



SmartOne™ C User Manual



This guide is based on the production version of the Globalstar SmartOne C. Software changes may have occurred after this printing.

Globalstar reserves the right to make changes in technical and product specifications without prior notice

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Table of Contents

1. SmartOne Basics	1
Overview.....	1
Modes of Operation.....	1
Standard Messaging.....	1
Reduced Messaging.....	2
Theft Recovery	2
Inputs.....	3
Serial Commands.....	3
Satellite Communications.....	4
Globalstar Satellite Network.....	5
2. Getting Started.....	6
The SmartOne Device.....	6
Installing Batteries	6
Turning On and Off.....	6
Mounting	6
Programming Overview	7
Inputs	7
Installation of Configuration Software.....	7
Connecting Devices.....	7
3. SmartOne Configuration Software Overview.....	8
User Data Entry Pane	8
Status Pane	9
ESN Status Display Table	9
List ESN(s) Button	9
View Summary Button	9
PROGRAM Button.....	9
Toolbar	10
File Menu.....	10
Tools Menu.....	12
Help Menu	14
4. User Data Entry Pane	15
Getting Started Tab	15
Standard Messaging.....	15
Standard Messaging Mode - Without Motion	15
Standard Messaging Mode - With Motion	15

Reduced Messaging Mode	16
Theft Recovery Mode	16
Standard Messaging - Without Motion	16
Location Messages Tab	16
Input Settings Tab	18
Options Tab	19
Standard Messaging Mode - With Motion	20
Motion Settings Tab	20
Location Messages Tab	21
Input Settings Tab	22
Options Tab	23
Reduced Messaging Mode	24
Change Location Tab	24
Input Settings Tab	26
Options Tab	27
Theft Recovery Mode	28
Change Location Tab	28
Input Settings Tab	30
Options Tab	31
5. Messages	32
Global Message Type	32
Type 0 Message Class	32
Message Format	32
Location Message	34
Device Turned On Message	34
Change of Location Area Alert Message	34
Input Status Changed Message	34
Undesired Input State Message	34
Re-Center Message	34
Type 1 Message Class	35
Truncated Message Type – Single Packet	35
Truncated Message Type – Multiple Packet Version	36
Type 2 Message Class	37
Raw Message Type – Single Packet Version	37
Raw Message Type – Multiple Packet Version	37
Type 3 Message Class	38
Diagnostic Message	38

Replace Battery Message	39
Contact Service Provider Message	39
Accumulate/Count Message	39
Messaging Priority	40
Prioritization of Periodic Standard Message Report Rates	40
Message Priorities	40
6. Serial Commands	41
Serial Packet Format (commands and answers)	41
Serial Packet Fields	41
CRC Algorithm	42
Serial Packet Types	42
Send Truncated Message (serial message type 0x26)	43
Send Raw Message (serial message type 0x27)	44
The Handshake Line	45
7. Connecting Serial Devices to the SmartOne	46
Appendix A - Glossary of Terms	47
Appendix B - Technical Support	50
Appendix C - RF Radiation Exposure Statement	51
Appendix D - Regulatory Notices	52
FCC/IC Notices	52
CAN ICES-3(A)/NMB-3(A)	52
Avis de la FCC/IC	52
CAN ICES-3(A)/NMB-3(A)1	52
CE Notices	53
Appendix E – General Warnings	54
Appendix F – Specifications & Standards	55
Appendix G – Latitude/Longitude Decoding	56
Appendix H – Standard Message Decoding	57
Appendix I - Diagnostic Message Decoding	58
Appendix J - Accumulate/Count Message Decoding	59
Appendix K - External Input Cables	60
Appendix L – Battery Life Estimate	61

1. SmartOne Basics

Overview

The SmartOne is designed to track the positions of trailers, cargo containers, heavy construction equipment, generators, boats/barges and any other mobile assets. The SmartOne also has 2 inputs to manage run time of engines and/or other alarm inputs.

The SmartOne processes GPS satellite signals to obtain its position in terms of longitude and latitude and transmits this information over Globalstar's Satellite Network. In addition to position information, the SmartOne transmits other message types that include battery status, input alarm status and diagnostic information. The SmartOne is configured using a computer and USB configuration cable to communicate these messages at certain times and/or under certain conditions.



Modes of Operation

The SmartOne can be configured to operate in three different Modes:

- Standard Messaging Mode
- Reduced Messaging Mode
- Theft Recovery Mode.

Standard Messaging

In Standard Messaging Mode, the SmartOne reports its position at regular time intervals that are programmed during the configuration process. Standard Messaging Mode can also be configured to utilize the SmartOne's internal motion sensor. If enabled, the SmartOne will transmit its position at independently configured regular time intervals when the device is In Motion.

Location messages can be programmed to be constant (Message Interval) or the device may be configured to use up to 12 different delays in sequence (Message-Time(s) of Day). Message Interval can be programmed in 1 minute intervals from 35 minutes up to 45 days.

- **Example of Message Interval:** The SmartOne is configured to report once every 24 hours when not In Motion and every 2 hours when In Motion. If the SmartOne went into motion at any time of day the Message Interval while In Motion would be every 2 hours beginning when the SmartOne started moving.
- **Example of Message-Time(s) of Day:** The SmartOne is configured with a message time of day of 9:00am, a second message time of day of 12:00 noon, a third message time of day of 8:00pm and once per hour when In Motion. The SmartOne would transmit 3 messages a day at the same configured times every day. If the SmartOne went In Motion it would transmit its location message every hour.
- **Usage Example:** A Company is required to report the GPS locations of their hazardous chemical containers twice a day. Based on this requirement the Company has 2 options: set a message interval of every 12 hours, the 12 hour interval begins when the device is powered up or when the configure message times of day are 12:00 noon and 12:00 midnight.

Reduced Messaging

Reduced Messaging Mode lowers the cost associated with transmitting messages over Globalstar's satellite network by sending messages at a minimal message interval when the asset is in a defined area and transmits at a higher message interval when the asset is changing locations. These message intervals are set as part of the configuration process based on the concept that repeated reporting information of the same location, when an asset has not moved from its defined area, is redundant and doesn't provide additional usable information about its current location.

By comparing current and prior position information, the SmartOne determines if its location is changing. The definable area in which the device should remain in Reduced Messaging Mode is called the Change of Location Area and it is a square. When the SmartOne goes outside of the square, its location is considered to be changing or relocating.

Usage Example: A fleet operator owns 1,000 trailers. When the trailer(s) are sitting at a depot they want a location message once a day. They also want a message notification within 1 hour when a trailer has left a depot. Lastly, they want a location message every 3 hours when a trailer is moving between depots. Based on this requirement, the fleet operator will need to set the Change of Location Area (size of the depots where the trailers will visit), the message interval while the trailers are inside the Change of Location Area (1 per day), the interval at which the SmartOne will check its location while in a State of Vibration and inside the Change of Location Area (1 per hour), set the number of messages when the trailer leaves the Change of Location Area (1 Change of Location Area Alert Message) and the message interval while the trailers are in transit between depots (every 3 hours).

Theft Recovery

When the SmartOne is configured to operate in the Theft Recovery Mode, it differentiates between authorized and unauthorized movement of an asset. While the power to the SmartOne is turned off, all movement of the asset is considered authorized. When power is turned on, the SmartOne obtains a position from GPS satellites. The position is used to set the center of the defined Change of Location Area in Theft Recovery Mode. While in the Change of Location Area, the SmartOne obtains position fixes at an interval set during configuration. As long as the SmartOne remains within the Change of Location Area all movement is considered to be authorized.

Once the SmartOne's position is outside of the Change of Location Area, it alerts the SmartOne to an unauthorized movement and immediately sends a location message (Change of Location Alert Message). The SmartOne continues to send location messages at a message interval set during the configuration process until the power is turned off or the battery is dead.

Usage Example: A construction company is working on a job site for 1 year and wants to ensure that their generators and other heavy equipment on site aren't stolen. The company wants to check the location of their equipment 12 times a day, every 2 hours, to confirm the asset hasn't been stolen, but only wants a transmitted location message once per day. Based on this requirement, the construction company will need to set the Change of Location Area (size of the job site), the message interval while inside the Change of Location Area (1 per day), the interval at which the SmartOne will check its location while in a State of Vibration and within the Change of Location Area (every 2 hours) and the message interval if the asset is outside the Change of Location Area (stolen).

Inputs

The SmartOne has an I/O port that provides ground, two dry contact inputs, power and soft-power down inputs.

The SmartOne allows sending Input Status Changed Messages for both Input 1 and Input 2. The Inputs must be asserted for at least 5 seconds in order to be acknowledged.

Usage Example: A construction company needs to document, per their contract, when they begin their work day and when they end their work day. Based on this requirement, the SmartOne would be connected to the ignition switch and configured to send a transmission with location when the input changes state.

The SmartOne also allows the user to define the Message Interval while the Inputs are in an Undesired State, either Opened or Closed.

Usage Example: A company has remote containers at job sites and would like to know if a door is ajar. If a door is left ajar the company would like a notification every 2 hours. Based on this requirement, the SmartOne would be connected to an open door sensor with the Undesired Input State Message enabled and set as Opened with a Message Interval of 2 hours.

Note: The SmartOne uses a 5 minute "hysteresis" window to prevent sending false alarms. This means that only one status change message can be sent during any 5 minute time window. Any subsequent status changes will be detected but not reported. Multiple status changes during any 5 minute window will result in the transmission of incorrect trigger bits. Refer to page 33 for Input Status Changed Message.

The SmartOne has the ability to send an Accumulate/Count Message at a regular configurable interval and/or based on configurable multiples of accumulated hours and/or number of counted events or hours of vibration.

Usage Example 1: A construction company needs weekly engine run times for their heavy equipment to manage their maintenance scheduling. Based on this requirement, the company would schedule a weekly Accumulate/Count Message.

Usage Example 2: A construction company wants to insure that no equipment is ever operated beyond 400 hours without maintenance. Based on this requirement, the company would schedule an Accumulate/Count Message for every 400 hours of use.

The SmartOne has the ability to send both Status Change and Undesired State messages based on vibration.

Serial Commands

The SmartOne uses the I/O port for unit configuration as well as interface to remote passive and smart sensors. Two commands are provided in the unit interface to support smart sensors. External sensors or instruments, that can format and communicate with the SmartOne, can send user data through the SmartOne by using these two commands.

The SmartOne connects to smart sensors via the SmartOne External Input Cable (see Appendix K – External Input Cable)

Satellite Communications

The SmartOne communicates with both the GPS satellite network and the Globalstar Satellite Network. All GPS locations are pulled from the GPS network and all transmissions are sent via the Globalstar Satellite Network.

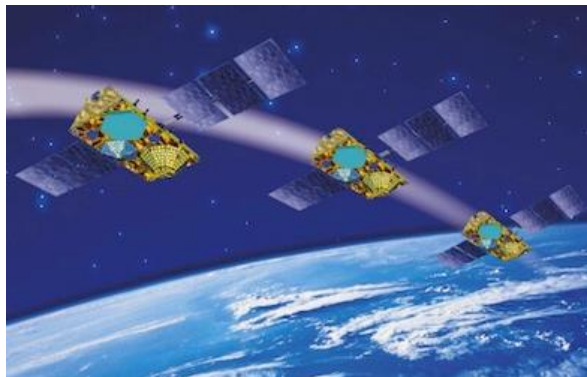


The SmartOne has the unique ability to check its GPS coordinates at a programmable rate while it is inside of the Change of Location Area without actually sending a message over the Globalstar Satellite Network.

For a Location Message, the SmartOne will wake up at a scheduled interval or time of day and begin to acquire a GPS fix. Once it receives its GPS fix, the SmartOne will transmit its location to the Globalstar Satellite Network.

Globalstar Satellite Network

The network consists of 32 Low Earth Orbiting (LEO) satellites that are constantly orbiting the earth and complete their orbits in less than 2 hours. Because of this, the SmartOne will be in contact with at least one of the satellites during each scheduled transmission. In LEO communication networks, the satellites are constantly changing their positions in the sky relative to the transmitter on earth. This minimized the shading effects seen in geostationary satellite systems where the mobile device must be pointed toward a specific direction in the sky. Geostationary satellites also orbit at a much higher altitude and move along the equator.



Messages are transmitted from the SmartOne via the Globalstar Satellite Network using an uplink-only connection (one-way data transmission) and received by a Globalstar Ground Station. The messages are then sent via an HTTP or FTP server to the internet and received by the VAR or end customer's back office application and converted into actionable data.

The SmartOne will send each message 3 times to insure that the message has been received by the Globalstar Satellite Constellation. Once Globalstar receives the message, any remaining duplicate messages are ignored and discarded (VAR or end user account is only charged for 1 transmission).

2. Getting Started

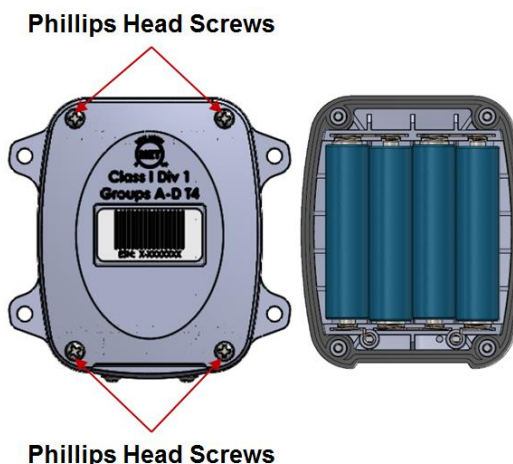
The SmartOne Device

Installing Batteries

The SmartOne C is powered by, and comes with, four installed 1.5v Lithium AAA batteries. The battery compartment is accessible from the bottom of the device by removing the four Philips head screws. Remove the water-tight cover and insert the batteries to align with the positive and negative markers.

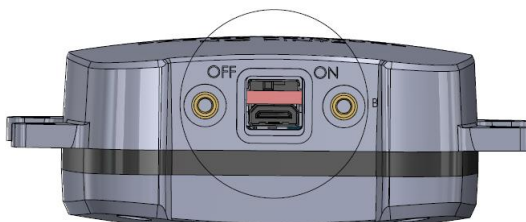
Note: When the batteries are removed and replaced the device will retain its configuration.

Caution: Replaceable Batteries: Risk of explosion of battery if replaced by an incorrect type. Dispose of used batteries according to the manufacturer's instructions.



Turning On and Off

To turn the device ON or OFF, remove the connector cover from the end of the device. Then slide the switch actuator towards the desired direction of the ON or OFF markings.



Mounting

The SmartOne is designed to be mounted to an asset using double-sided adhesive tape and/or the included mounting bracket. The mounting bracket has four screws that attach to the asset and allows the SmartOne to be mounted so the antenna can face the sky whether mounted internally or externally. This enables the antenna to have a direct view of the sky with mounting flexibility. The SmartOne attaches to the mounting bracket using four Phillips-head screws.

Mounting Bracket Screws



Mounting Bracket Screws

Programming Overview

The SmartOne comes ready to use with a factory configuration loaded in the device. The factory configuration, Standard Messaging without Motion and Interval Messaging of 12 hours, may be changed using the SmartOne Configuration Software, the USB Configuration Cable and a PC.

Inputs

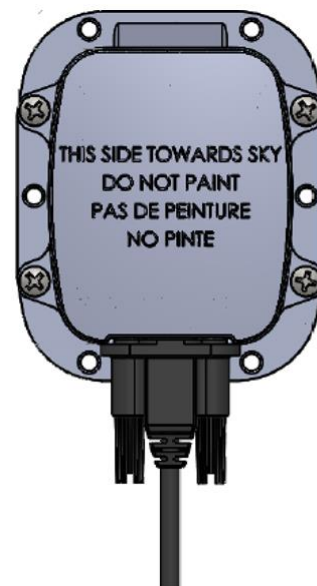
The SmartOne has two inputs that can be accessed by using the SmartOne External Input Cable, which is sold as an accessory to the device.

Installation of Configuration Software

The SmartOne Configuration Software can be downloaded from the Globalstar website at <http://var.globalstar.com>. Log-in to your VAR account using your username and password. The Configuration Software is located in the software downloads section and is supported by Windows 7, Windows Vista, Windows XP Service Pack 2, Windows 2000 and Windows 98.

Connecting Devices

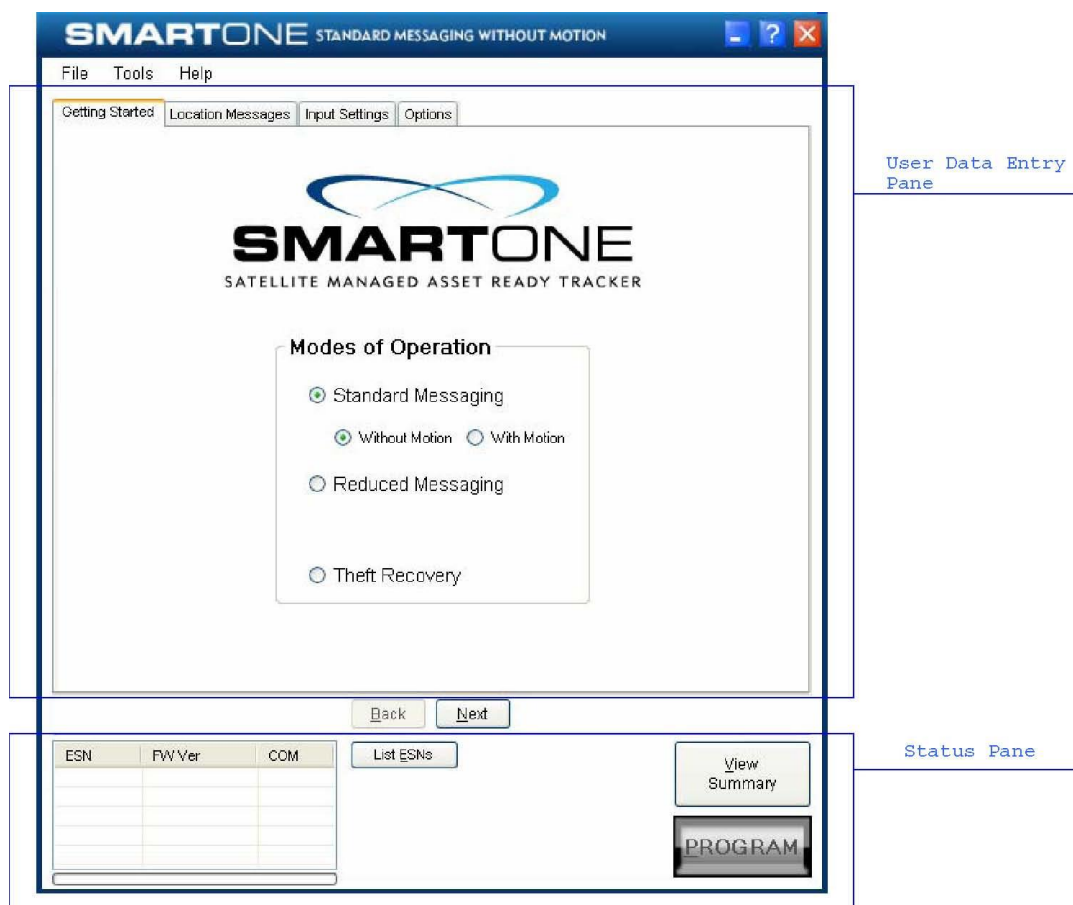
The SmartOne, with batteries installed and battery cover screwed down, connects to a PC using a USB Configuration Cable. The SmartOne Configuration Software may be used without being connected to devices to prepare configurations, but must be connected to a device using the USB Configuration Cable to Program. Once the Program button has been depressed the Configuration Cable should not be disconnected, if already connected, from the device and/or the computer. The USB Configuration Cable plugs into the SmartOne when the connector cover is removed.



USB Configuration Cable

3. SmartOne Configuration Software Overview

Once installed on a PC, the SmartOne Configuration Software is used to configure SmartOne's. The configuration has a tab-based, context-switched user data entry pane on the top screen of the window and a static status pane on the bottom.

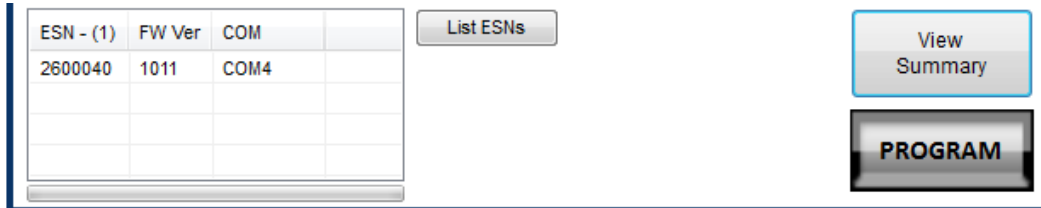


User Data Entry Pane

The user data entry pane contains a context-switched user entry area for displaying and inputting configuration data. The information is organized in pages with page manipulation provided through tabs along the top of the pane. Selecting a tab will change the context of the upper pane. The tabs are named to group similar functions on the same page. The tabs will change according to the operation Mode selected. The Back and Next buttons allow the user to move from tab to tab without clicking on the tab name.

Status Pane

The Status Pane contains a table with a list of devices connected to the PC, their ESN(s), firmware version and COMM port assigned to each device as well as the execution buttons for configuring connected SmartOne(s).



ESN Status Display Table

- **ESN Column** - This column displays a list of the Electronic Serial Numbers for SmartOne(s) connected to the PC.
- **FW Ver Column** - This column displays a list of firmware version for the main processor for each SmartOne in the list.
- **COM Column** - This column displays a list of the assigned communication ports for each SmartOne.

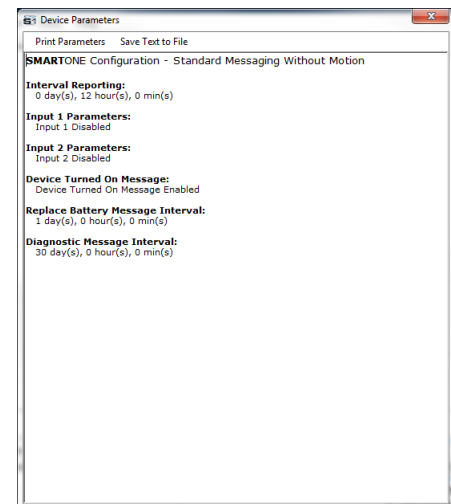
List ESN(s) Button

This button shall cause the Configuration Software to search for any valid devices that are connected to the PC. (A pop up window informs the user that the program is searching for devices connected to the computer while this search is being performed.)

View Summary Button

This button causes the Configuration Software to open a separate window, which contains plain text readout of every user configurable parameter that exists for the SmartOne.

- The Menu Bar in the View Summary Window allows the user to either print the parameters or save the configuration parameters to a text file.
- This window remains open while the user manipulates the fields in the User Data Entry Pane tabs and will update as changes are made.

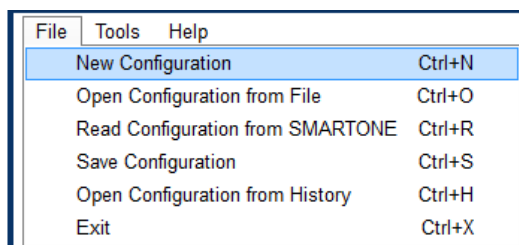


PROGRAM Button

The Program button in the Status Pane is used to send the data in the configuration software to the connected SmartOne(s). The SmartOne will be updated with the data from the Configuration Software. The user is queried to confirm device program before execution of the function.

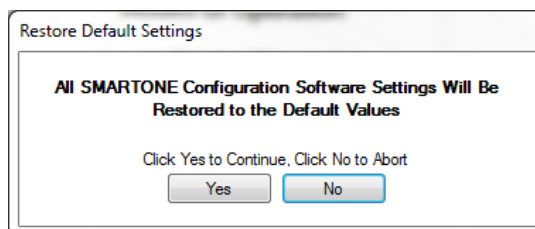
Toolbar

File Menu



- **New Configuration** - This will reset the values for all configurable parameters to default. Standard Messaging without Motion with a transmission every 12 hours is the default Mode of operation.

This selection will open a prompt window asking for confirmation to restore all settings to their default. This will not affect the settings stored inside the connected SmartOne(s). The settings will only reset in the software display, not in any device(s) connected to the PC unless the **PROGRAM** button is clicked to download configuration to the device.

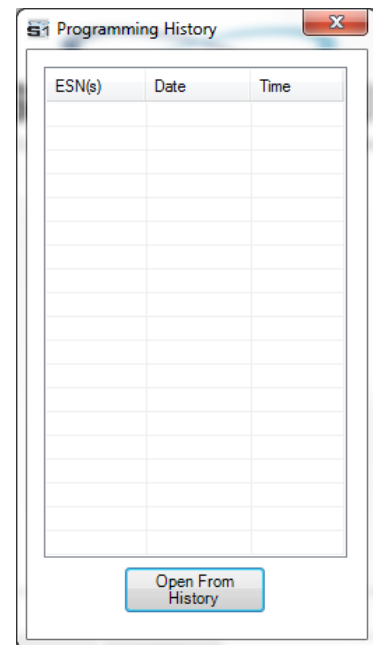


- **Open Configuration from File.** This opens a window that allows the user to browse for a valid configuration file that has previously been saved. Selecting a file will cause all of the settings contained in the file to be loaded into the software display only, not in any devices connected to the PC. Click the PROGRAM button to download configuration to the device.
- **Read Configuration from SmartOne.** This will query all of the configurable parameters saved in a device connected to the PC. The values for each configurable parameter in the device will be displayed in the User Data Entry Pane.
- **Save Configuration.** This will open a window that allows the user to browse to a location and save all of the configuration settings to two separate files:
 - The configuration file. This file is non-editable.
 - A text file. An ASCII format file that contains each parameter and
 - Parameter value in a standard delimited format.

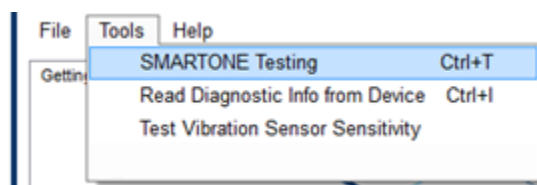
- **Open Configuration from History.** Every time a device is successfully programmed, the configuration will save that occurrence to a text log file. The information stored is the ESN of the device, the local time at which it was programmed and the actual configuration of the device.

When selected, a window opens where the user can sort by ESN or date/time of programming and select a configuration. This loads the selected configuration settings into the User Data Entry Pane, but not into any device(s) connected to the PC.

- **Exit.** This causes the program to close.

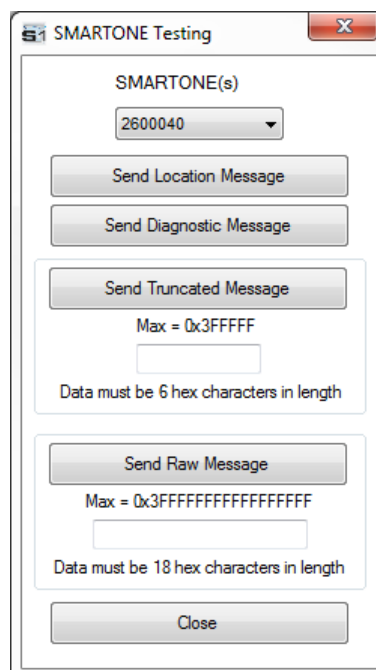


Tools Menu



- **SmartOne Testing** - This command opens up a window with the following options:

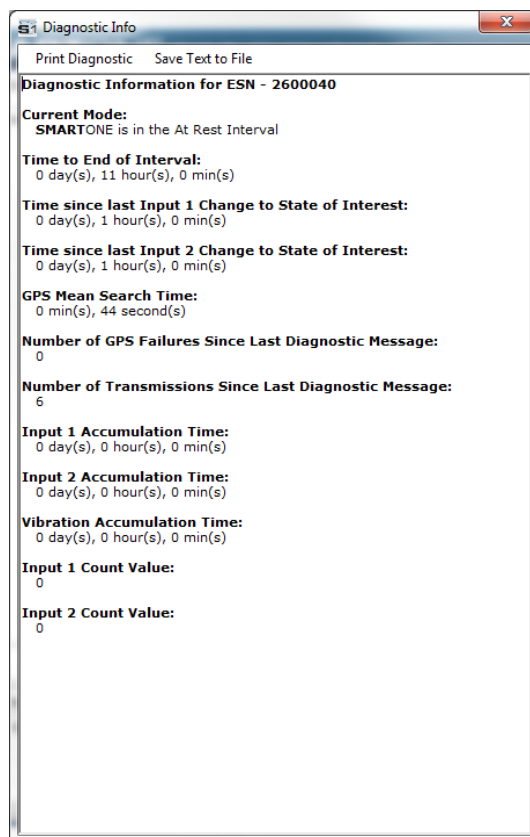
- **Send Location Message Button** - Causes the SmartOne connected to the COM port to obtain a GPS fix and send a Location Message.
- **Send Diagnostic Message Button** - Causes the SmartOne connected to send diagnostic information including battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.
- **Send Truncated Message Button** - Causes the SmartOne to seek a GPS location, and then send a Truncated SmartOne message (type 1). The hex-character data in the text box below the command will be appended to the GPS data and sent.
- **Send Raw Message Button** - Causes the SmartOne to send the first 8 bytes of data in the text box below the command as the payload for the Raw Payload Message (type 2). The hex-character data in the text box below the command will be sent instead of the normal SmartOne position data.
- **Close Button** - Causes the pop up window to close.



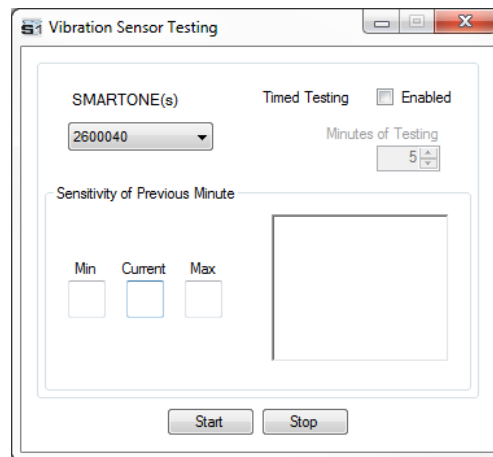
- **Read Diagnostic Information from Device.** This command line causes the Configuration Software to query the diagnostic information from the SmartOne and display the information in a pop up window in a text format.

There are two menu options available in the pop up window:

- **Print Diagnostic** – Prints the diagnostic information.
- **Save Text to File** – Opens a window, which allows the user to browse for a location and save the diagnostic information in a text file.



- **Test Vibration Sensor Sensitivity** - Is used to find the minimum, maximum and average vibration sensitivity detected by the sensor. This information helps to determine the appropriate Level of Sensitivity for the motion sensor. This window will update real time while connected to the SmartOne.



Help Menu



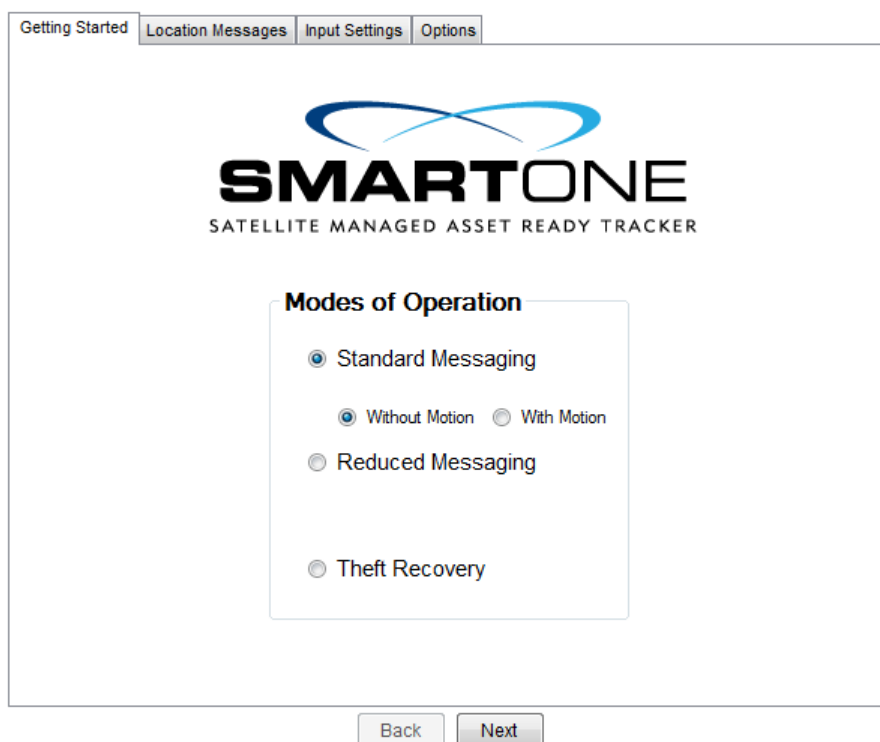
- **Product Specification.** This opens a PDF displaying the SmartOne's technical specifications
- **SmartOne Website.** This opens the SmartOne landing page located on the Globalstar website, displaying the SmartOne's features, accessories and how to buy.
- **Mixed Products Welcome.** This opens a dialog box stating that the SmartOne Configuration Software has been updated to be able to program both SmartOne Bs and SmartOne Cs. Additionally instructions on how to use a SmartOne B Configuration File are displayed.
- **About.** This pops up a window with the SmartOne Configuration version number.

4. User Data Entry Pane

Getting Started Tab

The Getting Started Tab allows the user to select the Mode of operation for the SmartOne. The Modes includes:

- Standard Messaging with or without motion
- Reduced Messaging
- Theft Recovery Mode.



The screenshot shows the 'Getting Started' tab of the SmartOne configuration interface. At the top, there are four tabs: 'Getting Started', 'Location Messages', 'Input Settings', and 'Options'. The 'Getting Started' tab is active. Below the tabs is the SmartOne logo, which consists of a blue infinity-like symbol above the word 'SMARTONE' in bold, and the text 'SATELLITE MANAGED ASSET READY TRACKER' below it. In the center, there is a box titled 'Modes of Operation'. Inside this box, there are four radio button options: 'Standard Messaging' (which is selected), 'Without Motion' (with a sub-radio for 'Without Motion' selected), 'With Motion' (with a sub-radio for 'With Motion' selected), 'Reduced Messaging', and 'Theft Recovery'. At the bottom of the screen, there are two buttons: 'Back' and 'Next'.

Standard Messaging

Standard Messaging Mode - Without Motion

The Standard Messaging without Motion Mode is selected for basic tracking functionality on the SmartOne. The SmartOne will automatically report its position at regular time intervals. The messages sent in this Mode are called Location Messages. These messages include the GPS coordinates of the actual location of the SmartOne.

In this Mode, the motion sensor is OFF.

Standard Messaging Mode - With Motion

The Standard Messaging with Motion Mode is selected for basic tracking functionality with motion detection capabilities. The user defines the motion parameters for each application including the Level of Sensitivity of the motion sensor, Time to be in a State of Vibration and Time to be in a State of Lacking Vibration. The SmartOne can be set to report at a different rate, Message Interval while In Motion, compared to the Location Message Interval.

Reduced Messaging Mode

The Reduced Messaging Mode is ideal for asset management with reduced messaging capability of the SmartOne. The SmartOne creates a Change of Location Area of configurable size around the device. If the SmartOne stays within its Change of Location Area, the number of transmissions will be reduced.

When the SmartOne leaves the Change of Location Area and returned to a State of Lacking Vibration a new Change of Location Area is created around the SmartOne.

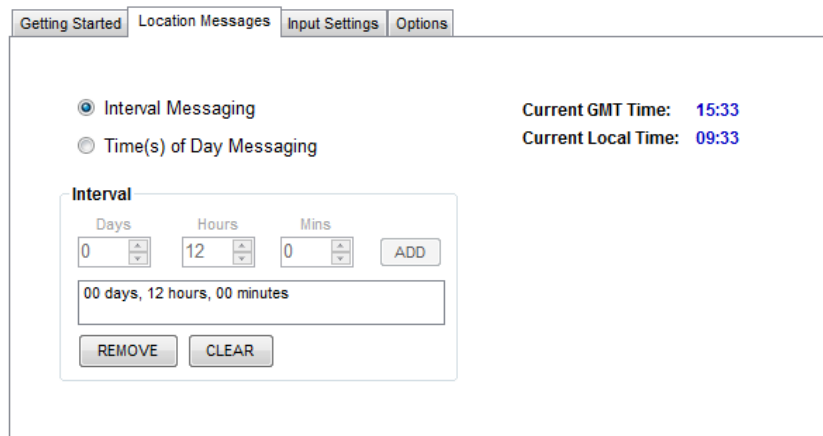
Theft Recovery Mode

The Theft Recovery Mode is ideal for assets that are high-risk for theft. In this Mode, the SmartOne creates a Change of Location Area around its location when powered. The size of the Change of Location Area is a configurable parameter equal to the distance the device must move to be considered outside the Change of Location Area. If outside the Change of Location Area, the SmartOne goes into recovery Mode, transmitting frequent messages until the asset is recovered. The message interval in recovery Mode is a configurable parameter; however, the default value is 10 minutes.

Standard Messaging - Without Motion

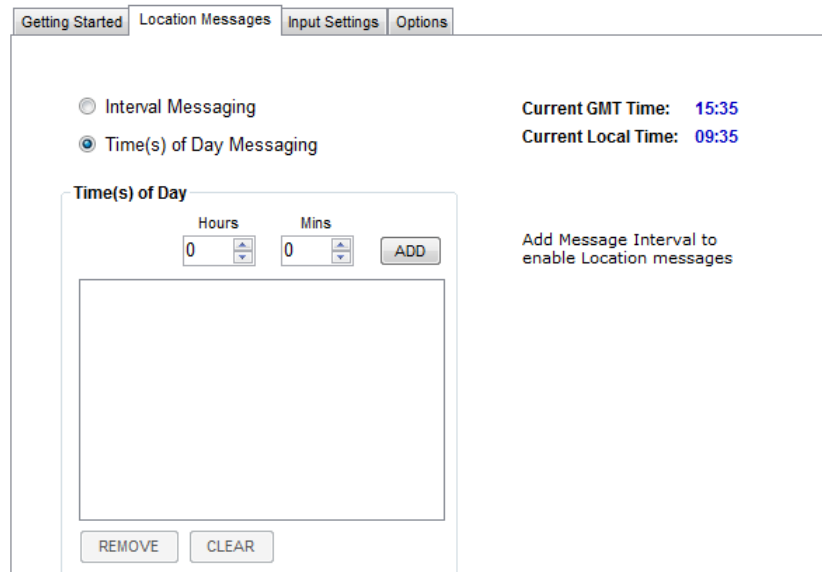
Location Messages Tab

- **Interval Messaging** - The SmartOne can be configured to report at a specific message interval specified by days, hours and minutes. The SmartOne accepts a single interval only.
 - Click the **ADD** button to accept the interval and add it to the message interval box.
 - Click the **REMOVE** button to delete the selected time of day or interval from the message interval box.
- Click the **CLEAR** button to delete all the time of days or interval in the message interval box.



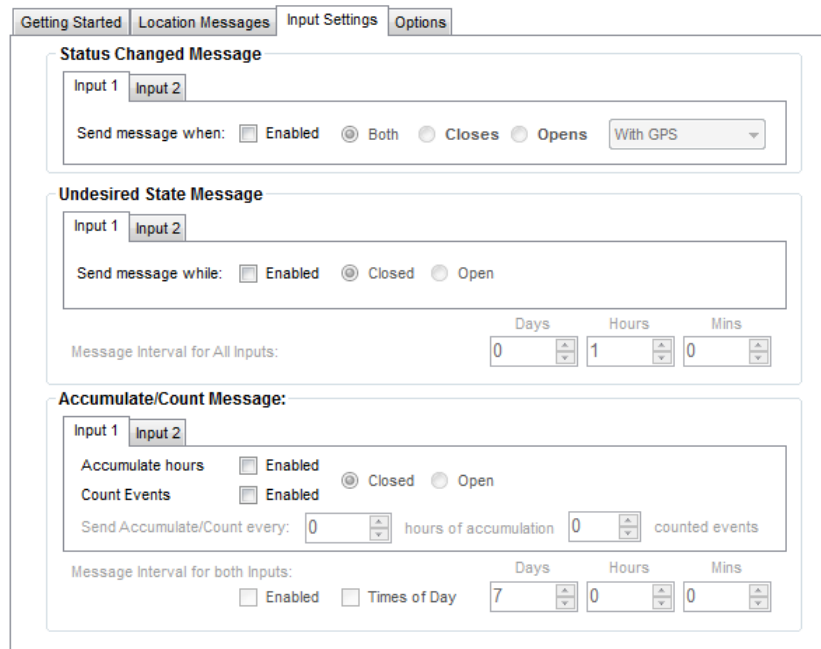
The screenshot shows the 'Location Messages' tab selected in a menu bar with options: 'Getting Started', 'Location Messages', 'Input Settings', and 'Options'. Below the menu, there are two radio buttons: 'Interval Messaging' (selected) and 'Time(s) of Day Messaging'. To the right, it displays 'Current GMT Time: 15:33' and 'Current Local Time: 09:33'. Under the 'Interval' section, there are three input fields for 'Days' (0), 'Hours' (12), and 'Mins' (0), each with up/down arrows. An 'ADD' button is to the right of these fields. Below the input fields, a text box shows '00 days, 12 hours, 00 minutes'. At the bottom of this section are 'REMOVE' and 'CLEAR' buttons.

- Time(s) of Day Messaging. The SmartOne can be configured to report at specific time(s) of day. The message interval box allows up to 12 times of day to send Location Messages.
 - Click the **ADD** button to accept the interval and add it to the message interval box.
 - Click the **REMOVE** button to delete the selected time of day or interval from the message interval box.
- Click the **CLEAR** button to delete all the time of days or interval in the message interval box.



The screenshot shows the 'Location Messages' tab in the configuration interface. It features two radio buttons: 'Interval Messaging' and 'Time(s) of Day Messaging', with the latter selected. To the right, it displays 'Current GMT Time: 15:35' and 'Current Local Time: 09:35'. Below the radio buttons, there is a 'Time(s) of Day' section with 'Hours' and 'Mins' spinners (both set to 0) and an 'ADD' button. A large empty rectangular box is provided for listing intervals. At the bottom of this section are 'REMOVE' and 'CLEAR' buttons. To the right of the 'Time(s) of Day' section, a text prompt reads: 'Add Message Interval to enable Location messages'.

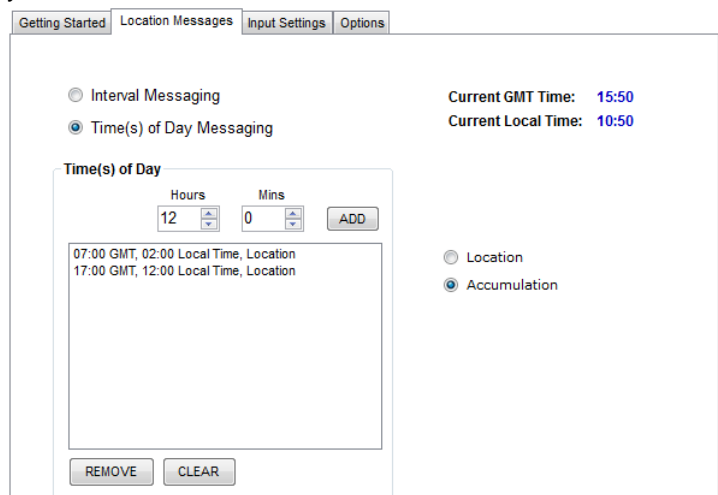
Input Settings Tab



The screenshot shows the 'Input Settings' tab with three main sections:

- Status Changed Message:** Includes 'Input 1' and 'Input 2' tabs. The 'Send message when' section has checkboxes for 'Enabled', 'Both' (selected), 'Closes', and 'Opens', along with a 'With GPS' dropdown menu.
- Undesired State Message:** Includes 'Input 1' and 'Input 2' tabs. The 'Send message while' section has checkboxes for 'Enabled', 'Closed' (selected), and 'Open'. Below this is a 'Message Interval for All Inputs' section with spinners for Days (0), Hours (1), and Mins (0).
- Accumulate/Count Message:** Includes 'Input 1' and 'Input 2' tabs. It has checkboxes for 'Accumulate hours' and 'Count Events' (both selected). The 'Send Accumulate/Count every' section has spinners for 'hours of accumulation' (0) and 'counted events' (0). Below this is a 'Message Interval for both Inputs' section with checkboxes for 'Enabled' and 'Times of Day', and spinners for Days (7), Hours (0), and Mins (0).

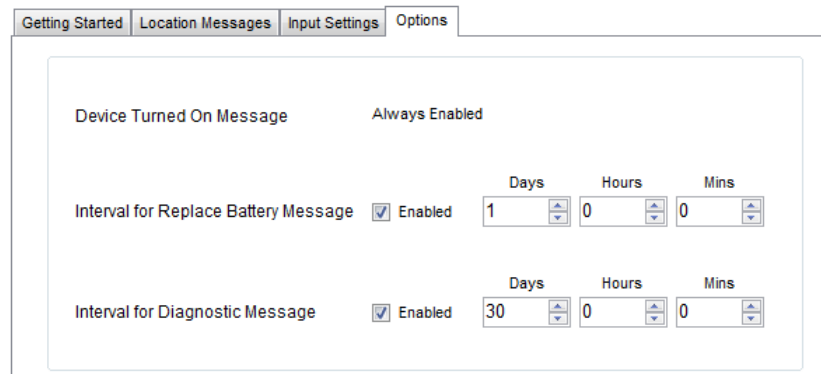
- **Status Changed Message** - The SmartOne has two inputs that can be configured to send a Status Changed Message once the selected input Opens, Closes, or Both. The Message sent can either contain or not contain the GPS coordinates of the device at the time the status of the input(s) changed.
- **Undesired State Message** - The SmartOne can be configured to send messages throughout the time the input is in the undesired state, either to the Open or Closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is disabled, the SmartOne will return to the message interval or time (s) of day for Location Messages.
- **Accumulate/Count Message** - The SmartOne can accumulate hours and count events while input 1 or input 2 is enabled. The SmartOne can send an accumulate/count message once the configurable intervals specified in days, hours, and minutes.
 - If Time(s) of Day Messaging was selected, user will specify the times in the Location Message Tab.



The screenshot shows the 'Location Messages' tab with the following elements:

- Navigation tabs: 'Getting Started', 'Location Messages' (selected), 'Input Settings', and 'Options'.
- Radio buttons for 'Interval Messaging' and 'Time(s) of Day Messaging' (selected).
- Current time display: 'Current GMT Time: 15:50' and 'Current Local Time: 10:50'.
- Time(s) of Day** section: Includes 'Hours' (12) and 'Mins' (0) spinners, an 'ADD' button, and a list box containing '07:00 GMT, 02:00 Local Time, Location' and '17:00 GMT, 12:00 Local Time, Location'.
- Radio buttons for 'Location' and 'Accumulation' (selected).
- 'REMOVE' and 'CLEAR' buttons at the bottom.

Options Tab



The screenshot shows the 'Options' tab of the SmartOne C configuration interface. It contains three settings:

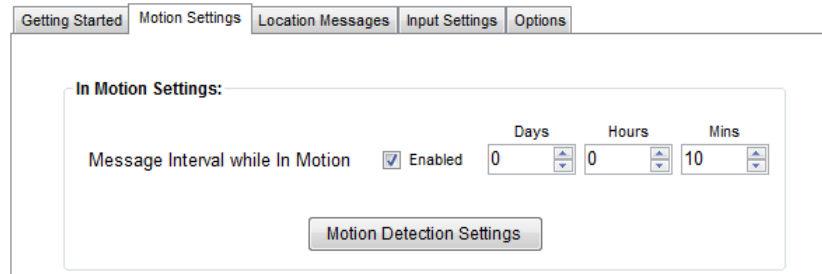
- Device Turned On Message**: Always Enabled
- Interval for Replace Battery Message**: ☒ Enabled. Days: 1, Hours: 0, Mins: 0.
- Interval for Diagnostic Message**: ☒ Enabled. Days: 30, Hours: 0, Mins: 0.

- **Device Turned On Message** - The SmartOne is configured to send a Device Turned On Message on Power-up by default.
- **Interval for Replace Battery Message** - The SmartOne can be configured to transmit a Replace Battery message based on a low battery condition.
 - Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.
 - The SmartOne will detect low battery conditions while at least 100 more messages can still be transmitted.
- **Interval for Diagnostic Message** - The SmartOne can send a diagnostic message with information on the diagnostic status of the device.
 - The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.
 - Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

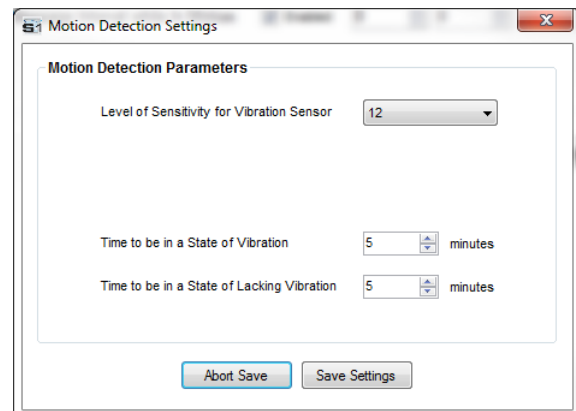
Standard Messaging Mode - With Motion

Motion Settings Tab

The Motion Settings Tab of the Configuration Software is used to define the Message Interval while In Motion. This tab also contains the Motion Sensor Settings, which define how the sensitivity of the motion sensor and how it determines the device is In Motion.

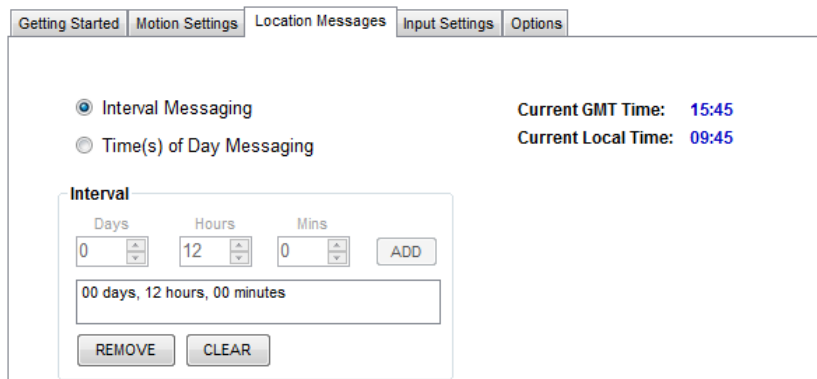


- **Message Interval while In Motion** - This parameter defines the transmission interval of location messages while SmartOne is In Motion with a transmission rate between 5 to 65,000 minutes (45 Days). The default is 10 minutes.
- **Motion Detection Settings Button** - This button activates the Motion Detection Settings window. This window contains settings to define how the motion sensor determines that the SmartOne is In Motion. These parameters include Level of Sensitivity for Vibration Sensor, Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.
 - **Level of Sensitivity for Vibration Sensor.** The motion sensor has a range of sensitivity from 1 to 31 (1 being most sensitive and 31 being least sensitive). The smaller the sensitivity level, the more sensitive the motion sensor would be to movement.
 - **Time to be in a State of Vibration.** Time the motion sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration.
 - **Time to be in a State of Lacking Vibration.** Time the vibration sensor must be below the sensitivity level before in a State of Lacking Vibration.



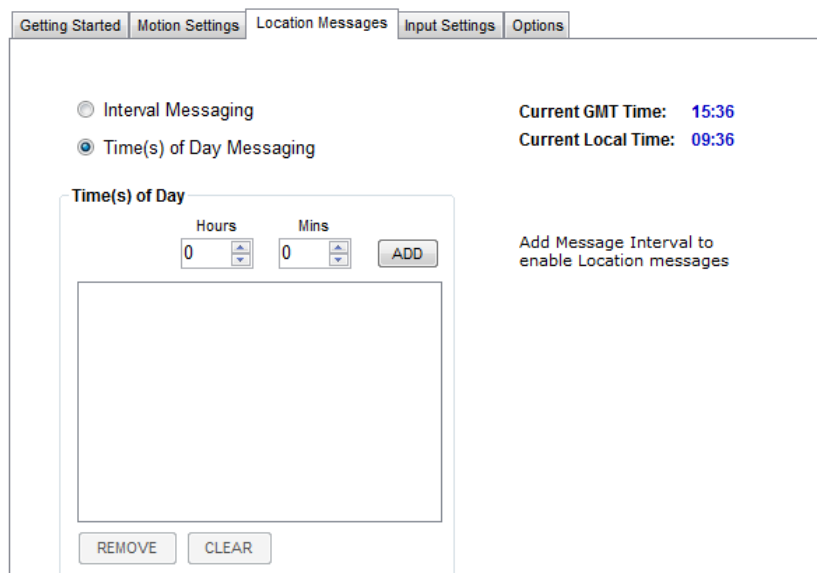
Location Messages Tab

- **Interval Messaging** - The SmartOne can be configured to report at a specific message interval specified by days, hours and minutes. The SmartOne accepts a single interval only.
 - Click the **ADD** button to accept the interval and add it to the message interval box.
 - Click the **REMOVE** button to delete the selected time of day or interval from the message interval box.
- Click the **CLEAR** button to delete all the time of days or interval in the message interval box.



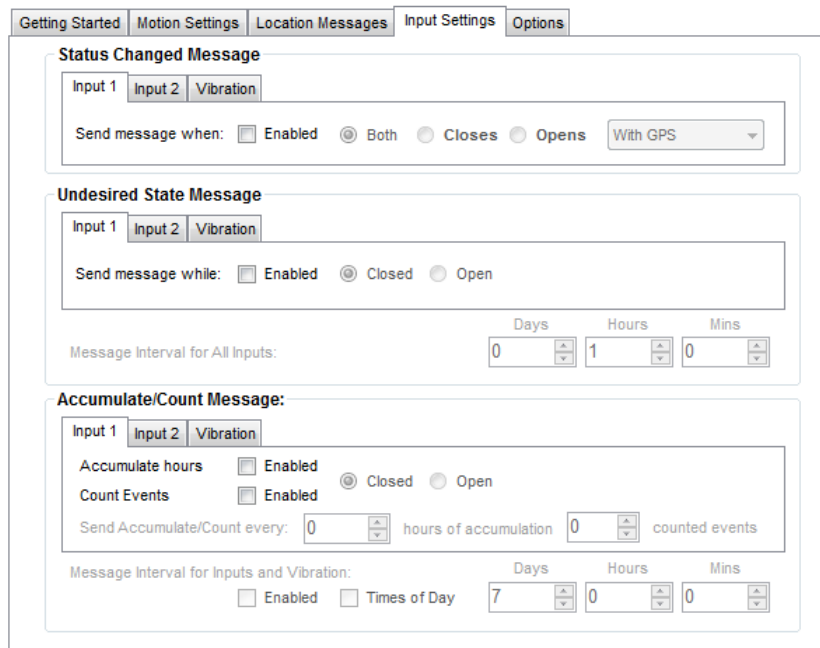
The screenshot shows the 'Location Messages' tab in the SmartOne configuration interface. At the top, there are five tabs: 'Getting Started', 'Motion Settings', 'Location Messages' (selected), 'Input Settings', and 'Options'. Below the tabs, there are two radio buttons: 'Interval Messaging' (selected) and 'Time(s) of Day Messaging'. To the right of these buttons, the 'Current GMT Time' is 15:45 and the 'Current Local Time' is 09:45. Below the radio buttons, there is a section titled 'Interval' with three input fields for 'Days' (0), 'Hours' (12), and 'Mins' (0). To the right of these fields is an 'ADD' button. Below the input fields, there is a text box displaying '00 days, 12 hours, 00 minutes'. At the bottom of the 'Interval' section, there are two buttons: 'REMOVE' and 'CLEAR'.

- **Time(s) of Day Messaging** - The SmartOne can be configured to report at specific time(s) of day. The message interval box allows up to 12 times of day to send Location Messages.
 - Click the **ADD** button to accept the interval and add it to the message interval box.
 - Click the **REMOVE** button to delete the selected time of day or interval from the message interval box.
 - Click the **CLEAR** button to delete all the time of days or interval in the message interval box.

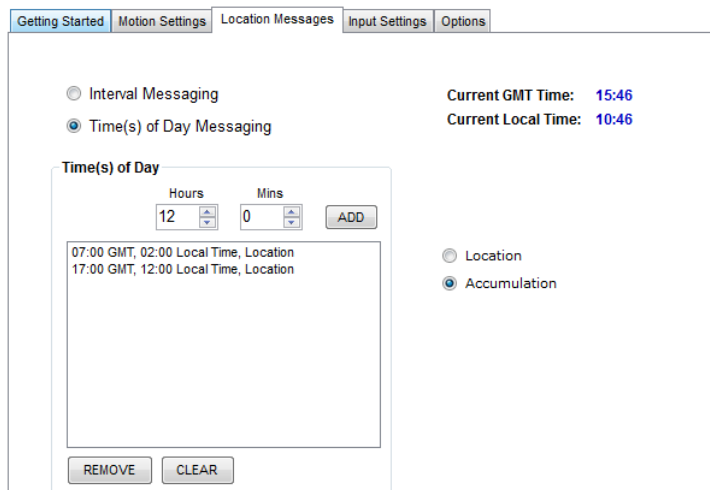


The screenshot shows the 'Location Messages' tab in the SmartOne configuration interface. At the top, there are five tabs: 'Getting Started', 'Motion Settings', 'Location Messages' (selected), 'Input Settings', and 'Options'. Below the tabs, there are two radio buttons: 'Interval Messaging' and 'Time(s) of Day Messaging' (selected). To the right of these buttons, the 'Current GMT Time' is 15:36 and the 'Current Local Time' is 09:36. Below the radio buttons, there is a section titled 'Time(s) of Day' with two input fields for 'Hours' (0) and 'Mins' (0). To the right of these fields is an 'ADD' button. Below the input fields, there is a large empty rectangular box for listing times of day. At the bottom of the 'Time(s) of Day' section, there are two buttons: 'REMOVE' and 'CLEAR'. To the right of the 'Time(s) of Day' section, there is a text box with the message 'Add Message Interval to enable Location messages'.

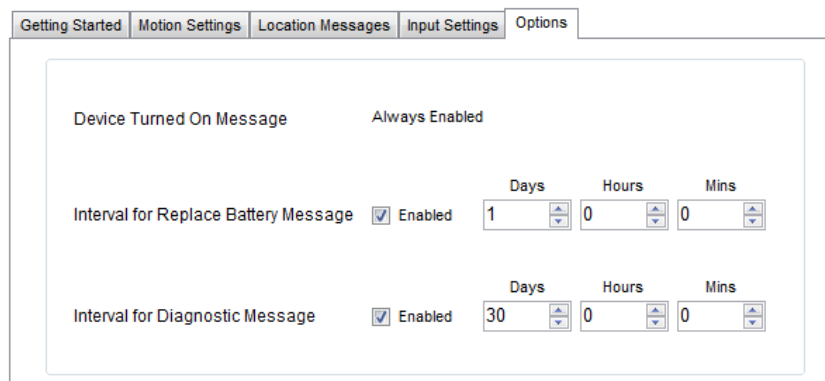
Input Settings Tab



- **Status Changed Message** - The SmartOne has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or both. The Message sent can or cannot contain the GPS coordinates of the device at the time the status of the input(s) changed. The SmartOne can also send this message when it enters or exits the Vibration State.
- **Undesired State Message** - The SmartOne can be configured to send messages throughout the time the input is in the undesired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is deactivated, the SmartOne will return to the message interval or time (s) of day for Location Messages. The SmartOne can also be configured to send messages throughout the time the device is in the State of Vibration.
- **Accumulate/Count Message** - The SmartOne can accumulate hours and events while input 1 or input 2 is enabled. The SmartOne can send an accumulate/count message once the configurable number of hours or events have been reached. In addition, The SmartOne can send the actual value of accumulated hours and events at configurable intervals specified in days, hours, and minutes. If Times of Day is selected, user will specify the times in the Location Message Tab.
 - If Time(s) of Day Messaging was selected, user will specify the times in the Location Message Tab.



Options Tab



The screenshot shows the 'Options' tab in the SmartOne C configuration interface. It contains the following settings:

- Device Turned On Message:** Always Enabled
- Interval for Replace Battery Message:** ☒ Enabled. Days: 1, Hours: 0, Mins: 0.
- Interval for Diagnostic Message:** ☒ Enabled. Days: 30, Hours: 0, Mins: 0.

- **Device Turned On Message** - The SmartOne is configured to send a Device Turned On Message on Power-up by default.
- **Interval for Replace Battery Message** - The SmartOne can be configured to transmit a Replace Battery message based on a low battery condition.
 - Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.
 - The SmartOne will detect low battery conditions while at least 100 more messages can still be transmitted.
- **Interval for Diagnostic Message** - The SmartOne can send a diagnostic message with information on the diagnostic status of the device.
 - The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.
 - Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Reduced Messaging Mode

Change Location Tab

Getting Started | **Change of Location** | Input Settings | Options

Inside Change of Location Area

Change of Location Range: 200 meters

Message Interval inside Change of Location Area: ☒ Enabled
 Days: 1 Hours: 0 Mins: 0

Position Check Interval while in State of Vibration: Days: 0 Hours: 1 Mins: 0

[Motion Detection Settings](#)

Outside Change of Location Area

Change of Location Message: 1

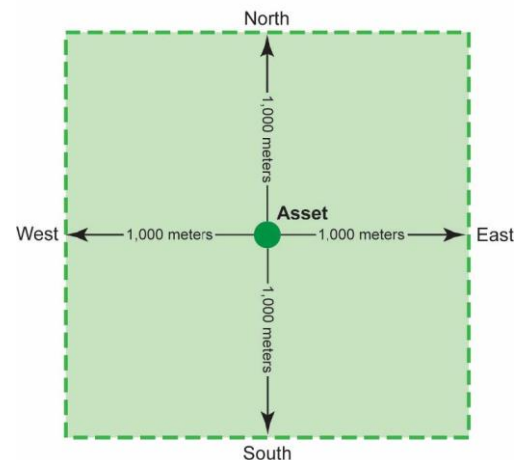
In Motion Interval: Days: 0 Hours: 1 Mins: 0

Change of Location Re-Center Message: ☒ Enabled

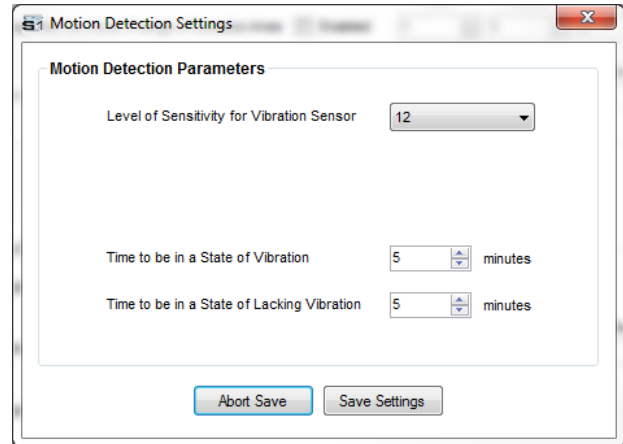
- **Inside Change of Location Area** The parameters in this section define the functionality of the device while inside its Change of Location Area while in Reduced Messaging Mode.

- **Change of Location Range** - Specifies the length (in meters, kilometers, yards, or miles) from the center of the Change of Location Area.
- **Message Interval inside the Change of Location Area** - The SmartOne can be configured to transmit messages while inside the Change of Location Area. This parameter allows you to configure the message interval inside the Change of Location Area in days, hours and minutes. In the Reduced Messaging Mode, the asset will send infrequent messages if asset is in its Change of Location Area.

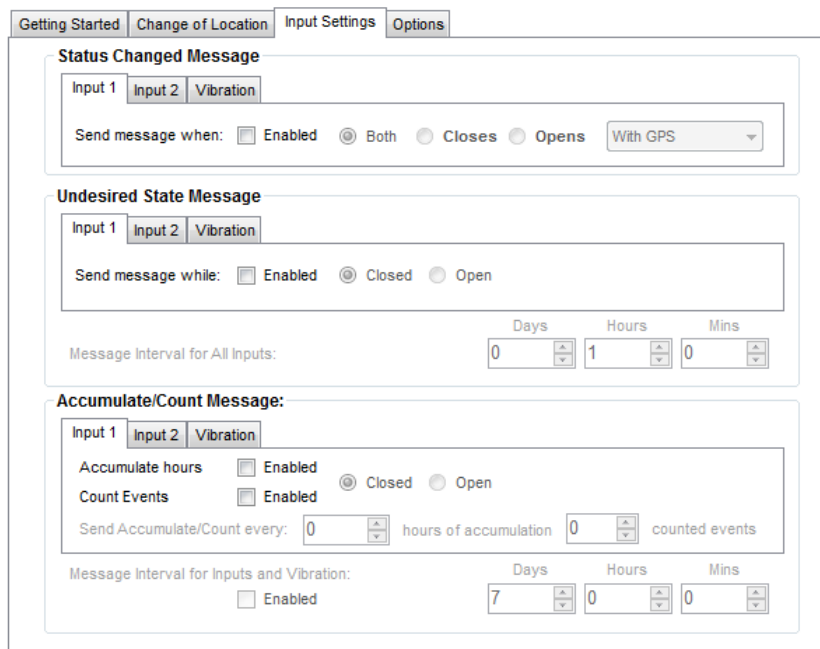
- **Position Check Interval while in State of Vibration** - The SmartOne can be configured to check GPS coordinates at a rate different from the transmission rate. This interval will determine the accuracy in time on how quickly the device will sense that it has left its Change of Location Area.



- **Motion Sensor Settings Button** - This button activates the Motion Settings window. This window contains settings to define how the motion sensor determines that the SmartOne is In Motion. These parameters include Level of Sensitivity for Vibration Sensor, Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.
 - **Level of Sensitivity for Vibration Sensor** - The vibration sensor has a range of sensitivity from 1 to 31 (1 being most sensitive and 31 being least sensitive). The smaller the sensitivity level, the more sensitive the motion sensor would be to movement.
 - **Time to be in a State of Vibration** - Time the motion sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration.
 - **Time to be in a State of Lacking Vibration** - Time the motion sensor must be below the sensitivity level before in a State of Lacking Vibration.
- **Outside Change of Location Area** - The parameters in this section define the functionality of the device while outside its Change of Location Area.
 - **Change of Location Alert Message** - The SmartOne can be configured to send a Change of Location Area Alert message when the device leaves the Change of Location Area. This special message can be processed by the back office application to send a notification to a cellular phone or to an email account that the asset has left the Change of Location Area. The number of Change of Location Area Alert messages sent by the device is set to 1.
 - **In Motion Interval** - This parameter determines the message interval once device is outside the Change of Location Area and In Motion.
 - **Change of Location Re-Center Message** - Once the SmartOne creates a new Change of Location Area after entering the At Rest State, it can or cannot send a Re-Center Message.



Input Settings Tab



Getting Started | Change of Location | **Input Settings** | Options

Status Changed Message

Input 1 | **Input 2** | Vibration

Send message when: ☐ Enabled ☒ Both ☐ Closes ☐ Opens With GPS

Undesired State Message

Input 1 | **Input 2** | Vibration

Send message while: ☐ Enabled ☒ Closed ☐ Open

Message Interval for All Inputs: Days: 0 Hours: 1 Mins: 0

Accumulate/Count Message:

Input 1 | **Input 2** | Vibration

Accumulate hours ☐ Enabled ☒ Closed ☐ Open

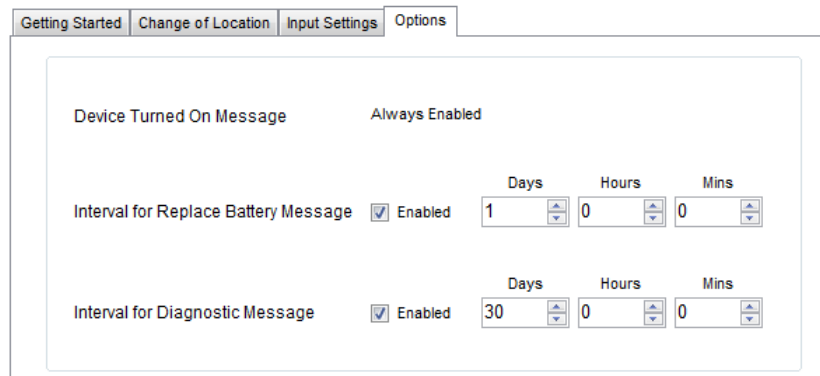
Count Events ☐ Enabled

Send Accumulate/Count every: 0 hours of accumulation 0 counted events

Message Interval for Inputs and Vibration: ☐ Enabled Days: 7 Hours: 0 Mins: 0

- **Status Changed Message** - The SmartOne has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or both. The Message sent can or cannot contain the GPS coordinates of the device at the time the status of the input(s) changed.
- **Undesired State Message** - The SmartOne can be configured to send messages throughout the time the input is in the undesired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is deactivated, the SmartOne will return to the message interval or time (s) of day for Location Messages.
- **Accumulate/Count Message** - The SmartOne can accumulate hours and events while Input 1, Input 2 or Vibration is enabled. The SmartOne can send an accumulate/count message once the configurable intervals specified in days, hours, and minutes.

Options Tab



- **Device Turned On Message** - The SmartOne is configured to send a Device Turned On Message on Power-up by default.
- **Interval for Replace Battery Message** - The SmartOne can be configured to transmit a Replace Battery message based on a low battery condition.
 - Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.
 - The SmartOne will detect low battery conditions while at least 100 more messages can still be transmitted.
- **Interval for Diagnostic Message** - The SmartOne can send a diagnostic message with information on the diagnostic status of the device.
 - The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.
 - Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Theft Recovery Mode

Change Location Tab

Getting Started | **Change of Location** | Input Settings | Options

Inside Change of Location Area

Change of Location Range: 200 meters

Message Interval inside Change of Location Area: ☒ Enabled
 Days: 1 Hours: 0 Mins: 0

Position Check Interval while in State of Vibration: Days: 0 Hours: 1 Mins: 0

Vibration Sensor Settings

Outside Change of Location Area

Change of Location Message: 1

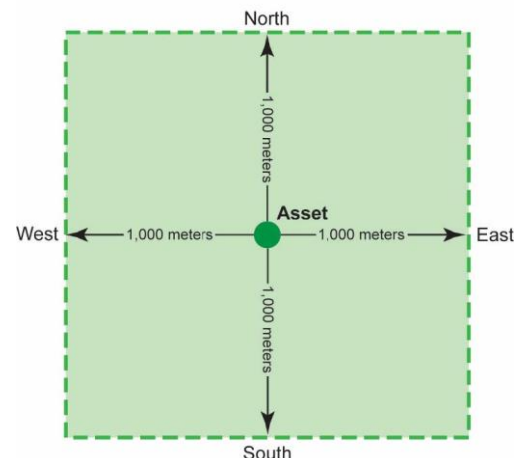
In Motion Interval: Days: 0 Hours: 0 Mins: 30

At Rest Interval: ☒ Enabled
 Days: 1 Hours: 0 Mins: 0

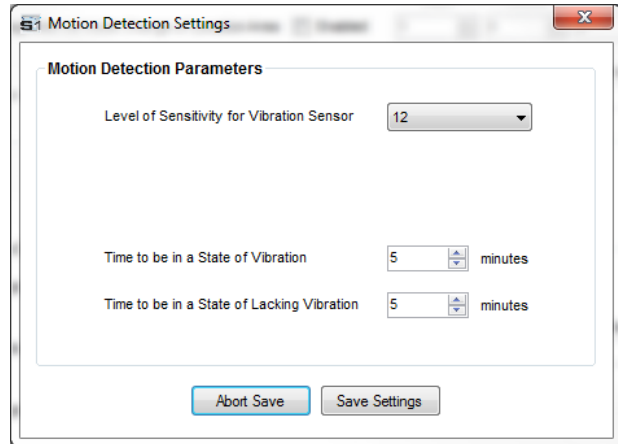
- **Inside Change of Location Area** The parameters in this section define the functionality of the device while inside its Change of Location Area while in Reduced Messaging Mode.

- **Change of Location Range.** **Change of Location Range** - Specifies the length (in meters, kilometers, yards, or miles) from the center of the Change of Location Area.
- **Message Interval inside the Change of Location Area** - The SmartOne can be configured to transmit messages while inside the Change of Location Area. This parameter allows you to configure the message interval inside the Change of Location Area in days, hours and minutes. In the Reduced Messaging Mode, the asset will send infrequent messages if asset is in its Change of Location Area.
- **Position Check Interval while in State of Vibration** - The SmartOne can be configured to check GPS coordinates at a rate different from the transmission rate. This interval will determine the accuracy in time on how quickly the device will sense that it has left its Change of Location Area.

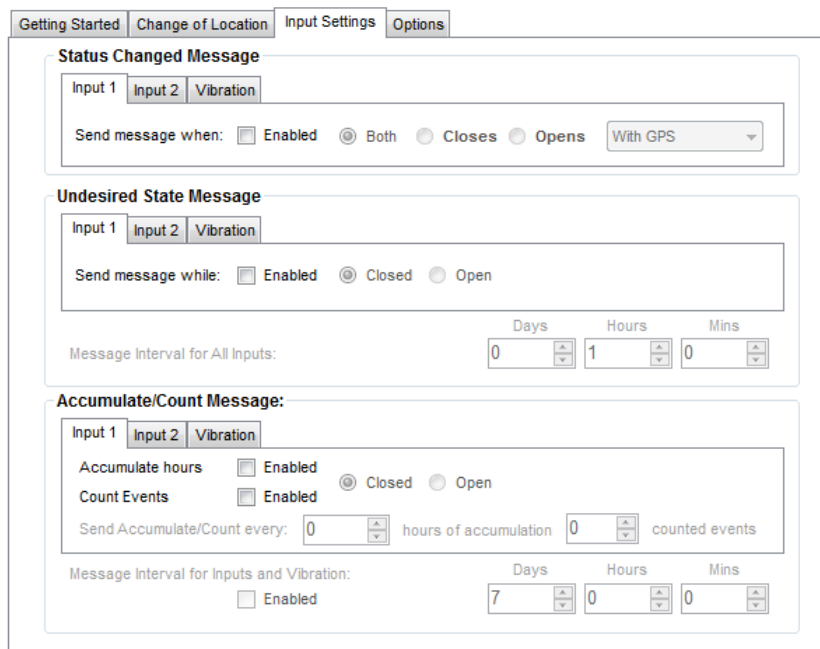
Change of Location Range: Reduce Messaging



- **Motion Sensor Settings Button** - This button activates the Motion Settings window. This window contains settings to define how the motion sensor determines that the SmartOne is In Motion. These parameters include Level of Sensitivity for Vibration Sensor, Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.
 - **Level of Sensitivity for Vibration Sensor** - The motion sensor has a range of sensitivity from 1 to 31 (1 being most sensitive and 31 being least sensitive). The smaller the sensitivity level, the more sensitive the motion sensor would be to movement.
 - **Time to be in a State of Vibration** - Time the motion sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration.
 - **Time to be in a State of Lacking Vibration** - Time the motion sensor must be below the sensitivity level before in a State of Lacking Vibration.
- **Outside Change of Location Area** - The parameters in this section define the functionality of the device while outside its Change of Location Area.
 - **Change of Location Alert Message** - The SmartOne can be configured to send a Change of Location Area Alert message when the device leaves the Change of Location Area. This special message can be processed by the back office application to send a notification to a cellular phone or to an email account that the asset has left the Change of Location Area. The number of Change of Location Area Alert messages sent by the device is set to 1.
 - **In Motion Interval** - This parameter determines the message interval once device is outside the Change of Location Area and In Motion.
 - In Theft Recovery Mode, the device will continue to send messages outside it Change of Location Area at the specified In Motion message interval until the device is Re-Centered by turning the connector in the device in the OFF and ON position.
 - The device will create a new Change of Location Area in the Theft Recovery Mode immediately after turning ON the device using the connector.
 - **At Rest Interval** - This parameter determines the message interval once device is outside the Change of Location Area and At Rest. The device is considered to be at rest when the comparison of a new GPS reading to a previous GPS reading indicates that the tracker has not changed location by more than a specified minimum distance.

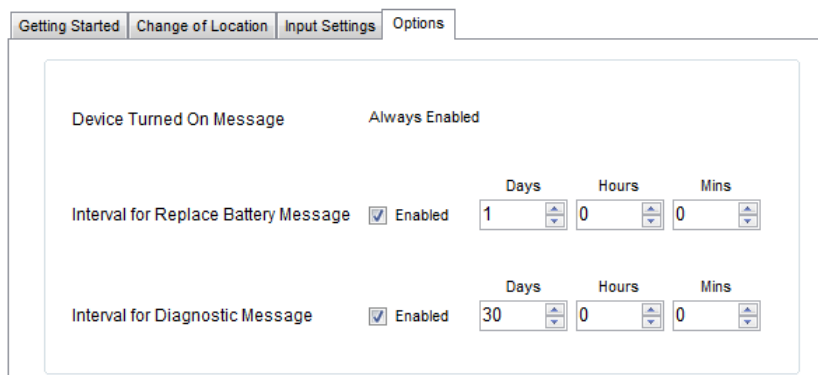


Input Settings Tab



- Status Changed Message:** - The SmartOne has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or both. The Message sent can or cannot contain the GPS coordinates of the device at the time the status of the input(s) changed.
- Undesired State Message:** - The SmartOne can be configured to send messages throughout the time the input is in the undesired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is deactivated, the SmartOne will return to the message interval or time (s) of day for Location Messages.
- Accumulate/Count Message:** - The SmartOne can accumulate hours and events while input 1 or input 2 is enabled. The SmartOne can send an accumulate/count message once the configurable intervals specified in days, hours, and minutes. If Time(s) of Day Messaging was selected, user will specify the times in the Location Message Tab.

Options Tab



The screenshot shows the 'Options' tab of the SmartOne C configuration interface. It contains three settings:

- Device Turned On Message**: Always Enabled
- Interval for Replace Battery Message**: ☒ Enabled. Days: 1, Hours: 0, Mins: 0.
- Interval for Diagnostic Message**: ☒ Enabled. Days: 30, Hours: 0, Mins: 0.

- **Device Turned On Message** - The SmartOne is configured to send a Device Turned On Message on Power-up by default.
- **Interval for Replace Battery Message** - The SmartOne can be configured to transmit a Replace Battery message based on a low battery condition.
 - Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.
 - The SmartOne will detect low battery conditions while at least 100 more messages can still be transmitted.
- **Interval for Diagnostic Message** - The SmartOne can send a diagnostic message with information on the diagnostic status of the device.
 - The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.
 - Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

5. Messages

The SmartOne produces on-air messages conforming to the Globalstar specified format.

The data being communicated to the end user is contained entirely in the 72 bit (9 byte) field.

This section will describe the use of the 9 byte user information segment for communicating the range of information that the SmartOne is able to convey to the user.

Note: User information is sometimes referred to as the message payload.

Global Message Type

Bits 0 and 1 in the first byte of the user data define the Global Message Type; there are four total global types. Types 0 and 3 are applicable to the function and features of the SmartOne, type 1 and 2 are user defined message types.

- **Type 0** - Standard Message: All of the various message types that contain Latitude and Longitude data that are transmitted by the SmartOne will be of this type.
- **Type 1** - Truncated Message: This message type provides for up to 2 bytes plus 6 bits of user data to be appended to the status byte and GPS location information.
- **Type 2** - Raw Message: This message type provides for up to 8 bytes plus 6 bits of user data.
- **Type 3** - Non Standard Message: This is the message type that covers the category "none of the above". The SmartOne will use this message type for messages that do not contain Latitude and Longitude data. Smart One message types which fall into this category include Accumulate/Count messages, Diagnostic messages, Contact Service Provider messages and Low Battery messages.

Type 0 Message Class

Message Format

The below table displays the format of all standard messages. Specific variants of the message will be shown individually in following subsections.

Byte #	Variable	Bits	Description
0	Type Field	2	Bit (1:0) = 0 = message type:
0	Battery State	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS Fail Counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.

1,2,3,4, 5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Message Sub-Type	4	Bits (7:4) message sub-type code. See subtypes below: Value is 0 in the location message. Value is 1 in the Device Turned On message. Value is 2 in the Change of Location Area alert message. Value is 3 in the Input Status Changed message. Value is 4 in the undesired input state message. Value is 5 in the re-centering message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration Triggered Message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration Bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Location Message

This is the message that is transmitted on an interval. When this message is received, it indicates that the transmission is due to a scheduled interval at either the At Rest rate or In Motion rate. Whether the device is At Rest or In Motion can be determined by the motion bit.

The Location Message Subtype field of this message, contained in byte 7, has a value of zero 0.

Device Turned On Message

This is the message transmitted at power on. It is a Standard message with a message sub-type value of 1.

Change of Location Area Alert Message

This is the message transmitted when the SmartOne detects that it has left its Change of Location Area.

The Standard Message Subtype field of this message, contained in byte 7, has a value of two 2.

Input Status Changed Message

This is the message that will be transmitted upon the change of state of the inputs if enabled and as selected by the user Input 1 open, input 1 closed, input 1 both, input 2 open, input 2 closed, input 2 both. The Message Sub Type is 3. The Input status value of byte 7 in the message indicates which input changed state to trigger the message and also reports the states of both inputs.

Undesired Input State Message

This is the message that is transmitted when the user has selected for an undesired input state to cause a different report rate. When this Mode is enabled, the user defined Undesired Input State report rate supersedes the At Rest and In Motion report rates when the input(s) is (are) in an undesired state. The Sub-Type value of this message is 4. The Input Status portion of byte 7 will indicate which input(s) are in the undesired state and triggering the Undesired Input State report rate.

Re-Center Message

The Re-Center message is transmitted when Reduced Messaging Mode is selected and the SmartOne re-centers (automatically sets a new Change of Location Area). The subtype value of this message is 5.

Type 1 Message Class

Truncated Message Type – Single Packet

This message type provides for up to 2 bytes plus 6 bits of user data to be appended to the status byte and GPS location information. The input and status bits data of the standard message are replaced with user data from the configuration port. The Truncated message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type
Latitude/Longitude	48	Byte1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of longitude coded in signed binary with 3 bytes and 180 degrees of latitude coded in signed binary with 3 bytes Positive longitude corresponds to East longitudes Positive Latitude corresponds to North latitudes
User Data	16	Byte 1 = User data byte 1 Byte 2 = User data byte 2

Truncated Message Type – Multiple Packet Version

The Globalstar simplex messaging protocol provides for single and multiple packet messaging. In the event that the user application requests a user data length exceeding 9 bytes, the SmartOne (running firmware version 2.1 or later) will automatically “packetize” the message, that is, transmit it as multiple 9 byte packets. The ground station appliqué will reverse the process, “de-packetizing” the message back into a single (“long”) message. From the user application point of view, this eliminates the 9 byte limitation allowing the user to compose longer messages transparently. They are presented to the user by the Globalstar back office as complete messages of a length longer than 9 bytes. The SmartOne supports user-defined messages (Class 1 and 2) of up to 54 bytes.

This message type provides for up to 47 bytes plus 6 bits of user data to be appended to the status byte and GPS location information. The input and status bits data of the standard message are replaced with user data from the configuration port. Note: Total message length will be a minimum of 9 bytes in length, and a maximum of 54 bytes in length, and the length sent to the user will always be divisible by 9. The Truncated message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type Bit (7:2) = submask data from Truncated user data
Latitude/Longitude	48	Byte1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of longitude coded in signed binary with 3 bytes and 180 degrees of latitude coded in signed binary with 3 bytes Positive longitude corresponds to East longitudes Positive Latitude corresponds to North latitudes
User Data	Variable	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 Byte 47 = User data byte 47

Type 2 Message Class

Raw Message Type – Single Packet Version

Message type 2 shall be a Raw Payload message. This message type provides for up to 8 bytes plus 6 bits of user data. This mode is provided to enable the user to directly send a single data burst through the network. The only bits not accessible to the user are the message type bits needed by the receiving data processor to delineate message type associated to the TXID. User data less than the full payload will be zero padded as necessary. The Raw Payload message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type Bit (7:2) = submask data from Raw Payload user data
User Data	Variable	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 Byte 4 = User data byte 4 Byte 5 = User data byte 5 Byte 6 = User data byte 6 Byte 7 = User data byte 7 Byte 8 = User data byte 8

Raw Message Type – Multiple Packet Version

The Globalstar simplex messaging protocol provides for single and multiple packet messaging. In the event that the user application requests a user data length exceeding 9 bytes, the SmartOne (running firmware version 2.1 or later) will automatically “packetize” the message, that is, transmit it as multiple 9 byte packets. The ground station appliqué will reverse the process, “de-packetizing” the message back into a single (“long”) message. From the user application point of view, this eliminates the 9 byte limitation allowing the user to compose longer messages transparently. They are presented to the user by the Globalstar back office as complete messages of a length longer than 9 bytes. The SmartOne supports user-defined messages (Class 1 and 2) of up to 54 bytes.

Message type 2 shall be a Raw Payload message. This message type provides for up to 53 bytes plus 6 bits of user data. This mode is provided to enable the user to directly send a single data burst through the network. The only bits not accessible to the user are the message type bits needed by the receiving data processor to delineate message type associated to the TXID. User data less than the full payload will be zero padded as necessary. Note: Total message length will be a minimum of 9 bytes in length, and a maximum of 54 bytes in length, and the length sent to the user will always be divisible by 9. The Raw Payload message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type Bit (7:2) = submask data from Raw Payload user data
User Data	Variable	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 Byte 53 = User data byte 53

Type 3 Message Class

The SmartOne will use the Type 3 message class for the following message types:

- Diagnostic Message – Subtype 21.
- Replace Battery Message – Subtype 22.
- Contact Service Provider Message – Subtype 23.

Note: Accumulate / Count Message – Subtype 24. Subtypes 0 – 3 are used by earlier tracker products.

Diagnostic Message

The Diagnostic Message includes battery status, GPS average acquisition time, GPS fails and number of transmissions since the last Diagnostic Message.

The format and fields of the SmartOne Diagnostic Message is shown in table 8 below.

Byte #	Variable	Bits	Description
0	Type Field	2	Bit (1:0) = 3 Non Standard message type:
0	Subtype	6	Bit (7:2) = 21 for Diagnostic Message. Bit (7:2) = 22 for Replace Battery Message. Bit (7:2) = 23 Contact Service Provider Message. Bit (7:2) = 24 Accumulate/Count message.
1	Number of Transmissions per Burst.	4	Bits(3:0) = Number of Transmissions (1 to 15 Transmissions)
1	Battery Condition	1	Bit 4: 0 = Good battery. 1 = Replace Battery
1	GPS Subsystem Fault	1	Bit 5: 0 = GPS system OK. 1 = Fault
1	Transmitter Subsystem Fault	1	Bit 6: 0 = Transmitter OK. 1 = Fault.
1	Scheduler Subsystem Fault	1	Bit 7: 0 = OK. 1 = Fault
2	Min Interval	8	Minimum Interval between transmission attempts (5 second resolution) Default is 300 seconds
3	Max Interval	8	Maximum Interval between transmission attempts. Default is 600 seconds
4	GPS Mean Search Time	8	Unsigned binary count in seconds for mean GPS search to acquire
5,6	# GPS Fails	16	Unsigned binary count of failed GPS attempts since last Diagnostic Message
7,8	# Transmissions	16	# of transmissions since last Diagnostic message

Replace Battery Message

The Replace Battery message has a format almost identical to the Diagnostic message. If enabled by the user, the Replace Battery message will be sent by the SmartOne when the battery charge level is at or below the replace battery advisement level. The message will be repeated at an interval configurable by the user for as long as the battery remains below the advisement level. The default configuration is for the Replace Battery message to be enabled and to be transmitted once per day when the battery is low.

Contact Service Provider Message

The SmartOne will send a Contact Service Provider message when an internal fault is detected. The SmartOne will send one such message upon the detection of an internal fault. It will then attempt to continue to operate normally. The SmartOne will not send another Contact Service Provider message unless the fault is determined to have cleared, and then determined to have come back again.

Accumulate/Count Message

The Accumulate/Count message is used to report the accumulation of time that an input is in a specified state as defined by the user, the accumulation of time that the device is in a State of Vibration, and/or the total transitions of the inputs as configured by the user. The message is transmitted either at a pre-set interval, at a point where any of the accumulation or count registers reach multiples as programmed by the user, just before rollover of any count/accumulate register, or all of the above.

Messaging Priority

Prioritization of Periodic Standard Message Report Rates

The SmartOne supports several rates at which it will send a periodic standard message. Periodic, scheduled standard message rates are mutually exclusive. This is the priority of the different rates at which the SmartOne will send a standard message. Highest is listed first:

- Rate specified by Undesired Input State.
- Rate specified for when the SmartOne is inside its Change of Location Area.
- Rate specified for when device is In Motion. (Note, when inside the Change of Location Area, this rate affects sampling, but not reporting, as indicated by a higher priority for inside Change of Location Area.)
- Rate specified for when the device is At Rest.

Message Priorities

It is possible that message types may collide. Whenever feasible, the SmartOne will examine its known schedule and reschedule lower priority messages to occur after higher priority ones. If there is not enough time in the known schedule for all scheduled messages to be transmitted in a reasonable time, or there is insufficient memory to queue them, the lowest priority message(s) could be dropped. In any case, unscheduled messages (for example, Input Status Changed) shall cancel pending messages of lower priority and not cancel pending messages of higher priority. The following list shows the priority of message types, with the highest priority being listed first.

- Contact Service Provider
- User Defined Raw message. *
- User Defined Truncated message. *
- Change of Location Area
- Replace Battery
- Undesired Input State
- Re-Center
- Diagnostics
- Accumulate/Count
- Input Status Changed
- Device Turned On
- Normal Location (In-Motion or At-Rest).

Note: The two user defined message types actually have equal priority. Either one will cancel the other one. If, for example, the user interface commands the device to send a Truncated message, and then, before it has time to obtain a fix and send the message, the user commands a Raw message, the raw will be sent.

6. Serial Commands

The SmartOne uses the I/O port for unit configuration as well as interface to remote passive and smart sensors. Two commands are provided in the unit interface to support smart sensors. External sensors that can format and communicate to the SmartOne can send user data through the SmartOne by using these two commands.

This section describes the serial interface between the SmartOne and a computer or other programming device. SmartOne will respond to any command that contains fields with invalid values with a NAK response (command field set to 0xFF).

Serial Packet Format (commands and answers)

Communication to the SmartOne will follow the following specific format:

Preamble	Length	Cmd	Data	CRC
1 byte	1 byte	1 byte	Variable length 0 – 54 bytes	2 bytes

Total length range permitted: 5 bytes (Data field length 0) to 59 bytes (Data field length 54).

Serial Packet Fields

The different fields are defined as:

Preamble	Fixed Pattern 0xAA
Length	Total number of bytes in the serial packet including the preamble
Cmd	Command type (See table below). Responses to commands carry the same command type as the command that initiated the answer
Data	Data associated with the command or answer
CRC Low	Least significant byte of the 16-bit CRC
CRC High	Most significant byte of the 16-bit CRC

CRC Algorithm

The Security Field is a 16-bit CRC of all of the previous fields including the preamble, length, and command bytes. The remainder is initialized to all 1's (0xFFFF) and the CRC is inverted before being sent. Following is a sample C routine that implements the algorithm using the reversed technique:

```
WORD crc16_Isb(BYTE *pData, WORD length)
{
    BYTE i;
    WORD data, crc;
    crc = 0xFFFF;
    if (length == 0)
        return 0;
    do
    {
        data = (WORD)0x00FF & *pData++;
        crc = crc ^ data;
        for (i = 8; i > 0; i--)
        {
            if (crc & 0x0001)
                crc = (crc >> 1) ^ 0x8408;
            else
                crc >>= 1;
        }
    }
    while (--length);
    crc = ~crc;
    return (crc);
}
```

As an example, for a type (0x01) "Get ID" message made up of the following bytes: **AA 05 01**

The following 2 byte CRC would be calculated: **D5 50**

The complete message sent by the host to the SmartOne is: **AA 05 01 50 D5**

Serial Packet Types

Cmd	Description/Usage/ Comment	Command Data Bytes	Acknowledge Data Bytes
0x01	User requests the SmartOne to reply with integral ESN (Electronic Serial Number). This is the ID used by Globalstar to identify the unit	None	Four data bytes, which contain the unit ID as an unsigned integer. The MSByte is sent first. Only the 27 LSbits are non-zero
0x26	Send Truncated Message	See Truncated Message section below	None
0x27	Send Raw Message	See Raw Message section below	None

Send Truncated Message (serial message type 0x26)

The **SmartOne** will perform a GPS location and append user data passed to the unit via the Truncated Message command 0x26.

Two bytes plus 6 bits of user data may be sent with the standard GPS location information in a messaging burst. Two bits are set in the on-air message by the SmartOne informing the recipient that the message is the Truncated type.

The following table defines the message structure of the “data” portion of the command used to send a Truncated message.

Communication to the SmartOne will follow the following specific format:

Byte	Bit	Parameter	Description	Default Value
0	7.2	Submask Bits	User data bits. Bits 1:0 are reserved and will be masked by SmartOne	0x00
Variable		User Data	Supports a maximum of 47 total bytes in this field. User application (smart sensor) should transmit only as many bytes as needed (don't pad the message) in order to keep on air packets to a minimum	

Example 1 - Sending a “Truncated” User Message

The host sends:

AA 08 26 10 22 33 <CRC-low> <CRC-High>

The SmartOne would respond:

AA 05 26 <CRC-Low> <CRC-High>

What would go out over the air is:

11 Lat-3 Lat-2 Lat-1 Lon-3 Lon-2 Lon-1 22 33

Example 2 - Using a Longer Message

The host sends:

AA 0D 26 10 22 33 44 55 66 77 88 <CRC-low> <CRC-High>

Note: The length field: 0D – 0D is the number 13 in hexadecimal, the length of the total serial command.

The SmartOne would respond:

AA 05 26 <CRC-Low> <CRC-High>

What would go out over the air is:

11 Lat-3 Lat-2 Lat-1 Lon-3 Lon-2 Lon-1 22 33 44 55 66 77 88 00 00 00 00

Note: All on air messages are padded to a multiple of 9 bytes. This is the reason for the trailing zeros in this example.

Note: The least two significant bits of the first byte are always “01” for a trunc message, the remaining 6 bits make up the top 6 bits of the first byte sent in the serial command, in this example 000100xx (with the “xx” representing the two bits that the SmartOne forces to “01”).

The 22 and the 33 that the user sent are appended after the 6 bytes of latitude and longitude.

Send Raw Message (serial message type 0x27)

The **SmartOne** will send raw user data using the Raw Payload command 0x27.

8 bytes plus 6 bits of user data may be sent. Two bits are set in the on-air message by the SmartOne informing the recipient that the message is Raw.

The following table defines the message structure used to send a Raw message.

Byte	Bit	Parameter	Description	Default Value
0	7.2	Submask Bits	User data bits. Bits 1:0 are reserved and will be masked by SmartOne	0x00
Variable		User Data	Any user data Supports a maximum of 53 total bytes in this field. User application (smart sensor) should transmit only as many bytes as needed (don't pad the message) in order to keep on air packets to a minimum	

Example 1 - Sending a Raw User Message:

She Host sends:

AA 0E 27 10 22 33 44 55 66 77 88 99 <CRC-low> <CRC-high>

The SmartOne Responds:

AA 05 27 <CRC-low> <CRC-high>

What actually goes out over the air is:

12 22 33 44 55 66 77 88 99

Example 2 - Using a Longer Message:

The Host sends:

AA 21 27 10 22 33 44 55 66 77 88 99 AA BB CC DD EE FF 11 22 33 44 55 66 77 88 99 AA 44 56 78 <CRC-low> <CRC-high>

Note: The length field, the command contains a total of 33 bytes. The length is 21 Hexadecimal, which is equal to 33 decimal.

The SmartOne Responds:

AA 05 27 <CRC-low> <CRC-high>

What actually goes out over the air is:

**12 22 33 44 55 66 77 88 99 AA BB CC DD EE FF 11 22 33 44 55 66 77 88 99 AA 44 56 78 00
00 00 00 00 00 00 00**

Note: All on air messages are padded to a multiple of 9 bytes. This is the reason for the trailing zeros in this example.

Note: The least two significant bits of the first byte are always “10” for a raw message (a HEX or decimal value of “2”, the remaining 6 bits make up the top 6 bits of the first byte sent in the serial command, in this example 000100xx (with the “xx” representing the two bits that the SmartOne forces to “10”).

A simple ACK or NAK from the SmartOne Device to the host (smart sensor):

ACKs.

AA 05 26 <crc crc> (for the Truncated message)

AA 05 27 <crc crc> (for the Raw message)

NAK:

AA 05 FF <crc crc> (NAK).

Note: As the SmartOne operates, some debugging traces come out of the serial port. Those traces should simply be ignored. Once the handshake line is pulled low, the unit is in “command mode” and debugging traces will stop.

Note: User commands will ALWAYS be responded to immediately with either an acknowledgement or a NAK (as shown in the examples above). Once an acknowledgement (or NAK) is received, the host should simply ignore the serial port until the next time it sends a command.

Note: The most common reasons for a NAK are incorrect CRC, incorrect length field, or incorrect command field (i.e. not 0x26 or 0x27 for trunc and raw respectively).

The Handshake Line

The handshake line should be pulled low before sending each serial message. The recommended use of the handshake line is:

- 1) Pull handshake low.
- 2) Wait 2 – 3 milliseconds.
- 3) Send command
- 4) Receive response.
- 5) Raise handshake high.

7. Connecting Serial Devices to the SmartOne

The SmartOne accepts a serial connection at 3 volt levels (Max), at 9600 baud. The relevant pins are TX, RX, Handshake and ground. The SmartOne can connect with devices that contain an asynchronous UART at 3 volt levels. (High State: 2.7-3 Volts, Low State: 0 Volts. Please contact Globalstar Support for more information.

Caution: NEVER attempt to connect the SmartOne directly to the pins on a computer's RS232 port. The voltages in RS232 are too high and can damage the SmartOne.

Any deviations from the above guidelines will violate all RMA requirements and prevent any no-cost replacement.

Note: See Appendix K for information on the External Input Cable for the SmartOne.

Appendix A - Glossary of Terms

A

Accumulate Hours – The activity time accumulated in the Inputs of the device while the Input is in the user defined state.

Activation – The activation of an ESN (electronic serial number) on the Globalstar satellite network. The process consists of programming a start and an end date for the use of the ESN and the payment of certain fees to Globalstar. Sometimes referred to as “provisioning.”

At Rest – a tracker is considered to be at rest when the comparison of a new GPS reading to a previous GPS reading indicates that the tracker has not changed location by more than a specified minimum distance. The specified minimum time and the specified minimum distance are both configuration parameters.

C

Configuration – the collection of variables that control the operating performance of a tracker, sometimes referred to as the “configuration.”

Configure (configuring) – Programming (setting) the variables that control the operation performance of a tracker.

Count Events – The accumulated number of state changes in the Inputs of the device.

D

Delay To Start – Specific delay in time following the programming of the device to commence operation.

Desired State – The state of the Input in normal condition defined by the user.

E

ESN – Electronic is used by the Globalstar Simplex Serial Number is a unique number assigned to each SmartOne device. The ESN Network to identify messages from the devices o the field.

F

Failed GPS reading – A GPS reading could not be processed from available GPS satellite signals.

FW Ver – Firmware version is the existing software loaded in the device main processor

G

GPS – The GPS (Global Positioning System) is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location.

GPS reading – The longitude, latitude, time, and date information obtained from processing the signals from the GPS satellites.

I

In Motion – The unit is considered to be In Motion when there is a State of Vibration – and – when a comparison of a new GPS reading to a previous GPS reading indicates the tracker has changed location by at least a specified minimum distance. The specified minimum time and the specified minimum distance are both configuration parameters.

Inaccurate GPS reading – The longitude and latitude information obtained from processing the signals from the GPS satellites when a tracker cannot observe an adequate number of satellites; the GPS signals were jammed by electronic interference; the GPS signals were reflected from objects creating multi-path conditions; or weather conditions distorted the GPS signals. An inaccurate GPS reading may have longitude and latitude errors of a mile or more.

Input – A digital channel in the device that allows the detection of switch stage changes. The inputs are dry contact inputs, ON/OFF.

L

Level of Sensitivity for Vibration Sensor – a configurable parameter that sets the number of pulses per minute that a motion sensor must detect to be considered sensing vibration.

M

Message – A collection of information that is transmitted in a group over the satellite network.

Message Interval – The amount of time specified by the user between Location Messages. The SmartOne transmits a Location Message once the Message Interval has elapsed. The internal clock on the device is reset to the interval time after each transmission. The SmartOne is in low power consumption Mode during the interval to preserve battery life.

Message Time(s) of Day – The specific time of day in military format for the SmartOne to transmit Location Messages. . The SmartOne is in low power consumption Mode between the specific times of day to preserve battery life.

Message Transmission – The process of sending a message over the satellite network. The process includes sending a message multiple times to improve the transmission success rate.

N

Number of message repeats – The number of times a message is send in a message transmission with the same UMN. The number of message repeats is configurable during the tracker set up process. Globalstar only counts repeated messages as one message if it is received three times or less. If the same message is receive more than three times Globalstar may count the message as more than one message for billing purposes

S

Self Test – An internal unit test that is performed by the processor. The test checks for proper operation of functions that can be tested by the processor.

State of lacking Vibration – The motion sensor is indicating a cease of vibration when the number of vibration pulses per minute is lower than the Level of Sensitivity for Vibration Sensor number for the time required to determine if a State of Vibration has ceased.

State of Vibration – The motion sensor is in a State of Vibration when the number of vibration pulses per minute exceeds the Level of Sensitivity for Vibration Sensor for the time required to detect a State of Vibration.

I

Time to be in a State of Lacking Vibration– a configurable parameter that sets the period of time vibration has to be absent to determine if a State of Vibration has ceased.

Time to be in a State of Vibration – a configurable parameter that sets the period of time used to determine if a State of Vibration exists.

U

Undesired State Message – The SmartOne sends this message at a user defined interval while any of its Inputs are in the closed or opened state depending on the user selection

Appendix B - Technical Support

We suggest VARs first reference our [VAR FAQ](#) online at www.glpconnect.com prior to contacting VAR Support. This reference should address most provisioning inquiries and minor frequently asked questions concerning provisioning and business account management functions.

All of support needs can be found at the Globalstar VAR Support Website: <http://var.globalstar.com/>

Please create an account by accessing the site and clicking on ***Sign Up for Access Here***

For additional support please contact Globalstar, Inc. corporate headquarters at:

- Email: varsupport@globalstar.com.
- Phone: +1 (985) 335-1590

Appendix C - RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

RAPPORT D'EXPOSITION DE RAYONNEMENT DE LA FCC RF Cet equipment est conforme aux limites d'exposition de rayonnement de la FCC RF determinees pour un environnement non controle. Cet equipment devrait etre installe et actionne avec une distance minimum de 20 cm entre le radiature et votre corps.

Appendix D - Regulatory Notices

FCC/IC Notices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Modifications: Any modifications made to this device that are not approved by Globalstar, Inc. may void the authority granted to the user by the FCC to operate this equipment

This Class A digital apparatus complies with Canadian ICES-003.

CAN ICES-3(A)/NMB-3(A)

This device complies with the requirements for Radio Astronomy Site avoidance as specified by the Globalstar National Science Foundation agreement of 2001. It is compliant with CFR25.213

This device automatically adjusts its transmission frequency according to its location and is compliant with international regulatory requirements.

Avis de la FCC/IC

Cet équipement a été testé et respecte les limitations d'un dispositif numérique de Classe A, conformément à la Partie 15 du Règlement FCC. Ces limitations sont conçues afin de fournir une protection raisonnable contre les interférences nuisibles lorsque l'équipement est utilisé dans un environnement commercial. Cet équipement génère, utilise et peut émettre rayonnement de fréquence radio, et s'il n'est pas installé et utilisé en conformité avec le manuel d'instructions, il peut causer des interférences nuisibles aux communications radio. L'utilisation de cet équipement dans une zone résidentielle est susceptible de causer des interférences nuisibles, auquel cas l'utilisateur sera tenu de corriger les interférences à ses frais.

Modifications: Toutes modifications apportées à ce dispositif qui n'ont pas été approuvées par Globalstar, Inc., peut annuler le droit accordé à l'utilisateur par la FCC d'opérer cet équipement.

Cet appareil numérique de Classe B est conforme au standard canadien ICES-003.

CAN ICES-3(A)/NMB-3(A)1

Ce dispositif est conforme aux exigences relatives à l'évitement des Sites de Radioastronomie tel que spécifié par l'accord de la Fondation Nationale Scientifique Globalstar de 2001. Il est conforme avec le Règlement CFR 25.213.

Ce dispositif ajuste automatiquement sa fréquence de transmission en fonction de sa position et est conforme avec les exigences réglementaires internationales.

CE Notices

DECLARATION OF CONFORMITY FOR EUROPEAN CUSTOMERS

Hereby, Globalstar Europe Satellite Services Ltd., declares that this Globalstar SmartOne C, is in compliance with the essential requirements and other relevant provisions of Directive 1995/5/EC. The Declaration of Conformity may be consulted at www.Globalstar.com/Support/Regulatory.

CE1313

IE Not to be Marketed in the Republic of Ireland

Appendix E – General Warnings



Warning - Installation and Service: Allow only authorized personnel to install or service the SmartOne C and accessories. Faulty installation or service can be dangerous and can invalidate the warranty.



Warning - Modifications: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



Caution - Replaceable Batteries: Risk of explosion of battery if replaced by an incorrect type. Dispose of used batteries according to the manufacturer's instructions.

Appendix F – Specifications & Standards

Specifications	
Dimensions	2.7" (h) x 3.25" (w) x 1" (d)
	6.86 cm (h) x 8.26 cm (w) x 2.53 cm (d)
Weight	3.6 oz (with 4 batteries and mounting hardware)
	102g (with 4 batteries and mounting hardware)
Temperature	-22°F to +140°F (The unit shall remain operational over the -40°F to +185°F range - may experience battery life and RF signal degradation)
	-30°C to +60°C (The unit shall remain operational over the -40°C to +85°C range - may experience battery life and RF signal degradation)
Line Power	Up to 48 VDC
Battery Type	4 AAA 1.5V Lithium

Standards		
Waterproof	IP67	Intrusion Protection
	IP68	Freeze – Thaw
	IP69K	High Pressure Washing
Mil Standards	MIL-STD-810F	95% to 100% Condensing (Humidity)
	MIL-STD-810E	Method 509.3 – 5% NaCl, 95% Distilled Water (Salt Fog)
SAE	SAE J1455	Random 20 Hz to 2000 Hz, 0.40 g ² /hz, One hour per axis (Vibration)
		Thermal Shock Test

Appendix G – Latitude/Longitude Decoding

Example Message = 0x002B5372BFF12F0A02

0x 00 2B 53 72 BF F1 2F 0A 02

Signed integer (MSB..LSB)

Lat2	Lat1	Lat0	Long2	Long1	Long0
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Calculating Latitude

Negative Latitude corresponds to Latitude in the SOUTHERN Hemisphere.
Positive Latitude corresponds to Latitude in the NORTHERN Hemisphere.

Degree_per_count_lat = $(90.0/2^{23})$

Hex Lat = 0X2B5372 ; Conversion to Decimal = 2,839,410

Latitude = Decimal Lat bytes * Degree_per_count_lat
 = 2,839,410 * $(90.0/2^{23})$
 = 30.463564 degrees NORTH

Note: If greater than 90 degrees, 180 must be subtracted from result

Calculating Longitude

Negative Longitude corresponds to Longitude in the WESTERN Hemisphere.
Positive Longitude corresponds to Longitude in the EASTERN Hemisphere.

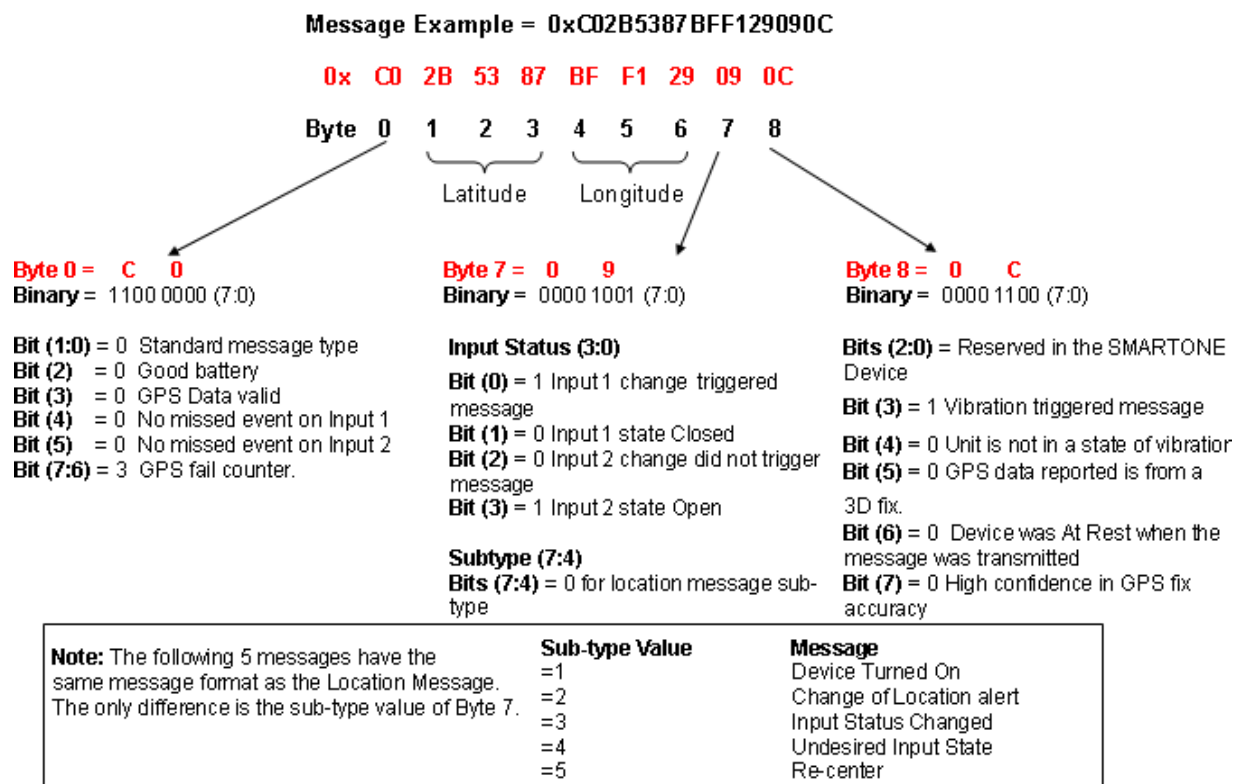
Degree_per_count_long = $(180.0/2^{23})$

Hex Long = 0XBFF12F ; Conversion to Decimal = 12,579,119

Longitude = Decimal Long bytes * Degree_per_count_long
 = 12,579,119 * $(180.0/2^{23})$
 = 269.918611

Note: If greater than 180 degrees, 360 must be subtracted from result. Therefore, 269.918611 degrees – 360 degrees
 = -90.081388 degrees
 = 90.081388 degrees WEST

Appendix H – Standard Message Decoding



Appendix I - Diagnostic Message Decoding

Message Example = 0x 57033C784F00000009

0x 57 03 3C 78 4F 00 00 00 09
Byte 0 1 2 3 4 5 6 7 8

Byte 0 = 5 7

Binary = 0101 0111 (7:0)

Bits (1:0) = 3 Non Standard message type

Bits (7:2) = 21 for Diagnostic Message

Byte 2 = 3 C

Decimal = 60

Minimum Interval between
transmission attempts

(5 second resolution, 300)

Byte 4 = 4 F

Decimal = 79

Unsigned binary count in
seconds for mean GPS
search to acquire

Byte 1 = 0 3

Binary = 0000 0011 (7:0)

Bits(3:0) = 3 Number of Transmissions

Bit (4) = 0 Good battery

Bit (5) = 0 GPS system OK

Bit (6) = 0 Transmitter OK

Bit (7) = 0 Scheduler Subsystem OK

Byte 3 = 7 8

Decimal = 120

Maximum Interval between
transmission attempts.

(5 second resolution, 600)

Byte 5 & 6 = 00 00

Decimal = 0

Unsigned binary count of
failed GPS attempts since
last Diagnostic Message

Byte 7 & 8 = 00 09

Decimal = 9

of transmissions since last
Diagnostic message

Note: The following 2 messages have the same message format as the Diagnostic Message. The only difference is the value of Bits(7:2) of Byte 0

Bits (7:2) Value	Message
=22	Replace Battery
=23	Contact Service Provider

Appendix J - Accumulate/Count Message Decoding

Message Example = 0x63FFFFFFFFFFFF7DFF

0x 63 FF FF FF FF FF FF 7D FF

Byte 0 1 2 3 4 5 6 7 8

Byte 0 = 6 3

Binary = 0110 0011 (7:0)

Bits (1:0) = 3 Non Standard message type

Bits (7:2) = 24 for Accumulate/Count Message

Byte 1 & 2 = FFFF

Accumulated time that Input 1 has been in its undesired state with a resolution of 10 minutes.

0xFFFF means that Input 1

Accumulate has been turned off

Byte 3 & 4 = FFFF

0xFFFF means that Input 2

Accumulate has been turned off

Byte 5 & 6 = FFFF

Accumulated time that the SMARTONE has been in a State of Vibration with a resolution of 10 minutes.

0xFFFF means that accumulate time of vibration been turned off

Byte 7 = 7D

Decimal = 125

The total number of openings or closings of Input 1

Byte 8 = FF

0xFF means that Input 2

Accumulate count has been turned off

Appendix K - External Input Cables

INSTRUCTIONS AND WIRING DIAGRAM FOR SmartOne C EXTERNAL INPUT CABLES 5v Cable (PN# 2030-0305-01) & 22v Cable (PN# 2030-0307-01)

INSTRUCTIONS

1. This cable is designed to work with 3.3 V logic only. Do not use with 5 V logic devices.
2. Be certain that unused wires do not short to each other.
3. All ground wires are common; therefore, any ground can be used with any function.

Color	Function
Brown	Setup (Handshake from Serial Device)
Red	RX
Orange	TX (to Serial Device RX)
Light Blue	Dry Contact 2
White	Dry Contact 1
Yellow	Soft Power Down (Normally Open)
Green	Ground
Blue	Ground
Violet	Line Power +

Appendix L – Battery Life Estimate

Battery life is dependent on several factors:

- View of the sky
- How often the device is transmitting
- Requesting GPS fixes
- Temperature
- Sleep Current

The more often that the SmartOne transmits data, the shorter the battery life. .

The below table is an example of clear sky transmissions

Msgs/Day	Estimated Battery Life (Days)
1	750 Days
2	500 Days
3	400 Days
6	200 Days
24	80 Days