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Chapter 1 Brief Introduction of K9 series

§1.1 About K9 series

KOLIDA always strives to provide advanced GNSS surveying technology and products to surveyors.

GNSS surveying technology has been taking important part in surveying work. As an industry leader in GNSS instrument producing and marketing, KOLIDA company sells thousands of GNSS receivers every year, serves surveyors who live in various countries and areas.

K9 series receiver is integrated with antenna, mainboard, radio module, receiving antenna, Bluetooth module and battery. To start working within CORS network, you just need 1 rover receiver and 1 controller.

When compared with old design GNSS receivers, K9 series has higher stability, lesser power consumption, the machine body is smaller and lighter.

As a special design, the batteries and built-in radio module is set in the bottom of receiver, it makes the waterproof and dustproof ability much better than before.

§1.2 Main features

High integration and Anti-interference ability

With highly integration module design, now there is very less cable inside receiver, it reduces signal interference greatly.

Professionally designed data-transfer radio eliminates Error Code

Mastering the core technology of data-transfer radio, the performance of KOLIDA GNSS receivers reaches the international standard level. It's convenient to set frequency value and avoid crosstalk.

Industrial proof design (dustproof, waterproof, shockproof)

Professional mold, high-intensity enclosure material and excellent waterproof function make K9 series works stably in field.

Double interfaces (USB, serial port) transfer with high speed, 64MB internal memory.

The built-in 64MB memory is able to save the measurement data of 80 hours static data collection (with 1 second interval). With longer interval setting, it saves data more than 80 hours.

Designed for networks

The excellent internal GPRS/CDMA net modules allow you to create high-speed connection to the reference network, simplify the operation and maximize your productivity.

Chapter 2 K9 series mainframe

§2.1 The Appearance of mainframe



Fig2-1 K9 series mainframe (Rover)

The mainframe is as the above photo shows, in the front there are keys and guiding lights, inside the bottom there are module (Receiving radio module and GPRS module) and battery warehouse.

§2.2 Interface

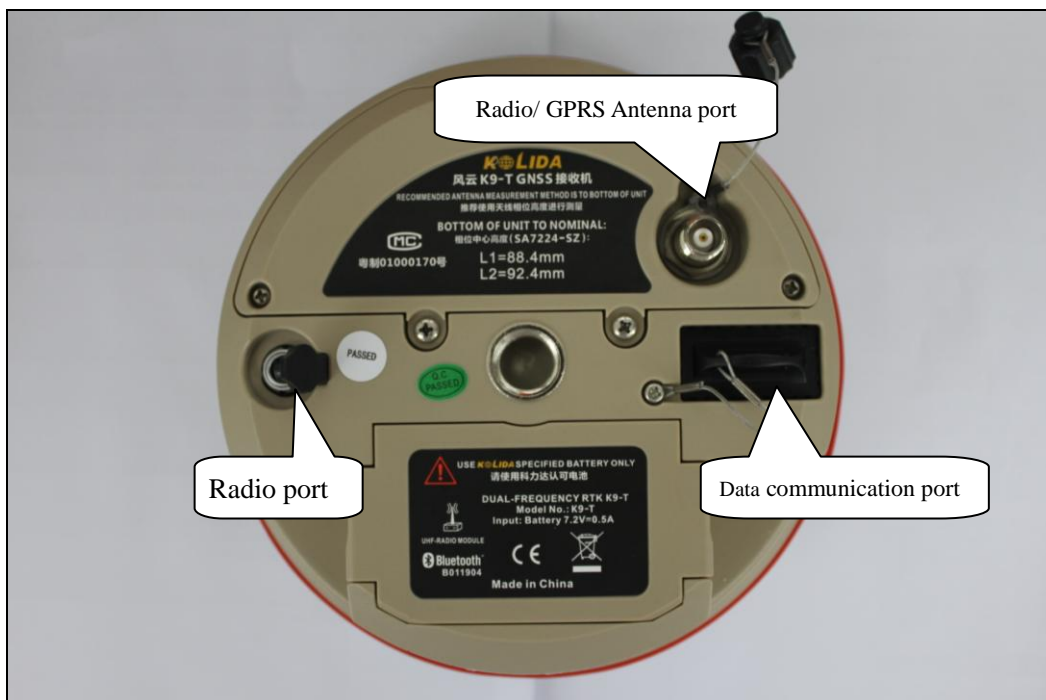


Fig 2-2 K9 series bottom interface (Rover)

Note: The mainframe interface is as Fig2-2 shows, the Radio Port is for external power supply and external radio transmitting, five pins; The Data Communication Port is used to connect computer for transferring data, or be used to connect the handheld controller with the mainframe.

§2.3 Installation of battery

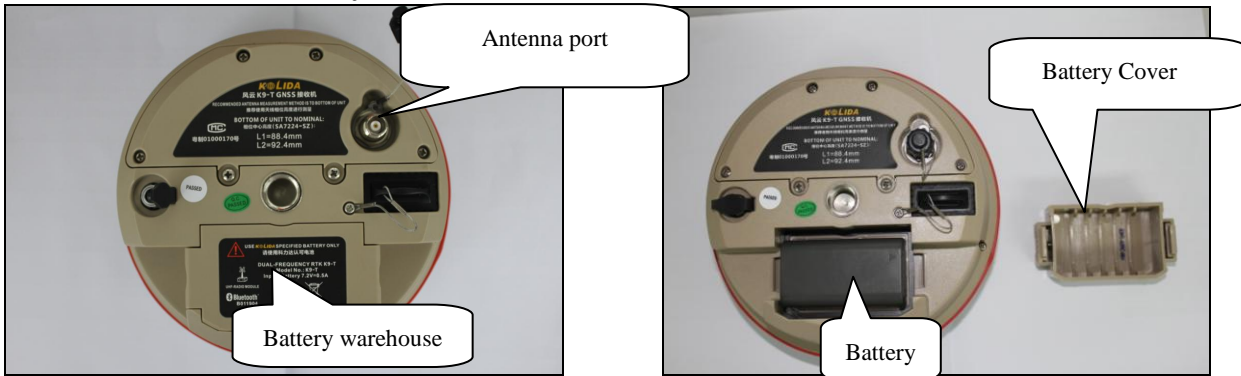


Fig 2-3 battery warehouse

Fig2-3-2 K9 series battery installation

§2.4 Guiding light and instrument settings

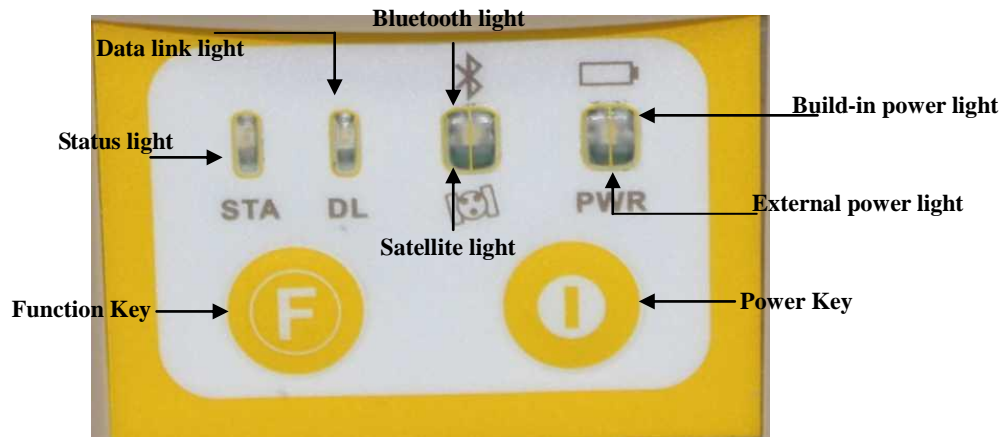


Fig 2-4 K9 series keys and indicator light

The indicator lights are on the operation panel, from the left to the right are: status indicator light, Bluetooth indicator light, built-in battery indicator light and data link indicator light, satellite indicator light, external power supply indicator light, the usages of them are as follows:

BAT: built-in power supply light. (Red)

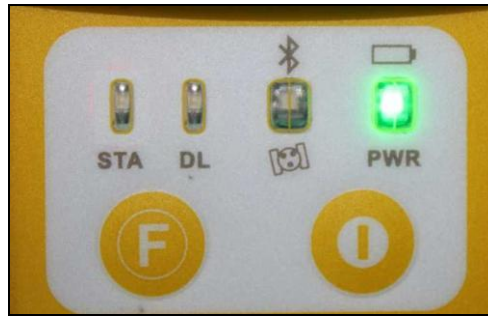


It includes two kind of status.

Light always on: Power supply in good condition

Flashing: Low power

PWR: external power supply light (Green)

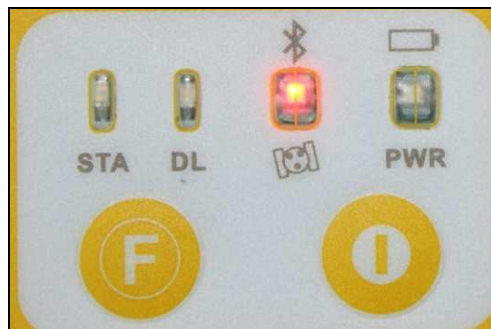


It includes two kinds of status.

Light always on: Power supply in good condition

Flashing: Low power

BT: Bluetooth indicator light (RED)



When you connect Psion controller with receiver, this light will be turned on.

SAT: Satellite light. It shows the amount of locked satellites (Green)

When the receiver get satellites signal, it will start to blink, the times it blinks means the amount of locked satellites.

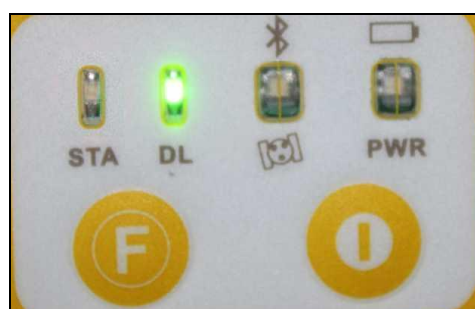
STA: Status light. (Red)



In static mode, the light will be always on.

in RTK mode, it shows if the data link module working in good condition (flashes 1 time each second).

DL: Data Link light. (Green)



In static mode, the light will be flashes as your data collection interval setting (E.g. 1 time every 5 seconds).
in RTK mode, it shows if the data link module working in good condition (flashes 1 time each second).

F Key: function key, which is in charge of the switch of working mode, and switch of radio and the mode of GPRS

P Key: Power key, which has power on/off receiver function and confirm function.

To power on receiver: Press P key one time, the receiver will power on.

To power off receiver: Press and hold P key for 3 to 10 seconds, then release the key, the receiver will power off .

Self-Check: when the receiver work abnormally, you can make a self-check to fix it, the operation way is: Press and hold P key for more than 10 seconds, release the key when you hear long beep. It will start to make a self-check.

It's better to run self-checking once on your new machine.

The basic operation of F key: select working mode when you power on receiver, select data link after the receiver enters normal work status.

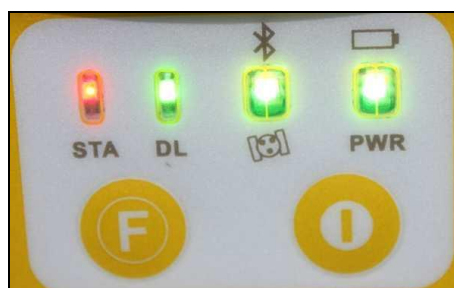
There are 3 work modes: *rover, base, static*.

There are 3 kinds of data link to select, *built-in radio, GPRS/GSM module, external radio*.

Note: *the built-in radio in receiver is just for receiving differential signal, can't transmit signal. So in base mode, we need connect an external radio to transmitting signal, we cant use the built-in radio in base mode.*

How to enter work mode selecting interface?

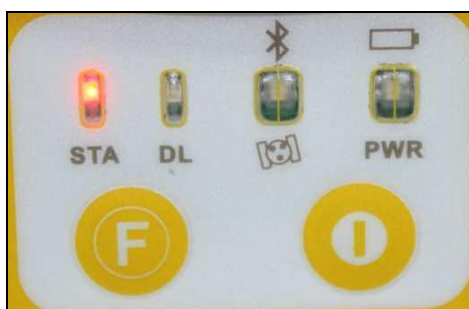
Insert the battery to the battery box, then press and hold P key + F key until the six lights blink at the same time, then release the keys.



Wait several seconds, keep pressing F key, the 6 lights will be turned on by turns, it's circular. You select different light, then press P key, it will enter different work mode.

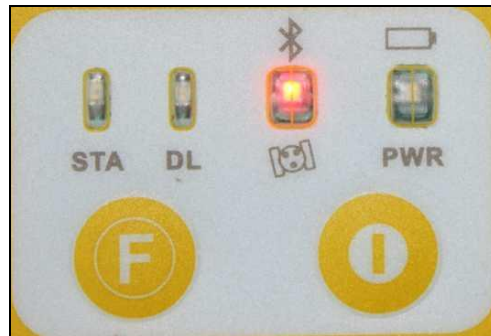
Rover mode

When the light stop on the STA light, press P key to confirm, you will enter rover mode. Such as following figure,



Base mode

When the light stop on the BT light, press P key to confirm, you will enter base mode. Such as following figure

**Static mode**

When the light stop on the BAT light, press P key to confirm, you will enter static mode. Such as following figure,

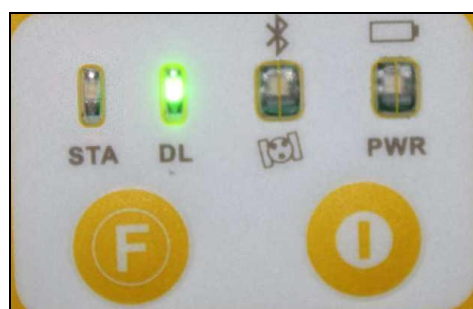
**How to select data link?**

After you enter normal working mode status, press and hold F key, when you hear 2 beeps, and see a green light blinking, release the key, wait several seconds, then press F key, the 3 green lights will blink by turns. Then you select different green light, means you select different data link.

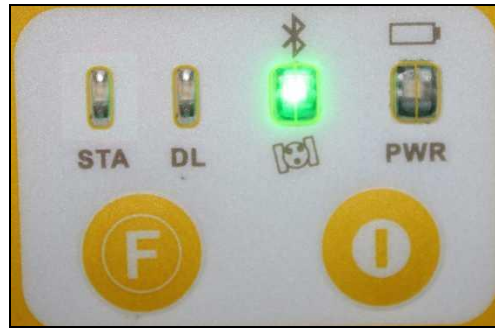
Note: in rover mode, you will see 3 green lights will blink by turns, but in base mode, you only see 2 green lights will blink, means you can only select gprs/gsm module and external radio. In static mode, no green light will blink.

Built-in radio

When the green light stop on the DL light, press P key to confirm, you will use built-in radio. such as following figure,

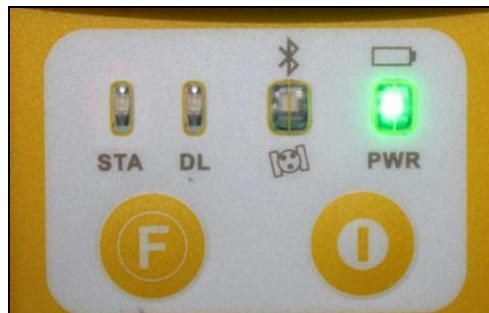
**GPRS/GSM module**

When the green light stop on the SAT light, press P key to confirm, you will use GPRS/GSM module as data link. such as following figure,



External radio

When the green light stop on the BAT light, press P key to confirm, you will use external radio as data link. such as following figure,



How to check the working mode and data link during work ?

You can press F key one time to check the work mode and data link

There are 6 kinds of status, such as follows,

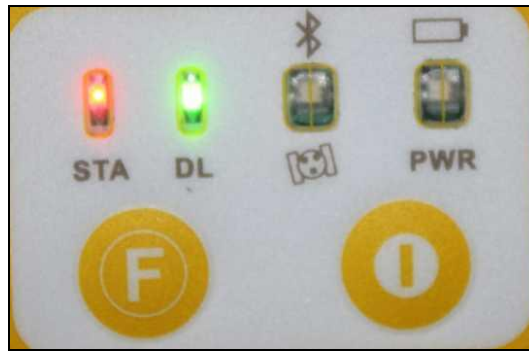
1. Static mode

When you press F key one time, if you see the following figure, it means static mode.



2. Rover + built-in radio

When you press F key one time, if you see the following figure, it means it's rover + built-in radio mode.



3. Rover +gprs/gsm module

When you press F key one time, if you see the following figure, it means rover + gprs/gsm module mode.



4. Rover + external radio

When you press F key one time, if you see the following figure, it means rover + external radio mode.



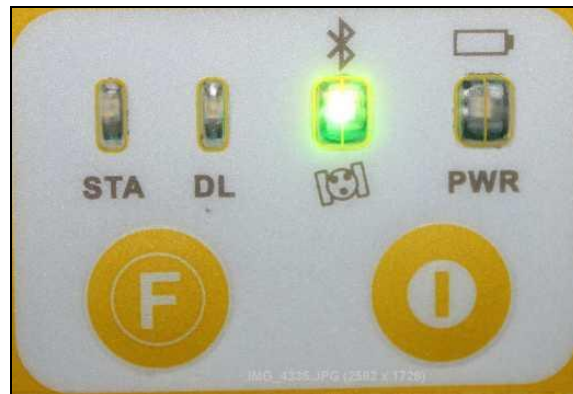
5. Base + external radio

When you press F key one time, if you see the following figure, it means base + external radio mode.



6. Base + gprs/gsm module

When you press F key one time, if you see the following figure (red and green lights turned on together), it means base + gprs/gsm module mode.



Chapter 3 Psion Controller Connect with Receiver by Bluetooth

§3.1 Psion setting

1. “start “→“setting” →“control panel”, in “Control Panel”, select “power”

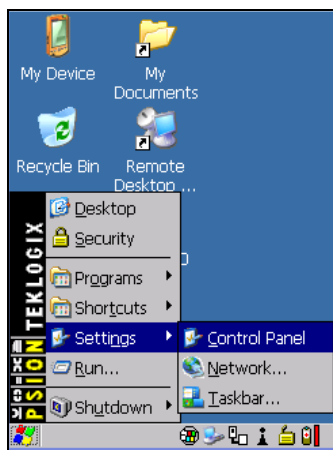


Fig 3-1



Fig 3-2

2. In power properties, select “ Built-in device”, select “ Enable Bluetooth”, click “OK” to close.

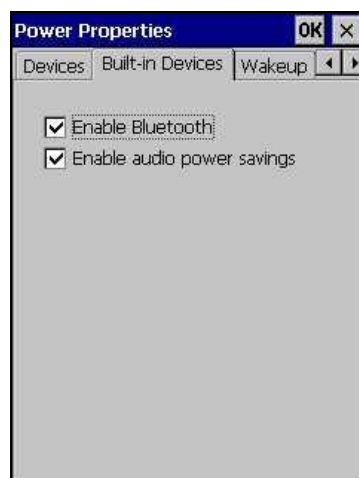



Fig3-3

3. Double click the icon , it will pop up “Bluetooth Manager”

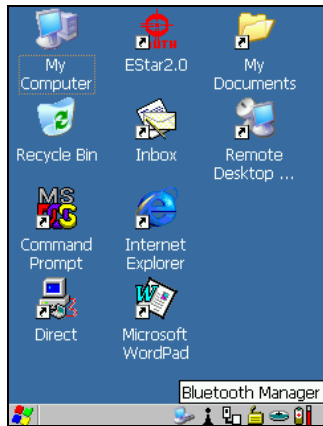


Fig 3-4

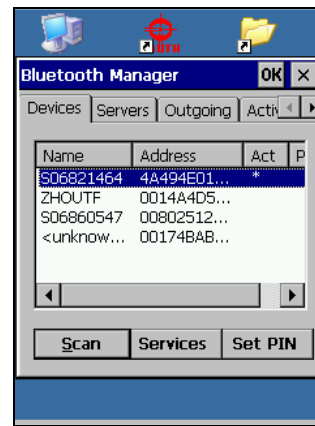


Fig 3-5

4. Click “Scan”, pop up “Scanning...”.

Note: The process will last 10 seconds, please be patient.

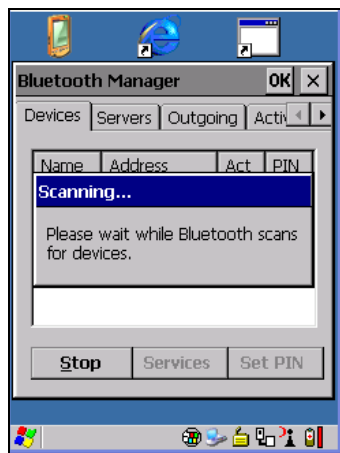


Fig3-6

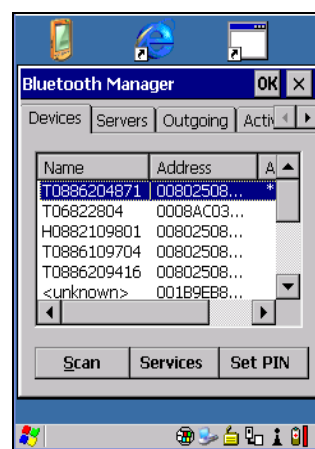


Fig 3-7

5. Select correct machine number, choose “Pair”, fig 3-9 will shows.



Fig 3-8



Fig 3-9

7. Click “Serial Port”, Fig 3-10 will shows, choose options as fig 3-10, click **Next**

Now you can check the instrument info in the page “Paired”.

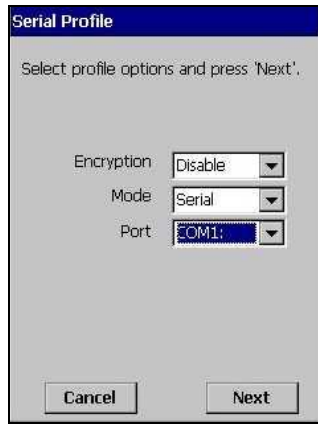


Fig 3-10

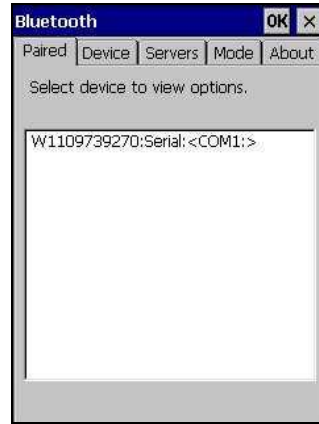


Fig 3-11

§3.2 Set connection

Install the Estar to the Psion, and keep the Psion power on, then do the settings as follows:

1. Open the Estar software, enter the Estar mainframe, click “ok” in the “Tip”

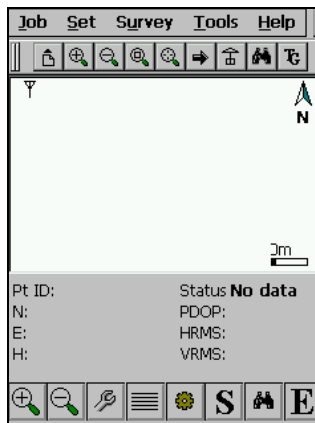


Fig3-12

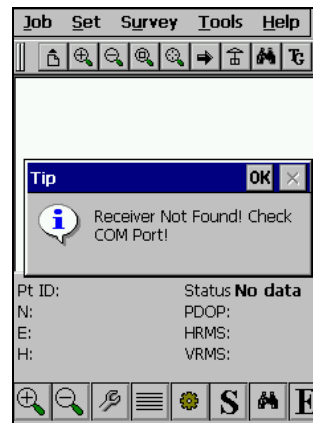


Fig3-13

2. “Set” →“Com port set”, in “com port set” dialog bar, select “Input com ”, click “connect”. If connect successfully, the status bar will show the related data.

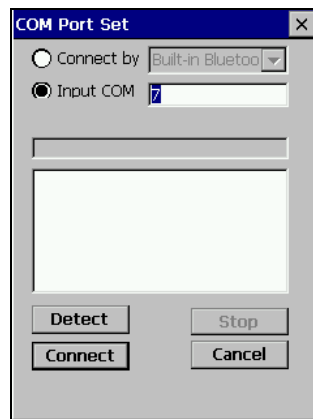


Fig3-14

Chapter 4 K9 series radio

§4.1 Introduction of radio

GDL20 radio is a high speed wireless semi-manual data transfer radio, the transferring rate can reach 19200 bps. The machine features of GDL 20 are the good heat emission ability and water-proof ability.

GDL20 radio adopts GMSK adjust method, 19200bps transfer rate, error-code rate is low. The transmission frequency can cover 450-470 MHz range. The data transfer mode of GDL25 is transparent mode, which means that all raw data will be sent to RTK receiver without change.

The data transfer interface of GDL25 radio is the standard RS-232 port, it can do data transferring with any terminal equipment that owns RS-232 port.

GDL25 data transfer radio adopts advanced wireless transmission technology, data processing technology and base-band processing technology, produced with high quality components, which secures that it runs for long time steadily.

Eight radio channels and relative frequency are listed in the following table:

Channel \ Rate	450-470MHz
channel	463.125
channel	464.125
channel	465.125
channel	466.125
channel	463.625
channel	464.625
channel	465.625
channel	466.625

§4.2 Introduction of GDL20 radio appearance

The external looking of GDL 25 radio is simple, the control panel indicator light shows the radio status, the operation of the keys is simple and convenient, one on one port can avoid connection error effectively.

§4.2.1 The panel of GDL20 radio

- (1) **Channel key**: switch radio channels, press this switch can switch between channel 1-8.
- (2) **on/off** : power on/off the radio (small red light shows the status).
- (3) **AMP PWR**: when the light is on, it means radio is working with lower power consumption mode.
- (4) **TX**: The light blinks every second when it is transmitting signal properly (internal 1 sec.).

The panel is as follows:



Fig 4-2 panel of radio

§4.2.2 Appearance of GDL20 radio

1. Interface of GDL20 radio

- (1) antenna port: Bayonet, for connecting transmitting antenna
- (2) mainframe port: 5-pins, for connecting Radio with GPS receiver and external battery.



Fig4-2-2 antenna interface and receiver interface



Fig 4-2-2-1 5-pins port

2. Size of GDL20 radio :

Volume: 175mm×157mm×67mm

Weight: 1000g

3. power switch:

The switch is for adjusting radio power, the AMP PWR light shows the radio power consumption, when it lights, means

that it is low power consumption mode, when the light shuts off, means that it is high power consumption mode. See as follows:

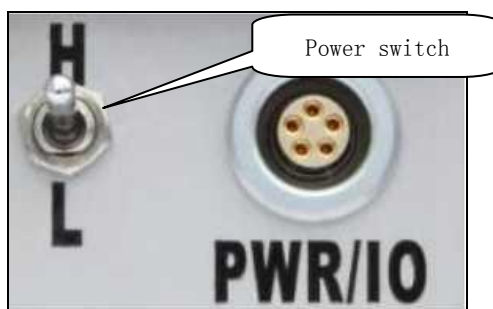


Fig 4-2-2-2 power switch

Note: It's better to use the low power consumption mode. **High consumption mode will doubly consume the power, and it harms battery life.**

§4.3 Notices for GDL20 radio operation:

§4.3.1 power supply

The requirement of power supply is as follows:

1. GDL20 radio power input is 12-15V (typical value is 13.8V), the RF power is 25W, the current is lower than 7.1A (when power input is 13.8V).
2. The quality of power effect the quality of communication, the ripple coefficient of power should be lower than 40mV, with lower ripple coefficient, communication gets higher quality.
3. The transmitting power is related with the power supply voltage.
4. Before powering on the GDL20 radio, you should check whether the anode and cathode are correctly connected, if they are reverse, it will damage the radio.
5. It strongly suggested to use a 12V/36Ah (or more) external power supply; When using external stabilized voltage supply, it should keep the current at 10A .

Notices for Storage Battery:

1. Using 12V/36Ah storage battery. If lower than that, it effect the working distance of radio, and reduce the battery life.
2. The battery should be recharged in time, don't overuse the battery, for example: a battery of 12V/36Ah can make the radio working for 14 hours (15W) constantly, if the time exceeds 14 hours, working efficiency will be very low and it is harms battery life.
3. **Using 25W radio will increase the power consumption of battery, and working range will not extend much. Usually the 15W is enough to work.**
In case of strong interference around, you can choose 25W radio.
4. After 6-12 months using, the working distance of the radio will be shortened, you may need to change a new battery.
5. **To plug or unplug cables (especially the cable that connects RTK receiver) please power off all connected device, to avoid any sudden damage.**



GDL-20 Radio

Chapter 5 Introduction of K9 series accessories

§5.1 The carrying case (bag)



Fig5-1 K9 series case

§5.2 Battery and Charger

The standard configuration contains two types of battery and charger:

1. Lithium battery and charger of receiver;
2. Handheld controller (Psion) battery and charger.

lithium battery and charger , see as Fig5-2-1、 Fig5-2-2:



Fig 5-2-1 lithium battery



Fig 5-2-2 charger

2. Psion battery and charger.



Fig 5-2-3 handheld Psion battery



Fig 5-2-4 handheld Psion charger

§5.3 The receiving antenna and transmitting antenna

K9 series adopts a UHF transferring antenna which is suitable for field surveying, and the receiving antenna is 450MHz all-direction antenna, See as Fig 5-3:



Fig 5-3 Base Station transmitting antenna



Rover Receiving Antenna (short one for GPRS and long one for Radio)

§5.4 Cables

1. Cable for all-direction antenna (with radio)

This cable is used for connecting the transmitting radio and antenna, there is a port in one side to fix the antenna to the pole. The other side can be connected with radio by bayonet. See as Fig5-4:



Fig 5-4 cable for all-direction antenna

Radio Frequency setting cable F9440(with base station): to connect computer with radio power supply cable



F9440

2. Multi-function external power supply cable (with base station):

Multi-function external power supply cable is shaped as a “Y” connection cable, it is used to connect the base mainframe (red), transmitting radio (blue) and connect the external storage battery (by red and blue clip). It has the function of power supply, data transfer. See as Fig 5-4-1:

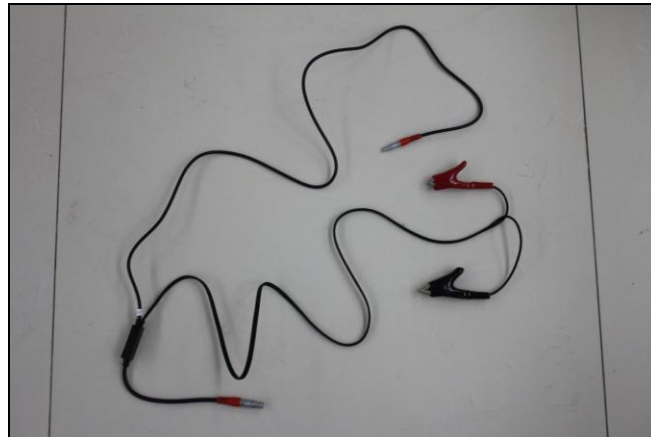


Fig5-4-1 Multi-function external power supply cable

3 .USB communication cable (with Rover station):

USB communication cable **PIU40** is used for connecting handheld controller (Psion) and computer, with the software (Microsoft ActiveSync) to upload the data.

USB communication cable **LI950** is used for connecting handheld controller (Psion) and receiver. (if bluetooth connection between controller and receiver doesn't work, use this cable)



Fig5-4-3 USB communication cable PIU40



USB communication cable LI950

4. Multi-function communication cable (1 with Rover and 1 with Base)

This cable is for connecting receiver and computer, transfer static data or update onboard firmware. See as FIG 5-4-4:



Fig5-4-4 Multi-function communication cable

§5.5 others

The other accessories are pole, bracket (Fig 5-5), plummet and tribrach, connector, measuring tape etc.



Fig 5-5 bracket



Tribrach with adapter

Chapter 6 Operation

§6.1 Setup of Base station and Rover station

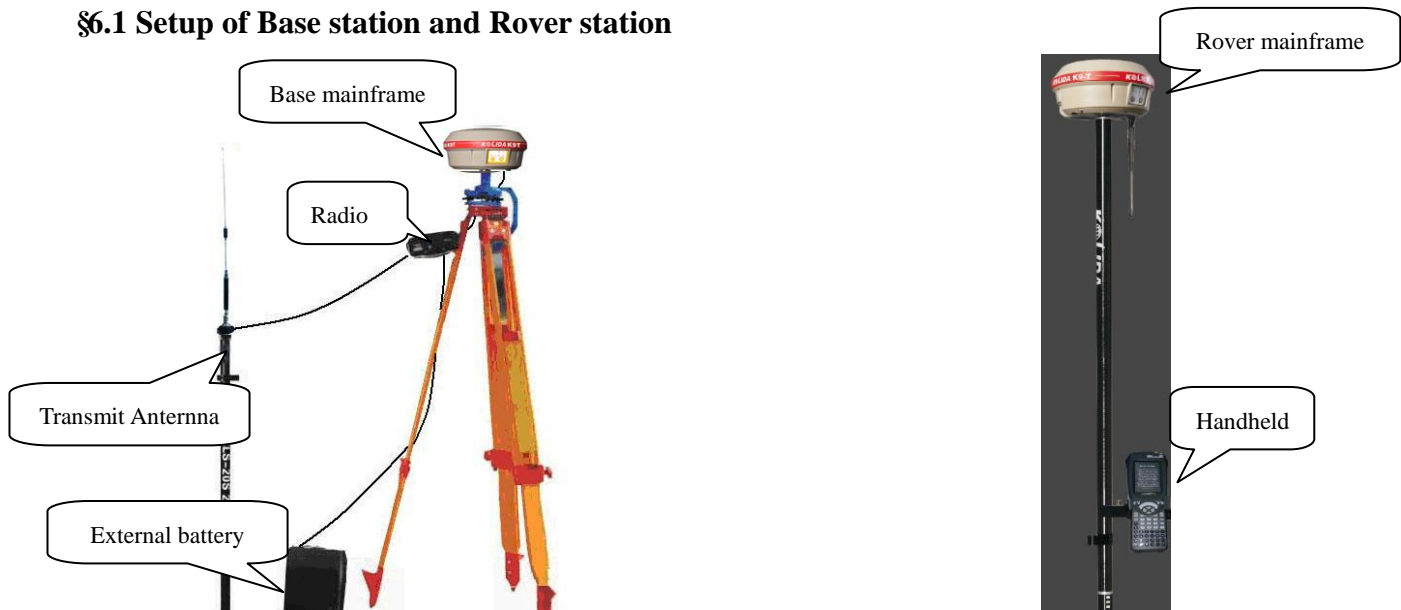


Fig 6-1

Setup Base

1. Put tripod on a location with known coordinates or unknown coordinates, amount tribrach on tripod, then put the base receiver with connector on the tripod, precisely level the tribrach.
2. Set the transmitting antenna and radio, using a tripod is better, rise the antenna as high as possible, then put the radio at suitable position, connect the multi-function communication cable and external power cable to receiver, radio, external power supplier.
3. Make sure that connection is ok, power on the battery first, then power on the radio and receiver.

Setup Rover

1. Install receiving antenna to receiver, amount receiver to pole, after that, power on the receiver.
2. Install the bracket onto pole, fix the controller onto the bracket, open the controller and connect the Bluetooth, then you can do setting of the instrument.

§6.2 Instrument settings

1) Setting by hand

The settings of base and rover can be set by hand, the details are as follows:

switch to RTK mode: keep pressing P+F, waiting for six lights flashing at the same time; press F key to choose the working mode, press P key when the STA is lighting so as to choose the working mode of ROVER; waiting for several seconds when the power light is normal, after that, keep pressing F key waiting for STA&DL lights flashing then relax F key (relax your hand after the second sound), press F key, DL, SAT, PWR circled flashing, when DL is lighting, press P key to confirm the choosing of radio transmit mode. When you power on the machine next time, the working mode is RTK.

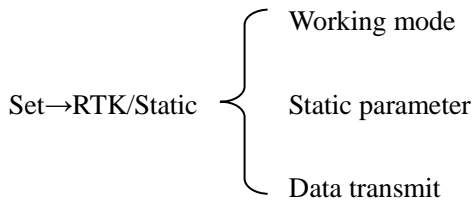
Static mode: keep pressing P+F, waiting for six lights flashing at the same time; press F key to choose the static mode, press P key when the BAT is lighting to choose the static mode. When you power on the receiver next time, the working mode is static.

2) Setting by controller

Controller can switch the receiver from RTK mode to STATIC mode, but can not switch it from STATIC to RTK.

After switch to STATIC mode, you can set the parameters of static data collection: point ID, interval, mask angel, antenna

height and the PDOP value.



Notice: when the controller connect with the receiver by cable, pay attention to set com port correctly.

§6.3 The display of instrument operation

1) Static mode

The data link light and power light will keep lighting, when satellites fit the condition, it will start recording epoch, the status indicator light will flash according to interval setting.(If you don't set up, the default is 5 seconds)

2) RTK mode

Base:

After setting up mode, power on the receiver, the base will enter the transmitting mode under 2 conditions:

1. PDOP<2.5.
2. The satellite amount>8 and PDOP<4.5.

The status indicator light flashes every 1 second means that the base transmits data correctly, the interval is 1 second. If you need to change the interval, or reset the transmit condition, you should connect the controller with receiver by cable or Bluetooth and set Base parameters.

Rover:

In RTK mode, power on the receiver directly, the system will search for the differential signal automatically, and lock the channel.

When the rover is on power on status, if it can't receive the differential signal for 1 minute, then the mainframe will auto start "Auto Rover" function, it beeps at several seconds interval, which means that the receiver is switching radio channel automatically, searching for differential signal.

§6.4 How to measure the antenna height

Instrument Size: The height of receiver is 96.5mm, the diameter is 186mm, the height from the sealed rubber ring to the bottom is 59mm.

Antenna height: the vertical height from phase center to the ground point.

In RTK mode, there are two methods to measure antenna height: measuring vertical height and measuring slide height.

Vertical height: the vertical height from the ground to the receiver's bottom + height from phase centre to the bottom of the receiver.

Slide height: the distance from surveying point to the middle of the rubber ring.

Select "Slide height" in the antenna height mode in data collection software on controller, and input the height value.

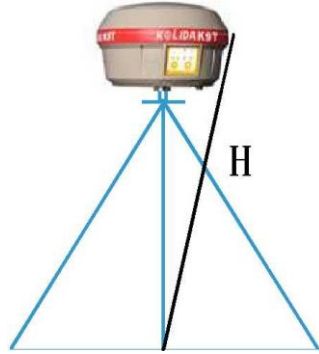


Fig 6-5 How to measure the antenna height

The antenna height of static mode: measure from the ground point to the middle of the rubber ring. When you input the data to post-processing software, select the correct antenna height type.

§6.5 operation diagram

1) Bluetooth connection

Note: The handheld controller of KOLIDA RTK, can connect and control the receiver in 10 meters range to measure and stakeout point. This connection is used for land survey usually.



Fig 6-6 Bluetooth wireless operation

2) External cable connection

Note: Using a junction cable, connect the 485 interface port from the receiver, and connect a 485 com port extension cable, then it can connect the receiver for long distance. This connection is used for marine survey usually, control the receiver by a laptop.

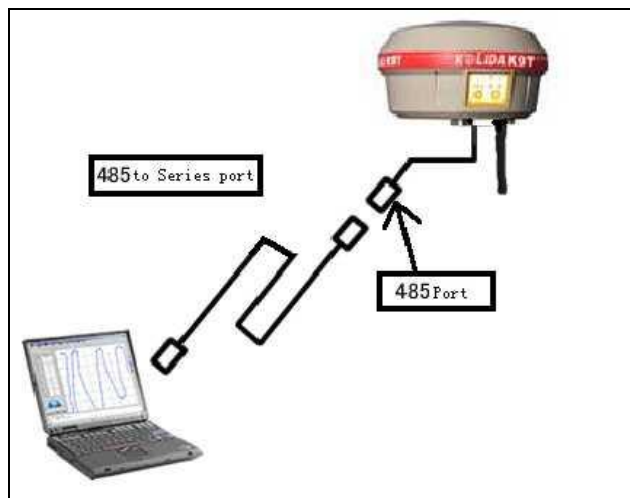


Fig 6-7 with cable connection operation

Chapter 7 Data Transfer, Upgrade and Registration

§7.1 Data transfer

§7.1.1 Copy from Flash Disk

K9 series receiver has USB connection function. The correct connection way is to power on the receiver first, then connect the USB cable. Insert the USB joint to the communication port of the receiver and insert the USB joint to the USB port of the computer, then the taskbar will show as follows (Fig 6-1):



Fig 7-1 Hot Plug Icon

The PC will show “removable disk” in “my computer” screen, open the “removable disk”, and then you can see the data files in the receiver memory.

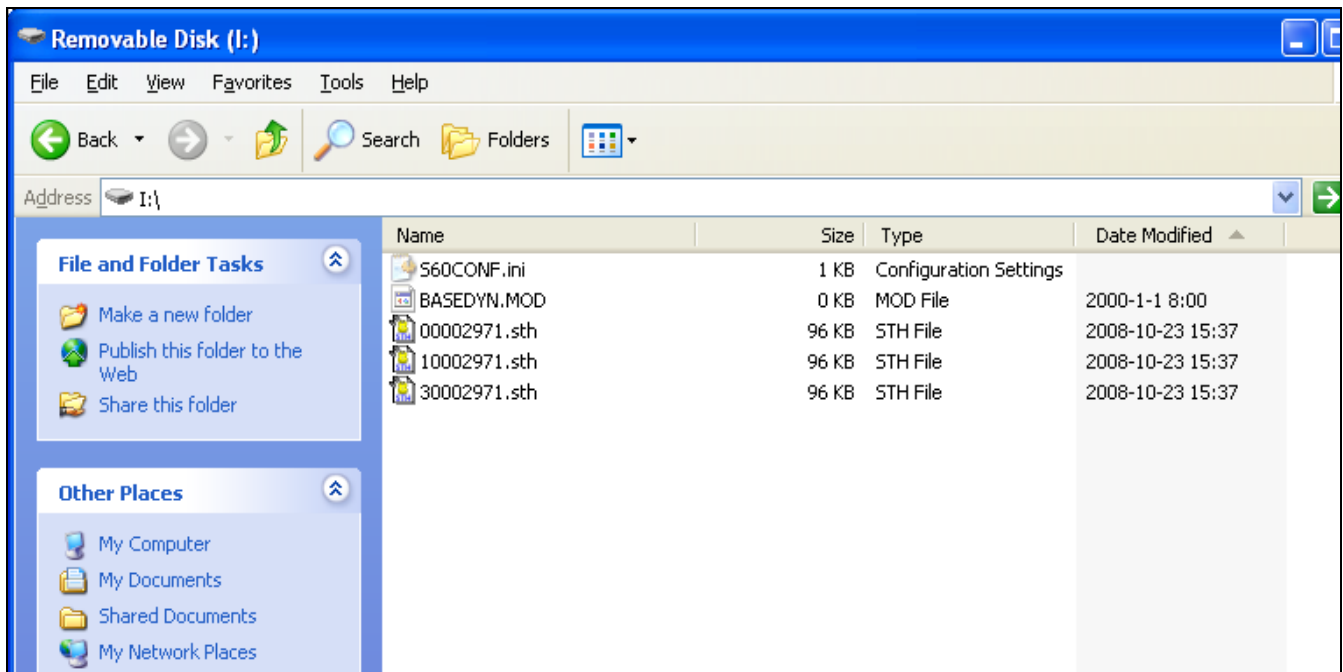


Fig 7-1-1

As Fig 7-1-1 shows, sth.file is the data file collected by receiver, the modified time is the ending time of data collecting, you can copy the original file to PC, or copy to PC by loading assistant software.

§7.1.2 Download by KOLIDA GNSS ASSISTANT

If you use Assistant software, you are allowed to modify the file name and antenna height.

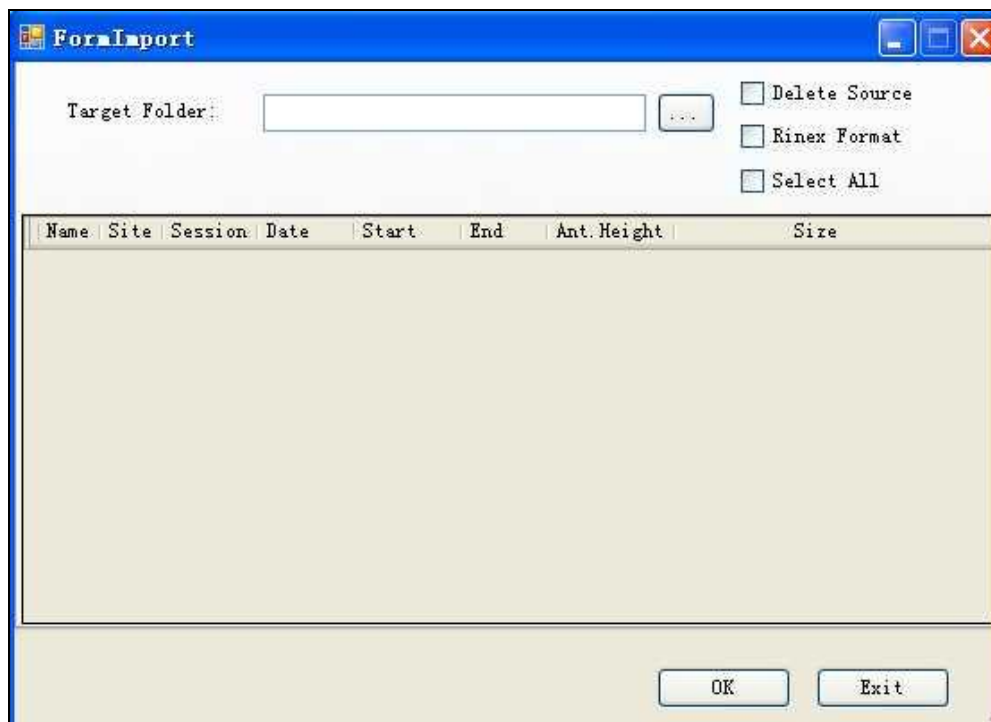


1. Install Assistant software
2. Connect receiver with computer by USD port, run KOLIDA GNSS ASSISTANT, power on the receiver.

Below screen will be shown:



3. Click **Import Record Data**, below screen shows:



Click to choose the target folder to store data, there are 2 options at the right side: to delete the raw data in receiver memory; transform raw data to Rinex format.

Double-click the point name, time, antenna height of each data unit, you can modify those values.

After all operations has been done, click .

§7.2 Firmware Update

Note: The firmware of K9 series is always be updated and modified periodically. After the data collection software being

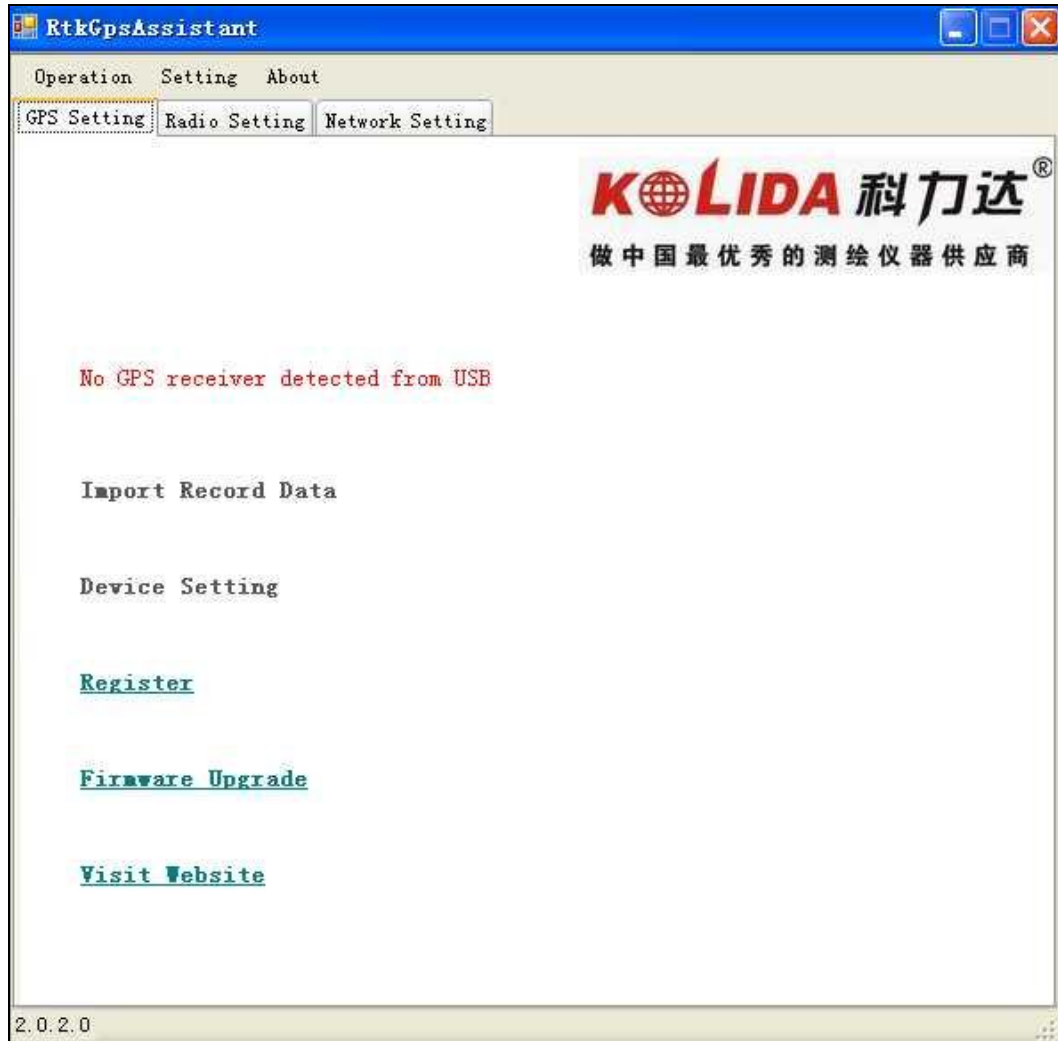
updated, the receiver onboard firmware should be upgraded too. Users can do upgrading according to the instruction follows:

Process: log on <http://www.kolidainstrument.com/faq/download.asp>, download K9 series specified upgrading program.

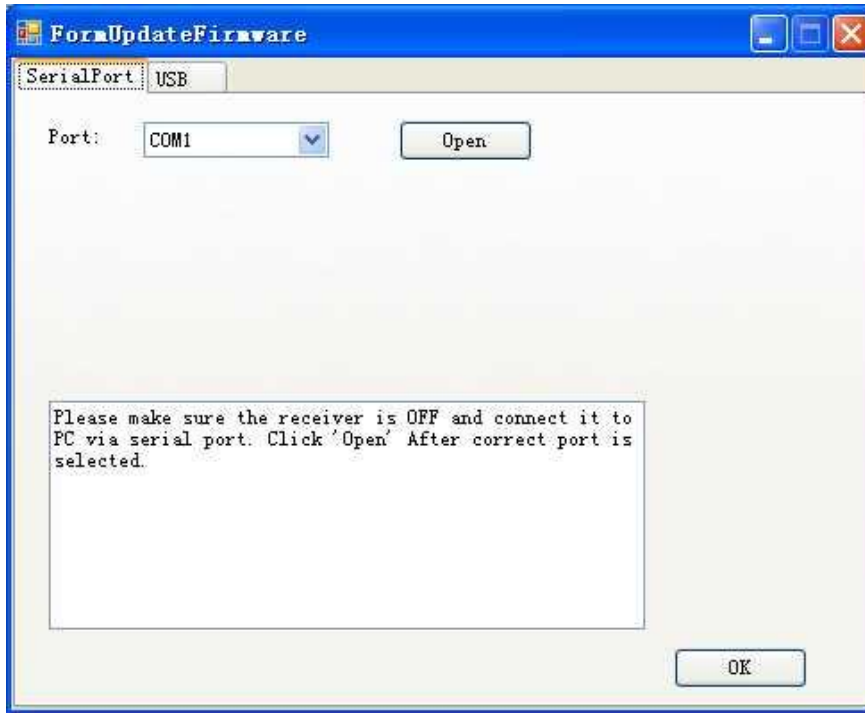
First, connect the receiver with PC through serial com port, run KOLIDA GNSS ASSISTANT program.

Notice: In the procedure of upgrading, don't cut the power supply or shutdown the receiver, or it will do harm to the receiver, it is better to upgrade according to the instruction, or consult your reseller.

Steps: As Fig 7-2, run KOLIDA GNSS ASSISTANT.



Choose **Firmware Upgrade**, below screen shows:



Choose com port, click **open**, below screen shows:



Power on the receiver, below screen shows:



Press **Add** to choose the newer firmware, for example H82-F101215.dat.

After that, press **OK**, to start upgrade. The progress bar will shows that upgrade is finished, click to confirm it.

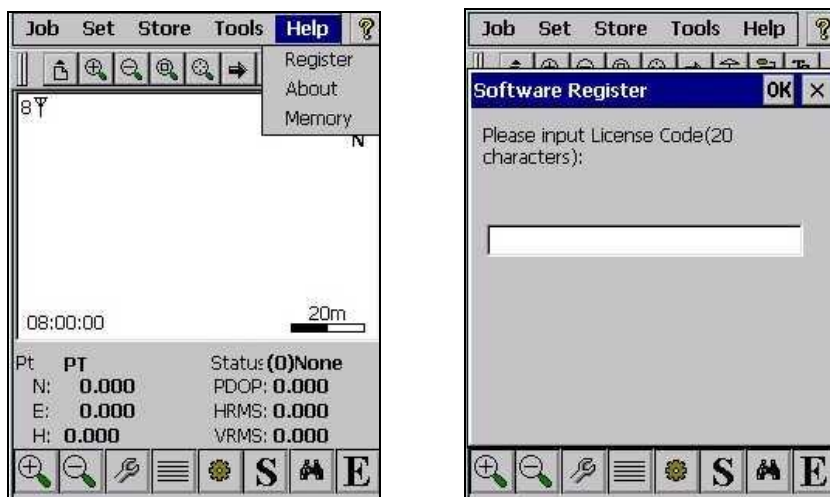
The receiver will beep for 3 times.

z §7.3 Registration (unlimited code input)

Register by Psion controller

Connect the receiver with Psion controller (by Bluetooth or cable), in the Estar toolbar, select “help”, then select “register”, input 16 or 20 digits register code,

then click “OK”



Register by Computer

Without Psion controller and Estar, you can modify an onboard file to register the machine.

You just connect the machine with computer by USB cable. Turn on the machine, you will see the machine displays as a flash memory disk. You just edit the .ini file as attached picture shows.



```
[SYSTEM]
MODE=3
SERIALNUMBER=W1082733271C974536056CECDA
[STATICMODE]
ANTHEIGHT=1000
CUTANGLE=0
SAMPLERATE=5
[DYNAMICMODE]
DATA LINK=7
DIFFTYPE=RTCM3
```

Modify the number marked with Blue color

Open the CONFIG.INI file by windows notepad or wordpad program, you can see above displays.

Replace the old code with your unlimited code, then save and quit.

Note: the code length must be same with the original one: machine number+16 digits code.