What is GPS?

GPS, standing for Global Positioning System, is becoming common nowadays. Following is a brief introduction.

The American Defense Department developed GPS originally for military operations. The system is available for use by the general public. For example, anybody can use GPS in association with modern vehicle navigation systems. Position precision for public use is approximately 15 m.

Moreover, precision can be improved when a vehicle is used for navigation and aboard ships through use of map matching technology and differential GPS techniques.

A total of 24 or more GPS satellites are at a high-level altitude of approximately 20,000 km on six circular tracks with an orbital radius of approximately 26,000 km. Therefore, there are four or more satellites located in each orbital track. For civilian use, the RF carrier frequency of the satellites is 1575.42 MHz. Spread spectrum (SS) technology is used over a bandwidth of 2.046 MHz to prevent interference among all the satellite signals on a common carrier frequency.

Position Determination Principle

The GPS receiver receives the radio signals transmitted from the GPS satellites. The receiver measures the time duration between when the signal leaves the satellite and when the signal arrives at the GPS receiver. Knowing this time allows calculation of the distance that the signal traveled from that particular satellite. By receiving multiple signals from different satellites and doing this distance calculation multiple times, the intersection of the spherical surfaces that represent the respective radius distances to the various satellites will determine a single point.

The precision of the determination of the intersecting point relies on the satellites and the data collected.

Datum (Geodetic Survey System)

The latitude and longitude information required by the GPS receiver does not allow for accurate representation of the unevenness of the Earth's surface. For use with GPS, the current standard that defines the precise shape of the Earth is called WGS-84. By using this standard in conjunction with mapping standards for each country, accurate position plotting on a map can be done.

GPS and APRS Position Format

Although position can be described in many different formats, such as degrees, degrees and minutes, and degrees, minutes and seconds, the GPS system and APRS have standardized on the degrees and decimal minutes format. Just like it is important to use proper international phonetics when spelling on the air, it is important in APRS as in any communications system to have a default standard for position. All operators should be trained to use the DDD MM.mm format by default in voice communications just like in data formats. Using these standards on the air will prevent communications errors, confusion, repeats, and conversions.

Interval and Total Distance

<table>
<thead>
<tr>
<th>Geographic Coordinates</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>DD MM.mm (degrees and minutes)</td>
<td>39 49.31N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+39 49.31</td>
</tr>
<tr>
<td>Longitude</td>
<td>DDD MM.mm (degrees and minutes)</td>
<td>84 15.39W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-84 15.39</td>
</tr>
</tbody>
</table>
INTERNAL GPS FUNCTION ON/OFF

Turn this function Off when connecting an external GPS receiver to the COM terminal.

Press [F], [MARK] to turn the Internal GPS receiver ON or OFF.

- When the Internal GPS receiver is ON, the “GPS” indicator appears on the display.
- When the Internal GPS receiver is On, the internal clock is automatically configured with the time data from the internal GPS receiver.
- You must set the time zone beforehand, through Menu No. 196.
- When determining your position for the first time after the power supply is turned On, the clock data is automatically set and is updated once per day thereafter.

When the Internal GPS receiver is On, pressing [POS] will display “Latitude longitude”, then press [OK] to cycle the display between “Time, Altitude, Travel direction, speed” >> “Target point distance, Travel direction” >> “Log meter” >> “GPS satellite information”.
- Press [ESC] to return to the previous display.

LATITUDE LONGITUDE

1 3 5 0 7 1 5
2 W 0 8 3 3 0 8 0

TIME, ALTITUDE, TRAVEL DIRECTION, SPEED

ALTITUDE
1 2 3 4

TARGET POINT DISTANCE, TRAVEL DIRECTION

1 TRAVEL DIRECTION 2 TARGET POINT DISTANCE
- When pressing [F] while the target point distance/ traveling direction is displayed, the North Up display (displays North as the top) changes to the Heading Up display (displays the current travel direction as the top) or vice-versa. In the Heading Up display, a “<” or “>” is used to help indicate the traveling direction.

INTERNAL GPS SETUP

■ Internal GPS operation mode

Enter Menu mode and access Menu 200.

GPS ONLY: The display shows only GPS information; the transceiver transmit and receive capabilities are turned OFF; only GPS operation is available.

NORMAL: The display continues to show your frequency, You can use it as a normal transceiver.
When set to “GPS Only”, you can operate only the following key functions.

<table>
<thead>
<tr>
<th>Key Name</th>
<th>[KEY]</th>
<th>[F], [KEY]</th>
<th>[KEY] (1s)</th>
<th>[KEY] + Power ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>[LAMP]</td>
<td>Lamp</td>
<td>Continuous Lamp On</td>
<td>Lamp</td>
<td>-</td>
</tr>
<tr>
<td>[▲]</td>
<td>-</td>
<td>Function/ Menu select</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[▼]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[OK]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[ESC ▼]</td>
<td>Menu mode</td>
<td>RF power select</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[A/B]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[1]</td>
<td>MARK</td>
<td>-</td>
<td>Register mode of Mark Waypoint</td>
<td>-</td>
</tr>
<tr>
<td>[2]</td>
<td>-</td>
<td>Starting the LOG function</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[3]</td>
<td>POS</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[F]</td>
<td>Function mode</td>
<td>-</td>
<td>-</td>
<td>Reset mode</td>
</tr>
</tbody>
</table>

### Battery Saver (GPS Save)

This function will turn the GPS power source Off after the programmed timer expires if position data is not determined during the maximum catching time (approximately 5 minutes). To prevent unnecessary battery consumption, when there are many reception satellites, the GPS is stabilized and position data can be determined, the GPS power source repeatedly turns On and Off.

1. Enter Menu mode and access Menu 201.
2. Set GPS Off time to “Off”, 1, 2, 4, 8, or “Auto”.

**Auto**: When set to Auto, the GPS Off time starts at 1 minute for the first time, then progresses to 2 minutes, 4 minutes and 8 minutes each additional time. The GPS Off time remains at 8 minutes thereafter. However, after having determined your position for the duration, if the GPS cannot pinpoint your location, the GPS Off time will restart at 1 minute.

**Note:**
- Position precision may be improved by setting the Battery Saver (GPS Save) function to “Off”.
- You cannot set the SBAS function to “On” when the Battery Saver (GPS Save) function is 1, 2, 4, 8, or Auto. Set the Battery Saver (GPS Save) function to “Off”.

### GPS Data PC Output

Turn this function on when you want to send the Internal GPS receiver data (NMEA) from the PC terminal using.

1. Enter Menu mode and access Menu 202.
2. Set PC Output to “Off” or “On”.

### GPS DATA SETUP

#### Land Survey System Datum

When using the Internal GPS receiver, set up the necessary land surveying system.

For APRS, select “WGS-84” (world land surveying system).

1. Enter Menu mode and access Menu 210.
2. Set Datum to “WGS-84”.
   - This function does not work when using an external GPS receiver.

#### Sentence

Adds an NMEA sentence to the Internal GPS receiver data output from the PC.

1. Enter Menu mode and access Menu 211.
2. Set Sentence to “$GPGGA”, “$GPGLL”, “$GPGSV”, “$GPGSV”, “$GPRMC”, “$GPVTG”, or “$GPZDA”.
   - With BEACON transmission, the “$GPGGA” “$GPRMC” check (x) cannot be removed in necessary information and satellite image information.
   - You cannot output an NMEA sentence from an external GPS receiver to a PC.
SBAS

Through the SBAS (Satellite Based Augmentation System) geostationary satellite, when using the system which offers the information of wide scope reinforcement, set this function to “On”.

1. Enter Menu mode and access Menu 212.

2. Set SBAS to “Off” or “On”.

Note: When the Battery Saver (GPS Save) setting is 1, 2, 4, 8, or Auto, you cannot the SBAS setting is “On”.

TRACK LOG

All movement is saved in the GPS LOGGER. Saved information includes latitude, longitude, altitude, travel direction, speed, time, and date. The log can retain up to 5000 points of data.

Press [F], [TNC] to turn the Track Log function On or Off.

When turning the Track Log function On, “Log Start” appears for approximately 5 seconds, followed by the “iLOG” icon.

- When setting Menu 200 to “GPS Only” and the Track Log function is turned On, the “●” icon appears.
- When turning the Track Log function Off, “Log Stop” appears on the display for approximately 5 seconds.
- With the Track Log function On, even if the power source is turned Off during Log acquisition, the log is backed up so that when the power is turned back on, the log acquisition resumes.
- You can verify the Log activity ratio in the GPS pinpointing screen.

Note:
- When the Track Log is turned On while the GPS is Off, the GPS will also turn On.
- When the GPS is not pinpointing, data is not saved to the log.
- Using the MCP-4A, you can read the Track Log.
- If the Track Log overwriting configuration is turned Off (see below), “Log Full” appears when the log memory is full.
- When the APRS is On, Log operation will begin only when the APRS menu COM terminal input is Off.

Track Log All Clear

1. Enter Menu mode and access Menu 220.

2. Select “Yes” or “No”.

Selecting “Yes” will clear the entire Track Log.

Overwriting the Track Log

When the Track Log becomes full, new data will begin overwriting the oldest Track Log data

1. Enter Menu mode and access Menu 221.

2. Select “On” or “Off”.

Selecting “On” will allow old data to be overwritten with new data.
LOG SETUP

Track Log Acquisition Type
You can set the conditions for saving portable Track information as GPS Logger.
You can change the settings for travel speed, etc.

1 Enter Menu mode and access Menu 230.

2 Select “Time”, “Distance”, or “Beacon” for the Record Method.

3 Access Menu 231.

4 Select an Interval time from 2 ~ 1800 seconds (in steps of 1 second).
   • The Interval setting is available only if the Record Method has been set to “Time”.

5 Access Menu 232.

6 Select a Distance from 0.01 ~ 9.99 (in steps of 0.01).
   • The Distance setting is available only if the Record Method has been set to “Distance”.
   • The units used for Distance can be set to miles (mi), kilometers (km) or nautical miles (nm).

Interval and Log Total Time:

<table>
<thead>
<tr>
<th>Point Q’ty</th>
<th>Interval time (second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>5000</td>
<td>166.7</td>
</tr>
<tr>
<td>2.8</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Interval and Total Distance:

<table>
<thead>
<tr>
<th>Point Q’ty</th>
<th>Interval distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>2.00</td>
</tr>
<tr>
<td>5000</td>
<td>50</td>
</tr>
</tbody>
</table>

TARGET POINT

You can register positional information for a target point.

1 Enter Menu mode and access Menu 240.

2 Select a Target Point (from 1 ~ 5).

3 Press [MHz]. The “in use” target point mark (●) appears to the left of the channel number.

4 Access Menu 241.

5 Enter a Target Point name (up to 8 characters).

6 Access Menu 242.

7 Enter the north/ south latitude.

8 Access Menu 243.

9 Enter the east/ west longitude.
MARK WAY POINT

You can register up to 100 points with the location’s latitude, longitude, altitude, time, name, and icon. Names and icons can be manually edited.

1 When the frequency or position is displayed, press [MARK] (1s) to enter Mark Waypoint registration mode.
   - When registering a Mark Waypoint, the following display appears for approximately 10 seconds.

   ![Marked !! Edt ▶ OK](image)

2 Press [OK] to enter Mark Waypoint editing Mode.

3 Selecting “Name” will enter the Name editing screen. You can enter up to 9 characters.

   ![1:MARK-1 Name Icon](image)

4 Selecting “Icon” will enter the Icon selection screen. Refer to the APRS explanation regarding the available icons.

   ![1:MARK-1 Icon](image)

Note:
- Even when the Log function is OFF, you can register a Mark Waypoint.
- The MCP-4A can read Mark Waypoints.

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**Copying the Mark Way Point to the Target Point**

You can copy the displayed Mark Way Point to the Target Point.

1 Select “Copy to TP” to display the Target Point list.

   ![1:MARK-1 Copy To TP](image)

2 Select the Target Point (1 ~ 5) that you want to copy.

   ![Copy To TP Target Pt. 1 Target Pt. 2](image)

**Mark Way Point List**

The information registered with the Mark Waypoint is confirmed.

Press [MARK] to display the Mark Waypoint list.
- The list of Mark way point appears.

   ![1:KENMOOD 2:HOME 3:HAM store](image)

- When there is no data registered in the Mark Waypoint, “No Mark” is displayed.
- Rotate the Tuning control: Selects the station data.
- Press [▲]: To move the cursor “▶” up the display, to the previous list number.
- Press [▼]: To move the cursor “▶” down the display, to the next list number.
- Press [◀OK]: Displays the details of the selected Mark Waypoint.
- Press [A/B]: Deletes the selected Mark Waypoint.
  - “Clear?” appears then press [◀OK] to clear.
- Press [A/B] (1s): Deletes all Mark Waypoints.
  - “Clear All?” appears. Press [◀OK], “Sure?” appears then press [◀OK] to clear all.
- Press [MENU]: Enters Mark Waypoint Edit mode.
- Press [MARK] or [ESC ▼]: Returns to the frequency display.

Note: When the Mark way point is no data registered, “No Mark” is displayed.
Detailed Display of a Mark Waypoint

The details of a Mark Waypoint are spread across 3 screen pages.

Page 1:

- Rotate the Tuning control: Changes to the previous/next detailed display.
- Press [ESC]: Returns to the Mark Waypoint list display.
- Press [OK]: Continues to the next page.
- Press [A/B]: Deletes the Mark Waypoint currently being displayed.
- Press [MENU]: Enters Mark Waypoint Edit mode.
- Press [LIST]: Returns to the frequency display.

Page 2:

- Rotate the Tuning control: Changes to the previous/next detailed display.
- Press [ESC]: Returns to the previous page.
- Press [OK]: Continues to the next page.
- Press [A/B]: Deletes the Mark Waypoint currently being displayed.
- Press [MENU]: Enters Mark Waypoint Edit mode.
- Press [LIST]: Returns to the frequency display.

Page 3:

- Rotate the Tuning control: Changes to the previous/next detailed display.
- Press [ESC]: Returns to the previous page.
- Press [A/B]: Deletes the Mark Waypoint currently being displayed.
- Press [MENU]: Enters Mark Waypoint Edit mode.
- Press [LIST]: Returns to the frequency display.