Rockwell Trooper™

Handheld GPS Receiver

Operator's Manual

About the Global Positioning System

Since the 1970's, the U.S. Government has been building a Global Positioning System ("GPS") using NAVSTAR satellites. Now, for the first time, accurate three dimensional position (longitude, latitude, altitude) is available worldwide.

The U.S. Department of Defense Global Positioning System is based on 24 navigational satellites orbiting 11,000 miles above the earth which provide all-weather 24-hour global position. Each NAVSTAR satellite sends signals at the speed of light that are time-stamped by its onboard atomic clock, accurate to one-billionth of a second. By reading the time it takes signals to reach the receiver and by knowing the speed of light, a GPS receiver calculates the distance between you and each satellite to triangulate your position.

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Section I

The Trooper Handheld GPS Receiver

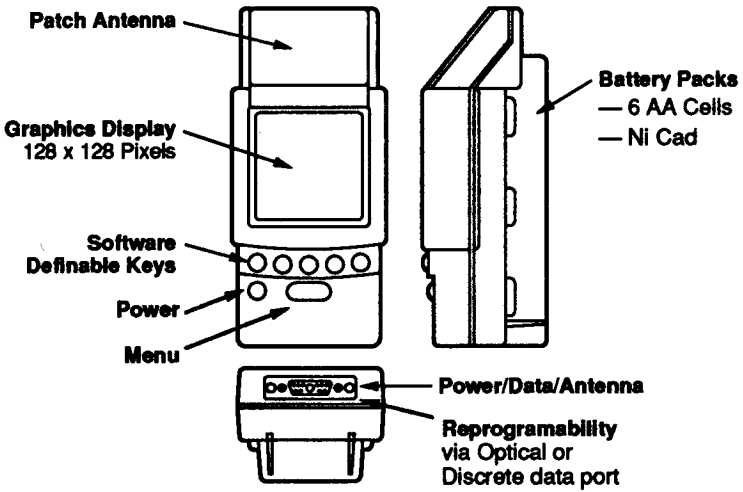
Congratulations! You are about to use the Rockwell Trooper Handheld GPS Receiver, the finest portable navigation instrument available.

The Trooper Handheld GPS Receiver features many advanced functions, and is one of today's most sophisticated GPS receivers. The Trooper has five parallel receiver channels. Four channels continuously track satellites to calculate position information. The fifth channel continuously collects data from all the other satellites in view. In this way, the Trooper is always ready to use any satellites which are in view.

The Trooper is compact enough for you to hold easily in your hand. It has a long-life, water-resistant keypad with which, by the touch of a key, selects every navigation feature you need. A beeper can alert you on arrival to waypoints and can be used to confirm keypresses.

Features

The Trooper has an easy-to-read graphic display and push-button controls. The built-in antenna is angled to optimize reception. Optical and electrical data ports allow the Trooper to be reprogrammed or loaded with waypoints and routes from an external computer or to transfer waypoints/routes from one Trooper to another.



The Trooper works in a fully automatic mode—you only need to turn it on! You don't even need to enter an approximate position. You can directly select many of the Trooper Handheld features from a single menu. Using the **Setup Page**, you can set a Waypoint Arrival Alarm and set universal or local time.

The graphic navigation "highway" shows your distance off your desired course and how to steer (right or left) to get back on course. It gives you both range and bearing to your destination. With the **Navigation Data Pages**, you can view course and speed over ground, estimated time of arrival, time to go, velocity and distance made good, your present position and altitude, or local magnetic variation.

You can easily store your current position in any of 100 waypoints. Each waypoint includes the date you recorded it for future reference. When at the **Edit Route Wpts Page**, you can scroll quickly through and view your listing of waypoints. Using the powerful route and waypoint editor, you can easily change existing waypoints. You also can pre-program up to 10 routes of 25 waypoints each for future use. If you need to follow a route stored in another Trooper, you can quickly copy the route to your unit.

Accessories

The following accessories are available. See Page 72 for ordering information.

- Vehicle Mounting Kit
- NiCad Battery Pack (batteries included)
- Mission Planning Station
- External Antennas and Cables
- Utility Cable
- Carrying Case

Section II

Operating the Trooper Handheld GPS Receiver

General

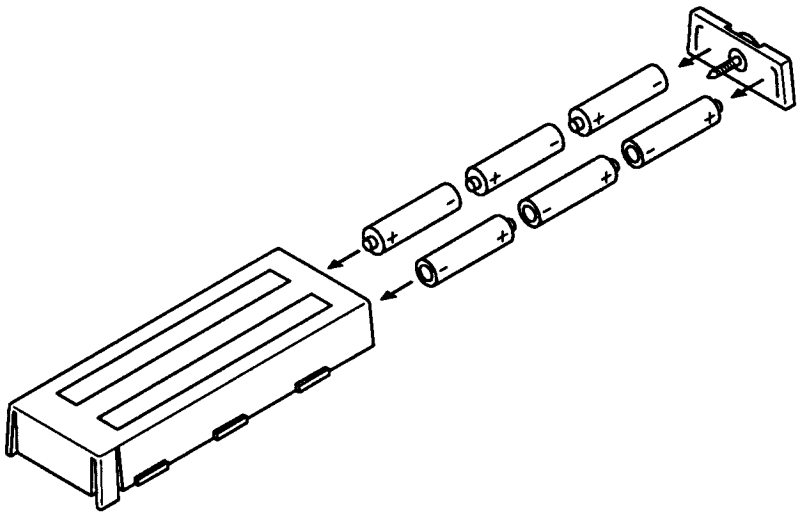
Using the Trooper is both easy and a pleasure. It has both fixed function keys and "softkeys". The fixed function keys (the **POWER** key, for example) do the same things each time you press them. The soft keys change function according to the display you have selected. Labels for these keys appear on each Menu Page so that you always know what they are used for.

Because manuals tend to get "lost", the Trooper has a built-in help system that solves this problem. All menus have brief instructions that tell you what keys to press for the function you want.

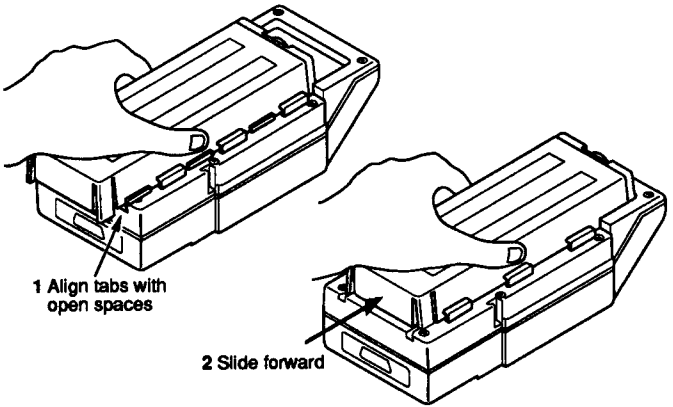
So, let's install the batteries in your Trooper and get started!

The Battery Pack

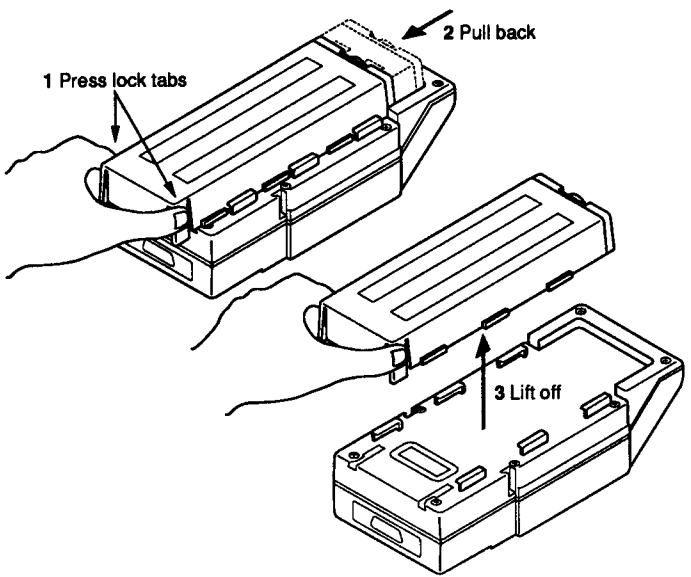
The receiver is shipped from the factory with a standard battery pack and six AA-size alkaline cells. Insert all six AA battery cells into the battery pack as shown (be sure to pay attention to battery polarity or your receiver will not operate!).



"Ears" on the back of the receiver lock with a set of tabs on the battery pack. To install the battery pack, align the tabs on the battery pack with the open spaces between the "ears" on the receiver as shown next page. Then, slide the battery pack in until it snaps into place.

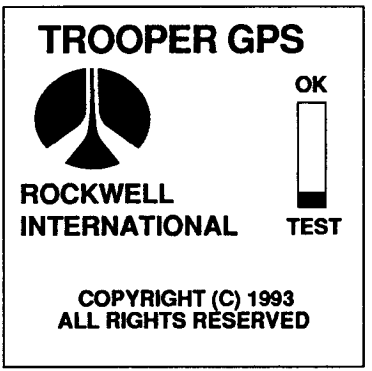


To remove the battery pack, merely squeeze the two lock tabs, as shown, and slide the battery pack down and off the receiver.



Turning On The Receiver

After installing the battery pack, press the **POWER** key to turn the Trooper on. The **Opening Page** appears when the unit is turned on. While operational checks are being performed, a bar moves up the page to indicate progress.



Remember: when the receiver is operating using batteries alone, the Trooper will notify you to use a single fix tracking mode for longer battery life. Press any key to continue. The Trooper will automatically turn off if you don't press any keys for 5 minutes to save battery life. A warning will alert you of automatic power-down. Press any key to reset the 5 minute automatic-off timer.

Turning Off The Receiver

Press and hold down the **POWER** key to turn the Trooper off. After holding down the key about one second, you'll see a message **"READY TO TURN POWER OFF, PLEASE RELEASE BUTTON"**. At that time, release the **POWER** key and your Trooper is off.

Battery Monitor

The power batteries are constantly monitored and an alert will appear to tell you when they are low. Follow the instructions on Page 5 to replace the battery pack.

Holding the Receiver

For optimum satellite signal reception hold the receiver so that its built-in antenna (angled surface above the display) is parallel (flat) with the earth. The antenna will still pick up satellite signals (though not quite as well) when it is laying flat or stood on end.

Menu Key & Menu Bar

- Press **MENU** to bring up the main function menus. Press the key beneath the menu item to select a different operation or function.
- **Menu 1** offers the following operations.

Keypress	What It Does
POS	Changes to the **Position Page**. Lets you adjust your type of fixes, position, time, navigation accuracy.
NAV	Changes to the **Navigate Page**. Displays a graphic navigation "highway", steering info.
PLOT	Changes to the **Plot Page**. Shows you a graphic "map" of your position and course history.
EDIT	Changes to the **Edit Waypoint Page**. Lets you edit your waypoints and routes.
SET	Changes to the **Setup 1 Page**. Lets you change your setup parameters for units, etc.

- Press **MENU** a second time to display **Menu 2**. **Menu 2** offers the following operations.

Keypress	What It Does
STAT	Changes to the main **Status Page**. Displays the system status.
CALC	Changes to the **Nav. Calculator Page**. Allows you to calculate the great-circle distance between two predefined waypoints. It will also find the bearing from the first waypoint to the second; and if you provide a constant speed, will determine the required travel time from the first to the second. See the Advanced Navigation Guide page 52 for more details.
DEMO	Changes to the **Demo Page**. Shows you a demonstration of navigation without actually tracking satellites or moving.
HELP	Changes to the **Help Page**. Displays on-line help for the Page currently displayed.

- Press **MENU** a third and last time to return to the original display.
- The **Menu Bar** is displayed in reverse video (white letters on dark back ground) to make it easy to see.

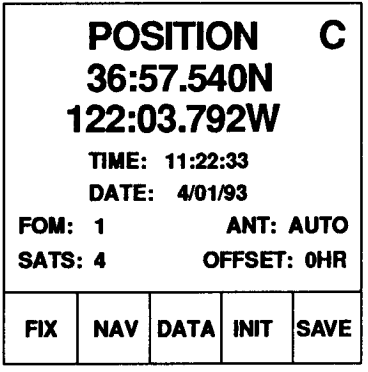
On-Line Help

You can get on-line help for the current display Page very easily, press **MENU**, **MENU**, **HELP**. The help will be for the display Page you were last looking at. It briefly describes the contents of the Page. To quickly return to that last Page, press the **ESC** key. There is always an escape key in Help.

To go into the Help Index, press the **INDX** key. This allows you to select other or related Help topics for more detailed Help information. Remember, press the **ESC** key to get out of Help and return to the last display Page.

Position Page

After all tests are passed during the **Opening Page**, the receiver will automatically change to the **Position Page**. You can activate the **Position Page** at any time by pressing the **Menu Key** and selecting **POS** from the **Menu Bar**.



The **Position Page** shows basic position data including: Position, Time and Date, as well as Figure of Merit (FOM) and the number of satellites currently being tracked. Figure of Merit represents a scale of how well the GPS receiver is tracking the satellites. Initially the FOM will be 9, meaning the Trooper hasn't obtained a position fix yet; a reading of 1 is the best. Position coordinates will display dashes until the GPS receiver is able to obtain a position fix.

When the unit is turned on for the first time, it may take several minutes for the receiver to obtain a position fix and display data. After the receiver gets a position fix, a 5 minute automatic-off timer starts, used to shut off the unit to conserve battery power. Pressing any key resets the automatic-off timer.

FIX

When in the single fix mode, you may get another position fix at any time by pressing the **FIX** softkey. After the **FIX** key is pressed, an "hourglass" ⧖ symbol appears in the upper right part of the display while the unit is getting a new position fix. More battery power is used when doing fixes; this is a battery saving feature.

NAV

The **NAV** key provides instant access to **Navigate Page** from the **Position Page**.

DATA

The **DATA** key brings up the **Navigation Data Pages** from the **Position Page**.

INIT (Initialize)

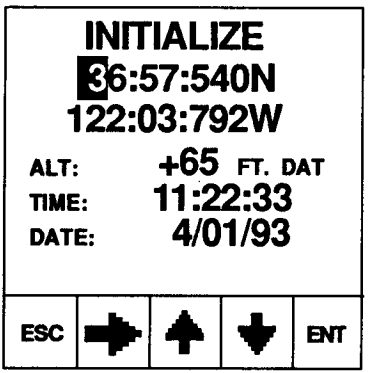
For first time turn on, or if you have moved more than 50 miles from the last start up location, you can speed up satellite acquisition by pressing the **INIT** softkey. You can speed up the time required to acquire satellites by pressing the **INIT** softkey on the **Position Page**. It is a good idea to initialize your Trooper if you have moved more than 50 miles (80 km) since you last acquired satellites or if your Trooper has had its battery pack removed for more than 5 minutes. This keypress takes you to the **Initialize Menu**, which lets you select among the initialization options. These options are as follows:

Initialize To - This option allows you to initialize to a major city which has been previously selected (see Select A Near City option). Pressing the **ENT** key takes you to the **Initialize Page**. This page has major city coordinates pre-loaded, you must manually enter the Time and Date.

Select A Near City - In order to use the **Initialize To** option, a major city must first be selected. Pressing the **ENT** key takes you to the **Select A City Page**. Select a city by pressing the **ENT** key when the cursor is at the city you wish to initialize to.

Select A Waypoint - This option allows you to initialize to one of your defined waypoints. Pressing the **ENT** key takes you to the **Select Waypoint Page**. Select a waypoint by pressing the **ENT** key when the cursor is at the waypoint you wish to initialize to.

Auto Config - This option allows the Trooper to automatically initialize itself. Press the **ENT** key when the cursor is at this option and wait approximately 7 minutes while the Trooper performs a "cold" start and searches for satellites by itself.



Manually Enter

The first time you power on your receiver, you must initialize it with the current date, time, and position. This is necessary because the receiver must have an approximate starting point (in time and space) before it can search the sky for satellites. However, before you initialize the receiver, you must know the following.

1. The number of hours difference between your local time zone and Greenwich Mean Time. For example, North America's Eastern Standard Time Zone is -5 hours offset from GMT. However, when Daylight Savings Time is in effect, the difference is -4.

2. Your approximate current position. If you don't know your current position, estimate it from a map or look up the nearest metropolitan city in the International Cities List Page 69.

Initialize the receiver as follows.

1. Turn your Trooper on by pressing and holding the **POWER** key until the **Opening Page** comes up. The receiver will display the Rockwell logo. Allow built-in test to complete, until the display changes to show the **Position Page**.
2. Press **MENU**, **SET**. The Trooper will change to the **Setup 1 Page**.
3. Move the cursor to the **Coord. Type** line. Press **ENT**. The text on the right side of the display will become highlighted.
4. Press the arrow keys until the coordinate type is **DEG:SEC**. Then press **ENT**. This changes the position coordinates into geodetic seconds: latitude and longitude displayed in degrees, minutes, and fractions of seconds.
5. Press **PG2**. The Trooper will change to the **Setup 2 Page**. Move the cursor to the **Time Zone** line.
6. Press **ENT**. The number at the end of the **Time Zone** line will highlight. Use the arrow keys to set the **Time Zone** offset to your offset. Press **ENT**. We are done setting up the receiver to our desired initial coordinates.
7. Now we need to enter the approximate current position, date, and time. Press **MENU**, **POS**, **INIT**. The Trooper will display the **Initialize Menu Page**. Move the cursor down to **Manually Enter**, press **ENT**.
8. Use the arrow keys to enter your approximate current position. Press **ENT**.
9. Use the arrow keys to enter the current local time of day. Press **ENT**.
10. Use the arrow keys to enter the current date. Press **ENT**. The receiver will change back to the **Position Page**, update the display with the new position, time, date, and begin searching the sky for satellites.

Tracking Modes

Your Trooper uses two different modes of tracking satellites: a single fix mode and a continuous tracking mode. The single fix mode obtains a position fix when it is turned on, then stops tracking satellites. This saves battery power.

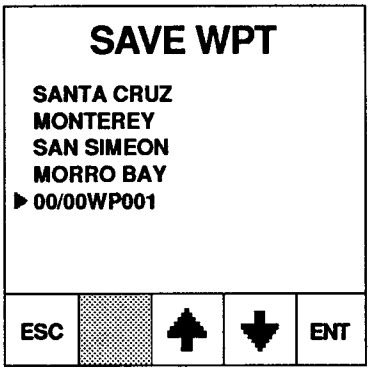
The continuous tracking mode tracks satellites and performs continuous fixes when it is turned on. To select either tracking mode, you must go to the **Setup 2 Page**. One of the following mode icons indicates the mode and status of fixes:

Icon	What it Means
	Trooper is in the single fix mode but has not completed the fix. Wait until the fix is complete for position and navigation data.
F	Trooper is in the single fix mode and completed the fix less than 5 minutes ago.
O	Trooper is in the single fix mode, but the fix and all navigation data is more than 5 minutes old.
C	Trooper is continuously tracking satellites and updating the position and navigation data.
D	The NavCore chip, which receives the satellite signals, is down (not responding to Trooper requests). Try turning the Trooper off, then on again. If the unit continues to come up with **D** displayed contact Rockwell Technical Support (see Page 72).

Save

You may save the current position as a waypoint by pressing the **SAVE** softkey. The **Save Waypoint Page** will appear indicating a date-coded and numbered new waypoint to store the current position. Press **ENT** to store the position here. In addition, you may use the **UP** and **DOWN ARROW** keys to select any waypoint currently listed to store the current position. After scrolling the arrow to the waypoint listed, press **ENT**.

After pressing **ENT**, the screen will return to the **Position Page**. Press **ESC** to return to the **Position Page** without saving the current position.



Navigate Page

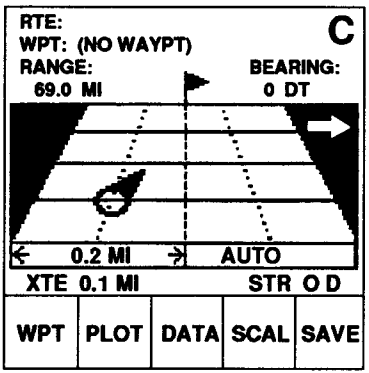
The **Navigate Page** can be displayed by pressing the **NAV** key from either the **Position Page** or the **Menu Bar**. The **Navigate Page** is a graphic "highway" showing bearing, range, and steering information to your destination waypoint.

The center of the highway is the most direct path to the destination from where you selected the waypoint as the destination. The flag at the "end of the highway" is your destination. You are the circle on the highway. As you travel, the pointer on the circle shows your movement relative to the destination (flag). The width of the highway, from center to edge, is shown at the bottom. It will automatically adjust when **Scale** is in the **Auto** mode which is shown to the right.

The line below shows your distance from the center of the highway (Cross Track Error, XTE) shows how far off course you are. Two large steering arrows show which way to turn (left or right) to get back on course (center of the highway). The Steering Angle is shown to the right (see Advanced Navigation Guide Pages 51, 52 for further explanation of these readouts).

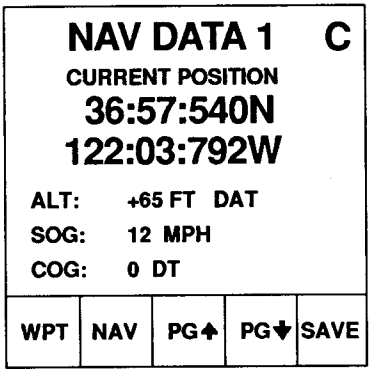
The keys on the **Navigate Page** perform the following functions.

Keypress	What It Does
WPT	Changes to the **Select Waypoint Page**. Lets you select destinations and routes.
PLOT	Changes to the **Plot Page**. Displays a "map" of your travel to the current destination.
DATA	Brings up the **Navigation Data Pages**, for current position and navigation data.
SCAL	Change between automatic and fixed scaling in the **Plot** and **Nav Pages**.
SAVE	Changes to the **Save Waypoint Page**. Lets you store your current position as a waypoint.

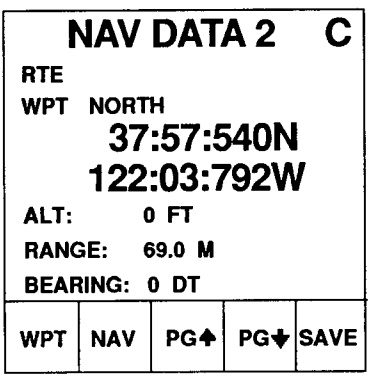


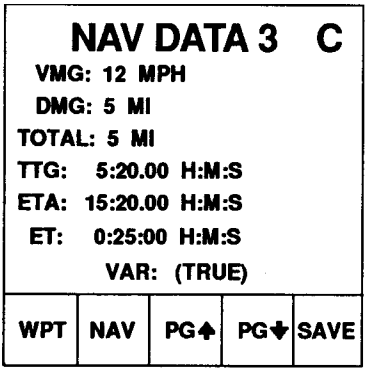
Navigation Data Pages

Press **DATA** in the **Navigate** or **Plot Pages** to select the **Navigation Data Pages 1, 2** and **3. Page 1** displays current position, altitude, Speed Over Ground (SOG) and Course Over Ground (COG).



Page 2 displays Route name (if a route is selected), Waypoint name, Waypoint position, Altitude, Range and Bearing to the waypoint.





Page 3 shows Velocity Made Good (VMG) along the course line, Distance Made Good (DMG) along the course line, Total distance traveled from the Start Point (of the course or route), Time To Go (TTG) before reaching the next waypoint, Estimated Time of Arrival (ETA) at the next waypoint, Elapsed Time (ET) from the Starting Point, and the Magnetic Variation Correction (Mag. Var.) used for magnetic bearings and whether the value of Mag. Var. is automatically calculated or has been entered manually on the **Setup 1 Page** (see Page 36).

The keys on the **Navigation Data Pages** perform the following functions.

Keypress	What It Does
WPT	Changes to the **Select Waypoint Page**. Lets you select destinations and routes.
NAV	Changes to the **Navigate Page**. Displays graphic navigation "highway", steering info.
PG↑, PG↓	Changes to the next **Navigation Data Page**.
SAVE	Changes to the **Save Waypoint Page**. Lets you store your current position as a waypoint.

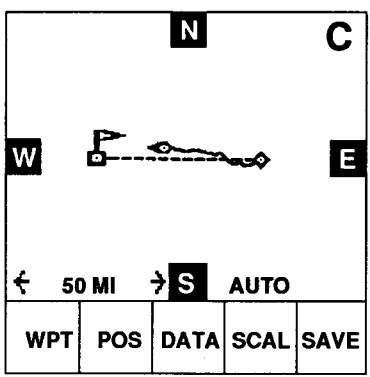
Scale

The **SCAL** key allows you to change between automatic and fixed scaling on the **Navigate Page** and the **Plot Page**. After changing to fixed scaling, repeated presses change the scale from 0.2 (units as selected on **Setup Page**, Page 36) to 0.5, 1, 2, 5, 10, 20, 50, 100, then back to **Auto**.

If the **Plot Page** scale is changed, additional fixed values of 200 and 500 may be selected. The scales of the **Navigate Page** and the **Plot Page** are changed independently.

Plot Page

The **Plot Page** is a "map" that shows your position and course history, the course starting point and currently selected waypoint. A dashed course line connects the points on the screen. A diamond shows the starting point and a flag the waypoint. A circle with a pointer shows the latest position fix and direction of movement (current course). A continuous line from the starting point shows the course history. The scale from the center of the plot square to the edge is the number in the lower left-hand corner of the plot square.



The keys on the **Plot Page** perform the following functions.

Keypress	What It Does
WPT	Changes to the **Select Waypoint Page**. Lets you select destinations and routes.
POS	Changes to the **Position Page**. Lets you adjust your type of fixes, position, time, navigation accuracy.
DATA	Brings up the **Navigation Data Pages**, for current position and navigation data.
SCAL	Change between automatic and fixed scaling of **Plot** and **Nav Pages**.
SAVE	Changes to the **Save Waypoint Page**. Lets you store your current position as a waypoint.

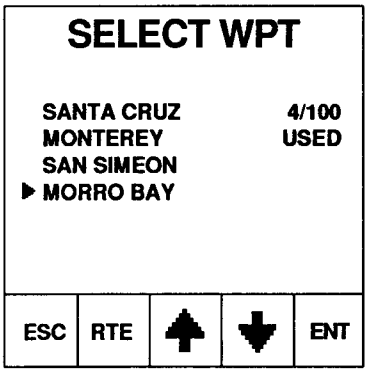
Select Waypoint Page

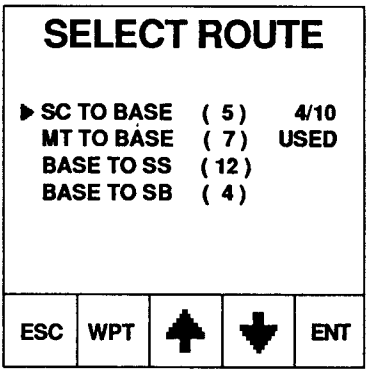
When you press **WPT**, from the **Navigate**, **Navigation Data Pages**, or **Plot Pages**, a Page comes up for selecting the destination waypoint. This Page contains a list of stored waypoints.

Use **UP ARROW** and **DOWN ARROW** to select the waypoint from the list, then press **ENT**.

The keys on the **Select Wpt Page** perform the following functions.

Keypress	What It Does
RTE	Lets you select a route for navigation (**Select Route Page**, Page 21).
ESC	Returns you to the page from which you pressed **WPT** (either **Navigate**, a **Navigation Data Page**, or the **Plot Page**).





Select Route Page

When you press **WPT** from the **Navigate, Navigation Data Pages**, or **Plot Pages**, a Page comes up for selecting the destination waypoint or route. This Page contains a list of stored waypoints.

Press **RTE** to bring up the **Select Route Page**, to select an existing route for navigation.

Use **UP ARROW** and **DOWN ARROW** to select the route you want, then press **ENT**.

The keys on the **Select Route Page** perform the following functions.

Keypress	What it Does
WPT	Returns you to the **Select Waypoint Page**.
ESC	Returns you to the Page from which you pressed **WPT**. (either **Navigate**, a **Navigation Data Page**, or **Plot Page**).

Edit Waypoint/Route Pages

To edit, delete, copy or enter offset waypoints or to edit routes, press the **EDIT** softkey from the **Menu Bar**. A waypoint or route currently in use cannot be edited or deleted. A star appears to the right of waypoints or routes currently in use on the **Edit Waypoint** and **Edit Routes Pages**.

NOTE: Waypoints with a star (*) to the right are used in a route.

The other keys on the **Edit Waypoint Page**:

Keypress	What it Does
RTE	Changes to the **Edit Routes Page**.
OPT	Changes to the **Waypoint Options Page**.

How to Create a Waypoint

There are five ways to create a waypoint on your Trooper.

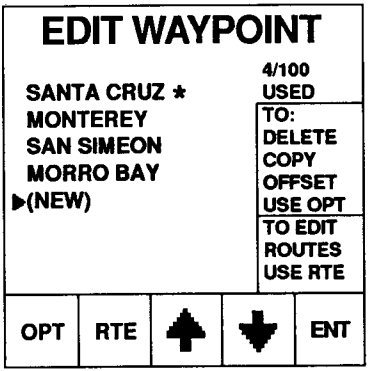
1. You can manually create a waypoint using the Trooper pages specially designed for the task.
2. You can create a waypoint offset from another waypoint.
3. You can save your current position in a waypoint.
4. You can download a waypoint from another Trooper.
5. You can download a waypoint from a Mission Planning Station.

The following describes how to create a waypoint using all five methods.

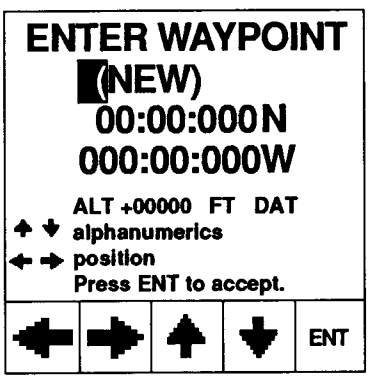
Manual Entry of a Waypoint

This section describes how to enter a waypoint manually.

1. Press **MENU**, **EDIT**. The Trooper will display the **Edit Waypoint Page**, which shows all the currently-defined waypoints in the receiver.



2. Use the **UP ARROW** or **DOWN ARROW** keys to select the waypoint called "(NEW)". (NEW) will always be the last waypoint in the list. Press **ENT** when the arrow is beside (NEW). The receiver will display the **Enter Waypoint Page**.



3. Use the **UP ARROW** and **DOWN ARROW** keys to change the characters in the waypoint name. Use the **LEFT ARROW** and **RIGHT ARROW** keys to move to the next character, or to change a character you already edited. When you've entered your waypoint name the way you want it, press **ENT**.

4. Enter the position of your waypoint, using the arrow keys the same way as you did the waypoint name. Press **ENT** to advance to the altitude line.
5. Enter the altitude of your waypoint. Press **ENT** when you're done.

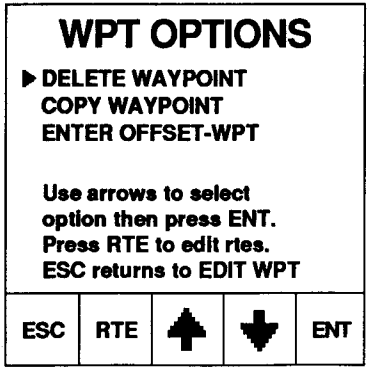
If you suddenly realize you made a mistake on the previous line, you cannot back up. You have two options.

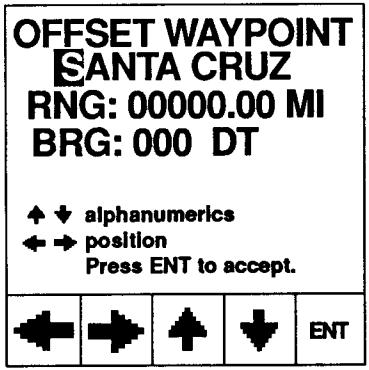
1. You can escape out of the **Enter Waypoint Page** by pressing **MENU** and another key. That will change the Trooper Page and abandon your new waypoint without saving it.
2. You can continue entering your data as if nothing had happened. Then you can go back and edit the waypoint to correct the error.

Creating an Offset Waypoint

You can create a waypoint offset from an existing waypoint.

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**, which displays all the currently-defined waypoints.
2. Use the arrow keys to select the waypoint from which the new waypoint will be offset.
3. Press **OPT**. The receiver will change to the **Wpt Options Page**.





4. Use the arrow keys to move the cursor to **Enter Offset-Wpt**. Press **ENT**.
5. Use the arrow keys as described in Manual Entry (Page 22) to change the name of the waypoint. You must change at least one character. Press **ENT** when you're done.
6. Enter the range (straight-arrow distance) of the new waypoint from the "base" waypoint. Press **ENT**.
7. Enter the bearing of the new waypoint from the base waypoint relative to the current north reference. Press **ENT**.

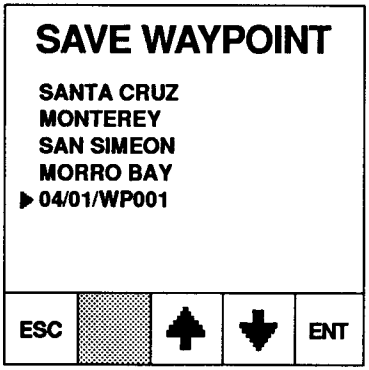
If you suddenly realize you made a mistake on the previous line, you cannot back up. Your safest recourse is to press **MENU**, **EDIT**, and start over again.

Saving Position As a Waypoint

You can save your current position as a waypoint. You must, of course, be located at the desired position.

1. Press **MENU**, **POS**. This will take you to the **Position Page**.
2. Now we want to get a fix on our current position. If your Trooper is in single-fix mode (meaning an "F", an "O", or an "hourglass" ⧖ is displayed in the upper right corner of the display), press **FIX**. Otherwise, your receiver is in continuous fix mode and is already trying to get a fix.

3. When the Figure of Merit is 3 or less, press **SAVE**. The Trooper will change to the **Save Waypoints Page**.



4. If you want to save the current position in the default, encoded waypoint name, simply press **ENT**. You may edit the waypoint name later, if you like. To save the current position in a different waypoint, use the arrow keys to move the cursor to the waypoint you want and press **ENT**.

And to abandon this option entirely, press **ESC**.

Waypoint from Another Trooper

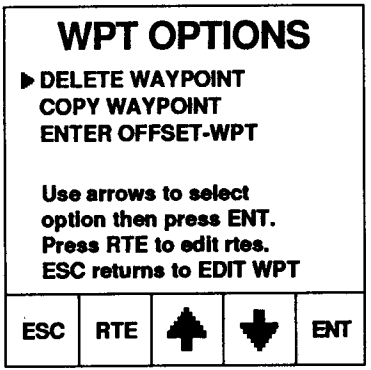
You can download a waypoint from another Trooper, if you like. For more information, see the section on the **Unit To Unit Updates in the Field** (Page 54).

Waypoint from the Mission Planning Station

You can download a waypoint from the Rockwell Trooper Mission Planning Station. For more information, see the *Mission Planning Station User's Guide.*

Waypoint Options

From the **Edit Waypoint Page**, press **OPT** to bring up the **Wpt Options Page**. This allows you to delete or copy the selected waypoint, or enter an offset waypoint from the selected waypoint.



NOTE: Options performed always affect the waypoint selected on the **Edit Waypoint Page**.

Use **UP ARROW** and **DOWN ARROW** to select the option from the list, then press **ENT**.

The keys on the **Wpt Options Page** perform the following functions.

Keypress	What it Does
RTE	Changes to the **Edit Routes Page**.
ESC	Returns control to the **Edit Waypoint Page**.

How to Delete Waypoints

You can delete a waypoint that is currently-defined in the receiver.

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**, which shows all the currently-defined waypoints in the receiver.
2. Use the arrow keys as described in Manual Entry (Page 22) to select the waypoint you wish to delete.

NOTE: If the waypoint selected is currently being used to navigate to, or is part of a route currently being used, a star (*) will appear to the right of the waypoint name and the Trooper will not allow you to delete.

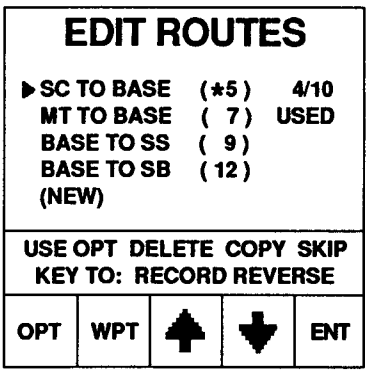
3. Press **OPT**. The Trooper will change to the **Wpt Options Page**.
4. Use the arrow keys to move the cursor to **Delete Waypoint**.
5. Press **ENT**. The **Edit Waypoint Page** will return with the deleted waypoint removed from the list.

How to Create a Route

There are six ways to create a route on your Trooper.

1. You can manually create a route using the Trooper pages specially designed for the task.
2. You can create a route that is a copy of an existing route.
3. You can create a route that reverses the order of the waypoints of an existing route.
4. You can automatically compile a route whenever you save current positions as waypoints.
5. You can download a route from another Trooper.
6. You can download a route from a Mission Planning Station.

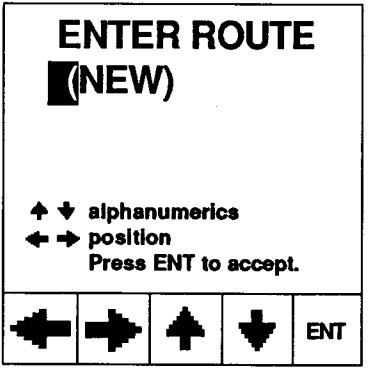
1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**. Press **RTE**. The Trooper will display the **Edit Routes Page**, which shows all the currently-defined routes in the receiver.



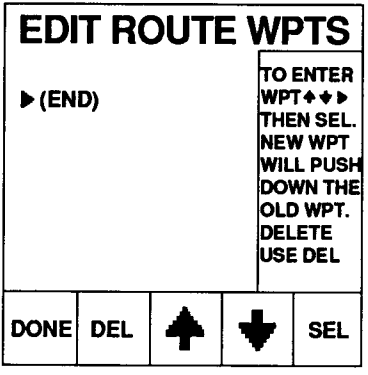
The **Edit Routes Page** contains a list of the currently defined routes. Each route name is followed by in parentheses the number of waypoints in that route. The current route (the route selected for navigation) will have a star (*) displayed just before the number of waypoints. The number of routes currently used out of 10 possible routes is displayed in the upper right hand corner of the **Edit Routes Page**. The keys on the **Edit Routes Page** perform the following functions.

Keypress	What It Does
WPT	Changes to the **Edit Waypoint Page**.
OPT	Returns control to the **Route Options Page**.

2. Use the **UP ARROW** or **DOWN ARROW** keys to select the route called **"(NEW)"**. **(NEW)** will always be the last route in the list. Press **ENT** when the arrow is beside **(NEW)**. The Trooper will display the **Enter Route Page**.



3. Use the **UP ARROW** and **DOWN ARROW** keys to change the characters in the route name. Use the **LEFT ARROW** and **RIGHT ARROW** keys to move to the next character, or to change a character you already edited. When you've entered your route name the way you want it, press **ENT**. The Trooper will change to the **Edit Route Wpts Page**.

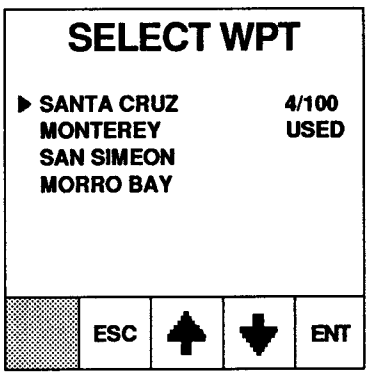


4. Press **SEL**. This will bring up the **Select Wpt Page**. Choose the first waypoint for your route using the **UP** and **DOWN ARROW** keys, then press **ENT**. The Trooper will return to the **Edit Route Wpts Page**.

5. Use the **UP ARROW** and **DOWN ARROW** keys to select the location in your route where the next waypoint is to be entered. Press **SEL** to again bring up the **Select Waypoint Page**. Repeat this process to add the rest of the waypoints to your route. If you decide that you do not want to choose a waypoint while you are on the **Select Waypoint Page**, press **ESC** to return to the **Edit Route Wpts Page** without a waypoint selected.

The keys on the **Edit Route Wpts Page** perform the following functions.

Keypress	What It Does
DEL	Deletes the selected waypoint.
DONE	Use when you are finished editing the route, to return to the **Edit Routes Page**.



6. To remove a waypoint from your route, use the **UP ARROW** and **DOWN ARROW** keys to select the waypoint. Press **DEL**, and the selected waypoint will be deleted from the route waypoint list.
7. When you have finished with creating your route, press **DONE**. This will return the Trooper to the **Edit Routes Page**. If you are finished creating or editing routes, you can press **MENU** and another key to bring your Trooper to other functions.

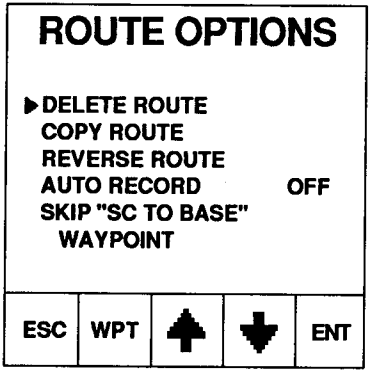
The keys on the **Select Wpts Page** perform the following functions.

Keypress	What it Does
ENT	Inserts new waypoint before selected waypoint, returns to **Edit Route Wpts Page**.

Route Options

From the **Edit Routes Page**, press **OPT** to bring up the **Route Options Page**. This allows you to delete, copy, reverse the waypoint order, control recording of the selected route (Auto Record), or skip a waypoint in the current route.

NOTE: The **Skip Waypoint** option only appears on the **Route Options Page** if a route has been selected for navigation (see Page 21) and affects only the current route. All other options affect the route selected on the **Edit Routes Page**. Use **UP** and **DOWN ARROW** to select the option from the list, then press **ENT**.



The keys on the **Route Options Page** perform the following functions.

Keypress	What it Does
WPT	Returns to **Edit Waypoint Page**
ESC	Returns to **Edit Routes Page** without performing any option.

Delete Route

Use the **Delete Route** option to delete the route list. Waypoints used in the route are unaffected. First, select the desired route from the **Edit Route Page**, then press **OPT**. Select **Delete Route** from the options list, and press **ENT** to delete the route. The display returns to the **Edit Routes Page** with the route deleted.

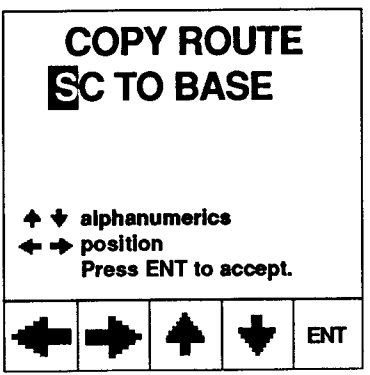
NOTE: If the route is being used, a star (*) will appear to the right of the route name and the Trooper will not allow you to delete that route.

Press **ESC** to return to the **Edit Routes Page** without performing any option.

Copying Routes

You can create a copy of an existing route.

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**. Press **RTE**. The Trooper will display the **Edit Routes Page**, which shows all the currently-defined routes in the receiver.
2. Use the arrow keys as described in Manual Entry (Page 29) to select the route you wish to copy.
3. Press **OPT**. The Trooper will display the **Route Options Page**. Use the arrow keys to select **Copy Route**. Press **ENT**. This will bring up the **Copy Route Page**.



4. Use the arrow keys as described in Manual Entry(Page 29) to change the name of the route.
5. Press **ENT**. The Trooper will return to the **Edit Routes Page** with the new route added to the list.

How to Create a Reverse Route

You can create a route with the waypoints in the reverse order of an existing route.

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**. Press **RTE**. The Trooper will display the **Edit Routes Page**, which shows all the currently-defined routes in the receiver.
2. Use the arrow keys as described in Manual Entry (Page 29) to select the route you wish to reverse.
3. Press **OPT**. The Trooper will display the **Route Options Page**. Use the arrow keys to select **Reverse Route**. Press **ENT**. The Trooper will return to the **Edit Routes Page** and the waypoints of the selected route will be in reverse order.

If you decide that you do not wish to reverse the route after you have selected to do so, pressing **ESC** returns you to the **Edit Routes Page** without reversing the route.

Auto Recording a Route

You can automatically record a route whenever you save current positions as waypoints.

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**. Press **RTE**. The Trooper will display the **Edit Routes Page**, which shows all the currently-defined routes in the receiver.
2. Press **OPT**. The Trooper will display the **Routes Options Page**. Use the arrow keys to select **Auto Record**.

3. Press **ENT**. Each push of the **ENT** key will alternate **ON** or **OFF** for the Auto Record feature. Press **ESC** to return to the **Edit Routes Page**.

If you have Auto Record **ON**, the Trooper will automatically compile a route whenever a current position is saved as a waypoint while using the **Position**, **Navigation** or **Plot Pages**. This process continues until the route has 25 waypoints. If you save more waypoints, they will automatically start compiling a new Auto Route.

Skip a Waypoint in the Current Route

In order for the **Skip Waypoint** option to appear on the **Route Options Page** the user must have a route selected for navigation (see Page 21).

1. Press **MENU, EDIT**. The Trooper will display the **Edit Waypoint Page**. Press **RTE**. The Trooper will display the **Edit Routes Page**, which shows all currently-defined routes in the receiver.

2. Press **OPT**. The Trooper will display the **Route Options Page**. Use the arrow keys to select **Skip Waypoint**. Press **ENT**. This will skip over the current waypoint and redisplay the next one in the route. Continue to press **ENT** until you are in the desired position in the route.

Route from Another Trooper

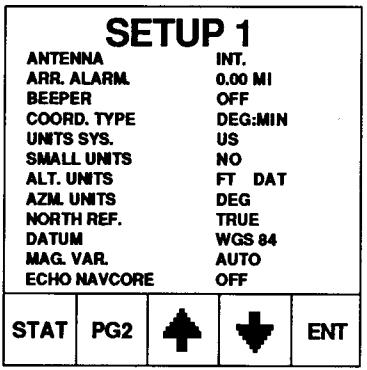
You can download a route from another Trooper, if you like. For more information, see the section in this manual on **Un it To Unit Updates in the Field**, Page 54.

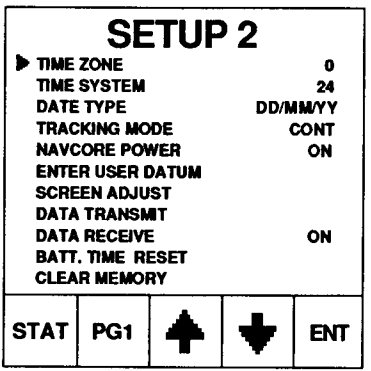
Route from the Mission Planning Station

You can download a route from the Rockwell Trooper Mission Planning Station. For more information, see the *Mission Planning Station User's Guide*.

Setup Pages

Press **MENU** to bring up **Menu Bar 1**. Press **SET** to bring up the first of two **Setup Pages**. These pages allow you to configure the Trooper for antenna use, alarm/beeper, position coordinates format, distance/speed units, and others.





- To change between **Setup 1** and **Setup 2 Pages**, press **PG2** key.
- Use **UP ARROW** and **DOWN ARROW** to select a Setup function from the list, then press **ENT**. This moves the highlight to the values for that function (example: to the INT, AUTO, EXT for the ANTENNA function).
- Use **UP ARROW** and **DOWN ARROW** to select desired value (example: **EXT**), then press **ENT** to elect the value. You can now select other Setup functions or keys.
- Use the **STAT** key to bring up the **Status Page** (see Page 44).
- You can also press **MENU** to bring up the **Menu Bar**.

Setup 1 Page Options

Option	Settings	Description
Antenna	auto	When powered by batteries, use the Trooper's internal antenna. Otherwise, use the external antenna.
	ext	Use the external antenna.
	int	Use the Trooper's internal antenna. Be sure to hold the Trooper so that the slanted part above the monitor is parallel with the ground.
Arrival Alarm	x.xx mi	If the Beeper option is set to on or Alarm Only, then beep when the Trooper is within the specified radius of the destination.
Beeper	off	Do not ever beep.
	on	Beep with each keypress.
	alarm only	Beep only when within the specified radius of the destination. Otherwise, do not beep.

Setup 1 Page Options (cont'd)

Option	Settings	Description
Coord. Type	deg:min	Display position in latitude and longitude degrees, in dd:mm.mmm format.
	deg:sec	Display position in latitude and longitude in dd:mm:ss.s format.
	MGRS	Display position in MGRS format.
	UTM/UPS	Display position in UTM/UPS format.
Units System	US	Display distance in statute miles, feet; display speed in miles per hour (MPH).
	naut	Display distance in nautical miles, yards; display speed in knots.
	met	Display distance in kilometers, meters; display speed in kilometers per hour (KPH).
Small Units	no	Display distances and velocities only in large units.
	yes	Display distances and velocities in small units up to the maximum allowed on the page; then it toggles over to large units.

Setup 1 Page Options (cont'd)

Option	Settings	Description
Altitude Units	feet	Display altitude in feet.
	meters	Display altitude in meters.
	dat	Use the datum reference for altitude.
	MSL	Use the mean sea level reference for altitude.
Azimuth Units	deg	Display angular units such as bearing in degrees.
	mils	Display angular units in mils.
	rad	Display angular units in radians.
North Reference	True	Use true north as the north reference.
	grid	Use grid north in the MGRS and UTM/UPS coordinate systems as the north reference.
	mag	Use magnetic north as the north reference.
Map Datum		Specify which map datum to use. You may select one of the datums listed in section V.

Setup 1 Page Options (cont'd)

Option	Settings	Description
Mag Var	auto	Let the Trooper determine the magnetic variation to use in navigation calculations.
	man	You define the magnetic variation to use. 99E to 99W.
Echo NavCore	off	Do not allow the NavCore chip to echo its outgoing messages.
	on	Allow the NavCore chip to echo its outgoing messages.

Setup 2 Page Options

Option	Settings	Description
Time Zone	-12..+12	This option allows you to define the number of hours' difference between your current time zone and Greenwich Mean Time. Be sure to add an hour if daylight savings time is in effect. For example: there are -5 hours' difference between North America's Eastern Standard Time and Greenwich Mean Time; but -4 hours' difference between Eastern Daylight Time and Greenwich Mean Time.

Option	Settings	Description
Time System	12	Display time of day in 12-hour a.m./p.m. format. Example: 5:00 p.m..
	24	Display time of day in 24-hour format. Example: 22:21 = 10:21 p.m.
Date Type	DD:MM:YY YY:MM:DD MM:DD:YY	Displays date in day/month/year. Displays date in year/month/day. Displays date in month/day/year.
Tracking Mode	Cont Fix	Initiates continuous tracking mode. The receiver will track satellites constantly in continuous tracking mode. Initiates single-fix mode. The receiver will track satellites until it gets a position fix; then it will stop tracking satellites. This mode conserves battery power.
NavCore Power	Off	When this master toggle is set to off, the NavCore chip will never turn on acquire satellites, even if the Trooper's tracking mode instructs it to turn on. This feature is helpful to ensure that the Trooper *will not* waste battery power (if it happens to be running on batteries).

Setup 2 Page Options (cont'd)

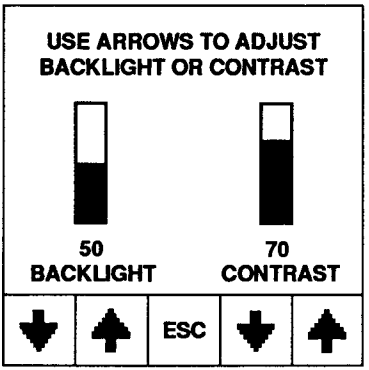
Option	Settings	Description
NavCore Power	On	(default) When this master toggle is set to on, the NavCore chip will turn on to acquire satellites if the Trooper's tracking mode instructs it to turn on. For example, when NavCore power is set to on, the tracking mode is FIX, and you press the FIX key on the Position Page, the Trooper will search the sky for satellites to get a new fix. If NavCore power is off, the receiver will not attempt to get a new fix.
Enter User Datum	---	Select this option to change to the Enter User Datum Page. There you may define two of your own map datums. For more information about defining your own map datum, see the US Defense Mapping Agency Technical Report DMA TR 8350.2: Department of Defense World Geodetic System 1984.
Screen Adjust	---	Select this option to change to the Screen Controls Page. There you can adjust backlight and contrast levels.

Setup 2 Page Options (cont'd)

Option	Settings	Description
Data Transmit	---	Select this option to change to the Data Transmit Page. There you can transmit data to another Trooper.
Data Receive	off	Do not allow the Trooper to receive data from another receiver.
	on	Do allow the Trooper to receive data from another Trooper.
Batt Time Reset	---	Select this option to change to the Battery Timer Reset Page. The Battery Timer Reset Page just verifies you really want to reset the battery timers.
Clear Memory	---	Select this option to change to the Clear Memory Page. There you can specify which part of memory to clear or change: clear all waypoints and routes, or return Setup values to their factory defaults.

Screen Controls

From the **Menu Bar**, select **SET** and press **PG2** to bring up **Setup 2 Page**. Use the **UP ARROW** and **DOWN ARROW** keys to select **Screen Adjust**, then press **ENT**. Use the **UP** and **DOWN ARROW** keys to raise or lower the settings. Press the **Menu Key** to return to the **Menu Bar** when the adjustment is completed.



Adjusting the Backlight

To turn backlighting on and off, press **POWER**. If backlight is on, you can adjust the backlight level by pressing the **UP ARROW** and **DOWN ARROW**. You can press and release the keys to step the level, or hold the key to scroll the level. The level is indicated as a percentage on the page. You can turn backlighting on or off at any time by pressing the **POWER** key.

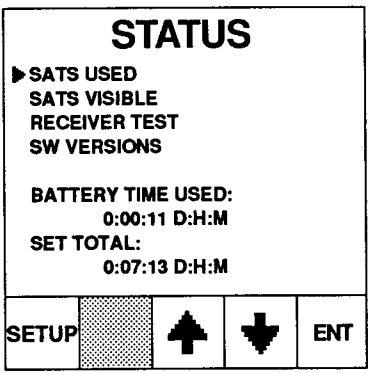
Adjusting the Contrast

To adjust the contrast of the display, press **UP** and **DOWN ARROW** keys on the right side of the display. Press the **DOWN** key for less contrast and the **UP** key for more contrast. You can press and release the keys for each incremental contrast level, or hold down the softkey to continuously sequence through the contrast levels.

Status Page

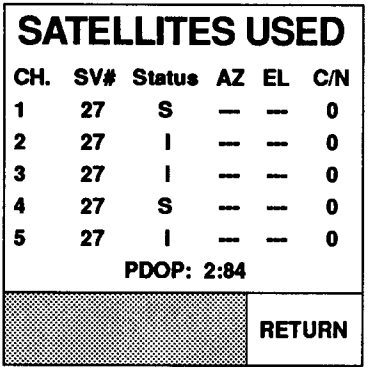
The **Status Page** is the source of the Trooper's status information pages. From here, you can change to pages monitoring the success of satellite acquisition, initiate a commanded built-in test, and determine the current versions of software loaded in the Trooper. You can also see how long the unit has been powered on during this session.

To get to the **Status Page**: press **MENU, MENU, STAT.**



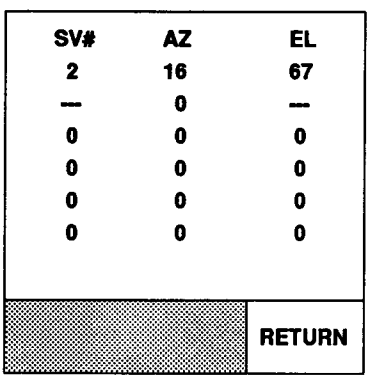
Satellites Used Page

This Page displays which satellites are being used by the Trooper receiver. You will see which satellites (SV#) each channel is using. The tracking status will show "S" for searching, "T" for tracking or "I" for idle. "AZ" and "EL" provide position information of azimuth and elevation of the corresponding satellite. "C/N" represents Carrier/Noise ratio.



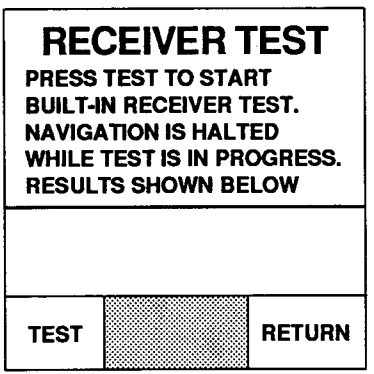
Satellites Visible Page

This Page displays all satellites visible to the Trooper receiver at the current time. Each satellite is identified by SV# and position azimuth and elevation.



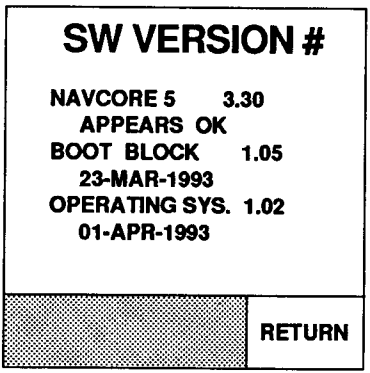
Receiver Test Page

To perform NavCore V receiver internal tests, press **TEST**. The Trooper will take about 10 seconds to complete the test. Test results will be displayed in the lower section of this Page. If a fault occurs, note the error message. Try turning the Trooper off, then on again. If the fault persists contact the Rockwell Technical Support Group (see Page 72).



SW Version Page

This Page provides software version identifier numbers for the Trooper. The Nav Core V is the internal receiver. The Boot Block software version is only important when entirely reprogramming the Trooper using the Mission Planning Station. Operating System software version represents the control display program.



Battery Time Used

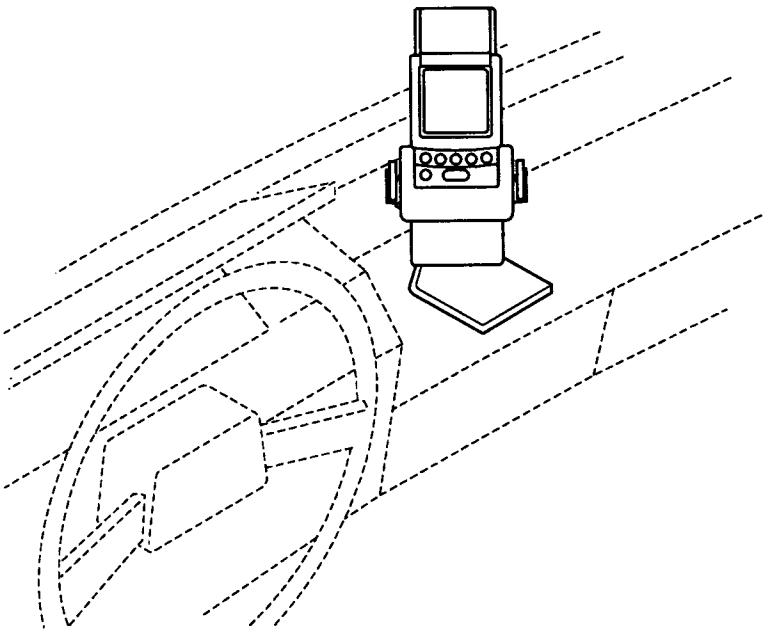
This displays the total time that the batteries have been in use.

Set Total

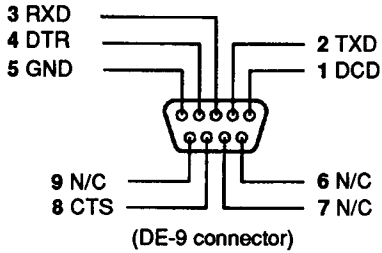
This displays the total time the unit has been used since it was built.

Vehicle Mount

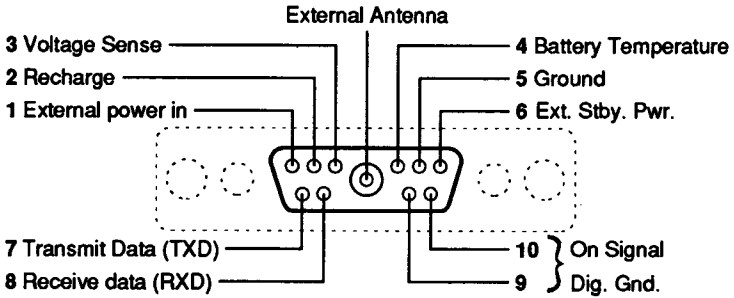
With the use of the Vehicle Mounting Kit, the Trooper can be installed in a vehicle.



The mounting bracket has a connector that mates with the connector at the base of the Trooper. This connector provides voltage from the vehicle to power the receiver, a connection to the vehicle GPS antenna cable, and a connection to an external computer. The vehicle mount has external connections for vehicle power (a 12'/4m cable), a TNC coaxial connector for the antenna cable, and a standard RS232 DE-9 connector for computer serial data. The illustration next page shows the pin assignments of the DE-9 connector.



(DE-9 connector)



(end view of receiver)

When slipped into the mounting bracket, you can adjust its tilt so that the antenna on top of the unit is flat relative to the earth.

Note: When operating on the receiver's built-in antenna while inside a vehicle, the metal roof of the vehicle can block reception of satellite signals. For best results, use an external antenna when the receiver is mounted inside a vehicle.

To install the mounting bracket, see the instructions on the sheet that came with the Vehicle Mounting Kit.

Section III
Advanced Navigation Guide

Section II of this manual gives the basics for using the Trooper. To use the receiver at its optimum, study this section. Use these navigational and GPS terms and concepts to sharpen your navigational skills.

GPS Modes

The Trooper operates in an automatic GPS Mode. When three satellites are visible to the receiver, 2-dimensional fixes for position are given. If four satellites are available, 3-dimensional fixes for position, including altitude, are given.

Navigational Terms

LATITUDE/LONGITUDE (LAT/LONG) Latitude is the distance measured in degrees North and South of the equator. Longitude is the distance measured in degrees West and East of the prime meridian at Greenwich, England.

SPEED OVER GROUND (SOG) This is the speed calculated from the time and distance over the ground you have traveled.

COURSE OVER GROUND (COG) This is the course over the ground on which you are currently traveling.

CROSS TRACK ERROR (XTE) This is the distance of your vehicle, either left or right, from the course line (start point to destination).

RANGE (RNG) Distance from present position to the selected waypoint.

BEARING (BRG) Angle from True (magnetic) North to the waypoint at present position.

ESTIMATED TIME OF ARRIVAL (ETA) This is an estimate based on the current time and your TIME TO GO (TTG) of when you will get to your destination.

TIME TO GO (TTG) This is calculated from the current DISTANCE TO GO (DTG) to your destination and your VELOCITY MADE GOOD (VMG) of how long it will take you to get to your destination.

VELOCITY MADE GOOD (VMG) This is the portion of your vehicle speed that is parallel to your course line. VMG is especially useful for traveling where closing speed on the desired waypoint displays regardless of course or bearing changes made enroute (for example, when detouring around obstacles).

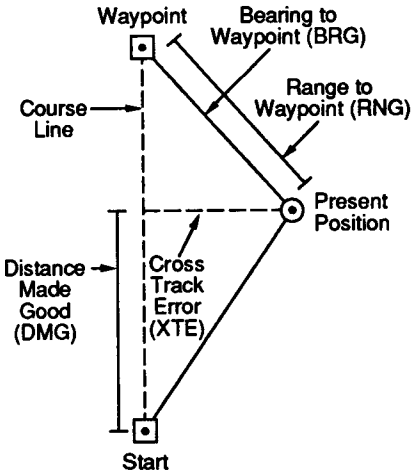
DISTANCE MADE GOOD (DMG) This is the portion of the distance you have traveled that is parallel to your course line.

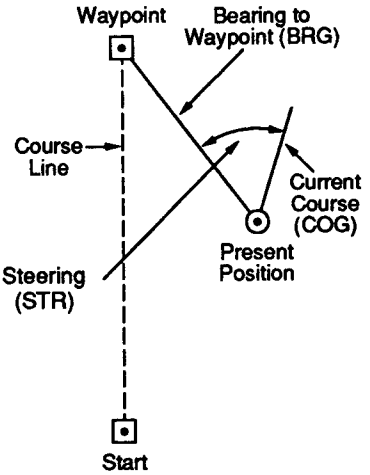
STEERING ANGLE (STR) This is the angle between your COURSE OVER GROUND (COG) and the BEARING to the waypoint (BRG). This angle helps you get back on track after detouring around obstacles.

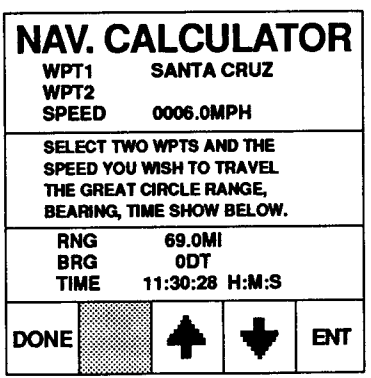
Nav Calculator

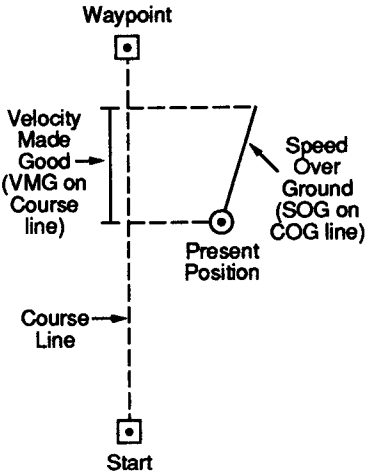
The **Nav Calculator Page** allows you to find the great circle distance and bearing between two waypoints. If you give it a constant speed, it will also calculate the estimated travel time between the waypoints. The next set of steps describes how to find the distance, bearing, and travel time between two waypoints.

1. Create your starting-point waypoint and destination waypoint, if they do not already exist.
2. Press **MENU**, **MENU**, **CALC**. The Trooper will change to the **Nav Calculator Page**.
3. Select the starting waypoint by using the **UP ARROW** and **DOWN ARROW** keys. Press **ENT** when the first waypoint is displayed.
4. Select the destination waypoint the same way. Press **ENT** when the destination waypoint is displayed.
5. Use the **UP ARROW** and **DOWN ARROW** keys to enter the first digit of the speed to travel. Press **RIGHT ARROW** when you've selected the correct character. Press **ENT** when the speed is displayed. The Trooper will display the range, bearing, and time between waypoints 1 and 2.


Waypoint
Bearing to Waypoint (BRG)
Range to Waypoint (RNG)
Course Line
Present Position
Distance Made Good (DMG)
Cross Track Error (XTE)
Start

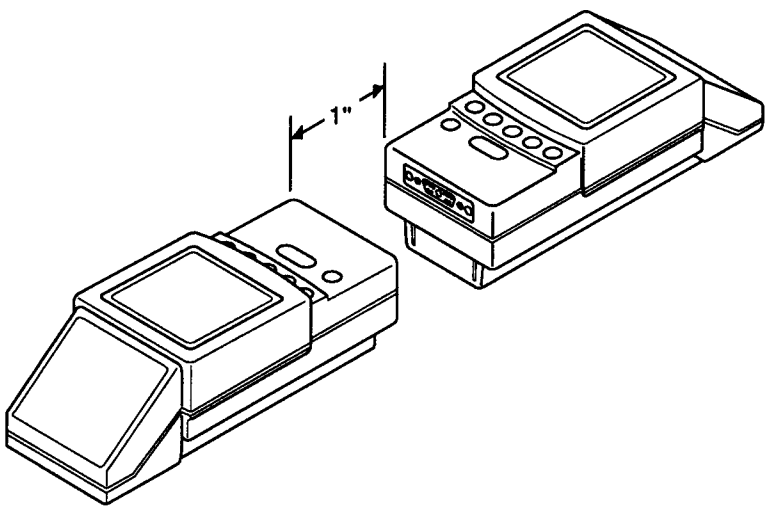

Waypoint
Bearing to Waypoint (BRG)
Course Line
Current Course (COG)
Present Position
Steering (STR)
Start


NAV. CALCULATOR
WPT1 SANTA CRUZ
WPT2
SPEED 0006.0MPH
SELECT TWO WPTS AND THE SPEED YOU WISH TO TRAVEL THE GREAT CIRCLE RANGE, BEARING, TIME SHOW BELOW.
RNG 69.0MI
BRG 0DT
TIME 11:30:28 H:M:S
DONE
ENT


Waypoint
Velocity Made Good (VMG on Course line)
Speed Over Ground (SOG on COG line)
Present Position
Course Line
Start

Unit-to-Unit Updates in the Field

1. Lay two receivers base-to-base, as close as possible with the dust covers open as shown in the diagram below.
2. Press **MENU**, **SET**, **PG2** on both receivers. This will take you to the **Setup 2 Page**.
3. On the receiver to receive data, select **Data Receive**. Press **ENT** until the word beside **Data Receive** is **ON**.
4. On the receiver to transmit data, select **Data Transmit**. Press **ENT**. This will take you to the **Data Transmit Page**.
5. Select the item(s) you want to transmit. Press **XMIT**. After a few seconds, the receiver will display a message informing you whether or not the transmission was successfully completed.



Updating a Receiver With a Computer

The navigation data in the receiver can be updated or changed by connecting the receiver to an external computer. A Mission Planning Station is available from Rockwell for this purpose. Please call Customer Service (see Page 72) for more information.

Error Messages & Troubleshooting

The Trooper Handheld GPS Receiver automatically tests itself each time you turn it on. It also monitors the operation of its receiver and the condition ("health") of the GPS signals. If a fault occurs, a message appears on its display that you can use to help you troubleshoot what is wrong.

To continue operation, press the appropriate key. If the fault again occurs, try turning the Trooper off, then on again. If the fault persists contact the Rockwell Technical Support Group (see Page 72).

A Brief Tutorial

In this brief tutorial, step-by-step instructions show you how to set up the Trooper, enter, copy, edit, and enter offset waypoints, and enter a route. Instructions also show you how to edit a route.

Set Up the Trooper— You will change the coordinates type to MGRS, select altitude units of meters and reference of MSL, distance units system of Metric, azimuth units of degrees, and chart datum of WGS 84.

1. Press **MENU, SET**. This brings up the **Setup 1 Page**.
2. Use the **UP** and **DOWN ARROW** keys to move the cursor so that **Coord. Type** is selected. Press **ENT** to select this item.
3. Notice that the cursor moved to the right side of the **Coord. Type** line. Press the **UP** and **DOWN ARROW** keys to scroll through the choices for coordinates type. When the type is **MGRS**, press the **ENT** key to enter this choice.
4. Notice that the cursor is now back at **Coord. Type**. Use the **UP** and **DOWN ARROW** keys to select **Units Sys.** and select it by pressing **ENT**.
5. Use the **UP** and **DOWN ARROW** keys to change the units system to **Metric** and press **ENT**.
6. Using the same methods, select **Alt. Units** and change to **M** (meters) and the reference to **MSL**. This is a little trickier because there are two items that can be changed on the right side of the **Alt. Units** line. Watch where the cursor is.
7. Change the **Azm. Units** to **Deg**. This changes the azumuth units to degrees.
8. Change the **Datum** to **WGS 84**. This selects the chart datum.
9. Press **PG2** to bring up the **Setup 2 Page**. Change the **Time Zone** to -6. This is a -6 hour offset from Greanwich Mean Time (Central Standard Time in the U.S.).

Create a Waypoint— The Trooper is configured for this tutorial. Enter the first waypoint.

1. Press **MENU, EDIT**. This brings up the **Edit Waypoint Page**. Your Trooper may or may not have waypoints stored from prior use.
2. Use the **UP** and **DOWN ARROW** keys to move the cursor so that **(NEW)** is selected. Press **ENT**.
3. Notice the **Enter Waypoint Page** contains the name of the waypoint you selected **(NEW)** and coordinates. The cursor is at the left side of the waypoint name, highlighting the " (". Press the **UP** and **DOWN ARROW** keys to scroll through the alphanumeric choices. The choices are **A-Z, 0-9**, and several other symbols. Scroll so the first character is **"S"**.

Note: You can press and hold either arrow key to speed scroll through characters.

4. Press the **RIGHT ARROW** key to move the cursor to the next character position. Scroll until it is **"T"**.
5. Move the cursor one position right and scroll until the letter **"A"** is displayed.
6. Enter the remaining letters **"R"** and **"T"**. Your new waypoint should now be named **START**. You can move the cursor left and right on the line to change any mistakes. When the name is correct, press **ENT**.
7. Now the cursor is at the beginning of the next line, the first position line. In MGRS format, this line contains the colomn/row and grid zone designators, and 5 digits of easting in meters. Enter the coordinates **11S QS 43117**. Press **ENT** when you have finished.
8. The next line is 5 digits of northing. Enter **56209** and press **ENT** when finished.
9. The last line to enter is the altitude. Enter **+00200** and press **ENT** when finished. The only two choices for elevation are **+** and **-**, so the **UP** and **DOWN ARROW** keys toggle between them.
10. When you finished the entry of the last line and pressed **ENT**, the **Edit Waypoint Page** came up. Notice that the new waypoint has been added to the list of waypoints.

Copy a Waypoint— You will change the coordinates type to UTM/UPS and copy the waypoint you entered in the last step. You will also edit the coordinate values.

1. Press **MENU, SET**. This brings up the **Setup 1 Page** again.
2. Use the **UP** and **DOWN ARROW** keys to select **Coord. Type** and press **ENT**.
3. Use the **UP** and **DOWN ARROW** keys to scroll through the choices for coordinates type. Select **UTM/UPS** and press **ENT**.
4. Press **MENU, EDIT**. This brings up the **Edit Waypoint Page**.
5. You want to copy waypoint **START** into another waypoint. The **Copy** function is a waypoint option, and all options are performed on the selected waypoint. First, select the waypoint to copy from. Use the **UP** and **DOWN ARROW** keys to select **START**. Press **OPT**.
6. This brings up the **Wpt Option Page**, with the list of possible options. Select the **Copy Waypoint** option and press **ENT**.
7. This brings up the **Copy Waypoint Page**, with the same data (name and coordinates) as the original waypoint **(START)**. The coordinates look a little different because of the different coordinate type (UTM/UPS). Change the name to **TURN1**. Press **ENT**.
8. This is the first line of position data in UTM/UPS format, showing the column/row designator and 7 digits of easting. Change the line to read **11S 0743071** and press **ENT**.
9. The second line show 7 digits of northing. Change it to **3658028** and press **ENT**. There is no altitude, it is the same as the original waypoint **START**.
10. When you finished the entry of the last line and pressed **ENT**, the **Edit Waypoint Page** came up. Notice that the new waypoint has been added to the list of waypoints.

Create an Offset Waypoint— You will change the coordinates type to Latitude/ Longitude (DEG:MIN) and define a waypoint by offset (range and bearing) using the waypoint from the last step as a reference.

1. Press **MENU, SET**. This brings up the **Setup 1 Page** again.
2. Select **Coord. Type** and press **ENT**.

3. Scroll the choices, select **DEG:MIN** and press **ENT**.
4. Press **MENU, EDIT**. This brings up the **Edit Waypoint Page** again.
5. We want to create a waypoint by entering the range and bearing from another waypoint. The **Enter Offset-Wpt** function is a waypoint option, so select the reference waypoint first. Select **TURN1**. Press **OPT**.
6. Select the **Enter Offset-Wpt** option on the **Wpt Options Page** and press **ENT**.
7. This brings up the **Offset Waypoint Page**, with places to enter a name, range and bearing. Enter the name **TURN2** and press **ENT**.
8. Enter a range of **1.2 km**. The decimal point is fixed on the display and you must enter leading zeros, so enter **0001.20** on the line. Press **ENT**.
9. Enter a bearing of **45 degrees**. Again, you must enter leading zeros, so enter **045**. Press **ENT**.
10. When you finished the entry of the last line and pressed **ENT**, the **Edit Waypoint Page** came up. Notice that the new waypoint has been added to the list of waypoints.
11. You may want to review the calculated coordinates of this waypoint. Select **TURN2** and press **ENT**.

Create a Route— You will enter 3 waypoints in a route.

1. If you are displaying the **Edit Waypoint Page**, press **RTE**. If not, press **MENU, EDIT, RTE**. This brings up the **Edit Route Page**. Your Trooper may or may not have routes already stored in it.
2. Select **(NEW)** and press **ENT**.
3. This brings up the **Enter Route Page**, for entering the name of the route. The cursor is once again at the start of the name. Change the name to be **START 2 T2**. You can enter blanks, but are limited to 10 characters. Press **ENT** when finished.
4. This brings up the **Edit Route Wpts Page**, for entering waypoints into the route. Since the route is new, there are no waypoints in it. Press **SEL** to bring up a list of waypoints to select from.
5. This brings up the **Select Wpt Page**, containing a list of waypoints to select from. Select the waypoint **START** and press **ENT**.

6. The display changes back to the **Edit Route Wpts Page** with the waypoint **START** added to the route. Press **SEL** again to return to the **Select Wpt Page**. Select waypoint **TURN1** and press **ENT**.
7. The display changes back to the **Edit Route Wpts Page** with the waypoint **TURN1** added in front of **START**. The selected waypoint is always placed in front of the cursor location. Select **(END)**, then press **SEL** again to return to the **Select Wpt Page**. Select waypoint **TURN2** and press **ENT**.
8. The display changes back to the **Edit Route Wpts Page** with the waypoint **TURN2** added to the route, this time in the desired order.
9. Your route list should now have these waypoints:
   TURN1
   START
   TURN2
   (END)
10. Press **DONE** to store the route and return to the **Edit Routes Page**.

Edit a Route—You will delete one of the waypoints in the route and enter it in the correct sequence.

1. Select the route **START 2 T2** and press **ENT**.
2. This brings you to the **Enter Route Page**. Press **ENT** again.
3. Select **TURN1** as the waypoint to delete and press the **DEL** key.
3. The waypoint **TURN1** has been deleted from the route. Select the place to insert waypoint **TURN1** (select **TURN2**) and press **SEL** bring up the **Select Wpt Page**. Select waypoint **TURN1** and press **ENT**.
4. The display changes back to the **Edit Route Wpts Page** with the waypoint **TURN1** added in front of **TURN2**. The waypoints are now in the order you want. Press **DONE** to store the route and return to the **Edit Routes Page**.

Section IV

Specifications

Receiver: Five Channel Parallel, LI C/A Code digital GPS receiver.

Antenna: Low profile, high gain, internal patch. Optional external antenna may be located up to 20 meters from the receiver.

Position and Navigation: Three dimensional navigation, 100 user defined waypoints and 10 user defined routes. Steering information displayed at velocities greater than 2.0 km/hr. Additional information provided includes - Speed Over Ground (SOG), Course Over Ground (COG), Time To Go (TTG), Velocity Made Good (VMG), Estimated Time of Arrival (ETA), Distance Made Good (DMG), and Cross Track Error (XTE).

Coordinate System: Latitude, Longitude, Altitude, Military Grid Reference (MGRS), British National Grid (BNG), Irish Transverse Mercator Grid (ITMG), and Universal Transverse Mercator (UTM). Altitude referenced to datum or MSL (Mean Sea Level).

Datums: 51 selectable datums including WGS84 and two user entered.

Units:

Date/time:	Universal Time Coordinate 24 Hr
Battery Usage:	Days, Hrs and Mins
Set Usage:	Days, Hrs and Mins
Azimuth:	Degrees, Mils, Radians, True, Magnetic and Grid North
Speed:	Knots, KPH, MPH
Distances:	Meters (m) Feet (Ft) Kilometers (Km) Yards (yd) Statute Mile Nautical Mile (nm)
Steering:	Degrees

Logistics:	Built-in test High reliability (15,000 hours MTBF)
Interfaces:	Optical Data Port (Receiver-to-Receiver Interface) Data Port (PC-to-Receiver Interface) External Power External Antenna
Display:	Large Graphics (128 x 128 pixels), 2.5" x 2.5" (6.3cm 6.3 cm) SuperTwist Liquid Crystal Sunlight Readable Adjustable backlighting and contrast
Memory:	Unlimited Shelf-life

Physical Characteristics

Dimensions:	7.5" H 3.5" W 2.7" D (19 cm H 9 cm W 6.7 cm D)
Volume:	<46 cu. in. (117 cu. cm.)
Weight:	<2 lbs.
Colors:	Grey and Black or Green and Black

Power

Batteries:	6 AA Alkaline cells, Nickel Cadmium
External:	9 to 40 VDC from 5 watt source (with vehicular mount)

Performance

Position:	<25 m SEP*
Velocity:	0.1 msec, RMS steady state*
Dynamics:	Velocity 0-300 msec Acceleration 2 g

Environmental (MIL-STD-810E)

Operating:	-10C to +70C
Storage:	-40C to +85C
Sine Vibration:	5 to 7 Hz, 1 inch Double Amplitude (DA) 7 to 40 Hz, at 2.5g 40 to 50 Hz , at 0.033 inch DA 50 to 500 Hz, at 4.2 g
Random Vibration:	0.02 g2/Hz, at 12 to 300 Hz -5 dB/octave, at 300 Hz to 1200 Hz
Mechanical Shock:	40 g sawtooth pulse for 11ms (operating). 75 g sawtooth pulse for 6 ms (non-operating). Shock applied along the X, Y and Z axes of the case
Humidity:	Relative humidity 0% to 100% (non-precipitation).
Transit Drop Test:	26 - 48" drops on a surface equivalent to the floor of a HMMWV.
Loose Cargo:	1 inch, double amplitude, 5 Hz vibration levels for 30 minutes on each of six faces.
Sand:	Fine sand particle (up to 150 microns) in a concentration of 0.3 grams/ft at air velocities up to 200 fpm for 28 hours.
Salt:	96 hours with a 5% salt solution (operating & non-operating).
EMI/EMC	MIL-STD-461 Rev C

***Note:** the receiver is subject to degradation of position, velocity and time under Department of Defense imposed Selective Availability. Position may be degraded up to 100 meter 2 dRMS. Velocity and time degradation has not been specified.

Specifications subject to change without notice.

Section V

Master Datum List

	Local Geodetic Systems	Abbreviation
1	ARC 1950 Mean Value (Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, and Zimbabwe)	ARC 1950
2	ARC 1960 Mean Value (Kenya and Tanzania)	ARC 1960
3	AUSTRALIAN GEODETIC 1966 Australia and Tasmania Island	AUST GEO 1966
4	AUSTRALIAN GEODETIC 1984 Australia and Tasmania Island	AUST GEO 1984
5	BOGOTA OBSERVATORY Columbia	BOGOTA OBSERV
6	CAMPO INCHAUSPE Argentina	CMPO INCHAUSP
7	CAPE South Africa	CAPE
8	CARTHAGE Tunisia	CARTHAGE
9	CHATHAM 1971 (New Zealand)	CHATHAM 1971
10	CHUA ASTRO Paraguay	CHUA ASTRO
11	CORREGO ALEGRE Brazil	CORREGO ALGRE
12	EUROPEAN 1950 Denmark, France, Federal Republic of Germany, Netherlands and Switzerland)	EUROPEAN 1950
13	Cyprus	CYPRUS
14	Egypt	EGYPT
15	Iran	IRAN
16	Sicily	SICILY

	Local Geodetic Systems	Abbreviation
17	EUROPEAN 1979 Mean Value (Austria, Finland, Netherlands, Norway, Spain, Sweden, and Switzerland)	EUROPEAN 1979
18	GANDAJIKA BASE Republic of Maldives	GANDAJIK BASE
19	GEODETIC DATUM 1949 New Zealand	GEODETIC 1949
20	HJORSEY 1955 Iceland	HJORSEY 1955
21	INDIAN Thailand and Vietnam	INDIAN
22	BANGLADESH India and Nepal	BANGLADESH
23	IRELAND 1965 Ireland	IRELAND 1965
24	KERTAU 1948 West Malaysia and Singapore	KERTAU 1948
25	LIBERIA 1964 Liberia	LIBERIA 1964
26	LUZON Philippines (Excluding Mindanao Island)	LUZON
27	MASSAWA Eritrea (Ethiopia)	MASSAWA
28	MERCHICH Morocco	MERCHICH
29	MINNA Nigeria	MINNA
30	NAHRWAN Saudi Arabia	NAHRWAN
31	NORTH AMERICAN 1927 Mean Value (Continental US)	NORTH AM 1927
32	ALASKA (Mean Value)	ALASKA

	Local Geodetic Systems	Abbreviation
33	CANADA (including Newfoundland Island)	CANADA
34	CENTRAL AMERICA (Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua, and Mexico)	CENTRAL AM
35	NORTH AMERICAN 1983 Alaska, Canada, Central America, Continental US, and Mexico	NORTH AM 1983
36	OLD EGYPTIAN Egypt	OLD EGYPT
37	OLD HAWAIIAN Mean Value	OLD HAWAII
38	OMAN Oman	OMAN
39	ORDNANCE SURVEY OF GREAT BRITAIN 1936 Mean Value (England, Isle of Man, Scotland, Shetland Islands and Wales)	GT BRIT 1936
40	PITCAIRN ASTRO 1967 Pitcairn Island	PITCAIRN 1967
41	QUATAR NATIONAL Quatar	QUATAR
42	QORNOQ South Greenland	QORNOQ
43	SCHWARZECK Namibia	SCHWARZECK
44	SOUTH AMERICA 1969 Mean Value (Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Guyana, Paraguay, Peru, Venezuela. Trinidad, and Tobago)	SOUTH AM 1969
45	Spare	
46	Spare	
47	ZANDERT Surinam	ZANDERIJ
48	WGS 1972	WGS 1972
49	WGS-84	WGS 84
50	USER ENTERED	USER 1
51	USER ENTERED	USER 2

List of Abbreviations

ALRM ..... Alarm
ALT ..... Altitude
ARR ..... Arrival
AUTO ..... Automatic
AZM ..... Azimuth

BATT ..... Battery
BRG ..... Bearing

C ..... Continuous running
CALC ..... Nav. Calculator
CH ..... Channel
C/N ..... Carrier/Noise
COG ..... Course Over Ground
CONT ..... Continuous
COORD .. Coordinates

DAT ..... Datum
DEG ..... Degrees
DEL ..... Delete
DD:MM:YY Day:Month:Year
D:H:M ..... Days:Hours:Minutes
DMG ..... Distance Made Good
DMM ..... Degrees, Minutes, Thousandths
DMS ..... Degrees,Minutes,Seconds
DN ..... Down
DT ..... Degrees True

E ..... East
EL ..... Elevation
ENT ..... Enter
ESC ..... Escape
ET ..... Elapsed Time
ETA ..... Estimated Time of Arrival
EXT ..... External

FT ..... Feet
FOM ..... Figure Of Merit

GPS ..... Global Positioning System

H:M:S ..... Hours:Minutes:Seconds

INIT ..... Initialize
INT ..... Internal
IR ..... Infrared

KM ..... Kilometer
KPH ..... Kilometers Per Hour

LAT ..... Latitude
LON(G) ... Longitude

M ..... Meters
MAG ..... Magnetic
MAG VAR .. Magnetic Variation
MET ..... Metric
MGRS Military Grid Reference System

MIN .....Minutes
MM:DD:YY Month:Day:Year
MSL.....Mean Sea Level
MPH .....Miles Per Hour

N .....North
NAUT .....Nautical
NAV.....Navigate
NM .....Nautical Miles

OPT.....Options

PDOP .....Position Dilution Of Precision
PG .....Page
POS .....Position

RADS .....Radians
RLA .....Row Letter Advance
RNG .....Range
RTE.....Route
RVRS .....Reverse

S.....South
SATS.....Satellites
SCAL.....Scale
SCR .....Screen
SEL .....Select
SET .....Setup

SOG .....Speed Over Ground
STAT .....Status
STR .....Steering
SV .....Space Vehicle (satellite)
SW .....Software
SYS.....System

TTG .....Time To Go

UPS.....Universal Polar System
US .....United States
UTM Universal Transverse Mercator

VMG .....Velocity Made Good

W.....West
WAYPT ..Waypoint
WGS84...World Geodetic Survey 1984
WPT .....Waypoint

XMIT .....Transmit
XTE .....Cross Track Error

YD .....Yard
YY:DD:MM Year:Day:Month

2D .....Two Dimensional
3D .....Three Dimensional

International Cities List

City	Position
Adak	N 51°47'09.206"
	W 176°40'53.152"
Akron	N 41°05'37.761"
	W 081°32'47.317"
Algiers	N 36°50'46.800"
	E 003°06'27.450"
Anchorage	N 61°15'45.939"
	W 149°39'19.841"
Ankara	N 40°04'37.569"
	E 32°46'28.561"
Athens	N 38°06'47.886"
	E 23°21'28.208"
Azores	N 37°47'23.722"
	W 25°41'14.420"
Baghdad	N 33°29'18.192"
	E 44°10'26.941"
Beijiing	N 39°53'13.168"
	E 116°16'09.359"
Beirut	N 33°55'56.302"
	E 35°16'28.655"
Berlin	N 52°29'36.210"
	E 13°01'57.870"
Billings	N 45°48'21.241"
	W 108°34'49.028"
Boise	N 43°36'41.580"
	W 116°16'38.231"
Boston	N 42°26'47.236"
	W 71°08'12.753"
Budapest	N 47°36'56.030"
	E 18°51'59.222"
Cairo	N 30°11'41.098"
	E 31°01'28.496"
Calgary	N 51°02'57.270"
	W 114°08'16.415"
Chicago	N 41°55'45.440"
	W 87°53'22.182"
Cleveland	N 41°33'11.406"
	W 81°49'00.485"
Delhi	N 28°33'58.733"
	E 77°07'44.181"
Denver	N 39°45'59.746"
	W 104°56'21.330"
Fairbanks	N 64°51'43.551"
	W 147°49'50.936"
Gander	N 49°00'23.449"
	W 54°38'49.928"
Gorkiy	N 56°27'07.192"
	E 43°57'40.839"
Hanoi	N 21°09'13.169"
	E 105°47'13.749"
Hong Kong	N 22°21'13.169"
	E 114°07'01.813"
Honolulu	N 21°21'32.599"
	W 157°54'41.313"
Istanbul	N 41°13'02.546"
	E 28°49'28.655"
Julianeahab	N 60°48'46.703"
	W 45°59'58.301"
Juneau	N 58°20'54.034"
	W 134°30'04.731"
Jerusalem	N 31°54'18.564"
	E 35°11'28.652"
Kabul	N 34°38'16.955"
	E 69°15'17.443"

Khatmandu	N	27°46'27.661"	Riyadh	N	24°40'55.701"
Nepal	E	85°09'42.783"		E	46°39'58.361"
London	N	51°29'45.170"	Roma	N	42°06'15.306"
	E	00°09'59.010"		E	12°30'45.580"
Los Angeles	N	34°04'18.848"	Sacramento	N	38°35'57.094"
	W	118°17'42.112"		W	121°30'08.750"
Madrid	N	40°19'43.269"	Salt Lake	N	40°53'41.847"
	W	04°28'18.321"		W	111°54'40.611"
Manila	N	14°37'13.169"	San Francisco	N	37°50'13.002"
	E	120°46'52.264"		W	122°26'30.045"
Moscow	N	55°58'39.197"	Seattle	N	47°37'50.431"
	E	37°31'27.628"		W	122°25'13.790"
New York	N	40°53'41.484"	Seoul	N	37°37'13.168"
	W	74°10'12.819"		E	126°48'43.459"
Nome	N	64°30'56.236"	Shanghai	N	31°13'13.169"
	W	165°31'50.673"		E	121°18'47.577"
Odessa	N	46°28'37.245"	Spokane	N	47°41'59.894"
	E	30°40'25.849"		W	117°28'22.064"
Omaha	N	41°27'32.898"	Stockholm	N	59°16'18.020"
	W	96°03'56.792"		E	17°50'18.557"
Oslo	N	59°46'42.455"	Sydney	S	33°55'00.000"
	E	10°33'35.903"		E	151°17'00.000"
Paris	N	49°23'43.269"	Tehran	N	35°53'46.843"
	E	02°02'54.914"		E	51°14'54.197"
Portland	N	45°31'43.389"	Tokyo	N	35°45'13.168"
	W	122°41'56.209"		E	139°43'45.782"
Reno	N	39°23'25.712"	Tunis	N	36°54'34.854"
	W	119°57'38.871"		E	10°06'27.712"
Reykjavik	N	64°10'07.704"	Warszawa	N	52°33'24.265"
	W	21°54'01.438"		E	21°05'52.949"
			Washington	N	38°58'02.425"
				W	77°08'25.384"

Appendix I

Limited 1 Year Warranty

Rockwell International Corporation warrants this Trooper™ Standard Handheld GPS Receiver, against defects in materials and workmanship for a period of 1 year from the date of retail sale. In case of a defect, Rockwell International will, at its option, repair or replace the Trooper (with a new or refurbished Trooper) without charge.

For service under this warranty:

1. Pack the Trooper carefully (preferably in its original container), to avoid breakage in transit.

2. With the Trooper enclose a copy of your invoice, sales slip, or other dated proof of purchase which shows the serial number of the unit being returned along with a full description of the problem.

3. Mail it prepaid insured to:

    Rockwell International Corporation
    Collins Avionics & Communications Division
    350 Collins Road N.E.
    Cedar Rapids, IA 52498
    Attn: GPS Trooper Customer Rep.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Exclusions and Limitations: This warranty does not extend to any damage or malfunction resulting from misuse, neglect or accident. Except for any implied warranty, this warranty contains the entire obligation of Rockwell, and the remedies described above are the exclusive remedies under this warranty or any implied warranty. The duration of any implied warranty is limited to 1 year. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.) **IN NO EVENT SHALL ROCKWELL BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you.)

Out-of-Warranty Service: If the warranty period has expired or the Trooper is returned without proof of purchase date or serial number documented, we will repair and return the Trooper C.O.D. or charges collect at prevailing service rates. To avoid delays call or write to the Rockwell Customer Representative in advance, for the amount of out-of-warranty charges, then forward your payment in advance.

Sales and Service

For sales, service, or repair information call 1-800-321-CACD (2223) or 1-319-395-5100 or Fax 1-319-395-4777 or write Rockwell for your nearest dealer:

Rockwell International Corporation
Collins Avionics & Communications Division
350 Collins Road NE
Cedar Rapids, IA 52498
Attn: GPS Trooper Customer Rep.

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Rockwell International

Collins Avionics &
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