d.ASH Product Manual

Revision 1.0

Overview

dConstruct Robotics specialises in autonomous robotics. This manual serves as a guide as to how maps for autonomous navigation is generated and how to connect to and operate your robot. Enjoy fast deployment with minimum hassle from anywhere in the world with dConstruct Robotics. View a comprehensive list of our offerings here.

Account Information

dConstruct Robotics will provide you with three items:

1. An account to login to our Fleet Manager, d.ASH Xplorer and d.ASH Nav platforms
2. A Wireguard tunnel to connect to the robots
3. A link to the Fleet Manager installer

First Time Set-Up

First download Fleet Manager and login with the credentials given to you. d.ASH Xplorer and d.ASH Nav can be downloaded and installed from Fleet Manager.

After logging in to Fleet Manager with the credentials given to you, click on "Download Apps" and download and run the d.ASH Xplorer and d.ASH Nav app installers

Please ensure that you install Wireguard as well as both d.ASH Xplorer and d.ASH Nav. Contact us here if you require help with the installation of our platforms or connecting to the Wireguard tunnel we provided you.

General Workflow

BLK Scanning

BIM Model Comparison

General Workflow

Mapping

d.ASH Pack is a mobile sensor system that allows users to record 3D point cloud data for various applications, including robot autonomous navigation and Digital Twin generation. **d.ASH Pack** can either be worn on the back of the user (just like a backpack) or mounted on a robot. The entire workflow is fully integrated with d.ASH Fleet Management system.

Connecting to d.ASH Pack

The d.ASH Pack Wi-Fi network SSID and Password will be provided to you on the access panel of the d.ASH Pack itself.

Use this to connect to your d.ASH Pack and access the user interface by keying this IP Address (https://192.168.10.1/) into a web browser from any device of your choice. Users can check the status of their d.ASH Pack and start/stop recordings here.

Status LEDs show different colours with each colour representing a different status. These LEDs are located on the side of the d.ASH Pack itself. **Green LEDs** means that the d.ASH Pack has been booted up fully and is ready for recording. **Red LEDs** means that something has gone wrong with d.ASH Pack. Use the status reflected in your d.ASH Pack's website to help trouble shoot the error. **Slow, Flashing Yellow LEDs** mean that the d.ASH Pack is currently recording.

Data Collection

Option 1 – Connect d.ASH Pack via Wi-Fi Network (No internet connection required)

1. Power up d.ASH Pack.

2. Connect to d.ASH Pack's Wi-Fi network from your phone or other electronic devices.

3. Open your web browser and key in "https://192.168.10.1/".

4. Name your d.ASH Pack recording file and select if you would like imaging (colour) in your scans.

5. Put on the d.ASH Pack and stand stationary for a short moment (e.g. 1s). Then, press start recording.

6. Walk around to cover the area that you would like to record. For better quality, please make sure to walk in loops back to previously visited areas.

7. Once you are done, press stop recording.

Option 2 – Use d.ASH Xplorer

1. Power up d.ASH Pack

2. Load your d.ASH Xplorer application on your PC

3. Login with your d.ASH credentials.

4. Click on the "d.ASH Pack Manager" tab at the top.

5. Select your d.ASH Pack.

6. Click on "d.ASH Pack Recording Control".

7. Name your d.ASH Pack recording file and select if you would like imaging (colour) in your scans.

8. Press "Start".

9. Walk around to cover the area that you would like to record. For better quality, please make sure to walk in loops back to previously visited areas.

10. Once you are done, press stop recording.

Generating the Nav Map

d.ASH Xplorer allows us to generate maps from *d.ASH Pack* to use with *d.ASH Nav* and send our robots on missions.

Because *d.ASH Xplorer* is fully integrated with [d.ASH Fleet Management system](#), an internet connection is required. Should you require d.ASH Xplorer without an internet connection, please [contact us](#) for more details.

Requirements

- PC with a CPU equivalent to or greater than an Intel i5 4th Gen or AMD R5 2000 series
- Nvidia GTX 960
- 16GB of RAM
- Internet Connection
- Windows 10/11

We recommend using a discrete Nvidia GPU greater than or equivalent to an RTX 3060. Some features such as "HD View" are disabled on other GPUs.

d.ASH Xplorer is built for Windows 10/11. Therefore, please ensure that you are running a discrete Nvidia GPU in High-Performance mode. Otherwise, some functionalities may be unsupported. You can enable this by going into Windows GPU Settings, and adding d.ASH Xplorer as an app and setting the "Graphics preference" to "High performance".
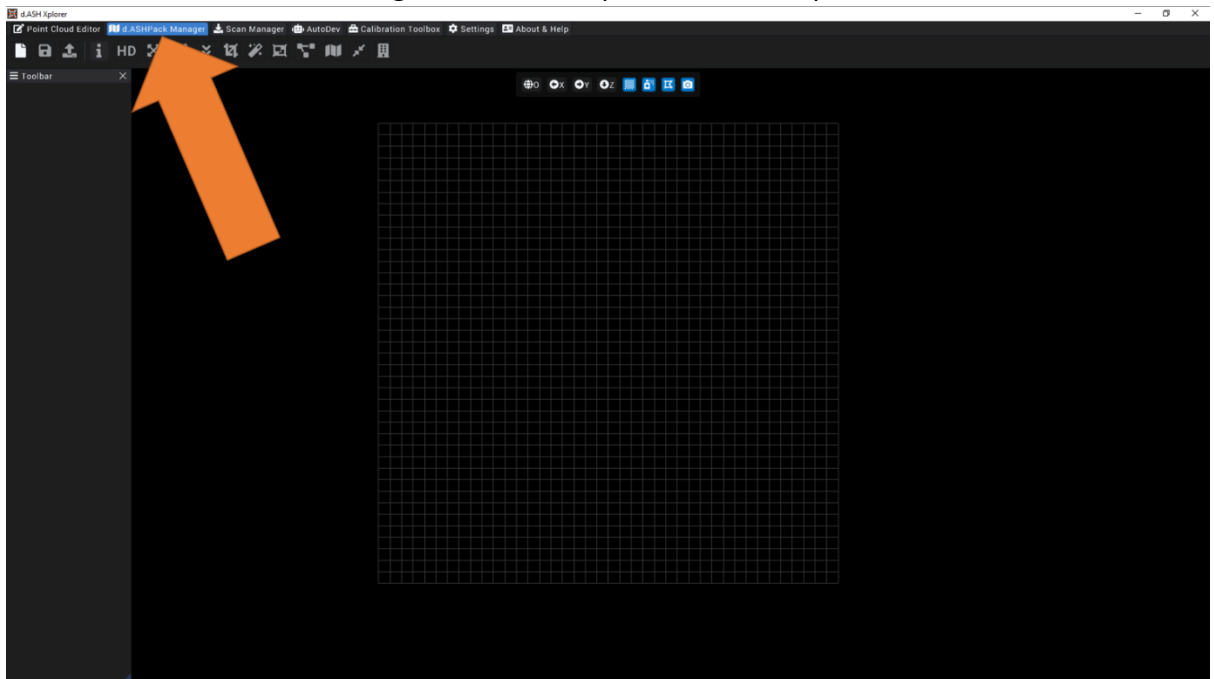
Generate and Process the Nav Map

The following section will detail the basic steps needed to generate a point cloud for usage with robots. Additional features offered by *d.ASH Xplorer* can be found on our [SDK documentation site](#).

1. Login to d.ASH Xplorer with the account we provide to you
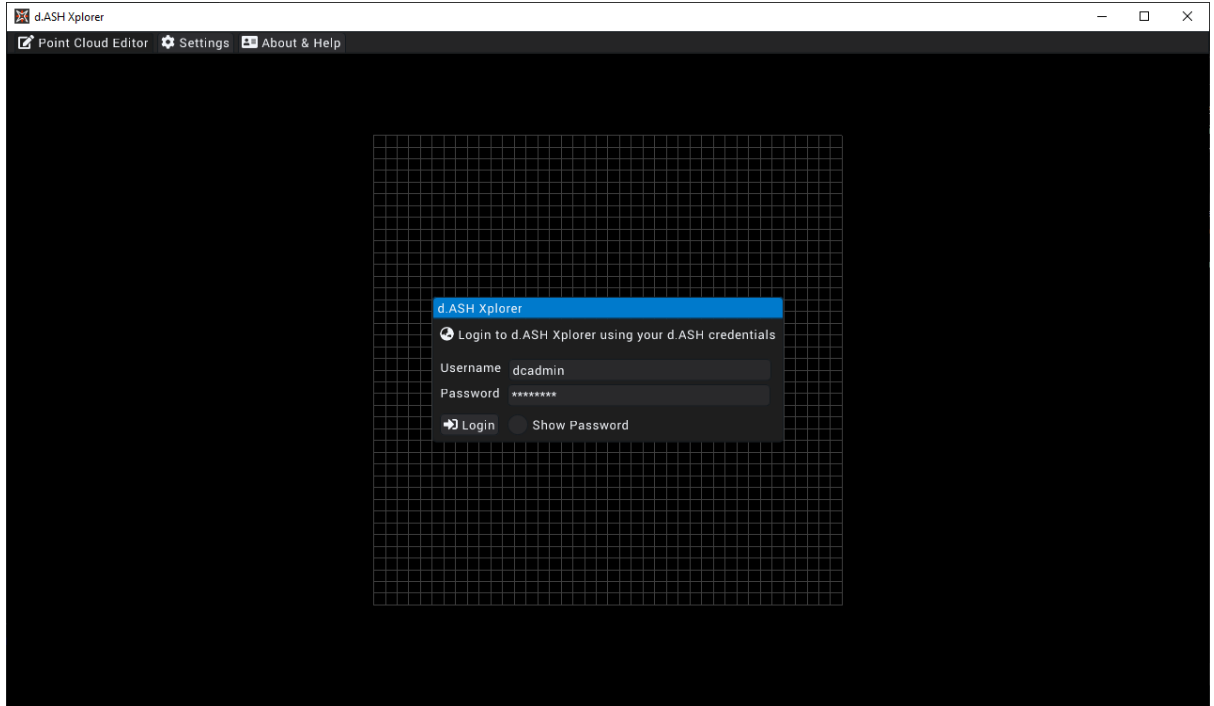
2. Click on the d.ASH Pack Manager tab at the top of the d.ASH Xplorer window

3. Connect to your d.ASH Pack and download your *.dpack* recording (We recommend connecting to your d.ASH Pack via an ethernet cable for much faster downloads)

4. After the download has completed, you will be prompted to generate a point cloud. Keep the settings at their recommended default and click *Generate Point Cloud*.
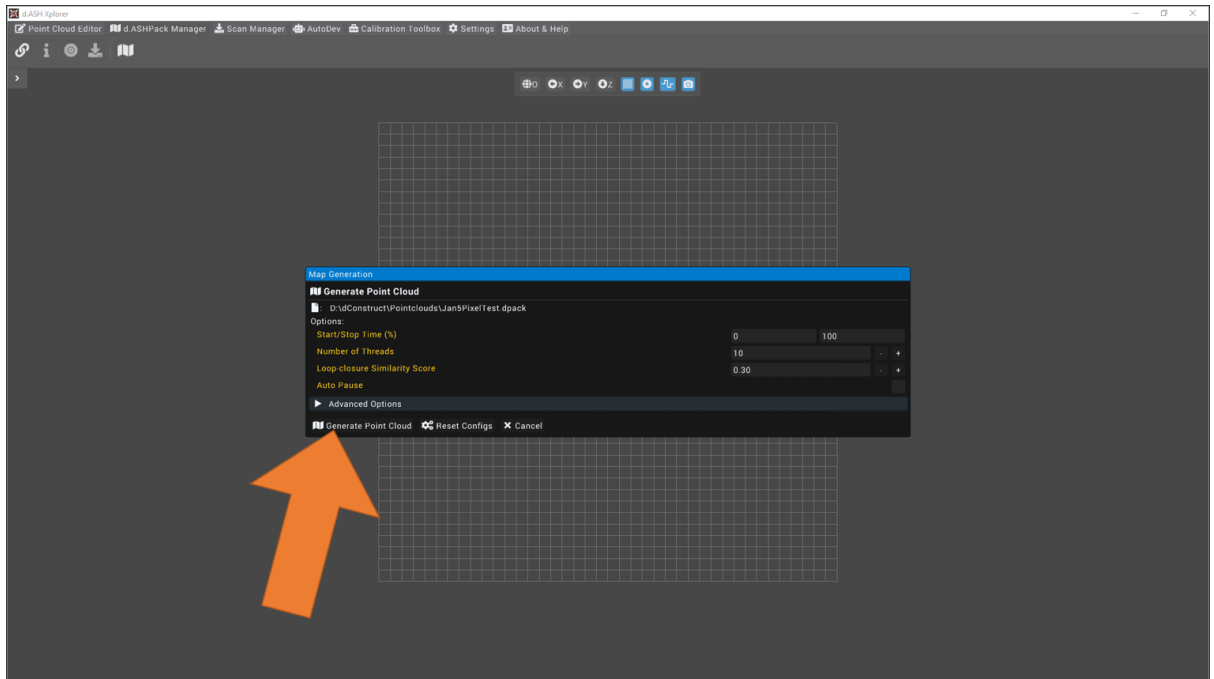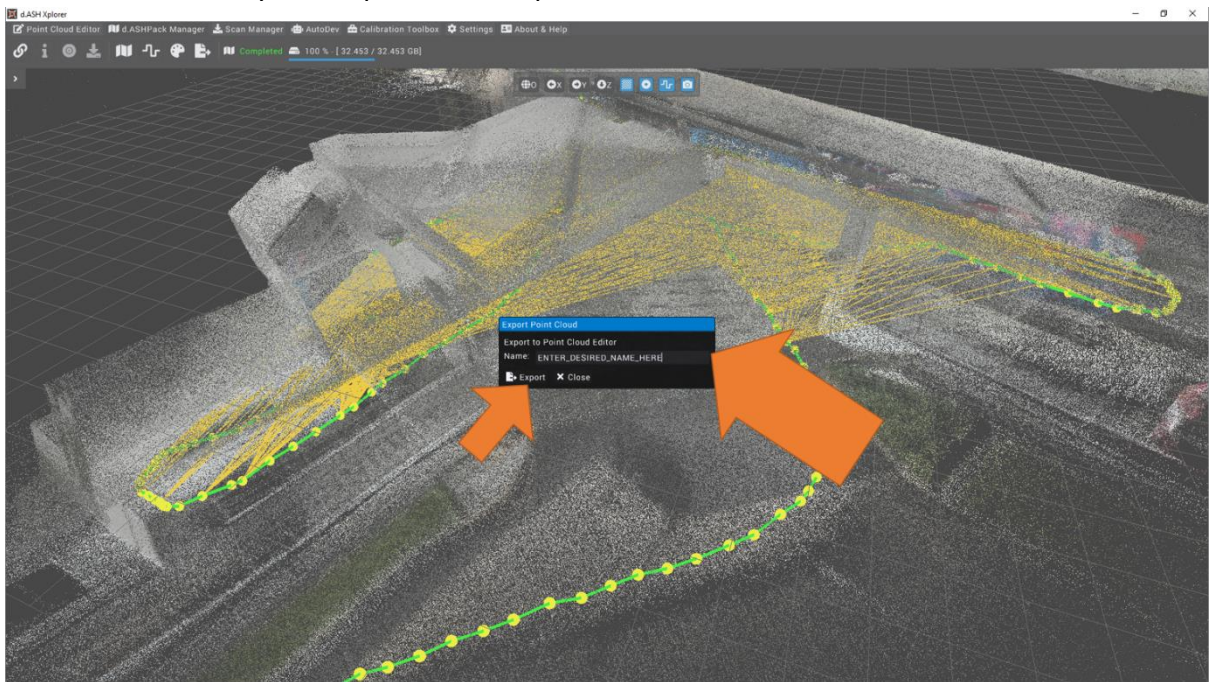

5. Once the map has been generated, configure the *Post-Processing Settings* by clicking on the *Post-Process* button in the prompt that follows
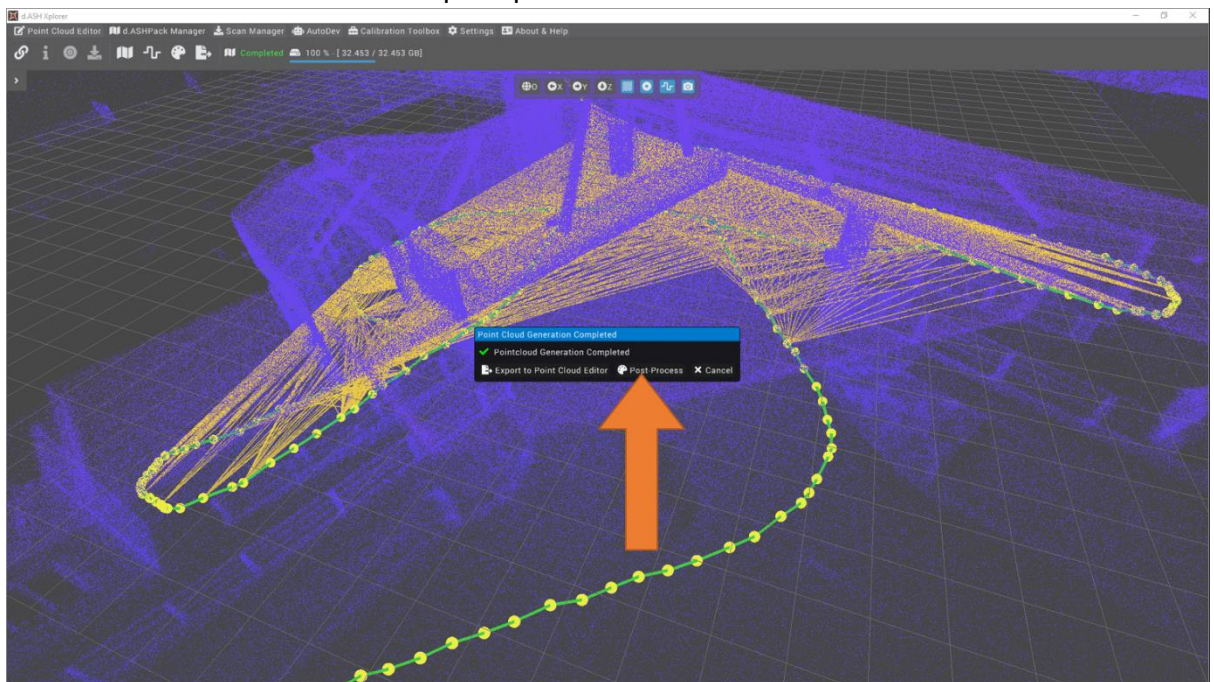
6. For *Post-Processing* Options, select the *Nav Map* option. Then click *Post-Process*
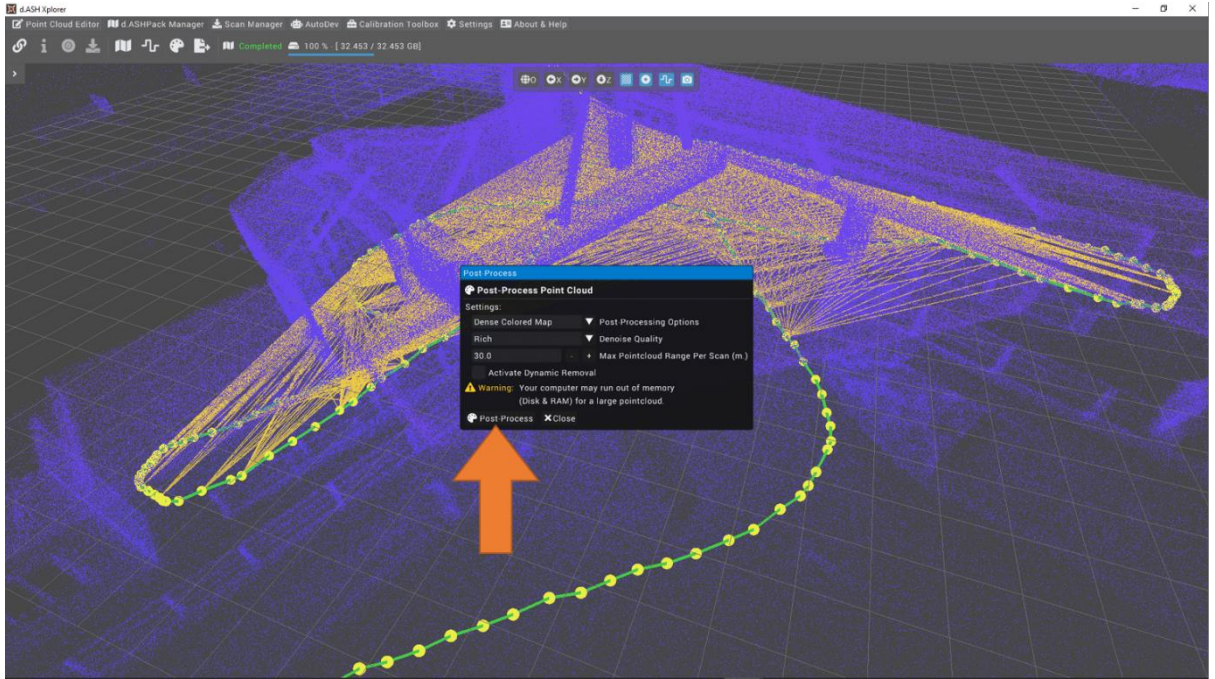
7. Once *Post-Processing* has completed, click *Export to Point Cloud Editor*

8. Choose a name for your map and click *Export*

9. In the *Point Cloud Editor*. Click the *Upload Navigation Map* Button located in the top-left corner of the Xplorer window.
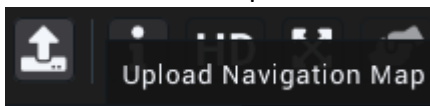
10. The generated recording can now be used for autonomous navigation with the d.ASH Fleet Management system.

Deploy your robots

d.ASH Nav is *the* platform for autonomous control of robots. Being seamlessly integrated in the [d.ASH Fleet Management](#) workflow, you can enjoy easy planning and deployment of your robots for various use cases. *D.ASH Nav* allows you to plot waypoints for autonomous navigation on maps, tracking and monitoring path planning, as well as overall monitoring of your robots.

Because *d.ASH Nav* is fully integrated with [d.ASH Fleet Management system](#), an internet connection is required. Should you require *d.ASH Nav* without an internet connection, please [contact us](#) for more details.

Requirements

- PC with a CPU equivalent to or greater than an Intel i5 4th Gen or AMD R5 1000 series
- Nvidia GTX 960
- 8GB of RAM
- Internet Connection
- Windows 10/11
- Gamepad/Joystick (e.g. Logitech F710 Gamepad)

We recommend using a discrete Nvidia GPU greater than or equivalent to an RTX 3060. Some features may run slower on other GPUs. A joystick is recommended for manual tele-operation control.

Deployment

The following section will detail the basic steps needed to start an autonomous mission. Additional features offered by *d.ASH Nav* can be found on our SDK documentation site.

1. Mount any additional sensors (e.g. Leica BLK 360) to your robot
2. Login to *d.ASH Nav* with the account provided to you
3. Create a new project, this allows you to save any routes created for use later
4. Load the map which you had generated and uploaded from d.ASH Xplorer
5. Create a new mission Route and plot any waypoints necessary
6. Connect to your desired robot in your robot fleet
7. Set the robot's initial starting pose on the 3D map
8. Start the robot with the route for your new mission

High Resolution Scanning with Leica BLK 360

One purpose for deployment is creating high density and accurate point clouds for use elsewhere. This can be easily achieved through d.ASH Nav and d.ASH Xplorer's built in integration with the Leica BLK 360 Scanner. For the purposes of the guide below we will be continuing from the steps in the general workflow guide above.

This is feature is limited to pro users of d.ASH Xplorer.

Attaching your BLK 360

DASHER contains a slot for attachments near the back of the robot. Simply attach the BLK 360 and mount it by sliding it into the rails.

Setting up d.ASH Nav

Once you have connected your BLK 360 Scanner, d.ASH Nav should have updated to reflect the status of the sensor. Several pieces of information are displayed to you including the sensor's battery level and scanning status.

Adding waypoints

After plotting the route you would like your robot to follow, now you need to convert some of these points to *Scan Points*. *Scan Points* mean that the robot will pause at that waypoint and start scanning with the BLK 360. It is recommended to leave a spacing of about five to ten metres between each scan point.

Starting your scan

After plotting the route and adding *Scan Points*, simply start running the route on your desired robot and wait for the robot to complete the route.

Downloading and processing the data

After recording, the data is downloaded and processed in d.ASH Xplorer, allowing you to edit the point cloud and export it to different formats such as *e57*.

scanMeta file (*.scanMeta) holds critical information for each scan point. Each 3D scan activated by the d.ASH robotics stack will generate a scanMeta file. The scanMeta data can be used to perform AutoMerge for creating a digital twin (high accuracy/density 3D point cloud model). scanMeta files are grouped by their project names which are set by d.ASH Autonomy Mission.
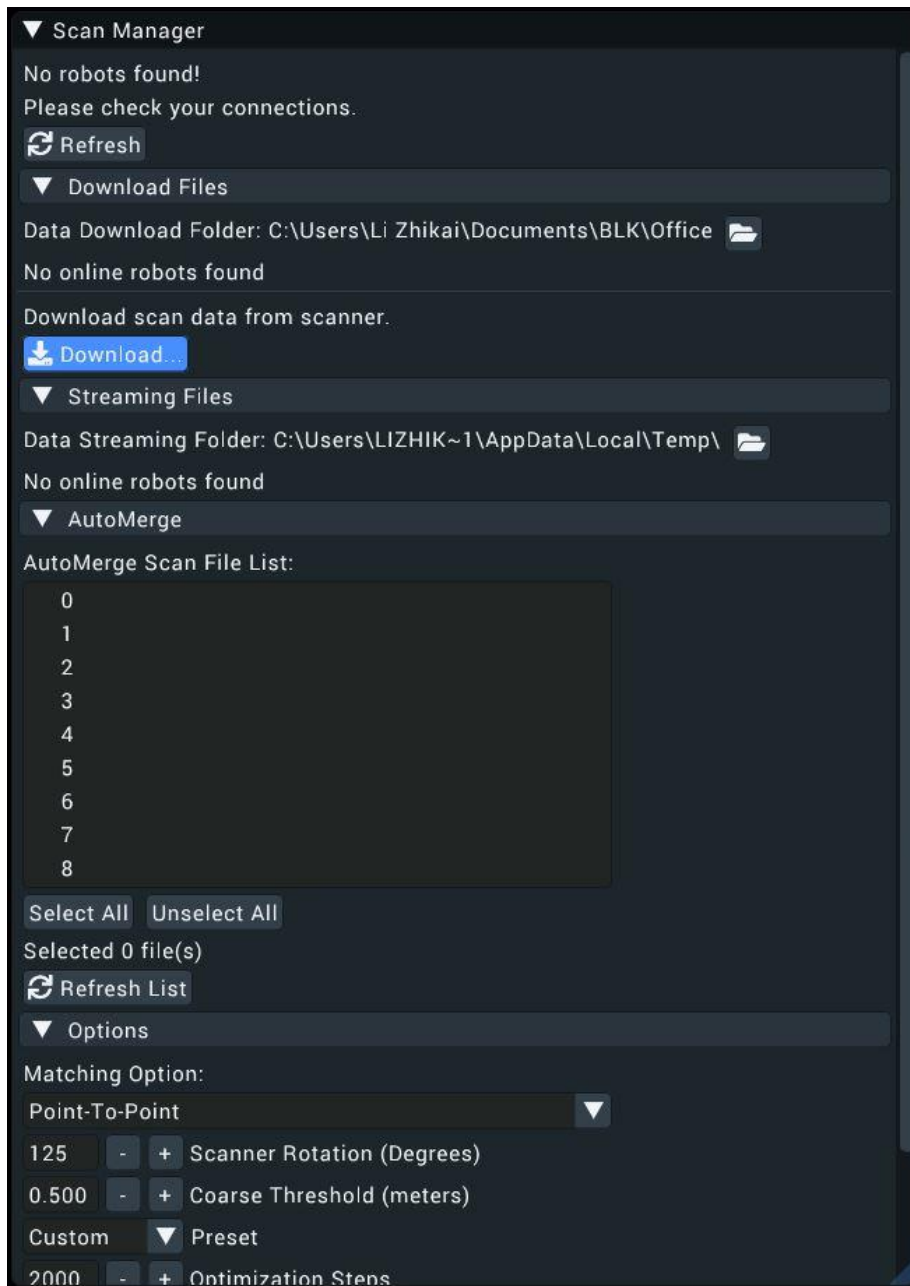
Downloading scan data

To download the scanMeta files, perform the following:

1. Connect your PC running *d.ASH Xplorer Pro* to the Internet and make sure that the robot is online

2. Log in to *d.ASH Xplorer Pro*, then connect to the server.

3. Click on the robot from the *Online Robot List* in the *Scan Manager* tab.

4. Select the desired data folder by clicking **the Folder icon**. This folder will be used to store downloaded scanMeta files. We recommend choosing an empty folder. Otherwise, scanMeta files from previous/other projects will be overwritten.

5. Click on *Download Files* to expand the window.
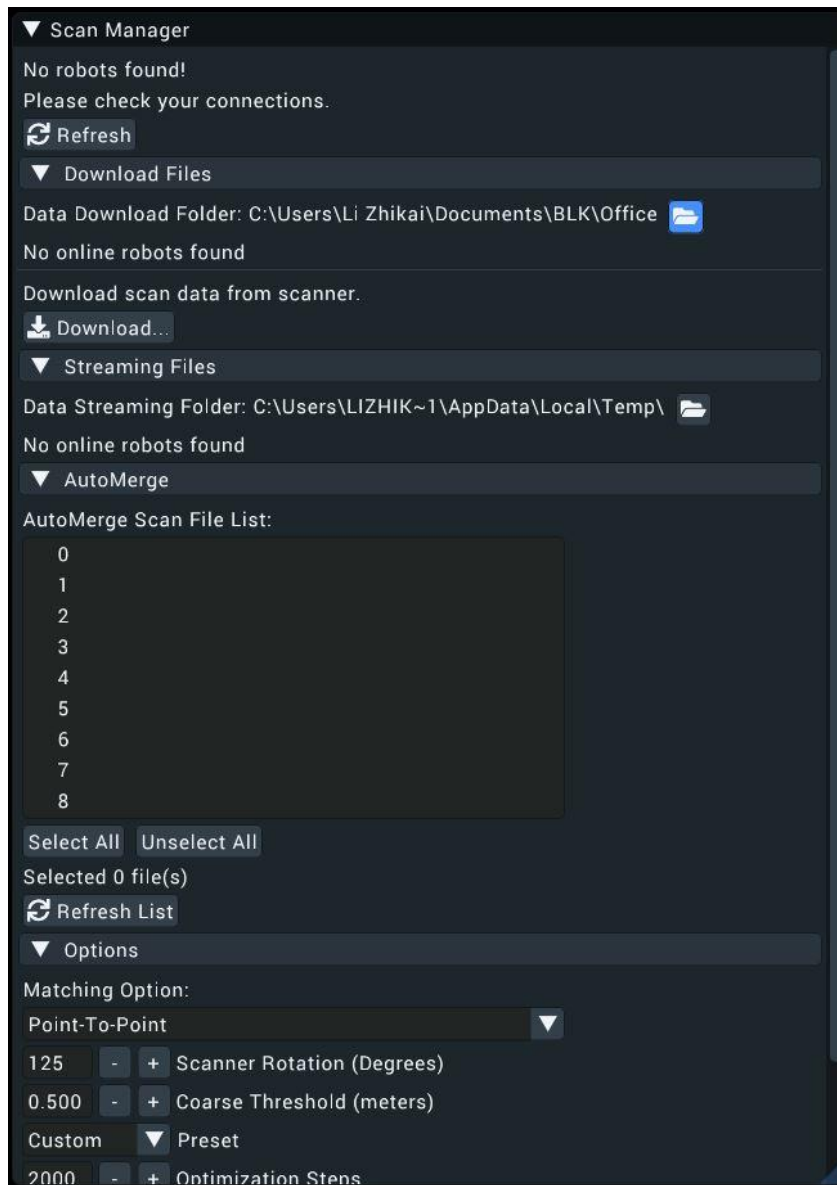
6. Click **Download** to download ScanMeta files for the entire project.

7. After downloading, all ScanMeta files will be stored in the folder selected in Step 3.

8. Select the desired data folder by clicking **the Folder icon** . This folder should have ScanMeta files.

9. Click on *Download Files* to expand the window.

10. Under "Download scan data from scanner", click **Download**

11. There will be a window popup showing all ScanMeta filenames found in the folder selected in Step 2. If 3D scan files and ScanMeta files with the same name exist, the filename will have "[Downloaded]" appended at the back of their names.

12. Use the checkboxes on the left to mark 3D scan data for downloading. Users can use **Select All** or **Unselect All** buttons for file selections.
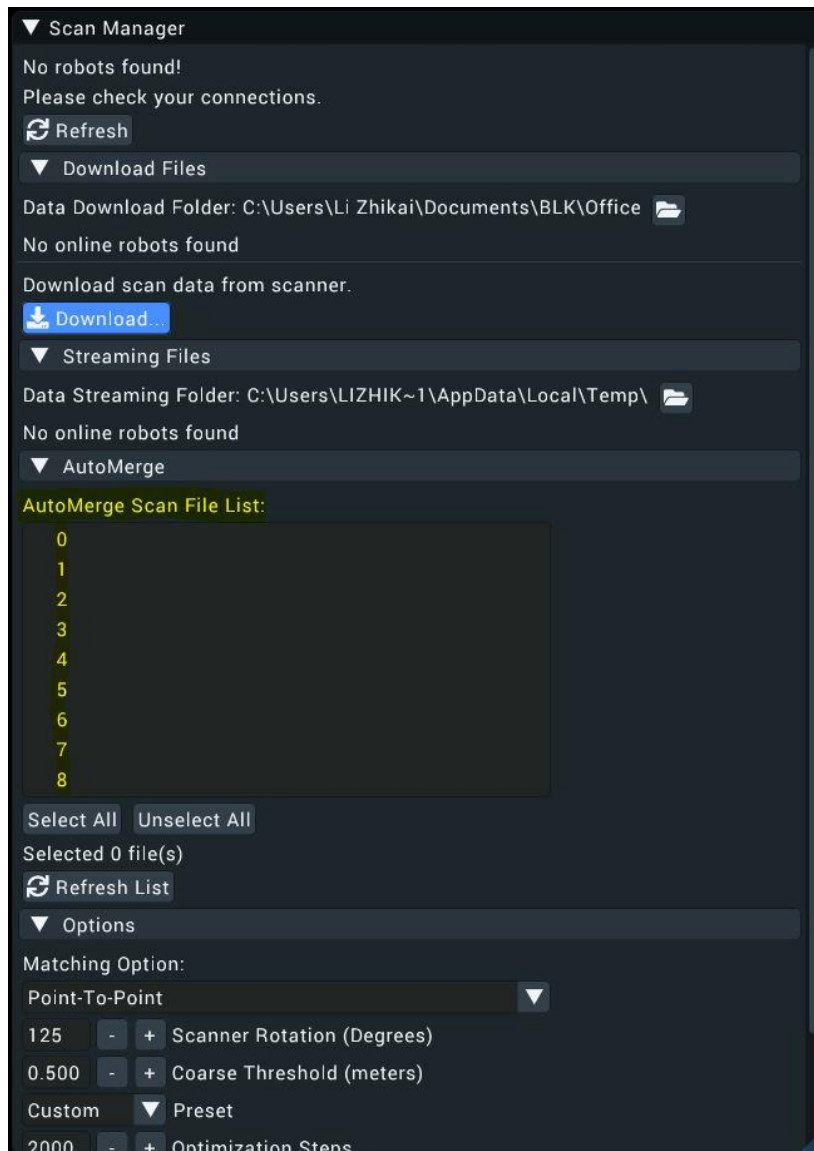
13. Click **Download** to start the 3D scan downloading process.

14. Once completed, Click **Close** to close the popup.

Merging scan data

AutoMerge utilizes sensor fusion techniques to automatically stitch and align multiple 3D scans for scale-consistent digital twin reconstruction. AutoMerge supports both colored and non-colored point clouds. AutoMerge is used to merge the downloaded scans into one point cloud for editing/exporting. To perform, AutoMerge:

1. Select the desired data folder by clicking **Change**. This folder should have both ScanMeta files and 3D scan data files.

2. Click on *AutoMerge* to expand the window.

3. *AutoMerge Scan File List* displays a list of files in the selected folder for AutoMerge. Only filenames with *.scanMeta* and *.pcd* are considered for AutoMerge.

4. Since AutoMerge relies on the orientation of the 3D scanner to perform stitching, users are encouraged to preview some scans first. This is done by selecting a few scans (greater than two) and clicking **Preview**.

5. After scan previews have loaded, expand *Options* and change the **Scanner Rotation** so that the selected scans are roughly aligned. These rotations will rotate the 3D scan about their centres. As the scanner rotation is changed, the 3D scan previews will also be rotated accordingly. Users do not have to perfectly align the 3D scans manually. Just a rough estimate is sufficient.

6. After configuring the scanner rotation, users can start AutoMerge. Click **AutoMerge** to start the AutoMerge process on the selected files (greater than one). You will see the 3D scans popping up and aligning themselves automatically after some time.

7. When AutoMerge has completed, users have the following options:
   - **Export**: Save the AutoMerge results and individual scans with corrected poses. Users can choose to export as .pcd, .dcloud, .las, or .e57 file formats.

   - **Edit**: Export the AutoMerge results to the **Map Editor** for editing.

BIM Model comparison with d.ASH Xplorer

d.ASH Xplorer allows you to compare a point cloud scan of a building with a pre-existing .bim model of said building. This can help show changes over time and can help identify issues such as defects after construction of a new building is completed. d.ASH Xplorer also helps to convert Revit files to .bim for comparison. This, however, requires an Autodesk account.

Using the BIM Manager

To access the BIM Manager, simply click on the BIM Manager button. To compare your loaded point cloud to a bim file of the same location:

1. Load your chosen BIM file
2. Click process. You can also crop the point cloud and BIM file to only compare certain portions
3. Once processing has completed, the data will be visualised for you to look and compare in d.ASH Xplorer