Bus Servo Controller Communication Protocol

Serial communication, baud rate: 9600

Command packet data type: Hexadecimal

Command Packet Format:

Frame Header	Data Length	Command	Parameters
0x55 0x55	Length	Cmd	Prm 1…Prm N

- Frame Header: Two consecutive 0x55 bytes indicate the start of a data packet.
- Data Length: The total length of the packet, calculated as the number of parameters (N) plus 2 bytes, 1 byte for the command and 1 byte for the length itself. The data length formula is Length = N + 2.
- Command: Various control commands.
- Parameters: Additional control information required by the command.

I. User-Initiated Data Transmission to the Controller

The user's transmission data pin should be connected to the controller's RX pin. Additionally, the user's control system must share a common ground (GND) with the controller. If the data sent is incorrect, the blue LED2 will remain steadily lit without blinking, and the buzzer will sound twice ("beep beep") to alert the user of the data transmission error.

1. Command Name: **CMD_SERVO_MOVE**

   Description: Controls the movement of any number of servos.

Frame Header	Data Length	Command	Parameters
0x55 0x55	Number of servos * 3 + 5	3	Prm 1…Prm N

Parameter 1: Number of servos to control

Parameter 2: Time low byte

Parameter 3: Time high byte

Parameter 4: Servo ID

Parameter 5: Angle position low byte

Parameter 6: Angle position high byte

Subsequent parameters: Same format as parameters 4, 5, and 6, for controlling additional servos' positions. Example:

① Control servo 1 to move to position 800 within 1000 ms:

0x55 0x55	0x08	0x03	0x01 0xE8 0x03 0x01 0x20 0x03

② Control servos 2 and 9 to move to position 800 within 800 ms:

0x55 0x55	0x0B	0x03	0x02 0x20 0x03 0x02 0x20 0x03 0x09 0x20 0x03

2. Command Name: **CMD_ACTION_GROUP_RUN**

Description: Controls the execution of an action group. Note that the action group must already be downloaded to the controller. You can set the number of times the action group runs. If you want it to run continuously, set the repeat count parameter to 0, which means infinite loops.

Frame Header	Data Length	Command	Parameters
0x55 0x55	5	6	Prm 1 Prm 2 Prm 3

Parameter 1: The ID number of the action group to run.

Parameter 2: Lower 8 bits of the repeat count.

Parameter 3: Upper 8 bits of the repeat count.

Examples:

① Run action group 8 once:

0x55 0x55	0x05	0x06	0x08 0x01 0x00

② Run action group 2 infinitely:

0x55 0x55	0x05	0x06	0x02 0x00 0x00

3. Command name: **CMD_ACTION_GROUP_STOP**

Description: Stop the currently running action group. If no action group is running, sending this command has no effect.

Frame Header	Data Length	Command	Parameters
0x55 0x55	2	7	None

Examples:

Stop the currently running action group：

0x55 0x55	0x02	0x07

4. Command name: **CMD_ACTION_GROUP_SPEED**

Description: Controls the speed of the action group, expressed as a percentage. For example, to set the speed of action group 1 to twice the original speed, set the percentage value to 200, meaning 200%. If the action group number is 0xFF, it means adjusting the speed of all downloaded action groups.

Note:

1) The adjusted speed parameter is not saved after power-off. Each time the device is powered on, the action groups will run at the default speed. If you need to adjust the speed, you must resend this command.

Servos have their own maximum speed limits. If the set speed exceeds the servo's maximum speed, the adjustment will not take effect.

Frame Header	Data Length	Command	Parameters
0x55 0x55	5	11	Prm 1 Prm 2 Prm 3

Parameter 1: Action group number to be adjusted

Parameter 2: Lower 8 bits of the speed percentage

Parameter 3: Higher 8 bits of the speed percentage

Examples:

① To set action group 8 to run at 50% speed:

0x55 0x55	0x05	0x0B	0x08 0x32 0x00

② To set all downloaded action groups to run at 300% speed (3× original speed):

0x55 0x55	0x05	0x0B	0xFF 0x2C 0x01

5. Command name: **CMD_GET_BATTERY_VOLTAGE**

Description: Get the battery voltage of the controller, in millivolts (mV). After this command is sent, the controller will immediately return a data packet containing two parameters.

Frame Header	Data Length	Command	Parameters
0x55 0x55	2	15	None

Returned data packet from the controller:

Frame Header	Data Length	Command	Parameters
0x55 0x55	4	15	Prm 1 Prm 2

Parameter 1: Lower 8 bits of the voltage value

Parameter 2: Higher 8 bits of the voltage value

Example：Get the controller's battery voltage:

0x55 0x55	0x02	0x0F

If the returned voltage value is 7500 mV:

0x55 0x55	0x04	0x0F	0x4C 0x1D

6. Command name: **CMD_MULT_SERVO_UNLOAD**

Description: Used to power off multiple servos. Once this command is sent, the specified servos will lose holding torque and can be freely rotated by hand.

Frame Header	Data Length	Command	Parameters
0x55 0x55	Number of servos to control + 3	20	Prm 1…Prm N

Parameter 1: Number of servos to control

Parameter 2: ID of servo a

Parameter 3: ID of servo b

Parameter ...: ID of servo x

Example:

① Unload servos with IDs 1, 2, and 3.

0x55 0x55	0x06	0x14	0x03 0x01 0x02 0x03

② Unload servos with IDs 1, 2, 3, 4, 5, and 6.

0x55 0x55	0x09	0x14	0x06 0x01 0x02 0x03 0x04 0x05 0x06

7. Command name: **CMD_MULT_SERVO_POS_READ**

Description: Reads the angle position values of multiple servos.

Frame Header	Data Length	Command	Parameters
0x55 0x55	Number of servos to control + 3	21	Prm 1…Prm N

Parameter 1: Number of servos to read

Parameter 2: ID of servo a

Parameter 3: ID of servo b

Returned data packet from the controller:

Frame Header	Data Length	Command	Parameters
0x55 0x55	Number of servos to read*3 + 3	21	Prm 1…Prm N

Parameter 1: Number of servos to read

Parameter 2: Servo ID

Parameter 3: Angle position low byte

Parameter 4: Angle position high byte

Parameters ...: The format is the same as Parameters 2, 3, and 4, and is used to read the angle position of different servo IDs.

Examples:

Read the angle positions of servos with IDs 1, 2, 3, 4, 5, and 6:

0x55 0x55	0x09	0x15	0x06 0x01 0x02 0x03 0x04 0x05 0x06

For example, if all returned angle position values are 500:

0x55 0x55	0x15	0x15	0x06 0x01 0xF4 0x01 0x02 0xF4 0x01 0x03 0xF4 0x01 0x04 0xF4 0x01 0x05 0xF4 0x01 0x06 0xF4 0x01

Ⅱ. Data Sent by the Controller

During operation, when the controller's status changes, it will actively send data to the user via the serial port. For example, when an action group finishes running. There are multiple ways to operate the controller, such as using a PS2 controller, connecting via a Bluetooth module, or using the user's custom serial interface. Hence, it is necessary for different control methods to be aware of the current status of the controller to facilitate proper management and operation. The following are the instructions that the controller returns to the user.

1. Command name: **CMD_ACTION_GROUP_RUN**

Description: When the user sends a data packet to start running an action group, at the moment the action group starts running, the controller returns a data packet. The data format is exactly the same as the data packet sent by the user.

Frame Header	Data Length	Command	Parameters
0x55 0x55	5	6	Prm 1 Prm 2 Prm 3

Parameter 1: The action group ID to be run.

Parameter 2: Low byte of the number of times to run the action group.

Parameter 3: High byte of the number of times to run the action group.

Example:

When action group 8 is running and is set to run once, the controller returns the following data packet to the user:

0x55 0x55	0x05	0x06	0x08 0x01 0x00

2. Command name: **CMD_ACTION_GROUP_STOP**

   Description: When a running action group is forcibly stopped by another method, for example, via the gamepad or by the user sending a stop command, this command is returned. The data packet format is the same as the one sent by the user when actively sending a stop command.

Frame Header	Data Length	Command	Parameters
0x55 0x55	2	7	None

Examples:

When an action group that is currently running is forcibly stopped, the following data is returned:

0x55 0x55	0x02	0x07

3. Command name: **CMD_ACTION_GROUP_COMPLETE**

Description: When an action group finishes running naturally, not forcibly stopped, but completes on its own, this command is returned.

Frame Header	Data Length	Command	Parameters
0x55 0x55	5	8	Prm 1 Prm 2 Prm 3

Parameter 1: The action group ID to be run.

Parameter 2: Low byte of the number of times to run the action group.

Parameter 3: High byte of the number of times to run the action group.

Example:

When action group No. 8 is set to run once and finishes naturally, the controller returns the following data to the user:

0x55 0x55	0x05	0x08	0x08 0x01 0x00