



A30 GNSS Receiver User Manual

Version 1.0

Suzhou FOIF Co.,Ltd

Introduction

Congratulations! You have just acquired the latest dual-frequency A30 GNSS Surveying System from FOIF! GNSS has revolutionized control surveys, topographic data collection and construction surveying. Purchasing the right tools for a professional job is essential in today's competitive business environment. Learning to put these tools to work quickly and efficiently will be the focus of the present manual. Compared with other GNSS products, A30 is more compact and lightweight while integrating more technology, such as the exclusive multi-constellation (GPS+GLONASS+SBAS) capabilities.

A30 performs a more advanced features than A20 such as designing and operating. You will find many modifications in this instrument different from the generation A20. A30 keeps the same RTK accuracy as A20, still it gives you the accuracy with horizontal 1cm+1ppm and vertical 2cm+1ppm. Super bright OLED and voice message give you more convenience through working time. Internal memory is enlarged from 256MB to 4GB which should be enough for your whole project. There has a built-in sensor inside the instrument to help you adjusting the tilt around 3 minutes automatically by software. The biggest modification is the position of SIM slot has been changed from beside the battery to the bottom of it which can give you a more stable wcdma signal than before.

FCC Statement

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

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

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Safety Information

This manual describes the A30 GNSS Receiver.

Before you use your receiver make sure that you have read and understood this manual, as well as all safety requirements.



WARNING

Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.



CAUTION

Ignoring this indication and making an operation error could possibly result in personal injury or property damage.

Regulations and safety

The receivers contain integra Bluetooth wireless technology, and may also send radio signal through the antenna of an internal radio-modem, or through an externally-connected data communication radio. Regulations regarding the use of the 460MHz radio-modems vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. Other countries require end-user licensing. For licensing information, consult your local FOIF dealer. Bluetooth operates in license-free bands.

Exposure to radio frequency radiation

For radio (410~430MHz/430~450MHz/450~470MHz)(RX Only)

It is safety. Exposure to RF energy is an important safety consideration. Proper use of this radio modem results in exposure below government limits.

The following precautions are recommended:

DO NOT operate the transmitter when someone is within 20cm of the antenna.

DO NOT collocate (place within 20cm) the radio antenna with any other transmitting antenna.

DO NOT operate the transmitter unless all RF connectors are secure and any open connectors are properly terminated.

DO NOT operate the equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to FOIF installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

For wcdma radio

- For your own safety, always observe the precautions listed here.
- Always maintain a minimum separation distance of 20cm between yourself and the radiating antenna on the radio-modem.
- Do not collocate (place within 20cm) the radio antenna with any other transmitting antenna.



CAUTION

For Bluetooth radio

The radiated output power of the internal Bluetooth wireless radio is far below radio frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the FOIF receiver is 20cm or further from the human body. The internal wireless radio operates within guidelines found in radio frequency safety standards and recommendations, which reflect the consensus of the scientific community. FOIF therefore believes the internal wireless radio is safe for use by consumers. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radio.

Installing antennas



CAUTION

- For your own safety, always observe the precautions listed here.
- Always maintain a minimum separation distance of 20cm between yourself and the radiating antenna.
- Do not collocate (place within 20cm) the radio antenna with any other transmitting antenna.

This device has been designed to operate with the antennas listed below.

UHF Antennas not included in this list, or that have a gain greater than 5dBi, are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

The antennas that can be used (country dependent) with the 460 MHz radio are 0dBi and 5dBi whip antennas(only for UHF, RX only).

The antenna that can be used with the wcdma radio is the 5dBi whip antenna.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic ally radiated power is not more than that permitted for successful communication.

Rechargeable Lithium-ion batteries

These receivers use a rechargeable Lithium-ion battery.



WARNING

- Do not damages the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and /or property damage. To prevent injury or damage:
- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping,

and leaking battery fluid.

- Do not expose the battery to fire, high temperature, or direct sunlight.



- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

- Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.

To prevent injury or damage:



- If the battery leaks, avoid contact with the battery fluid.
- If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.



- Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.

To prevent injury or damage:

- Do not charge or use the battery if it appears to be damaged or leaking.
- Charge the Lithium-ion battery only in FOIF product that is specified to charge it. Be sure to follow all instructions that are provided with the battery charger.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in FOIF equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.

Other Warning



- Operating or storing the receiver outside the specified temperature range can damage it.

For more information, refer to 7. SPECIFICATION.

1**Summary**

A30 is regarded as an highly integrated, semi-open structure and modular designed RTK system independently researched by FOIF. GNSS antenna, data link, WCDMA, Li-Ion battery, memory device, bluetooth etc. are all focused in one receiver. Moreover, GNSS antenna, datalink and battery are independently modules which are easy to replace thus which is convenient in the products maintainance and upgrade. Stable industry standard handheld for A30 has inner or external GPS antenna and camera for optional function to upgrade this handheld to a GIS collector. 3G memory device is also optional for the handheld, thus can further upgrade to a highly accurate GIS collector. Meanwhile, besides the two data transmission ways (WCDMA, data Link), we can use 3G function of the mobile phone to do the RTK job, in this way, we can say A30 has already existed in 3G period.

With high accuracy, fast tracking function of inner GNSS mainboard, A30 can track the satellite signal as more as 220 channels simultaneously.

Highly sealed, waterproof, dustproof, shockproof, low power consumption are its basic inspecting rules. With super and weatherable OLED screen built on A30 receiver, the real time information of the receiver can be shown on the screen. 4 lights and 4 buttons are easily used to set the receiver, and the voice aided is helpful to the outdoors surveying.

Downloading and backups of the static data could be convenient because of the inner SD slot, thus resolves your trouble for the insufficient memory.

Due to its advanced compatibility, static surveying with GNSS products of other companies is no problem but also for the compatibility in the CORS of other companies. In order to fulfill the characteristic of compatibility in A30, inner radio can easily be upgraded to be compatible with GNSS products of other companies in the RTK field. The electric power design for A30 is also very advanced, large capacity of Li-Ion batteries(5800mAh) can also be used on the total station (810 series) made by FOIF. These batteries are available on both external and internal charging ways. A30 can also be used by external DC power (7-18V).

A30 is widely used for control survey, engineering survey, topography survey, GIS, boundaries location, area survey, deformation monitoring etc. And in the education subjects based on GNSS products, you can also find A30.

2 Unpacking the Container

2.1 Container Contents

Description

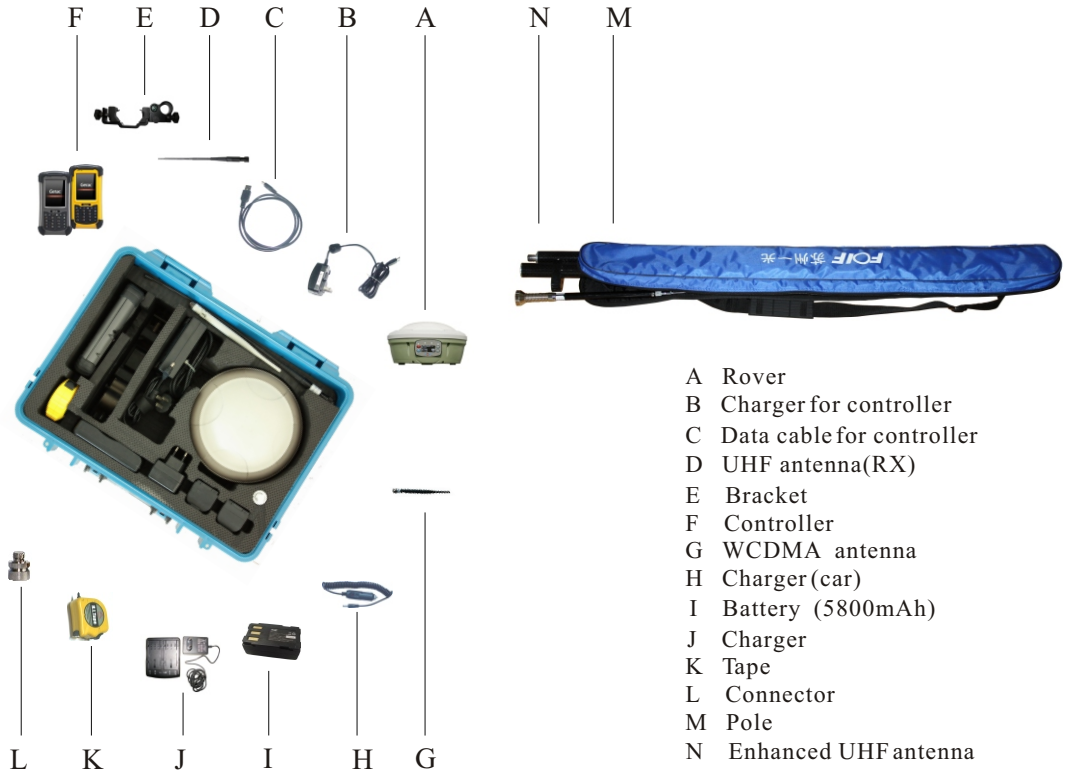
The main components required for the cableless GNSS real-time system are combined in one transport container.

Container for A30 and delivered accessories part 1 of 2



- A Base
- B UHF antenna(RX)
- C WCDMA antenna
- D Y cable for both data transferring and upgrading
- E RF cable(6.0m)
- F Connector
- G Supporting pole
- H Charger (car)
- I Battery (5800mAh)
- J Charger
- K RX Radio (Optional)
- L Tape

**Container for
A30
and delivered
accessories
part 2 of 2**



Detailed information can check from A30 equipment list.

2.2

Controllers

PS236 series



- a) Microsoft Windows Mobile 6.1 OS
- b) 3.5inch transreflective sunlight readable LCD
- c) Embedded high sensitivity GPS receiver
- d) MIL-STD-810G and IP67 compliance
- e) Long battery life provides all-day power
- f) 3.5G WWAN optional (HSDPA/WCDMA/EDGE)

PS535F series (optional)



- a) Microsoft Windows Mobile 5.0/6.1 OS
- b) 3.5inch transreflective sunlight readable LCD
- c) Embedded high sensitivity GPS receiver(PS535F)
- d) MIL-STD-810F and IP54 compliance
- e) Long battery life provides all-day power

3 Setting Up Receivers

3.1 Base Station (External Receive Radio)

Choose a suitable place for your base station setting up.

- 1) The place for base station setting up should be wide opened and easy to receive the signal of satellites.
- 2) Higher place would be better for setting up, thus signal of UHF is easy to receive. If rover is far from base, then the enhanced antenna should be raised by using bipod.
- 3) Base should be far away from the high power WiFi objects, e.g. radio, MWS etc. Distance between them needs to be more than 200m. And less than 50m from power lines is also forbidden to set up base.

**Picture showing
real-time
base station
setup**



Base

External Radio

Process:

1. Set up the tripod mount and level the tribrach onto the tripod.
2. Check that the tribrach is correctly centred over the marker.
3. Place and lock the receiver on the tribrach.
4. Check that the tribrach is still correctly positioned and leveled.
5. Choose external radio module from FOIF Survey_GPS software.
6. Fix the radio beside tripod, using cable FG-DB9-M* to do the connection work between radio and receiver.
7. Fix enhanced UHF antenna(RX).

8. Connecting radio and storage with cable FDL-1-1 and cable FDL-1-2.*

*check from A30 equipment list

Notice:

When plugging in an cable with LEMO plug, make sure that the red dots on the receiver port and the cable connector line up. Do not use force to plug cables in, as this may damage the connector pins.

When disconnecting an cable with LEMO plug, grasp the cable by the sliding collar or lanyard and then pull the cable connector straight out of the port. Do not twist the connector or pull on the cable itself.

To securely connect a TNC antenna, align the antenna connector with the receiver receptacle and then thread the antenna connector onto the receptacle until it is snug.

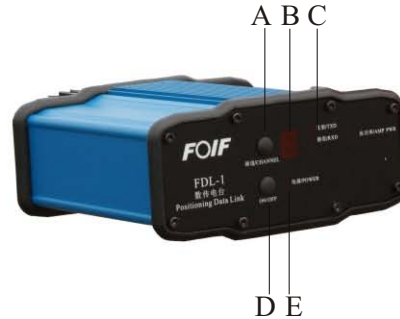
Avoid the following sources of electrical and magnetic noise:

- | | |
|---------------------------------------|--------------------------------|
| a) Gasoline engines (spark plugs) | b) Televisions and PC monitors |
| c) Alternators and generators | d) Electric motors |
| e) Equipment with DC-to-AC converters | f) Fluorescent lights |
| g) Switching power supplies | |

Avoid exposure to extreme environmental conditions, including:

- | | |
|-------------------------|-------------------------------|
| a) Water | b) Hot than 65°C |
| c) Cold less than -30°C | d) Corrosive fluids and gases |

External Receive Radio

Frontal panel (buttons and channel displayed)**External
Radio**

- A Channel 0~9&A~F
- B Channel displayed
- C Signal light
- D Power
- E Power light
- F Button for power setting
- G Heat sink
- H Data input&battery supplied
- I Antenna port

Back panel (ports detailed)



Notice:

- 1) Connection should be tight between every part(cable,radio,receiver) to confirm the successful data transferring.
- 2) Storage battery used should distinguish the positive and negative poles to avoid the electric short circuit.
- 3) Suggested brand of storage battery is Panasonic, other brands such as camel, fengfan ect. are also accepted as long as the output voltage is 12V and power consumption is not less than 17Ah.
- 4) 5m pole is suggested in raising the UHF antenna for better signals.
- 5) Distance between UHF antenna and A30 should be more than 3m.
- 6) Considering the safety of yours, A30 is not suggested to be used at the weather of thunder or storms.

3.2 Base Station (Receiver Powerer Amplifier)

Choose a suitable place for your base station setting up.

- 1) The place for base station setting up should be wide opened and easy to receive the signal of satellites.
- 2) Higher place would be better for setting up, thus signal of UHF is easy to receive. If rover is far from base, then the enhanced antenna should be raised by using bipod.
- 3) Base should be far away from the high power WiFi objects, e.g. radio, MWS etc. Distance between them needs to be more than 200m. And less than 50m from power lines is also forbidden to set up base.

**Picture showing
real-time
base station
setup**



Base

Process:

1. Set up the tripod mount and level the tribrach onto the tripod.
2. Check that the tribrach is correctly centred over the marker.
3. Place and lock the receiver on the tribrach.
4. Check that the tribrach is still correctly positioned and leveled.
5. Choose internal radio module from FOIF Survey_GPS software.
6. Fix the power amplifier beside tripod, using cable FDL-3-2* to do the connection work with receiver.
7. Fix enhanced UHF antenna(RX).

Power Amplifier

8. Connecting radio and storage with cable FDL-3-1*.

*check from A30 equipment list

Notice:

When plugging in an cable with LEMO plug, make sure that the red dots on the receiver port and the cable connector line up. Do not use force to plug cables in, as this may damage the connector pins.

When disconnecting an cable with LEMO plug, grasp the cable by the sliding collar or lanyard and then pull the cable connector straight out of the port. Do not twist the connector or pull on the cable itself.

To securely connect a TNC antenna, align the antenna connector with the receiver receptacle and then thread the antenna connector onto the receptacle until it is snug.

Avoid the following sources of electrical and magnetic noise:

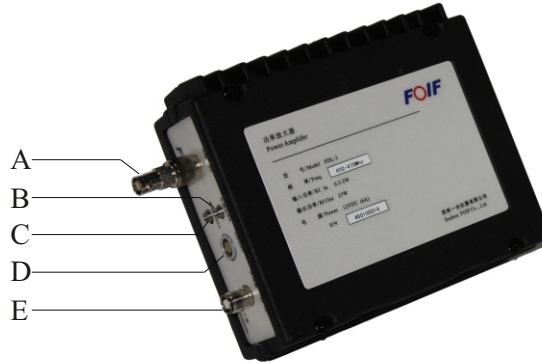
- a) Gasoline engines (spark plugs)
- b) Televisions and PC monitors
- c) Alternators and generators
- d) Electric motors
- e) Equipment with DC-to-AC converters
- f) Fluorescent lights
- g) Switching power supplies

Avoid exposure to extreme environmental conditions, including:

- a) Water
- b) Hot than 65°C
- c) Cold less than -30°C
- d) Corrosive fluids and gases

Power Amplifier

Power Amplifer



- A Port for ANT
- B PWR Light
- C DATA Light
- D PWR Port
- E Port for RF.IN

Function:

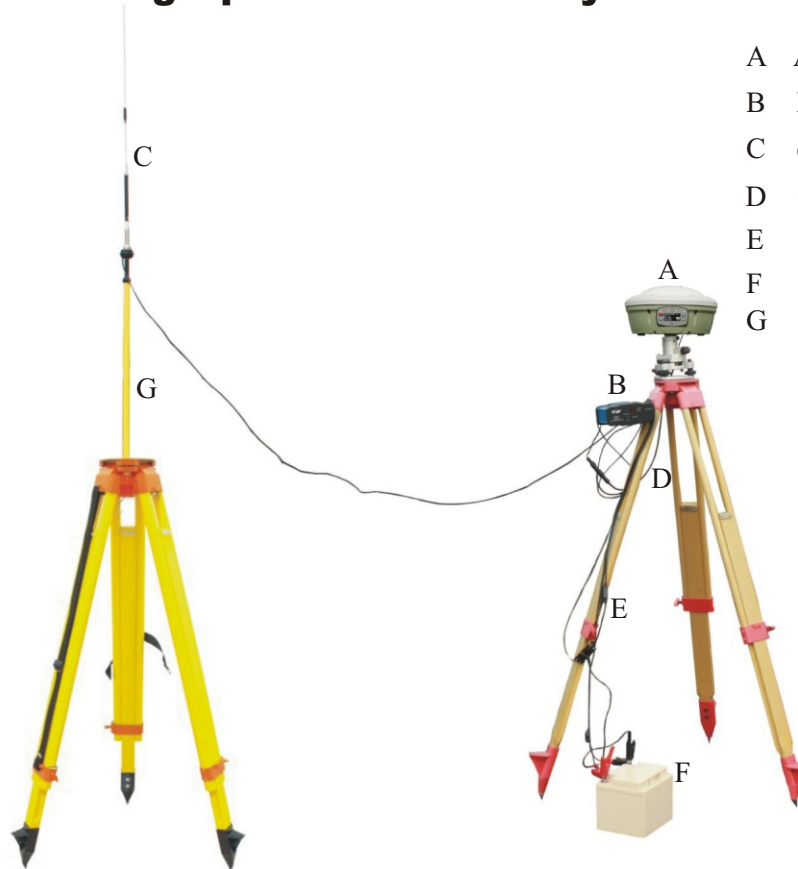
Power Amplifier can enlarge transferring distance which is the same function as external radio, but should work together with A30 which has inner emitting radio. Because A30 has many Product Numbers for different configurations, so if your A30 doesn't have internal emitting radio, then Power Amplifier is not suitable, only external radio.

Notice:

- 1) Connection should be tight between every part(cable, power amplifier, receiver) to confirm the successful data transferring.
 - 2) Storage battery used should distinguish the positive and negative poles to avoid the electric short circuit.
 - 3) Suggested brand of storage battery is Panasonic, other brands such as camel, fengfan ect. are also accepted as long as the output voltage is 12V and power consumption is not less than 17Ah.
 - 4) 5m pole is suggested in raising the UHF antenna for better signals.
 - 5) Confirm that the antenna is connecting with the Power Amplifier before emitting the data.
 - 6) Finish working, make sure to stop emitting the data firstly, then remove the cable.
 - 7) Distance between UHF antenna and A30 should be more than 3m.
 - 8) Considering the safety of yours, A30 is not suggested to be used at the weather of thunder or storms.
- 5) and 6) are all benefit for protecting the Power Amplifier.

3.3 Setting Up Base Station by External Radio

Two tripods supported

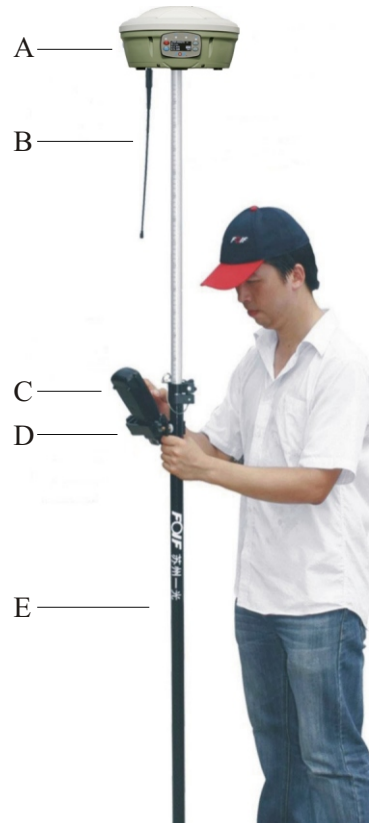


- A A30 receiver
- B External Radio
- C enhanced UHF antenna
- D connecting line for serial data
- E Y cable
- F Storage Battery (12V)
- G Supporting pole

3.4

Rover Station

Picture showing real-time rover station setup



- A A30 receiver
- B UHF antenna
- C controller
- D bracket
- E telescopic pole

Process:

1. Thread the receiver onto the pole.
2. Attach the controller bracket to the pole.
3. Insert the controller into the bracket.

Notice:

1. If telescopic pole is used, height of receiver can be got directly from the pole.
2. Confirm that connection between bracket and controller is tight to avoid that controller dropping to the ground.
3. If network is used, then UHF antenna does not need to fix on A30.

3.5

3.5.1

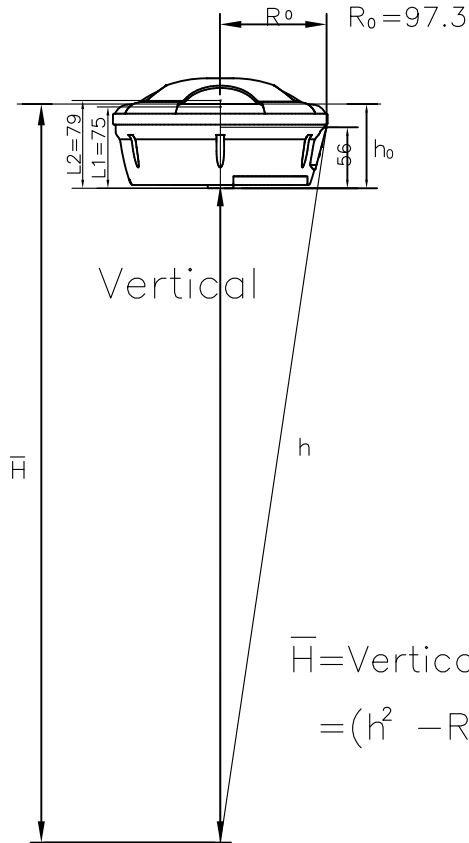
Measuring the Antenna Heights

Measuring the Antenna Heights for a Tripod Setup

Ways: Pay attention to the buckle of rubber fixing around the receiver, use your tapeline from the buckle to the point where your base is setting up, thus the reading on tapeline is the height of base.

**Measuring the
antenna heights,
a quick overview**





**Calculation
(sketch shown)**

$$\begin{aligned} \bar{H} &= \text{Vertical} + h_0 \\ &= (h^2 - R_0^2)^{1/2} + [(L_1 + L_2) / 2 - 56] \end{aligned}$$

3.5.2**Measuring the Antenna Heights for a Pole Setup**

Height of rover = pole(2m) + h₀

Considering the normal height of pole is 2m, so while setting the rover, you just only choose “vertical height” and enter “2m”, which is also the default choice, h₀ could be add automatically by software (FOIF Survey_GPS). If telescopic pole is used, then “2m” should be changed to the actual height of pole.

3.6 Controller Connecting

Two ways are supported connecting between controller and A30, bluetooth and RS232.





3.6.1 Bluetooth

1. Connecting work should be done first before start FOIF survey_GPS. Using controller scan the bluetooth signal of A30. When bluetooth is found, the SN of A30 is shown in controller, then select this SN to finish the connecting work.
2. Set port (No. of port can be searched from bluetooth settings in controller.) and baud rate of controller to finish connecting.(More shown in FOIF_survey User Manual)

3.6.2 RS232

Using serial port cable to build the connection by setting the port with COM1 and baud rate with 19200.

3.6.3 State of Connecting Shown

When connection is successful whether by bluetooth or RS232, you can confirm from the screen of A30.  or  would be displayed on the screen,  means RS232 while  means bluetooth.

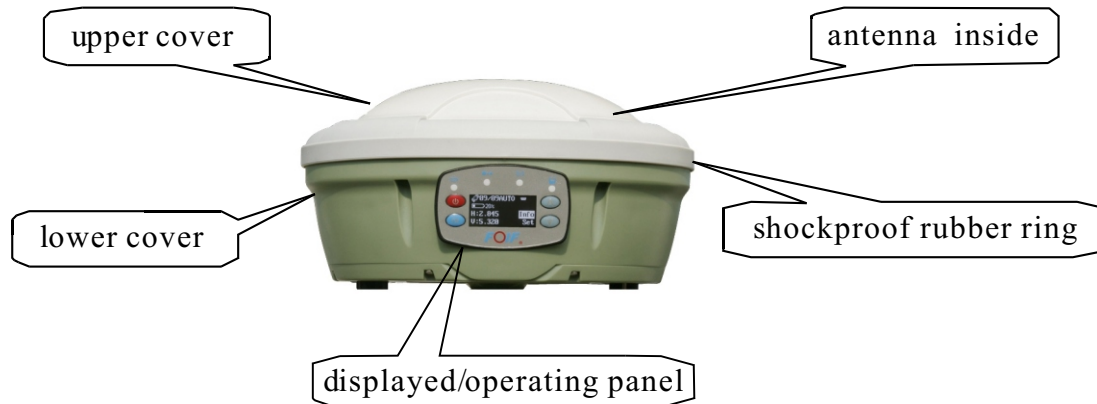
3.6.4 Disconnecting

Menus in FOIF Survey_GPS software, Configuration—> Com configuration, you can stop the connecting work by selecting the other COM port. While doing so, A30 receiver is still working normally, but you can not control the receiver by using your controller.

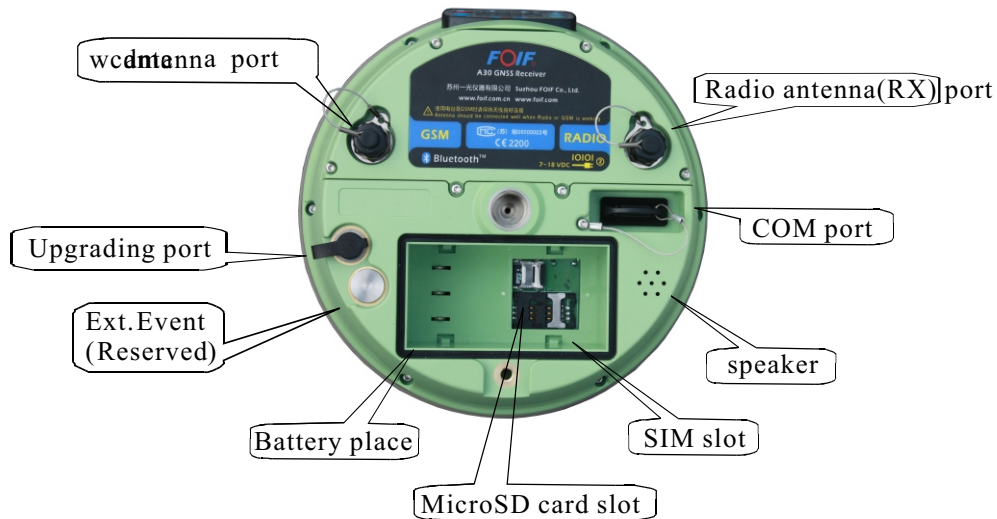
4 General Introduction

4.1 Nomenclature

Frontal panel

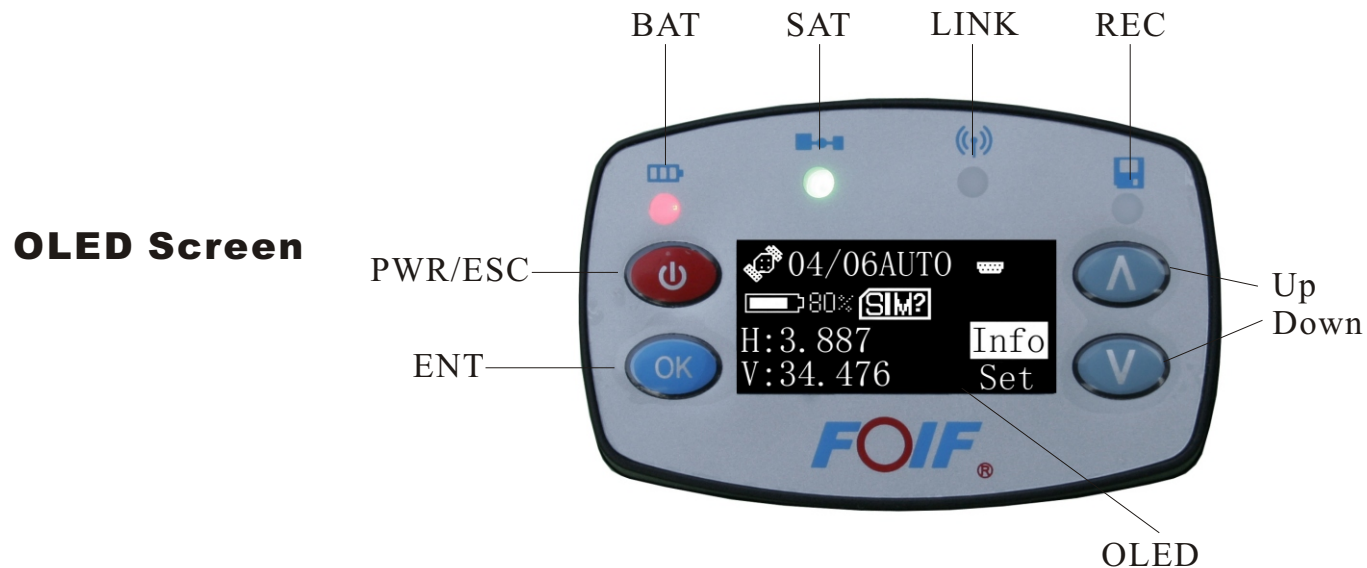


Bottom of panel



4.2

Displayed Panel and Keyboard



4.3

Battery

4.3.1

Ways of Battery Supplied

Two ways are supported in battery supplied: inner Li-Ion battery or external storage battery. While using the inner Li-Ion battery mode, capacity of battery would be displayed on the screen by real-time detection. Charging time for Li-Ion battery should normally be less than 6 hours.

4.3.2

Supplied by Inner Li-Ion Battery

Working time for A30 is more than 10 hours due to its high capacity chargable Li-Ion battery. (but actual using time may have certain difference because of different environments)

4.3.3

Supplied by External Storage

A30 can be supported by external storage using the Y cable standard in A30 equipment list which can also be used in connecting A30 with computer.

5 Receiver Operation

5.1 Buttons

5.1.1

 Power/Escape (red)

Function:

1、 Turn on/off (Default:off)

Turn on

1)Confirm that A30 is at shutdown state.

2)Press , then loosen it.

3)Start screen would be displayed on the screen of A30.



4)You can hear the voice while turning on A30.

5)Light(BATT) is on and light(GPS) is blinking.

6)Finish.

Turn off

1)Comfirm that A30 is at working state.

2)Press  for about 3 seconds unless you hear the voice while the information “loosen the power button, the receiver will be closed” ,then lossen  button.

3)The screen and lights on it would all be closed.

4)Finish.


5.1.2

 Enter

Function:

- 1) Confirm the settings.
- 2) Go to the next menu.

5.1.3

 Up and down.

- 1) Up or forward.
- 2) Down or backward.

Notice:

In order to avoid misoperating, you should press the button for about 1 second to achieve your choice. If the item you want to choose is not the next item (e.g. 3 or 4 items after the cursor's current position), then you can press without stop until the cursor switch to the item you want.

5.2

LED Indicating Lights


5.2.1

 Battery (green)

Function: Power Indicator.

- 1) >60%, green light is on without blinking.
- 2) 40% ~60%, flash one time for every second.
- 3) 20% ~40%, flash two times for every second.
- 4) 10% ~20%, flash four times for every second.
- 5) <10%, you will be mentioned by voice of A30.

5.2.2

 Satellite (green or red)

Function: Display the number of satellites tracked by A30.

- 1) While blinking in red, indicating that A30 is searching the signals of satellites.
- 2) While blinking in both red and green, the times that the light blinks in green shows the number of satellites tracked by A30.

5.2.3

 Link (blue)

Function: Differential Signal Indicator.

- 1) OFF: no signals transferring.
- 2) Blink regularly: normally sending or receiving signals.
- 3) Blink irregularly: unreliable in difference link.

5.2.4

 Record (green)

Function: Static working mode.

1)OFF: no static surveying.

2)Blinking regularly: Static surveying, the speed of blinking is the setting interval recording.

5.3

Displayed Menu

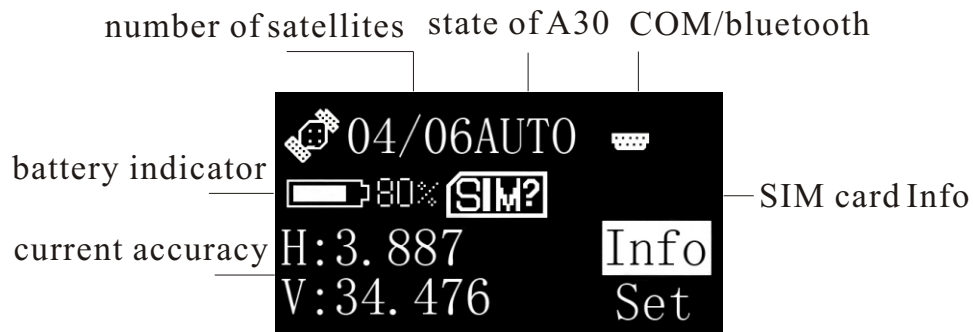
5.3.1






Start Screen



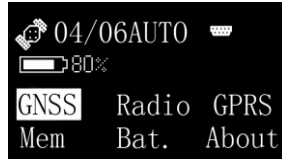
5.3.2

Main Interface



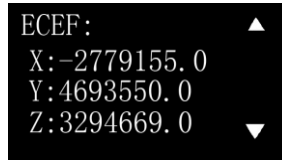
 indicates that SIM card is not in the receiver. If SIM card is put into the receiver,  would be displayed instead of . If receiver is connected to the controller by bluetooth,  would be displayed instead of  which is the COM port symbol.

5.3.3

Menus in A30

Info menu

Select Info. at the main interface, you will see the options like GNSS, Radio, WCDMA, Mem, Bat. and about.



Info/GNSS/P1

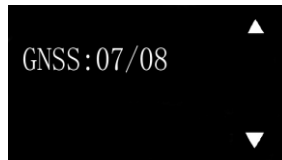
Select GNSS, you will see the followed 3 interfaces. Switch them by up or down arrow.

Coordinate



Info/GNSS/P2

Quality of satellites' signals



Info/GNSS/P3

Number of satellites tracked

Operating Menu (1)

Operating Menu (2)

Type:ADL
Channel:02

Info/Radio

Select Radio, you will see the model and channel of radio.

04/06AUTO 
 80% 
 SQ: 16
 Model: Q24PL001

Info/WCDMA

Select WCDMA, you will see the model and signal of WCDMA.

04/06AUTO 
 80% 
 Memory Info:
 Flash

Info/Mem

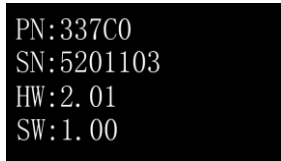
Select Mem, you will see the Info. of memory.

Ext. Power:none
 Batt:7.7V
 CC:none

Info/Bat.

Select Bat. , you will see the Info. of battery.

Operating Menu (3)



PN: 337C0
SN: 5201103
HW: 2.01
SW: 1.00

Info/About

Select About, you will see the Info. of A30 such as PN, SN, edition of software and hardware.



04/06AUTO 
80%  
GPS Link
Memory System

Set menu

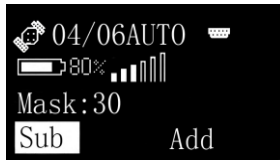
At the main interface, if you choose Set, you will see the setting options for A30 such as GPS, Link, Memory and System.






04/06AUTO 
80%  
Mask Base
Rover Static

Set/GPS

Choose GPS, you will see four options for your setting such as Mask, Base, Rover, Static.



04/06AUTO 
80%  
Mask: 30
Sub Add

Set/GPS/Mask

Select Mask, here you can set the mask of A30.

Operating Menu (4)

```
Format: CMR+
Linker:Ext Radio
Pos:Current
Cancel    OK
```

Set/GPS/Base

If you choose base, then you have many options for your base setting such as Format, Linker and Position.

```
Broadcast Format
RTCM2. X  RTCM3. X
CMR      CMR+
```

Set/GPS/Base/Format

In the Format column, you can choose the most suitable format for your surveying.

```
Broadcast Format
Int Radio
Int GPRS
Ext Radio  Baud
```

Set/GPS/Base/Linker

In the Linker column, you can choose the module of different linkers.

```
Base Position
Last
Current
```

Set/GPS/Base/Pos

In the Pos. column, you can choose the coordinate of base position. If the base has not moved, you can choose Last for the position of base. Instead, you can choose Current for the position of base. But be sure to do the coordinate converting because the accuracy of base in current mode is 10m by AUTO state.(Please check the next picture for reference.)



Now the base station setup is finished.

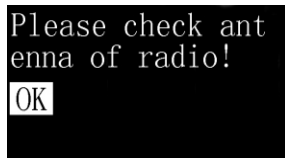
Radio is emitting.

Our base station would be emitted automatically if you just directly power off the receiver without exiting the base mode and power on again next time.

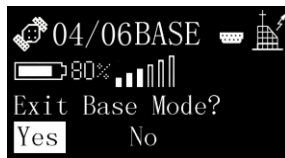
Notice: This is suggested to do in order to save you a lot of time for the base settings next time. But you should remember to connect the antenna before power on the receiver, otherwise, internal radio would be damaged.

Also, we have information displayed on the screen to remind you plug the antenna when you power on the receiver again.

Operating Menu (5)



Left information to remind you connect the antenna for the base.



If you do not want this receiver still be the base mode, then you can press **OK** button to exit the base mode.

Operating Menu (6)

Rover setting
Format: **CMR/CMR+**
Cancel OK

Set/GPS/Rover

Choose Rover for your rover setting.

Broadcast Format
RTCM2. X RTCM3. X
CMR **CMR+**

Set/GPS/Rover/Format

At the rover setting menu, you can select the format e.g. CMR etc.

Store:SD&Flash
Interval: 1
Height:1. 366m
Cancel OK

Set/GPS/Static

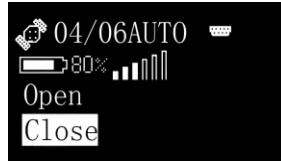
If you choose Static, then 3 options for your setting such as Store position, Interval and Antenna Height. Two ways are available for your memory, NAND flash and SD card.

04/06AUTO 
 80% 
GPRS
Radio

Set/Link

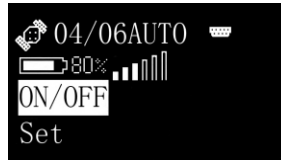
If you choose link, then you would have two ways for your data transferring.(WCDMA)

Operating Menu (7)



Set/Link/WCDMA

You can either Open or Close the WCDMA linking.



Set/Link/Radio

This is the Radio(inner radio) setting interface.



Set/Link/Radio/Set

Select Set, you would see the Setting Radio procedure.



Set/Memory

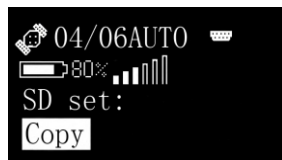
You can also choose Memory to set it for storage medium.
(Flash or SD card)

Operating Menu (8)



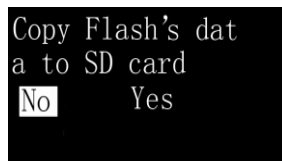
Set/Memory/Flash

You can Check or Format NAND Flash.



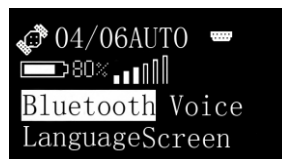
Set/Memory/SD card

If you choose SD card as memory, then you would be mentioned to copy Flash's data to SD card.



Set/Memory/SD card/Copy

This is the copying procedure.

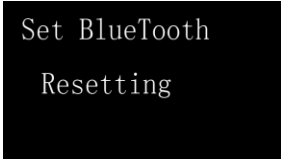


Set/System

In the System menu, you have 4 options to set.

Bluetooth, Voice, Language and Screen.


Operating Menu (9)






Set BlueTooth
Resetting

Set/System/Bluetooth

This is the Bluetooth Resetting procedure.



04/06AUTO 
 80% 
Open
Close

Set/System/Voice

Here you can Open or Close the Voice.



04/06AUTO 
 80% 
English
Chinese

Set/System/Language

Two options are available for language.

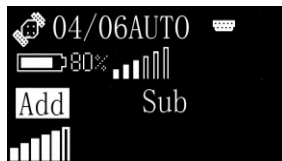


04/06AUTO 
 80% 
Contrast
OLED

Set/System/Screen

Screen to set Contrast and OLED.

Operating Menu (10)



Set/System/Screen/Contrast

Choose Add or Sub to set the contrast of the screen.



Set/System/Screen/OLED

This is power saving mode by choosing OLED, then you would be asked whether auto off OLED or not. If you choose Yes, the screen would be Off automatically after 1 minute without affecting your surveying job.

6 Static Surveying

A30 also has static surveying function, which includes outdoors surveying and office working.

6.1 Process

- 1) Fix A30 on tripod.
- 2) Measure the height of A30.
- 3) Turn on A30 while more than 4 satellites are tracked by this instrument, then start the static surveying from the buttons of A30 screen.
- 4) It is important to record the surveying time, SN of A30,height of A30, etc. on a notebook while this receiver is doing the static surveying.
- 5) When outdoors surveying is over, turn off A30.

Notice:

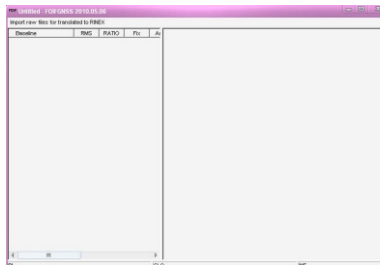
Normally, it is better to record the static data on SD card.

6.2 Data Downloading and Format Converting

- 1) Connecting A30 and PC for data downloading.
- 2) File name given should according to the notes of outdoors surveying made by yourself. SN of A30, surveying time and point name should all be indicated in the file name for your easy distinction. For example, A30, the detailed information is,A300000086(SN

of receiver) for the first time surveying at 9am to 10am on CPI0023(point name), so we can give its name as 0023086A. Further more, still this receiver for the second time surveying at 11am to 12am on CPI0027. So then we can give its name as 0027086B which is different from 0023086A,although we use the same receiver to do the job.(The front 4 numbers are point name, the later numbers are SN of receiver, the last capital letter is surveying time.)

- 3) Convert these data to RINEX format and input the height of A30. You can finish this by the software FOIFGNSS shown below.



- 4) Click “Import raw files for translated to RINEX” , choose the files that need to be converted.(These files are downloaded from receivers.) This software can convert as much as 16 files at the same time.
- 5) Choose the files that you want to convert, then click “Open” . The converted files are saved at the same path as your original files on your PC.

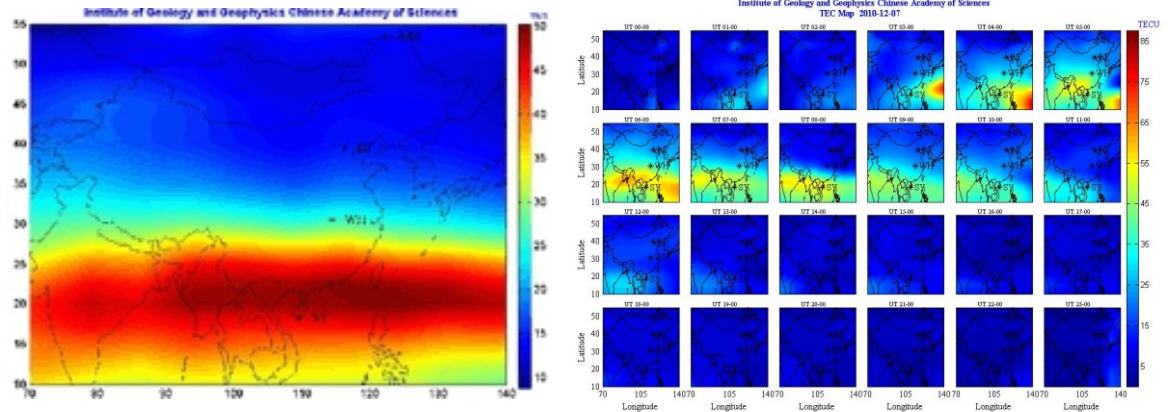
6.3 Ways of Outdoors Working for Static Surveying

- 1) Surveyors should give a general understanding about their surveying district e.g. point position, difficulties of making point and also includes the economic level, culture custom, traffic situation etc. at that place.
- 2) Ephemeris forecast: Good surveying opportunities should depend on the surveying position and the latest satellite ephemeris. The satellite ephemeris includes many aspects e.g. visibility of satellites, satellite constellation, PDOP etc. If big building is beside the point, then you should give a conclude on whether this big object would influence the effects of static surveyings on that point.
- 3) Give a detailed surveying procedure on the paper.
- 4) Outdoors surveying: Comply with the surveying procedure and related receiver manual to lead your job.
- 5) Data transferring: Check the consistency between outdoors notes making and the files in the receiver by PC.
- 6) Process baselines to determine the accuracy of your surveying thus leading your next working plan.
- 7) Finish working if there has no problem in step 6) and then print your adjusted results report.

Notice:

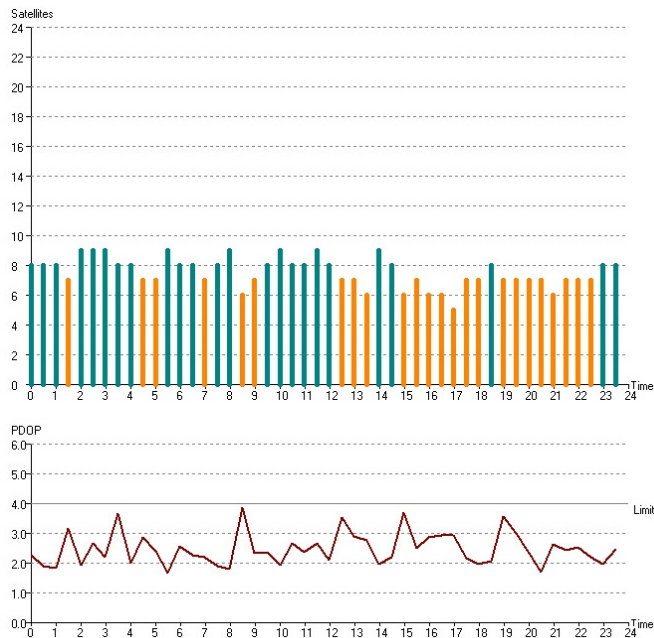
To achieve a better accuracy and reliability of the project, it is asked that you should have a knowledge of the ephemeris and the status of ionosphere to avoid the troubles from surveying.

Followed pictures show you the detailed situation of ephemeris.



You can visit followed website to see the status of ionosphere. The status of ionosphere is updated every 24 hours.

<http://space.iggcas.ac.cn/TEC.asp>



6.4

6.4.1

GPS Network Network Designing

- 1) The baselines should be closed. Single baseline is not accepted in the designing.
- 2) It is not right to say that the more the baselines, the better the results are. Three baselines for one point is suitable for the reliability of network.
- 3) For getting the higher accuracy of the point, one point for two times surveying is suggested.
- 4) In order to convert GPS system to your local coordinate system, you should have at least 3 to 5 higher accuracy known point that are equally spread in the survey district for your good coordinate converting. At the same time, if you want to get your good elevation of the surveying points, then you should have certain leveling points for your research on the elevation of your surveying district.
- 5) Considering the convenience of static surveying, it is suggested for you to give your points in the wild place where you are easy-going.

6.4.2

Accuracy Standard in Static Surveying

Accuracy standard in static surveying is judged by the “rms” of distance in the adjacent two points.

$$\sigma = \pm \sqrt{a^2 + (b * d)^2}$$

σ : rms (mm)

a : fixed error (mm)

b : scale factor (ppm)

d : distance (km)

The surveying accuracy for GPS is divided into 6 levels by Surveying Standard for GPS published in 2001 (AA, A, B, C, D, E). AA, A, B are for country's GPS control surveying. Level C is mainly in engineering surveying of big or middle cities. D and E are for control surveying in middle or small cities

Items	AA	A	B	C	D	E
Fixed error:a (mm)	≤3	≤5	≤8	≤10	≤10	≤10
Scale factor: b(ppm)	≤0. 01	≤0. 1	≤1	≤5	≤10	≤20
Minimum distance for adjacent two points (km)	300	100	23	4	2	1
Maximum distance for adjacent two points(km)	3000	900	210	36	20	8
Average distance for adjacent two points(km)	1000	300	70	10~15	5~10	0.2~5

6.4.3**GPS Network**

There are many kinds of GPS network designing such as tracking, alternately observation, multi-base, single-base, normal.

Tracking: Several receivers fixing at the certain points for a long time observation (such as 1 year without stop), which is suitable for level AA control survey or permanent monitoring survey.

Alternately observation: Several receivers fixing at the points of certain district, they also need long time surveying (several days), after this procedure, change the receivers to the other points of this district, then use the same surveying way. This mean can eliminate the influence of SA. It is suitable for the GPS network survey of level A and B survey.

Multi-base: While several receivers are fixing at the base points (like CORS) with long time surveying, then we can use other rovers working in this net simultaneously. It is suitable for level C and D survey.

Single-base: Use one receiver fixing at the base point working continuously, then use rovers to do the surveying job around base point. These rovers do not need synchron. As a rover fix at one point, one baseline is formed. Several rovers then can form many baselines which have the same base point like a star. It is suitable for level D and E survey.

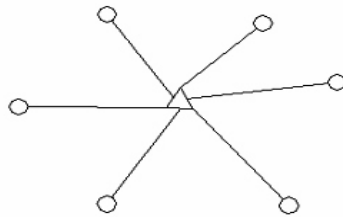
Normal: This way is just the general way for customers. You just follow the manual and do not

need to have many professional knowledge. Detailed way is, using 3 or more receivers fixing on points to do the static surveying for a certain while (usually 40-60 minutes) simultaneously. This moment, one polygon is formed by these receivers. After the first surveying time is over, move these receivers to other points doing the same surveying job (another polygon is formed by the second time surveying) but make sure that the two polygons should have common side. The whole GPS network is formed by these polygons. It is suitable for level C and D survey.

6.4.4

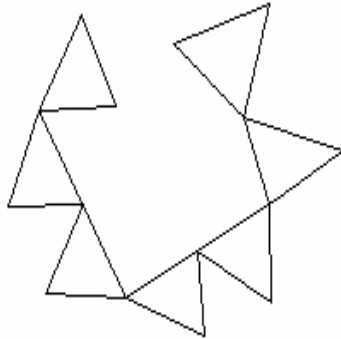
Shapes of GPS Network

Depend on different applications, shapes of GPS network can be divided into several types: Radial network, Point connecting network, Side connecting network, Polygon connecting network and Mixed connecting network.



Radial network

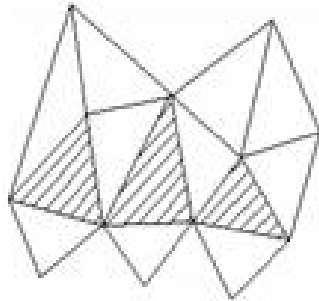
Radial network is a simple geometric figure, but it is not easy to check the accuracy because all the sides of that network are not closed. The advantages for this type is: only need 2 receivers, which is regarded as an easy-working, fast-tracking way. It is widely used in low precision engineering surveying, cadastra survey, mapping and so on.



Point connecting network

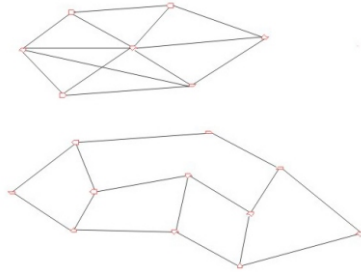
Point connecting network is defined as a figure by connecting two adjacent shapes by only one common point. The advantages for this type is high efficiency, fast extending, but it also can not confirm the high precision surveying. So it is not suggested in precise working.

On the left is 3 receivers working simultaneously in the Point connecting network.



Side connecting network

Side connecting network is defined as a figure by connecting two adjacent shapes by their common side. It is as same as normal GPS network designing shown in the last paragraph and is widely used in the surveying field because of its high precision.



Polygon connecting network

Polygon connecting network is defined as a figure connecting the two adjacent shapes by at least 3 common points. So this network at least needs 4 receivers. It is better than side connecting network in accuracy but not working time. So it is only suggested for high precision control surveying.

Mixed connecting network

Because every type of network has its own disadvantage, so we can use Mixed connecting network which can combine the advantages of these types to achieve higher efficiency working but lower investment both in time and money.

Mixed connecting network is also the common type in doing the surveying job.

6.4.5

Principles of GPS Network Designing

Principles for GPS network designing include 3 parts, point position, reliability and accuracy.

Point position

- 1) Widely place is suggested because of good satellites' signals, big buildings are not allowed at the range of $10^{\circ} \sim 15^{\circ}$ in elevation mask.
- 2) Keep 200m away from high power WiFi object, e.g. radio, powerline etc.
- 3) It is better to be removed from the large water area, high building etc. to avoid or reduce the effects of multipath.
- 4) The place for point position should be easy-going and also steady for further applications.

Reliability

- 1) Longer surveying time.
- 2) Repeated station setting is suggested.
- 3) Confirm that one point should be involved at least 3 baselines.
- 4) The sides for every part of the network should not exceed 6.

Precision

- 1) Synchronous surveying is suggested in the adjacent points.
- 2) GPS network designing is suggested.
- 3) The sides for every part of network should not exceed 6.
- 4) High precision EDM instrument is recommended to use together with GPS receivers.
- 5) Leveling points should be equally spread in the district for better elevation fitting.
- 6) Surveying time (times) could be added appropriately for higher precision surveying.
- 7) Known points should be equally spread in the district for better precision surveying.

7

7.1

Specifications

Physical Specifications

Feature	Specification
Size	197mm*101mm(Φ *H)
Weight:with battery	$\leq 1.5\text{kg}$
Operating time	5.8Ah (>13hrs optional) (UHF rover at 20°C)
Operating temperature	-30°C to +65°C (-22F to 149F)
Storage temperature	-40°C to +75°C (-40F to 167F)
Humidity	Up to 100%
Water/Dustproof	IP67,IEC529
Drops	2M pole drop

7.2

Positioning Specifications

Feature	Specification
Post processing	Static and fast static
Horizontal	$\pm 2.5\text{mm}+1\text{ppm}*\text{D}$
Vertical	$\pm 5\text{mm}+1\text{ppm}*\text{D}$
Real-time(RMS)	RTK
Horizontal	$\pm 10\text{mm}+1\text{ppm}*\text{D}$
Vertical	$\pm 20\text{mm}+1\text{ppm}*\text{D}$

D:distance (Km)

7.3

Technical Specifications

GNSS Engine	Communication
120channels,GPS 14L1,14L2, GLONASS12L1,12L2,2SBAS	1.Internal radio Satel UHF-Link (403~473MHz) Rx only
220channels,GPS:L1 C/A,L2E,L2C,L5 GLONASS:L1 C/A,L1P, L2 C/A,L2P SBAS:L1 C/A,L5 GLOVE-A:L1 BOC,E5A,E5B,E5AltBOC GLOVE-B:L1 CBOC,E5A,E5B,E5AltBOC GALILEO:L1 CBOC,E5A,E5B,E5AltBOC	UHF-Link (390~430MHz/430~450MHz/ 450~470MHz) Rx only
I/O Interface RS232*2 (LEMO&DB9), Bluetooth, (optional):Ethernet, PPS, Ext Event	Operation RTK rover/base, post-processing RTK Network rover: VRS, FKP, MAC Point-to-Point Circuit Switched Data (wcdma) WCDMA mode through Real-time Data Server Software(internal wcdma or external cell phone)
Data formats RTCM 2.x, RTCM 3.x, CMR, CMR+ NMEA0183	Internal memory 4GB

7.4**Technical Specifications for Controller
Getac PS236****7.4.1**

Feature	Specification
CPU	PXA310 806MHz, 32bit RISC CPU
Operation system	Microsoft Windows Mobile 6.1
Display	3.5" TFT LCD VGA (640*480)
Camera	3 Megapixel Auto-focus camera
Memory	128MB MDDR
	256MB NAND Flash, 4GB iNAND
Communication	Integrated bluetooth and RS232
Working distance	≤10m (for bluetooth)
I/O Interface	USB/RS232
Dimensions	178*89*30mm
Weight	0.5kg (Include battery)
Operating temp	-30°C~+60°C
Storage temp	-40°C~+70°C
Humidity	95%
Water/Dust	IP65, IEC529
Drops	1.52m (5ft) drops to polished concrete

7.4.2**Getac PS236C**

Feature	Specification
CPU	PXA310 806MHz, 32bit RISC CPU
Operation system	Microsoft Windows Mobile 6.1
Camera	3 Megapixel Auto-focus camera
Display	3.5" TFT LCD VGA (320*240)
Memory	128MB MDDR
Communication	Integrated bluetooth and RS232
Working distance	≤10m (for bluetooth)
I/O Interface	USB/RS232
Dimensions	178*89*30mm
Weight	0.5kg (Include battery)
Operating temp	-30°C~+60°C
Storage temp	-40°C~+70°C
Humidity	95%
Water/Dust	IP65, IEC529
Drops	1.52m (5ft) drops to polished concrete

7.4.3**Getac PS236S**

Feature	Specification
CPU	PXA310 806MHz, 32bit RISC CPU
Operation system	Microsoft Windows Mobile 6.1
Display	3.5" TFT LCD VGA (640*480)
Memory	128MB MDDR
	256MB NAND Flash, 4GB iNAND
Communication	Integrated bluetooth and RS232
Working distance	≤10m (for bluetooth)
I/O Interface	USB/RS232
Dimensions	178*89*30mm
Weight	0.5kg (Include battery)
Operating temp	-30℃~+60℃
Storage temp	-40℃~+70℃
Humidity	95%
Water/Dust	IP65, IEC529
Drops	1.52m (5ft) drops to polished concrete



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