Instructions Manual

Model Name: Laser Illumination Light Source

Model Code: MBURD-RGBW-G5

Prototype No: RGBW-G5 (1.8b)

Revision:

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Name	Signature	Date

Issued by   :   Akio Furukawa   Feb 9, 2018

Precaution for Use

- When operating this light source, a light guide cable must be connected, and the light guide output should be pointed to a safe area. Direct viewing of the light guide output may result in eye damage.

- When the light guide cable is disconnected, a safety interlock system will turn off the light emission, and a mechanical shutter will close the receptacle aperture. Never connect

Laser Safety Information

- This light source is equipped with visible wavelength lasers (405nm, 445nm, 525nm, 638nm) and an invisible, infrared laser (808nm).

- At the light guide cable output, the laser light is classified as below according to the international standard of safety of laser products: IEC 60825-1. When applicable, protective measures should be taken to avoid eye damage.

	Condition*	Laser Class (IEC 60825-1:2007)	Laser Class (IEC 60825-1:2014)
Visible laser light	Output from light guide at maximum power operation	Class 2	Class 1**
Infrared laser light	Output from light guide at maximum power operation	Class 3R	Class 1**

*Light guide diameter:4.5mm, length:3m.

**Evaluated under "Section 4.4 Laser products designed to function as conventional lamps"

- Illumination of infrared laser light is classified as Class 3R laser product under IEC 60825-1:2007. At this condition, protective eye wear should be used at operation depending on regional rules. When IEC 60825-1:2014 can be applied, both visible and infrared laser light can be classified as Class 1 laser product, where protective eye wear is not necessary.

- IEC 60825-1:2014 is adopted in Europe (EN60825-1:2014), Canada (CAN/CSA-E60825-1:15) Japan (JIS C 6082:2014) and many other countries. The USA refers to IEC 60825-1:2007 .

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1. Overview

1.1 Features

The laser illumination light source MBURD-MBG-G5 is a hybrid illumination light source that outputs light to a light guide cable, where light is combined from the below solid state emitting devices. Intensity of each color can be controlled individually from the touch screen or external control signals. While any combination of the visible light can be mixed in arbitrary ratios, visible light and infrared light cannot be turned on simultaneously. This is due to the high output power of the infrared laser, and to suppress thermal dissipation of the system. However by using fast switching between the visible and infrared light, it is possible to mix in time divisional manner.

Abbreviation Code	Color	Wavelength	Emitter Type
R LD	Red	638nm	Laser Diode
G LD	Green	525nm	Laser Diode
B LD	Blue	445nm	Laser Diode
V LD	Violet	405nm	Laser Diode
W LED	White	450-700nm	LED
IR LD	Infrared	808nm	Laser Diode

1.2 Part Names and Functions

1.2.1 Front panel
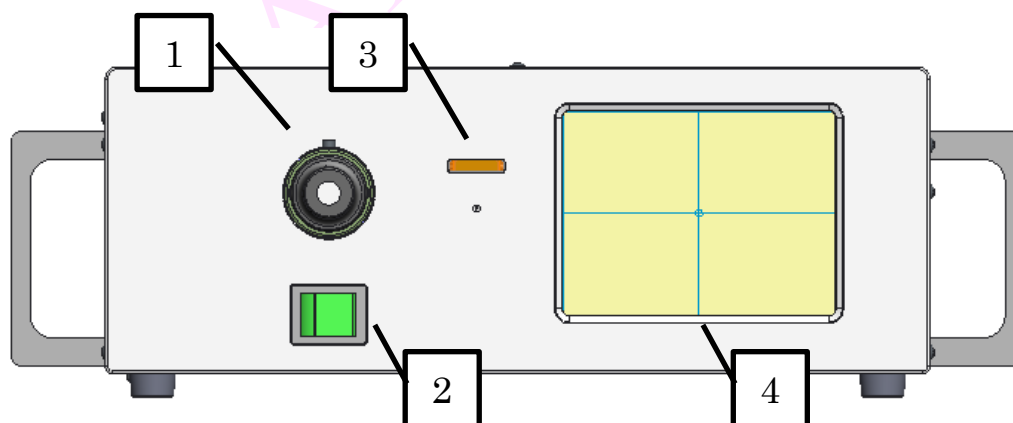
1. Light guide receptacle
2. Power Switch
3. IR LD Indicator: Indicates to warn when IR LD is activated.
4. Touch Screen: Provides user controls and system feedback.

1.2.2 Rear panel
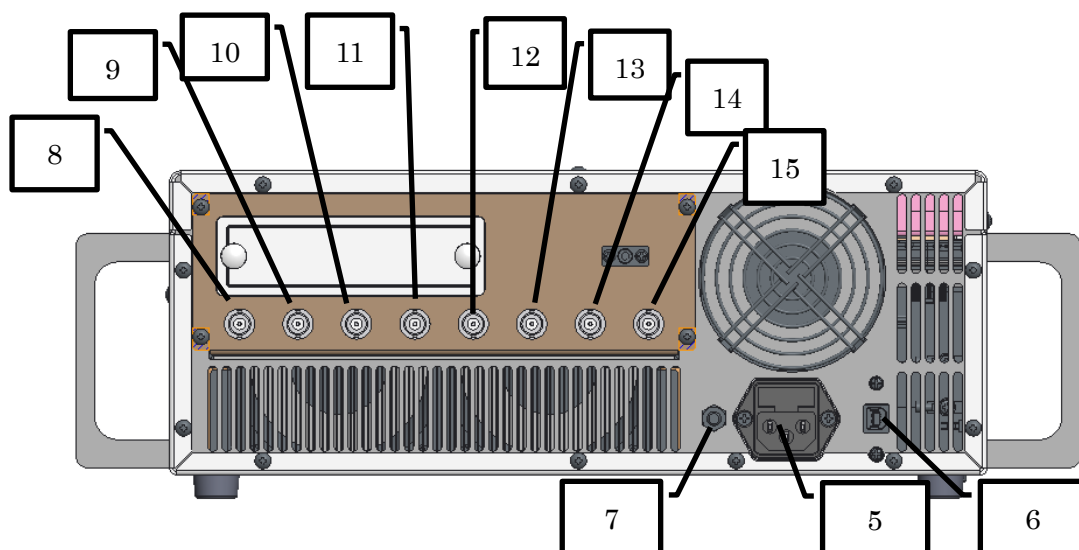
5. AC Inlet: Connects to the provided power cord for AC power supply.

6. External Control: Externally control the light source by RS-232C.

7. Equipotential ground plug: Connects to a potential equalization conductor.

8. Sync OUT: Let an external unit to synchronize to this light source.

9. Sync IN : Accepts external signal for this light source to synchronize to.

10. White LED Enable: Accepts external signal for turning W-LED light on/off.

11. V LD Enable: Accepts external signal for turning V-LD light on/off.

12. B LD Enable: Accepts external signal for turning B-LD light on/off.

13. G LD Enable: Accepts external signal for turning G-LD light on/off.

14. R LD Enable: Accepts external signal for turning R-LD light on/off.

15. IR LD Enable: Accepts external signal for turning IR-LD light on/off.
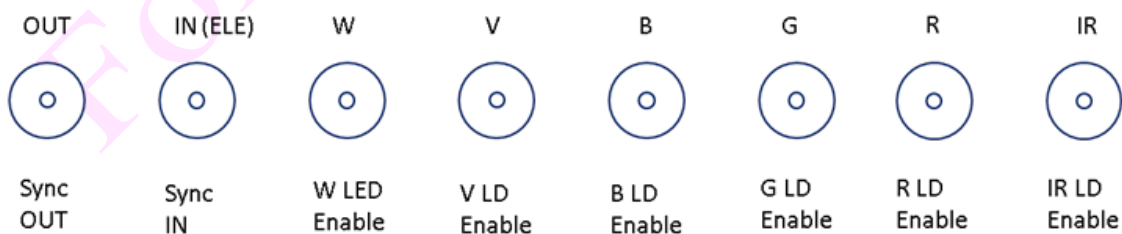
2. How to operate

2.1 Setup

Connect the AC power cable. Connect the light guide cable.

Make sure that the output light is directed to a safe area that will avoid direct viewing.

2.2 Powering the light source on and off

To power on the light source, turn on the power switch on the front panel. The switch will illuminate and the touch screen will be activated.

To power off the light source,

1. Turn off the light by pressing the LD button on the home screen.

2. Turn off temperature control by pressing the TEC button on the home screen.

3. Switch off the power switch on the front panel.

2.3 Touch screen interface

The touch screen will respond with a high tone beep when user input is detected.

If setting values are changed by the input, it will follow shortly after with a low tone beep when the user input is accepted by the main controller.

2.4 White continuous lighting

On the home screen, press LD button to turn on the light. Temperature control automatically starts when it is off. Press LD button to turn off the light...

Press TEC button to start or stop temperature control, Press Up/Down button to adjust illuminating power level.
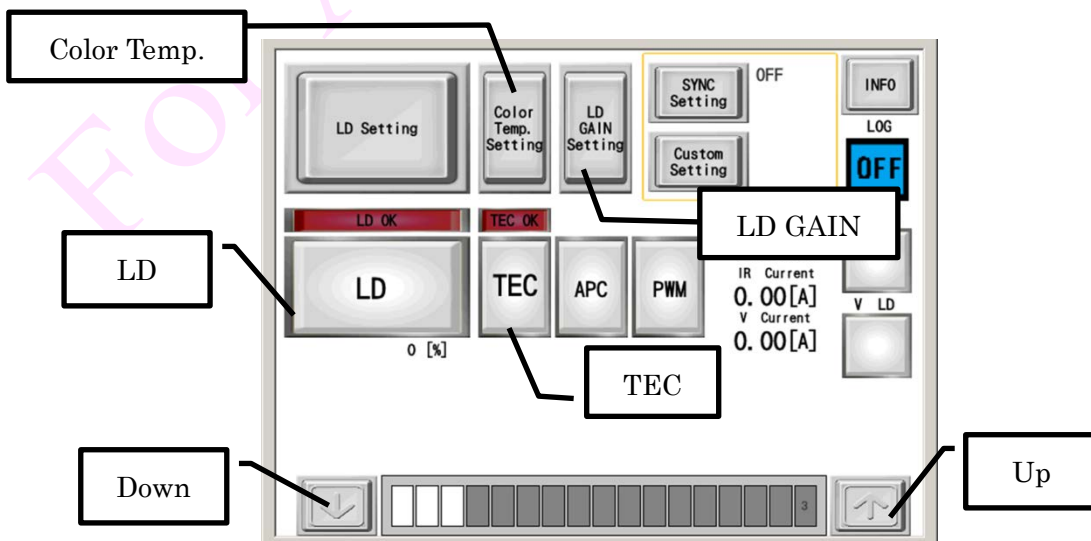
2.5 Select Color Temperature Settings

On the home screen, press Color Temp. Setting button to jump to Color Temp. Setting screen. Selectable settings are 0% (0% LED mixture), 50% (50% LED mixture), Custom1, and Custom2. Press the setting button to select the desired setting.

For each setting, you can modify mixing ratios of the colors for the lowest power level (Lv1) and highest power level (Lv17) by touching the values on the screen. Mixing ratio for power levels in between (Lv2 to Lv16) will be linearly interpolated. Sum of each ratio of LD or LED is normalized to 1.0 internally, according to the below formula:

$$Rratio = Rvalue / (Rvalue + Gvalue + Bvalue + Vvalue + Wvalue)$$

$$Gratio = Gvalue / (Rvalue + Gvalue + Bvalue + Vvalue + Wvalue)$$

$$Bratio = Bvalue / (Rvalue + Gvalue + Bvalue + Vvalue + Wvalue)$$

$$Vratio = Vvalue / (Rvalue + Gvalue + Bvalue + Vvalue + Wvalue)$$

$$Wratio = Wvalue / (Rvalue + Gvalue + Bvalue + Vvalue + Wvalue)$$

Note that values can be 0.0 but sum of values must be greater than 0.0.

If sum of values is equal to 0.0, the power is set to 0.0.

After changing values, press APPLY button and four beep sound will follow.

If the mixing ratio is within the emitter output range, "Success" message will show on top of the setting button. Otherwise, "Fail" message will show. In this case, modify the mixing ratio to the previous setting, or revert to factory defaults by following the instructions in Section 2.14 "Viewing Device Information".

To save the current values of mixing ratio to non-volatile memory, press the SAVE button. Press LOAD button to load the saved values. Also, saved values will be automatically loaded at startup. Press the HOME button to return to home screen.
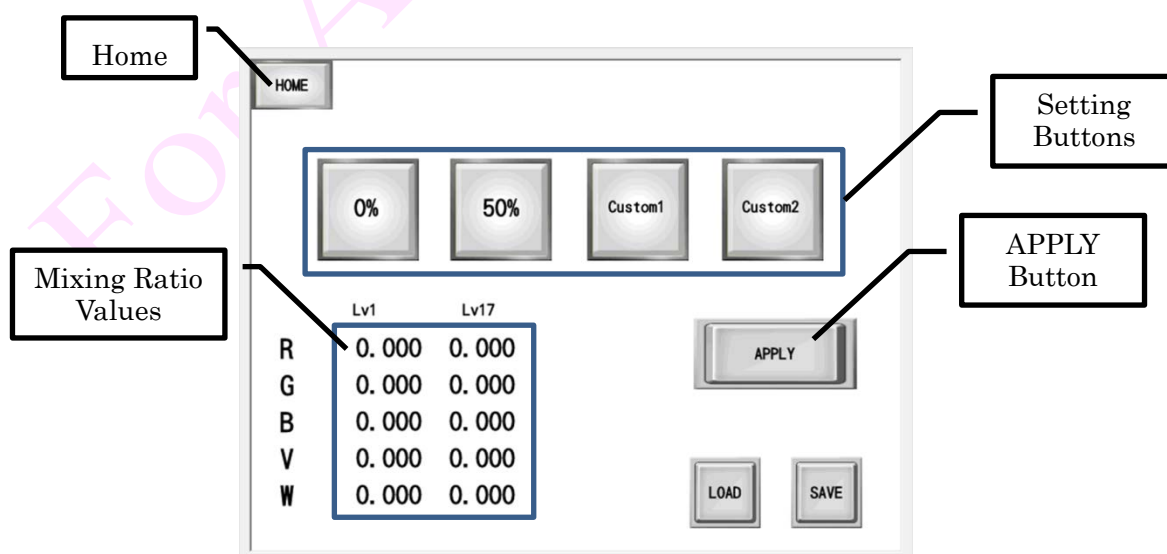
2.6 Adjusting Color Gain

On the home screen, press LD Gain Setting button to jump to LD Gain Setting screen.

Here, you can change the gain of each LD/LED. Gain is calculated by the next formula:

$$Xgain = 2/100 * (Xvalue + 50); -50 \leqq Xvalue \leqq 50, X=R/G/B/V/W$$

According to the gain, the output power of each LD/LED is modified as below:

$$Rpower = Rgain * Rratio * power$$

$$Gpower = Ggain * Gratio * power$$

$$Bpower = Bgain * Bratio * power$$

$$Vpower = Vgain * Vratio * power$$

$$Wpower = Wgain * Wratio * power$$

These gains are automatically saved to the non-volatile memory when you turn ON or OFF the light by operating the LD ON/OFF button on the home page. And they are automatically loaded when turn on the device.

Press each Up button to increase each gain.

Press each Down button to increase each gain.

Press the Reset ALL button reset all gains to 0.

Press each reset button reset each gain to 0.

Press the HOME button jump to home page.
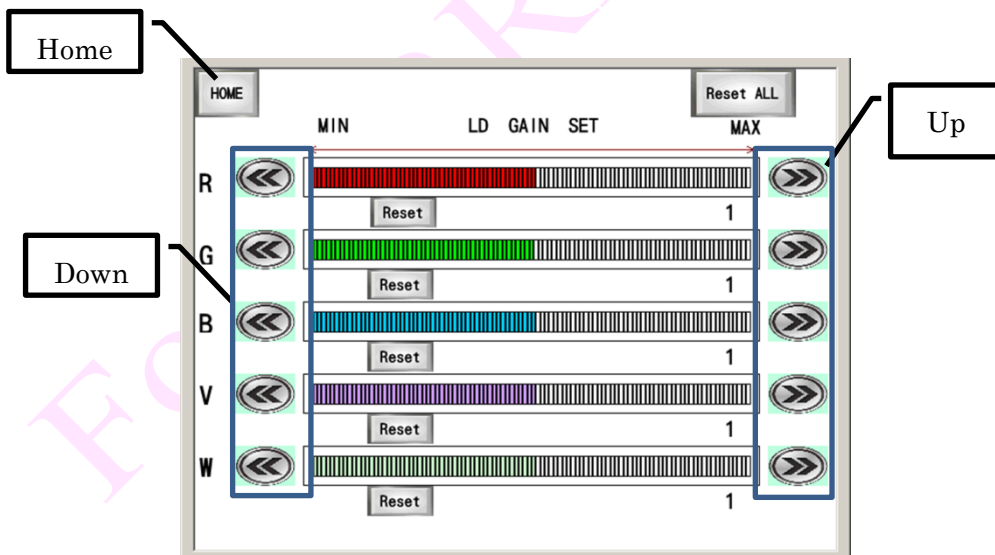
2.7 Lighting IR LD

On the Home screen, press IR LD ON/OFF button to turn ON/OFF the IR LD. You should start thermal control by pressing the TEC button prior to turn ON the IR LD.

Make sure to turn off any visible light source. If any of the visible light source is turned on, the IR LD will not light up except synchronous lighting mode.

You can change driving current by pressing the IR Current indicator. Ten-key will pop up and you can enter the current value and then press the ENTER button.

The maximum value for IR LD driving current is 11A.

While the IR LD is turned on, the orange IR LD Indicator lamp on the front panel will light up.
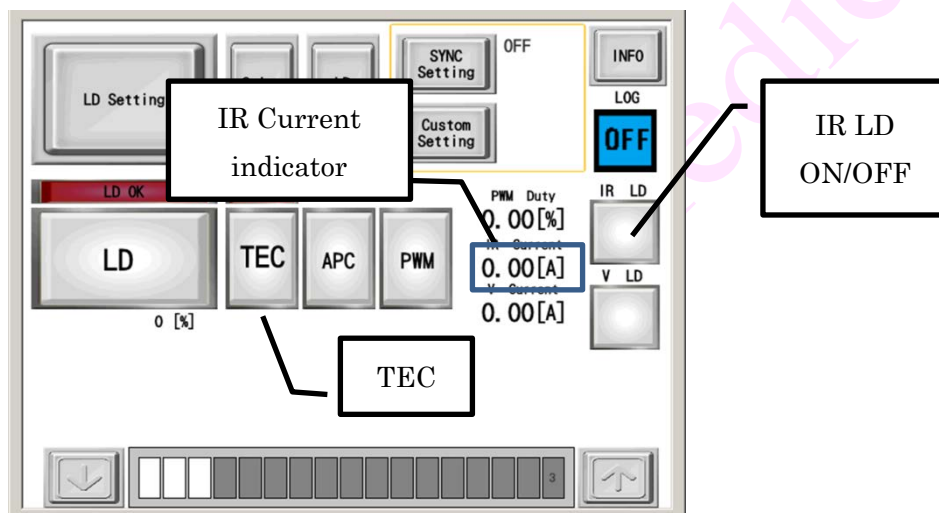
2.8 Lighting V LD

On the Home screen, Press V LD ON/OFF button to turn on/off the V LD. You should start thermal control by pressing the TEC button prior to turn ON the V LD. You can change driving current by pressing the V Current indicator.

The maximum value for V LD driving current is 1.4A.
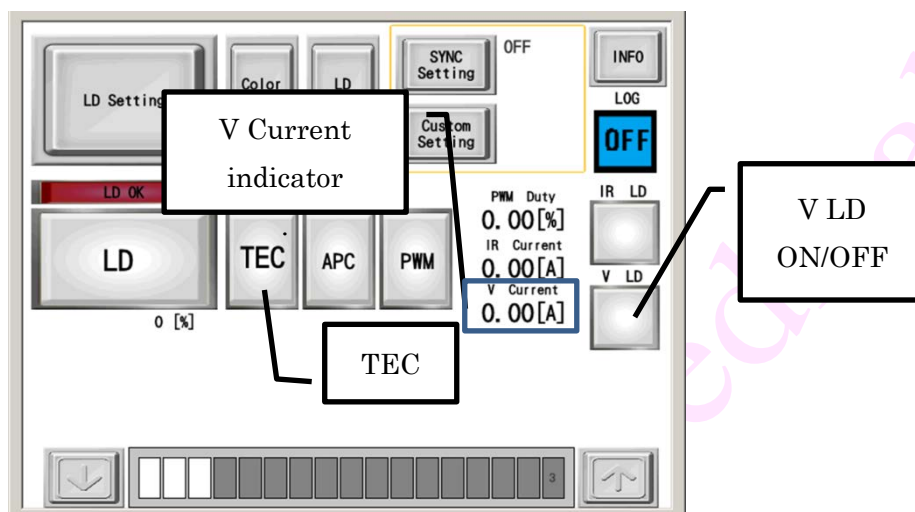
2.9 APC Mode

On the Home screen, Press APC ON/OFF button to change from ACC (Automatic Current Control) mode to APC (Automatic Power Control) mode and vice versa.

In ACC mode, the emitters are driven with constant current that is pre-determined for each power level. In APC mode, the drive current is automatically control to maintain the output power of each color that is monitored inside the light source to be a pre-determined value for each power level.

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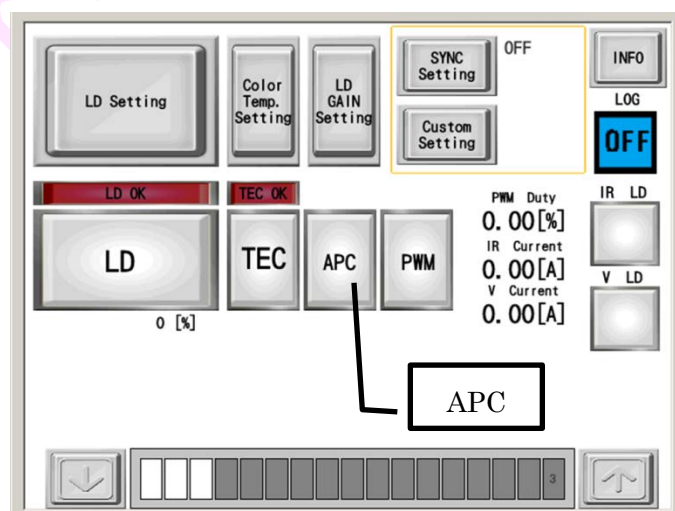
2.10 PWM Mode

On the Home screen, Press PWM ON/OFF button to change CW (Continuous Wave) mode to PWM (Phase Width Modulation) mode and vice versa.

You can change PWM duty by pressing the PWM duty indicator. Ten-key will pop up and you can enter the duty and then press the ENTER button.
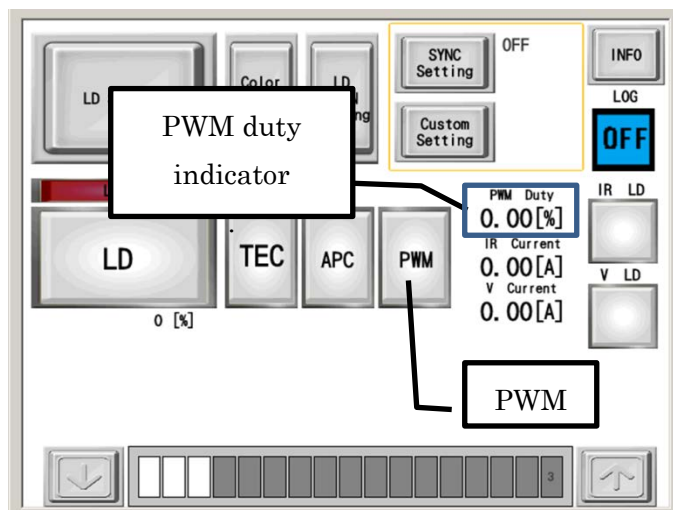
2.11 Manual Mode

From Home screen, press LD Setting button to jump to the LD manual operation screen. There are 4 pages for R LD, G LD, B and V LD, IR LD and W LED.

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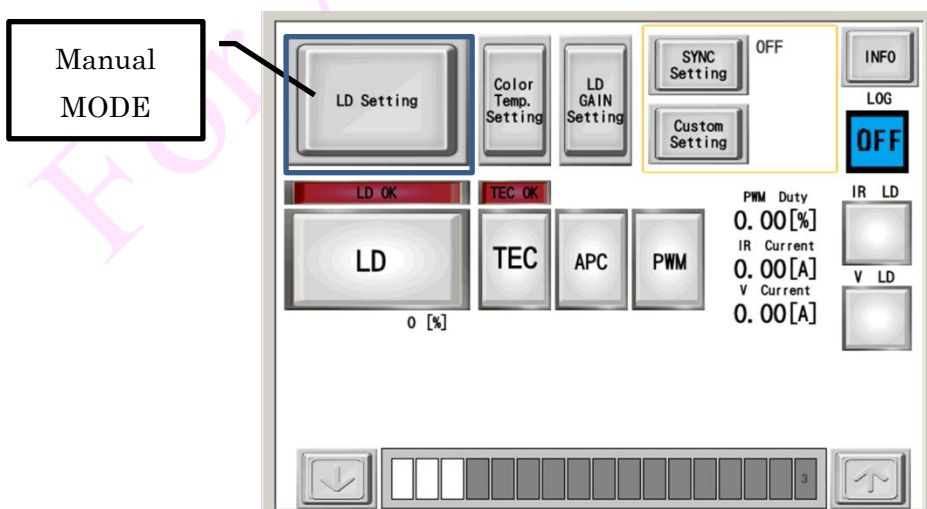
2.11.1 R LD

In R LD manipulation page, you can turn on/off the R LD and start/stop the associating thermal control. You should start thermal control prior to turning on the LD. If the thermal control is not activated, the LD won't light.

Press TEC ON/OFF button to start/stop thermal control.

Press LD ON/OFF button to turn on/off the R LD.

Press Current Setting indicator to change operation current of the LD. The Current Setting value will also change if you modify brightness level on the Home screen, or W-LED ratio in the Color Temp. Setting screen or gain values in the LD Gain Setting screen.

Press Temp. Setting indicator to change target temperature of the temperature control. This value is truncated to an integer when stored to the non-volatile memory.

The power monitor shows the output power value from the sensor that monitors R LD power.

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2.11.2 G LD

In G LD manipulation page, you can turn on/off the G LD and start/stop the associating thermal control. You should start thermal control prior to turning on the LD. If the thermal control is not activated, the LD won't light.

Press TEC ON/OFF button to start/stop thermal control.

Press LD ON/OFF button to turn on/off the G LD.

Press Current Setting indicator to change operation current of the LD. The Current Setting value will also change if you modify brightness level on the Home screen, or W-LED ratio in the Color Temp. Setting screen or gain values in the LD Gain Setting screen.

Press Temp. Setting indicator to change target temperature of the temperature control. This value is truncated to an integer when stored to the non-volatile memory.

The power monitor shows the output power value from the sensor that monitors G LD power.

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2.11.3 B/V LD

In B/V LD manipulation page, you can turn on/off the B LD and/or V LD and start/stop the associating temperature control.

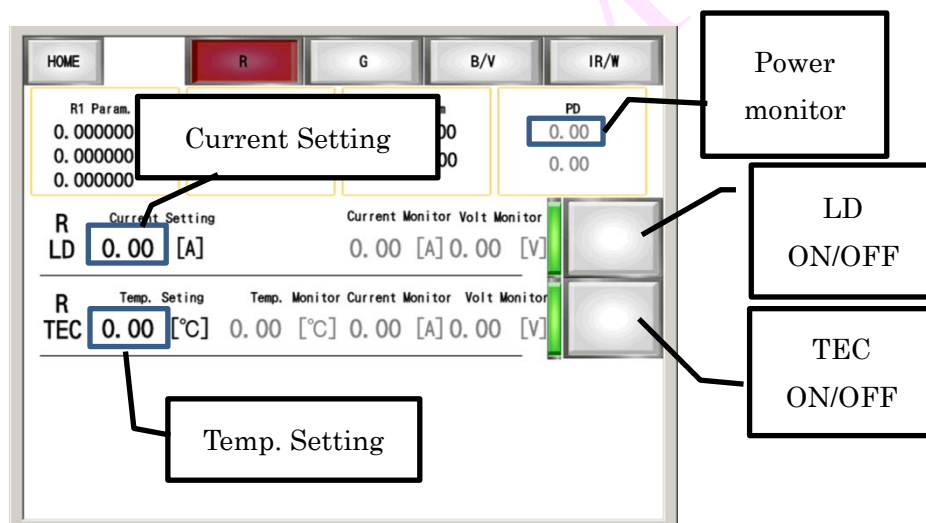You should start temperature control prior to turning on the LD. If the thermal control is not activated, the LD won't light.

Press TEC ON/OFF button to start/stop temperature control.

Press B LD ON/OFF button to turn on/off the B LD.

Press V LD ON/OFF button to turn on/off the V LD.

Press Current Setting indicator to change operation current of the B LD.

Press Current Setting indicator to change operation current of the V LD.

The Current Setting value will also change if you modify brightness level on the Home screen, or W-LED ratio in the Color Temp. Setting screen or gain values in the LD Gain Setting screen.

Press Temp. Setting indicator to change target temperature of the temperature control. This value is truncated to an integer when stored to the non-volatile memory.

The power monitor shows the output power value from the sensor that monitors B LD power.
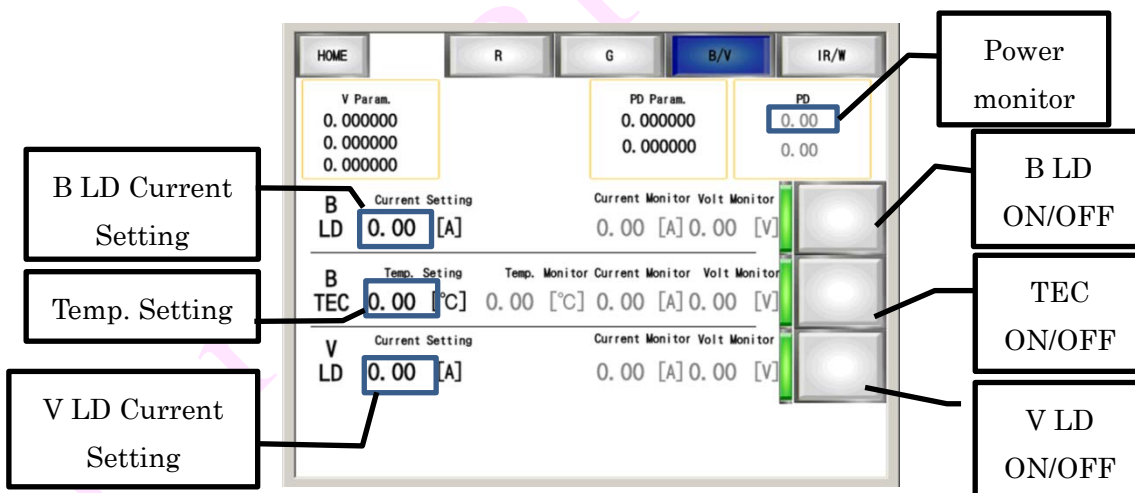
2.11.4 IR LD/W LED

In IR LD and W LED manipulation page, you can turn on/off the IR LD and White LED and start/stop IR LD temperature control.

You should start temperature control prior to turning on the LD. If the temperature control is not activated, the LD won't light.
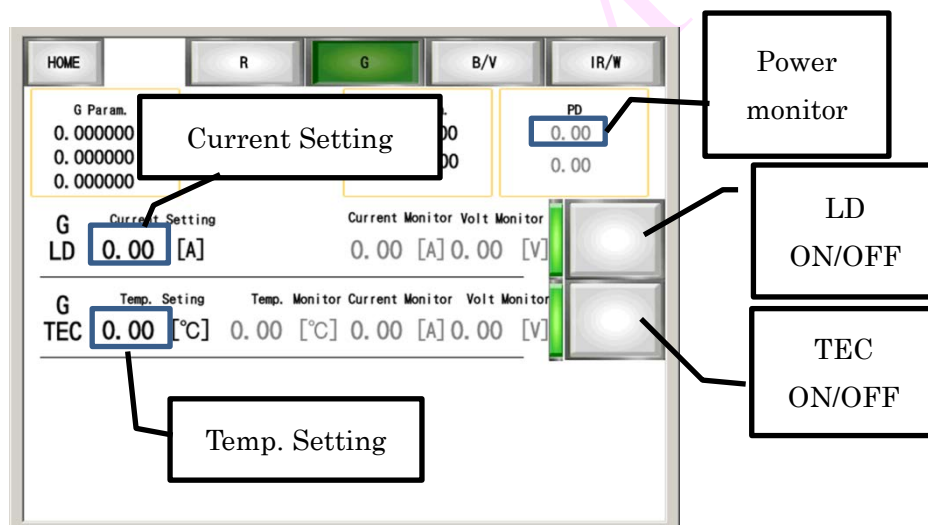
Press TEC ON/OFF button to start/stop IR LD temperature control.

Press IR LD ON/OFF button to turn on/off the IR LD.

Press W LED ON/OFF button to turn on/off the W LED.

Press IR LD Current Setting indicator to change operation current of the IR LD.

Press W LED Current Setting indicator to change operation current of the White LED.

The Current Setting value will also change if you modify brightness level on the Home screen, or W-LED ratio in the Color Temp. Setting screen or gain values in the LD Gain Setting screen.

Press Temp. Setting indicator to change target temperature of the temperature control. This value is truncated to an integer when stored to the non-volatile memory.

Press W-LED fan duty Setting indicator to change duty of W-LED fan.

The IR and W power monitor shows the output power value from the sensor that monitors IR LD power and W LED power, respectively.

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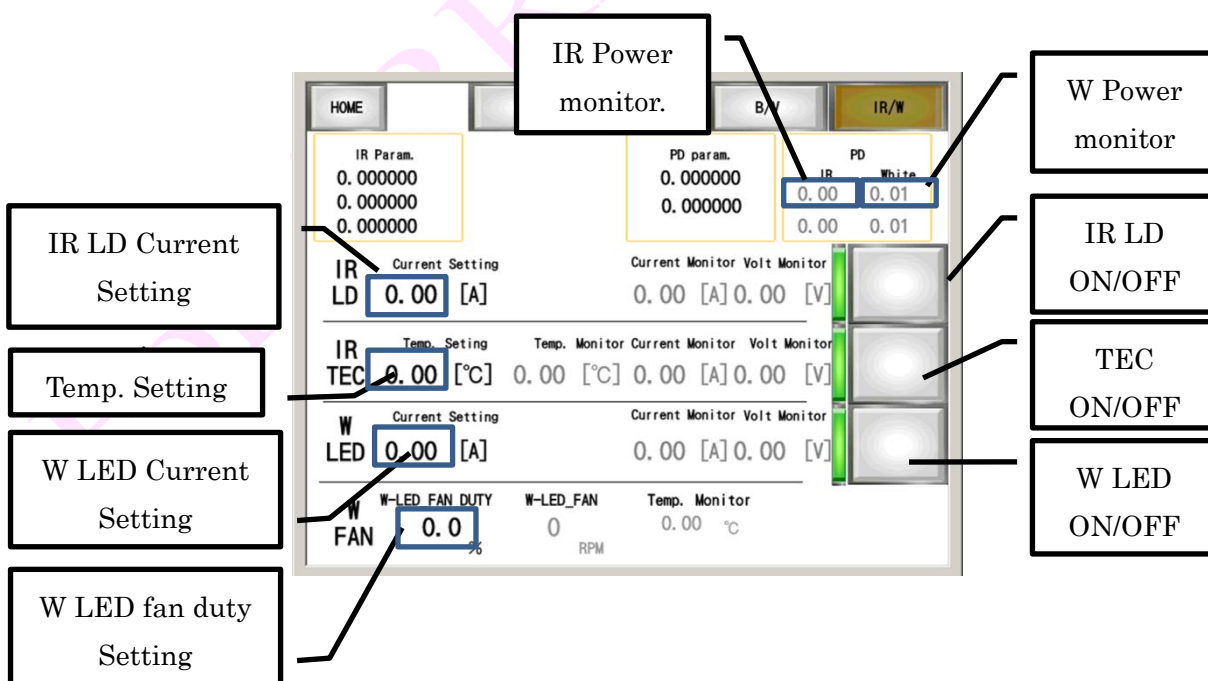
2.12 Synchronous Lighting (VSYNC)

The light source can emit light synchronously with external or internal synchronous signals in synchronous lighting mode. With this feature, the light source can synchronize with a camera or image capturing system.

From the HOME screen, press SYNC Setting button to activate synchronous lighting, and select the VSYNC checkbox.
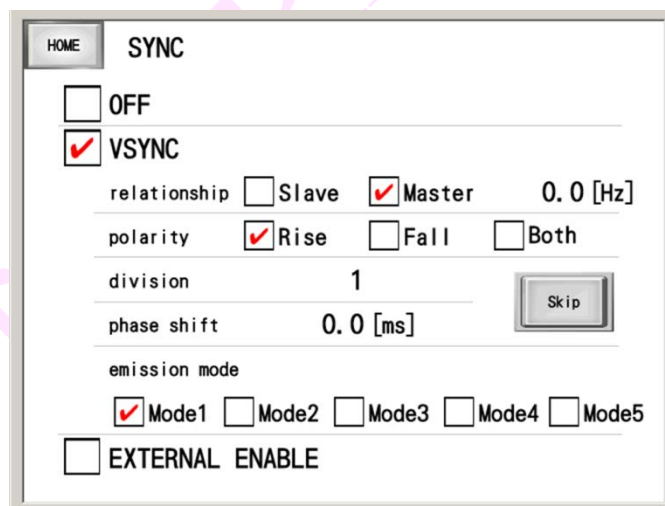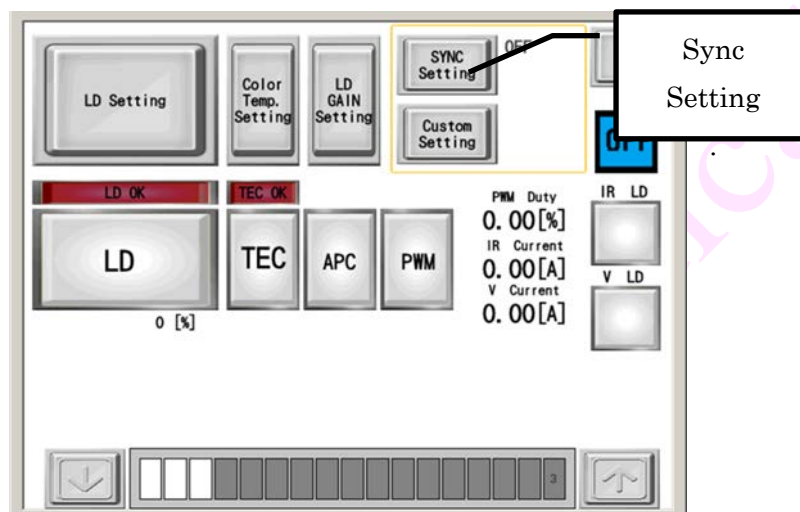
2.12.1 Slave mode synchronous lighting

In slave mode, connect the sync signal output of the camera system or an image capturing system to the Sync IN terminal of this light source. Electrical specifications for the acceptable synchronous signal are illustrated below.
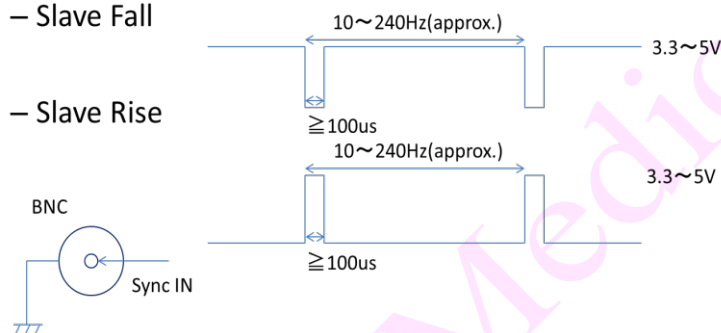
2.12.2 Master mode synchronous lighting

In master mode, the light source will output internally generated synchronous signal from the Sync OUT terminal in the rear panel. Connect the Sync OUT terminal to the sync input of a camera system or an image capturing system. Electrical specifications are illustrated below. You can change the frequency of the signal by touching the frequency value on the SYNC Setting screen,

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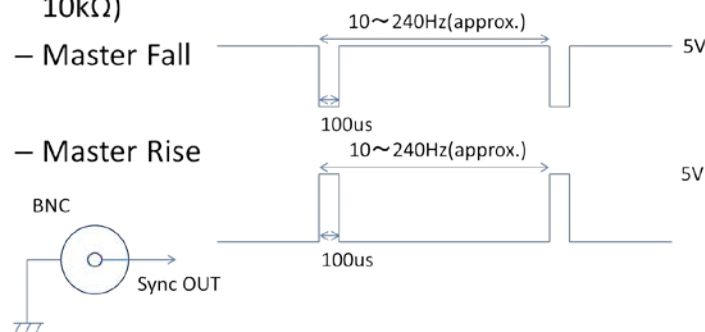
2.12.3 Synchronous signal modification

In the SYNC Setting screen, there are three methods for modifying the synchronous signal. Use these features to adjust the synchronous illumination timing to the external system.

Method	Function	Setting Value
Division	Devides the synchronous sinal. Example: If the synchronous signal is 60Hz and division is set to 2, synchronization willl be done to a internally devided 30Hz signal.	Integer number
Phase shift	Synchronization will be done to a phase shifted timing	Value with 0.1ms resolution
Skip	By pressing this button, synchronization will be skipped for a single period.	None

2.12.4 Custom settings of the emission modes

You can sepcify 5 different synchronous illumination sequences as Mode1 to Mode5. From the Home screen, press Custom Setting button to jump to the Custom Setting screen, where you can configure each sequence in detail.
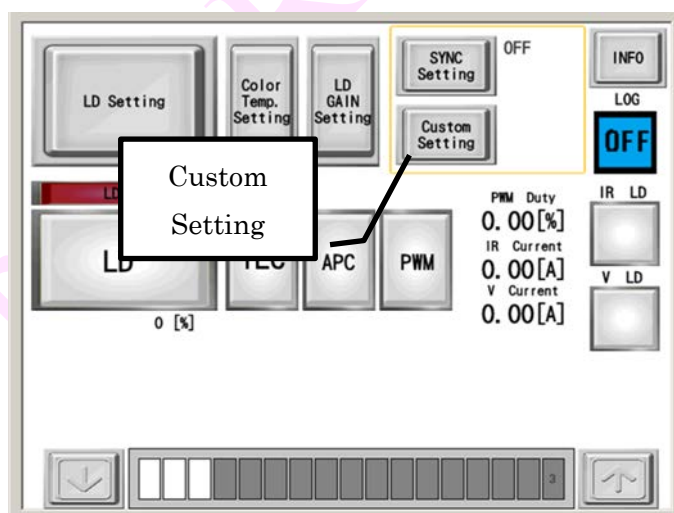
In the Custom Setting screen, there are individual pages for every emission mode. Mode1 to Mode4 is for normal sequences where the output power for each color is constant, and the sequence is configured by illumination on/off timing only. Mode5 is for HDR sequences where you can define two levels of output power. In addition to the on/off timing for each color, the power level of high/low can also be configured.

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2.12.5 Custom setting for Mode1 to Mode4 (Normal sequence)

The Custom Setting screen for Mode1 to Mode4 is as illustrated as below. You can switch between modes by pressing the buttons on the top. For each mode, there is a RGB/IR page and V/W page. You can switch between these pages by pressing the RGB/IR button or V/W button on the up right corner of the screen.
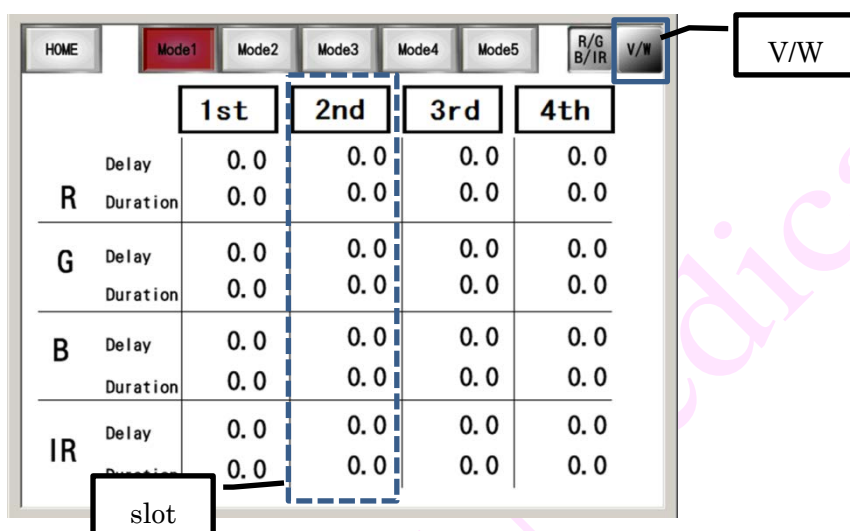
There are 4 slots for each mode, and for each slot you can define the Delay and Duration time for every color in 0.1ms resolution. Press the value you would like to change, and then a 10 key will appear. Input the desired value and press Enter. Relationship between the setting values and light on/off sequence for a single slot is illustrated below.
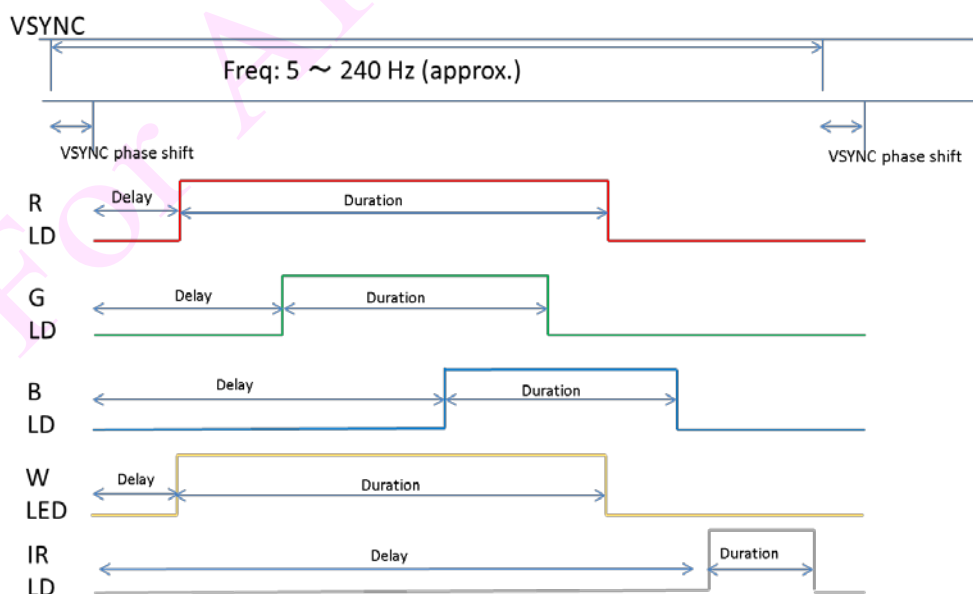
You can also change the sync order (1st to 4th or OFF) of each slot by pressing the sync

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order value. By assigning two or more sync orders, and change the on/off timing in the associated slots, you can form a sequence of different illumination color, in synchronization with the external system. You also can assign a same sync order to up to two slots, which is useful when configuring multiple on/offs in a single frame. The sync order must be assigned to the slots in ascending order. Below is an example where slot 1 and 2 is assigned to 1st sync, slot 3 to 3rd sync, and slot 4 to the 4th sync.
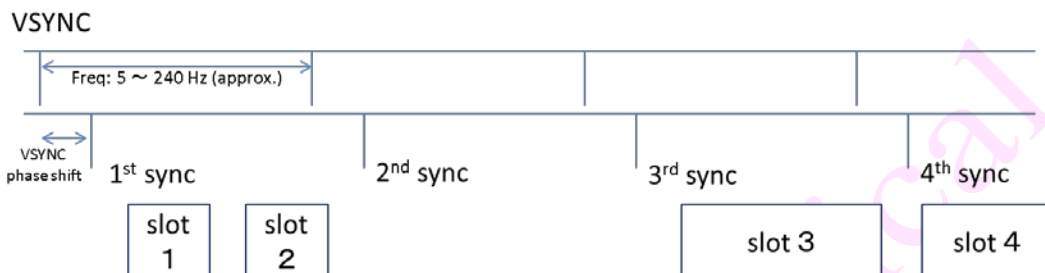
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By pressing the Save button in the V/W page, the Cutom Setting values are saved in the non-volatile memory inside the light source. By pressing the Load button, the save values will be recalled.
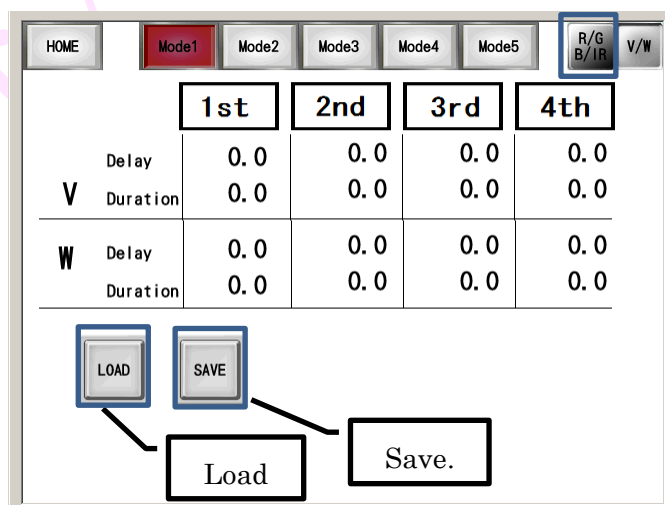
2.12.6 Custom setting for Mode5 (HDR sequence)

The Custom Setting screen for Mode5 of the synchronous mode is as below. In addition to the Delay and Duration setting for each color and 4 slots, the power level of H (High) or L (Low) can be configured individually for each light on event. To set the values, use the 6 highlighted buttons and values in the top row. Select the target cell to configure by changing the Light select and Slot Select toggle buttons. Next, change the High/Low, Delay and Duration values. Lastly, press Set button to apply. Confirm that the values are changed in the target cell. Functions of the Delay, Duration and slots/sync order settings are identical to the normal sequence in Mode1 to Mode4.

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There are two ways to configure the output for the High and Low levels. In the Custom Setting screen for Mode5, press the Custom button in the upper right corner, and switch to Current Custom Setting screen. In the Current Select checkbox list, you can select between Bar and Custom. When Custom is selected, the High and Low levels are defined by the driving current that is set in the Current Setting Table. Changes can be to the table by touching the values, and can be saved and loaded to/from the non-volatile memory.
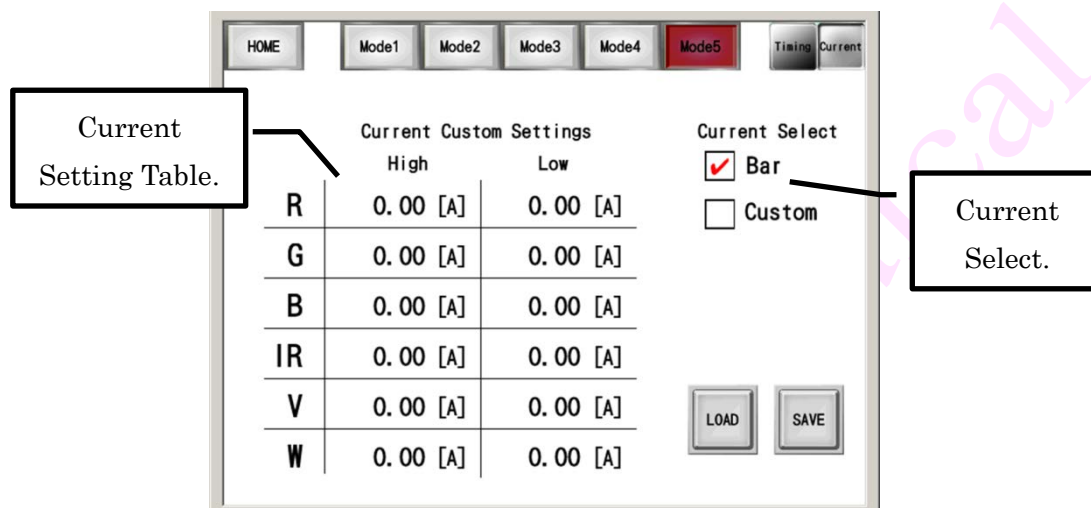
When Bar is selected, the High and Low levels are defined by the two level bars that appear in the Home screen, only when Mode5 is activated.
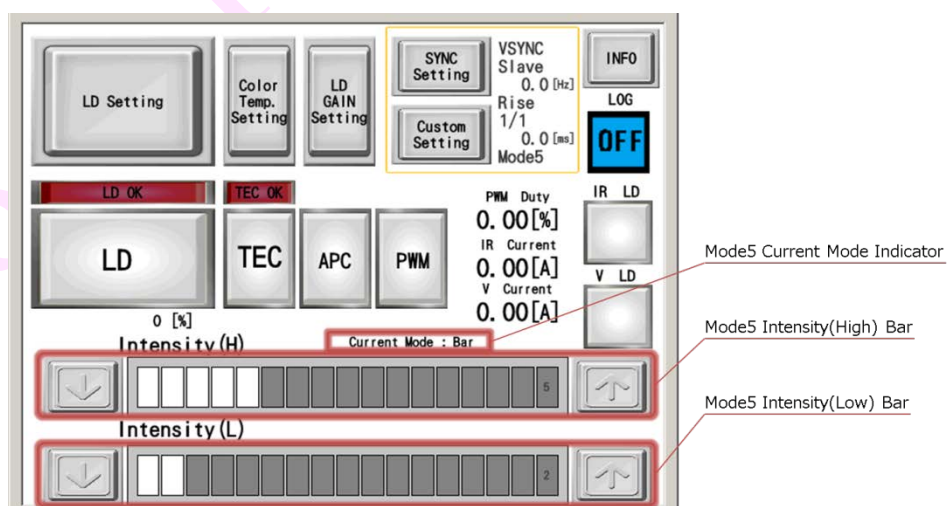
2.12.7 Synchronous Lighting Examples

Example 1） Slave mode, polarity set to rise, division 1, 1.0ms phase shift.

Slot1 assigned to 1st Sync, other slots are OFF.

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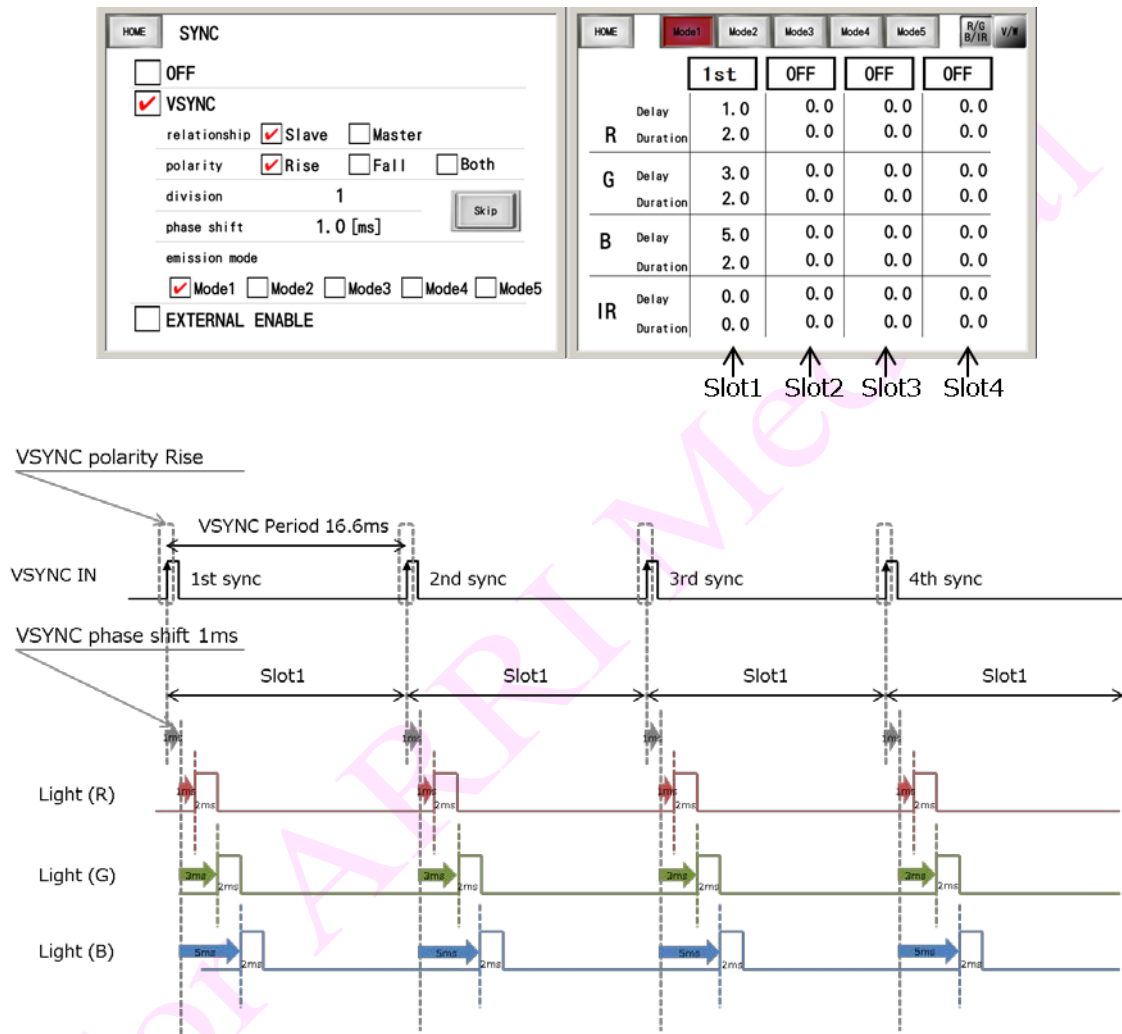
Example 2） Slave mode, polarity set to rise, division 2, 1.0ms phase shift.

Slot1 assigned to 1st Sync, other slots are OFF.

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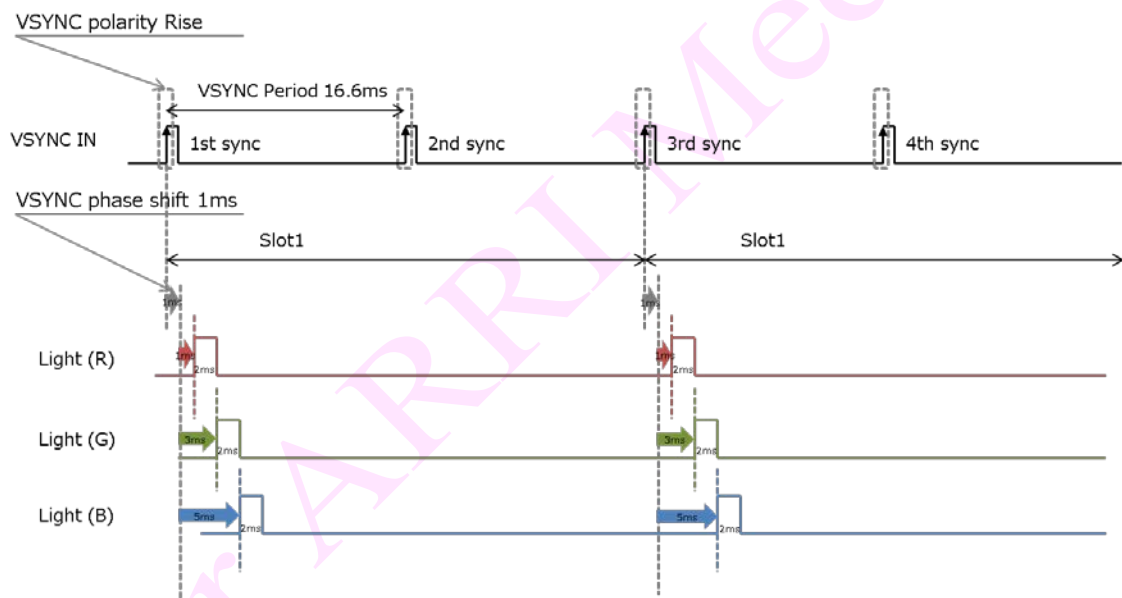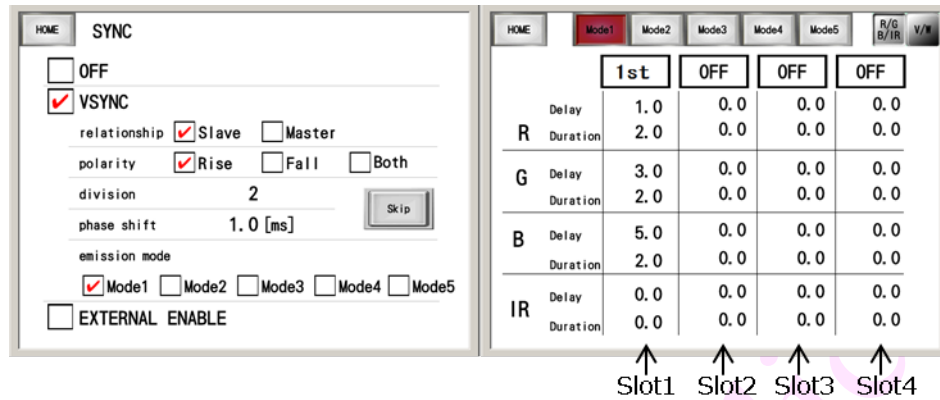
Example 3） Slave mode, polarity set to fall, division 1, 1.0ms phase shift.

Slot1 to Solt3 assigned to 1st,2nd,3rd Sync, Slot4 is OFF.

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Example 4） Slave mode, polarity set to fall, division 1, 1.0ms phase shift.

Slot1 and Solt2 assigned to 1st Sync, Slot3 to 2nd Sync, Slot4 is OFF.

HOME	SYNC
☐	OFF
☑	VSYNC
	relationship ☑ Slave ☐ Master
	polarity ☐ Rise ☑ Fall ☐ Both
	division 1 [Skip]
	phase shift 1.0 [ms]
	emission mode
	☑ Mode1 ☐ Mode2 ☐ Mode3 ☐ Mode4 ☐ Mode5
☐	EXTERNAL ENABLE

		1st	1st	2nd	OFF
R	Delay	1.0	10.0	0.0	0.0
	Duration	2.0	3.0	0.0	0.0
G	Delay	3.0	10.0	0.0	0.0
	Duration	2.0	3.0	0.0	0.0
B	Delay	5.0	10.0	0.0	0.0
	Duration	2.0	3.0	0.0	0.0
IR	Delay	0.0	0.0	0.0	0.0
	Duration	0.0	0.0	15.6	0.0

Slot1 Slot2 Slot3 Slot4

VSYNC polarity Fall

VSYNC Period 16.6ms

VSYNC IN   1st sync   2nd sync   3rd sync   4th sync

VSYNC phase shift 1ms

Slot1,2   Slot3   Slot1,2   Slot3

Light (R)

Light (G)

Light (B)

Light (IR)

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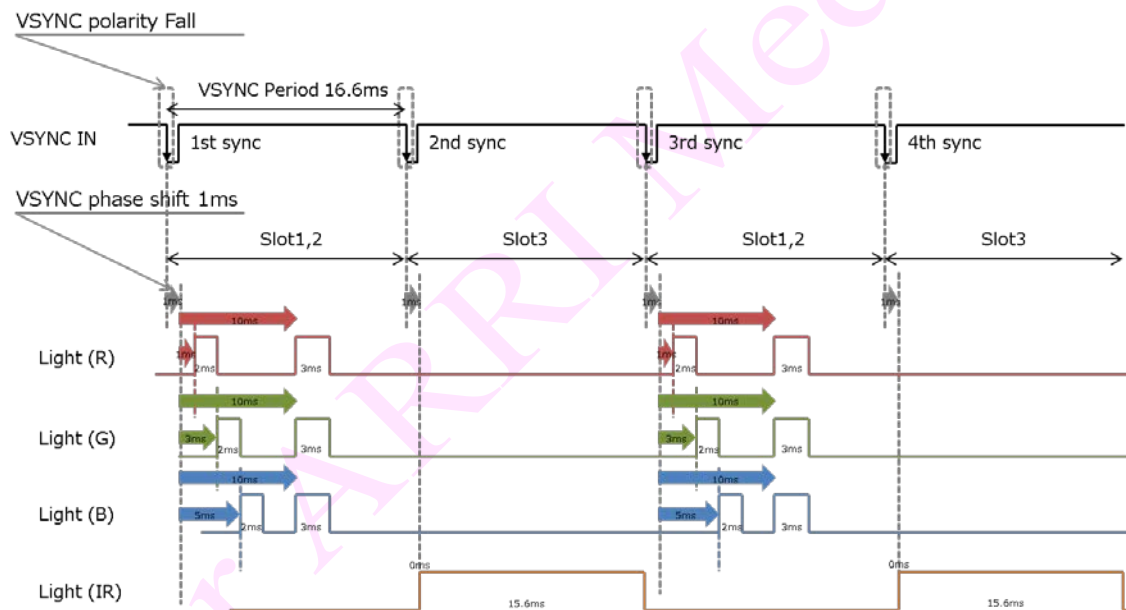
Example 5） Slave mode, polarity set to rise, division 1, 2.0ms phase shift.

Using Mode5 for HDR sequence.

Slot1 to Solt4 assigned to 1st to 4th Sync.

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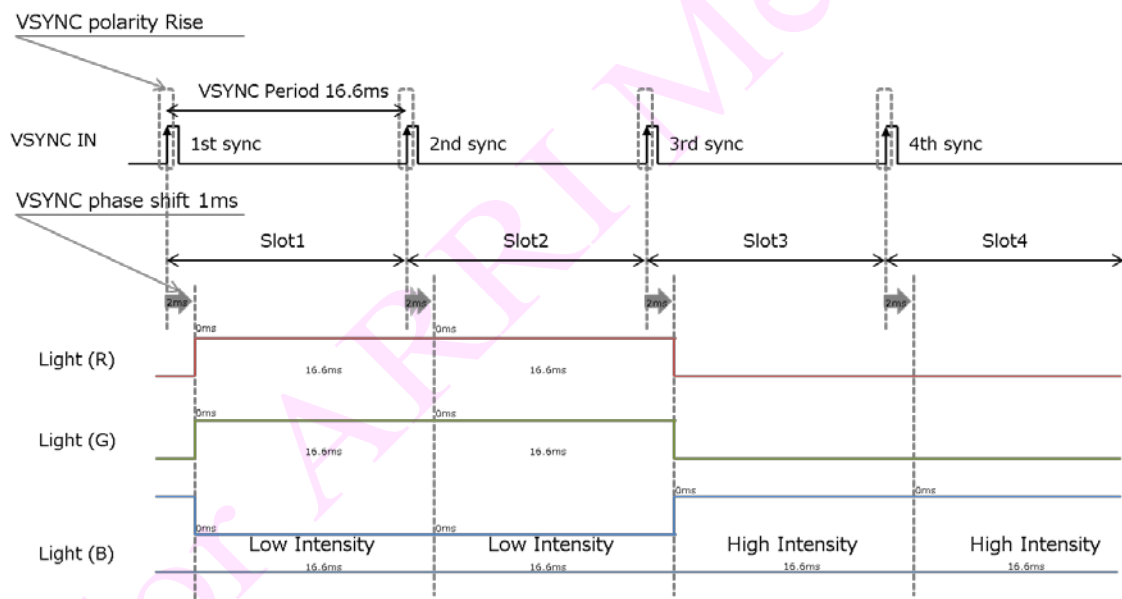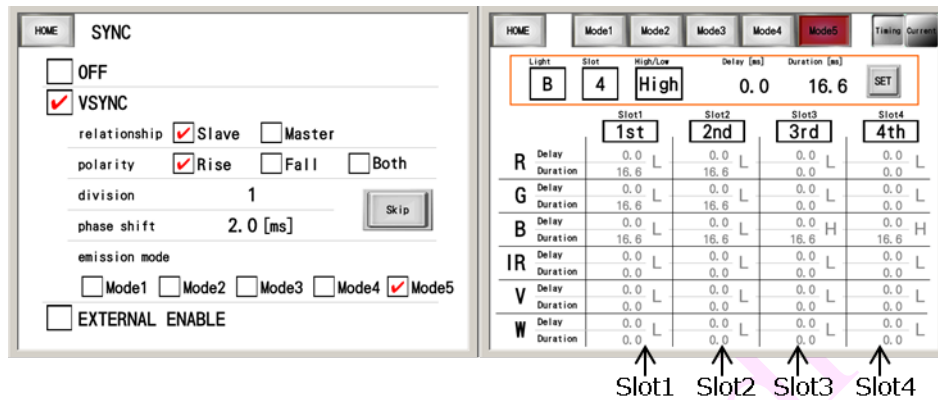
2.13 Synchronous Lighting (External Enabled)

Other than synchronizing to a constant frequency VSYNC signal and define the delay and duration based on it, you can directly define each color's on/off timing by external timing signals. To do this, press Sync Setting button on the Home screen, and select the EXTERNAL ENABLED checkbox.
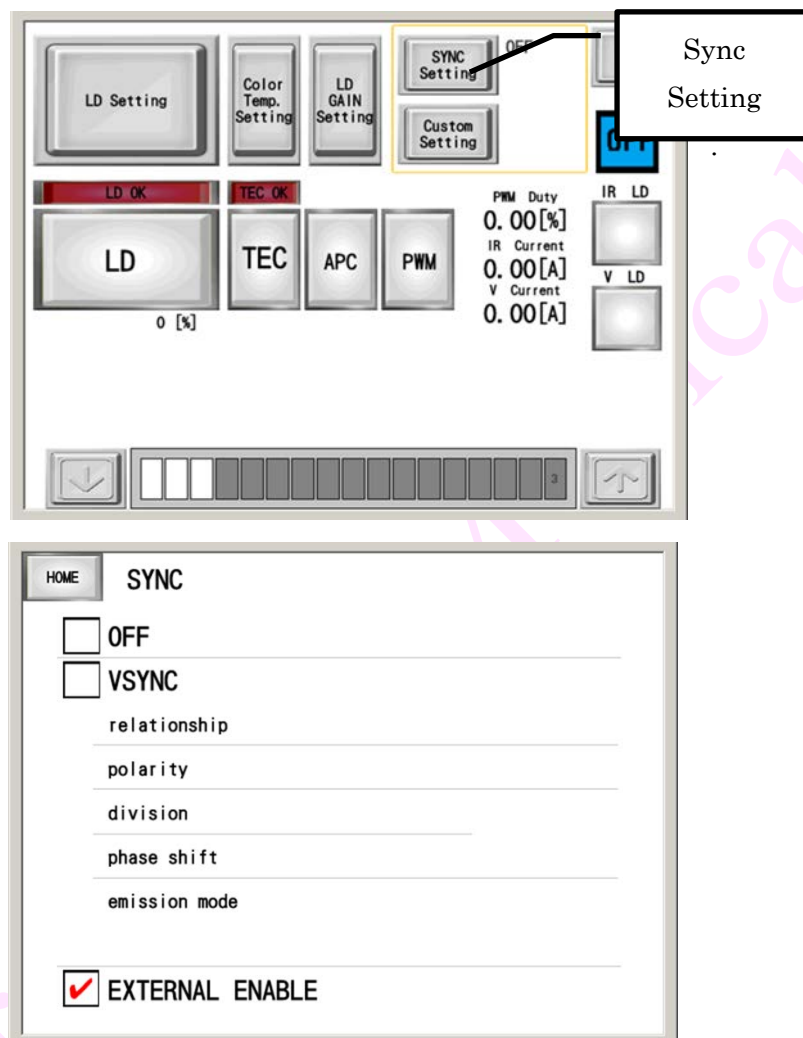
Connect the external signal to one of the External Enable terminals in the rear panel of the light source. Electrical specification is same as the Sync IN terminal (3.3V CMOS logic, 5V tolerant). The light will be on when the signal level is high.

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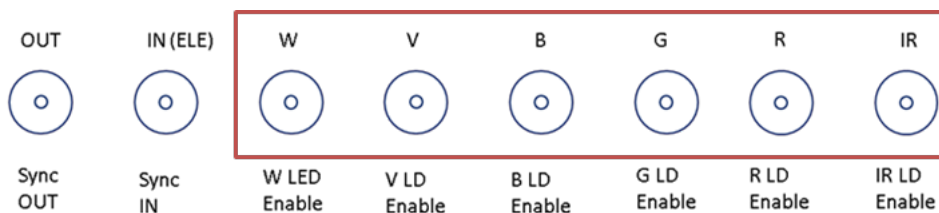
2.14 Viewing Device Information

To see the device's information, press INFO key on the Home screen to show the Info screen.
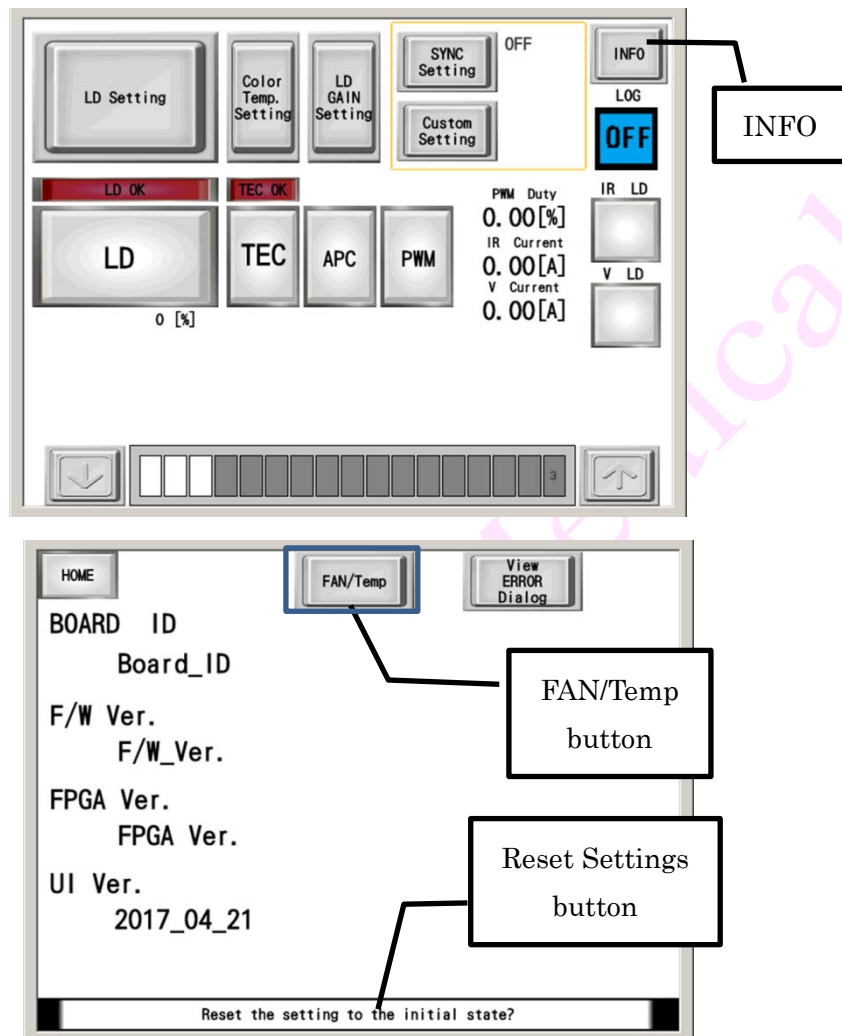
By pressing the wide Reset settings button on the bottom, the RGBVW ratios saved from the Color Temp. Setting screen will be cleared. After this operation, default values will be recalled when pressing the Load button in the Color Temp. Setting screen.

By pressing the FAN/Temp button, the Device Info screen will appear and show the temperature for various devices and fan rotation speed.
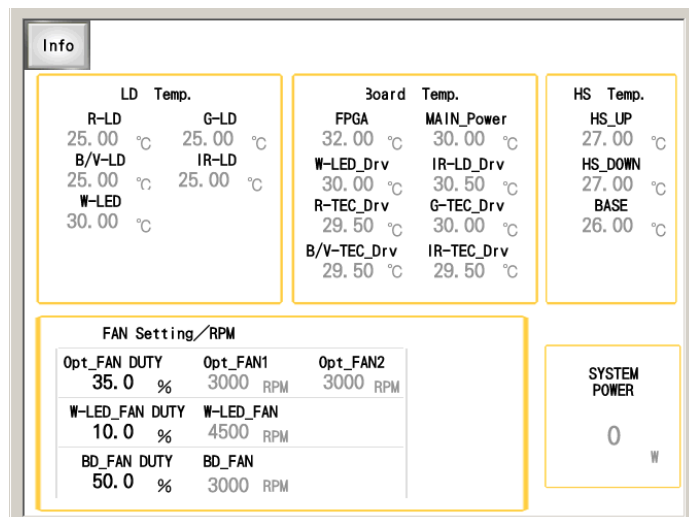
You can change the fan duty cycle by pressing the values. Be aware that small duty values will cause to stop the cooling fan and the system will display an ERROR dialog. Fan duty values are stored in non-volatile memory.

2.15 Error Dialog

If an error occurs, the system will automatically pop the Error Dialog. Wait for a moment and press the buttons that is blinking to see if the error is resolved. When the fan duty is changed to a low value, error associated to TEC might occur. In this case, go back to the Device Info screen and set the fan duty to a higher value. If all buttons go green, the ERROR dialog page will automatically disappear.
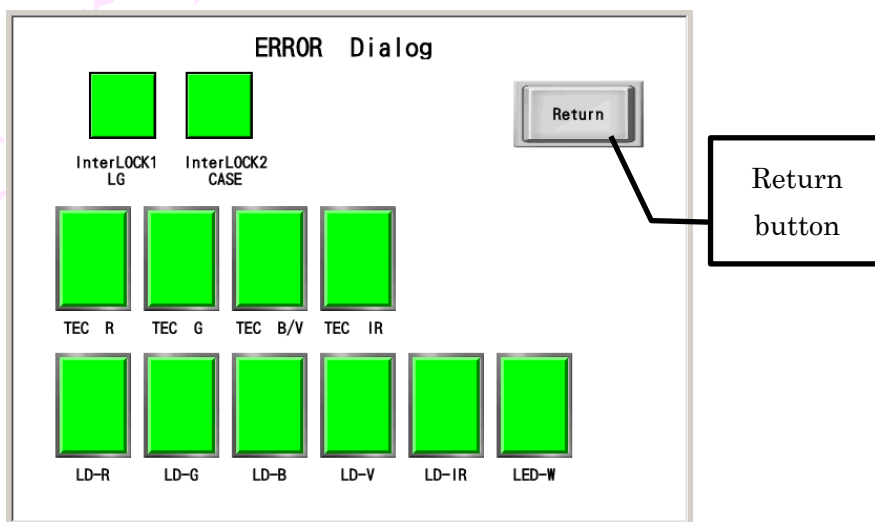
3. External Control

The light source can be externally controlled via RS232C interface through the External Control connector in the rear panel. Connect a PC to this connector with a USB cable. Drivers for the USB-Serial convertor chip from FTDI might be needed. In this case, you can download it from: http://www.ftdichip.com/Drivers/VCP.htm.

External Control
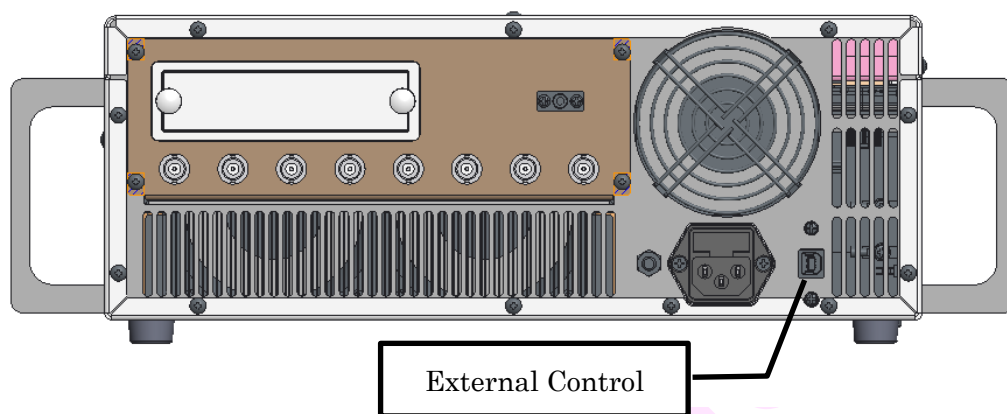
3.1 Control protocol

Baud rate: 38400bps

Data bits: 8bit

Parity: None

3.2 Frame Format

Command Frame Format   less than or equals to 64bytes

Header	ID	Command + Data（ASCII）	terminator
'<' + ' '	Integer + ' '		CR + LF
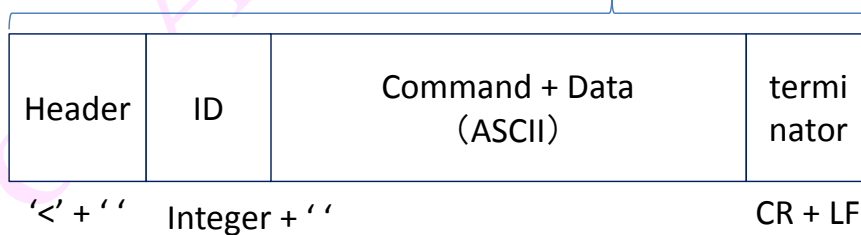
Response Frame Format   less than or equals to 64bytes

Header	ID	Response + Data（ASCII）	terminator
'>' + ' '	Integer + ' '		CR + LF

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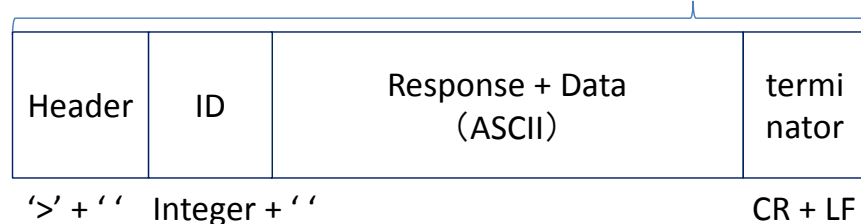
3.3 Commands

3.3.1 READY command

NAME

> READY

COMMAND FRAME

> < <#id> READY[CR][LF]

DESCRIPTION

> Check if the device is ready for remote control or not.
>
> **<#id>**
>
> Any integer value for the ID of the command.

RESPONSE FRAME

> > <#id> READY[CR][LF]
>
> > <#id> NOT READY[CR][LF]

3.3.2 RGBW command

NAME

> RGBW

COMMAND FRAME

> < <#id> RGBW ON|OFF[CR][LF]

DESCRIPTION

> Turn on or turn off the light.
>
> **<#id>**
>
> Any integer value for the ID of the command.
>
> **ON**
>
> To turn on the light.
>
> **OFF**
>
> To turn off the light.

RESPONSE FRAME

> > <#id> ON|OFF[CR][LF]
>
> > Succeeded to turn on or turn off the light.
>
> > <#id> INVALID PARAMETER[CF][LF]
>
> > Failed because something wrong in the command frame.

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3.3.3 R command

NAME

R

COMMAND FRAME

< <#id> R ON|OFF[CR][LF]

DESCRIPTION

Turn on or turn off the R-laser.

<#id>

Any integer value for the ID of the command.

ON

To turn on the R-laser.

OFF

To turn off the R-laser.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the R-laser.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.4 G command

NAME

G

COMMAND FRAME

< <#id> G ON|OFF[CR][LF]

DESCRIPTION

Turn on or turn off the G-laser.

<#id>

Any integer value for the ID of the command.

ON

To turn on the G-laser.

OFF

To turn off the G-laser.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the G-laser.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.5 B command

NAME

    B

COMMAND FRAME

    < <#id> B ON|OFF[CR][LF]

DESCRIPTION

    Turn on or turn off the B-laser.

    <#id>

    Any integer value for the ID of the command.

    ON

    To turn on the B-laser.

    OFF

    To turn off the B-laser.

RESPONSE FRAME

    > <#id> ON|OFF[CR][LF]

        Succeeded to turn on or turn off the B-laser.

    > <#id> INVALID PARAMETER[CF][LF]

        Failed because something wrong in the command frame.

3.3.6 V command

NAME

    V

COMMAND FRAME

    < <#id> V ON|OFF[CR][LF]

DESCRIPTION

    Turn on or turn off the V-laser.

    <#id>

    Any integer value for the ID of the command.

    ON

    To turn on the V-laser.

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OFF

To turn off the V-laser.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the V-laser.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.7 W command

NAME

V

COMMAND FRAME

< <#id> W ON|OFF[CR][LF]

DESCRIPTION

Turn on or turn off the W-LED.

<#id>

Any integer value for the ID of the command.

ON

To turn on the W-LED.

OFF

To turn off the W-LED.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the W-LED.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.8 IR command

NAME

IR

COMMAND FRAME

< <#id> IR ON|OFF[CR][LF]

DESCRIPTION

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Turn on or turn off the IR-laser.

<#id>

Any integer value for the ID of the command.

ON

To turn on the IR-laser.

OFF

To turn off the IR-laser.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the IR-laser.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.9 TEC command

NAME

TEC

COMMAND FRAME

< <#id> TEC R|G|BV|IR ON|OFF[CR][LF]

< <#id> TEC ON|OFF[CR][LF]

< <#id> TEC R|G|BV|IR[CR][LF]

DESCRIPTION

Turn on or turn off each TEC; thermal electric coolers.

Turn on or turn off all TECs.

Get status of each TEC.

<#id>

Any integer value for the ID of the command.

R   Identify the TEC to turn on/off or to get status.

G   Identify the TEC to turn on/off or to get status.

BV   Identify the TEC to turn on/off or to get status.

IR   Identify the TEC to turn on/off or to get status.

ON   To turn on each TEC or all TECs.

OFF   To turn off each TEC or all TECs.

RESPONSE FRAME

> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off each TEC or all TECs.

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Status of selected TEC.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.10 LV command

NAME

LV

COMMAND FRAME

< <#id> LV <level>[CR][LF]

DESCRIPTION

Set illumination level of the light.

<#id>

Any integer value for the ID of the command.

<level>

Illumination level, 1.0 <= <level> <= 17.0.

RESPONSE FRAME

> <#id> <level>[CR][LF]

Succeeded to set the level and returns the level.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.11 LVH command

NAME

LVH

COMMAND FRAME

< <#id> LVH <level>[CR][LF]

DESCRIPTION

Set illumination level of the light of High intensity.

<#id>

Any integer value for the ID of the command.

Illumination level, 1.0 <= <level> <= 17.0.

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RESPONSE FRAME

> <#id> <level>[CR][LF]

    Succeeded to set the level and returns the level.

> <#id> INVALID PARAMETER[CF][LF]

    Failed because something wrong in the command frame.

3.3.12 APC command

NAME

    APC

COMMAND FRAME

    < <#id> APC ON|OFF[CR][LF]

DESCRIPTION

    Turn on or turn off the APC mode.

    <#id>

    Any integer value for the ID of the command.

    ON

    To turn on the APC mode.

    OFF

    To turn off the APC mode.

RESPONSE FRAME

    > <#id> ON|OFF[CR][LF]

        Succeeded to turn on or turn off the APC mode.

    > <#id> INVALID PARAMETER[CF][LF]

        Failed because something wrong in the command frame.

3.3.13 SETCURRENT command

NAME

    SETCURRENT

COMMAND FRAME

    < <#id> SETCURRENT R|G|B|V|W|IR <current>[CR][LF]

    < <#id> SETCURRENT R|G|B|V|W|IR[CR][LF]

DESCRIPTION

    Set the set driving current of each light.

    <#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

<current>

value of the driving current to set.

RESPONSE FRAME

> <#id> <current>[CR][LF]

Succeeded to set the driving current and returns the set value.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.14 GETCURRENT command

NAME

GETCURRENT

COMMAND FRAME

< <#id> GETCURRENT

R|G|B|V|W|IR|TECR|TECG|TECBV|TECIR[CR][LF]

DESCRIPTION

Get the driving current of each light/TEC.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

TECR   Identify the TEC.

TECG   Identify the TEC.

TECBV

Identify the TEC.

TECIR

Identify the TEC.

RESPONSE FRAME

> <#id> <current>[CR][LF]

Succeeded to set the driving current and returns the

set value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the light/TEC.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.15 GETVOLTAGE command

NAME

GETVOLTAGE

COMMAND FRAME

< <#id> GETVOLTAGE

R|G|B|V|W|IR|TECR|TECG|TECBV|TECIR[CR][LF]

DESCRIPTION

Get the driving voltage of each light/TEC.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

TECR

Identify the TEC.

TECG

Identify the TEC.

TECBV

Identify the TEC.

TECIR

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Identify the TEC.

RESPONSE FRAME

> <#id> <voltage>[CR][LF]

Succeeded to set the driving voltage and returns the
set value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the light/TEC.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.16 SETPOWER command

NAME

SETPOWER

COMMAND FRAME

< <#id> SETPOWER R|G|B|V|W|IR <power>[CR][LF]

DESCRIPTION

Set the set driving power of each light.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

<power>

value of the driving power to set.

RESPONSE FRAME

> <#id> <power>[CR][LF]

Succeeded to set the driving power and returns the
set value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the light.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.17 GETPOWER command

NAME

GETPOWER

COMMAND FRAME

< <#id> GETPOWER R|G|B|V|W|IR[CR][LF]

DESCRIPTION

Get the driving power of each light.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

RESPONSE FRAME

> <#id> <power>[CR][LF]

Succeeded to get the driving power and returns the value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the light.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.18 SETTEMP command

NAME

SETTEMP

COMMAND FRAME

< <#id> SETTEMP TECR|TECG|TECBV|TECIR <temp>[CR][LF]

DESCRIPTION

Set the set temperature of each TEC.

<#id>

Any integer value for the ID of the command.

TECR

Identify the TEC.

TECG

Identify the TEC.

TECBV

Identify the TEC.

TECIR

Identify the TEC.

<temp>

value of the temperature to set.

RESPONSE FRAME

> <#id> <temp>[CR][LF]

Succeeded to set the temperature and returns the set value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the TEC.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.19 GETTEMP command

NAME

GETTEMP

COMMAND FRAME

< <#id> GETTEMP R|G|BV|IR[CR][LF]

DESCRIPTION

Get temperature of each TEC.

<#id>

Any integer value for the ID of the command.

R

Identify the TEC.

G

Identify the TEC.

BV

Identify the TEC.

IR

Identify the TEC.

RESPONSE FRAME

> <#id> <temp>[CR][LF]

Succeeded to get temperature and returns the value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the TEC.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.20 DUTY command

NAME

DUTY

COMMAND FRAME

< <#id> DUTY R|G|B|V|W|IR|RGBW|ALL <duty>[CR][LF]

DESCRIPTION

Set the duty of each light.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

IR   Identify the light.

RGBW

Identify all visible lights.

ALL   Identify all lights.

<duty>

value of the duty(%) to set.

RESPONSE FRAME

> <#id> <power>[CR][LF]

Succeeded to set the duty and returns the set value.

> <#id> NO SUCH DEVICE[CR][LF]

Failed to identify the light.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.21 GAIN command

NAME

GAIN

COMMAND FRAME

< <#id> GAIN R|G|B|V|W <gain>[CR][LF]

DESCRIPTION

Set the gain of each light.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

<gain>

value of the gain to set. 0.0 <= <gain> <= 2.0.

RESPONSE FRAME

> <#id> <gain>[CR][LF]

Succeeded to set the gain and returns the set value.

> <#id> NO SUCH DEVICE OR PARAMETER ERROR[CR][LF]

Failed to identify the light or invalid value of the gain.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.22 WLED command

NAME

WLED

COMMAND FRAME

< <#id> WLED 0|10|20|50[CR][LF]

DESCRIPTION

Set the WLED mix mode.

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<#id>

Any integer value for the ID of the command.

0   WLED 0%.

10   Custom1.

20   Custom2.

50   WLED 50%.

RESPONSE FRAME

> <#id> <wled>[CR][LF]

Succeeded to set the WLED mix mode and returns the set value.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.23 RATIO command

NAME

RATIO

COMMAND FRAME

< <#id> RATIO R|G|B|V|W <ratio>[CR][LF]

DESCRIPTION

Set the ratio(LV1) of each light of current WLED mix mode.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

<ratio>

value of the ratio to set.

RESPONSE FRAME

> <#id> <ratio>[CR][LF]

Succeeded to set the ratio(LV1) and returns the set value.

> <#id> NO SUCH DEVICE OR PARAMETER ERROR[CR][LF]

Failed to identify the light or invalid value of the ratio.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.24 RATIO17 command

NAME

RATIO17

COMMAND FRAME

< <#id> RATIO17 R|G|B|V|W <ratio>[CR][LF]

DESCRIPTION

Set the ratio(LV17) of each light of current WLED mix mode.

<#id>

Any integer value for the ID of the command.

R   Identify the light.

G   Identify the light.

B   Identify the light.

V   Identify the light.

W   Identify the light.

<ratio>

value of the ratio to set.

RESPONSE FRAME

> <#id> <ratio>[CR][LF]

Succeeded to set the ratio(LV17) and returns the set value.

> <#id> NO SUCH DEVICE OR PARAMETER ERROR[CR][LF]

Failed to identify the light or invalid value of the ratio.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.25 PWM command

NAME

PWM
COMMAND FRAME
< <#id> PWM ON|OFF[CR][LF]
DESCRIPTION
Turn on or turn off the PWM mode.

<#id>

Any integer value for the ID of the command.

ON

To turn on the PWM mode.

OFF

To turn off the PWM mode.
RESPONSE FRAME
> <#id> ON|OFF[CR][LF]

Succeeded to turn on or turn off the PWM mode.

> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.26 SYNC command

NAME
SYNC
COMMAND FRAME
< <#id> SYNC OFF|MASTER RISE|MASTER FALL|SLAVE
RISE|SLAVE FALL|EXT[CR][LF]
DESCRIPTION
Set SYNC mode.

<#id>

Any integer value for the ID of the command.

OFF

SYNC OFF.

MASTER RISE

To set SYNC MASTER with rising edge.

MASTER FALL

To set SYNC MASTER with falling edge.

SLAVE RISE

To set SYNC SLAVE with rising edge.

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SLAVE FALL

To set SYNC SLAVE with falling edge.

EXT

EXTERNAL ENABLE.

RESPONSE FRAME

> <#id> OFF|MASTER RISE|MASTER FALL|SLAVE RISE|SLAVE FALL|EXT[CR][LF]

    Succeeded to set SYNC mode.

> <#id> INVALID PARAMETER[CF][LF]

    Failed because something wrong in the command frame.

3.3.27 EMIT command

NAME

    EMIT

COMMAND FRAME

    < <#id> EMIT MODE1|MODE2|MODE3|MODE4|HDR[CR][LF]

DESCRIPTION

    Set emit mode.

    <#id>

    Any integer value for the ID of the command.

    MODE1

    To select Mode1.

    MODE2

    To select Mode2.

    MODE3

    To select Mode3.

    MODE4

    To select Mode4.

    HDR

    To select Mode5.

RESPONSE FRAME

    > <#id> MODE1|MODE2|MODE3|MODE4|HDR [CR][LF]

        Succeeded to set emit mode.

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> <#id> INVALID PARAMETER[CF][LF]

Failed because something wrong in the command frame.

3.3.28 FPS command

NAME

FPS

COMMAND FRAME

< <#id> FPS[CR][LF]

DESCRIPTION

Get the frame rate to sync.

<#id>

Any integer value for the ID of the command.

RESPONSE FRAME

> <#id> <fps>[CR][LF]

Succeeded to set the frame rate and returns the set value.

4. Specifications

Electrical

    Primary: 100 – 240 VAC, 50/60 Hz, 400W

Dimensions

    Height: 140mm

    Width: 350mm

    Depth: 480mm

    Weight: 12kg

Laser Safety: IEC60825-1:2007, 4.5 mm dia./ 3m long light guide output

                       Visible light: Class 2

                       Infrared light: Class 3R

          IEC60825-1:2014, 4.5 mm dia./ 3m long light guide output

                       Visible light: Class 1

                       Infrared light: Class 1

Light Source

    Red LD: 638nm(typ.)

    Green LD: 525nm(typ.)

    Blue LD: 445nm(typ.)

    Violet LD: 405nm(typ.)

    IR LD: 808nm(typ.)

    White LED

Operating Conditions

    10 to 40 ℃

I/F level

    SYNC OUT: 5V open drain / Internally pulled up 10kΩ

    SYNC IN: 5V tolerant 3.3V CMOS

    ENABLE Input: R LD/G LD/B LD/V LD/W LED/IR LD

                     5V tolerant 3.3V CMOS

History

Revision	Date	Author	Change Description
1.0	9-Feb-2018	Akio Furukawa	First Edition