CM002X1 LED Control Specification

History

V0.1: Initial version.

V0.2: Changed to Little Endian.

V0.3: Saving LED Control table to flash.

Overview

This specification defines a LED control interface over USB HID output report. The application can control the LED color and operation mode with this control interface.

HID Output Report Definition

The total 16-bytes output report is defined below. The first byte is report ID. The report ID is defined as 0xFF for LED control interface(Driver would recognize this report ID in HID report descriptor to tell device supports this feature or not). The second byte is the field of LED control command. The following 14 bytes are parameters of the LED control command. The details of all LED commands are defined in the following chapter.

	Description	Size
Byte 0	HID Report ID. 0xFF: LED control	1
Byte 1	LED control command	1
Byte 2~Byte 15	Parameters	14

LED Control Commands

Several LED control commands are defined and wrapped into the HID output report. Totally four commands are defined in this specification. The application should follow the flow listed below to activate the correct LED display mode.

“LED Stop” -> “Send LED Configuration” -> “Send Color Array”…… -> “LED Start”

The device should keep former LED Configuration and Color Array if the application doesn’t send “Send LED Configuration” or “Send Color Array” command between “LED Stop” and “LED Start”. If the device gets a command which format or parameter is wrong or not supported by the device, the device should stall the set-output-report request directly.

- LED Control Command: LED Start

	Description	Size

Byte 0	HID Report ID. 0xFF: LED Control	1
Byte 1	LED Control Command. 0x01: Start	1
Byte 2~Byte 15	Reserved.	14

The “LED Start” command makes the device start the LED display sequence with the “LED Configuration” and “Color Array” sent by the application previously. The application should issue commands “Send LED Configuration” and “Send Color Array” before “LED Start” command. A “Color Array” here is a collection of data elements which stand for the RGB code.

- LED Control Command: LED Stop

	Description	Size
Byte 0	HID Report ID. 0xFF: LED Control	1
Byte 1	LED Control Command. 0x02: Stop	1
Byte 2~Byte 15	Reserved.	14

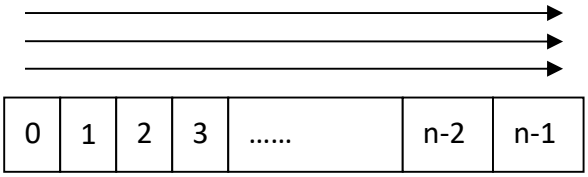
The “LED Stop” command makes the device stop the LED display sequence. The device should drive the LED to default status after getting “LED Stop” command.

- LED Control Command: Send LED Configuration

	Description	Size
Byte 0	HID Report ID. 0xFF: LED Control	1
Byte 1	LED Control Command. 0x03: Send LED Configuration	1
Byte 2	Operation Mode. 0x00: Static 0x01: Repeat Forward 0x02: Back And Forth 0x03: Lookup Table	1
Byte 3(LSB) ~ Byte 4(MSB)	Color Array Size. The numbers of elements in Color Array. Each element is composed of three bytes (RGB). For operation mode “Static”, this field is always 1.	2
Byte 5(LSB) ~ Byte 6(MSB)	LED Update Interval. The display interval (ms) between two color elements in Color Array. For operation modes “Static” and “Lookup Table”, this field is always 0.	2

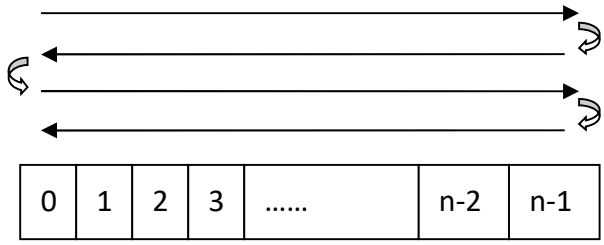
Byte 7~Byte 15	Reserved.	9

There are four operation modes defined in this specification. “Static” mode means the device always drives the LED with the only one color defined in Color Array. For “Repeat Forward” and “Back And Forth” mode, the device updates the LED with the interval declared in filed “LED Update Interval” and with colors defined in Color Array infinitely. For “Repeat Forward” mode, the device updates the Color Array’s colors in forward order repeatedly as shown in following diagram.



Color Array Size = n

For “Back And Forth” mode, the device updates the Color Array’s colors repeatedly in the manner of back and forth sequence as shown in following diagram.



Color Array Size = n

For “Lookup Table” mode, Color Array is a lookup table in which the device searches the color corresponding to audio output amplitude. If “Color Array Size” is n, the color of index 0 is corresponding to the minimum amplitude; and the color of index n-1 is corresponding to the maximum amplitude. For searching easily, “Color Array Size” should be power of 2.

- LED Control Command: Send Color Array

	Description	Size
Byte 0	HID Report ID. 0xFF: LED Control	1
Byte 1	LED Control Command. 0x04: Send LED Table	1

Byte 2(LSB) ~ Byte 3(MSB)	Offset. A zero-based value identifying the index in the Color Array. It means the offset of the four color elements wrapped in this HID output report.	2
Byte 4 ~ Byte 6(RGB)	The RGB code of the element with index “Offset”. Byte 4 ~ 6 is in the sequence of RGB.	3
Byte 7 ~ Byte 9(RGB)	The RGB code of the element with index “Offset+1”. Byte 7 ~ 9 is in the sequence of RGB.	3
Byte 10 ~ Byte 12(RGB)	The RGB code of the element with index “Offset+2”. Byte 10 ~ 12 is in the sequence of RGB.	3
Byte 13 ~ Byte 15(RGB)	The RGB code of the element with index “Offset+3”. Byte 13 ~ 15 is in the sequence of RGB.	3

After sending “Color Array Size” to the device with command “Send LED Configuration”, the application sends the whole Color Array to the device with multiple “Send Color Array” commands. The application must send all elements of Color Array sequentially. The device should ignore the elements with the index exceeding “Color Array Size”.

Saving LED Control table to flash

Since the LED color and control mode must be kept after unplugging from PC, LED Control table needs to save to flash. For CM002X1 demo board, LED Control table is saving to the sector from 0x8000 to 0x9000. Firmware erases this sector if it receives LED Stop command, and saves the table to flash if it receives LED Start command.

LED Control table:

	Description	Size
Byte 0 ~ Byte 2	“LED” means this table exists, or no table.	3
Byte 3	Operation Mode.	1
Byte 4	LED Color Number(N)	1
Byte 5	LED Update Interval in 10 ms.	1
Byte 6 ~ Byte 8	The RGB code of the 1st element.	3
……		
Byte (3+3N) ~ Byte (5+3N)	The RGB code of the last element.	3