



Alpha3D Mobile Mapping System

User Manual

V1.0.1



Table of Content

Table of Content.....	2
1 Reading Tips.....	5
1.1 Symbol Explanation.....	5
1.2 Recommendation.....	5
1.3 Service & Support	5
1.4 Disclaimer.....	6
2 User Guide	7
2.1 Operation Environment.....	7
2.2 Attentions Before Using	7
2.3 Attentions When Using	7
2.4 Attentions After Using.....	8
3 Product Overview.....	9
3.1 Product Introduction.....	9
3.2 Product Component.....	10
3.2.1 Configuration List	10
3.2.2 Instrument Container.....	12
3.2.3 Orange Battery Container	13
3.3 Product Details.....	14
3.3.1 Alpha3D Hardware	14
3.3.2 Physical Characteristics	17
3.3.3 Electrical Characteristics	17
3.4 Primary Sensor Introduction	17
3.4.1 LiDAR VUX-1HA	17
3.4.2 High-precision IMU	18
3.4.3 G5ant-3AT1 Antenna	19
3.4.4 LADYBUG 5+ Panoramic Camera.....	19
3.5 Data Storage Introduction.....	19
3.6 Vehicle Platform Introduction	21
3.6.1 Roof Rack Extension.....	21
3.6.1.1 Extension Installation.....	22
3.6.1.2 Alpha3D installation.....	25
3.6.2 Other Platform Installation	26
3.7 Rotation Platform Introduction.....	26
3.7.1 Rotation Platform Overview.....	26
3.7.2 Installation Steps	28
4 Battery Container Overview.....	29
4.1 Battery Container Introduction	29
4.1.1 Battery Container Components	29

4.1.2	Orange Container Port	30
4.1.3	Controller Box Port.....	31
4.2	Functional Specification	33
4.2.1	Orange Container Function	33
4.2.1.1	Orange Container Light Condition	33
4.2.1.2	Orange Container Discharge Condition	33
4.2.1.3	Orange Container Charge	33
4.2.1.4	Orange Container Communication	33
4.2.1.5	Orange Container Low Voltage Alarm.....	33
4.2.1.6	Orange Container Overcurrent Protection	33
4.2.1.7	Orange Container Use.....	34
4.2.1.8	Orange Container Screen Explain	34
4.2.2	Controller Box Function	35
4.2.2.1	Controller Box Electric Parameter.....	35
4.2.2.2	Controller Box Working Condition	35
4.2.2.3	Controller Box Temperature Control System	36
4.2.2.4	Controller Box Communication.....	36
4.2.2.5	Controller Box Overcurrent Protection	36
4.2.2.6	Controller Box Screen Explain.....	36
4.3	Electrical Parameter	37
4.3.1	Battery Parameters	37
4.3.2	Charger Parameters.....	37
4.4	Operation Instruction.....	38
4.4.1	Battery Installation Steps	38
4.4.2	Containers Assemble Steps	42
4.4.3	Charge Steps.....	43
4.5	Common Problems & Solutions	44
5	Software Overview	46
5.1	CoCapture - Data Acquisition Software.....	46
5.1.1	CoCapture Interface Overview	46
5.1.2	CoCapture Function Description	47
5.1.2.1	Setting & Control Toolbar	47
5.1.2.2	GNSS, IMU, SCANNER, DATA Status	51
5.1.2.3	Viewer Interface.....	52
5.1.2.4	Status Information Display Bar	54
5.1.3	CoCapture Version Update.....	55
5.1.4	CoCapture Quick Guide	55
5.2	Inertial Explorer - GNSS + IMU Post Processing Software.....	61
5.2.1	Inertial Explorer Overview	61
5.2.2	Inertial Explorer Quick Guide	61
5.2.2.1	Pre-prepared.....	61

5.2.2.2	Base Data Processing	65
5.2.2.3	License Activation	67
5.2.2.4	Data Format Conversion	68
5.2.2.5	POS Processing.....	69
5.2.2.6	GPS/INS Combine Processing	76
5.2.2.7	Export POS File.....	78
5.3	CoPre - Point Cloud Processing Software	81
5.3.1	CoPre Software Overview	81
5.3.2	CoPre Quick Guide	81
5.3.2.1	Import Project.....	81
5.3.2.2	Solve Point Cloud Data.....	83
5.3.2.3	Picture Collation.....	84
5.3.2.4	Point Cloud Colorized.....	86
6	Alpha3D Operation Quick Guide	87
6.1	Pre-Requirement for Installation.....	87
6.2	Operation Steps.....	87
6.3	Data Pre-Processing Steps.....	88
7	Safety Directions	89
7.1	General Requirements	89
7.2	System Delivery Tips.....	89
7.3	Alpha3D Using Tips	90
7.4	Alpha3D Storage.....	90

1 Reading Tips

1.1 Symbol Explanation

: Forbid

: Warning

: Important attention

: Instruction

1.2 Recommendation

CHCNAV provides follow documents for user:

- Items List
- Alpha3D Mobile Mapping User Manual

The above content is recommended for user to read carefully before first-time use.

1.3 Service & Support

CHCNAV website: <http://www.chcnav.com>

Service hotline: 400-620-6818

Wechat public account:



1.4 Disclaimer

- Client needs to use and maintain the instrument as per CHCNAV requirements. If the instrument's life is affected even broken because of customer's incorrect operation & maintenance, CHCNAV will not assume the relevant responsibilities and all maintenance services will be charged at standard rates.
- Client needs to provide stable vehicle roof rack based on special technical parameters. If the instrument is broken or damaged because of other reasons, CHCNAV will not assume all relevant consequences and responsibilities.
- During transit, if the instrument is damaged because of logistics company, CHCNAV will not assume relevant responsibilities.
- During using process, if the instrument is damaged because of self-assembly or self-disassembly operations without CHCNAV support, CHCNAV will not assume all relevant responsibilities.
- Customer needs to use original battery and accessories for Alpha3D. If customer uses non-dedicated battery or charger, it may cause accidents for example explosion and burning. CHCNAV will not assume relevant responsibilities if client uses non-dedicated accessories, and the warranty qualification will become invalid.

2 User Guide

2.1 Operation Environment

- Not recommend using on rainy day, snowy day and foggy day for security and more noise points reasons.
- Not recommend using on a dusty environment as it will reduce instrument's lifetime.
- Do not put instrument and accessories under extreme temperature. The environment temperature should not lower or higher than specific temperature.
- When client moves instrument from cold environment to much warm environment, water may condense on some inside components. To avoid such situation, please put instrument under sealed plastic first before moving. After the condensed water evaporates, then start Alpha3D.

2.2 Attentions Before Using

- Check whether the laser optical glass cover is normal. The instrument needs to be cleaning if there is dust.
- Check whether all ports are cleaning, and whether stitches are distorted.
- Check whether all connected cables are stable and confirm GNSS cable is no curving and broken.
- Check whether battery power is enough for requirement.

2.3 Attentions When Using

- Please ensure all cables are connected to correct ports based on one by one check to avoid mistake. Do not insert or extract cables forcibly.
- After the instrument is powered, check whether wireless & wired network and laser network are connected normally. (Detailed steps please see **Hardware Operation Instruction**)
- The instrument should put at an open & good signal place when start work. Check whether GPS satellites' signal is normal.
- If buzzer is not ringing properly after startup or during data capture process, please check whether instrument is normal immediately.
- Check the rest volume of SSD drive before data capture start. If rest volume less than 10% or not enough for this time's requirement, please delete laser data files in advance.
- Check whether the protection cover of laser scanner is take down before data capture.

- Check whether the indicator light of Ladybug camera is orange after powered on.

2.4 Attentions After Using

- After work finished, turn off laser on CoCapture first, then turn off battery and remove power cable. Finally put instrument and all accessories into case.
- Please move case carefully during transit and do not bump.
- The battery box should be turn off.

3 Product Overview

3.1 Product Introduction

The Alpha3D is an advanced mobile mapping system which completely designed and integrated by CHC Navigation Company. It combines several state-of-the-art high-performance sensors, for example 3D laser scanning module, satellite positioning module, inertial navigation module and 360°HD panoramic camera. The Alpha3D can obtain high-precision ground object's point cloud information and HD image data because of flexible, short cycle, high precision, high resolution and real-time multi-source data fusion features. It can widely use in digital urban management, digital city, digital land, road, emergency, public security, navigation and civil information construction areas.



3.2 Product Component

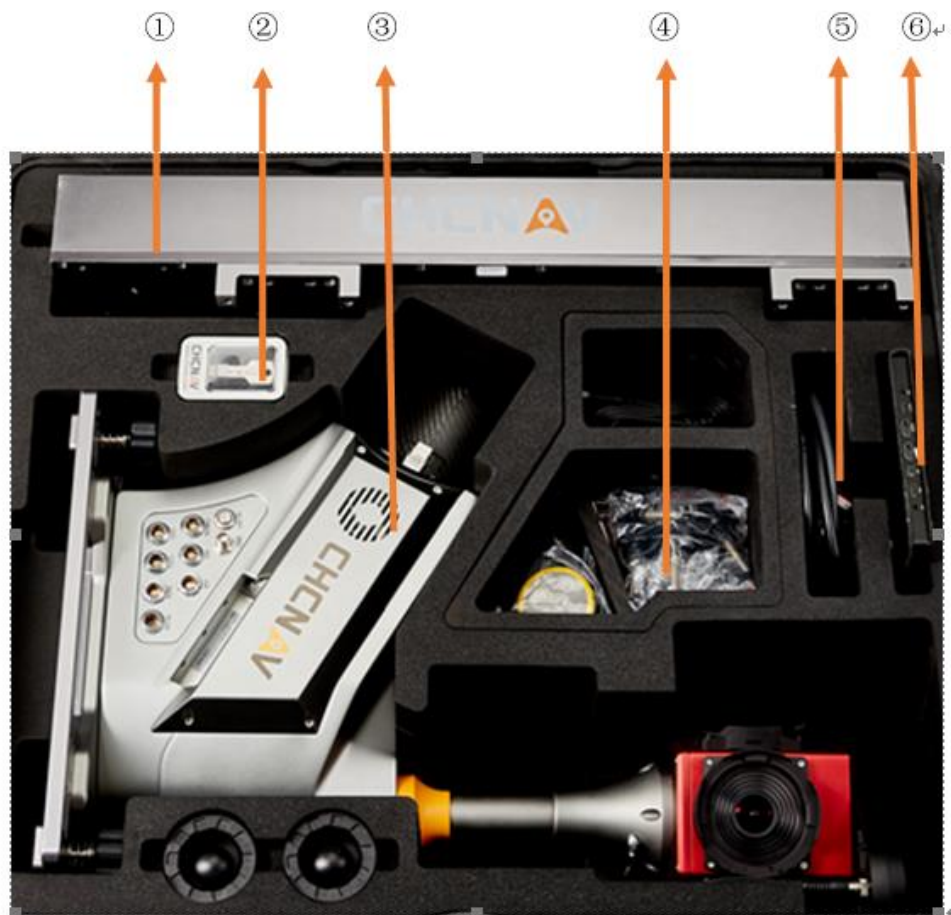
3.2.1 Configuration List

Alpha3D Mobile Mapping System		
Part Number	Description	Pcs
System components		
191206020252 030 000	Alpha3D Mobile Mapping unit	1
1903 110 005	Alpha3D battery in transport case	1
3204 050 002	Alpha3D transport container	1
2404 010 004	Panoramic camera LadyBug5+	1
0101 080 018	1TB SSD drive	1
0201 050 363	Rotational mount	1
1911 110 013	Roof rack extension	1
0105 000 443	Power cable	1
0105 000 370	Ethernet cable	1
0105 000 453	GNSS cable 240mm	1
0101 070 087	Power cord, CHN standard	1
0105 000 479	Power cord, EU standard	1
0105 000 480	Power cord, NA and related standard	1
0201 050 413	Car Power plug cable	1
3204 990 009	Rugged weather cover	1
0201 050 379	Unit fixed screws on roof rack (set)	4
0102 100 772	dust proof plug	7
0102 100 747	dust proof plug	2
0201 050 379	Extension fixed screws	2
3204 070 001	USB stick	1
3204 990 016	Alpha3D user manual, Engl.	0
3204 990 008	CHC tape	1
0101 070 086	Ground Power Supply (220V)	1
0105 000 412	Data Copy Connector	1
Scanner Configuration		
0101 100 003	Riegl VUX-1HA scan head	1
0101 100 002	Riegl VUX-1UAV scan head	0
Software		
2405 030 040	Inertial Explorer license	1

1904 110 014	Inertial Explorer 1yr CSP	1
1904 110 664	CoCapture license	1
1904 110 015	CoCapture 1yr CSP	1
1904 110 662	CoPre license	1
1904 110 016	CoPre 1yr CSP	1
1904 110 660	CoProcess license-(better \$12500)	1
1904 110 017	CoProcess 1yr CSP	1
1904 110 666	CoSurvey AutoCAD license-(better \$6250)	1
1904 110 018	CoSurvey AutoCAD 1yr CSP	1
1904 110 668	CoManager GIS license	1
1904 110 019	CoManager GIS 1yr CSP	1
1904 110 667	CoView (Panoramic publishing platform for Web)	1
1904 110 020	CoView (Panoramic publishing platform for Web) 1yr CSP	1
3205 030 001	Orbit 3DM feature extraction bundle	1
1904 110 021	Orbit 3DM feature extraction bundle CSP	1
Optional accessories		
3204 020 002	Additional GNSS antenna with magnetic mounting	0
0105 000 454	GNSS cable 3m	1
1908 110 010	Wheel encoder (DMI)	0
3203 010 003	Tablet	0
0105 000 372	Display cable	1
0105 000 481	Calbe VGA to miniVGA	1
3204 010 001	Displayer	1
3204 990 001	Wireless keyboard	1
0101 080 022	2TB SSD drive	0
0101 080 023	4TB SSD drive	0
0101 070 062	Lead acid battery kid	2
Services		
1904 110 022	Alpha3D 1yr CSP	1
1904 110 023	Alpha3D HW and SW training 5 days max. 5 person	1
1904 110 024	Alpha3D 1-day project support (on site)	1

3.2.2 Instrument Container





- ① Roof rack extension: Fixed on the car roof for installation of instrument;
- ② USB stick: Used to store initial parameters and product manual;
- ③ Instrument: Used for data capture and storage;
- ④ Accessories cables: Power cable, VGA cable, data line etc;
- ⑤ Displayer cable: Used for connection between instrument and displayer;
- ⑥ Displayer: Used for test and recondition.

3.2.3 Orange Battery Container



3.3 Product Details

3.3.1 Alpha3D Hardware

- Main instrument: Used for data capture and data storage.



- Power cable: Used for main instrument charged. The output interface is 1B Lemo four-core aerial plug which mainly used for indoor testing. The input voltage of power adapter is 100-240VAC, output voltage is 24V and maximum power is 221W.



- Antenna: Used to receive satellite signal for GPS timing.



- GNSS cable: Used for connection between antenna and instrument.



- Portable displayer kit: Used for indoor test and recondition.



- Wireless keyboard: Used for software operation and parameter configuration.



- Data line: One internet access and two USB interfaces which are 1B 17-core aerial plug.



- VGA video line: One side connect to displayer and another 1B 10-core Lemo aerial plug connect to DISP interface.



- Battery power cable: One side is 1B 4-core aerial plug with needle which connect to battery power; Another side is 1B 4-core aerial plug with hole which connect to DC24V interface.



- Hardware operation interface:



ON/OFF: Button to control switch on/off with green light.

CAMERA: External camera interface.

EXT1: Firmware upgrade interface.

GNSS: Secondary GNSS antenna interface.

ODO: Wheel coder interface.

EXT2: Reserved interface.

DISP: Video interface.

DATA: Data transport interface.

DC24: Power interface, DC 24V.

GNSS main antenna interface which shown in above right Figure.

3.3.2 Physical Characteristics

Instrument shape size	51.26 × 31 × 67.17cm
Instrument weight	20.6 kg
Roof rack extension size	72 × 31 × 12 cm
Roof rack extension weight	16.6kg

3.3.3 Electrical Characteristics

Input voltage	24V ± 10% DC(9-32V DC)
Rated power	120W
Working temperature	-10℃ — + 40℃
Storage temperature	-20℃ — +50℃
Humidity	Maximum 80%
IP level	IP64

3.4 Primary Sensor Introduction

3.4.1 LiDAR VUX-1HA

Class 1 safety laser, 360° Field Of View (FOV), Scanning frequency 10-250Hz.



online waveform processing, multiple-time-around-capability

Laser Pulse Repetition Rate PRR ¹⁾	300 kHz	500 kHz	750 kHz		1000 kHz	
			full power	reduced power ²⁾	full power	reduced power ²⁾
Max. Measuring Range ^{3) 4)}						
natural targets $\rho \geq 10\%$	150 m	120 m	100 m	50 m	85 m	40 m
natural targets $\rho \geq 80\%$	420 m	330 m	270 m	135 m	235 m	120 m
Max. Number of Targets per Pulse ⁵⁾	practically unlimited (details on request)					

Notice: There are four frequently used PRR: 300KHz, 500KHz, 750KHz and 1000KHz. For example, If scanner works as 300KHz: when the object reflectivity $\geq 10\%$, the maximum measuring range is only 150m; And when the object reflectivity $\geq 80\%$, the maximum measuring range is 420m. So, it can be concluded that both PRR and object reflectivity will influence the maximum measuring range. When you use high PRR for scanning such as 750KHz and 1000KHz, the maximum measuring range is highly influenced by battery level: When scanner works as 750KHz and object reflectivity $\geq 80\%$, the maximum measuring range is 270m under full charged condition but only 135m under low charged condition; When scanner works as 1000KHz and object reflectivity $\geq 80\%$, the maximum measuring range is 235m under full charged condition but only 120m under low charged condition.

3.4.2 High-precision IMU

Orientation accuracy	0.01°
Attitude accuracy	0.005°
Positioning accuracy	$\leq 1\text{cm}$
Heading error	$< 0.03^\circ$
Data updating rate	600HZ
Weight	140g

PERFORMANCE DURING GNSS OUTAGES⁷⁾

Outage Duration	Positioning Mode	POSITION ACCURACY (M) RMS		VELOCITY ACCURACY (M/S) RMS		ATTITUDE ACCURACY (DEGREES) RMS		
		Horizontal	Vertical	Horizontal	Vertical	Roll	Pitch	Heading
0 s	RTK ⁸⁾	0.02	0.05	0.015	0.010	0.010	0.010	0.030
	SP	1.20	0.60	0.015	0.010	0.010	0.010	0.030
	PP ⁹⁾	0.01	0.02	0.015	0.010	0.005	0.005	0.010
10 s	RTK ⁸⁾	0.12	0.10	0.040	0.020	0.020	0.020	0.040
	SP	1.30	0.65	0.040	0.020	0.020	0.020	0.040
	PP ⁹⁾	0.01	0.02	0.020	0.010	0.005	0.005	0.010

3.4.3 G5ant-3AT1 Antenna



Frequency Range	GPS L1/L2 GLONASS L1/L2 BDS B1/B2/B3
Horizontal Coverage Angle	360°
Phase Center Error	± 2mm
Working Voltage	2.5~24VDC
Working Current	< 50mA
Working Temperature	-55°C~+85°C
Weight	256g

3.4.4 LADYBUG 5+ Panoramic Camera

The camera is set as automatic mode to adapt weather changes. No need to adjust exposure, shutter and diaphragm these settings



Max resolution	Panorama 12000*6000
Data interface	USB3.0
Shutter form	Global shutter
Field angle	360
Optical lens	2.5mm prime lens
Working voltage	12V
Weight	2.9kg

3.5 Data Storage Introduction

- **Step 1:** Push the button down to open the external cover of hard disk cartridge which shown in below:



- **Step 2:** Use index finger to pull fastener up which will bounce off automatically:



- **Step 3:** Take out disk by hand:



- **Step 4:** After copied data, return disk into card slot and the direction of lock label should in upward direction. Then fix fastener and finally close external cover:



3.6 Vehicle Platform Introduction

3.6.1 Roof Rack Extension

This roof rack extension is easy to assemble, and it also has a high working efficiency.





3.6.1.1 Extension Installation

Firstly, using 4 manufacture standard M8 screws to fix roof rack and vehicle cross-bar (**THULE** brand is recommended), which shown in Figure 1. Then, unscrew the screws of roof rack and adjust the extension length, which shown in Figure 2. The maximum length is 400mm which divided into 4 sections and each section is 100mm. The brand of vehicle cross-bar is chosen as THULE and the maximum load weight is 70kg. Turning in clockwise direction to unscrew thumb screws and turning in anti-clockwise direction to lock thumb screws, which shown in Figure 3.



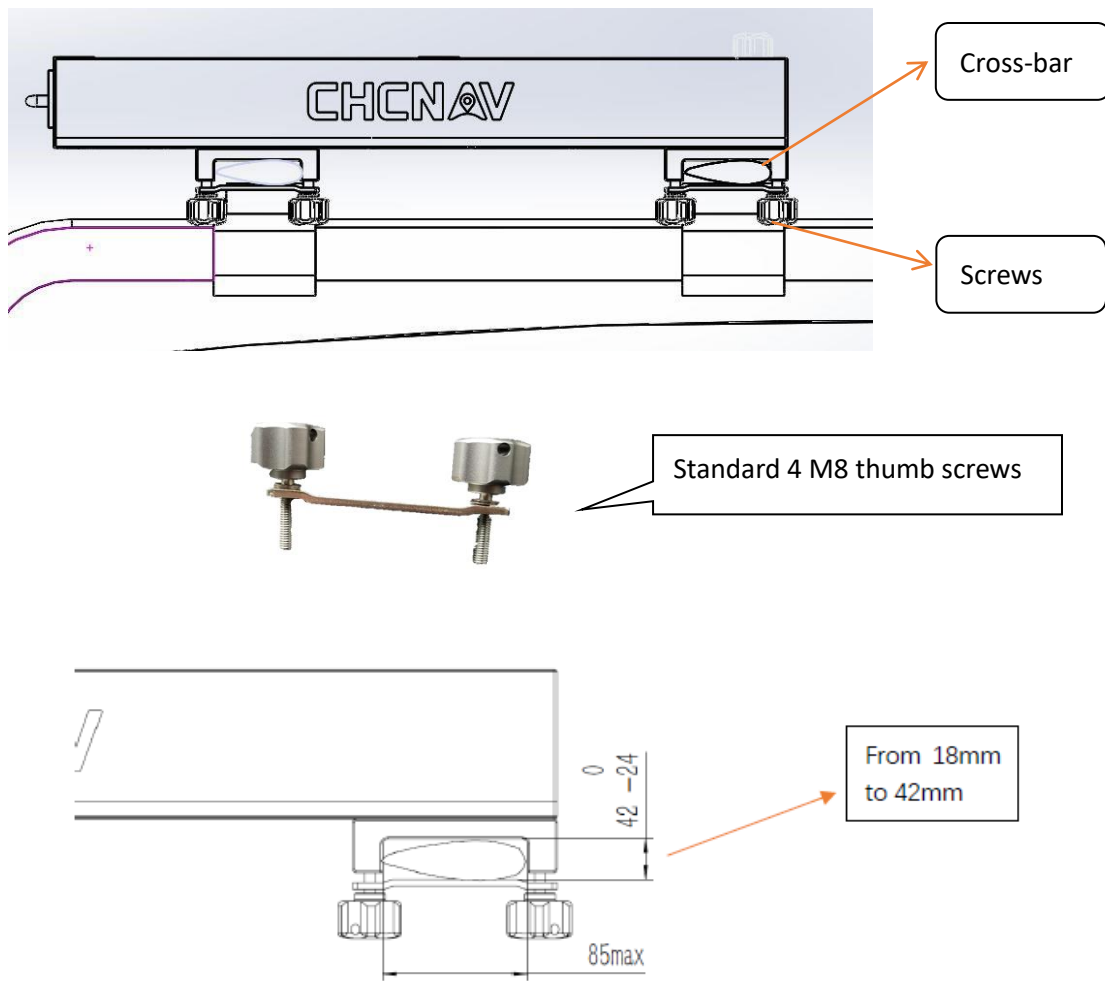


Figure 1

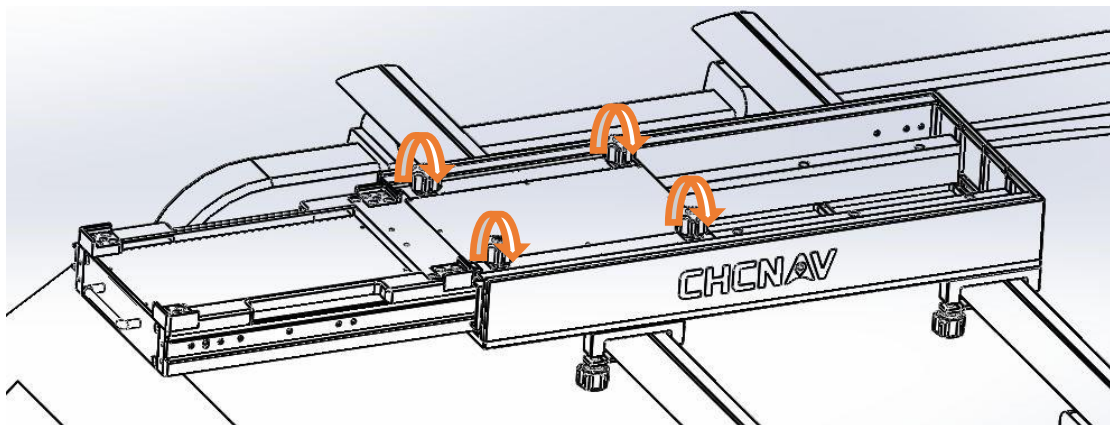


Figure 2

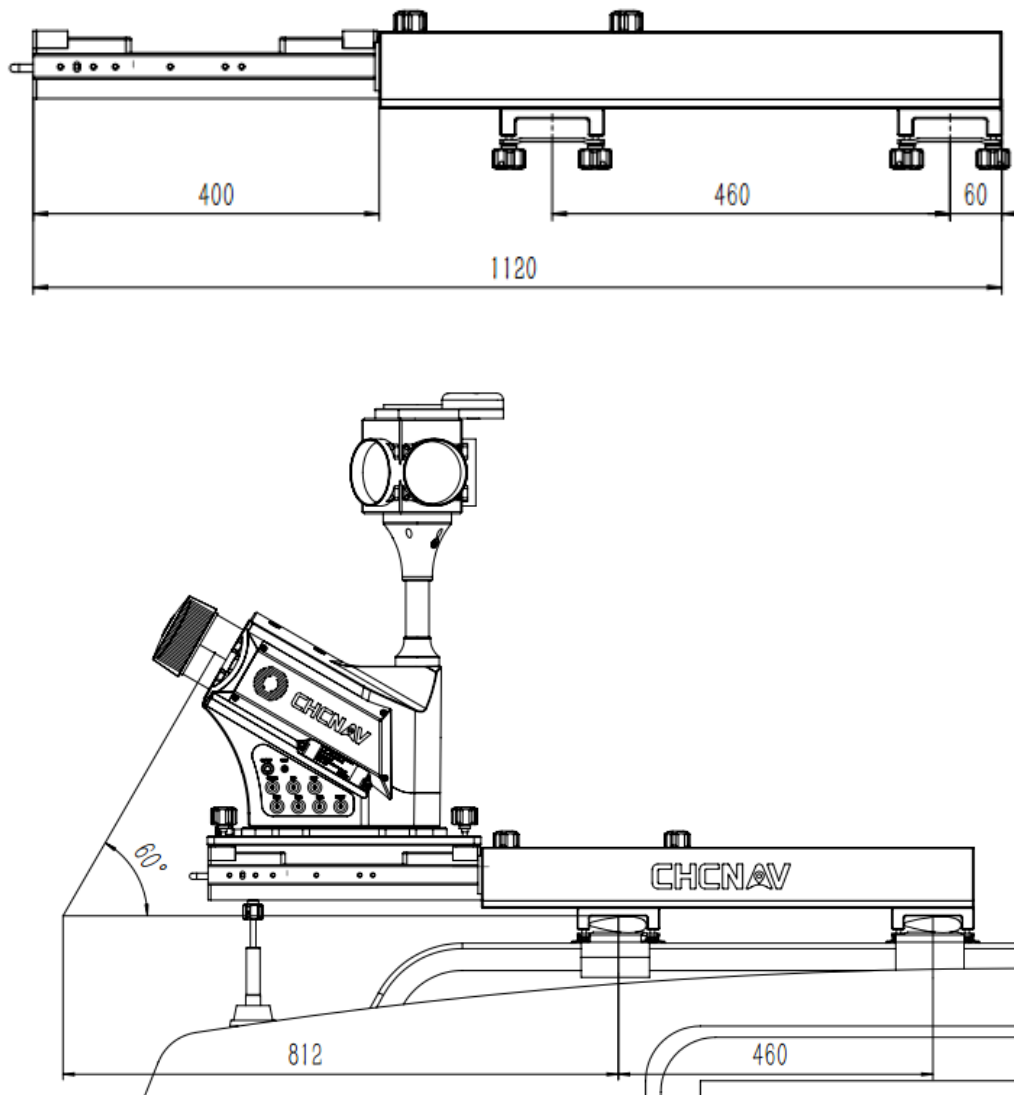
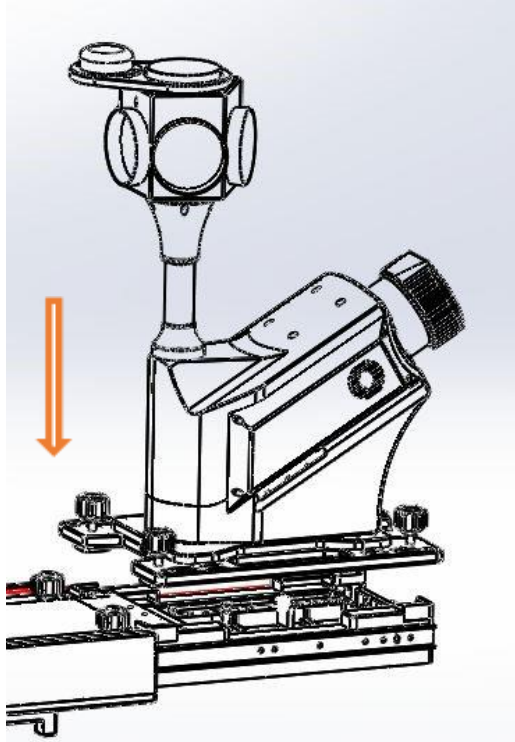


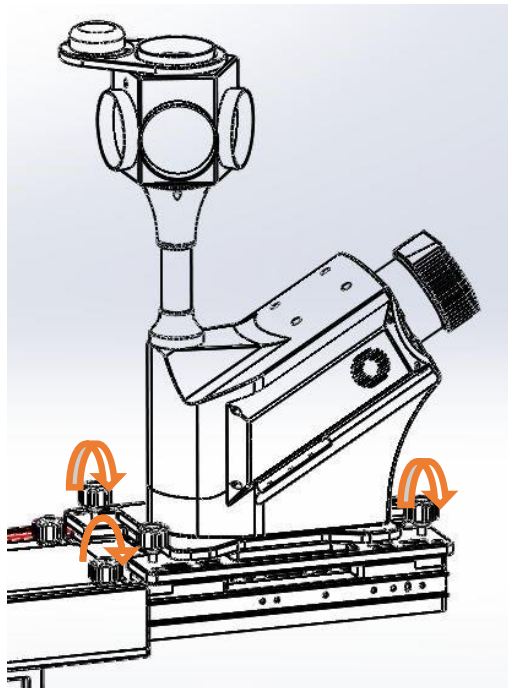
Figure 3

3.6.1.2 Alpha3D installation

- **Step 1:** Tighten 4 bottom corners of Alpha3D with 4 installation blocks of roof rack and put it down accurately.

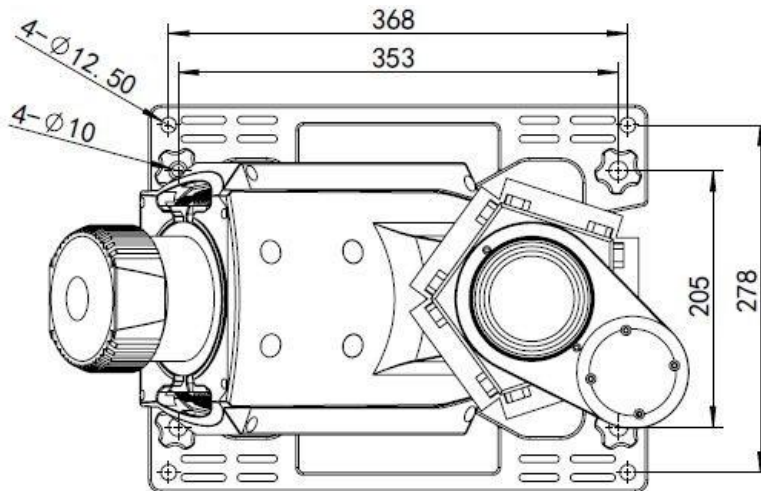


- **Step 2:** Turning 4 thumb screws in clockwise direction to fix Alpha3D.



3.6.2 Other Platform Installation

If you use other platform to hold Alpha3D, the platform needs to be punched in advance with 4- $\varnothing 12.5$ holes which can assemble screw and nut.

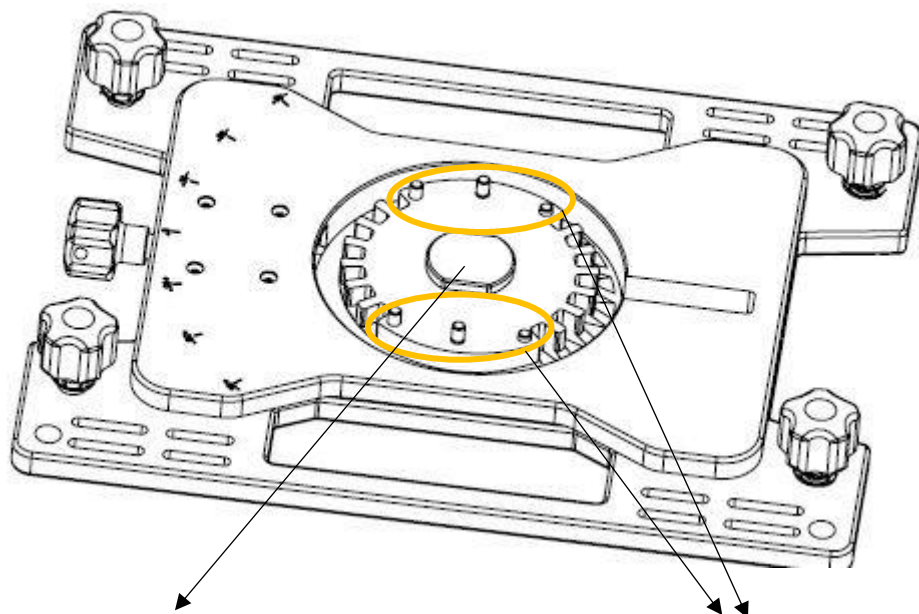
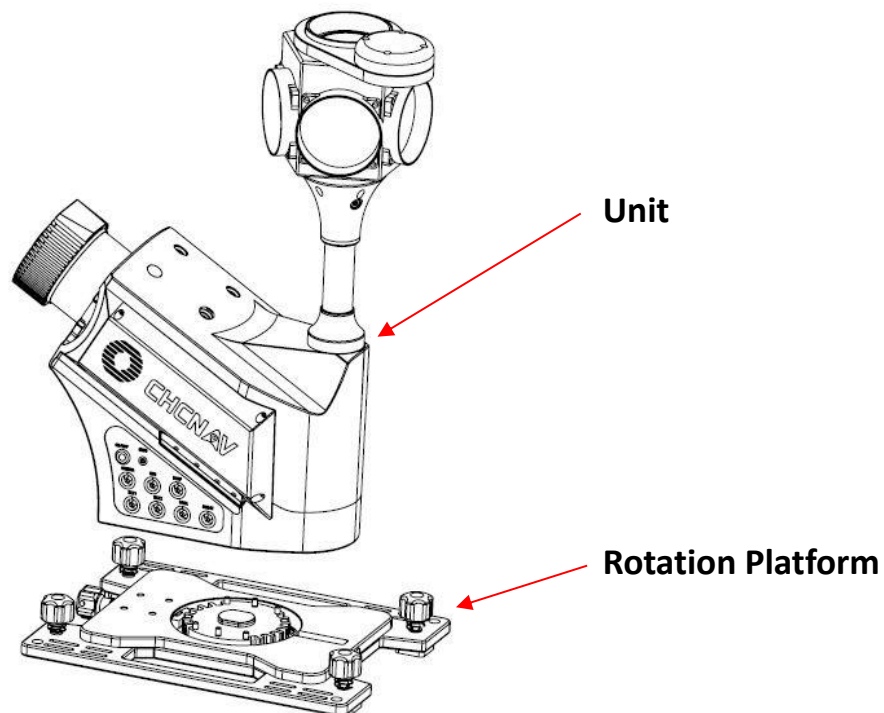


3.7 Rotation Platform Introduction

3.7.1 Rotation Platform Overview

Alpha3D is equipped with a rotation platform which can adjust scanning angle for better view. There are 7 rotation angles of platform can be chosen: -45° , -30° , -20° , 0° , 20° , 30° , 45° .



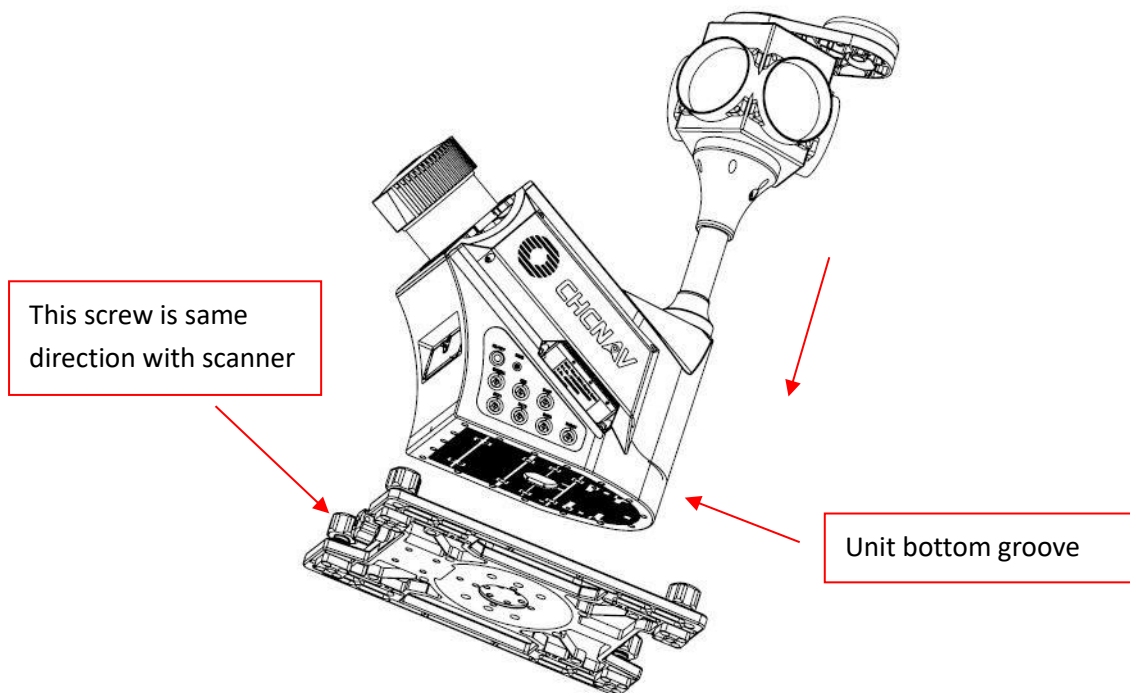


Positioning convex of rotation platform

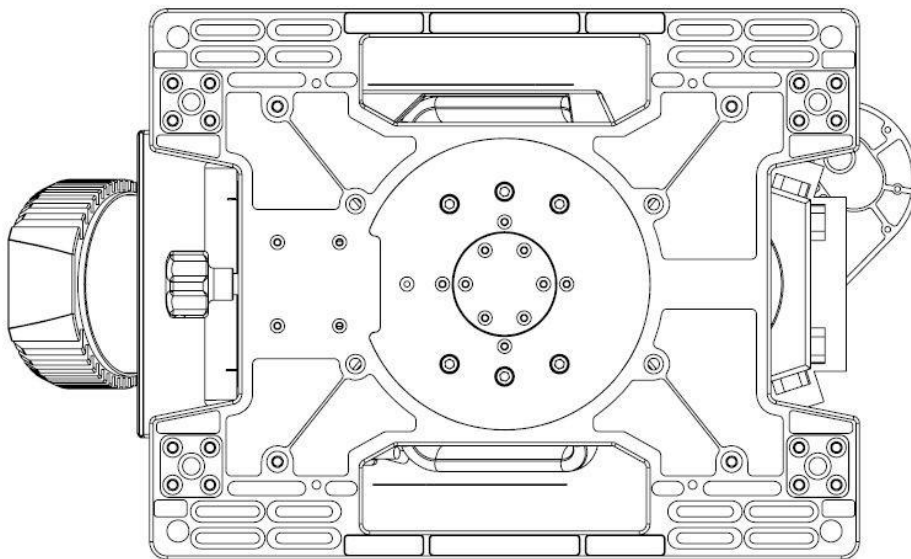
Six connection screws of rotation platform

3.7.2 Installation Steps

- Put unit downward to align unit bottom groove with rotation platform convex, make these two parts fit stable.



- Using a 5mm hexagon wrench to tighten circled six M6 screws, and torque is 9N·m.



4 Battery Container Overview

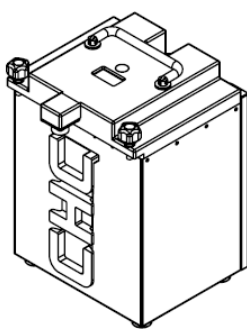
4.1 Battery Container Introduction

Alpha3D battery container is a small set of power supply unit which includes three parts: orange container, controller box and battery charger. The number of used orange containers is depending on user requirement. The Alpha3D battery container has following characteristics:

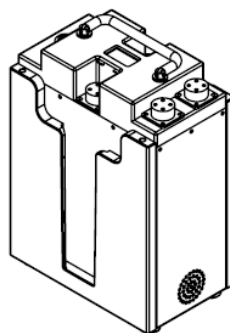
- Support hot plug for orange container during external power supply process.
- IP64 protection level.
- Support both lead-acid cell and lithium battery.
- Cable-less connection between orange container and controller unit.
- Support plenty functions such as low voltage alarm, anti-reverse connection and overcurrent protection.
- Alpha3D battery container has RS485 communication function, which can transfer orange container information into controller box and display it; Meanwhile, controller box also transfers battery information into instrument.
- Product power convert module can be upgraded and support maximum 500w output.

4.1.1 Battery Container Components

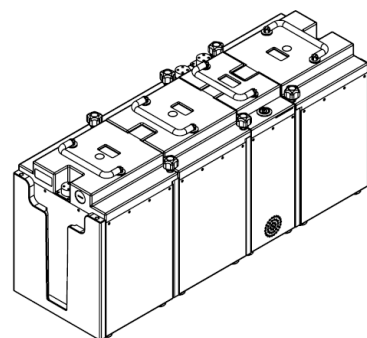
A set of Alpha3D battery container has three components: orange container, controller box and battery charger.



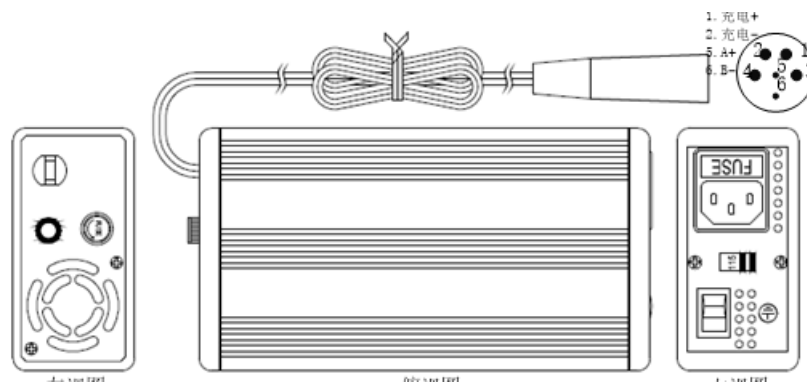
1. Orange Container



2. Controller box



3. A set of battery (3+1)

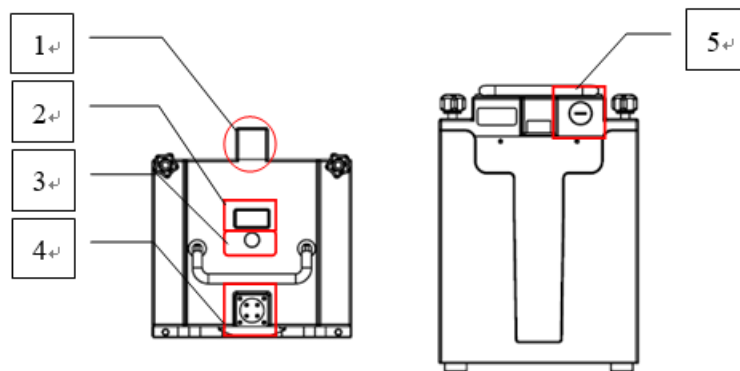


4. Battery Charger

4.1.2 Orange Container Port

The top of orange container consists of five parts: output port, display screen, switch button, input port and fuse:

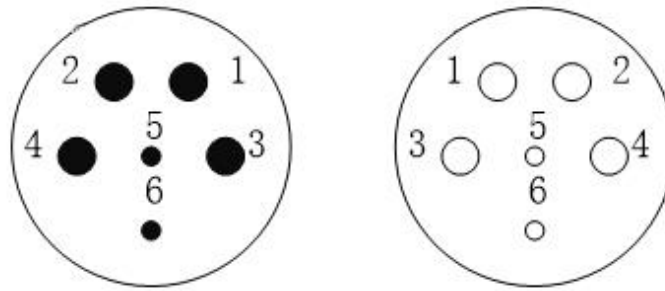
Number	1	2	3	4	5
Name	Output port	Display screen	Switch button	Input port	Fuse



1. Top View

2. Front View

The detailed sketch map of orange container port definition is shown below:



1. Output port (Male head)

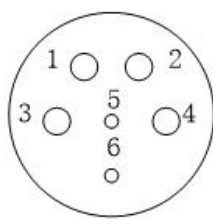
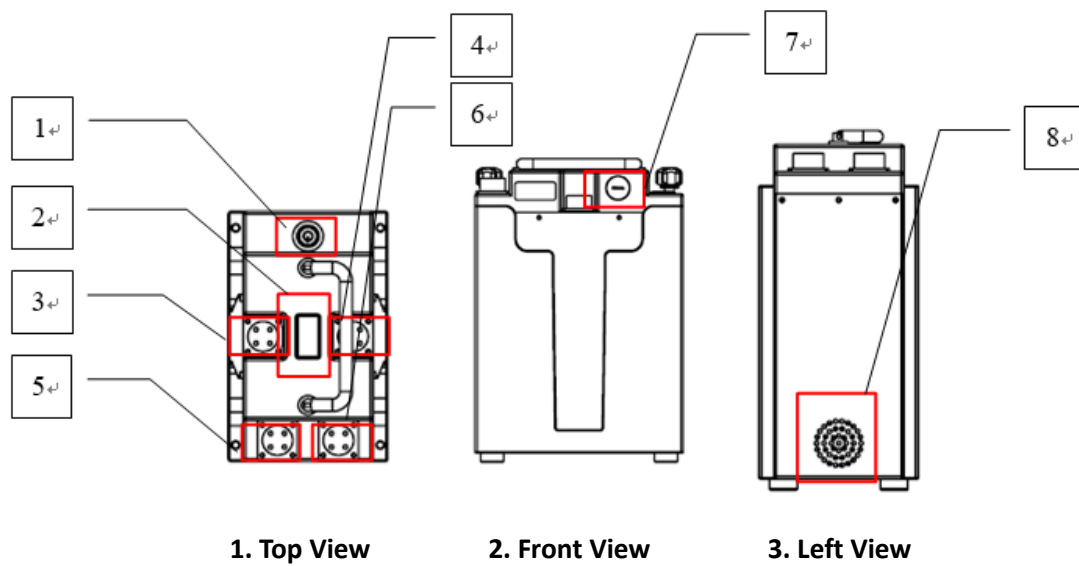
2. Input port (Female head)

Number	1	2	3	4	5	6
Output Port Definition	/	/	Vout+	Vout-	RS485A+	RS485B-
Input Port Definition	Charge+	Charge-	Vin+	Vin-	RS485A+	RS485B-

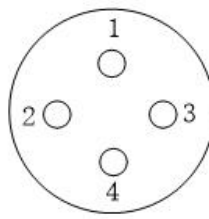
4.1.3 Controller Box Port

The top of controller box consists of seven parts: self-locking switch, display screen, input port 1, input port 2, 24V output port, 12V output port and fuse.

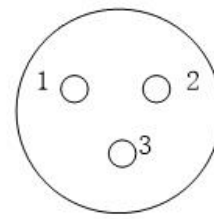
Number	Name
1	Self-locking switch
2	Display screen
3	Input port 1
4	Input port 2
5	24V Output port
6	12V Output port
7	Fuse
8	Cooling fan



1. Input Port (female head)



2. 24V Output Port (female head)



3. 12V Output Port (female head)

Number	1	2	3	4	5	6
Input Port Definition	/	/	Vin+	Vin-	RS485A+	RS485B-
24V Output Port Definition	Vout+	Vout-	RS485A+	RS485B-	/	/
12V Output Port Definition	Vout+	Vout-	/	/	/	/

4.2 Functional Specification

4.2.1 Orange Container Function

4.2.1.1 Orange Container Light Condition

When orange container is turn off, long-press switch button until buzzer sounds and display screen shows battery information; Again, long-press switch button until buzzer sounds, and orange container will turn off. If orange container is not used for a long time, it is recommended to turn off it manually. Otherwise, it will turn off automatically after half hour under light condition.

4.2.1.2 Orange Container Discharge Condition

The orange container will turn on automatically when it loads greater than 0.5A current and the display screen will present battery information. Under load condition, the switch button cannot work.

4.2.1.3 Orange Container Charge

The orange container is equipped with a 13.8V 7.2A battery charger for charge. It will turn on automatically when it connects to charger with greater than 0.5A current and the display screen will present battery information. Under charge condition, the switch button cannot work. When charger light changes from red to green and charge current is 0A, it means the battery is full charged.

4.2.1.4 Orange Container Communication

The orange container supports RS485 communication function which can transfer battery information to controller unit and present under power-on condition.

4.2.1.5 Orange Container Low Voltage Alarm

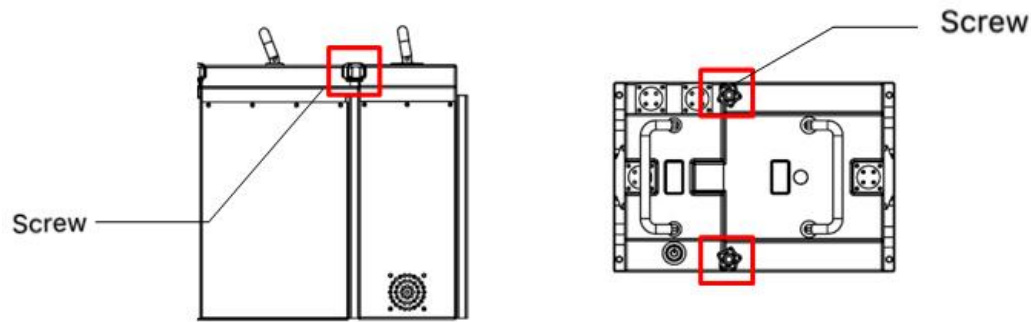
Under power-on condition, the orange container will continuously alarm if voltage below 10.5V. Short press switch button to turn off sound after alarm.

4.2.1.6 Orange Container Overcurrent Protection

The orange container supports overcurrent protection function. If output port is short connection or current is higher than 30A, the fuse will burn out. Change another 6*30mm 30A glass fuse and the orange container will use normally.

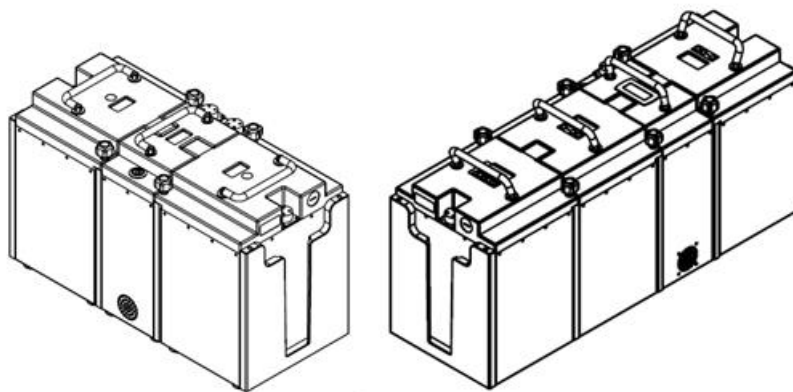
4.2.1.7 Orange Container Use

Only one orange container can also be used or combine several containers to use like building blocks. The highest voltage orange container will give priority to supply power for Alpha3D which will have N orange containers charge time.



1. Side View

2. Top View

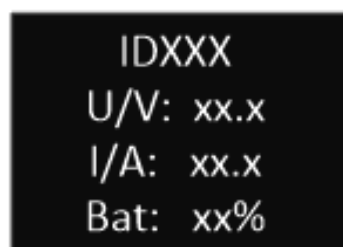


1. 2+1 Combination

2. 3+1 Combination

4.2.1.8 Orange Container Screen Explain

“IDXXX” represents the ID number of orange container, “U/V” represents battery voltage and “I/A” represents battery current. The minus current represents charging and “Bat” represents rest battery power.



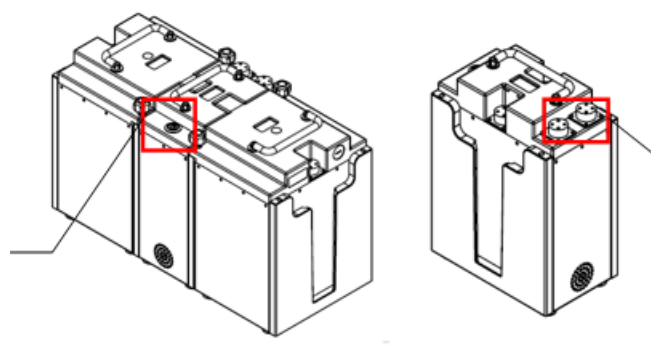
4.2.2 Controller Box Function

4.2.2.1 Controller Box Electric Parameter

Power	See label	See label
Input voltage range	9~18VDC	10.2V~12.9V
Output voltage	24V	10.2V~12.9V
Output voltage stability	1%	/
Output voltage adjusting range	10%	/

4.2.2.2 Controller Box Working Condition

The controller box supports both two output routes and two input routes. Two output routes are 12V (three-core) and 24V (four-core). After connect orange container (power-on state) and controller box, press self-locking switch and it will present green color. Meanwhile, the display screen will turn on which shows operating state. When orange container connected with controller box, 12V port is always charged and 24V port is controlled by self-locking switch.

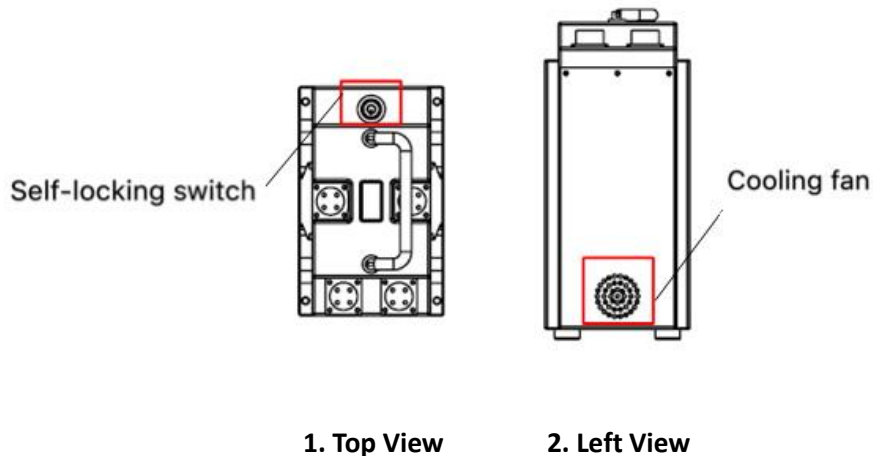


1. Self-locking switch

2. Output port

4.2.2.3 Controller Box Temperature Control System

Generally, the controller box can rely on cooling fin for natural cooling during work time. If internal temperature of controller unit is higher than 40°C, the temperature control system will open fan for cooling automatically.



4.2.2.4 Controller Box Communication

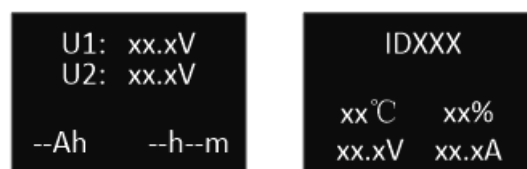
The controller box supports RS485 communication function which can transfer received orange container information to Alpha3D (under operating state) for display.

4.2.2.5 Controller Box Overcurrent Protection

The controller box supports overcurrent protection function. If output port is short or current exceed than 30A, the fuse will burn out. Change another 6*30mm 30A glass fuse and the controller unit will use normally.

4.2.2.6 Controller Box Screen Explain

Below figures show initial interface of controller box: U1 represents output voltage of four-core port and U2 represents output voltage of three-core port. "--Ah" represents total power of battery and "--h--m" represents rest working time of battery. After connecting with battery, the display screen will show battery information: temperature, rest power, voltage and current.



4.3 Electrical Parameter

4.3.1 Battery Parameters

- The parameter of orange container battery is 12V 24Ah.

Capacity	Power Supply Time
12V24Ah	1.5h (5A24V)

- Discharge parameter of orange container is shown below:

Discharge current	1.2A-4.8A	4.8A-12A	12A-24A
Cut-off voltage	10.5V	10.2V	9.9V

- Battery size is 165mm*125mm*175mm (length*width*height), total height is 179mm and total weight is 8.1kg. Same specification 12V lead-acid or 12V lithium battery can also be used.

4.3.2 Charger Parameters

Different colors of charger light represent different use conditions:

- Red: Charging. (Fan start)
- Red & Green flicker: Alternate between charging mode and full-charge mode.
- Green: Full-charge mode complete and start light-charge mode. (Fan stop)
- Green flicker: Empty connect or pulse state.

Suitable temperature of charging environment is 5℃~35℃.

Input	200-240VAC/110-130VAC 50/60Hz
Output	13.8V——7.2A



Left View:

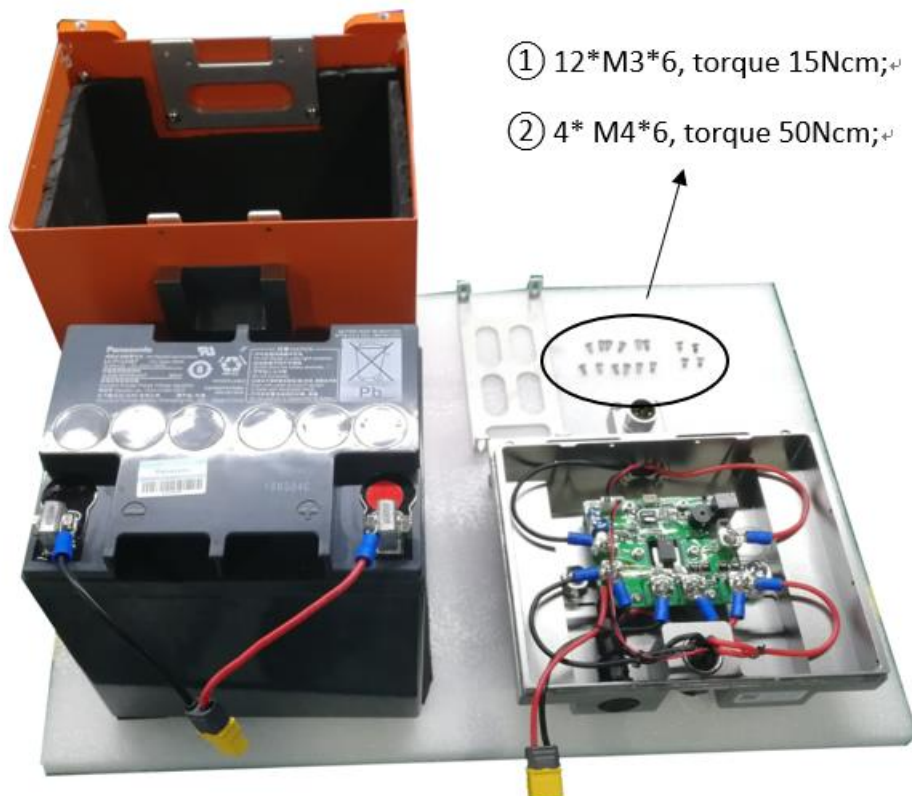
Red light: CC fast charge.

Green light: Small current charge

4.4 Operation Instruction

4.4.1 Battery Installation Steps

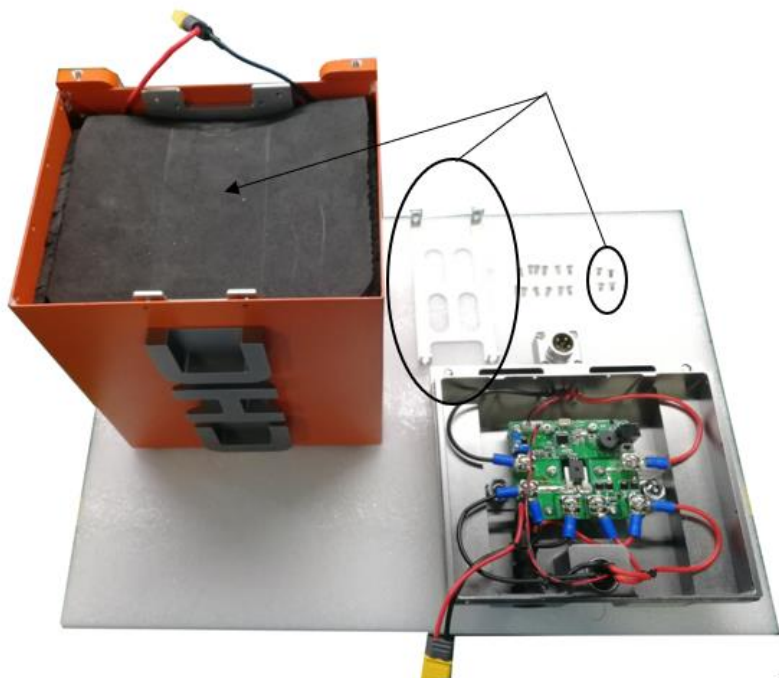
- Prepared accessories list: orange container, standard battery, 12*M3*6 torque 15Ncm and 4*M4*6 torque 50Ncm.



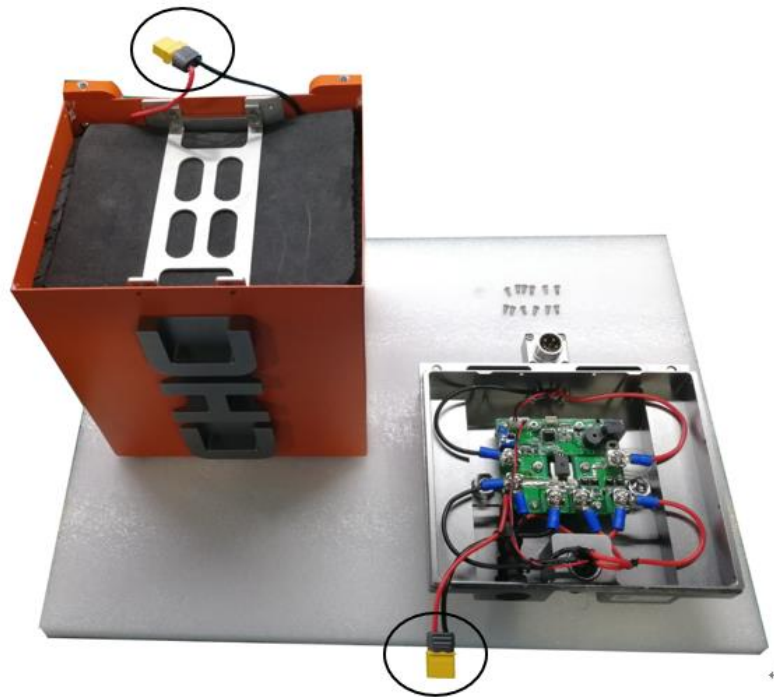
- Clamp the electrode wire with the battery electrode first and then put the battery inside of case.



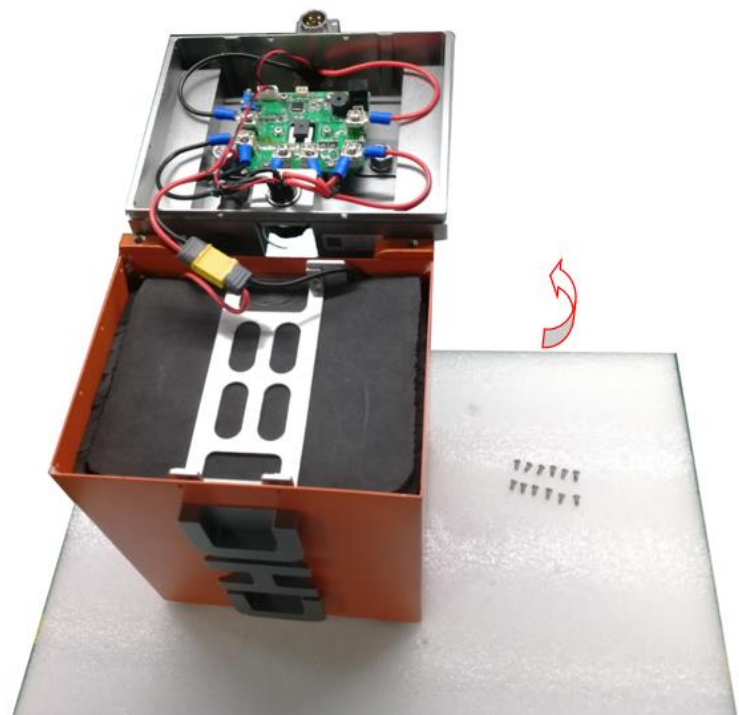
- Put the cushion on the battery above for protection and prepared limiting plate and four screws for next step installation.



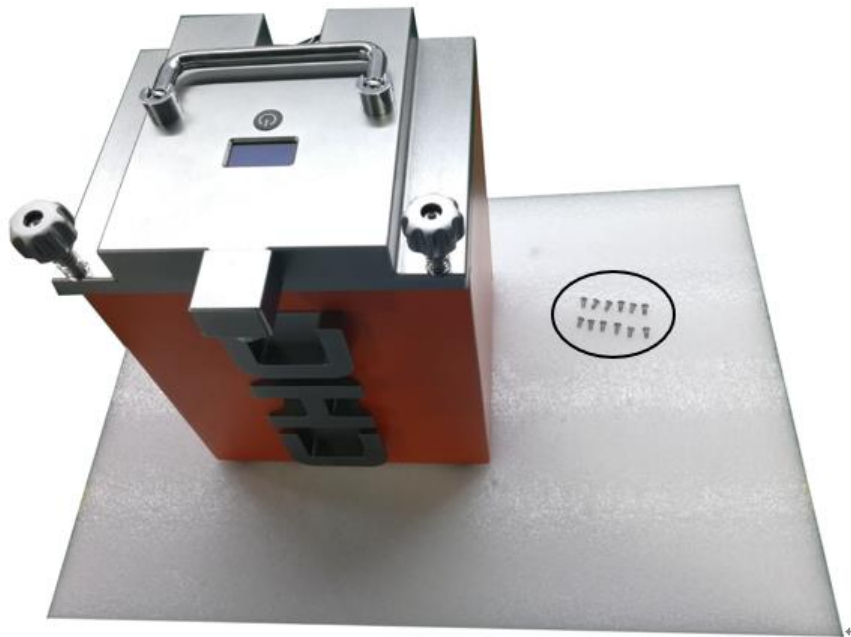
- Install limiting plate on the above of cushion with four M4 screws. Prepared to connect two power ports on next step.



- Connect two power interfaces which shown in below:



- Put the lower edge of cover completely inside the battery case and use 12 M3 screws to fix it.

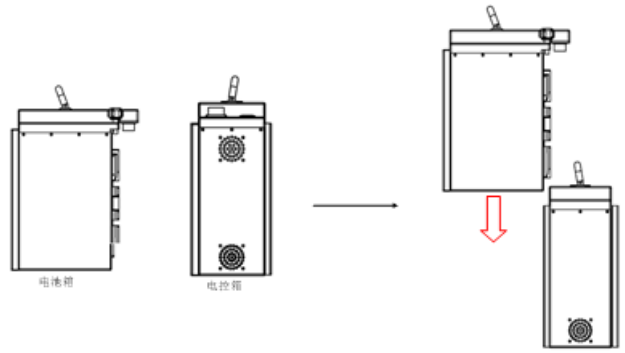


- Finally, complete orange container installation.

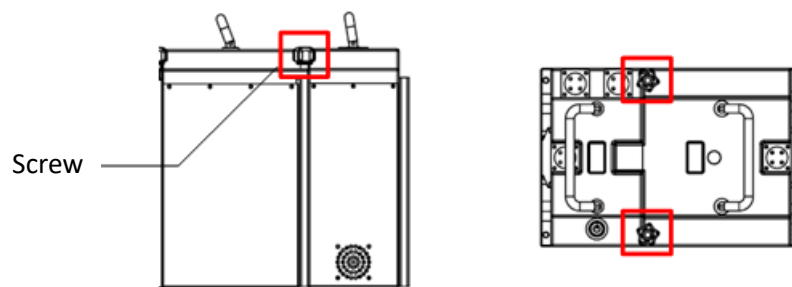


4.4.2 Containers Assemble Steps

- First, connect orange container and controller box which shown below:



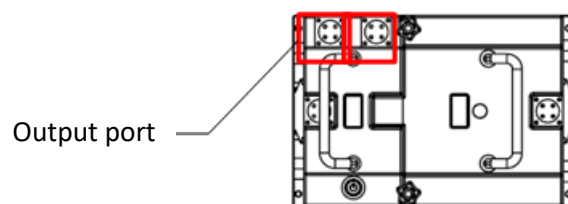
- Second, tighten the screws if transport is required:



1. Side view

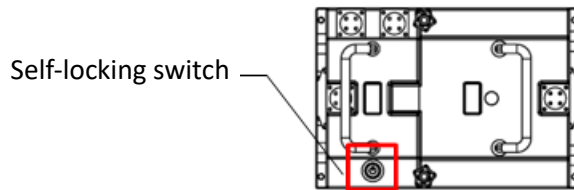
2. Top view

- Third, connect power cable with output port of controller box.



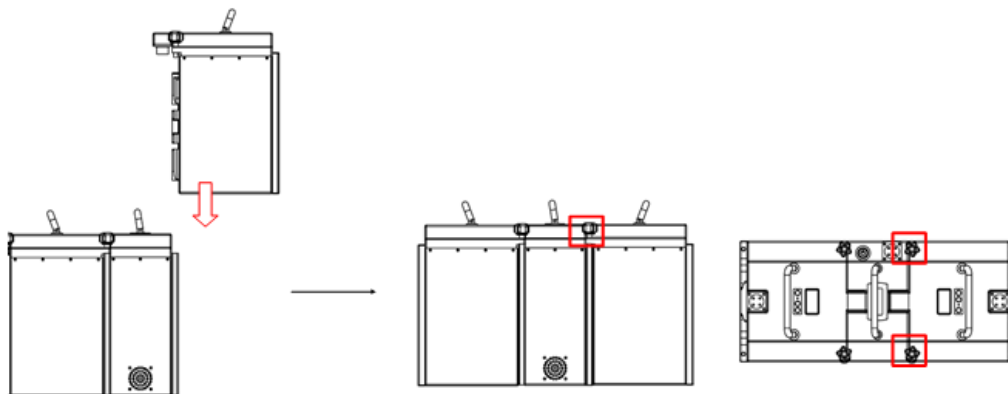
1. Top view

- Fourth, press self-locking switch of controller box to start 24V power supply. (12V port is always powered)

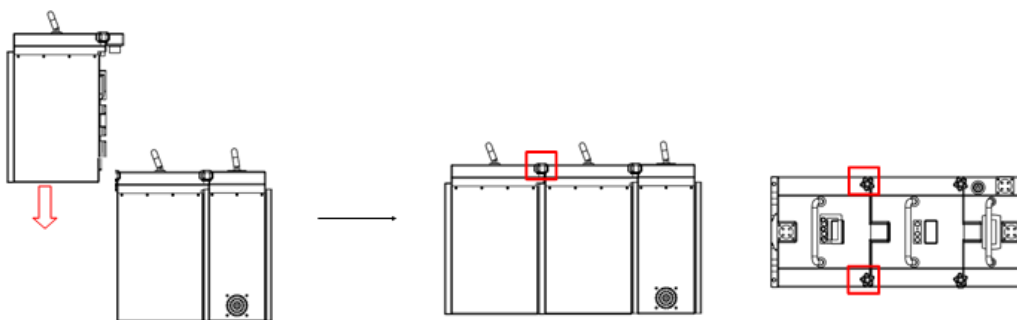


1. Top view

- Can add more orange containers according to actual needs:



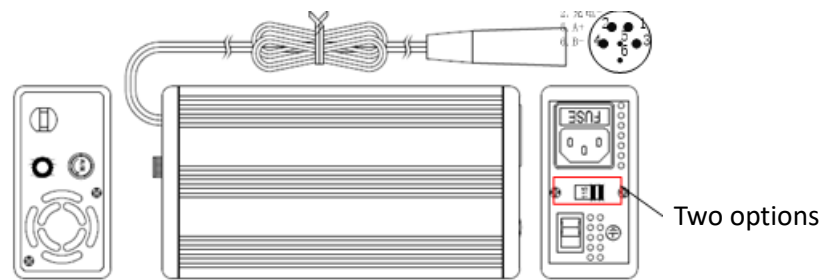
1. Two orange containers & One controller box (2+1, two sides)



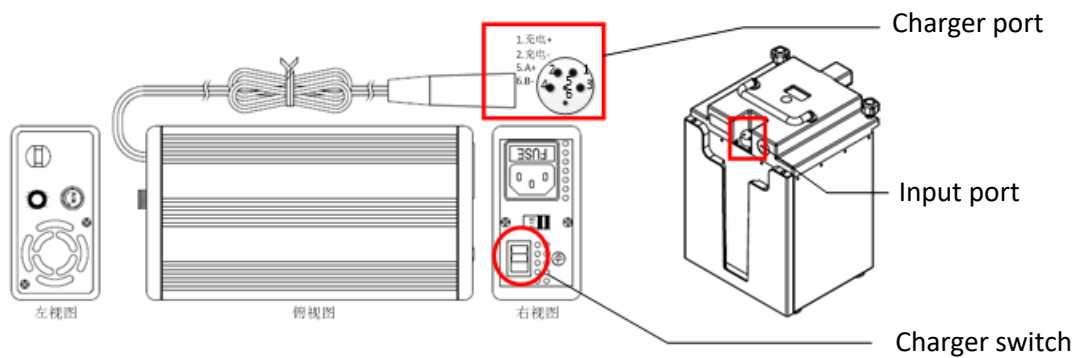
2. Two orange containers & One controller box (2+1, one side)

4.4.3 Charge Steps

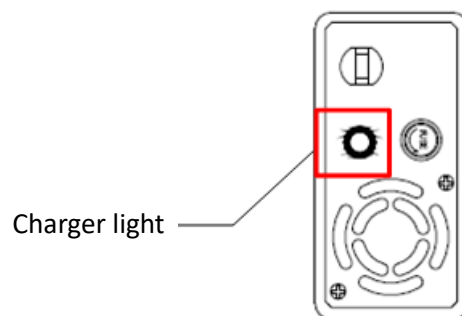
- First step is to adjust input voltage range of charger to suitable values. There are two options can select: 200-240VAC and 110-130VAC.



- Second step is to connect charger and orange container. Open charger switch, the charger light should present red and fan is start work, which means in charge already.



- Third step: Battery is full charged when charger light changes to green and current is 0. Then, turn of charger switch and unplug charger.



4.5 Common Problems & Solutions

- Orange container cannot power-on:

Solution: First, connect charger for charge to check whether can power-on now. Second, check whether the fuse is burn out and needs to be replaced.

- Controller box cannot work after connecting with orange container:

Solution: Check whether orange container is connected with controller unit; Check whether fuses needs to be replaced.

- Charger fails to charge:

Solution: Check whether select suitable voltage range (115V or 230V); Check whether the input or output fuses are burn out; Check whether the orange container's fuse is burn out.

- Battery cannot full charged:

Solution: Keeping charge for one hour to check whether voltage is rising. If not, maybe the reason is because aging of battery, it is recommended to change a new battery.

- Battery consumption is too fast

Solution: Low environment temperature may influence battery life; Prepared more orange containers as actual request; Aging of battery may influence battery life and it's recommended to change a new battery.

If instrument still can not work, please contact CHC Support team for further check and maintenance.

5 Software Overview

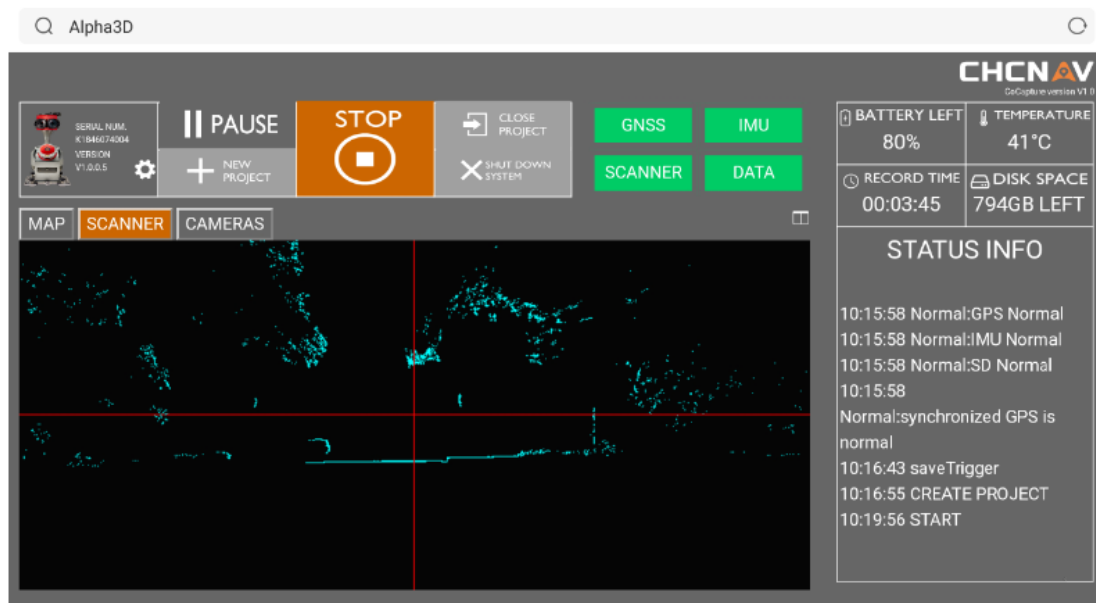
5.1 CoCapture - Data Acquisition Software

CoCapture is a CHC designed web-based software which used to manage mission and automatically capture data. The interface has a very simple, intuitive and user-friendly design which can easily control operation and status of Alpha3D. As any browser-based operation unit, user can connect different types of laptop or tablets, based on different OS. Meanwhile, both WiFi and LAN cable connection are supported which makes work more flexible.



5.1.1 CoCapture Interface Overview

The interface is shown as below. Left-above is setting & control toolbar which used to change parameters and manage missions. The green interface which next to setting & control toolbar shows status of **GNSS**, **IMU**, **SCANNER** and **DATA**. Below is viewer setting interface which support both trajectory, real-time scanning line and panoramic views. Right-side is status information display bar which shows basic information and working status of device. If both above interfaces display normally, it means the initialization of device is successful and it's ready for work.



5.1.2 CoCapture Function Description

5.1.2.1 Setting & Control Toolbar

- **PAUSE:** During data capture process, if there is a traffic jam or needless data, click here, the scanner still working but data is not recorded.



- **NEW PROJECT:** It's used to create a new project folder at Alpha3D folder of D disk, for example "@@2017-09-27-123146". This icon will show grey when it can be clicked.



- **CLOSE PROJECT:** It's used to close current project folder and stop recording data when finished work. This icon will show grey when it can be clicked.



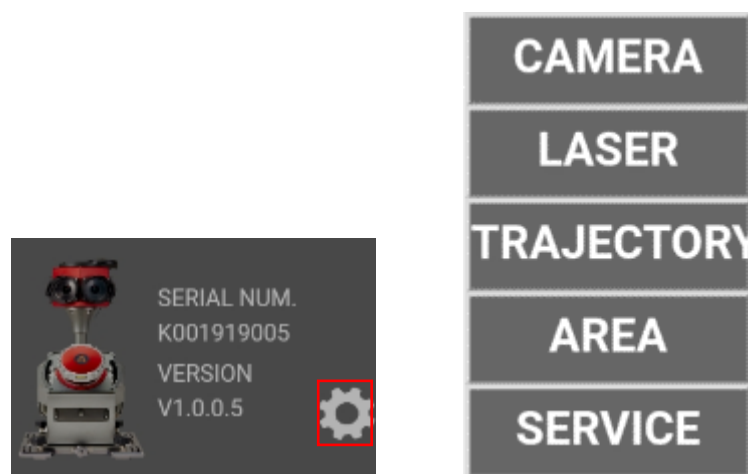
- **START & STOP:** It's used to control laser scanner. Below figures show start scanning and stop scanning respectively.



- **SHUT DOWN SYSTEM:** It's used to turn off scanner, and after 10 seconds, the computer will close automatically, and the internal system is out of power.



- **Parameter Setting:** Click below icon to set laser scanner parameters and camera parameters. If the parameter can be set, the color is dark grey, and the icon can be clicked. If the parameter cannot be set, the color is grey, and the icon cannot be clicked.

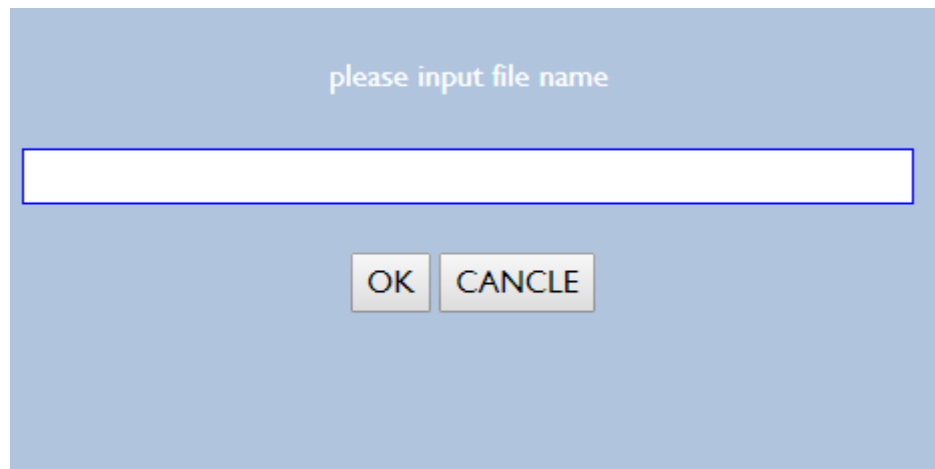


CAMERA: It's used to set parameters of camera includes trigger time interval and camera exposure mode. Once the parameters are set, click **APPLY** to use new parameters. Click **SAVE** will save these parameters although restart device or software. Click **CANCEL** will exit this window without any changes.

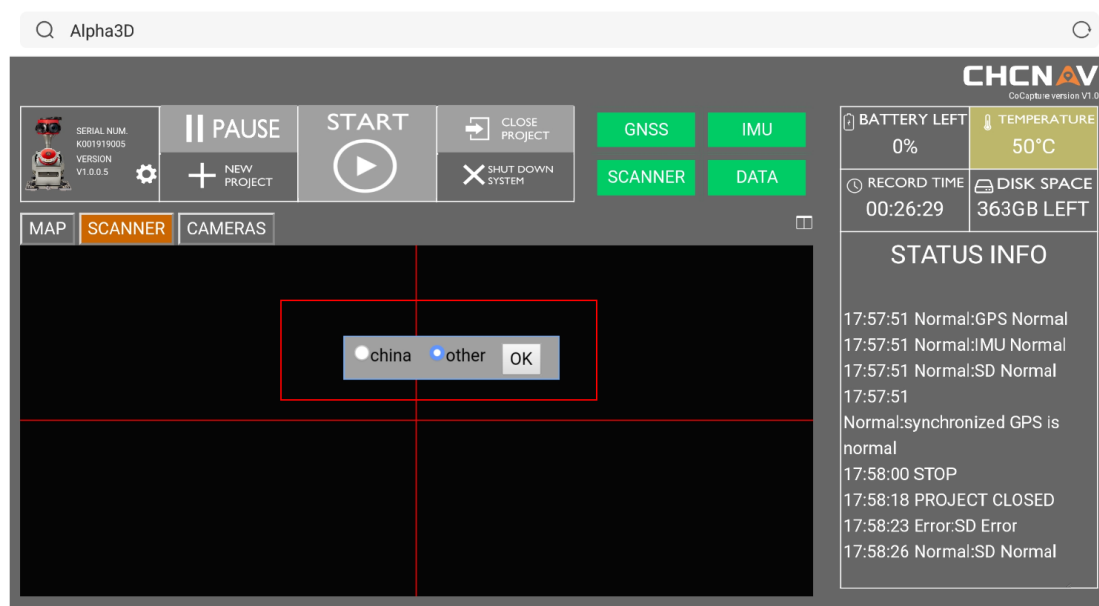
LASER: It's used to set parameters of laser scanner include line speed and pulse frequency. For line speed, there are 25 gears can be selected between 10-200. For pulse frequency, there are 7 gears can be selected: 50KHz, 100 KHz, 200 KHz, 300 KHz, 380 KHz, 550 KHz, 1000KHz. Select optimal parameter based on different requirements. Click **OK** to save when finish setting. Click **CANCEL** will exit this window without any changes.

TRAJECTORY: It's used to manage real-time trajectory. Click **import** will list all saved kml files before.

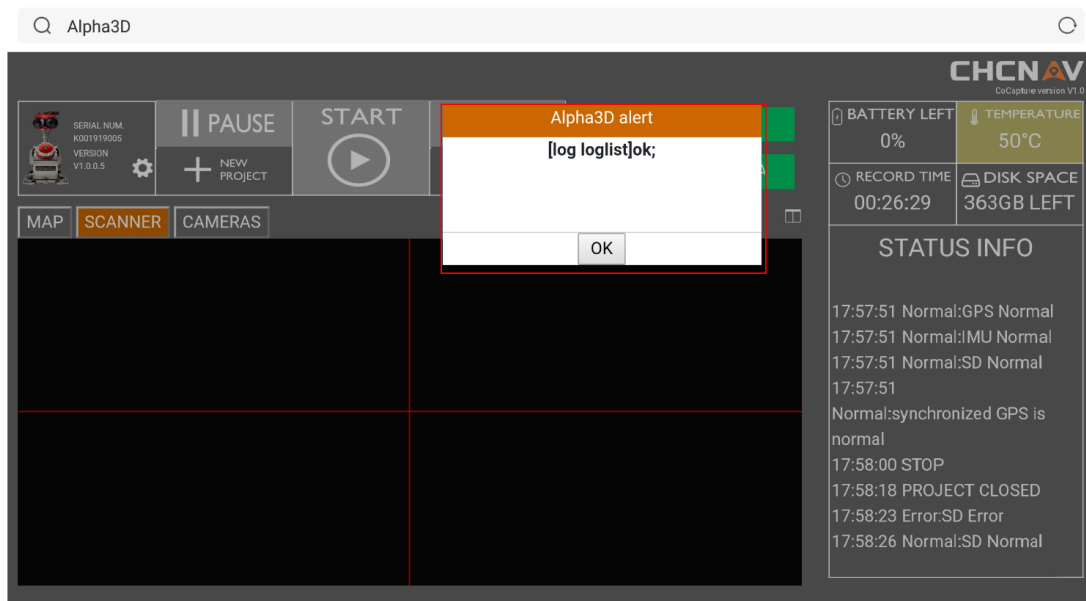
Click **save** will save opened real-time trajectory as a kml file. In below prompt box, input a file name and click **OK** to save trajectory for next time use.



AREA: It's used to set region of project. Click **AREA** and it will show China and other. If this setting is wrong, the trajectory on the map will be offset.



SERVICE: It's used to set NovAtel board card parameters. Please write needed command under **setboard** folder in D disk.

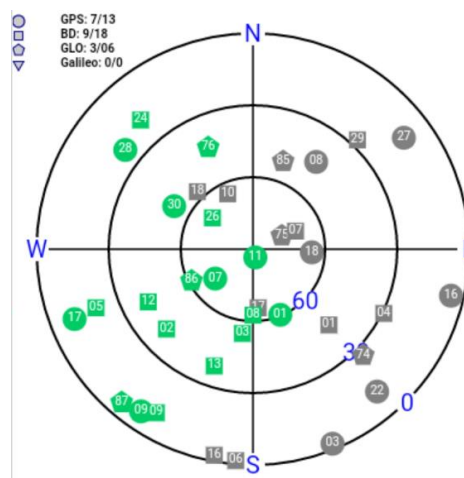


5.1.2.2 GNSS, IMU, SCANNER, DATA Status

Red represents error, green represents normal and yellow represents warning.



Click **GNSS**, it will show a detailed satellite map which includes type, number and status. If satellite number is less than 3, it will show yellow; If satellite number is 0, it will show red.

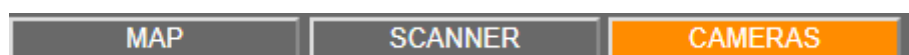


Click **DATA**, it will pop up below interface which shows trigger mode, imu temperature, miss number of pictures, number of pictures and laser data size.

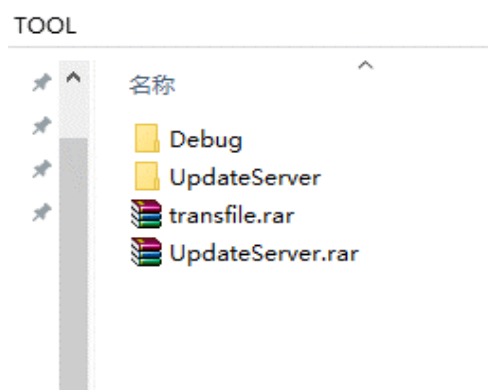
```
Trigger Mode:Internal
imuTemp:58°C
MissNum:0
LadybugNum:2016
LaserSize:19GB506MB
```

5.1.2.3 Viewer Interface

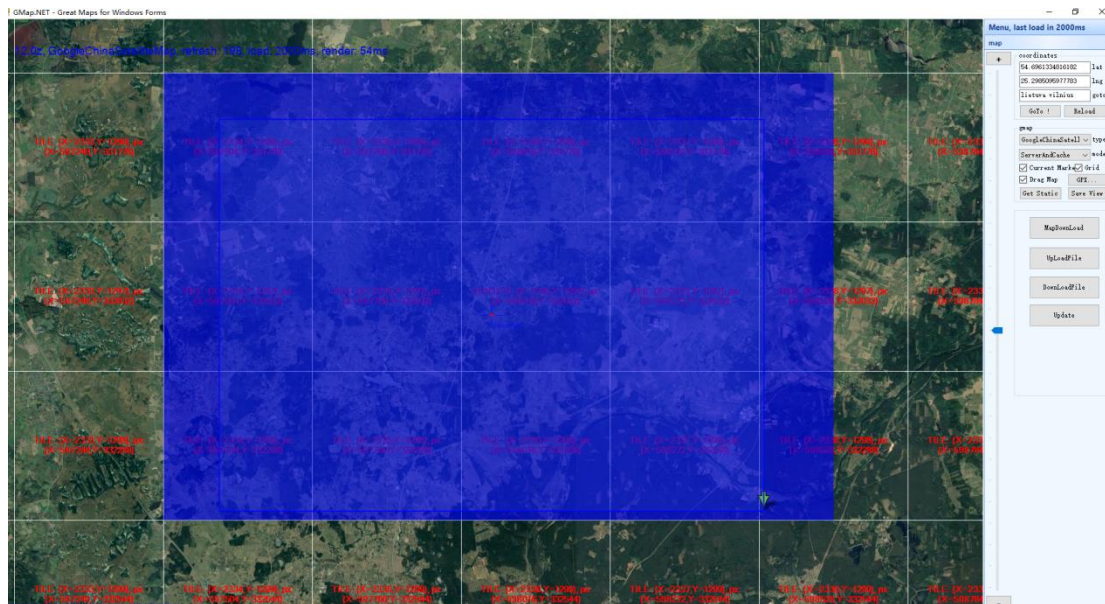
CoCapture supports three viewer interfaces: map, scanner and cameras. Click below icons to switch to corresponding interface. This icon will present orange.



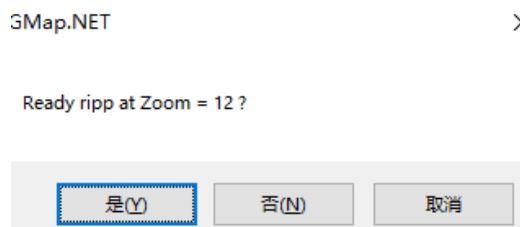
- Map download & upload:



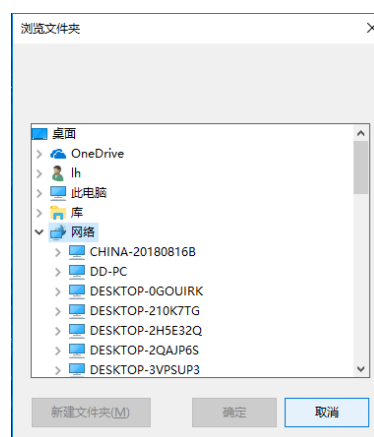
Open **TOOL** folder in **D** disk of device. Move **transfile** to own computer and **UpdateServer** to device computer. Add **UpdateVersion.exe** to startup. First, set up sharing between the tool directory and device server directory. Then, open **Demo.WindowsForms.exe** which stored in Debug folder after **transfile** extracted.



Enter **SHIFT** and click left mouse to draw a rectangle contains areas which you want to download. Then, click “**MapDownload**” icon on right to start download. In the following pop-up prompt box, choose whether to download current map layer first. The local storage path is GisMap directory which under current tool directory. Click **YES** to download current layer; Click **NO** to pass current layer; Click **CANCEL** to exit download.



Click “**UploadFile**” to upload map which will pop-up path selection box:



Click **INTERNET** and choose local shared path, click **OK**. Then choose the catalog server of

device and click **OK**, the map will upload to device. Attention, when you click “**DownloadFile**” to start download, first choose server path and then choose local path.

5.1.2.4 Status Information Display Bar

This display bar shows operate & status information, and all information will be recorded into log file. From left to right and from top to bottom, the display shows battery power level, maximum temperature of device, recording time and rest disk capacity. If current voltage is less than 21V, the background color will present red and should stop working.

 BATTERY LEFT 80%	 TEMPERATURE 41°C
 RECORD TIME 00:03:45	 DISK SPACE 794GB LEFT

TEMPERATURE shows environment temperature of device. If environment temperature is higher than 45°C, the background color shows faint yellow; If environment temperature is higher than 55°C, the background color shows red and scanner should stop working.

 TEMPERATURE 49°C	 TEMPERATURE 57°C
---	---

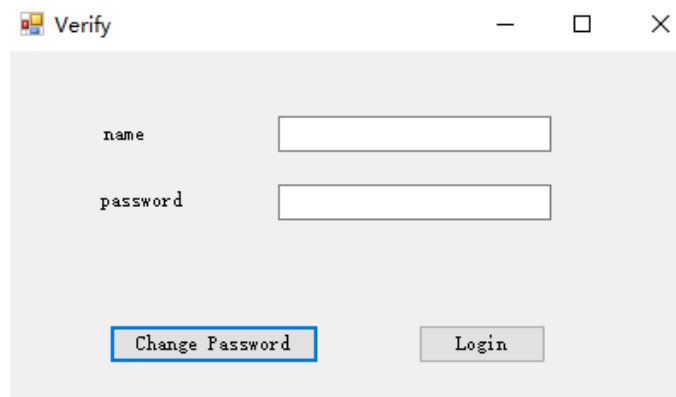
Below is the information display area which will show operate and status information, meanwhile, CoCapture will automatically save this information in log file.

STATUS INFO
10:15:58 Normal:GPS Normal
10:15:58 Normal:IMU Normal
10:15:58 Normal:SD Normal
10:15:58
Normal:synchronized GPS is normal
10:16:43 saveTrigger
10:16:55 CREATE PROJECT
10:19:56 START

5.1.3 CoCapture Version Update

Click **“Update”** to update version. Version update needs to input username and password. Default username and password are both **123**. It can be changed after login in successfully.

If you forget your username and password, you can also use superuser account to login in. Default super username and password are both **123** but it cannot be changed. Click **UPDATE** to pop-up below prompt box:

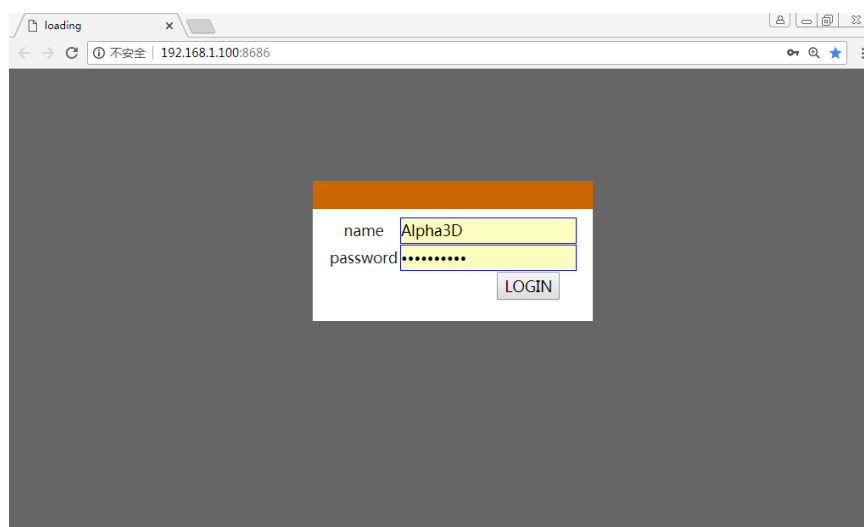


A dialog box titled "Verify" with a close button (X) in the top right corner. It contains two input fields: "name" and "password". Below the "password" field, there are two buttons: "Change Password" (highlighted with a blue border) and "Login".

Input username and password and then click **“Login”**. After login in successfully, select the procedure of local shared path and then click **“OK”** to finish update.

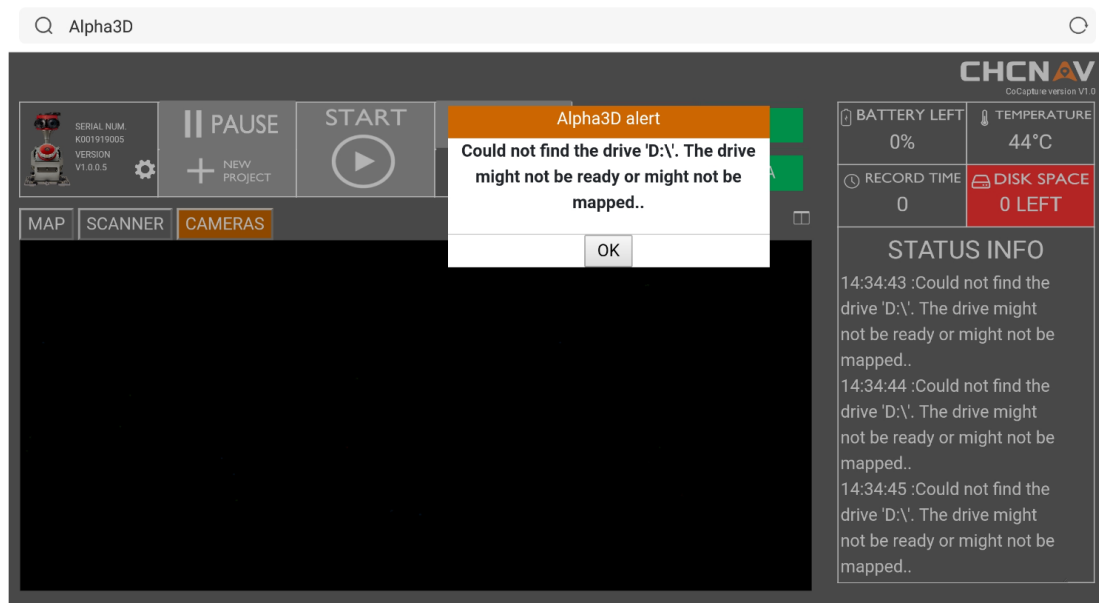
5.1.4 CoCapture Quick Guide

Power-on Alpha3D first and wait about 3 minutes until unit's Wi-Fi signal appeared. Then, connect tablet with unit's Wi-Fi signal and enter IP address **192.168.0.100:8686** in browser. Enter name **“Alpha3D”** and password **“CHCAAlpha3D”** to log in.

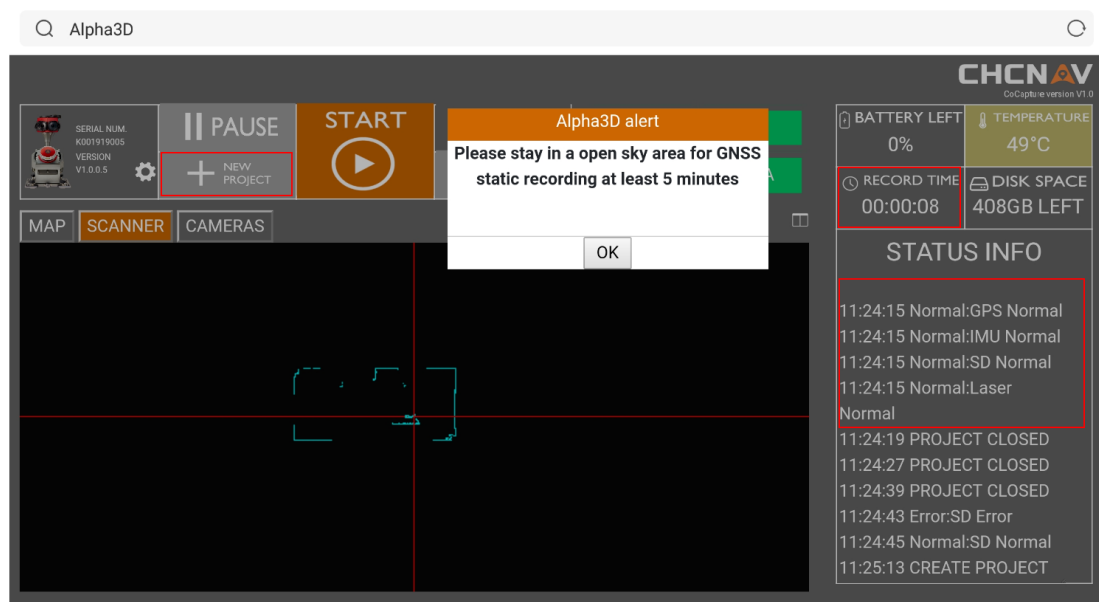


A screenshot of a web browser window showing a login page. The address bar displays "192.168.0.100:8686". The page has a dark gray background. In the center, there is a white login box with an orange header. Inside the box, there are two input fields: "name" (containing "Alpha3D") and "password" (containing "*****"). Below the password field is a "LOGIN" button.

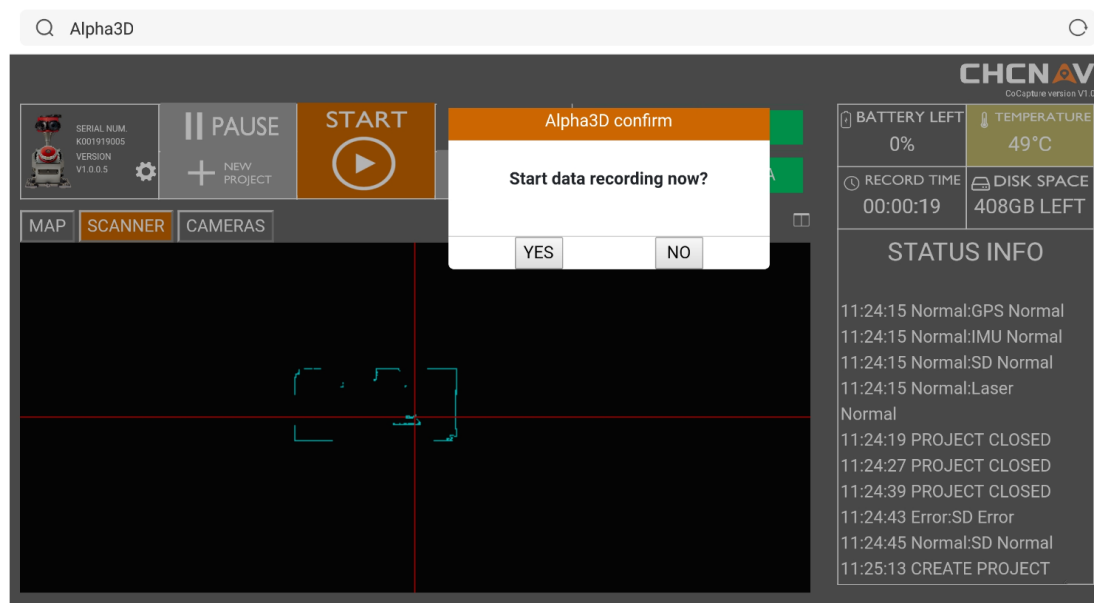
Notice: If the SSD drive is not plug in, the interface will show **Alpha3D alert** and **DISK SPACE** changes to red, and the project will can not be worked.



Check all functions are in normal and start work. First step is click **NEW** to create a new project and **RECORD TIME** on the right side will start to count. The interface will show an Alpha3D alert which shown in below:



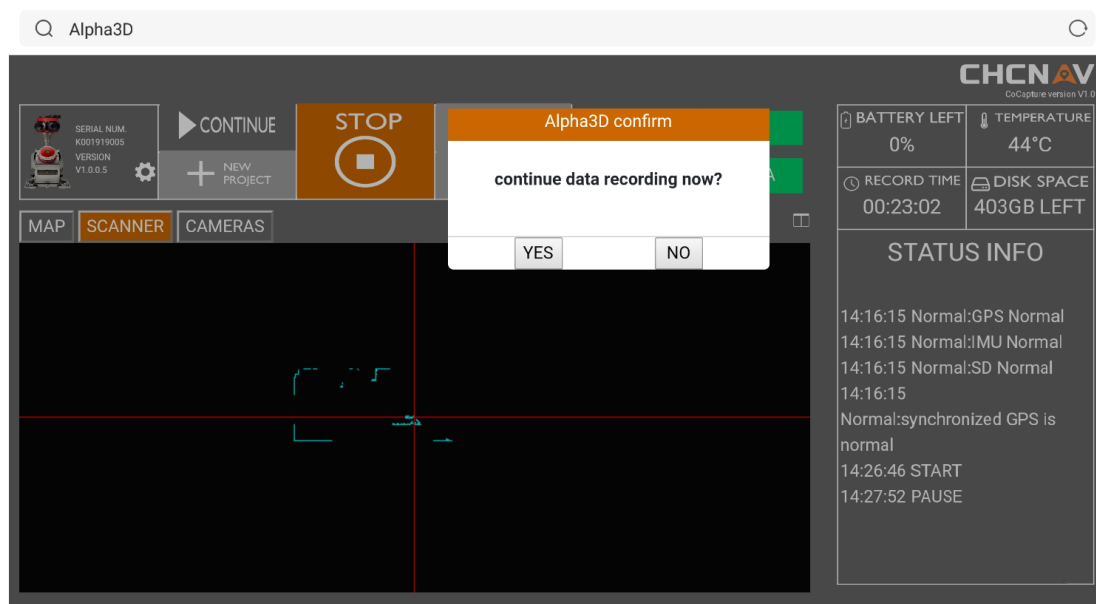
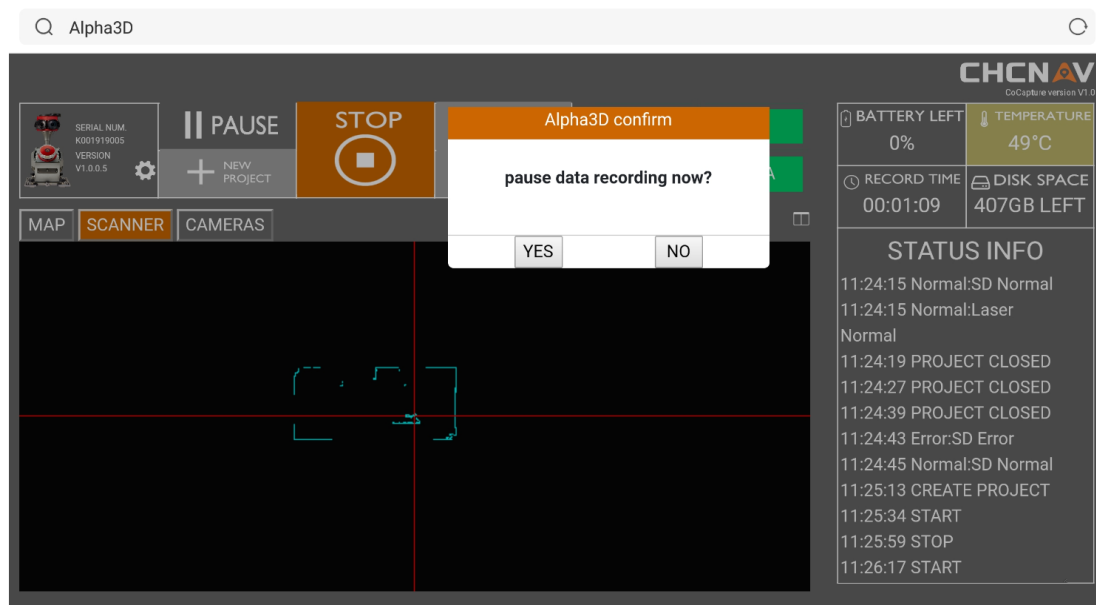
After both static & kinematic alignment of IMU finished, click **START** to turn on laser scanner and a prompt box will be appeared which shown below. Finally, click **YES** to start data capture.



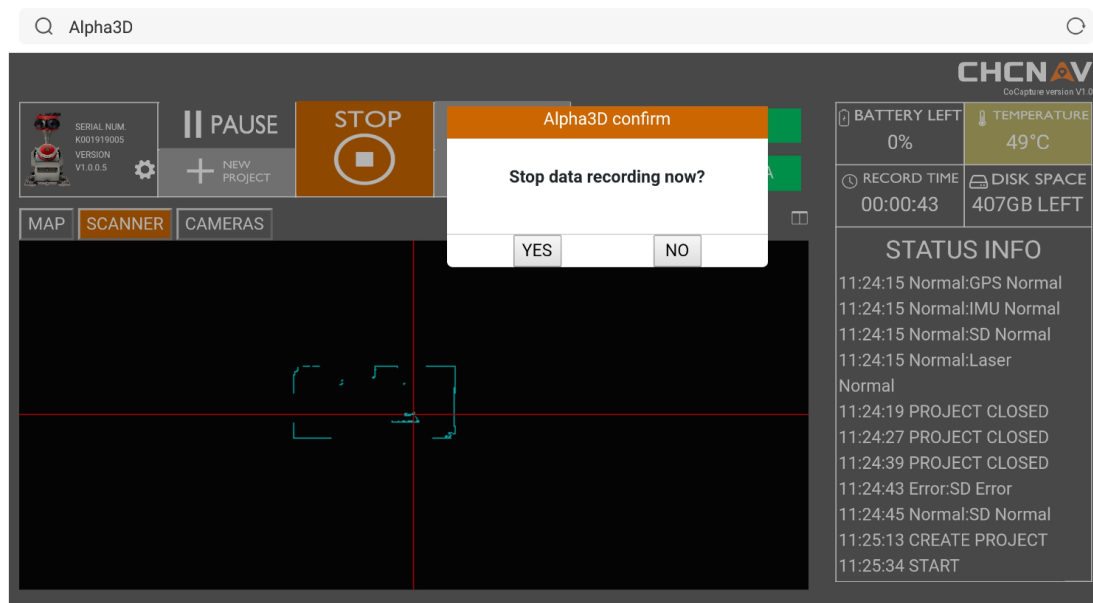
After click **START**, a gif will be appeared which represent scanner is start work and the button will change like below:



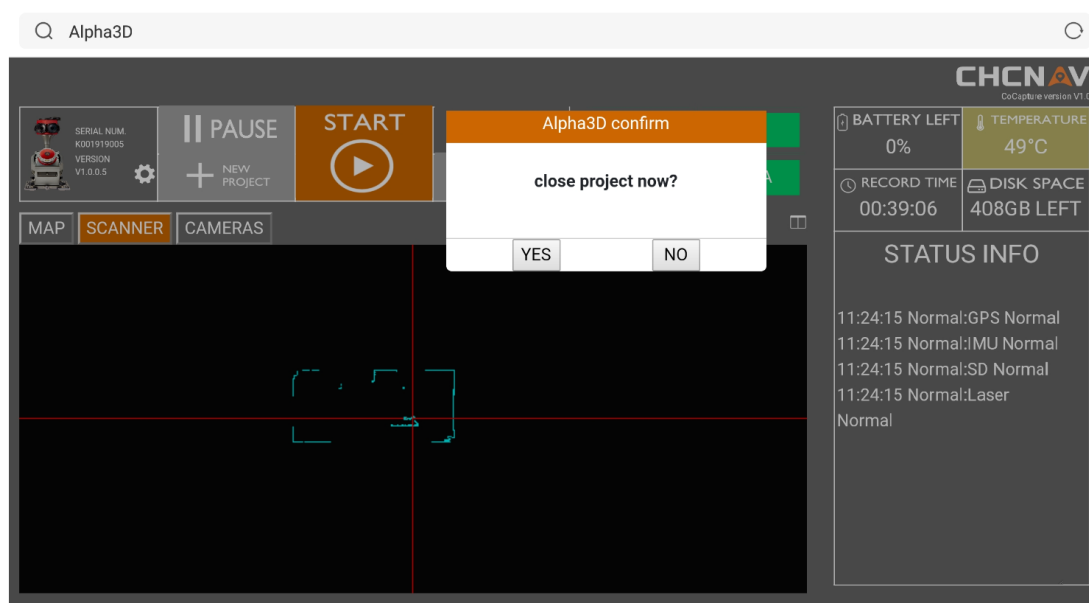
During data capture process, if vehicle faces red light or traffic jam need to stop, the **PAUSE** button can be chosen to click which can stop data recording (scanner still work); When it can be captured normally, click **CONTINUE** to keep capture.

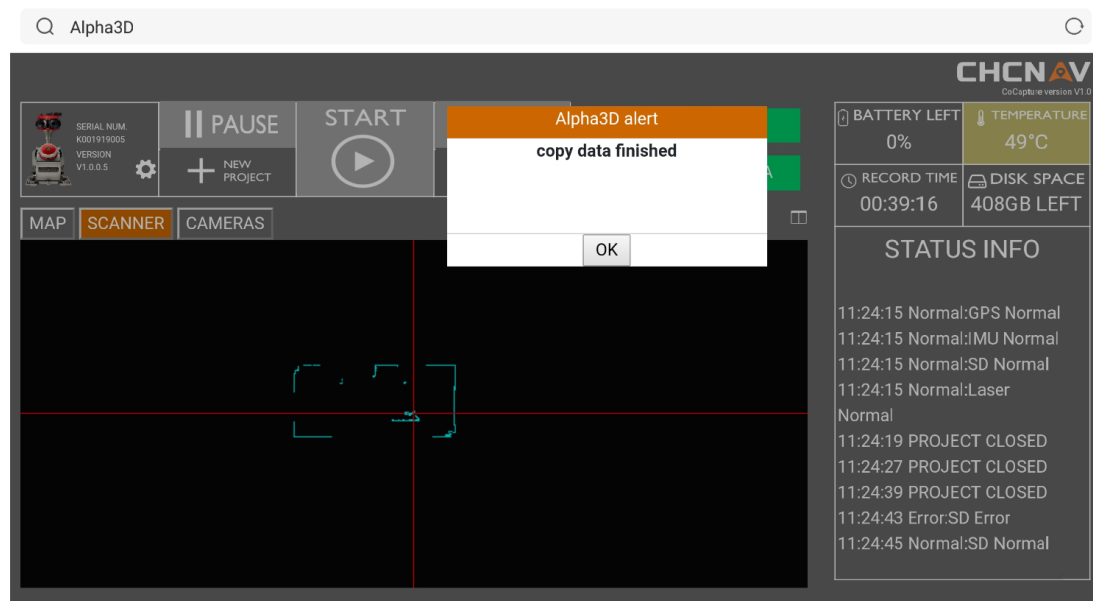


When capture is finished, click **STOP** to stop laser data capture and the interface will shown as below. The laser scanner is stop working now and the button changes to **START**. If you want to continue collection, click **START** again, a new rpx file will be generated under project folder. **Notice:** The laser data is not segmented if click **PAUSE** during capture and only one rpx file exits under project folder.

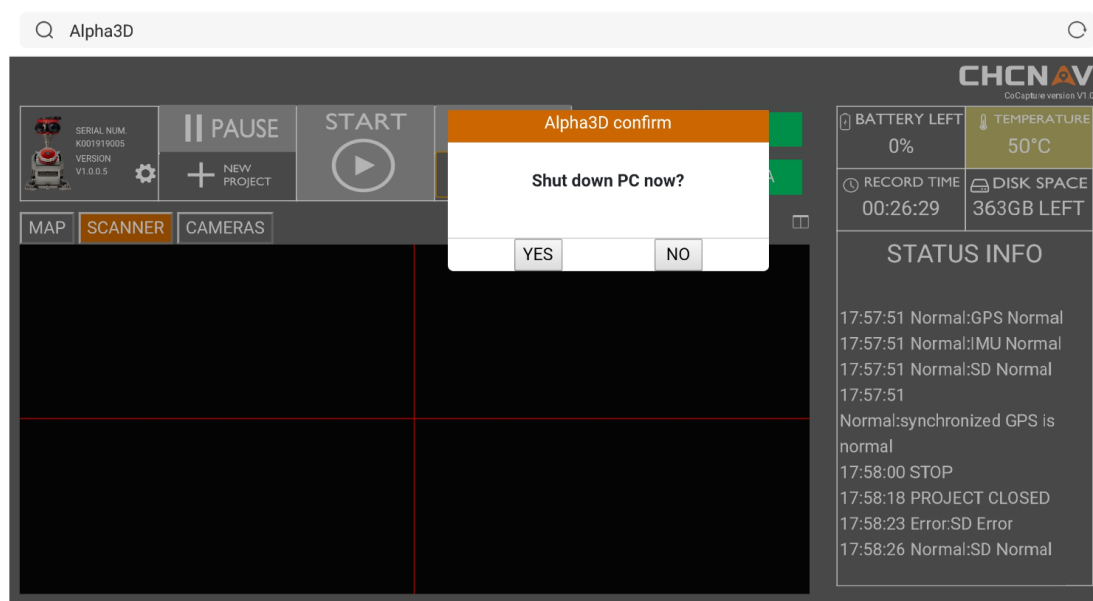


After final static & kinematic alignment finish, click **CLOSE PROJECT** and the unit will automatically copy I, S, T files under **ROVER** folder. During this process, it is normal that **DATA** button may become red. When copy is finished, the interface will be shown as below which represents data capture successfully.





After work is finished, click **SHUT DOWN SYSTEM** to power off scanner. After 2 minutes the PC will automatically shut down. Finally, short press unit power button to turn off unit system.



5.2 Inertial Explorer - GNSS + IMU Post Processing Software

5.2.1 Inertial Explorer Overview

Inertial Explorer is a powerful GNSS combine IMU post processing software which belongs to NovAtel's Waypoint Product Group which offers GNSS post-processing software package. Both loosely coupled (LC) and tightly coupled (TC) are supported for both single and multi-base differential and Precise Point Positioning (PPP). Inertial Explorer has a friendly Windows based Graphical User Interface (GUI) and use the same precise GNSS processing engine.

In Alpha3D solution, Inertial Explorer is an important software which used to combine GNSS data and IMU data from both base and rover. It will generate trajectory and POS files which can be use in CoPre (See 5.3) for further point cloud data processing.

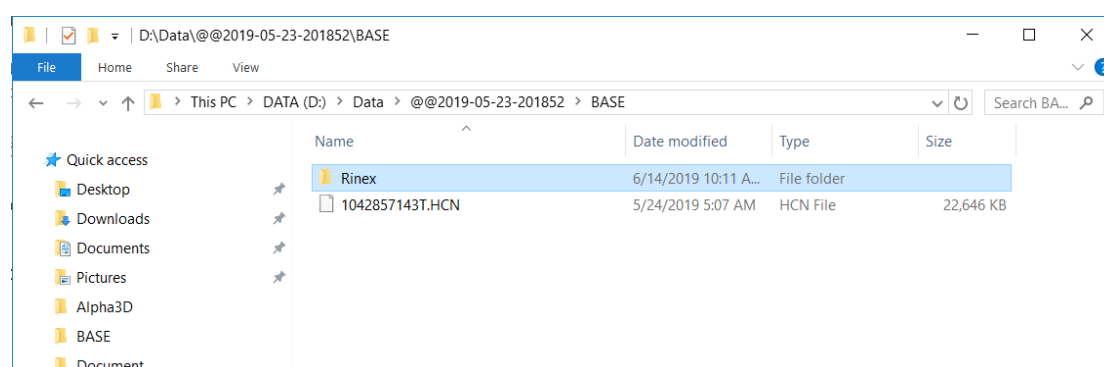
5.2.2 Inertial Explorer Quick Guide

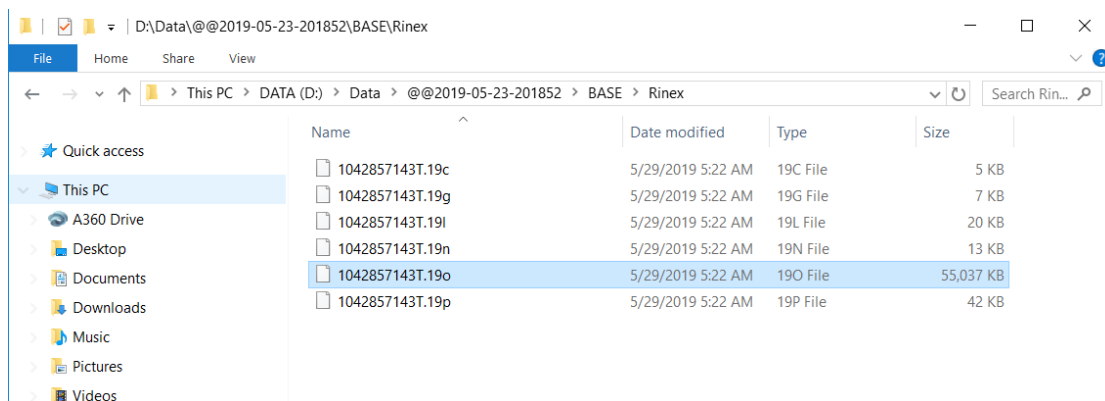
5.2.2.1 Pre-prepared

Before start using Inertial Explorer, please collate all data files into right folder for further convenience. Take an Alpha3D project folder as example:

■ BASE:

This folder contains base station files which copied from base receiver or download from CORS station. Generally, we need Rinex format data as it can be read by Inertial Explorer (**xxxx.xso** file). If base data is other formats, please convert it into Rinex format first. (For example **HCN** file)





■ CCD:

This folder contains panoramic picture data. For Alpha3D, the panoramic picture data will be saved in **ladybug** folder automatically. Other folders are useless as they were designed for other LiDAR systems.

