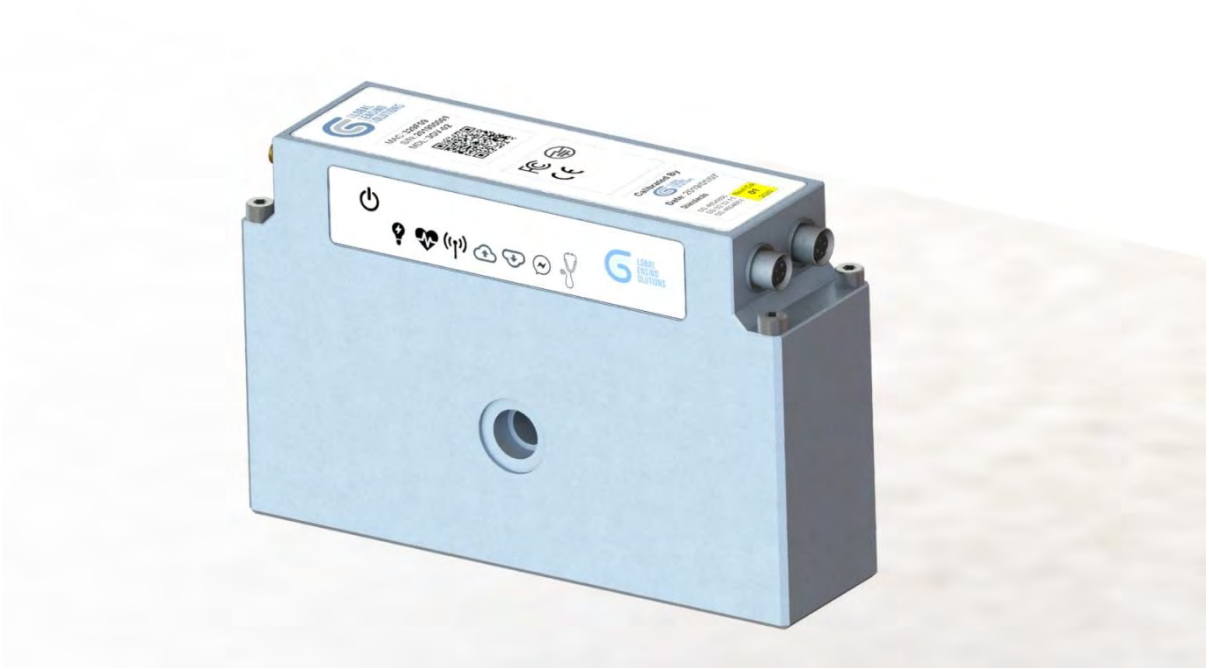
Vibration Monitor

User Manual



Release Version: 6.0

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DOCUMENT INFORMATION

DISCLAIMER

GSS reserves the right to change product specifications without notice. Wherever possible, GSS will issue changes to functionality and specifications in the form of product-specific errata sheets or in new versions of this document. GSS advises customers to check with GSS for the most recent updates on this product.

LIFE SUPPORT POLICY

GSS does not authorize its products for use in safety-critical applications (such as life support) where a failure of the GSS product is likely to cause severe personal injury or death. GSS customers using or selling GSS products in such a manner do so entirely at their own risk and agree to indemnify GSS and its representatives against any damages arising out of the use of GSS products in such safety-critical applications.

FCC APPROVAL

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC RF Exposure Warning Statements:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment shall be installed and operated with minimum distance 20cm between the radiator & body.

IC APPROVAL

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L’émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes:

(1) L' appareil ne doit pas produire de brouillage;

(2) L' appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d' en compromettre le fonctionnement.

IC Radio Frequency Exposure Statement:

This equipment complies with IC exposure limits set forth for an uncontrolled environment. This equipment shall be installed and operated with minimum distance 20cm between the radiator & body.

Cet équipement est conforme aux limites d'exposition IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et le corps.

1 Introduction

The GSS 5GV Vibration Monitor is a sophisticated vibration sensor with an integrated 3G/4G network gateway. The 5GV requires no back-end processing and generates SMS and MQTT alerts, captures and uploads alerts, waveforms and interval files to the user-defined FTP server. The 5GV supports MQTT which provides the benefit bi-directional communication and real-time data uploads using inexpensive IoT SIMs that provide data services worldwide.

The 5GV has many configuration settings, so GSS provides an Android mobile application that uses Bluetooth to communicate with and reconfigure the 5GV. The GSS 3GV Console, which is a PC-based application, can also be used to view alerts, waveforms and peak interval files. However, it cannot be used to reconfigure the 5GV.

GSS has a “fit for purpose” communication strategy, where the user can select the best communication module for their site. In addition to the 3G/4G/LTE communication module, GSS offers Wi-Fi, 2.4GHz mesh and will soon be offering a LoRa and UHF mesh communication modules.

The 5GV Vibration Monitor has been developed after years of research with input from geotechnical engineers, construction companies, consultants and GIS providers. After setting up the 5GV unit, it is quick and easy to deploy and can be remotely managed and reconfigured as necessary.

The user should carefully read and follow the instructions contained herein to quickly set-up and configure the 5GV Vibration Monitor. The user should also keep this manual for their frequent and future reference.

2 Hardware Overview

2.1 Package Contents

The standard device purchase comes in a protectively packaged gift box and contains the 5GV device itself, a 3G stub antenna, and a Bluetooth antenna. Magnet keys may also be provided for new customers.

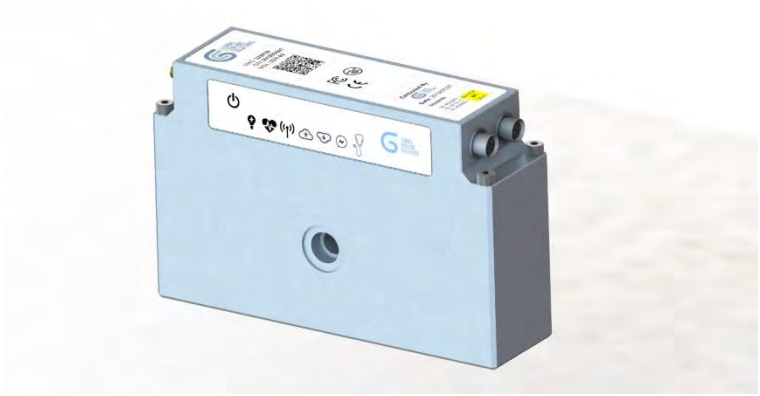


Figure 1 – 5GV Standard Device

If the user prefers, the purchase may also include accessories for the unit. Available accessories are a custom USB to LEMO connector, mounting bracket, flange lock, flange spacers (quantity 4), and standoffs (quantity 4).

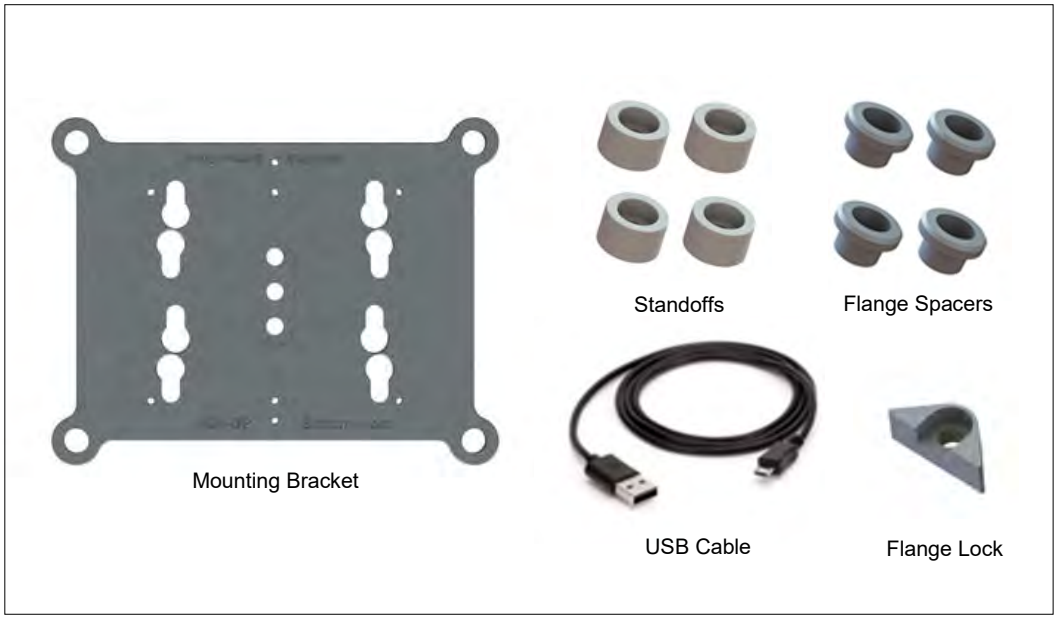


Figure 2 – Optional Accessories

2.2 Key Hardware Features

The 5GV's case is precision CNC machined from corrosion resistant aluminium and textured using bead blasting and natural colour anodising. The design mitigates corrosion and all exposed connectors provide water ingress protection.

The 5GV comprises two sections; a top section that houses the electronics and indicators and a bottom section that houses the batteries and protection circuitry. The bottom section has a centre hole to allow easy attachment directly to the structure or to GSS custom designed mounting brackets.

The 5GV's electronics adopts a modular approach, whereby all major modules plug into a main board. This approach offers ease of maintenance as well as future expandability.

The 5GV provides easy access to the communication module, to allow users to change communication modules in a matter of minutes. The 5GV includes a baffle plate with slotted cut-outs to help align communication module pins with the receptacle on the main board.

The 5GV comes with 2 antennas; one is a Bluetooth Antenna that is standard. The other antenna depends on the communication module installed. The 5GV comes with a 3G/4G/LTE communication installed. The 5GV has a 3rd antenna connector which is for GPS and is a future optional item.

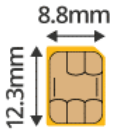
The 5GV has 2 connectors; one is for USB and external power. GSS offers a custom USB cable for communications and external power, and also offer a barrel jack connector designed to support external power via external battery packs and solar panels. The AUX connector supports GSS microphone for sound monitoring and GSS Pods that serve as a single-channel data logger for Vibrating Wire, 4-20mA, RS-485, and others. The GSS Pods can be daily chained up to 6 channels. This is in addition to the vibration monitor and tilt meter functionality already build-in to the 5GV.

Note: GSS advises customers not to remove modules other than the communication module. Only GSS certified individuals are allowed to remove/install the subsystem modules as users could easily damage the fragile connectors. **Uncertified individuals removing communication modules invalidates the warranty.**

Figure 3 – 5GV Top Case inside view (communication module installed)

3 SIM Card Installation

The device come standard with an EG25 3G/4G modem that features a push-push Nano SIM card holder. The user should ensure they have the correct SIM card (depicted in the image at right) for their model. Install the SIM card according to the following instructions.



Nano SIM

Figure 4 – Nano SIM Cards

3.1 Open the Case

First loosen the corner M4 hex capture screws in the sequence shown. (This relieves stress on the screws and aluminium threads.) Then in the same sequence, unscrew the screws completely to separate the top and bottom sections of the case.

Figure 5 – Top Case Screw Removal Sequence

Now disconnect the ribbon cable between the top section and the battery-retainer.

3.2 Inserting the SIM

Locate the modem module that sits above the main board. Then push the Nano SIM card into the push-push SIM card holder, as shown in the red box and arrow below. The SIM card will lock into place. To remove the SIM card push again in the same direction as the arrow, and it releases.

Figure 6 – Insert Nano SIM card

4 Battery Installation

4.1 Accessing Battery Compartment

The battery compartment is located under the battery board as shown in the following image. To access the battery compartment, remove the battery-retaining board by removing the 6 screws.

Note: Due to logistics challenges associated with shipping lithium batteries, GSS does not ship devices with batteries installed.

Figure 7 – Battery Base

Note: The battery base has notches that match with the alignment guide on the battery-retainer. **These need to line up otherwise it can obstruct the top case o-ring and lead to water ingress.** The base notches and alignment guides are highlighted by a red circle below.

4.2 Installing the Batteries

Insert four D-Cell primary lithium batteries into the battery slots, with the positive terminal facing up (as shown in the following image). Next, position the battery board over the batteries by aligning the two small cut-outs on the side of the battery board with the matching protrusions in the case. Finally, screw down the 6 screws to secure the batteries into place.

There is a button on the battery board that can be pressed to check that all 4 batteries are providing power. When the button is pressed a red LED will turn on for each of the 4 batteries. If any of the LEDs don't turn on, then check that your batteries are correctly oriented, battery board correctly installed (notches) and batteries are good quality (test with a power meter).

Figure 8 - Batteries Installation

Note: The battery orientation is also shown on the battery retainer with the positive end up.

Note: If the user does not have the required batteries available, the device can be powered via USB if you have the custom USB cable, which is an optional accessory. Plug one end into the USB port on a PC and the other end into the device USB LEMO connector. The device top label has text to identify the USB connector, which is the only 6-pin connector and is keyed. The keyed connector means only the correct cable can be used.

4.3 Battery Models

The device takes four primary lithium batteries, preferably spiral-wound to cope with high surge currents. GSS has tested many brands and models of battery, and the following are approved by GSS to work correctly.

Brand	Modem	Comments
SAFT	LS20H	13Ah rating and fitted with 5A fuse. *Be careful not to short the terminals; a blown fuse renders the SAFT battery useless.*
FANSO	ER34615M	14Ah rating and not fitted with a fuse. (The device has fuses on the battery retainer PCB to compensate.)

Note: High-current batteries are required when using the 3G/4G/LTE communication module. GSS are testing lower current batteries (ER34615 19Ah) that have a higher capacity and can increase battery life, which could be used with other communication modules (i.e. Wi-Fi) that don't require high-current.

Note: Please note that high current batteries are ER34615M and not ER34615 or ER34615H. If you purchase the wrong batteries, then the device may not have enough current to power the 3G/4G/LTE modem.

4.4. Reassembly

After the batteries have been installed, re-connect the battery cable between the battery board and the device Main board. Check that the top case O-ring is installed and there should be no damage on the base case protrusions that mate with the O-ring. Put the top case on top of the base case and firmly tighten the four M4 screws.

Check that the metal caps that cover the LEMO connectors are also securely attached. Push the cap top firmly to lock and ensure that it is properly seated.

To remove the metal cap or connectors grip the sleeve (green check) and pull back.

Note: LEMO connectors and metal caps are push-pull. Do not attempt to twist the cable connector or ends of the metal caps. The end of the metal caps contains an O-ring for water ingress protection. Ensure that the end of metal caps is tight.

5 Antennas

5.1 GSM Antenna

The standard unit supports 3G GSM, 4G LTE-M1 and LTE-NB1 with different frequency bands assigned according to region.

The GSM antenna shipped with the device is a wide-band model covering the range 300MHz to 1GHz and is suitable for most installations.

It is important to be aware of the following:

- If the signal strength at a particular location is weak, remove the antenna and replace it with one offering better response in the desired frequency band.
- If the device installation location is unable to receive a 3G/4G signal, the user can relocate the antenna to a more suitable location and then run a low-loss coaxial cable connecting the device to the antenna.

5.1.1 Loss of Connectivity

If the device is unable to register with a network operator or upon occasional loss of connection, the unit continues to operate in standalone mode based on the configuration settings loaded onto the MicroSD.

If the unit has registered on the cellular network at least once prior to installation, its internal clock should still be correct.

All Alerts, Interval and Waveform data is stored on the MicroSD until the network becomes available again. An operator can query the number of files pending upload and trigger their upload using the “Send” command.

5.2 Bluetooth Antenna

The device supports Bluetooth and a 2.4GHz stub antenna ships with the device, which has adequate gain for up to 10m. This antenna may also server other purposes in the future including Wi-Fi and Wireless Mesh.

The **GSSLink** application is freely available on Google Play and can be downloaded and installed on an Android device to locate and manage 5GV devices in the area.

5.3 GPS Antenna

The device comes standard with GPS antenna connector, but a GPS functionality and antenna are not a standard option. GSS uses an active patch antenna to improve GPS receive sensitivity. GSS plans to offer GPS functionality as an optional licensed function and an GPS antenna as an accessory. Contact GSS if you have an interest in adding GPS functionality.

6 MicroSD Card

The device features an industrial-grade MicroSD card, offering long life and high reliability. The file system is standard FAT16 and therefore easily accessed using a PC or MAC with a MicroSD card reader.

Note: GSS recommends using the PC Console application to transfer files from the MicroSD card as removing the MicroSD requires removing multiple screws and users may cause damage when removing the memory module.

7 Powering the 5GV

The following section gives instructions for the power up and power down of the 5GV unit.

7.1 Power On

The device has an external power switch (magnet activated) and an internal power switch (tactile button).

To power the unit on with a magnet; hold the magnet next to the power symbol on the side of the device for about one second. When the magnet is close enough, the power indicator will glow red and when removed, the red indicator turns green to indicate the power up sequence has begun.

Note: If the power indicator does not start blinking green, power-on was not successful and you should repeat the process, this time holding the magnet in place a little longer.

The device begins with a self-diagnostics process and uses the LED indicators to indicate the diagnostic step (binary step code). When the device successfully connects to the network and starts monitoring, the power and heartbeat indicator flash green in unison every 5 seconds. The sensor indicator blinks briefly every 5 seconds and is independent of other indicators.

Important Note: To disable self-diagnostics mode issue the command “cfg diags off” from the PC Console or serial terminal. The next time the device is reset, it will not perform self-diagnostics. To turn diagnostics back on issue the command “cfg diags off”.

Figure 9 – Front Label

	Power Symbol	Position magnet here to power on and off the device
	Power	Solid red indicates power on; Solid green indicates powering off
	Heartbeat	Flashing green every 5 seconds when device operational
	Communication	Flashing green every 5 seconds when communications operational
	Upload	Flashing green during uploads
	Download	Flashing green during downloads
	SMS	Flashing green when sending or receiving SMS messages
	Sensor	Flashing green every 5 seconds when sensor operational

The results of the diagnostics are displayed when using a serial terminal. The table below shows the normal results when powered via USB cable.

Test	Result	Description
LED PIO Expander	[PASS]	LED Function Check
GSM PIO Expander	[PASS]	Communication Module Function Check
PWR PIO Expander	[PASS]	Power Module Function Check
BAT PIO Expander	[Not Done]	Battery Module Function Check
Real Time Clock	[PASS]	Real Time Clock Function Check
Battery Gauge	[PASS]	Battery Fuel Gauge Function Check
ADXL355 Sensor	[PASS]	2,4,8G Accelerometer Function Check
ADXL357 Sensor	[PASS]	10,20,40G Accelerometer Function Check
PSRAM Memory	[PASS]	Memory Module Function Check
MicroSD Storage	[PASS]	MicroSD Storage Function Check
Config Load/Save	[PASS]	Configuration File Read/Write Check
Bluetooth Modem	[PASS]	Bluetooth Modem Function Check
3G/4G Modem	[PASS]	GSM Modem Check
FTP Connection	[PASS]	FTP Connection Check

7.2 Power Off

You can power off the device with a magnet, internal power switch or command sent via SMS or MQTT, Bluetooth or the USB Serial port. When powering off with a magnet or the internal switch, hold the magnet or depress the switch for at least 3 to 5 seconds.

When the device detects a power off notification, the power indicator turns green to acknowledge the power off request and prevents the power module form powering down until all outstanding tasks are complete.

When using the magnet power off method, remove the magnet after the power indicator turns from red to a mix of red and green, to turn off the red indicator.

7.2.1 Controlled Shutdown

The controlled shutdown sequence performs the following tasks:

1) Stops new files from being queued
2) Stops the FTP upload task after the current upload finishes
3) Flushes the memory based Log buffer to disk
4) Finally, the power indicator extinguishes and the power module shuts off.

8 Configuring the Device

The device provides a number of local and remote configuration mechanisms, including:

1) GSS PC Console application
2) GSS Bluetooth mobile application
3) Serial terminal commands (over USB)
4) SMS commands from a mobile device
5) MQTT commands from a MQTT client
6) Configuration file download from an FTP server

8.1 GSS PC Console Application

The GSS PC Console Application provides a Console tab through which the user can enter commands when connected to the device in Live Mode commands.

Refer to the 3GV Console Application User Manual for further information. A new GSS Console will be released in the future that will be more applicable for this device.

8.2 GSS Bluetooth Mobile Application (GSSLink)

The GSS Bluetooth mobile application, GSSLink, offers the most intuitive mechanism. You can retrieve the current configuration settings from the device, edit and then save them back to the device. The mobile application provides a *load defaults* button on several screens so you can quickly set default values.

Refer to the GSS Bluetooth Mobile Application User Manual.

8.3 Command Line Method

After connecting the device to a Windows PC and powering it on, the device manager displays a COM port associated with the device and reports it as a “USB Serial Device”. Here is an example from the Device Manager panel.

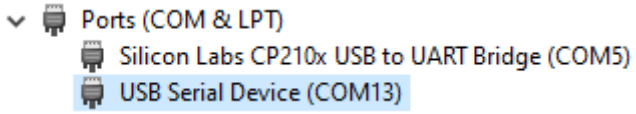


Figure 10 – Windows Device Manager COM Ports

Open a serial terminal on PC (or MAC), set to 8 data bits, 1 stop bit and no parity and disable all flow control.

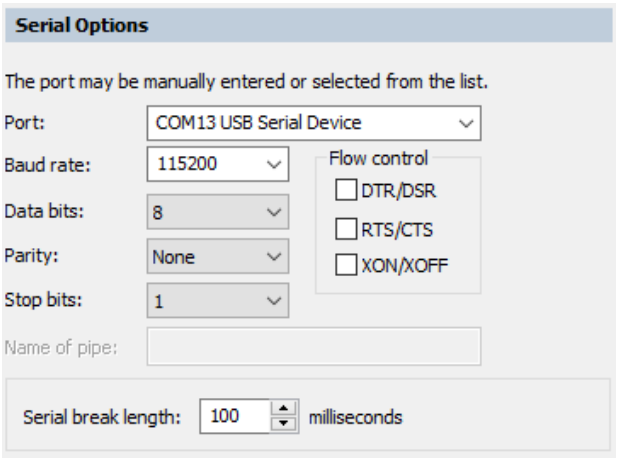


Figure 11 – Serial Terminal Device Settings

8.4 SMS Commands Method

If the device is fitted with a 3G/4G/LTE communication module and powered up, it will try to register with an operator. Providing registration succeeds, the device will enter into sleep mode and you can send an SMS command to the cell number associated with the installed SIM card. All SMS commands have the same syntax as those supported by the serial terminal command line.

8.5 MQTT Commands

The device can be configured to use MQTT. The device monitors a COMMAND topic associated with the MAC address and responds on a REPLY topic also associated with the device's MAC address.

Use an MQTT client to setup the queues and make sure you set **QoS to 1** to guarantee delivery. MQTT works with Wi-Fi and 3G/4G/LTE communication modules. The Wi-Fi module is more responsive than the 3G/4G/LTE communication module due to differing power save algorithms. The Wi-Fi response is almost instantaneous, but with the 3G/4G/LTE communication module the response can take up to 5 minutes, depending on configuration settings.

8.6 FTP Based Method

FTP based configuration relies on the device downloading a configuration image from the configured FTP server and after validation, replacing the current configuration image with the downloaded image,

The recommended approach is to take a snapshot of the current configuration image, a process that also uploads it to the FTP server. You then download and edit the file and upload it back to the FTP with a ".new" filename extension.

After uploading the modified configuration file, you send the "cfg download" command to the device to download the configuration file from the FTP server. You can use a PC console, SMS, MQTT (if configured) or GSSLink Bluetooth mobile app to initiate the download.

The device also supports periodic checks for ".new" configuration files if the "CHECK_CFG" option is set in the [MAIN] section of the configuration file. If the option is TRUE, the device checks for a new configuration file each time it uploads a vibration peak-interval file, or a tilt beat file.

9 Cellular Network Guide

This section is a guide for clients setting up a device for use on a Cellular Network.

Note: Only for devices fitted with 3G/4G/LTE communication module

New wireless network standards continually evolving to keep pace with technology and increased traffic, the number of access technologies and SIM providers also increased, making configuration more challenging than when there was only GSM/GPRS.

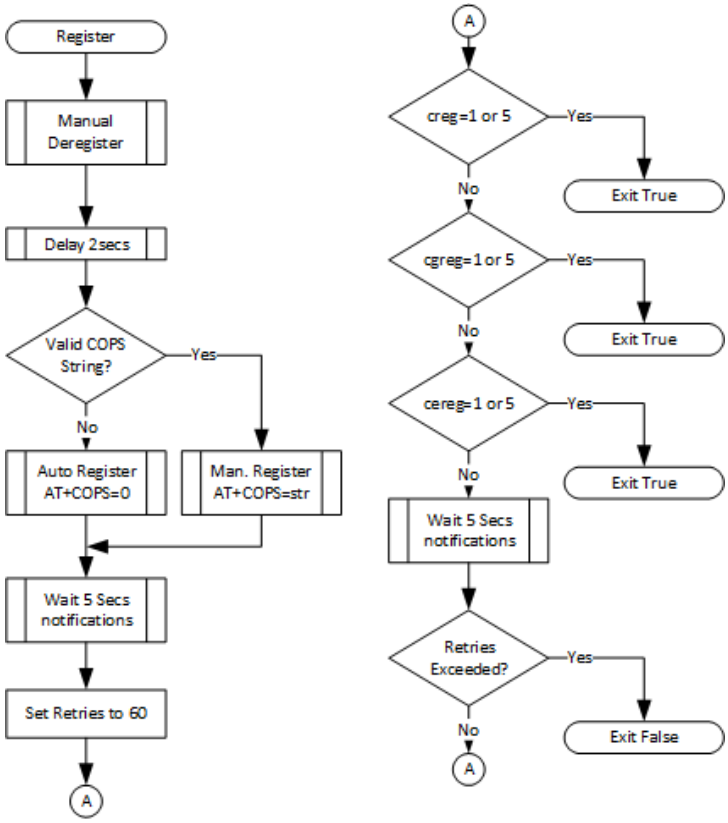
Global SIMs are becoming more prevalent and provide low-cost roaming access that can greatly ease global deployment. SIM providers may not have agreements with all carriers in a region, which complicates the network registration process as it the modem needs to scan and attempt registration with discovered carriers. This can take from 30 seconds to many minutes unless the device is “steered” to a specific carrier and access technology.

Here is an example; SmarTone, 3, Hutchison, CSL and China Mobile in Hong Kong provide 3G, LTE; CSL still spotty 2G support. In the case of a Twilio (global) SIM, users can only register on the ‘’3” network, which may not have the strongest signal. Registration can take many minutes. The “3” network supports WCDMA and LTE, but unless the device is steered to these two access technologies, network registration can take many minutes.

The next few sections provide information on the registration flow, key settings and working with Twilio SIM cards, and finally commands that identify the available networks and how to configure for the best results.

9.1 Registration Flow Chart

The device implements a new carrier registration flow, which was developed based on testing with a variety of SIMs and network behaviour.



1. The device first sends a manual de-register command to the modem to avoid false registration notifications when using roaming SIMs.
2. The device delays 2 seconds.
3. The device then checks if the configuration file contains a valid COPS setting, meaning, 4 parameters (4,2,45400,7 for example). If invalid, the device sends an auto register command AT+COPS=0, else it sends AT+COPS=configuration value
4. The device waits for 5-seconds for asynchronous registration notifications
5. The device enters a loop with a retry limit of 60 x 5 seconds = 5 minutes
    a. The device exits the loop if creg =1 or 5, cgreg=1 or 5 or cereg = 1 or 5 (5=roaming)
    b. The device waits 5-seconds for asynchronous registration notifications
6. The device returns **true** if one of the registrations succeeds (creg=CS, cgreg = PS and cereg=EPS), else False (causing a modem reset retry).

The device retries resetting the Modem up to 3 times, but if still unable to register, it powers down the modem for 30 minutes before retrying.

9.2 Key Modem Settings

The following settings in the configuration file affect network search and registration:

APN	Access Point Name (required for data connectivity)
APN_USR	Access Point login name (if required)
APN_PWD	Access Point login password (if required)
SCANSEQ	Scan Sequence for Access Technologies
SCANMODE	Network Search Mode Configuration
SCANBAND	Band Configuration (A, B, C)
ROAMING	Sets roaming option (off, enabled or auto)
SERVICE	Sets the Service Domain (circuit switch, packet switched or both)
COPS	Operator Selection (A,B,C,D)

Please refer to **GSM Configuration Section** for more information on each of these settings

9.3 Commands and Configuration

In most cases, a valid APN is required in order to access the Internet. The default settings are for CSL Hong Kong, so you need to change them according to the installed SIM card. *Check with your mobile operator for the APN settings.*

After installing the SIM and powering up the device, you may use the commands documented in the sections below, to configure the modem for fast registration and high-speed data.

The device accepts these configuration commands via a serial terminal or SMS

Note: Take care when using SMS as devices in the field may become unresponsive if you set invalid registration details or APN.

9.4 Net Dflt

The **net dflt** command changes the device configuration file to use default settings. Dflt is short for default.

9.5 Net Scanoper

The **net scanoper [2g\|3g\|4g\|all]** scans for all operators in the 2G, 3G, and 4G band.

Note: We recommend selecting the desired network (i.e. **4g**) instead of **all,** as the scan operation may timeout searching all the networks.

The example below shows how to scan for all operators on the 4G network. The response shows the results that come as three separate responses. The first shows the device scanning for network operators, the next is when the scan completes, and the last is the list of operators with identifiers.

Example Command:

net scanoper 4g

Response:

```
Scanning 4G Operators
Net Scan Completed OK
Operator Name        Identifier
SmarTone HK          45406
China Mobile HK      45412
CSL                  45400
3                    45403
```

Note: If you do not see a response after 5 minutes, run the command again. The modem often times out during this operation. Re-issuing the command normally resolves the issue.

Note: Use the network provider identifier in the **net scanband** command. When using an IoT SIM, check with the IoT supplier for supported network providers.

9.6 Net Scanband

The **net scanband nnnn [2g\|3g\|4g\|all]** scans the bands supported by the selected operator, where nnnn is the network operator identifier. You can get this from the **net scanband** command if not known.

This example relates to the previous **net scanoper** example and shows a scan of bands associated with CSL network operator (identifier 45400) on the 4G network. The response shows thee separate responses. The first shows the device scanning the CSL network for 4G bands, then next when the scan completes, and the last is the list of CSL Bands found and the quality of the signal (great, good, fair and edge)

Note: We recommend you select the desired network (i.e. **4g**) instead of **all,** as the scan operation may timeout searching all the networks.

Example Command:

net scanband 45400 4g

Response:

```
Scanning Operator 45400 4G Bands
Net Scan Completed OK
CSL Bands
#       Name   B       Qual
 1      B8     8       Great
```


2	B3	3	Great
3	B26	26	Good
4	B7	7	Edge

Note: Network band scan command is only for 3G/4G/LTE communication modules. The device returns an error if it detects a different modem.

Note: If you do not see a response after 5 minutes, run the command again. The modem often times out during this operation. Re-issuing the command normally resolves the issue.

9.7 Net Switch

The **net switch n{,n,n}** configures the modem to use the selected setting from the "net scanband" command. You can set one or multiple options by separating them with commas. For example, **net switch 1,3,4.**

The example below shows CSL Band B8 selected and the response sets the SCANBAND and SCANSEQ settings in the configuration file. The device prompts the user to reset the modem for the configuration change to take effect.

Example Command:

net switch 1

Response:

MAIN->SCANBAND is 400,4,3f
MAIN->SCANSEQ is 04
Send 'reset modem' to invoke
>>reset modem

Note: The net switch change is persistent.

9.8 SIM PIN

SIM cards all come with a security feature called a PIN Lock and are not supplied locked. You can set a PIN Lock to prevent unauthorised use if someone steals the SIM.

9.8.1 Setting PIN

When the SIM has a PIN Lock, you need to configure the PIN in order to access the mobile network; note that three invalid PIN attempts will brick the SIM and you need to contact the provider to obtain a PUK to unlock it.

You set the PIN code using the command:

cfg sim_pin {value}

The {value} is a PIN number between 4 and 8 digits.

9.8.2 Unlock PIN

If a SIM has a PIN and you want to remove it, use the command:

cfg sim_unlock {value}

Note: We recommend NOT setting a SIM PIN if you frequently swap SIMs between devices. If the device sends the wrong PIN code three times, the SIM becomes bricked and you need to obtain the Pin Unlock Code (PUK) to unbrick it.

10 Configuration File

For all operation settings, the device relies on a master configuration file called *TGV3GCFG.INI* for firmware 5.x.0 and *5GVCFGV2.INI* for firmware 5.2.x. Both are stored in the */CONFIG* folder on the MicroSD card. (There is also a backup file, in case of file corruption).

Note: Firmware 5.2.x contains new features including Wi-Fi, MQTT, and Sound Microphone, as such, the configuration file has been revised to support these new features and also renamed for backward compatibility.

The configuration file is text-based and uses the Windows INI format to make it easier to edit bulk settings.

The following sections of cover the various sections of the configuration file and what changes the user can make. The tables indicate sections that apply to firmware 5.2.x with 5.2.x.

Section	Description
[MAIN]	General settings
[GSM]	GSM or LTE modem settings – 5.2.x
[WIFI]	Wi-Fi settings – 5.2.x
[MQTT]	MQTT messaging settings – 5.2.x
[SCHEDULE]	Task schedules
[FTP]	FTP client settings
[HTTP]	HTTP client settings
[ROUTE_FILE]	Route file type settings (FTP, HTTP) – 5.2.x
[ROUTE_MSG]	Route message type settings (MQTT, SMS, None) – 5.2.x
[EXPORT]	File Export options
[OTAP]	Firmware update FTP settings
[REM_DIR_FLAT]	FTP server flat directory structure and file naming convention
[REM_DIR_NEST]	FTP server nested directory structure and file naming convention
[SMS]	SMS phone number settings
[SENSORS]	Sensor options (mode and licence)
[xxxxxx_VIBR]	Sensor vibration settings
[xxxxxx_TILT]	Sensor tilt settings (if licensed)
[MIC]	Microphone settings (if licensed) – 5.2.x
[STATUS]	Status data from the sensor (not sent to the sensor)

Table 1 - Configuration File Sections

With each parameter entry, the user should be sure to enter the correct value or format. Some of the terms you should be familiar with before reading the following section of this manual are as follows.

- **Integer** – An integer value is a whole number value.
- **String** – A string value is any ordered sequence of characters (char). If a parameter is a string, you should be follow the given format for the entry.
- **Boolean** – A Boolean value is a value type that only has two possible values: true or false. For all of the Boolean parameter entries in this manual, the user may set the value to “true” by entering either “T” or “t” or “True” or “1” and set the value to “false” by entering either “F” or “f” or “False” or “0”.

- *Deprecated* – A *deprecated* value or code, indicates phasing out of that item and no longer in use. If the user comes across deprecated data entries in this manual, changes made to those values will have no effect.
- *Unimplemented* – An *unimplemented* value or code indicates the feature is not yet not functional. If the user comes across *unimplemented* data entries in this manual, changes made to those values will have no effect.

10.1 [MAIN] Section

The [MAIN] section of the configuration file contains the following configuration parameters.

Field	Description	Value	Comments
VER_MAJ	Version Major. No validation; user-defined	A integer value 0 to 255	
VER_MIN	Version Minor. No validation; user-defined	A integer value 0 to 255	
DATE	Date. No validation; user-defined	A 12-char string	Used by GSS Cloud to keep track of modifications
SERIAL	Serial Number. No validation; user-defined.	A 20-char string	Normally filled in with device MAC Address
NUMBER	Phone Number. No validation; user-defined.	A 12-char string	Normally filled in with the phone number of the device if it has a SIM card.
LOCATION	Location. **GPS option:** contains latitude, longitude, and altitude coordinates. **No GPS:** user-defined.	A 64-char string	User can use any location tracking system, such as Google Maps.
APN	Network APN	A 32-char string	These fields are here for backwards compatibility with firmware 5.0.x and migrated to the GSM Section in firmware 5.2.x.
APN_USR	Network APN Username	A 20-char string	
APN_PWD	Network APN Password	A 20-char string	
SCANSEQ	Network Scan Sequence	A 10-char string Default "0405030201"	
SCANMODE	Network Scan Mode	An integer value	
SCANBAND	Network Scan Band	A 32-char string Default "ffff,800d5,3f"	
IOTOPMODE	Network Category for LTE	An integer value	
SERVICE	Network Service	An integer value	
ROAMING	Network Roaming	An integer value	
COPS	Network Device Register	An integer value	
NTP_URL	The IP address or URL of the Network Time Server to contact in case the network carrier does not support the NITZ time command	A 64-char string	Default is Google Time Server: 216.239.35.12
NTP_PORT	This parameter is an Integer that specifies the TCP port on the NTP time-server.	A integer value 0 to 65535	Default NTP port is set to 123 (industry standard)
NTP_TZ	Specifies the Time Zone used. NTP does not recognize time zones; instead, it manages all time information based on UTC. The NTP Time Zone is the offset from UTC in 15-minute increments.	A integer value -96 to +96	For instance, Hong Kong is 8 hours ahead of UTC; therefore, it is set to 32.
NTP_TIME	Controls whether the device prioritizes NTP over the GSM network provider.	True or False (default)	NTP_TIME relies on the NTP_URL and NTP_PORT to be correct. The default

Field	Description	Value	Comments
	Setting the value to True, the device uses the NTP server and use NTP_TZ to set the current time. Setting the value to False, the device retrieves the time from the network provider using NITZ and automatically sets the NTP_TZ to the correct value. If the network provider is unable to provide the time, then NTP is used.		values in MAIN should be used unless you have a preferred NTP Server
LOG	Logging Level; Warning "W" is recommended when device deployed. **Information "I" is for troubleshooting only. DO NOT leave it in this mode in the field.**	I = Information W = Warning (default) E = Errors	**If set to "I", the log buffers will quickly fill and the device will frequently store log files on the microSD or upload them. Both can cause battery to drain, so only set "I" when required.**
BAT_WARN	Sets the battery percentage at which the device sends a warning message. The default alert level is 10 (meaning 10%); however, the user can set this to any value between 5 and 95.	An integer value between 5 and 95 Default is 25.	Once the unit sends out the battery alert, it sends reminders until the battery level reaches 5%
SEND_ALERT	Instructs the device to enable/disable the upload of alert files.	True (default) or False	If set to False, then the alert files will remain on the device microSD card
SEND_BEAT	Instructs the device to enable/disable the upload tilt beat files.	True (default) or False	If set to False, then the tilt beat files will remain on the device microSD card
SEND_PEAK	Instructs the device to enable/disable the upload vibration peak interval files.	True (default) or False	If set to False, then the peak interval files will remain on the device microSD card
SEND_DATA	Instructs the device to enable/disable the upload vibration waveform files	True (default) or False	If set to False, then the waveform files will remain on the device MicroSD card Note: SEND_DATA are the data files and not the alert files. For instance, vibration data files are the waveform files. The vibration alert file contains the alert summary information and is controlled by SEND_ALERT

Field	Description	Value	Comments
SEND_CFG	Instructs the device to enable/disable the upload the current configuration file every time it uploads the peak interval or beat file.	True or False (default)	
CHECK_CFG	Instructs the device to enable/disable the check for a .new file on the FTP server every time it uploads the vibration peak interval or tilt beat file.	True (default) or False	
SEND_LOG	Instructs the device to enable/disable the upload log files.	True or False (default)	If set to False, then the log files will remain on the device MicroSD card
SEND_SMS	Instructs the device to enable/disable the sending of SMS messages	True or False (default)	SMS messages include up notices, vibration alerts, tilt alerts and battery alerts.
GSM_OFF	Instructs the device to enable/disable the 3G/4G/LTE modem	True or False (default)	
WIFI_OFF	Instructs the device to enable/disable the Wi-Fi modem	True or False (default)	
BT_OFF	Instructs the device to enable/disable the Bluetooth modem	True or False (default)	Note: The BLUE field in the SCHED section controls the time at which Bluetooth is enabled.
MIC_OFF	Instructs the device to enable/disable the microphone	True or False (default)	
MQTT_OFF	Instructs the device to enable/disable MQTT	True of False (default)	
WAIT_FOR_TIME	Instructs the device to wait until it has a valid time before starting the sensor subsystem. When True, the device checks its internal clock to see if it is within 3 years of the current build time. If not, it waits until it gets a time from the cellular modem, NTP, Wi-Fi, Bluetooth Mobile App or User before it starts monitoring.	True of False (default)	
HTTP_ALERT	Send alerts via HTTP	True of False (default)	These fields are here for backwards compatibility to firmware 5.0.x. All these configuration fields have been migrated to the ROUTE_FILE Section from firmware 5.2.x.
HTTP_BEAT	Send beats via HTTP		
HTTP_PEAK	Send peaks via HTTP		
HTTP_DATA	Send waveforms via HTTP		
HTTP_CFG	Send configuration files via HTTP		
HTTP_LOG	Send log files via HTTP		
HTTP_RECOVER	Send recover files via HTTP		

Table 2 - MAIN Configuration Settings

10.2 GSM

This section is only found in firmware 5.2.x, but many of the field names will be in MAIN for firmware 5.0.x

Field	Description	Value	Comments
APN	Specifies the Access Point Name (APN) for the SIM card provided by the network carrier.	A 32-char string	For example, a CSL SIM card in Hong Kong requires the APN "csl"
APN_USR	APN Login Name	A 20-char string	This may not be required or left blank
APN_PWD	APN Password	A 20-char string	This may not be required or left blank
SCANSEQ	Network Scan Sequence. Please refer to the SCANSEQ section below.	A 10-char string Default "0405030201"	
SCANMODE	Network Scan Mode 0 AUTO 1 GSM only 2 WCDMA only 3 LTE only 4 TD-SCDMA only 5 UMTS only 6 CDMA only 7 HDR only 8 CDMA and HDR only	Integer from 0 to 8	We recommend setting the value to 0 (auto). If you want to steer to a the latest access technologies, use 2 or 3
SCANBAND	Network Scan Band Please refer to the SCANBAND section below.	A 32-char string	
IOTOPMODE	Network Category for LTE 0 = LTE Cat M1 (default) 1 = LTE Cat NB1 2 = LTE Cat M1 and Cat NB1	A integer value (0,1,2)	To force the device to search Cat M1 only and ignore NB1 carriers, set the value to 0. To ignore Cat M1, set the value to 1. To search for Cat M1 and NB1, set the value to 2.
SERVICE	Network Service 0 = Circuit Switched (2G and some 3G) 1 = Packet Switched (most 3G and LTE) 2 = Circuit and Packet Switched (default)	A integer value (0,1,2)	Some network carriers might reject Circuit Switched Network if the SIM has no Calling feature.
ROAMING	Network Roaming	An integer value	
COPS	Network Device Register Please refer to the COPS section below.	A char string	

10.2.1 SCANSEQ

This parameter specifies the search sequence for the 4G modem. It can be a 6-digit or 10-digit number composed of three two-digit numbers. The format is “AABBCC” and “AABBCCDDEE” respectively, where “AA” is the first mode scanned, “BB” is the second mode scanned, “CC” is the third mode scanned, “DD” is the fourth mode scanned, and “EE” is the last mode scanned. The available modes’ values are:

For the EG25 modem, valid values are:

- 00 Automatic (LTE/ WCDMA/TD-SCDMA/GSM)
- 01 GSM
- 02 TD-SCDMA
- 03 WCDMA
- 04 LTE
- 05 CDMA

To scan for only GSM operators when using a EG25, use “0101010101”

When using an EG25 modem, you might want to search LTE, then CDMA, then WCDMA and finally TD-SCDMA and GSM. In this case, use the value “0405030201” (the default setting for the device).

10.2.2 SCANBAND

This parameter specifies the frequencies the modem should look for when searching for suitable carriers. This comprises three hexadecimal, comma-separated values.

For EG25, they represent GSM/WCDMA, LTE and TDS bands.

The user can set the values to search all frequencies, but it is best to select only those supported by the carrier in the country.

10.2.2.1 EG25 Modems

For the EG25 modem, the GSM / WCDMA field is a bit combination of the following:

- **00000000** No change (means do not modify the current value)
- **00000001** GSM900
- **00000002** GSM1800
- **00000004** GSM850
- **00000008** GSM1900
- **00000010** WCDMA 2100
- **00000020** WCDMA 1900
- **00000040** WCDMA 850
- **00000080** WCDMA 900
- **00000100** WCDMA 800
- **00000200** WCDMA 1700
- **0000FFFF** Any frequency band

For the EG25 modem, the LTE field is a bit combination of the following:

- **0x00000000001** LTE B1
- **0x00000000002** LTE B2
- **0x00000000004** LTE B3
- **0x00000000008** LTE B4
- **0x00000000010** LTE B5
- **0x00000000040** LTE B7
- **0x00000000080** LTE B8
- **0x00000000800** LTE B12
- **0x00000001000** LTE B13

- **0x00000020000** LTE B18
- **0x00000040000** LTE B19
- **0x00000080000** LTE B20
- **0x00001000000** LTE B25
- **0x00002000000** LTE B26
- **0x00008000000** LTE B28
- **0x02000000000** LTE B38
- **0x04000000000** LTE B39
- **0x08000000000** LTE B40
- **0x10000000000** LTE B41

For the EG25, the TDS band value is bit combination of the following:

- **0x01** TDS BCA
- **0x02** TDS BCB
- **0x04** TDS BCC
- **0x08** TDS BCD
- **0x10** TDS BCE
- **0x20** TDS BCF

The device sets the scan-band to the following default values. "**3ff, 1F00B0E18DF, 3f**" which covers all GSM/WCDMA, LTE and TDS bands.

10.2.3 COPS

In cases where you need to steer the modem to a specific operator and access technology, use the COPS setting with appropriate arguments.

The COPS setting has the form "arg1, arg2, arg3, arg4"

10.2.3.1 COPS Arg1

This argument instructs the modem as to what type of registration to perform.

- **0** = automatic mode (default)
- **1** = manual selection (manual selection)
- **4** = manual selection with fall back to auto if it fails

Important Note: Only use these values; other values could disconnect the modem and you will lose contact with the device.

10.2.3.2 COPS Arg2

This argument indicates for format of the operator that you are providing:

- **0** = 16 char value (Full Operator name)
- **1** = short alphanumeric value (Short Operator name)
- **2** = local area identification number (PLMNID of the operator)

10.2.3.3 COPS Arg3

This argument contain text or a number according to the Arg2 value.

For example; if Arg2=0, then this field would contain a text string up to 16 characters ion length. If Arg2=1, then it contains a short form of the operator name. When set to two (2), the recommended method, it contains the MCC+MNC code (PLMNID) assigned to the operator.

Find the PLMNID for the operator in the country of interest at this link: https://mcc-mnc-list.com/list

10.2.3.4 COPS Arg4

This argument indicates what access technology the modem should try to use when registering.

For the EG25 modem, it could be one of the following:

- 0 GSM
- 2 UTRAN
- 3 GSM W/EGPRS
- 4 UTRAN W/HSDPA
- 5 UTRAN W/HSUPA
- 6 UTRAN W/HSDPA and HSUPA
- 7 E-UTRAN
- 100 CDMA

In the case of the EG25 which does not have CAT-M1 or NB1, you would use LTE or WCDMA. To steer the device to CSL in Hong Kong and LTE, use the command:

cfg main cops 4,2,45400,7

Note: GSS recommends setting the COPS value to **0** initially to allow the modem to locate an appropriate operator. Once registered, query the device with the **stat 3g** command to determine to which operator and access technology the device registered.

When using a roaming SIM, it is worthwhile to steer to a specific operator to save time registering each time the modem restarts.

To switch to the default GSS settings, issue the command **cfg switch gss**.

10.3 [WIFI] Section

This section is only found in firmware 5.2.x.

Field	Description	Value	Comments
SSID	Specifies the service set identifier (SSID) or network name that uniquely names a Wi-Fi network.	A 32-char string	
PWD	Specifies the SSID password to log into the network	A 64-char string	
SEC_PROT	Security Protocol 0 = Open 1 = WEP 2 = WPA 3 = WPA2 (default) 4 = WPA+WPA2 5 = WPA3 OWE 6 = WPA3 SAE 7 = WPA2 RSN & WPA3 SAE	A integer value (0 - 7)	
SEC_ENCR	Security Encryption Type 0 = TKIP 1 = AES (default) 2 = TKIP+AES	A integer value (0,1,2)	
NTP_RATE	The SNTP client update interval in seconds. The default is 86,400 or 1 day.	Integer value	Device requests the time from, the Wi-Fi modem at start-up. The modem resynchs at the specified interval
CC	Country Code as defined by ISO 3166-1 alpha-2 standard	Default is “HK” for Hong Kong	For instance, KR = Republic of Korea US = USA JP = Japan CH = China

Note: The device requires a valid SSID, Login credentials and Security mode in order to join local Wi-Fi network. The device will not be able to successfully register to Wi-Fi networks where access requires logging into a web page, i.e. in hotel rooms, coffee shops, etc.

10.4 [MQTT] Section

This section is only found in firmware 5.2.x.

Field	Description	Value	Comments
HOST	Specifies the MQTT Broker IP Address	128 char string or IP address	
PORT	Specifies the port used by the MQTT Broker	Integer value in the range 0 to 65535	Defaults to 1883
QOS	Specifies the Quality of Service	Integer value in the range 0 to 2	Device sets this to 1 to ensure delivery to subscribers
TLS	Specifies the Transport Layer Security used to secure the communication channel	Integer value in the range 0 to 7	Check the WiFi network to determine the type of security used
USR	Specifies the user name of the MQTT account		
PWD	Specifies the password for the MQTT account		
PUB_SAMP	Publishes vibration peak and tilt beat reading messages to the SAMP queue		
PUB_ALERT	Publishes alert messages to the ALERT queue		
PUB_NOTIFY	Publishes informational messages to the NOTIFY queue		
PUB_REPLY	Responds to COMMAND messages by publishing response messages on the REPLY queue		
SUB_COMMAND	Subscribes to the COMMAND queue to react to COMMAND messages		

10.4.1 TLS Security

This field specifies the type of security employed by the Wi-Fi router.

0	**OPEN**	No security, so no USR or PWD required.
1	**WEP**	Wired Equivalent Privacy no longer used due to security flaws
2	**WPA**	Wi-Fi Protected Access (or TKIP standard)
3	**WPA2**	Wi-Fi Protected Access (like WPA but supports CCMP and AES encryption)
4	**WPA+WPA2**	Supports both WPA and WPA2 security
5	**WPA3 OWE**	Enhanced WPA2 with Opportunistic Wireless Encryption
6	**WPA3 SAE**	Enhanced WPA2 with Simultaneous Authentication of Equals
7	**WPA2 RSN & WPA3 SAE** same as above but with Robust Security Network feature	

10.5 [SCHEDULE] Section

The schedule section of the configuration file specifies the intervals at which the device will perform various tasks. The schedule format is “DD:HH:MM:SS” where “DD” represents days, “HH” represents hours, “MM” represents minutes, and “SS” represents seconds.

Field	Description	Value	Comments
STATUS	Specifies the interval at which the device requests a status update from the sensor module.	“DD:HH:MM:SS” Default “00:00:05:00”	
RESET	Specifies the interval at which the device resets the modem so it disconnects and re-joins the cellular network.	“DD:HH:MM:SS” Default “00:08:00:00”	The device resets the modem at this scheduled interval. This helps mitigate lockups, apply configuration changes and re-acquire a strong signal
PEAK	Specifies the interval at which the device queues the peak interval file to upload.	“DD:HH:MM:SS” Default “00:04:00:00”	Uploads the Peak Interval file at this scheduled interval, providing the **send_peak** setting is not False.
BEAT	Specifies the interval at which the device queues the peak interval file to upload.	“DD:HH:MM:SS” Default “00:08:00:00”	Uploads the Beat file at this scheduled interval, providing the **send_beat** setting is not False.
HOUSEKEEP	Specifies the interval at which the device performs housekeeping tasks.	“DD:HH:MM:SS” Default “00:12:00:00”	Unimplemented. This is a future function intended for cleaning up old files (i.e. log files)
BLUE	Used to configure operational time Bluetooth is available.	“HH:MM,HH:MM” Default: “00:00,00:00”	Set the start / end time during which the device monitors the Bluetooth connection. Set to “00:00,00:00” to keep active.
ACTIVE	Used to configure the operational time of the device. When not active, the device goes into low power sleep mode. The device uploads its data prior to going into low power mode	“HH:MM,HH:MM” Default: “00:00,00:00”	Set the start / end time during which the device is active. When inactive, not monitoring takes place. Set to “00:00,00:00” to keep active.

Table 3 - SCHEDULE Configuration Settings

Note: The device uploads PEAK and BEAT files at the start of the minute closest to the scheduled setting. For instance, if the upload schedule is set to 00:04:00:00 (every 4 hours), then it will upload at 4AM, 8AM, 12PM, 4PM, 8PM and 12AM. If set to 00:00:15:00, it will upload at 00:15, 00:30, 00:45 etc.

10.6 [FTP] Section

This section defines the FTP/FTPS settings for FTP client.

Field	Description	Value	Comments
URL	URL is the specified IP address or domain name of the FTP server	64-char	Not for OTAP
PORT	Port number for the FTP server. Default is 21, which is industry standard. In case of FTPS, the port may change from 21 to 990.	Integer 0 to 65535	
USR	Login name for the FTP connection	39-char	
PWD	Login password for the FTP connection	15-char	
SSL_TYPE	Specifies the type of connection 0 = FTP client (vanilla with no only account / password security) 1 = FTPS client (FTP over implicit TLS/SSL) 2 = FTPS client (FTP over explicit TLS/SSL)	A integer value (0,1,2) Default “0”	
SSL_CIPHER	SSL Cipher Suite used when establishing an FTPS connection • **53** TLS_RSA_WITH_AES_256_CBC_SHA • **47** TLS_RSA_WITH_AES_128_CBC_SHA • **5** TLS_RSA_WITH_RC4_128_SHA • **4** TLS_RSA_WITH_RC4_128_MD5 • **10** TLS_RSA_WITH_3DES_EDE_CBC_SHA • **61** TLS_RSA_WITH_AES_256_CBC_SHA256 • **49169** TLS_ECDHE_RSA_WITH_RC4_128_SHA • **49170** TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA • **49171** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA • **49172** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA • **49191** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 • **49192** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 • **49199** TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 • **65535** Support all cipher suites above (default)		
SSL_LEVEL	Specifies the SSL authentication mode 0 = No authentication (default – avoids having to store a certificate on the modem or attempt the validate the server certificate) 1 = Manage server authentication 2 = Manage server and client authentication if requested by the remote server	Default “0”	
SSL_VERSION	Specifies the SSL version the device supports 0 = SSL3.0 1 = TLS1.0 2 = TLS1.1 3 = TLS1.2 4 = All (default, which supports all the above SSL standards)	Default “4”	
ACT	Specifies if the FTP server is active (True) or passive (False). Most FTP servers are passive.	True or False (default)	When you see a 637 error in the log, it implies you need to switch to Active mode.

Table 4 - FTP Configuration Settings

10.7 [HTTP] Section

This section defines the HTTP/HTTPS settings for the HTTP client.

Field	Description	Value
HOSTNAME	Specifies the IP address or URL of the target HTTP server for all file uploads and configuration downloads	A 64-char string
PROTOCOL	Specifies the HTTP protocol that is used, which are “http” (default) and https	A 5-char string
PATH	Specifies the path of the upload file.	A char string
PORT	Default is “P”	A char string
FIELD	Sets the login password for the FTP connection	A char string
USR	Specifies the HTTP login account username	A 40-char string
PWD	Specifies the HTTP login account password	A 32-char string
SSL_CIPHER	SSL Cipher Suite used when establishing an FTPS connection • **53** TLS_RSA_WITH_AES_256_CBC_SHA • **47** TLS_RSA_WITH_AES_128_CBC_SHA • **5** TLS_RSA_WITH_RC4_128_SHA • **4** TLS_RSA_WITH_RC4_128_MD5 • **10** TLS_RSA_WITH_3DES_EDE_CBC_SHA • **61** TLS_RSA_WITH_AES_256_CBC_SHA256 • **49169** TLS_ECDHE_RSA_WITH_RC4_128_SHA • **49170** TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA • **49171** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA • **49172** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA • **49191** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 • **49192** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 • **49199** TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 • **65535** Support all cipher suites above (default)	

The HTTP settings are not generic and require configuring according to the requirements of the HTTP uploader running on the back-end.

GSS uses a PHP script service running on Laravel; other HTTP upload services may use different back-end file handlers.

10.7.1 HTTP Post Format

The device sends files as HTTP Posts with **multipart/form-data** content.

The HTTP Put is similar to this:

```
POST path HTTP/1.1\r\n
Host: host\r\n
Authorization: Basic auth\r\n
User-Agent: 5GV/fw_ver\r\n
Accept: */*\r\n
Content-Length: length\r\n
Content-Type: multipart/form-data; boundary="Boundary"\r\n\r\n
--Boundary\r\n
Content-Disposition: form-data; name="field"; filename="rem"\r\n
Content-Type: application/octet-stream\r\n\r\n
image
\r\n--Boundary–
```

- Path comes from HTTP setting: **PATH**
- Host comes from HTTP setting: **HOSTNAME**
- Auth comes from base64 encoding HTTP settings: “USR:PWD”
- Fw_ver comes from F/W version; e.g. 5.2.8
- Length number of bytes in the area shown in red
- Field comes from HTTP setting: FIELD
- Rem the remote file name (no paths)
- Image file being uploaded (raw data).

Path is the URL to which device sends the POST request.

- For GSS, we set this to **/gss/upload**. You must check with your back-end provider to obtain the HTTP upload settings; they can fussy and difficult to troubleshoot.

The **auth** parameter may or may not be required, but check with your back-end provider to obtain the User and Password information to set in device’s HTTP configuration.

The **host** parameter should be set to your company’s domain; however, it is OK to leave it as **globalsensingssolution.com**. Check with your back-end provider in case they require it set to a specific domain.

Note: HTTP uploads all files to the root (/) folder. Using a Nested file structure has no impact on the directory where the files are uploaded. Even “cfg snap” places files at the root (/) instead of the configuration (/CONFIG) folder.

10.8 [EXPORT] Section

This section defines export options and the directory format for the remote server.

Field	Description	Value	Comments
REM_DIR_FLAT	FTP Directory Structure True = Flat (default) False = Nested	True (default) or False	Default “True” as preference of GIS service providers
EVENT_FMT	Vibration Alerts 0 = CSV (default) 1 = JSON	A integer value (0,1)	Customers without GIS prefer CSV to view using Excel.
WAVE_FMT	Vibration Waveforms 0 = CSV 1 = JSON 2 = Binary (default)	A integer value (0,1,2)	Use Binary mode for fast uploads and conserve battery.
PEAK_FMT	Vibration Peak PPV or Interval Files 0 = CSV (default) 1 = JSON	A integer value (0,1)	Customers without GIS prefer CSV to view using Excel.
ALERT_FMT	Tilt Alert 0 = CSV (default) 1 = JSON	A integer value (0,1)	Customers without GIS prefer CSV to view using Excel.
DATA_FMT	Tilt Alert Data. 0 = CSV (default) 1 = JSON	A integer value (0,1)	Customers without GIS prefer CSV to view using Excel.
BEAT_FMT	Tilt Heartbeats 0 = CSV (default) 1 = JSON	A integer value (0,1)	Customers without GIS prefer CSV to view using Excel.
PPA_UNITS	Acceleration 0= g (default) 1 = m/s2	A integer value (0,1)	1g = 9.80665m/s2
PPV_UNITS	Peak Particle Values 2 = mm/s (default) 3 = in/s	A integer value (2,3)	
PPD_UNITS	Displacement 6 = mm (default) 7 = inches 8 = mil	A integer value (6,7,8)	1mil = 1/1000th inch

Table 5 - EXPORT Configuration Settings

10.9 [OTAP] Section

This section defines the FTP/FTPS settings for the GSS OTAP FTP server.

Field	Description	Value	Comments
URL	URL is the specified IP address or domain name of the OTAP FTP server. The default is the GSS OTAP server 108.167.143.78.	A 64-char string	
PORT	Port number for the OTAP FTP server. Default is 21, which is industry standard.	A integer value 0 to 65535	
USR	Login name for the OTAP FTP connection. Default is "5gvfw@globalsensingsolutions.com"	A 39-char string	
PWD	Sets the login password for the FTP connection Default is "gss5gv2022"	A 15-char string	
SSL_TYPE	Specifies the type of connection 0 = FTP client (vanilla with no only account / password security) 1 = FTPS client (FTP over implicit TLS/SSL) 2 = FTPS client (FTP over explicit TLS/SSL)	A integer value (0,1,2) Default "0"	
SSL_CIPHER	SSL Cipher Suite used when establishing an FTPS connection • **53** TLS_RSA_WITH_AES_256_CBC_SHA • **47** TLS_RSA_WITH_AES_128_CBC_SHA • **5** TLS_RSA_WITH_RC4_128_SHA • **4** TLS_RSA_WITH_RC4_128_MD5 • **10** TLS_RSA_WITH_3DES_EDE_CBC_SHA • **61** TLS_RSA_WITH_AES_256_CBC_SHA256 • **49169** TLS_ECDHE_RSA_WITH_RC4_128_SHA • **49170** TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA • **49171** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA • **49172** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA • **49191** TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 • **49192** TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 • **49199** TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 • **65535** Support all cipher suites above (default)		
SSL_LEVEL	Specifies the SSL authentication mode 0 = No authentication (default – avoids having to store a certificate on the modem or attempt the validate the server certificate) 1 = Manage server authentication 2 = Manage server and client authentication if requested by the remote server	Default "0"	
SSL_VERSION	Specifies the SSL version the device supports 0 = SSL3.0 1 = TLS1.0 2 = TLS1.1 3 = TLS1.2 4 = All (default, which supports all the above SSL standards)	Default "4"	
ACT	Specifies if the FTP server is active (True) or passive (False). The GSS OTAP FTP server is passive.	True or False (default)	

Table 6 - OTAP Configuration Settings

10.10 [SMS] Section

This section of the configuration file defines the mobile phone numbers to which the device sends notifications.

Field	Description	Value	Comments
1	Contains mobile phone number (with + and country code) to receive an SMS when the device sends an Up message or an alert	A 20-char string	Example for Hong Kong: +85212341234
2	Contains mobile phone number (with + and country code) to receive an SMS when the device sends an alert	A 20-char string	
3	Contains mobile phone number (with + and country code) to receive an SMS when the device sends an alert	A 20-char string	
4	Contains mobile phone number (with + and country code) to receive an SMS when the device sends an alert	A 20-char string	
5	Contains mobile phone number (with + and country code) to receive an SMS when the device sends an alert	A 20-char string	
EN1	Specifies if SMS 1 is active or disabled	True or False (default)	
EN2	Specifies if SMS 2 is active or disabled	True or False (default)	
EN3	Specifies if SMS 3 is active or disabled	True or False (default)	
EN4	Specifies if SMS 4 is active or disabled	True or False (default)	
EN5	Specifies if SMS 5 is active or disabled	True or False (default)	

Table 7 - SMS Configuration Settings

The unit sends SMS messages to one or more configured cell phones for alert events.

Prior to firmware 5.2.x, the SMS entry contained the phone number and an enabled flag like this:

cfg sms n Phone#,Flag => CFG SMS 1 +85212341234,T

The device will respond with an acknowledgement of the following form:

5GV sms n set to Phone#,FLAG

In the case of 5.2.x firmware, there are two settings:

cfg sms n Phone# => CFG SMS 1 +85212341234

A second setting enables/disables the number.

cfg sms ENn Phone# => CFG SMS EN1 FLAG

5GV sms ENn set to FLAG

10.11 ROUTE_FILE

This section of the configuration file defines the file routing that is used to upload files from the device to a server via FTP or HTTP. It also specifies the file routing to download OTAP files.

Field	Description	Value	Comments
EVENT	The file routing for vibration event (alert) files.	FTP (default), HTTP	Initiated by alert
DATA	The file routing for vibration data files	FTP (default), HTTP	Initiated by alert
PEAK	The file routing for vibration peak interval files	FTP (default), HTTP	Initiated by scheduler or “peak snap” command
BEAT	The file routing for tilt heartbeat reading files	FTP (default), HTTP	Initiated by scheduler or “beat snap” command
CONFIG	The file routing for the device configuration file	FTP (default), HTTP	Initiated by scheduler or “cfg snap” command
OTAP	The file routing for the device to download the OTAP file.	FTP (default), HTTP	GSS stores firmware files on an FTP server
LOG	The file routing for the device log files.	FTP (default), HTTP	Initiated by scheduler or “log snap” command

10.12 ROUTE_MSG

This section of the configuration file defines the message routing that is used to send messages to the end users or backend systems. SMS should only be used with 3G/4G/LTE communication module. If using Wi-Fi, then MQTT is the only option to send and receive messages to the device.

Field	Description	Value	Comments
IND	The message routing of indicator messages	None (default), SMS, MQTT	Indicator messages include Up messages
EVENT	The message routing of vibration and tilt event messages	None (default), SMS, MQTT	
ALARM	The message routing of alarm messages	None (default), SMS, MQTT	Alarm messages include Battery Warning messages
PEAK	The message routing of vibration peak interval messages	None (default),MQTT	If using 3G/4G/LTE, then this can quickly drain the batteries.
BEAT	The message routing of tilt beat messages	None (default),MQTT	If using 3G/4G/LTE, then this can quickly drain the batteries.

Note: When the device is using a 3G/4G/LTE communication module, it is best to set PEAK and BEAT to MQTT only if the device has access to external power. The 3G/4G/LTE modem draws a lot of power and can quickly drain batteries. If the device is using a Wi-Fi communication module, then the power drain is not as fast.

10.13 Directory and File Naming Sections

You need to understand the use of “substitution” macros before making changes to the REM_DIR_FLAT or REM_DIR_NEST configuration sections.

When using a flat-file format, the file name template should provide a unique file name so as not to clash with other files; for example, the vibration alert file template is like this:

```
VIBR_ALT={ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.event
```

Note: Specify the Vibration Alert File output format (CSV or JSON) in the EVENT_FMT setting under the EXPORT section of the Configuration File. In this example, EVENT_FMT = 1 (JSON)

With the following settings:

- ROOT = **“/”**
- PRE = **“5GV_”**
- MAC = **123456**
- Alert ID = **23**
- Alert time = **2023/03/04 09:27**

The template substitutes the following:

- **{ROOT}** is replaced with “/”
- **{MAC}** is replaced with “123456”
- **{SEQ3}** is replaced with “023”
- **{YYYY}** with is replaced by “2023”
- **{MM}** is replaced with “03”
- **{DD}** is replaced with “04”
- **{hh}** is replaced with “09”
- **{mm}** is replaced with “27”

The resulting file path becomes:

```
/5GV_123456_023_202303040927_1.event.json
```

10.13.1 Keywords

Keywords allow the user to enter a generalized value in order to call specific values in the file names.

8.6.1.1 Sequence Numbers

These reserved keywords allow the user to format the sequence number associated with the file type (e.g. Alert, Peak, etc.) into the number of digits specified. The number following “SEQ” sets the number of digits in the sequence, as shown below.

- **{SEQ2}** sets a 2-digit sequence
- **{SEQ3}** sets a 3-digit sequence
- **{SEQ4}** sets a 4-digit sequence
- **{SEQ5}** sets a 5-digit sequence

Note: If using a smaller sequence format to hold a large number, the device keeps only the leading digits. For example, using SEQ2 for the number 1234, results in 12.

8.6.1.2 Other Substitution Keywords

Some other substitution keywords are as follows:

- **{MAC}** Device MAC address as 6 Hex Characters
- **{YYYY}** Year as a 4-digit value
- **{YY}** Year as a 2-digit value (0-99)
- **{MM}** Month as a 2-digit value
- **{DD}** Day of Month as a 2-digit value
- **{hh}** Hour as a 2-digit value
- **{mm}** Minute as a 2-digit value

These reserved keywords allow the user to use various timestamp fields and the MAC address when constructing file names.

10.14 [REM_DIR_FLAT] Section

This section defines the path and file naming conventions for all files uploaded to a single folder on the backend server. A flat directory structure works best for GIS systems that “poll” a single directory for changes. Configuration reside in a separate folder.

Field	Description	Value
ROOT	This value substitutes for the {ROOT} keyword.	A char string Default “/”
PRE	This value substitutes for the {PRE} keyword.	A char string Default “5GV_”
NEW_CFG	Format of a New configuration file path and name	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.new
CUR_CFG	Format of the Current configuration file path and name	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.config"
BAD_CFG	Format of a Rejected configuration file path and name	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.new.bad"
VIBR_ALT	Format of a Vibration Alert file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.event"
VIBR_DATA	Format of a Vibration Waveform file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.waveform"
VIBR_PEAK	Format of a Vibration Peak interval file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.interval"
TILT_ALT	Format of a Tilt Alert file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.talert"
TILT_DATA	Format of a Tilt Data file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.tdata"
TILT_BEAT	Format of a Tilt Beat file path and name	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.beat"
LOG_FMT	Format of a Log file	A char string. Default: "{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.log.txt"

10.15 [REM_DIR_NEST] Section

This section defines the path and file naming conventions for all files uploaded to multiple directories on the backend server. A nested directory structure is easy to navigate when grouping files by MAC address and File Type etc.

Note: HTTP uploads all files to the root (/) folder. Using a Nested file structure has no impact on the directory where the files are uploaded. Even “cfg snap” places files at the root (/) instead of the configuration (/CONFIG) folder.

Field	Description	Value
ROOT	This value substitutes for the {ROOT} keyword.	A char string Default “/”
PRE	This value substitutes for the {PRE} keyword.	A char string Default “5GV_”
NEW_CFG	Format of a New configuration file path and name. This is the file that “cfg download” command is looking for	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.new
CUR_CFG	Format of the Current configuration file path and name	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.config"
BAD_CFG	Format of a Rejected configuration file path and name	A char string. Default: "{ROOT}CONFIG/{PRE}{MAC}.new.bad"
VIBR_ALT	Format of a Vibration Alert file path and name	A char string. Default: "{ROOT}{MAC}/FILES/VIBR/ALT_{SEQ4}"
VIBR_DATA	Format of a Vibration Waveform file path and name	A char string. Default: "{ROOT}{MAC}/FILES/VIBR/VACC{SEQ4}"
VIBR_PEAK	Format of a Vibration Peak interval file path and name	A char string. Default: "{ROOT}{MAC}/FILES/PEAKS/{YY}{MM}{DD}{SEQ2}"
TILT_ALT	Format of a Tilt Alert file path and name	A char string. Default: "{ROOT}{MAC}/FILES/TILT/ALT_{SEQ4}"
TILT_DATA	Format of a Tilt Data file path and name	A char string. Default: "{ROOT}{MAC}/FILES/TILT/DAT_{SEQ4}"
TILT_BEAT	Format of a Tilt Beat file path and name	A char string. Default: "{ROOT}{MAC}/FILES/BEATS/{YY}{MM}{DD}{SEQ2}"
LOG_FMT	Format of a Log file	A char string. Default: "{ROOT}{MAC}/LOG/{YY}{MM}{DD}{SEQ2}.txt"

10.16 [SENSORS] Section

This section of the configuration file defines the sensor modes available within the device. The device supports only one mode at a time.

The format of this configuration entry is MAC = “MODE, KEY”. The respective settings are as follows:

- MAC = the device MAC address (**123456** for this example)
- MODE = can be either “VIBR” or “TILT” (if appropriately licenced)
- KEY = Licence key (not required for Vibration mode)

If the sensor licensing is only valid for vibration, the licence key will be all zeroes, as shown in the following example.

123456 = "VIBR,00000000000000000000000000000000"

The following example shows a licence key that enables vibration and tilt operation:

123456 = "VIBR,58022F1EFF4FDE680FA83914DE0AB185"

10.17 [000000_VIBR]

This section defines the vibration configuration settings for the sensor. *Note that some of the parameters in this section are unimplemented or deprecated.*

Field	Description	Value	Comments
FLG_RAW	Instructs the device to enable/disable the capture of raw vibration waveform files	True (default) or False	
FLG_ACC_X	Instructs the device to enable/disable alerts using X-axis acceleration threshold.	True or False (default)	Unimplemented
FLG_ACC_Y	Instructs the device to enable/disable alerts using Y-axis acceleration threshold.	True or False (default)	Unimplemented
FLG_ACC_Z	Instructs the device to enable/disable alerts using Z-axis acceleration threshold.	True or False (default)	Unimplemented
FLG_ALT_X	Instructs the device to enable/disable alerts using X-axis velocity threshold.	True (default) or False	
FLG_ALT_Y	Instructs the device to enable/disable alerts using Y-axis velocity threshold.	True (default) or False	
FLG_ALT_Z	Instructs the device to enable/disable alerts using Z-axis velocity threshold.	True (default) or False	
FLG_ORIENT	Instructs the device to enable/disable XYZ->LTV mapping based on the installed orientation	True (default) or False	Z-axis follows gravity.
SAMP_FREQ	Sets sample rate in Hertz • 1000 (default) • 2000 • 4000	An integer value Default: 1000	
PEAK_SPAN	Sets the peak PPV reporting interval in seconds. Peak interval readings start and align at the top of the hour at the :00 second mark. If set to 300 (5 minutes), then peak readings will start at 5-minute interval on the clock (i.e. xx:00:00, xx:05:00, xx:10:00, etc.	An integer value (30 to 3600) Default: 300	
TRIG_LEVEL	Sets trigger level in mg	An integer value (64 to 2048). Default: 80	Deprecated
PPV_MAX_X	Sets X-axis (L) alert threshold in velocity (mm/sec)	A float value (0.01 to 254) Default: 5.0	
PPV_MAX_Y	Sets Y-axis (T) alert threshold in velocity (mm/sec)	A float value (0.01 to 254) Default: 5.0	
PPV_MAX_Z	Sets Z-axis (V) alert threshold in velocity (mm/sec)	A float value (0.01 to 254) Default: 5.0	
ACC_MAX_X	Sets X-axis (L) alert threshold in acceleration (g)		Unimplemented
ACC_MAX_Y	Sets Y-axis (T) alert threshold in acceleration (g)		Unimplemented

Field	Description		Value	Comments
ACC_MAX_Z	Sets Z-axis (V) alert threshold in acceleration (g)			Unimplemented
PRE_SEC	Sets pre-trigger recording time in seconds		An integer value (1 to 30. Default: 1	
MIN_SEC	Sets the post-trigger recording time in seconds with auto-extend if the device detects more alerts.		An integer value Default: 2	The limit is based on sample frequency
MAX_SEC	Sets the maximum recording time in seconds after the alert. At a sample rate of 1000, the limit would be 120 with the assumption that pre_sec is set to 1. If pre_sec is more than 1, then deduct from the limit, i.e. pre_sec 5, then max_sec limit is 115.		An integer value Default: 10	
REA_SEC	Sets the minimum time between alerts in seconds.		An integer value (1 to 10). Default: 2	
ACC_SCALE	Set the accelerometer range (g). The default is 8 as it has the highest range and the lowest noise. Use higher settings to avoid over-range.		An integer value (2, 4, 8, 10, 20, 40)	
FILTER	Sets the filter number		An integer value (1 to 16)	
	1 = ISEE (default) 2 = DIN 4150-3 3 = DIN 4150-2 4 = BS 7385 5 = AS 2187-2 6 = ONORM 9012 7 = ISO 8569 8 = IN1226	9 = NS 8176 10 = NS 8141 11 = NS8141-1 12 = SS 4604866 13 = SS 025211 14 = SS 4604861 15 = Geophone 16 = ICPE 86		

10.18 [000000_TILT]

This section defines the Tilt configuration settings for the sensor. (A licence key is required for these to take effect).

Field	Description	Value	Comments
BEAT_RATE	Sets the beat-message or sample-reading rate in seconds.	An integer value (10 to 86400)	1 hour: 3600 1 day: 86400
PRE_REC	Sets the number of seconds recorded prior to tilt alert.	An integer value (0 to 120). Default is 5.	These readings are stored in the data file
PST_REC	Sets the number of seconds recorded after the tilt alert	An integer value (0 to 120). Default is 5.	These readings are stored in the data file
FLG_ALT_P	Instructs the device to enable/disable pitch alerts	True (default) or False	
FLT_ALT_R	Instructs the device to enable/disable roll alerts	True (default) or False	
FLG_REA_P	Instructs the device to enable/disable rearm stable checking on the pitch axis	True (default) or False	
FLG_REA_R	Instructs the device to enable/disable rearm stable checking on the roll axis	True (default) or False	
FLG_TRIG	Instructs the device to enable/disable impact detection	True (default) or False	Deprecated
FLG_REBASE	Instructs the device to enable/disable the re-establishing a pitch and roll baseline after an alert. This is advised to be True otherwise it could lead to alert after alert until the battery dies	True (default) or False	
FLG_ORIENT	Instructs the device to enable/disable automatic reorientation of the sensor	True or False (default)	Unimplemented
ALT_P	Sets the pitch change in degrees that triggers an alert.	A float value (0.5 to 70). Default is 5	
ALT_R	Sets the roll change in degrees that triggers an alert.	A float value (0.5 to 70). Default is 5	
TRIM_P	Sets the Pitch Trim value. Adjusts the Pitch reading to compensate for changes when removing and re-installing the device.	A float value (-45 to +45. Default is 0.0	
TRIM_R	Sets the Roll Trim value. Adjusts the Roll reading to compensate for changes when removing and re-installing the device.	A float value (-45 to +45. Default is 0.0	
REA_P	Sets the pitch rearm value	A float value (0.5 to 70. Default is 5.0	
REA_R	Sets the roll rearm value	A float value (0.5 to 70. Default is 5.0	
REA_SEC	Sets the rearm delay time in seconds to prevent false re-triggering. Recommend to leave at 30 seconds minimum just in case there is a need to change it between alerts.	An integer value (15 to 180). Default is 30.	

Field	Description	Value	Comments
TRIG_LEVEL	Sets the impact detection trigger in milli-g	An integer value (80 to 2048). Default is 250.	Deprecated

10.19 [STATUS] Section

This section of the configuration file contains the most recent device status information and the device updates it each time it uploads the current configuration data to the server.

Configuration file uploads occur each time an interval file is uploaded when CFG MAIN SEND_CFG True.

Note: It is important to note that this section simply displays data from the sensor, and is not for sending information to the sensor.

Field	Description	Value
MAC	The MAC address of the device. This is a unique identifier. Example: 123456	Hex values from 000000 to ffffff
HARDWARE_VERSION	The hardware version of the device. Example: 1.1	Integer range 0.0 to 9.9
MAIN_FIRMWARE	The main firmware version of the device. Example: 5.2.7	Integer 0.0.0 to 99.99.99
TEMPERATURE	The temperature in degrees Celsius. Example: 26.62	Values in the range -40.00 to 85.00
POWER	The power source, which could be “Battery” when running on internal batteries or “External” if powered via external power such as USB or solar panel.	Battery or External
CAPMAH	The total new battery capacity in mAh. The value is 0.00 when running on external power.	Values range from 0.00 to 99999.99
USEDMAH	The total used battery capacity in mAh.	Ranges from 0.00 to 99999.99
REMPCT	The battery capacity remaining as a percentage. The value is 0 when running on external power.	An integer range (0 to 100)
IDLEMA	The used capacity when the modem is not operational. The value is 0 when running on external power.	An integer range (0 to 100)
MODEM	The radio module’s make	A 16-char string
MODEL	The radio module’s model	A 16-char string
REV	The radio module’s firmware version	A 64-char string
OPERATOR	The communication module modem network operator. This field is only applicable for 3G/4G/LTE.	A 32-char string
RSSI	Received signal strength at the antenna	Integer value (0 to 99)
MODE	Sensor mode, Vibration (VIBR) or TILT	A string VIBR or TILT
STATE	The sensor monitoring state **MONITORING** = sensor monitoring and detecting alert thresholds. This is the correct state for remote monitoring. **IDLE** = sensor not recording. This is the correct state when in manual monitoring mode. You can pick up and move the device to a new location. **INITIALISING** = sensor is starting up. It should not remain in this state for long. If it does, then something is not working correctly. Issue a “reset sensor” to see if it resolves the issue.	A 16-char string

Field	Description	Value
OPTIONS	The installed sensor options	ADXL355,ADXL357 etc.

11 Sample Configuration File

Below is a sample configuration file from a device with a MAC address 123456.

```
; Device Configuration Snapshot

[MAIN]
VER_MAJ=1
VER_MIN=1
DATE="07/09/23"
SERIAL="123456"
NUMBER=""
LOCATION="22.287,114.1483,6"
APN="csl"
APN_USR=""
APN_PWD=""
SCANSEQ="0405030201"
SCANMODE=0
SCANBAND="3FF,1F00B0E18DF,3F"
IOTOPMODE=0
SERVICE=0
ROAMING=0
COPS="0"
NTP_URL="216.239.35.12"
NTP_PORT=123
NTP_TZ=32
LOG="W"
BAT_WARN=25
SEND_ALERT=True
SEND_PEAK=True
SEND_BEAT=True
SEND_DATA=True
SEND_CFG=True
CHECK_CFG=True
SEND_LOG=False
SEND_SMS=True
GSM_OFF=False
WIFI_OFF=False
BT_OFF=False
MIC_OFF=True
NTP_TIME=False
WAIT_FOR_TIME=False
HTTP_ALERT=False
HTTP_BEAT=False
HTTP_PEAK=False
HTTP_DATA=False
HTTP_LOG=False
HTTP_CFG=False
HTTP_RECOVER=False

[GSM]
APN="csl"
APN_USR=""
APN_PWD=""
SCANSEQ="0405030201"
SCANMODE=0
SCANBAND="3FF,1F00B0E18DF,3F"
IOTOPMODE=0
SERVICE=0
ROAMING=0
COPS="0"
```


```
[WIFI]
SSID="GSS"
PWD="xxx1234567"
SEC_PROT=3
SEC_ENCR=1
NTP_RATE=132
CC="HK"

[MQTT]
HOST="101.78.149.211"
PORT=1883
QOS=0
TLS=0
USR="mqtt"
PWD="Password"
PUB_SAMP="{MAC}/SAMP"
PUB_ALERT="{MAC}/ALERT"
PUB_NOTIFY="{MAC}/NOTIFY"
PUB_REPLY="{MAC}/REPLY"
SUB_COMMAND="{MAC}/COMMAND"

[SCHEDULE]
STATUS="00:00:05:00"
RESET="00:08:00:00"
PEAK="00:08:00:00"
BEAT="00:08:00:00"
HOUSEKEEP="00:12:00:00"
BLUE=00:00,00:00
ACTIVE=00:00,00:00

[FTP]
URL="gss.hk"
PORT=21
USR="gss"
PWD="password"
SSL_TYPE=0
SSL_CIPHER=65535
SSL_LEVEL=0
SSL_VERSION=4
ACT=False

[HTTP]
HOST="globalsensingsolutions.com"
PROTOCOL="http"
PATH="/gss/upload"
PORT="P"
FIELD="upload_file"
USR="gss"
PWD="password"
SSL_CIPHER=65535
SSL_LEVEL=0
SSL_VERSION=4

[SMS]
1=""
2=""
3=""
4=""
5=""
EN1=False
EN2=False
EN3=False
EN4=False
EN5=False
```


```
[ROUTE_FILE]
EVENT=FTP
DATA=FTP
PEAK=FTP
BEAT=FTP
CONFIG=FTP
OTAP=FTP
LOG=FTP

[ROUTE_MSG]
IND=MQTT
EVENT=MQTT
ALARM=MQTT
PEAK=MQTT
BEAT=MQTT

[REM_DIR_FLAT]
ROOT="/"
PRE="5GV_"
NEW_CFG="{ROOT}CONFIG/{PRE}{MAC}.new"
CUR_CFG="{ROOT}CONFIG/{PRE}{MAC}.config"
BAD_CFG="{ROOT}CONFIG/{PRE}{MAC}.new.bad"
VIBR_ALT="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.event"
VIBR_DATA="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.waveform"
VIBR_PEAK="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.interval"
AUDIO_DAT="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.audio"
AUDIO_PEAK="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.levels"
TILT_ALT="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.talert"
TILT_DATA="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.tdata"
TILT_BEAT="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.tbeat"
LOG_FMT="{ROOT}{PRE}{MAC}_{SEQ3}_{YYYY}{MM}{DD}{hh}{mm}_1.log.txt"

[REM_DIR_NEST]
ROOT="/"
PRE="5GV_"
NEW_CFG="{ROOT}CONFIG/{PRE}{MAC}.new"
CUR_CFG="{ROOT}CONFIG/{PRE}{MAC}.config"
BAD_CFG="{ROOT}CONFIG/{PRE}{MAC}.new.bad"
VIBR_ALT="{ROOT}{MAC}/FILES/VIBR/ALT_{SEQ4}"
VIBR_DATA="{ROOT}{MAC}/FILES/VIBR/VACC{SEQ4}"
VIBR_PEAK="{ROOT}{MAC}/FILES/PEAKS/{YY}{MM}{DD}{SEQ2}"
AUDIO_DAT="{ROOT}{MAC}/FILES/AUDIO/AUD_{SEQ4}"
AUDIO_PEAK="{ROOT}{MAC}/FILES/AUDIO/{YY}{MM}{DD}{SEQ2}"
TILT_ALT="{ROOT}{MAC}/FILES/TILT/ALT_{SEQ4}"
TILT_DATA="{ROOT}{MAC}/FILES/TILT/DAT_{SEQ4}"
TILT_BEAT="{ROOT}{MAC}/FILES/BEATS/{YY}{MM}{DD}{SEQ2}"
LOG_FMT="{ROOT}{MAC}/LOG/{YY}{MM}{DD}{SEQ2}.txt"

[OTAP]
URL="108.167.143.78"
PORT=21
USR="5gvfw@globalsensingsolutions.com"
PWD="gss5gv2022"
SSL_TYPE=0
SSL_CIPHER=65535
SSL_LEVEL=0
SSL_VERSION=4
ACT=FALSE

[EXPORT]
REM_DIR_FLAT=True
EVENT_FMT=0
WAVE_FMT=2
```


```
AUDIO_FMT=2
PEAK_FMT=0
ALERT_FMT=0
DATA_FMT=0
BEAT_FMT=0
PPA_UNITS=0
PPV_UNITS=2
PPD_UNITS=6

[MIC]
SAMP_RATE=48000
SAMP_SIZE=100
WEIGHT="A"

[SENSORS]
123456 = "VIBR,00000000000000000000000000000000"

[123456_VIBR]
FLG_RAW=True
FLG_ACC_X=False
FLG_ACC_Y=False
FLG_ACC_Z=False
FLG_ALT_X=True
FLG_ALT_Y=True
FLG_ALT_Z=True
FLG_ORIENT=True
MODE=PPV
SAMP_FREQ=1000
PEAK_SPAN=300
TRIG_LEVEL=80
PPV_MAX_X=5.000000
PPV_MAX_Y=5.000000
PPV_MAX_Z=5.000000
ACC_MAX_X=0.000000
ACC_MAX_Y=0.000000
ACC_MAX_Z=0.000000
PRE_SEC=1
MIN_SEC=2
MAX_SEC=10
REA_SEC=2
FILTER=1
ACC_SCALE=8

[STATUS]
MAC=123456
MAIN_FIRMWARE=5.2.8
TEMPERATURE=26.62
POWER=External
CAPMAH=   0.00
USEDMAH=   0.00
REMPCT=0
IDLEMA=0
MODEM=Quectel
MODEL=EG25
REV=EG25GGBR07A08M2G
OPERATOR=1O1O 1O1O
RSSI=16
MODE=VIBR
STATE=Monitor
OPTIONS=ADXL355,ADXL357
```

12 Bluetooth Support

The device comes standard with a Bluetooth Low Energy radio module, which is compatible with the GSSLink Bluetooth Mobile application.

With the GSSLink Bluetooth Application, you can:

- Configure and monitor all GSS Bluetooth Enabled Devices (i.e. Razor, 5GV, GVWD)
- Perform Admin Functions (i.e. Snapshots, Status, Storage, Power and Reset Functions)
- Perform File Management Functions (i.e. View, Upload, Delete)
- View Data Buffers (i.e. Peak Interval, Tilt Beats, VW Beats)
- Take manual samples and generate reports

The pictures below are screenshots from the GSSLink Bluetooth Mobile application. *Refer to the GSS Bluetooth Application user manual for more details*.

Figure 12 - Select Bluetooth Device

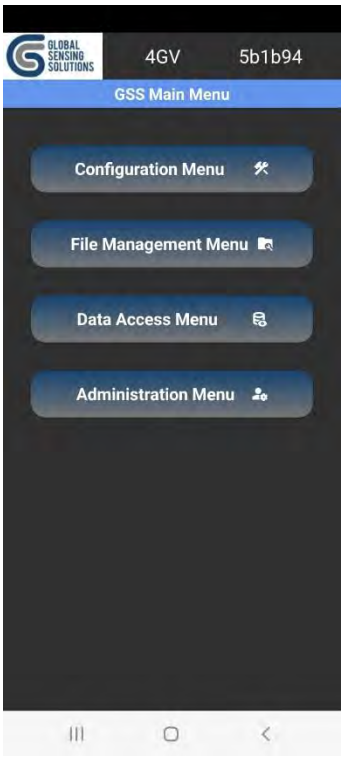


Figure 13- Main Menu

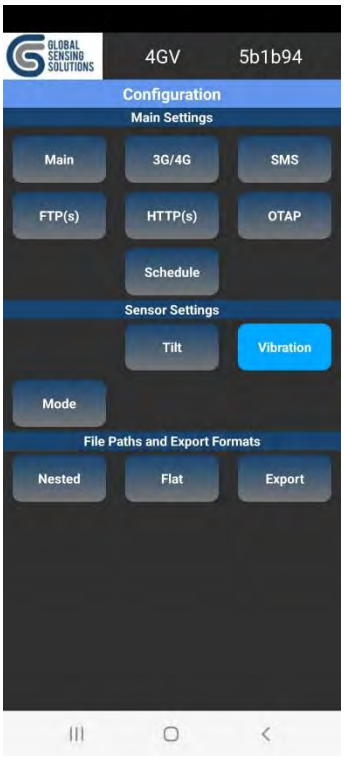


Figure 14 - Configuration Settings

Figure 15 - Admin Functions

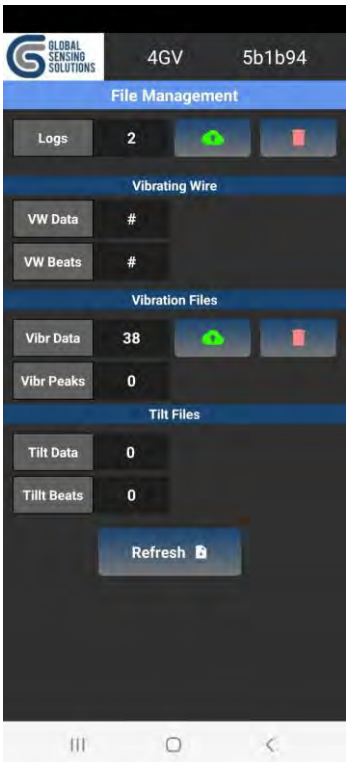


Figure 16 - File Management

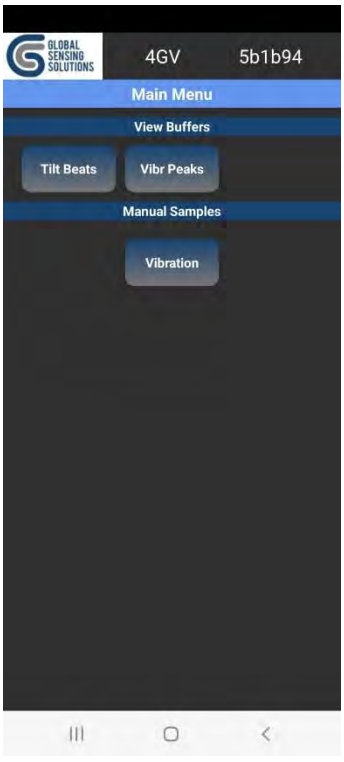


Figure 17 - View Buffers & Perform Manual Samples

13 Console and SMS Commands

The device accepts text-based commands over the USB serial port, via the SMS interface (when on a 3G/4G network) and via MQTT COMMAND queue. *The same commands work for all methods.*

In some cases, the response to a console-based command (over USB serial) or MQTT will differ from that sent over SMS due to the 160-character limit on the size of an individual SMS message.

Note: The device firmware handles double-byte characters used some Asian regions. For example, 00530074006100740020003300 67 is the double-byte format for “stat 3g”. The device detects and converts this to the internal single byte format.

13.1 Configuration Commands

Use configuration commands (CFG) to view or change the current setting.

- To view the current setting, issue the command without a value.
- To change the setting, issue the command followed by the new value.
- After issuing the command, send the command “CFG APPLY” to save the settings.

To change the settings via command, the user should send a message to the device in the following format:

cfg {section} {field} {value}

Where {section} is the section of the configuration file (i.e. MAIN, FTP, SCHED), {field} is an accepted field name (as shown in the following tables) and {value} is the desired value to be set.

Note: The commands can be upper or lowercase as shown below in the examples.

The URL field in the FTP section accepts either a domain name or an IP address as follows:

cfg ftp url ftp.globalsensingsolutions.com

cfg ftp url 108.167.143.78

The device will respond with an acknowledgment of the following form:

ftp url set to {value}

The responses to the above commands are as follows:

FTP URL set to ftp.globalsensingsolutions.com

ftp url set to 108.167.143.78

The following table contains more examples of how to view and change configuration settings.

Command	Outcome
CFG MAIN APN	Returns the current APN value
CFG VIBR PEAK_SPAN	Returns Vibration value peak_span, which is the interval of Peak PPV readings

Changing configuration settings is the same as viewing them, except that the user must also provide a *value*. The following examples show how to change configuration settings.

Command	Outcome
CFG MAIN APN CSL	Changes the APN value to CSL
CFG VIBR PEAK_SPAN 900	Changes the Vibration mode peak_span to 900 seconds (15 minutes)

Note: If the user forgets to send the “CFG APPLY” command after making configuration changes, these new settings would be lost in the event of a device reboot.

13.1.1 Vibration

To change the Vibration sensor configuration parameters, send a message to the device in the format below:

cfg vibr {field} {value}

For examples:

cfg vibr flg_raw T

cfg vibr peak_span 300

The first example sets the sensor raw data flag to “true”. The second example sets the sensor peak PPV interval to be 300 seconds (5 minutes).

The unit would respond with an acknowledgment message of the following form:

Sensor vibr {field} set to {value}

The device would send the following confirmation response messages to the example messages given above:

Sensor vibr flg_raw set to T

Sensor vibr peak_span set to 300

Note: If the user forgets to send the CFG APPLY command after making configuration changes, these settings would be lost in the event of a device reboot.

13.2 Custom Configuration Files

The device allows users to create custom configuration files, save and switch to them with simple commands as follows:

cfg save {name}	Creates a new configuration file based on the current configuration settings
cfg switch {name}	Loads the specified configuration file

13.2.1 Create New Configuration File

Create a new configuration file using the **cfg save {name}** command, where {name} is a user-defined 8-character alphanumeric field that must start with an alphabetic value.

The following example uses the name “testing”; the file is created on the microSD card and stored in the /CONFIG directory. The device allows the creation of many configuration files. For instance, one for blasting and another for piling.

> **cfg save TESTING**

[SMS] Save Config to ./CONFIG/TESTING.INI

[CFG] Config -> ./CONFIG/TESTING.INI

[CFG] Config -> ./CONFIG/TGV3GCFG.BIN

CFG Stored OK

Note: In the future, the device will allow transferring these files to and from the FTP server using the File Transfer function in the 3GV or 5GV Consoles. The latest 3GV Console allows files on the microSD to be transferred directly from the device to PC when connected with the USB cable.

13.2.2 Switch Configuration File

The “**cfg switch gss”** command changes the configuration file to use GSS default settings. These settings will work with the GSS FTP and HTTP servers.

The “**cfg switch {name}”** command forces the device to load the specified configuration file. The example below shows a switch to the “testing” configuration file.

> **cfg switch testing**

[CFG] Backup current config

[CFG] Trying to load ./CONFIG/TESTING.INI

[CFG] Config -> ./CONFIG/TGV3GCFG.SNP

[CFG] Config -> ./CONFIG/TGV3GCFG.BIN

CFG Switch to testing OK

Note: If you use the “**cfg switch {name}”** command that contains altered sensor settings, then you must issue a **reset sensor** command, otherwise the settings will not take effect until the next device reset.

The **cfg switch {name}** command does not change the device from vibration to tilt or vice versa.

13.3 Download Configuration Files

The device can be instructed to download new configuration files on the FTP server using the “cfg download” command. Please refer to Flat and Nested File Structure for the New Configuration filename. By default, it will end with .new.

New Configuration Files can be created or edited using the GSS PC Console application or even a text editor. It is recommended to load the current configuration file, make the desired changes and save it as a .new file.

For instance, let’s use the configuration below with a MAC address of 123456.

The current configuration filename is /CONFIG/5GV_123456.config

The new configuration filename is /CONFIG/5GV_123456.new

```
ROOT="/"
PRE="5GV_"
NEW_CFG="{ROOT}CONFIG/{PRE}{MAC}.new"
CUR_CFG="{ROOT}CONFIG/{PRE}{MAC}.config"
BAD_CFG="{ROOT}CONFIG/{PRE}{MAC}.new.bad"
```

If the device is remote, then recommend to issue “cfg snap” to obtain the latest configuration file on the device, download the file (5GV_123456.config) using an FTP client (i.e. Filezilla), make the desired changes to the configuration file and rename it to 5GV_123456.new and upload it to the /CONFIG folder. Issue “cfg download” to the device and it will retrieve the .new config file and overwrite the current configuration file stored on the device.

Note: The device will apply the configuration file. However, some sensor settings require the device to be reset as they are loaded upon sensor initialization. Issue the “reset sensor” to ensure all the .new configuration changes are applied..

13.4 Status Commands

13.4.1 STAT 3G

The device provides a status report in response to a 3G stat request, which provides useful information about the unit.

The format of the command is as follows:

stat 3G

The device returns a formatted text message representing the status. Below is an example of a “Stat 3G” response message, and the entries’ respective indications.

Note: Issuing the “Stat 3G” command from the command line and MQTT provides some additional information because it isn’t restricted to SMS maximum character length.

```
MAC:     123456
HW:      1.1
FW:      5.2.8
Temp:    25.2
Pwr:     External
Volts:   0.0
Modem:   Quectel
Model:   EG25
Rev:     EG25GGBR07A08M2G
Oper:    1O1O 3G
RSSI:    31
Bat:     0%
Net:     4G
Act:     FDD LTE
PLMNID:  45400
Band:    LTE_BAND_3
Chan:    1400
```

MAC:123456	The Short MAC address of the device, which is unique for each device and used as the “Root” folder for all files on the FTP server
HW: 1.1	Hardware version of the device
FW:5.2.8	Release and Build of the firmware currently running in device
Temp: 25.2	Internal temperature in degrees Celsius
Pwr: External	How the device is being powered, this can be External or Batteries
Volts: 0.0	Battery voltage; should be around 3.6 for new batteries, but will be 0.0 when powered by External batteries.
Modem: Quectel	Modem manufacturer
Model: EG25	Modem model number
Rev: EG25GGBR…	Modem firmware version

Oper: 1010 3G	Current registered operator (in this case, 1010). 3G indicates a 3G connection is active
RSSI: 31	Received Signal Strength (higher is better)
Bat: 0%	Remaining battery capacity. The device reports 0% when on external power, as the device is not running on batteries
Net: 4G	Network Type (2G/3G/4G).
Act: FDD LTE	Access Technology the device is currently using; in this case LTE
PLMNID: 45400	Public Land and Mobile Network identifier assigned to the registered operator. Identifies the country and carrier.
Band: LTE_BAND_3	Network band within the Access Technology the device is operating on
Channel: 1400	Frequency channel within the network band

13.4.2 STAT GET

The unit provides a function to query the status of the sensor using stat get command.

The format of the command is as follows:

stat get

The device returns a formatted text message representing the sensor's status. Below is an example of a "stat get" response message, and the entries' respective indications.

```
Temp:   28.1
Mode:   VIBR
State:  Monitor
Opts:   ADXL355 ADXL357
```

Temp: 24.8	Indicates the internal temperature of the sensor in degrees Celsius
Mode: VIBR	The device current operating mode; either Vibration (VIBR) or Tilt (TILT)
State: Monitor	The device current state (sensors go through various states during start-up and in operation, including Initialising, Orienting, Monitoring, Alert, and Rearming)
Opts: ADXL…	Installed options; i.e. ADXL355 (2, 4, and 8g) and ADXL357 (10g, 20g, 40g) accelerometers and RTC clock

13.4.3 STAT SCHED

Queries the schedule for various timed activities, including uploads and internal status checks.

The format of the command is **stat sched**

The device returns a formatted text message representing the sensor's status. Below is an example of a "stat sched" response message, and the entries' respective indications.

```
Peak: 00:00:14:09
Beat: 00:02:14:09
Vibr: 00:00:00:09
Tilt: 00:02:14:09
Cell: 00:02:14:09
Batt: 00:00:00:09
Powr: 00:00:00:09
Actv: 00:00:00:09
```

Peak: Indicates the amount of time until the next vibration peak PPV (interval) file upload in DD:HH:MM:SS format; the duration is based on the peak schedule

Beat: Indicates the amount of time until the next tilt heartbeat file upload in DD:HH:MM:SS format; the duration is based on the beat schedule.

Vibr: Indicates the amount of time until the next vibration peak PPV (interval) reading to be written to the MicroSD card in DD:HH:MM:SS format; the duration is based on the Vibration peak_span setting.

Tilt: Indicates the amount of time until the next tilt heartbeat reading to be written to the MicroSD card in DD:HH:MM:SS format; the duration is based on the Tilt beat_rate setting.

Cell: Indicates the amount of time until the next modem reset will be performed in DD:HH:MM:SS format; the duration is based on the reset schedule.

Batt: Indicates the amount of time until the next battery check will be performed in DD:HH:MM:SS format; the duration is internally set at every 5 minutes

Powr: Indicates the amount of time until the next power check will be performed in DD:HH:MM:SS format; the duration is internally set at every 1 minute

Actv: Indicates the amount of time until the active schedule check will be performed in DD:HH:MM:SS format; the duration is internally set at every 1 minute

13.5 Battery Commands

The device has a battery fuel gauge that measures “coulomb usage” and provides commands to query and configure the gauge.

Note: When the device is on USB power, it disables the Battery Fuel Gauge since the dvice is not consuming the batteries. The commands in this section assume an enabled battery fuel gauge; hence, the device is running on Batteries and not USB power.

13.5.1 NEW BAT

The “newbat” command sets the battery capacity when installing new batteries. Use it to set the total capacity of the installed batteries. The fuel gauge tracks battery drain and reports the used mAh, remaining mAh and capacity as a percentage

The format of the command is as follows: **newbat {mAh}**

- {mAh} is the new total battery capacity in mAh.
- If installing 4 x 14Ah batteries, use the command: **newbat 56000**

The device sends the following response:

New Battery Accepted.

Send STAT BAT for details

Note: Not all battery brands or battery batches may be the same quality. Many battery manufacturers are from China and quality can vary. Consider reducing the newbat amount to a lower value if you suspect poor quality.

13.5.2 STAT BAT

The device provides a function to query the battery status using the stat bat command.

The format of the command is as follows:

stat bat

The device returns a formatted text message representing the sensor’s battery status. Below is an example of a “stat bat” response message, and the entries’ respective indications.

```
Last Upd : 2022-09-02T15:14:16.010+08:00
Cap  mAh : 2200
Used mAh : 12
Rem  mAh : 2188
Meas mA  : 0
Idle mA  : 0
Meas Volt:  0.01
Rem  Pct : 99
```

Last Upd: The last time the device read the fuel gauge

Cap mAh: Total battery capacity in milliamp hours (mAh); set using “newbat” command

Used mAh: Accumulated battery consumption in milliamp hours (mAh)

Rem mAh: Remaining battery capacity in milliamp hours (mAh)

Meas mA: Instantaneous battery consumption in milliamps. Zero if externally powered.

Idle mA: Idle battery consumption, measured when the Modem is asleep and power drain is at a minimum. Zero if externally powered.

Meas Volt: Indicates battery voltage (between 3.5 and 3.7v is normal for lithium cells).

Rem Pct: Indicates remaining battery capacity as a percentage

13.6 Base Command

The baseline command provides a means by which to set the reference value for a tilt to the current reading. (This is necessary when installing the device, so that changes from the starting value are detectable.)

The format of the command is as follows: **base**

The device sends the following response to indicate that the sensor acknowledges the command:

Baselining sensor

13.7 Mode commands

The device supports Vibration and Tilt operating modes. Vibration mode is standard, while tilt requires a licence key. You can change mode at any time using a simple command documented below.

13.7.1 Vibration Mode

To change the sensor to Vibration Mode, the format of the SMS command is as follows:

cfg mode vibr

The device immediately changes to vibration mode and sends the response as follows:

Mode now [VIBR]

13.7.2 Tilt Mode

To change the sensor into Tilt Mode, the format of the SMS command is as follows:

cfg mode tilt

The device immediately changes to vibration mode and sends the response as follows:

Mode now [TILT]

If the device has no Tilt licence key, it will not change into Tilt mode and instead, send the following response:

Mode [TILT] unlicensed

13.7.3 Licence Key

A licence key is required to activate extended features. You may contact GSS if you require a licence for Tilt Mode.

The format of the command is as follows:

cfg licence {32-character licence key provided by GSS}

13.8 Snapshot Commands

Snapshot commands will prompt the device to take a “snapshot” of the current settings. It allows the user to obtain readings from the device immediately, rather than waiting for the next scheduled event.

13.8.1 CFG SNAP

The configuration snapshot command instructs the device to take a snapshot of the dynamic configuration settings. The device creates an INI file from the settings in static memory on the MicroSD card under the SNAPSHOT folder.

Send the following command to the device:

cfg snap

The device acknowledges the command with this message:

CFG Snap in Prog

After completing the snapshot and uploading the file to the FTP server, the device sends a response similar to following screenshot.

```
Config File
CONFIG/
5GV_123456.config
Upload OK
```

- In this example, the MAC address of the device is 123456.
- When using a GSS FTP server, the device returns a hyperlink to the file to allow you to view it directly in a browser.

13.8.2 PEAK SNAP

The device dumps the peak PPV (interval) data to the disk based on its schedule. However, the user may want to see the most recent peak PPV readings. In this case, the peak snapshot command instructs the device to upload all peak PPV readings stored in its memory and MicroSD card.

The format of the command is as follows: **peak snap**

When the device receives the command, it sends the following SMS message indicating that the command execution is in progress: **Peak dump in progress**

Once the peak snapshot upload is complete, the device sends a message indicating the result: **Interval Upload OK**

When using a GSS FTP server, the device returns a hyperlink to the file to allow you to view it directly in a browser.

13.8.3 BEAT SNAP

The device writes tilt heartbeat readings to a temporary file based on the beat_rate setting and uploads them based on the Scheduled beat setting. If you need to access the readings prior to the scheduled upload time, there is a **Beat Snapshot** command, which immediately uploads the Tilt readings from the MicroSD card to the back-end.

The format of the command is as follows: **beat snap**

When the device receives the command, it sends the following message indicating that the command execution is in progress: **Tilt Beat dump in progress**

Once the peak snapshot upload is complete, the device sends a message indicating the result. **Beat Upl OK**

When using a GSS FTP server, the device returns a hyperlink to the file to allow you to view it directly in a browser.

13.8.4 LOG SNAP

The user can take a snapshot of the current log file at any time (to save waiting for the buffers to fill and flush to disk).

The log snapshot uploads the snapshot file to the FTP server and then sends an SMS message with the name of the log file and a URL to the file (if using GSS FTP server).

The format of the command is as follows: **log snap**

When the device receives the command, it then sends the following SMS message that the command execution is in progress: **Log file dump in progress**

Once the LOG snapshot upload is complete, the device sends the following message indicating the result: **File Upload OK**

Note: For detailed troubleshooting, set logging to “I” (informational) using the **log I** command. However; remember to change it back to **log w** when done, otherwise excessive logging and associated uploads will drain the batteries.

13.9 Files Commands

At times, it is useful to check how many files are waiting to upload to the FTP server. This command returns a count of the files in various folders.

files vibr	Returns the number of vibration alert and waveform files
files peak	Returns the number of vibration peak PPV files
files tilt	Returns the number of tilt alert and data files
files beat	Returns the number of tilt heartbeat files
files log	Returns the number of log files

13.9.1 VIBR files

To retrieve the number of Vibration Files ready for upload, use the command: **files vibr**
The device sends the following response: **{nnn} files available for upload**

- Where {nnn} indicates the number of pending files.

13.9.2 PEAK files

To retrieve the number of Peak Files ready for upload, use the command: **files peak**
The device sends the following response: **{nnn} files for upload**

- Where {nnn} indicates the number of pending files.

13.9.3 TILT files

To retrieve the number of Tilt Files ready for upload, use the command: **files tilt**
The device sends the following response: **{nnn} files available for upload**

- Where {nnn} indicates the number of pending files.

13.9.4 BEAT files

To retrieve the number of Beat Files ready for upload, use the command: **files beat**
The device sends the following response: **{nnn} files for upload**

- Where {nnn} indicates the number of pending files.

13.9.5 LOG files

To retrieve the number of Log Files ready for upload, use the command**: files log**
The device sends the following response: **{nnn} files for upload**

- Where {nnn} indicates the number of pending files.

13.10 Send Commands

The **send** command allows you to upload files from the MicroSD to the backend server, even if the configuration setting associated with the file type is set to false.

The device only removes a file from the MicroSD card after successfully uploading it to the back-end.

The send commands and their respective outcomes are as follows:

send vibr	Queues pending vibration alert and waveform files for upload
send peak	Queues pending peak PPV files for upload
send log	Queues pending log files for upload
send tilt	Queues pending tilt alert and data files for upload
send beat	Queues pending tilt heartbeat files for upload

13.10.1 Sending VIBR files

Upload pending Vibration files, using the command: **send vibr**

The device sends the following response: **{nnn} files added to FTP queue**

- Where {nnn} indicates the number of files added to the queue.

13.10.2 Sending PEAK files

Upload pending Peak files, using the command: **send peak**

The device sends the following response: **{nnn} files added to FTP queue**

- Where {nnn} indicates the number of files added to the queue.

13.10.3 Sending LOG files

Upload pending LOG files using the command: **send log**

The device sends the following response: **{nnn} files added to FTP queue**

- Where {nnn} indicates the number of files added to the queue.

If there are many Log files and you do not want to upload all of them, you can use a variation of the **send log** command.

To send the latest files, use the command **send log –n**

- Where n indicates how many files to queue for upload. For instance, “send log -2” will queue the 2 most recent log files.

To send the oldest files, use the command **send log n.**

- Where n indicates how many files to queue for upload. For instance, “send log 2” will queue the 2 oldest log files.

13.10.4 Sending TILT files

Upload pending Tilt files using the command: **send tilt**
The device sends the following response: **{nnn} files added to FTP queue**

- Where {nnn} indicates the number of files added to the queue.

13.10.5 Sending BEAT files

Upload pending Beat files using the command: **send beat**
The device sends the following response: **{nnn} files added to FTP queue**

- Where {nnn} indicates the number of files added to the queue.

13.11 Cull Log Command

The cull command removes log files from the device microSD card using a date parameter shown below.

The command is cull log yy{{mm}{dd}}
yy = year (00 = all years)
mm = month (00 = all months within specified year)
dd = mday (00 = all days within specified month)

Remove all log files for the Year 2023: **cull log 23**

Remove all log files for the Year 2023 and Month of September: **cull log 2309**

Remove all log files for the Year 2023 and the 16th of September: **cull log 230916**

The cull command responds with: **Removed [#] log files**. For instance, Removed [2] log files.

13.12 Clean Commands

This section covers the following clean commands:

clean vibr	Removes all pending VIBR alert and Waveform files
clean peak	Remove all pending Peak PPV files
clean log	Remove all pending LOG files
clean tilt	Remove all pending TILT alert files
clean beat	Remove all pending TILT heartbeat files

13.12.1 Clean VIBR

This command is useful if the user wants to remove all pending vibration alerts and waveform files so the device will not upload them to the FTP server.

Clean all Vibration files with the command: **clean vibr**

The device sends the following response: **Clean Successful**

13.12.2 Clean PEAKS

This command is useful if the user wants to remove *all* pending interval files so the device will not upload them to the FTP server.

Clean all Peak files with the command: **clean peak**

The device sends the following response: **Clean Successful**

13.12.3 Clean LOG

The device log files can get quite large and uploading them consumes battery power. In the event there are pending log files of no interest, the user can remove them using this command.

Clean all Vibration files with the command: **clean log**

The device sends the following response: **Clean Successful**

13.12.4 Clean TILT

This command is useful if the user wants to remove all pending tilt alert files so the device will not upload them to the FTP server.

Clean all Tilt files with the command: **clean tilt**

The device sends the following response: **Clean Successful**

13.12.5 Clean BEATS

This command is useful if the user wants to remove *all* pending heartbeat files so the device will not upload them to the FTP server.

Clean all Beat files with the command: **clean beat**

The device sends the following response: **Clean Successful**

13.12.6 Clean MicroSD

If you need to remove all files, except the main configuration and sequence files from the MicroSD, you can use the **Clean MicroSD** command. This backs up the current configuration and other key files to memory before rebooting the device and performing a disk format. After formatting, the device re-creates the directory structure and restore the key files.

Use the following command to clean the MicroSD: **clean microsd {MAC Address}**

The device sends the following SMS response: **device will now reset and format its disk**

Once the operation completes, the device reboots and sends an “Up” notification:

MAC: {MAC Address} – Ver 5.2.7 - Up

13.13 Reset Commands

Reset commands allow the user to reset the device or baseline readings if necessary.

13.13.1 RESET {MAC}

The reset {Mac} command performs a warm boot of the device, almost as if you pressed the reset button. The device will dump out the log file, upload the current Peak and Beat files before resetting.

Use the following command to reset the device: **reset {MAC Address}**

- Where {MAC address} is the device address. An example reset would be “Reset 123456”.

Note: Consider using **power cycle** command if you want the device to be completely powered off and restarted.

13.13.2 RESET SEQ

The device maintains sequence numbers for all file types. If you need to reset these to zero, use the **reset seq** command. After issuing the command, Alert, Waveform, Beat, Peak and Log file sequence numbers are all set to zero.

Use the following command to reset the sequence numbers: **reset seq**

The device sends the following response: **Resetting Sequence Numbers**

13.14 Power Related Commands

Power related commands allow the user to put the device into power save mode, power off the device or power cycle the device.

13.14.1 Power Save

There are certain network providers or even certain bands that continually communicate with the device and this can cause a power drain. The power save command turns off the radio completely and wakes up every 5 minutes to check if there are any SMS or MQTT COMMAND queue messages to respond.

To check if the power save status of the device: **cfg pwrsave**

Use the following command to put the device in Power Save mode: **cfg pwrsave on**

13.14.2 Power Off

The device can be remotely powered off using the power off command. The device will dump out the log file, upload the current Peak and Beat files before powering off.

Use the following command to power off the device: **pwroff**

The device sends the following response: **Powering down**

13.14.3 Power Cycle

The device can be remotely power cycled using the power cycle command. A power cycle is different from a reset in that the device is completely turned off before it is restarted. The reset command is a warm reset, while the power cycle is a cold reset. In certain cases a cold reset may provide better results than an warm reset.

Use the following command to power cycle the device: **power cycle**

The device sends the following response: **Cycling down**

13.15 Samp Commands

The device normally operates in real-time mode, sampling, analysing, recording and reporting alerts. In situations where you need to take manual readings, the device provides a manual Sample command.

The manual sample command is ideal for

- Recording ambient vibration readings (samples up to 2 minutes at 1000 samples per second)
- Taking instant readings from remote devices in the field
- Use in standalone monitoring where the device is moved from location to location
- Taking a quick reading, with or without capturing a waveform

13.15.1 Sample Command Parameters

The format of the sample command is as follows:

samp secs Hz g filter upload analyse

Use the sample command to request a manual sample. The parameters for the command shown in the following table along with the range and defaults.

Parameter	Description	Valid Values	Mandatory
Secs	Seconds to sample	@ 1000 samp/sec: a numeric value 1 to 120 @ 2000 samp/sec: a numeric value 1 to 60 @ 4000 samp/sec: a numeric value 1 to 30	Yes
Hz	Sample Rate	1000, 2000, 4000	Yes
Range	The sensor range in g	2, 4, 8, 10, 20, 40	Yes
filter	filter to apply	1 - ISEE_SEISMOGRAPH 2 - DIN_4150_3 3 - DIN_4150_2_KB 4 - BS_7385 5 - AS_2187_2_2006 6 - ONORM_S_9012 7 - ISO_8569_ACC 8 - IN1226 9 - NS_8176_COMFORT 10 - NS_8141_CONSTRUCTION 11 - NS_8141_1 12 - SS_4604866_PILING 13 - SS_025211_SHAFT 14 - SS_4604861_COMFORT 15 – GEOPHONE 16 - ICPE_CIRCULAR_86	Yes
Upload	Create waveform file	0 = No, 1 = Yes (slower)	0
Analyse	Analyse the waveform data	0 = Basic Results, 1 = Full Analysis (slower)	0

Table 8 - Manual Sample Parameters

13.15.2 Sample Command Examples

We recommend using the 2G range when carrying out ambient vibration monitoring when anticipating low-level vibrations. Switch to the 8G range for lower sensitivity to avoid over-ranging the accelerometer.

When upload is set to one (1), the sensor will create a waveform file and based on the send_data setting, upload it to the back-end, or just save it to the MicroSD.

Sample Command	Description
samp 5 1000 2 15	Generates a 5-second sample at 1000 samples per second using the 2G range, geophone filter, no raw data, no analysis
samp 10 1000 2 1 1 1	Generates a 10-second sample at 1000 samples per second using the 2G range, ISEE filter and generates a waveform file, + analysis
samp 5 2000 8 3 0	Generates a 5-second sample at 2000 samples per second using the 8G range, DIN 4150-2 KB filter, and no waveform file , no analysis
samp 30 4000 2 15 1	Generates a 30-second sample at 4000 samples per second using the 2G range, geophone filter and generates a waveform file, no analysis

Table 9 - Manual Sample Examples

13.16 Sensor Commands

The device provides commands to control the state of the sensor component. You can start, idle and reset the sensor.

13.16.1 SENSOR IDLE / STOP

If the user moves the sensor while it is monitoring, the device is likely to generate one or more alerts. Before moving the sensor, we recommend idling it first.

Use the following command to idle the sensor: **sensor idle (or sensor stop)**

The device sends the following response: **Sensor idled**

Note: When the sensor is idle, it will not generate peak PPV messages

13.16.2 SENSOR RUN / START

The run command returns the sensor monitoring state, with associated alert detection and Peak PPV samples.

Use the following command to resume the sensor: **sensor run (or sensor start)**

The device sends the following response: **Sensor Resumed**

13.17 OTAP Commands

The device supports over-the-air firmware updates with the OTAP command. The device downloads requested image from the configure FTP server and saves it to the MicroSD card. The device then reboots into the bootloader to apply the image.

13.17.1 OTAP MAIN

The **otap main** command provides a means to update the device with compatible firmware versions. For example, 5.2.8

Use this command to update the device firmware: **otap main {version}**

- Where {version} is the firmware version. For example, to update to version 5.2.8, enter the 50208 for the version as shown here. **otap main 50208**

The device sends one of the following responses depending on the success or failure of the download:

- **OTAP Download Error <CRLF>Try again..**
- **OTAP OK<CRLF>Updating Firmware.. ~1min**

Once the device finishes updating the firmware, it sends an up message like this:

MAC: 123456 - Ver 5.2.8 - Up

Note:	An error is normally due to difficulty in the modem downloading the OTAP file from the FTP server before timeout. The GSS FTP server is located in the USA, and high volume internet traffic can cause downloads to be slow and exceed timeout. In the event of an error, the user should retry the OTAP command. If the user continues to receive errors, contact GSS.

14 Console Only Commands

There are some commands that are only available via a terminal console. These commands can be useful for troubleshooting.

14.1 Logging Commands

14.1.1 LOG CON ON

After opening a COM port for the device, use the “log con on” command to enable logging to the screen.

- The format of the command is as follows: **log con on**
- The device responds with the message: **Console ON**

14.1.2 LOG {MODE}

The device supports a few log filter types:

- I = Informative Detailed information logging
- W = Warning Warning Messages only
- E = Error Error messages only
- U = Unfiltered Messages that are not filtered

The MAIN section of the configuration file contains the LOG level setting and in production, this is normally set to W to avoid excessive disk and upload activity.

You can override the filter with the **log** command but to make it persistent, use the cfg main log {I or W or E} followed by a **cfg apply**.

- To change logging to informative, use the command: **log i**
- The device responds with the following message: **Log Filter = I**

14.1.3 LOG COM ON

The device supports detailed communications logging to allow debugging problem connectivity issues. This works for the GSM modem as well as the WiFi module.

The format of the command is as follows: **log com on**

The device responds with the following messages:

GSM Modem Log ON

WiFI Modem Log ON

The device will output all messages to and from the GSM or WiFi module when turned on as highlighted below:

```
16/09/23 16:39:02 I [ AT ] Modem READY
16/09/23 16:39:02 I [ AT ] +CPIN: READY
16/09/23 16:39:02 I [ AT ] SIM Status: SIM Ready and Unlocked
16/09/23 16:39:02 I [ AT ] +QUSIM: 1
16/09/23 16:39:02 I [ AT ] SIM Type: 1
16/09/23 16:39:02 I [ AT ] +CFUN: 1
16/09/23 16:39:02 I [ AT ] URC +CFUN: ignored
16/09/23 16:39:02 I [ AT ] +QIND: SMS DONE
16/09/23 16:39:02 I [ AT ] SMS DONE
16/09/23 16:39:03 I [ AT ] +QIND: PB DONE
```

14.1.4 LOG COM OFF

To turn off the detailed communication logging, use the “log com off” command.

- Use this command to turn off communication logging: **log com off**
- The device responds with the following messages:

  GSM Modem Log OFF

  WiFI Modem Log OFF

14.1.5 LOG SENSE ON

The device provides a command to allow you to view the real-time PPV results on the console.

- Use the following command to turn on sensor logging: **log sense on**
- The device responds with the message: **Sensor Log ON**

After enabling sensor logging, the device displays Vibration (or Tilt) data every second.

Here is an example when the sensor is in vibration mode

```
Sensor Log ON
PPV: 0.603  1.060  0.692 HZ:10.417  7.692 13.889
PPV: 0.612  0.915  0.579 HZ: 6.944  7.042  4.673
PPV: 0.192  0.409  0.200 HZ: 8.197  8.197  8.621
```

14.1.6 LOG SENSE OFF

To turn off sensor logging from “log sense on”, use the “log sense off” command.

- Use this command to turn off sensor logging: **log sense off**
- The device responds with the message: **Sensor Log OFF**

14.2 Directory Commands

14.2.1 DIR

The device has a MicroSD card that uses a FAT16 file system. You can view the files on the MicroSD card with the ubiquitous “dir” command.

You will find this command helpful when checking for the presence of specific files on the MicroSD card.

- Use the following command to view the root structure: **dir**
- The device responds with the following:

```
Directory Listing for /mnt/5gv
2022/09/12, 17:01  <DIR>        /CONFIG
2022/09/12, 17:01  <DIR>        /FILES
2022/09/12, 17:01  <DIR>        /FIRMWARE
2022/09/12, 17:01  <DIR>        /MAINT
2022/09/12, 17:01  <DIR>        /LOG
2022/09/12, 17:01  <DIR>        /SNAPSHOT
2022/09/12, 17:01  <DIR>        /TEMP
2022/09/12, 17:01  <DIR>        /RECOVER
```

You can also specify a directory path, though this will only show the directories and files under that path.

14.2.2 DIR /S

The device also supports a recursive directory listing option when you append “/s” to the directory command.

- Use the following command to view the root structure: **dir /s**
- The device responds with something like this:

```
Directory Listing for /mnt/5gv
2022/09/12, 17:01  <DIR>            /CONFIG
2022/09/15, 18:50  3,347            /CONFIG/TGV3GCFG.INI
2022/09/21, 10:01  4,351            /CONFIG/TGV3GCFG.BIN
2022/09/21, 10:00  16               /CONFIG/TGVSEQ.BIN
2022/09/15, 18:50  3,347            /CONFIG/TGV3GCFG.BAK
               4 File(s)          11,061 bytes

2022/09/12, 17:01  <DIR>             /FILES
2022/09/12, 17:01  <DIR>             /FILES/PEAKS
2022/09/12, 17:01  <DIR>             /FILES/BEATS
2022/09/12, 17:01  <DIR>             /FILES/VIBR
2022/09/12, 17:01  <DIR>             /FIRMWARE
2022/09/12, 17:01  <DIR>             /MAINT
2022/09/12, 17:01  <DIR>             /LOG
2022/09/19, 18:26  65,280            /LOG/220919.048
2022/09/20, 01:00  65,261            /LOG/220920.049
2022/09/20, 07:46  65,265            /LOG/220920.050
2022/09/20, 09:44  30,049            /LOG/220920.051
… more
```

When checking the directory listing, bear in mind that you may see unsent files; this could mean the send option is disable for that file type, or there is a communications issue.

- Use “reset modem” and the appropriate “send” command to initiate the upload to view the logs and see if there is an issue with the SIM card, network provider, FTP Server or modem.
- If there are many files in the **/LOG** folder and the device is operating normally, consider removing them with the “clean log” command.
- When the device is operating normally, you will see “.$$$ files in the /FILES/PEAKS and /FILES/BEATS folders as these are the current files that are yet to be flushed and uploaded.

15 Mounting

The device design and the accompanying mounting accessories give the user a choice of mounting methodologies to suit the client's requirements. The choices are as follows:

- M8 anchor bolt through the hole in the battery compartment
- Optional standoffs to affix the device to uneven surfaces
- Via mounting plate bolted to the target surface
- Via mounting plate epoxied to the target surface

15.1 Anchor Bolt – No Standoffs

The following image depicts the device bolted to a surface with an M8 anchor bolt.

Figure 18 – Anchor Bolt Installed

To install with the anchor bolt, drill a hole in the target surface; the diameter of the hole should be in accordance with the specification of the M8 bolt. (Generally, this would be an M10 hole to accommodate the sleeve.) The depth of the hole must accommodate the entire sleeve and leave sufficient thread exposed to fit the sensor and a nut onto the bolt. The user should consider the following:

- If too much thread protrudes through the base case, either drill a deeper hole or cut off the excess thread with a hacksaw.
- Make sure there is a metal washer under the nut to prevent the nut coming into direct contact with the device housing.
- The device has protruding nylon shoulder washers for protection; make sure they have not fallen out.

15.2 Using Standoffs

It is unlikely that the mounting surface is perfectly smooth; often metal standoffs are necessary to separate the device from the surface.

The user can affix three or more standoffs to the back of the device base case and use an anchor bolt to secure the device in place.

The following image depicts three standoffs fitted to the rear of the device to adapt to curved or uneven surfaces.

Figure 19 – Device with 3 Standoffs

The standoffs attach to the device base case via M3 x 6mm socket head screws; they provide 6mm of clearance between the device and the mounting surface.

15.3 Using a Mounting Plate

The mounting plate provides a quick and easy way to mount the device and alleviates the need to re-align the device axis during re-attachment.

The following image depicts the front and back of the mounting plate.

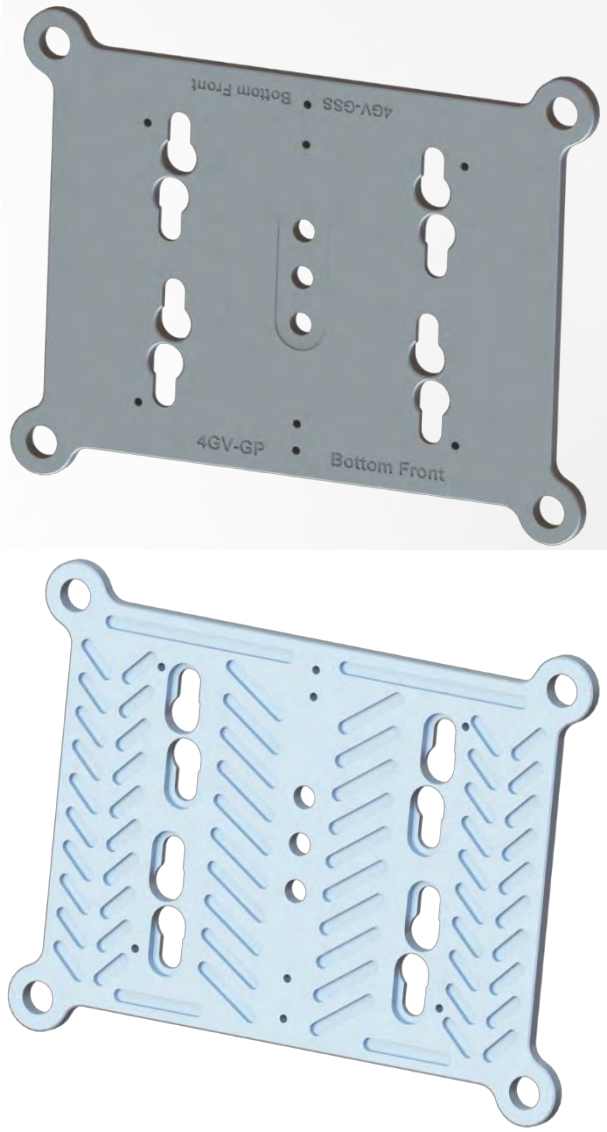


Figure 20 – Mounting Plate Front and Rear Views

The mounting plate holds the device in place using four flange spacers that drop into the holes on the plate and slide into place. An optional flange lock provides a means of locking the device in place to make removal more difficult.

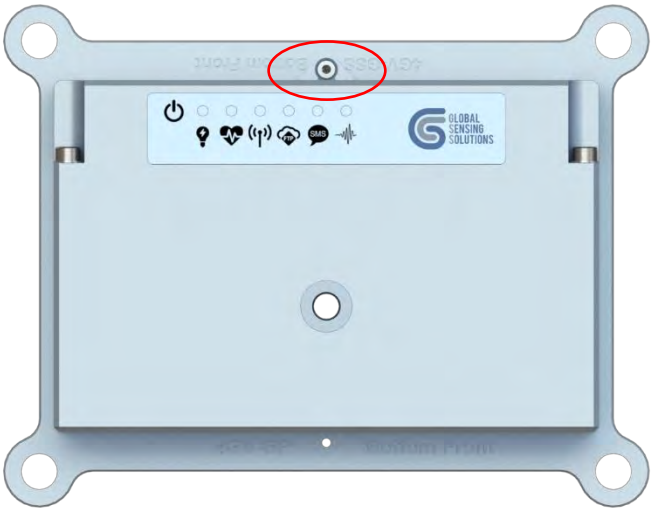


Figure 21 – Device Locked to Mounting Plate

The mounting plate design allows for direct attachment to the target surface using either of the following:

1) The four corner mounting holes
2) Epoxy smeared on the back

The device attaches to the mounting plate using either of the following:

1) Flange spacers that fit into holes and slots cut into the mounting plate
2) An M8 bolt screwed into the hole in the mounting flange.

15.4 Using Bolts

The mounting plate can be attached to a thin surface using four M8 bolts and nuts. It can also attach it to a solid surface using M8 anchor bolts.

The following image depicts the mounting plate fitted with four M8 bolts and washers.

Figure 22 – Mounting Plate with Bolts

15.4.1 Adding Standoffs

Standoffs may be necessary to help level the mounting plate on uneven surfaces. As with the device base case, the mounting plate allows for multiple standoff positions on the rear of the plate. The following image depicts three standoffs fitted to the rear of the mounting plate to adapt to curved or uneven surfaces.

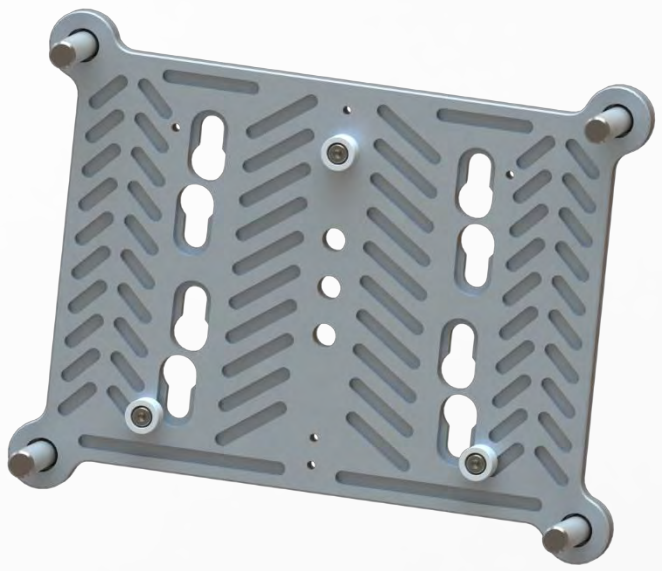


Figure 23 – Mounting Plate with Standoffs

The standoffs attach to the rear of the mounting plate via M3 x 6mm socket head screws; they provide 6mm of clearance between the mounting plate and the surface.

15.5 Single Bolt and Mounting Plate

One final mounting option for the device and mounting plate is to use an M8 threaded rod screwed into the mounting plate with a nut and washer on top to lock the device onto the plate.

The user can fit flange spacers or the flange lock to stop the device from turning on the mounting plate (this may not be necessary).

The following “cut-away” image depicts the threaded bolt approach:

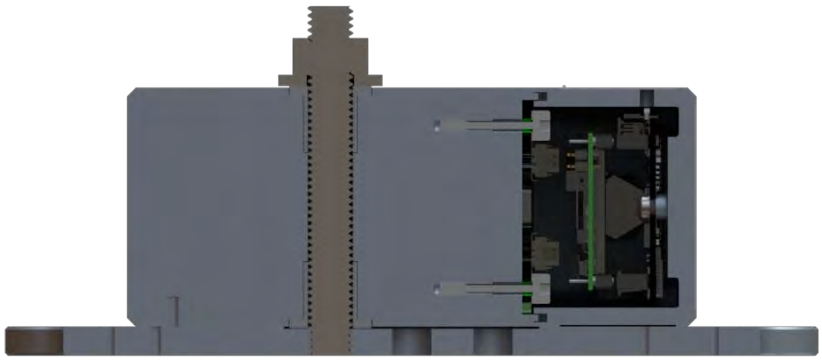


Figure 24 – Device Fixed with Threaded Rod to Mounting Plate

The above image shows a mid-line cut of the device on the mounting plate. In view is an M8 threaded rod screwed into the mounting plate, along with a nut and washer that lock the device in place.