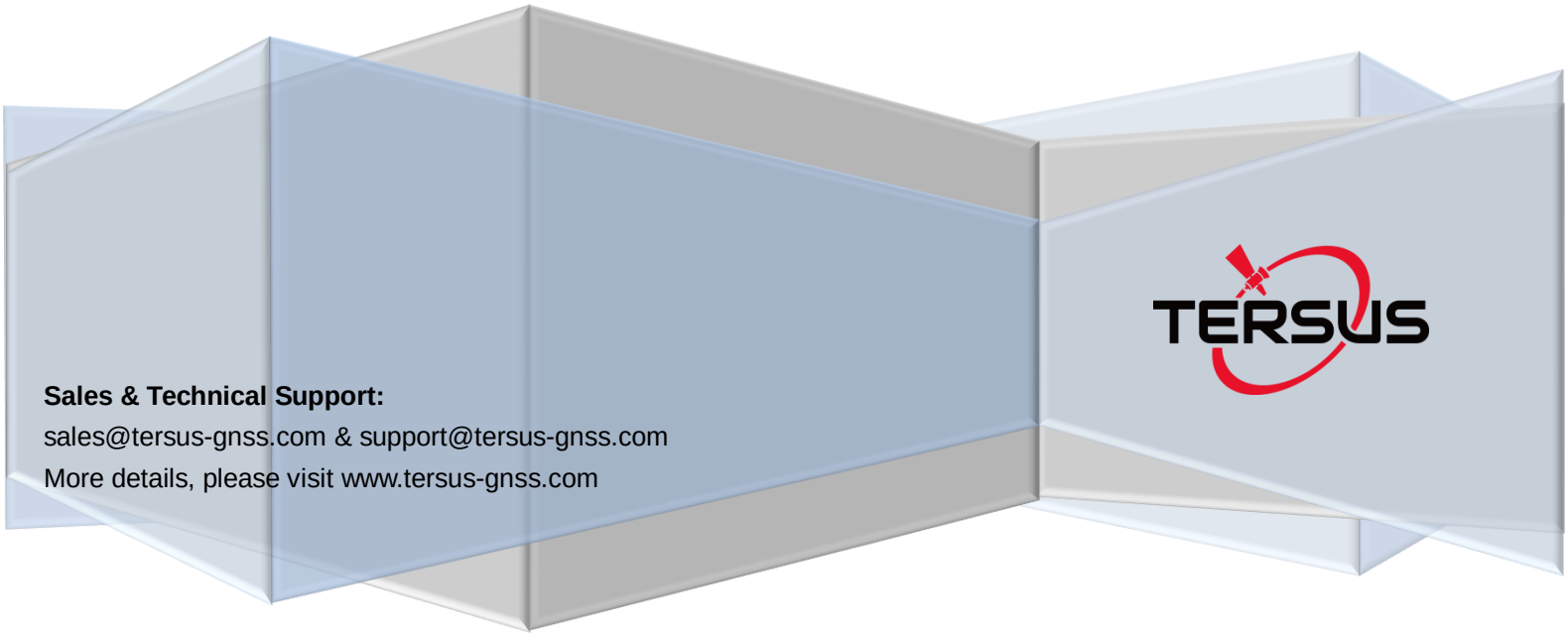
User Manual

Version V1.0-20180702

User Manual
For David GNSS Receiver



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Notices

The following notices apply to DAVID receiver.

⚠	Changes or modifications to this equipment not expressly approved by Tersus could void the user's authority to operate this equipment or even has risk to damage the DAVID.

Conventions

The following conventions are used in this manual:

!	Information that supplements or clarifies text.

⚠	A caution that actions, operation or configuration may lead to incorrect or improper use of the hardware.

⚠	A warning that actions, operation or configuration may result in regulatory noncompliance, safety issues or equipment damage.

NUWA is Tersus survey app, four tabs (Project, Device, Survey and Tools) are provided in the Nuwa® main window. So, in chapter 0, all the operations in the Survey software will start from these four tabs.

In all the figures, a line with two arrows at the two sides means it's a cable. A line with one arrow gives the installation direction.

Table 1 The document / software used in this user manual

Name	Description	Link
Log & Command document	Document giving all the loggings output from David and all the commands to David	https://www.tersus-gnss.com/assets/upload/file/20180420120508 17.pdf
Tersus GNSS Center	Graphical tool to communicate with David	https://www.tersus-gnss.com/assets/upload/file/20180418153351 742.zip
Nuwa	Survey application running in the Android platform, David can be configured with Nuwa.	
Tersus Geomatics Office	Post processing tool for static data	https://www.tersus-gnss.com/assets/upload/file/20180418153011 5.rar

TersusDownload	A tool to download files on eMMC card	https://www.tersus-gnss.com/assets/upload/file/20180612144338820.zip

Support

If you have a problem and cannot find the information you need in the product documentation, request technical support using the Tersus website at www.tersus-gnss.com, or mail to support@tersus-gnss.com

1. Overview

1.1 Introduction

Tersus DAVID is a cost-efficient, palm-sized GNSS receiver, mainly for the mass survey market, but also for UAV/AGV/Agriculture application.

Nuwa, a survey App on Android system, is working with David, which can communicate with an Android platform such as a phone or tablet via USB cable or an external Bluetooth module. The David can work as a base or a rover, it can support real-time RTK positioning as well as saving data for PPK application. Up to 4GB on-board EMMC card makes it easy to save data for PPK.

The RS-232 serial port, IP67 standard and the external Bluetooth module can remove most of the inconvenience for field workers. All the operating can be done in the App Nuwa except downloading raw measurement data file, which will be done with Tersus GNSS Center, see Table 1 and section 3.5 Download Files from Internal eMMC Card for detail.

Figure 1 Outlook of David GNSS receiver

1.2 Receiver Features

- Supports GPS L1/L2, BDS B1/B2 and GLONASS G1/G2.
- Support RTCM2.3/3.x, CMR, CMR+ corrections.

- Easy to connect an external powerful radio for longer range.
- Solution rate can be 5Hz.
- 20Hz raw measurements output for post processing.
- The accuracy of carrier phase can be 1mm.
- On-board 4GB eMMC card for data collection
- Static post-processing for mm-level accuracy.
- Bluetooth module makes wireless connection.
- Input power range is 5 - 12V, connect to battery bank directly.
- IP67 for water & dust proof, work reliably in harsh condition
- The Lemo connectors support mis-installation avoidance.

1.3 Brief Introduction of GNSS and RTK

Tersus BX306 GNSS receiver is integrated in David, the board is receiving the GNSS signals from satellites and RTK corrections from the base, and is outputting cm-level position, velocity and time. Figure 2 shows David system; see https://www.tersus-gnss.com/product/bx306-oem-board for more about BX306 receiver.

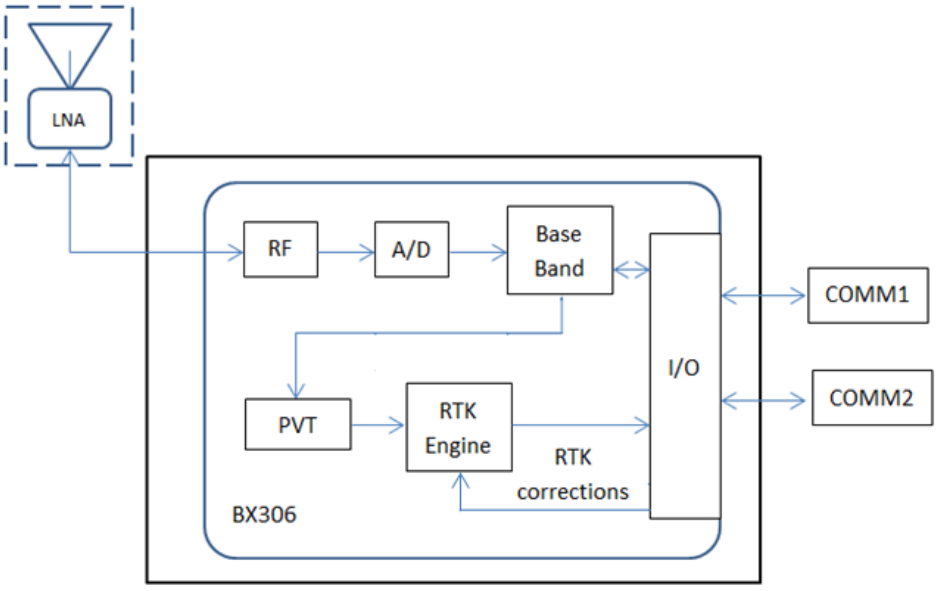


Figure 2 Outline of David System

The RTK corrections are transmitted from a base, which can be a CORS station or a David receiver. The RTK corrections can be transmitted to the rover via Internet or with external radios.

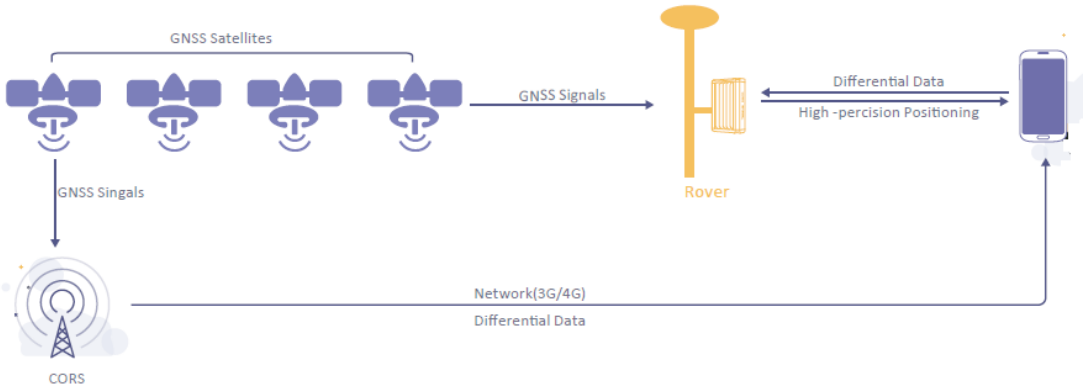


Figure 3 Corrections transmitted via Internet

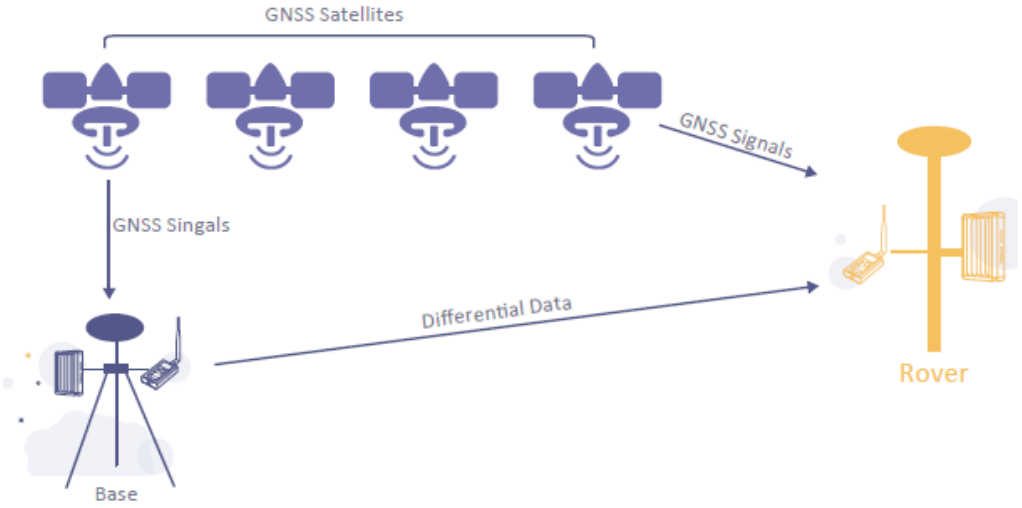


Figure 4 Corrections transmitted with radios

If RTK corrections are transmitted via Internet, an Android phone will be included in the RTK system to transmit/receive the RTK corrections, see section 6.1 and section 6.2 for detailed operating.

2. Devices in David Package

This chapter will give detailed introduction about all the devices in the package.

David has seven variants, which are convenient for customers to select per their application. Different accessories are included in each variant. Table 2 gives a brief description of the seven variants. For more about them, refer to section 2.1 to section 2.7.

All the seven variants are shipped in a plastic box in Figure 5.

Figure 5 David in the box

Table 2 Seven David Variants

David variants	Description
Rover Kit Mobile Mode	The David receiver will receive RTK corrections from a NTRIP caster or a TCP server.
Rover Kit with 1W Radio Station	The David receiver will receive RTK corrections from an external 1W 915Mhz radios.
Rover Kit with 2W Radio Station	The David receiver will receive RTK corrections from an external 2W 460MHz radios.
Base Kit Mobile Mode	The David receiver will output RTK corrections to a NTRIP caster or a TCP server.
Base Kit with 1W Radio Station	The David receiver will output RTK corrections to an external 1W 915Mhz radio.

Base Kit with 2W Radio Station	The David receiver will output RTK corrections to an external 2W 460MHz radio.
Base Kit with 30W Radio Station	The David receiver will output RTK corrections to an external 30W 460MHz radio.

!	1. Rover Kit Mobile Mode and Base Kit Mobile Mode can work independently. 2. Rover Kit with 1W Radio Station must work with Base Kit with 1W Radio Station. 3. Rover Kit with 2W Radio Station must work with Base Kit with 2W Radio Station or Base Kit with 30W Radio Station.

2.1 Rover Kit Mobile Mode

In this variant, the David will be connected to an Android phone with Bluetooth module or with cables. Tersus Survey Nuwa® App will run in the Android phone to receive RTK corrections from a NTRIP caster or a TCP server.

Refer to section 6.1 for detailed operation.

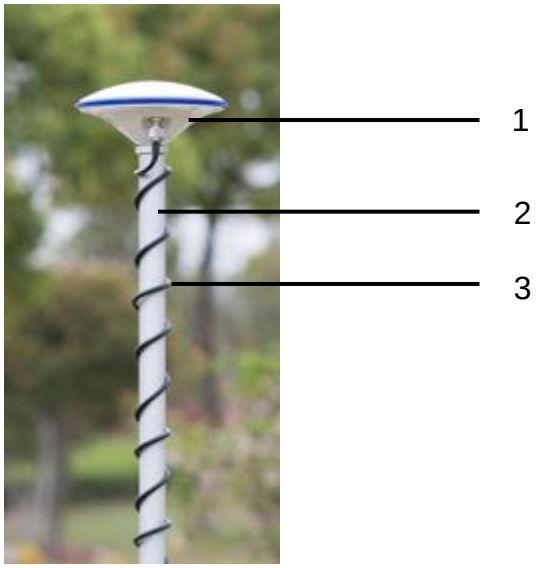


Figure 6 Field photo 1 - 1

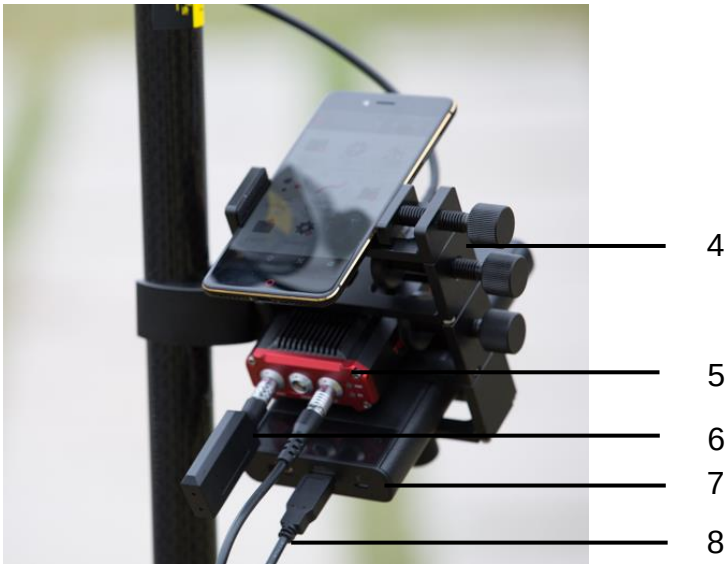


Figure 7 Field photo 1 - 2

!	The power bank in Figure 7 is not included in the package.

Table 3 Devices in rover mobile mode

Devices	Number	Items in the field photos
David GNSS receiver	1	5
GNSS antenna	1	1
GNSS antenna connector	1	Not in the field photo, refer to section 2.1.6 for detail.
GNSS antenna cable	1	3
2pin-USB power cable	1	8, see Figure 11
COMM1-Bluetooth module	1	6, refer to 2.1.4
COMM2-7pin-USB & DB9 Data cable	1	Not in the field photo, refer to section 2.1.7
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
Ranging pole	1	2
Height measure accessory	1	Not in the field photo, See Figure 18.
Bracket for rover	1	4, see section 2.1.5
Battery bank	1	7, see Figure 19 and 3.2 Power on David

2.1.1 David Receiver

David has four interfaces, see Figure 8 David Receiver.

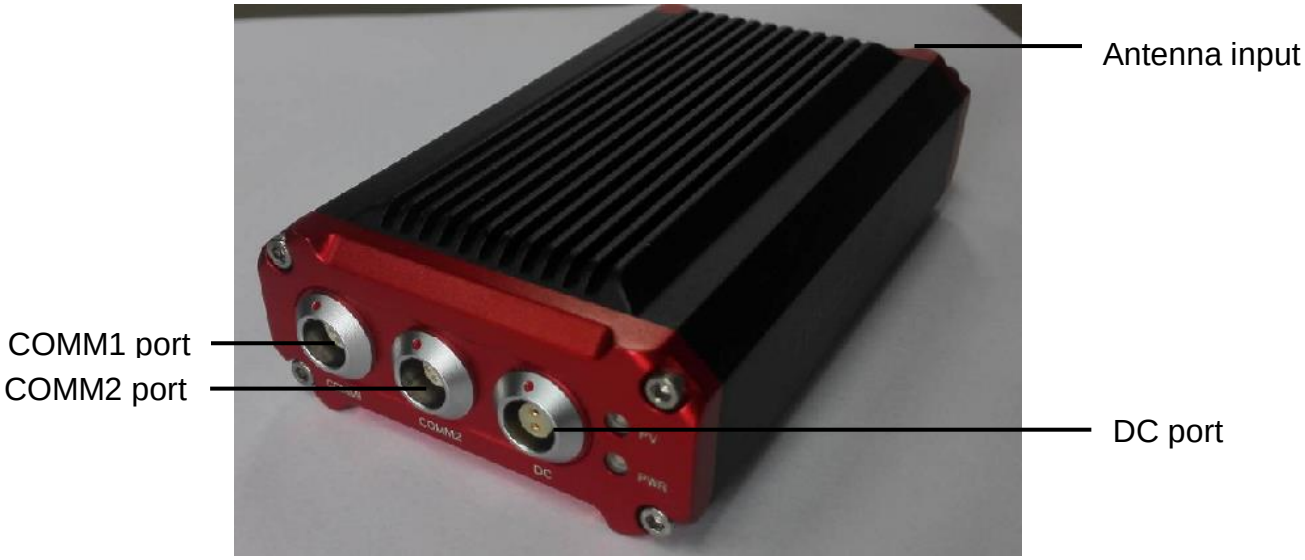


Figure 8 David Receiver

David's DC is for power input, COMM1 port is for COM1 and CAN ports, and COMM2 port is for COM2 and USB ports, see chapter 5 for detail.

Table 4 Definition of LEDs

LED	Colour	Description
PWR	RED	ON: the David is power on.
PV	BLUE	ON: David in Fixed solution. Blink: David in Float solution OFF: David in other position types.

Please see section 3.2 Power on David for more about the booting up procedure.

Refer to Chapter 5 for the specification of David receiver and the detailed definition of COMM1, COMM2 and DC ports.

2.1.2 GNSS Antenna

GNSS antenna is used to receive the RF signal from the satellites. AX3702 is provided in the package, which must be connected to the David with the RF cable in the package.

Figure 9 AX3702 antenna

⚠	If an antenna from other companies will be used, contact Tersus to get permission, or the David may not work as it's expected.

Figure 10 RF cable

2.1.3 The 2pin-USB Power Cable

The power cable is used to connect a battery bank to the DC port of David.

Figure 11 2pin-USB Power Cable

2.1.4 COMM1-bluetooth Module

This Bluetooth module will use the COM1 port of David.

Figure 12 Bluetooth Module

⚠	The Bluetooth can only be installed to the COMM1 port of David.

The SSID for this Bluetooth module is BT420A-xxxxx_xxxxxx, where the first xxxxx is the last 5 digits of the Bluetooth serial number, which is printed on the Bluetooth module. No password is needed to pair with it.

2.1.5 Bracket for Rover

Bracket for rover is used to fix all the devices on the ranging pole, which bring much convenience to field staffs.

Figure 13 Bracket for Rover

2.1.6 GNSS Antenna Connector

The GNSS antenna connector is used to install the GNSS antenna or the 30W radio station antenna to a tripod.

Figure 14 GNSS Antenna Connector

2.1.7 COMM2-7pin-USB & DB9 Data Cable

The COMM2-7pin-USB & DB9 Data Cable has three functions:

Table 5 Functions of COMM2-7pin-USB & DB9 Data Cable

1. Connect to an external 1W radio module.
2. Connect to USB Type A Male to DB9 Male cable (see Figure 16) to download file saved on the internal eMMC card, refer to section 3.5 Download Files from Internal eMMC Card;
3. Connect to USB Type A Female to USB (Micro +Type C) OTG cable (see Figure 17) to connect the Android phone with David, refer to section 3.3.1.

Figure 15 COMM2-7pin-USB & DB9 Data Cable

!	The COMM2-7pin-USB cable can only be installed into the COMM2 port of David.

2.1.8 Other accessories

USB Type A Male to DB9 Data cable, USB Type A Female to USB (Micro + Type C) OTG cable and Height Measure Accessory are included in this variant.

Figure 16 USB Type A Male to DB9 Male cable

The driver for the cable above can be downloaded https://www.ugreen.com/drivers/list-USB_To_RS232_Driver-en.html

Figure 17 USB Type A Female to USB (Micro + Type C) OTG cable

The height measure accessory is used to determine the height of the antenna with higher accuracy.

Figure 18 Height Measure Accessory

A battery bank is used to power on the David, it's not included in the package, and has to be provided by the customers, see section 3.2 Power on David for more detail.

Figure 19 Battery Bank

2.2 Rover Kit with 1W Radio Station

In this variant, the David will be connected to an external 1W radio to receive RTK corrections from a base. With an external Bluetooth or with cables, the David will be connected to an Android phone, which is running Tersus Survey Nuwa® to configure the David.

!	Rover Kit with 1W Radio Station must work with Base Kit with 1W Radio Station.

!	Rover Kit with 1W Radio Station can support Rover mobile mode.

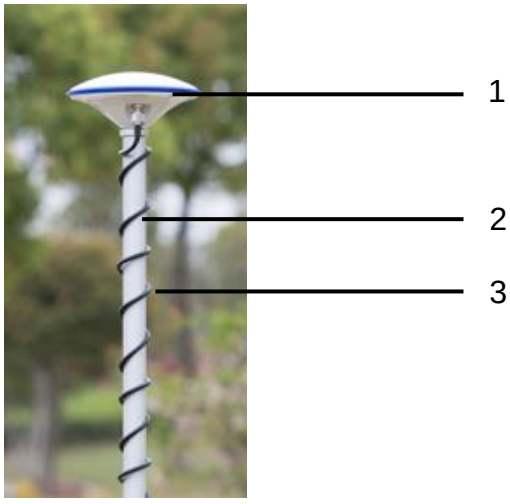


Figure 20 Field Photo 2 - 1

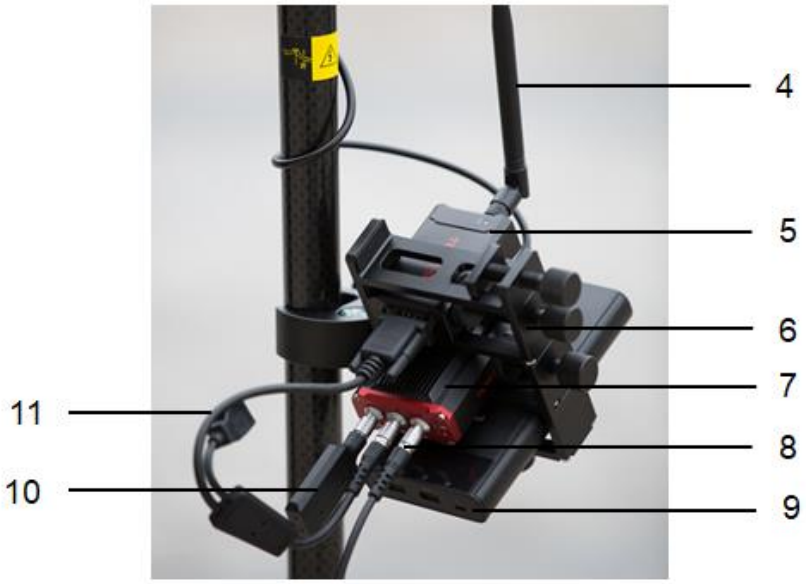


Figure 21 Field Photo 2-2

!	The power bank in Figure 21 is not included in the package.

Table 6 Rover Kit with 1W Radio Station

Devices	Number	Items in the field photos
David GNSS receiver	1	7
GNSS antenna	1	1
GNSS antenna connector	1	Not in the field photo, refer to section 2.1.6 for detail.
GNSS antenna cable	1	3
2pin-USB power cable	1	8
COMM1-Bluetooth module	1	10, refer to 2.1.4.
COMM2-7pin-USB & DB9 data cable	1	11, refer to section 2.1.7.
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
RS900C 1W/915MHz radio	1	5, refer to section 2.2.1.
RS900C radio antenna	1	4
Ranging pole	1	2
Height measure accessory	1	Not in the field photo, See Figure 18.
Bracket for rover	1	6, see section 2.1.5
Battery bank	1	9, see Figure 19 and 3.2 Power on David

2.2.1 RS900C 1W/915MHz Radio

This radio can work at 915MHz frequency only, the output power of this radio is 1W and the typical range is 3km. Refer to chapter 5 for detailed specification.

Figure 22 RS900C 1W Radio Station

Table 7 LED Definition

LED	Description
P/S	When power on, this LED will blink RED once and keep off. If data is transmitting, this LED will blink RED. If data is receiving, this LED will blink BLUE.

2.3 Rover Kit with 2W Radio Station

In this variant, the David will be connected to an external 2W radio to receive RTK corrections from a base. With an external Bluetooth or with cables, the David will be connected to an Android phone, which is running Tersus Survey Nuwa® to configure the David.

!	Rover Kit with 2W Radio Station can work with Base Kit with 2W Radio Station or Base Kit with 30W Radio Station.

!	Rover Kit with 2W Radio Station can support Rover mobile mode.

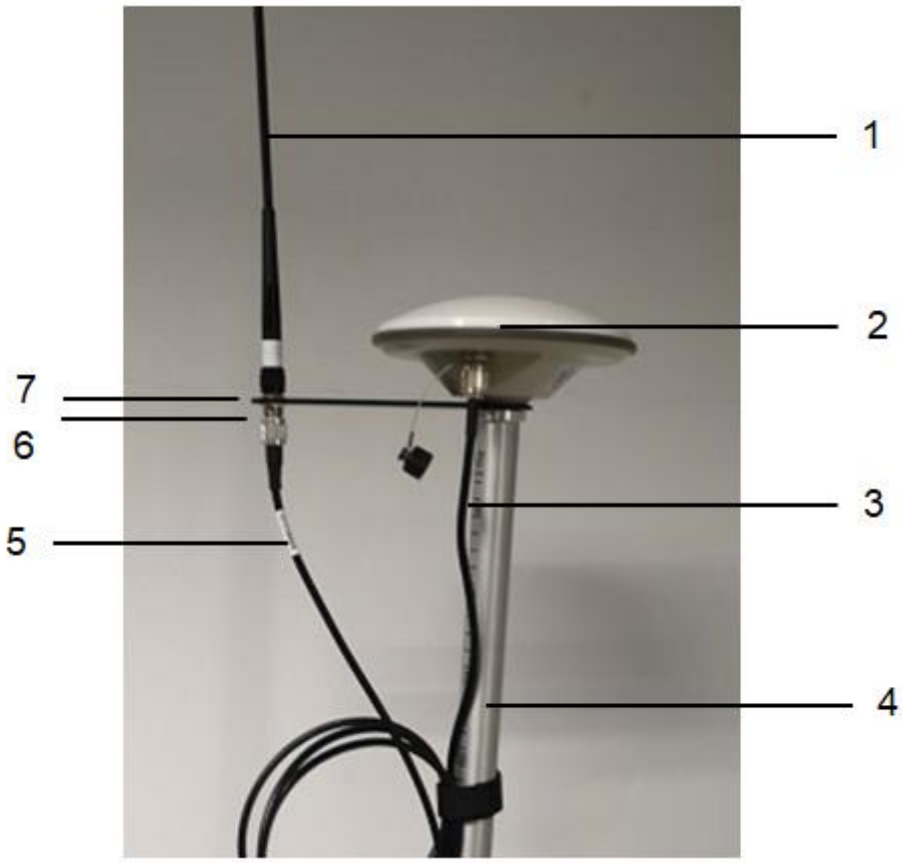


Figure 23 Field Photo 3 - 1

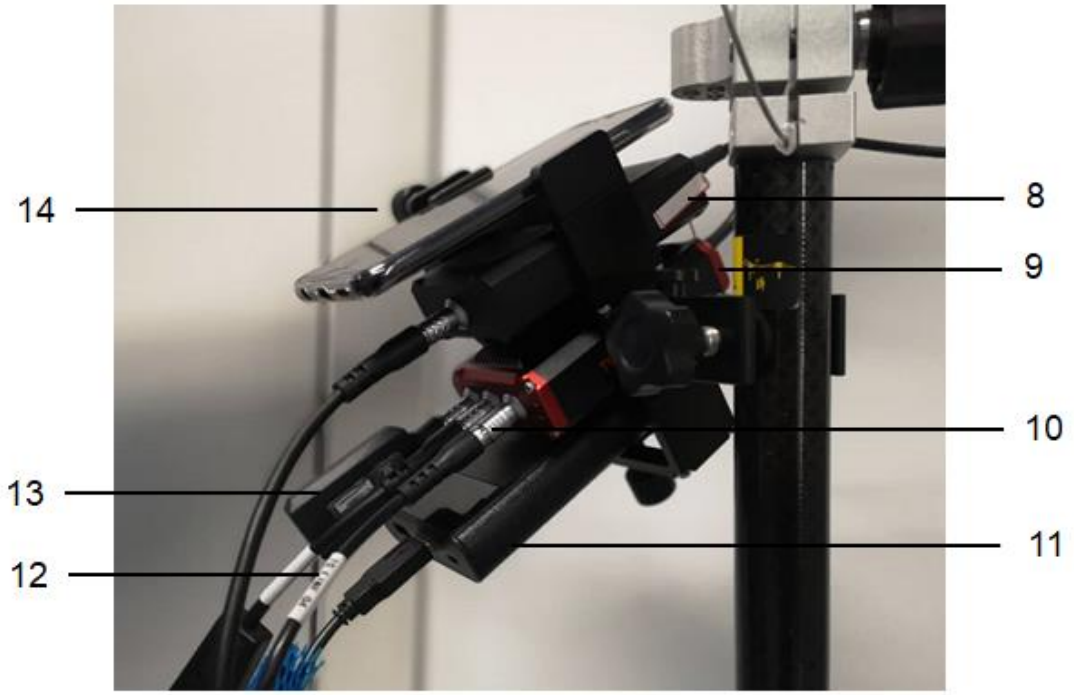


Figure 24 Field Photo 3 - 2

!	The power bank and the smartphone in Figure 24 are not included in the package.

Table 8 Rover Kit with 2W Radio Station

David variants	Number	Items in field photos
David GNSS receiver	1	9
GNSS antenna	1	2
GNSS antenna connector	1	Not in the field photo, refer to section 2.1.6 for detail.
GNSS antenna cable	1	3
2 Pin-USB power cable	1	10
COMM1-Bluetooth module	1	13, refer to 2.1.4
COMM2-7pin-USB & DB9 Data cable	1	Not in the field photo, refer to section 2.1.7.
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
COMM2-7pin-USB & 5pin cable (0.55m)		12, refer to Figure 26
RS400L2 2W/460MHz radio	1	8, refer to 2.3.1
2W/460MHz radio antenna	1	1

TNC-J/TNC-J cable 1.0M	1	5
TNC - TNC converter	1	6, see Figure 28
Ranging pole	1	4
Height measure accessory	1	Not in the field photo, See Figure 18.
Bracket for 460M antenna	1	7, see Figure 28
Bracket for rover	1	14, see section 2.1.5
Battery bank	1	11, see Figure 19 and 3.2 Power on David

2.3.1 RS400L2 2W/460MHz Radio

This radio can work at 460MHz frequency, the max. output power of this radio is 2W and the typical range is 5km. Refer to chapter 5 for detail specification.

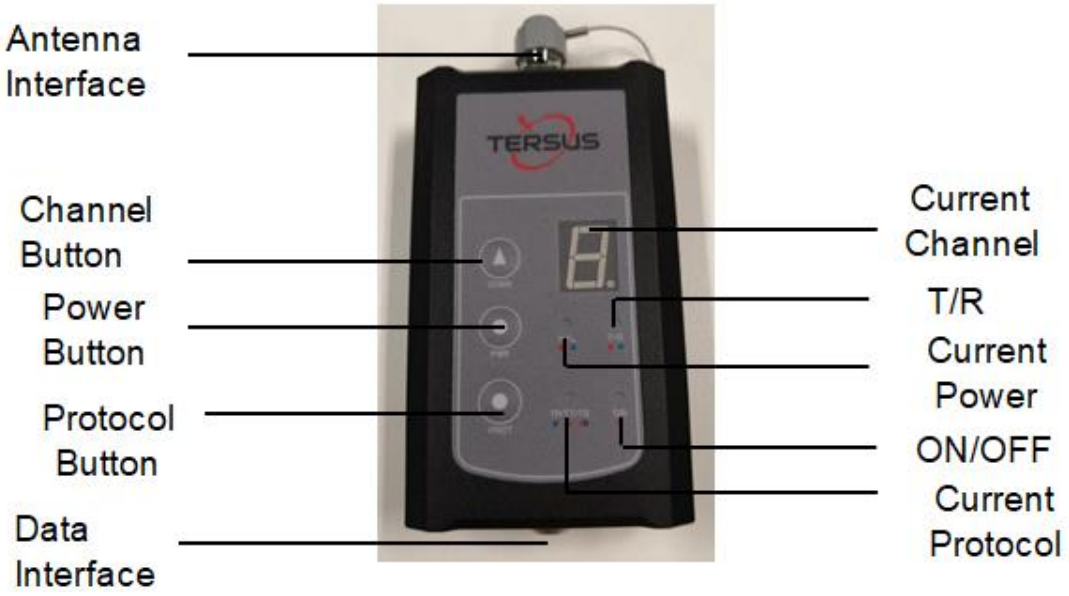


Figure 25 2W /460MHz Radio

Table 9 Button Manual

Button	Description
Channel Button	Press once, the current channel will increase 1, channel 0~ 9 are available.
Power Button	Press once to select the output power, which can be 1W or 2W.
Protocol Button	Protocol button is pressed to switch the protocol between TP (Transparent EOT protocol) , TT (TT450S protocol) and TS (Tersus protocol)

!	Two 2W radios must have the same protocol and the same channel frequency before they can communicate each other.

Table 10 LED Definition

LED	Description
H/L	RED: 2W output is selected, BLUE: 1W output is selected.
T/R	Blink RED: data is transmitting. Blink BLUE: data is receiving.
TP/TT/TS	BLUE: Transparent protocol is selected. RED: TT450S protocol is selected. BLUE&RED: Tersus protocol is selected.
ON	Is solid on after the power is on.

2.3.2 Accessories

The COMM2-7pin-USB & 5pin Cable is used to connect the David to the 2W radio station & an Android phone, or connect the David to the 30W radio station & an Android phone. The cable's length can be 0.55m or 1m in different variants.

Figure 26 COMM2-7pin-USB & 5pin Cable

⚠	COMM2-7pin-USB & 5pin Cable can only be installed into the COMM2 port of David.

Figure 27 TNC-J/TNC-J cable 1.0M

Figure 28 TNC - TNC converter & Bracket for 460M antenna

2.4 Base Kit Mobile Mode

In this variant, the David, working as a base, will transmit RTK corrections to a NTRIP caster or a TCP sever.
The David will be connected to an Android phone with an external Bluetooth or with cables. Tersus Survey Nuwa® is running in the Android phone to configure the David.

!	Base Kit Mobile Mode can work independently or work with Rover Kit Mobile Mode.

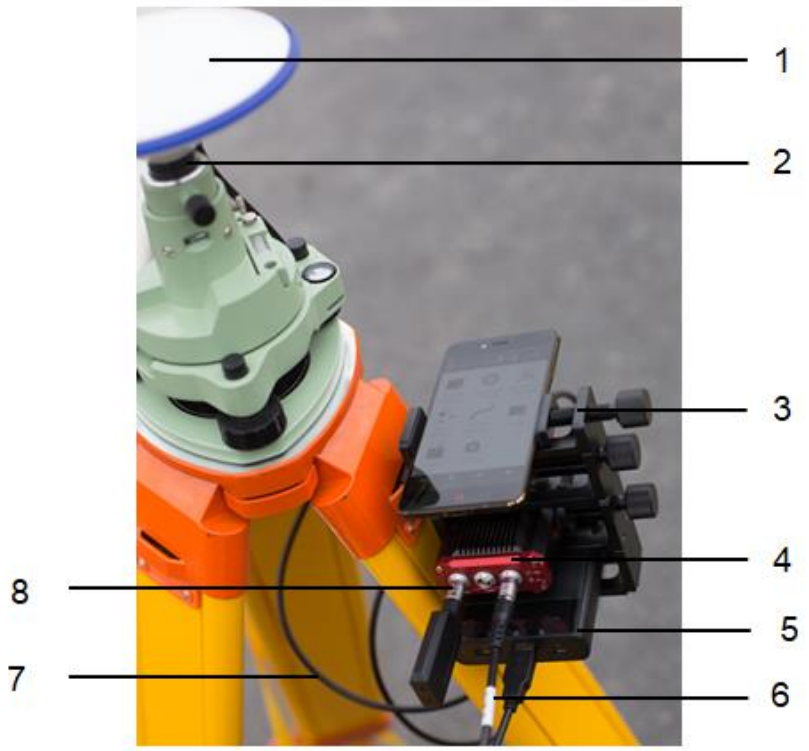


Figure 29 Field Photo 4

!	The tripod, the battery bank, the tribrach and the smartphone are not included in the package.

Table 11 Base Kit Mobile Mode

Devices	Number	Items in field photo
David GNSS receiver	1	4
GNSS antenna	1	1
GNSS antenna connector	1	2
GNSS antenna cable	1	7
2 Pin-USB power cable	1	6
COMM1-Bluetooth module	1	8, refer to 2.1.4
COMM2-7pin-USB & DB9 Data cable	1	Not in the field photo, refer to section 2.1.7.
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
Tape meter	1	See Figure 31
Height measure accessory	1	Not in the field photo, See Figure 18.
Bracket for base	1	3, see Figure 30
Battery bank	1	5, see Figure 19 and 3.2

		Power on David

2.4.1 Bracket for Base

This bracket is hooked on the tripod and all the devices in the field (an Android phone, a radio, a David and a battery bank) can be installed on it, which brings much convenience for field job.

Figure 30 Bracket for Base

2.4.2 Tape Meter

Working with height measure accessory, the tape meter can give position of a point on ground with mm-level accuracy.

Figure 31 Tape Meter

2.5 Base Kit with 1W Radio Station

In this variant, the David, working as a base, will transmit RTK corrections to an external 1W radio.
The David will be connected to an Android phone with cables or with the Bluetooth module. Tersus Survey Nuwa® is running in the Android phone to configure the David.

!	Base Kit with 1W Radio Station can work with Rover Kit with 1W Radio Station only.

!	Base Kit with 1W Radio Station can support Base mobile mode.

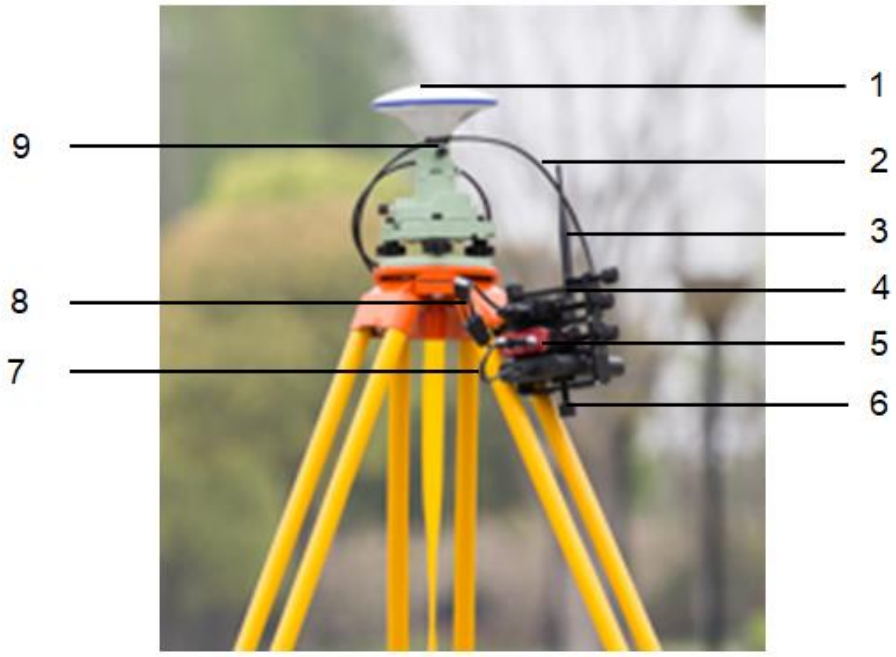


Figure 32 Field Photo 5

!	The tripod, the tribrach and the battery bank are not included in the package.

Table 12 Base Kit with 1W Radio Station

Devices	Number	Items in field photo
David GNSS receiver	1	5
GNSS antenna	1	1
GNSS antenna connector	1	9
GNSS antenna cable	1	2

2 Pin-USB power cable	1	7
COMM1-Bluetooth module	1	Not in the field photo, refer to 2.1.4
COMM2-7pin-USB & DB9 Data Cable	1	8
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
RS900C 1W/915MHz radio	1	4
1W/915MHz radio antenna	1	3
Tape meter	1	See Figure 31Figure 31 Tape Meter
Height measure accessory	1	Not in the field photo, See Figure 18.
Bracket for base	1	6
Battery bank	1	see Figure 19 and 3.2 Power on David

2.6 Base Kit with 2W Radio Station

In this variant, the David, working as a base, will transmit RTK corrections to an external 2W radio.
The David will be connected to an Android phone with cables or with the Bluetooth module. Tersus Survey Nuwa® is running in the Android phone to configure the David.

!	Base Kit with 2W Radio Station can work with Rover Kit with 2W Radio Station only.

!	Base Kit with 2W Radio Station can support Base mobile mode.

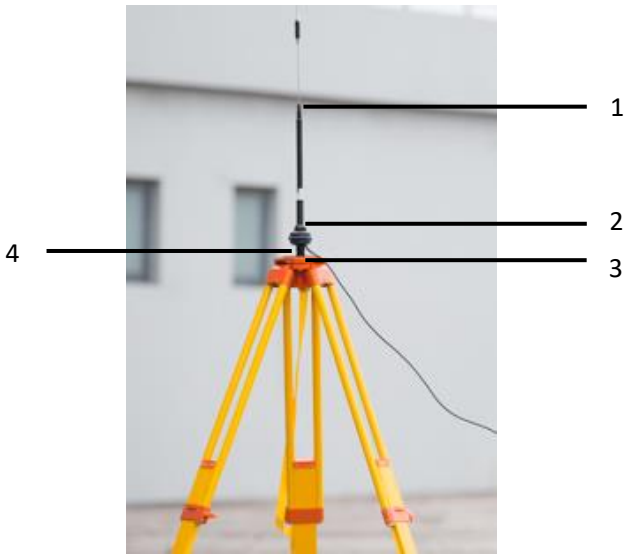


Figure 33 Field photo 6 - 1

Figure 34 Field Photo 6 - 2

!	The two tripods and the tribrach in Figure 33 and Figure 34 are not included in the package.

Table 13 Base Kit with 2W Radio Station

Devices	Number	Items in field photo
David GNSS receiver	1	9
GNSS antenna	1	5
GNSS antenna connector	2	4
GNSS antenna cable	1	6
2pin-USB power cable	1	Not in the photo, see Figure 11
Power cable for 30W radio	1	Not in the field photo, see Figure 36
2pin-Bullet DC CON Cable	1	10, see Figure 35
COMM1-Bluetooth module	1	11
COMM2-7pin-USB & DB9 Data Cable	1	refer to section 2.1.7
USB Type A Female to USB(Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16
COMM2-7pin-USB & 5pin Cable (0.55m)	1	12, refer to Figure 26
RS400L2 2W/460MHz radio	1	8, refer to 2.3.1
30W radio antenna	1	1, see Figure 40
Metal plate for radio antenna	1	3
Telescopic pole for radio antenna	1	2, see Figure 41
Tape meter	1	See Figure 31
Height measure accessory	1	Not in the field photo, See Figure 18.
Hook and screws for David	1	See Figure 37
Hook and screws for 2W radio	1	See Figure 38
Bracket for Mobile	1	See Figure 39

2.6.1 Accessories

Figure 35 2pin-Bullet DC CON Cable

Figure 36 Power cable for 30W radio

Figure 37 Hook and Screws for David

Figure 38 Hook and Screws for 2W Radio

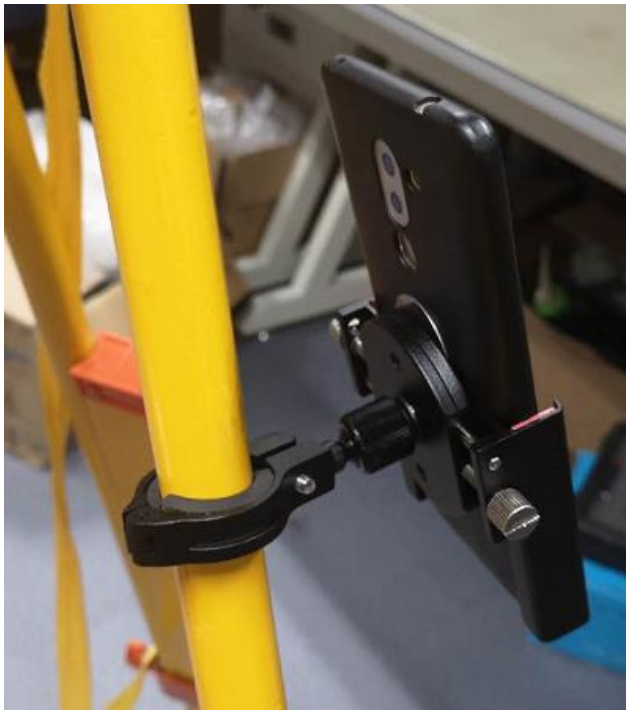


Figure 39 Bracket for Mobile

Figure 40 30W Radio Antenna

Figure 41 Telescopic Pole for Radio Antenna

2.7 Base Kit with 30W Radio Station

In this variant, the David, working as a base, will transmit RTK corrections to an external 30W radio.
The David will be connected to an Android phone with cables or with the Bluetooth module. Tersus Survey Nuwa® is running in the Android phone to configure the David.

!	Base Kit with 30W Radio Station can work with Rover Kit with 2W Radio Station only.

!	Base Kit with 30W Radio Station can support Base mobile mode.

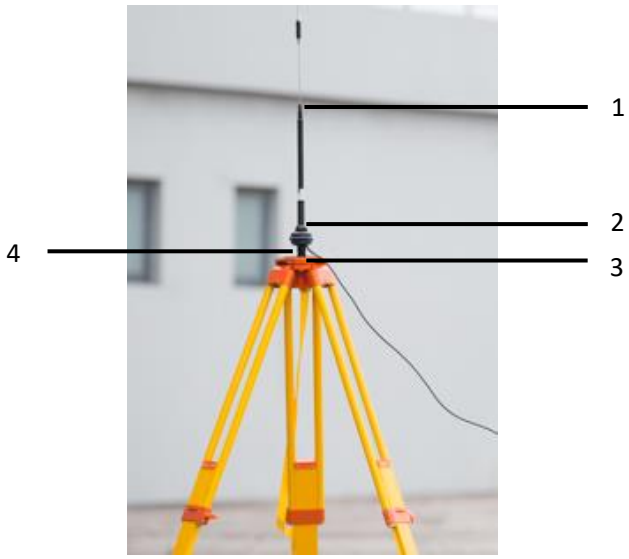


Figure 42 Field Photo 7 - 1

Figure 43 Field Photo 7 - 2

!	The two tripods and the tribrach in Figure 42 and Figure 43 are not included in the package.

Table 14 Base Kit with 30W Radio Station

Devices	Number	Items in field photos
David GNSS receiver	1	12
GNSS antenna	1	5
GNSS antenna connector	2	4
GNSS antenna cable	1	7
2pin-USB power cable	1	Not in the photo, see Figure 11
COMM1-Bluetooth module	1	Not in the field photo, refer to 2.1.4
COMM2-7pin-USB & DB9 Data cable	1	Not in the field photo, refer to section 2.1.7.
USB Type A Female to USB (Micro + Type C) OTG cable	1	Not in the field photo, refer to Figure 17
USB Type A Male to DB9 Male cable	1	Not in the field photo, refer to Figure 16.
COMM2-7pin-USB & 5pin Cable (1m)	1	10, refer to Figure 26.
Power cable for 30W radio	1	9, refer to Figure 36
COMM cable for 30W radio	1	11, refer to Figure 45
RS400L30 30W radio	1	8, refer to 5.5 30W Radio RS400L30

30W radio antenna	1	1, see Figure 40
Metal plate for radio antenna	1	3
Telescopic pole for radio antenna	1	2, see Figure 41
Tape meter	1	Not in the field photo, See Figure 31 Tape Meter
Height measure accessory	1	Not in the field photo, See Figure 18.
Hook and screws for David	1	See Figure 38
Bracket for mobile	1	See Figure 39

2.7.1 30W Radio

The 30W radio is used when a longer baseline is required. The typical range is 15km, see chapter 5 for detail specification.

Figure 44 30W Radio Station

Table 15 and Table 16 give the definition of the control buttons and the LED, respectively.

Table 15 The Definition of the Control Buttons

Buttons	Function
ON/OFF	Press 1s to power on the radio Press 2s to power off the radio
ARROW UP/DOWN	To select the channel
RF PWR	Press 1s to select the RF output power

Table 16 Definition of LEDs

LEDs	Description
ON/OFF	RED: the input voltage is normal. Blink RED: the input voltage is out of the min limits.
TX/RX	Blink RED: the radio is transmitting. Blink BLUE if the radio is receiving.
Channel	Show the current channel
BAT CAP	Show the battery left.
RF PWR	Show the current RF output power: OFF: 30W BLUE: 20W RED: 10W RED+BLUE: 5W

Figure 45 COMM cable for 30W radio

3. General operation

The general operation of David is related to the Tersus Survey Nuwa® software, which will be introduced in the software manual. This chapter only describes how to do the hardware connection.

⚠	■ To make David work, the customer must provide qualified power to David (refer to chapter 5 for requirement), power to the 30W radio (if 30W radio is used, refer to chapter 5 for detail) and an Android phone to run Tersus Survey Nuwa® software. ■ David may be damaged if devices from other companies are used to replace the ones in the package. And the warranty may be void if that happen.

3.1 Install the GNSS antenna

Connect the antenna to David with the RF cable. Please ensure the connectivity is reliable.

!	The ideal place for a GNSS antenna is a point without GNSS signals blockage from horizon to horizon and is far away from any potential interfering source.

3.2 Power on David

The input voltage to David is 5 – 12 VDC.

⚠	It's highly recommended to power on David with an USB port (5VDC and 2A or more current output) from a battery bank with the power cable in the package, or the David may not boot up successfully.

⚠	After power on, the PV LED will be ON for 3 to 5 seconds, then it will be OFF, which means the David is booting up successfully. If the PV LED is NOT acting as the above, it means the David is NOT

	booting up successfully.

⚠	If other power than a battery bank is used to power on David, the customer has to make a power cable themselves and take all the risks involved.

The working time of David depends on the capacity of the battery bank.

The following formula can be used to estimate the operating time (assume the output voltage is 5V):

If no radio or an external 30W radio is connected to the David:

Time (hour) = capacity (mA.Hour) *5 / (1000 * 3.2)

If 1W radio is connected to the David:

Time (hour) = capacity (mA.Hour) *5 / (1000 * (3.0+3.2))

If 2W radio is connected to the David:

Time (hour) = capacity (mA.Hour) *5 / (1000 * (6.5+3.2))

!	1) It's highly recommended the capacity of the battery bank is 10,000mA.H or more. 2) The working time above are only theoretical values at 25°C temperature. But according to our experience, the real working time may be 2/3 of even less of above values.

3.3 Communication between Android phone and David

David can communicate with an Android phone with wires or with Bluetooth.

3.3.1 With Wires

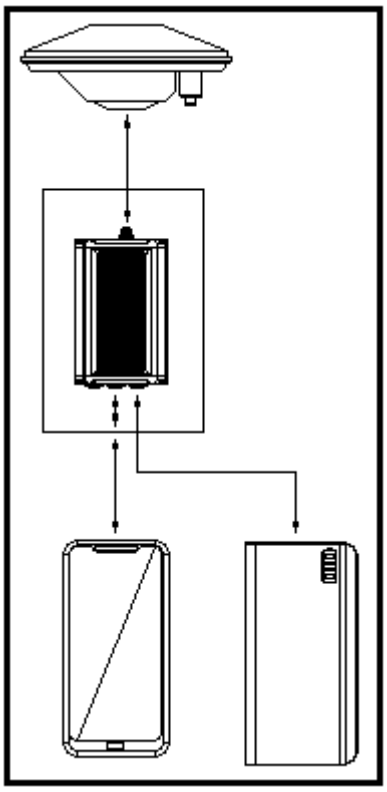


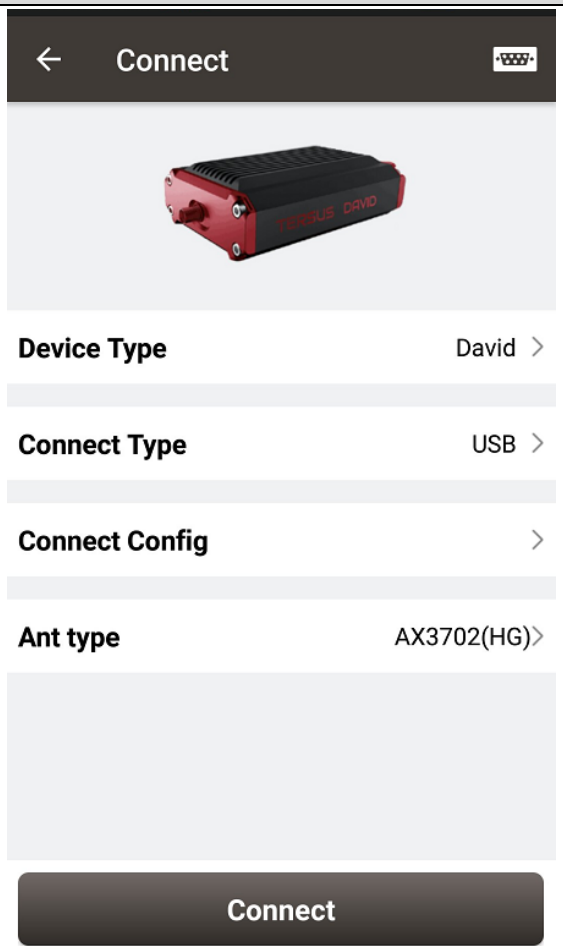
Figure 46 Outline of Android phone to David with Wires

!	Two cables are used to connect the COMM2 port of David to the USB port of the Android phone. They are: ● COMM2-7pin-USB & DB9 Male cable or COMM2-7pin-USB & 5pin cable. ● USB Type A Female to USB (Micro + Type C) OTG cable

!	The Android phone will NOT be charged when it's connected to David with wires.

Table 17 Detailed steps

1. Connect the David's COMM2 port to the USB port of the Android phone with cables.
2. Connect the antenna to David with the RF cable (optional).
3. Power on the David with a battery bank.
4. Run Nuwa, Device ->Device Connect



5. Connect Type " USB"
6. Press Connect Config to update accordingly.
7. Press Connect to enable the communication with the David.

3.3.2 With an External Bluetooth

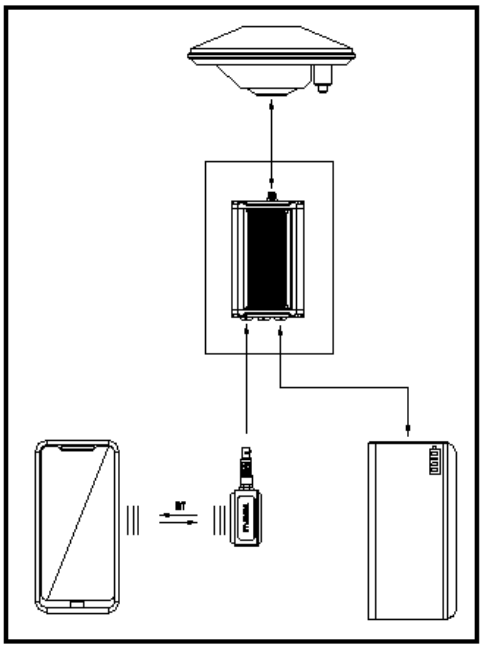
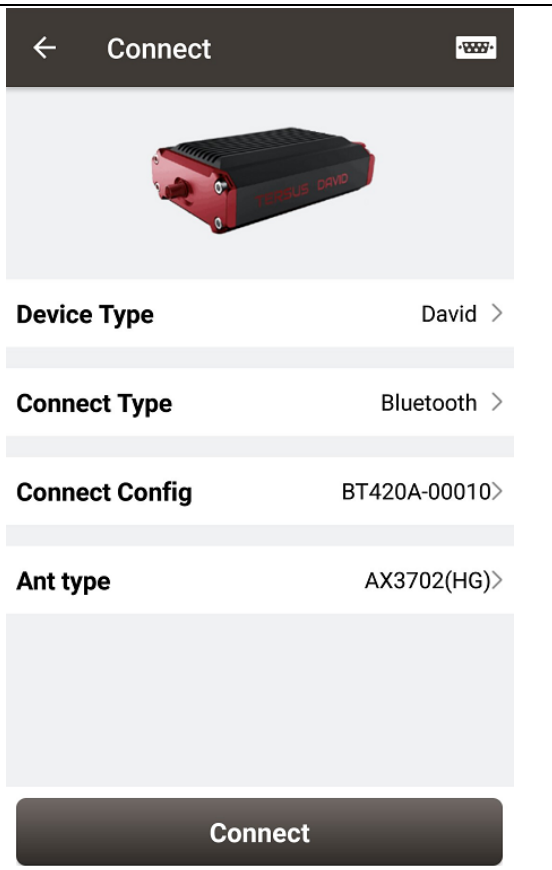


Figure 47 Outline of Android phone to David with Bluetooth

!	All the seven variants can support connection with Bluetooth as well as with cables.

Table 18 Detailed steps

1. Install the Bluetooth module to the David's COMM1 port.
2. Connect the antenna to David with the RF cable (optional).
3. Power on the David with a battery bank.
4. Run Nuwa, Device ->Device Connect



5. Bluetooth is selected for Connect Type
6. Connect Config -> Search. The SSID is BT420A-xxxxx_xxxxxx. No password is needed to pair with it.
7. Press Connect to enable the communication with the David.

!	You can remove a Bluetooth device from the Available Device list by pressing it for several seconds.

3.4 FW Upgrade & Auth code

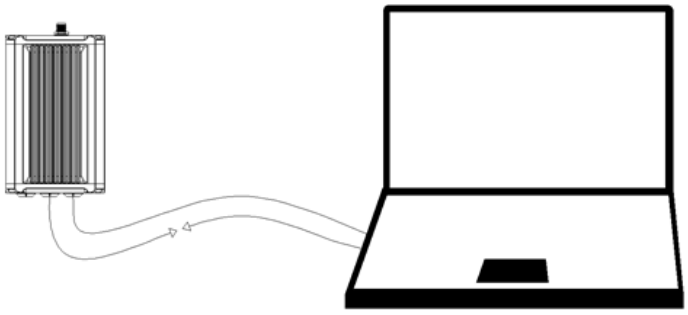
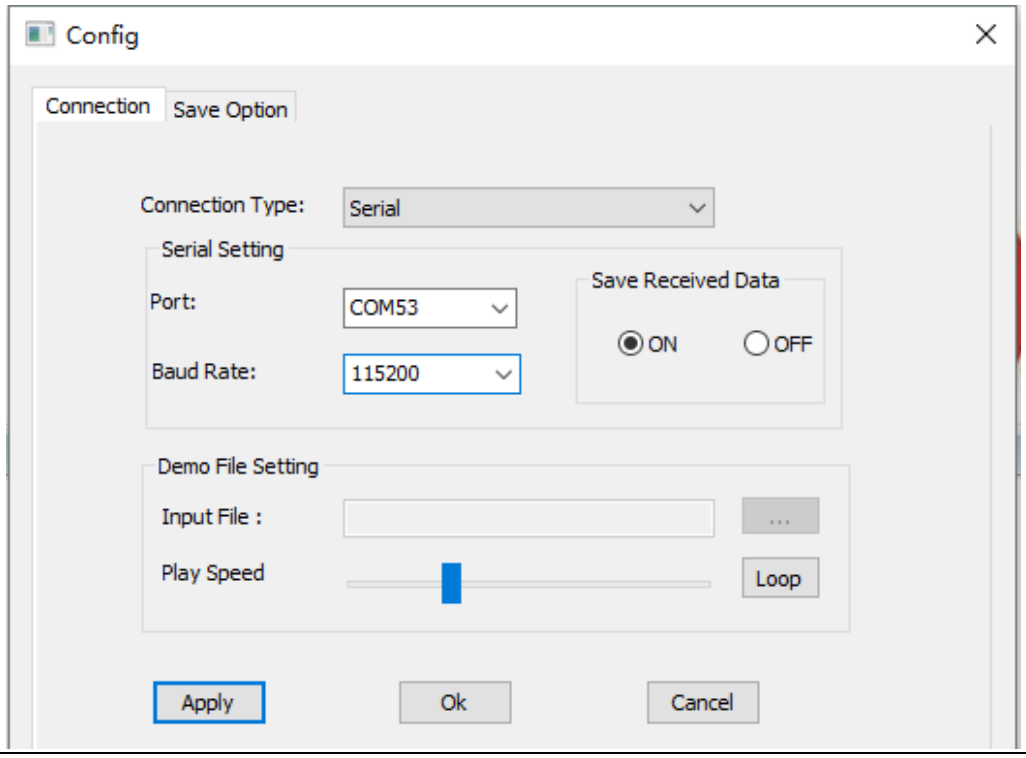


Figure 48 Outline of David connected to a Computer

Table 19 Preparation for FW update

Hardware Installation
1. Install the USB Type A Male to DB9 Male cable to a computer's USB port. The cable will be mapped to a serial port, check the port number in the Device Manager of the computer.
2. Install the COMM2-USB + DB9 cable to the COMM2 port of the David.
3. Connect the two cables together.
4. Power on the David with the computer's USB port or with an external battery bank.
5. Run Tersus GNSS Center, fill the parameters in the Config page, press OK to communicate with the David. 

!	The default baud rate for the serial port is 115200, which will change to 921600 temporarily during FW updates by Tersus GNSS Center, see section 3.4.1 Firmware Updates for detail.

3.4.1 Firmware Updates

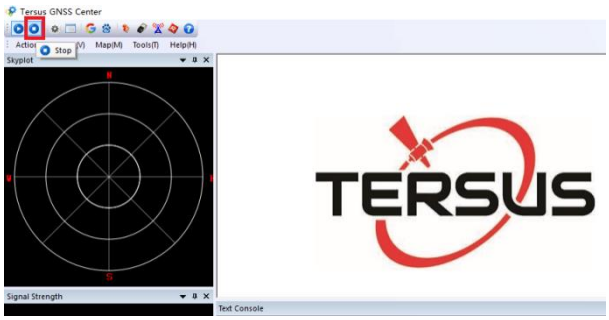
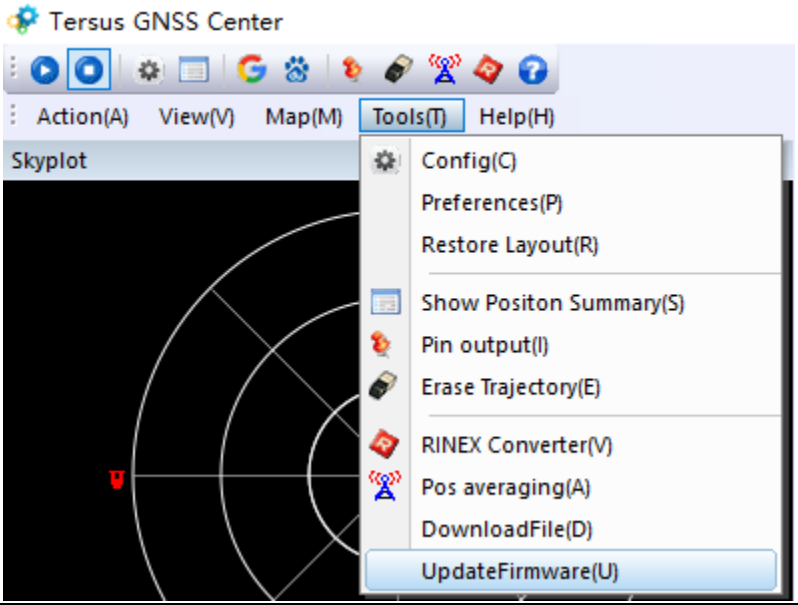
If a new firmware update is released, it will be available on the Tersus web site https://www.tersus-gnss.com/software, or you can get the updates from Tersus support.

The FW version of David receiver can be updated in field. Connect the David with Tersus GNSS Center, and input 'LOG VERSION', the following information will be output:

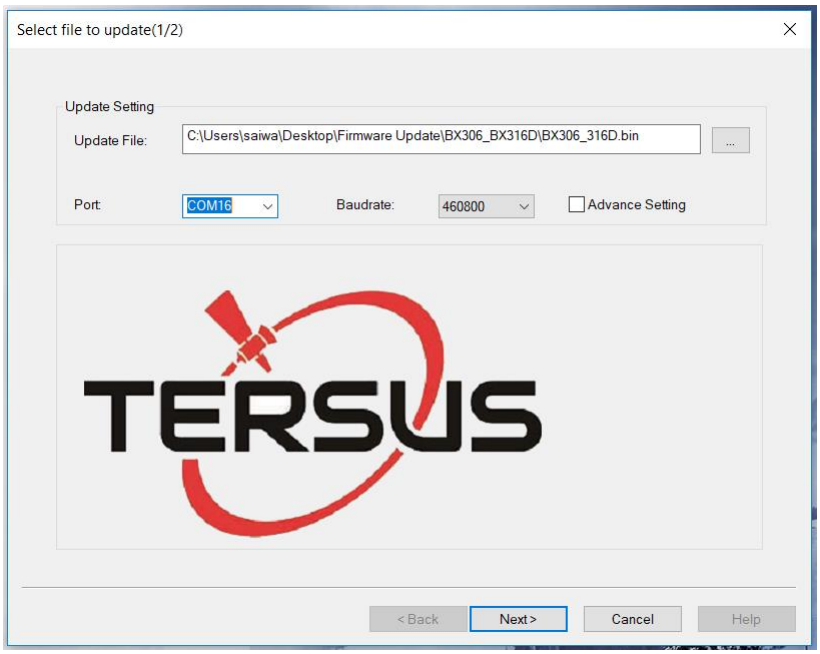
VERSION COM2 0 0.0 UNKNOWN -1 0.000 00000000 0 20161214
< 1
< BX306 G2SB2G2 0080011749100000171 0021 20161123 3.0 Apr 24 2018 12:23:48

0021 is the FW version. See 'VERSION' in Tersus GNSS Log & Command Reference document for more detail about this log.

Table 20 Detailed Steps for FW update

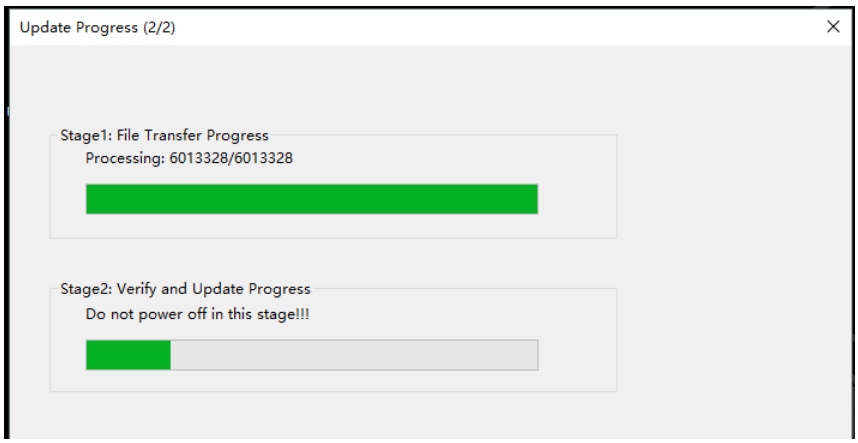
Hardware Installation
Follow Figure 48 and the detailed steps in Table 19 to create communication between a David receiver and Tersus GNSS Center.
Software Configure
1. Press Stop button to stop the communication between the computer and the receiver. 
2. Select Tools -> UpdateFirmware 
3. Select the upgrade file, when a file is selected, the file will be shown in the

Update File bar. Select the port and baud rate, press Next

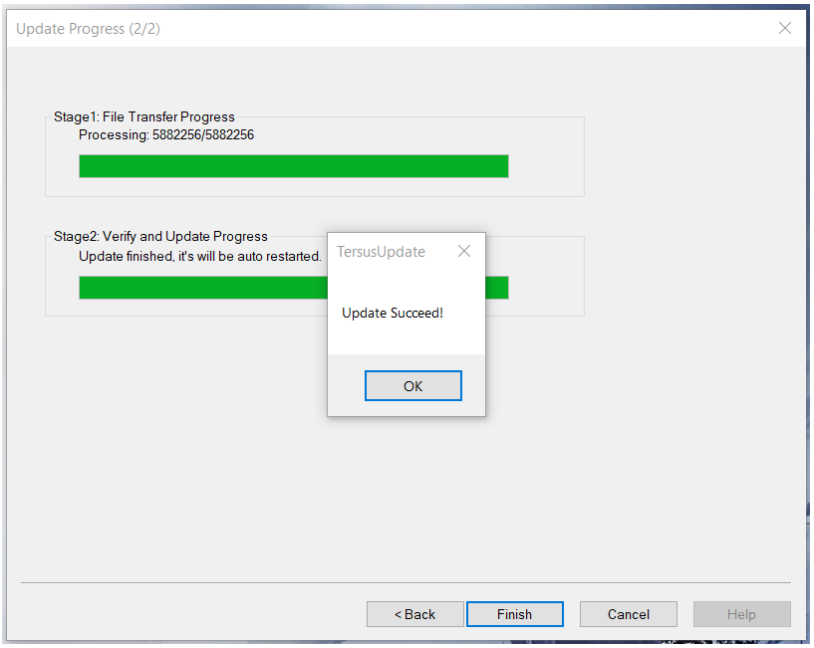


4. The following figure shows the FW is upgrading, two progresses are included in the FW update.

   Do not power off the receiver during the verify and update process.



5. After the FW is upgraded successfully, The following show

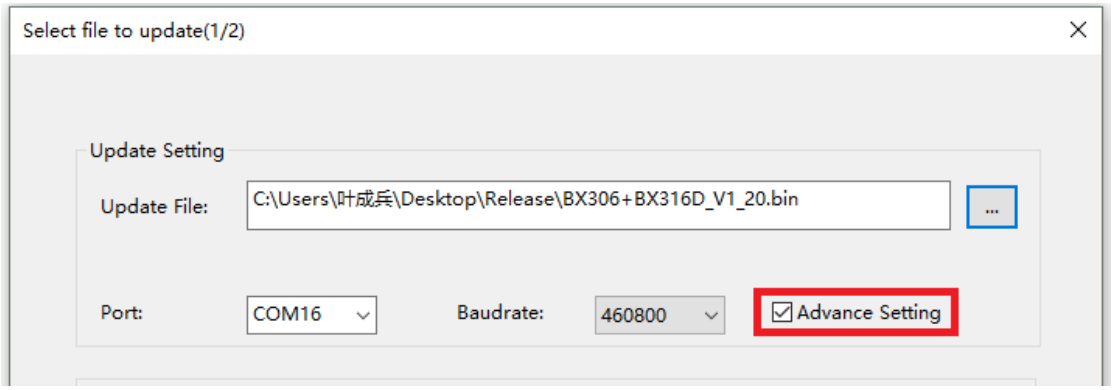


6. Press OK and Finish buttons to close the FW upgrade windows, the receiver will reset automatically.
7. After the board is booted, you can confirm the FW version by connecting to the receiver and input ‘LOG VERSION’ and check the FW version.

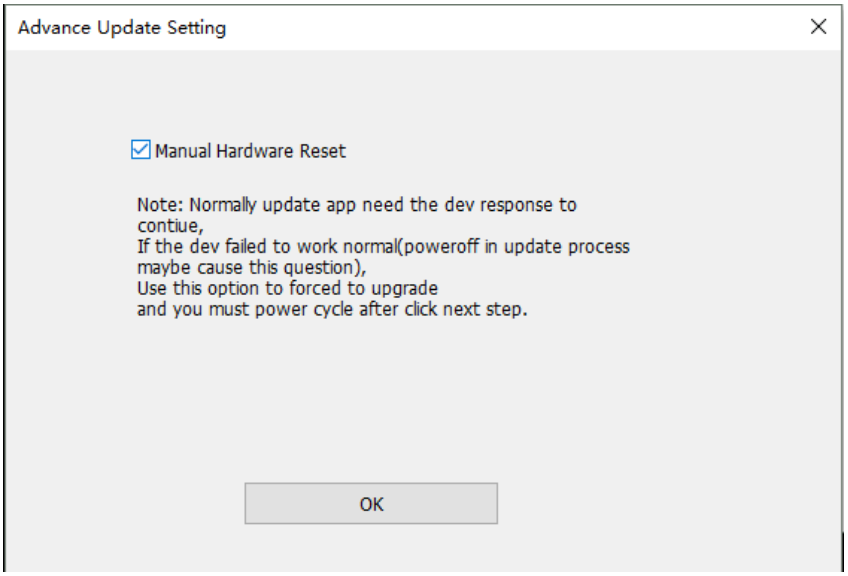
There is Advance Setting option in the FW update page, If a receiver

- **can’t boot up successfully, or**
- **can’t work well after boot up, or**
- **can’t finish FW update successfully according to the above steps,**

you can select Advance Setting option to start FW update again.



If it’s selected, the following page will be displayed, select ‘Manual Hardware Reset’ and press OK.



Press Next in the former page and power off the receiver, wait for 5 seconds and power on it again.

After FW update is finished, power off the receiver, wait for 5 seconds and power on it again.

⚠	**This option is for sophisticated users. If you're not sure whether it should be selected, contact Tersus support before select this option.**

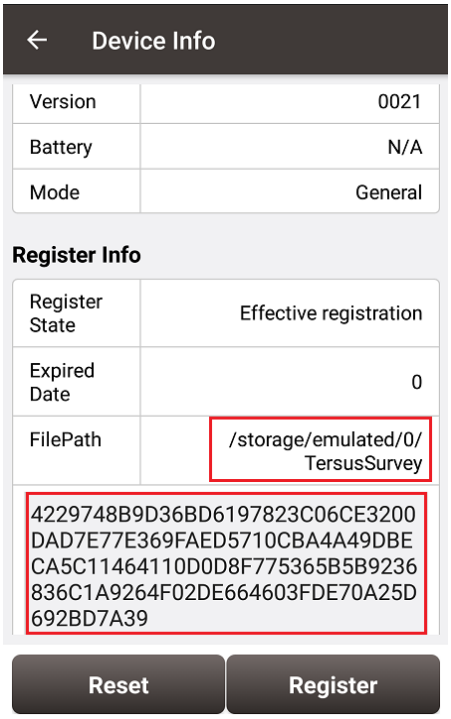
3.4.2 Auth Code

An auth code is used to determine the features and valid time for a David receiver. If the auth code is expired, the receiver will not work. And a license requirement is output from all the ports.

Before you contact Tersus for new auth code, please:

1) Follow Figure 48 and the detailed steps in Table 19 to create communication between a David receiver and Tersus GNSS Center.
2) Input: LOG VERSION //get the version info LOG AUTHLIST //get the auth list info to the David receiver, and send all the output info to Tersus support. If the auth code application is approved by Tersus, you will get a reg.txt file, in which

AUTHCODE command with the code will be given, copy all of them and input them to the David receiver in the console window of Tersus GNSS Center, or



3) Connect the David with Nuwa App, go to Device -> Device Info, the right window will be shown
4) Confirm the reg.txt file is copied to the FilePath.
5) The auth code will be given in the window below, press Register to input the new auth code.

3.5 Download Files from Internal eMMC Card

The files saved on David's internal eMMC card can be copied to the computer via a serial port or an USB port (recommended and used in the following example).

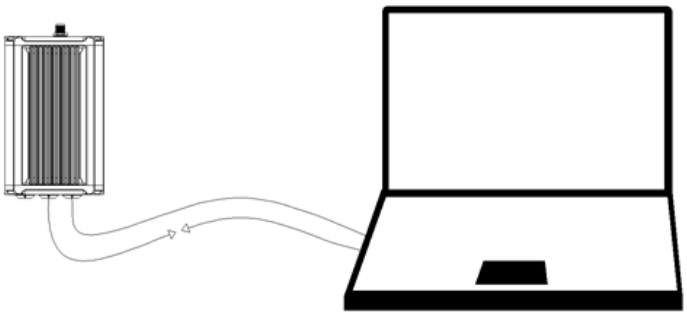


Figure 49 Download file from eMMC card

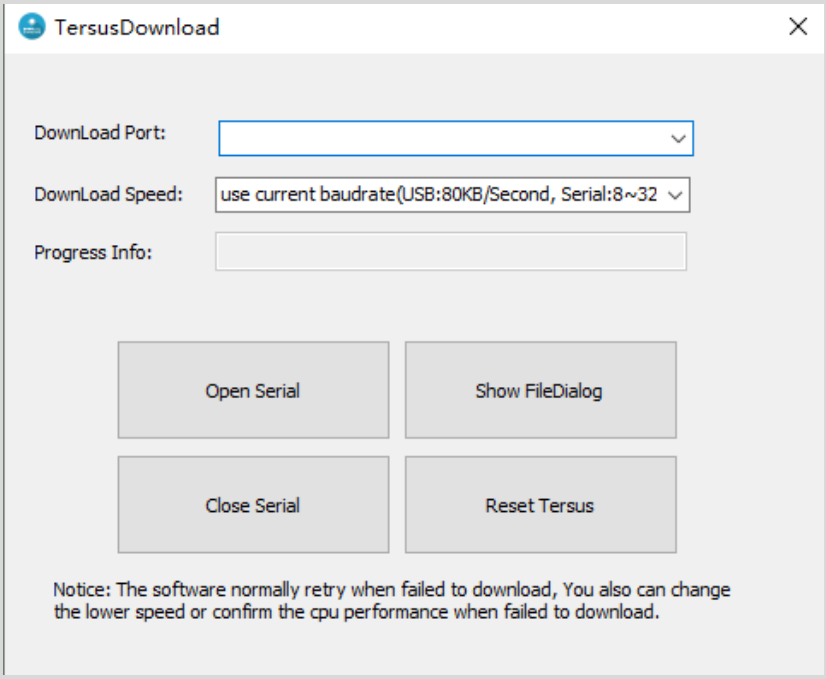
Table 21 Detailed Steps to download files from eMMC card

Hardware Installation
1. Connect the David's COMM2 port to a computer's USB port with COMM2-7pin-USB & DB9 data cable or COMM2-7pin-USB & 5pin cable.

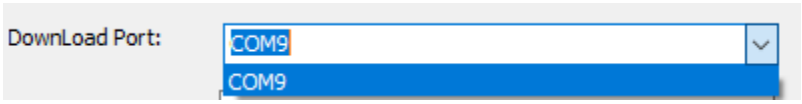
2. Power on the David.

Software Configure

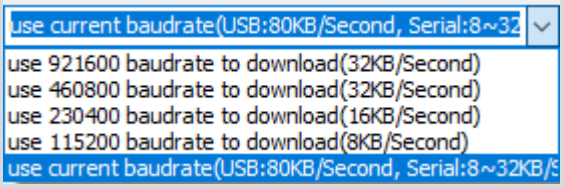
3. Run the TersusDownload, the following page will display:



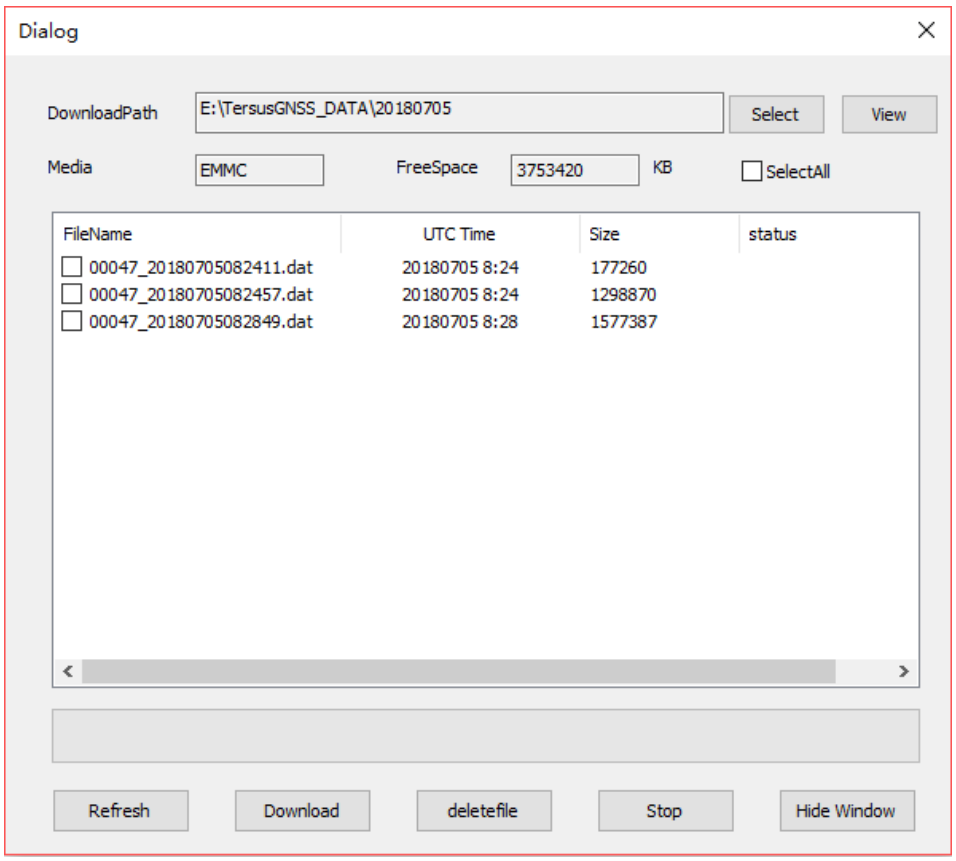
4. Choose the serial port to communicate with the David



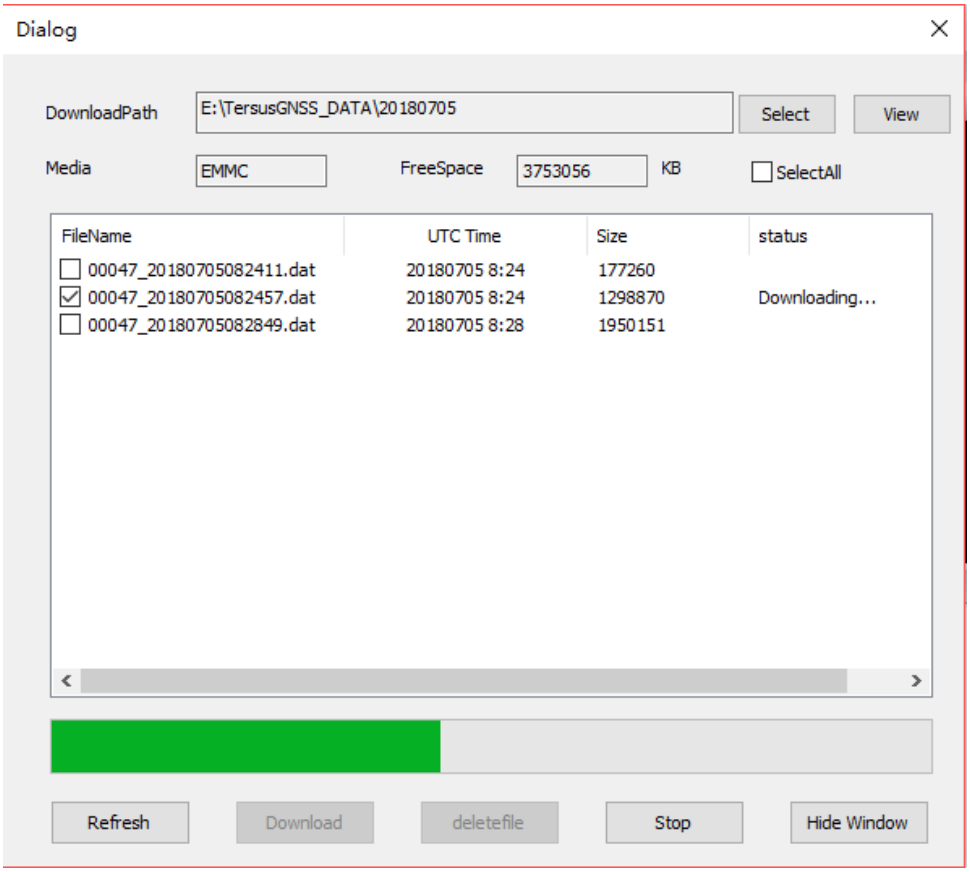
5. Choose the download speed (the example is using USB port. Select the baud rate if a serial port is used to download the file)



6. Press the Open Serial button, all the files on the David's eMMC card will be read and shown, see the following figure:



7. Give the downloadpath and select the files to be downloaded, press Download button to start downloading:



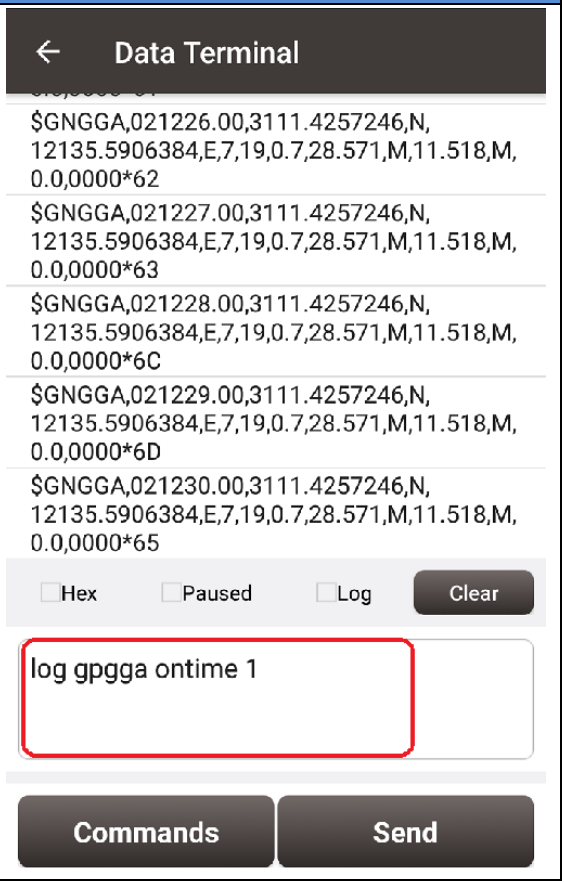
The files will be saved on the DownloadPath directory.

!	The downloading rate is about 2M/min, the downloading time can be estimated based on it.

3.6 Input command directly to the GNSS board

Users can input commands to the BX306 board inside the David directly, the steps are given in Table 22.

Table 22 Input commands to the BX306 directly

Hardware Installation	
Follow section 3.3.1 or section 3.3.2 to connect the Android phone to the David.	
Software Configure	
1) Run Nuwa and go to Device -> Data Terminal 2) The page at the right will be shown; users can input all the commands in the Log & Command document in the window. 3) Then press Send button, the command will be input to the BX306 board.	

4. Introduction of Nuwa®

Nuwa® is the Tersus survey app, which is running in the Android phone. All the configure commands for the David are input with Nuwa®, and all the operation of David are done with Nuwa®. Four tabs menus are provided in the main window. They are Project, Device, Survey and Tools. See the Nuwa® user manual for detail.

Figure 50 Booting up page

!	Tersus Survey Nuwa® is supporting Android system; no IOS version is available now.

⚠	The minimal requirements for Android phone: 1) The phone must support OTG, otherwise, it can't be connected to David with cables, but only with Bluetooth. 2) The Android system is 6.0 or later version.

!	1) There are lots of Android versions in market, so an Android phone meeting the minimal requirements above may still have problems to run Nuwa. 2) Nuwa is tested with: Huawei Mate 7/Honor 7/9, Oppo A57, Vivo X9 and Samsung C7 Pro. 3) It's highly recommended that an Android phone with better hardware performance than those above is used to run Nuwa.

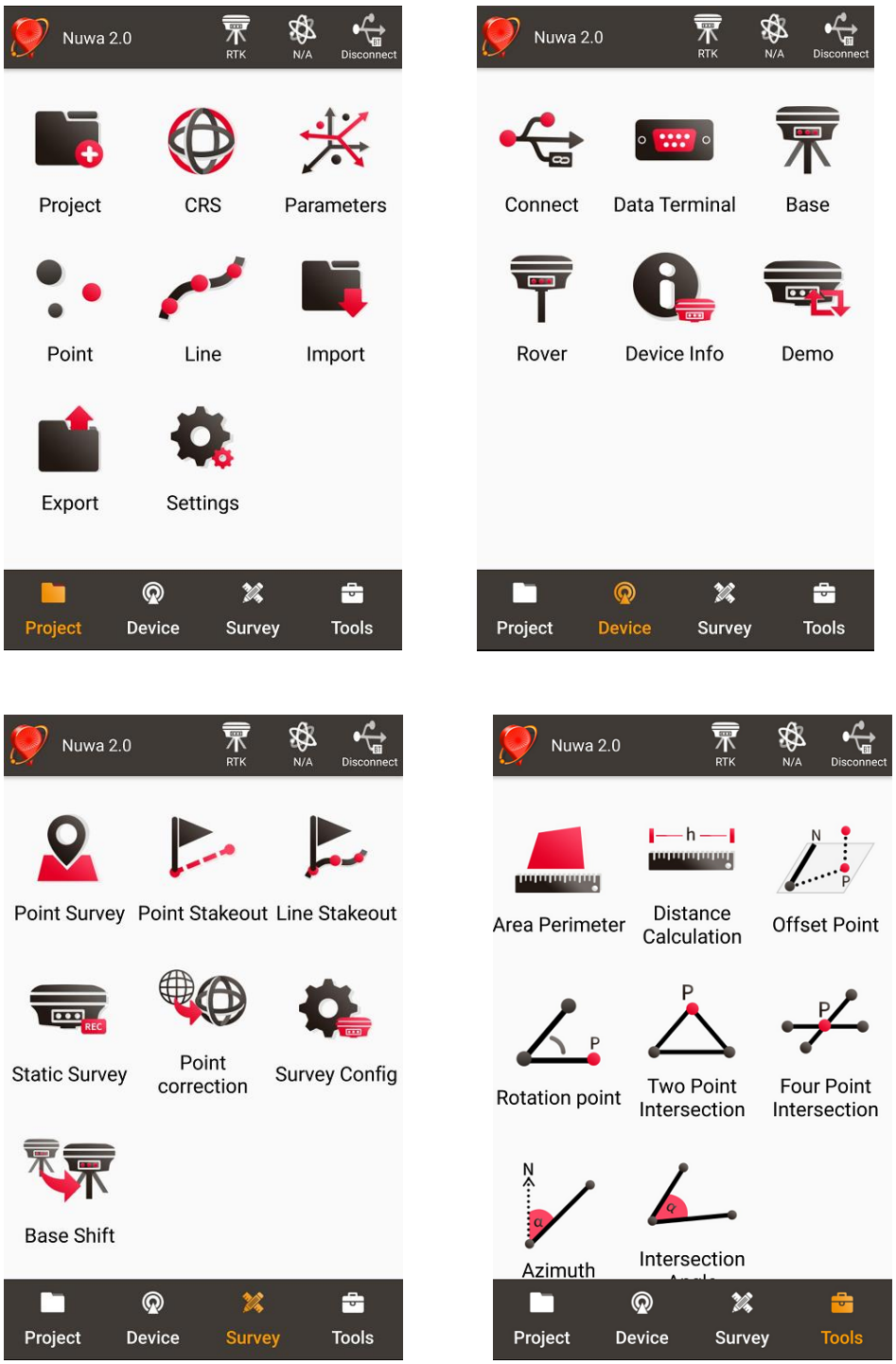


Figure 51 Four Main Windows of Nuwa

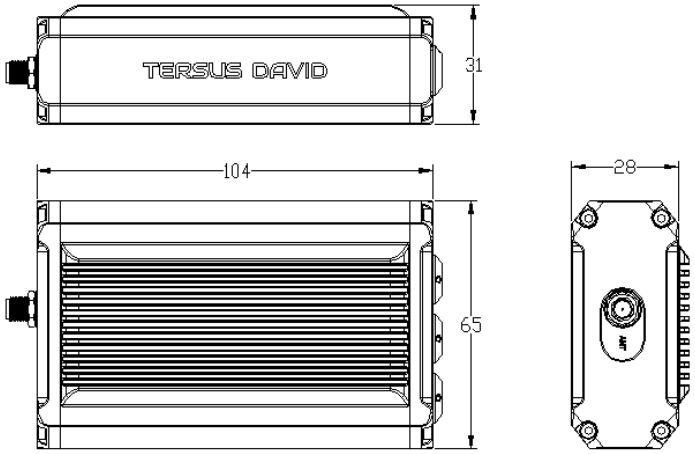
APPENDIX A

5. Specification

5.1 David Receiver

Table 23 David GNSS Performance

GNSS Performance		
Position Accuracy	Single positioning	1.5m RMS (Horizontal)
		3.0m RMC (Vertical)
	RTK Positioning	10mm+1ppm (Horizontal)
		15mm+1ppm (Vertical)
	Static post processing	3mm+0.5ppm (Horizontal)
		5mm+0.5ppm (Vertical)
Time to First Fix	Cold Start: <50s Warm Start: <30s	
Reacquisition	0.5 s L1 (typical) 1.0 s L2 (typical)	
Data Rate	Measurements	20Hz
	Position	5Hz
Time Accuracy	20ns RMS	
Velocity Accuracy	0.03m/s RMS	
Measurement Precision	C/A Code	10cm
	P Code(zenith direction)	10cm
	Carrier Phase(zenith direction)	1mm
Physical Description		
Size	104*65*31 mm^3 (David only)	
Weight	250g (David only)	
Mechanical Drawing		



ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +95°C
Humidity	MIL-STD-810G, Method 507.5 Procedure II (95%)
Random Vibration	MIL-STD 810G Method 514.6, Category 24 (7.7 g RMS)
Sinusoidal Vibration	IEC 60068-2-6 (5 g)
Bump	ISO 9022-31-06 (25 g)
Shock	Operating: MIL-STD-810G, Method 516.6, Procedure I (40 g) Non-operating: MIL-STD-810G, Method 516.6, Procedure V (75 g)
Water & dust proof	IP67
Power Requirement	
Input Voltage	+5 – 12 VDC
Power Consumption	3.2W without external Radio 6.2W with external 1W radio RS900C 9.8W with external 2W radio RS400L2

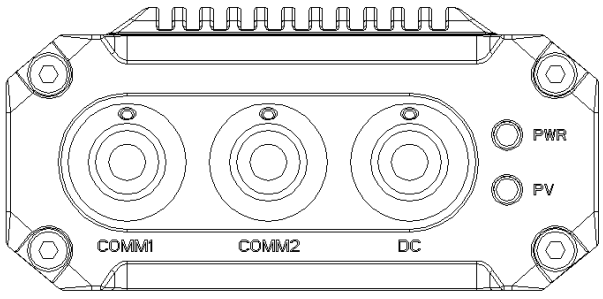


Figure 52 Panel of David

Table 24 Pin Definition

Connector Pin No.	COMM1 LVTTL	COMM2 RS-232	DC
1	PWR	PWR	PWR
2	GND	GND	GND
3	TXD1	TXD2	
4	RXD1	RXD2	
5	GND	GND	
6	CAN_H/PPS[1]	USB D+	
7	CAN_L/EVENT[1]	USB D-	

Note 1: The default configure for pin6 and pin7 in COMM1 port are CAN_H and CAN_L. The two signals are multiplexed with PPS and EVENT. This feature is related to FW release, contact support@tersus-gnss.com for confirmation.

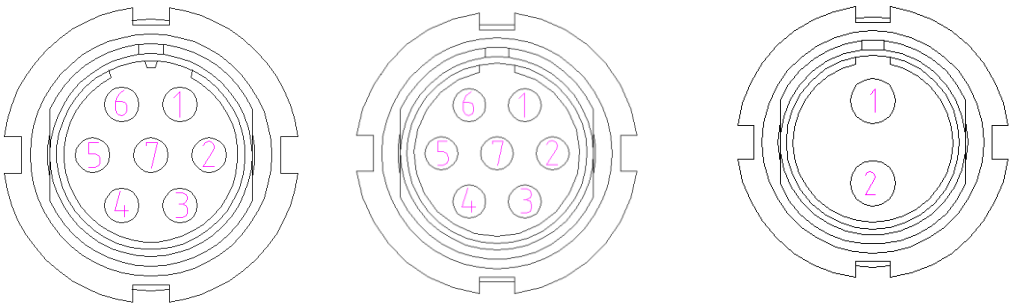
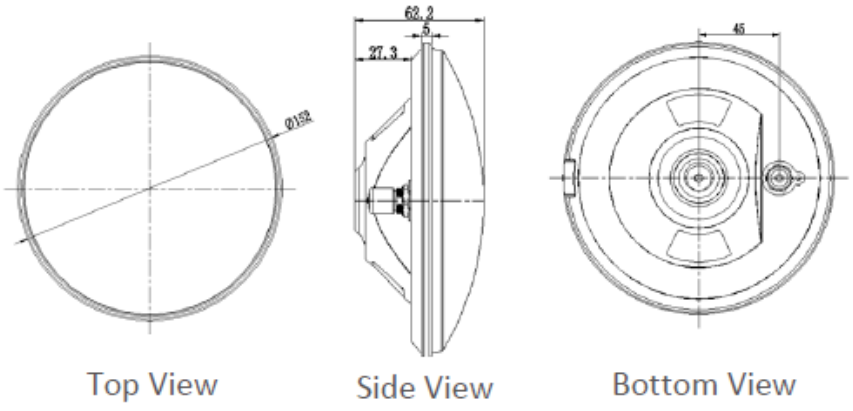


Figure 53 Pin Definition of the COMM1/COMM2/DC ports

5.2 ANTENNA AX3702

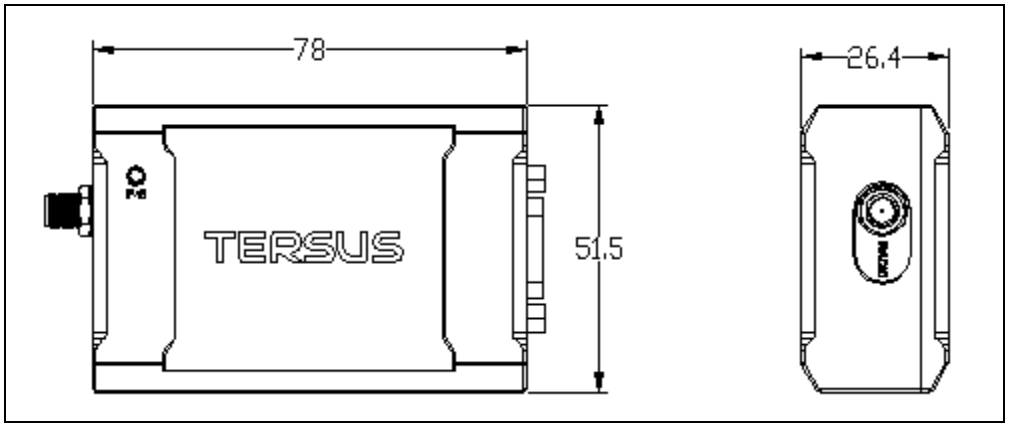
Table 25 Antenna AX3702

Antenna Specification	
Tracking signals	GPS L1/L2/L5; BDS B1/B2/B3; GLONASS L1/L2
Impedance	50 Ohm
Polarization	RHCP
Axial Ratio	≤ 3dB
Azimuth Coverage	360°
Output VSWR	≤ 2.0
Peak Gain	5.5dBi
Phase Center Error	± 2mm
LNA Specification	
LNA Gain	40±2dB
Noise Figure	≤ 2.0dB
VSWR	≤ 2.0
Input Voltage	3.3~12V DC
Operating Current	≤ 45mA
Ripple	± 2dB
Physical Description	
Dimension	Φ152*62.2mm
Signal Connector	TNC Female
Installation connector	5/8'' x 11
Environment	
Operating temperature	-45°C - +85°C
Storage temperature	-45°C - +85°C
Damp	45% - 95%
Mechanical Drawing	
	

5.3 1W Radio RS900C

Table 26 Specification for RS900C

General Specification	
Working Frequency	915MHz
Data level	RS-232
Serial port baud rate	115200
Data interface	DB-9 male
Size	78 * 51.5 * 26.4 mm^3
Operating Temperature	-40 - +85℃
Antenna impedance	50Ω
Input voltage	DC 5V – 12V
Power consumption	3.0W (transmitting)
	180mW (receiving)
Receiver Specification	
Sensitivity	-123dBm (20kbps)
Spurious response immunity	≥ 65dB
Intermodulation immunity	≥ 60dB
Stand by current	≤ 65mA
saturation	≥ 90dB
Distortion	≤ 5%
Error rate	≤ 0.001%
Transmission specification	
Modulation	QPSK/BPSK
Transmission power	>1000mW
Modulation distortion	≤ 3%
Maximum frequency deviation	≤ 5KHz
Transmission current	≤ 1000mA/DC 5V
Carrier frequency tolerance	≤ 5*10-6
Spurious frequency components	≤ -65dB
Sleep current	≤ 5uA
Working range	>2km (@1Mbps)
	>5Km (@20Kbps)
Mechanical Drawing	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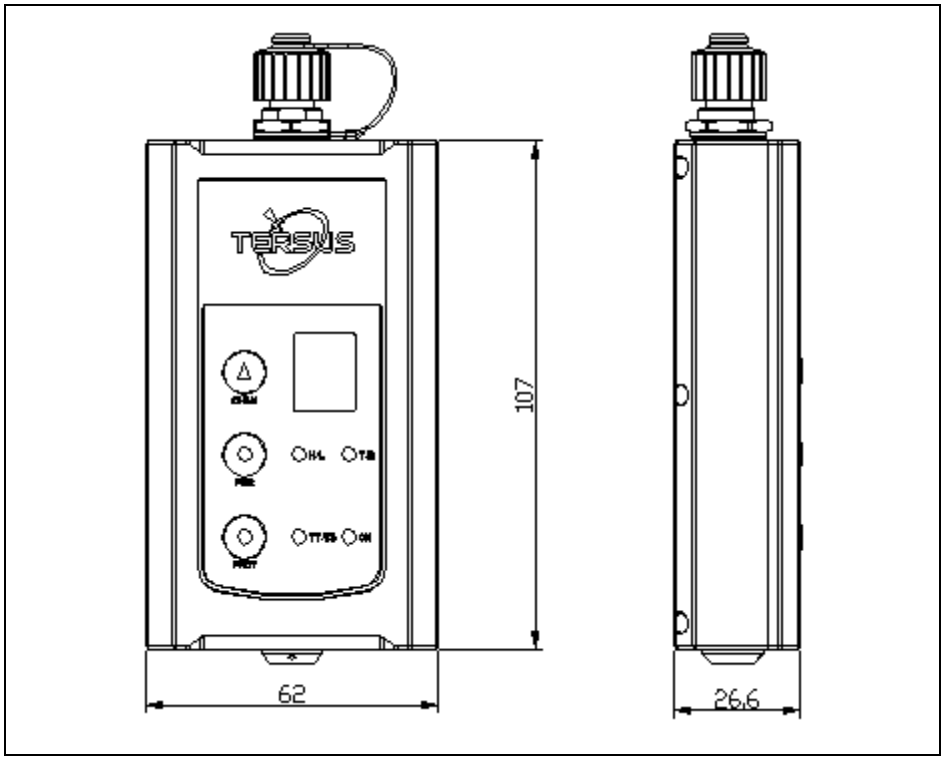
5.4 2W Radio RS400L2

Table 27 Specification for RS400L2

Communication Interface		
Interface	9.6kbps in the air	
	Lemo connector, RS-232, baud rate 38400	
Voltage and Power		
Input voltage	DC 5 – 12V	
Power consumption in transmitting	6.5W (DC 12V, transmitting power 2W) 4W（DC 12V, transmitting power 1W）	
Power consumption in receiving	<400mW (DC 5V)	
External Antenna		
Impedance	50 Ohm	
VSMR	≤ 1.5	
Interface	MCX female	
Modulation & Demodulation		
Modulation	GMSK	
Data rate in air	9600bps@25KHz	
RF sensitivity	Better than 13dB@-119dBm	
Code sensitivity	-116 dBm BER 10E-5@9600bps	
Protocol	Transparent EOT, TT450S and Tersus	
RF Specification		
Frequency range	10MHz (457MHz – 467MHz)	
Channel width	25KHz	
Frequency stability	±1.5 ppm(25C)	
Channel number	10 configurable channels	
Adjacent channel selectivity	≥ 60dB	
Transmission power	High power (2W)	33.5 ± 0.5dBm@DC5.5V
	Low power (1W)	30.0 ± 0.5dBm@DC5.5V
Environment		
Temperature	-30°C - +60°C (operating)	
	-40°C - +85°C (storage)	
Mechanical		
Size	107 * 62 * 26.6	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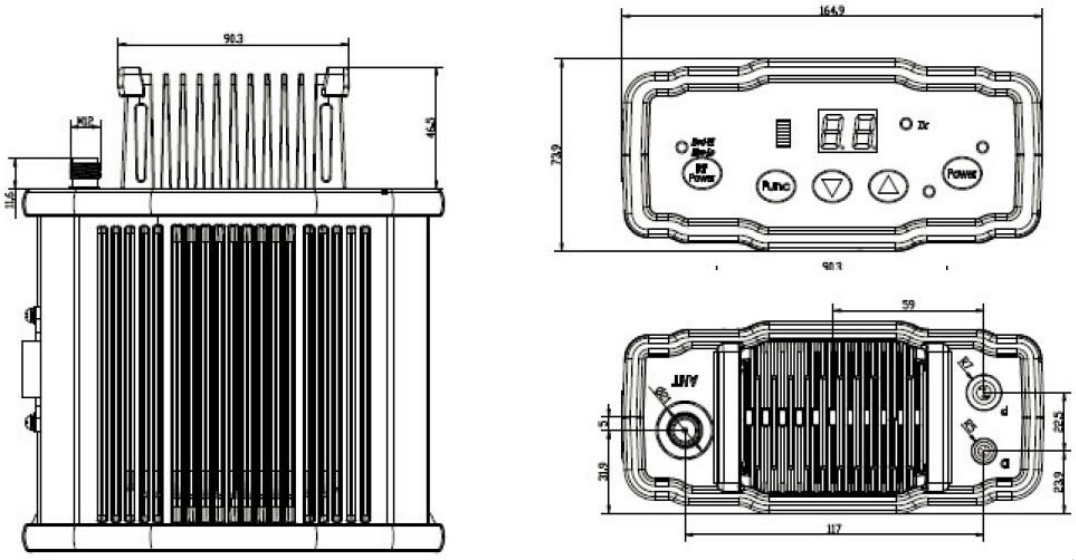
5.5 30W Radio RS400L30

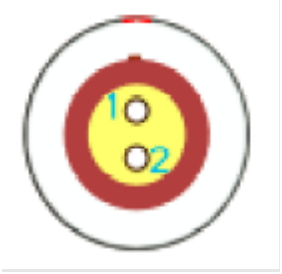
Table 28 RS400L30 Radio Specification

Communication Interface		
DTE-DCE Interface	9.6kbps in the air	
	Serial port: RS-232, Band rate 38400	
Interaction		
Power level	High (about 30W)	PWR LED: OFF
	2nd high (about 20W)	PWR LED: BLUE
	Middle (about 10W)	PWR LED: RED
	Low (about 5W)	PWR LED: RED&BLUE blink
Charging Alarm	DC 11.60 ± 0.2V	
Battery Monitor	B4	DC 13.00 ± 0.2V
	B3	DC 12.50 ± 0.2V
	B2	DC 12.00 ± 0.2V
	B1	DC 11.60 ± 0.2V
Power In/Out		
Input voltage	DC 10.5 – 15.0V	
Power in transmitting (typical)	85W (DC 12.8V, 30W output) 65W (DC 12.8V, 20W output) 46W (DC 12.8V, 10W output) 33W (DC 12.8V, 5W output)	
Transmitting prohibition voltage	DC 11.40 ± 0.2V (default) DC 10.50 – 11.5V (configure range)	
Power in receiving (typical)	<3W (Input voltage DC 12.8V)	
Antenna		
Input Impedance	50 Ohm	
VSWR	≤ 1.5	
Interface	TNC female	
Modulation/Demodulation		
Modulation	GMSK	
Data rate in air	9600bps@25KHz	
RF sensitivity	Better than 13dB@-119dBm	
Decode sensitivity	-116 dBm BER 10E-5@9600bps	
Protocol	Transparent EOT, SOUTH	
Radio		
Frequency range	457 – 467MHz	
Channel width	25KHz	
Stability	±1.5ppm (25C)	

Channel number	116 (channel 00 – 15 are configurable, channel 16 – 116 are fixed)	
Adjacent channel selectivity	≥60dB	
Environment		
Temperature	Operating	-30 – +60°C
	Storage	-40 – 85°C
Dust proof and waterproof	IP68	
Physical Description		
Size	165 * 74 * 185.5 mm^3 with plastic protector	
Weight	About 1.75Kg	
Data port	LEMO EGA.0B.305	
Power input port	LEMO EGG.1B.302	
Installation	Hook	
Mechanical Drawing		



Signal definition		
Data Port		Pin 1: GND Pin 2: GND Pin 3: Output power (3A, same voltage as the input) Pin 4: RXD Pin 5: TXD

Power input port		Pin 1: GND Pin2: PWR input

6. Typical operating

⚠	■ The LEMO connectors in the David system support mis-installation avoidance. But it's highly recommended to double check the module/cable before they are installed to the correct ports. ■ Mis-installation with force can damage the David.

!	The following may be used for David system: ● A battery bank for David ● An Android phone ● An external large capacity power if a base kit with 30W or with 2W radio station is used. ● A tripod (optional). ● A tribrach (optional)

⚠	It's highly recommended that a David base variant is installed on a tripod.

6.1 David as a Rover to receive corrections from Internet

!	From section 6.1 to section 6.4, David and Android phone are connected with cables; refer to section 3.3.2 for the connection with Bluetooth.

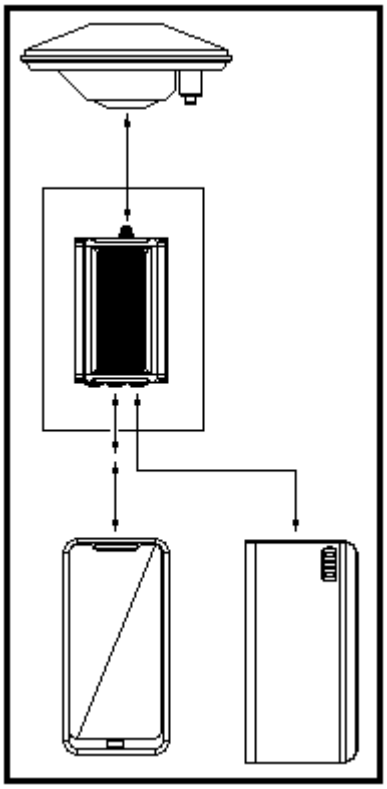
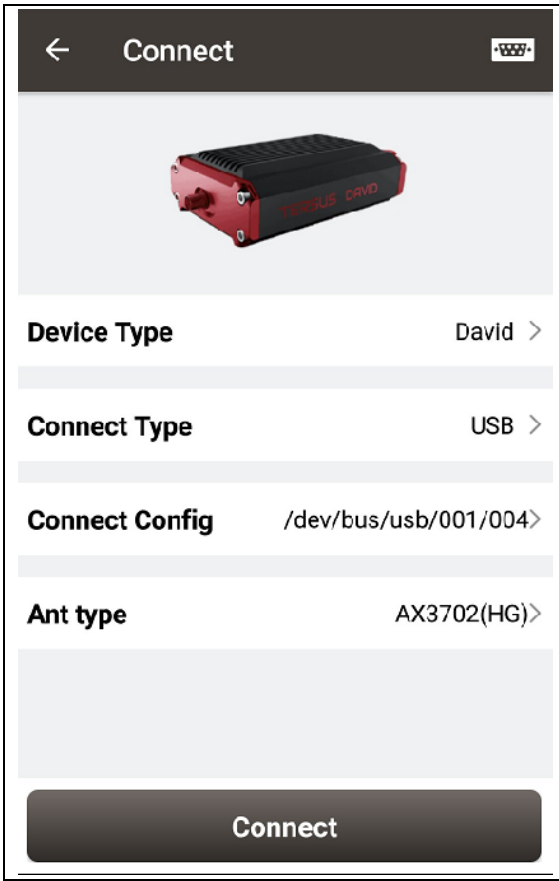


Figure 54 Outline of Android phone to David with Wire

!	Two cables are used to connect the COMM2 port of David to the USB port of the Android phone. They are: ● COMM2-7pin-USB & DB9 Male cable or COMM2-7pin-USB & 5pin cable. ● USB Type A Female to USB (Micro + Type C) OTG cable

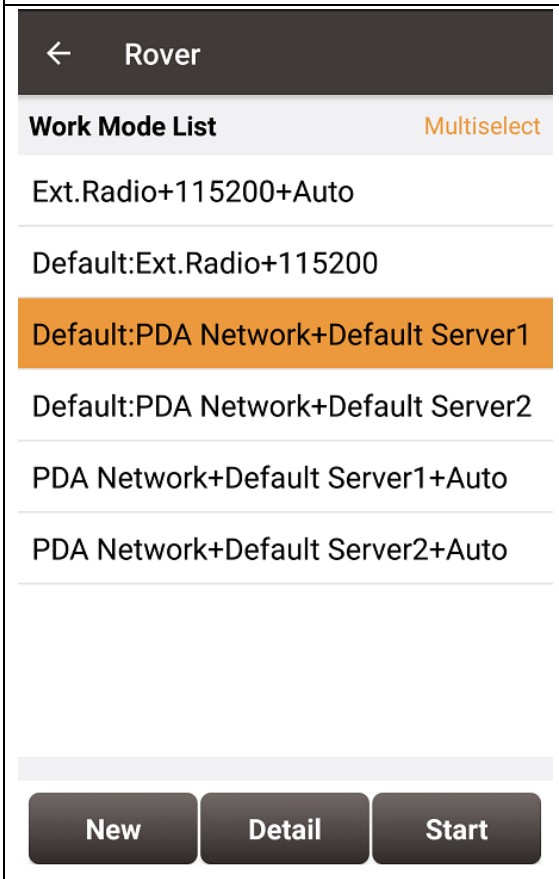
Table 29 Detailed steps for rover receive corrections from Internet

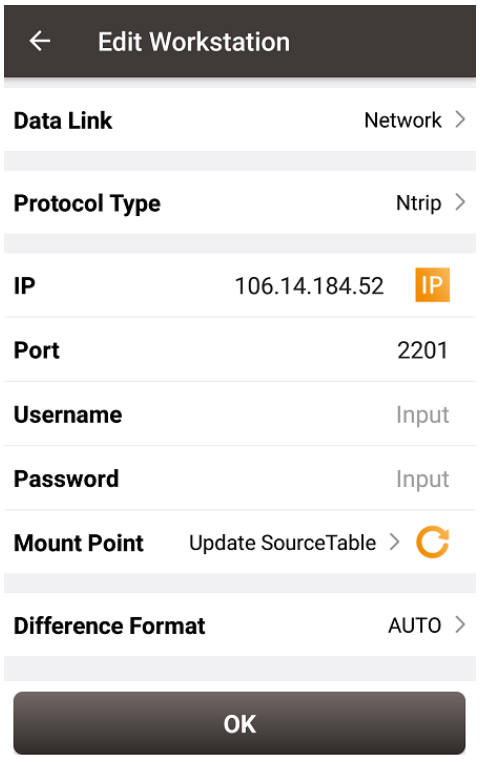
Hardware Installation
1. Install the GNSS antenna on a ranging pole at a point interested.
2. Connect the antenna to David with the RF cable.
3. Connect the David's COMM2 port to the USB port of the Android phone with cables.
4. Power on the David with a battery bank.
Software Configure
5. Run Nuwa, Device ->Device Connect

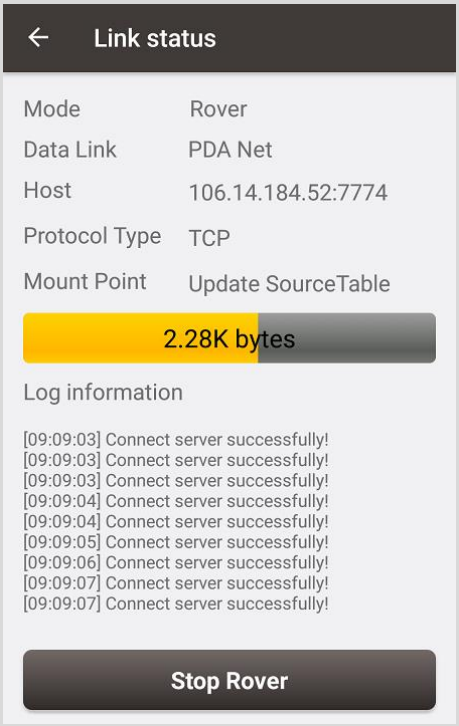


6. Connect Type “ USB”
7. Press Connect Config to update accordingly.
8. Press Connect to enable the communication with the David.

9. Go back to: Device -> Rover Station





10. Select PDA Network+Default Server1, then press Detail to configure the parameters about the Network. 11. Select Network for Data Link 12. If Ntrip is selected for Protocol type, please input: IP, Port, Username, Password and Mount Point. 13. If TCP is selected for Protocol type, please input: IP and Port. 14. Go back to the Rover Station page and press “Start”. 15. If all the configure above are correct, the right page will show the rover is receiving RTK corrections.	

6.2 David as a Base to transmit corrections to Internet

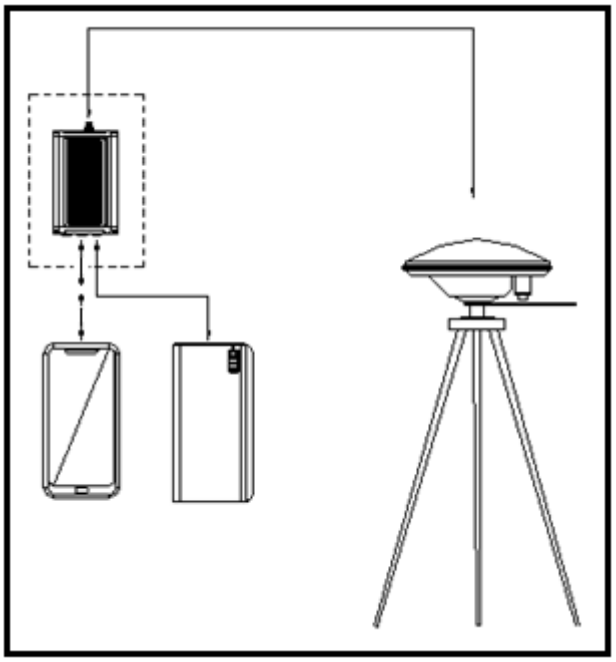


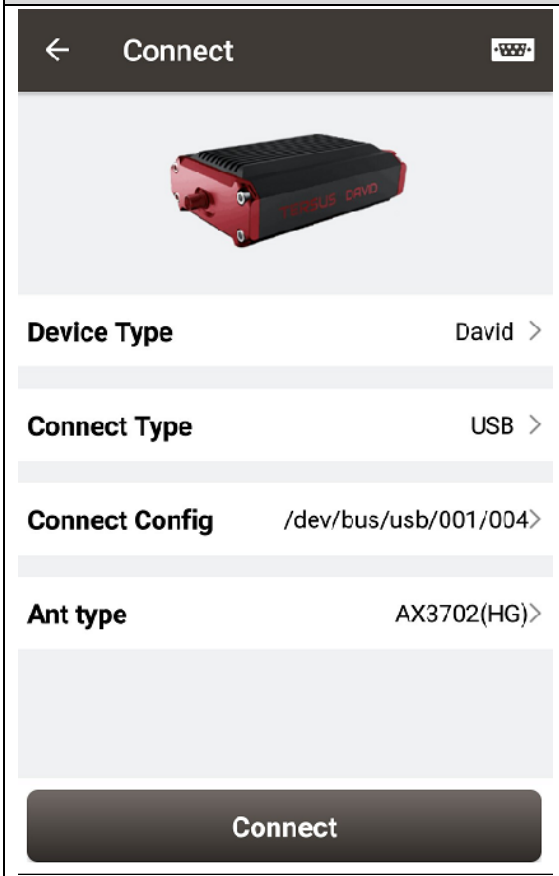
Figure 55 Outline of Android phone to David with Wire

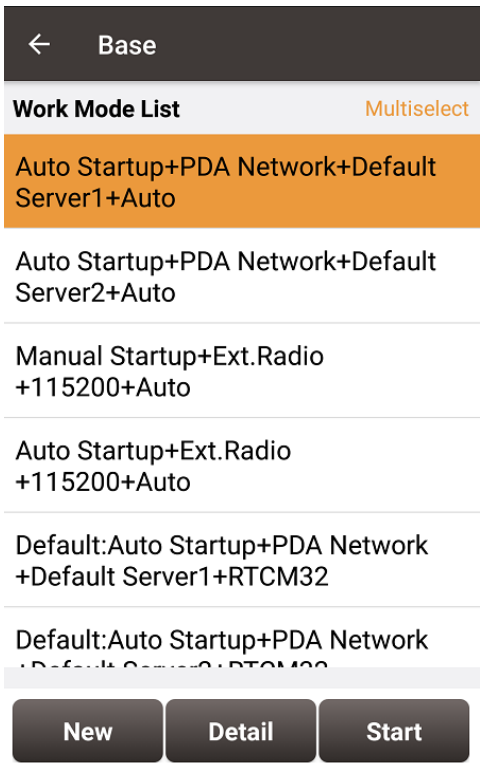
!	Two cables are used to connect the COMM2 port of David to the USB port of the Android phone. They are:

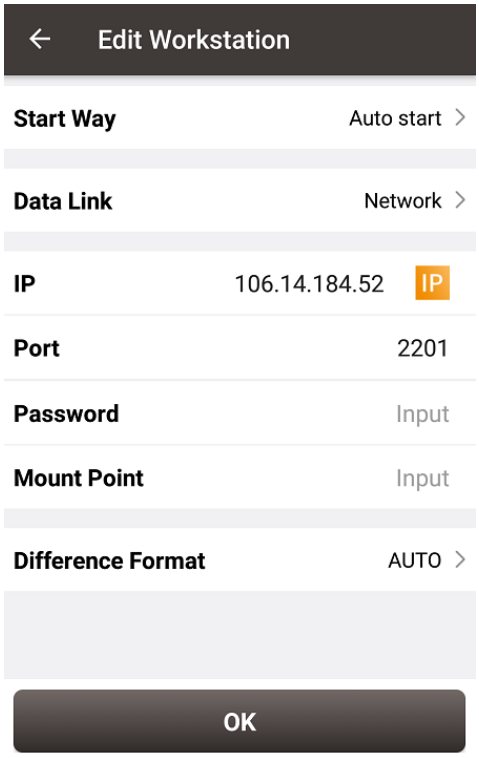
	● COMM2-7pin-USB & DB9 Male cable or COMM2-7pin-USB & 5pin cable. ● USB Type A Female to USB (Micro + Type C) OTG cable

!	It's highly recommended that a base David is installed on a tripod.

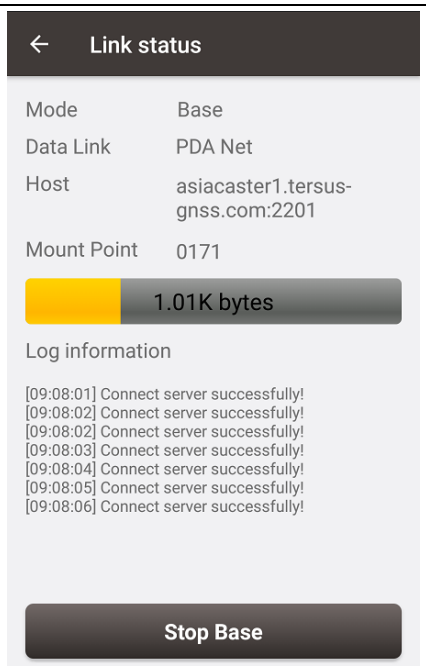
Table 30 Detailed steps for Base transmit corrections to Internet

Hardware Installation	
1. Install the tripod at a point interested.	
2. Install a tribrach on the tripod, adjust it to horizontal level and install the GNSS antenna and the antenna connector on it.	
3. Connect the antenna to David with the RF cable.	
4. Connect the David's COMM2 port to the USB port of the Android phone with cables.	
5. Power on the David with a battery bank.	
Software Configure	
6. Run Nuwa, Device ->Device Connect	
	7. Connect Type " USB" 8. Press Connect Config to update accordingly. 9. Press Connect to enable the communication with the David.
10. Go back to: Device -> Base Station	





11. Select Auto Startup+PDA Network+Default Server1+Auto, then press Detail to configure the parameters about the Networ
12. If Auto Start is selected for Start Way, go to Step 14.
13. If Manual Start is selected for Start Way, input the base's position manually.
14. If Ntrip protocol is selected, please input: IP, Port, Username, Password and Mount Point.
15. Go back to the Base Station page and press "Start"
16. If all the configure above are correct, the right page will show the base is transmitting RTK corrections.



6.3 Radios Transmit RTK Corrections between Two Davids

!	● 1W base must work with 1W rover. ● 2W base must be work with 2W rover. ● 30W base must work with 2W rover.

Only 30W base and 2W rover are given in this section since the other two configure are very simple.

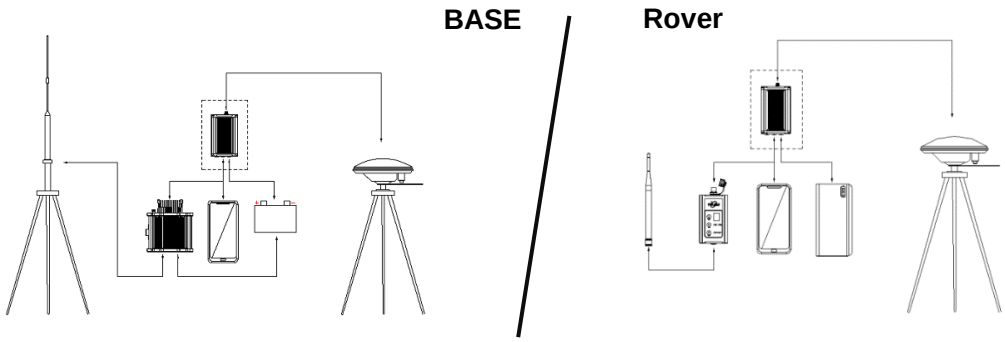


Figure 56 Outline of Base/Rover with Radios

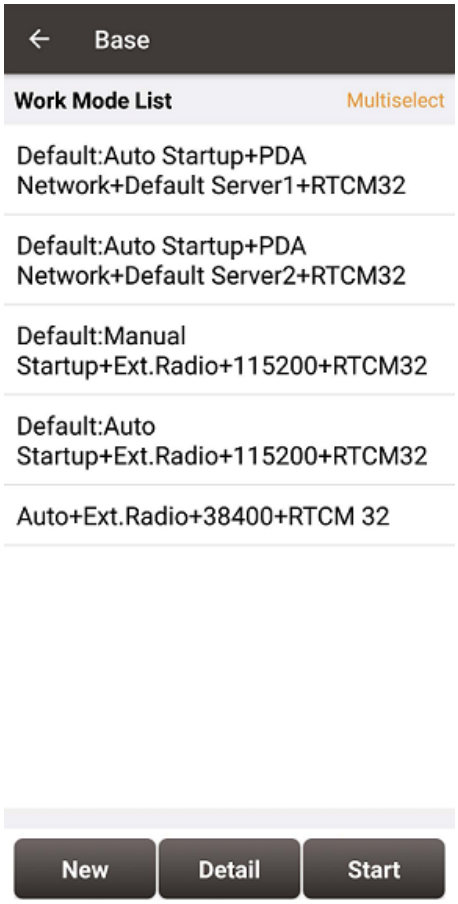
Table 31 Detailed steps for David with Radios

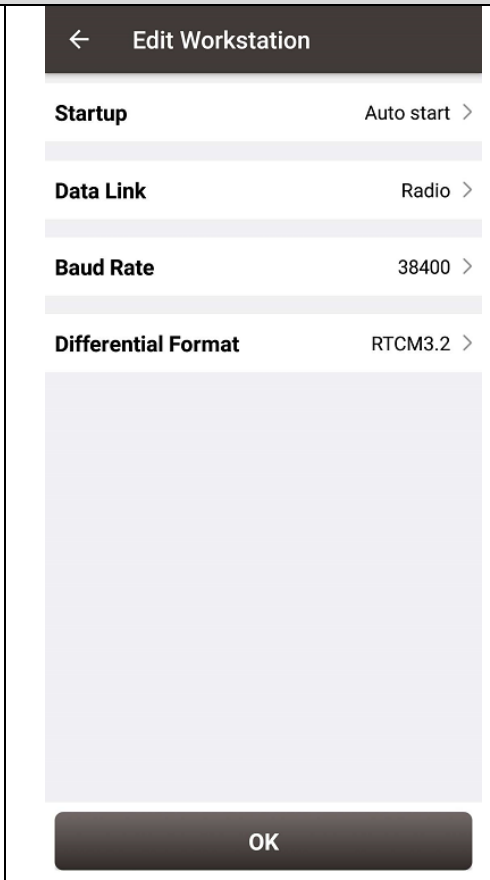
Hardware Installation for the 30W Base
1. Install the two tripods at the points interested.
2. Install the 30W radio antenna with the telescopic pole for radio antenna.
3. Refer to Figure 42, install the metal plate, the GNSS antenna connector and the 30W radio antenna on one tripod.
4. Install a tribrach on the other tripod, adjust it to horizontal level and install the GNSS antenna and the antenna connector on it.
5. Connect the antenna to the base David with the RF cable.
6. Connect the David's COMM2 port to the USB port of the Android phone with cables.
7. Install the RF cable from the telescopic pole to the 30W radio station.
8. Connect the COMM cable to 30W radio, and to the base Daivd's DC port, respectively. Then connect it to the power cable for 30W radio.
9. Double check the cables above and connect the power cable to the external battery.
Hardware Installation for the 2W Rover
10. Install the GNSS antenna on a ranging pole and place it at the point interested.
11. Connect the rover antenna to the rover David with the RF cable.
12. Install the COMM2-7pin-USB & 5pin cable to the COMM2 port of the rover David, and connect the other two connectors to the USB port of the Android phone with cables and to the 2W radio station, respectively.

13. Power on the David with an external battery bank.

Software Configure for the 30W Base

14. Refer to 3.3.1 to communicate the Android phone with the base David.
15. In Survey Nuwa, go to: Device -> Base Station

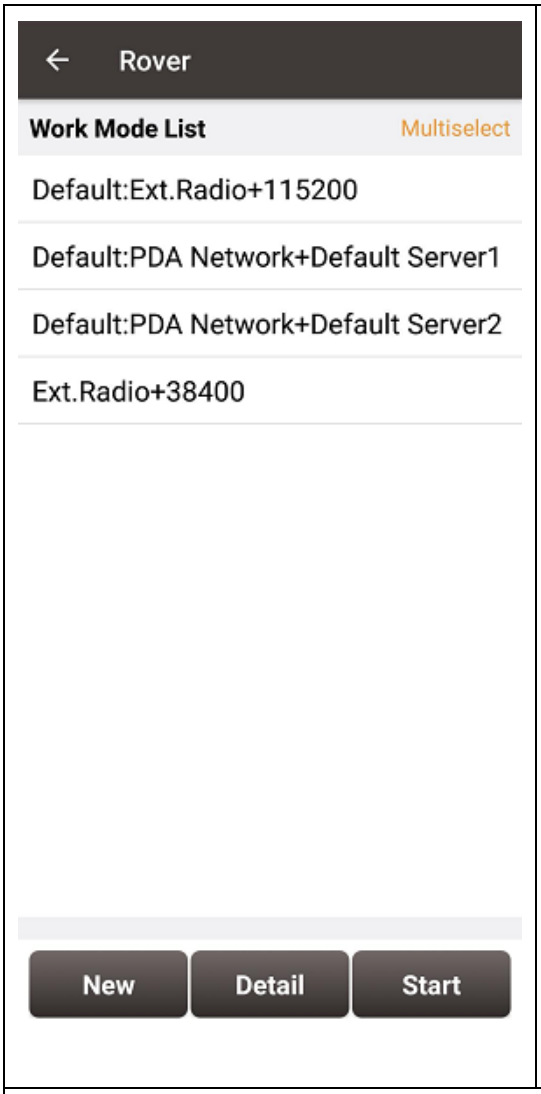


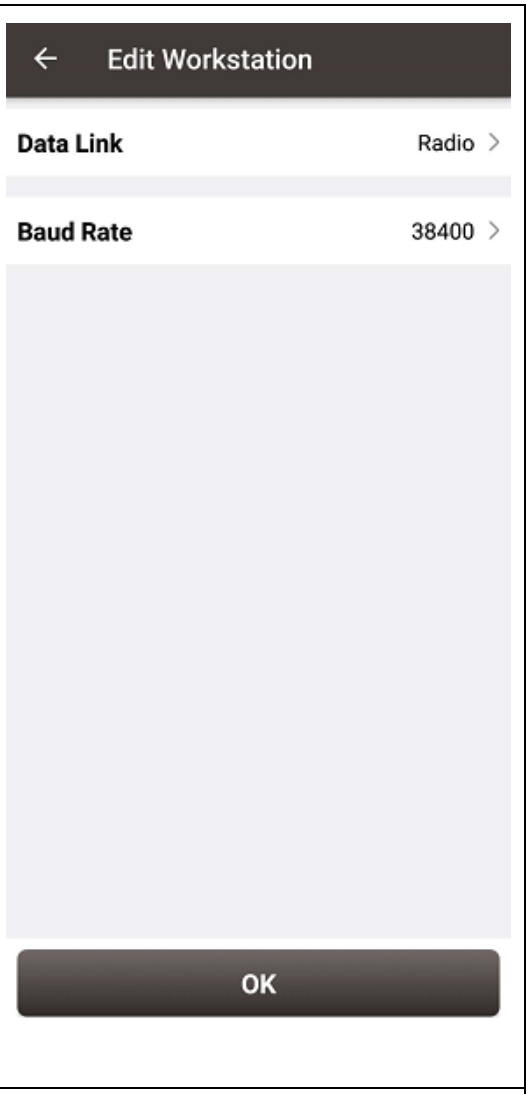


16. Select Auto +Ex.Radio+38400+RTCM 32, press Detail
17. If Auto Start is selected for Start Way, go to Step 20.
18. If Manual Start is selected in for Start Way, input the base's position manually.
19. Press OK to go back to the Base page, press Start.

Software Configure for the 2W Rover

20. Refer to 3.3.1 to communicate the Android phone with the rover David.
21. Go back to: Device -> Rover Station





22. Select Ext.Radio+38400, press Detail
23. Data Link is Radio and ensure the Band Rate is correct.
24. Go back to the rover page, and press Start.

6.4 Data Collection for Post Processing

!	The size of the logging: Collect raw measurements at 1Hz (about 110KByte/min if 20 satellites are tracked, about 165KByte/min if 30 satellites are tracked) If the collection frequency increased, the data size will be increased proportionately.

⚠	David provides up to 4GB internal eMMC card for data collection, before data collection, estimate whether the free space is enough for the data collection. Refer to Table 21 to delete the files on eMMC card to get more free space.

⚠	During data collection, the antenna must be installed on a tripod.

!	Rules for the file name & update time in the internal eMMC card: 1) Name: file name is the 00..00xx..xx.dat, totally 8 digits, in which xxxx is the working time (seconds/100) of the David. For example, the David has worked 500 hours 40min, (500*3600 + 40*60)/100 = 18024, the file name will be 00018024.dat. 2) Update time: if the David hasn't gotten the GNSS time, the update time of the files will be19800000 0:0 (YYYYMMDD HH:MM). If the David has gotten the GNSS time, the update time will be the UTC time.

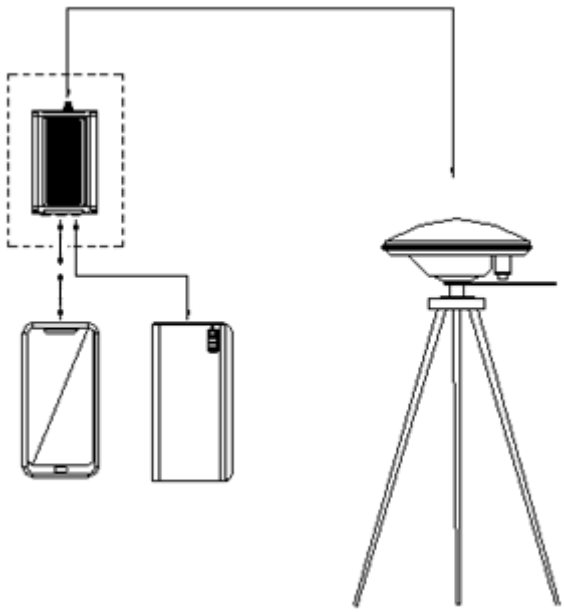


Figure 57 Outline of Static Data Collection

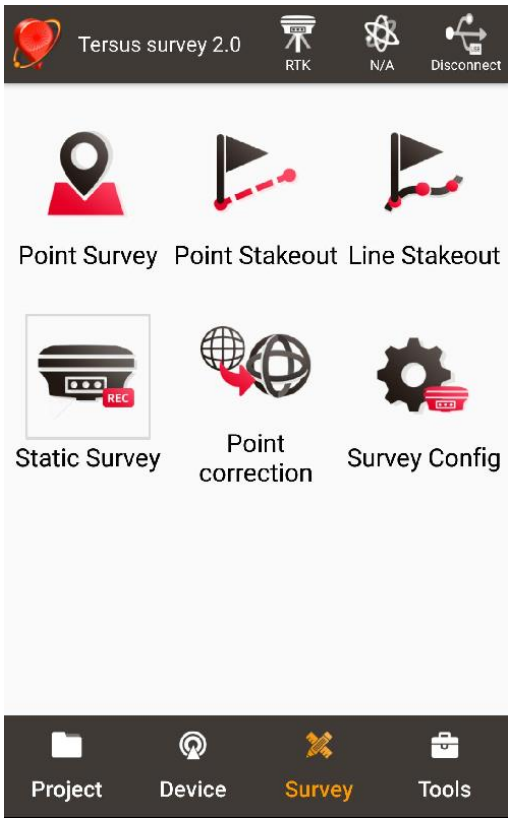
Table 32 Detailed Steps for Static Data Collection

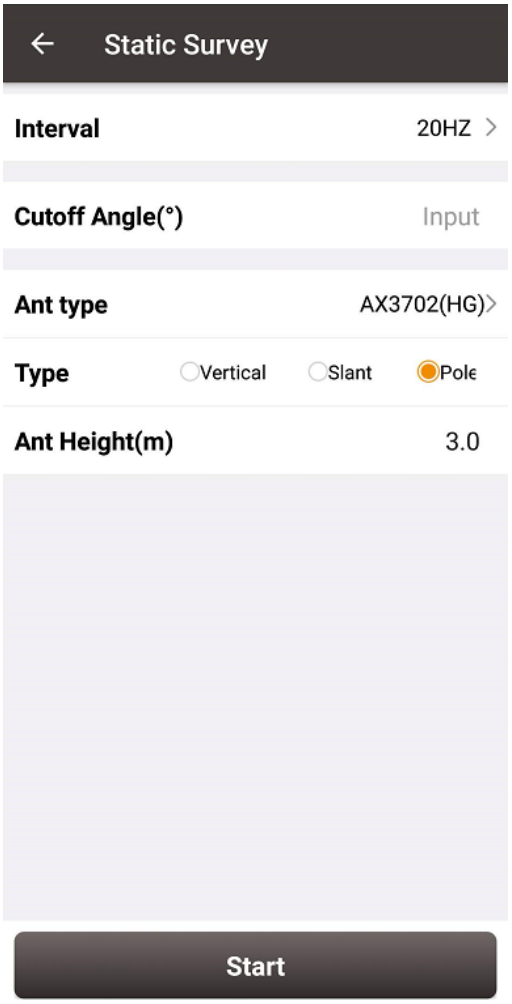
Hardware Installation
1. Install a tripod at a point interested.
2. Install a tribrach on the tripod, adjust it to horizontal level and install the GNSS antenna and the antenna connector on it.
3. Connect the antenna to the David with the RF cable.

4. Create communication between the David and the Android phone with cables, refer to section 3.3.1.

Software Configure

5. In Tersus Survey Nuwa, go to Survey->Static Survey





6. Ensure the necessary parameters, including data frequency and cutoff angle, etc. Press Start.
7. Follow steps 1 - 6 above to collect static data at other points interested.

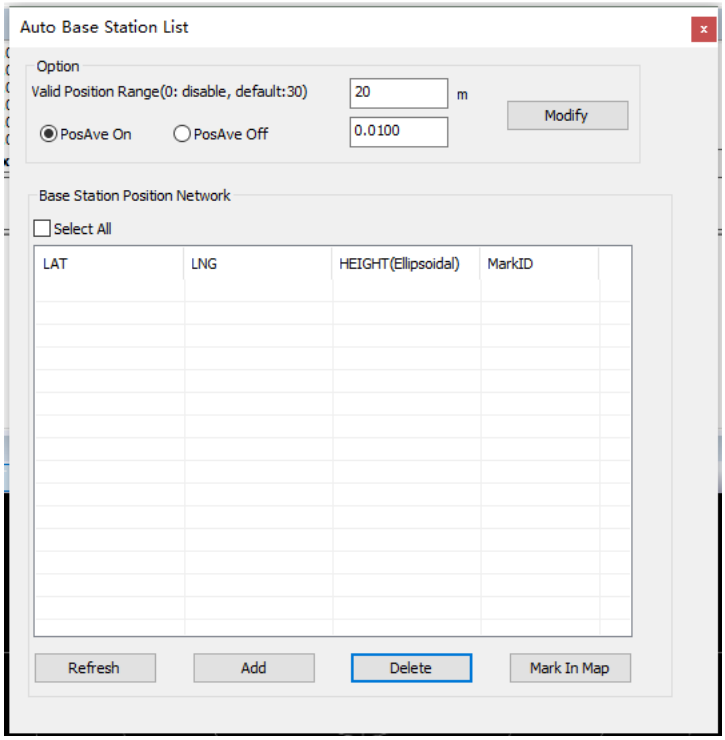
6.5 Auto Base Station List Function

If a base is setup with command POSAVE, according to its origianl definition, even if the receiver is installed at the same point. Aftera a power cycle, the fixed position may be different, see more about coommand POSAVE in the Log & Command document. For the users who what the base to keep the same fixed position after a power cycle, auto base station list function is

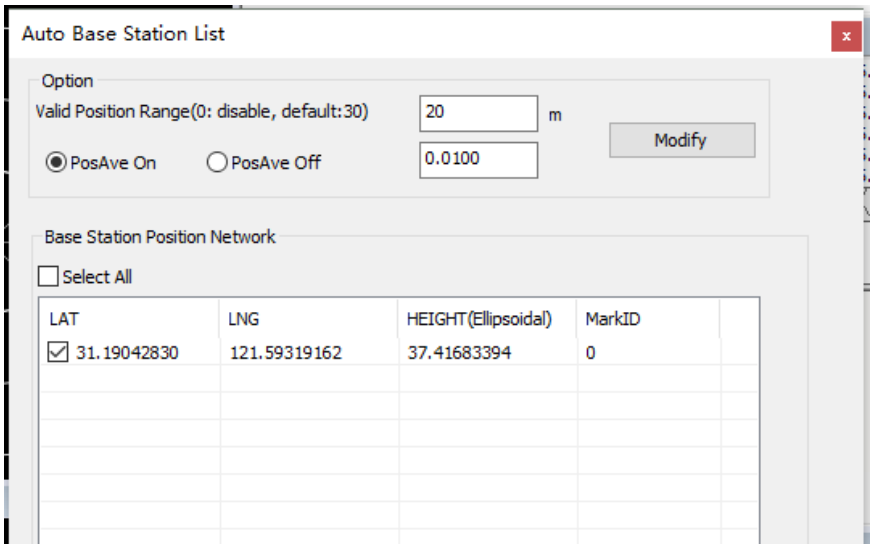
introduced.

The procedure is introduced below:

1) Follow Figure 48 and the detailed steps in Table 19 to create communication between a David receiver and Tersus GNSS Center.
2) Go to Menu Tool -> Base Network for Posave, the follwing page will be displayed.



3) Fill the valid position range, PosAve On and fill the time (unit is hour), press the Modify button. It's recommended that valid position range is >20m.
4) After the time (in the example, 0.01 hour, that is, 36 seconds), the base will be fixed with the 36 seconds averaging position.
5) Press Refresh button, the fixed position will be displayed on the window.



6) Then after a power cycle, if the base is not moved 20m away from the last position, it will fixed with the same position, in the example, latitude will keep 31.19042830, longitude will keep 121.59319162 and ellipsoid height will keep 37.4168.

7. Terminology

Table 33 List of terminology

Abbreviation	Definition
ASCII	American Standard Code for Information Interchange
CMR	Compact Measurement Record
DC	Direct Current
ESD	Electro Static Discharge
ECEF	Earth Center Earth Fixed
GLONASS	GLObal NAvigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IF	Intermediate Frequency
IMU	Inertial Measurement Unit
IO	Input/Output
LED	Light Emitting Diode
LNA	Low Noise Amplifier
MPU	Micro Processing Unit
NMEA	National Marine Electronics Association
PC	Personal Computer
PPS	Pulse Per Second
RF	Radio Frequency
RINEX	Receiver Independent Exchange format
RMS	Root Mean Squares
RTK	Real-Time Kinematic
RTCM	Radio Technical Commission for Maritime Services
SMA	Sub-Miniature-A interface
TTFF	Time to First Fix
TTL	Transistor-Transistor Logic level
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial BUS
WGS84	Word Geodetic System 1984