

# BUNKER USER MANUAL



**BUNKER**

**AgileX Robotics Team**

**USER MANUAL V.2.0.0 2023.09**

## Document version

No.	Version	Date	Edited by	Reviewer	Notes
1	V1.0.0	2023/03/17	谢瑞亲		Document creation

2	V2.0.0	2023/09/01	吴忠义		Remote control data update Synchronize the operation of github official website Bunker chassis firmware tutorial Adjust document format
3	V2.0.1	2023/09/02	谢瑞亲		Add rendering image Document checking

## Safety Information

**This chapter contains important safety information, before the robot is powered on for the first time, any individual or organization must read and understand this information before using the device. If you have any questions about use, please contact us at [support@agilex.ai](mailto:support@agilex.ai). Please follow and implement all assembly instructions and guidelines in the chapters of this manual, which is very important. Particular attention should be paid to the text related to the warning signs.**

The information in this manual does not include the design, installation and operation of a complete robot application, nor does it include all peripheral equipment that may affect the safety of the complete system. The design and use of the complete system need to comply with the safety requirements established in the standards and regulations of the country where the robot is installed. BUNKER integrators and end customers have the responsibility to ensure compliance with the applicable laws and regulations of relevant countries, and to ensure that there are no major dangers in the complete robot application. This includes but is not limited to the following:

### Effectiveness and responsibility

- Make a risk assessment of the complete robot system. Connect the additional safety equipment of other machinery defined by the risk assessment together.
- Confirm that the design and installation of the entire robot system's peripheral equipment, including software and hardware systems, are correct.

- This robot does not have a complete autonomous mobile robot, including but not limited to automatic anti-collision, anti-falling, biological approach warning and other related safety functions. Related functions require integrators and end customers to follow relevant regulations and feasible laws and regulations for safety assessment , To ensure that the developed robot does not have any major hazards and safety hazards in actual applications.
- Collect all the documents in the technical file: including risk assessment and this manual.
- Know the possible safety risks before operating and using the equipment.

## **Environmental Considerations**

- For the first use, please read this manual carefully to understand the basic operating content and operating specification.
- For remote control operation, select a relatively open area to use Bunker, because Bunker is not equipped with any automatic obstacle avoidance sensor.
- Use Bunker always under -10°C~45°C ambient temperature.
- If Bunker is not configured with separate custom IP protection, its water and dust protection will be IP44 ONLY.

## **Check**

- Make sure each device has sufficient power.
- Make sure Bunker does not have any obvious defects.
- Check if the remote controller battery has sufficient power.
- When using, make sure the emergency stop switch has been released.

# **Precautions**

## **Operation Precautions**

- In remote control operation, make sure the area around is relatively spacious.
- Carry out remote control within the range of visibility.
- The maximum load of BUNKER is 70KG. When in use, ensure that the payload does not exceed 70KG.
- When installing an external extension on BUNKER, confirm the position of the center of mass of the extension and make sure it is at the center of rotation.
- Please charge in time when the device voltage is lower than 48V.
- When BUNKER has a defect, please immediately stop using it to avoid secondary damage.

- When BUNKER has had a defect, please contact the relevant technical to deal with it, do not handle the defect by yourself.
- Always use BUNKER in the environment with the protection level requires for the equipment.
- Do not push BUNKER directly.
- When charging, make sure the ambient temperature is above 0°C.

## **Battery**

- The battery of BUNKER products is not fully charged when it leaves the factory. The specific battery power can be read from the voltage display meter at the rear of the BUNKER chassis or the CAN bus communication interface;
- Please do not charge the battery after it is exhausted, and charge it in time when the low voltage at the tail of the BUNKER is lower than 48V;
- Static storage conditions: The optimal storage temperature is -10°C~45°C. When the battery is not in use, it must be charged and discharged once every month, and then stored at full voltage. Do not leave the battery in a Put into fire, or heat the battery, do not store the battery at high temperature;
- Charging: You must use the matching dedicated lithium battery charger for charging. Do not charge the battery below 0°C. Do not use non-original standard batteries, power supplies, and chargers.

## **Usage environment**

- The working temperature of BUNKER is -10°C~45°C. Please do not use it in environments with temperatures below -10°C and above 45°C;
- The relative humidity requirements of BUNKER's operating environment are: maximum 80%, minimum 30%;
- Do not use in an environment with corrosive or flammable gases or in an environment close to flammable substances;
- Do not exist around heating elements such as heaters or large winding resistors;
- Except for the specially customized version (customized with IP protection level), BUNKER is not waterproof, so please do not use it in environments with rain, snow, or standing water;
- It is recommended that the altitude of the operating environment does not exceed 1000M;
- It is recommended that the temperature difference between day and night in the use environment should not exceed 25°C;
- Regularly inspect and maintain the track tensioner.

## **Electrical external extension**

- The current of the extended power supply at the tail does not exceed 6.25A, and the total power does not exceed 300W;

### **Additional safety advice**

- If you have any questions about the use process, please follow the relevant instruction manual or consult relevant technical personnel;
- Before using the equipment, pay attention to the on-site conditions to avoid improper operation that may cause personal safety problems;
- In case of emergency, power off the device by tapping the emergency stop button;
- Please do not modify the internal device structure without technical support and permission.

### **Maintenance**

- Regularly check the tension of the hanging crawler, and tighten the crawler every 150~200h.
- After every 500 hours of operation, the bolts and nuts of each part of the car body should be inspected. If they are loose, they must be tightened immediately.
- In order to ensure the storage capacity of the battery, the battery should be stored under electricity, and it should be charged regularly when not used for a long time.

### **Other notes**

- When transporting and setting up, do not drop or turn it upside down;
- Non-professionals, please do not disassemble it without permission.

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# 1 BUNKER Introduction

BUNKER is designed as a multi-purpose tracked chassis with different application scenarios considered: simple and sensitive operation, large development space, adapt to various fields of development and application, independent suspension system, high payload and suspension, strong climbing ability, can climb stairs. It can be used for the development of special robots such as inspection and exploration, rescue and detonation, special shooting, special transportation, etc., to solve the robot mobile solution.

## 1.1 Component list

Name	Quantity
BUNKER Robot Body	x1
Battery Charger(AC 220V)	x1
Aviation plug (4Pin)	x1
FS remote control transmitter(Optional)	x1
USB to RS232	x1
USB to CAN communication module	x1

## 1.2 Tech specifications

Parameter Types	Items	Values
Dimensions	Dimensions	1023*778*400mm

	Chassis height	90mm
	Track width	150mm
	Length	560mm
Weight	Weight	About 130kg
	Load	70kg
Battery	Type	Lithium battery
	Capacity	30AH
	Voltage	48V
Performance	Maximum climbing capacity	30°
	Maximum Speed	1.5m/s
	Minimum turning radius	Be able to turn on a pivot
	Maximum obstacle	170mm
	Motor parameters	2×650W brushless servo motor
	Code wheel parameters	Line 1024
	Operating temperature	-10~45°C
	Reduction ratio	1:15
Control	Control mode	Remote control Command control mode
	RC transmitter	2.4G/extreme distance 200m
	Communication interface	CAN



## 1.3 Required for development

FS RC transmitter is provided (optional) in the factory setting of BUNKER, which allows users to control the chassis of robot to move and turn; CAN and RS232 interfaces on BUNKER can be used for user's customization.

## 2 The Basics

This section provides a brief introduction to the BUNKER mobile robot platform. It is convenient for users and developers to have a basic understanding of BUNKER chassis.

### 2.1 Description of electrical interface

The interface at rear end is shown in Figure 2-1, where Q1 is CAN and 48V power supply aviation interface; Q2 is the power switch; Q3 is the recharging interface; Q4 is the aerial; Q5 is the drive test interface; Q6 is the emergency stop switch; Q7 is the display of battery voltage.

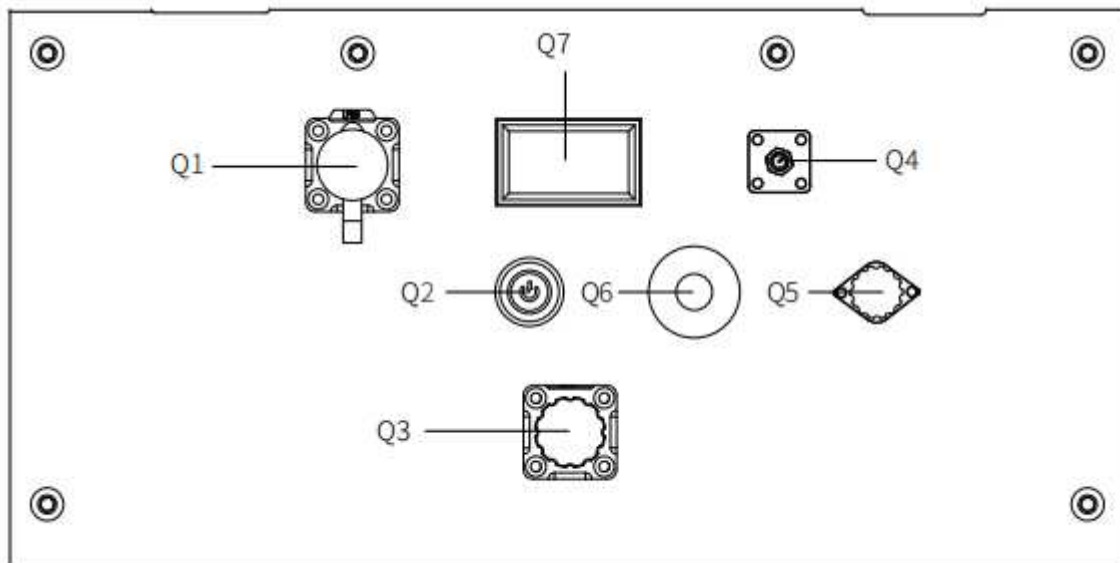
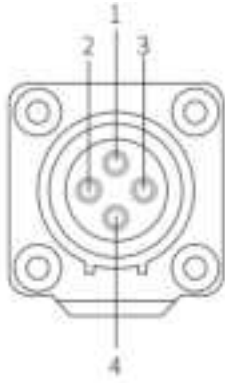


Figure 2.1 Tail electrical interface

The definitions of Q1 communication and power interface as shown in Figure 2-2.



Pin No.	Pin Type	Function and Definition	Remarks
1	Power	VCC	Power positive, voltage range 46 - 54V, maximum current 10A
2	Power	GND	Power negative
3	CAN	CAN_H	CAN bus high
4	CAN	CAN_L	CAN bus low

Figure 2.2 Pin definition figure of tail aviation expansion interface

## 2.2 Instructions on remote control

FS RC transmitter is an optional accessory of BUNKER for manually controlling the robot. The transmitter comes with a left-hand-throttle configuration. The functions of the buttons are defined as: SWA, SWC, SWD are enabled by default. SWB for control mode selection, top position for command control mode and the middle position for remote control mode. When configuring the autowalker navigation system, the bottom is the navigation control mode. S1 is the throttle button to control the forward and backward of BUNKER; S2 controls the rotation, POWER is the power button, and it can be turned on at the same time. It should be noted that when the remote controller is turned on, SWA, SWB, SWC, SWD all need to be at the top.



Figure 2.3 Schematic Diagram of Buttons on FS RC transmitter

#### Remote control interface description:

Bunker : model

Vol: battery voltage

Car: chassis status

Batt: Chassis power percentage

P: Park

Remoter: remote control battery level

Fault Code: Error information (Represents byte [5] in 211 frame)

## 2.3 Instructions on control demands and movements

A reference coordinate system can be defined and fixed on the vehicle body as shown in Figure 2.4 in accordance with ISO 8855.

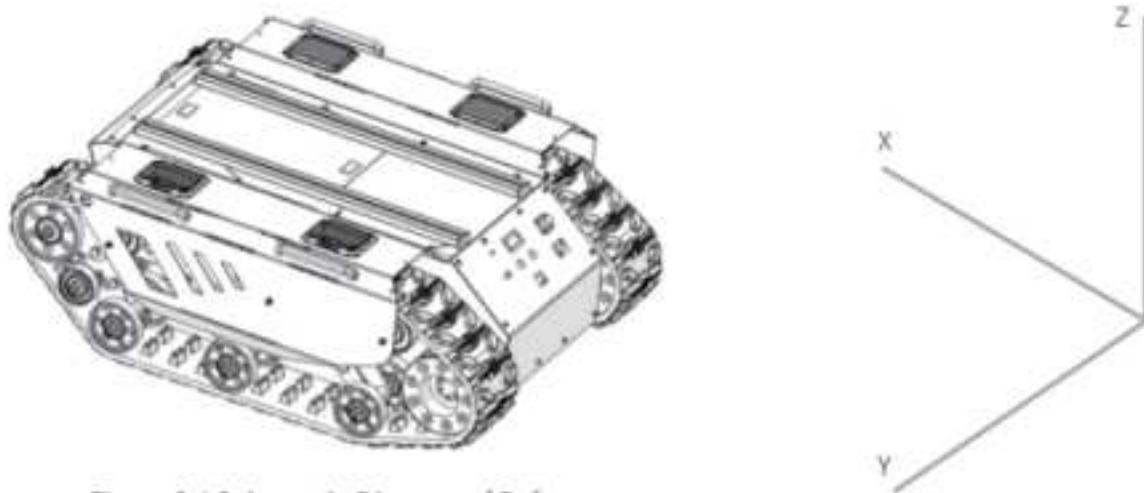


Figure 2.4 Schematic Diagram of Reference Coordinate System for Vehicle Body

As shown in Figure 2.4, the vehicle body of BUNKER is in parallel with X axis of the established reference coordinate system.

In RC control mode, push the remote control stick S1 forward to move in the positive X direction, push stick S1 backward to move in the negative X direction. When S1 is pushed to the maximum value, the movement speed in the positive X direction is the maximum, when S1 is pushed to the minimum value, the movement speed is the maximum in the negative direction of the X direction. The remote control stick S2 controls the rotation of the car body left and right. The remote control joystick S2 controls the rotation of the car body left and right. When S2 pushes the car body to the left, it rotates from the positive direction of the X axis to the positive direction of the Y axis. When S2 pushes the car body to the right, it rotates from the positive direction of the X axis to the negative direction of the Y axis. S2 When pushing to the left to the maximum value, the counterclockwise rotation speed is the maximum. When S2 is pushed to the right to the maximum value, the clockwise rotation speed is the maximum.

Following this convention, a positive linear velocity corresponds to the forward movement of the vehicle along positive x-axis direction and a positive angular velocity corresponds to positive right-hand rotation about the z-axis.

## 3 Getting Started

This section introduces the basic operation and development of the BUNKER platform using the CAN bus interface.

### 3.1 Use and operation

#### Check

- Check the condition of vehicle body. Check whether there are significant anomalies; if so, please contact the after-sale service personnel for support;
- Check the state of emergency stop switches. Make sure Q6 emergency stop button at the rear is released;
- For first-time use, check whether Q3 (drive power supply switch) on the rear panel has been pressed down; if so, please release it, and then the drive will be powered off;

#### Startup

- Press the key switch (Q2 on the electrical panel), and normally, the voltmeter will display correct battery voltage and front and rear lights will be both switched on;
- Check the battery voltage. If the voltage is higher than 48V, it means the battery voltage is correct; if the battery power level is low, please charge the battery;

#### Shutdown

- Press the key switch to cut off the power supply;

#### Emergency stop

- Press down emergency push button at the rear of BUNKER vehicle body;

#### Basic operating procedure of remote control

- After the chassis of BUNKER mobile robot is started correctly, turn on the RC transmitter and select the remote-control mode. Then, BUNKER platform movement can be controlled by the RC transmitter.

### 3.2 Charging

BUNKER is equipped with a standard charger by default to meet customers' recharging demand.

**The detailed operating procedure of charging is shown as follows:**

- Make sure the electricity of BUNKER chassis is powered off. Before charging, please make sure Q2 (key switch) in the rear control console is turned off;
- Insert the charger plug into Q3 charging interface on the rear control panel;
- Connect the charger to power supply and turn on the switch in the charger. Then, the robot enters the charging state.

### 3.3 Communication using CAN

BUNKER provides CAN interfaces for customization and development. Users can send command to control the chassis through the CAN interface.

BUNKER uses CAN2.0B communication standard with 500K baud rate and Motorola message format. The moving linear speed and the rotational angular speed of chassis can be controlled by CAN bus interface. The feedback of current motion status and chassis status would be provided from BUNKER simultaneously.

The protocol includes system status feedback frame, motion control feedback frame and control frame, please refer to the content as below for detail:

The system status feedback command provides the feedback about current status of the chassis, control mode status, battery voltage and system failure. The information is given in Table 3.1.

Table 3.1 Bunker Chassis Status Feedback Frame

Command Name	System Status Feedback Command			
Sending node	Receiving node	ID	Cycle(ms)	Receive-timeout(ms)
Steer-by-wire chassis	Decision-making control unit	0x211	200ms	None
Data length	0x08			
Position	Function	Data type	Description	

byte [0]	Current status of vehicle body	unsigned int8	0x00 Normal condition 0x01 Emergency stop 0x02 System Error
byte [1]	Mode control	unsigned int8	0x00 Stand by 0x01 CAN command control 0x03 Remote control
byte [2] byte [3]	Battery voltage upper 8 bits Battery voltage lower 8 bits	unsigned int16	Actual voltage × 10(with an accuracy of 0.1V)
byte [4]	Reserve	-	0x00
byte [5]	Failure Information	unsigned int8	Refer to Table3.2 Failure Information Description
byte [6]	Reserve	-	0x00
byte [7]	Count Parity bit (Count)	unsigned int8	0~255 Loops counting. Count is incremented once while single command sent every time

Table 3.2 Description of Failure Information

Description of Failure Information		
Byte	Bit	Meaning

byte [5]	bit [0]	Low-voltage failure
	bit [1]	Low-voltage warning
	bit [2]	Remote control signal lost protection(0: Normal 1: Lost signal)
	bit [3]	Drive 1 communication failure(0: Normal 1: Failure)
	bit [4]	Drive 2 communication failure(0: Normal 1: Failure)
	bit [5]	Reserve, default value 0
	bit [6]	Reserve, default value 0
	bit [7]	Reserve, default value 0

The motion control feedback frame includes the feedback of linear and angular speed of chassis. Please

refer to Table 3.3 for detail.

Table 3.3 Motion Control Feedback Frame

Command Name    Movement Control Feedback Frame				
Sending node	Receiving node	ID	Cycle(ms)	Receive-timeout(ms)
Steer-by-wire chassis	Decision-making control unit	0x221	20ms	None



Data length	0x08		
Position	Function	Data type	Description
byte [0] byte [1]	Moving speed upper 8 bits Moving speed lower 8 bits	signed int16	Actual speed X 1000 (with an accuracy of 0.001m/s)
byte [2] byte [3]	Rotation speed upper 8 bits Rotation speed lower 8 bits	signed int16	Actual speed X 1000 (with an accuracy of 0.001rad/s)
byte [4]	Reserved	-	0x00
byte [5]	Reserved	-	0x00
byte [6]	Reserved	-	0x00
byte [7]	Reserved	-	0x00

The motion control frame includes linear speed, angular speed and checksum. Please refer to Table 3.4 for detail.

Table 3.4 Motion Command Control Frame

Command Name	Motion Command Control Frame			
Sending node	Receiving node	ID	Cycle(ms)	Receive-timeout(ms)
Decision-making control unit	Chassis node	0x111	20ms	500ms
Data length	0x08			
Position	Function	Data type	Description	

byte [0] byte [1]	Linear velocity upper 8 byte  Linear velocitylower 8 byte	Signed int16	Linear moving speed mm/s(unit) Range[-1500,1500]
byte [2] byte [3]	Linear speed percentage Angular speed percentage	Signed int16	Rotation angular speed 0.001rad/s(unit) Range [-1000,1000]
byte [4]	Reserved	—	0x00
byte [5]	Reserved	—	0x00
byte [6]	Reserve	—	0x00
byte [7]	Reserve	—	0x00

[Note] Sample data, the following data is only for testing. (You need to set the control mode to command mode before testing)

1.The chassis moves forward at 0.15m/s.

byte [0]	byte [1]	byte [2]	byte [3]	byte [4]	byte [5]	byte [6]	byte [7]
0x00	0x96	0x00	0x00	0x00	0x00	0x00	0x00

2.The chassis steering 0.2rad

byte [0]	byte [1]	byte [2]	byte [3]	byte [4]	byte [5]	byte [6]	byte [7]
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0xC8

The control mode setting frame is used to set the terminal interface. Please refer to Table 3.5 for detail.

Table 3.5 Control Mode Setting Frame

Command		Control mode Frame		
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Decision-making control unit	Chassis node	0x421	20ms	500m/s
Data length	0x01			
Location	Function	Data type	Description	
byte [0]	CAN Command Mode	Unsigned int8	0x01 CAN Command mode 0x00 Stand by	

Note[1] Description for control mode

When the remote control is power off, the control mode of BUNKER is can command control by default , that means chassis can be controlled by commands directly. Please note that the control mode in command still need to set 0x01 if the speed command need to be executed successfully. If you power on the remote control, then the remote control has the highest priority, the chassis would switch the control mode based on remote control only.

The status clear frame is used to clear the system failures, please refer to table 3.6 for detail.

Table 3.6 Status Clear Frame

Command	Status Clear Frame			
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Key Unit	Chassis node		None	None
Data length	0x01	0x441		
Location	Function	Data type	Description	

byte [0]	Failures clear command	Unsigned int8	0x00 Clear all failures 0x01 Clear motor1 failures 0x02 Clear motor2 failures
----------	------------------------	---------------	-------------------------------------------------------------------------------------

In addition to the feedback of chassis status, there are also feedback data from the motors and sensors.

Table 3.7 Motor Rotational Speed Feedback Frame

Command Name	Motor Rotational Speed Feedback Frame			
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Decision-making control unit	Chassis node	0x251~0x254	20ms	None
Data length	0x08			
Position	Function	Data type		Description
byte[0] byte[1]	Motor rotational speed upper 8bits Motor rotational speed lower 8bits	signed int8		Motor rotational speed(RPM)
byte[2] -byte[7]	Reserve	--		0x00

Table 3.8 Motor Temperature, Voltage and Status Feedback Frame

Command Name	Motor Rotational Speed Feedback Frame			
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Steer-by-wire chassis	Decision-making control unit	0x261-0x264	None	None

Data length	0x08		
Location	Function	Data type	Description
byte [0]	Reserved	-	0x00
byte [1]	Reserved	-	0x00
byte [2] byte [3]	Drive temperature upper 8 bits Drive temperature lower 8 bits	Signed int 16	Unit: 1°C
byte [4]	Reserved	-	0x00
byte [5]	Drive status	Unsigned int 8	Refer to Table 3.9 for detail
byte [6]	Reserved	-	0x00
byte [7]	Reserved	-	0x00

Table 3.9 Drive Status Byte

Byte	Bit	Description
byte [5]	bit [0]	Low-voltage (0: Normal 1: Low)
	bit [1]	Motor over- temperature (0: Normal 1: Over-temperature)
	bit [2]	Reserved
	bit [3]	Reserved
	bit [4]	Reserved

	bit [5]	Reserved
	bit [6]	Reserved
	bit [7]	Reserved

Table 3.10 Odometer Feedback Frame

Command Name		Odometer Feedback Command		
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Steer-by-wire chassis	Decision-making control unit	0x311	20ms	None
Data length	0x08			
Location	Function	Data type	Description	
byte [0] byte [1] byte [2] byte [3]	Left wheel odometer highest bit  Left wheel odometer second highest bit  Left wheel odometer second lowest bit  Left wheel odometer lowest bit	Signed int 32	Left wheel odometer feedback (Unit: mm)	

byte [4]	Right wheel odometer highest bit	Signed int 32	Right wheel odometer feedback (Unit: mm)
byte [5]	Right wheel odometer second highest bit		
byte [6]	Right wheel odometer second lowest bit		
byte [7]	Right wheel odometer lowest bit		

Table 3.11 Remote Control Information Feedback Frame

Command Name	Remote Control Information Feedback Command			
Sending node	Receiving node	ID	Cycle (ms)	Receive-timeout(ms)
Steer-by-wire chassis	Decision-making control unit	0x311	20ms	None
Data length	0x08			
Location	Function	Data type	Description	

byte [0]	SW feedback	Unsigned int8	bit[0-1]: SWA : 2- Up 3-Down bit[2-3]: SWB : 2-Up 1-Middle 3-Down bit[4-5]: SWC : 2-Up 1-Middle 3-Down bit[6-7]: SWD: 2-Up 3-Down
byte [1]	Right joystick left and right	Signed int8	Range[-100,100]
byte [2]	Right joystick up and down	Signed int8	Range[-100,100]
byte [3]	Left joystick up and down	Signed int8	Range[-100,100]
byte [4]	Left joystick left and right	Signed int8	Range[-100,100]
byte [5]	Left knob VRA	Singed int8	Range[-100,100]

### 3.3.2 CAN Cable Connection

BUNKER ships with the vehicle and provides a male aviation plug as shown in Figure 3.2. The definition of the wires is: yellow is CANH, blue is CANL, red is the positive power supply, and black is the negative power supply.

**Note: In the current BUNKER version, only the tail interface is open to external expansion interfaces. The power supply in this version can provide a maximum current of 10A.**





Figure 3.2 Schematic diagram of aviation plug male connector

### 3.3.3 Implementation of CAN

Correctly start the chassis of BUNKER mobile robot, and turn on FS RC transmitter. Then, switch to the command control mode, i.e. toggling SWB mode of FS RC transmitter to the top. At this point, BUNKER chassis will accept the command from CAN interface, and the host can also parse the current state of chassis with the real-time data fed back from CAN bus. For the detailed content of protocol, please refer to CAN communication protocol.

## 3.4 Firmware upgrades

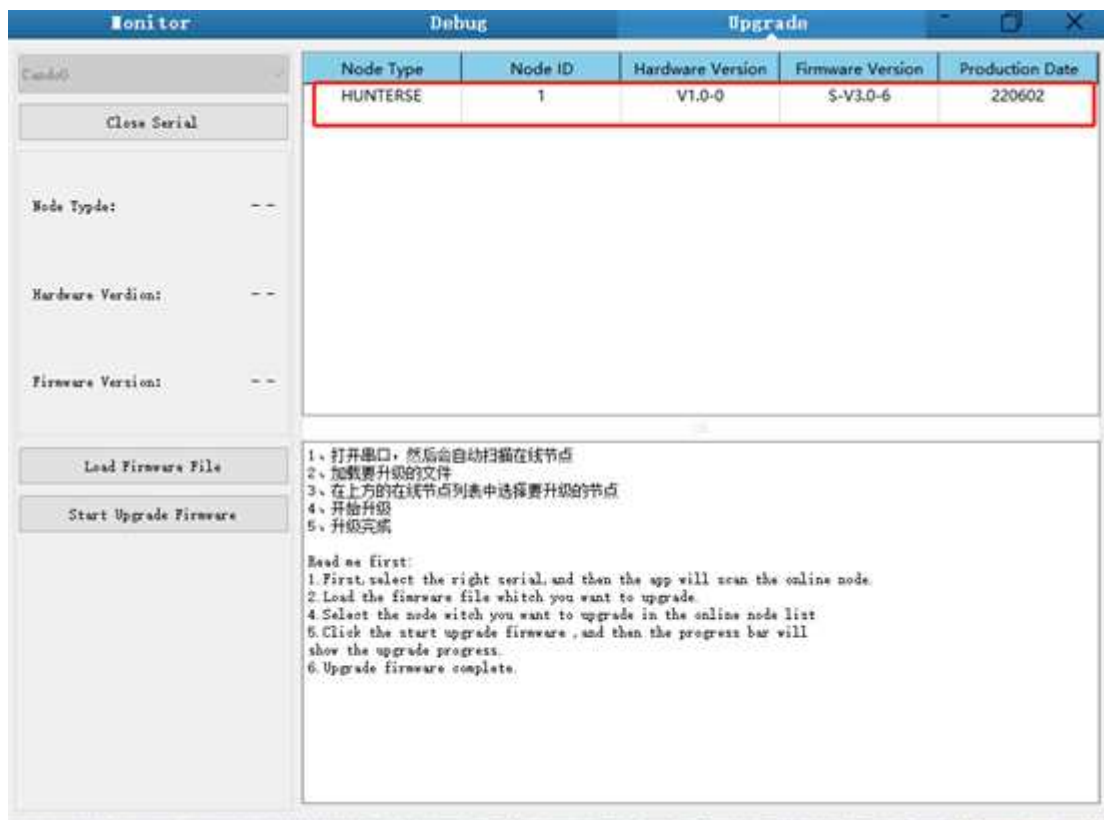
In order to facilitate users to upgrade the firmware version used by BUNKER and bring customers a more complete experience, BUNKER provides a firmware upgrade hardware interface and corresponding client software.

### Upgrade Preparation

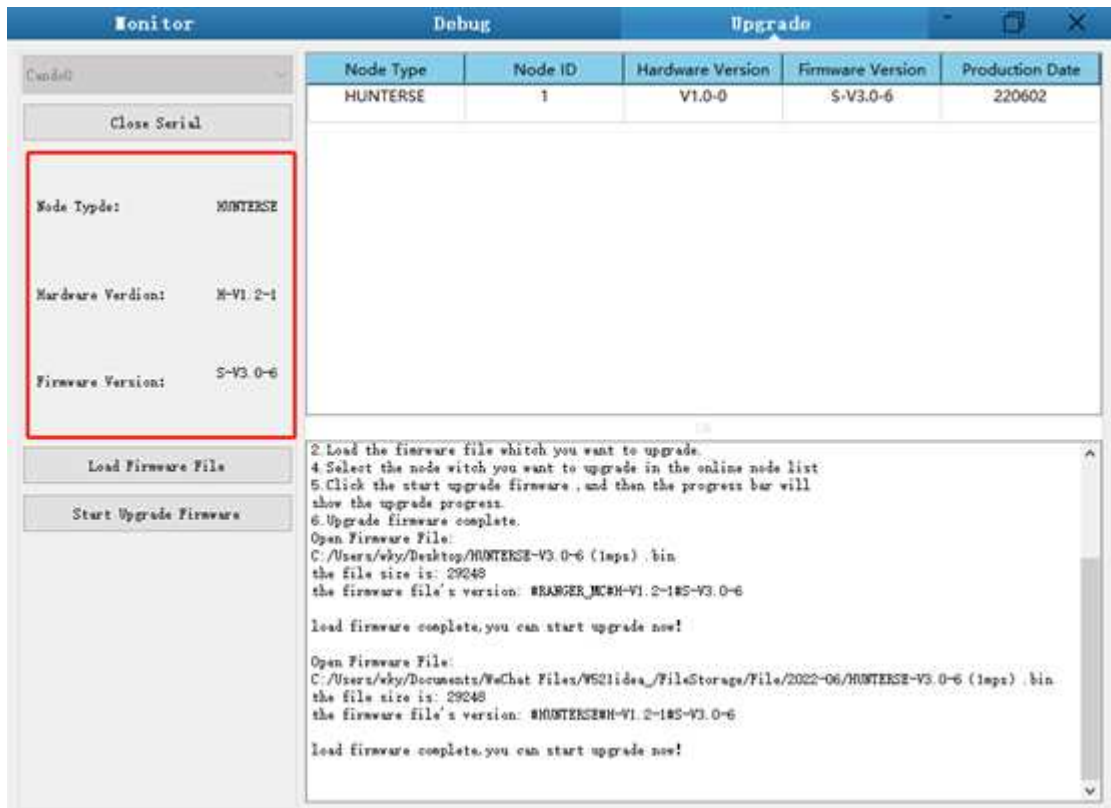
- Agilex CAN debugging module X 1
- Micro USB cable X 1
- BUNKER 2.0 chassis X 1
- A computer (WINDOWS OS (Operating System)) X 1

## Upgrade Process

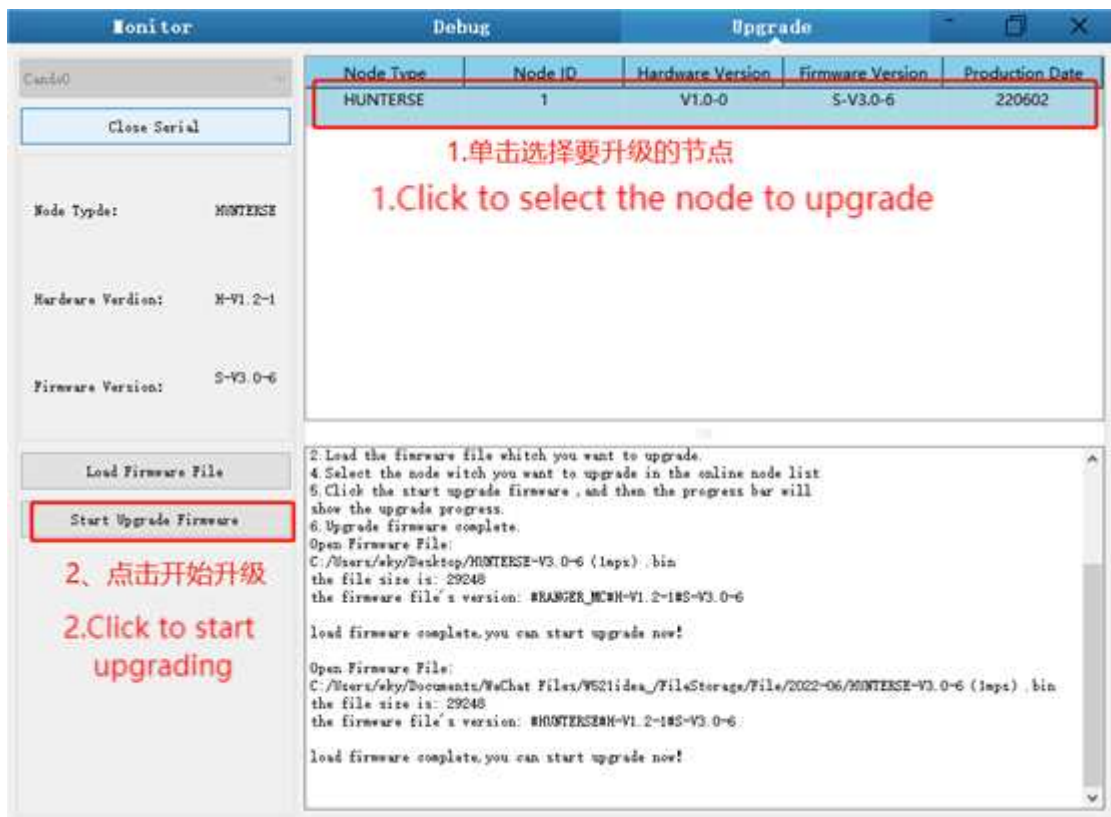
1. Plug in the USBTOCAN module on the computer, and then open the AgxCandoUpgradeToolV1.3\_boxed.exe software (the sequence cannot be wrong, first open the software and then plug in the module, the device will not be recognized).
2. Click the Open Serial button, and then press the power button on the car body. If the connection is successful, the version information of the main control will be recognized, as shown in the figure.

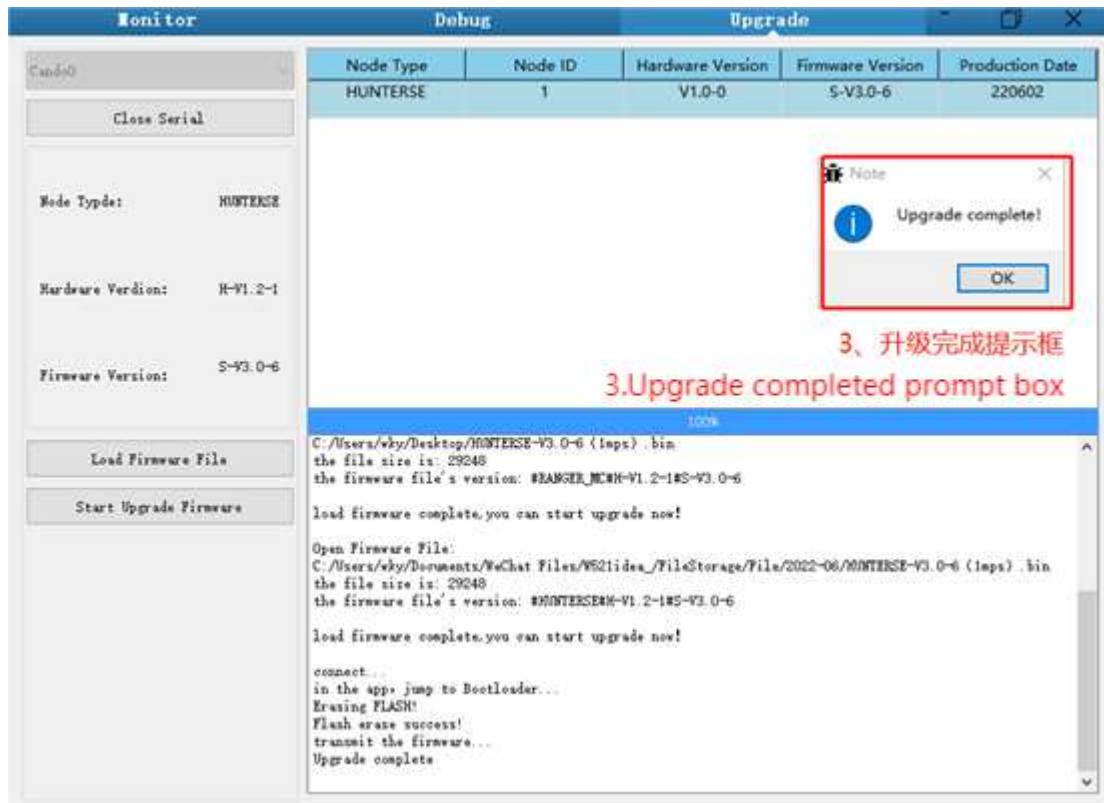


3. Click the Load Firmware File button to load the firmware to be upgraded. If the loading is successful, the firmware information will be obtained, as shown in the figure



4. Click the node to be upgraded in the node list box, and then click Start Upgrade Firmware to start upgrading the firmware. After the upgrade is successful, a pop-up box will prompt.





## 3.5 BUNKER ROS Package Use Example

ROS provide some standard operating system services, such as hardware abstraction, low-level device control, implementation of common function, interprocess message and data packet management. ROS is based on a graph architecture, so that process of different nodes can receive, and aggregate various information (such as sensing, control, status, planning, etc.) Currently ROS mainly support UBUNTU.

### Preparation

#### Hardware preparation

- CANlight can communication module ×1
- Thinkpad E470 notebook ×1
- AGILEX BUNKER mobile robot chassis ×1
- AGILEX BUNKER remote control FS-i6s ×1
- AGILEX BUNKER top aviation power socket ×1

#### Use example environment description

- Ubuntu 18.04

- ROS melodic
- Git

## Hardware connection and preparation

- Lead out the CAN wire of the BUNKER top aviation plug or the tail plug, and connect CAN\_H and CAN\_L in the CAN wire to the CAN\_TO\_USB adapter respectively;
- Turn on the knob switch on the BUNKER mobile robot chassis, and check whether the emergency stop switches on both sides are released;
- Connect the CAN\_TO\_USB to the usb point of the notebook. The connection diagram is shown in Figure 3.4.



Figure 3.4 CAN connection diagram

## ROS installation and environment setting

For installation details, please refer to

<http://wiki.ros.org/kinetic/Installation/Ubuntu>

## Test CANABLE hardware and CAN communication

Setting CAN-TO-USB adaptor

- Enable gs\_usb kernel module



复制代码

```
sudo modprobe gs_usb
```

- Setting 500k Baud rate and enable can-to-usb adaptor



复制代码

```
sudo ip link set can0 up type can bitrate 500000
```

- If no error occurred in the previous steps, you should be able to use the command to view the can device immediately

▼

复制代码

```
ifconfig -a
```

- Install and use can-utils to test hardware

▼

复制代码

```
sudo apt install can-utils
```

- If the can-to-usb has been connected to the BUNKER robot this time, and the car has been turned on, use the following commands to monitor the data from the BUNKER chassis

▼

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```
candump can0
```

Please refer to:

[1] [https://github.com/agilexrobotics/agx\\_sdk](https://github.com/agilexrobotics/agx_sdk)

[2] [https://wi-ki.rdu.im/\\_pages/Notes/Embedded-System/Linux/-can-bus-in-linux.html](https://wi-ki.rdu.im/_pages/Notes/Embedded-System/Linux/-can-bus-in-linux.html)

## AGILEX BUNKER ROS PACKAGE download and compile

- Download ros package

▼

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```
sudo apt install ros-$ROS_DISTRO-teleop-twist-keyboard
sudo apt install ros-$ROS_DISTRO-joint-state-publisher-gui
sudo apt install ros-$ROS_DISTRO-ros-controllers
sudo apt install ros-$ROS_DISTRO-webots-ros
sudo apt install libasio-dev
```

- Clone compile bunker\_ros code

▼

复制代码

```
cd ~/catkin_ws/src
git clone https://github.com/agilexrobotics/bunker_ros.git
git clone https://github.com/agilexrobotics/agx_sdk.git
cd ~/catkin_ws
catkin_make
```

Please refer to: [https://github.com/agilexrobotics/bunker\\_ros](https://github.com/agilexrobotics/bunker_ros)

## Start the ROS node

- Start the based node

▼

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```
roslaunch bunker_bringup bunker_robot_base.launch
```

- Start the keyboard remote operation node

▼

📄 复制代码

```
roslaunch bunker_bringup bunker_teleop_keyboard.launch
```

Github ROS development package directory and usage instructions

\*\_base:: The core node for the chassis to send and receive hierarchical CAN messages. Based on the communication mechanism of ros, it can control the movement of the chassis and read the status of the bunker through the topic.

\*\_msgs: Define the specific message format of the chassis status feedback topic.

\*\_bringup: startup files for chassis nodes and keyboard control nodes, and scripts to enable the usb\_to\_can module

## 4 Q&A

**Q: BUNKER is started up correctly, but why cannot the RC transmitter control the vehicle body to move?**

A: First, check whether the drive power supply is in normal condition, whether the drive power switch is pressed down and whether E-stop switches are released; then, check whether the control mode selected with the top left mode selection switch on the RC transmitter is correct.

**Q:BUNKER remote control is in normal condition, and the information about chassis status and movement can be received correctly, but when the control frame protocol is issued, why cannot the vehicle body control mode be switched and the chassis respond to the control frame protocol?**

A:Normally, if BUNKER can be controlled by a RC transmitter, it means the chassis movement is under proper control; if the chassis feedback frame can be accepted, it means CAN extension link is in normal condition. Please check the CAN control frame sent to see whether the data check is correct and whether the control mode is in command control mode.

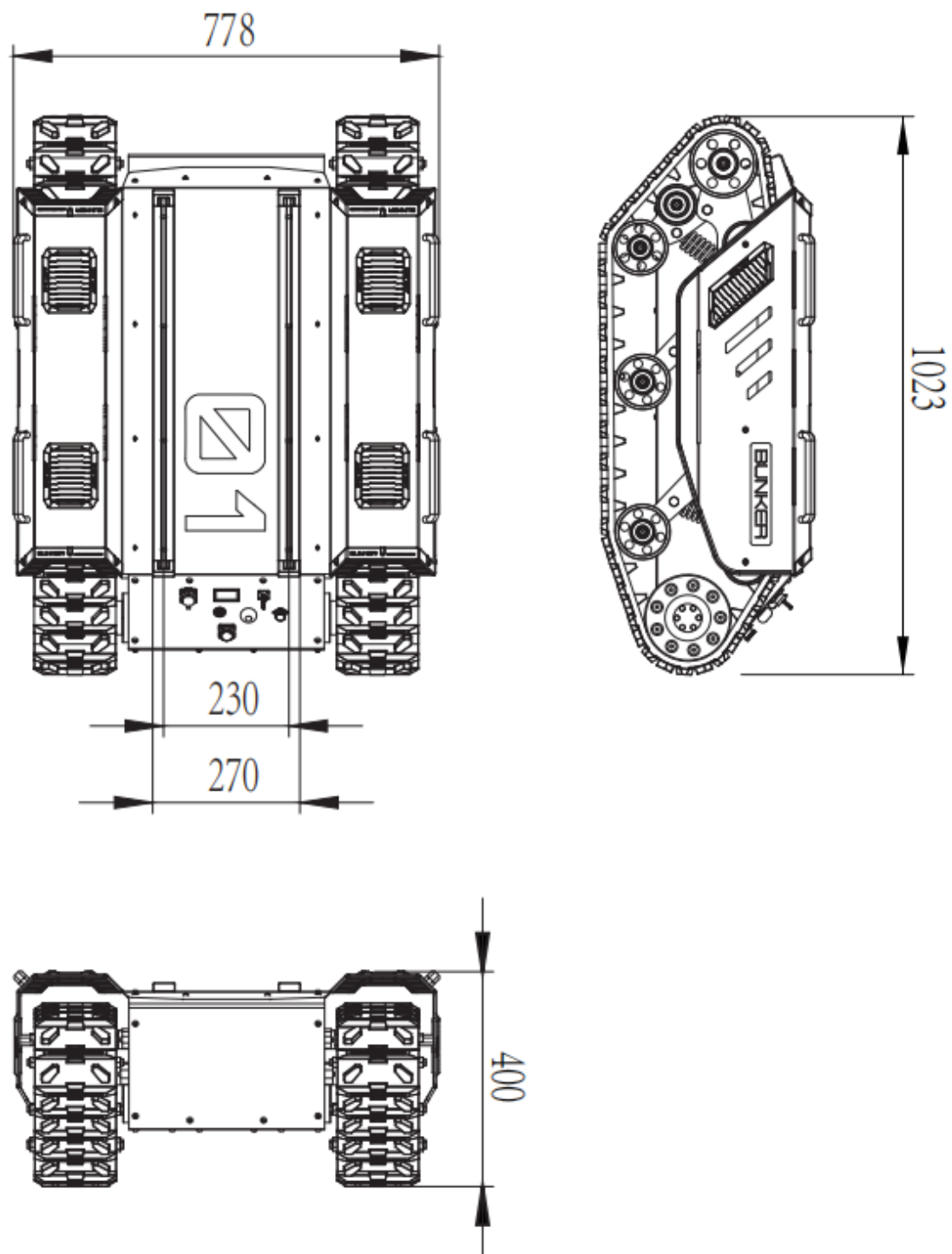
**Q:When communication is implemented via CAN bus, the chassis feedback command is issued correctly, but why does not the vehicle respond to the control command?**

A:There is a communication protection mechanism inside BUNKER, which means the chassis is provided with timeout protection when processing external CAN control commands. Suppose the vehicle receives one frame of communication protocol, but it does not receive the next frame of control command after 500ms. In this case, it will enter communication protection mode and set the speed to 0. Therefore, commands from upper computer must be issued periodically.

## **5 Product Dimensions**

### **5.1 Product outline dimension illustration**





## 5.2 Top expansion stent size description diagram

