Geogram ONE

Application Overview 3.0

1. Introduction

The Geogram ONE is an open source tracking device based off the Arduino platform. The main board comes preinstalled with an application that gives the user the ability to implement a fully functional SMS/UDP based tracking device. Some of the features included with application are:

- Locations in Google maps format via SMS
- Real Time tracking with GPS-Trace Orange
- Geofencing
- Speed monitoring
- Motion detection
- and more

2. Initial Hardware Setup

a. With the main battery disconnected, install an unlocked 2G SIM card into the SIM card holder on the underside of the main board.
b. Connect an appropriate cellular GSM antenna to the main board's U.fl connector.
c. Confirm the (2) two jumpers are installed on the pin headers labeled Rx and Tx next to the GPS IC.
d. (Optional) Install a 12mm coin cell backup battery for the GPS memory on the underside of the board. Please note the correct polarity of the battery before installing the battery. While this step is optional, using a backup battery for the GPS will ensure a faster time to fix if the main battery is ever disconnected.
e. Install a single cell lithium polymer battery to the main board via the 2 pin JST connector.
f. If possible, move the unit outdoors so the GPS engine can get a satellite fix to download the necessary almanac data to compute a position fix. If

it's not possible to move the unit outdoors, try to place it as close as possible to the nearest window. It can take up to 15 minutes for the GPS to get an initial satellite fix and download the necessary data. While the GPS is acquiring the signal, the LED located next to the GPS will blink. Once the GPS has a signal, the LED will shut off. The last known set of valid coordinates will always be stored in memory (unless the main battery is removed) and will be updated every second.

g. Wait for the GSM to register to the cellular network. As soon as power is applied to the Geogram ONE, the onboard GSM will attempt to register the SIM card with the appropriate cellular network carrier. While attempting to register to the network, the NETLIGHT LED will flash at a fast rate (64ms On/ 800ms Off). Once the GSM connects to the appropriate network, the LED will change to a slower blink rate (64ms On/ 3000ms Off). If the unit fails to register to the network after a minute or so, try removing the main battery and reseating the SIM card.

3. Initial Test

Once the Geogram ONE has successfully registered to the GSM network and a satellite fix has been acquired, the device is now ready to accept commands. Each command is broken down into three separate parts: a 4 digit security PIN code, command option and one or more command parameters. Most command and/or command options will end with a period (with a few exceptions that will be discussed later).

The first step is to check the functionality of the Geogram ONE by sending an SMS command to the device requesting the device's location. Each command that is sent to the Geogram ONE needs to be preceded by a 4 digit security PIN code. The default PIN code is 0000. Command option 0 (zero) tells the Geogram ONE to send a Google Maps link, containing the longitude and latitude of the device's location, back to the requester.

Open your SMS application and send the below command to the Geogram ONE:

0000.0.

Depending on your service provider, it will usually take between 15 and 30 seconds to receive a response. You should receive a response back from the Geogram ONE containing a Google Maps link with the longitude and latitude of the device. Simply click the link and it will open up Google Maps and show the device's location.

4. Detailed Description of Command Options

Each command consists of multiple parts. The first part is the 4 digit passcode, 0000 by default. Following the passcode is a period, which separates the command option. Each command option and associated parameters will also be separated by periods. Each command will end with either a period or an asterisk as a terminating character. Please see section 7. EEPROM Table for a list of correct terminating characters.

1. **Command Option 0** – Track using SMS.
   EEPROM SETTINGS USED:
   5, 21, 22, 23, 233, 281

   Send back the coordinates of the Geogram ONE formatted as a Google Maps link. The Geogram ONE will always report back the last known valid position of the device. This is a useful feature when the device moves into a location that blocks reception of the GPS satellites.

   There are no parameters associated with Option 0.

   Example: **0000.0.**

   Sample Response Back:

   11/14/15,20:55:37,1,359,GO FW_3_0b,76%,9,10,BAT
   http://maps.google.com/maps?q=42+20.2678,-71+39.4623

   As you can see the default response back from the Geogram ONE consists of two lines of data.

   The first line contains the following information in order:
   1. Date,
   2. Time,
   3. Speed,
   4. Course,
   5. GO ID (default value is current Firmware installed),
   6. Battery percentage,
   7. RSSI,
   8. Number of satellites used,
   9. Charge status – running on battery only (BAT) or charger plugged in (CHG).

   The second line gives us the Google Maps link containing the longitude and latitude of the device.

2. **Command Option 1** – Motion detection alert.
   EEPROM SETTINGS USED:
   5, 121

   Sending a command using Option 1 to the Geogram ONE places the device into sleep mode and activates the internal motion sensor. If the device detects movement (default movement sensitivity level is set to highly sensitive), the unit wakes up and sends a user customizable message to the default address stored in the EEPROM. It's important to note that while the Geogram ONE is in sleep mode, it is incapable of sending and receiving SMS messages. Since the GPS engine is also in sleep mode, it too is incapable of maintaining a satellite fix. Once the GPS wakes from sleep mode, it will attempt to lock on to the satellites. Depending on the amount of time the device is in sleep mode and device placement, the current latitude and longitude may not be immediately available.

   There are no parameters associated with Option 1.
   Example: **0000.1.**

   Sample Response Back:
   Motion Detected

3. **Command Option 2** – Set EEPROM values.

   Sending a command using Option 2 to the Geogram ONE gives the user the ability to make changes to the settings that are stored in nonvolatile (does not change with power removed) EEPROM. This is a very powerful feature that gives the user the ability to customize the operation of the Geogram ONE. The EEPROM contains all the settings that control how and when different features of the tracking device are implemented. The first parameter will reference the EEPROM memory address. The second parameter will be the new value stored in the EEPROM address. Some examples include Geofence size, speed tracking, message customization, PIN code, etc. The different options will be explained later in each of the corresponding features section. It's important to note that while most commands sent to the Geogram ONE need to end in a period, some of the commands using option 2 will not end in a period. These particular EEPROM memory locations will be pointed out later. It's also important to note that there are no responses sent back with option 2. Here are just a few examples of option 2:

   Set PIN from 0000 to 1234 (EEPROM address 0)
   0000.2.0.1234.
   Set time zone to EST (-4) (EEPROM address 22)
   0000.2.22.-4.
   Set default SMS address in EEPROM (EEPROM address 5, ends with asterisk)
   0000.2.5.5085551212*

4. **Command Option 3** – Read EEPROM values.

   Sending a command using Option 3 to the Geogram ONE gives the user the ability to read the current contents of the EEPROM for a specified memory location. If an invalid address is used the device will respond accordingly.

   Get current time zone (EEPROM address 22)
   0000.3.22.
   Sample Response Back
   -4
   Get default stored SMS address (EEPROM address 5)
   0000.3.5.
   Sample Response Back
   5085551212
   Get speed limit setting (EEPROM address 44)
   0000.3.44.
   Sample Response Back
   75
   Get an invalid address
   0000.3.2.
   Sample Response Back
   Invalid EEPROM Address

5. **Command Option 255** – Reboot Geogram ONE.

   Sending a command using Option 255 to the Geogram ONE will force the device to do a power reset. This option is strictly used for troubleshooting purposes and is not necessarily used during normal operation.

5. Standard Features

The Geogram ONE contains several different features above and beyond a basic SMS based tracking device. Some of the features include motion alert detection, speed limit monitoring, geofencing, advanced sleep functions to extend battery life, low battery alerts, real time tracking using UDP several more. Each feature along with its corresponding EEPROM settings will be discussed below.

Some of the features available will require the user to enter parameters of length (feet or meters) and speed (mph or kph) so it's important to update the regional settings in EEPROM for your corresponding preferences. Other features require a default SMS number stored in EEPROM for notification purposes. Please see the Geogram ONE EEPROM Map for a detailed description of possible settings.

1. **Low Battery Alert**
   EEPROM SETTINGS USED: 5, 24, 137

   The GO has the ability to monitor the battery level and alert the user when it falls below a user definable level. Any level from 32 to 99% can be programmed in the EEPROM. The low battery message will be sent to the default SMS address stored in memory.

2. **Speed Limit Monitoring**
   EEPROM SETTINGS USED: 5, 23, 44, 46, 201, 217, 281

   A maximum speed limit can be programmed into the GO. If the device exceeds the speed limit, a message will be sent to the default SMS address stored in memory. The message will indicate the speed limit was exceeded and will contain a Google maps link with the coordinates. While travelling above the speed limit, the GO will continue to monitor the current speed and when the device falls back below the speed limit a second SMS message will be sent. The second SMS will contain a Google maps link along with a second message detailing the maximum speed attained while above the limit. The unit will continue to monitor the speed limit, no other intervention is required to reactive. Setting the speed limit parameter to 0 in the EEPROM will disable this feature.

3. **Geofence**
   EEPROM SETTINGS USED: 5, 23, 47, 51, 55, 59, 63, 67, 71, 75, 79, 83, 84, 153, 169, 185

   A Geofence is a radius defined circular area around a given point that can be used to alert the user if the Geogram ONE leaves (inside fence) or enters (outside fence) the circular region. The user has the ability to configure up to three (3) different Geofences. The three parameters associated with each Geofence are the radius (feet or meters as defined by regional settings), longitude and latitude. Each parameter is stored separately in memory. Please refer to the Geogram ONE EEPROM Map for a detailed description about how to store longitude and latitude in memory.

The easiest implementation of the Geofence is to set the fence radius around your current position. Changing the Geofence radius setting in EEPROM will activate a fence. Using a positive value will enable an inside fence while using a negative value will enable an outside fence. To automatically configure a Geofence around your current position simply append an asterisk (*) to the radius. See the example below:

Configure an inside Geofence around your current position with 1000 ft radius. This will automatically save the current longitude and latitude into memory and activate the fence.

0000.2.47.*1000.

You can have up to three different Geofences running at one time. When the device leaves an inside fence area (or enters an outside fence area) a message will be sent to the default SMS address stored in memory. Once the device gets back inside the Geofence area, the status will reset and will continue to monitor for the next breach. Setting the corresponding radius to a 0 will disable the Geofence.

It's important to note that due to the inherent inaccuracies of GPS, Geofences work best on larger areas (50 feet and above). As a way to combat some of the inaccuracies the GO has implemented two additional customizable parameters in EEPROM, Breach Speed and Breach Repetitions.

Breach speed gives the user the option to only monitor a Geofence if the reported speed (mph or kph) is greater than what is saved in EEPROM.

Breach repetitions defines how many consecutive repetitions the device will have to be in fence breach prior to an alert. Since GPS data is updated every second, each repetition corresponds to one second. As an example, if breach repetition was set to 10, the device would have to be outside the fence area for 10 consecutive seconds before an alert would be sent.

4. **SMS Send Interval**

EEPROM SETTINGS USED: 5, 22, 23, 110, 114, 281

You can program the GO to send tracking updates on regular intervals to the default SMS number stored in EEPROM. There are two settings in EEPROM that control the send interval, battery and plugged in/charging. Since sending SMS messages consumes battery power, you have the ability to set a separate interval for when the GO is plugged in and charging and a separate interval for when the GO is running off battery power.

5. **Real Time Tracking using UDP**
   EEPROM SETTINGS USED: 22, 99, 103, 317, 333, 369, 405, 407

   Along with SMS tracking, the Geogram ONE has the ability to send data to a server online using the UDP protocol. The Geogram ONE comes preconfigured to upload data to a free online service called GPS Trace Orange.

   To sign up for a free online account visit http://gps-trace.com/ and create an account. During the configuration you will be prompted to select the type of GPS device. Choose Wialon IPS from the list. You will then be required to provide a Unique ID to identify the tracking device on the network. This is where you will enter the IMEI number. The IMEI is the 15 digit number printed on the SIM900 cell phone chip on the front side of the Geogram ONE. You will also need to fill in the Unit Name field. The Unit Name will be displayed on the map showing the location of the device. The rest of the fields may be left blank. Due to differences in the Geogram ONE firmware the time may not be displayed correctly. To correct for this, you will need to set the time zone in the regional settings on the GO to 0.

   As with the SMS Send Interval feature, you have the ability to control what interval UDP updates are sent to the server. There are separate interval settings for both battery and plugged in/charging. Depending on your service provider the Geogram ONE has been shown to be stable all the way down to 2 second updates.

   Note: Unlike SMS, real time tracking with UDP consumes data on the SIM card which is typically separate from that of text messages. Each transmitted packet size is typically 50 bytes of data, however some service providers will round data usage. Please contact your service provider for details.

6. Advanced Features

1. **Sleep Timer**.
   EEPROM SETTINGS USED: 35, 36, 40

   When the Geogram ONE is running at full power it draws a significant amount of current which limits the time the device can operate on a single charge of the main battery. The Geogram ONE has the ability to power down/sleep specific subsystems on the main board which, in turn, can reduce the power consumption of the device and further extend the battery life. The three main onboard subsystems are:
   - GPS Engine which is responsible for download coordinate information from the satellites in orbit.
   - GSM (cellular IC) which is responsible for all communications over the cellular network.
   - Microcontroller which is the onboard processor

There are two EEPROM settings that control the timer with regards to sleep functions: Sleep Time On and Sleep Time Off. Sleep Time On, in seconds, defines how long the device will stay awake functioning normally. Sleep Time Off, in seconds, defines how long the device will power down in sleep mode. Example, setting sleep time on to 3600 and sleep time off to 3600 will force the device to sleep for one hour and be awake for the next hour. This sequence would then continue to repeat itself. If running purely off the battery, these setting in essence would double the battery life. Setting either one of these parameters to a zero will disable the sleep function completely.

The next setting that affects the sleep timer is the Sleep Configuration setting. This EEPROM setting determines which of the subsystems will be put to sleep when the device enters sleep mode. The two primary subsystems that can be configured to sleep are the GPS and GSM. The microcontroller subsystem will always enter sleep mode regardless of the configuration settings. It also controls the sleep function overrides which will be discussed further below.

In addition to being able to put different subsystems to sleep, the Geogram ONE also has the ability to override these sleep functions using two different overrides.

The first override is motion. Since the GO has an onboard accelerometer (can detect small movements), it can be programmed to wake the device up if any motion is detected. This can be useful if a power source is not readily available to recharge the main battery.

The second override is the charging source. As mentioned above, the GO uses a significant amount of power during normal operation. When the device is solely running off the battery it is important to minimize power draw. When the device is connected to a power source capable of recharging the main battery, power consumption is not as important. The reason being is the recharge source can charge the battery faster than the maximum current draw.

Below are some sample application settings and their associated impacts on battery performance. Performance specs are based off average idle current draw of 35mA with all subsystems powered on using a standard 1500mAh battery that is not connected to a charging circuit. Putting all subsystems into sleep mode will also reduce battery consumption to 0.45mA. Based off these values the Geogram ONE has the ability to run for roughly 43 hours while fully awake and over 3000 hours while fully asleep. Please keep in mind these are just estimates.

Example 1:

Sleep Time On	= 3600 seconds (60 minutes)
Sleep Time Off	= 0 seconds (0 minutes)
Power draw (mAh)	= (60/60 * 35) + (0/60 * 0.45)
	= (35 mA) + (0 mA) = 35
Total Battery Life	= (1500 / 35) = 42.86 hours

Example 2:

Sleep Time On	= 1800 seconds (30 minutes)
Sleep Time Off	= 1800 seconds (30 minutes)
Power draw (mAh)	= (30/60 * 35) + (30/60 * 0.45)
	= (17.5 mA) + (0.225 mA) = 17.725
Total Battery Life	= (1500 / 17.725) = 84.6 hours

Example 3:

Sleep Time On	= 300 seconds (5 minutes)
Sleep Time Off	= 3300 seconds (55 minutes)
Power draw (mAh)	= (5/60 * 35) + (55/60 * 0.45)
	= (2.92mAh) + (0.4125mAh) = 3.3245
Total Battery Life	= (1500 / 3.3245) = 451 hours

Example 4:

Sleep Time On	= 300 seconds (1 minutes)
Sleep Time Off	= 3300 seconds (59 minutes)
Power draw (mAh)	= (1/60 * 35) + (59/60 * 0.45)
	= (0.583mAh) + (0.4425mAh) = 1.0258
Total Battery Life	= (1500 / 1.0258) = 1462 hours

2. **Digital/Analog IO pins**

EEPROM SETTINGS USED: 5, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 249, 265

The Geogram ONE has several digital/analog IO pins that give the user the ability to access the outside world. There are two dedicated digital pins (D4 and D10), three pins that can be configured as analog in or digital IO pins (A1 – A3). There is also a single pin that is dedicated as analog input only (A6).

When a pin is configured as a digital output it can switch between two different states, LOW (0 volts) and HIGH (3.3 volts).
When a pin is configured as a digital input it is capable of reading a signal that is LOW (0 volts) or HIGH (3.3 volts).
When a pin is configured as an analog input it is capable of reading a voltage range from 0 to 3.3 volts and returning a value from 0 to 1023.

Digital pins D4 and D10 can also be configured as interrupt driven inputs. The digital pin will be pulled to a HIGH level via an internal pullup resistor and when connected to ground (LOW) the message stored in EEPROM will be sent to the default SMS number that is stored in EEPROM.

7. EEPROM MAP

GEOGRAM ONE EEPROM MAP					
EEPROM Address	Contents	Range	Description	Default	Terminating Character
0	Pin Code	4 digit alphanumeric	Four digit alpha numeric pin code.	0000	.
5	SMS Number	up to 15 digits numeric	Default SMS number that reply messages get sent to by tracking device.	NULL	*
21	Return Address Configuration	1 digit numeric	• 0 - Reply back to SMS address of incoming message. • 1 - Send message to SMS address stored in EEPROM.	0	.
22	Time Zone	-12 to +14	Time zone correction setting based off UTC. (i.e. EST = -4)	0	.
23	Standard or Metric	1 digit numeric	• 0 - English units (MPH, feet, etc…). • 1 - Metric units (KPH, meters, etc…).	0	.
24	Battery Low Alert	32 - 99	Percentage level at or below which a "Low Battery Alert" message is sent to the SMS address stored in EEPROM.	32	.

25	IO STATE D4	0 - 2, 4 - 7	**Pin Configuration Settings for Digital Pin D4.** • 0 - Digital Out, Active Low. • 1 - Digital Out, Active High. • 2 - Digital Input, Pull-ups enabled. • 4 - Digital Input Interrupt. If pin is switched to GND, message stored in EEPROM is sent to SMS address stored in EEPROM. **Polling commands for D4. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the digital pin when configured as a Digital Input. • 6 - Single Pulse H -> L -> H (Output High config only) • 7 - Double Pulse H -> L -> H -> L -> H (Output High config only)	2	.
26	IO STATE D10	0 - 2, 4 - 7	**Pin Configuration Settings for Digital Pin D10.** • 0 - Digital Out, Active Low. • 1 - Digital Out, Active High. • 2 - Digital Input, Pull-ups enabled. • 4 - Digital Input Interrupt. If pin is switched to GND, message stored in EEPROM is sent to SMS address stored in EEPROM. **Polling commands for D10. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the digital pin when configured as a Digital Input. • 6 - Single Pulse H -> L -> H (Output High config only)	4	.

			• 7 - Double Pulse H -> L -> H -> L -> H (Output High config only)		
27	IO STATE A1	0 – 3, 5 - 7	**Pin Configuration Settings for Digital Pin A1.** • 0 - Digital Out, Active Low. • 1 - Digital Out, Active High. • 2 - Digital Input, Pull-ups enabled. • 3 - Analog Input (Analog range is 0 - 3.3 volts DC). **Polling commands for A1. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the analog pin when configured as an Analog Input (0 - 1023 w.r.t. to 0 - 3.3 vdc). • 5 - Read the digital pin when configured as a Digital Input. • 6 - Single Pulse H -> L -> H (Output High config only) • 7 - Double Pulse H -> L -> H -> L -> H (Output High config only)	2	.

28	IO STATE A2	0 – 3, 5 - 7	**Pin Configuration Settings for Digital Pin A2.** • 0 - Digital Out, Active Low. • 1 - Digital Out, Active High. • 2 - Digital Input, Pull-ups enabled. • 3 - Analog Input (Analog range is 0 - 3.3 volts DC). **Polling commands for A2. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the analog pin when configured as an Analog Input (0 - 1023 w.r.t. to 0 - 3.3 vdc). • 5 - Read the digital pin when configured as a Digital Input. • 6 - Single Pulse H -> L -> H (Output High config only) • 7 - Double Pulse H -> L -> H -> L -> H (Output High config only)	2	.
29	IO STATE A3	0 – 3, 5 - 7	**Pin Configuration Settings for Digital Pin A3.** • 0 - Digital Out, Active Low. • 1 - Digital Out, Active High. • 2 - Digital Input, Pull-ups enabled. • 3 - Analog Input (Analog range is 0 - 3.3 volts DC). **Polling commands for A3. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the analog pin when configured as an Analog Input (0 - 1023 w.r.t. to 0 - 3.3 vdc). • 5 - Read the digital pin when configured as a Digital Input. • 6 - Single Pulse H -> L -> H (Output High config only)	2	.

			• 7 - Double Pulse H -> L -> H -> L -> H (Output High config only)		
30	IO STATE A6	3, 5	**Pin Configuration Settings for Digital/Analog Pin A6.** • 3 - Analog Input (Analog range is 0 - 3.3 volts DC). (ONLY SETTING ALLOWED) **Polling commands for A3. Writing the below number to the address will execute the corresponding commands.** • 5 - Read the analog pin when configured as an Analog Input (0 - 1023 wrt to 0 - 3.3 vdc).	3	.
31	IO Sing. Pulse Time	1 - 255	Digital pin configured as Output High can be pulsed Low (H->L->H). Low period is specified by value x10 mseconds. Example: max value of 255 equals a low pulse of 2.55 seconds.	255	.
32	IO Dbl Pulse Time1	1 - 255	Digital pin configured as Output High can be double pulsed (H->L->H->L->H). First Low period is specified by value x10 mseconds. Example: value of 128 equals a low pulse of 1.28 seconds.	255	.
33	IO Dbl Pulse Time2	1 - 255	Digital pin configured as Output High can be double pulsed (H->L->H->L->H). Second High period is specified by value x10 mseconds. Example: value of 50 equals a high pulse of 0.5 seconds.	255	.
34	IO Dbl Pulse Time3	1 - 255	Digital pin configured as Output High can be double pulsed (H->L->H->L->H). Second Low period is specified by value x10 mseconds. Example: value of 5 equals a low pulse of 50 milliseconds.	255	.

35	Sleep Configuration	0 - 15 (BWV)	Configuration settings to determine which subsystems get turned off during sleep mode and which overrides are in place to wake up device. • Bit 0 - Turn GSM off when set to 1. • Bit 1 - Turn GPS off when set to 1. • Bit 2 - Override sleep when plugged into charger when set to 1. • Bit 3 - Override sleep when motion is detected when set to a 1. <u>Example 1:</u> Set value = 15 (1111), Both GSM and GPS are turned off when sleeping. Device will not go to sleep if plugged into the charger or if motion is detected. <u>Example 2:</u> Set value = 10 (1010), Only GPS is turned off when sleeping. Device will not go to sleep if motion is detected.	3	.
36	Sleep: Time On	0 - 4,294,967,296 seconds	Time, in seconds, the device will stay awake. If set to 0, the sleep function is disabled.	0	.
40	Sleep: Time Off	0 - 4,294,967,296 seconds	Time, in seconds, the device will sleep. If set to 0, the sleep function is disabled.	0	.
44	Speed Limit	0 - 65536 MPH / KPH	If speed exceeds setting a message will be sent to the SMS address stored in EEPROM. When device speed falls below setting, minus Hysteresis, a second message is sent	0	.

			indicating maximum speed achieved during time. If set to 0, the speed limit monitoring feature is disabled.		
46	Speed Limit Reset Hysteresis	0 - 255	Offset below Speed Limit the device must achieve before sending maximum speed message. Example: If hysteresis is set to 0 and speed limit is set to 65, going just above 65 will send the first message and falling just below 65 will send the second message. If Hysteresis is set to 5, then exceeding 65 will send the first message but the second message will not be sent until the speed falls below 60 (speed limit - hysteresis).	3	.
47	Geofence 1 Radius	+/- 2,147,483,648	The radius around the stored longitude/latitude settings in EEPROM used to define the fence area. A positive radius value activates an inside fence (i.e. if you leave the defined area) while a negative value activates an outside fence (ie if you enter the defined area). A value of zero deactivates fence monitoring. Preceding the value with an asterisk (*) will save the current longitude and latitude settings in EEPROM. Value is in meters or feet depending on Standard or Metric setting.	0	.
51	Geofence 1 Latitude	See Description	Latitude is typically formatted as ddmm.mmmm with South being negative. EEPROM format to store is the same without the use of the decimal point. Example: South latitude of 2701.3904 would be stored in EEPROM as -27013904. Example: North latitude of 5832.3356 would be stored as 58323356.	0	.

55	Geofence 1 Longitude	See Description	Longitude is typically formatted as dddmm.mmmm with West being negative. EEPROM format to store is the same without the use of the decimal point. Example: West longitude of 12701.3904 would be stored in EEPROM as -127013904. Example: East longitude of 15832.3356 would be stored as 158323356.	0	.
59	Geofence 2 Radius	+/- 2,147,483,648	See Geofence 1 description	0	.
63	Geofence 2 Latitude	See Description	See Geofence 1 description	0	.
67	Geofence 2 Longitude	See Description	See Geofence 1 description	0	.
71	Geofence 3 Radius	+/- 2,147,483,648	See Geofence 1 description	0	.
75	Geofence 3 Latitude	See Description	See Geofence 1 description	0	.
79	Geofence 3 Longitude	See Description	See Geofence 1 description	0	.
83	GF Breach Speed	0 - 255	Device speed can be included in Geofence breach calculation. Sometimes GPS signals wander and report false signals. By including speed into the calculation you can reduce false breaches. Example: Setting is 3 (mph). The device would have to moving faster than 2 mph before it would detect a breach of the Geofence.	3	.

84	GP Breach Repetitions	0 - 255	The number of Geofence breach repetitions can be included in the calculation. Sometimes GPS signals wander and report false signals. By including consecutive breach repetitions into the calculation you can reduce false breaches. Each repetition would be consecutive based off the location update frequency which is once per second. Example: Setting is 10 (seconds). The device would need to have breached the fence area for 10 consecutive seconds before it would activate the alarm.	10	.
85	BMA - 0x0F	0 - 255	See BMA250 datasheet for explanation of register	5	.
86	BMA - 0x10	0 - 255	See BMA250 datasheet for explanation of register	8	.
87	BMA - 0x11	0 - 255	See BMA250 datasheet for explanation of register	0	.
88	BMA - 0x16	0 - 255	See BMA250 datasheet for explanation of register	7	.
89	BMA - 0x17	0 - 255	See BMA250 datasheet for explanation of register	0	.
90	BMA - 0x19	0 - 255	See BMA250 datasheet for explanation of register	4	.
91	BMA - 0x1A	0 - 255	See BMA250 datasheet for explanation of register	0	.
92	BMA - 0x1B	0 - 255	See BMA250 datasheet for explanation of register	0	.
93	BMA - 0x20	0 - 255	See BMA250 datasheet for explanation of register	6	.
94	BMA - 0x21	0 - 255	See BMA250 datasheet for explanation of register	0x8E (HEX)	.
95	BMA - 0x25	0 - 255	See BMA250 datasheet for explanation of register	0x0F (HEX)	.
96	BMA - 0x26	0 - 255	See BMA250 datasheet for explanation of register	0xC0 (HEX)	.
97	BMA - 0x27	0 - 255	See BMA250 datasheet for explanation of register	5	.
98	BMA - 0x28	0 - 255	See BMA250 datasheet for explanation of register	4	.
99	UDP Send Interval on Battery	0 - 4,294,967,296	Time interval in seconds that position information is sent using UDP to the server while running off just the battery. Setting to 0 disables the feature.	0	.

103	UDP Send Interval on Charger	0 - 4,294,967,296	Time interval in seconds that position information is sent using UDP to the server while the device is plugged into the charger. Setting to 0 disables the feature.	0	.
107	UDP Power Profile	0 - 255 (BWV)	Override settings for UDP send interval based off motion and/or speed conditions. • Bit 0 - When set to a 1 only send UDP if motion is sensed while plugged into the charger. • Bit 1 - When set to a 1 only send UDP if speed is exceeded while plugged into the charger. • Bit 2 – When set to a 1, UDP Send Interval on Charger will start when GO wakes from sleep. • Bit 4 - When set to a 1 only send UDP if motion is sensed while running off the battery. • Bit 5 - When set to a 1 only send UDP if speed is exceeded while running off the battery. • Bit 6 – When set to a 1, UDP Send Interval on Battery will start when GO wakes from sleep. <u>Example 1:</u> Set value = 0 (00000000), No overrides used, device will send UDP at preprogrammed interval on battery or charger. <u>Example 2:</u> Set value = 51 (00110011), UDP data will only be sent at the UDP interval if motion is detected or the speed limit is exceeded on both battery and charger.	0	.

			Example 3: Set value = 32 (00100000), While plugged in the charger no overrides are enabled and UDP data will be sent at interval. While on battery, UDP data will only be sent when speed limit is exceeded.		
108	UDP Speed on Battery	0 - 255	Speed limit to enable UDP send interval when active running off battery.	0	.
109	UDP Speed on Charger	0 - 255	Speed limit to enable UDP send interval when active while plugged in to charger.	0	.
110	SMS Send Interval on Battery	0 - 4,294,967,296	Time interval in seconds that position information is sent using SMS to the number saved in EEPROM while running off just the battery. Setting to 0 disables the feature.	0	.
114	SMS Send Interval on Charger	0 - 4,294,967,296	Time interval in seconds that position information is sent using SMS to the number saved in EEPROM while the device is plugged into the charger. Setting to 0 disables the feature.	0	.

118	SMS Power Profile	0 - 255 (BWV)	Override settings for SMS send interval based off motion and/or speed conditions. • Bit 0 - When set to a 1 only send SMS if motion is sensed while plugged into the charger. • Bit 1 - When set to a 1 only send SMS if speed is exceeded while plugged into the charger. • Bit 2 – When set to a 1, SMS Send Interval on Charger will start when GO wakes from sleep. • Bit 4 - When set to a 1 only send SMS if motion is sensed while running off the battery. • Bit 5 - When set to a 1 only send SMS if speed is exceeded while running off the battery. • Bit 6 – When set to a 1, SMS Send Interval on Battery will start when GO wakes from sleep. <u>Example 1:</u> Set value = 0 (00000000), No overrides used, device will send SMS at preprogrammed interval on battery or charger. <u>Example 2:</u> Set value = 51 (00110011), SMS data will only be sent at the SMS interval if motion is detected or the speed limit is exceeded on both battery and charger. <u>Example 3:</u> Set value = 32 (00100000), While plugged in the charger no overrides are enabled and SMS data will be sent at interval.	0	.

			While on battery, SMS data will only be sent when speed limit is exceeded.		
119	SMS Speed on Battery	0 - 255	Speed limit to enable SMS send interval when active running off battery.	0	.
120	SMS Speed on Charger	0 - 255	Speed limit to enable SMS send interval when active while plugged in to charger.	0	.
121	Motion Message	15 digit ASCII	Motion Detected message that is sent.	Motion Detected	*
137	Low Battery Message	15 digit ASCII	Low Battery message that is sent	Low Battery	*
153	Geofence 1 Message	15 digit ASCII	Geofence 1 breach message that is sent	Fence 1 Breach	*
169	Geofence 2 Message	15 digit ASCII	Geofence 2 breach message that is sent	Fence 2 Breach	*
185	Geofence 3 Message	15 digit ASCII	Geofence 3 breach message that is sent	Fence 3 Breach	*
201	Speed Limit Message	15 digit ASCII	Speed limit exceed message that is sent	Speed Exceeded	*

217	Max Speed Limit Message	15 digit ASCII	Maximum Speed limit message that is sent	Max Speed =	*
233	Geogram ONE ID	15 digit ASCII	Geogram ONE user ID	GO FW_3.0b	*
249	Pin D4 Message	15 digit ASCII	Pin D4 Interrupt message that is sent	Pin D4 Alert	*
265	Pin D10 Message	15 digit ASCII	Pin D10 Interrupt message that is sent	Pin D10 Alert	*
281	Hyperlink 1	35 digit ASCII	Google Maps link	http://maps.google.com/maps?q=	*
317	IMEI	15 digit ASCII	IMEI data stored here	*	*
333	UDP APN	35 digit ASCII	APN used for UDP	wholesale	*
369	UDP Host	35 digit ASCII	Host used for UDP	193.193.165.166	*
405	UDP Port	0 - 65536	Port used for UDP	20332	.
407	UDP Header	15 digit ASCII	Header used for UDP	#SD#	*
423 - 1023 UNUSED					