

GPIO reads input pin level	Command packet format	0x04	0x00	Index_id	0x41	GPIO	CRC					
	Response packet format	0x05	0x00	Index_id	0x41	Operation_status	GPIO_level_status	CRC				
	Command Details	(1) Function Description: Reads the input pin level. (2) Input Parameters: Index_id (Device ID), GPIO (representing the pin) (3) Return Parameters: Operation_status, GPIO_level_status (4) Instruction Code: 0x41 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful Note 2: GPIO_level_status Operation status 0: Low level 1: High level Note 3: GPIO 1: Represents GPIO1 2: Represents GPIO2										
GPIO external interrupt mode configuration	Command packet format	0x06	0x00	Index_id	0x50	GPIO	GPIO_up/down	Trigger_mode	CRC			
	Response packet format	0x04	0x00	Index_id	0x50	Operation_status	CRC					
	Command Details	(1) Function Description: External interrupt mode configuration. (2) Input Parameters: Index_id (device index ID), GPIO (indicates pin), GPIO_up/down (indicates whether pull-up/pull-down is required), Trigger_mode (trigger mode) (3) Return Parameter: Operation_status (4) Instruction Code: 0x50 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful Note 2: GPIO_up/down 0: Indicates pull-up 1: Indicates pull-down 2: Indicates no pull-up or pull-down Note 3: Trigger_mode 0: Rising edge 1: Falling edge 2: Rising/falling edge										
ADC mode configuration	Command packet format	0x04	0x00	Index_id	0x60	GPIO	CRC					
	Response packet format	0x04	0x00	Index_id	0x60	Operation_status	CRC					
	Command Details	(1) Function Description: ADC mode configuration. (2) Input Parameters: Index_id (Device Index ID), GPIO (3) Return Parameters: Operation_status (4) Instruction Code: 0x60 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful Note 2: GPIO 1: Indicates GPIO1 2: Indicates GPIO2										
ADC Readout	Command packet format	0x04	0x00	Index_id	0x61	GPIO	CRC					
	Response packet format	0x06	0x00	Index_id	0x61	Operation_status	ADC_value_low	ADC_value_high	CRC			
	Command Details	(1) Function Description: Reads collected data. (2) Input Parameters: Index_id (Device Index ID), GPIO (3) Return Parameters: Operation_status, ADC_value (ADC collected value) (4) Instruction Code: 0x61 Note 1: Operation_status Operation status 0: Operation failed 1: Operation successful 2: Mode mismatch (ADC mode not configured, please configure first) Note 2: ADC_value = (uint16_t)((ADC_value_high < 8) ADC_value_low) (0 ~ 4095, reference voltage 3.3V) Note 3: GPIO 1: Indicates GPIO1 2: Indicates GPIO2										
Work status inquiry	Command packet format	0x03	0x00	Index_id	0x70	CRC						
	Response packet format	0x05	0x00	Index_id	0x70	GPIO1_work_status	GPIO2_work_status	CRC				
	Command Details	(1) Function Description: Working status query. (2) Input Parameter: Index_id (Device Index ID) (3) Return Parameter: GPIO_work_status (Pin Working Status) (4) Instruction Code: 0x70 Note 1: GPIO_work_status 0: Indicates no working status 1: Output working status 2: Input working status 3: Indicates NVIC working status 4: ADC working status 5: I2C working status										
GPIO external interrupt return	Command packet format	None										
	Response packet format	0x05	0x00	Index_id	0xE0	Trigger_mode	GPIO	CRC				
	Command Details	(1) Function Description: The interrupt mode configuration returns actively. (2) Input Parameters: Index_id (device index ID), GPIO (indicates pin), Trigger_mode (trigger mode) (3) Return Parameters: GPIO, Trigger_mode (4) Instruction Code: 0xE0 Note 1: GPIO 1: indicates GPIO1 2: indicates GPIO2 Note 2: Trigger_mode 0: rising edge 1: falling edge										
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										

	Header	Index_id	Device ID	Device Type	Device Code	CRC	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Check 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: The device type code of Unit ChainBus is 0x0006											
Enumeration requests	Command packet format	None											
	Response packet format	0x03	0x00	0xFF	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 connected devices in the link. (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;
}

```