User Manual

Version V1.2-20211015

User Manual
For Tersus AG990

GNSS Auto-Steering System

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Revision History

Version	Revision Date	Change Summary
1.0	20190416	Initial Release
1.1	20200331	Update Table 5.1
1.2	20211015	Update section2.2.6

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1. Introduction

This chapter mainly introduces the overview, system structure and package list of the Tersus AG990 GNSS Auto-Steering System.

1.1 Overview

The Tersus AG990 Auto-Steering System is an automatic steering system which uses high-torque motor control steering wheel. It integrates the advantages of convenient installation, large torque, high precision, low noise, low heat and quick debugging. It is suitable for various applications of tractors, harvesting machines, plant protection machinery, rice transplanters and other agricultural models.

The system consists of a base station and a vehicle control part. The vehicle control part includes a control tablet integrated with a high-precision GNSS board, a steering wheel motor with a built-in controller, and an angle sensor. It can be widely used for sowing, cultivating, trenching, ridging, spraying pesticide, transplanting, land consolidation, harvesting and other work scenarios.

1.2 System Composition

The whole system includes one T100 Control Tablet, one EMS2 Motor Wheel, two AX3702 GNSS antennas, one Angle Sensor, and other accessory cables. They need external power source to power them up, from vehicle or independent power supply. The two antennas are installed on the top the vehicle, the angle sensor is installed on wheel of the vehicle, the motor wheel is installed to replace the original steering wheel, and the tablet is installed beside the motor wheel for monitoring purpose.

Figure 1.1 Major parts in AG990 Auto-Steering System

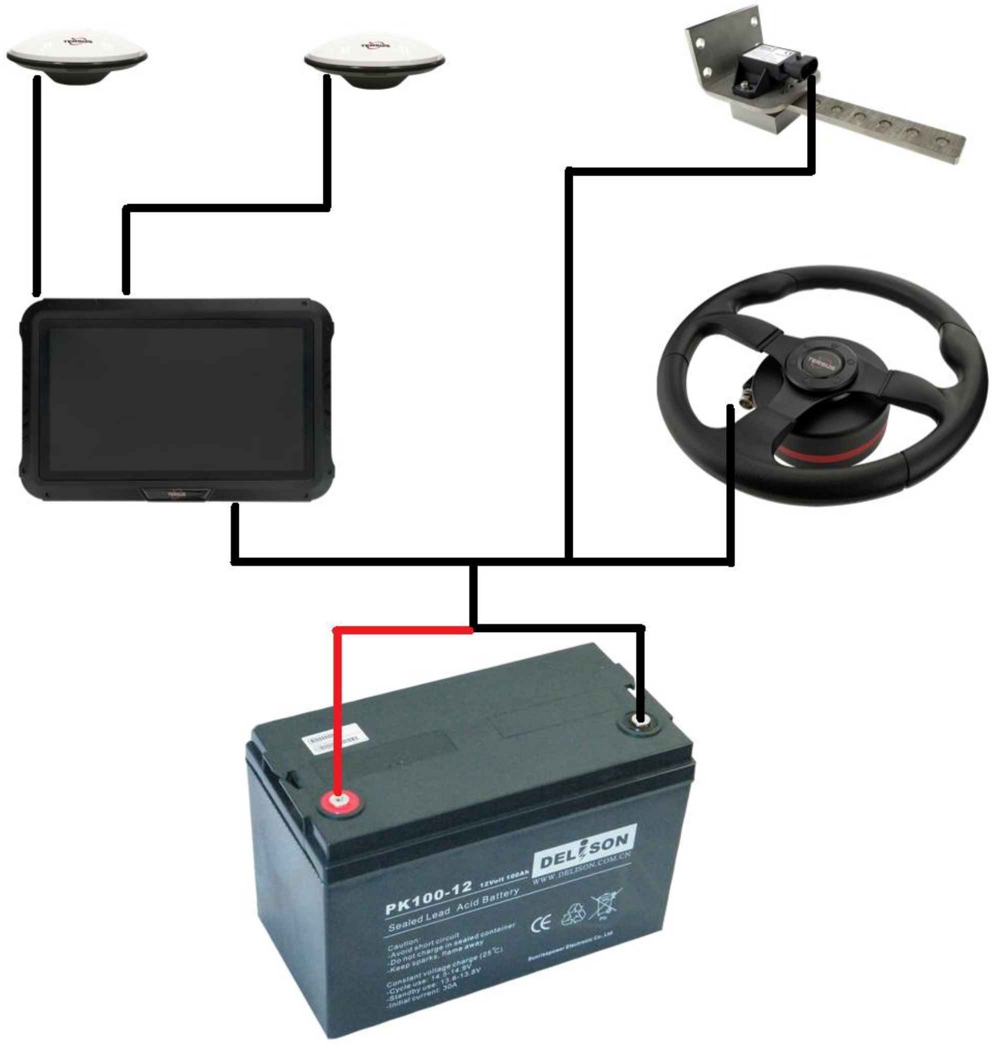


Figure 1.2 AG990 auto-steering system structure

1.3 Main Devices in the package

1.3.1 T100 Control Tablet

T100 Control Tablet is a portable, robust android tablet which is equipped with a built-in high-precision GNSS board offering centimetre level accuracy positioning and heading.

T100 Control Tablet provides RS232, RS485, USB2.0, CAN and etc. interfaces to connect with other equipment, and supports Wi-Fi, 3G/4G LTE wireless communication. The detailed specification refers to section 3.1 T100 Control Tablet. The outlook of T100 Control Tablet is shown as below.

Figure 1.3 T100 Control Tablet

1.3.2 AX3702 GNSS antenna

AX3702 GNSS antenna is used to receive the RF signal from the satellites. There are two antennas in the package. The detailed specification of this antenna refers to section 3.2 AX3702 GNSS Antenna.

Figure 1.4 AX3702 GNSS Antenna

⚠	If an antenna from other companies is used, contact Tersus to obtain permission, or the system may not work as expected.

1.3.3 EMS2 Motor Wheel

The EMS2 Motor Wheel is an electric motor steering wheel. It is designed for easy-to-install operation. With high-torque, direct-drive electric motor, EMS2 can provide up to 2.5cm RTK accuracy. The detailed specification of this motor wheel refers to section 3.3 EMS2 Motor Wheel.

Figure 1.5 EMS2 Motor Wheel

1.3.4 Angle Sensor

Angle sensor is an auxiliary part which provides higher accuracy and stability. It is used to detect the angle change of the steering tire.

Figure 1.6 Angle sensor

2. General Operations

This chapter introduces how to set up the system and make it start working properly.

2.1 Assembly and Installation

2.1.1 EMS2 installation

The EMS2 Motor Wheel is an electric motor steering wheel. The most important part is the **spline sleeve**, which is based on the selection of the vehicle model refer to the table in Appendix. Please indicate your vehicle model before placing order of this system. The other components include dustproof cover, steering wheel, shaft sleeve, jacket and screws which are shown as below.

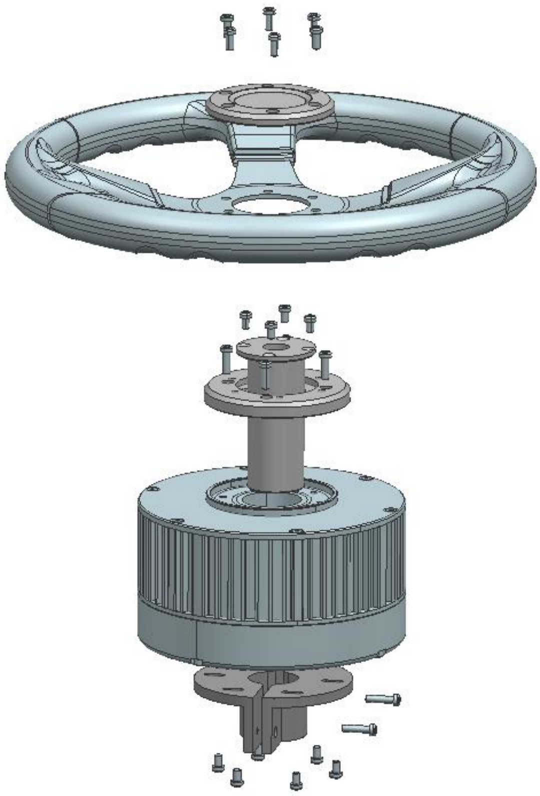


Figure 2.1 Assembly diagram of EMS2 motor wheel

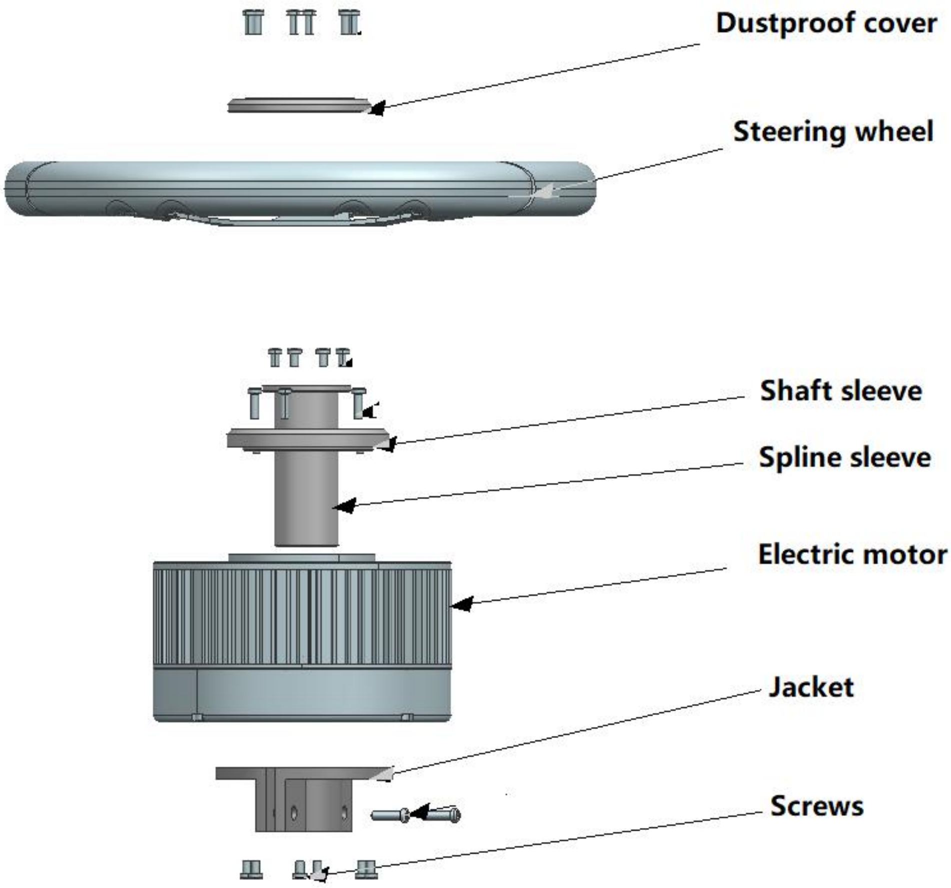


Figure 2.2 Descriptions of the EMS2 assembly components

The detailed steps of installing EMS2 Motor Wheel are shown as below.

1) Prepare the components needed for EMS2 Electric Motor.

Figure 2.3 Components needed for electric motor

2) Use the corresponding screws in the package to fixate the bracket and motor on the vehicle to replace the original steering wheel.

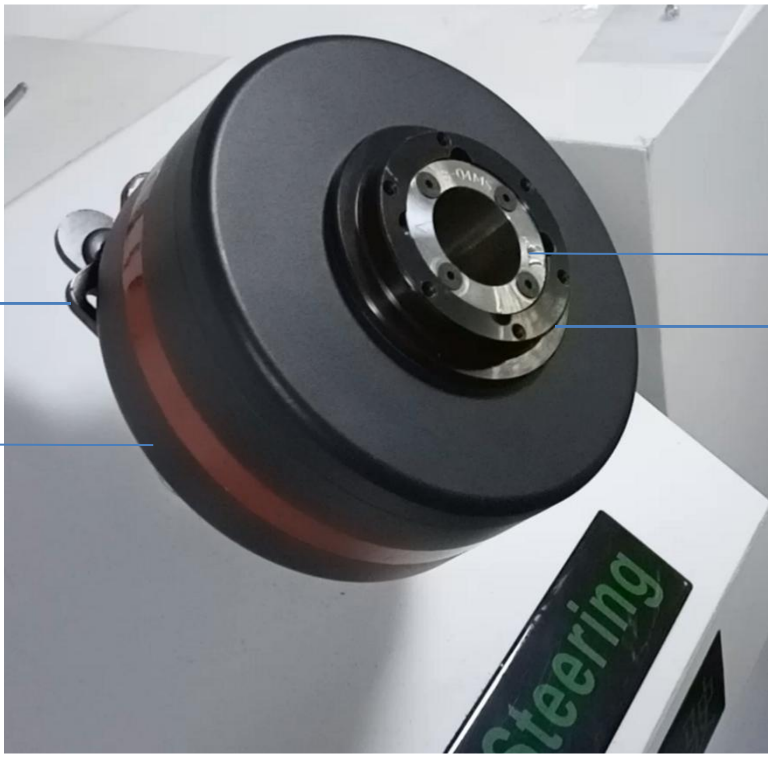


Figure 2.4 Installation example of electric motor

Figure 2.5 Installation example of bracket for fixating EMS2 Motor Wheel

3) Use screws to install the steering wheel and dustproof cover.

Figure 2.6 Installation example of EMS2 Motor Wheel

4) Now the installation of EMS2 Motor Wheel is completed. It should be connected to the main cable after all parts are assembled properly. The cables connection refers to section 2.1.4 Cables Connection.

2.1.2 Angle Sensor installation

The detailed steps of installing Angle Sensor are shown as below.

1) Prepare the components needed for installing Angle Sensor.

Figure 2.7 Components needed to install angle sensor

2) Install the two pairs of U shape parts and the L shape part to the connecting shaft of vehicle's front wheels as shown below. It can be installed near the front right wheel or the front left wheel.

Figure 2.8 Install the parts to fixate angle sensor

3) Adjust the position of angle sensor to be properly installed. Find the best position and use the screws to fixate the angle sensor to the fixing parts of the vehicle.

Figure 2.9 Possible position of angle sensor – 1

Figure 2.10 Possible position of angle sensor – 2

4) Use the screws to fixate the T shape part on the wheel of the vehicle, and connect the T shape part with the angle sensor using the Transmission Rod. The completed installation of angle sensor is shown as below.

Figure 2.11 Installation example of angle sensor

5) Now the installation of Angle Sensor is completed. It should be connected to the main cable after all parts are assembled properly. The cables connection refers to section 2.1.4 Cables Connection.

2.1.3 Dual-antenna installation

Two GNSS antennas are fixed on the roof of the vehicle. The line between the two antennas should be perpendicular to the direction of the vehicle's route. Normally the left antenna is the primary antenna, and the right antenna is the secondary antenna.

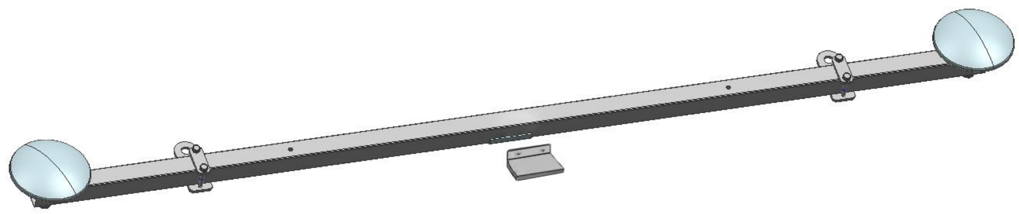


Figure 2.12 Assembly diagram of dual-antenna

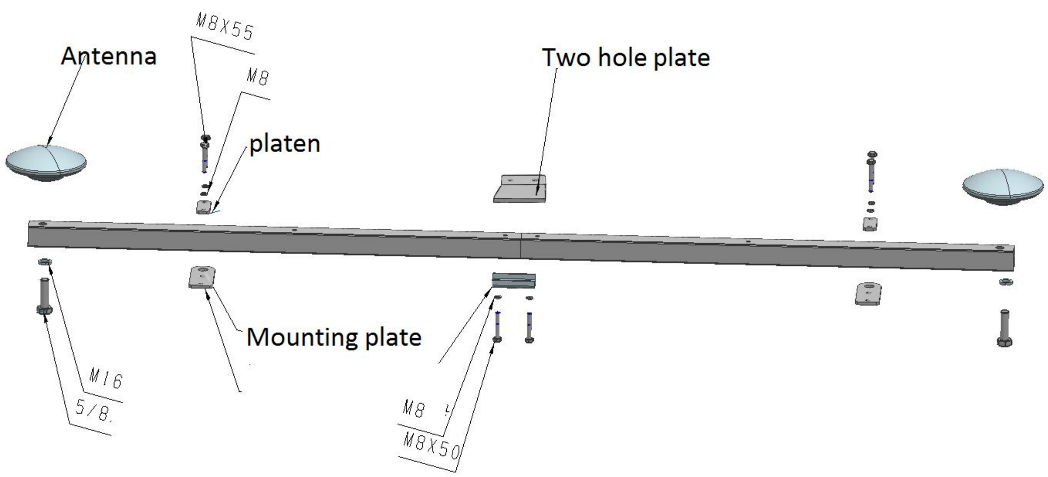


Figure 2.13 Descriptions of dual-antenna components

Figure 2.14 Installation example of dual-antenna – 1

Figure 2.15 Installation example of dual-antenna – 2

2.1.4 Cables Connection

The cables connection should be paid much attention during assembly as there are various connectors on the main cable which is shown below.

Connects to power extension cable with two wires

Connects to Angle Sensor

Connects to T100 Control Tablet

Connects to EMS2 Motor Wheel

Connects to cable for Attitude Sensor (IMU)

Connects to Power Switch with cable

Figure 2.16 Main Cable with multiple connectors

Figure 2.17 Power extension cable with two wires

Figure 2.18 Angle Sensor

The Attitude Sensor (IMU) is optional. It is only required when the angle sensor is not able to be installed on the vehicle.

Figure 2.19 Cable for Attitude Sensor (IMU)

Figure 2.20 Attitude Sensor (IMU)

Figure 2.21 Power Switch with cable

Figure 2.22 Main Cable connects to EMS2 Motor Wheel

Figure 2.23 T100 Control Tablet connects to main cable and two antennas

Normally the T100 Control Tablet is installed in the control room of the vehicle using the bracket which is shown as below.

Figure 2.24 Bracket for T100 Control Tablet

2.2 Software Operations

The software pre-installed in the T100 Control Tablet is called **AutoSteer**.

2.2.1 Software Installation

Power on the T100 Control Tablet by turning on the power switch after all cables and parts are assembled properly. The home screen is shown as below.

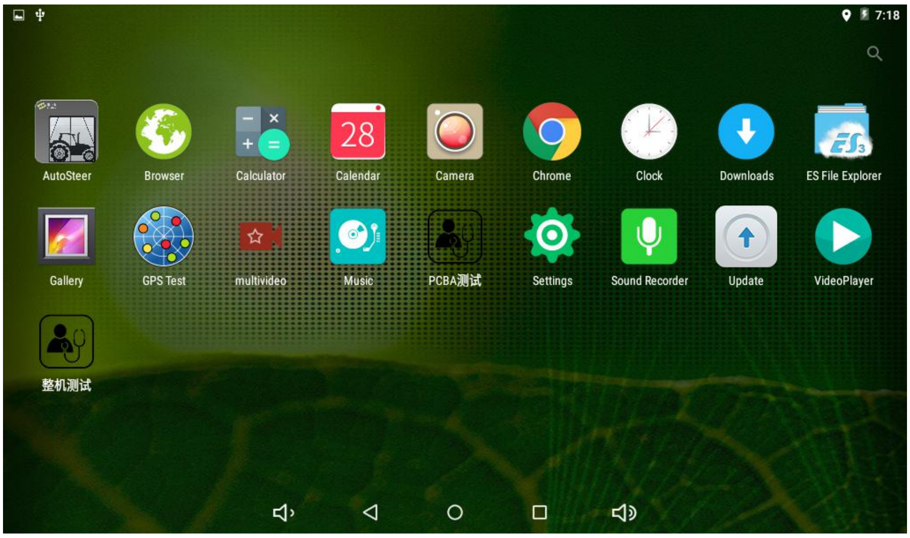


Figure 2.25 Home screen of T100 Control Tablet

If AutoSteer application should be re-installed for any reason, copy the .apk file into a USB drive and insert it to the USB port of the T100 Control Tablet.

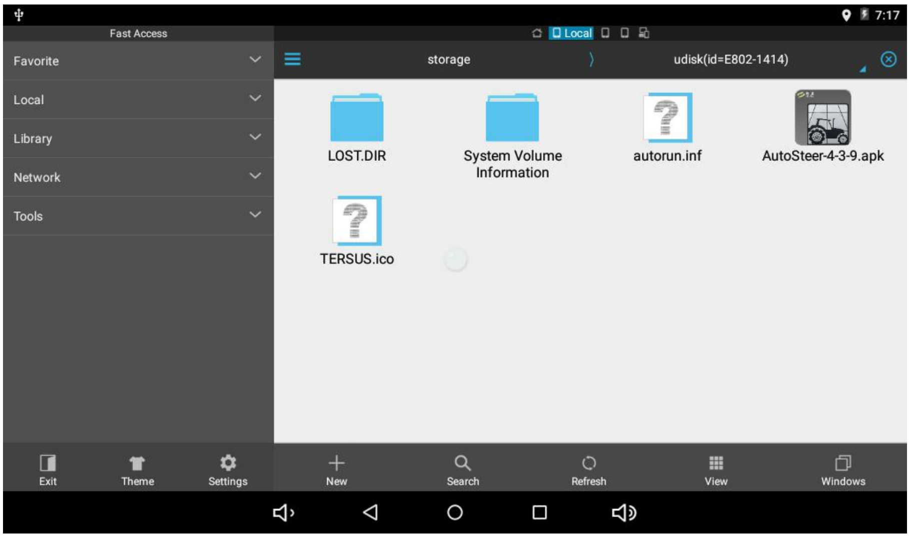


Figure 2.26 Installation file of AutoSteer

Click the installation file (.apk file) of AutoSteer to install the software to the tablet. The icon will be on the home screen which is shown in Figure 2.25 Home screen of T100 Control Tablet.

Click the AutoSteer app on the home screen to enter the software, users should accept the public liability disclaimer notice to enter the main interface of the software.

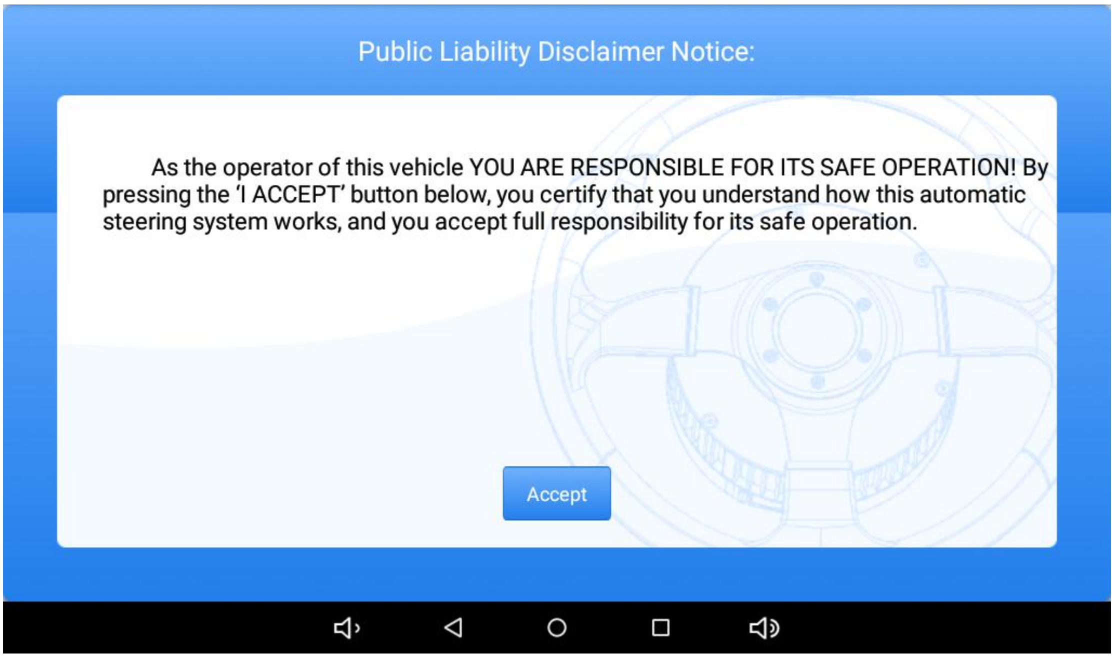


Figure 2.27 Public liability disclaimer notice

2.2.2 Software Activation

The software AutoSteer is activated before shipping out to customer. If users encounter any situation which needs activate this software or any other questions on the software or firmware, please contact Tersus Technical Support by email support@tersus-gnss.com for guidance.

2.2.3 Configurations

The main interface of AutoSteer software is shown as below.

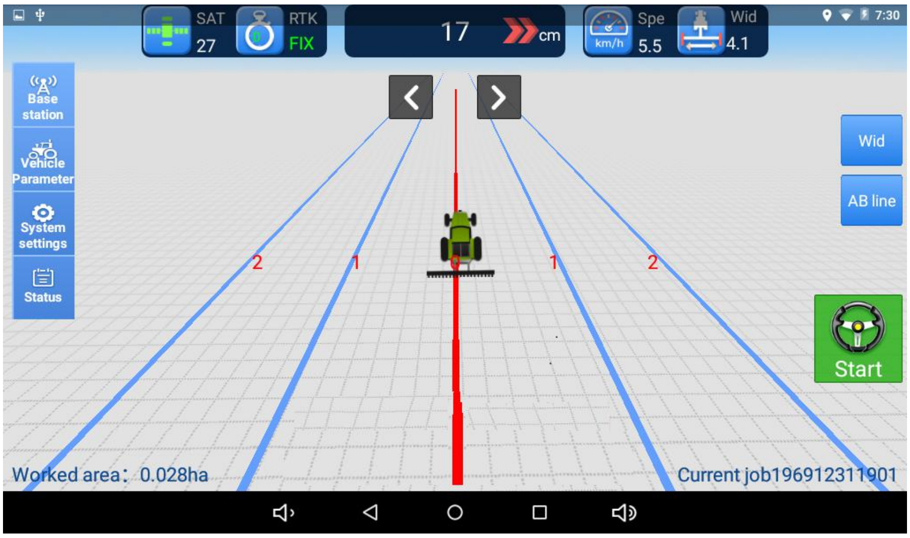


Figure 2.28 AutoSteer software main interface

RTK configuration steps are:

1) Select [Base station] in the main interface;
2) Select CORS or External Datalink mode, the external datalink can be a Ntrip Modem or a radio module;
3) Edit the information as below for example:

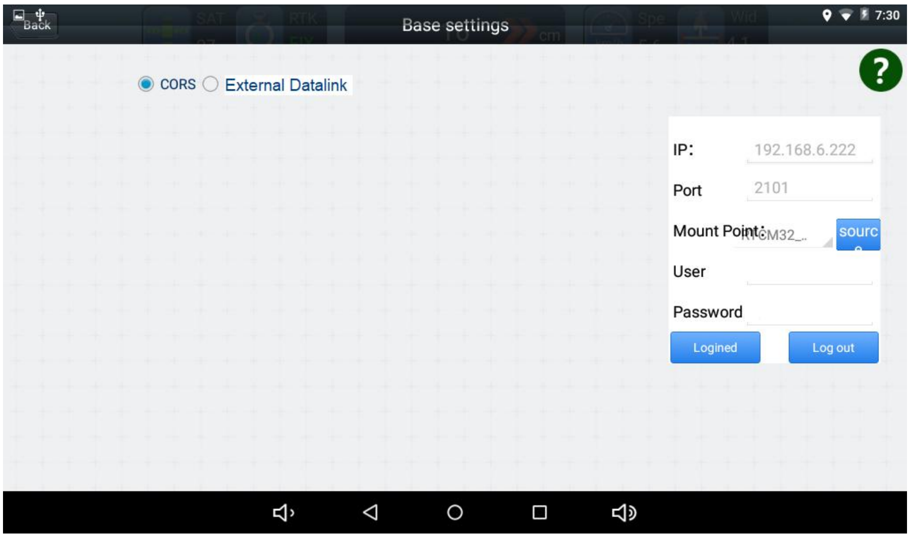


Figure 2.29 RTK base configuration

4) Back to the main interface, RTK status becomes Fix.

Vehicle configuration steps are:

1) Select [Vehicle Parameter] in the main interface;

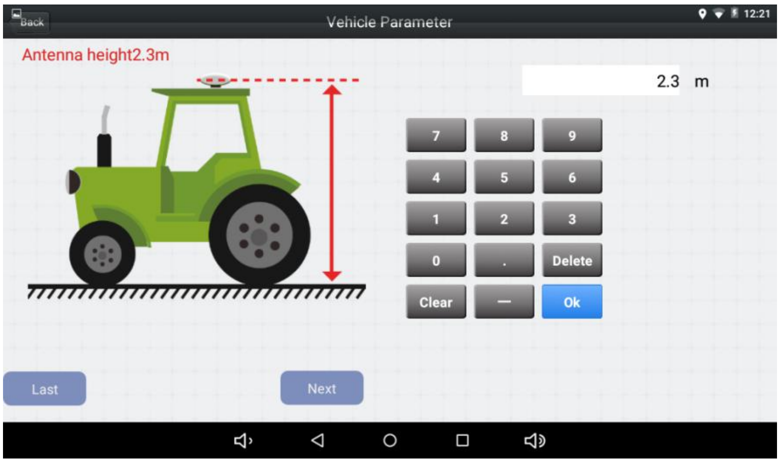


Figure 2.30 Vehicle parameter configuration – antenna height

2) Fill the parameter and select [Next];

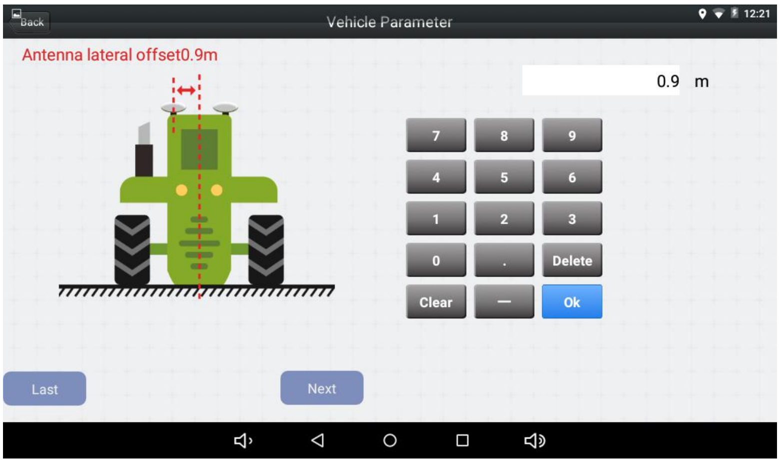


Figure 2.31 Vehicle parameter configuration – antenna lateral offset

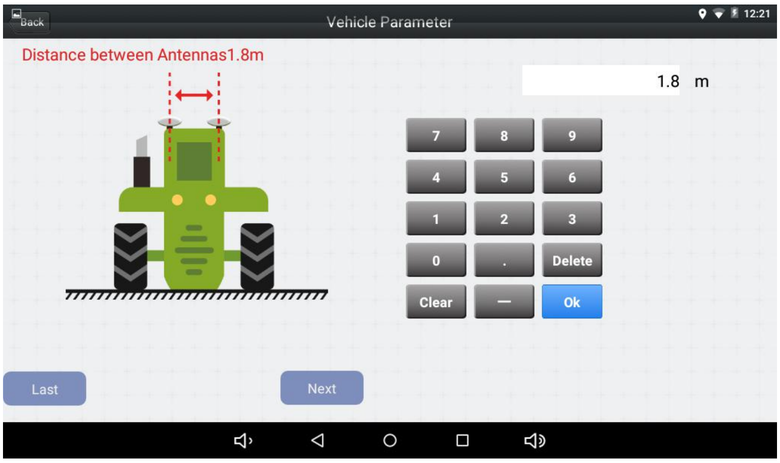


Figure 2.32 Vehicle parameter configuration – antenna distance

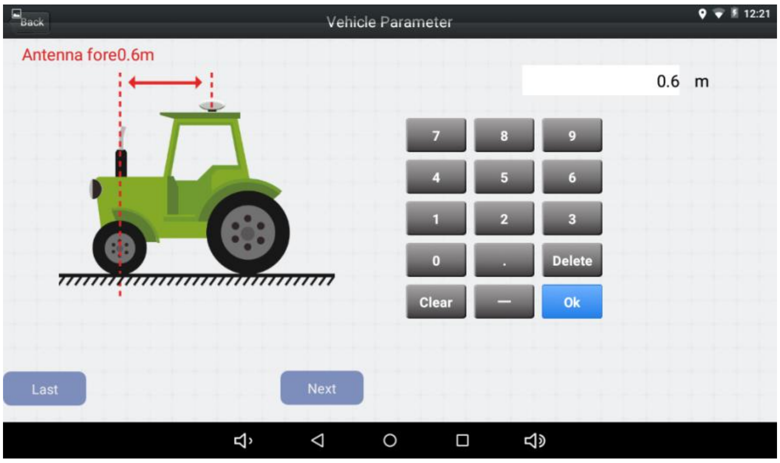


Figure 2.33 Vehicle parameter configuration – antenna fore

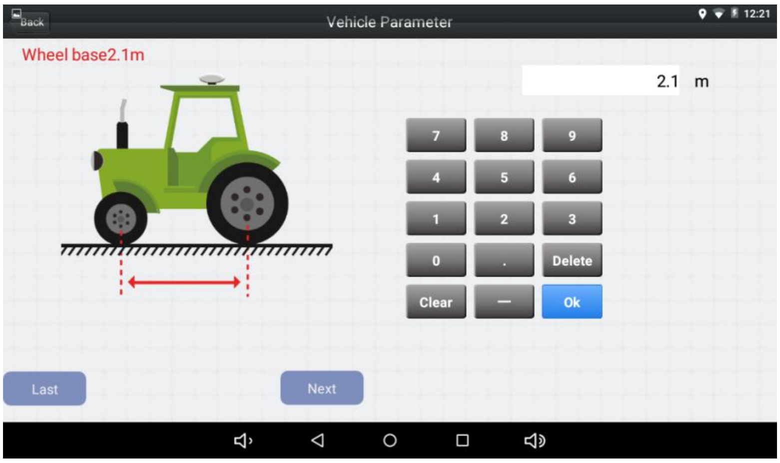


Figure 2.34 Vehicle parameter configuration – wheel base

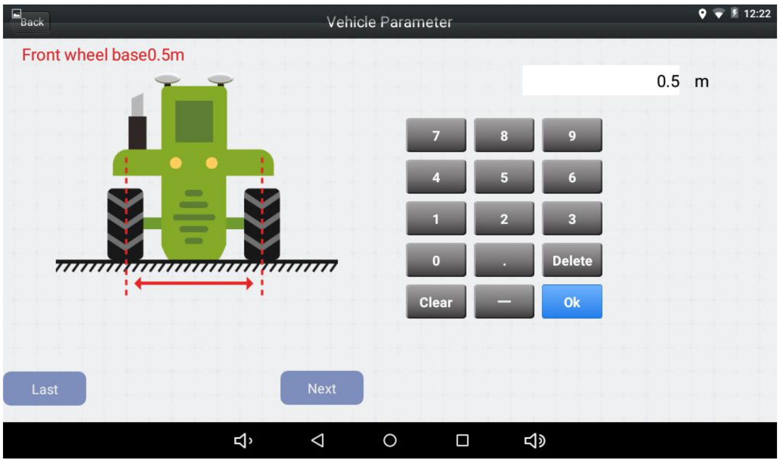


Figure 2.35 Vehicle parameter configuration – front wheel

3) After all the parameters are set, click [Back] on the upper left corner to return to the main interface.

2.2.4 Calibration

Before the AG990 Auto-Steering system is enabled for the field work, it is recommended to perform the calibration for specific vehicle following below steps.

1) Select [System settings] in the main interface;

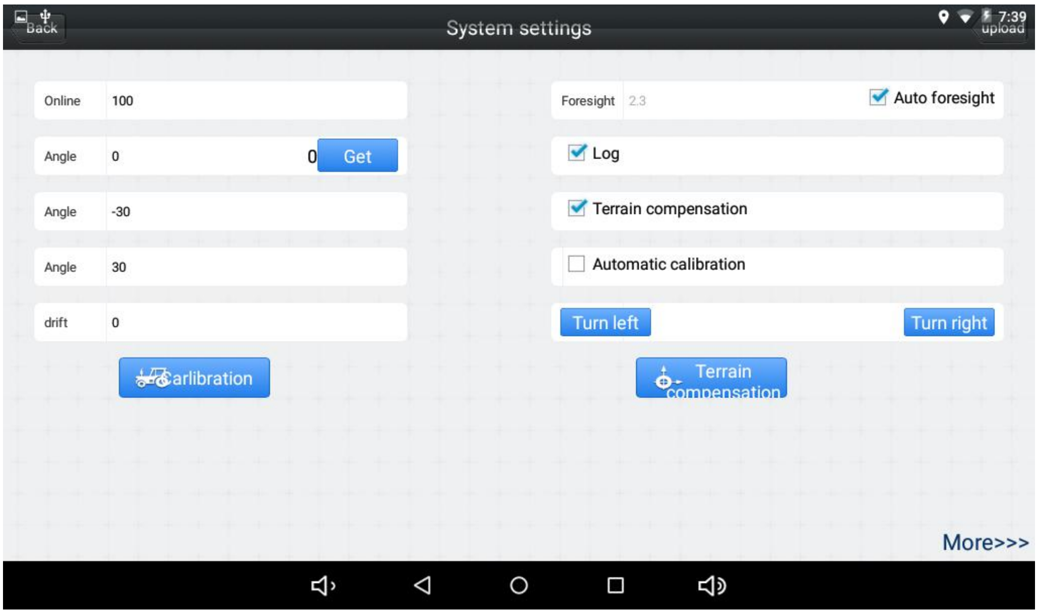


Figure 2.36 System setting interface

2) Select [Middle], and then click [Get] to obtain the centering angle. The number will be around 90;

Note: Before clicking [Get], ensure the front wheel of the vehicle is in the middle.

3) Select [Turn left] and [Turn right]. Click [Turn left] and [Turn right] respectively, and the front wheel will rotate 5 degrees in the corresponding direction, respectively. The minimum tire angle and maximum tire angle should be in the range from -20 to +120 degrees.

Note: Power up the vehicle before clicking the buttons.

4) Select [Calibration], and do the calibration according to the screen wizard.

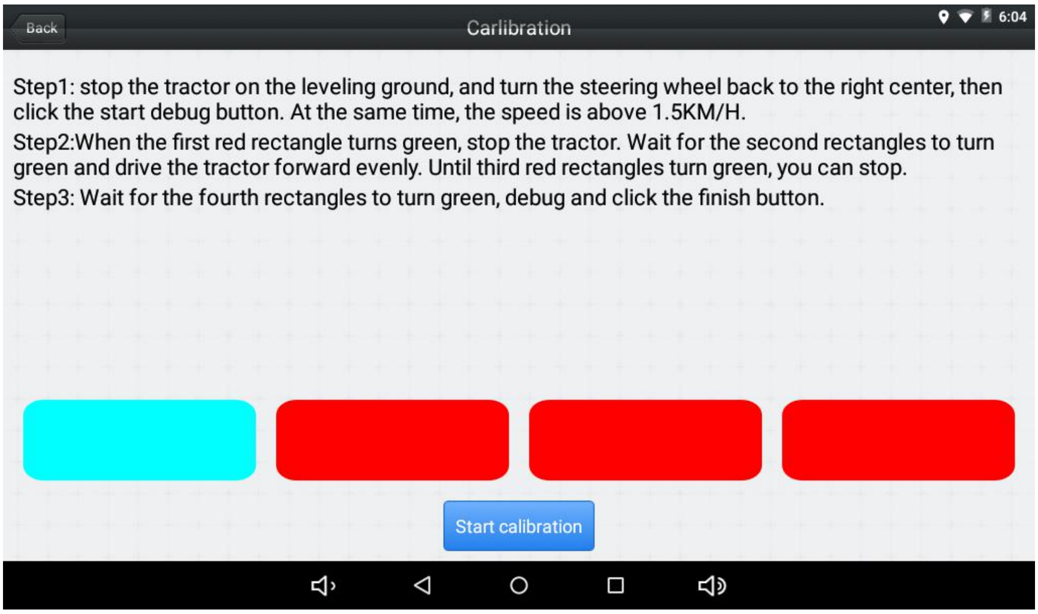


Figure 2.37 Calibration wizard

5) Select [Terrain Compensation], and do the calibration according to the screen wizard.

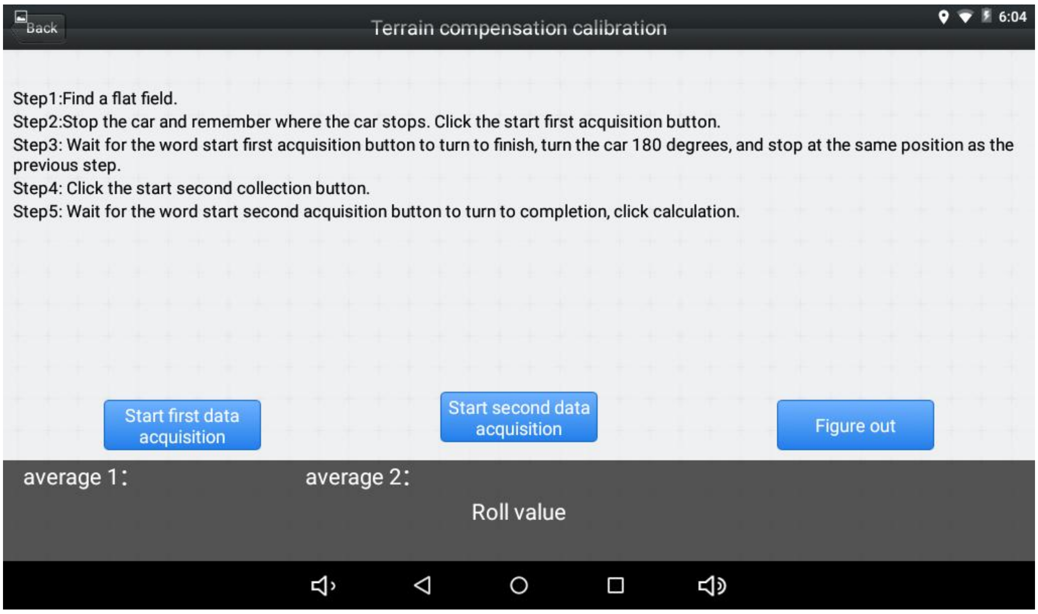


Figure 2.38 Terrain compensation wizard

Note: If the ground is not flat, roll debugging needs to be opened, and roll adjustment is needed after the roll adjustment is opened.

6) Select [more] in the lower right corner, and select [Angle sensor position] correctly.

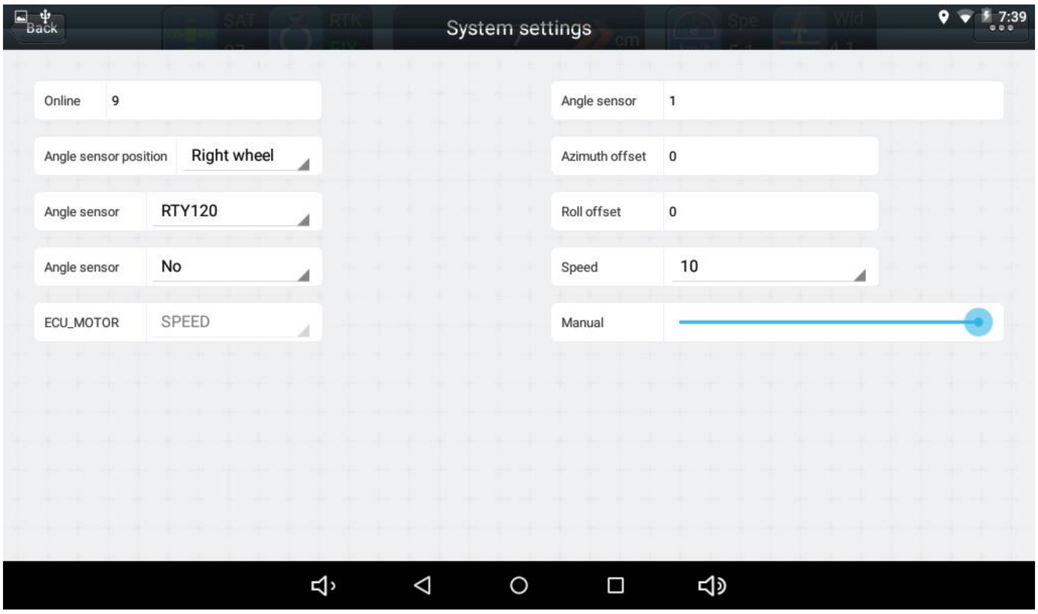


Figure 2.39 More settings in system setting

2.2.5 Navigation line setting

Here takes the AB line for example of the navigation line.

1) Select [Width] in the main interface, set the width and offset of the task.

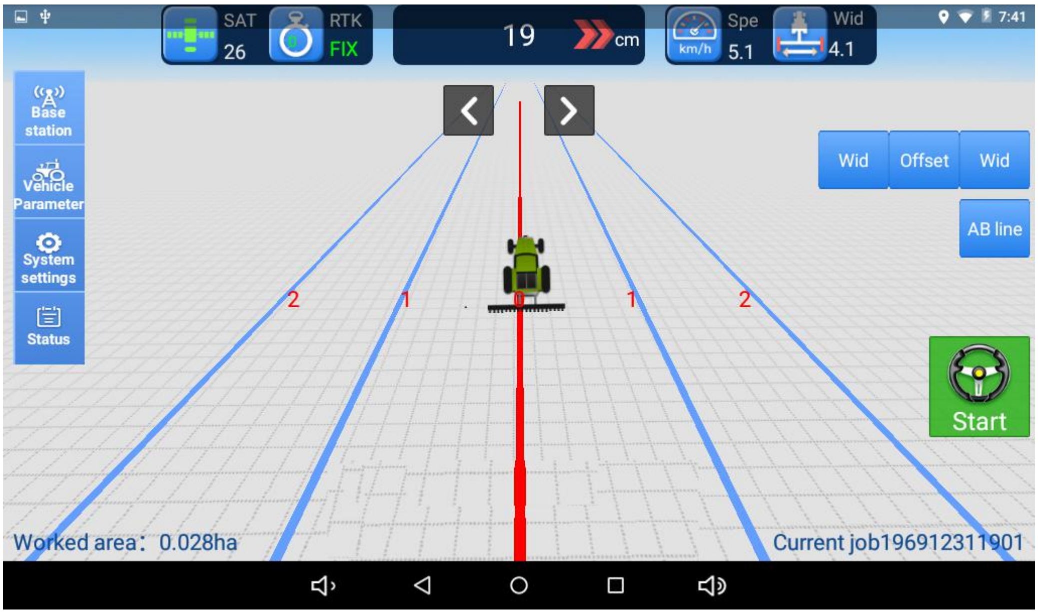


Figure 2.40 Set width and junction

2) Select [AB line], set A and B when creating a new navigation job. Or import the AB line if there is already an AB line data in the tablet.

Note: set up the AB line first, or the tractor cannot work.

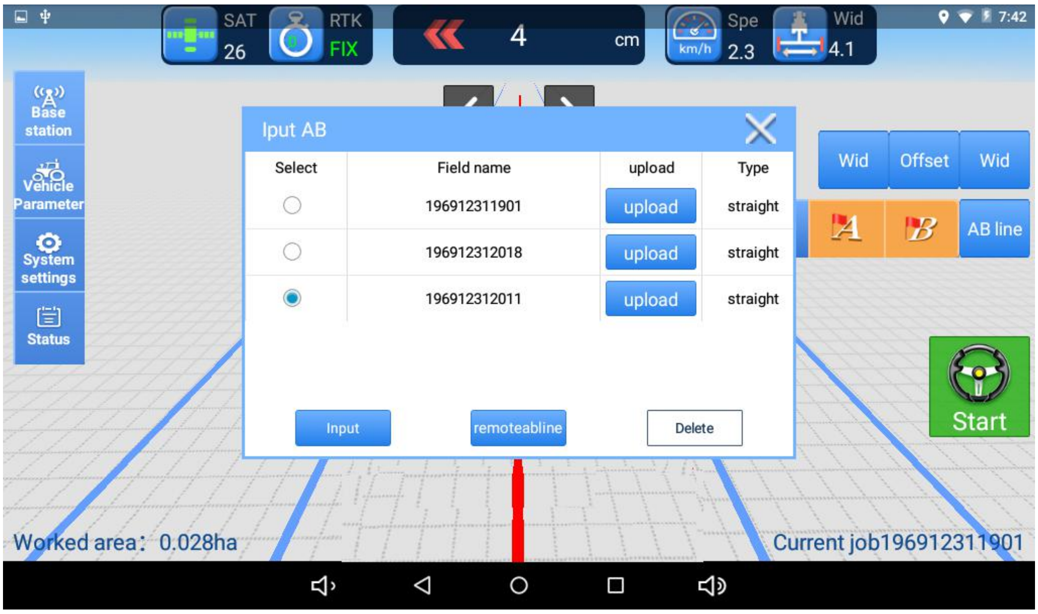


Figure 2.41 Import AB line

3) Return to the home screen. Click [Start] to start the system.

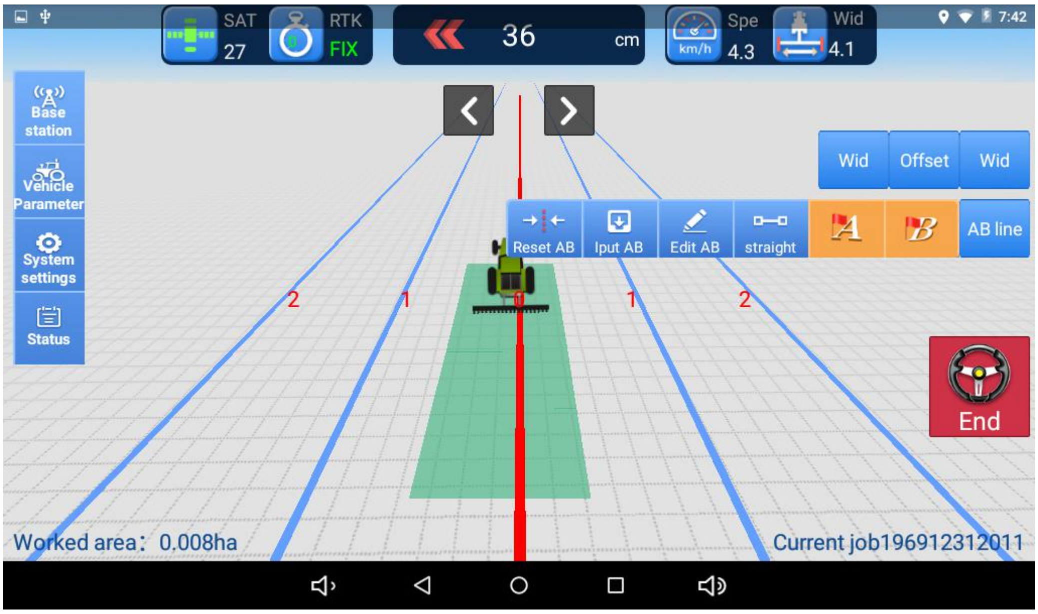


Figure 2.42 Agricultural operation in progress

2.2.6 Harrowing Use Method

1) Premises for the use of harrowing function

- The automatic driving equipment with standard configuration needs to add an angle sensor or a dual gyro. Single gyro currently cannot meet the operational requirements.
- When the vehicle is debugged, it must be ensured that the vehicle can travel normally at a straight-line speed of about 12km/h (not out of control), and it must be ensured the antenna crossbar is installed to the middle and the error cannot be too large.
- Recommended parameters: dynamic front view, line stabilization coefficient 130, motor speed 16, and operation width: 20cm smaller than the operation width of the harrowing.

2) Precautions for using harrowing software

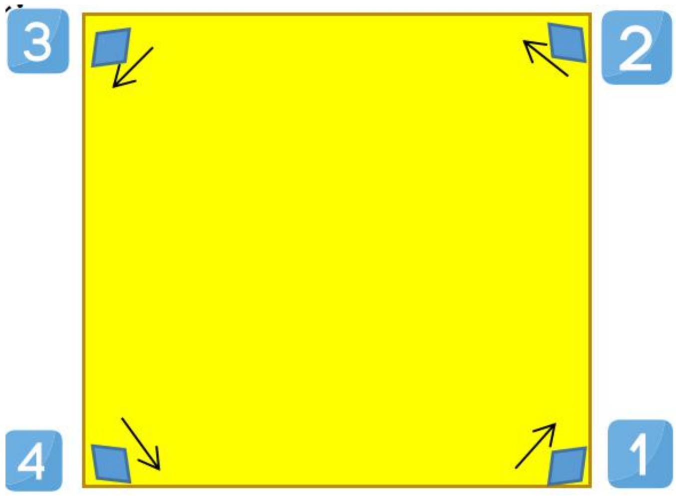
- Set in sequence, start with the extended side of the first two sets, and the front of the vehicle is as close to the corner of the ground as possible when setting up.
- Vehicle needs to decelerate to less than 6km/h when reaching the corner. When the planned area exceeds the yellow set area, users need to decide whether deceleration control is required according to the actual situation. Vehicle on the remaining corner sections within the planned area does not need to decelerate.

3) How to set

- After entering the software, select the operation mode "harrowing" first, and then set. There are 4 points (A, B2, B3, B4)around the edge of the ground to enclose a plot, which is similar to unmanned enclosure. Then the software will automatically plan the track, user only needs to drive the vehicle to the start point and click "start"(after selecting the harrowing operation mode, set directly without exiting the software).

- The order of setting can be clockwise or counterclockwise, but A to B2 is best to be the long side. When set around the edge, user can completely expand the harrows .
- The way of setting (the front of the vehicle should be as close to the corner of the ground as possible when setting)

  I.Standard rectangular plot

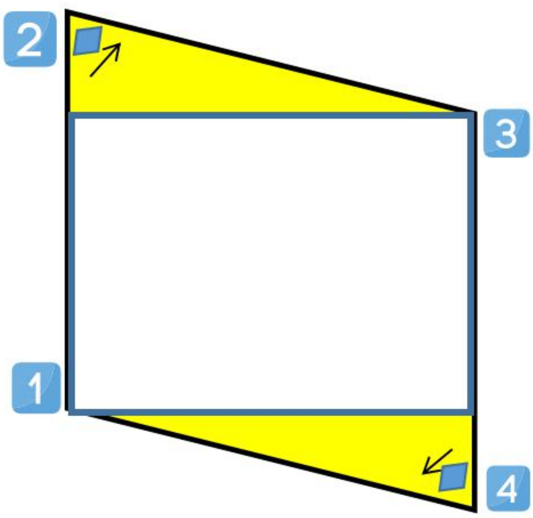


Note:

*The direction of the arrow is the front of the vehicle.

*When setting, the best angle between the tractor and the corner is 45 degrees.

II.Parallelogram or parallelogram-like plot

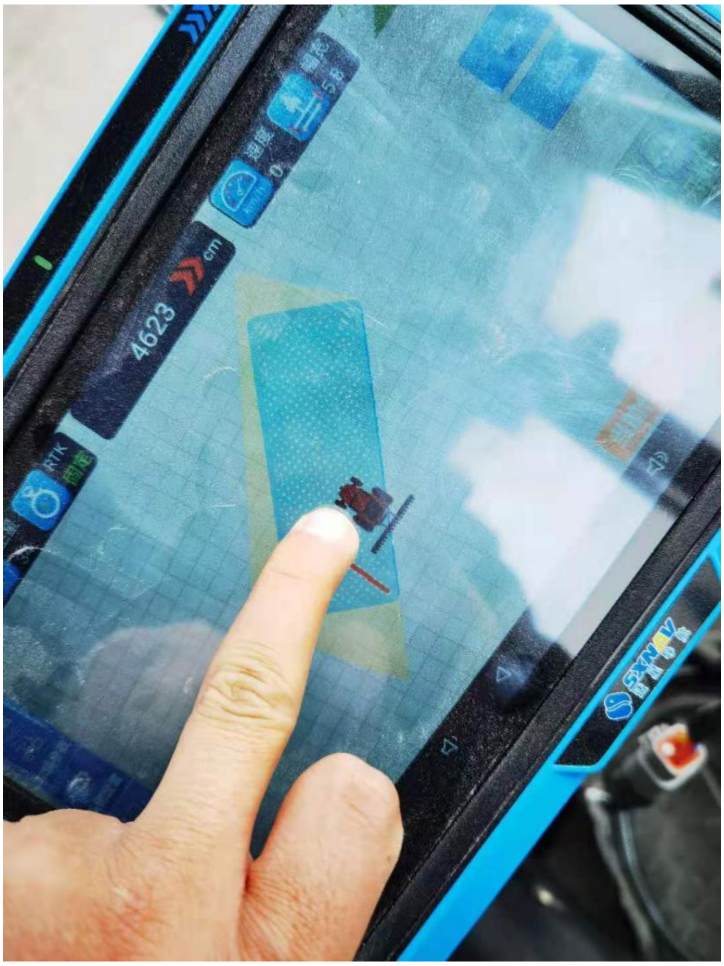


Note:

*Choose the larger angle as the starting point when setting (the first point A) .

*The white area in the above picture is the work area, and the other yellow area is the area that our software can't plan and need to be manually repaired later.

*For plots with non-parallel long sides, the software is not effective now, as shown below.



- The yellow area is enclosed plot, while the blue area is the trajectory planned by our software,and the surrounding areas that are not included in the blue trajectory area belong to missing harrowing area.

4) Precautions for harrowing operation

- At present, the software works efficiently for plots whose long sides are parallel to each other, but it is not very effective for irregular plots such as trapezoids, diamonds and other irregular plots(more missing harrowing area or over harrowing area whose harrowing area is beyond the planned area).

- The base station cannot be switched during the operation, but the software can be exited normally and restarted after power off. When entering the software again, the software will record the position of the last navigation, use only needs to drive the vehicle to the red track line to start navigation.
- If the trajectory line planned by the navigation (blue border) exceeds or overlaps with the boundary of the yellow plot we have circled, user will be reminded of canceling the navigation, manually control the tractor to turn in advance. Then click “Restart Navigation” when the farm tool is parallel to the ground edge.
- The maximum speed of the operation of the harrowing function is about 12km/h, and the deceleration speed should be reduced to about 6KM where the corner turning radius is small. Generally, it is the first two times when reaching the corner (turning in the middle of long side does not need to decelerate).
- After the harrowing operation is completed, the plots planned for this time must be completed before the next tracing (for the current software harrowing trajectory, the last planned trajectory will be automatically deleted after the next trajectory planning is completed).

3. Specifications

This chapter includes the specifications of T100 Control Tablet, AX3702 GNSS Antenna and EMS2 Motor Wheel.

3.1 T100 Control Tablet

Table 3.1 T100 Control Tablet Specifications

GNSS Performance		
Signal Tracking	GPS L1, L2 GLONASS L1, L2 BeiDou B1, B2 GALILEO E1, E5b QZSS L1, L2 SBAS L1	
GNSS Channels	432	
Position Accuracy	Single Point Positioning	1.5m RMS (Horizontal)
		2.5m RMC (Vertical)
	DGPS Positioning	0.4m (Horizontal)
		0.8 (Vertical)
	RTK Positioning	10mm+1ppm (Horizontal)
		15mm+1ppm (Vertical)
Heading Accuracy	0.1° RMS @ 1m baseline	
Time Accuracy	20ns RMS	
Velocity Accuracy	0.03m/s RMS	
Reacquisition	< 1s	
Correction	RTCM 2.3/3.0/3.2	
Date Output	NMEA-0183	

Heading and RTK update rate	20Hz
Network Protocol	NTRIP， TCP/IP
System Performance	
Operating System	Android 6.0
CPU	Quad-Core 1.5GHz
Memory	2GB RAM + 16GB ROM
LCD	10.1“ Capacitive Touch Screen
Resolution	1024x600 pixels
Communications	
Wi-Fi	2.4GHz IEEE 802.11 b/g/n
Cellular	FDD-LTE 800 / 1800 / 2100 / 2600MHz TD-LTE 1900 / 2300 / 2500 / 2600MHz WCDMA 850 / 900 / 1900 / 2100MHz GSM 850 / 900 / 1800 / 1900MHz
Bluetooth	V4.0
USB	USB 2.0 (host & debug) x1
Audio	3.5mm Audio Jack for Audio
Serial Port	RS232 x2, RS485 x1
CAN Port	CAN x2 (J1939, CANOpen, ISO15765)
Ethernet	RJ45 (100M Ethernet) x1
Electrical	
Power Input	9V~36V DC
Power failure detection	supported
Power output	12V DC x2
Physical	
Dimension	281mmx181mmx42mm
Weight	1.5kg

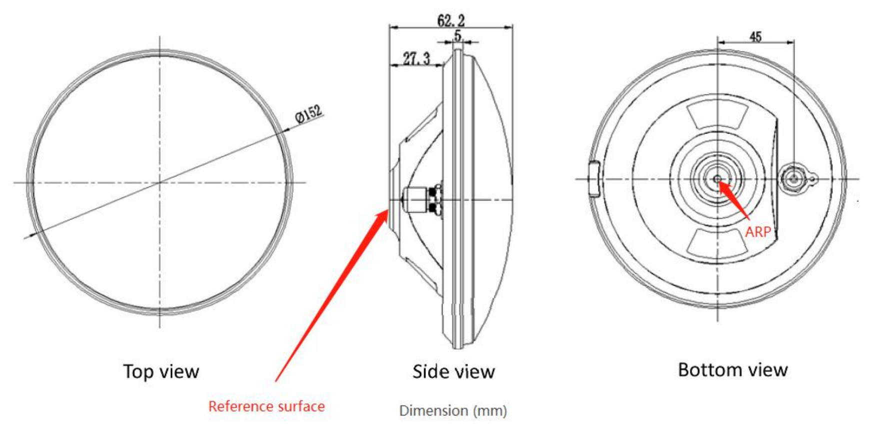
Environmental	
Operating Temperature	-20°C to +70°C
Storage Temperature	-40°C to +85°C
Water & Dust proof	IP65
Vibration	MIL-STD-810G
Road Vehicle Standards	ISO16750
Humidity	0%~90%RH @ -20℃~+70℃ 30%~95%RH @ -40℃~+85℃

3.2 AX3702 GNSS Antenna

Table 3.2 AX3702 GNSS Antenna

Antenna Specification	
Tracking signals	GPS L1/L2; 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	
Dimension	Φ152*62.2mm
Weight	374g
Signal Connector	TNC Female
Installation connector	5/8'' x 11 UNC Female
Environmental	
Operating temperature	-45°C - +85°C
Storage temperature	-45°C - +85°C
Damp	45% - 95%
Mechanical Drawing	



3.3 EMS2 Motor Wheel

Table 3.3 EMS2 Motor Wheel

Motor Performance	
Rated speed	100 rpm
Rated torque	10 N·m
Guaranteed continuous	100 rpm

operation speed	
Maximum freewheel error	0 (without reducer)
Supply voltage	8V~16V DC
Rated current	10A
Stall current	25A
Rated voltage	12V
Communication	
Communication protocol	ModBUS
Encoder resolution	1000 lines, 4000 pulses / circle
Encoder interface(protocol)	parallel, no protocol
Encoder maximum output rate	200KHz
Communication interface	RS232
Physical	
Dimension	Φ187x100.2mm (motor) Φ410x32mm (steering wheel)
Weight	6.35kg (motor only)
Material	Aluminum alloy
Environmental	
Operating temperature	-40°C - +105°C (motor)
Storage temperature	-45°C - +150°C (motor)

4. Typical Applications

4.1 Base Station example

It is recommended using GeoBee system as the base station to cooperate with AG990 auto-steering system. With Tersus Ntrip Caster Service, Ntrip Modem and David Receiver, the GeoBee opens the possibility for users to transmit Real Time Kinematic (RTK) corrections via Internet (Ethernet or 2G/3G/4G) in a simple, user-friendly way, just using a SIM card or Ethernet cable without any need of a static IP.

Here reveals the quick start guide of how to set up GeoBee system quickly, the detailed user manual refers to *User Manual for Tersus GeoBee* which can be downloaded on Tersus official website.

Set up the GeoBee system according to the figure below.

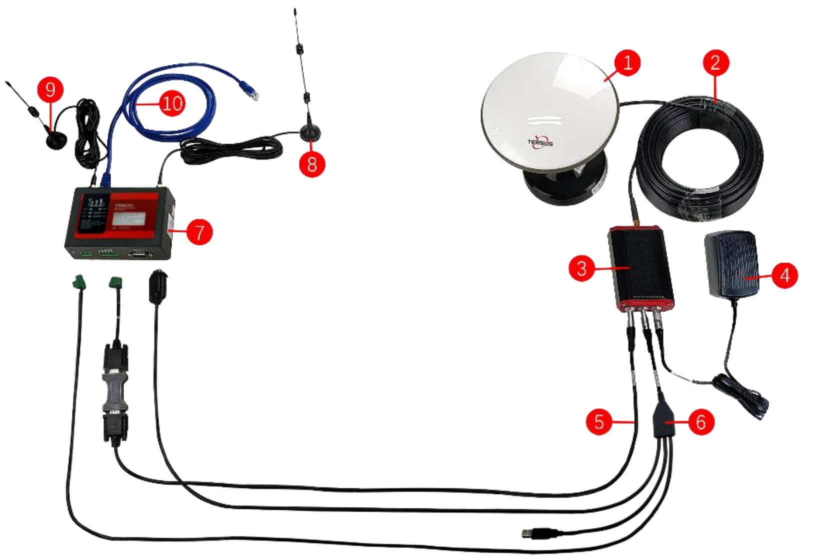


Figure 4.1 GeoBee System Structure

No.	Name
1	Antenna (AX3702 in the figure above, customizable)
2	TNC-J to SMA cable (25m by default, customizable)
3	David GNSS Receiver
4	Power Adapter (short for ‘DC-2pin AC Power Adapter with 1.2m cable’)
5	COMM1 cable (short for ‘COMM1-7pin to DB9 male cable’)
6	COMM2 cable (short for ‘COMM2-7pin to TR600-DC-2pin & DB9 female & USB cable’)
7	Ntrip Modem TR600
8	4G antenna for TR600
9	Wi-Fi antenna for TR600
10	Ethernet cable 1.5m

Note:

1) There are two configuration modes for GeoBee. GeoBee system is configure-free if customer adopts GeoCaster provided by Tersus GNSS Inc., as GeoBee is pre-configured when shipped out of factory. GeoBee system needs to be configured if customers demand to set up caster by themselves.
2) David GNSS receiver uploads RTCM stream to the NTRIP caster using Ethernet (default) or Wi-Fi or 2G/3G/4G sorted by priority. For Ntrip Modem TR600, Wi-Fi client and Wi-Fi hotspot are both supported, however they cannot be enabled simultaneously. Wi-Fi client function is to use Wi-Fi connection to communicate with caster. Wi-Fi hotspot function is to share internet connection to other devices.
3) Place the antenna (AX3702 in the Figure 4.1) in the outdoor open environment. Install Wi-Fi antenna when Wi-Fi connection is available for communication. Install 4G antenna when 2G/3G/4G SIM card is used for communication.
4) GeoBee starts to work in auto start mode by default once it is powered up. According to the autonomous positioning (without RTK or DGPS), it smooth out the average value to be the

base coordinate. GeoBee outputs the RTCM32 corrections data and sends to the Ntrip caster through LAN, WIFI or 2G/3G/4G mobile network.

5) For the known phase center coordinates of the AX3702 antenna, the two configuration methods are as follows:

a. Use the 'DB9 Female to USB Type A Male converter cable' to connect the COMM1 cable in Figure 1.1 and a computer, open Tersus GNSS Center application on the computer, and type below commands in the command window:

POSAVE OFF //Turn off position average

UNDULATION USER 0.0 //Set user specified undulation value for ellipsoid height[1]

FIX POSITION B L H // B: latitude (degree), L: longitude (degree), H: height (m)

For example: FIX POSITION 31.24523012 121.58922341 40.35

SAVECONFIG //save configuration

Note 1: If customer needs to use global geoidal height model EGM96 for mean sea level height, type below command to replace the undulation command above.

UNDULATION EGM96 //Set EGM96 geoidal height model

More details about logs and commands refer to *Log & Command Reference* document.

b. Use the COMM1-Bluetooth module in the package, insert the Bluetooth module to the COMM1 port of David GNSS receiver. Launch Nuwa app on an android device, connect David by paring Bluetooth. Create a base configuration with manual start in radio mode, fill in the base coordinates and antenna height, and set Baud Rate as 115200 bps and Differential Format as RTCM3.2. Detailed operation refers to *User Manual for David GNSS Receiver*.

6) The known phase center coordinates of the AX3702 antenna can be obtained from surveying and mapping department of local government, or calculated from commercial software such as Bernese or Gamit.

There are various applications that AG990 GNSS Auto-Steering System can be used. Here list three working scenarios.

4.2 Spraying Pesticide

Figure 4.2 Spraying pesticide using AG990 auto-steering system

4.3 Transplanting

Figure 4.3 Transplanting using AG990 auto-steering system

4.4 Other tractor work

Figure 4.4 Other tractor works using AG990 auto-steering system

5. Appendix

Here lists current available spline sleeves, new spline sleeve can be customized if your vehicle is not include in the table below. Contact Tersus Technical Support via email support@tersus-gnss.com for more details.

Table 5.1 List of Available Spine Sleeves

No.	Mark	Matched Vehicles
1	A	**John Deere** models (350, 720, 754, 804, 850, 854, 904, 954, 7830, 2204, 8295, 1204, 1404, 1354, 6605 and JD 5-754, 5-850, 5-854, 5-900, 5-904, N754, 6B954), 5050D, 8430 (Lengthen) **JDT** (750, 754, 804, 824, 1204, 5-754, TN904) **East Red** YTO 954 and 1204 (old) **Wuzheng Renault** model 2204 **French Renault** model 1404 **ZOOMLION** PL2604 **Case New Holland** Puma 2304
2	B	**WORLD 1304** **LOVOL** models 900, 1004, 1654 **East Red** Foton 700, 750, 754, LX800, 90, 904, LF904, 1204 FT454, 904 **DFAM** models 704, 904, 1204, 1504 **Hummer** 2204 HX2104, 804 HANWO2004, 2104 **John Deere** 484, KAT2804
3	D1	**DEUTZ FAHR** models 1804, 2604, 6205G (ϕ20.6mm)
4	E	**CHERY** model HZRC954
5	F	**Valmet**

6	JG	**DFISEKI** models PZ60 (rice transplanter), T954 (tractor)
7	JH	**Jinghe** rice transplanter
8	K	**Belarus MTZ** 824, 1204
9	KN	**Case New Holland** models T1654 and T6080
10	N	**Case New Holland** model 535 LX904 **CLAAS** model 2204 **MASSEY FERGUSON** 204, S1304-C
11	N1	LX1004
12	NH40	**Case New Holland** model 904 (ф 17.4mm 40 teeth) **Case New Holland Shanghai** model SNH904 **Favot** models
13	SD	SADING
14	T	**KUBOTA** models M704, 954 **YANMAR** rice transplanters
15	W	**LOVOL** models 654, 800, 900, 904, 1204, 1304, 1504 LT1504 HCWR1404 Shuhe 554, 604, 704, 904, 1000, 1204, 1404 FMD 604, 704 LA604 LuT 404, 1004, 1104 LUOYANG504 **Dongfeng** model 750, 800, 904 **East Red** model 2004
16	Y1	**Yanmar** rice transplanter (18 teeth)
17	Deere60	JDT60, 654, 724 TN600, 654, 720, 724

6. Terminology

BDS	BeiDou Navigation Satellite System
DC	Direct Current
DGPS	Differential Global Positioning System
GLONASS	GLObal NAvigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
PC	Personal Computer
RMS	Root Mean Squares
RTK	Real-Time Kinematic
RTCM	Radio Technical Commission for Maritime Services
USB	Universal Serial BUS