

Set the mapped value	Command packet format	0x14	0x00	Index_id	0x33	Mapped value 16 byte	Save_to_flash	CRC						
	Response packet format	0x03	0x00	Index_id	0x33	Operation_status	CRC							
	Command Details	(1) Function description: Set the mapped value. (2) Input parameters: Index_id (device index ID), Mapped value (Map value), Save_to_flash (whether to save the configuration to the internal Flash) (3) Return parameters: Operation_status (4) Instruction code: 0x33 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful Note 2: Save_to_flash Whether to save to the internal Flash 0: Do not save 1: Save Note 3: The setting takes effect immediately upon success Note 4: Saving to the internal Flash requires erasing the page, which takes a relatively long time (about 20ms). During this process, the serial port interrupt will be turned off, and frequent operations will affect the lifespan of the device.												
Get the 16-bit value after mapping	Command packet format	0x03	0x00	Index_id	0x34	CRC								
	Response packet format	0x07	0x00	Index_id	0x34	JoystickX_ADC_Low	JoystickX_ADC_High	JoystickY_ADC_Low	JoystickY_ADC_High	CRC				
	Command Details	(1) Function Description: Obtain Joystick 16ADC. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Joystick value (-4095~4095) (4) Instruction Code: 0x34 Note 1: JoystickX_ADC = (int16_t) (JoystickX_ADC_High << 8) JoystickX_ADC_Low Note 2: JoystickY_ADC = (int16_t) (JoystickY_ADC_High << 8) JoystickY_ADC_Low												
Get the mapped 8-bit value	Command packet format	0x03	0x00	Index_id	0x35	CRC								
	Response packet format	0x05	0x00	Index_id	0x35	JoystickX_ADC	JoystickY_ADC	CRC						
	Command Details	(1) Function Description: Obtain Joystick 8ADC. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Joystick value (-128~127) (4) Instruction Code: 0x35 Note 1: JoystickX_ADC = (int8_t) JoystickX_ADC Note 2: JoystickY_ADC = (int8_t) JoystickY_ADC												
Button press	Command packet format	None												
	Response packet format	0x05	0x00	Index_id	0xE0	Status	0x00	CRC						
	Command Details	(1) Function Description: Chain device presses, actively sends (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Status (Button Trigger Status) (4) Instruction Code: 0xE0 Note 1: Status Button Status 0: Single Click 1: Double Click 2: Long Press Note 2: This data packet is only sent in active reporting mode. After the data packet is sent, the RGB light will have an effect superimposed on the lighting effect set by the user: • Single Click superimposes green (G) • Double Click superimposes blue (B) • Long Press superimposes red (R) The color channel value superimposed each time is 255, and it gradually decays within 1 second with a period of 10ms, and finally the superimposed value drops to 0, restoring the color effect set by the user. Example: The user sets the RGB light to purple (R=128, G=0, B=128) and the brightness to 50%. After brightness compression, the actual display is: R=64, G=0, B=64. • When the user clicks, the G channel is overlaid with 255: displayed as R=64, G=255, B=64. Within 1 second, the overlaid G value gradually decays to 0, eventually returning to R=64, G=0, B=64. • When the user double-clicks, the B channel is overlaid with 255: originally B=64, after overlay, values exceeding 255 are treated as 255, resulting in R=64, G=0, B=255. Within 1 second, the overlaid B value gradually decays to 0, eventually restoring to R=64, G=0, B=64. • When the user long-presses, the R channel is overlaid with 255: originally R=64, after overlay, values exceeding 255 are treated as 255, resulting in R=255, G=0, B=64. Within 1 second, the overlaid R value gradually decays to 0, eventually restoring to R=64, G=0, B=64.												
Check button status	Command packet format	0x03	0x00	Index_id	E1	CRC								
	Response packet format	0x04	0x00	Index_id	E1	Status	CRC							
	Command Details	(1) Function description: Query button status (2) Input parameter: Index_id (Device index ID) (3) Return parameter: Status (4) Instruction code: 0xE1 Note 1: Status Button status 0: Not pressed 1: Pressed												
Set key interval	Command packet format	0x05	0x00	Index_id	E2	Double	Long	CRC						
	Response packet format	0x04	0x00	Index_id	E2	Operation_status	CRC							
	Command Details	(1) Function Description: Set the key data interval (2) Input Parameters: Index_id (Device Index ID), Double (Double-click time interval), Long (Long-press time interval) (3) Return Parameter: Operation_status (4) Command Code: 0xE2 Note 1: Double: Double-click time interval (default 1) (Double+1)*100ms 0 ~ 9 (100ms ~ 1000ms) Note 2: Long: Long-press time interval (default 0) (Long+3)*1s 0 ~ 7 (3s ~ 10s) Note 3: Operation_status Operation status 0: Operation failed 1: Operation successful												
Get key press interval	Command packet format	0x03	0x00	Index_id	E3	CRC								
	Response packet format	0x05	0x00	Index_id	E3	Double	Long	CRC						
	Command Details	(1) Function Description: Get key data interval (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Double, Long (4) Instruction Code: 0xE3 Note 1: Double double-click interval 0 ~ 9 (100ms ~ 100ms) Note 2: Long long-press interval 0 ~ 7 (3s ~ 10s)												
Set button mode	Command packet format	0x04	0x00	Index_id	E4	Mode	CRC							
	Response packet format	0x04	0x00	Index_id	E4	Operation_status	CRC							
	Command Details	(1) Function Description: Set button mode (2) Input Parameters: Index_id (Device Index ID), Mode (Button Mode) (3) Return Parameter: Operation_status (4) Instruction Code: 0xE4 Note 1: Mode (Default 1) 0: Non-active reporting 1: Active reporting Note 2: Operation_status Operation status 0: Operation failed 1: Operation successful												

Get key mode	Command packet format	0x03	0x00	Index_id	E5	CRC						
	Response packet format	0x04	0x00	Index_id	E5	Mode	CRC					
	Command Details	(1) Function Description: Get button mode (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Mode (4) Instruction Code: 0xE5 Note 1: Mode (Default 1) 0: Non-active reporting 1: Active reporting										
Query device unique UID	Command packet format	0x04	0x00	Index_id	0xF8	UID_Type	CRC					
	Response packet format	0x04+4/12	0x00	Index_id	0xF8	Operation_status	UID (multi-byte)	CRC				
	Command Details	(1) Function Description: Query the unique UID of the device. (2) Input Parameters: Index_id (Device Index ID), UID_Type (3) Return Parameters: Operation_status, UID (4) Command Code: 0xF8 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful Note 2: UID_Type UID type 0: 4-byte UID 1: 12-byte UID										
Query the upgrade program version number	Command packet format	0x03	0x00	Index_id	0xF9	CRC						
	Response packet format	0x04	0x00	Index_id	0xF9	Bootloader_version	CRC					
	Command Details	(1) Function Description: Query the upgrade program version number. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Bootloader_version (4) Command Code: 0xF9										
Query device software version number	Command packet format	0x03	0x00	Index_id	0xFA	CRC						
	Response packet format	0x04	0x00	Index_id	0xFA	Firmware_version	CRC					
	Command Details	(1) Function Description: Query the device software version number. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Firmware_version (4) Instruction Code: 0xFA										
Query device type	Command packet format	0x03	0x00	Index_id	0xFB	CRC						
	Response packet format	0x05	0x00	Index_id	0xFB	Device_type_low	Device_type_high	CRC				
	Command Details	(1) Function Description: Query device type. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: Device_type (4) Instruction Code: 0xFB Note 1: Device_type = (uint16_t)((Device_type_high << 8) Device_type_low) Note 2: Joystick's device type code is 0x0004										
Enumeration requests	Command packet format	None										
	Response packet format	0x03	0x00	Index_id	0xFC	CRC						
	Command Details	(1) Function Description: Enumerate requests, send requests from the end device of the chain link change, and send requests when the device powers on, to notify the host to update the link device status. (2) Input Parameter: none (3) Return Parameter: none (4) Instruction Code: 0xFC										
Heartbeat Pack	Command packet format	0x03	0x00	0xFF	0xFD	CRC						
	Response packet format	0x03	0x00	0xFF	0xFD	CRC						
	Command Details	(1) Function Description: Heartbeat packet, a timed communication between chain devices, can detect whether it is a terminal device. The host can also use the heartbeat packet to determine whether there is a chain device connected. (2) Input Parameter: none (3) Return Parameter: none (4) Instruction Code: 0xFD										
enumerate	Command packet format	0x04	0x00	0xFF	0xFE	Send_num	CRC					
	Response packet format	0x04	0x00	0xFF	0xFE	Receive_num	CRC					
	Command Details	(1) Function Description: Enumerates and obtains the number of cascaded devices. (2) Input Parameter: Send_num (default 0, used to record the number of devices) (3) Return Parameter: Receive_num (value represents the number of devices) (4) Instruction Code: 0xFE										

Note 1: The maximum data packet length is 256 bytes.
Note 2: Data length is from Index_id to CRC, including Index_id and CRC, but excluding the data length itself.
Note 3: When calculating CRC, the packet header, packet trailer, length, and the CRC field itself need to be excluded; only the remaining data is summed.
Note 4: Serial communication baud rate is 115200, 8 data bits, 1 stop bit, no parity bit.

```
uint8_t calculateCRC(const uint8_t *buffer, uint16_t size)
{
    uint8_t crc8 = 0;
    for (uint8_t i = 4; i < (size - 3); i++) {
        crc8 += buffer[i];
    }
    return crc8;
}
```