Serial protocol

Document purpose

This document applies to the communication protocol of data interaction between any host computer and XGO series

robot dog driver board. It is suitable for secondary development of XGO by high-level developers.The communication protocol is based on standard TTL serial communication and features XH2.54 4PIN interface connection.

Update record

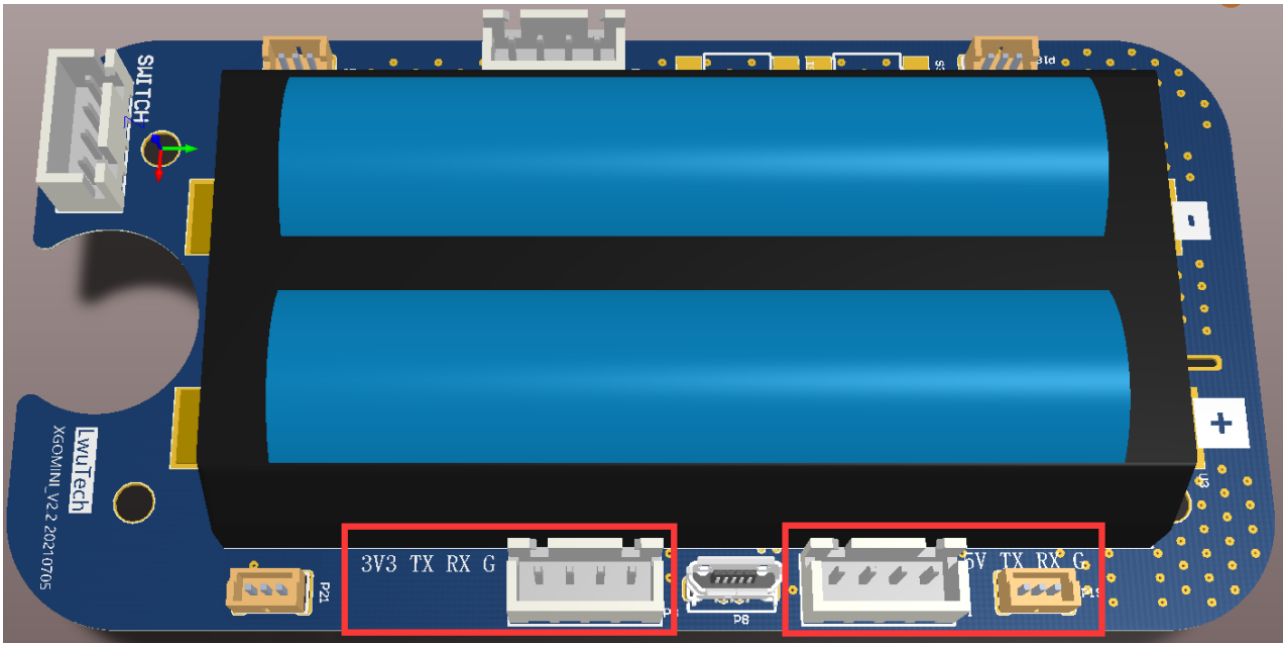
2022.3.10 Create.

Hardware connection

Use a hexagonal wrench to unscrew the two screws on the back, the screws on the left and right sides, and the two screws on the tail, remove the back panel of the robot dog, and unplug the switch cable.

As shown in the figure below, there are two serial communication interfaces on one side of the motherboard, which are connected according to the motherboard silkscreen line sequence and the host computer line sequence (TX to RX, RX to TX), and then you can debug. The external power supply voltages of the two terminals are 5V and 3.3V respectively, which cannot be used at the same time.

By default, the 3.3V terminal is occupied by the AI module. If you want to use other devices for serial control, please unplug the AI module and the motherboard.



XGO-Mini Board

Software interface

Standard TTL serial communication.

Baud Rate	115200
Data Bits	8
stop bit	1
Parity Bits	None

Data frame format

The data frame is a fixed format: frame header + frame length + data + checksum + frame tail.

Frame header	Fixed to 0x55 0x00
Frame Length	Number of bytes in the entire data frame
Data	has different meanings depending on the type of command, see Part II
Checksum	Add all bytes of length and data, take the least significant byte, and negate
End of frame	Fixed at 0x00 0xAA

Instructions

Write command, no response (0x00)

Frame Header	Frame Length	Command Type	First Address	Data	Checksum	Frame End
0x55 0x00		0x00		data		0x00 0xAA

The write command will continuously modify the data starting from the first address, and no response will be generated.
>For example, modify the forward speed of the robot dog, the forward speed address is 0x30, so that it advances at the maximum speed, that is, the speed content is 0xFF, the specific instructions are as follows:
>0x55 0x00 0x09 0x00 0x30 0xFF 0xC7 0x00 0xAA
> where the checksum calculation process is as follows:
>0x09+0x00+0x30+0xFF=0x138, take the lowest byte 0x38, negate it to get 0xC7

Read command, there is a response (0x02)

frame header	frame length	command type	first address	read length	checksum	**frame end* *
0x55 0x00		0x02		uint_8		0x00 0xAA

The write command will continuously read the data starting from the first address, and no response will be generated.
The format of the returned packet is:

Frame Header	Frame Length	Command Type	First Address	Data	Checksum	Frame End
0x55 0x00		0x12		data		0x00 0xAA

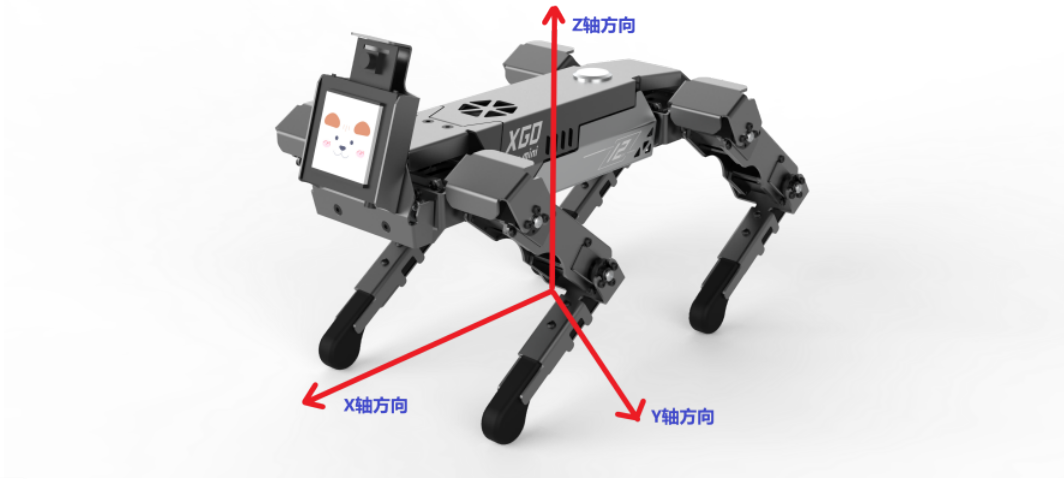
>For example, read the angles of 12 servos, 0x50 is the address of the first servo position, and 0x0C means read 12 consecutively. The specific instructions are as follows:
>0x55 0x00 0x09 0x02 0x50 0x0C 0x98 0x00 0xAA
> where the checksum calculation process is as follows:
>0x09+0x02+0x50+0x0C=0x67, negate to get 0x98

>Read return packets:
>0x55 0x00 0x14 0x12 0x50 0x80 0x80 0x80 0x80 0x80 0x80 0x80 0x80 0x80 0x80 0x80 0x89 0x00 0xAA

Robot dog coordinate system definition

Machine coordinate system

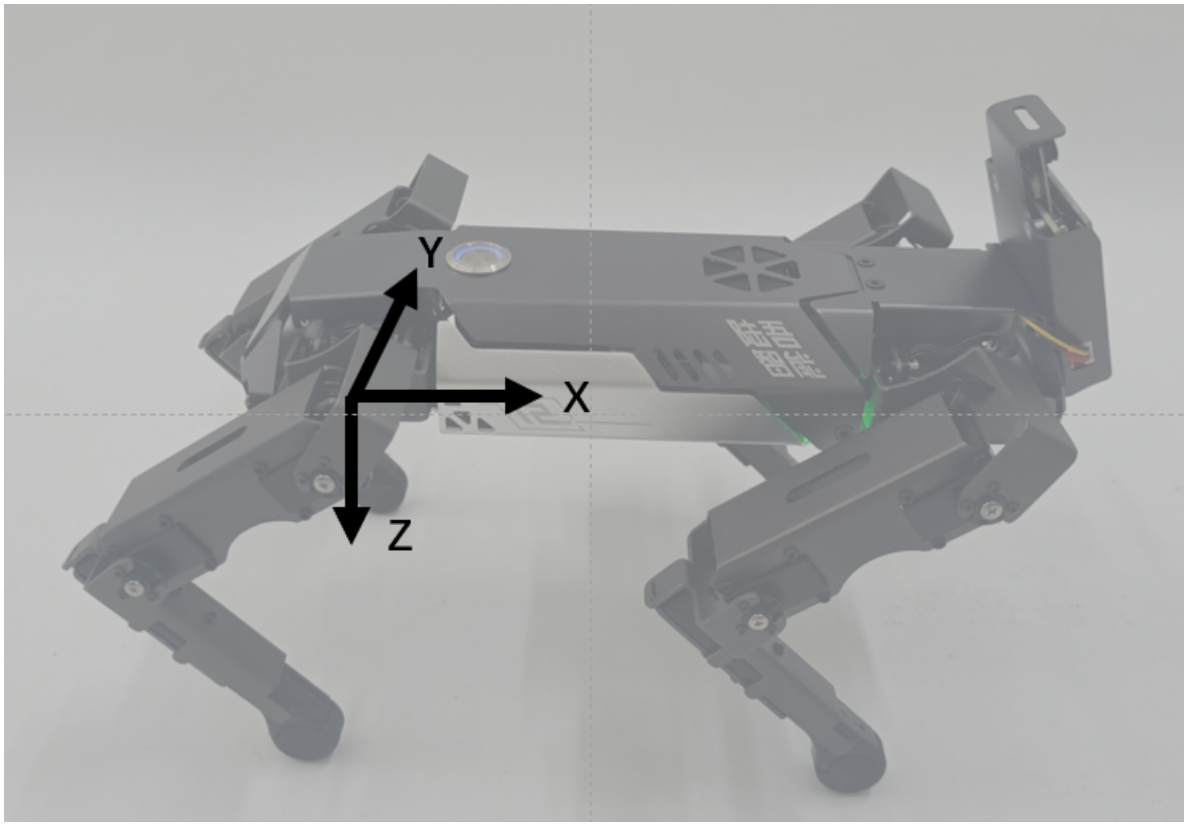
In the initial standing position, the origin is directly below the fuselage, the forward direction of the robot dog is the positive X axis, the left is the positive Y axis, and the top is the positive Z axis.



Schematic diagram of the coordinate system of the robot dog

Single leg coordinate system

The single-leg coordinate system is used to describe the position of the foot. The four legs correspond to four independent single-leg coordinate systems. The thigh joint is the origin. The forward direction of the robot dog is the positive x-axis, the left is the positive Y-axis, and the bottom is the positive Z-axis. Towards.



Schematic diagram of the single-leg coordinate system of the robot dog

The MemTable of XGO is as below

Adress	Function	Read-Write	Initial Value	Note	Mode
0x00	Mode of operation	Read	0x00		State information
0x01	Battery level	Read	0xff	Range: 0-100, linearly corresponding to the lowest-highest battey level	
0x02	XGO version	Read		0x00 MINI 0x01 Lite 0x02 PRO	
0x03	Performance mode	Write	0x00	0x00 normal control mode 0x01 cyclic action	

Adress	Function	Read-Write	Initial Value	Note	Mode
0x04	Calibration mode	Write	0x00	0x01 Enter the calibration mode 0x00 Exit the calibration mode	
0x13	Bluetooth	Write	XGOMINI	The length of the name is 10 bytes, and it cannot be Chinese. After naming, the Bluetooth name is XGO_xxxxxx	
0x20	Unmount Servo	Read-Write	0x00	0x00 Servo in normal operation, 0x01 Unmount all servo, 0x11-0x14 Unmount 1-4 leg in order, 0x21-0x24 Remount 1-4 leg in order	debug mode
0x21	Reset zero posttion of servo	Write	0x00	0x00 servo nornal ,0x01 record the current position as the zero position,Once set as 0x01, the register will automatically jump to 0x00	
0x30	Forward/backward movement speed	Read-Write	0x80	Range: 0x00-0xff, linearly corresponding to the revers max. value-forward max. value. The forward direction is the same as the robot coordinate system	Whole unit mode
0x31	Left/right movement speed	Read-Write	0x80	Range: 0x00-0xff, linearly corresponding to the revers max. value-forward max. value. The forward direction is the same as the robot coordinate system	
0x32	Clockwise/counterclockwise rotation speed	Read-Write	0x80	The direction follows the right hand principle	
0x33	Body shift distance along the x direction	Read-Write	0x80	The point of contact between the foot and the ground remains unchanged and the body twists	
0x34	Body shift distance along the x direction	Read-Write	0x80	The point of contact between the foot and the ground remains unchanged and the body twists	
0x35	Body height	Read-Write	0x80	The point of contact between the foot and the ground remains	

Adress	Function	Read-Write	Initial Value	Note	Mode
				unchanged and the body twists	
0x36	Angle at which the body rotates around the x axis	Read-Write	0x80	The direction follows the right hand principle	
0x37	Angle at which the body rotates around the y axis	Read-Write	0x80	The direction follows the right hand principle	
0x38	Angle at which the body rotates around the z axis	Read-Write	0x80	The direction follows the right hand principle	
0x39	A given period in which the body rotates around the x axis	Read-Write	0x00	0x00 stops, 0x01-0xff linearly corresponds to the minimum-maximum rotation speed, this function cannot work at the same time as setting the position register directly	
0x3A	A given period in which the body rotates around the y axis	Read-Write	0x00	0x00 stops, 0x01-0xff linearly corresponds to the minimum-maximum rotation speed, this function cannot work at the same time as setting the position register directly	
0x3B	A given period in which the body rotates around the y axis	Read-Write	0x00	0x00 stops, 0x01-0xff linearly corresponds to the minimum-maximum rotation speed, this function cannot work at the same time as setting the position register directly	
0x3C	mark time	Read-Write	0x00	0x00 stop, 0x01-0xff linearly corresponds to the min.-max. marktime height	
0x3D	Moving mode	Read-Write	0x00	0x00 Move at normal speed 0x01 Move at slow speed 0x02 Move at high speed	
0x3E	action	Write	0x00	List of action commands, 0 is the default stance 1-N means each action (0-N is decimal value), 1: lying down, 2: standing up, 3:	

Adress	Function	Read-Write	Initial Value	Note	Mode
				creeping, 4: circling, 5: stepping, 6: squatting, 7: rolling , 8: pitching, 9: yawing, 10 three-axis rotation, 11 peeing, 12 sitting, 13 beckoning, 14: stretching, 15: waving, 16 swaying, 17 begging for food, 18 searching food, 19 shaking hands	
0x80	A given period in which the body shifts along the X axis	Read-Write	0x00	0x00 stop, 0x01-0xff corresponds to the min.-max. rotation speed, the extent of movement is a half of the position limit	
0x81	A given period in which the body shifts along the Y axis	Read-Write	0x00		
0x82	A given period in which the body shifts along the Z axis	Read-Write	0x00		
0x40	X position of leg 1	Read-Write	0x80	Range: 0x00-0xff, linearly corresponding to the reverse max. value-forward max. value, the forward direction is the same as the robot coordinate system	leg mode
0x41	Y position of leg 1	Read-Write	0x80		
0x42	Z position of leg 1	Read-Write	0x80		
0x43	X position of leg 2	Read-Write	0x80		
0x44	Y position of leg 2	Read-Write	0x80		
0x45	Z position of leg 2	Read-Write	0x80		
0x46	X position of leg 3	Read-Write	0x80		
0x47	Y position of leg 3	Read-	0x80		

Adress	Function	Read-Write	Initial Value	Note	Mode
		Write			
0x48	Z position of leg 3	Read-Write	0x80		
0x49	X position of leg 4	Read-Write	0x80		
0x4A	Y position of leg 4	Read-Write	0x80		
0x4B	Z position of leg 4	Read-Write	0x80		
0x50	Position of Servo 11	Read-Write	0x80	Range: 0x00-0xff, linearly corresponding to the reverse max. servo mode value-forward max. value	
0x51	Position of Servo 12	Read-Write	0x80		
0x52	Position of Servo 13	Read-Write	0x80		
0x53	Position of Servo 21	Read-Write	0x80		
0x54	Position of Servo 22	Read-Write	0x80		
0x55	Position of Servo 23	Read-Write	0x80		
0x56	Position of Servo 31	Read-Write	0x80		
0x57	Position of Servo 32	Read-Write	0x80		
0x58	Position of Servo 33	Read-Write	0x80		
0x59	Position of Servo 41	Read-Write	0x80		

Adress	Function	Read-Write	Initial Value	Note	Mode
0x5A	Position of Servo 42	Read-Write	0x80		
0x5B	Position of Servo 43	Read-Write	0x80		
0x5C	Servo speed	Read-Write	0x80	Range: 0x00-0xff, linearly corresponding to the min. - max. value (only applicable under this mode)	
0x5D	Standing posture	Write	0x00	0x00 inactive. 0x01 The gear position returns to the standing position. Once set as 0x01, the register will automatically jump to 0x00	
0x61	IMU state	Read-Write	0x00	0x00 close 0x01 self-stabilizing mode	
0x62	ROLL	Read	0x01		
0x63	PITCH	Read	0x02		
0x64	YAW	Read	0x03		

NEWER
Python Lib

OLDER
Can not connect by bluetooth