

SHOUT nano USER'S GUIDE

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POWERED by IRIDIUM™

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Glossary

AES	Advanced Encryption Standard
BIS	Bureau of Industry and Security
CE	Conformite Europeene
CEP	Circular Error Probable
DoD	Department of Defense
DoD EMSS	DoD Enhanced Mobile Satellite Services
EAR	Export Administration Regulations
FCC	Federal Communications Commission
FDMA	Frequency Division Multiple Access
GPS	Global Positioning System
HACC	Horizontal Accuracy
HDOP	Horizontal Dilution of Precision
IC	Industry Canada
IMEI	International Mobile Equipment Identification
LBT	L-Band Transceiver
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNA	Low Noise Amplifier
NOC	Network Operation Center
OFAC	Office of Foreign Asset Controls
PDA	Personal Digital Assistant
PMS	PECOS Message Structure
POP	Post Office Protocol
RF	Radio Frequency
RUDICS	Router-Based Unrestricted Digital Internetworking Connectivity Solution
SBAS	Satellite Based Augmentation System
SBD	Short Burst Data
SMTP	Simple Mail Transfer Protocol
TBR	Time-Between-Reports
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
VDOP	Vertical Dilution of Precision
USB	Universal Serial Bus

Introduction

The SHOUT nano is a handheld, global, two-way satellite messaging and personal tracking device. It utilizes Iridium's short burst data (SBD) service to provide location information determined by a GPS receiver, two-way inbound and outbound status, text messaging, and emergency/alert notifications. The SHOUT nano significantly improves service reliability over existing tracking products by allowing two-way communications and confirmation of the nature of the distress to the first responder community. This reduces false alerts, helps identify the nature of the emergency so that the correct assets can be deployed thereby reducing search and rescue costs, and provides communications feedback capability to the user to assist in rescue efforts. The SHOUT nano is 100% backward compatible with the SHOUT. In this document, the terms SHOUT nano and nano are used interchangeably.

The nano is designed with ultra-low power consumption electronics drawing less than 35µA during sleep. With an internal 1.95 A-Hr rechargeable Li-Ion battery and depending on the environmental conditions, it can send a position report every ten minutes for more than ten days (more than 1,500 reports). User is recommended to read Appendix C to learn about the impact of blocked antennas on the number of reports. The nano is equipped with a high resolution color LCD and on-screen keyboards allowing transmission of free-text, canned messages and a combination of free-text and canned messages. The menu options are displayed as icons for quick access. The device can periodically wake up from sleep to send its position report to a command center. A 911 button is used for immediate emergency/alert notifications. Data are packaged in either standard or 256-bit AES encrypted format.

The nano is capable of sending position reports in PECOS Message Structure (PMS). The PMS complies with the Blue Force Tracking Data Format Specification. The nanos are shipped without PMS features activated and can only be enabled by NAL Research at the request of an authorized user. Functions related to PMS can be found in Appendix A.

The nano offers a variety of services including:

- **Normal Tracking** — The nano can be programmed to automatically wake up and send a position report at a set interval ranging from once every minute to once a day.

- **Emergency Alert** — When the emergency 911 button is pushed, the nano immediately sends alerts to a designated corporate e-mail, home e-mail and/or monitoring center. The home base and the user can then communicate to define further specifics of the situation and a response to the emergency.
- **Free-Text Messaging** — The nano allows users to send free-text via three different sets of on-screen keyboards.
- **Canned Text Messaging** — The nano allows users to send canned (pre-defined) messages. Up to 600 pre-defined messages stored in memory can be retrieved and sent. Sending canned messages saves bandwidth (effectively cost) because only short codes are transmitted to the server instead of the entire message body.
- **Waypoint Tracking** — The nano lets users send and/or save waypoints for later retrieval. A waypoint is a GPS location that a user wants to identify and mark with a specific name tag for future reference.
- **Check-In** — The nano allows a quick check-in message to be sent using a single soft key.

IMPORTANT: NAL Research can enable the SHOUT nano for use on the DoD EMSS Gateway. However, accessing the EMSS Gateway is not authorized until the nano is provisioned (sign up for airtime). Unauthorized attempts to access the EMSS Gateway will result in immediate disabling of the offending device, which must then be returned to NAL Research for repair. Please see webpage <https://sbd.pac.disa.mil> for more information regarding DoD EMSS service provisioning.

IMPORTANT: Users should not disassemble the nano for repair or services. The warranty is voided if the nano is disassembled. It should be returned to NAL Research for services by calling 703-392-1136 x203 or e-mailing contact@nalresearch.com.

Using the SHOUT nano

DEVICE DESCRIPTION

The SHOUT nano has eight buttons, one LED and a USB port. The buttons are used to power up the device, access the menus for parameter setting, initiate Check-In and Way Point functions and activate emergency notification. The USB port is for charging, firmware update and parameter setting.



- ① Power/Enter: 1. Turns device ON/OFF when hold down for two seconds or
2. Used to select highlighted item on a menu.
- ② Arrow Up/Down/Right: Used to navigate the cursor.
Arrow Left: 1. Used to navigate the cursor or
2. Used to go back to the previous menu.
- ③ Check-In Soft Key: Used to access the Check-In feature.
- ④ Way Point Soft Key: Used to access the Way Point features.
- ⑤ USB Port: Used to charge the battery, update firmware or setup operating parameters using a computer.
- ⑥ Emergency: Used to send an emergency 911 alert/notification.
- ⑦ Guard: Protects emergency button from being accidentally activated.
- ⑧ LED: Displays tracking and emergency statuses.
- ⑨ Antenna: Embedded GPS antenna (DO NOT BLOCK).
- ⑩ Antenna: External Iridium antenna* (DO NOT BLOCK).

***IMPORTANT:** For best performance, NAL Research only recommends the use of the Sarantel SL3104 decafilar antenna (www.sarantel.com). Performance degradation including dropped coverage and shortened battery life can occur if a different antenna is used. NAL Research will void the warranty if the nano is replaced with a non-Sarantel antenna.

CHARGING THE BATTERY


The SHOUT nano package includes manuals, software, an AC wall adapter, and a standard USB-to-mini USB cable. The nano is shipped with its internal Lithium-Ion battery partially charged. User should fully charge the nano before use. There are two ways of charging the nano. One is to use the supplied AC wall adapter. The other is to connect to a standard USB device—make sure to use the USB cable provided with the nano. With the AC wall adapter, the charging time is approximately five hours. Charging time using a USB port depends on the type of USB port. USB 1.0 should be able to charge the nano in about a day assuming the port is capable of producing an output current of 100mA. USB 2.0 can charge in about four hours assuming the current output of 1.5A. NAL Research offers 12VDC and 24-36VDC chargers sold as separate items. For pocket size solar charges, NAL Research recommends any of the Solio® (www.solio.com) products. While using the nano, a low battery warning message will appear when remaining power is less than 10%.








WARNING!

All batteries can cause property damage, injury or burns if a conductive material, such as jewelry or keys, touches exposed terminals. The material may complete an electrical circuit and become extremely hot. To protect against such unwanted current drain, exercise care in handling any charged battery, particularly when placing it inside your pocket, purse or other container with metal objects.







Users should not disassemble the SHOUT nano for replacing battery. It should be returned to NAL Research for services. Risk of explosion if battery is replaced with an incorrect type. Dispose of the batteries (nano) according to local, state and federal regulations or laws.

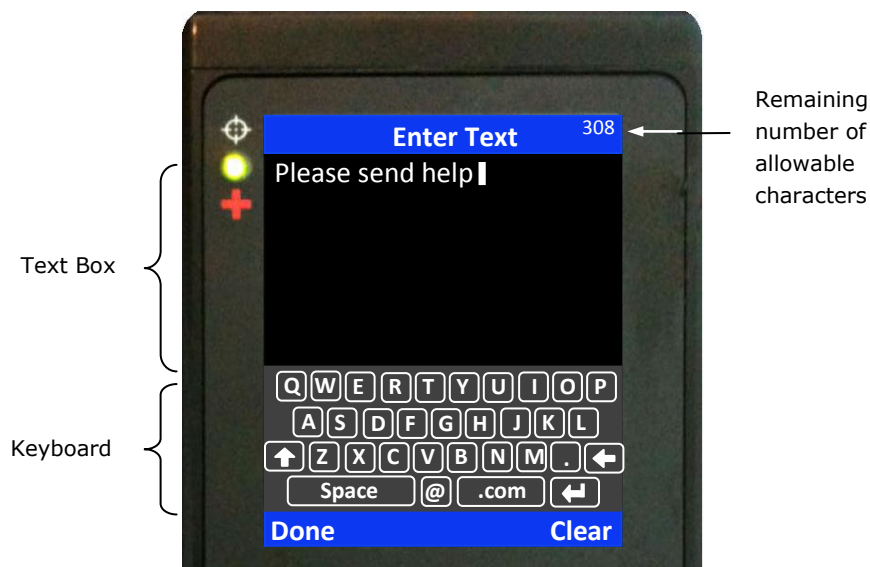
The nano has a battery status icon  on the top right corner of its LCD screen indicating the charging status. When charging is complete the icon should show five bars (not counting the last battery icon). The device can be safely operated and does not need to be turned off while charging. The charging cycle will complete quicker while the device is shut down.

BASIC NAVIGATION

The SHOUT nano can be turned on by holding down the power/enter  button for approximately two seconds. Once the device is on, the arrow   buttons can be used to position the cursor over a menu icons and the enter  button can be used to select the highlighted icon. Each menu has a BACK  button, which returns the device to the previously accessed screen. On most menus, frequently used options are programmed into two soft keys allowing quick and easy access. The nano can be turned off (completely off with no tracking and no text messaging) at anytime by holding down the power/enter button for approximately two seconds. The device automatically "goes to sleep" after 90 seconds of inactivity.

USING THE KEYBOARDS

Some options require the use of on-screen keyboards to enter information. Three different keyboards are available. Picture below is an example of a keyboard for entering waypoint labels. The up  key can be pressed repeatedly to switch between the keyboards. The four arrow     buttons on the nano are for navigating around the keyboards and enter  button is for selecting a highlighted character. While entering text, the position of the cursor in the text box is shown as a thin, solid rectangular block. The entered text can be edited by pressing the up arrow button until the cursor exits the keyboard into the text box and begins to blink. The four arrow buttons can again be used to navigate and to place over a character to be corrected. Pressing the enter button takes user back to the keyboard exiting the text box. The number displayed on the right corner of the LCD indicates the remaining allowable number of characters that can be entered into the text box.



NETWORK OPERATING CENTER (NOC)

The SHOUT nano comprises of a 9602 transceiver board capable of SBD connectivity to the Iridium satellite network. As a messaging and tracking device, its function is to send GPS reports and text messages to a network operating center (NOC). It can be provisioned by NAL Research or any certified Iridium airtime service provider including the DoD DISA EMSS office to send messages and reports to five different destinations (a combination of e-mail addresses, IP addresses and other mobile devices). While in the field, the nano can also accept real-time text messages and commands from a NOC.

A NOC could be a sophisticated central monitoring center equipped with servers connected to high-speed networks. A NOC could also be as simple as a PDA, a laptop or a desktop attached to the Internet, to an Iridium transceiver or to any wireless device. A NOC is required to receive and implement the logic necessary for analyzing the nano messages and determine the appropriate response.

SERVER FOR TRACKER SOFTWARE

Upon request, NAL Research will provide the Server for Trackers software allowing users to install on their NOCs to retrieve NAL Research's formatted GPS reports from the remote nano. In addition, the program will let a NOC communicate with modems attached to its serial ports, communicate with POP3/SMTP servers, communicate with Iridium SBD DirectIP servers, and/or act as a RUDICS server/client to support incoming and outgoing communications with the nanos. Under special cases, NAL Research will release our proprietary GPS report formats for developers to implement into their own tracking software.

SATTERM SOFTWARE

Along with the Server for Tracker software, SatTerm software is included for users to set up the nano operating parameters, Address Book and Canned Messages. Most of the operating parameters can be set using the nano on-screen menus. However, more sophisticated features such as encryption must be carried out via SatTerm and a connected computer to the nano. For address book and canned messages, the nano sends only short codes instead of the message body to a NOC server. Short codes are then mapped to the real addresses or canned messages with a lookup table saved on the NOC server during setup. Therefore, when SatTerm is used to enter address book and canned messages, SatTerm will synchronize short codes between the nano and the NOC server.

MAPPING NOC SERVER

NAL Research also makes available a mapping NOC server to our customers only for demonstration purposes. Application developers can call to inquire on how to setup a free demo account. The server implements Google Earth to display the tracking information. NAL Research assumes no responsibility for any claims or

damages arising out of the use of our server. NAL Research makes no warranties on the performance or the availability of our server.

Home Screen

HOME SCREEN

Immediately after powered up, the SHOUT nano momentarily displays the NAL Research logo followed by the home screen. Device status symbols will be shown along the top of the home screen. Some symbols will not appear until an event is initiated such as sending or receiving a message.



Status Symbols

✂ denotes the Iridium transceiver is off. The Iridium transceiver is always kept off to preserve battery life until a message is required to be transmitted.

✂ denotes: (1) the Iridium transceiver is on with real-time signal strength represented by the number of vertical bars and (2) SBD message transmission is in progress. The signal strength can range from the lowest of zero to the highest of five bars. During transmission, the antenna must have a clear view of the sky. The nano cannot send reports from inside a building.

✂ denotes the GPS receiver is off. The GPS receiver is always kept off to preserve battery life until time, date or position information is needed.

✂ denotes the GPS receiver is on with real-time satellite acquisition status represented by the number of vertical bars. One bar represents valid time and date fix, two bars represent 2-D fix or dead reckoning, three bars represent 3-D fix with HDOP higher than 2.0 and four bars represent 3-D fix with HDOP less than 2.0. Although the nano GPS receiver can often obtain a location fix when the antenna is partially blocked (near buildings, in a room next to a window, etc.), it is recommended that the antenna must have a clear view of the sky to minimize acquisition time and better position accuracy.

✱ denotes tracking mode is off when the tracking symbol is dimmed blue.

✱ denotes tracking mode is on when the tracking symbol is bright white. Next to the tracking symbol is the countdown timer to the next report.

🔇 denotes all the audio alerts are off.

🔊 denotes the audio alert is on.

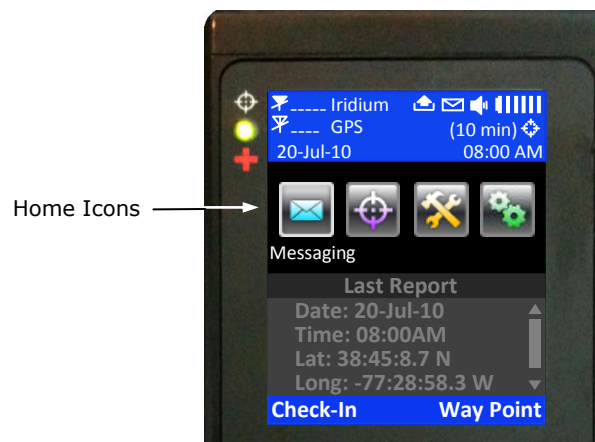
✉ denotes unread message(s) is in the Inbox.


📧 denotes message(s) is in the Outbox ready to be sent or message(s) in queue failed to send.

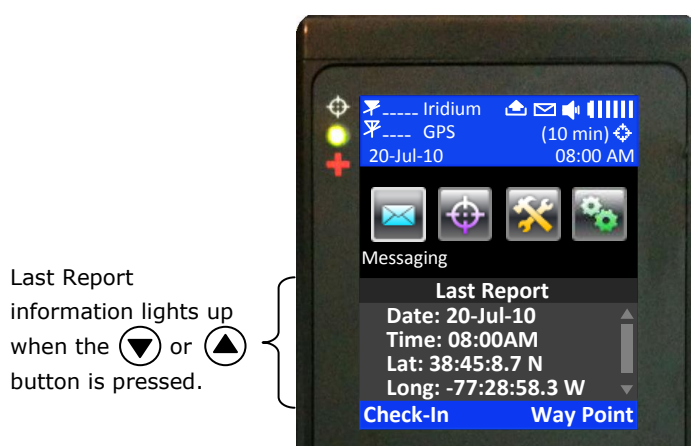
||||| is the battery indicator with five bars being fully charged.

Date/Time The current time and date are displayed with the formats defined using the Settings/Time and Date menu. The GPS receiver has an internal clock and, as long as the battery is not depleted and a valid position fix was previously acquired, the SHOUT nano can recall the correct date and time. The message “Date/Time unavailable” is displayed when the nano is unable to restore information from the GPS receiver.

Home Icons Immediately below date and time, the SHOUT nano displays four main icons each representing a menu option—Messaging, Tracking, Utilities and Settings. Detailed descriptions of each of these menu options are included in the next section. The arrow ⏪ ⏩ buttons are used to place the cursor over an icon. The perimeter of an icon lights up and a label underneath it appears when the cursor is placed over it. The enter ↵ button is used to select the menu option.



Last Report The last successful report sent by tracking or emergency notification is displayed in the text box below the main icons. Check-In, Way Point, free-text and canned messages are not considered as “reports” and, therefore, will not be displayed on the home screen even if a message was sent successfully. With limited space on the LCD screen, only date, time, latitude, longitude and altitude are visible in dimmed gray text. Additional information can be seen by pressing the arrow down button. After the arrow button is pressed the text will change from gray to bright white for better readability. Displayed text can be changed back to gray by repeatedly pressing the left arrow  button. The Last Report information is saved on the nano’s non-volatile memory. Even if battery power is removed, the information can still be restored. All displayed GPS parameters are self-explanatory except Vvel, which stands for vertical velocity.




Check-In (Soft Key)

Check-In soft key allows user to send a quick message with a single, easy-accessed button. When the Check-In button is pressed from the home screen, a second screen will appear requesting for confirmation. Once confirmed, the SHOUT nano sends out a short code representing a Check-In message. If Settings/Include GPS option is enabled, GPS location will be attached to the Check-In message. Check-In messages with GPS location takes longer to complete since the nano has to acquire a GPS fix first. Depending on the validity of the stored ephemeris data or the Accuracy setting, it could take an additional 29 seconds. Check-In message uses the same canned message’s short code format.

Way Point (Soft Key)




A waypoint is a GPS location that user wants to identify and mark with a specific name tag for future reference. When the Way Point soft key is pressed from the home screen, the SHOUT nano immediately turns the GPS receiver on to acquire

a fix. User then has the options to go back to the home screen without further action, to re-acquire a new GPS fix, or to save the waypoint. Selecting the Next option will bring up a full keyboard allowing user to enter the waypoint label. Use the  key to toggle between the keyboards.

A waypoint label can have up to 309 characters long. As each character is entered the remaining allowable number of characters for the label is displayed on top of the LCD. The Add option saves the waypoint into the nano's non-volatile memory for later retrieval. The nano can store up to 1,000 waypoints. The oldest point is overwritten as the memory becomes full. After saving a waypoint, user can also send it to a NOC server. The server differentiates Way Point report from normal tracking report by their short codes.

Quick Start

Before use, airtime must first be purchased from NAL Research or from any of Iridium certified airtime resellers. The nano's IMEI number must be registered by an airtime reseller to "point" to a NOC server. User is recommended to read the remaining of the manual to learn how to operate the nano as a messaging device. However, as a tracking device, user can quickly set up the nano with just three simple steps:

1. Turn the nano on by holding down the power/enter button  for about two seconds.
2. Go to Report Rate menu to set the reporting frequency .
3. Go to Track On/Off menu to enable tracking . The nano is now in tracking mode and is ready to send position reports at a rate chosen in Step 2. No further action is required. The unit automatically goes to "sleep" in between reports.

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Messaging Menu

MESSAGING



The Messaging menu allows user to compose, save, view, and send canned or free-text messages. There are six options under the Messaging menu including Address Book, Compose, Inbox, Drafts, Outbox and Sent and a Check Mailbox soft key.



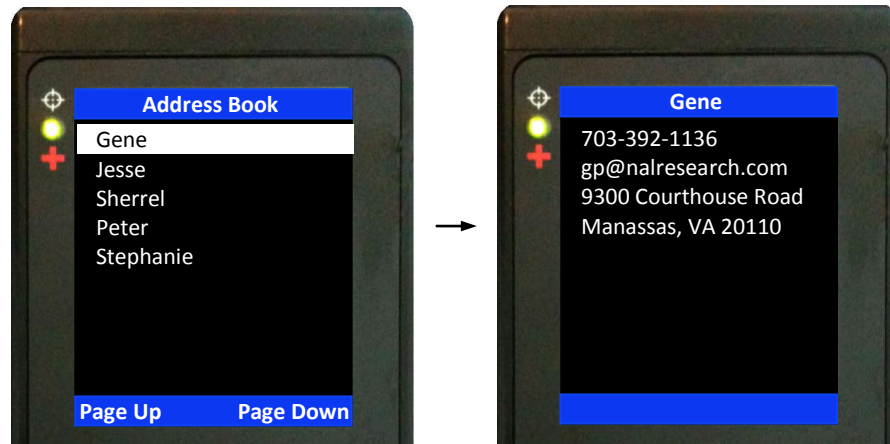
Address Book



The Address Book lists contacts created and saved into the SHOUT nano's memory using NAL Research's SatTerm software. During setup SatTerm requires connectivity between the nano and a NOC server to synchronize the lookup table of short codes. As with canned messages, short codes are used to map real addresses to a lookup table located at a NOC.


The nano can save 1,200 contacts in memory with a maximum contact name of 30 characters long. Each contact has its data stored in a three-line format. The first line can have up to 30 characters, the second can have 50 characters and the third can have 30 characters. The information contained in each line is defined by developers.

Figure below displays an example of the formatted Address Book contact *defined by the NAL Research's NOC server*. The first line has the contact phone number, the second line has the e-mail address and the third line has the home address. Upon receiving a free-text or canned message from the nano referenced to a specific Address Book contact, the NAL Research's NOC server forwards the message to the e-mail address listed on the second line of the Address Book contact. Application developers can *define their own set of rules* with information contained in the Address Book contact so that their NOC servers can use to determine the appropriate response.

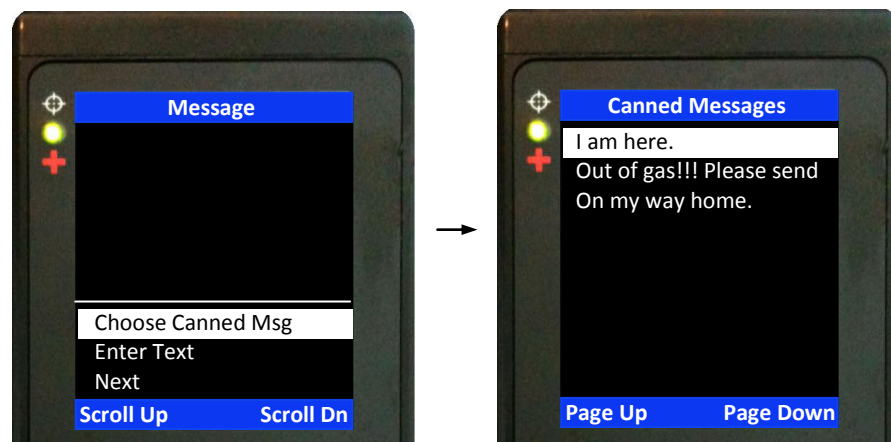





Compose





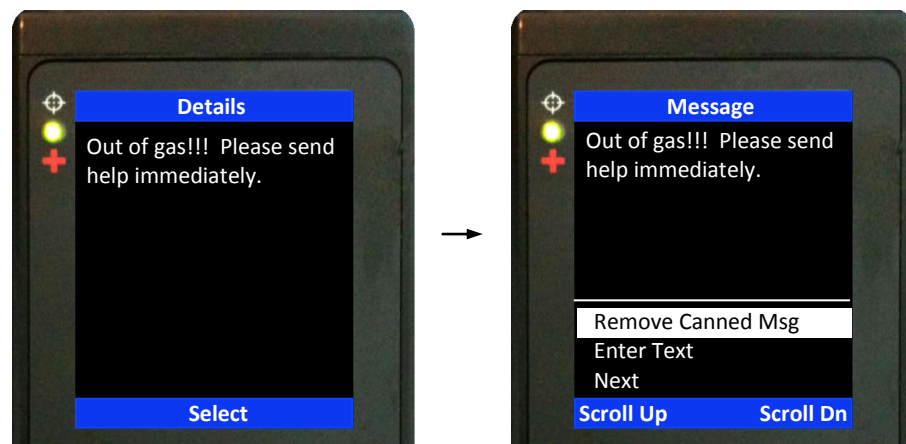
The Compose menu allows user to edit and send canned messages, free-text messages or a combination of canned and free-text messages to a NOC server. Three on-screen keyboards are available for information to be entered or modified. The up  key can be pressed repeatedly to switch between the keyboards. When Compose is selected, the Message menu appears with three options to choose from—Choose Canned Msg, Enter Text and Next.

The Choose Canned Msg option lists out canned messages user can select to send to a NOC. Sending canned messages saves bandwidth and airtime cost because it is only short codes that are being transmitted instead of the entire message body. SatTerm is used to create and save canned messages into the SHOUT nano's memory. During setup SatTerm requires connectivity between the nano and a NOC server to synchronize the lookup table of short codes. As with the Address Book, short codes are used to map the actual canned messages to a lookup table located at a NOC. The short codes are defined by application developers and not by the nano.



The nano can store up to 600 canned messages. Figure on the previous page displays examples of a few canned messages entered using SatTerm. Each message is shown on a single line. Some canned messages are too long and can only be partially displayed on the LCD screen. User can navigate by pressing the up and down arrow   buttons and by pressing the enter  button to show the entire message on the Details screen.

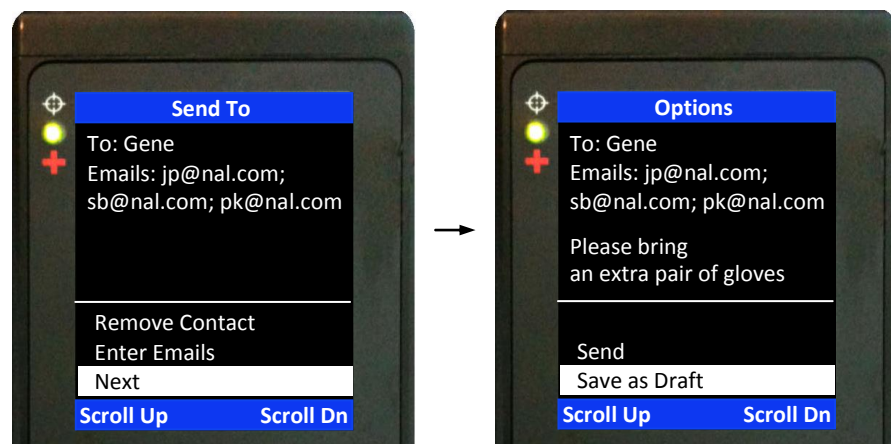
When a canned message is selected from the list, for example 'Out of gas!!! Please send' as shown in the figure below, the Details screen will appear to show the complete message. User has the option to pick a canned message by pressing the enter  button to Select or the BACK  button to go back to the original list of canned messages. If the enter button is pressed, the Message menu will reappear with the selected canned message displayed in the text box. Scroll Up and Scroll Dn soft keys are used to view part of the canned message that does not fit inside the text box. Remove Canned Msg deletes the message from the text box at anytime even after free-text is entered.



Enter Text option lets user create free-text messages with three on-screen keyboards. Each free-text message is allowed to have up to 309 characters because the Iridium 9602 limits outbound messages to 340 characters. These 309 characters are shared between a free-text message and any additional e-mail addresses attached to it (including the semi-colon or space used as e-mail address separator). Long e-mail addresses or multiple e-mail addresses will reduce the number of characters available for the free-text message (see detailed description in the next section). If a canned message is previously selected and appears in the text box then the entered free-text will be appended to the canned message.



After finish composing a message, the Next option is used to send the message to a NOC server. A contact selected from the Address Book and e-mail addresses to whom the message is destined must be entered through the Choose Contact and Enter Emails options. Choose Contact opens the Address Book screen. Enter Emails opens on-screen keyboards allowing user to enter e-mail addresses separated by a semi-colon. The total number of characters of all e-mail addresses including the semi-colons must be less than the difference between 309 and the number of characters in the free-text message. The nano keeps track of the limit and will prevent user from entering e-mail addresses longer than allowed.



Once all required information is entered, user can either Send the message or Save as Draft. If Send is selected, a Success screen will appear to indicate that the message has been added to the Outbox. The nano must be held with the antennas having full view of the sky. If the Settings/Include GPS option is turned on then GPS location will be added to the message. Messages with GPS location takes longer to complete since the nano has to acquire a GPS fix.

Inbox



The Inbox folder contains all incoming read and unread messages with the newest message on top of the list. Read messages have a white opened envelope icon next to them. Unread messages have a green closed envelope icon next to them. The arrow buttons are used to place the cursor over a message and the enter button is used to read highlighted message. The message icon will appear on top of the home screen when an unread message(s) is in the Inbox. The speaker will provide an audible alert for all new incoming messages. The SHOUT nano can store up to 690 messages in the Inbox.

Drafts

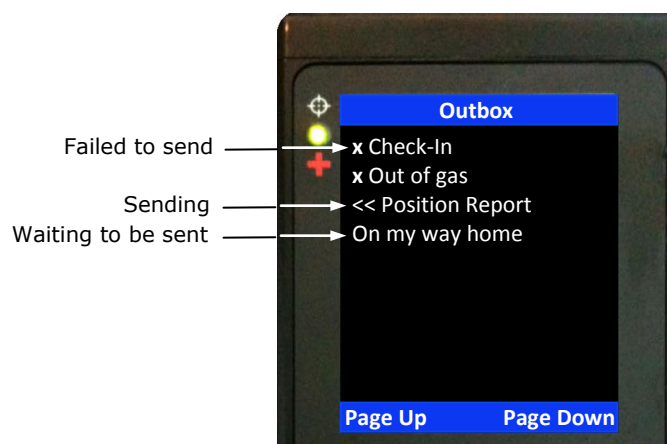



The Drafts folder contains draft messages saved under the Compose menu. The nano can store an approximately 190 draft messages with the newest message displayed on top and the oldest message displayed on bottom of the list. The arrow up/down buttons are used to place the cursor over a draft message. The enter button is used to recall and display the highlighted message content. Options/Edit takes user back to the Compose menu for editing and Options/Delete removes the message from the Drafts folder. If Send is selected, a Success screen will appear to indicate that the message has been added to the Outbox. The nano must then be held in a position with the antennas having full view of the sky. If the Settings/Include GPS option is turned on then GPS location will be attached to the message. Messages with GPS location can take longer to complete since the nano has to acquire a GPS position.

Outbox



The Outbox folder contains either messages in queue ready to be sent or messages failed to send. A message *in the process* of being sent has a << symbol next to it. A message *failed* to send has an X symbol. And a message *in queue* waiting to be sent has no symbol. Once a message is failed to send, it can stay in the Outbox until user decides to either resend (Enqueue) or delete. The Outbox can store ~170 messages with the oldest message on top of the list.



For each message queued in the Outbox, the nano attempts up to three times to transmit. After three failures, the message will be dequeued to avoid draining the battery. User has to manually requeue a message. If the nano is at a location not suited for transmission, user has to monitor the Outbox and repeatedly requeue until the message is successfully transmitted. The  symbol appears on top of the home screen when there is a queued or dequeued message(s) in the Outbox.

NOTE: The SHOUT nano will NOT resend “failed messages” even after the Iridium signal becomes available. User has to manually requeue a failed message(s) in order to resend. This is to prevent unintentional depletion of battery power in case there is large number of failed messages in the Outbox. Failed Cancel 911 message also needs to be requeued.

Sent



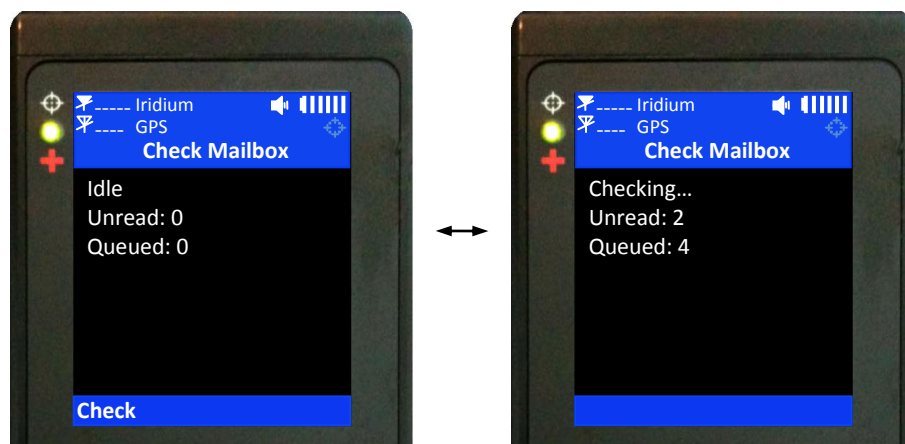
The Sent folder contains messages successfully sent to a NOC server. When the enter button is pressed on a highlighted message, detailed information about the message appears. The message can be deleted with the Delete soft key. Or the Options soft key can be selected to resend, forward or delete the message. Resend puts the message back on the bottom of the Outbox folder’s sending queue. Forward takes user back to the Compose menu for additional information to be entered. User can then resend the message after modifying it or cancel the process. Same as the Delete soft key in the Header menu, Delete permanently removes the message from the Sent folder. The nano can store ~580 messages in the Sent folder with the newest message displayed on top of the list.

Check Mailbox (Soft Key)

There are four ways the SHOUT nano initiates a mailbox check for any pending messages at the Iridium gateway:

1. User can manually force the nano to check the mailbox at anytime by pressing the Check Mailbox soft key under the Messaging menu.
2. User can manually force the nano to check the mailbox at anytime using the Utilities/Check Mailbox menu.
3. When tracking mode is enabled, the nano automatically checks the mailbox each time it wakes up to send a position report.
4. When tracking mode is enabled and in addition to checking the mailbox each time it wakes up to send a report, the nano also automatically wakes up and checks the mailbox at a preset mailbox check rate. The mailbox check rate is set using the Report Rate menu option. A position report will not be sent when the SHOUT nano wakes up to check the mailbox unless the mailbox check rate coincides with the tracking report rate.

The Check Mailbox menu can either be in Idle or Checking the Iridium gateway for any pending messages to be downloaded. As the messages are being downloaded, the nano shows the number of Unread messages in the Inbox and the number of messages still Queued at the Iridium gateway to be downloaded.



Tracking Menu

TRACKING





The Tracking menu allows user to enable the SHOUT nano tracking mode, disable the tracking mode, set the reporting rate, set the mailbox check rate, cancel the emergency 911 signal, view the unit reporting data, set GPS location accuracy, and set the position report format.



Track On/Off




Track On/Off option is used to set the SHOUT nano tracking mode. When Enable Tracking is selected, the tracking symbol  changes from dimmed blue to bright white. The nano immediately turns the GPS receiver on to acquire a GPS fix and then attempts to transmit a position report. The next position report is sent automatically based on the reporting rate set under the Report Rate option. A countdown timer to the next report is displayed inside the parentheses next to the tracking symbol. When tracking is enabled and the nano sleeps in between reports, the status LED  flashes once every five seconds. It can be turned off during sleep to reduce power consumption by using Settings/LED option. The emergency 911 button can be activated at anytime during tracking mode or non-tracking mode. The nano can also be powered up at anytime and be used as a messaging device.

When wake up to transmit a location report, the nano antennas must have full view of the sky; otherwise, it will fail to send. A missed report will not be resent. The entire reporting duration can take up to two minutes depending on the Iridium satellite visibility and the validity of the GPS ephemeris data. Ephemeris data saved on the GPS receiver is valid for approximately two hours allowing the receiver to obtain a hot-start fix. Report rate (time between reports) set to more than two hours forces the GPS receiver into either a warm-start or cold-start fix


(~29 seconds). As a result, the nano will consume more battery power and the total number of reports is significantly reduced. User is encouraged read the Power Consumption section.





When Tracking is On, the tracking symbol changes from blue to white. Countdown timer to next report is shown inside the parentheses.


NOTE: When the SHOUT nano is in the middle of sending a report and user forces it to power off by holding down the power  button, the nano will attempt to complete sending the report before shutting down. A warning message will appear on the LCD screen and will remain until either a position report is sent or failed to send. User can go back to the home screen by simply pressing the BACK button.


The nano logs and saves all position reports in its circular memory. When its memory is full, the oldest reports are over-written. SatTerm can be used to retrieve all position reports saved on the nano.


Report Rate  Report Rate option is used to set the report frequency (time between reports) when Track On/Off is enabled. Once a report rate is selected, a new menu appears requesting for mailbox check rate. The mailbox check rate can be the same as the report rate. In this case, the nano checks the mailbox each time it wakes up to send a report. If the mailbox check rate is different than the report rate, the nano will wake up in between reports to check the mailbox without sending a position report. The nano only offers the mailbox check rates that are evenly divisible to the report rate.

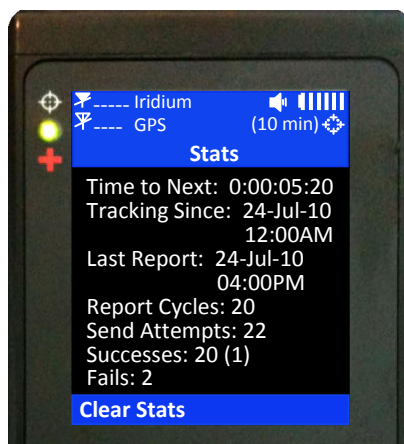
IMPORTANT: The total number of reports the nano can send with a fully charged battery depends on three settings—the report rate, the mailbox check rate and the Accuracy. User is encouraged to read the Power Consumption section for details on how these settings can affect the nano performance.

Cancel 911  After the red emergency  button on the back of the nano is pressed, user can deactivate the emergency alert by selecting the Cancel 911 option. A screen will appear with two options to choose from: (i) With Gateway Ack or (ii) Without Gateway Ack.

When With Gateway Ack is selected and confirmed, the cancellation message is queued in the Outbox to be transmitted. If the cancellation message is successfully transmitted and acknowledged by the Iridium gateway, the emergency mode ends, the emergency LED  is turned off and the top and bottom bars turn from red to blue. Powering the nano off will not cancel the emergency mode. User MUST select Cancel 911 option to cancel emergency.

When Without Gateway Ack is selected and confirmed, the cancellation message is queued in the Outbox to be transmitted. The emergency mode ends immediately, the emergency LED  is turned off and the top and bottom bars turn from red to blue.

Stats  When Track On/Off is enabled, the SHOUT nano monitors useful statistics which are displayed under the Stats screen. Data are cumulative over all tracking cycles. Displayed data can be manually reset at anytime using the Clear Stats soft key. A countdown timer to the next report is shown beside Time to Next and is replaced with Off when Track On/Off is disabled. The number of Successes represents the total number of position reports successfully transmitted to the Iridium network both with valid and invalid position fix. The number inside the parentheses next to Successes represents the number of position reports successfully transmitted but with invalid GPS fix. The number of Fails represents the total number of valid position reports failed to send to the Iridium network.



Accuracy



Accuracy option allows user to select either Standard or Best accuracy when acquires a 3-D GPS fix. For Standard setting, the nano acquires 3-D fix using saved ephemeris data in its non-volatile memory. The ephemeris is updated only when becomes invalid. For Best setting, the nano always updates the ephemeris data first before attempting to obtain a 3-D fix. The Best setting takes longer for a 3-D fix. However, the probability of obtaining position accuracy to within 2.5 meters is much higher than for the Standard setting. Best setting is not recommended when operated in environments with limited view of the sky such as under heavy foliage. Choosing Best accuracy setting can significantly reduce the total number of reports on a fully charged battery because of longer GPS acquisition time. Choosing Best accuracy is the same as setting the report rate to more than two hours. For both cases, the nano has to update the ephemeris data. Again, as a reminder, user is encouraged to read the Power Consumption section.

Format



The SHOUT nano can transmit position reports in either 30-byte format or 10-byte format. The 30-byte format includes UTC date, UTC time, latitude, longitude, altitude, speed, course, vertical velocity, number of satellites used to obtain 3-D fix, HDOP and VDOP. The latitude and longitude are recorded with ~ 0.18 meters resolution.

The 10-byte format includes UTC time, latitude, longitude and PDOP. With UTC date omitted, the nano relies on the NOC server to record the date. Encryption cannot be used with the 10-byte format. Latitude and longitude are recorded with ~ 1.1 meters resolution. Even though the message length is shorter, a 10-byte format message consumes the same amount of power to transmit as a 30-byte format. It is to be selected strictly for the purpose of airtime cost-saving.

Utilities Menu

UTILITIES



The Utilities menu provides six options used mainly to check for proper hardware and network setup. These include Check GPS, Check Iridium, send Test Report, Check Mailbox, Check-In and Way Points.



Check GPS



Check GPS option forces the SHOUT nano to turn on its GPS receiver and to continuously update and display GPS data in real-time whether there is a valid fix or not. The GPS receiver remains on until user leaves this screen by pressing the BACK button. The Reset Ephemeris soft key is used to force the nano to erase saved ephemeris in its memory and download a new set of ephemeris data. User must be careful not to deplete the battery power by staying on this option for too long.

The accuracy of the position can be monitored by observing the HACC. HACC stands for horizontal accuracy in meters. HACC is defined as the radius of a circle centered on the true value that contains the GPS measurement. Thus, a position fix with ten meters HACC accuracy indicates that it is within ten meters of the true position—the higher the HACC value, the less accurate the GPS measurement.

Check GPS option is a good indicator of letting user know whether or not to initiate a Way Point or a Test Report when located in a challenging environment; e.g. in dense foliage or around urban settings with tall buildings. HACC can be monitored in real-time to make sure it converges to a small and stable value (usually less than 30 meters). At which point, it is certain that a 3-D fix can be obtained with the most current ephemeris data being updated and saved. User

can then go back to the Utilities menu to send a test report. When the GPS receiver cannot acquire a fix, HACC gradually increases and, at some point, stops at a value of 4294967.500. It is an indicative that the surrounding obstructions prevent the GPS receiver from obtaining a fix and user should move on to a different location.

Check Iridium



Check Iridium option forces the SHOUT nano to turn on its Iridium transceiver and continuously update and display signal strength information in real-time. The Iridium transceiver remains on until user leaves this screen by pressing the BACK button. User must be careful not to deplete the battery power by staying on this option for too long.

Test Report



When the Test Report option is selected, the SHOUT nano immediately turns the GPS receiver on to refresh its location data. The location information is continuously updated and displayed in real-time whether there is a valid fix or not. Similar to the Check GPS option, HACC can be monitored to see if a valid fix is possible. Once a valid fix is obtained, the GPS receiver is turned off and the most recent 3-D fix information is displayed on the screen. This information called test report can be forced to send to a NOC server by pressing the Send soft key. A test report has the same format as a regular position report and is being treated as such by a NOC. Sending a test report will not disrupt or change the tracking reporting rate.

Test Report option is a good diagnostic tool used to ensure proper operation of the GPS receiver and the Iridium transceiver. It can also be used to manage battery life by turning off tracking mode and strategically send on-demand location reports. It can be considered as “manual tracking mode”.

Check Mailbox



Detailed description of this option can be found on page 22.

Check-In



Detailed description of this option can be found on page 14.

Way Points



The Way Points menu is used to acquire, view, save, delete or send a waypoint to a NOC. Choosing the New option is the same as pressing the Way Point soft key on the home screen (see page 14 for detailed description). A list of saved waypoints can be displayed and viewed by selecting the List option. After

selecting the List option, any saved waypoint label can be edited, sent/re-send or erased. The nano can save up to 1,000 way points in its circular memory. SatTerm can be used to retrieve waypoints saved on the nano.

Settings Menu

SETTINGS




The Settings menu allows user to view and configure the SHOUT nano hardware settings. There are twelve options available.



Audio



Audio option is used to change the alert frequency and tone, mute incoming message alert and mute all audio feedback. The  icon will appear on the home screen if Mute All is on. User can test the audio volume and sound before selecting by using the Preview soft key.

Contrast



Contrast option is used to change the LCD contrast by pressing the arrow up and down buttons. Press the enter button to select the setting and press the BACK button to go back to the Settings menu without change.


Backlight





Backlight option is used to set the period of inactivity after which time the SHOUT nano turns the LCD backlight off. The nano consumes approximately 40mA less with the LCD backlight set to Always Off. Setting the backlight to Always On is recommended for night time use.


LED





The SHOUT nano has a single status LED  on the top left corner to alert user of whether the device is in tracking mode or emergency mode. The LED flashes once every five seconds when Track On/Off is enabled and the device sleeps (in between tracking reports). The LED turns solid green when Emergency mode is enabled regardless of whether the device is on or off. The LED can be turned off for either of these two cases to save battery power using the LED option. The nano consumes approximately 3mA less with the LED disabled during emergency and 125μA less with LED disabled during tracking mode.


Include GPS  Include GPS option forces the SHOUT nano to attach GPS location to Check-In, canned and free-text messages. Under default setting, these messages do not have GPS information included. Messages with GPS location included can take longer to complete since the nano has to acquire a GPS fix first. Depending on the validity of the stored ephemeris data or the Accuracy setting, it could take an additional 29 seconds.


Format  Format option is used to select one of three different GPS position formats to be *displayed on the LCD screen*. This option is not to be confused with the Format option under Tracking, which defines the format of position report to be *transmitted to a NOC*.


Time and Date  Time and Date option is used to select UTC time and date formats to be displayed on the LCD screen for all menus. Local time zone can also be set.

Soft Keys  When tracking mode is enabled and the SHOUT nano is off (sleeps between reports), either Check-In or Way Point can be activated by pressing one of these two soft keys without first pressing the power on button. This feature can be disabled by using the Soft Keys option to prevent accidental powered up and, thus, forcing user to turn the nano on first by pressing the power button before activating the Check-In or Way Point soft key.

User Info  User Info option displays user information entered using SatTerm software.



Unit Info  Unit Info option displays the internal 9602 module's IMEI number, Iridium FCC ID, Iridium IC ID and the nano's firmware version.

Memory  Memory option is used to clear messages in all mail boxes or clear messages in each individual mail box—Drafts, Inbox, Outbox and Sent.

Reset  Reset option restores all setup parameters back to the manufacturer's settings. When Reset is selected, a screen will appear with the current settings and user will be asked to confirm whether or not to reset these current settings back to the manufacturer's default settings.

Additional Features

EMERGENCY (911) BUTTON


The red emergency 911 button  is located underneath a rotating guard in the back of the SHOUT nano. It can be used at anytime regardless of the tracking status (enabled or disabled) or the power status (on or off) of the device. When pressed, the emergency LED  immediately turns solid green to indicate that the device is in emergency mode. The LED can be deactivated to extend the battery life by using the Settings/LED/Power LED emergency option. If the LCD screen is on during emergency activation, the blue bars across the top and bottom of the screen turn red. The device sends three consecutive reports to a NOC as quickly as possible. After sending the first three emergency reports, the nano reverts back to the default emergency time-between-reports (TBR) of two minutes. During emergency a NOC can send an acknowledgement back to the nano.

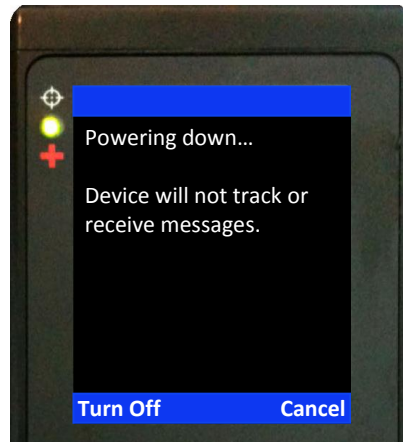


STATUS LED

There is one status LED on the top left of the SHOUT nano. The LED turns solid green when the nano is in emergency mode, which can be deactivated to save power using Settings/LED/Power LED Emergency option. It flashes once every five seconds when the nano is off and tracking is enabled. Again, it can be deactivated to save power using Setting/LED/Power LED Tracking option.

POWERING DOWN

The SHOUT nano can be powered down by holding the power On/Off  button for approximately two seconds. A power down screen will appear with a message indicating tracking and messaging will be completely turned off. The screen stays on for approximately ten seconds before shutting down. User can "Turn Off" the nano immediately by pressing the left soft key or can "Cancel" shut down by pressing the right soft key.



Appendix A: PMS Features

TRACKING



The nano is capable of sending position reports in PECOS Message Structure (PMS). The PMS complies with the Blue Force Tracking Data Format Specification as defined in the document PECOS 200708-001 Version 1.3. The nanos are shipped without PMS features activated and can only be enabled by NAL Research at the request of an authorized user. When PMS is enabled, the Format menu has an additional option called PECOS as shown in the figure below.

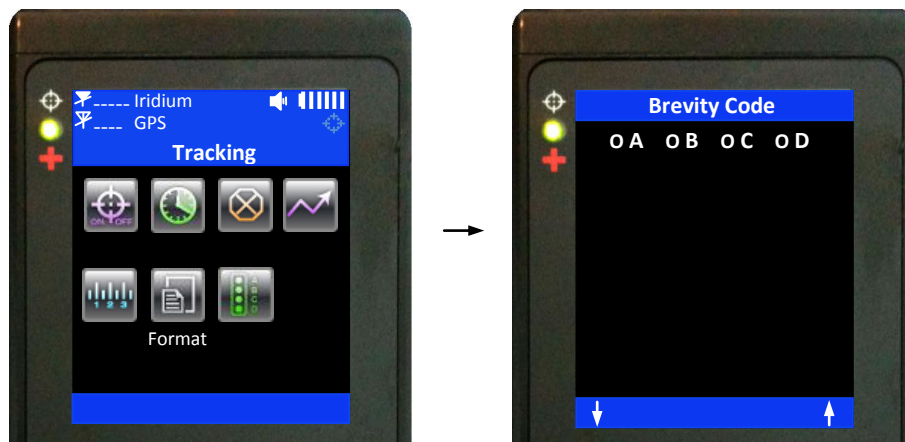


Brevity Code

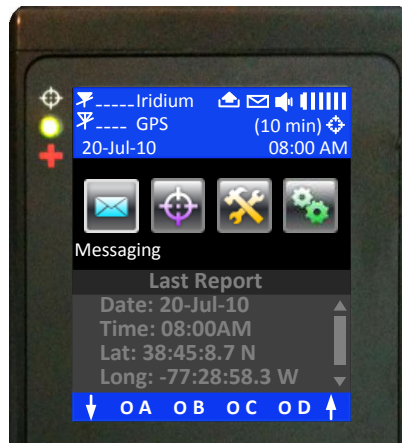


With PMS enabled, user has the option to select any one of sixteen Brevity Codes (0000 through 1111) to be included in the tracking reports. There are two ways to set the Brevity Code:

1. Under the Tracking/Brevity Code menu, the ↓ and ↑ soft keys can be pressed repeatedly to browse through the list of codes. The code appeared on the screen will be automatically used by the nano to include in the tracking reports. No further action is needed to select the brevity code.



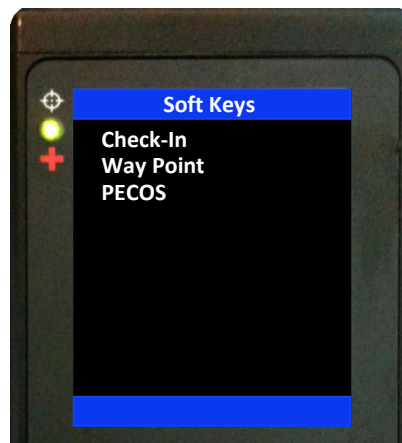
- When the PECOS format is selected using the Tracking/Format menu, the default Brevity Code setting appears at the bottom of the home screen replacing Check-In and Way Point. The ↓ and ↑ soft keys can be pressed repeatedly to browse through the list of Brevity Codes. The code appeared on the screen will be automatically used by the nano to include in the tracking reports. No further action is needed to select the brevity code.



Soft Keys

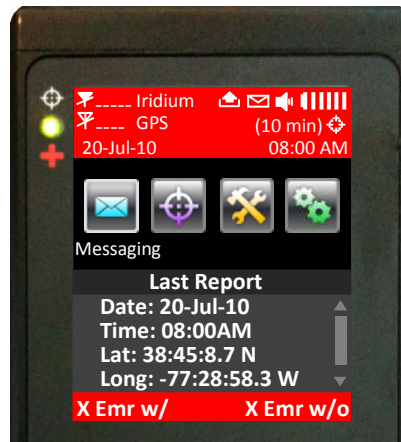


When the PECOS format is enabled using the Tracking/Format menu, the Check-In and Way Point features are replaced with the Brevity Code at the bottom of the home screen. User can override the Brevity Code soft keys and revert back to the Check-In and Way Point soft keys by going to the Settings/Soft Keys/PECOS menu to turn the PECOS soft keys off. After turning the PECOS soft keys off, the Brevity Code setting can only be configured through the Tracking/Brevity Code menu.



Cancel 911 With Soft Keys

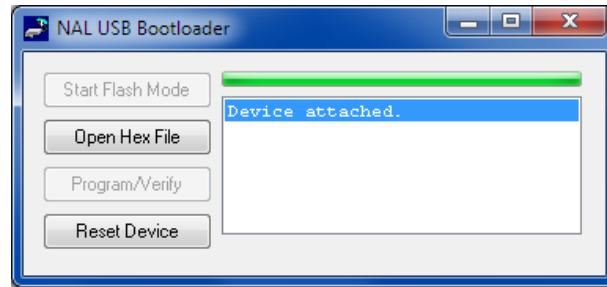
When the PECOS format is enabled and after the emergency button is pressed, the soft keys on the home screen are replaced with "X Emr w/" and "X Emr w/o" as shown in the figure below. As an alternative to using the Cancel 911 menu, these two soft keys can also be used to deactivate the emergency alert. Pressing the "X Emr w/" soft key is the same as choosing the With Gateway Ack under the Cancel 911 menu. Pressing the "X Emer w/o" soft key is the same as choosing the Without Gateway Ack under the Cancel 911 menu.



Appendix B: Upgrading the Firmware

The SHOUT nano firmware can be upgraded using a PC connected to the USB port of the device. The device drivers support Windows XP, Windows Vista and Windows 7.

1. Run the NAL USB Bootloader program.



2. With a USB cable attached to a computer and the device, press the "Start Flash Mode" button.
3. Wait until it activates and then press the "Open Hex File" button.
4. Browse and select a valid NAL device BIN file. NAL Research makes the BIN file available upon request.
5. Once the BIN file is loaded, press the "Program/Verify" button.
6. Wait for the programming to complete.
7. Press the "Reset Device" button.
8. The new firmware is now loaded on the device.

Appendix C: Power Consumption

The SHOUT nano has an internal 1.95 A-Hr Li-Ion rechargeable battery. When both the Iridium and GPS antennas have clear view of the sky and the battery is fully charged, the nano is capable of sending more than 1,500 tracking reports with the following settings: (1) report rate of less than two hours, (2) mailbox check rate and the report rate are the same and (3) Standard Accuracy. Blocked or partially blocked antennas will force the nano to retry multiple SBD transmissions for each report and, as a result, can significantly reduce the overall number of reporting cycles.

The nano saves valid ephemeris data after each 3-D fix. The data is used to reduce acquisition time in the next reporting cycle from cold-start to hot-start. If the ephemeris data is older than two hours (time between reports is set for more than two hours), the GPS receiver will go through cold-start each time it wakes up to send a report. As a result, the nano configured for report rate of more than two hours and Standard Accuracy can only send ~750 tracking reports. Setting the Accuracy to Best also reduces the number of tracking reports to ~750 regardless of the report rate setting.

IMPORTANT: Data presented here are only estimates and are highly dependent on the operating environment, accuracy setting and antenna type. Data are based on measurements made with multiple nano devices placed on the roof of NAL Research's facility with no blockage.

Each time the nano wakes up to send a report, it has two minutes to acquire a GPS fix and send an Iridium SBD message. Assuming the ephemeris data is valid (less than two hours old or time-between-reports is less than two hours) and the Accuracy option is set to Standard, the GPS receiver takes about 10 seconds for a position fix drawing approximately 55mA. The Iridium transceiver takes about 10 seconds to transmit an SBD message drawing an average current of 110mA. The nano circuit draws about 125mA during 25-second reporting cycle. The entire reporting cycle consumes ~1.32 mA-Hr of battery power. If the Iridium antenna is blocked or an overhead Iridium satellite is not available, the Iridium transceiver can potentially stay on for another 100 seconds in attempting to send a report. This results in additional consumption of 9.7 mA-Hr or 11 mA-Hr total. A missed report consumes ~8.5 times more power than a 'normal' transmitted report.

Appendix D: Design Specifications

The SHOUT nano comprises of a 9602 Iridium modem, a u-blox GPS receiver, a GPS and an Iridium antennas, a Li-Ion battery, an LCD and an NAL Research controller board. It is designed to operate with the Iridium network using SBD only.

Mechanical Specifications

Dimensions: 4.0" x 2.2" x 0.8" (102 mm x 56 mm x 20 mm)
Weight: ~6.5 oz (184 g)
Enclosure: Hard anodized aluminum housing/EMI shielding
Connector: USB
Antennas: Helix for Iridium and patch for GPS
Keyboard: Seven buttons
Emergency: Guarded button
LED: One status LED (power, tracking and emergency)

Electrical Specifications

Main Input Voltage: 3.0VDC to 5.0VDC
Peak Current: 1.5A @ 4.2VDC
Battery Type: Lithium Ion
Battery Capacity: 1.95 A-Hr
Charging Voltage: USB 1.0, USB 2.0 or 4–5VDC
Rechargeable Cycles: 500 times
Power Consumption: See previous section

Iridium Transceiver

Operating Frequency: 1616 to 1626 MHz
Duplexing Method: TDD
Multiplexing Method: TDMA/FDMA
Link Margin Downlink: 13 dB average (free space)
Link Margin Uplink: 7 dB average (free space)

GPS Receiver

GPS Receiver: u-blox NEO-5Q or NEO-6Q
Receiver Type: L1, C/A, 50-channel
Update Rate: 4 Hz
Accuracy: 2.5 m CEP (position)

2.0 m CEP (SBAS)
Acquisition: 29 seconds cold-start
29 seconds warm-start
<1 second hot-start
Sensitivity: -160 dBm (tracking)
-160 dBm (reacquisition)
-144 dBm (cold-start)

Environmental Specifications (Electronics)

Operating Temperature: -40°F to +185°F (-40°C to +85°C)
Operating Humidity: ≤ 75% RH
Storage Temperature: -40°F to +185°F (-40°C to +85°C)
Storage Humidity: ≤ 93% RH

Environmental Specifications (Battery)

Operating Temperature: -4°F to +140°F (-20°C to +60°C)
Operating Humidity: ≤ 90% RH
Storage Temperature: -4°F to +95°F (-20°C to +35°C)
Storage Humidity: ≤ 95% RH
Charge Temperature: 32°F to +113°F (0°C to +45°C)

Environmental Specifications (LCD)

Operating Temperature: -4°F to +131°F (-20°C to +55°C)
Operating Humidity Range: ≤ 90% RH
Storage Temperature Range: -40°F to +185°F (-40°C to +85°C)
Storage Humidity Range: ≤ 95% RH

Appendix E: Standard Compliance

The SHOUT nano has an internal Iridium 9602 transceiver. The 9602 is tested to the regulatory and technical certifications shown below. It is assigned to the FCC Identifier Q639602. The 9602 and, therefore, the SHOUT nano must not be readily accessible to human subjects closer than 20 centimeters.

REGULATORY APPROVALS	RADIO TESTS	EMC TESTS	MECHANICAL/ ELECTRICAL TESTS
CE	ETSI EN 301 441 V1.1.1 (2000-05)	ETSI EN 301 489-1 V1.4.1 (2002-08)	EN60950-1:2001 Part 1
FCC	FCC CFR47 Parts 2, 15, and 25	ETSI EN 301 489-20 V1.2.1 (2002-11)	UL60950-1 Part 1
Industry Canada	Industry Canada RSS170 Issue 1, Rev 1, November 6, 1999	EN61000-4-2: 1995/A2:2001 Part 4.2	
		EN61000-4-3: 2002 Part 4.3	
		EN61000-4-4: 1995/A1:2001/A2:2001 Part 4.4	
		EN61000-4-6: 1996/A1: 2001 Part 4.6	
		EN55022: 1998/A1: 2000/A2: 2003	

Appendix F: Export Compliance

The SHOUT nano is controlled by the export laws and regulations of the United States of America (US). It is the policy of NAL Research to fully comply with all U.S. export and economic sanction laws and regulations. The export of NAL Research products, services, hardware, software and technology must be made only in accordance with the laws, regulations and licensing requirements of the U.S. Government. NAL Research customers must also comply with these laws and regulations. Failure to comply can result in the imposition of fines and penalties, the loss of export privileges, and termination of your contractual agreements with NAL Research.

The export and re-export of NAL Research products and services are subject to regulation by the Export Administration Regulations (15 CFR 730-744), as administered by the U.S. Department of Commerce, Bureau of Industry and Security ("BIS"). See: <http://www.bxa.doc.gov> for further information on BIS and the Export Administration Regulations (EAR). Additional export restrictions are administered by the U.S. Department of the Treasury's Office of Foreign Asset Controls ("OFAC"). See: <http://www.ustreas.gov/ofac> for further information on OFAC and its requirements.