

KUROBOX/PRO

Microcomputer Communication Specifications

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2. Functions

2.1. Overview of Functions

Communicates with the main CPU via UART. The main functions are shown below.

- Power SW monitoring
- Initialization SW monitoring
- Power control
- Temperature measurement
- Buzzer control
- Watchdog function (However, watchdog function is disabled on u-boot)
- LAN ACT monitoring
- LED display
- Reset sequence generation
- LED Illumination

3. UART Communication with Main CPU

3.1. Transmission System

3.1.1. UART Basic Settings

- Transmission speed: 38400bps
- Data bit: 8bit
- Parity: Even
- Stop bit: 1 bit or more

3.2. Communication with Main CPU

- Basic communication is performed by the transmission of commands, data, and parity.
- When switches etc are pressed, a level interrupt occurs. The interrupt is cleared when reporting to the CPU is completed.
- If many frame errors occur, regulate the guard time on the main CPU.

3.3. Protocol

3.3.1. Preamble

The receive buffer is completely cleared by sending FF 35 times.

3.3.2. Main CPU -> Microcomputer

Data Payload 0 Bytes

1	Transfer direction (BIT7)	Data payload (0)
2	Command	
3	Parity 0-(byte1+byte2)	

Data Payload n bytes

1	Transfer direction (BIT7)	Data payload ()
2	Command	
3	Data 0	
		•
		•
		•
		•
n-1	Data n	
n	Parity 0 - Σ (byte 1 to byte n-1)	

3.3.3. Microcomputer -> Main CPU

Responses to commands other than the read command (when data does not exist)

1	0 (BIT7)	Data payload (1)
2	Sent command	
3	ACK	
4	Parity 0-(byte1+byte2+byte3)	

Response to read command

1	0 (BIT7)	Data payload (N)
2	Sent command	
3	Data 1	
n-1	Data N	
n	Parity 0 - Σ (byte 1 to byte n-1)	

Response when communication error occurs

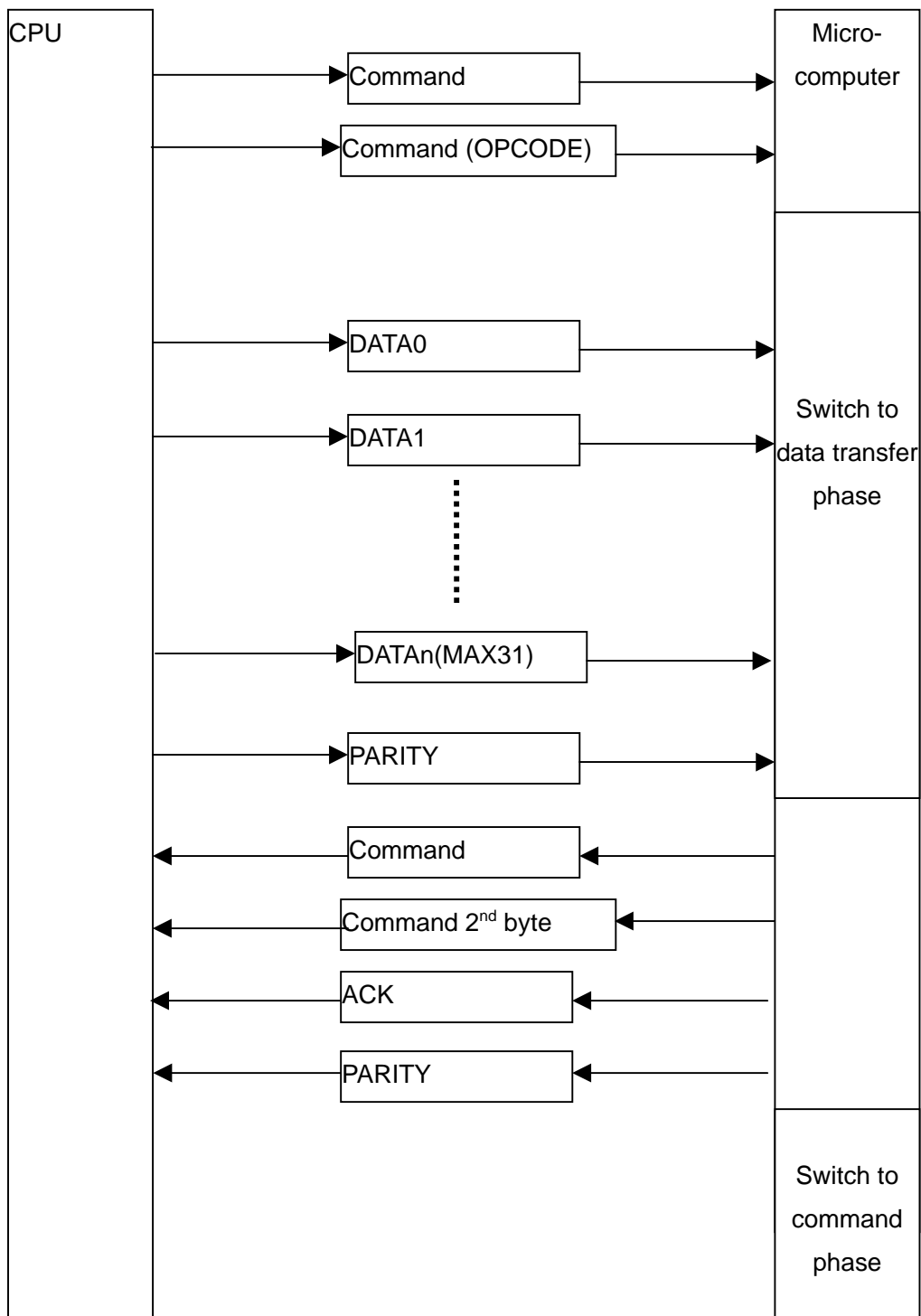
1	0 (BIT7)	Data payload (1)
2	Sent command	
3	NACK	
4	Parity 0-(byte1+byte2+byte3)	

3.4. ACK/NACK List

HEX	mnemonic	
0x00	ACK	Good
0xF1	OVER_RUN	UART physical layer error Physical layer buffer over
0xF2	FRAMING_ERR	UART physical layer error Physical layer frame error
0xF3	PARITYERROR	UART physical layer error Physical layer parity error
0xF4	Invalid_COM	Command does not exist
0xF5	Com_len_err	Command and data payload values do not correspond
0xF6	RX_BUFF_OVER	Payload larger than 32 bytes specified.
0xF7	DATA_PARITY_ERROR	Data parity is wrong.

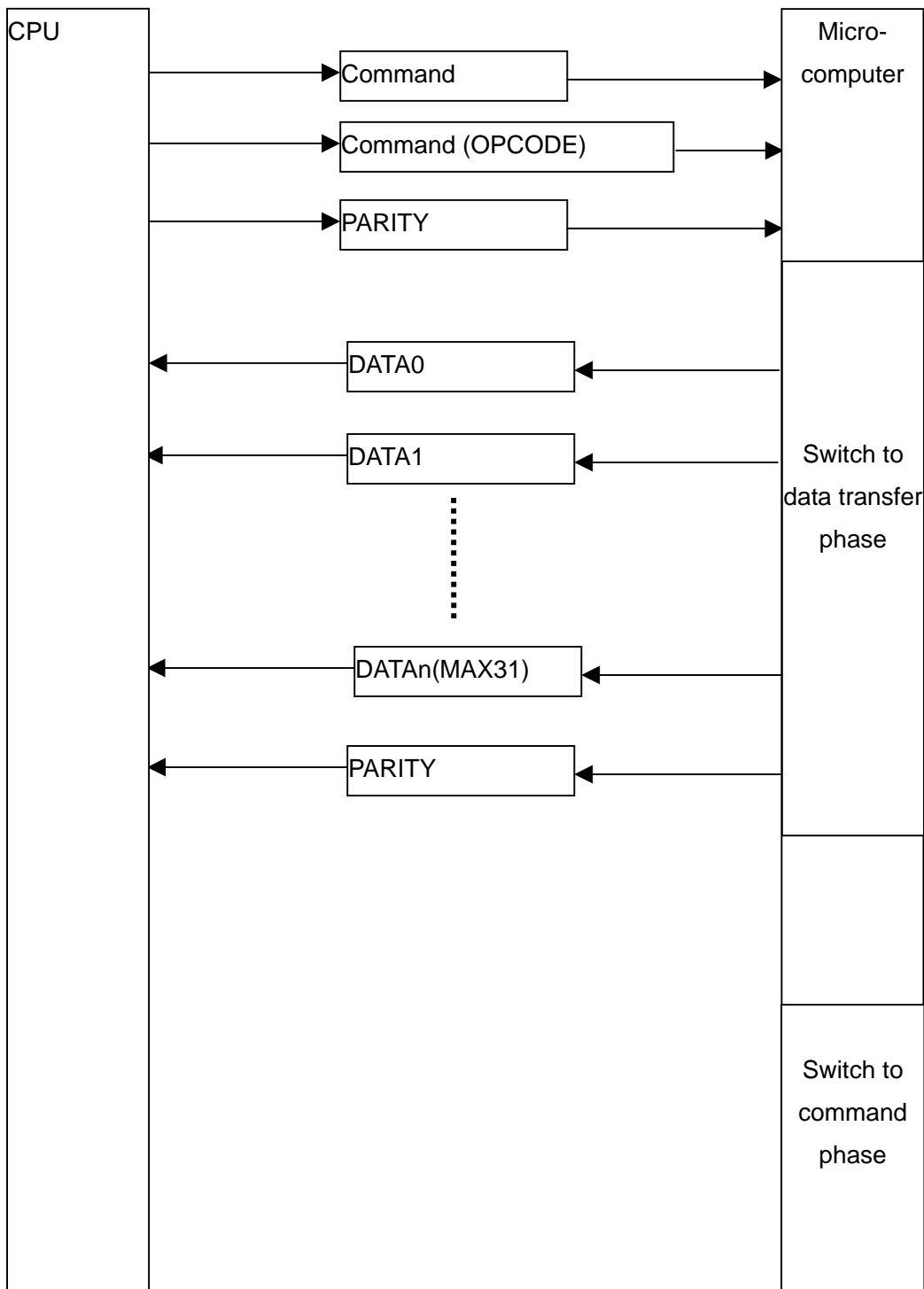
3.4.1. Write Command

LED Lighting control etc



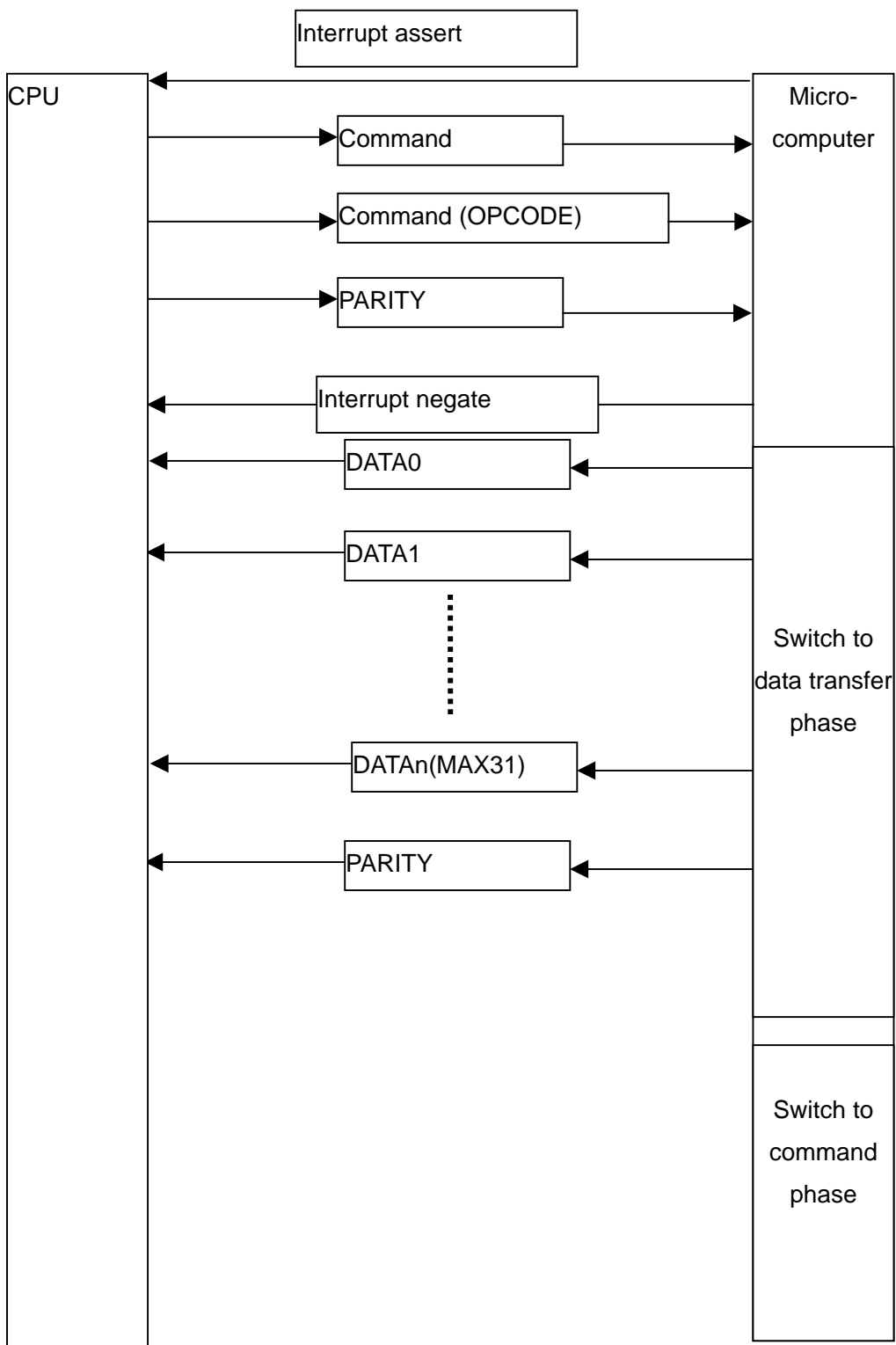
3.4.2. Read Command

Temperature read by CPU



3.4.3. Interrupt + Read Command

SW



3.5. Command

3.5.1. Command Construction

The command is a 2 byte command.

Write (CPU -> Microcomputer)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	Length					

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
OPCODE							

Read (Microcomputer -> CPU)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1	0						

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
OPCODE							

Command List

3.5.2. Commands with no data payload

Command		Command name	Microcomputer operation
1Byte	2Byte		
FF	---	NOP	Used in preamble
0x00	0x02	BOOT_START	Boot starts, CPU sends this command at the start. If this command is not received within 10 seconds after reset, power does not go on. This is displayed during boot.
0x00	0x03	BOOT_END	The boot display is completed, and the device operates normally. If this command is not received within 5 minutes, power goes off.
0x00	0x06	POFF	Power switches off.
0x00	0x0C	SHUT_DOWN_WAIT	SHUT DOWN preparations
0x00	0x0D	SHUT_DOWN_WAIT_N	Cancel SHUT DOWN preparations
0x00	0x0E	REBOOT	REBOOT (system reset) start

3.5.3. Data Payload 1 Byte Command

0x01	0x30	BZ_ON	Buzzer sounds.
-----			Buzzer control, with fine selection of whether to sound for 1 byte of data
0x01	0x33	FANSPEED_CTL	FAN speed can be selected.
0x80			0 Stopped 3 Maximum Settings above 3 (only enabled for lower 2 bits)
0x01	0x35	SYSTEM_WDT	Performs clear and settings for system watchdog.
0x80			
	0x37	TEMP	Obtains the temperature.
0x80			Receivable data is in Centigrade
	0x38	FANSPEED	Obtains fan speed information
0x80			Double the number of FAN revolutions in 3 seconds is displayed. rpm= (obtained data) ×10.
0x01	0x3a	LED_BRIGHT	Adjusts the brightness of the current LED
0x80			
0x01	0x3b	HDD_POWER	Controls the HDD power supply
0x80			
	0x3c	MAIN_STATUS	Obtains the STATUS of the microcomputer
0x80			

3.5.4. Data Payload 2 Byte Command

0x02	0x50	LED_CPU_MCON	Switches LED between main CPU control and microcomputer control.
0x80			
0x02	0x51	LED_ON_OFF	Controls whether the LED is on or off
0x80			
0x02	0x52	LED_BLINK	Selects the LED for LED flashing display
0x80			
0x02	0x53	BZ_FREQ	Buzzer frequency settings
0x80			
0x02	0x54	LED_PATTERN	Controls LED flashing
0x80			

3.6. Buzzer ON/OFF

3.6.1. Command

0x01 First operand read 0x80

0x30 Second operand

3.6.2. Data

0x00 Stop the sound

0x01 [Pi-po]

0x02 [Pi]

0x03 Continuous sound [Piiii-]

0x04 Sounds every 0.3 seconds

0x10 Repeats sounding for 0.5 seconds then stopping for 0.3 seconds.

0x20 [Pi-po-pa-po]

3.7. Buzzer pitch

3.7.1. Command

0x02 First operand setting

0x80 First operand reading of settings.

0x53 Second operand

3.7.2. Data 0

Frequency settings lower order

3.7.3. Data 1

Frequency settings upper order

3.7.4. Relationship between sound pitch and frequency

A	A#	B	C	C#	D	D#	E	F	F#	G	G#
55	58	62	65	69	73	78	82	87	92	98	104
110	117	123	131	139	147	156	165	175	185	196	208
220	233	247	262	277	294	311	330	349	370	392	415
440	466	494	523	554	587	622	659	698	740	784	831
880	932	988	1047	1109	1175	1245	1319	1397	1480	1568	1661
1760	1865	1976	2093	2217	2349	2489	2637	2794	2960	3136	3322

Relationship between values set on microcomputer and sound pitch

A	A#	B	C	C#	D	D#	E	F	F#	G	G#
		FC04	F062	E273	D60A	C852	BE8C	B399	A9D6	9F70	963D
8E0B	858C	7F08	7746	7068	6A4A	6429	5EB2	5949	5475	4FB8	4B1E

4705	430F	3F42	3BA3	3868	3525	323D	2F59	2CC5	2A3A	27DC	25A6
2382	2187	1FA1	1DE0	1C34	1A9E	191E	17B5	1662	151D	13EE	12CD
11C1	10C3	0FD0	0EEC	0E16	0D4C	0C8C	0BD8	0B2F	0A8E	09F7	0968
08E0	0860	07E8	0777	070C	06A6	0647	05EC	0597	0547	04FB	04B4
		3F4									
		1FA									
		FD									

3.8. System Watchdog

3.8.1. Command

0x01 First operand read 0x80 when setting

0x35 Second operand

3.8.2. Data

Set the time until the power goes OFF for forced OFF. You can set up to 255 seconds.

However, setting to 0 will cause the system watchdog to stop and not operate.

If read is performed, the time for the watchdog to operate is displayed.

0xFF – (time to shutdown) = Setting value

3.9. Temperature Read

3.9.1. Command

0x80 First Operand (read only)

0x37 Second operand

3.9.2. Data

The temperature on the board can be read.

The read data is signed char.

The data is from -55°C to 125°C.

3.10. SW Read

3.10.1. Command

0x80 First Operand (read only)

0x36 Second operand

3.10.2. Data

bit7-bit4	bit4	bit3	bit2	bit1	Bit0
0	1	F_INIT_SW	1	1	Power SW

If SW or INITSW is pressed, an interrupt occurs. **You can research the cause of an interrupt by reading the SW.**

Reading this resistor clears the interrupt.

*If the SW is released at the point when read is started, the value returns to 1. Therefore, measure the pressed time on the CPU to judge.

bit4: Always 1

bit3: 0 when INIT_SW is pressed

bit2: Always 1

bit1: Always 1

bit0: Power_SW 0 when Power_SW is pressed

3.11. LED Display

3.11.1. Command

0x01 No.1 operand read 0x80 when setting

No.2 operand

Switching LED control rights: 0x50

Switching LED on/off: 0x51

Flash LED: 0x52

3.11.2. Data

DATA0

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	LINK	DIAG	INFO	Power

DATA1

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	0	0	0

3.11.3. Data Meaning

Control Rights Switching

- 0: LED control performed by microcomputer
- 1: LED control performed by CPU

Switching on/off

- 0: Switch LED off
- 1: Light LED

Flash Switching

- 0: Do not flash LED
- 1: Flash LED

3.12. LED brightness

3.12.1. Command

0x00 First operand 0x80 read

0X3a Second operand

3.12.2. Data

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0				LED Illumination			

3.12.3. Data Meaning

LED Illumination

Setting possible in the 0-0xf range

0x0= Off

0xf = Maximum illumination

3.13. HDD Power control

3.13.1. Command

0x00 First operand 0x80 (read)

0X3b Second operand

3.13.2. Data

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
				0	0	0	HDD

4. ACK/NACK List

HEX	mnemonic	
0x00	ACK	Good
0xF1	OVER_RUN	UART physical layer error Physical layer buffer over
0xF2	FRAMING_ERR	UART physical layer error Physical layer frame error
0xF3	PARITYERROR	UART physical layer error Physical layer parity error
0xF4	Invalid_COM	Command does not exist
0xF5	Com_len_err	Command and data payload values do not correspond
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0xF7	DATA_PARITY_ERROR	Data parity is wrong.