



CHCNAV AlphaUni 900

User Manual



Mobile Mapping | June 2020

Make your work more efficient

Table of Content

Table of Content.....	2
1 Reading Tips.....	4
1.1 Copyright.....	4
1.2 Symbol Description	4
1.3 Recommendations	4
1.4 Service & Support	4
1.5 Disclaimer.....	4
2 Using Requirements	6
2.1 Using Environment.....	6
2.2 Tips Before Using.....	6
2.3 Tips During Using	6
2.4 Tips After Using	7
3 Product Overview.....	8
3.1 Product Introduction.....	8
3.2 Product Component.....	9
3.2.1 Configuration List	9
3.2.2 Instrument Container.....	10
3.2.3 Orange Battery Container	11
3.3 Product Details.....	11
3.3.1 AlphaUni 900 Hardware	11
3.3.2 Physical Characteristics	12
3.3.3 Electrical Characteristics	12
3.4 Primary Sensor Introduction	13
3.4.1 VUX-1UAV Laser Scanner	13
3.4.2 High-precision IMU	13
3.4.3 AT312 Antenna	14
3.5 Multi-platforms Introduction	14
3.5.1 Airborne Platform	14
3.5.2 Vehicle Platform.....	15
3.5.3 Vehicle Platform with Ladybug5+	18
3.5.4 Backpack Platform.....	19
4 Battery Container Overview.....	20
4.1 Battery Container Introduction	20
4.1.1 Battery Container Components	20
4.1.2 Orange Container Port	21
4.1.3 Controller Box Port.....	22
4.2 Functional Specification	23
4.2.1 Orange Container Function.....	23
4.2.2 Controller Box Function	25
4.3 Electrical Parameter	27

4.3.1	Battery Parameters	27
4.3.2	Charger Parameters	27
4.4	Operation Instruction.....	28
4.4.1	Battery Installation Steps	28
4.4.2	Containers Assemble Steps	31
4.4.3	Charge Steps.....	33
4.5	Common Problems & Solutions	34
5	Product Using.....	35
5.1	Advance Preparation.....	35
5.2	Equipment Installation	35
5.3	Cable Connection	35
5.4	LiDAR Power On	35
6	Capture Operation Instructions.....	36
6.1	Remote Controller Unit	36
6.1.1	Controller Interfaces	36
6.1.2	Initialization Interface Description	37
6.1.3	Main Display Interface	38
6.1.4	System Setup Interface	41
6.1.5	Laser Settings	42
6.1.6	Capture Process	43
6.2	Data Copy	43
6.2.1	Manual Copy	43
6.2.2	Automatic Copy.....	44
6.2.3	Data Structure	46
7	LiDAR Turn Off.....	47
8	Frequently Asked Questions	48
9	Matters Need Attention.....	49
9.1	Important Notes.....	49
9.2	Product Transportation	49
9.3	Using Notes	50
9.4	Storage Notes.....	50

1 Reading Tips

1.1 Copyright





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1.2 Symbol Description

-  Forbid
-  Warning
-  Important note
-  Operate & Using tips

1.3 Recommendations

CHCNAV provides below documents for user:

- AlphaUni 900 multiplatform LiDAR user manual

It is recommended for user to read above documents before first time using.

1.4 Service & Support

CHCNAV website: www.chcnav.com

Email: sales@chcnav.com | support@chcnav.com

Tel: +86 21 542 60 273 | Fax: +86 21 649 50 963

1.5 Disclaimer

- The customer should use and maintain the equipment in accordance with the requirements of the manual. If the service life of equipment is affected due to improper use or maintenance, even broken, CHCNAV will not bear the relevant responsibility. All repairs and maintenance services resulting from this will be charged at standard prices.
- The customer should provide a stable vehicle roof rack in accordance with the

requirements of the technical indicators. If the equipment is broken or damaged due to 3rd brand's reason, CHCNAV will not bear the relevant responsibility.

- During the transportation, if the equipment is damaged due to improper logistics operation, CHCNAV will not bear the relevant responsibility.
- During equipment using time, if customer disassembles and assembles the equipment without CHCNAV's suggestions & permission, and resulting in damage, CHCNAV will not bear the relevant responsibility.
- Customer should use default batteries and accessories. If use non-dedicated batteries, the charger may cause unexpected situations like explosions, fires etc. The use of non-original accessories is not eligible for warranty; if occur accident, the manufacturer will not bear the corresponding responsibility.

2 Using Requirements

2.1 Using Environment

- It is not recommended to use in rainy, snowy, or foggy weather for safety. Also the point cloud data will have more noise.
- It is not recommended to frequently use in dusty environment, which will affect the service life of equipment.
- It is forbidden to expose the device and accessories under extreme temperature. The environment temperature must not be lower or higher than the specification temperature.
- When the equipment is transferred from a cold environment to a warm environment, water may condense on certain components inside the scanner. To avoid this, it is recommended to place the scanner in a sealed plastic bag before transferring. When the condensate is evaporated, then turn on the plastic bag.

2.2 Tips Before Using

- Check whether the laser glass is normal, if there is dust exist, please use the cleaning kit to clean it.
- Check whether the ports are clean, and whether the pins are normal.
- Check whether the connecting cables are reliable and stable, and whether the GPS cable is stable and normal.
- Check whether the remote controller has sufficient power.

2.3 Tips During Using

- When using, make sure that all cables and ports are connected correctly.
- After powered on, check whether the connection between remote controller and equipment is normal, and whether the status of tracking satellite and board is normal (the "A" icon in the CHCHAV logo on the upper left side of the controller will display orange which indicate the connection is normal, otherwise, the communication is abnormal if always show gray).
- Place equipment at an open sky area with good GPS signal during powered on.
- If the buzzer sounds abnormally during the capture process, please check immediately whether the equipment status is normal.
- Before start work, check the remaining capacity of the scanner memory card. If the remaining capacity is less than 10% or does not meet the current collection capacity

requirements, the laser data file need to be deleted in advance.

- Before start work, please check whether the controller's laser parameter settings are correct. If not correct, please reset it again according to the project requirements.

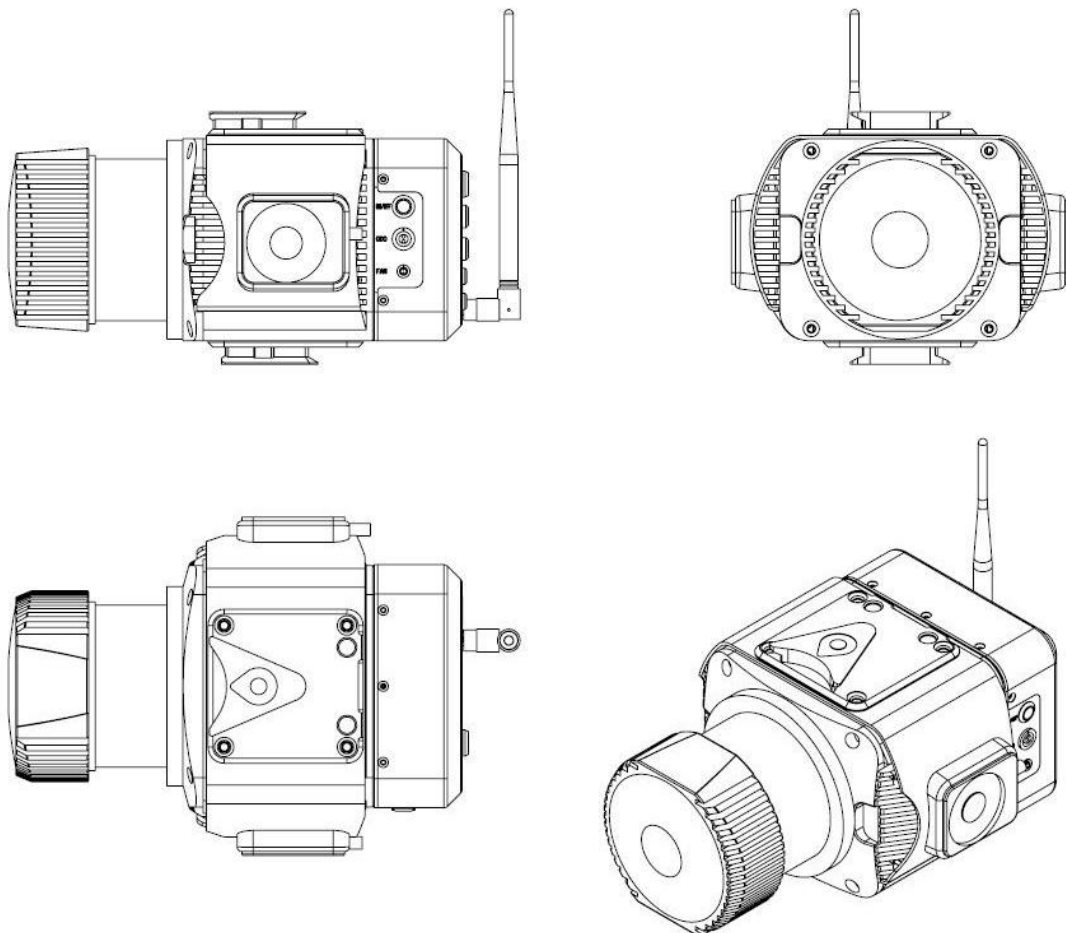
2.4 Tips After Using

- After using, unplug the cable first, then place the equipment into equipment case and accessories into accessory case.
- During transportation, take care the equipment and try to avoid bump.

3 Product Overview

3.1 Product Introduction

AlphaUni 900 is one of the most advanced multi-platform lidar measurement system in the field of photogrammetry and remote sensing. The system integrates one high-precision laser scanner and one inertial navigation system. Due to its small structure and light weight, it is suitable for data collection on various mobile platforms. As an advanced mobile measurement equipment which integrates various high-precision sensors, the AlphaUni 900 can quickly collect real-time 3D data on the surface of an object to achieve professional and efficient geographic mapping information. The product diagrams are shown below:



3.2 Product Component

3.2.1 Configuration List

AlphaUni 900 multiplatform LiDAR system configuration list is shown below:

N	Classification	Name	Model	Number
1	AlphaUni 900	LiDAR system	AlphaUni 900	1
2	Standard Accessories	Remote controller	RC-8	1
3		GPS antenna feeder		1
4		Indoor power supply line		1
5		CN power line		1
6		Data copy line		1
7		UNF antenna		2
8		8G USB flash		1
9		Softdog		1
10		Clean suits		1
11		Transport container		1
12		Standard Capture & processing Software	CoCapture	
13	CoPre			1
14	Airborne Standard Configuration	XT60 airborne power line		1
15		Airborne antenna		1
16		Airborne connection suite		1
17	Airborne Optional Configuration	AS-C240 camera system	AS-C240	1
18		AS-C420 camera system	AS-C420	1
19		Accessories container		1
20		BB4 Multi-rotor UAV	BB-4	1
21		KK4 Multi-rotor UAV	KK-4	1
22		KK6 Multi-rotor UAV	KK-6	1
23		X-C Fixed Wing UAV		1
24	Vehicle Standard Configuration	XT90 vehicle power line		1
25		Vehicle antenna		1
26		Vehicle connection suite		1
27		Panorama camera	ladybug5+	1

28	Vehicle Optional Configuration	Vehicle based panoramic platform	AS1300HL-Pano -set	1
29		Simple vehicle platform	Mag-mount	1
30		Vehicle extension platform	Roof rack extension	1
31	Other	Professional backpack	Backpack frame pro	1
32		Multiplatform backpack	Lidar backpack	1
33		22000mAh smart battery		2
34		PC520 charger		1
35		PC1080C charger		1
36		CoMapping		1
37		CoProcess V1.0		1
38		CoRefineV1.0		1
39		CoSurvey for CAD V1.0		1
40		CoPower V1.0		1
41		CoManager V1.0		1
42		Inertial ExplorerV8.7		1

3.2.2 Instrument Container



3.2.3 Orange Battery Container



3.3 Product Details

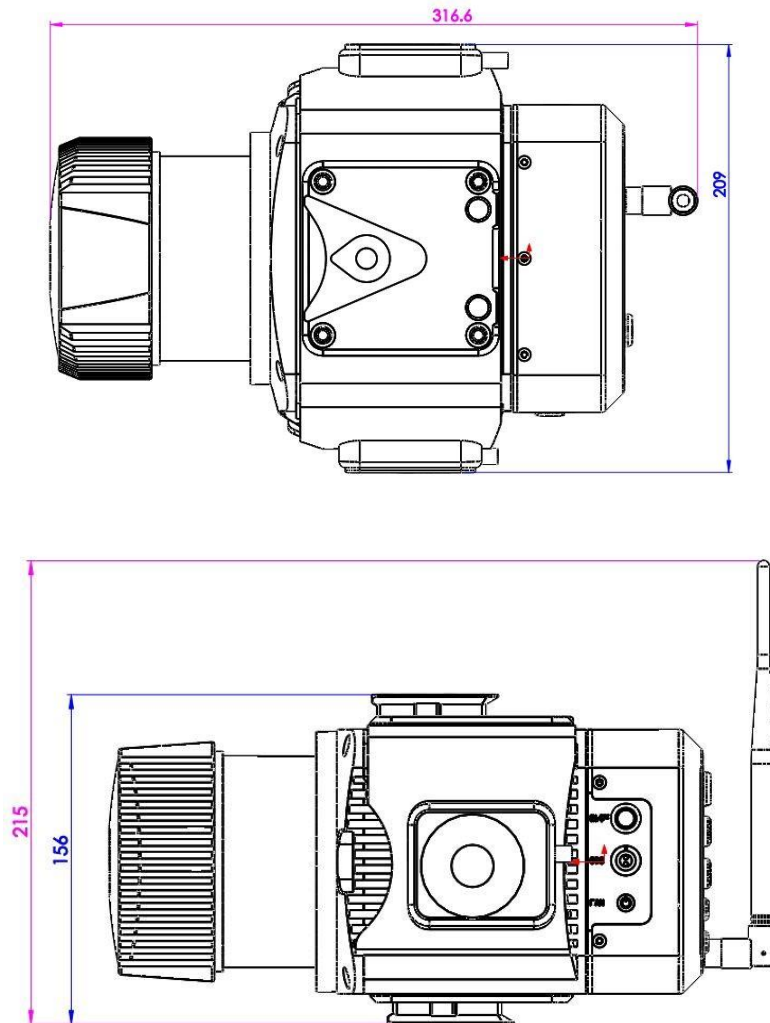
3.3.1 AlphaUni 900 Hardware



- ON/OFF: Power on or power off the instrument with green light.
- ODO: Wheel encoder interface.
- FAN: Fan connect interface.
- DC24V: Power interface with DC24V.
- CAMERA: External camera connect interface.
- DATA: Data copy interface.
- GNSS-S/GNSS-M: GNSS antenna interface, always choose GNSS-M.

3.3.2 Physical Characteristics

Instrument shape size	31.66*20.9*15.6 (cm)
Instrument weight	4.5 kg
Roof rack extension size	72*31*12 (cm)
Roof rack extension weight	16.6 kg



3.3.3 Electrical Characteristics

Input voltage	DC24V (11~32 V)
Rated power	75 W (Max)
Working temperature	-10 °C to +40 °C
Storage temperature	-20 °C to +50 °C
Humidity	<80%, non-condensation

3.4 Primary Sensor Introduction

3.4.1 VUX-1UAV Laser Scanner



Laser Pulse Repetition Rate PRR ¹⁾	50 kHz	100 kHz	200 kHz	300 kHz	380 kHz	550 kHz	
						full power	reduced power ²⁾
Max. Measuring Range ^{3) 4)}							
natural targets $\rho \geq 20\%$	550 m	400 m	280 m	230 m	200 m	170 m	85 m
natural targets $\rho \geq 60\%$	920 m	660 m	480 m	400 m	350 m	300 m	150 m
natural targets $\rho \geq 80\%$	1050 m	760 m	550 m	450 m	400 m	340 m	170 m
Max. Operating Flight Altitude AGL ^{1) 5)}							
@ $\rho \geq 20\%$	350 m (1150 ft)	250 m (820 ft)	180 m (590 ft)	150 m (490 ft)	130 m (430 ft)	110 m (360 ft)	55 m (180 ft)
@ $\rho \geq 60\%$	590 m (1940 ft)	420 m (1380 ft)	310 m (1020 ft)	260 m (850 ft)	230 m (760 ft)	190 m (620 ft)	100 m (330 ft)
Max. Number of Targets per Pulse up to ⁶⁾	15	15	13	9	7	4	4

¹⁾ Rounded values.
²⁾ Laser power optimized (reduced) for measurements of short ranges with high pulse repetition rate.
³⁾ Typical values for average conditions. Maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the max. range is shorter than under overcast sky.
⁴⁾ Ambiguity to be resolved by post-processing with RIMTA software.
⁵⁾ Flat terrain assumed, scan angle $\pm 45^\circ$ FOV.
⁶⁾ If more than one target is hit, the total laser transmitter power is split and, accordingly, the achievable range is reduced.

3.4.2 High-precision IMU

The standard update rate is 200Hz, but the option is up to 600Hz.

Orientation accuracy	0.01°
Attitude accuracy	0.005°
Positioning accuracy	≤ 1cm
Heading error	≤ 0.03°
Data updating rate	200 Hz
Weight	140 g

3.4.3 AT312 Antenna

The AT312 is a CHC designed versatile geodetic GNSS antenna which can meet multiple requirements of any land surveying, construction, and engineering applications.

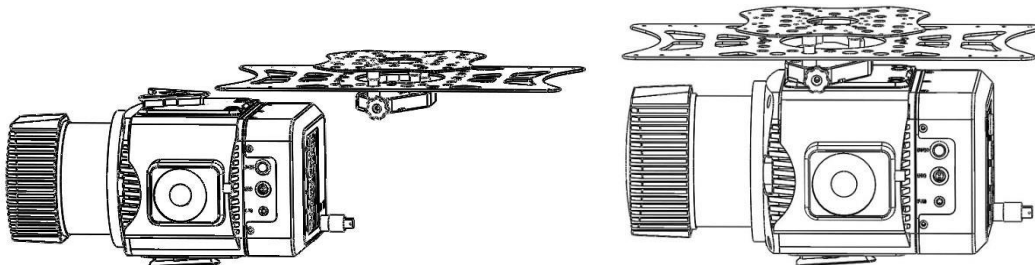
Signals tracking	GPS L1,2,5 GLONASS L1,2,3 BDS 1,2,3 Galileo
Dimensions	154mm*63mm (6.1in*2.5in)
Phase Center Accuracy	+/- 2mm
Working Temperature	-40° C to +85° C
Connector	TNC Female
Weight	450g

3.5 Multi-platforms Introduction

3.5.1 Airborne Platform

3.5.1.1 Airborne installation steps

- Push the slider of scanner into the quick-release clamp which on the bottom of the airborne load plate in the direction of the arrow until hear a fix sound.
- Tighten the side screw bolts to make it stable and finally finished the installation.



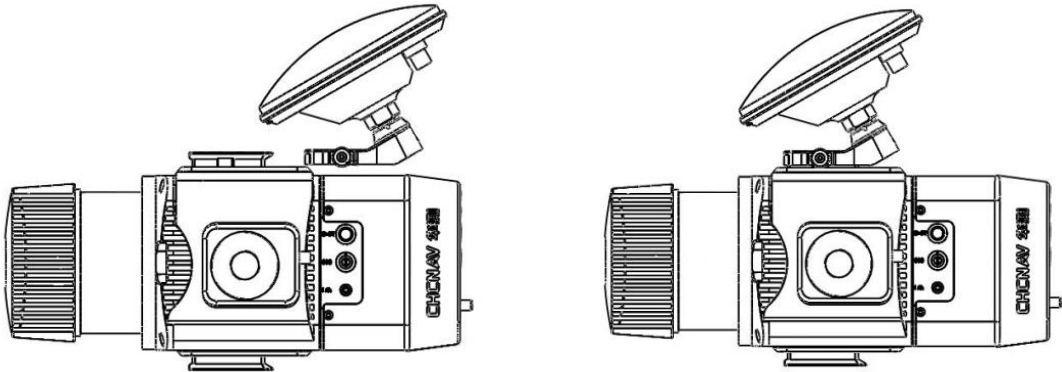
3.5.1.2 Airborne disassemble steps

- Hold the bottom of scanner with left hand and turn the handle bolt on the side of the quick release fixture counterclockwise with right hand until the threaded part of the handle bolt disengages.
- Pull the handle bolt back to the maximum position with the right hand and keep it. The left hand can translate the scanner to the head direction to complete the separation of the scanner and quick-release module.

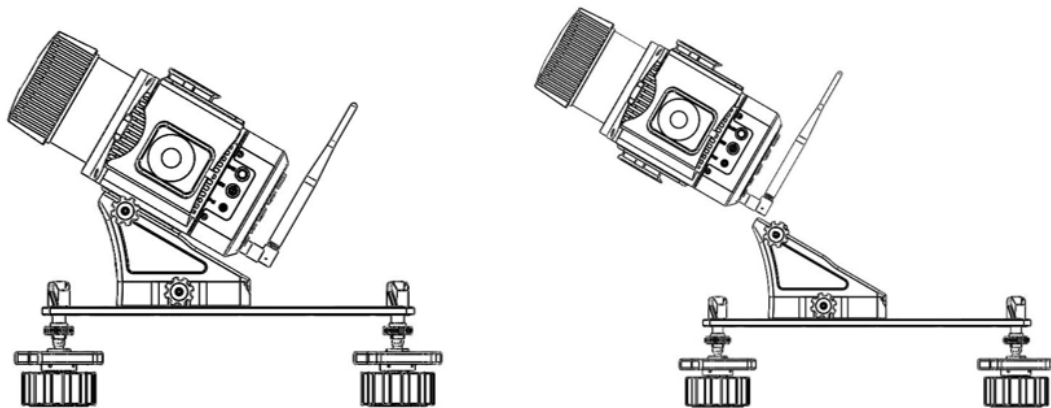
3.5.2 Vehicle Platform

3.5.2.1 Simple platform

- As shown in the figure below, push the antenna with the fixed fixture from the end of the quick-release slider which locate at the bottom of the scanner to the direction of scanner head. Tighten the bolt on the side handle of the antenna fixing fixture to complete the scanner and antenna fixing.



- Install the vehicle quick release platform at the proper position on the roof first, then push the bottom slider of the V-shaped groove of scanner until a sound is heard.



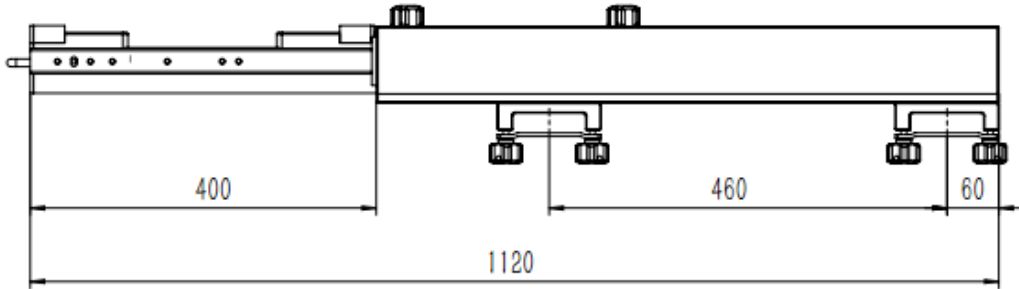
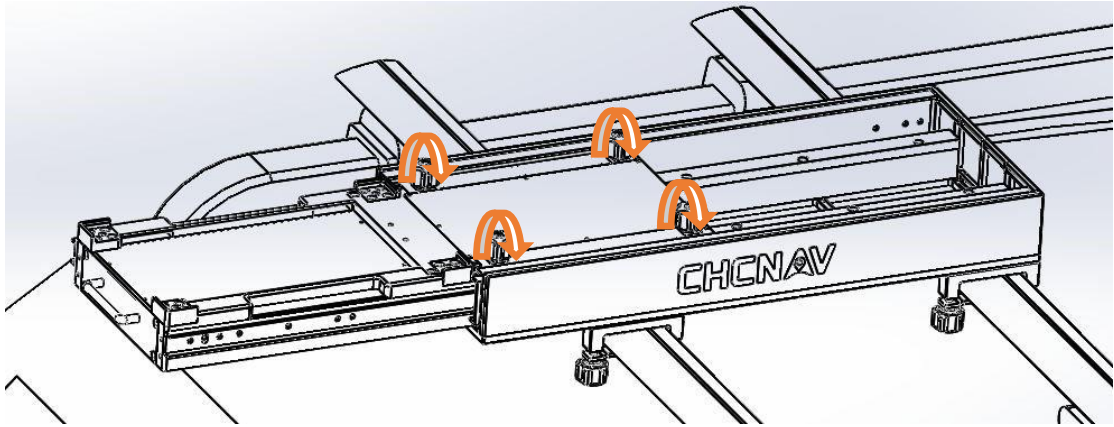
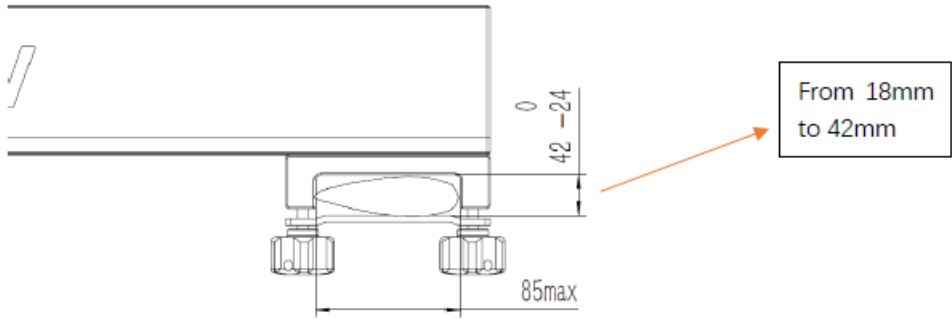
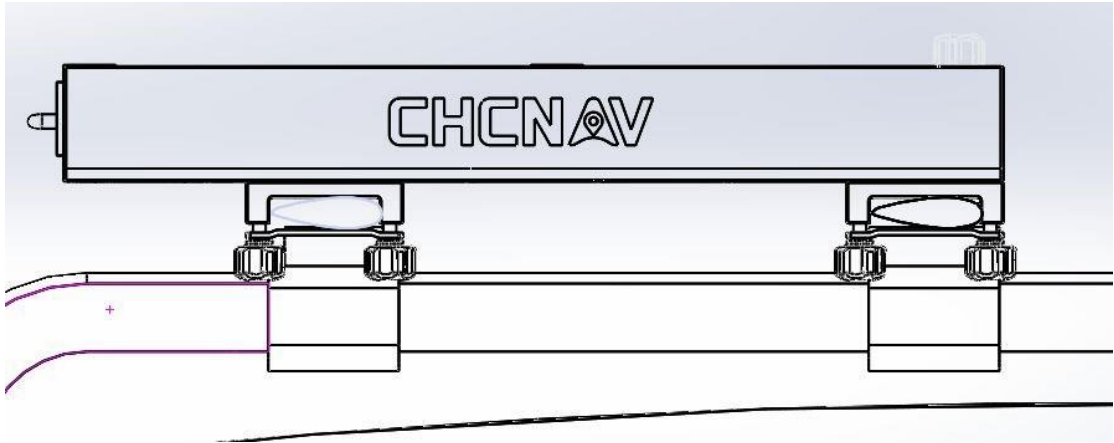
3.5.2.2 Extension platform

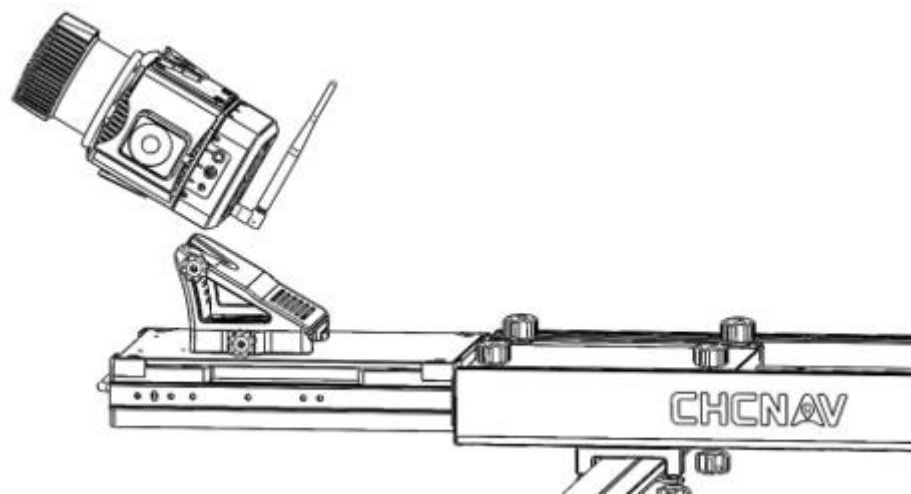
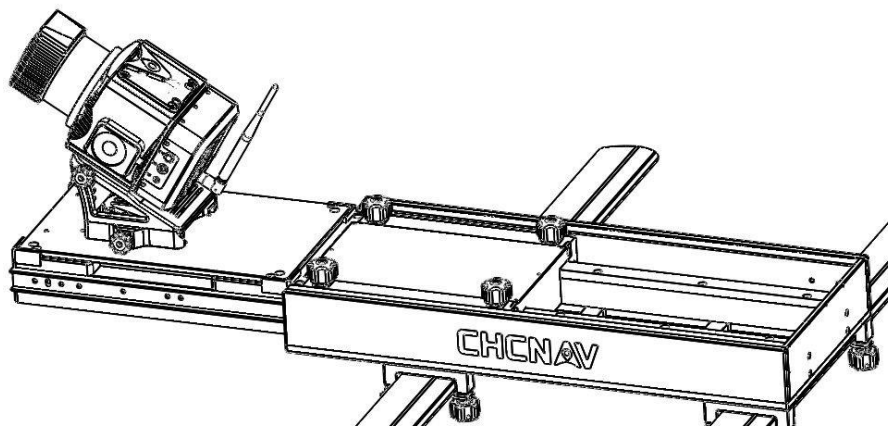
The roof rack extension platform is easy to assemble, and it also can easily solve “laser scanner is covered” problem.



The installation steps are simple: Firstly, using 4 manufacture standard M8 screws to fix roof rack and vehicle cross-bar (THULE brand is recommended). Then, unscrew the screws of roof rack and adjust the extension length. 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.







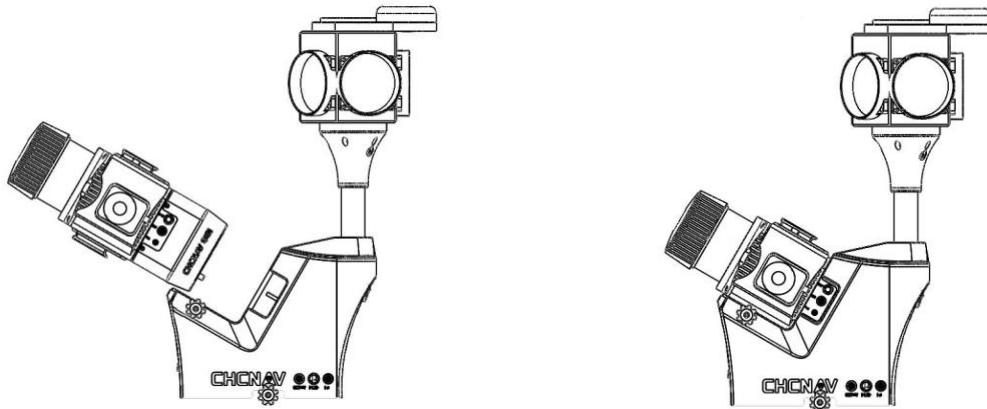
3.5.2.3 Vehicle disassemble steps

- Same with airborne platform disassemble steps, turn the handle bolt on the side of the vehicle platform counterclockwise until the threaded portion of the handle bolt is out of engagement.
- Pull the handle bolt to the maximum position with the left hand and maintain. Push the scanner diagonally upward toward the scanner head to complete the separation.
- The antenna removal method is the same as above.

3.5.3 Vehicle Platform with Ladybug5+

- As shown in the figure, push the scanner bottom slider into the quick-release platform with ladybug5 + in the direction of the arrow.
- Tighten the side screw until scanner is stable.
- Drag the bottom of the scanner with left hand and turn the handle bolt on the side of the quick release fixture counterclockwise until the threaded part of the handle bolt disengages.

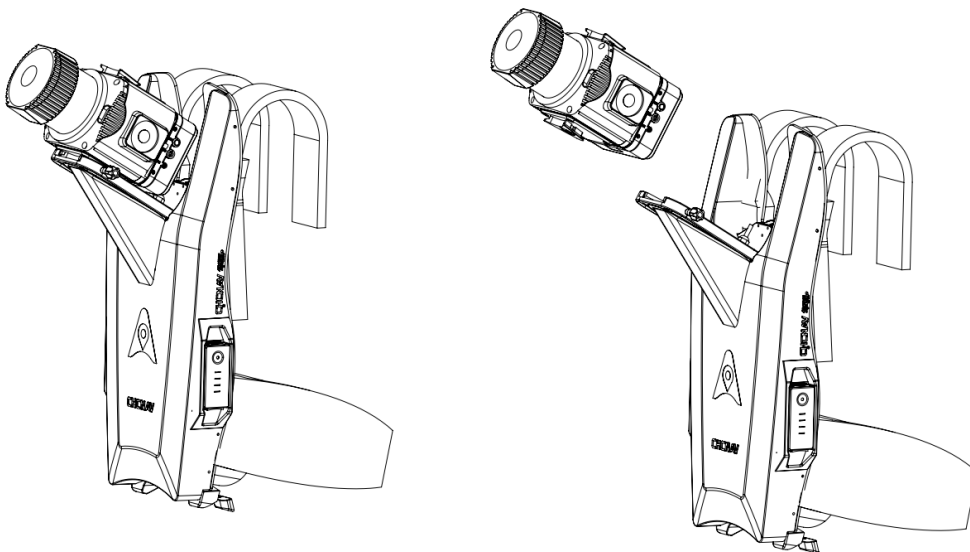
- Pull the handle bolt back to the maximum position with the right hand and keep it. The left hand can translate the scanner to the head direction until the separation complete.



3.5.4 Backpack Platform

3.5.4.1 Backpack install steps

Install the top slider of the scanner to the V-shaped chute of the backpack rod. Tighten the handle bolts on the side of the scanner to complete the installation.



3.5.4.2 Backpack disassemble steps

Pull the handle bolt to the maximum position with the left hand and maintain and twist the thumb screw with right hand until the threaded part of the handle bolt is out of engagement. Push the scanner diagonally upward toward the scanner head to complete the separation.

4 Battery Container Overview

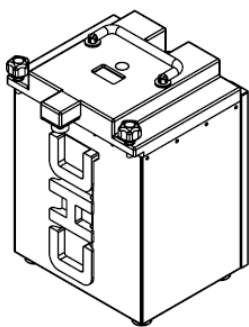
4.1 Battery Container Introduction

AlphaUni 900 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 container has following characteristics:

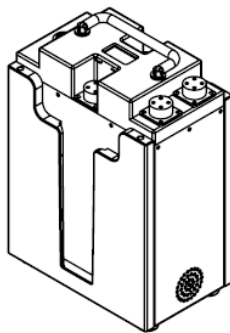
- Support hot plug for orange container during external power supply process.
- IP64 protection level.
- Support both lead-acid cell and lithium battery.
- Cable-less connection between orange container and controller unit.
- Support plenty functions such as low voltage alarm, anti-reverse connection, and overcurrent protection.
- The 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

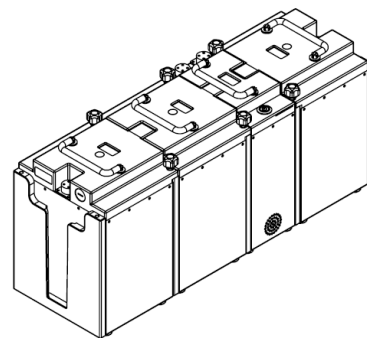
A set of AlphaUni 900 battery container has three components: orange container, controller box and battery charger.



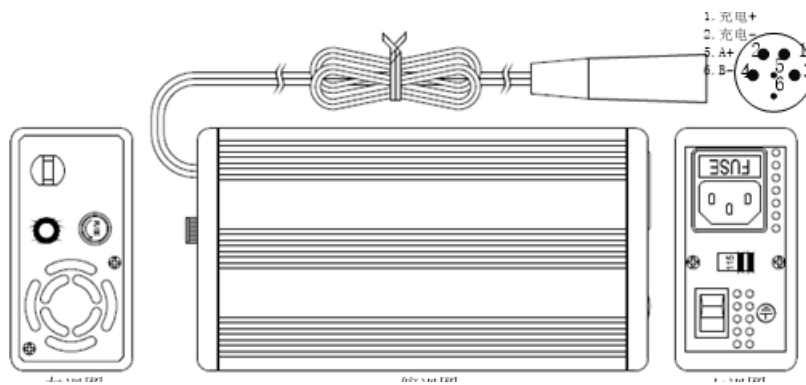
1. Orange Container



2. Controller box



3. A set of battery (3+1)

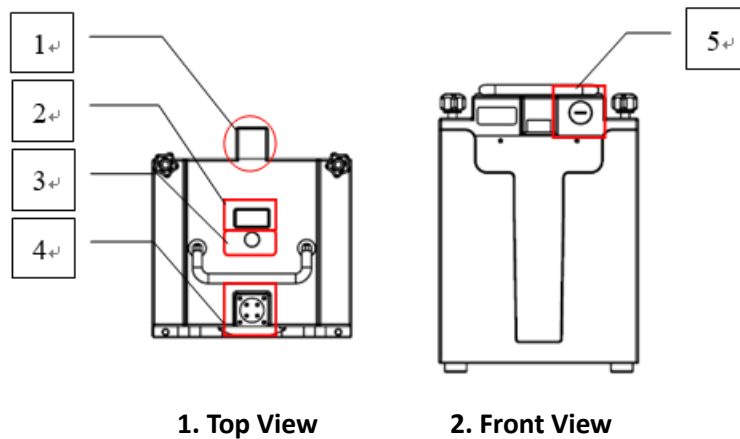


4. Battery Charger

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:

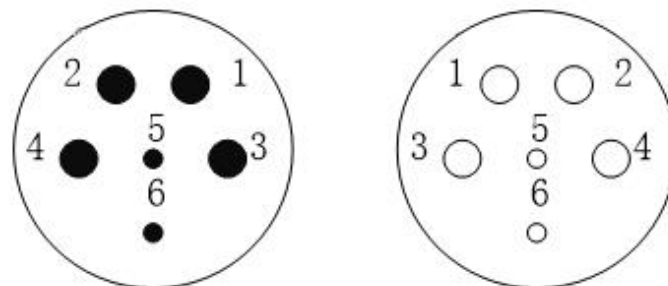
Number	1	2	3	4	5
Name	Output port	Display screen	Switch button	Input port	Fuse



1. Top View

2. Front View

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



1. Output port (Male head)

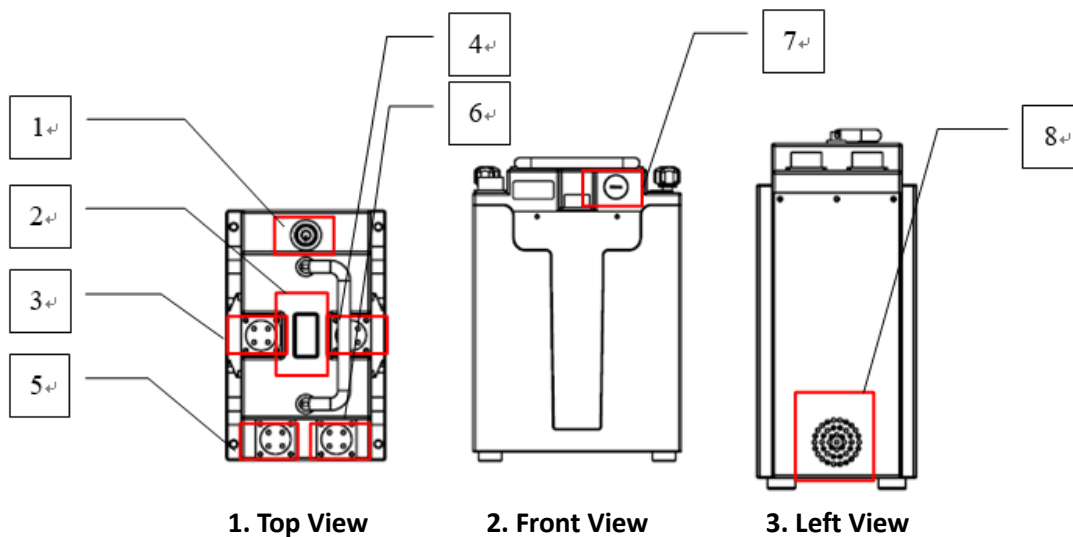
2. Input port (Female head)

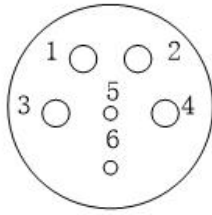
Number	1	2	3	4	5	6
Output Port Definition	/	/	Vout+	Vout-	RS485A+	RS485B-
Input Port Definition	Charge+	Charge-	Vin+	Vin-	RS485A+	RS485B-

4.1.3 Controller Box Port

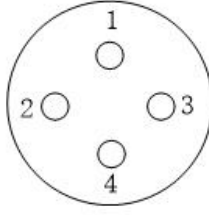
The top of controller box consists of seven parts: self-locking switch, display screen, input port 1, input port 2, 24V output port, 12V output port and fuse.

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

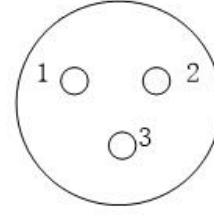




1. Input Port (female head)



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

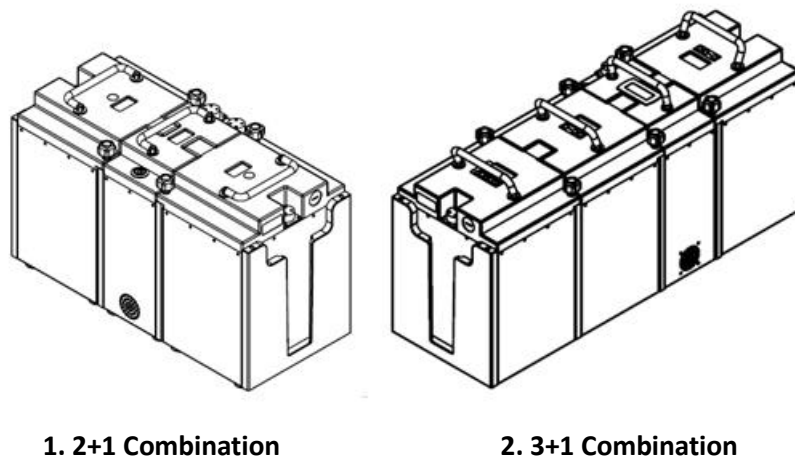
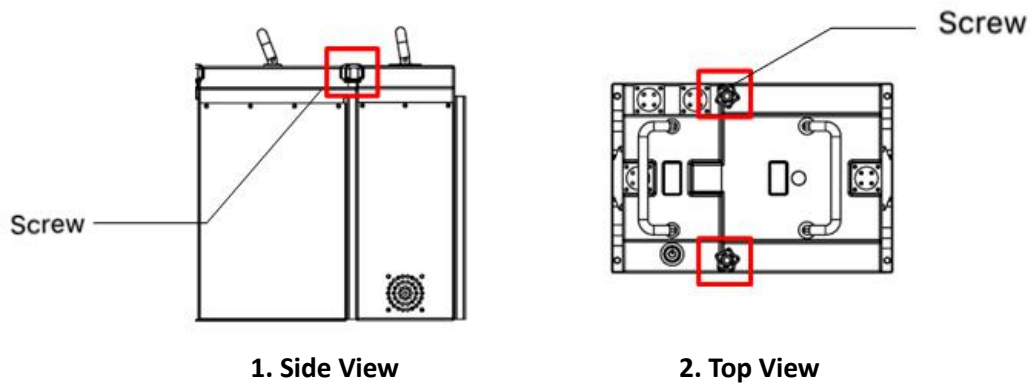
Under power-on condition, the orange container will continuously alarm if voltage below 10.5V. Short press switch button to turn off sound after alarm.

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.

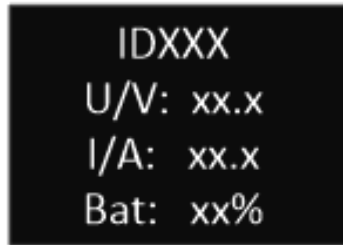
4.2.1.7 Orange Container Use

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 AlphaUni 900 which will have N orange containers charge time.



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.



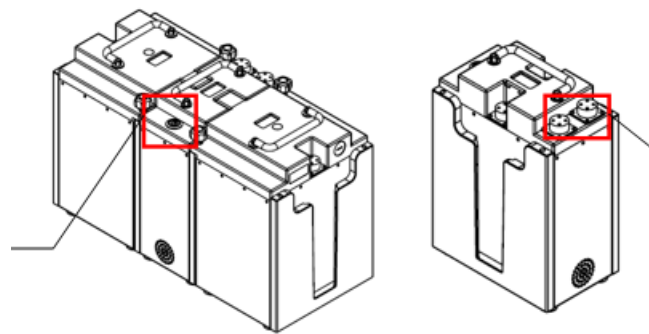
4.2.2 Controller Box Function

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.

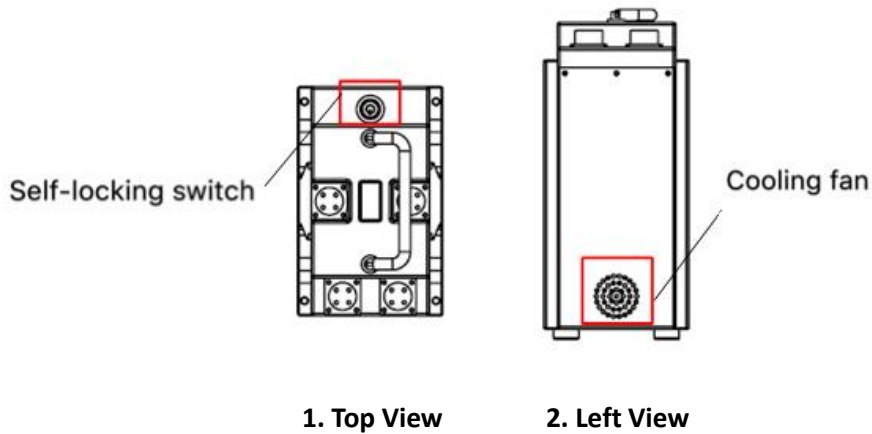


1. Self-locking switch

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

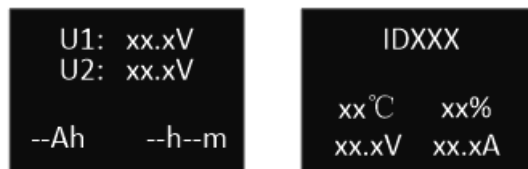
The controller box supports RS485 communication function which can transfer received orange container information to AlphaUni 900 (under operating state) for display.

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°C~35°C.

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



Left View:

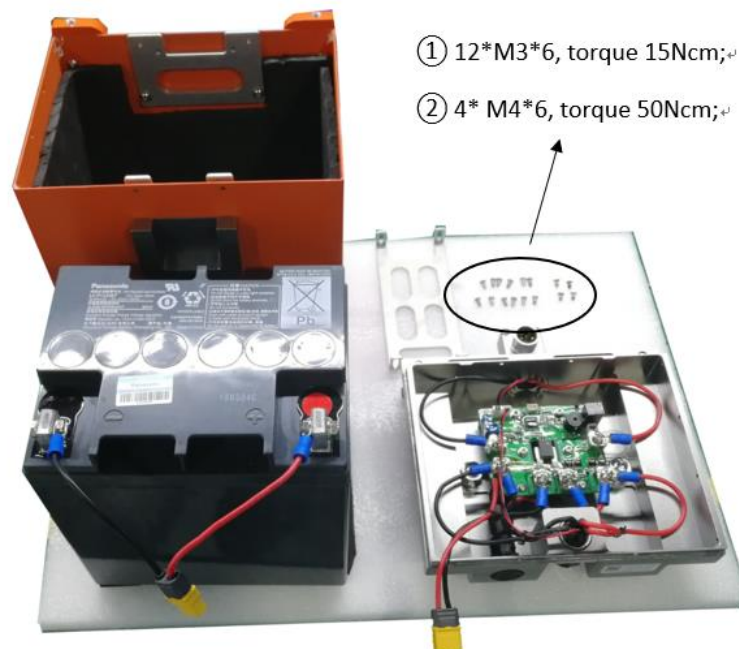
Red light: CC fast charge.

Green light: Small current charge

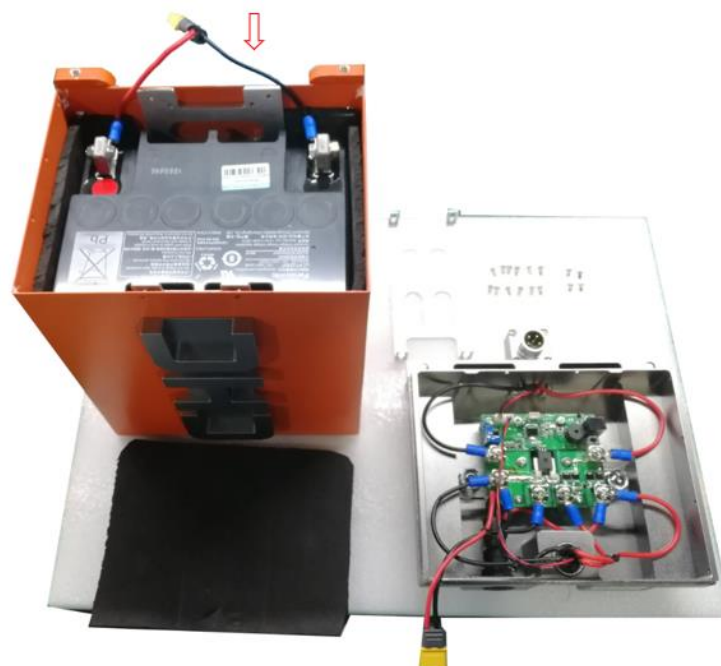
4.4 Operation Instruction

4.4.1 Battery Installation Steps

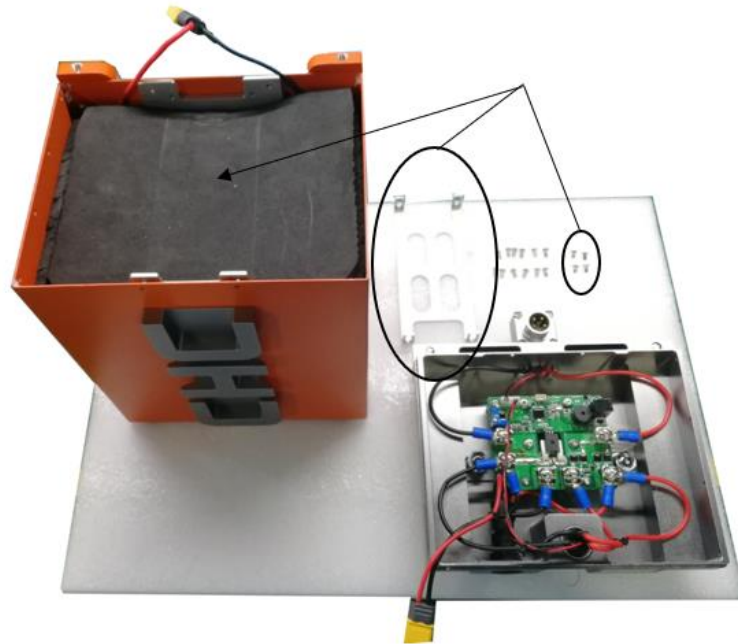
- Prepared accessories list: orange container, standard battery, 12*M3*6 torque 15Ncm and 4*M4*6 torque 50Ncm.



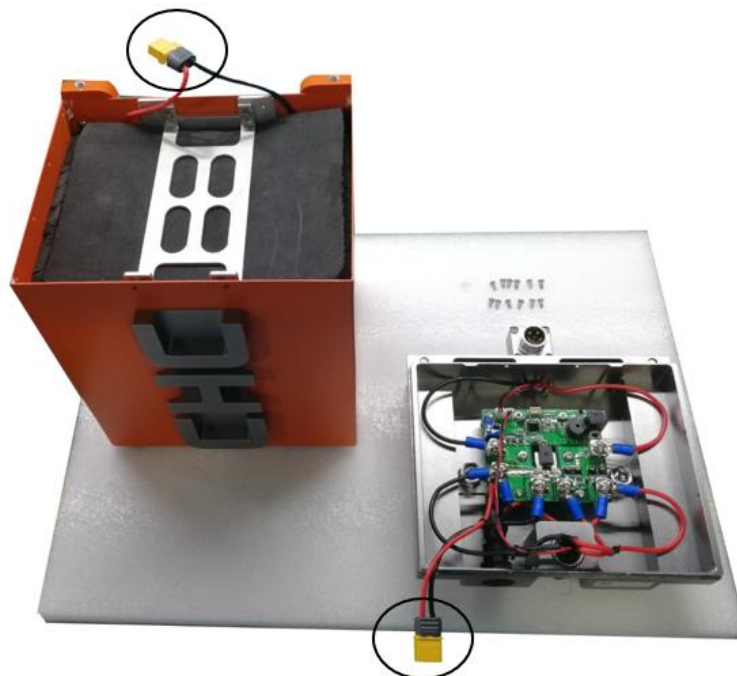
- Clamp the electrode wire with the battery electrode first and then put the battery inside of case.



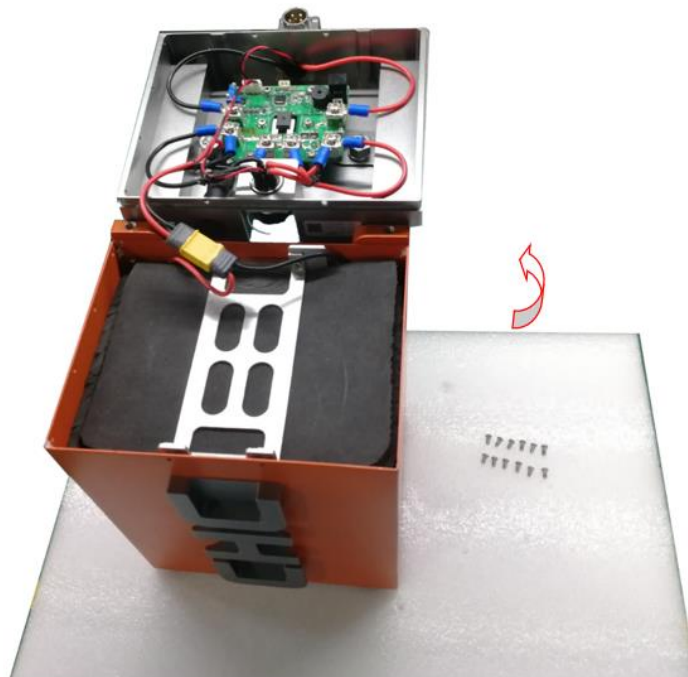
- Put the cushion on the battery above for protection and prepared limiting plate and four screws for next step installation.



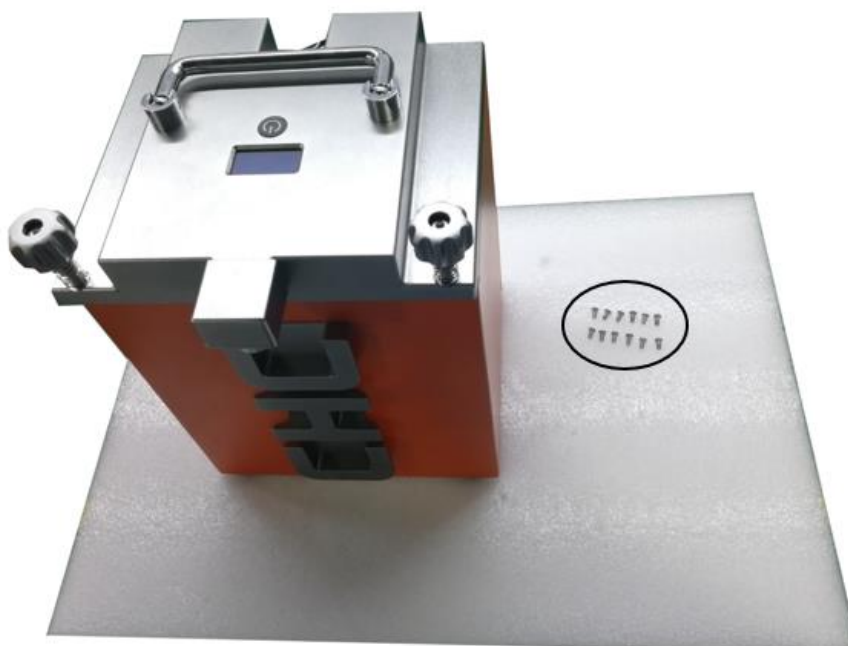
- Install limiting plate on the above of cushion with four M4 screws. Prepared to connect two power ports on next step.



- 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.

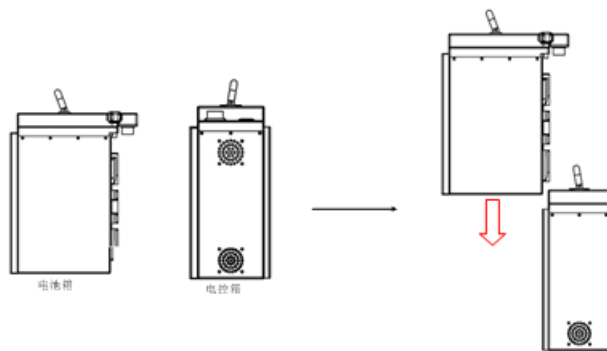


- Finally, complete orange container installation.

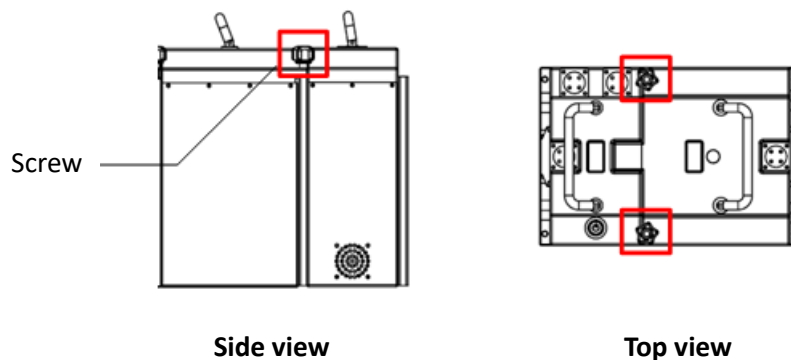


4.4.2 Containers Assemble Steps

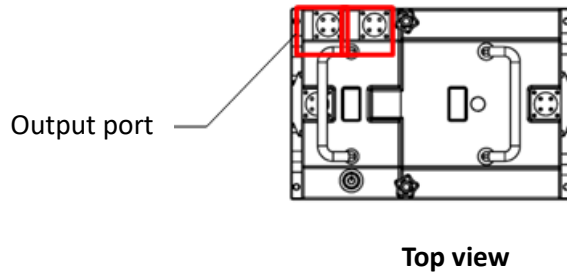
- First, connect orange container and controller box which shown below:



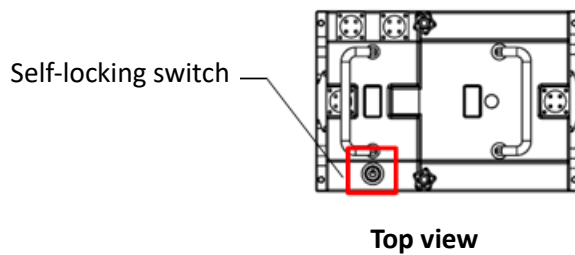
- Second, tighten the screws if transport is required:



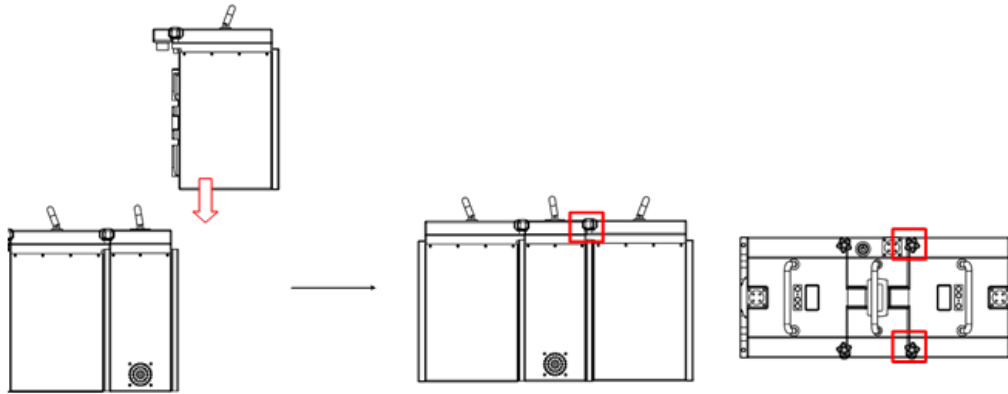
- Third, connect power cable with output port of controller box.



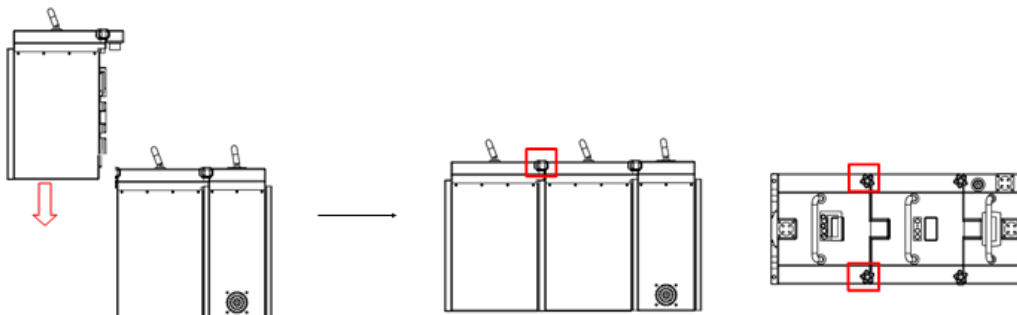
- Fourth, press self-locking switch of controller box to start 24V power supply. (12V port is always powered)



- Can add more orange containers according to actual needs:



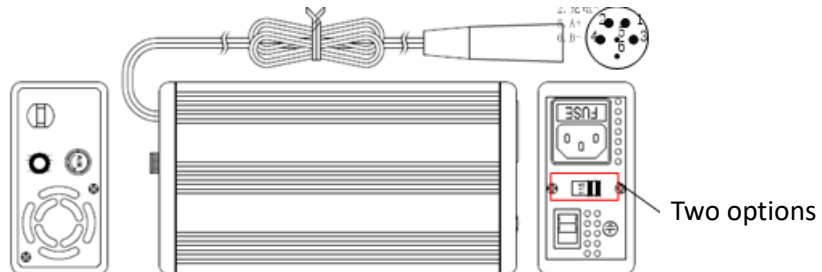
Two orange containers & One controller box (2+1, two sides)



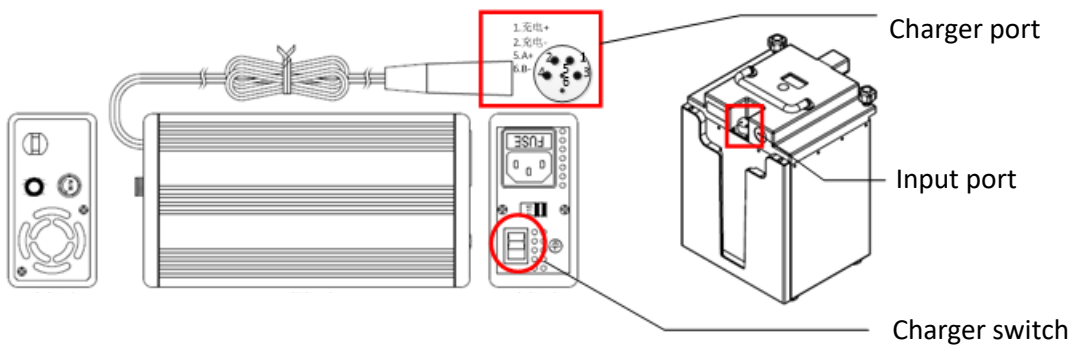
Two orange containers & One controller box (2+1, one side)

4.4.3 Charge Steps

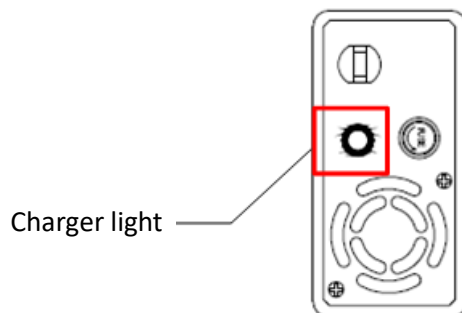
- First step is to adjust input voltage range of charger to suitable values. There are two options can select: 200-240VAC and 110-130VAC.



- 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 charge:

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 is recommended to change a new battery.

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

5 Product Using

5.1 Advance Preparation

Take out the equipment from the container before using. Install it on the corresponding platform and connect all cables. Meanwhile, set up the base station at an open sky area. Turn on the equipment after the base station start recording static. During capture, one person driving or control the flight, and the other person operates the remote controller.

5.2 Equipment Installation

- First, install the equipment on the platform and lock it with screws. Remember to remove the scanner protective cover.
- Connect both power supply cable and GPS feeder cable of equipment and start power on.
- Put the equipment at an open sky area and turn on LiDAR & remote controller. Check whether the controller and equipment status are normal. Detailed settings introduction please check Quick Guide.

5.3 Cable Connection

- For vehicle platform, if a wheel encoder is used, connect the cable into “ODO” port.
- Connect the cable with “CAMERA” label into “CAMERA” port.
- Connect the cable with “DC24V” label into “DC24V” port, which is the main supply interface.
- Connect the GPS feeder cable into “GNSS-M” port to timing the equipment.

5.4 LiDAR Power On

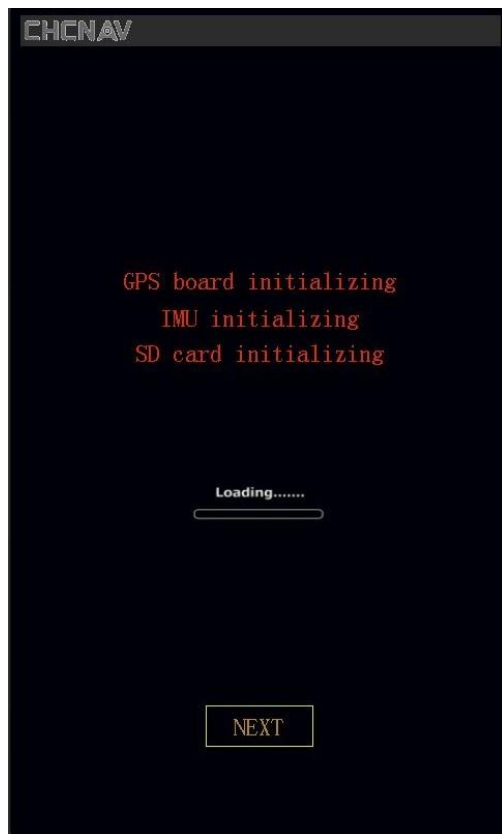
- Before power on, check all cables are connect correctly and power supply is normal.
- Long press the equipment’s “ON/OFF key” until light is on and buzzer is ring, which means the equipment is powered on successfully.
- Long press the remote controller’s “ON/OFF key” about one second until screen shows a progress bar, which means the remote controller is powered on successfully.
- After powered on, the remote controller will blink one time, then the screen will show operate interface. If using tablet App, it will show same information compare with remote controller.

6 Capture Operation Instructions

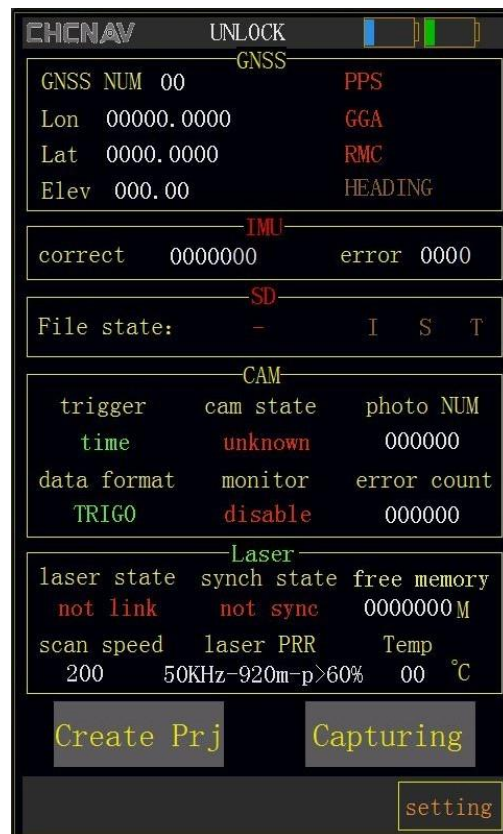
6.1 Remote Controller Unit

6.1.1 Controller Interfaces

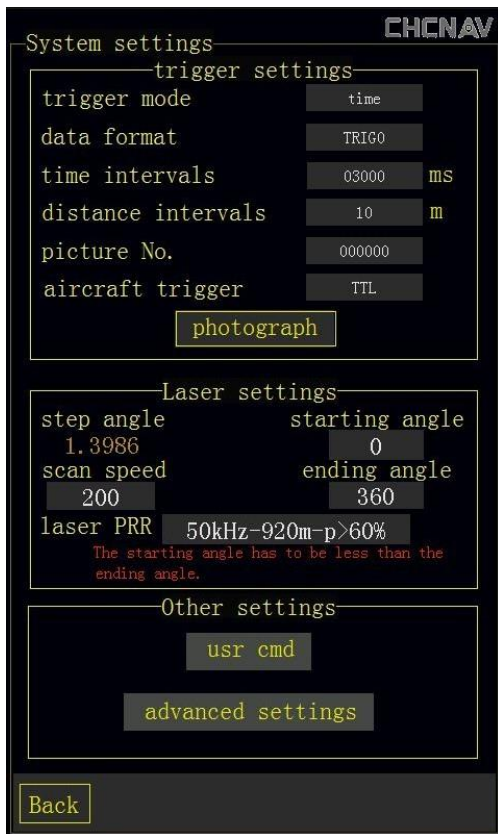
The remote controller interface is mainly composed of four parts: initialization interface, main display interface, system settings interface and laser settings interface which are shown below:



Initialization interface



Main display interface



System setup interface



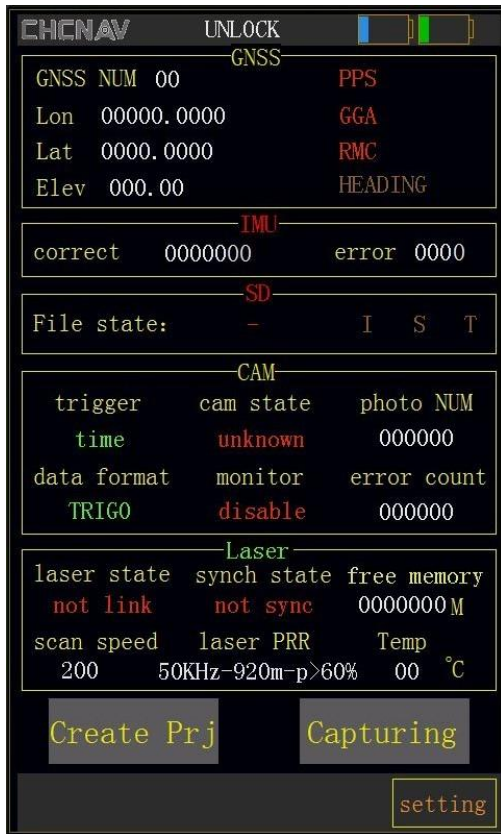
Laser setup interface

6.1.2 Initialization Interface Description

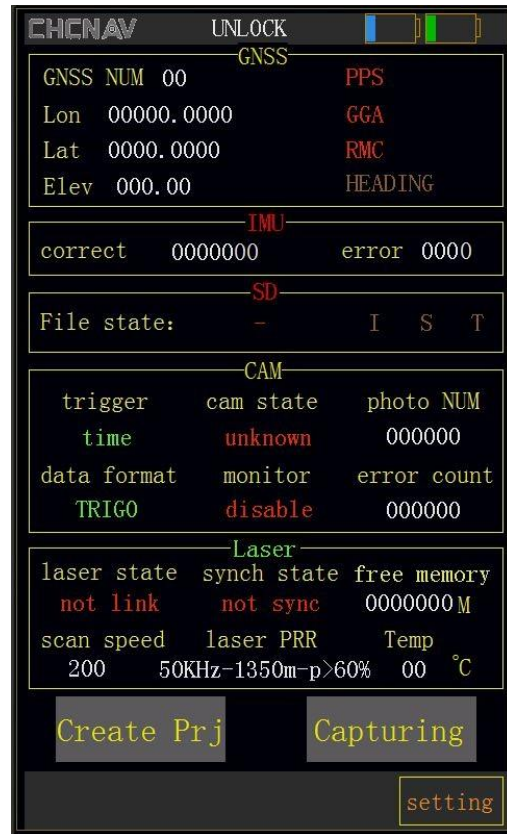
Long press Power On/Off key until heard a sound and the screen will automatically becoming bright and stay in the initialization interface. The progress bar is in the moving state, and the system is in the self-test state. When the communication between the controller and the equipment is normal, the "A" icon in the upper left CHCNAV icon will appear orange, otherwise it will always show grey which indicate abnormal communication and LiDAR is not connected. If any one or more of the GNSS, IMU and SD fail to pass the initialization, the controller will stay in the initialization interface all the time. If it stays in the initialization interface all the time (for example, more than 5 minutes), it means that the corresponding uninitialized components fail, or during the initialization process, the communication between the controller and LiDAR is abnormal. It is necessary to check the device components or communication problem, at this time, user can directly click the "next" button to enter the main display interface. According to the relevant prompts of the main display interface, you can know which part is abnormal.

6.1.3 Main Display Interface

Below figures show the main display interface of AlphaUni 900 and AlphaUni1300 controller which contains System state, GNSS state, IMU state, SD card state, Camera state, Laser state and related buttons.



AlphaUni 900 Interface



AlphaUni1300 Interface

6.1.3.1 System state

System state shows connection state, timing information, and current battery power. When system timing fails, the UNLOCK will be displayed. When system timing is successfully, the current UTC time is displayed. User needs to check whether the current time is completely correct. If the time is correct, the next operation can be carried out. The icon on the upper right side indicates current controller and LiDAR power. Blue icon represents the power of equipment and green icon represents the power of controller.

6.1.3.2 GNSS state

GNSS state will show rich system GNSS information such as tracking satellites number, longitude, latitude, elevation, PPS, GGA, RMC and HEADING signal respectively.

6.1.3.3 IMU state

When the system timing successfully, the initialization of all system parts is normal. After user clicks "Create Prj", the IMU state starts to display the correct count and error count number of IMU. If the initialization of IMU is normal, it will show green. Otherwise, it will display red. In the process of operation, user need to pay attention to the correct count and error count. When the correct count is increasing all the time and the error count keeps 0, also the IMU icon shows green which indicates the IMU is working normally.

6.1.3.4 SD card state

If the initialization of SD card is normal, it will display green, otherwise the icon will display red. After the user clicks "Create Prj", the status of SD card will display whether the file is created or not. If the I, S and T icons are displayed in green, it means that each file is writing to SD card normally, otherwise, it will be red.

6.1.3.5 Camera state

- Trigger: Trigger is an operation mode that control the camera to take photos, which including time trigger, distance trigger and manual trigger.
- Data format:
 - TRIG0: Ladybug camera selecting TRIG0;
 - TRIG1: Single camera selecting TRIG1;
 - TRIG2: Dual camera selecting TRIG2;
- CAM state: The camera state is defined as unknown, normal, and abnormal. When the camera is connected and can take pictures normally, the camera state is displayed as "normal". When the camera fails to work, the camera state will be displayed as "abnormal" , and the rest will be displayed as "unknown".
- Monitor: Check whether the camera is missing shots. If the camera has missed shots, the number of missed shots will be recorded in the display part of "error count". When the equipment is powered on and starts to work, the Monitor will be turned on automatically and displayed as "enable".
- Photo NUM: After the collection is started, the photo number will continually be increasing until project finish. The default start display is 000000.
- Error count: In the process of data collection, If the camera misses one or more shots, the number of missed shots is recorded at the error count, if the error count is always 0, it means that the camera is working normally. The default record is 000000.

6.1.3.6 Laser state

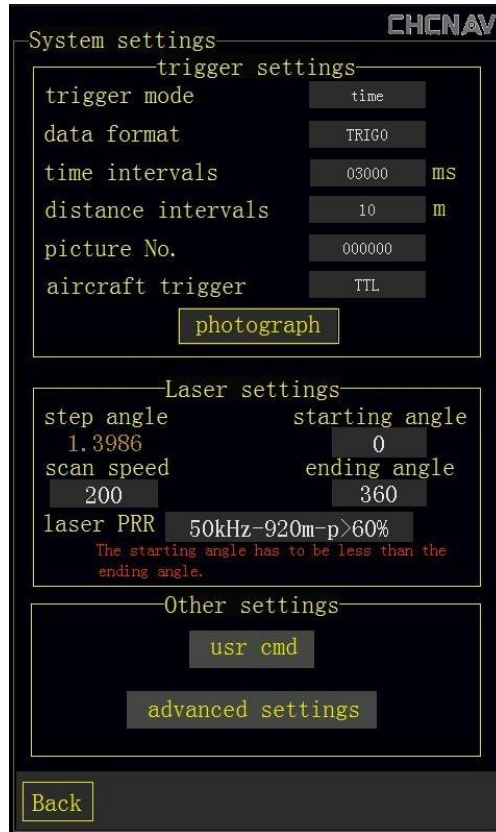
- Laser icon: It indicates the laser scanner status and generally it will show green, If the laser scanner does not work normally, it will display red color and please contact CHCNAV Support Team.
- Laser state: After successfully connect to LiDAR, the "link" state will be displayed. When the collection operation begins, the laser status will be shown as "capturing". When the laser fails and disconnects during collection, the laser state will show "not link".
- Synch state: After successfully connect, the controller will query the laser synchronization state. When the equipment is successfully timed, it will display "synchronized". Otherwise, it will display "not synchronized".
- Free memory: It indicates the remaining capacity of the SD card. Before the collection, please check whether the rest of SD card is enough.
- Scan speed: It indicates the laser rotation linear speed. After the system is powered on, the laser scan speed will be automatically set to "200".
- Laser PRR: After the system is powered on, the laser point frequency will be automatically set to "50khz-920m".
- Temp: It indicates the internal temperature of equipment.

6.1.3.7 Related Buttons

After system is successfully initialize, click "Create Prj" to start work. After start, keep the equipment as stationary for more than 5 minutes, and then click "Capturing" to start data collection.

6.1.4 System Setup Interface

As shown in below figure, the system setup interface consists of trigger settings, laser settings and other settings.



6.1.4.1 Trigger settings

- Trigger mode: There are three types if trigger mode: time trigger, distance trigger and manual trigger. The default is manual trigger.
- Data format:
 - TRIG0: Ladybug camera selecting TRIG0;
 - TRIG1: Single camera selecting TRIG1;
 - TRIG2: Dual camera selecting TRIG2;
- Time intervals: The time range is between 100 ~ 25500ms, and the user should set the corresponding time interval according to demand. It is recommended to set it as an integer for example multiples of 100.
- Distance intervals: If set as distance trigger mode, the system will take picture at a fixed distance between 1 to 99 meters.
- Picture No: It indicates the number of taken pictures.
- Photograph: Before work start, click here to take a photo manually to check whether camera is connected properly.

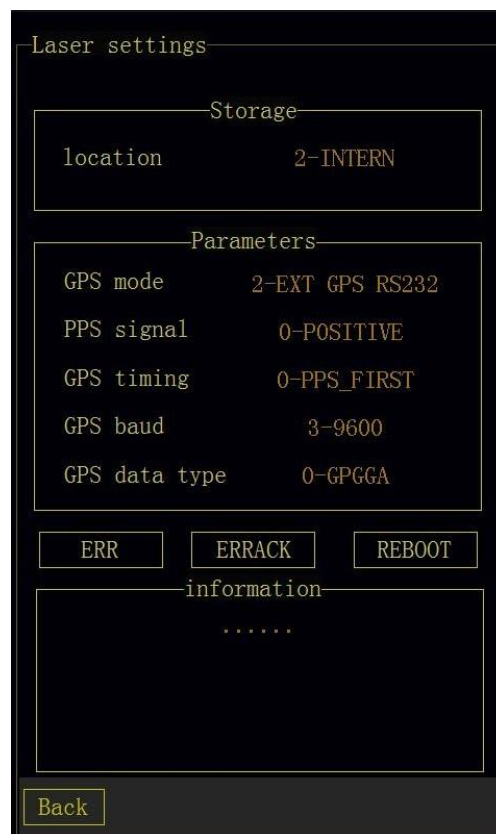
6.1.4.2 Laser settings

Before start project, user need to set the scan speed and laser PRR first, then the Step Angle will be calculated automatically. The starting angle and the ending angle are 0 and 360 by default. It is important to note that the starting angle need to lower than the ending angle.

6.1.4.3 Other settings (Generally no use)

- Usr cmd: Support input relative code to check system when has issues.
- Advanced settings: Enter password 123321 and the controller will enter the “Laser Settings” interface.

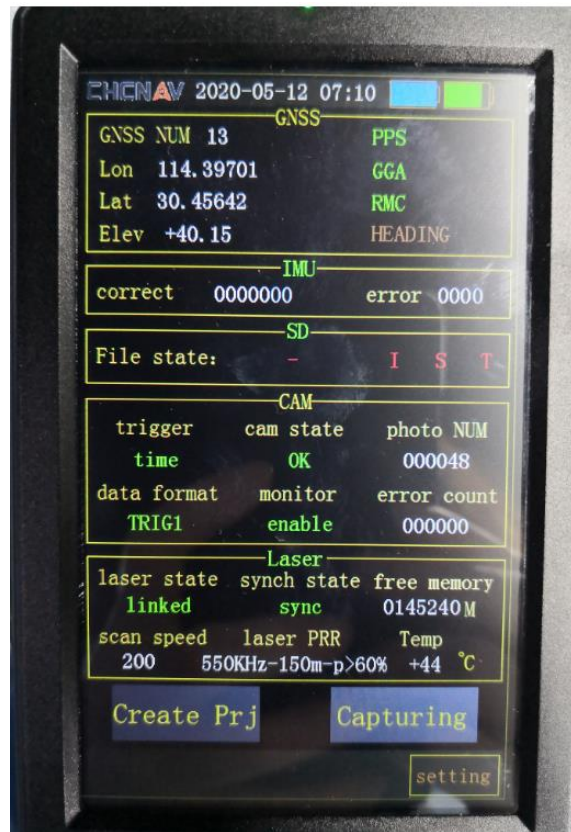
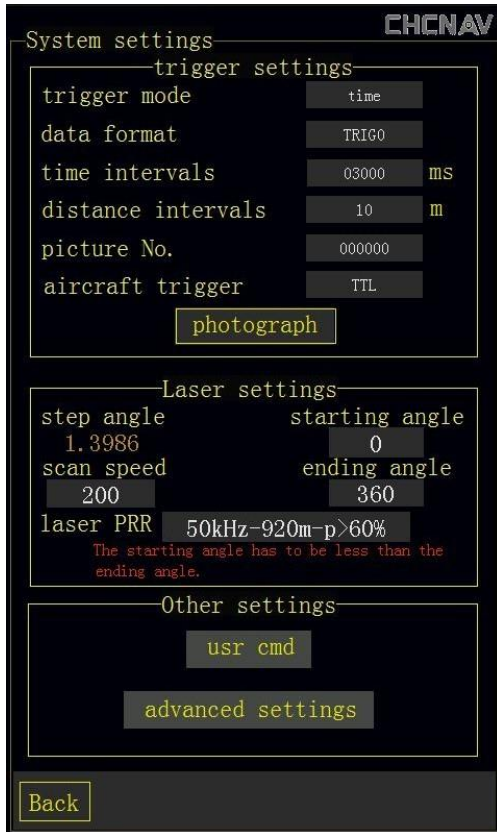
6.1.5 Laser Settings



- Storage: The storage location of the raw laser data is inside the AlphaUni 900 equipment.
- Parameters: It indicates some synchronization parameters which no need to modify here.

6.1.6 Capture Process

1. After the system is initialized successfully, click “setting” to config relative parameters as required.



2. After settings are saved, click “Create Prj” to start POS collection.
3. When the time is starting, keep the equipment as stationary for more than 5 minutes to ensure the IMU is initialized successfully.
4. After 5 minutes static alignment, click “Capturing” to start laser data collection.
5. When data collection is completed, click “Stop” to stop laser data collection. Then, wait for 5 minutes and also keep static.
6. Finally, click “Close Prj” to finish this project and power off the equipment later.

6.2 Data Copy

6.2.1 Manual Copy

6.2.1.1 Export POS data

Before the equipment is powered on, connect the data copy line between DATA interface and PC first and then power on unit. PC will show an AlphaUni 900 disk where can copy POS data.

The project is named by creation date for example 20170509.

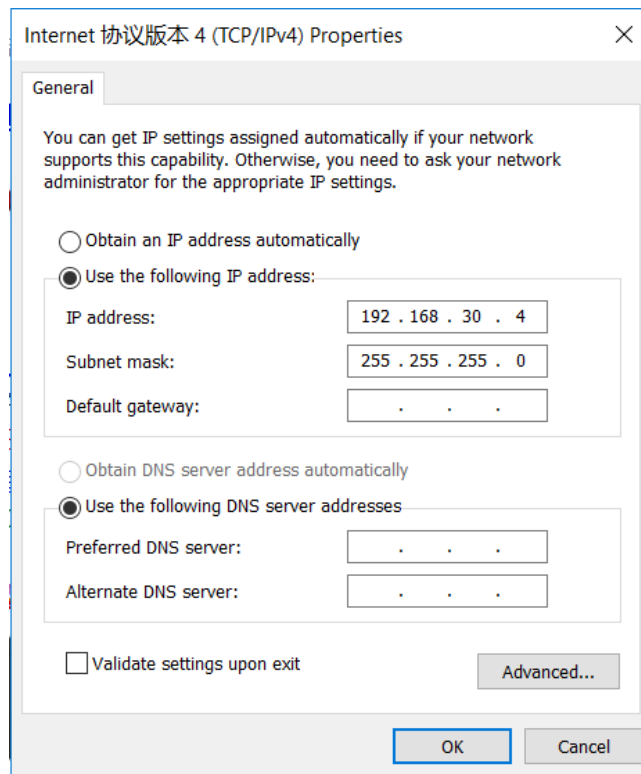


In the folder, the collected four files will be stored here:

- xxxxxx_D.DMR: Recorded DMR data (if have).
- xxxxxx_I.IMR: Recorded IMU data.
- xxxxxx_S.TXT: Recorded the data sent by control board.
- xxxxxx_T.TXT: Recorded GPS differential ephemeris data.

6.2.1.2 Export laser data

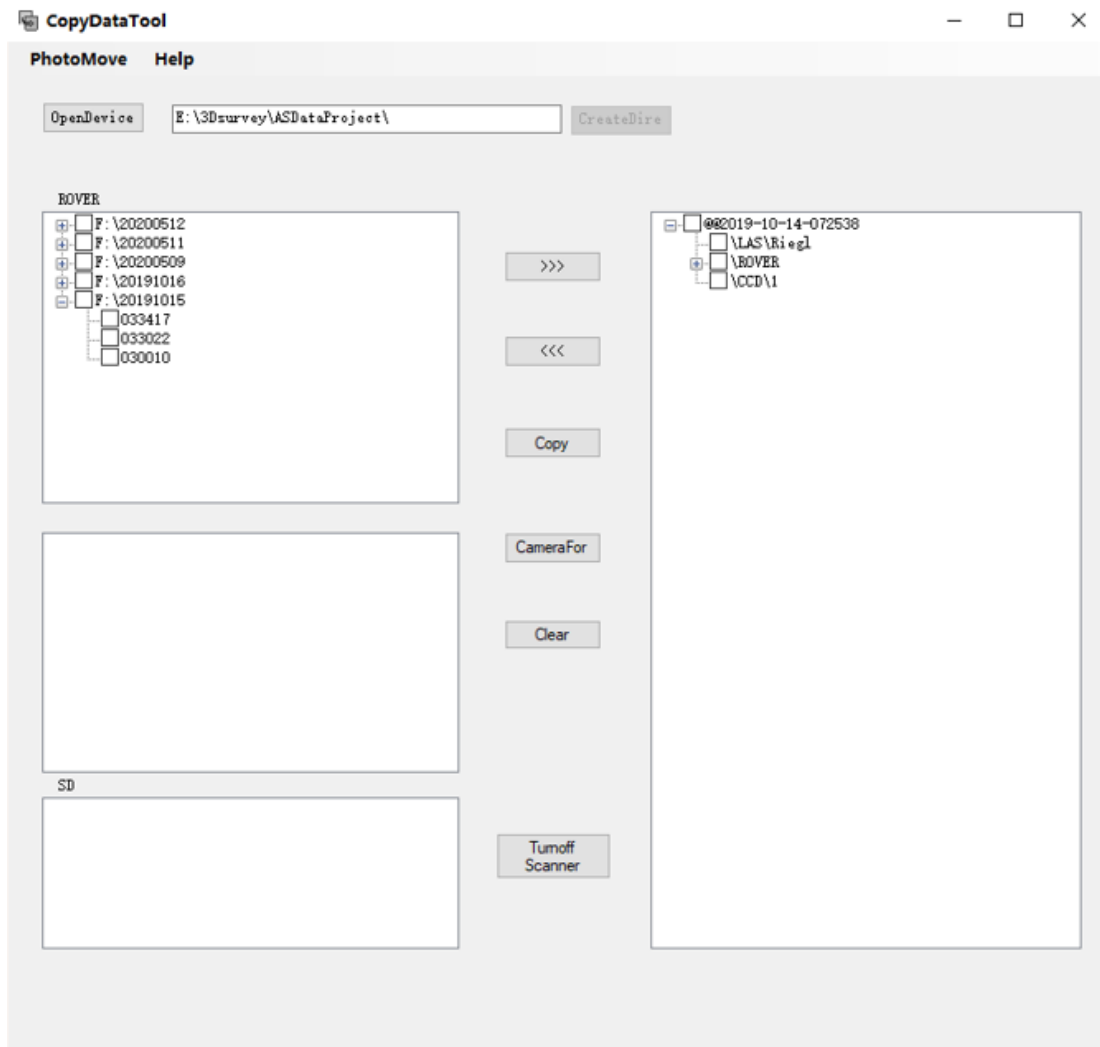
Connect the data copy line between DATA interface and PC, and the other end of the network cable to computer network port. Power on the equipment, configure the network to 192.168.0.x (X can be any number other than 128) after the laser initialization is completed.



Enter [\\192.168.0.128](http://192.168.0.128) into the address field in My Computer and select laser data (RXP format) to copy.

6.2.2 Automatic Copy

Connect the data copy line between DATA interface and PC first (both USB port and network port) and then power on unit. Turn on the equipment and wait about 1 minute until the laser initialization is completed. Click **CopyDataTool** software and enter the following interface:



The left column shows all stored projects in equipment. Set the storage path first. Choose relative project based on capture data and time, click “>>>” and the selected data will be moved to the right column. Finally, click “Copy” and the software will automatically download both POS and laser data into storage path folder.

 **Tips:**

- Make sure the IP address is configured correctly, otherwise the “DataCopyTool” software cannot be opened.
- Select project first then choose “Copy”, otherwise it will report an error.
- Multiple sets of data can be chosen and copied at one time.
- If user selects wrong data project, choose relative project in right column and click <<< to move it back to left column.
- After the data copy is finished, click the "Turnoff scanner" button to power off the equipment. Do not directly press the power on/off key on the equipment as it may cause

abnormal shutdown of the device.

- For camera data copy, remove the camera memory card and copy pictures with card reader. Note, this memory card can not be formatted and also can not delete internal folder.

6.2.3 Data Structure

BASE	1/15/2020 6:32 PM	File folder
CCD	2/13/2020 1:52 PM	File folder
LAS	1/15/2020 6:23 PM	File folder
PARA	2/13/2020 1:53 PM	File folder
POST	3/9/2020 9:27 AM	File folder
ROVER	3/9/2020 9:27 AM	File folder
SYNC	1/15/2020 6:25 PM	File folder
TRACE	1/15/2020 9:52 AM	File folder

BASE: Save base data which recorded by GNSS receiver in static mode.

CCD: Store pictures raw data.

LAS: Store raw data of laser scanner.

PARA: Store parameter files (include default and new files which create during process)

ROVER: Store GPS and IMU data.

SYNC: Store log and TRIG data (No used during processing).

TRACE: Store trace data (No used during processing).

7 LiDAR Turn Off

- Before turning off equipment, please make sure the project is already stopped.
- Long press equipment “ON/OFF” button to turn off equipment until the light is out and buzzer is ring.
- After the buzzer is stop ringing, disconnect the power supply cable to finish turn off.

8 Frequently Asked Questions

- Equipment can not power on or power off normally: Check whether the power supply and connect port are normal. If still can not power on or power off, please contact CHCNAV Support team for repair.
- Equipment can not be timed or need long time: Check whether the GPS feeder cable connection is stable.
- Equipment's buzzer kept ringing after power on and the camera light is out: Check whether the camera cable and work statue are normal. If camera connection is normal, the issue may because of internal IMU, please contact CHCNAV Support team for repair.



Tips: Do not connect camera and camera cable to PC before the equipment powered on. As USB cable will power the camera in reverse which will cause the camera can not turn on.

- Camera missed shooting: There are two reasons may influence: First is camera already shoot but controller does not detect which caused 1 picture missed. This is normal situation and it will not influence follow-up work. If faced this issue, just stop collection and restart collect. Second is camera SD memory is full which caused camera connection cable poor contact and incorrect status after power on.
- The remote controller will show normal status after connect camera. Even disconnect camera later, it will still show normal: This is a normal situation.
- Each time connect scanner, the remote controller will do a initial setup and a "Setting Successfully" will automatically pop-up.
- In order to ensure the equipment work normally, some settings can not be changed during work.

9 Matters Need Attention

9.1 Important Notes

LiDAR measure system is a complex and precise survey system. In daily carrying, using and storing, please operate equipment correctly and maintenance properly. There are some important notes listed below:

- Do not disassemble equipment privately. If equipment has issue, please contact CHCNAV Support team.
- Please use the default battery and accessories. Use non-dedicated battery may cause charger exploding or burning. The use of non-original accessories is not eligible for warranty.
- When using charger for charging, please keep away from fire, flammable or explosive materials to avoid serious consequences such as fire.
- Do not dispose of waste batteries at will. Please follow local laws or standards.
- Strictly follow this manual to connect all cables. Make sure each connector plugs tightly, and the power switch should be turned on in order.
- It is forbidden to plug and unplug each connection without cutting off the power supply.
- Do not continue using any broken cables. Please purchase and replace new cables in time to avoid unnecessary damage.
- Avoid any strong impact or vibration.
- Use an umbrella or tarpaulin to prevent water inside.
- After the equipment is used, move it to the container quickly and make sure the container inside is dry.
- If need to continue using the instrument for a long period of time or under special conditions such as high humidity environment, please consult the relevant precautions of CHCNAV Support team in advance. Generally, the damaged occurred under a special environment is not covered by the product warranty.

9.2 Product Transportation

- CHCNAV AlphaUni product equipped special container. During transportation, make sure the container is fixed at a stable location.
- During transportation, please tell relative person that this is precise system container and it needs to be handled gently. Also with fragile label on container.
- If the equipment is sent by express service, the container needs an outer box with foam inside also for safety.

- The equipment should be used and kept by designated personal and it is not allowed to borrow to others without permission.

9.3 Using Notes

- The equipment should be handled gently during use to avoid soiling and scratching its surface, and it is strictly forbidden for surveyors or others sit on the container.
- After the external test or operation, the surface of equipment should be cleaned regularly by provided clean suits (3-5 days), and check whether the structural screws and plugs are loose, and whether the peripheral cables are loose.
- After long time storage in store, it needs to be taken out regularly (about one month) for power-on test to check whether the function is normal.
- The limitation of environment temperature is between $-10\text{ }^{\circ}\text{C} \sim +40\text{ }^{\circ}\text{C}$, the humidity limitation is $<80\%$ RH and no condensation.
- During the assembly and testing phases, the equipment should be placed on a cabinet or a special shelf and covered with a dustproof cloth. The laser head should be protected with a dustproof cover.
- If the equipment is disassembled or loosen, it should be re-calibrated.
- When it is difficult to rotate any rotating parts of the equipment, please do not forcibly rotate. After the equipment is damaged, please do not continue using, otherwise the damage of the equipment will increase. Do not disassemble equipment in field.
- If faced rain or snow in field during work, please move the equipment into the container quickly. Do not work in the cold environment with low temperature in winter, in case to prevent condensation of water vapor on the optical lens and inside the instrument.
- The single camera memory card cannot be formatted, and the internal folders cannot be deleted except photos, otherwise there will be a phenomenon that the photos cannot be taken.

9.4 Storage Notes

- When the equipment is not using, the battery must be removed and handled gently to avoid bumps. The battery can not be inverted.
- The equipment should be placed at a dry area in store. Try to avoid long-term stacking and placing
- The room where the equipment is stored should be clean, dry, bright and well ventilated. It should be placed flat or upright, and it should not be leaned casually to prevent distortion.



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