# RAC Geo II

## User's Manual

### Distance Measuring with GPS



JAMAR
Technologies, Inc.

## WARNING

Use of the RAC Geo II while driving could cause an accident, resulting in serious injury or death. As with any in-vehicle instrumentation, the information provided by the RAC Geo II should be observed as part of the normal operation of the vehicle. Changes to the RAC Geo II should only be done in a safe manner.

Installing the RAC Geo II should be done with caution as to not cause unsafe conditions.
DO NOT mount the RAC Geo II where it will obstruct the driver's view.
DO NOT mount the RAC Geo II over or near an air bag.
DO NOT route cables in a manner that would interfere with operation of the vehicle.

## LIMITED WARRANTY

JAMAR Technologies, Inc. warrants the RAC Geo series instruments for a period of five (5) years limited warranty against defects in material and workmanship as follows: first year, parts and labor; years two through five, parts only, flat labor charge. Sensors, cables, connectors, brackets and other hardware are warranted for ninety (90) days. Refer to Chapter 2 for information on proper installation and use of the hardware.

JAMAR Technologies, Inc. warrants each new instrument manufactured by the company to be free from defective material and workmanship and agrees to remedy any such defect. At its option, it may furnish a new part in exchange for any part of any instrument of its manufacture which, under normal installation, use and service discloses such defect. The instrument must be returned to the JAMAR factory or authorized service agent intact, for examination, with all transportation charges prepaid.

This warranty does not extend to any products which have been subject to misuse, neglect, accident, incorrect wiring not our own, improper installation or use in disregard of instructions furnished by JAMAR. This warranty does not extend to products which have been repaired or altered outside the JAMAR factory or authorized service agent.

In no event shall JAMAR Technologies, Inc. be liable for any damages arising from the use of this product including damages arising from the loss of information.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for JAMAR Technologies, Inc. any other liability in connection with the sale or use of JAMAR products.

JAMAR Technologies, Inc. reserves the right to make improvements on the product and/or specifications at any time without notice. Questions concerning this warranty or any JAMAR Technologies, Inc. product should be directed by e-mail, mail or telephone to:

JAMAR Technologies, Inc.
1500 Industry Road, Suite C, Hatfield, PA 19440
215-361-2244 • sales@jamartech.com

*We are pleased that you have chosen the RAC Geo II for your distance measuring needs. We have strived to develop a unit that is easy to use and has the options that our customers require. The RAC Geo II has undergone extensive testing to verify the accuracy of its operations, and each unit is tested before it leaves our facility. However, just like other complex electronic devices, problems can occur. We always suggest that users verify the continuing accuracy of any device they use. Should you detect any problems with any of our products, please notify JAMAR Technologies immediately and discontinue use of the unit until we have verified its operation.*

If you have any questions about the use of the RAC Geo II, please call the following number:

**1-215-361-2244**

**Monday — Friday, 8:00 AM to 5:00 PM Eastern time**

You may also contact us by e-mail at:

**sales@jamartech.com**

For more information on our products, or for the latest news in product development, visit our web site at:

**www.jamartech.com**

For support information specific to RAC devices, go to:

**www.jamartech.com/RACSupport.html**

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# Table of Contents

**Technical Support ..... iii**

**Quick Start Guide & Introduction to the RAC Geo II ..... 1-1**
Quick Start ..... 1-2
What is the RAC Geo II? ..... 1-3
How Does it Work? ..... 1-3

**Installation ..... 2-1**
Installing the RAC Instrument ..... 2-2
Connecting Power to the RAC Instrument ..... 2-3
Installing the External Antenna ..... 2-4

**Start Up, Key Functions & Menu Options ..... 3-1**
Power On ..... 3-2
GPS Sensor Mode Start Up ..... 3-3
Key Functions ..... 3-4
Menu Functions ..... 3-7
Additional Features ..... 3-25

**External Sensor Mode ..... 4-1**
GPS Sensor or external sensor... which is right for you? ..... 4-2
Switching from GPS Mode to External Sensor Mode ..... 4-3
Installation ..... 4-4
Before You Begin ..... 4-4
Installing External Distance Sensor ..... 4-5
Installing the RAC Instrument & Antenna ..... 4-5
Automatic Calibration Procedure ..... 4-6
If Your RAC Fails to Calibrate ..... 4-9
Manual Calibration Procedure ..... 4-11

**Troubleshooting ..... 5-1**
Frequently Asked Questions ..... 5-2

**Appendix ..... A-1**
Connection and Output Formats ..... A-2
RAC Geo II Specifications ..... A-3
Glossary ..... A-4
Vehicle Calibration Record ..... A-6

# Chapter 1

# Quick Start Guide & Introduction to the RAC Geo II


# Quick Start

**Step 1** Install your RAC Geo by mounting it on or near your dash and plugging in the Geo's auto adapter power supply into your vehicle's 12V outlet. Screw the GPS antenna into the top of the unit and mount the antenna on the roof of your vehicle. *Note that the antenna is not required, but is recommended for best accuracy and quickest GPS lock.*

**Step 2** Perform a test measurement with your vehicle. Once your RAC has been installed, you should perform a test measurement over a known distance. This will ensure that the instrument is working correctly. To do a test measurement, drive to your starting point and stop. Turn on the Geo and wait for it to acquire a GPS signal, as described below.

When first powered on, the Geo will display *GPS FO* in the upper display and begin to look for GPS satellites. This will switch to *GPS F1* in about 60 seconds.

A *0* will then be shown in the upper display while *CH* is shown on the lower display. Next, press the CH (count hold) button to release the instrument from count hold and then drive the distance to be measured. Stop and/or press the CH button once you reach the end of the distance to be measured.

**Step 3** Familiarize yourself with the features and options of the RAC Geo II. Refer to Chapter 3 for more detailed instructions on the functions and procedures of the unit. We recommend that you practice using the RAC Geo before attempting to use the instrument on a job to be sure you are comfortable with how to operate it.

# What is the RAC Geo II?

The JAMAR Technologies Road Analysis Computer (RAC) Geo II is an accurate, easy-to-use distance measuring instrument (DMI) that incorporates GPS technology.

The RAC Geo II has been designed with features to provide you with a versatile and functional instrument that can be learned in a very short time. This cost-effective unit saves time & money by allowing personnel to measure distance, accurate up to 1 foot per mile, while recording GPS coordinates of roadway features.

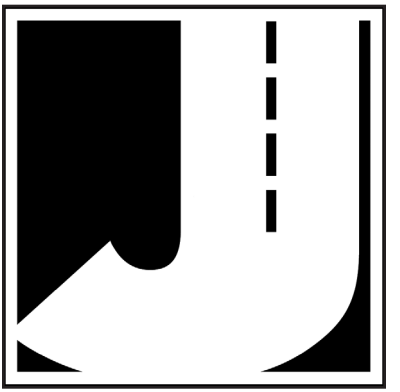
# How does it work?

The RAC Geo II has an on-board GPS receiver built into the unit. Once it locks onto the GPS satellites, it can track movement. Power is provided by a 12V auto adapter, which makes the unit completely portable from vehicle to vehicle. (Power can also come from any existing DMI power wiring if you already have this.)

While the on-board GPS receiver will track distance, we recommend the use of the external GPS antenna for the best accuracy. This screws into the top of the Geo II and comes with the unit.

*Accuracy using GPS-based distance measuring is approximately 1 foot per 1000 feet. If you require greater accuracy, an external distance sensor (such as a modular or magnetic sensor) can be used with the unit to provide accuracy up to 1 foot per mile (5280 feet). Information on using an external distance sensor can be found in Chapter 4.*

In addition to distance measuring, the RAC Geo II also has the unique ability to track and store GPS coordinates using the on-board GPS receiver. The GPS coordinates of road features (intersections, bridges, signs, guardrails, etc.) can then either be internally stored for download to the RACPro software, or read directly off the RAC's display.



# Chapter 2

# Installation

# Installing the RAC Instrument

The compact case design of the RAC Geo allows mounting of it in a number of convenient locations. Popular locations include on the front of the dashboard, above or below the dashboard, or on the windshield using the optional windshield mounting bracket. Wherever you decide to mount the instrument, remember it should be within easy reach and the display should be visible without obstructions.

It is most common to mount the RAC to the front of the dashboard using the Velcro provided. Two plastic 'L' brackets are also provided to facilitate mounting to the top of the dashboard if that is your preferred location. For best results, attach the 'L' bracket so that the bottom of the 'L' is facing away from the RAC as shown in figure 2.1.

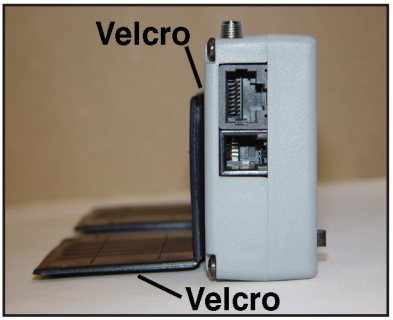



**Fig. 2.1 - 'L' Bracket Side View**

Using the two 'L' brackets allows you to compensate for curved dashboards even if it requires the RAC to be mounted on a left or right slope.


**Fig. 2.2 - 'L' Bracket on Curved Dashboard**

**Note:** While the RAC Geo II is designed to withstand very high temperatures, we recommend disconnecting the RAC and storing it in the glove box or below the dash if the vehicle will be left for long periods of time in direct sunlight and high temperatures.

# Connecting Power to the RAC Instrument

After mounting the RAC, plug the Geo's auto adapter power supply into your vehicle's 12V outlet and connect the other end to the PWR port on the RAC Geo, as shown below.


**Fig. 2.3 - Connecting Power**

You may want to consider allowing enough slack in the cable to permit a passenger to hold/operate the RAC if necessary. Regardless of the mounting location, Velcro strips are provided for quick, easy mounting & removal of your RAC.

*******WARNING*******

**When disconnecting the power adapter, be sure to grasp the base of the adapter while pulling it out, as shown below. Failure to do this may result in damage to the adapter.**

**Fig. 2.4 - Proper Disconnection of Power Adapter**

# Installing the External Antenna

The RAC Geo comes with an external GPS antenna that screws into the top of the Geo. *Note that the antenna is not required when using the Geo, but it is recommended for best accuracy and quickest GPS lock.*

To use the antenna, screw it into the top of the RAC Geo, being sure to get a tight connection. Once screwed into the unit, route the antenna to the roof of your vehicle. The antenna has a magnetic base, so it will attach itself to any metal.

*Note that it is recommended that you do not touch the metal antenna connection while a count in progress as this can interfere with the GPS signal.*


**Fig. 2.5 - Using the External Antenna**

# Chapter 3

# Start Up, Key Functions & Menu Options


**Fig. 3.1 — RAC Geo Key Layout**

Your RAC Geo DMI has been designed for simple operation, using large individual keys which provide a click and tone feedback.

The two 6-digit high-intensity LED display windows allow flexibility in displaying data to you. The upper, larger display window (referred to as D-1) is primarily used to display distance. It is also used to indicate menu locations, time and GPS coordinates. The lower, smaller display window (referred to as D-2) is used to display count status, speed, interval distance, menu descriptions, event codes, GPS coordinates, etc.

## Power On

This is the slide switch which provides power to the RAC Geo. When turned on, the RAC will go into start-up mode, which will vary depending on if the unit is set to GPS sensor mode or external sensor mode (refer to chapter 4).


**OFF/ON**

## GPS Sensor Mode Start-Up

When starting in GPS Sensor mode, the RAC Geo will Display *GPSSen* in D-1, indicating it is set to GPS Sensor Mode. It will then switch to display *GPS FO* in D-1 and *SEnSor* in D-2 and begin to look for GPS satellites.


**Fig. 3.2 —**
**GPS Sensor Mode Start-Up**


**Fig. 3.3 —**
**Looking for GPS Satellites**

The RAC Geo will display *GPS F1* in D-1 once it has found a minimum number of satellites for a GPS signal (usually in less than 60 seconds).

Once the RAC Geo has reached an F1 lock the Geo will set itself in Count Hold with *CH* displayed in D-2 and *0* displayed in D-1. At this point, the Geo is ready to start counting or access menu functions.


**Fig. 3.4 — GPS Satellites Found**


**Fig. 3.5 — Ready to Start**

*Once F1 is achieved, the Geo is ready to start, but it will continue to try to find more satellites in the background. Also during start up, the RAC Geo will perform some behind-the-scenes functions including: set the unit of measuring (feet, mile, meter) and the vehicle number to be the last one used when the RAC was turned off, set itself to count up, and set the Distance Pulse Output interval to zero.*

## Key Functions


**Count Hold**

The Count Hold key will start or stop the computation of distance pulses. When in Count Hold, **CH** will be displayed in D-2 and the RAC will not accumulate any distance. If speed is also being displayed, it will continue as CH **does not** stop the computation of vehicle speed. When released, CH in D-2 will go out and distance computation will resume.


**Display Hold**

Display Hold will stop the display from updating while the RAC will continue to accumulate distance internally. When in Display Hold, **DH** will be displayed in D-2. If speed is also being displayed, it will continue as DH **does not** freeze the speed display. **Note:** You cannot put the RAC in both Count Hold and Display Hold at the same time. Count Hold will take precedence over Display Hold.


**Unit**

The Unit key allows you to select the desired unit of measurement. This can be selected/changed while moving or at rest. When pressed, the distance will cycle from total feet to miles to kilometers/meters. The LEDs to the left of D-1 indicate which unit is currently being used.


**Speed**

The Speed key allows you to turn on or off the display of speed (mph or kph) in D-2. The display of speed is not interrupted by either the Count Hold or Display Hold keys.


**Menu**

The Menu key allows you to select from a variety of functions. After pressing the Menu button, the Add and Sub keys can be used to scroll through the options, which are displayed in D-2. To select an option, press the ENT (Enter) key. The options are:

Menu 1 - Auto Calibration (A-CAL)
Menu 2 - Manual Calibration (E-CAL)
Menu 3 - Pre-Distance (P-diS)
Menu 4 - Clock Set (CLoSEt)
Menu 5 - Distance Pulse Output (dPO)
Menu 6 - Memory Store (StorE)
Menu 7 - Memory Status (StAtUS)
Menu 8 - Memory Erase (ErASE)
Menu 9 - Store GPS (Str-g)
Menu 10 - Track GPS (Str-t)
Menu 11 - Display GPS (gPS-n)
Menu 12 - Format GPS (gPS-Fo)
Menu 0 - Return to Normal Operation (rEturn)

See pages 3-6 to 3-24 for specific menu instructions.


**Add**

The Add key instructs the RAC to count **up**. It is also used in the Menu function to scroll up through the various options, and is used in the Pre-Distance function.


**Subtract**

The Sub key instructs the RAC to count **down**. When in this mode, the LED indicator for the active unit of measurement will flash to indicate that you are subtracting distance. Should you count down to zero (0), the RAC will provide a tone and automatically begin counting up.

The Sub key is also used in the Menu function to scroll down through the various options, and is used in the Pre-Distance function to subtract a desired distance from the displayed distance.


**Dim**

The Dim key allows you to select from four (4) levels of display brightness to best suit the ambient light conditions. Full bright is best for daylight conditions while full dim may best suit night conditions. Each time the Dim key is pressed, the brightness will drop one level until the lowest level is reached. It will then jump back to the high brightness level. Both D-1 and D-2, as well as the LED indicators, are controlled by the Dim key.


**Clear**

The Clear key is normally used to clear the D-1 distance display as well as the Interval Distance in D-2 if that function has been selected. Clear can be used on the run (while measuring), which allows you to establish a zero starting point without having to stop your vehicle in traffic or the center of a busy intersection. Clear will not reset the Time Counter in normal mode.


**Enter**

The Enter key instructs the RAC to accept the previously keyed value currently on the display. It is also used in the Menu function and Interval Distance application.


**Numbers 0 - 9**

The numeric keys are used to identify menu options and select numbers desired for calibration, pre-distance, distance pulse output, clock set, etc.

# Menu Functions

The Menu key allows you to select a variety of functions. After pressing the Menu button, the Add and Sub keys can be used to scroll through the options, which are displayed in D-2. To select an option, press the ENT (Enter) key.

## Menu 1 & 2 - Calibration Procedures

Calibration is only required when using an external distance sensor. Refer to Chapter 4, *External Distance Sensor*, for details on calibration procedures.

## Menu 3 - Pre-Distance

The Pre-distance feature will allow you to enter a known distance starting point other than zero. It could be where you left off before lunch, or just beginning at a known station. This feature also allows you to Add or to subtract off a distance currently on display in D-1.

**Note:** The RAC must be in **Count Hold** to use Pre-Distance.

### Step 1

Press the **Menu** key, the **#3** key then the **Enter** key. At this point, the unit is ready to have a distance entered.


**Fig. 3.6 — Enter Pre-Distance**

### Step 2

Using the numeric keys, key in the desired distance (up to 6 digits), then press **Enter.**


**Fig. 3.7 — Distance Entered**

### Step 3

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. You are now back in the normal mode with the distance set to the value you entered.


**Fig. 3.8**
**Normal mode w/ Pre-distance set**

**Note:** If you just want to **add** to the distance already on display in D-1, in Step 2, rather than pressing Enter, press the Add key. To **subtract** from the current distance, press the Sub key.

## Menu 4 - Clock Set

The RAC Geo will compute & display time as either **elapsed time** from when the instrument was powered up, or **real time** if the timer has been set. The timer starts automatically at zero when the RAC is powered-up. Time is displayed in D-1 as hh.mm.ss.

### To View Elapsed Time:

Press the **Menu** key, then the **#4** key, then the **Enter** key. D-1 shows the elapsed time since the RAC was powered on. At this time you can stop and reset the timer with the CLR (clear) key or just let it continue to run. To return to normal mode, press the **Menu** key then the **Enter** key.


**Fig. 3.9 — Elapsed Time**

### To Set Timer to Real-Time:

### Step 1

Press the **Menu** key, then the **#4** key, then the **Enter** key. D-1 shows the elapsed time since the RAC was powered on, as shown in Figure 3.9 above.

### Step 2

Press the **Clear** key. Using the number keys, key in the time you wish to display (hh.mm.ss format). This can be either 12 or 24 hour format (i.e 1 PM = 13 hrs).

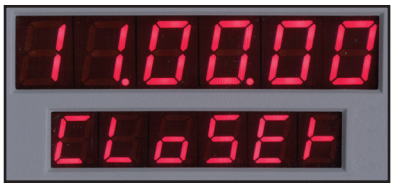



**Fig. 3.10 — Clock Time Entered**

### Step 3

Wait until the keyed in time is reached and press the **Enter** key to begin the clock counting.

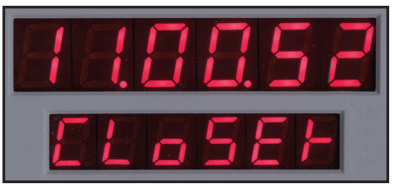



**Fig. 3.11**
**Counting from Entered Time**

### Step 4

To return to normal mode, press the **Menu** key then the **Enter** key.

**Note:** To view the Clock/Timer while in the normal measuring mode (not as a Menu function), press the #1 key. D-1 will then display the clock/timer in hh.mm.ss format. Press the #1 key again to toggle back to distance. This function does not interrupt the distance count.

**IMPORTANT:** Once the RAC is turned off, the clock/timer shuts off and will reset to zero on the next power up. Also note that the Count Hold **does not** stop the clock/timer.

## Menu 5 - Distance Pulse Output (DPO)

*Note: Use of the Distance Pulse Output feature with a Modular Distance Sensor (MDS) requires a factory modification to the MDS. Contact us using the information on page iv if you need to use this feature with an MDS.*

When activated, the distance pulse output (DPO) will provide a +5 VDC (TTL level) output pulse at a pre-selected distance interval and signal duration. This low level signal is provided on the red wire in the power/signal cable. The +5 VDC signal can be used to send distance pulsed to a computer or other device that can accommodate low voltage, low current signals. Should you wish to control a +12 VDC high current device, you will need our optional DPO Amplifier.

In addition to creating a DPO pulse at the pulse interval, one byte of data is sent out on the RS-232 communications port. This byte contains an ASCII 'S' at 9600 baud. This capability allows the RAC to effectively signal a PC or other type of unit at the leading edge of the DPO pulse.

**CAUTION: The DPO signal can be used to control potentially hazardous equipment. When activated, the DPO could cycle this equipment at any time. If you are working with this type of equipment, TURN OFF the RAC, which will deactivate the DPO signal.**

### To activate the DPO signal:

#### Step 1

Press the **Menu** key, the **#5** key, then the **Enter** key. At this point, the RAC is ready to have an interval distance entered.


**Fig. 3.12 — Enter DPO Distance**

## Step 2

Using the numeric keys, enter the interval distance that you want the DPO signal generated, based on your selected unit of measurement (feet, mile, meter).


**Fig. 3.13 — DPO Distance Entered**

## Step 3

Press the **Enter** key and you will be prompted to enter how long the DPO signal should last. You can key in a desired signal duration from 10 milliseconds (key in 1) to 2.55 seconds (key in 255). Keep in mind that if you select a long output duration your signals may run together at high speeds. A 10 millisecond pulse duration is usually adequate for sending pulses to a laptop computer and will not overlap at normal highway speeds.


**Fig. 3.14 — Enter DPO Duration**

## Step 4

Press **Enter** and you will be prompted to select whether or not you want an audible tone to sound when the DPO signal is triggered. The 1 in D-1 signifies that the tone is **on**. If you want a tone with each output pulse, leave 1 in D-1. If you **do not** want a tone, enter zero (0) or press the Clear key.


**Fig. 3.15 — DPO Tone On**

## Step 5

Once you have selected whether you want a tone or not, press **Enter**. D-2 will then indicate that the DPO signal has been activated.


**Fig. 3.16 — DPO Activated**

## Step 6

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. You are now back in the normal mode with the DPO signal set.

## To turn off the DPO signal:

### Step 1

Press the **Menu** key, the **#5** key then **Enter**. The current DPO interval distance is then displayed in D-1.


**Fig. 3.17 — Current DPO Distance**

### Step 2

Press the **CLR** (clear) key and the DPO distance is removed.


**Fig. 3.18 — DPO Distance Cleared**

### Step 3

Press the **Enter** key and D-2 will then indicate that the DPO signal has been deactivated.

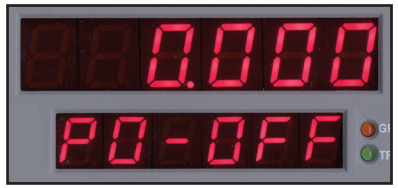



**Fig. 3.19 — DPO Deactivated**

### Step 4

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. You are now back in the normal mode with the DPO signal turned off.

**Note:** When the RAC is turned off, the DPO distance interval duration resets to zero (0), thereby deactivating the output. If you turn the RAC off, you must reset this if you want the DPO to be activated again.

## Menu 6 - Memory Store

*Used with RACPro software*

The RAC Geo II has the capability to store up to 400,000 events in its internal memory in this mode. Using this feature, you can manually key in numeric codes to identify various events, such as intersections, signs, culverts, bridges, pavement markings, telephone/power poles, etc. The numeric code can be up to four (4) digits in length. This feature makes the RAC Geo II ideal for road inventories, outside plant inventories, asset management and engineering.

Note: Data collected in this mode must be downloaded using the RACPro software, or other interface software.

Note: This option is for storing the distance of events only. To store distance in combination with GPS data, refer to the instructions for Menus 9 and 10 later in this chapter.

### Step 1

Press the **Menu** key, then the **#6** key. D-2 then indicates that you are in the Memory Store function.


**Fig. 3.20 — Memory Store**

### Step 2

Press **Enter**. D-1 displays the last date that was used in the memory store function. Note: There is no check to ensure that a valid date is entered or correct. If you want to enter a new date, press the **CLR** (clear) key, then, using the numeric keys, enter the date you wish to use (mm.dd.yy).


**Fig. 3.21 — Enter Date**

### Step 3

Once you have keyed in a date, press **Enter**. D-2 will then display 'Other'. At this point, you have the option of entering a number, up to six digits, that can be associated with the stored data. This could be the inventory route number, an operator identifier number, etc. It is not mandatory to key in a number. If you do not want one, leave the value set to zero.


**Fig. 3.22 — Enter Optional Identifier**

## Step 4

Once you have selected the identifier you want, press **Enter**. At this time, if you wish to start at a distance other then zero, you can enter a starting distance using the numeric keys.


**Fig. 3.23 — Enter Starting Distance**

## Step 5

Press **Enter** and the RAC will be ready to begin at the starting distance you entered.

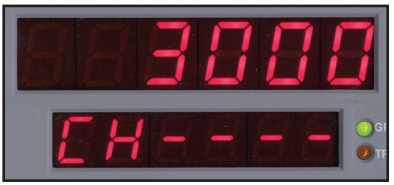



**Fig. 3.24 — Ready to begin survey**

## Step 6

Align your vehicle with the starting point of the survey. We recommend that you enter a starting code number of up to four digits (such as 1111) and press the Enter key. This stores the starting reference code and distance in memory.


**Fig. 3.25 — Enter Starting Reference Code**

## Step 7

Press the CH key to release the Count Hold. The distance in D-1 will begin to count once the vehicle begins to move.

The four digits in D-2 display the numeric code numbers as they are keyed in. Using a numeric code (0-9999) you are able to identify up to 10,000 separate events for inventory purposes. For example, an intersection to the right might be a 1, to the left a 2, a bridge a 6, a telephone pole a 7, a power pole an 8, a culvert a 22, a 45 mph speed limit sign a 45, a municipal boundary line a 500, etc.

As you see the event ahead of you, key in the code number using the numeric keys. The number will appear in D-2. When you reach the event (using a reference point on the vehicle), press


**Fig. 3.26 — Enter Event Codes**

**Enter**. The event code, distance, speed and time (elapsed or real) are stored in memory.

There is a short delay (1/2 second) when you press Enter before you can key in another event code. However, the code you entered is written to memory at the instant you press Enter.

Should you key in an incorrect code number, you can overwrite that number by simply keying in the correct number. This must be done prior to pressing the Enter key. Once you hit the Enter key, the code that was in D-2 is stored in memory.

## Step 8

When the inventory route is completed, press the **CH** key. Key in an ending reference code (such as 9999) to mark the end of the survey, then press **Enter**. Note that you can store up to 400,000 events in the RAC Geo II's memory.

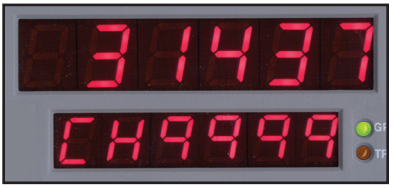



**Fig. 3.27 —**
**Enter Ending Reference Code**

## Step 9

To exit the memory store function, the RAC must be in Count Hold. Press the **Menu** key, then press **Enter**. You are now back in normal mode.

**Note:** To begin another survey, go back to **Step 1**.

## Menu 7 - Memory Status

*Used with RACPro software*

If you are conducting numerous field surveys before downloading the data to a computer, you may want to check the status of the RAC's memory from time to time to make sure you have enough memory left for a new survey.

### Step 1

Press the **Menu** key, then the **#7** key to access the Memory Status function.


**Fig. 3.28 — Memory Status**

### Step 2

Press **Enter** and the RAC will change to show the amount of memory remaining and the number of surveys stored. D-1 shows the percentage of remaining internal memory (i.e. Str 95 means 95% of memory is still available). D-2 shows the number of surveys stored in memory (i.e. Sur 2 means there are currently 2 surveys stored in memory.


**Fig. 3.29 — Memory Percentage and Surveys Stored**

### Step 3

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. You are now back in the normal mode.

## Menu 8 - Memory Erase

*Used with RACPro software*

This feature allows you to clear **all** memory locations that have been stored in the RAC Geo II. Note that when doing this **ALL** memory locations are cleared. You are not able to clear partial memory or selected surveys.

### Step 1

Press **Menu**, the **#8** key and then **Enter** to access the Memory Erase function. *Erase* will be listed in both D-1 and D-2.


**Fig. 3.30 — Memory Erase**

### Step 2

Press **Enter** and D-1 will begin flashing to alert you that you are about to clear **ALL** surveys in memory.

### Step 3

Press **Enter** again and D-1 will change to *Done*, indicating that the memory has been erased.


**Fig. 3.31 — Memory has been erased**

### Step 4

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. You are now back in the normal mode.

Note: If at any point prior to Step 3 you change your mind about erasing the memory, just press the **Menu** key then **Enter**. You will be returned to the normal mode without erasing the memory.

## Menu 9 - Store GPS & Menu 10 - Track GPS

*Used with RACPro software*

These options are the same as Menu 6 - Store Memory, but with the addition of storing GPS data. The Store GPS and Track GPS options are set up the same way. However, with Store GPS, GPS coordinates are only saved to memory when you enter an event. With Track GPS, GPS coordinates are saved to memory every second, along with events you manually record. Up to 50,000 events can be stored in Store GPS mode. Up to 100,000 events, or up to 30 hours of data, can be stored when using Track GPS.

Note: Data collected in either of these modes must be downloaded using the RACPro software, or other interface software.

### Step 1

Press the **Menu** key, then the **#9** key for Store GPS mode or the **Menu** key, then the **#1** and **#0** keys for Track GPS mode. D-2 indicates the function you have selected function.


**Fig. 3.32 — Store GPS**


**Fig. 3.33 — Track GPS**

### Step 2

Press **Enter**. The Geo will then switch to display *GPS FO* in D-1 and begin to look for GPS satellites.

The RAC Geo will display *GPS F1* in D-1 once it has found a minimum number of satellites for a GPS signal (usually in less than 60 seconds).

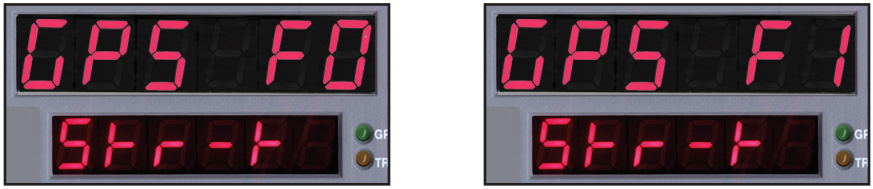



**Fig. 3.34 — GPS Search Progression**

Once the RAC Geo has reached an F1 lock the Geo will go to the Date screen.

D-1 will display the last date that was used in the Store or Track function. Note: There is no check to ensure that a valid date is entered or correct. If you want to enter a new date, press the **CLR** (clear) key, then, using the numeric keys, enter the date you wish to use (mm.dd.yy).


**Fig. 3.35 — Enter Date**

## Step 3

Once you have keyed in a date, press **Enter**. D-2 will then display 'Other'. At this point, you have the option of entering a number, up to six digits, that can be associated with the stored data. This could be the inventory route number, an operator identifier number, etc. It is not mandatory to key in a number. If you do not want one, leave the value set to zero.


**Fig. 3.36 — Optional Identifier**

## Step 4

Once you have selected the identifier you want, press **Enter**. At this time, if you wish to start at a distance other then zero, you can enter a starting distance using the numeric keys.


**Fig. 3.37 — Starting Distance**

## Step 5

Press **Enter** and the RAC will be ready to begin at the starting distance you entered.

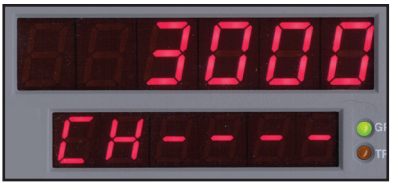



**Fig. 3.38 — Ready to begin survey**

## Step 6

Align your vehicle with the starting point of the survey. We recommend that you enter a starting code number of up to four digits (such as 1111) and press the Enter key. This stores the starting reference code and distance in memory.


**Fig. 3.39 — Enter Starting Reference Code**

## Step 7

Press the CH key to release the Count Hold. The distance in D-1 will begin to count once the vehicle begins to move.

The four digits in D-2 display the numeric code numbers as they are keyed in. Using a numeric code (0-9999) you are able to identify up to 10,000 separate events for inventory purposes. For example, an intersection to the right might be a 1, to the left a 2, a bridge a 6, a telephone pole a 7, a power pole an 8, a culvert a 22, a 45 mph speed limit sign a 45, a municipal boundary line a 500, etc.

As you see the event ahead of you, key in the code number using the numeric keys. The number will appear in D-2. When you reach the event (using a reference point on the vehicle), press **Enter**. The event code, GPS coordinates, distance, speed and time (elapsed or real) are stored in memory.


**Fig. 3.40 — Enter Event Codes**

There is a short delay (1/2 second) when you press Enter before you can key in another event code. However, the code you entered is written to memory at the instant you press Enter.

Should you key in an incorrect code number, you can overwrite that number by simply keying in the correct number. This must be done prior to pressing the Enter key. Once you hit the Enter key, the code that was in D-2 is stored in memory.

## Step 8

When the inventory route is completed, press the **CH** key. Key in an ending reference code (such as 9999) to mark the end of the survey, then press **Enter**. Note that you can store up to 50,000 events in memory when in Store GPS mode. You can store up to 100,000 events, or up to 30 hours of data, in memory when in Track GPS mode.

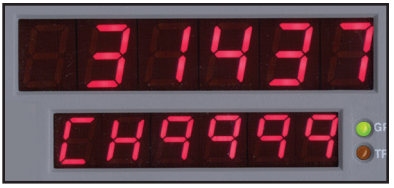



**Fig. 3.41 —**
**Enter Ending Reference Code**

## Step 9

To exit the memory store function, the RAC must be in Count Hold. Press the **Menu** key, then press **Enter**. You are now back in normal mode.

To begin another survey, go back to **Step 1**.

# Menu 11 - Display GPS

This feature allows you to record and view GPS information directly on the display of the RAC Geo II, along with distance information. With this feature you do not have to download your data to a computer.

## Step 1

Press the **Menu** key, then the **#1** and **#1** key. D-2 indicates that you are in the Display GPS function.


**Fig. 3.42 — Display GPS**

## Step 2

Press **Enter**. The Geo will then switch to display *GPS FO* in D-1 and begin to look for GPS satellites.

The RAC Geo will display *GPS F1* in D-1 once it has found a minimum number of satellites for a GPS signal (usually in less than 60 seconds).



**Fig. 3.43 — GPS Search Progression**

Once the RAC Geo has reached an F1 lock the Geo will then go into Count Hold mode and wait for you to begin.


**Fig. 3.44 — Count Hold, Ready to Begin**

## Step 3

When you are ready to begin the data collection, we recommend that you first check the quality of the GPS signal you are receiving and, if you want, record the starting location.

To do this, press the #9 key and the GPS Accuracy screen will be displayed.


**Fig. 3.45 — GPS Accuracy Displayed**

The first two digits on D-1 will display the 'Fix Value' of the GPS information.

D-2 shows the number of satellites that are being used to calculate the current position. In general, the more satellites the receiver can see, the better the data will be. The number can vary from 3 to 8 or more.

Press **#9** again and the latitude of your location will be shown, with the first three digits of the coordinates shown in D-1 and the last six shown in D-2. In figure 4.41, this would be read as 40.215497 degrees North.


**Fig. 3.46 — Latitude Displayed**

Press **#9** again and the longitude of your location will be shown, again with the first three digits of the coordinates shown in D-1 and the last six shown in D-2. In figure 3.47, this would be read as 75.159008 degrees West.


**Fig. 3.47 — Longitude Displayed**

*North/South and East/West are determined by a '-' before the first three GPS digits. If the latitude is North, just the coordinates are shown. If it is South, the coordinates are preceded by '-'. Likewise, if the longitude is East, just the coordinates are shown. If it is West, the coordinates are preceded by '-'.*

Note that there are three different formats for showing the GPS coordinates, represented by a '0', '1' or '2' shown at the far left of D-1 when viewing either latitude or longitude. The formats are:

0 – Degrees, Decimal Minutes (40° 12.9474')
1 – Degrees, Minutes, Seconds (40° 12' 56.844")
2 – Decimal Degrees (40.215790°)

Setting the format is done with Menu 12, described later in this chapter.

Press **#9** again and you will be returned to the distance screen.

## Step 4

Once you have checked your GPS accuracy, and noted any initial recordings, you are ready to collect data. Release the Count Hold and begin driving. When you reach an event you want to mark, press the **Display Hold** key (DH). The display will freeze and a *calculated GPS position* (see side box) will be recorded and available for viewing using the #9 keys as described earlier.

**Calculated GPS Positions**

The GPS receiver transmits position information to the RAC every second. When you record an event with DH, it is possible it could occur between two seconds. To allow for this, the RAC uses two separate GPS positions (one before the event and one after) to determine the *calculated GPS position* that gets recorded for review, providing greater accuracy in your GPS data.

Once the GPS and distance information has been recorded, press **DH** to release display hold. You can then record subsequent events using the same procedures described above.

*Note that if you want to monitor the status of the incoming GPS information as you drive, you can do so by pressing the #7 key. This will show the GPS accuracy information and GPS coordinates as they are coming in on a second by second basis from the GPS receiver.*

# Menu 12 - Format GPS

This feature allows you to select the format for showing GPS information.

## Step 1

Press the **Menu** key, then the **#1** and **#2** key. D-2 indicates that you are in the Format GPS function.


**Fig. 3.48 — Format GPS**

## Step 2

Press **Enter**. D-2 changes to prompt you to enter the format you want to use. There are three formats that can be selected, by pressing either the #0, #1 or #2 key. The formats are:


**Fig. 3.49 — Enter GPS Format**

0 – Degrees, Decimal Minutes (40° 12.9474')
1 – Degrees, Minutes, Seconds (40° 12' 56.844")
2 – Decimal Degrees (40.215790°)

Once you have select either 0, 1 or 2, press **Enter** and the format you selected will be set in the RAC. Press **Enter** again to exit the menu function.

# Additional Features

## Interval Distance

This feature allows you to determine distance between points of interest, such as telephone poles, signs, pavement markings, etc. You can activate Interval Distance at any time as long as you are in the normal measuring mode and not using the menu functions.

### Step 1

To activate the Interval Distance feature, press the **#4** key. The INT DIST LED indicator will then light. D-1 will be used to show the actual travel distance, while D-2 will be used to show the Interval Distance.


**Fig. 3.50 — Interval Distance Activated**

### Step 2

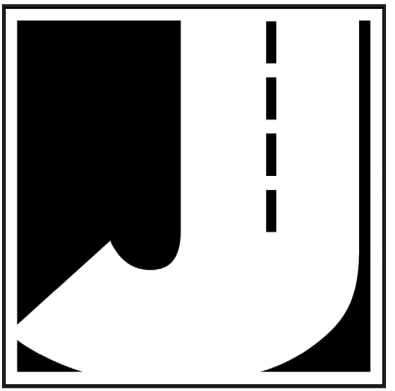
As you pass each reference point, press the **Enter** key. D-1 continues to show overall distance travelled, while D-2 will lock on the current interval distance. Each time the Enter key is pressed, D-2 will update to the most recent interval distance. There is no limit to the number of times you can use the Enter key to update the interval distance display.


**Fig. 3.51 — Interval Distance Displayed**

### Step 3

To exit the Interval Distance feature, press the **#4** key.

Note: If speed is already being displayed in D-2, Interval Distance will take precedence over speed until the Interval Distance feature is ended.



# Chapter 4

# External Sensor Mode

# GPS sensor or external sensor... which is right for you?

The RAC Geo II contains an internal GPS receiver that allows it to do distance measuring without the need of an external distance sensor like a modular or magnetic sensor. The benefit of using the internal sensor is that it means you do not have to install any wiring in the vehicle or get under the hood. You also do not have to calibrate the instrument.

The trade off for this benefit, however, is a reduction in overall accuracy. The error rate of using the internal GPS sensor is approximately 1 foot per 1000 feet, while the error rate of a properly installed modular or magnetic sensor is approximately 1 foot per mile (5280 feet).

*Note that if you choose to use an external distance sensor for your distance measuring, you can still use the internal GPS receiver for all other GPS functions, such as viewing coordinates or storing GPS data to memory.*

# Switching from GPS sensor mode to external sensor mode

The RAC Geo II can do distance measuring using either of two modes: **GPS sensor mode** or **external sensor mode**.

By default, new instruments are shipped set to GPS sensor mode, which means the Geo will use its internal GPS sensor for distance measuring. However, if you have installed and are using an external sensor (such as modular or magnetic), you can easily toggle the unit to external sensor mode.

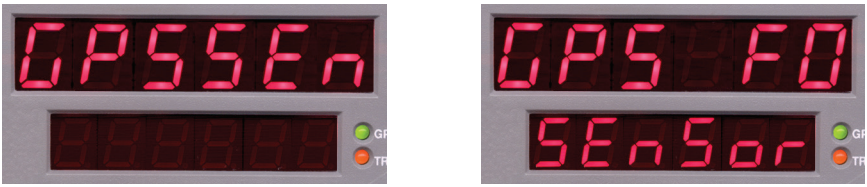



**Fig. 4.1 - Start-up screens for GPS sensor mode**

When the RAC Geo is first turned on, it will show *GPSSen* in the upper display, then begin searching for GPS satellites, as shown in figure 4.1 above. This indicates that the unit is set to GPS sensor mode.

To set the RAC Geo to external sensor mode, first turn the Geo off. Next, press down and hold down the ENT & #3 buttons. While holding down the ENT & #3 buttons, turn the Geo on. The Geo will then display its calibration number, indicating that it is in external sensor mode. After several seconds, the display will change to show 0 in the top display and Count Hold (CH) in the lower display.

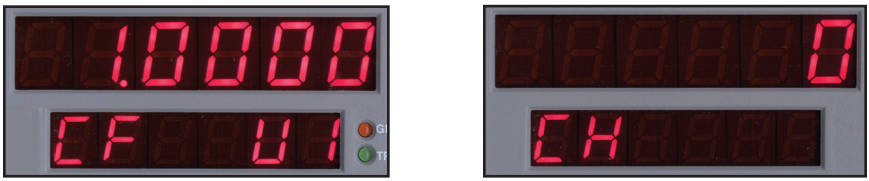



**Fig. 4.2 - Start-up screens for External sensor mode**

Repeat the same process to toggle the unit back to internal sensor mode.

# Installation

*Note: This section only applies to users who are using an external distance sensor (such as modular or magnetic) for distance measuring rather than the RAC Geo's internal GPS sensor.*

# Before You Begin

The JAMAR RAC Geo II distance measuring instruments are very reliable and highly accurate when used with an external distance sensor. However, when using an external sensor there are some known issues that could affect proper operation and the ability to accurately measure distance traveled. By observing a few simple precautions you will be able to eliminate potential problems.

• **Do not** install wires near any object that could cause stray pulses to be picked up, such as the alternator, spark plugs or engine coil.

• **Do not** install the wires or sensor near any objects that will get hot, such as the manifold. The installation wires or sensor can melt if they are too close to a heat source.

• **Do not** install wires near any objects that could vibrate and cut the wires.

• Tire pressure should be the maximum suggested by the tire manufacturer, typically 32-35 PSI cold. The tire should have ample tread depth. Steel belted radial tires are highly recommended.

• Drive the vehicle 3 to 5 miles (depending on climate) to warm the tires up to normal operating temperatures prior to calibrating your RAC. Refer to the calibration section later in this chapter for more detailed instructions.

# Installing External Distance Sensor

If you are planning to use an external distance sensor for distance measuring, rather than the RAC Geo's internal GPS sensor, install the external sensor using the instructions that came with the external sensor.

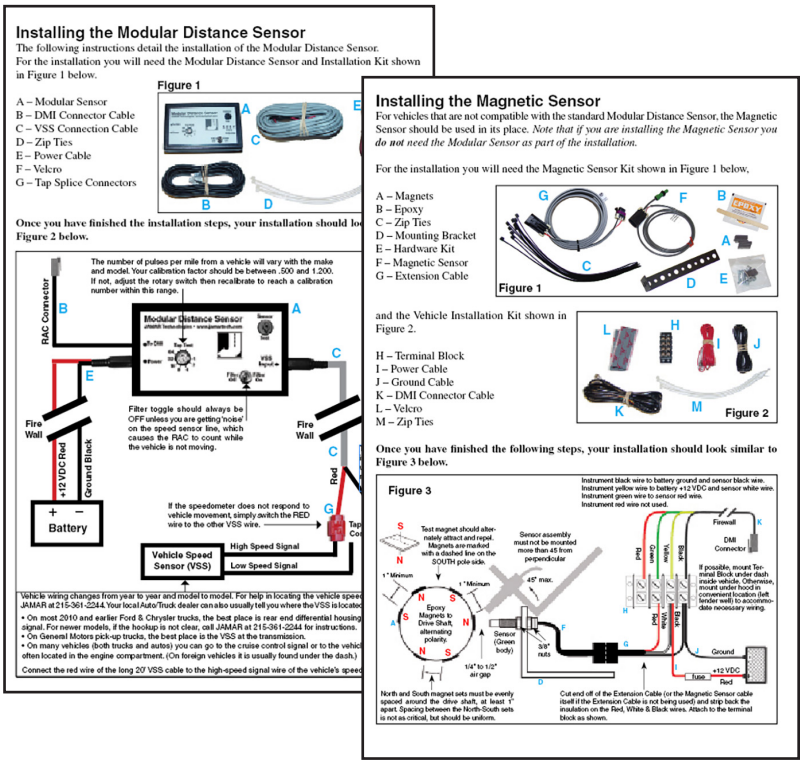



**Fig. 4.3 - External Sensor Instructions**

# Installing the RAC Instrument & Antenna

Refer to pages 2-2 and 2-4 for instructions on how to install the RAC instrument and its antenna.

# Automatic Calibration Procedure

*Note that calibration is only required if you are using an external sensor, such as a modular or magnetic sensor. If you are using the built-in GPS receiver to do distance measuring you* **DO NOT** *need to calibrate the Geo.*

In order to accurately measure distance, your RAC must know the exact distance that the vehicle will travel based on pulses from the vehicle's speed sensor. The calibration number is the automatic calculation that represents the number of pulses received over a set distance. This number, once calculated, will remain accurate until a change to the vehicle occurs, such as different size tires are put on the vehicle, tire wear, tire pressure change, etc. Such changes will require a re-calibration in order to maintain proper accuracy.

**Calibration is only needed if you are using an external distance sensor**

The RAC Geo has the ability to store four (4) separate vehicle calibration numbers in memory. This simplifies sharing one instrument between up to four different vehicles.

In order to calculate the calibration number for your particular vehicle, you must first establish a **calibration course**. The length of the course can be any known distance more than 500 feet. One thousand feet is ideal, but the course can be any distance over 500 feet (for example, 623 feet from pole to tree). Your course should be **straight** and **accurate**, so take the time to measure the course using a 100' tape or hand wheel. Mark the beginning and ending points so they can be seen from inside your vehicle. Remember, the course length can be any **accurate** distance over 500 feet, so for convenience you could use a telephone pole or other marker as reference point.

**Note: If you are using the Metric unit of measuring, laying out the calibration course in feet is required to obtain the most accurate calibration number.**

## Step 1

Slide the ON/OFF switch to ON. Your RAC will perform a brief Self Test. The current calibration number will be shown in the larger, upper display (D-1) and CF U(vehicle 1, 2, 3 or 4) in

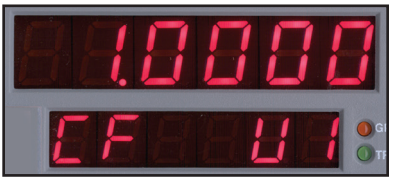



**Fig. 4.4**
**Calibration Display on Start-up**

the smaller, lower display (D-2). This is displayed for 3-4 seconds while a tone sounds, then **0** is shown in D-1 (0.000 if the mile or meter unit of measurements is selected) while **CH** is shown in D-2.

## Step 2

Press the **Menu** key, the **# 1** key and **Enter**. At this point, the unit of measurement will automatically change to feet. You can then select the vehicle number that this calibration will be for by using the 1 through 4 numeric keys.


**Fig. 4.5**
**Vehicle Number Selection**

## Step 3

Once the vehicle number has been selected, press **Enter**. Key in the course length (in feet) to be used for the calibration using the number keys, then press **Enter** again.


**Fig. 4.6 - Enter Course Length**

## Step 4

Using a reference point on your vehicle (i.e. the window post, door handle, your shoulder, etc.), align your vehicle to the beginning course marker.

## Step 5

Press the **CH** key and drive away. As you drive, the pulses received from the vehicle are being shown in D-1. This is not the distance being traveled, so don't panic when the display doesn't equal the actual length of your calibration course. When you reach the end of the course, stop your vehicle so you are exactly aligned (using the same reference point in the vehicle) with the end course marker.

**If your RAC does not count during the calibration procedure, refer to the trouble-shooting section on the next page.**

## Step 6

Press the **CH** key. The calibration factor will then be shown in D-1. You should record the calibration number, vehicle number and date in the Appendix of this manual on page A-6. It


**Fig. 4.7**
**Calibration Number Displayed**

is also recommended that you put this same information on a piece of tape attached to the inside of the vehicle's glove box.

## Step 7

Press **Enter** and the unit of measurement will return to your desired unit of feet, mile or meter. Press **Enter** again to exit the menu function and return to normal operation. Your calibration number for the vehicle selected is now stored in the RAC's nonvolatile (permanent) memory. The calibration number will stay in memory for more than 50 years, or until you re-calibrate or manually change the data. You are able to view the calibration number and unit (vehicle) number every time you power up the RAC.

You should rerun the calibration course, in the normal mode, to verify the calibration for your vehicle. Press the CH key prior to measuring. If this is the first time you have calibrated a DMI, you may want to run the course a couple of times to practice being properly aligned when starting and stopping at the course markers.

**Important: Ideally, the calibration number used should be between .5000 and 1.2000.** If your calibration number is below this range, you need to use a higher division factor such as 16 on the Modular Distance Sensor (MDS). Of course, if your calibration number is too high, you can lower the number by using a lower number such as 1 on your MDS. This is done by adjusting the rotary switch on the MDS so it points to 1, 2, 8, 16, 32 or 64.

**Your calibration number should be between .5000 and 1.2000. If not, you need to adjust the rotary switch on your MDS.**

**Any time** you adjust the rotary switch setting, **you must re-calibrate** to get the correct calibration number. Changing the switch setting **will not** change the calibration number, only the number of pulses being received by the RAC. Several calibration runs may be necessary to determine which division factor is best for your vehicle.

# If Your RAC Fails to Calibrate

If your RAC fails to count during calibration, perform the following operational checks:

## Step 1

Locate the Sensor Test button on the front upper right of the MDS, shown in Figure 4.8. When pressed, this will generate an internal low-level signal that is fed directly into the VSS Input circuit. First, unplug the VSS Input connector from the right side of the MDS. Second, turn on the RAC and press the CH key just like you would prior to starting a measurement. Next, using a small pointed object (pen, pencil, screwdriver, etc.) or your finger press the Sensor Test button for a few seconds. The RAC should count when the button is pushed. What number it counted doesn't matter as long as it did count.


**Fig. 4.8 – Sensor Test**

If the RAC did count, everything from the MDS up to the RAC is okay and the problem is most likely either a poor connection at the vehicle's speed sensor or the connection is not at the correct location to get the vehicle speed signal. The speed sensor output is generally at the transmission or the rear differential. If you are unsure about being attached to the correct output, disconnect the plug and move the vehicle. If the speedometer does not function, you have chosen the correct plug wires.

If you are at the correct location, make sure you have a good electrical connection at the tap in point. Once you are sure you tapped into the correct location, it is always better to wire solder the connection.

After checking the connection, plug the VSS Input connector back into the MDS and try the RAC again. If the RAC counts, you can proceed with calibration. If the RAC still does not count, go to Step 2.

## Step 2

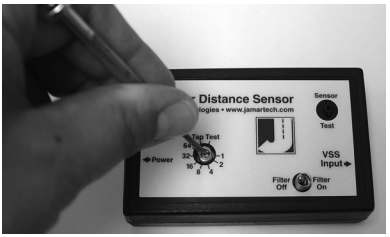



**Fig. 4.9 - Tap Test**

The Tap Test will determine if the distance pulses being sent from the MDS are getting to, and being processed by, the RAC. The Tap Test is performed using the rotary switch shown in figure 4.11. First make sure you note the current position of the rotary switch (1, 2, 4, 8,16, 32 or 64), as you will have to return the slot back to this same position after the test is completed.

Next, turn on the RAC. Press the CH key just like you were beginning to measure. Using a small screwdriver, rotate the switch between the Tap and Test positions four or five times. (Note that when the switch is turned clockwise until it stops, it is at the Test position.) The RAC should register. The count shown does not matter, just as long as the RAC did register a count. If it did count, the cable from the MDS to the RAC and the instrument itself are OK. If the RAC did not count, the problem is most likely a bad cable to the RAC or the RAC itself is bad. If available, try another RAC and repeat the Tap Test. If the second RAC doesn't count, the problem has to be the cable between the MDS and the RAC.

Once the test is complete, return the Rotary Switch to the previous position.

If the previous steps do not correct the problem, contact us using the information on page iv.

# Manual Calibration Procedure

It is very common to share one RAC on a plug-in basis between a number of different vehicles that have been equipped to accept the instrument. Installing additional vehicle kits on other vehicles is an inexpensive and cost effective means to greatly expand your measuring capabilities. Obviously, each vehicle so equipped would have to be calibrated and the number recorded.

The RAC Geo has the unique ability to store in memory four (4) different vehicle numbers and their associated calibration numbers. If you are moving the RAC from vehicle to vehicle you will need to enter the correct vehicle (unit) number prior to measuring with that vehicle. The following procedure assumes the calibration number for a particular vehicle has already been determined and is stored in memory.

## Step 1

Slide the ON/OFF switch to ON. The RAC Geo will complete a brief Self Test during which a tone will sound and the active calibration number will be displayed in D-1 while the vehicle number is displayed in D-2. After the self test, **0** is shown in D-1 (0.000 if the mile or meter unit of measurements is selected) while **CH** is shown in D-2.

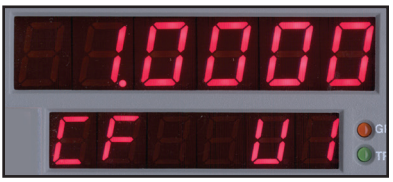



**Fig. 4.10**
**Calibration Display on Start-up**

## Step 2

Press the **Menu** key, the **#2** key and **Enter**. You can then select the vehicle number for the calibration that you wish to change by using the 1 through 4 numeric keys. If all you want to do is change the **active vehicle number**, press **Enter** and go to Step 5. If you want to change the calibration factor, proceed to Step 3.


**Fig. 4.11**
**Vehicle Number Selection**

## Step 3

Press the **Enter** key and the current calibration number for the vehicle selected will be displayed. Press the Clear key (CLR) to clear the current number.


**Fig. 4.12**
**Calibration Number Cleared**

## Step 4

Using the numeric keys, key in the desired calibration number for the vehicle selected.

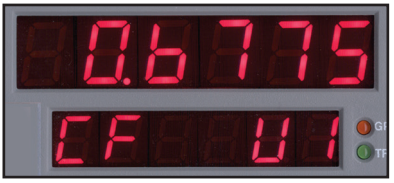



**Fig. 4.13**
**New Calibration Number Entered**

## Step 5

Press **Enter** to return to the initial menu screen, then press **Enter** again to exit the menu function. The new vehicle number and/or calibration number is stored in memory and the RAC is back to normal measuring mode.

**Once your RAC is properly installed and calibrated, you are ready to begin accurately measuring distance.**

# Chapter 5

# Troubleshooting

# Frequently Asked Questions

**Q. When I turn on my RAC Geo II it does not search for satellites. What's wrong?**

**A.** If your Geo does not search for satellites when you turn it on it has probably been switched into external sensor mode. In this mode, the unit does not use GPS for measuring and, as such, will go right to Count Hold (CH) when turned on.

To toggle back to GPS mode, first turn the unit off. Next, turn the unit back on **while holding the ENT & #3 keys**. This will set the unit back to GPS mode.

This procedure can be used to toggle back and forth between GPS mode and external sensor mode.

**Q. I'm using an external sensor and my RAC will not count. What's wrong?**
**A.** In most cases, when a RAC Geo won't count with an external sensor, it is not the unit itself that has the problem. It is usually a problem with the interface sensor or wiring. Check the following:

**1. Ensure the RAC has a calibration number in memory.** The RAC will not count if there is not a number in memory. As you switch on the RAC, the calibration number will be displayed for about three seconds. The factory uses .900 as the test number. If no number is listed, refer to the Manual Calibration Procedure in chapter 4 for information on how to enter a number.

**2. Ensure that you are attached to the speed sensor output.** It is generally at the transmission or the rear differential. If you are unsure about being attached to the correct output, disconnect the plug and move the vehicle. If the speedometer does not function, you have chosen the correct plug wires.

**3. Perform a Sensor Test**. Locate the Sensor Test button on the front upper right of the Modular Distance Sensor. When pressed, this will generate an internal low-level signal that is fed directly into the VSS

Input circuit. First, unplug the VSS Input connector from the right side of the MDS. Second, turn on the RAC and press the CH key just like you would prior to starting a measurement. Next, using a small pointed object (pen, pencil, screwdriver, etc.) or your finger press the Sensor Test button for a few seconds. The RAC should count when the button is pushed. What number it counted doesn't matter as long as it did count.

If the RAC did count, everything from the MDS up to the RAC is okay and the problem is most likely a poor connection at the vehicle's speed sensor. Make sure you have a good electrical connection at the tap in point. Once you are sure you tapped into the correct location, it is always better to wire solder the connection.

After checking the connection, plug the VSS Input connector back into the MDS and try the RAC again.

**4. Perform a Tap Test.** The Tap Test will determine if the distance pulses being sent from the MDS are getting to, and being processed by, the RAC. The Tap Test is performed using the rotary switch on the MDS. First make sure you note the current position of the rotary switch (1, 2, 4, 8,16, 32 or 64), as you will have to return it back to this same position after the test is completed.

Next, turn on the RAC. Press the CH key just like you were beginning to measure. Rotate the switch between the Tap and Test positions four or five times. (Note that when the switch is turned clockwise until it stops, it is at the Test position.) The RAC should register. The count shown does not matter, just as long as the RAC did register a count. If it did count, the cable from the MDS to the RAC and the instrument itself are OK. If the RAC did not count, the problem is most likely a bad cable to the RAC or the RAC itself is bad. If available, try another RAC and repeat the Tap Test. If the second RAC doesn't count, the problem has to be the cable between the MDS and the RAC.

Once the test is complete, return the Rotary Switch to the previous position.

5. If after checking these items the RAC still does not count, contact us using the information on page iii.

**Q. My RAC counts while the vehicle is not moving. What's wrong?**
**A.** There are three possible causes for this.

**1. Your wiring may be picking up stray pulses from the vehicle.** This can occur if the wiring is too close to the alternator, spark plugs, distributor cap or engine coil. To eliminate this noise, turn the filter toggle on the modular distance sensor to ON.

**2. Your ground wire may not be connected properly.** Double check its connections.

**3. Your Modular Distance Sensor may not be working correctly.** Contact JAMAR using the information on page iii for information on getting replacement parts.

**Q. My RAC will not turn on. What's wrong?**
**A.** There are several possible causes for this.

**1.You may have a loose or bad connection.** Double check all connections at the distance sensor and RAC to make sure they are tight and at the correct locations. If you are using the 12V auto adapter, make sure it is plugged in tight. The adapter has a small green LED on it that will be lit if it is getting power. If the LED is not lit, try unplugging the adapter and plugging it back into your vehicle.

**2. There may be a problem with the telephone jack on the power/ signal cable.** Check to make sure the contacts are not bent.

**Q. When using an external sensor, my RAC counts in increments of 2, 5, 10, etc. What's wrong?**
**A. Your calibration number is too high.** The calibration number should be between .500 and 1.200. You can lower the calibration number by adjusting the rotary switch on your modular distance sensor. Refer to Chapter 4 for more detailed information.

# Appendix

# Connection and Output Formats

## Power Connector

**Pin 1 (Yellow)** +12 VDC
**Pin 2 (Green)** Sensor Input
**Pin 3 (Red)** DPO
**Pin 4 (Black)** Signal Ground


## Memory/Serial (RS-232) Output

Since the RAC Geo II has a large internal memory, it is usually not practical to try to view the data on the display on an event by event basis. It is necessary to download this data to a computer for processing.

The output format of the RAC Geo II is a binary format, which means it cannot be read with standard text capturing software (as could be done with earlier RAC models).

The JAMAR **RACPro** software is designed to retrieve the data from the RAC Geo II and generate a report showing the data collected in the field. You can also save the data in a variety of standard formats (Excel spreadsheet, Access database, comma-delimited text file) so that you can work with the data using your own software.

The software is Windows based and is compatible with Windows versions 7, 8 & 10. You need a custom cable (available from JAMAR) to interface the RAC Geo II to your computer.

The RACPro software has the following features:

- Reads directly from the RAC Geo II
- Converts event codes to plain language text (You can edit and store different schemes that translate an event code to a text phrase.)
- Capable of merging multiple surveys together
- Insert/delete events from existing surveys
- Export data in a variety of formats

**Refer to the RACPro manual for specific information on how to retrieve and process data from the RAC Geo II.**

# RAC Geo II Specifications

**Power**: 9 to 16 VDC, negative ground. **Data Output**: Serial RS-232
**Display**: Dual 6 digit window, high intensity LED. Separate LED indicators for unit or measurement and interval distance. Four brightness levels.
**Accuracy**: +/- 1 foot per 1000 feet with GPS distance sensor, +/- 1 foot per mile with modular or magnetic sensor.
**Resolution**: 1 foot.
**Keyboard**: 20 sealed keys, 5 million operation with click & tone feedback. ON/OFF slide switch.
**Speed Display:** Three digit 0-999 (mph & kph) displayed with distance.
**Time**: Elapsed/Real Time (hh,mm,ss). **Count**: Bi-Directional (Up/Down).
**Calibration**: Automatic & manual with four vehicle calibration and vehicle number ability.Non-Volatile EEPROM Memory.
**Calibration resolution:** Four decimal places
**Test**: System check on power up w/display of calibration & vehicle number.
**Automatic Distance Conversion**: Miles (thousandths) to Total Feet to Meters (kilometers).
**Count Hold**: Stops accumulation of distance.
**Display Hold**: Freezes display without loss of distance.
**Pre-distance**: Capability of starting at known distance or Add/Subtract desired distance value from current distance display.
**Interval Distance**: Display of distance between selected events & total distance.
**Distance Pulse Output**:0-5 VDC, low going hi, selectable interval & duration.
**Sensor Error Detection**: Checks for error due to vehicle's dynamic motion.
**Memory Retention**: Non-Volatile EEPROM for calibration & vehicle numbers — 50+ years retention.
**Memory**: In Memory Store mode (menu 6), up to 400,000 event locations. In Store GPS mode (menu 9), up to 50,000 event location. In Track GPS mode (menu 10), up to 100,000 event locations or 30 hours of data.
0-9999 Event code identifiers, Distance, Time & Speed.
**Memory Retention:** Non-volatile EEPROM, calibration & vehicle numbers.
**Circuitry**: Solid state, surface mount, modular, EEPROM, micro-computer.
**Case**: ABS non-warping plastic.
**Dimensions**: 7.8"W x 2.3"H x 1.2" D **Weight**: 6.5 oz.
**Operating Temperature**: 0°C to 75°C **Warranty**: 5-year instrument warranty.
**Example:** JAMAR Technologies RAC Geo II

# Glossary

***Refer to the page number listed after each entry for more information.***

***Add*** — black button used to count up or add value to the screen on the RAC. Page 3-6.

***Dim*** — blue button on the RAC, it is used to change the brightness of the display. Page 3-6.

***calibration course*** — known distance used when calibrating the RAC. One thousand feet is ideal, but it should not be less than 500 feet. Page 4-6.

***calibration number*** — a number, unique to each vehicle, that represents the pulses from the transmission received over a set distance. This number should be as near to 0.500 - 1.200 as possible, and is necessary for the RAC to count when using an external sensor. Page 4-6.

***CLR (Clear)*** — red button on the RAC that resets the distance or time to zero. Page 3-6.

***CH (Count Hold)*** — red button on the RAC which stops the computation of distance pulses. Page 3-4.

***DH (Display Hold)*** — red button on the RAC which stops the display, but allows the RAC to continue accumulating distance internally. Page 3-4.

***DMI*** — generic industry term meaning Distance Measuring Instrument. The RAC Geo II is a DMI.

***DPO (Distance Pulse Output)*** — menu function on the RAC, when activated it will provide a +5VDC (TTL level) output pulse at a pre-selected distance interval and signal duration. Page 3-9.

***ENT (Enter)*** — green button on the RAC, it accepts any number keyed into the display. Page 3-6.

***Erase*** — menu function of the RAC, it is used to clear all memory locations in the RAC. Page 3-16.

***LED*** — stands for light emitting diode, the display used with the JAMAR RAC Geo. Page A-3.

***MENU*** — yellow button on the RAC which is used to access many of its operation functions. Page 3-5.

***Modular Distance Sensor (MDS)*** – a device which, when installed, conditions pulses from a vehicle's speed sensor to the RAC. Page 4-4.

***nonvolatile memory*** — the permanent memory of the RAC, it is where the data and calibration number are stored. It will remain here for fifty years or more unless changed. Page A-4.

***pulses*** — signals generated by a vehicle which, when conditioned through an external sensor, are read by the RAC to calculate distance traveled. Page 4-6.

***pulse rate*** — the frequency at which pulses are sent to the RAC from an external sensor. They can vary from 4,000 to more than 100,000 per mile. Page 4-8.

***P-Dis (Pre-Distance)*** — menu function of the RAC, it allows you to enter a known distance into the RAC. Page 3-7.

***RAC*** — Road Analysis Computer. Brand name for JAMAR's distance measuring instruments.

***RACPro*** — software available from JAMAR for use with the RAC Geo. The program can analyze data downloaded from the RAC Geo. Page A-2.

***SP (Speed)*** — black button on the RAC, it allows you to show your speed. Page 3-4.

***Store*** — menu function of the RAC Geo, it is used for the memory store procedure. Page 3-12.

***Sub*** — black button used to count down or subtract value from screen on the DMI. Page 3-6.

***Unit*** — gray button on the RAC, it selects the desired unit of measurement, from miles to feet to meters. Page 3-4.

# Vehicle Calibration Record

**Date:** _____ **Date:** _____

**Veh. No:** _____ **Veh. No:** _____

**Cal. Factor:** _____ **Cal. Factor:** _____

**Veh. Odometer:** _____ **Veh. Odometer:** _____

**User Initials:** _____ **User Initials:** _____

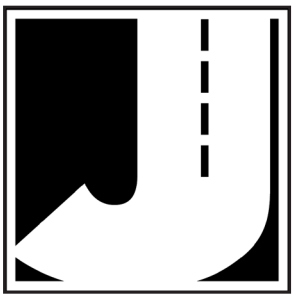
**Date:** _____ **Date:** _____

**Veh. No:** _____ **Veh. No:** _____

**Cal. Factor:** _____ **Cal. Factor:** _____

**Veh. Odometer:** _____ **Veh. Odometer:** _____

**User Initials:** _____ **User Initials:** _____



*We are pleased that you have chosen the RAC Geo II for your distance measuring needs. We have strived to develop a unit that is easy to use and has the options that our customers require. The RAC Geo II has undergone extensive testing to verify the accuracy of its operations, and each unit is tested before it leaves our facility. However, just like other complex electronic devices, problems can occur. We always suggest that users verify the continuing accuracy of any device they use. Should you detect any problems with any of our products, please notify JAMAR Technologies immediately and discontinue use of the unit until we have verified its operation.*