapped [SPACE].

If the response message is not recognized, it will be displayed as is. Since UBX messages are encoded in binary, the response message may not be readable.

10.GPS-Clock Display



Time and Date (black) synchronized with satellite clocks

Time and Date (red) maintained by GDT

The local Maidenhead grid coordinates are shown to six places on the top line of the clock display.

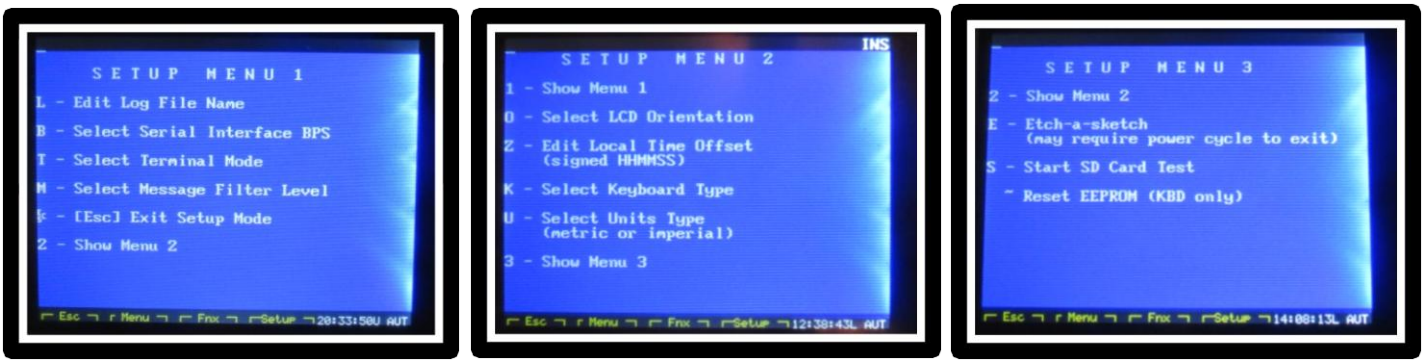
Set offset between Local Time and Universal Time (UTC) with **Setup > 2 > Z [SCROLL-LOCK Z]:**

Z - Edit Local Time Offset

Offset must be **negative** (leading zeros optional) if local time zone is East of Greenwich (west or negative longitude), England and **positive** (plus sign and leading zeros optional) if local time zone is West of Greenwich.

Offset for U.S. Mountain Standard Time shown (-7 hours). The NUM PAD automatically activates when **Edit Local Time Offset** is selected.

11.SETUP MODE



Tap **Setup** [SCROLL LOCK] to enter Setup Mode. Tap '**1**' [1], '**2**' [2] and '**3**' [3] to navigate between the three Edit Menus.

Completing a selection or tapping **Setup** [**SCROLL LOCK]** will exit Setup mode back to the previous GPS mode display.

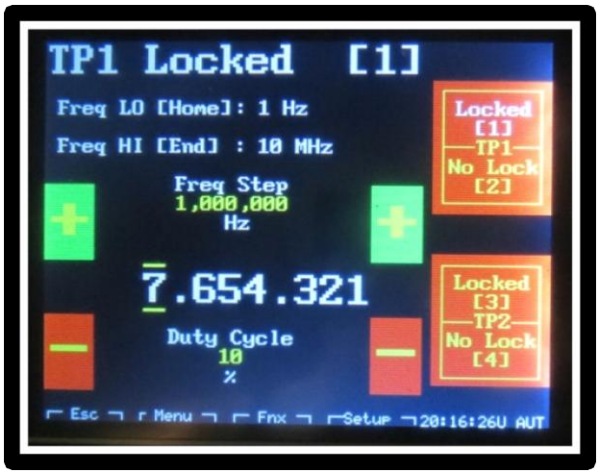
Make a selection by tapping (except for '**~**') the menu line or the line below or by keying the first character of the menu line.

B - Serial Interface BPS (baud) must match the baud of the device connected to the serial interface.

E - Etch-a-Sketch can only be terminated by entering **Esc** from the keyboard or by cycling GDT power. The permanent buttons are disabled when Etch-a-Sketch is active to allow the total touch screen to be used.

S - Start SD Card Test writes a number of files on the SD card, verifies their content, and then deletes the files, one at a time, verifying the remaining files after each delete. The test sequence pauses after each test part until the operator taps the screen [SPACE].

12.SIGNAL GENERATOR MODE



Signal Generator mode controls the frequency and duty cycle of a u-blox GPS receiver's TimePulse signal(s). The frequency and duty cycle of each of up to two TimePulse signals can be independently controlled for when the receiver has and does not have lock.

The ***frequency*** display always shows the current frequency as reported by the GPS receiver.

The following touch screen controls are available on this screen:

- **Freq LO** [Home] - set ***frequency*** to minimum (1 Hz).
- **Freq HI** [End] - set ***frequency*** to maximum (10 MHz).
- Tap a digit in the ***frequency*** display [←→] to position the yellow bars and change the **Freq Step** value.
- [+ or UP ARROW] - Add **Freq Step** to ***frequency***.
- [− or DOWN ARROW] - Subtract **Freq Step** from ***frequency***.
- **TP1 Locked** [1]
- **TP1 No Lock** [2]
- **TP2 Locked** [3] u-blox receivers with timing only
- **TP2 No Lock** [4] u-blox receivers with timing only

The TimePulse **Duty Cycle** for the currently selected TimePulse is set in **Signal Generator** mode by tapping **Menu** [**CTRL-M]:**

The **NUM PAD** activates automatically when **Menu** [CTRL-M] is selected in **Signal Generator** mode. The number is square brackets ("[3]") shows which TimePulse the duty cycle is being set for. For example, the above screen displays is for setting the duty cycle of TimePulse 2 when the receiver has lock.

Enter as a percentage between 0.00001% and 99.99999%. Non-significant, trailing zeros after the decimal point are suppressed in all duty cycle displays.

13.DOS MODE

Enter DOS mode by entering **ESCAPE** while in **Command** mode. The first sector of the current directory is displayed.

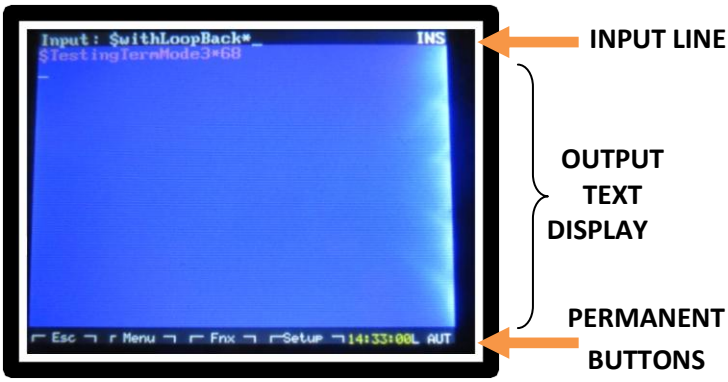
Two permanent buttons changed to Left and Right Arrows. Left and Right arrows navigate between directory sectors.

Two ways to build and execute a DOS command:

1. Tap the file name in the **DIR** display then select the command from the Command menu. The complete DOS command is then displayed on the prompt (top) line. If the command is correct, select **Yes** from the Confirmation screen to execute the command.
2. Enter command followed by file name (if required) and press **ENTER**.

See User Guides for detailed DOS command descriptions.

14.TERMINAL MODES



There are four terminal modes in which serial receive data is displayed at a very basic level and text entered on the input line can be transmitted to the GPS receiver. The four modes differ in how the input text is processed and how received text is displayed. The Terminal mode is set with

Setup > T - Select Terminal Mode.

GPS [0] The default terminal mode. Displays GPS messages as described earlier with the GPS-Terminal Display. NMEA ("$....*") and u-Blox proprietary UBX ("ALT-F2 b ....") message formats are recognized and, before transmission, the appropriate checksum is calculated and appended to the Input line text. The Input line must contain complete messages with no extra characters. Message content is not validated.

The display pauses when a UBX message is received until the screen is tapped [SPACE] in the text area.

The other three Terminal modes are normally used for non-GPS related functions. In these Terminal modes the GDT display is locked and can only be changed using Setup mode to change the Terminal mode. All navigation controls except **Setup** [Scroll Lock] are disabled and, when entered, the associated Special Extension Codes (SECs) are queued on the Input line for transmission. The **NUM PAD** may be activated by tapping the Input line.

The following Terminal modes can be checked out offline with a loop-back connector on the serial interface.

NORMAL [**1**] - Editing functions are active using **NUM PAD** or keyboard. ↵ [Enter] will cause text buffered on the Input line to be transmitted with ending CR. (Emulates a simple ASCII terminal or PC terminal application.) Alt↵ [ALT-Enter] will cause text on the Input line to be transmitted without the ending CR. Any character other than the editing characters (including Esc) can be buffered and transmitted.

TRANSPARENT [**2**] - Same as **NORMAL** except hotkeys and editing functions are not active. When entered these characters will be sent as Special Extension Codes (SEC).

DIRECT [**3**] - Text is transmitted as it is entered and is not directly displayed on the GDT display. The receiving device must echo the text to have it displayed. Special control characters are recognized in the received text giving the remote device control of many aspects of the display. See GDT User Guide for complete details.