



Fast
Accurate
Proven
Efficient

ZEB-REVO User Guide



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1. INTRODUCTION

The ZEB-REVO portable laser scanner provides a rapid and simple means of capturing 3D point cloud data. Data is captured as the user walks through the area of interest. The ZEB-REVO negates the need for time consuming scanner set-ups and data registration associated with traditional terrestrial laser scanning methods.

Provided the simple guidelines set out in this manual are adhered to accurate 3D point clouds can be generated in a fraction of the time taken with traditional terrestrial laser scanning methods.

1.1 SPECIFICATION

Maximum range	Up to 30m in optimal conditions Typical max range 15-20m
Points per scan line	432 (0.625° interval)
Field of view	270° x 360°
Scan rate	100 lines/s 43200 points/s
Scan range noise	±30mm
Laser safety classification	CLASS I Laser Product (21 CFR 1040.10 and 1040.11)
Laser wavelength	905nm
Operating conditions	Temperature 0°C to +50°C Humidity <85% RH
Power supply	12VDC ±10% approx. 1.5A
Weight	Scanning head 1.0kg Carry case and contents 4.1kg
Dimensions	Scanning head 80x113x140mm (287mm incl handle) Carry case and contents 470x220x180mm
Battery life	Approximately 4 hours continuous use

Table 1-1: Specification

1.2 PRINCIPAL OF OPERATION

The ZEB-REVO consists of a 2D time-of-flight laser range scanner rigidly coupled to an inertial measurement unit (IMU) mounted on a motor drive. The motion of the scanning head on the motor drive provides the third dimension required to generate 3D information. A novel 3D simultaneous localization and mapping (SLAM) algorithm is used to combine the 2D laser scan data with the IMU data to generate accurate 3D point clouds.

The ZEB-REVO captures raw laser range measurement and inertial data. This data must be processed using GeoSLAM's SLAM algorithm to convert the raw data into a 3D point cloud. The data can be processed either using the GeoSLAM cloud data processing server or (optionally) using the GeoSLAM Desktop SLAM processing software.

1.3 LIST OF PARTS

Part no.	Description
1 GS_610042	ZEB-REVO hand held laser scanner
2 GS_610048	ZEB-DL2600 data logger
3 GS_610008	ZEB-REVO main cable
4 GS_610024	ZEB-DL2600 download cable
5 GS_USB	USB memory stick
6 DEB_BAT_CH	Battery Charger and adapters
7 DEB_CAR	12V Auto socket charger
8 SWA_138576	Backpack
9 GS_510047	ZEB-REVO mount plate and fixings

Table 1-2: List of parts



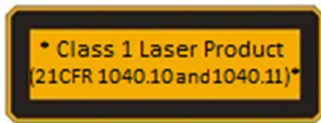
2. SAFETY

2.1 GENERAL SAFETY

The ZEB-REVO Portable Mapping System should only be used by trained operators. Always follow basic safety precautions when operating the ZEB-REVO Portable Mapping System to reduce the risk of personal injury and to prevent damage to the equipment. Do not operate the equipment with suspected defects or obvious mechanical damage. Please refer all servicing of the equipment to qualified service personnel. Only use the components and accessories supplied with your system or other accessories recommended by GeoSLAM Ltd. Before operating the system for the first time please read this manual in full.

The equipment contains sensitive electrical and mechanical parts and thus requires appropriate handling. Do not bend or pull the cables forcibly. Never push objects of any kind into the connectors or sockets. Keep the equipment out of the reach of children. Under no circumstances should any modifications be made to the ZEB-REVO Portable Mapping System without prior written permission from GeoSLAM Ltd.

2.2 LASER SAFETY



The ZEB-REVO incorporates a Hokuyo UTM-30LX-F laser scanner. The UTM-30LX is classified as a CLASS 1 Laser Product in accordance with IEC 60825-1 : 2007 (2nd Edition) *Safety of laser products. Equipment classification and requirements*. Class 1 Laser Products

are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

2.3 ELECTROMAGNETIC COMPATABILITY

The ZEB-REVO Portable Mapping System meets or exceeds the following standards:

EN61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Industrial Location Immunity - (immunity section only)

EN61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Group 1, Class A equipment - (emissions section only)

CFR 47 Code of Federal Regulations: Pt 15 Subpart B- Radio Frequency Devices - Class A Unintentional Radiators

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

2.4 BATTERY SAFETY

DO NOT attempt to dismantle the battery.

DO NOT short circuit the battery.

ONLY use the charger supplied with the system.

Excess heat will degrade the battery rapidly. Always store the battery in a cool dry place.

DO NOT leave for long periods in the sun or in a hot vehicle.

The battery is splash proof but not water proof – do not immerse in water.

2.5 SYSTEM DISPOSAL



When the ZEB-REVO Portable Mapping System reaches the end of its life-cycle please dispose of the equipment in accordance with Directive 2002/96/EC on Waste Electrical and Electronic equipment (WEEE).

GeoSLAM Ltd is prepared to take back the waste equipment and accessories free of charge at the manufacturing unit in Bingham, UK for proper treatment with the objectives of the WEEE.

2.6 INSTALLATION

The ZEB-REVO can be used as a handheld device using the supplied removable handle or can be mounted to mobile platform using the supplied mounting plate (see Section 7.3).Introduction

2.7 FURTHER HELP AND INFORMATION

Contact GeoSLAM by any of the following methods:

Phone: +44 1949 831814

Email: info@geoslam.com

Website: www.geoslam.com

3. DATA CAPTURE

This chapter describes how to connect the ZEB-REVO hardware, how to collect raw scan data and how to download the raw scan data from the data logger.

3.1 CONNECTING THE HARDWARE

Connect the ZEB-REVO main cable to the socket on the side of ZEB-REVO scanner head.

Connect the other end of the ZEB-REVO cable to the ZEB (white) socket on the DL2600 data logger.

DO NOT attempt to connect the ZEB-REVO cable (12 pin) to the AUX socket (14 pin- with blue marker)

Connect the DL2600 battery connector to the external battery.

3.2 COLLECTING DATA

The process of collecting data using the ZEB-REVO scanning system is highly automated. However, care must be taken to ensure that the collected data can be successfully processed into a 3D point cloud using GeoSLAM's unique SLAM algorithm. It is strongly recommended that the user conducts a survey plan taking into account the recommendations set out in the Usage Guidelines in chapter 4 before commencing data collection.

When you are ready to start collecting data follow the steps in the table below:

Step 1	Position the ZEB-REVO scanner on a flat stationary surface. Turn on the ZEB-DL2600 data logger by pressing the on/off button. The LED's on the data logger may flash briefly and then cycle green-orange-red whilst the data logger boots up and connects to the scanner.	ZEB LED 
Step 2	Once booted the ZEB LED will switch to pulsing red– Standby mode .	
Step 3	To initiate a scan the user must manually rotate scanner head through 90 degrees or more. The ZEB LED will switch to constant red – Preparing to scan mode .	
Step 4	After approximately 3 seconds the LED on the scanner will switch to flashing orange – Initialisation mode . The scanner must remain stationary during initialization. If the scanner is disturbed during initialisation the system will revert to Preparing to scan mode (step 3). The ZEB LED will revert to red and wait to start initializing again.	

Step 5	After the ZEB-REVO scanner has been in initialisation mode for 15 seconds the LED will switch to green – Scanning mode. Press the motor start/stop button on the side of the scanner head to start the scanner rotation and commence the survey.	
Step 4	When the survey is complete position the ZEB-REVO scanner in approximately the same position as used for initialisation (Step 2) and press the motor start/stop button to stop the scanner rotation. After the scanner has been stationary for approximately 5 seconds the LED will switch back to flashing orange - De-initialisation mode. If the scanner is disturbed during de-initialisation the ZEB LED will revert to green and wait to start de-initialising again	
Step 5	After the ZEB-REVO scanner has been in de-initialisation mode for 15 seconds the LED will switch to pulsing red– Standby mode. When the ZEB-REVO scanner enters standby mode the AUX LED will flash orange for a short period whilst the recorded data is compressed into a single data file ready for downloading. ! Do not turn the data logger off until the AUX LED is off	

Step 6	To download the raw scan data see section 3.3	
	To repeat the scan, or start a new scan, simply rotate the scanner head through 90 degrees. The LED will change to red, Preparing to scan mode and the sequence will repeat from Step 3	
	To shut down the system, press and hold the data logger power button for 1 second. ! Do not turn the data logger off until the AUX LED is off Disconnect the battery connector to prevent battery discharging whilst in storage.	

! The scanner must remain static during initialisation and de-initialisation

During data capture the data logger can either be carried in your spare hand or placed in the backpack carry case.

3.3 DOWNLOADING THE RAW SCAN DATA

To download the raw scan data, switch on the ZEB-DL2600 data logger. Connect the DL2600 download cable to the AUX socket (with blue socket marker) and connect the supplied USB memory stick to the download cable. The AUX LED light will light green whilst the data is transferring to the memory stock. The USB stick must not be removed when the AUX LED is lit green. After a few seconds (dependent on the size of the data files to be transferred) the AUX LED will turn off. All data that has not previously been transferred will be transferred and the USB memory stick can be removed.

! Do not remove the USB memory stick while the green AUX LED is lit

If there is a problem with the USB memory stick, for example there is insufficient capacity or the format is not recognised the AUX LED will flash red. The raw data will remain on the internal memory of the data logger. The following memory stick file formats are supported, exFAT, FAT16, FAT32 and NTFS.

Downloading data is an automatic process whereby only data that has not previously been downloaded will be transferred. If for some reason data needs to be downloaded again please follow the instructions in chapter 5 to use the ZEB uploader to program the USB stick.

3.4 FILE NAMING

Files are automatically named in accordance with the start date and time of the dataset recording (with respect to the time/date set on the data logger clock).

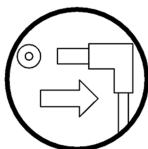
An example file name for a dataset recorded at 13:41 on 31st August 2015 is:

2015-08-31_13-41-26.ZIP

The system date/time can be changed using the Prepare USB tool described in chapter 7.2.

3.5 SHUTTING DOWN

To shut the DL2600 data logger down press and hold the power button for 1 second. After the data logger is shut down the battery cable should be disconnected from the battery to prevent the battery from being drained.



**DISCONNECT BATTERY
WHEN NOT IN USE**

! Disconnect the battery when not in use

ZEB-REVO LED		Description
	Red-orange-green	System booting
	Red pulse	Standby mode
	Red	Preparing to scan
	Orange flash	Initialising or de-initialising – data is being logged
	Green	Scanning - data is being logged
	Red flash/ green	Warning – low battery voltage
	Red flash x 1	Error – scanner not detected
	Red flash x 2	Error – IMU not detected
	Red flash x 3	Error – neither scanner or IMU detected

Table 3-1: ZEB-REVO LED status summary

AUX LED		Description
	Green	Copying data to USB memory stick
	Orange flash	Compressing files
	Red flash	USB memory stick error (format error or disk full)

Table 3-2: AUX LED status summary

4. USAGE GUIDELINES

This chapter provides guidelines for how the ZEB-REVO Portable Mapping System should be used to achieve the best possible results. Prior to conducting a survey the user should plan the proposed survey path in order to identify potential problem areas, e.g. feature poor environments, doorway transitions and stairwells. In these areas the user should plan how to conduct the survey taking into account the recommendations in this chapter. The plan should also make provision for “closing loops” where ever possible. Please adhere to these guidelines in order to achieve the best results. It is recommended that users also watch the accompanying training videos provided on the GeoSLAM YouTube channel.

4.1 THE ENVIRONMENT

The SLAM algorithm used to process the raw laser scan data into a 3D point cloud relies on there being features in the scanned environment that are repeatedly scanned as the operator passes through the scanned environment. For a feature to be significant the ratio of its size to its range must be approximately 1:10, e.g. at 5m range for a feature to be significant it must be >0.5m in size. ‘Feature poor’ environments include open spaces and smooth walled passageways. In smooth walled passageways there may not be sufficient features in the direction of travel for the SLAM algorithm to determine forward motion. In feature poor environments we recommend the following steps are taken:

- If possible augment the environment with additional features (e.g. boxes in a corridor or a parked vehicle in an open field).
- Ensure that whatever limited features are available are scanned repeatedly as you move through the environment by pointing the ZEB-REVO in the direction of the feature. By doing so more measurement points are made of the feature increasing the likelihood that it will be used by the SLAM algorithm. This is particularly important when the feature is at long range (>10m), e.g. when scanning a smooth walled passageway where the only feature in the direction of travel is the end wall or door.
- Avoid scanning moving objects (e.g. passing pedestrians or vehicles) as the SLAM algorithm may lock on to these objects as static features.

4.2 LOOP CLOSURE

The SLAM algorithm used to process the raw scan data into a point cloud uses a method analogous to the Traverse technique used in survey practice, in that a previously known position is used to determine its current position. This method can result in the compounding of any error introduced causing measure position to “drift”. It is good survey practise to “close the loop” by re-surveying a known position so that the compounded error can be spread around the loop.

As a minimum it is required that the operator must start and end the survey in the same position to ensure at least one loop closure. However it is recommend where possible that the operator closes the loop as often as possible in order to minimise error and improve the accuracy of the resulting point cloud.

In general it is better to do circular loops rather than “there and back” loops where the survey path simply doubles back on itself. This applies to horizontal and vertical loops, i.e. if possible enter and exit through different doors, move between floors via different stair wells.

It is important to scan the closed loop regions carefully to ensure the key features are scanned from a similar perspective. It may be necessary to turn around if you return to a region from a different direction. This is particularly important in feature poor environments.

4.3 TRANSITIONING BETWEEN ENVIRONMENTS

Extra care must be taken when transitioning between environments, for example passing through a doorway or turning through a tight bend to avoid introducing errors. When transitioning between environments the local view may change abruptly and the SLAM algorithm may have difficulty placing the new environment relative to the previous environment. This may result in rooms either side of a doorway being slightly misaligned.

Transition through doorways slowly and ensure that there is a period when the scanner can view features on both sides of the doorway (i.e. into both rooms).

Try to open all doors before starting the survey. Avoid scanning doors as they are being opened. If necessary, face away from the door and open from behind then pass through the doorway backwards.

Transition around tight bends slowly and ensure that there is a period when the scanner can view features on both sides of the bend.

Take care when transitioning from an enclosed feature rich environment to an open feature poor environment, for example exiting a building. It may be necessary to turn and face the exit and the exterior of the building if no other features are within range.

Avoid scanning any other moving objects (e.g. walking pedestrians) as you pass through a transition.

4.4 WALKING SPEED

It is recommended that data is captured at a slow walking pace to ensure good coverage and high resolution data. If the forward movement is too fast there may not be enough repeat scans of features for the SLAM algorithm to be able to process the raw laser data into a point cloud.

4.5 MINIMUM AND MAXIMUM RANGE

Data within a small range value is not processed (by default) to eliminate data from the scanner operator being included in the final point cloud. Avoid close proximity to walls and ceilings.

The maximum range of the scanner is 30m. This range will only be achieved in optimal conditions (indoors with good target reflectivity). The typical maximum range will be 15-20m in most conditions. It is recommended that the range is kept to less than 10m where possible to ensure good point density and to assist the SLAM algorithm.

4.6 DURATION OF SCANNING

For very large surveys the project should be broken down into more than one scan mission. This is to avoid very large file sizes as well as reduce any drift that might be created in the data. It is recommended that each survey is limited to 30 minutes. At slow walking pace it is possible to cover 1000-3000m of survey distance.

4.7 SURVEY AREAS WITH RESTRICTED OR DIFFICULT ACCESS

The scanning head can remain stationary for short periods of time whilst the operator negotiates difficult access points (e.g. tight squeezes in cave systems). The scanning head can also be held in the hand and moved up and down to mimic the normal oscillating motion for short periods of time to assist transition through survey areas with restricted or difficult access.

4.8 MOVING OBJECTS IN THE ENVIRONMENT

In most cases the SLAM algorithm is able to handle moving objects in the environment. In order to estimate the scanner motion the algorithm must assume a large proportion of the environment is static. However, in some feature poor environments where 3D structure is lacking in some dimensions, moving objects can have a greater impact on the solution. In particular, moving objects should be avoided in long tunnel-like environments (e.g. corridors), relatively open spaces and when transitioning through doorways.

It is best practice not to have other people closely accompany the operator during the scan acquisition as they will be scanned throughout the map leaving streaks of data and potentially corrupting the solution in feature poor environments. If people are required to follow the operator they should ideally maintain a distance of 20m or more from the operator.

5. DATA PROCESSING

It is necessary to process the raw data collected by the ZEB-REVO portable mapping system using GeoSLAM's novel 3D SLAM algorithm in order to generate a 3D point cloud of the environment that has been mapped. This is done by either uploading the raw data to the GeoSLAM Cloud processing server or, for those customers that have purchased a license, using the GeoSLAM Desktop processing software. Section 5.1 describes how to process data using the Cloud based service. Section 5.2 describes how to use the local desktop application.

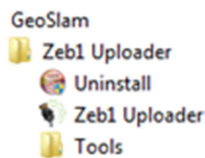
5.1 GEOSLAM CLOUD PROCESSING SERVER

This section describes how to:

- Upload raw data to the GeoSLAM Cloud Processing Server for processing;
- Download the resulting point cloud data;
- Flag datasets that have not correctly processed for reprocessing;
- Manage the data and your ZEB-REVO processing account;

5.1.1 ZEB UPLOADER

The GeoSLAM processing server is accessed using the **ZEB-REVO Uploader** desktop application. To use the Uploader application you must first have a user account on the GeoSLAM processing server. An account is created for each ZEB-REVO system with at least one user. The user(s) receive an email with login detail and a download link for the ZEB-REVO Uploader application. The application must be installed on a PC with a Microsoft Windows operating system (Windows XP or later) and internet access.



The ZEB-REVO Uploader application is installed in the GeoSLAM Program Group and can be accessed via the Windows start menu or via the shortcut installed in the Desktop folder

If you need help with your ZEB-REVO processing account contact support@geoslam.com.

Copy the raw scan data zip file (*filename.zip*) from the ZEB-DL2600 data logger (see chapter 3.3) to the memory stick and then copy onto the PC with the **ZEB-REVO Uploader** application installed (or simply upload directly from the memory stick).

Start the **ZEB-REVO Uploader** desktop application and log on to the service using your account login details (see Figure 5-1).

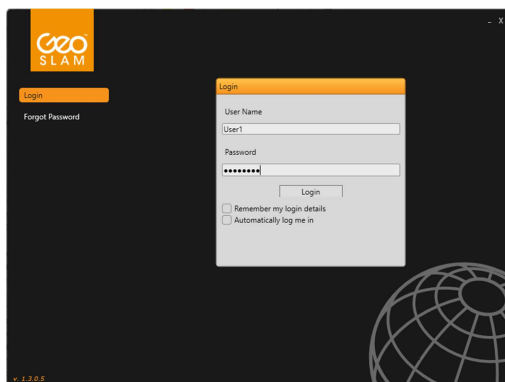


Figure 5-1 – ZEB-REVO Uploader login screen

The application will open on the **Upload** page (see Figure 5-2).

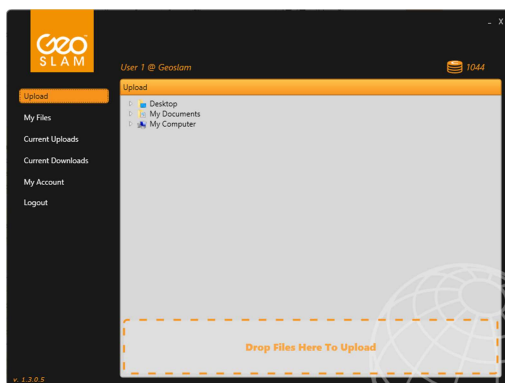


Figure 5-2 – ZEB-REVO Uploader Upload page

Either navigate to the location of the raw scan data zip file(s) from within the Upload page and double click the file(s) to be uploaded or 'drag and drop' files from Windows Explorer onto the Upload page. After the file(s) have been selected the application automatically switches to the **Current Uploads** page and progress bar(s) are displayed showing the progress of each file upload (see Figure 5-3).

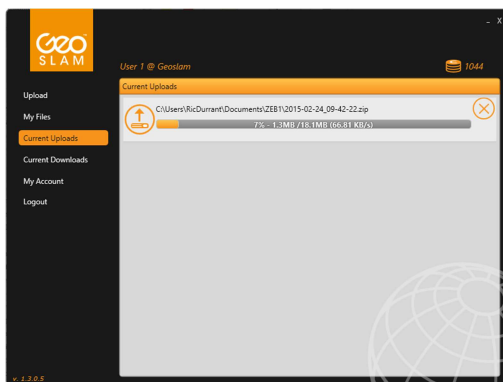


Figure 5-3 – Current Uploads page

Once the upload is complete the file will be added to the **My Files** page. Click on **My Files** to display the page.

All uploaded files are displayed on the **My Files** page. The files can be sorted using the **Sort By** function in the Options panel at the bottom of the page. Each file has a Status level displayed after the filename. There are 3 status levels:

Processing - The data is currently being processed on the online server. The data processing algorithm processes at a similar rate to the rate of data capture, i.e. a 10 minute survey will take 8-10 minutes to process. The actual processing time will be dependent on the number of processing jobs in the queue on the GEOSLAM server.

Complete - The data has been processed and is ready to be downloaded. Please see section 5.1.2 **File management** for information on file management once data processing is complete.

Error - There has been a problem during processing and the data has not processed successfully. If the dataset returns an Error status, please **DO NOT** re-upload the data. The GeoSLAM support team are informed of the error immediately and the problem will be investigated. A support team operator will contact you by email and advise why the error occurred and whether it will be possible to manually process the dataset.

5.1.2 FILE MANAGEMENT

5.1.2.1 PAYING FOR DATA

The GeoSLAM data processing service is a paid for service. Users must pay for processed datasets in order to make them available for download. Datasets are paid for using Processing Credits. The number of processing credits available on your account is displayed in the top right hand corner of the Uploader window. After a dataset has been processed and its status level has changed to *Complete* the cost of the dataset (in

processing credits) is displayed below the status line and the *Pay* and *Delete* icons are enabled (for GeoSLAM Desktop users the *Flag Dataset* icon is also enabled). For details of how the data processing cost is determined see Section 7.1. To pay for the dataset, click the *Pay* icon and click OK on the confirmation popup window (see Figure 5-4). Once the data set has been paid for, the number of credits remaining in the account will be updated.

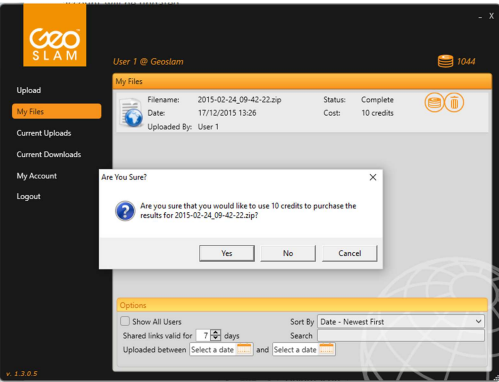


Figure 5-4 – Paying for a data set



Delete icon



Pay icon



Flag for support
GeoSLAM desktop users only
See Section 5.1.2.3

5.1.2.2 DOWNLOAD DATA

After a dataset has been paid for three new icons appear against it on the **My Files** page:



Download icon



Flag for support

See Section 5.1.2.3



Share data icon

See Section 5.1.2.4

To download a processed dataset, click on the *Download* icon relating to the dataset (see Figure 5-5). The Save Results dialogue box is displayed (see Figure 5-6). The processed data is compressed into a zip file. The default name for the zip file is *filename_results.zip*. Select a suitable location to download the data and a suitable filename (we recommend using the default filename) and click Save. The application will automatically switch to the **Current Downloads** page where the progress of the current download can be seen (see Figure 5-7).

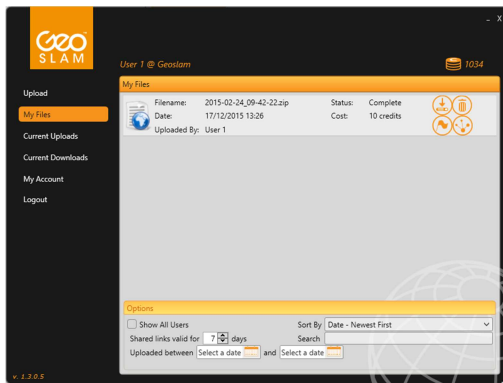


Figure 5-5 – Processed data file ready for download

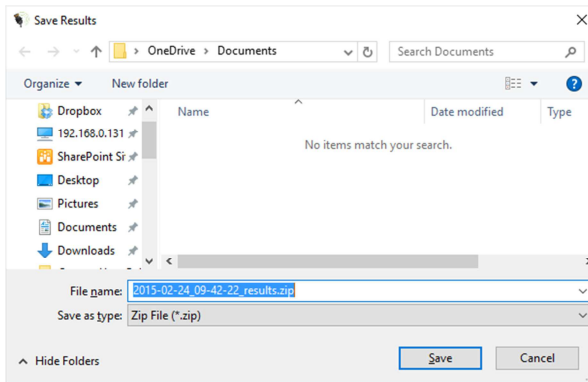


Figure 5-6 – Save Results dialogue box

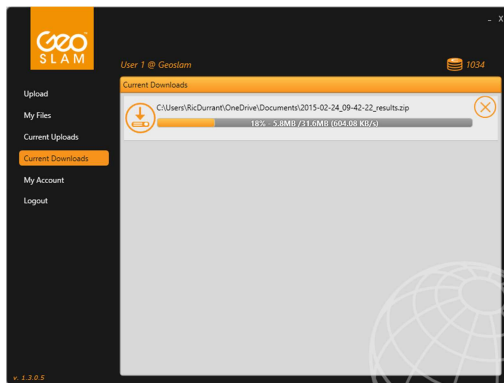


Figure 5-7 – Current Downloads page

While a dataset is being downloaded the download can be cancelled by clicking the Cancel icon.



Cancel Download icon

After a dataset has been downloaded the following icons are enabled:



Remove from the downloads list



Open Containing Folder icon

5.1.2.3 FLAG FOR SUPPORT

If you find an error in a processed dataset, click the *Flag Data* icon relating to the dataset on the **My Files** page. This will automatically alert a member of the GeoSLAM support team that there is a problem with the dataset. Problem datasets are investigated during regular UK office hours. A member of the GeoSLAM support team will contact you by email and advise why the error occurred and whether it has been possible to fix the dataset.

5.1.2.4 SHARE DATA

After the dataset has been paid for it is possible to make the data available to a third party to download by clicking on the *Share Data* icon relating to the dataset on the **My Files** page. A download link will be copied to your clipboard. The link can then be pasted into an email to a colleague or client for them to download directly from the GeoSLAM server. The time validity of shared links can be set in the *Options* panel on the **My Files** page. The default is 7 days.

5.1.3 ACCOUNT ADMINISTRATION

Users with Administrative rights can access the **Administration** page on the Uploader application (see Figure 5-8). On this page new users can be added, existing users passwords can be reset and credit units can be purchased.

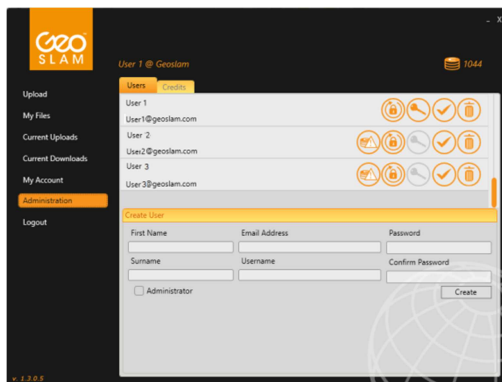


Figure 5-8 – Administration Panel

5.1.3.1 CREATING A NEW USER ACCOUNT

It is recommended that personal user accounts are created for all users within your organisation. To create a new user, enter the new users details in the Create User panel on the bottom of the **Administration** page. If the Password and Confirm Password fields are left blank a password will automatically be generated and sent to the users' email address. Alternatively the administrator can create the password and communicate it directly to the new user.

The icons that can appear next to each user are outlined below.

-  User has Administration rights
-  User **does not** have Administration rights
-  User enabled
-  User disabled
-  Delete User
-  Set credit limit

A new user can be created with administration rights by either checking the Administrator check box when creating the account or by activating the **Key** icon next to the user once the user has been created. Within the **Administration** page you can also disable a user’s account or delete them entirely by clicking on the appropriate button.

5.1.3.2 SETTING A CREDIT LIMIT

If an account administrator needs to set a credit limit for a certain user due to loan or hire of the ZEB-REVO this can be done using the **Credit Limit** icon. First ensure the user is not an administrator on the account so that the **Credit Limit** icon is enabled. When clicked, the sliding icon reveals a box where the administrator can set the credit limit for a particular user (see Figure 5-9). The user will then only have access to the number of credits provided.

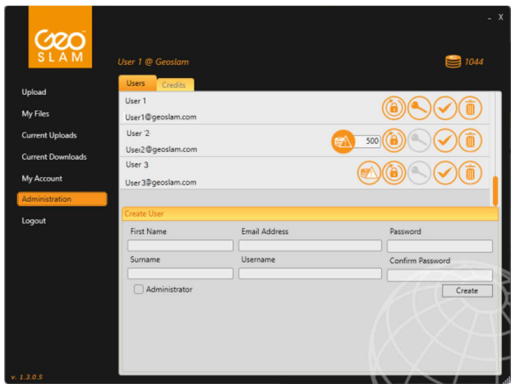


Figure 5-9 – Credit limit button

5.1.3.3 PURCHASING PROCESSING CREDITS

If your account has been set up in GBP, EUR or USD, processing credits can be purchased using credit card on the **Credits** tab on the **Administration** page (see Figure 5-10). From the drop down menu select the Product (number of credits) you would like to purchase and fill in your payment details. Click the OK button and when your payment has been approved the processing units will be added to your account.

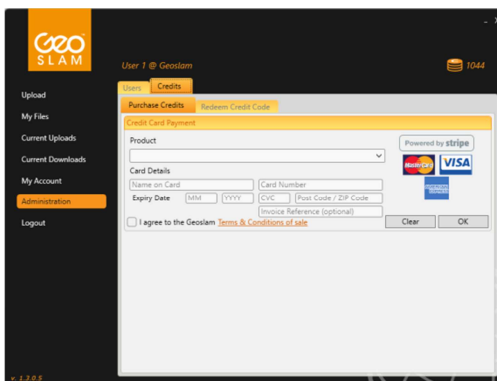


Figure 5-10 – Administration/Credits page

For high usage users or if your account is set up in any currency not listed above, credits must be purchased through your reseller or distributor. Once payment has been received the credits will be added to your account.

5.2 GEOSLAM DESKTOP SOFTWARE

The installation and application of the (optional) GeoSLAM Desktop software is cover in the User Guide supplied with the software.

5.2.1 FLAGGING DATA

If you encounter a problem during data processing using GeoSLAM Desktop and you have an up to date support and maintenance subscription you can upload the problem dataset to the GeoSLAM Cloud processing server using the ZEB Uploader application (see section 5.1) and the login details provided when you purchased the system. After uploading to the Cloud server a *Flag Data* icon can be activated to alert GeoSLAM support team that there is a problem with the dataset. Problem datasets are investigated during regular UK office hours. A member of the GeoSLAM support team will contact you by email and advise why the error occurred and whether it has been possible to fix the dataset.

5.3 OUTPUT FILE FORMATS

The following processed data files are created by the GeoSLAM Cloud processing service:

File name	Description
<i>filename.laz</i>	All data points in zipped LAS format – see http://www.laszip.org/
<i>filename.las</i> (Desktop processor only)	All data points in zipped LAS format – see http://www.laszip.org/
<i>filename_traj.laz</i> (Cloud processor only)	Trajectory of the ZEB-REVO scanner in LAZ format
<i>filename_9pct.ply</i> (Cloud processor only)	Every 11 th point (9%) in PLY format
<i>filename_9pct_cond.ply</i> (Cloud processor only)	Every 11 th point in PLY format, coloured by “Condition” which is an indicator of robustness of the matching solution for each point. Blue = good condition Red = poor condition
<i>filename_9pct_timecolored.ply</i>	Every 11 th point in PLY format, coloured by time. This is useful for assessing closed loop accuracy
<i>filename_9pct_shaded.ply</i>	Every 11 th point in PLY format, grey scale shaded based on calculated point normal.
<i>filename_9pct_traj2.ply</i>	Trajectory of the ZEB scanner in PLY format coloured by time
<i>filename_9pct_traj_cond.ply</i>	Trajectory of the ZEB in PLY format coloured by “condition”

Table 5-1 – List of output files

The *.ply files can be viewed in the free point cloud viewer:

MeshLab <http://meshlab.sourceforge.net/>

The *.ply and *.laz files can be viewed in the free point cloud viewer:

CloudCompare <http://www.cloudcompare.org/>

6. BATTERY

6.1 SPECIFICATION

Output voltage	12V nominal
Capacity	8Ah (+/-5%) 96Wh
Charge voltage	12.6V
Weight	0.6kg
Charging temperature	0°C to 45°C
Life cycle	>300 cycles
Protection	Over charge, over discharge and short circuit protected
Transportation	UN 38.3 transportation test certified

Table 6-1 – Battery specification

6.2 RECHARGING

Plug the charger into the AC mains – the LED light will glow green.

Plug the charger lead firmly into the battery the LED light will change to red to indicate charging.

When the LED light changes back to green the battery is fully charged.

Disconnect the charger from the battery and from the AC mains.

! Do not leave the charger connected to the battery for long periods after the battery is charged.

6.3 CHARGE INDICATOR

Press and hold the charge indicator push button:



3 green & 2 red LEDs
2 green & 2 red LEDs
1 green & 2 red LEDs
2 red LEDs
1 red LED
No LED

75-100% capacity
50-75% capacity
20-50% capacity
10-20% capacity
<10% capacity
0%

6.4 BATTERY CARE

DO NOT dispose of in normal household waste.

DO NOT attempt to dismantle the battery.

DO NOT short circuit the battery.

ONLY use the charger supplied with the battery.

The battery should be charged fully before use.

If storing the battery, store in a charged state. Recharge after every 6 months.

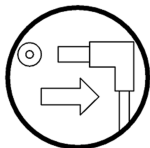
Excess heat will degrade the battery rapidly. Always store the battery in a cool dry place. DO NOT leave for long periods in the sun or in a hot vehicle.

It is recommended to recharge the battery within 12 hours if fully discharged.

The battery is splash proof but not water proof – do not immerse in water.

6.5 TRANSPORTATION

The battery has been tested and passed section 38.3 of the UN Manual of Tests and Criteria (UN Transportation Testing) and is approved for air shipment. The battery is below the 100Wh limit for transportation on passenger planes. For the purposes of air transportation the battery is classed as “Packed with equipment” (ICAO/IATA Packing Instruction 966, Section II) – Cells or batteries contained in a package with associated electronic equipment. Special rules may apply to the transportation of spare batteries. It is recommended that you check with your local air transportation safety authority and/or the proposed air carrier for specific requirements on lithium battery transportation.



**DISCONNECT BATTERY
WHEN NOT IN USE**

! Disconnect the battery during transportation

7. APPENDICES

7.1 APPENDIX 1 – DATA PROCESSING CHARGE CALCULATION

The data processing charge is calculated by determining the number of unique 2m cubes that the user walks through when making the survey. This allows the calculation of “unique distance” so re-surveying the same area during the same survey is not charged. The price is quoted per 2 cubic metre of “unique distance”. See Figure 7-1 and Figure 7-2 for illustrations of different examples of calculations of “unique distance”.

Each Credit Unit will purchase one 2m cube of “unique distance”.

Each processing job will have a minimum “unique distance” of 10 cubes.

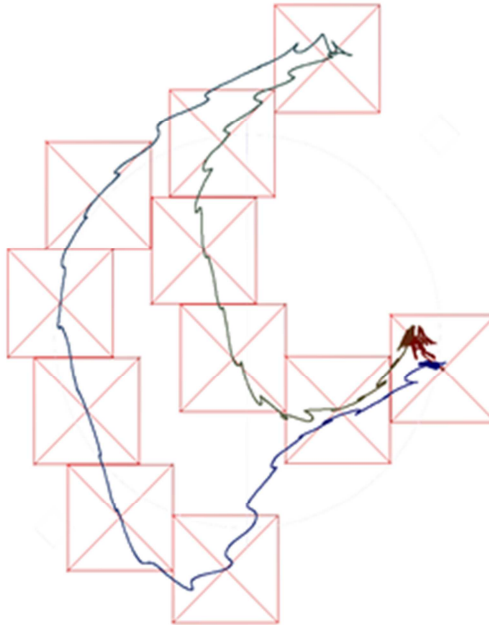


Figure 7-1 – Unique cubes plan view – single storey survey

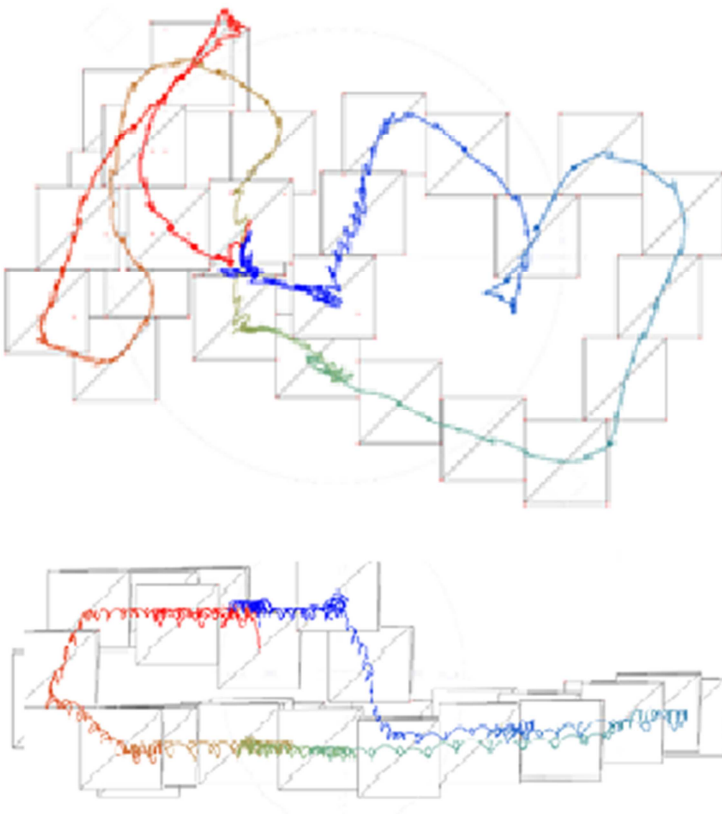


Figure 7-2 – Unique cubes plan and side view – two storey survey

7.2 APPENDIX 2 - USB PREPARE TOOL

The USB Prepare application in the Tools folder in the GeoSLAM Windows Program Group enables users to perform some basic interaction with the ZEB DL-2600 data logger. The Program Group is accessed via the Windows Start button.

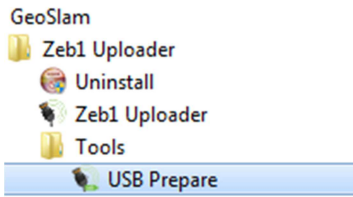


Figure 7-3 – GeoSLAM Program Group

The following tasks can be performed:

- Download Log File
- Delete All Files
- Download All Files
- Download specific Files
- Set Time and Date

To perform any of the above tasks, insert a USB memory stick into a USB port on your computer and start the USB Prepare Tool. Select the Drive with the USB memory stick (see Figure 7-4) and check the tick box against the task you want to perform.

In order to **Download Specific Files**, enter the date of the required files (YYYY-MM-DD). The example in Figure 7-4 will download all data collected during May 2014.

In order to **Set Time and Date**, enter the required time and date.

Click **Prepare** and a small command file will be written to the USB memory stick. Eject the USB memory from the computer and attached to it to the ZEB DL-2600 data logger. Start the data logger and the requested task(s) will be performed after the data logger has booted. For the download tasks the data will be written to the USB memory stick. If you have selected **Download All Files** a USB memory stick of at least 64GB is recommended.

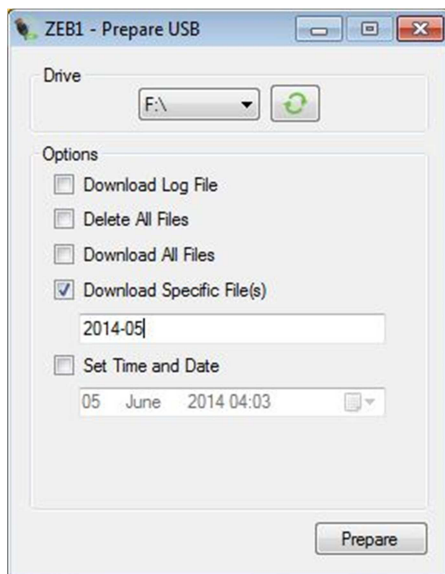
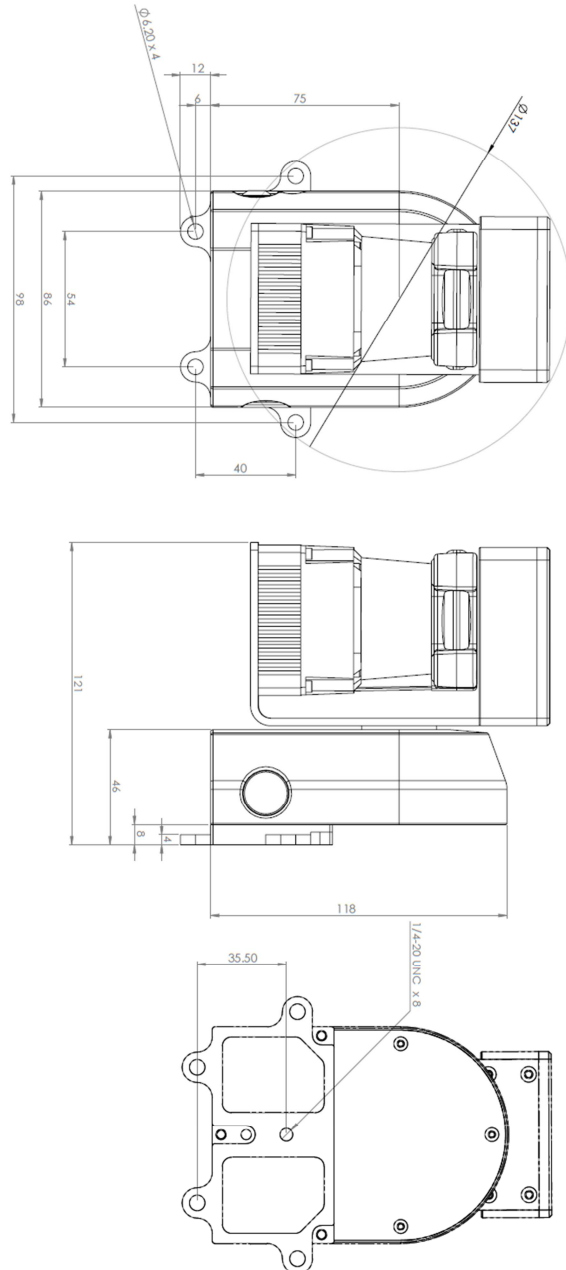


Figure 7-4 - Prepare USB window

7.3 APPENDIX 3 – DIMENSIONAL DRAWINGS

Mounting plate on rear face



Mounting plate on bottom face

