# USB协议分类

## USB Device Requests：8bytes

**bmRequestType** : 1Byte, Characteristics of request:

**bRequest** : 1Byte, Specific request (refer to Table 9-3)

**wValue** : 2Byte, Word-sized field that varies according to request

**wIndex**: 2Byte,Word-sized field that varies according to request; typically used to pass an index or offset

**wLength**: 2Byte, Number of bytes to transfer if there is a Data stage

**bmRequestType：**

80 06 00 01 00 00 12 00 ==》 80 : Device-to-host | Standard | Device //Get Descriptor

00 09 01 00 00 00 00 00 ==》 00 : Host-to-device | Standard | Device //Set Config

01 0B 00 00 01 00 00 00 ==》 01 : Host-to-device | Standard | Interface //Set Interface

A1 86 00 04 00 01 01 00 ==》 A1 : Host-to-device | Class | Interface //Get Class Interface

### bmRequestType

D7: Data transfer direction

0 = Host-to-device //Set

1 = Device-to-host //Get

D6...5: Type

0 = Standard

1 = Class

2 = Vendor

3 = Reserved

D4...0: Recipient

0 = Device

1 = Interface

2 = Endpoint

3 = Other

4...31 = Reserved

### bRequest：Standrad

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bmRequestType(1) | bRequest(1) | wValue(2) | wIndex(2) | wLength(2) | Data(2) |
| 0x00  0x01  0x02 | CLEAR\_FEATURE(0x01) | Feature Selector | Zero Interface Endpoint | 0x0000 | None |
| 0x80  0x81  0x02 | GET\_STATUS(0x00) | 0x0000 | Zero Interface Endpoint | 0x0002 | Device, Interface, or Endpoint Status |
| 0x00  0x01  0x02 | SET\_FEATURE(0x03) | **Feature Selector** | Zero Interface Endpoint | 0x0000 | None |
| 0x82 | SYNCH\_FRAME(0x0C) | 0x0000 | Endpoint | 0x0002 | Frame Number |
| 0x00 | SET\_ADDRESS(0x05) | Device Address | 0x0000 | 0x0000 | None |
| 0x80 | GET\_CONFIGURATION(0x08) | 0x0000 | 0x0000 | 0x0001 | Configuration Value |
| 0x00 | SET\_CONFIGURATION(0x09) | Configuration Value | 0x0000 | 0x0000 | None |
| 0x81 | GET\_INTERFACE(0x0A) | 0x0000 | Interface | 0x0001 | Alternate Interface |
| 0x01 | SET\_INTERFACE(0x0B) | Alternate Setting | Interface | 0x0000 | None |
| 0x80 | GET\_DESCRIPTOR(0x06) | **Descriptor Type** and Descriptor Index | 0x0000 or Language ID | Descriptor Length | Descriptor |
| 0x00 | SET\_DESCRIPTOR(0x07) | Descriptor Type and Descriptor Index | 0x0000 or Language ID | Descriptor Length | Descriptor |

### bRequest：Class-Specific

wValue: specifies the Control Selector (CS) in the high byte, and the low byte must be

set to zero.

wIndex: specifies the interface or endpoint to be addressed in the low byte, and the

entity ID or zero in the high byte.

ctrl->wIndex & 0xff :

= UVC\_INTF\_CONTROL = 0

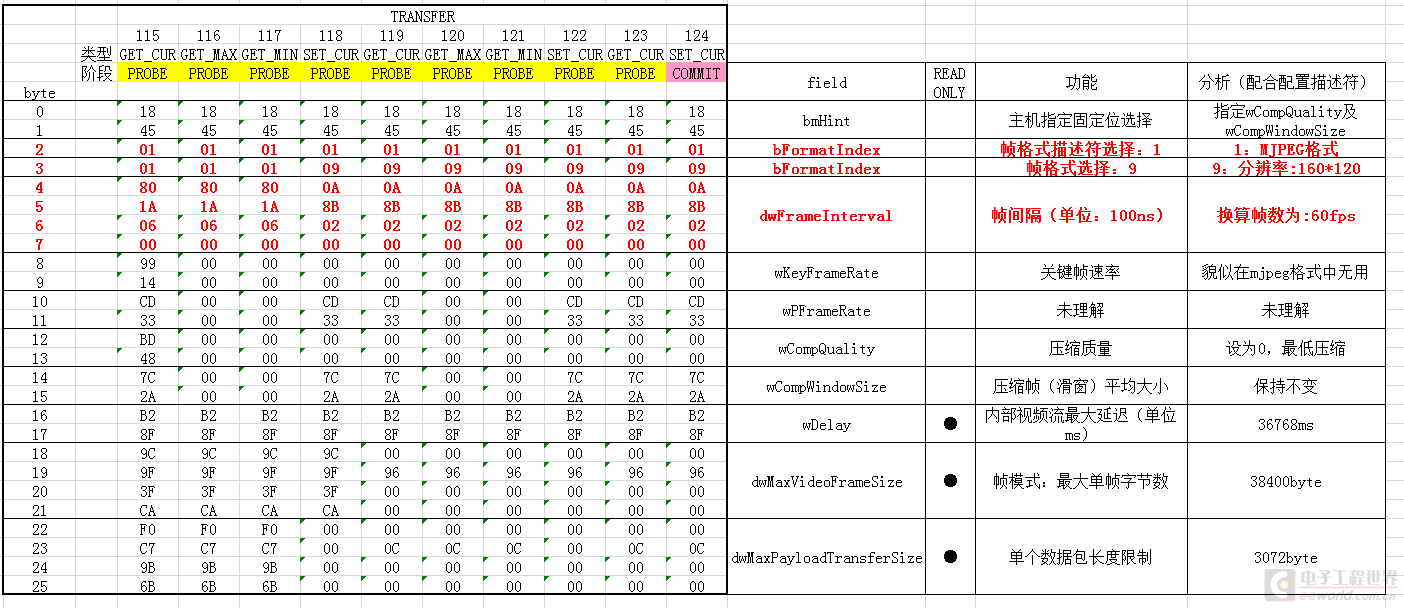
= UVC\_INTF\_STREAMING = 1

#### VideoControl Requests

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bmRequestType(1) | bRequest(1) | wValue(2) | wIndex(2) | wLength(2) | Data(2) |
| 0x21 | SET\_CUR (0x01) | CS | Entity ID and Interface  wIndex & 0xff = 0 | Length of parameter block | Parameter block. |
| 0xA1 | GET\_CUR(0x81)  GET\_MIN(0x82)  GET\_MAX(0x83)  GET\_RES(0x84)  GET\_LEN(0x85)  GET\_INFO(0x86)  GET\_DEF(0x87) | CS | Entity ID and Interface  wIndex & 0xff = 0 | Length of parameter block | Parameter block. |

#### VideoStreaming Requests

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bmRequestType(1) | bRequest(1) | wValue(2) | wIndex(2) | wLength(2) | Data(2) |
| 0x21 | SET\_CUR (0x01) | CS | Zero and Interface  wIndex & 0xff = 1 | Length of parameter block | Parameter block. |
| 0xA1 | GET\_CUR(0x81)  GET\_MIN(0x82)  GET\_MAX(0x83)  GET\_RES(0x84)  GET\_LEN(0x85)  GET\_INFO(0x86)  GET\_DEF(0x87) | CS | Zero and Interface  wIndex & 0xff = 1 | Length of parameter block | Parameter block. |



#### CS

**VideoControl Interface Control Selectors**

VC \_CONTROL\_ UNDEFINED 0x00

VC\_VIDEO\_POWER\_MODE\_CONTROL 0x01

VC\_REQUEST\_ERROR\_CODE\_CONTROL 0x02

Reserved 0x03

Terminal Control Selectors

TE\_CONTROL\_UNDEFINED 0x00

Selector Unit Control Selectors

SU\_CONTROL\_UNDEFINED 0x00

SU\_INPUT\_SELECT\_CONTROL 0x01

Camera Terminal Control Selectors

CT\_CONTROL\_UNDEFINED 0x00

CT\_SCANNING\_MODE\_CONTROL 0x01

CT\_AE\_MODE\_CONTROL 0x02

CT\_AE\_PRIORITY\_CONTROL 0x03

CT\_EXPOSURE\_TIME\_ABSOLUTE\_CONTROL 0x04

CT\_EXPOSURE\_TIME\_RELATIVE\_CONTROL 0x05

CT\_FOCUS\_ABSOLUTE\_CONTROL 0x06

CT\_FOCUS\_RELATIVE\_CONTROL 0x07

CT\_FOCUS\_AUTO\_CONTROL 0x08

CT\_IRIS\_ABSOLUTE\_CONTROL 0x09

CT\_IRIS\_RELATIVE\_CONTROL 0x0A

CT\_ZOOM\_ABSOLUTE\_CONTROL 0x0B

CT\_ZOOM\_RELATIVE\_CONTROL 0x0C

CT\_PANTILT\_ABSOLUTE\_CONTROL 0x0D

CT\_PANTILT\_RELATIVE\_CONTROL 0x0E

CT\_ROLL\_ABSOLUTE\_CONTROL 0x0F

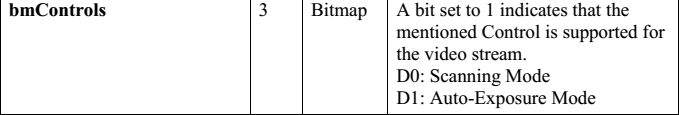
CT\_ROLL\_RELATIVE\_CONTROL 0x10

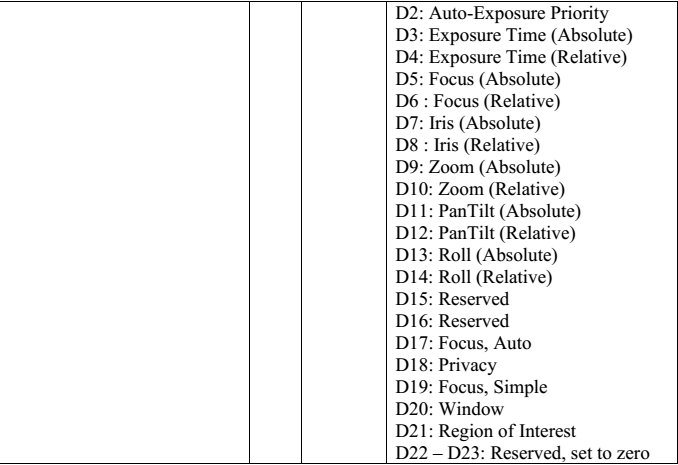
CT\_PRIVACY\_CONTROL 0x11

CT\_FOCUS\_SIMPLE\_CONTROL 0x12

CT\_WINDOW\_CONTROL 0x13

CT\_REGION\_OF\_INTEREST\_CONTROL 0x14





Processing Unit Control Selectors

PU\_CONTROL\_UNDEFINED 0x00

PU\_BACKLIGHT\_COMPENSATION\_CONTROL 0x01

PU\_BRIGHTNESS\_CONTROL 0x02

PU\_CONTRAST\_CONTROL 0x03

PU\_GAIN\_CONTROL 0x04

PU\_POWER\_LINE\_FREQUENCY\_CONTROL 0x05

PU\_HUE\_CONTROL 0x06

PU\_SATURATION\_CONTROL 0x07

PU\_SHARPNESS\_CONTROL 0x08

PU\_GAMMA\_CONTROL 0x09

PU\_WHITE\_BALANCE\_TEMPERATURE\_CONTROL 0x0A

PU\_WHITE\_BALANCE\_TEMPERATURE\_AUTO\_CONTROL 0x0B

PU\_WHITE\_BALANCE\_COMPONENT\_CONTROL 0x0C

PU\_WHITE\_BALANCE\_COMPONENT\_AUTO\_CONTROL 0x0D

PU\_DIGITAL\_MULTIPLIER\_CONTROL 0x0E

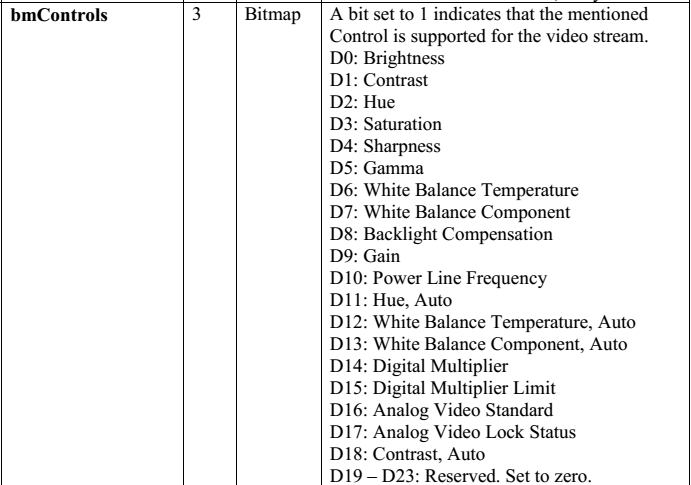
PU\_DIGITAL\_MULTIPLIER\_LIMIT\_CONTROL 0x0F

PU\_HUE\_AUTO\_CONTROL 0x10

PU\_ANALOG\_VIDEO\_STANDARD\_CONTROL 0x11

PU\_ANALOG\_LOCK\_STATUS\_CONTROL 0x12

PU\_CONTRAST\_AUTO\_CONTROL 0x13



Encoding Unit Control Selectors

EU\_CONTROL\_UNDEFINED 0x00

EU\_SELECT\_LAYER\_CONTROL 0x01

EU\_PROFILE\_TOOLSET\_CONTROL 0x02

EU\_VIDEO\_RESOLUTION\_CONTROL 0x03

EU\_ MIN\_FRAME\_INTERVAL\_CONTROL 0x04

EU\_ SLICE\_MODE\_CONTROL 0x05

EU\_RATE\_CONTROL\_MODE\_CONTROL 0x06

EU\_AVERAGE\_BITRATE\_CONTROL 0x07

EU\_CPB\_SIZE\_CONTROL 0x08

EU\_PEAK\_BIT\_RATE\_CONTROL 0x09

EU\_QUANTIZATION\_PARAMS\_CONTROL 0x0A

EU\_SYNC\_REF\_FRAME\_CONTROL 0x0B

EU\_LTR\_BUFFER\_ CONTROL 0x0C

EU\_LTR\_PICTURE\_CONTROL 0x0D

EU\_LTR\_VALIDATION\_CONTROL 0x0E

EU\_LEVEL\_IDC\_LIMIT\_CONTROL 0x0F

EU\_SEI\_PAYLOADTYPE\_CONTROL 0x10

EU\_QP\_RANGE\_CONTROL 0x11

EU\_PRIORITY\_CONTROL 0x12

EU\_START\_OR\_STOP\_LAYER\_CONTROL 0x 13

EU\_ERROR\_RESILIENCY\_CONTROL 0x14

Extension Unit Control Selectors

XU\_CONTROL\_UNDEFINED 0x00

VideoStreaming Interface Control Selectors

VS\_CONTROL\_UNDEFINED 0x00

VS\_PROBE\_CONTROL 0x01

VS\_COMMIT\_CONTROL 0x02

VS\_STILL\_PROBE\_CONTROL 0x03

VS\_STILL\_COMMIT\_CONTROL 0x04

VS\_STILL\_IMAGE\_TRIGGER\_CONTROL 0x05

VS\_STREAM\_ERROR\_CODE\_CONTROL 0x06

VS\_GENERATE\_KEY\_FRAME\_CONTROL 0x07

VS\_UPDATE\_FRAME\_SEGMENT\_CONTROL 0x08

VS\_SYNCH\_DELAY\_CONTROL 0x09

#### GET\_INFO

**the wLength field shall always be set to a value of 1 byte.**

**wData:**

Bit field Description Bit State

D0 : 1=Supports GET value requests //Capability

D1 : 1=Supports SET value requests //Capability

D2 : 1=Disabled due to automatic mode (underdevice control) //State

D3 : 1= Autoupdate Control //Capability

D4 : 1= Asynchronous Control //Capability

D5 : 1= Disabled due to incompatibility with Commit state. //State

D7..D6 Reserved (Set to 0) --

### wValue ：Descriptor Types

DEVICE 1

CONFIGURATION 2

STRING 3

INTERFACE 4

ENDPOINT 5

DEVICE\_QUALIFIER 6

OTHER\_SPEED\_CONFIGURATION 7

INTERFACE\_POWER1 8

### Standard Feature Selectors

Feature Selector Recipient Value

DEVICE\_REMOTE\_WAKEUP Device 1

ENDPOINT\_HALT Endpoint 0

TEST\_MODE Device 2

## UVC Control

### uvc\_camera\_terminal

static const struct uvc\_camera\_terminal\_descriptor uvc\_camera\_terminal = {

.bLength = UVC\_DT\_CAMERA\_TERMINAL\_SIZE(3),

.bDescriptorType = USB\_DT\_CS\_INTERFACE,

.bDescriptorSubType = UVC\_VC\_INPUT\_TERMINAL,

**.bTerminalID = 1, //wIndex**

.wTerminalType = cpu\_to\_le16(0x0201),

.bAssocTerminal = 0,

.iTerminal = 0,

.wObjectiveFocalLengthMin = cpu\_to\_le16(0),

.wObjectiveFocalLengthMax = cpu\_to\_le16(0),

.wOcularFocalLength = cpu\_to\_le16(0),

.bControlSize = 3,

.bmControls[0] = 2,

.bmControls[1] = 0,

.bmControls[2] = 0,

};

#### bmControls：

D0: Scanning Mode

D1: Auto-Exposure Mode

D2: Auto-Exposure Priority

D3: Exposure Time (Absolute)

D4: Exposure Time (Relative)

D5: Focus (Absolute)

D6 : Focus (Relative)

D7: Iris (Absolute)

D8 : Iris (Relative)

D9: Zoom (Absolute)

D10: Zoom (Relative)

D11: PanTilt (Absolute)

D12: PanTilt (Relative)

D13: Roll (Absolute)

D14: Roll (Relative)

D15: Reserved

D16: Reserved

D17: Focus, Auto

D18: Privacy

D19: Focus, Simple

D20: Window

D21: Region of Interest

D22 – D23: Reserved, set to zero

#### wIndex

**.bTerminalID = 1, //wIndex**

#### wValue

/\* A.9.4. Camera Terminal Control Selectors \*/

#define UVC\_CT\_CONTROL\_UNDEFINED 0x00

#define UVC\_CT\_SCANNING\_MODE\_CONTROL 0x01

#define UVC\_CT\_AE\_MODE\_CONTROL 0x02

#define UVC\_CT\_AE\_PRIORITY\_CONTROL 0x03

#define UVC\_CT\_EXPOSURE\_TIME\_ABSOLUTE\_CONTROL 0x04

#define UVC\_CT\_EXPOSURE\_TIME\_RELATIVE\_CONTROL 0x05

#define UVC\_CT\_FOCUS\_ABSOLUTE\_CONTROL 0x06

#define UVC\_CT\_FOCUS\_RELATIVE\_CONTROL 0x07

#define UVC\_CT\_FOCUS\_AUTO\_CONTROL 0x08

#define UVC\_CT\_IRIS\_ABSOLUTE\_CONTROL 0x09

#define UVC\_CT\_IRIS\_RELATIVE\_CONTROL 0x0a

#define UVC\_CT\_ZOOM\_ABSOLUTE\_CONTROL 0x0b

#define UVC\_CT\_ZOOM\_RELATIVE\_CONTROL 0x0c

#define UVC\_CT\_PANTILT\_ABSOLUTE\_CONTROL 0x0d

#define UVC\_CT\_PANTILT\_RELATIVE\_CONTROL 0x0e

#define UVC\_CT\_ROLL\_ABSOLUTE\_CONTROL 0x0f

#define UVC\_CT\_ROLL\_RELATIVE\_CONTROL 0x10

#define UVC\_CT\_PRIVACY\_CONTROL 0x11

### uvc\_processing

static const struct uvc\_processing\_unit\_descriptor uvc\_processing = {

.bLength = UVC\_DT\_PROCESSING\_UNIT\_SIZE(2),

.bDescriptorType = USB\_DT\_CS\_INTERFACE,

.bDescriptorSubType = UVC\_VC\_PROCESSING\_UNIT,

**.bUnitID = 2, //wIndex**

.bSourceID = 1,

.wMaxMultiplier = cpu\_to\_le16(16\*1024),

.bControlSize = 2,

.bmControls[0] = 1,

.bmControls[1] = 0,

.iProcessing = 0,

};

#### bmControls：

D0: Brightness

D1: Contrast

D2: Hue

D3: Saturation

D4: Sharpness

D5: Gamma

D6: White Balance Temperature

D7: White Balance Component

D8: Backlight Compensation

D9: Gain

D10: Power Line Frequency

D11: Hue, Auto

D12: White Balance Temperature, Auto

D13: White Balance Component, Auto

D14: Digital Multiplier

D15: Digital Multiplier Limit

D16: Analog Video Standard

D17: Analog Video Lock Status

D18: Contrast, Auto

D19 – D23: Reserved. Set to zero

#### wIndex

**.bUnitID = 2, //wIndex**

#### wValue

/\* A.9.5. Processing Unit Control Selectors \*/

#define UVC\_PU\_CONTROL\_UNDEFINED 0x00

#define UVC\_PU\_BACKLIGHT\_COMPENSATION\_CONTROL 0x01

#define UVC\_PU\_BRIGHTNESS\_CONTROL 0x02

#define UVC\_PU\_CONTRAST\_CONTROL 0x03

#define UVC\_PU\_GAIN\_CONTROL 0x04

#define UVC\_PU\_POWER\_LINE\_FREQUENCY\_CONTROL 0x05

#define UVC\_PU\_HUE\_CONTROL 0x06

#define UVC\_PU\_SATURATION\_CONTROL 0x07

#define UVC\_PU\_SHARPNESS\_CONTROL 0x08

#define UVC\_PU\_GAMMA\_CONTROL 0x09

#define UVC\_PU\_WHITE\_BALANCE\_TEMPERATURE\_CONTROL 0x0a

#define UVC\_PU\_WHITE\_BALANCE\_TEMPERATURE\_AUTO\_CONTROL 0x0b

#define UVC\_PU\_WHITE\_BALANCE\_COMPONENT\_CONTROL 0x0c

#define UVC\_PU\_WHITE\_BALANCE\_COMPONENT\_AUTO\_CONTROL 0x0d

#define UVC\_PU\_DIGITAL\_MULTIPLIER\_CONTROL 0x0e

#define UVC\_PU\_DIGITAL\_MULTIPLIER\_LIMIT\_CONTROL 0x0f

#define UVC\_PU\_HUE\_AUTO\_CONTROL 0x10

#define UVC\_PU\_ANALOG\_VIDEO\_STANDARD\_CONTROL 0x11

#define UVC\_PU\_ANALOG\_LOCK\_STATUS\_CONTROL 0x12

### uvc\_output\_terminal

static const struct uvc\_output\_terminal\_descriptor uvc\_output\_terminal = {

.bLength = UVC\_DT\_OUTPUT\_TERMINAL\_SIZE,

.bDescriptorType = USB\_DT\_CS\_INTERFACE,

.bDescriptorSubType = UVC\_VC\_OUTPUT\_TERMINAL,

**.bTerminalID = 3, //wIndex**

.wTerminalType = cpu\_to\_le16(0x0101),

.bAssocTerminal = 0,

.bSourceID = 2,

.iTerminal = 0,

};

# USB协议解析

## USB Camera Insert //参见bRequest:Standrad

### 80 06 00 01 00 00 12 00 // 00 01 = DEVICE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0x80 | GET\_DESCRIPTOR(0x06) | **Descriptor Type** and Descriptor Index | 0x0000 or Language ID | Descriptor Length | Descriptor |

#### 80 =（Device-to-host | Standard | Device）//GET

#### 06 = (GET\_DESCRIPTOR)

12 01 00 02 EF 02 01 40 DA 0B 41 1A 06 00 03 01 02 01

### 80 06 00 02 00 00 FF 00 // 00 02 = CONFIGURATION[0]

09 02 92 05 02 01 04 80 FA 08 0B 00 02 0E 03 00 05 09 04 00 00 01 0E 01 00 05 0D 24

01 00 01 4E 00 C0 E1 E4 00 01 01 12 24 02 01 01 02 00 00 00 00 00 00 00 00 03 0E 20

00 0B 24 05 02 01 00 00 02 7F 17 00 09 24 03 03 01 01 00 04 00 1B 24 06 04 8C A7 29

12 B4 47 94 40 B0 CE DB 07 38 6F B9 38 02 01 02 02 00 06 00 07 05 83 03 10 00 06 05

25 03 10 00 09 04 01 00 00 0E 02 00 00 0F 24 01 02 A5 04 81 00 03 02 01 00 01 00 00

1B 24 04 01 0D 59 55 59 32 00 00 10 00 80 00 00 AA 00 38 9B 71 10 01 00 00 00 00 2A

24 05 01 00 80 02 E0 01 00 00 65 04 00 00 CA 08 00 60 09 00 15 16 05 00 04 15 16 05

00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00 2A 24 05 02 00 A0 00 78 00 00 50 46 00 00 A0

8C 00 00 96 00 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00 2A

24 05 03

### 80 06 00 02 00 00 92 05 // 00 02 = CONFIGURATION[0]

#### bLength: Byte0

#### bDescriptorType: Byte1

#define USB\_DT\_DEVICE 0x01

#define USB\_DT\_CONFIG 0x02

#define USB\_DT\_STRING 0x03

#define USB\_DT\_INTERFACE 0x04

#define USB\_DT\_ENDPOINT 0x05

#define USB\_TYPE\_STANDARD (0x00 << 5)

#define USB\_TYPE\_CLASS (0x01 << 5)

#define USB\_DT\_CS\_DEVICE (USB\_TYPE\_CLASS | USB\_DT\_DEVICE) 0x21

#define USB\_DT\_CS\_CONFIG (USB\_TYPE\_CLASS | USB\_DT\_CONFIG) 0x22

#define USB\_DT\_CS\_STRING (USB\_TYPE\_CLASS | USB\_DT\_STRING) 0x23

#define USB\_DT\_CS\_INTERFACE (USB\_TYPE\_CLASS | USB\_DT\_INTERFACE) 0x24

#define USB\_DT\_CS\_ENDPOINT (USB\_TYPE\_CLASS | USB\_DT\_ENDPOINT) 0x25

#### bDescriptorSubtype：Byte2

##### Video Class-Specific VC Interface Descriptor Subtypes

**bDescriptorType = USB\_DT\_CS\_INTERFACE**

VC\_DESCRIPTOR\_UNDEFINED 0x00

VC\_HEADER 0x01

VC\_INPUT\_TERMINAL 0x02

VC\_OUTPUT\_TERMINAL 0x03

VC\_SELECTOR\_UNIT 0x04

VC\_PROCESSING\_UNIT 0x05

VC\_EXTENSION\_UNIT 0x06

VC\_ENCODING\_UNIT 0x07

##### Video Class-Specific VS Interface Descriptor Subtypes

**bDescriptorType = USB\_DT\_CS\_INTERFACE**

VS\_ UNDEFINED 0x00

VS\_INPUT\_HEADER 0x01

VS\_OUTPUT\_HEADER 0x02

VS\_STILL\_IMAGE\_FRAME 0x03

VS\_FORMAT\_UNCOMPRESSED 0x04

VS\_FRAME\_UNCOMPRESSED 0x05

VS\_FORMAT\_MJPEG 0x06

VS\_FRAME\_MJPEG 0x07

Reserved 0x08

Reserved 0x09

VS\_FORMAT\_MPEG2TS 0x0A

Reserved 0x0B

VS\_FORMAT\_DV 0x0C

VS\_COLORFORMAT 0x0D

Reserved 0x0E

Reserved 0x0F

VS\_FORMAT\_FRAME\_BASED 0x10

VS\_FRAME\_FRAME\_BASED 0x11

VS\_FORMAT\_STREAM\_BASED 0x12

VS\_FORMAT\_H264 0x13

VS\_FRAME\_H264 0x14

VS\_FORMAT\_H264\_SIMULCAST 0x15

#### Data

09 **02** 92 05 02 01 04 80 FA // CONFIG

08 **0B** 00 02 0E 03 00 05 // INTERFACE\_ASSOCIATION

09 **04** 00 00 01 0E 01 00 05 // INTERFACE

0D **24** 01 00 01 4E 00 C0 E1 E4 00 01 01 // CS\_INTERFACE

//0D =UVC\_DT\_HEADER\_SIZE (1) = 12+1

//24 = CS\_INTERFACE = 0x24

//01 =UVC\_VC\_HEADER = 0x01

12 **24** 02 01 01 02 00 00 00 00 00 00 00 00 03 0E 20 00

//12 = UVC\_DT\_CAMERA\_TERMINAL\_SIZE(3) = 15+3

//24 = CS\_INTERFACE = 0x24

//02 = UVC\_VC\_INPUT\_TERMINAL = 0x02

//01 = bTerminalID: uniquely identified

//0E 20 00 : 0000 0000 0010 0000 0000 1110

//D1: Auto-Exposure Mode

// D2: Auto-Exposure Priority

// D3: Exposure Time (Absolute)

// D13: Roll (Absolute)

0B **24** 05 02 01 00 00 02 7F 17 00

//0B =UVC\_DT\_PROCESSING\_UNIT\_SIZE (2) = 9+2

//24 = CS\_INTERFACE = 0x24

//05 =UVC\_VC\_PROCESSING\_UNIT = 0x05

//02 = bUnitID: uniquely identified

09 **24** 03 03 01 01 00 04 00

//09 =UVC\_DT\_OUTPUT\_TERMINAL\_SIZE = 9

//24 = CS\_INTERFACE = 0x24

//03 =UVC\_VC\_OUTPUT\_TERMINAL = 0x03

//03 = bTerminalID: uniquely identified

1B **24** 06 04 8C A7 29 12 B4 47 94 40 B0 CE DB 07 38 6F B9 38 02 01 02 02 00 06 00

//1B =UVC\_DT\_EXTENSION\_UNIT\_SIZE(p, n) = 27

//24 = CS\_INTERFACE = 0x24

//06 =UVC\_VC\_EXTENSION\_UNIT = 0x06

//04 = bUnitID: uniquely identified

07 **05** 83 03 10 00 06 // ENDPOINT

05 **25** 03 10 00

09 **04** 01 00 00 0E 02 00 00

0F **24** 01 02 A5 04 81 00 03 02 01 00 01 00 00

1B **24** 04 01 0D 59 55 59 32 00 00 10 00 80 00 00 AA 00 38 9B 71 10 01 00 00 00 00

2A **24** 05 01 00 80 02 E0 01 00 00 65 04 00 00 CA 08 00 60 09 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 05 02 00 A0 00 78 00 00 50 46 00 00 A0 8C 00 00 96 00 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 05 03 00 B0 00 90 00 00 D0 5C 00 00 A0 B9 00 00 C6 00 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 05 04 00 40 01 F0 00 00 40 19 01 00 80 32 02 00 58 02 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 05 05 00 60 01 20 01 00 40 73 01 00 80 E6 02 00 18 03 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 05 06 00 80 02 E0 01 00 00 65 04 00 00 CA 08 00 60 09 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2E **24** 05 07 00 20 03 58 02 00 F0 49 02 00 B0 71 0B 00 A6 0E 00 80 1A 06 00 05 80 1A 06 00 20 A1 07 00 2A 2C 0A 00 40 42 0F 00 80 84 1E 00

22 **24** 05 08 00 00 04 00 03 00 00 C0 03 00 00 80 07 00 00 18 00 40 42 0F 00 02 40 42 0F 00 80 84 1E 00

22 **24** 05 09 00 00 05 D0 02 00 00 65 04 00 00 CA 08 00 20 1C 00 40 42 0F 00 02 40 42 0F 00 80 84 1E 00

1E **24** 05 0A 00 00 05 00 04 00 00 40 06 00 00 40 06 00 00 28 00 80 84 1E 00 01 80 84 1E 00

1E **24** 05 0B 00 80 07 38 04 00 40 E3 09 00 40 E3 09 00 48 3F 00 80 84 1E 00 01 80 84 1E 00

1E **24** 05 0C 00 40 06 B0 04 00 C0 27 09 00 C0 27 09 00 98 3A 00 80 84 1E 00 01 80 84 1E 00

1E **24** 05 0D 00 00 08 00 06 00 00 00 09 00 00 00 09 00 00 60 00 D5 DC 32 00 01 D5 DC 32 00

36 **24** 03 00 0C 00 08 00 06 40 06 B0 04 80 07 38 04 00 05 00 04 00 05 D0 02 00 04 00 03 20 03 58 02 80 02 E0 01 60 01 20 01 40 01 F0 00 B0 00 90 00 A0 00 78 00 00

06 **24** 0D 01 01 04

0B **24** 06 02 0D 01 01 00 00 00 00

2A **24** 07 01 00 80 02 E0 01 00 00 65 04 00 00 CA 08 00 60 09 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 02 00 A0 00 78 00 00 50 46 00 00 A0 8C 00 00 96 00 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 03 00 B0 00 90 00 00 D0 5C 00 00 A0 B9 00 00 C6 00 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 04 00 40 01 F0 00 00 40 19 01 00 80 32 02 00 58 02 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 05 00 60 01 20 01 00 40 73 01 00 80 E6 02 00 18 03 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 06 00 80 02 E0 01 00 00 65 04 00 00 CA 08 00 60 09 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 07 00 20 03 58 02 00 D0 DD 06 00 A0 BB 0D 00 A6 0E 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 08 00 00 04 00 03 00 00 40 0B 00 00 80 16 00 00 18 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 09 00 00 05 D0 02 00 00 2F 0D 00 00 5E 1A 00 20 1C 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 0A 00 00 05 00 04 00 00 C0 12 00 00 80 25 00 00 28 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

2A **24** 07 0B 00 80 07 38 04 00 C0 A9 1D 00 80 53 3B 00 48 3F 00 15 16 05 00 04 15 16 05 00 80 1A 06 00 20 A1 07 00 2A 2C 0A 00

22 **24** 07 0C 00 40 06 B0 04 00 40 77 1B 00 80 EE 36 00 98 3A 00 15 16 05 00 02 15 16 05 00 2A 2C 0A 00

22 **24** 07 0D 00 00 08 00 06 00 00 00 2D 00 00 00 5A 00 00 60 00 15 16 05 00 02 15 16 05 00 2A 2C 0A 00

36 **24** 03 00 0C 00 08 00 06 40 06 B0 04 80 07 38 04 00 05 00 04 00 05 D0 02 00 04 00 03 20 03 58 02 80 02 E0 01 60 01 20 01 40 01 F0 00 B0 00 90 00 A0 00 78 00 00

06 **24** 0D 01 01 04

09 **04** 01 01 01 0E 02 00 00

07 **05** 81 05 80 00 01

09 **04** 01 02 01 0E 02 00 00

07 **05** 81 05 00 02 01

09 **04** 01 03 01 0E 02 00 00

07 **05** 81 05 00 04 01

09 **04** 01 04 01 0E 02 00 00

07 **05** 81 05 00 0B 01

09 **04** 01 05 01 0E 02 00 00

07 **05** 81 05 00 0C 01

09 **04** 01 06 01 0E 02 00 00

07 **05** 81 05 80 13 01

09 **04** 01 07 01 0E 02 00 00

07 **05** 81 05 00 14 01

### 80 06 02 03 09 04 FF 00 // 02 03 = STRING[2]

1A 03 32 00 30 00 30 00 39 00 30 00 31 00 30 00 31 00 30 00 30 00 30 00 31 00 //200901010001

### 80 06 00 03 00 00 FF 00 // 02 03 = STRING[0]

04 03 09 04

### 80 06 01 03 09 04 FF 00 // 02 03 = STRING[1]

16 03 55 00 53 00 42 00 20 00 43 00 61 00 6D 00 65 00 72 00 61 00 //USB Camera

### 80 06 00 01 00 00 12 00 // 00 01 = DEVICE

### 80 06 00 02 00 00 09 00 // 00 02 = CONFIGURATION[0]

09 02 92 05 02 01 04 80 FA

### 80 06 00 02 00 00 92 05 // 00 02 = CONFIGURATION[0]

### 00 09 01 00 00 00 00 00 // 01 00 = Configuration[1]

#### 00 =（Host-to-device | Standard | Device）//SET Config

#### 09 = (SET\_CONFIGURATION)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0x00 | SET\_CONFIGURATION(0x09) | Configuration Value | 0x0000 | 0x0000 | None |

### 01 0B 00 00 01 00 00 00 // 00 00 = Alt=0=OFF, 01 00 = iface=1

#### 01 =（Host-to-device | Standard | Interface）//SET Interface

#### 0B = (SET\_INTERFACE)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0x01 | SET\_INTERFACE(0x0B) | Alternate Setting | Interface | 0x0000 | None |

### 80 06 05 03 09 04 04 00 // 05 03 = STRING[5]

STALL

### 80 06 05 03 09 04 22 00 // 05 03 = STRING[5]

22 03 55 00 53 00 42 00 32 00 2E 00 30 00 20 00 33 00 4D 00 20 00 63 00 61 00 6D 00 65 00 72 00 61 00 //USB2.0 3M camera

### 01 0B 00 00 01 00 00 00 // 00 00 = Alt[0], 01 00 = Interface[1]

### A1 86 00 04 00 01 01 00 //00 04 = EXPOSURE\_TIME\_ABSOLUTE

#### A1 =（Device-to-host | Class | Interface）//GET

0F

### A1 82 00 04 00 01 04 00

32 00 00 00

### A1 83 00 04 00 01 04 00

10 27 00 00

### A1 84 00 04 00 01 04 00

01 00 00 00

### A1 87 00 04 00 01 04 00

10 27 00 00

### A1 82 00 04 00 01 04 00

32 00 00 00

### A1 83 00 04 00 01 04 00

10 27 00 00

### A1 84 00 04 00 01 04 00

01 00 00 00

### A1 86 00 03 00 01 01 00 //00 03 = VC:AE\_PRIORITY

### //86 = GET\_INFO

### //00 01 = IT

03

### A1 82 00 03 00 01 01 00

### //82 = GET\_MIN

00

### A1 83 00 03 00 01 01 00

### //83 = GET\_MAX

01

### A1 84 00 03 00 01 01 00

### //84 = GET\_RES

01

### A1 87 00 03 00 01 01 00

### //87 = GET\_DEF

01

### A1 86 00 09 00 01 01 00 //00 09 = VC:IRIS\_ABSOLUTE

STALL

### A1 81 00 02 00 00 01 00 //00 02 = VC:AE\_MODE

### //81 = GET\_CUR

06

### A1 86 00 0F 00 01 01 00 //00 0F = VC: ROLL\_ABSOLUTE

03

### A1 82 00 0F 00 01 02 00

00 00

### A1 83 00 0F 00 01 02 00

03 00

### A1 84 00 0F 00 01 02 00

01 00

### A1 87 00 0F 00 01 02 00

00 00

### A1 86 00 02 00 02 01 00 //00 02 = VC:BRIGHTNESS

### //86 = GET\_INFO

### //00 02 = PU

03

### A1 82 00 02 00 02 02 00

00 00

### A1 83 00 02 00 02 02 00

FF 00

### A1 84 00 02 00 02 02 00

01 00

### A1 87 00 02 00 02 02 00

80 00

### A1 86 00 03 00 02 01 00 //00 03 = VC:CONTRAST

03

### A1 82 00 03 00 02 02 00

00 00

### A1 83 00 03 00 02 02 00

FF 00

### A1 84 00 03 00 02 02 00

01 00

### A1 87 00 03 00 02 02 00

80 00

### A1 86 00 06 00 02 01 00 //00 06 = VC:HUE

03

### A1 82 00 06 00 02 02 00

00 00

### A1 83 00 06 00 02 02 00

FF 00

### A1 84 00 06 00 02 02 00

01 00

### A1 87 00 06 00 02 02 00

80 00

### A1 86 00 07 00 02 01 00 //00 07 = VC:SATURATION

03

### A1 82 00 07 00 02 02 00

00 00

### A1 83 00 07 00 02 02 00

FF 00

### A1 84 00 07 00 02 02 00

01 00

### A1 87 00 07 00 02 02 00

80 00

### A1 86 00 08 00 02 01 00 //00 08 = VC:SHARPNESS

03

### A1 82 00 08 00 02 02 00

00 00

### A1 83 00 08 00 02 02 00

FF 00

### A1 84 00 08 00 02 02 00

01 00

### A1 87 00 08 00 02 02 00

80 00

### A1 86 00 09 00 02 01 00 //00 09 = VC:GAMMA

03

### A1 82 00 09 00 02 02 00

00 00

### A1 83 00 09 00 02 02 00

FF 00

### A1 84 00 09 00 02 02 00

01 00

### A1 87 00 09 00 02 02 00

80 00

### A1 86 00 0A 00 02 01 00 //00 0A = VC:WB\_TEMPERATURE

0F

### A1 82 00 0A 00 02 02 00

F0 0A

### A1 83 00 0A 00 02 02 00

64 19

### A1 84 00 0A 00 02 02 00

0A 00

### A1 87 00 0A 00 02 02 00

F8 11

### A1 86 00 01 00 02 01 00 //00 01 = VC:BACKLIGHT

03

### A1 82 00 01 00 02 02 00

00 00

### A1 83 00 01 00 02 02 00

02 00

### A1 84 00 01 00 02 02 00

01 00

### A1 87 00 01 00 02 02 00

00 00

### A1 86 00 04 00 02 01 00 //00 04 = VC:GAIN

03

### A1 82 00 04 00 02 02 00

00 00

### A1 83 00 04 00 02 02 00

FF 00

### A1 84 00 04 00 02 02 00

01 00

### A1 87 00 04 00 02 02 00

80 00

### A1 86 00 05 00 02 01 00 //00 05 = VC:POWER\_LINE\_FREQUENCY

03

### A1 82 00 05 00 02 01 00

00

### A1 83 00 05 00 02 01 00

02

### A1 84 00 05 00 02 01 00

01

### A1 87 00 05 00 02 01 00

01

### A1 85 00 0A 00 04 02 00 //00 0A = VC:EU cmd

### //85 = GET\_LEN

### //00 04 = EU

08 00

### A1 86 00 0A 00 04 01 00

### //86 = GET\_INFO

03

### A1 82 00 0A 00 04 08 00

00 00 00 00 00 00 00 00

### A1 83 00 0A 00 04 08 00

FF FF FF FF FF FF FF FF

### A1 84 00 0A 00 04 08 00

01 00 00 00 00 00 00 00

### A1 87 00 0A 00 04 08 00

00 00 00 00 00 00 00 00

### A1 85 00 0B 00 04 02 00 //00 0A = EU cmd

08 00

### A1 86 00 0B 00 04 01 00

03

### A1 82 00 0B 00 04 08 00

00 00 00 00 00 00 00 00

### A1 83 00 0B 00 04 08 00

FF FF FF FF FF FF FF FF

### A1 84 00 0B 00 04 08 00

01 00 00 00 00 00 00 00

### A1 87 00 0B 00 04 08 00

00 00 00 00 00 00 00 00

## USB Camera Open

VideoStreaming Interface Control Selectors

VS\_CONTROL\_UNDEFINED 0x00

VS\_PROBE\_CONTROL 0x01

VS\_COMMIT\_CONTROL 0x02

VS\_STILL\_PROBE\_CONTROL 0x03

VS\_STILL\_COMMIT\_CONTROL 0x04

VS\_STILL\_IMAGE\_TRIGGER\_CONTROL 0x05

VS\_STREAM\_ERROR\_CODE\_CONTROL 0x06

VS\_GENERATE\_KEY\_FRAME\_CONTROL 0x07

VS\_UPDATE\_FRAME\_SEGMENT\_CONTROL 0x08

VS\_SYNCH\_DELAY\_CONTROL 0x09

### A1 81 00 01 01 00 1A 00 // 00 01 = VS:PROBE

### //01 00 = VS

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### A1 83 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### A1 82 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### 21 01 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 00 00 00

00 00

01 //bFormatIndex

09 //bFrameIndex

80 84 1E 00 //dwFrameInterval = 0x001e8480 = 2000000\*100ns = 200ms

00 00

00 00

00 00

00 00

20 00

00 20 1C 00 //dwMaxVideoFrameSize

00 00 00 00

### A1 81 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### A1 83 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### A1 82 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### A1 81 00 03 01 00 0B 00 //00 03 = VS:STILL\_PROBE

01 01 00 00 00 60 00 00 0C 00 00

### A1 82 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 83 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### 21 01 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 00 00 00

### A1 81 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 82 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 83 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 81 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 82 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 83 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### 21 01 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 00 00 00

### A1 81 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 82 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### A1 83 00 03 01 00 0B 00

01 01 00 00 00 60 00 00 0C 00 00

### 21 01 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 00 00 00

### A1 81 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### 21 01 00 02 01 00 1A 00 //00 02 = VS:COMMIT

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### 01 0B 07 00 01 00 00 00 // 07 00 = Alt=7=ON, 01 00 = iface=1

#### 01 =（Host-to-device | Standard | Interface）//SET Interface

#### 0B = (SET\_INTERFACE)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0x01 | SET\_INTERFACE(0x0B) | Alternate Setting | Interface | 0x0000 | None |

### 01 0B 00 00 01 00 00 00 //data

### 21 01 00 01 01 00 1A 00 //00 02 = VS:PROBE

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 00 00 00

### A1 81 00 01 01 00 1A 00

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### 21 01 00 02 01 00 1A 00 //00 02 = VS:COMMIT

00 00 01 09 80 84 1E 00 00 00 00 00 00 00 00 00 20 00 00 20 1C 00 00 0C 00 00

### 01 0B 07 00 01 00 00 00 // 07 00 = Alt=7=ON, 01 00 = iface=1

# End