## **User Manual**

Version V2.0-20220706

# User Manual For SMAJAYU JY302

## **GNSS Auto-Steering System**

©2020 SMAJAYU Inc. All rights reserved.





# **Revision History**

Version	<b>Revision Date</b>	Change Summary
1.0	16/04/2019	Initial Release
2.0	21/08/2020	Upgrade Product Figure



# **Table of Contents**

Revision History	2
Table of Contents	3
List of Figures	4
List of Tables	6
1. Introduction	7
1.1 Overview	7
1.2 System Composition	8
1.3 Main Devices in the package	10
2. General Operations	13
2.1 Assembly and Installation	13
2.2 Software Operations	26
3. Gyro Calibration	37
3.1 Single Gyro	37
4. Specifications	40
4.1 T100 Control Tablet	40
4.2 A10 GNSS Antenna	42
4.3 EMS2 Motor Wheel	43
5. Typical Applications	45
5.1 Base Station example	45
5.2 Spraying Pesticide	46
5.3 Transplanting	46
5.4 Other tractor work	47
6. Appendix-1	48
7. Terminology	50
8. Set Imple and Joint width	52
8.1 Abstract	52
8.2 Specific operation process	52
9. About Farm Management Fuction	55
10. JY302 FAQ	61
11. JY302 Common fault causes and solutions	I



# **List of Figures**

Figure 1.1 Major parts in JY302Auto-Steering System
Figure 1.2 JY302 auto-steering system structure9
Figure 1.3 T100 Control Tablet 10
Figure 1.4 A10 GNSS Antenna11
Figure 1.5 EMS2 Motor Wheel 12
Figure 1.6 Angle sensor 12
Figure 2.1 Assembly diagram of EMS2motor wheel
Figure 2.2 Descriptions of the EMS2 assembly components 14
Figure 2.3 Components needed for electric motor
Figure 2.4 Installation example of electric motor
Figure 2.5 Installation example of bracket for fixating EMS2 Motor Wheel
Figure 2.6 Installation example of EMS2 Motor Wheel 16
Figure 2.7 Components needed to install angle sensor
Figure 2.8 Install the parts to fixate angle sensor
Figure 2.9 Possible position of angle sensor – 1
Figure 2.10 Possible position of angle sensor – 2
Figure 2.11 Installation example of angle sensor
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
Figure 2.16 Main Cable with multiple connectors
Figure 2.17 Power extension cable with two wires
Figure 2.18 Angle Sensor
Figure 2.19 Cable for Attitude Sensor (IMU)
Figure 2.20 Attitude Sensor (IMU)
4 / 00



Figure 2.21 Power Switch with cable	24
Figure 2.22 Main Cable connects to EMS2 Motor Wheel	24
Figure 2.23 T100 Control Tablet connects to main cable and two antennas	
	25
Figure 2.24 Bracket for T100 Control Tablet	25
Figure 2.25 Home screen of T100 Control Tablet	26
Figure 2.26 Installation file of AutoSteer	26
Figure 2.27 Public liability disclaimer notice	27
Figure 2.28 AutoSteer software main interface	28
Figure 2.29 RTK base configuration	28
Figure 2.30 Vehicle parameter configuration – antenna height	29
Figure 2.31 Vehicle parameter configuration – antenna lateral offset	29
Figure 2.32 Vehicle parameter configuration – antenna distance	29
Figure 2.33 Vehicle parameter configuration – antenna fore	30
Figure 2.34 Vehicle parameter configuration – wheelbase	30
Figure 2.35 Vehicle parameter configuration – front wheel	30
Figure 2.36 System setting interface	31
Figure 2.37 Registration	32
Figure 2.38 More settings in system setting	32
Figure 2.39 Angel Sensor Adjust	32
Figure 2.40 Terrain compensation wizard	33
Figure 2.41 Calibration wizard	33
Figure 2.42 Set width and junction	33
Figure 2.43 Import AB line	34
Figure 2.44 Agricultural operation in progress	34
Figure 4.1 Smajayu System Structure	40
Figure 4.2 Spraying pesticide using JY302 auto-steering system	43
Figure 4.3 Transplanting using JY302 auto-steering system	43
Figure 4.4 Other tractor works using JY302auto-steering system	44



# **List of Tables**

Table 3.1 T100 Control Tablet Specifications	35
Table 3.2 A10 GNSS Antenna	37
Table 3.3 EMS2 Motor Wheel	38
Table 5.1 List of AvailableSpine Shafts	45

### \*\*\*When you need to enter the registration code, an interface will pop up with the machine code on it. Please enter the corresponding registration code according to the machine code.

### Please click the link to check the registration code:

https://drive.google.com/drive/folders/1hoZ0AU8wWquh YHr8y I6hujdSRlwawu?usp=sharing



# **1.** Introduction

This chapter mainly introduces the overview, system component and package list of the SMAJAYU JY302 GNSS Auto-Steering System.

## **1.1** Overview

The SMAJAYU JY302 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 transplants and other agricultural vehicles.

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 A10 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 JY302 Auto-Steering System





Figure 1.2 JY302 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 centimeter level accuracy positioning and heading.

T100 Control Tablet provides RS232, RS485, USB2.0, CAN 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 A10 GNSS antenna

A10 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 A10 GNSS Antenna.



Figure 1.4 A10 GNSS Antenna

If an antenna from other companies is used, contact SMAJAYU 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 Loge cover, steering wheel, flange, bracket 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 Loge 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 angle sensor on left front wheel. Take off screw on left front wheel and install angel sensor board, notes plane with screw holes on angel should face to vehicle body when installation.



Figure 2.8 Install the parts to fixate angle sensor



Mind turn angel sensor in right position before install on board. Please make sure plane A and plane B keep parallel and face to vehicle body when installation.



 Adjust the position of angle sensor to be properly installed.
 Find the best position and make sure angle sensor could turn in normally. Then, use screw fix angle sensor bracket.



Figure 2.9 Possible position of angle sensor -1





Figure 2.10 Fix angle sensor -2

 Extend board could be used if this part do not have a screw could use for fix angel sensor bracket.



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.



Figure 2.16 Main Cable with multiple connectors





The current hardware supports 12V and 24V power supplies



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 AttitudeSensor (IMU)

Figure 2.20 Attitude Sensor (IMU)





Figure 2.21 Power Switch with cable

Figure 2.22 Main Cable connects to EMS2 Motor Wheel





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 Registration.

Please ask SMAJAYU engineer support to complete registration.

Also, please supply follow information to SMAJAYU Support.

1) Device Code. "System Setting" >> "More" >> "…"

ettings	(- < -)		Back			RTK	Syster	n sett	ings		♥ \$ <sup>™</sup> \$ 9:16
Angle sensor	1	Heading mode	Online value	þ					Angle sensor	1	Heading mode
Azimuth offset	-1.2	Set heading	Angle sensor	R	ight wheel				Azimuth offset	-1.2	Set heading
		input regcode.	Angle sensor	R	Device Code	425213	31				lipput regcode.
Roll offset	0	Update	Angle sensor	F	Register Code	c936f9					coefficient
Motor gain	10	Plugging coefficient	ECU_MOTOR	Р							the board
Manual	•	Reboot the board	AB line type	s							motor version
		Get the motor version	Alarm	20	Ok						Cancel rential 1
Area statistics	Automatic	Get the maximum current									Set differential2
Unit of	mu	Set differential 1									
		Set differential2									
					5	>	$\bigtriangledown$	0		ŝ	



- 2) Motor SN, PN and device code number.

3) Tablet PN and SN number.



4) Gyro PN and SN number. (If in use)



5) Upload JY302 device parts installation figures.

### 2.2.3 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 SMAJAYU technical support by email android.development@smajayu.com for guidance.

#### **2.2.4** 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.
- Select CORS or External Datalink mode, the external datalink can be a Ntrip Modem or a radio module.
- 4) Back to the main interface, RTK status becomes Fix.



3) Edit the information as below for example:



Figure 2.29 RTK base configuration

Vehicle configuration steps are:

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

Back	Vehicle P	arameter				🍳 👻 📱 12:21
Antenna height2.3m						
	1				2.3	m
		7	8	9		
		4	5	6		
		1	2	3		
		0		Delete		
	min	Clear	_	Ok		
Last	Next					
ц,	< <		<b>り</b>			

Figure 2.30 Vehicle parameter configuration – antenna height

2) Fill the parameter and select [Next]. (0.8 m in normally)

Back	v	ehicle Parameter			<b>9</b> 🔻 🕈 12:21
Antenna lateral o	offset0.9m		111	0.9	m
		7	8	9	
		4	5	6	
		1	2	3	
$\sim$		0	. De	elete	
		Clear		Ok	
	*******	1121			
Last	Next				
	⊈, ⊲	0	⊐ _1»		

 $Figure \ 2.31 \ Vehicle \ parameter \ configuration - antenna \ lateral \\ offset$ 



Back	Ve	ehicle Parameter			٠	💎 💈 12:2
Distance between An	tennas1.8m ↔				1.8 m	
		7	8	9		
		4	5	6		
	-	1	2	3		
×		0		Delete		
mmmmm		Clear		Ok		
Last	Next					
	ς Υ	0 🗆	<b>り</b>			

Figure 2.32 Vehicle parameter configuration – antenna distance



Figure 2.33 Vehicle parameter configuration – antenna fore



Figure 2.34 Vehicle parameter configuration – wheelbase





Figure 2.35 Vehicle parameter configuration - front wheel

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

#### 2.2.5 Calibration

Before the JY302 Auto-Steering system is enabled for the field work, it is recommended to perform the calibration for specific vehicle following below steps.

Back		-	-	Sys	tem sett	ings	_		Upl	load
Coefficient of	-	•		100		Foresight	2.8		Auto foresight	
Median value	60		113.9	Get		Transmission			150	
Minimum tire	-30					🗹 Log file				
Maximum tire	30					Low spe	ed mode		Slope correction	
Drift	0					Automat	ic calibration			
Implement	0					Turning 30	0			
		<b>de</b> arlibration						Terrain		
									More	>>>
		ъ Ľ		$\bigtriangledown$	0		り の			

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

Figure 2.36 System setting interface



2) Select [more] in the lower right corner and select [Angle sensor

Back		2 RTK	Syst	em se	ttings		H Widt	♥ 🖇 🚰 🧏 9:44
Online value	9				Angle sensor	1		
Angle sensor	Right wheel				Azimuth offset	0		
Angle sensor	RTY120			]	Roll offset	0		
Angle sensor	Face up				Motor gain	10		
ECU_MOTOR	POSITION				Manual		•	
AB line type	straight				Area statistics	Automatic		
Alarm	20				Unit of	mu		
* * * *	* * * * *	Ъ	$\triangleleft$	0		<b>山</b> 》	* * * * *	

position] correctly. The angel sensor position chosen of "Right Wheel" or "Left Wheel" is depend on the position of angel sensor installation. Angel sensor choose "RTY 90".

 Select [Middle], and then click [Get] to obtain the centering angle. The number should between 50-70. Please adjust angel sensor if the data is not in the range.



#### Figure 2.39 Angel Sensor Adjust Note: Before clicking [Get], ensure the front wheel of the vehicle is in the middle.

4) Turn the steering wheel to the left and right to check the changes in real-time data, and confirm that the angle sensor is installed and not damaged. Then return to the positive direction, and modify the manually entered value to the data that is not far from the real-time value. Then drive a distance, confirm that the angle sensor is detecting the vehicle, and the real-time data is changing



ick	System	n settings	Uplo
Coefficient of	100	Foresight 2.3	Muto foresight
Median value 0	0 Get	Transmission	- 150
Minimum tire -30		💽 Log file	
Maximum tire 30Enter data mar	nually	Real-time data	Slope correction
Drift -0		Automatic calibration	
Implement 0		Turning 6	
Carlib	oration		Terrain
			More>>

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

Back	Terr	ain com	pensation ca	libration			🕈 👻 💈 6:04
Step1:Find a flat field. Step2:Stop the car and remember w Step3: Wait for the word start first a previous step. Step4: Click the start second collect Step5: Wait for the word start secon	there the car sto cquisition butto ion button. Id acquisition bu	ps. Click t n to turn to atton to tu	he start first ac o finish, turn th rn to completio	cquisition bu e car 180 de on, click calc	itton. grees, and st ulation.	op at the same pos	ition as the
Start first data acquisition		Star a	t second data acquisition			Figure out	
average 1:	average 2	F	Roll value				
	<b>む</b>	$\triangleleft$	0		<b>山</b> 》		

Figure 2.40 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 [Calibration] and do the calibration according to the screen wizard.



Figure 2.41 Calibration wizard

### **2.2.6** Navigation line setting

Here takes the AB line for example of the navigationline.

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



Figure 2.42 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 2.43 Import AB line



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

Figure 2.44 Agricultural operation in progress



# **3.** Gyro Calibration

## 3.1 Single Gyro

#### Step 1: Select Single Gyro.

"System Setting">> "More"

Back	SAT	RTK		lystem se	ttings	V	Widt	* 8:14
Online value	9				Angle sensor	1		
Angle sensor	Single Gro				Azimuth offset	0		
Angle sensor	RTY120				Roll offset	0		
Angle sensor	Face up				Motor gain	10		
ECU_MOTOR	Position control				Manual release	•		
AB line type	Straight				Area statistics	Automatic		
Alarm	20				Unit of	Mu		
		IJ,	$\bigtriangledown$	0		<b>山</b> 》		
					. ~			

Figure 3.1 Single Gyro



Back			Sy	vstem settings		¥ §p8:02
Coefficient of		•	100	) Foresight	2.3	Auto foresight
Median value	0		0 Get	Cog file		
Minimum tire	-30			Low spe	eed mode	Slope correction
Maximum tire	30			🗹 Automa	tic calibration	
Drift	0			Turn let	ft	Turn right
Implement	0				¢- Te	errain
	<mark>⊹/</mark> €ar	libration				
+ + + +		۲ <sup>,</sup>	$\triangleleft$	0 🗆	L ⊂J≫	Wore>>>

Figure 3.2 Single Gyro Calibration

Step 3: "Carlibration">> "Single gyro debugging"





Figure 3.4 Single Gyro Calibration

Adjust Azimuth Offset if there are deviation when using Auto-Steering. Always left deviation decrease "Azimuth Offset" value and always right deviation increase "Azimuth Offset" value.



Back	SAT SAT	RTK	Syster	m settii	ngs	Widt 🕴 🖁 8:05
Online value	9			A	ngle sensor	1
Angle sensor	No angle sensor2			A	zimuth offset	0
Angle sensor	RTY120			R	oll offset	0
Angle sensor	Face up			м	lotor gain	10
ECU_MOTOR	Position control			м	lanual release	•
AB line type	Straight			A	rea statistics	Automatic
Alarm	20			U	nit of	Ми
	+ + + + + +	Ц,	$\triangleleft$	0		<b>小</b> 》

Figure 3.7 Azimuth Offset for Auto-Steering Deviation



# **4.** Specifications

This chapter includes the specifications of T100 Control Tablet,

A10 GNSS Antenna and EMS2 Motor Wheel.

## 4.1 T100 Control Tablet

GNSS Performance			
Signal Tracking	GPS L1, L2		
	GLONASS L1, L2		
	BeiDou B1, B2 GALILEO		
	E1, E5b QZSS L1, L2		
	SBAS L1		
GNSS Channels	432		
		1.5m RMS (Horizontal)	
	Single Point Positioning	2.5m RMC (Vertical)	
Derivities Assessed		0.4m (Horizontal)	
Position Accuracy	DGPS Positioning	0.8 (Vertical)	
		10mm+1ppm (Horizontal)	
	KIK Positioning	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	20Hz
update rate	
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°C~+70°C		
	30%~95%RH @ -40°C~+85°C		

## 4.2 A10 GNSS Antenna

Table 3.2 A10 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		
LN	A Specification		
LNA Gain	40±2dB		
Noise Figure	≤ 2.0dB		
VSWR	≤ 2.0		
Input Voltage	3.3~12V DC		



Operating Current	$\leq$ 45mA		
Ripple	$\pm 2 dB$		
Phy	ysical		
Dimension	Φ152*62.2mm		
Weight	374g		
Signal Connector	TNC Female		
Installation connector	5/8" x 11 UNC Female		
En	vironmental		
Operating temperature	-45 C - +85 C		
Storage temperature	-45 C - +85 C		
Damp	45% - 95%		
Mechanical Drawing			
Top View	Image: side View     Bottom View		

## 4.3 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				
Col	mmunication				
Communication protocol	ModBUS				
Encoder resolution	1000 lines, 4000 pulses / circle				
Encoder interface(protocol)	parallel, no protocol				
Encoder maximum output	200KHz				
rate					
Communication interface	RS232				
Phy	ysical				
Dimension	Φ187x100.2mm (motor)				
	Φ410x32mm (steering wheel)				
Weight	6.35kg (motor only)				
Material	Aluminum alloy				
En	vironmental				
Operating temperature	-40 C - +105 C (motor)				
Storage temperature	-45 C - +150 C (motor)				



# **5.** Typical Applications

## **5.1** Base Station example

It is recommended using Smajayu system as the base station to cooperate with JY302 auto-steering system. With SMAJAYU Ntrip Caster Service, Ntrip Modem and Base Receiver, the Smajayu 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.



Figure 5.1 Smajayu System Structure



There are various applications that JY302 GNSS Auto-Steering System can be used. Here list three working scenarios.

## **5.2** Spraying Pesticide



Figure 5.2 Spraying pesticide using JY302 auto-steering system

## **5.3** Transplanting



Figure 5.3 Transplanting using JY302 auto-steering system



## **5.4** Other tractor work



Figure 5.4 Other tractor works using JY302 auto-steering system



# 6. Appendix-1

Here list current available spline shafts, new spline shaft can be customized if your vehicle is not including in the table below. Contact SMAJAYU Technical Support via email android.development@smajayu.com for more details.

Table 5.1 List of Available Spine Shafts

No.	Mark	Matched Vehicles			
1	А	John Deere models (350, 720, 754, 804, 850, 854, 904, 954, 7830, 2204,			
		295, 1204, 1404, 1354, 6605 and 5-754, 5-850, 5-854, 5-900, 5-904, N754, 6B954			
		5082E) East Red models 954 and 1204			
		RENOMAN models 2204 and 1404			
		ZOOMLION PL2604			
		Case New Holland Puma 2304			
2	A1	John Deere model 5-754			
3	В	LOVOL models 900, 1004, 1654			
		East Red models 700, 750, 754, LX800, 90, 904, LF904, 1204			
		John Deere 484, KAT2804			
		<b>DFAM</b> models 704, 904, 1204, 1504			
4	N	Case New Holland model 535			
		CLAAS model 2204			
5	KN	Case New Holland model T1654			
6	NH40	Case New Holland model 904 (\u03c617.4mm 40 teeth)			
		Case New Holland Shanghai model SNH904			
7	D	DEUTZ FAHR models (φ20.4mm)			
8	D1	<b>DEUTZ FAHR</b> models 1804, 2604 ( $\phi$ 20.6mm)			
9	Е	CHERY model RC954			



10	JG	DFISEKI models PZ60, T954			
11	W	LOVOL models 654, 800, 900, 904, 1204, 1304, 1504			
		DFAM model 750			
		East Red model 2004			
12	Т	KUBOTA models M704K, 954			
		YANMAR rice trans planters			



# 7. 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

If you encounter difficulties during use, you can email our technical support team and we will solve any problems for you.

Address:Room 213-214, Building 1, Mingliang Science Park, No. 88, Zhuguang North Road, Taoyuan Street, Nanshan District, Shenzhen, China,518055.

Email: support@smajayu.com & tech@smajayu.com

#### **Proprietary Notice**

All Information in this document is subject to change without notice and does not reflect the commitment on SMAJAYU. No part of this manual may be reproduced or transmitted by all means without authorization of SMAJAYU. The software described in this document must be used in terms of the agreement. Any modification without permission from SMAJAYU. is not allowed.



# 8. Set Imple and Joint width

## 8.1 Abstract

This paper mainly introduces how to set the specific operation of farm tool distance and handover line distance, and how to correctly set these two values in different operation scenarios.

## 8.2 Specific operation process

8.2.1 Before setting these two values, we first need to understand their specific meaning. As shown below:

**Imple** (implement width, the distance between the two most seed rows) **Joint width** (distance between two adjacent seed rows)





8.2.2 There are three possible situations when setting these two data.

(1) When working in the field, it is necessary to measure and set the width and joint distance.

(2) When working in the field, the width needs to be measured and set, but the joint distance is 0.

(3) If the width distance to be input is less than the measured distance of agricultural tools, the input width shall be measured according to the actual situation

8.2.3. After determining the width and joint data to be input, we can input these data on the software. The specific operations are as follows:



(1) Click the width button as shown in the figure.

(2) Click the Width button as shown in the figure.





(3) Enter the Imple and Joint width data in the places shown in the figure, and then click OK to operate normally.



SKIA JAYU

## **About Farm Management Fuction**

1. When we create a new AB line, we can choose which farm and which plot this AB line belongs to, or we can choose to use the previous Job to build a new AB line, and the next Job area will be accumulated on the basis of the selected Job. , the previous job track will be retained.

	SAT 39 Fix 0	0	122 >>>> 4.2 k	m/h 3 m	● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●
Gostatus	SN: 1020121938 Job Name:2021061 Job:Planting Crops	Enter Job	Information	0 🔺 🧿	?
9.0		AB line name	20210617120214		B S
System		Farm	Default Farm 🗸		AB
Farm		Field	Default Plot 🗸		Straight
		Job Name	20210617120214 🕑		
200		Ø	Yes		
	/	₽, Q	0 🗆 📢		
	SAT 38 Fix 1		44 >>>> 3.7 k	m/h 3 m	
	SAT 38 Fix 1 SN: 1020121938 Job Name:2021061	() 12:02 ((((	44 >>> 3.7k	m/h 3 m	0(Mu) <b>?</b>
Status	SAT 38 Fix 1 Fix 1 SN: 1020121938 Job Name:2021061 Job:Planting Crops	() 12:02 ((() Se	44 3.7 k /////	m/h 3m	<b>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</b>
Status System	SAT 38 Fix 1 Fix 1 SN: 1020121938 Job Name:2021061 Job:Planting Cropy	Default Farm	44 3.7 k elect current farm	m/h 3 m	<ul> <li>3:49</li> <li>0(Mu)</li> <li>3:49</li> <li>4:40</li>     &lt;</ul>
Status System Farm	SAT 38 Fix 1 Fix 1 SN: 1020121938 Job Name:2021061 Job:Planting Crops	Default Farm 111	44 3.7 k elect current farm	m/h 3 m	O(Mu)
Status System Farm	SAT 38 Fix 1 Fix 1 SN: 1020121938 Job Name:2021061 Job:Planting Crops	Default Farm 111 Cancel	44 3.7 k elect current farm	m/h 3 m	O(MU)



User Manual for SMAJAYU JY302 GNSS Auto-Steering System v2.0



2 <sup>0</sup>			<b>«</b> 14	2 >>>	0	<b>.</b>		3:50
	SAT 36 Fix	(1 12:04			3.6 km/l	h 3m	0(Mu)	
<b>O</b> Status	SN: 1020121938 Job Name:2021061 Job:Planting Crop:		Select	task			• ?	
ste		Search				Q		0
10		Job Name	Ownership Farm	Plot owner	Create Time	Select	Β	03
System		20210617120212	Default Farm	Default Plot	2021-06-17 12:03	$\circ$		AB
Farm		20210617120244	Default Farm	Default Plot	2021-06-17 12:02	0		A B Straight
		20210617120356	Default Farm	Default Plot	2021-06-17 12:03	$\bigcirc$		
		20210617120342	Default Farm	Default Plot	2021-06-17 12:03	0		
		Car	ncel	Ø	Yes			
		ц,					E	

2. In the farm management interface, you can create a new farm and edit the farm name and farm ownership. Create a new plot in the corresponding farm, upload the plot or display it on the map. All AB lines in the selected plot are displayed in the



000 🔊 የ 🖇 💎 🚄 💈 3:51 13 Task Plot Details Û Default Farm 0 Default Plot Field Default Plot 111 Plot owner Default Farm ▶ 111 Create Time 2022-09-06 10:25:39 Area: 0 Mu 餐 Display Map 🧭 Yes 🙆 Plot upload 😮 Cancel M Add Plot L Spor  $\triangleleft$ \$ Farm Plot Task ▼ Default Farm ٢ Job Default Plot 111 ▶ 111 🔒 Add Farm Add Plot 🗲 Impor

Task, and the AB lines can be edited or imported and deleted.







User Manual for SMAJAYU JY302 GNSS Auto-Steering System v2.0

Farm	Farm Plot	Task	
	Plot-默认地块	Task Details	
Job	20210617120356-1623902558	Job Name	20210617120244
	20210617120214	Job	默认地块 Planting
	20210617120212	Сгор	Cotton
	20210617120244	Create Time	2021-06-17 12:02
	20210617120356	Workload	0.01 Mu
	20210617120342	Length:	31.67m
	20210617120307		
		C Display paint	Delete Continue the job

3. On the Job page, you can see all Job (AB line) situations. Click on the details to choose the display track, continue the work on the selected AB line or delete the AB line.

Farm	Job Stats		
	Job List	Create Time	Workload
Job	20210617120356-1623902558(Using)	2021-06-17 12:02	0 Mu Details
	20210617120214	2021-06-17 12:01	0 Mu Details
	20210617120212	2021-06-17 12:03	0 Mu Details
	20210617120244	2021-06-17 12:02	0.01 Mu Details
	20210617120356	2021-06-17 12:03	0.02 Mu Details
	20210617120342	2021-06-17 12:03	0.07 Mu Details
	20210617120307	2021-06-17 12:02	0.14 Mu Details



• • 5			₪ 9 ≭ ▼⊿ ۶	3:55
Farm		Task Details		
1	Jc Basic Job Information			
Job	202 Name:	20210617120307 Area	0.14Mu Details	
	202 Length	30.02 Creation Time	2021-06-17 12:02 Details	
	Farm Ownership	Default Farm Longitude Zone <sup>*</sup>	51.0 Détails	
	202		Details	
	202		Details	
	202	Delete Display paint	Continue the job	
	20210617120307	2021-06-17 12:02	0.14 Mu Details	
	<b>ਪ</b> `		<u> २</u> ७	



## JY302 FAQ

What is the working accuracy of JY302?
 2.5 cm

#### • Does JY302 need internet for work? If there is a network, use the network; if there is no network, use the radio signal.

• Is the JY302 tablet with battery? Without

#### • What is the function of the LED light on the top of the JY302 panel?

Indicates the direction of the error, if the error of the AB line is on the left, the light on the left is on. The larger the error, the more the light is on.

#### • How do I know if JY302 can be compatible with my tractor?

JY302 can be used if your tractor is steered with a steering wheel and it matches our spline model. For specific measurement standards, please refer to the document "Measure spline.pdf"

#### • Why does JY302 have two A10s, and what are their functions?

One for positioning (connected to ANT1 port) and one for orientation (connected to ANT2 port)

Because JY302 has high requirements on accuracy, using two A10s is more accurate (accurate because the base station is connected to realize differential positioning), and the orientation can obtain the heading information of the tractor faster, ecision, and if the base station is connected, it is differential precision.

#### • What work options does the auto guidance system have?

1. Walk in a straight line

2. Walk the curve

3. Take the historical path (only one historical path can be determined, and it will not be extended

which is easy to make adjustments. If the base station is not connected, it is single-point pr

#### What is the function of the accessory (switch)?

Open the automatic driving software. During the official operation, press the switch button to turn on the automatic driving function without clicking the steering wheel icon on the screen.

#### • Sensors (two optional):

Angle sensor (installed on the front wheel)
 IMU (installed in the car)



#### • About auto guidance system (JY302)

1. Auto guidance system only controls the steering wheel, and other functions are not affected.

2. Auto guidance system must be powered.

3. Auto guidance system is activated, manually turn the steering wheel to release the navigation (the manual release level can be lowered).

# 11. JY302 Common fault causes and solutions

serial number	abnormal situation	Problem Description	Possible cause of the problem	Solution
1	The main antenna is not connected The secondary antenna is not connected	Star search is O, positioning status: unresolved	1. Problems during ignition 2. During driving 3. Antenna or cable failure	1. The aging problem of the battery causes the ignition voltage drop to be too large, which does not affect the use. 2. Increase the voltage regulator module (8-30) 3. Replace the antenna or whether the cable or receiver connector is loose or not plugged in. 4. Use a multimeter to measure the antenna interface Voltage, whether it is 3. 3V and above, if not, replace the receiver;
2	Receiver not connected	The screen prompts that the receiver is not connected	1. The R71 receiver plug is not plugged in or not plugged in tightly 2. The 232 serial port Deutsch connector is not plugged in or not plugged in tightly 3. The default configuration of the receiver is not output	1. Re-plug the R71 receiver plug 2. Re-plug the 232 DEUTSCH connector plug 3. Switch the China Mobile location service, restart the software or restart the system
3	attitude sensor not connected	The screen prompts that the attitude sensor is not connected	1. The R72 receiver plug is not plugged in tightly 2. The CAN Deutsch connector is not plugged in tightly 3. Check whether it is a high-speed CAN panel, the SN number starts with 1322 or 1422	1. Re-plug the R72 receiver plug 2. Re-plug the CAN DEUTSCH connector plug 3. If the high-speed CAN tablet can only use the integrated software (version 347 or above), or the classic software upgrade test version
4	float	The star search is normal, the delay is relatively small, and the floating car is always prompted to stop and fix, and the star drops or floats when starting.	1. Base station antenna occlusion problem 2. Far from the base station, long baseline problem 3. There is interference from the positioning module on the car (especially the Dongfanghong car)	1. Check the base station installation and configuration problems 2. Connect to China Mobile service 3. Check whether there is a positioning module on the car
5	Static error jump, veloci	The car is stationary, the display is fixed, the error jumps back and forth by a few centimeters, or even larger, and the speed jumps by a few tenths	ionosphere active	1. Upgrade board, download link: update.allynav.cn/autosteer/bksj2.apk 2. Upgrade test board software, 11.20

6	small bend	The overall effect of the work looks straight, but there are small bends if you look closely.	1. The vehicle parameters are not input or the input is wrong. 2. The sensitivity and transmission coefficient are not adjusted. 3. There is a problem with the motor installation. 4. The vehicle steering is too sensitive. 7. There is side slip on sandy land	1. Check and modify the correct vehicle parameters. 2. By modifying these two values, there are no small broken bends. 3. Re-adjust the bracket. Tighten the farm implements; 6. Perform single gyro debugging; if the tractor direction clearance is greater than 45 degrees, it is recommended that the user repair the vehicle. Replace the horn head 7 of the steering rod, work on sandy soil, and change the parameter to fixed front view 2.1 or 2.2.
7	S bend	1. Take a big S bend in the ground.	1. The gyro data is abnormal; 2. The steering gear of the tractor is out of oil, or there is a problem with the steering gear. 3. The motor version cannot be recognized, and 0 is displayed. The parameters required by the mine have changed. 6. Check the motor alarm, and the power supply problem. 7. The base station problem.	1. When the vehicle is turned off, click the software status, and click Self-check to see if the gyroscope data is 0 or $\pm 0.1$ . If it is not, the receiver needs to be replaced; 2. The tractor steering gear is out of oil, turn the steering wheel in place, and press the accelerator deeply. to be able to move. Add steering oil or repair steering gear. 3. Upgrade the motor firmware or replace the motor 4. Restart after re-plugging the R72 main line 5. Fix the previous life and adjust the parameters (line stability coefficient, transmission coefficient) 6. Check whether the battery wiring pile is oxidized, loose, or has poor contact, and whether the motor has any feedback Relatively slow, correct discontinuity 7. Replace other base stations or use China Mobile services 8. Input after measuring parameters; 9. Comprehensive software records vehicle parameters, after uploading the AB line, delete the PrecisionAg folder.
8	The screen does not move	Clicking anywhere on the screen doesn't work	1. The tablet is stuck	Reboot the device
9	Tablet without network	Unknown in the upper right corner of the tablet	<ol> <li>The operator information is not obtained</li> <li>There is a problem with the 4G card</li> </ol>	1. Re-select the operator in the APN and restart 2. Replace the tablet mobile card

10	Motor is not enabled	The motor is boring after turning on the navigation	1. The motor is in a state of suffocation. 2. The battery is seriously fed, and the generator does not generate electricity. 3. The voltage and current are not enough, and the current can be measured. 4. Check whether there is an abnormal motor alarm.	1. Re-adjust the motor mounting bracket, check the vehicle steering 2. Replace the motor or repair the generator
11	Motor spins violently	The wheel swings violently, the line is not connected, the motor is killed, and the large error cannot be eliminated	1. The battery voltage is too low or this is overcharged 2. Modify the parameters to restart 3. The antenna installation error is large, resulting in a large azimuth angle error	1. Replace the battery 2. Restart the device after modifying the parameters 3. After re- adjusting the antenna, modify the sensitivity and transmission, and use automatic calibration to eliminate errors
12	Start the steering wheel killed	Click to start, the steering wheel will be turned to the end in one direction	1. The left and right antennas are reversed, and the car model on the screen will reverse when the vehicle is driving forward. 2. In the angle sensor mode, install the angle sensor in reverse, observe the left and right wheel angles in the status bar, the angle becomes larger when the direction is turned to the left, and the value of the angle to the left should be smaller under normal circumstances. 3. If the firmware has just been upgraded, switch the motor control mode. 4. Check whether the line stability coefficient or foresight distance value is abnormal 5. Check whether the wheelbase value is abnormal6. Motor failure problem (according to the file prompts in the root directory to understand the motor failure status and make a judgment, it is recommended that each technician should be equipped with a multimeter) 7. There is no problem in identifying the motor, and a single gyro debugging is required	1. Replace the left and right antenna connections. 2. Select the angle sensor reverse installation in the advanced settings.3. Check the battery according to the fault code, etc.

-					
	13	The forward error is large, the left and right swing error is not fixed	When the automatic driving is forward, the error is sometimes left, sometimes right, and both left and right are more than 3	1. The working conditions are poor 2. Check whether the line stability coefficient value is normal 3. Check whether there is an error in the measurement of vehicle parameters 4. Check whether there is a gap in the steering wheel book of the vehicle 5. Check whether the motor firmware in the "Status" column is 0 6. Check if the Azimuth Offset value is too large	1. Appropriately decelerate 2. Appropriately reduce the line stability coefficient 3. Check vehicle parameters
	14	There is an error in the advance, and the direction of the error is biased to one side	Fixed bias to one side when autonomous driving forwards	1. There is a roll break in the operating plot 2. There is a deviation in the centering angle in the angle sensor mode	1. Check slope correction 2. Re-do vehicle debugging
	15	There are left and right errors when moving forward, the steering wheel swings violently left and right, and there are small broken bends on the ground	The steering wheel swings left and right when the automatic driving is forward, and there are small broken bends	1. The working conditions are poor 2. Check whether the line stability coefficient value is normal 3. Check whether there is an error in the measurement of vehicle parameters 4. Check whether there is a gap in the steering wheel book of the vehicle	1. Appropriately decelerate 2. Appropriately increase the line stability coefficient 3. Check the vehicle parameters
	16	Reversing left and right swing error	When reversing, the performance is abnormal, the error is getting bigger and bigger, and the correction is slow, or the steering wheel swings back and forth	1. Check whether there is a gap in the steering wheel. 2. Check the front sight distance. If the front sight distance is too large, the reverse correction will be slow and the error will be large. If the front sight distance is too small, the correction will be too severe. The steering wheel swings back and forth. deviation	1. Properly adjust the foresight distance according to the performance (if you use the dynamic foresight, first open the fixed foresight to increase the foresight distance, and then close the fixed foresight) 2. Check whether the tire is biased, there is a problem with the front speed, and correct the tire

17	transfer bank problem	The handover row is large on one side and small on the other, but the total width is no problem	1. It may be caused by the misalignment of agricultural implements. Check whether the implements are misaligned. 2. It may be that the vehicle adjustment is inaccurate, and there is a fixed deviation.	1. Push the farm implement, and push the 1/4 of the difference in the direction of the larger connection; if the farm implement cannot be pushed, you can use the simulated push tool to push the 1/4 of the difference in the direction of the larger connection. 2. Adjust first. Check the deviation of the vehicle to ensure that the deviation value can jump around 0. 3. Check whether the value in the offset is abnormally large, and whether the distance from the antenna to the central axis is abnormal. After clearing the zero, the normal input is re-adjusted.
17		The transfer line is the same left and right, but the transfer line is larger or smaller	There may be a problem with filling in the width	Re-measure the actual working width
		Left and right handover lines are inconsistent and the total width is wrong	There may be problems in filling in the total width, and farm implements may also be skewed	First adjust the overall width, and then adjust the left and right connections correctly
		The same line of the handover line is suddenly large and then small, and the change is relatively large.	1. It is the problem of poor straightness, the error is displayed normally, but in fact the car is taking a big S curve	Adjust the straight line by adjusting the sensitivity or fixing the parameters such as the foresight value and the transmission coefficient to ensure that the change of the same connection is relatively small.
18	Automatically unnavigate	Navigation ends automatically during normal operation. Automatically disengage	1. The manual release level is too low; 2. The software reports that the antenna is not connected during driving.	1. Pull the manual release level to the highest level; 2. Check whether the antenna interface and the mushroom head are loose.
		navigation during start- up	1. The fire started when starting, causing the	1. Replace the battery or add a voltage regulator module