BUNKER MINI

AgileX Robotics Team

User Manual V.1.0.0 2022.3

This chapter contains important safety information that must be read and understood by any individual or organization before using the equipment when the robot is powered on for the first time. You can contact us at support@agilex.ai if you have any questions about usage. It is very important that all assembly instructions and guidelines in other chapters of this manual are followed and implemented. Particular attention should be paid to text associated with warning signs.

⚠ Safety Information

The information in this manual does not include the design, installation and operation of a complete robotic application, nor does it include any peripherals that may affect the safety of this complete system. The design and use of this complete system requires compliance with the safety requirements established in the standards and specifications of the country where the robot is installed.

It is the responsibility of BUNKERMINI's integrators and end customers to ensure compliance with relevant specifications and effective laws and regulations, so as to ensure that there are no major hazards in the complete robot application example. This includes but is not limited to the following:

1.Validity and Responsibility

- Make a risk assessment of the complete robot system.
- Link together the additional safety equipment for other machinery as defined by the risk assessment.。
- Confirm that the design and installation of the peripherals of the complete robot system, including software and hardware systems, are accurate.
- This robot does not have relevant safety functions of a complete autonomous mobile robot, including but not limited to automatic anti-collision, anti-falling, biological approach warning, etc. These functions require integrators and end customers to conduct safety assessments in accordance with relevant rspecifications and effective laws and regulations, so as to ensure that the developed robot does not have any major dangers and safety hazards in practical applications.
- Gather all documents in the technical file: including the risk assessment and this manual.
- Be aware of possible safety risks before operating and using the equipment.

2.Environment

- When using it for the first time, please read this manual vehicleefully to understand the basic operation contents and operation specifications.
- For remote operation, choose a relatively open area for use, and the vehicle itself does not have any automatic obstacle avoidance sensors.
- Use in an ambient temperature of -10℃~45℃.
- The waterproof and dustproof capability of the vehicle is IP67, and the test conditions are: (1) no flowing clean water, with a water depth of 1 meter; (2) the test time is 30 minutes.

3.Inspection

- Make sure that each device has sufficient power.
- Make sure there is no obvious abnormality in the vehicle.
- Check that the remote control's batteries are fully charged.
- Make sure the emergency stop switch has been released when in use.

4.Operation

- Ensure that the surrounding area is relatively empty during operation.
- Remote control within sight distance.
- When installing an external extension on BUNKER MINI, confirm the centroid position of the extension and make sure it is at the center of rotation.
- The maximum load of BUNKER MINI is 35KG. When in use, make sure the payload does not exceed 35KG.
- When the equipment is abnormal, please contact the relevant technical personnel, and do not handle it without authorization.
- Please use the equipment in an environment that

- Please charge in time when the device voltage is lower than 24V.
- When the equipment is abnormal, please stop using it immediately to avoid secondary injury.

meets the protection class requirements according to its IP protection class.

- Do not push the vehicle directly.
- When charging, make sure the ambient temperature is greater than 0°C.

5.Maintenance

- Regularly check the tension of the crawler, and tighten the crawler every 100~150H of operation.
- After every 200 hours of operation, it is necessary to check the fastening of bolts and nuts of various parts of the vehicle body, and tighten them immediately if they are loose.
- In order to ensure the storage capacity of the battery, the battery should be stored with electricity, and it should be charged regularly when not in use for a long time.

目录

1 Introduction of BUNKER MINI

BUNKER MINI is an all-round tracked chassis vehicle for industrial applications. It is featured with simple and sensitive operation, large development space, adaptability to development and application in various fields, IP67 dustproof and waterproof, and great gradeability, etc. It can be used for the development of special robots such as inspection and exploration, EOD rescue, special shooting, and special transport, and is a solution to robot movement.

1.1 Product List

Name	Quantity
BUNKER MINI robot body	x1
Battery charger (AC 220V)	x1
Aviation plug male（4Pin）	x1
FS remote control (optional)	x1
USB to RS232	x1
USB to CAN communication module	x1

1.2 Performance parameters

Parameter type	Item	Item
Size	Dimensions	660mm*584mm*286mm
	Chassis height	65.5mm
	Track width	100mm
	Ground length	670mm
Weight	Weight	约 54kg
	Load	25kg
Battery	Type	Lithium battery
	Capacity	30AH
	Voltage	24V
Performance parameters	Max.gradeability	30°
	Maximum speed	1.5m/s
	Minimum turning radius	Can rotate in place
	Maximum obstacle clearance	115mm
	Motor parameters	2×250W DC brush motor
	Code wheel parameters	1024 line
	Operating temperature	-10~45℃
	Reduction ratio	23.2：1
Control parameters	Control Mode	遥控控制
	Remote Control	2.4G /critical distance200m
	Communication interface	CAN

1.3 Required for development

BUNKER MINI is equipped with FS remote control from the factory, through which users can control the chassis of the BUNKER MINI mobile robot to complete the movement and rotation operations. Besides, BUNKER MINI is equipped with a CAN interface, through which users can conduct secondary development.

2 The Basics

This part will give a basic introduction to the BUNKER MINI mobile robot chassis, so that users and developers can have a basic understanding of BUNKER MINI chassis.

2.1 Electrical interface description

The rear electrical interface is shown in Figure 2.1, in which Q1 is the emergency stop switch, Q2 is the power switch, Q3 is the power display interaction, Q4 is the charging interface, and Q5 is the CAN and 24V power aviation interface.

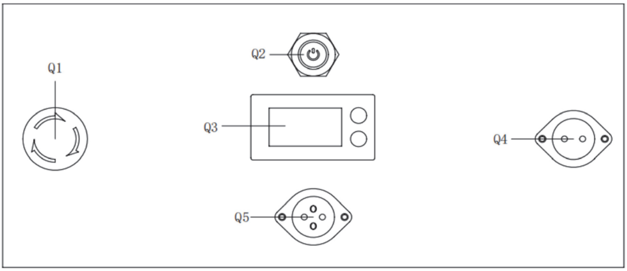
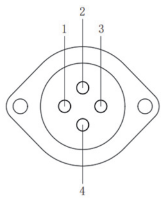


Figure2.1 Rear electrical interface

The definition of the communication and power interface of Q5 is shown in Figure 2-2.



Pin No.	Pin Type	Function and Definition	Remarks
1	Power	VCC	Positive power supply, voltage range 46~54v, maximum current 10A
2	Power	GND	Negative power supply
3	CAN	CAN_H	CAN bus high
4	CAN	CAN_L	CAN bus low

Figure 2.2 Pin definition diagram of the rear aviation extension interface

2.2 Remote control instructions

FS remote control is an optional accessory for BUNKER MINI products. Customers can choose it according to their actual needs, and can easily control BUNKER MINI universal robot chassis by using the remote control. In this product, we adopt the design of the left-hand accelerator. See Figure 2.3 for its definition and functions.

Figure 2.3 Schematic diagram of FS remote control buttons

The functions of the button are defined as: SWA and SWD are temporarily disabled. SWB is the control mode selection button, turning to the command control mode when pushed to the top, and the remote control mode when pushed to the middle. SWC is the lamp mode button, which is pushed to the top for the lights-normally-on mode, the middle for the lights-on mode when the vehicle is moving, and the bottom for the lights-normally-off mode. S1 is the accelerator button, which controls BUNKER MINI to move forward and backward; S2 controls the rotation, and POWER is the power button. Press and hold at the same time to turn on the remote control. It should be noted that SWA, SWB, SWC, and SWD need to be at the top when the remote control is turned on.

2.3 Control command and motion description

We establish the coordinate reference frame of the ground mobile vehicle according to the ISO 8855 standard as shown in Figure 2.4.

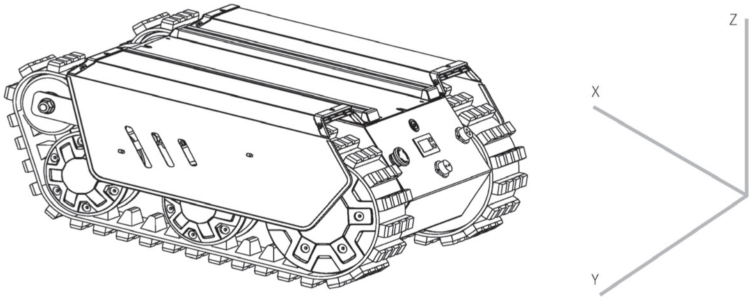


Figure 2.4 Schematic diagram of the vehicle body reference frame

As shown in 2.4, the BUNKER MINI body is parallel to the X-axis of the established reference frame.

In the remote control mode, the remote control joystick S1 moves in the positive direction of X when pushed forward, and moves in the negative direction of X when pushed backward. When S1 is pushed to the maximum value, the movement speed in the positive direction of X is the largest, and when pushed to the minimum value, the movement speed in the negative direction of the X direction is the largest. The remote control joystick S2 controls the rotation of the vehicle body left and right. When S2 is pushed to the left, the vehicle body rotates from the positive direction of the X axis to the positive direction of the Y axis. When S2 is pushed to the right, the vehicle body rotates from the positive direction of the X axis to the negative direction of the Y axis. When S2 is pushed to the left to the maximum value, the linear velocity of counterclockwise rotation is the largest, and when it is pushed to the right to the maximum value, the linear velocity of the clockwise rotation is the largest.

In the control command mode, the positive value of the linear velocity means moving in the positive direction of the X-axis, and the negative value of the linear velocity means moving in the negative direction of the X-axis. The positive value of the angular velocity means that the vehicle body moves from the positive direction of the X-axis to the positive direction of the Y-axis, and the negative value of the angular velocity means that the vehicle body moves from the positive direction of the X axis to the negative direction of the Y axis.

3 Getting Started

This part mainly introduces the basic operation and use of the BUNKER MINI platform, and introduces how to carry out the secondary development of the vehicle body through the external CAN port and the CAN bus protocol.

3.1 Use and operation

Check

- Check the vehicle body condition. Check whether there is any obvious abnormality in the vehicle body; if so, please contact after-sales support;
- Check the emergency stop switch status. Confirm that the Q1 emergency stop button at the rear is in a released state;
- When using for the first time, confirm whether Q2 (power switch) in the rear electrical panel is pressed; if so, please press and release it, and it will be in a released state

Start up

- Press the power switch (Q2 in the electrical panel), under normal circumstances, the light of the power switch will be on, and the voltmeter will display the battery voltage normally;
- Check the battery voltage. If the voltage is greater than 24V, it indicates that the battery voltage is normal. If it is less than 24V, the battery is low, please charge it;

Power off

- Press the power switch to cut off the power;

Emergency stop

- Press the emergency stop switch at the rear of the BUNKER MINI body;

Basic operation process of remote control

- After the BUNKER MINI robot chassis is started normally, turn on the remote control and select the control mode as the remote control mode, so that the motion of BUNKER MINI platform can be controlled by the remote control.

3.2 Charging

BUNKER MINI products are equipped with a standard charger by default, which can meet the charging needs of customers.

The specific operation process of charging is as follows:

- Make sure that the BUNKER MINI chassis is in a power-off state. Before charging, please confirm that Q2 (power switch) in the rear electrical console is turned off;
- Insert the plug of the charger into the Q4 charging interface in the rear electrical control panel;
- Connect the charger to the power supply and turn on the charger switch to enter the charging state.
- When charging by default, there is no indicator light on the chassis. Whether it is charging or not depends on the status indication of the charger.

3.3 Development

BUNKER MINI products provide a CAN interface for users' development, through which users can command and control the vehicle body.

BUNKER MINI products adopt CAN2.0B standard for the CAN communication standard, with the communication baud rate of 500K and the message format of MOTOROLA. The moving linear velocity and

rotating angular velocity of the chassis can be controlled through the external CAN bus interface. Besides, BUNKER MINI will feedback the current motion state information and the state information of the BUNKER MINI chassis in real time, etc.
The protocol includes a system state feedback frame, a motion control feedback frame, and a control frame. The details of the protocol are as follows:

The system state feedback command includes current vehicle body state feedback, control mode state feedback, battery voltage feedback and fault feedback. The protocol contents are shown in Table 3.1.

Table 3.1 BUNKER MINI Chassis State Feedback Frame

Command name	System state feedback command			
Sending node	Receiving Node	ID 0x211	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit		200ms	None
Data length	0x08			
Location	Function	Data Type	Description	
byte [0]	Current vehicle body state	unsigned int8	0x00 System normal 0x01 Emergency shut-down mode 0x02 System exception	
byte [1]	Mode control	unsigned int8	0x00 Standby mode 0x01 CAN command control mode 0x03 Remote control mode	
byte [2] byte [3]	The upper eight bits of battery voltage The lower eight bits of battery voltage	unsigned int16	Actual voltage X10 (accurate to 0.1V)	
byte [4]	Reserved	-	0x0	
byte [5]	Fault information	unsigned int8	For details, see [Fault Information Description]	
byte [6]	Reserved	-	0x00	
byte [7]	Count check(count)	unsigned int8	0~255 loop count, count up once every time a command is sent	

Table 3.2 Explanation table of fault information

Fault information description		
Byte	Bit	Meaning
byte [5]	bit [0]	Battery undervoltage fault
	bit [1]	Battery undervoltage warning
	bit [2]	Remote control disconnection protection（0: normal, 1: remote control disconnection）
	bit [3]	Reserved, default 0
	bit [4]	Drive 2 communication fault (0: no fault, 1: fault)
	bit [5]	Drive 3 communication fault (0: no fault, 1: fault)
	bit [6]	Reserved, default 0
	bit [7]	Reserved, default 0

The motion control feedback frame command includes the feedback of current vehicle body's motion linear velocity and motion angular velocity. The specific content of the protocol is shown in Table 3.3.

Table 3.3 Motion Control Feedback Frame

Command name	Motion control feedback command			
Sending Node	Receiving Node	ID	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit	0x221	20ms	None
Data length	0x08			
Location	Function	Data Type	说明	
byte [0]	The upper eight bits of the movement speed	signed int16	Actual speed X 1000 (accurate to 0.001m/s)	
byte [1]	The lower eight bits of the movement speed			
byte [2]	The upper eight bits of the rotation speed	signed int16	Actual speed X 1000 (accurate to 0.001rad/s)	
byte [3]	The lower eight bits of the rotation speed			
byte [4]	Reserved	-	0x00	
byte [5]	Reserved	-	0x00	
byte [6]	Reserved	-	0x00	
byte [7]	Reserved	-	0x00	

The control frame includes the linear velocity control opening, the angular velocity control opening and the checksum. The specific protocol content is shown in Table 3.4.

Table 3.4 Motion Control Command Control Frame

Command name	Control command			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Decision control unit	Chassis node	0x111	20ms	None
Data length	0x08			
Position	Function	Data Type		
byte [0]	The upper eight bits of the linear velocity	signed int16	Travel speed of the vehicle body, unit mm/s, value range [-1500, 1500]	
byte [1]	The lower eight bits of the linear velocity			
byte [2]	The upper eight bits of the angular velocity	signed int16	Rotational angular velocity of the vehicle body, unit 0.001rad/s, value range [-1000, 1000]	
byte [3]	The lower eight bits of the angular velocity			
byte [4]	Reserved	—	0x00	
byte [5]	Reserved	—	0x00	
byte [6]	Reserved	—	0x00	
byte [7]	Reserved	—	0x00	

The mode setting frame is used to set the control interface of the terminal, and its specific protocol content is shown in Table 3.5

Table 3.5 Control Mode Setting Frame

Command name	Control mode setting command			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Decision control unit	Chassis node	0x421	20ms	500ms
Data length	0x01			
Position	Function	Data type	Description	
byte [0]	CAN control enabling	unsigned int8	0x00 Standby mode 0x01 CAN command mode enabling	

Note[1] Control mode description

When the remote control for BUNKER MINI is not turned on, the default control mode is the standby mode, and you need to switch to the command mode to send the motion control command. If the remote control is turned on, it has the highest authority and can block the control of commands. When the remote control switches to the command mode, it still needs to send the control mode setting command before responding to the speed command.

The state setting frame is used to clear system errors, and its specific protocol content is shown in Table 3.6.

Table 3.6 State setting frame

Command name	State setting command			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Decision control unit	Chassis node	0x441	None	None
Data length	0x01			
Position	Function	Data type	Description	
byte [0]	Error clearance command	unsigned int8	0x00 Clear all errors 0x01 Clear motor 1 error 0x02 Clear motor 2 error	

Note 3: Example data, the following data is for testing use only

1. The vehicle moves forward at a speed of 0.15/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 vehicle rotates at 0.2RAD/S

byte [0]	byte [1]	byte [2]	byte [3]	byte [4]	byte [5]	byte [6]	byte [7]
0x00	0x00	0x00	0xc8	0x00	0x00	0x00	0x00

In addition to the feedback of the chassis state information, the chassis feedback information also includes motor data and sensor data

Table 3.7 Feedback of motor speed current position information

Command name	Motor driver high-speed information feedback frame			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit	0x251~0x254	20ms	None
Data length	0x08			
Position	Function	Data type	Description	
byte [0]	The upper eight bits of motor speed	signed int16	Current Motor speed unit RPM	
byte [1]	The lower eight bits of motor speed			
byte [2]	The upper eight bits of motor current	signed int16	Current motor current unit 0.1A	
byte [3]	The lower eight bits of motor current			
byte [4]	The current position of the motor is the highest	signed int16	The current position of the motor Unit: number of pulses	
byte [5]	The current position of the motor is the second highest	signed int16		
byte [6]	The current position of the motor is the second lowest	signed int16		
byte [7]	The current position of the motor is the lowest	signed int16		

Table 3.8 Feedback of motor temperature, voltage and state information

Command name	Motor driver low-speed information feedback frame			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit	0x261~0x264	20ms	None
Data length	0x08			
Position	Function	Data type	Description	
byte [0]	The upper eight bits of driver voltage	signed int16	Current driver voltage unit0.1v	
byte [1]	The lower eight bits of driver voltage			
byte [2]	The upper eight bits of driver temperature	signed int16	unit 1℃	
byte [3]	The lower eight bits of driver temperature			
byte [4]	Motor temperature	signed int8	unit1℃	
byte [5]	Actuator state	unsigned int8	See Table 3-9 for details	
byte [6]	Reserved	-	0x00	
byte [7]	Reserved		0x00	

Table 3.9 Actuator sate

Fault information description		
byte [5]	bit [0]	Whether the power supply voltage is too low (0: normal 1: too low)
	bit [1]	Whether the motor is over-temperature (0: normal 1: over-temperature)
	bit [2]	Whether the motor is over-current (0: normal 1: over-current)
	bit [3]	Whether the drive is over-temperature (0: normal 1: over-temperature)
	bit [4]	Sensor state (0: normal 1: abnormal)
	bit [5]	Actuator error state (0: normal 1: abnormal)
	bit [6]	Actuator enabling state (0: Disabling 1: Enabling)
	bit [7]	Reserved

Table 3.10 Odometer Feedback Frame

Command name	Odometer information feedback frame			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit	0x311	20ms	None
Data length	0x08			
Position	Function	Data type	Description	
byte [0]	The highest bit of the left wheel odometer	signed int32	The odometer feedback of the left wheel of the chassis Unit：mm	
byte [1]	The second highest bit of the left wheel odometer			
byte [2]	The second lowest bit of the left wheel odometer			
byte [3]	The lowest bit of the left wheel odometer			
byte [4]	The highest bit of the right wheel odometer	signed int32	The odometer feedback of the right wheel of the chassis Unit：mm	
byte [5]	The second highest bit of the right wheel odometer			
byte [6]	The second lowest bit of the right wheel odometer			
byte [7]	The lowest bit of the right wheel odometer			

Table 3.11 Remote control information feedback

Command name	Remote control information feedback frame			
Sending node	Receiving node	ID	Cycle（ms）	Receiving Timeout (ms)
Wire-controlled chassis	Decision control unit	0x241	20ms	None
Data length	0x08			
Position	Function	Data type	Description	
byte [0]	Remote control SW feedback	unsigned int8	bit[0-1]: SWA ：2-up 3-down bit[2-3]: SWB：2-up 1-mid 3-down bit[4-5]: SWC：2-up 1-mid 3-down bit[6-7]: SWD：2-up 3-down	
byte [1]	Right joystick left and right	signed int8	Value range：[-100,100]	
byte [2]	Right joystick up and down	signed int8	Value range：[-100,100]	
byte [3]	Left joystick up and down	signed int8	Value range：[-100,100]	
byte [4]	Left joystick left and right	signed int8	Value range：[-100,100]	
byte [5]	Left knob VRA	signed int8	Value range：[-100,100]	
byte [6]	Reserved	--	0x00	
byte [7]	Count check	unsigned int8	0-255 loop count	

3.3.2 CAN line connection

BUNKER MINI provides an aviation plug male as shown in Figure 3.2. The definition of the line is that the yellow is CANH, the blue is CANL, the red is the positive power supply, and the black is the negative power supply.

Note: The current BUNKER MINI version only has the top interface open to the external extension interface. The power supply in this version can provide a maximum current of 10A.

Figure 3.2 Schematic diagram of aviation plug male

3.3.3 Realization of CAN command control

Start the BUNKER MINI mobile robot chassis normally, turn on the FS remote control, and then switch the control mode to command control, that is,push the SWB mode selection button of the FS remote control to the top, then the BUNKER MINI chassis will accept the command from the CAN interface, and the host also analyze the current chassis status through the real-time data fed back by the CAN bus. Refer to the CAN communication protocol for the specific protocol content

3.4 Use and operation

In order to facilitate users to upgrade the firmware version of BUNKER MINI and bring to customers more perfect experience, BUNKER MINI provides the hardware interface for firmware upgrade and the corresponding client software. Its client interface is shown in Figure 3.3.

Upgrade preparation

- Serial X 1 USB to serial port X 1
- BUNKER MINI chassisX 1
- PC(WINDOWS operating system) X 1

Firmware upgrade software

- https://github.com/agilexrobotics/agilex_firmware

Upgrade preparation

- Ensure that the robot chassis power is off before connection;
- Use the Serial to connect to the BUNKER MINI chassis to upgrade the serial port, and connect it to the computer;
- Open the client software;
- select the port number;
- BUNKER MINIchassis is powered on, click Start Connection immediately, (BUNKER MINI) chassis will wait for 6S before power-on; if the time exceeds 6S, it will enter the application);if the connection is successful, it will prompt "connection successful" in the text box;
- Load BIN file;
- Click on upgrade and wait for the prompt that the upgrade is complete; Disconnect the Serial, power off the chassis, and power it on again.

Figure 2.4 Schematic diagram of the vehicle body reference frame

3.5 BUNKER MINI ROS Package Usage Example

ROS provides some standard operating system services, such as hardware abstraction, low-level device control, implementation of common functions, inter-process messaging, and data packet management. ROS is based on a graphical architecture, so that processes of different nodes can receive, publish, and aggregate various information (such as sensing, control, state, planning, etc.). Currently ROS mainly supports UBUNTU.

Development preparation

Hardware preparation

- CANlight can communication module X1
- Thinkpad E470 Laptop X1
- AGILEX BUNKER MINI mobile robot chassis X1
- AGILEX BUNKER MINI supporting remote control FS-i6s X1
- AGILEXBUNKER MINI top aviation receptacle X1

Environment description of usage example

- Ubuntu 16.04 LTS（this is a beta version, tested on Ubuntu 18.04 LTS）
- ROS Kinetic（also tested in subsequent versions）
- Git

Hardware connection and preparation

- Pull out the CAN line of the BUNKER MINI 4-core aviation or rear plug, and connect the CAN_H and CAN_L in the CAN line to the CAN_TO_USB adapter respectively;
- Turn on the chassis knob switch of the BUNKER MINI mobile robot, and check whether the emergency stop switches on both sides are released;
- Connect CAN_TO_USB to the USB port of the laptop. The connection diagram is shown in Figure 3.4.

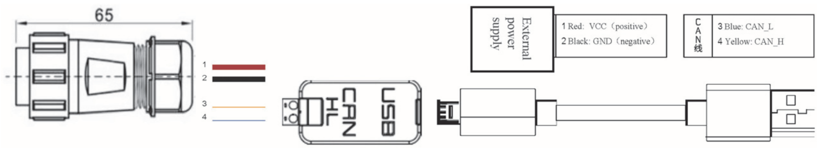


Figure 3.4 CAN line connection diagram

ROS Installation and Environment Setup

- For installation details, please refer to http://wiki.ros.org/kinetic/Installa- tion/Ubuntu

Test CANABLE hardware and CAN communication

Set up CAN-TO-USB

- adapter Enabling
  gs_usb kernel module
  $ sudo modprobe gs_usb
- Set 500k baud rate 和 Enabling can-to-usb adapter
  $ sudo ip link set can0 up type can bitrate 500000If
- no errors occurred in the previous steps, you should be able to view the can device immediately with the command
  $ ifconfig -a
- Install and use can-utils to test hardware
  $ sudo apt install can-utils
- If the can-to-usb has been connected to the BUNKER robot this time, and the vehicle is powered on, use the following commands to monitor the data from the BUNKERchassis
  $ candump can0
  Reference：
- [1]https://github.com/agilexrobotics/agx_sdk
  [2]https://wiki.rdu.im/_pages/Notes/Embed-ded-System/Linux/can-bus-in-linux.html

AGILEX BUNKER ROS PACKAGE Download and compile

- Download ros dependencies
  $ sudo apt install
  ros-$ROS_DISTRO-teleop-twist-key- board
  $ sudo apt install libasio-dev
- Clone and compile the bunker_ros source code
  $ cd ~/catkin_ws/src
  $ git clone --recursive
  https://github.com/agilexrobotics/ ugv_sdk.git
  $ git clone
  https://github.com/agilexrobotics/bunker_
  ros.git
  $ cd ..
  $ catkin_make
  Reference：
  https://github.com/agilexrobotics/bunker_ros

Start the ROS node

- Start the base node
  $ roslaunch bunker_bringup
  bunker_minimal.launch Start the keyboard
  remote operation node
- $ roslaunch bunker_bringup
  bunker_teleop_keyboard.launch

4 Attention

This part contains some points that should be paid attention to when using and developing BUNKER MINI.

4.1 Battery precautions

- The battery of the BUNKER MINI product is not fully charged when it leaves the factory. The specific battery power can be displayed by the BUNKER MINI chassis rear voltage display or read through the CAN bus communication interface;
- Please do not charge the battery after the it is exhausted. Please charge it in time when the low voltage at the rear of the BUNKER MINI shows below 24V;
- Static storage conditions: The best storage temperature is -10℃~45℃. The battery should be charged and discharged once a month or so when it is not in use, and then the battery should be stored at full voltage. Do not put the battery into fire, or heat the battery, and do not store the battery at high temperature;
- Charging: It must be charged with a special charger for lithium batteries. Do not charge the battery below 0°C, and do not use batteries, power supplies and chargers that are not standard in the original factory.

4.2 Precautions for operational environment

- The working temperature of BUNKER MINI is -10 ℃~45 ℃, please do not use it in the environment where the temperature is lower than -10℃ and higher than 45℃;
- Do not use it in an environment with corrosive or flammable gases or in an environment close to flammable substances;
- Do not store it around heating elements such as heaters or large coiled resistors;
- The waterproof and dustproof grade of BUNKER MINI is IP67, please do not use it in water for a long time, and check to remove rust regularly;
- It is recommended that the altitude of the environment should not exceed 1000M;
- It is recommended that the temperature difference between day and night should not exceed 25℃;
- Regularly check and maintain track tensioners.

4.3 Precautions for electrical external expansion

- The rear expansion power supply current does not exceed 6.25A, and the total power does not exceed 300W;

4.4 Safety precautions

- If you have any questions during the use process, please follow the relevant instruction manuals or consult relevant technical personnel;
- Before operating the equipment, pay attention to the on-site situation to avoid personnel security problems caused by misoperation;
- In case of emergency, power off the equipment by tapping the emergency stop button;
- Do not modify the internal device structure without technical support and permission

4.5 Other precautions

- When carrying and setting up operation, please do not drop or turn it upside down;
- for non-professionals, please do not disassemble it without permission.

5 Q&A

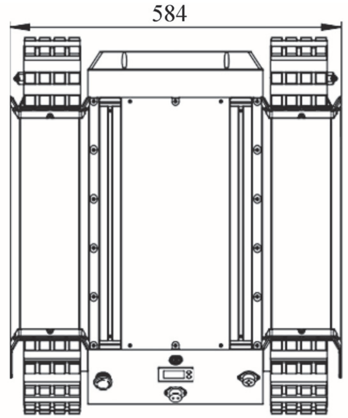
Q: BUNKER MINI starts normally, but the vehicle body does not move with the remote control?
A: First, determine whether the power switch is pressed and whether the emergency stop switch is released, and then confirm whether the control mode selected by the mode selection switch on the upper left side of the remote control is correct.

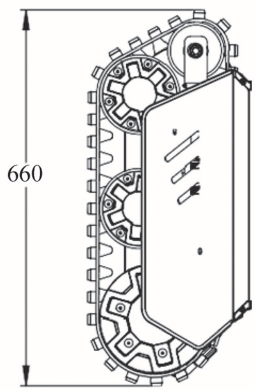
Q: When the BUNKER MINI remote control is normal, the chassis state and motion information feedback is normal, and the control frame protocol is issued, why the vehicle body control mode cannot be switched, and the chassis does not respond to the control frame protocol?
A: Under normal circumstances, if BUNKER MINI can be controlled by the remote control, it means that the chassis motion control is normal, and it can receive the feedback frame of the chassis, which means that the CAN extension link is normal. Please check whether the command is switched to CAN control mode..

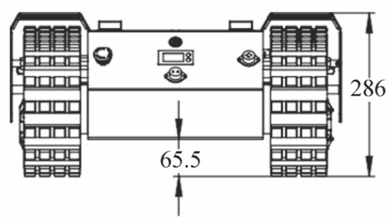
Q: When the relevant communication is carried out through the CAN bus, and the chassis feedback command is normal, why does the car do not respond after the control is issued?
A: BUNKER MINI has a communication protection mechanism inside. Chassis has a timeout protection mechanism when dealing with external CAN control commands. Assuming that after the vehicle receives a frame of communication protocol, it does not receive the next frame of control commands for more than 500MS, and it will enter the communication protection with a speed of 0, so the command from the host computer must be periodically issued.

6 Product Dimensions

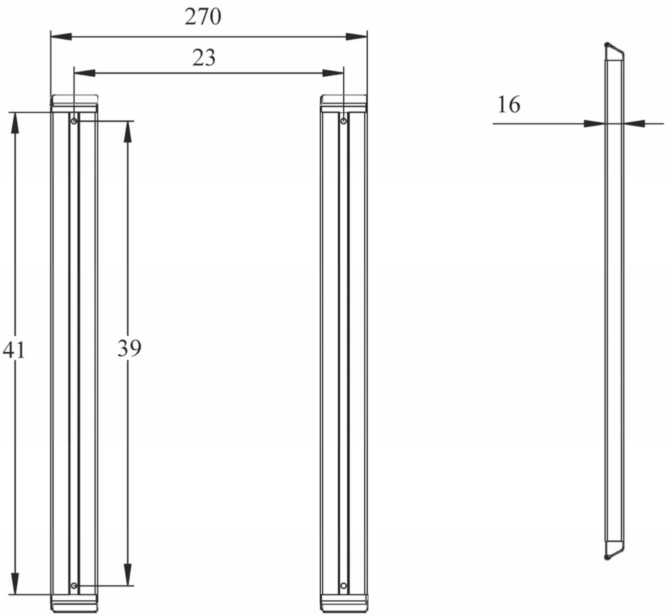
6.1 Illustrations of product outline dimensions

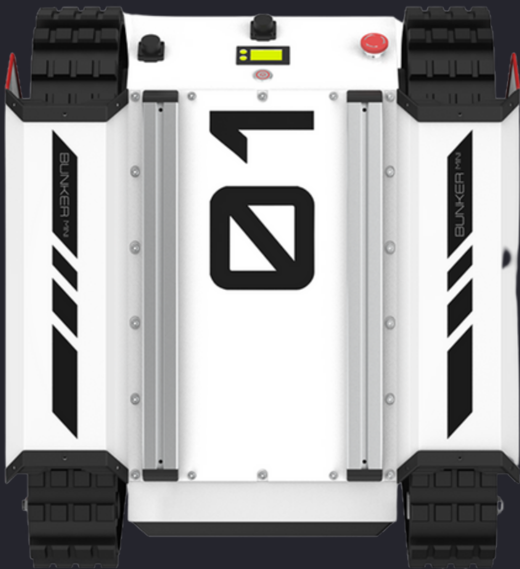






6.2 Illustrations of top expansion bracket dimensions





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