

■ Support for the China RoHS directive



For details on the support for the China RoHS directive (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.

http://www.optex-fa.com/rohs_cn/

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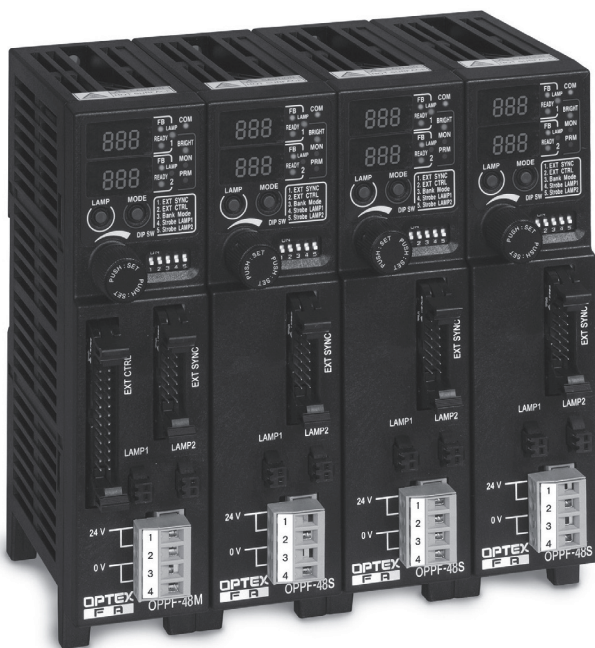
<http://www.optex-fa.com>

LED controller Advanced

OPPF-48 series

User's Manual

OPTEX
FA



- Thank you for the purchase of the LED controller Advanced "OPPF-48 series."
- Before using it, please read this manual carefully to ensure proper use.
- After reading this manual, keep it carefully in an easily accessible location for future reference.
- This product should not be used as safety equipment intended for the protection of human body.
- The warranty period of this product is two years, starting from the delivery date.

Optex FA will repair or replace the product free of charge if it should fail to function within the specified warranty period.

However, any fault attributable to natural disasters or any other similar disasters or undue alteration or repair will be excluded from the scope of the warranty.

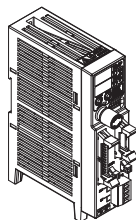
Introduction

Features

LED controller Advanced “OPPF-48 series”

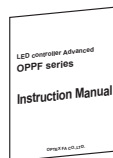
- Compatible with two modes, including PWM lighting and strobe lighting.
- Capable of lighting brightness/temperature monitoring and feedback control by utilizing “FALUX sensing.”
- The external brightness control is compatible with three communication modes of RS232, parallel and analog 0-5 V.
- Equipped with the bank registration functionality of the brightness values, making it possible to switch the bank with fewer input lines.
- The synchronous input may be selected from 5-30 V input type and TTL input type.
- Added alarm upper limit, expanded PWM frequency setting, and added function for automatically making fine adjustments to the slave device PWM frequency (version 112/514 or later)
- Capacity expanded from 30 W to 48 W. The strobe can also support lighting devices up to 24 W. (OPPF-48 Series)
- Supports batch reception of up to 8 request commands by way of RS232 communication (version 116/516 or later)
- Added a setting fixed to 100 kHz to the PWM frequency switching settings (version 117/516 or later)

The following items are contained in the package. Make sure that everything is in place.



OPPF series unit

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Instruction Manual

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Product Line Up

Type	Part number		Version
	Standard type	Illumination control TTL type	Display version/controller version
Master NPN	OPPF-48MN	OPPF-48MN-TTL	117/516 or later
Slave NPN	OPPF-48SN	OPPF-48SN-TTL	
Master PNP	OPPF-48MP	OPPF-48MP-TTL	
Slave PNP	OPPF-48SP	OPPF-48SP-TTL	

Versions

You can see version of each hardware / software through PRM setting mode (p15).

Display version (dU_r): Shows the software version of the user interface.

Controller version (P_{U_r}): Shows the software version of the controller (1-2 digit) and logic version (3rd digit).

Lighting device version (L_{U_r}): Shows the software version of the lighting device connected.

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For Safe Use of the Product

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols. Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

The safety symbols and their meanings are as follows.

 Warning	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
 Caution	Indicates that any improper operation or handling may result in minor injury or property damage.

 Warning	
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	Do not use this product in water or in a location where it may be exposed to water. Do not use this product if wet. Doing so may cause a fire or damage the product.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in a fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in a fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where water, oil, or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct sun light.
	Do not use this product in a non-industrial environment. Doing so may cause induction or radiation interference.
	In the event of a malfunction such as smoke comes out from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the housing becoming very hot, immediately stop operating the product and turn off the power to the controller. Doing so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact the Optex FA sales office.
	In case water enters the product If water or any other liquid enters the product, immediately stop operating the product and turn off the power to the controller. Using the product in this condition may cause a fire.

 Caution	
	Do not touch the product with wet hands. Doing so may damage the product.
	Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
	During operation, this product becomes very hot. Do not keep touching it. Doing so may cause a low-temperature burn.
	Follow the instructions in this manual or the specified instruction manual when wiring the product for the correct wiring method. Incorrect wiring can damage the product or cause a malfunction. Output cannot be connected with other LED controller in series nor in parallel.
	Use the dedicated cable for connecting the product to the lighting. Use of anything other than the dedicated cable may cause a malfunction or damage the product.
	Do not excessively twist or apply stress to the cable. Doing so may damage the cable or the connector.
	When connecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.
	When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
	Route wiring separately from high-voltage circuits and power circuits. If the wires are routed together, induction may occur, which can cause a malfunction or damage the product. If this is unavoidable, use a conductive object such as a properly grounded conduit as a shield.
	Install this product as far away from high-voltage equipment, power equipment, equipment that generates large switching surges, welders, inverter motors, or any equipment that can be a source of noise.
	Use the product within the rated ranges.
	Install this product and the dedicated controller securely. Failure to ensure secure installation can result in the products falling and becoming damaged.
	Make sure to turn the power off before connecting or disconnecting the cable. Connecting or disconnecting while energized may damage the product.

Handling Precautions

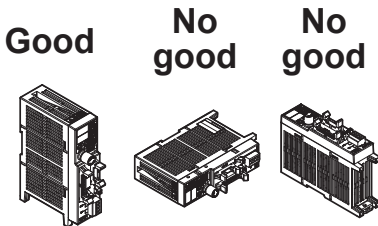
1. After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
2. All specifications may be changed without notice.
3. When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
4. This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
5. This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety.
Do not use this product as a detection device for protecting the human body.
6. Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application.
Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
7. For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an Optex FA sales representative.
Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations.
Optex FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.

Installation Notes

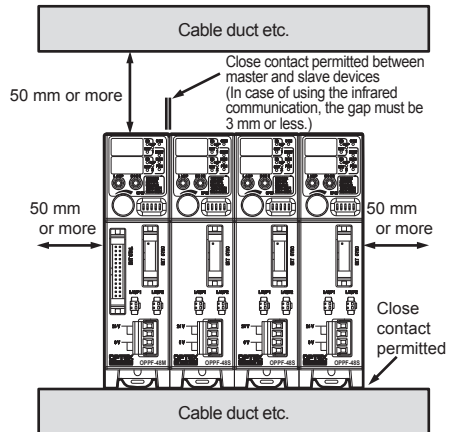
Fit the controller to the DIN rail or use the screw holes on the bottom surface to securely fix it.

Notes about the Installation Position of the Controller

Install the controller in a position shown "Good" in the figure below. Avoid any other positions for the installation.



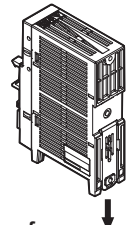
- (1) Allow a gap of 50 mm or more and left- and right-hand sides of the OPPF series.
- (2) Avoid closing the openings above and below the unit. Take sufficient care to cause convection for release of heat.
- (3) The ambient temperature range of the OPPF series is 0-45°C. Take the following into consideration.
 - Avoid installing the unit directly over devices that generate a large amount of heat (heater, transformer, power supply unit etc.).
 - Where the ambient temperature may exceed 45°C, install a forced cooling fan or air conditioner.
 - When installing the controller in an enclosure, locate it at the bottom wherever possible.
- (4) To ensure safe connection of cables, secure a gap of 70 mm or more on the front of the connector panel surface of this product.



Securing The Unit

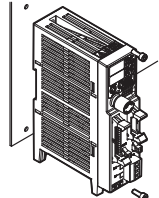
When installing on DIN rail

The master and slave devices are specified for installation on DIN rail. When attaching or removing the unit, pull the claw at the bottom in the direction of the arrow.



When installing by the back surface

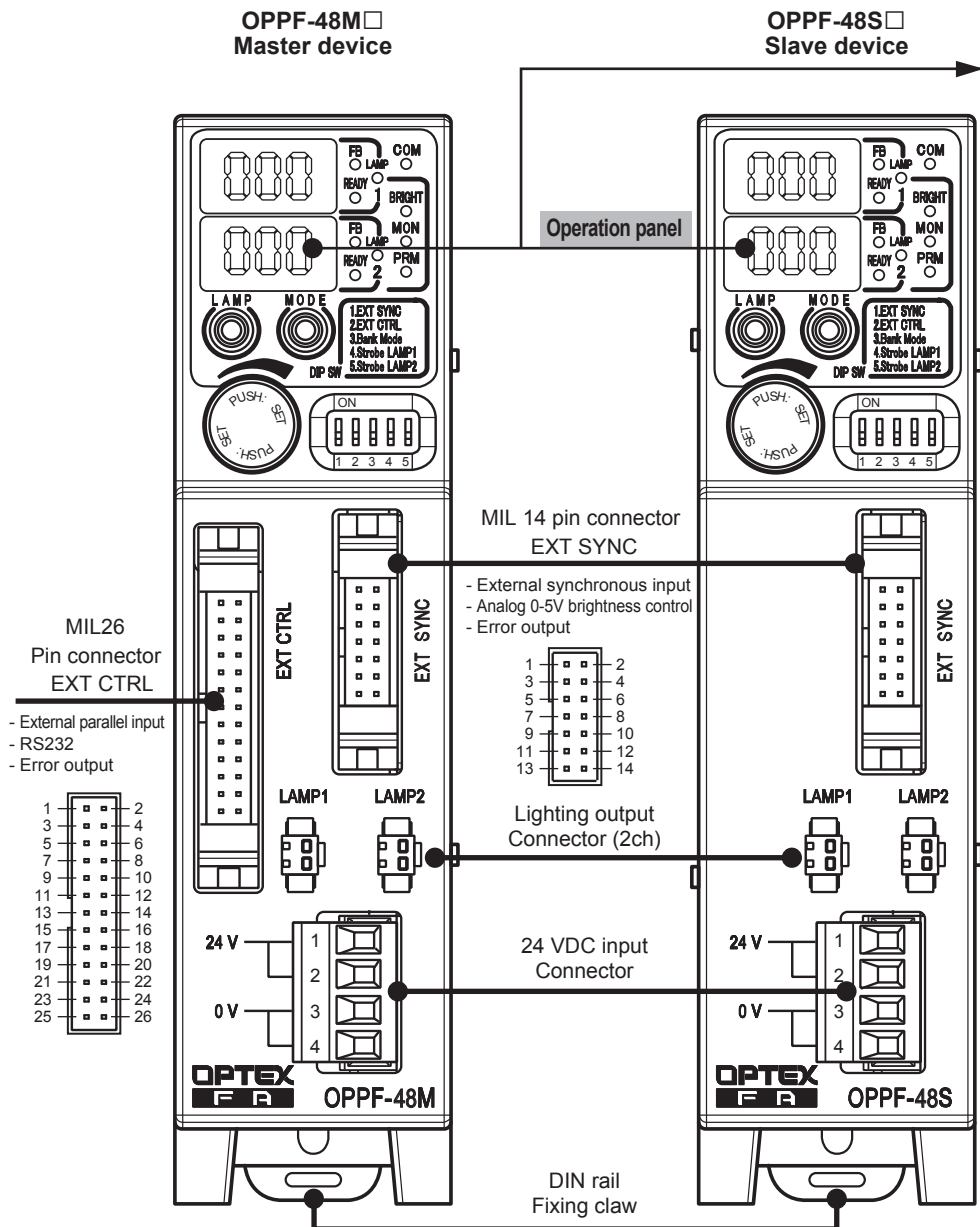
Install this unit at a stable, vibration-free location.



Housing hole dimension:
2-φ4.5
For further details, see the drawing of the unit.

Part Names and Functions

Master Device and Slave Device



Operation panel

LAMP1 monitor

Brightness
value/monitored value
Setting name

LAMP2 monitor

Brightness
value/monitored value
Setting

Lamp switch button

Mode switch button

Value setting dial confirmation button

READY status display

Red: lighting ready
Flashing red: LED output over current or LED
over heat
Unlit: insufficient input voltage of 24 VDC

FB (feedback) status display

Green: FB working
Flashing orange: FB error or alarm on
monitored brightness
Red: communication with the lamp
terminated
Unlit: feedback function not used

Infrared communication between COM master/slave device status display

Green: communication normal
Flashing red: communication error (slave only)
Red: communication shut down (slave only)
Unlit: no communication underway

LAMP1/2 selection display

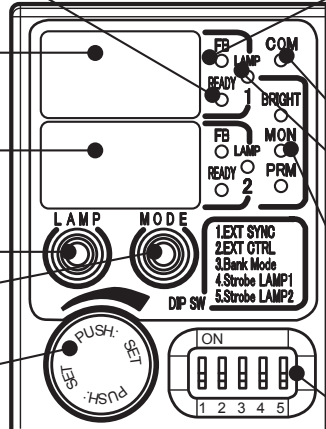
Displays the selected lamp

Mode display

BRIGHT: brightness value setting/display mode
MON: monitoring mode
PRM: parameter setting mode

DIP SW dip switches (ON when raised)

DSW1: external synchronization mode
(common to LAMP1 & 2)
DSW2: external brightness control mode
DSW3: bank mode
DSW4: strobe mode LAMP1
DSW5: strobe mode LAMP2



Operations for Each Mode

BRIGHT brightness value setting/display mode

When BRIGHT is lit, the brightness control values are shown on the LAMP1 and LAMP2 monitors. The behavior when operating the buttons and dial with BRIGHT lit is shown below.

	Press	Selects either LAMP1 or LAMP2 for setting the brightness value with the dial.
	Press long	Turns OFF the lighting device output for both LAMP1 and LAMP2.
	Press	Switches to the MON monitoring mode.
	Press long	Switches to the PRM setting reference mode.
	Rotate	Changes the brightness value of the currently selected lamp. A counterclockwise turn by one click decreases the value by 1 and a clockwise turn increases it by 1.
	Press	Moves the digit of the brightness value to be changed. When in the bank mode, the relevant bank number is displayed first. If left for 30 seconds, the digit for the change returns to the lowest digit.
	Press long	Pressing the two buttons at the same time brings about a locked state. Performing the same operation again unlocks the state. In the locked state, the brightness values and settings cannot be changed.

PRM setting reference mode (The upper menu display flashes.)

When BRIGHT is selected, a long press of the MODE button switches the LED controller to the PRM setting reference mode.

The behavior when operating the buttons and dial with PRM lit is shown below.

	Press	Selects a setting to be displayed from LAMP1 and LAMP2.
	Press long	Returns to the BRIGHT brightness setting/display mode.
	Rotate	Switches the setting item to be displayed.
	Press	Transitions to the PRM setting reference mode.

MON monitoring mode

When MON is lit, the monitored values are shown on the LAMP1 and LAMP2 monitors. If no lighting device is connected, "—" will be displayed.

For lighting devices that do not support sensing, "b-" is displayed when communication is shut down automatically. (See "Monitoring and Feedback Functions" on page 12.)

The automatic communication shut down is reset when the power is turned OFF.

The behavior when operating the buttons and dial with MON lit is shown below.

	Press	While the button is pressed, the voltage correction factors (%) for LAMP1 and LAMP2 are displayed. Where the feedback function is not used, "100" will be displayed.
	Press	Returns to the BRIGHT brightness setting/display mode.
	Press	Displays the internal temperature (°C) of the lamp. If no lamp is connected, "—" will be displayed.
	Press simultaneously	Displays the internal temperatures (°C) of the power supply device. The upper and lower values represent the temperatures in the vicinity of the LAMP1 and LAMP2 driving circuits, respectively. Once either of the temperatures reaches 105°C or more, the brightness value is decreased to a 1/4 level to protect the internal circuits.

PRM setting change mode (The lower setting display flashes.)

In the PRM setting reference mode, pressing the dial switches the LED controller to the PRM setting change mode. The behavior when operating the buttons and dial in this mode is shown below.

	Press long	Returns to the PRM setting reference mode without writing the changed setting.
	Rotate	Changes the currently displayed setting.
	Press	Moves the digit of a setting to be changed. If left for 30 seconds, the digit for the change returns to the lowest digit.
	Press long	Writes the changed setting and returns to the PRM setting reference mode.

Connecting Cables

Connecting Cables

24 VDC input (power supply)

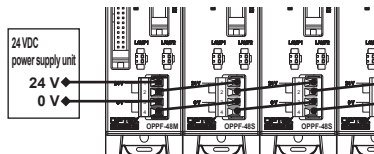
Connector : PHOENIX CONTACT plug 4-pole type
MSTB2.5/4-ST-5.08

Applicable wire : 0.2 - 2.5 mm², 24-12AWG

Length of stripping part : 7 mm

Caution : Use one pole for one wire. When supplying power across devices, use vacant terminals.

Pin number	Signal
1	24 V
2	24 V
3	0 V
4	0 V



Lighting output (LAMP1, LAMP2)

Connector : JST's SMR-02V-B housing



- 1: Lighting device output positive side
- 2: Lighting device output negative side

Master device: MIL 26 pin connector (EXT CTRL)

Master device/slave device: MIL 14 pin connector (EXT SYNC)

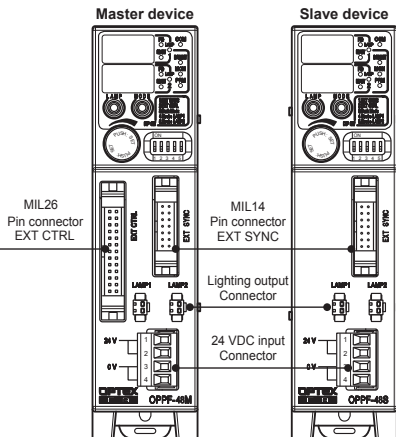
[Optional cables]

MIL socket connector wiring harness (type with one side trimmed)
AWG28 twisted-pair double-shielded cable

Master device: MIL 26 pin type (3 m) → OP-ECBF26-3

Common to master and slave devices: MIL 14 pin type (3 m) → OP-ECBF14-3

Caution: Use shielded cables in any environment subjected to noises.

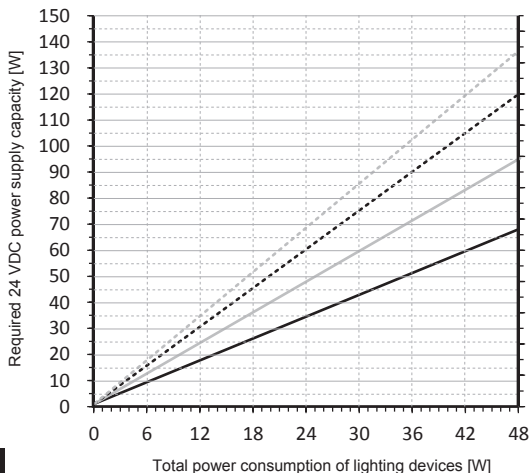


Required 24 VDC Power Supply Capacity to Handle Power Consumption of Lighting Devices

Based on the total power consumption of the LED lighting to be connected, select a 24 VDC power source that offers more than the required capacity.

Note: When using in conjunction with other equipment, the characteristics of the other equipment will affect the power supply, so be sure to choose a power supply that has a sufficient margin (about twice as much) as that shown in the table.

* Evaluation power source: IDEC PS5R-SF24 (120 W), PS5R-SG24 (240 W)



Lighting Device Output Capacity

<PWM mode>

Max. 30 W per channel

Max. 48 W for 2 channels (total)

Lighting device (1)	Lighting device (2)	Total
24 W	+ 24 W	→ 48 W
25 W	+ 20 W	→ 45 W
26 W	+ 16 W	→ 42 W
27 W	+ 12 W	→ 39 W
28 W	+ 8 W	→ 36 W
29 W	+ 4 W	→ 33 W
30 W	+ 0 W	→ 30 W

<Strobe mode>

Max. 24 W per channel

Max. 48 W for 2 channels (total)

Required 24 VDC power supply output current [A]

- <PWM mode> (FB: OFF)
- <PWM mode> (FB: ON)
- - - <Strobe mode> (FB: OFF)
- - - <Strobe mode> (FB: ON)

Infrared Communication

Major Functions of Infrared Communication between Master and Slave Devices

- Copy of setting onto the slave device by the operation on the master device (setting c^{PY})

All settings of the master device's LAMP1 are copied into LAMP2 of the master device and LAMP1 and LAMP2 of all slave devices. A long press on the mode button on the operation panel causes the transition to the "PRM setting mode." Now the copy is enabled by the setting c^{PY} .

* The following exceptions exist only when copying the PWM frequency (Pfr) setting. • Master device LAMP1 setting: 99, 98, or 97 kHz → Copy value: 100 kHz

* Only when copying from a master device with version 112/514 or later to a slave device with a version older than 112/514 and when b^{RH} does not equal 0, bank b14/b15 will not be copied correctly.

- Setting the brightness values and switching the bank of the slave device by the master device through external parallel input

The states of DSW2 and DSW3 must be set to be the same for both master and slave devices.

If the settings differ, the slave device cannot accept commands through the external parallel input.

Response time from the parallel input to the master device to the switching of the brightness control value (bank):

- Master device: 1.1 to 2.8 ms
- Slave device (#1, 2, or 3): 5.7 to 14.8 ms (* When the input is applied within 250 ms from the previous parallel input: 5.7 to 7.4 ms)

- Setting the brightness values, switching the bank, reading & writing the settings, and reading the state of the slave device by the master device through RS232

Response time from the master device's reception of the serial command transmission to the switching of the brightness control value (bank):

- Master device: 1.1 to 2.8 ms
- Slave device (#1, 2, or 3): 5.7 to 14.8 ms
- (* When the command is transmitted within 250 ms from the previous command transmission: 5.7 to 7.4 ms)

- Reflecting the error state of the slave device on the error output of the master device

Any occurrence of a feedback error or LED output over current error of the slave device causes the error output of the master device to turn ON.

There will be a maximum delay of 250 ms from the occurrence of an error on the slave device to the error output turning ON on the master device.

* The speed of infrared communication has been increased as of version 105/306.

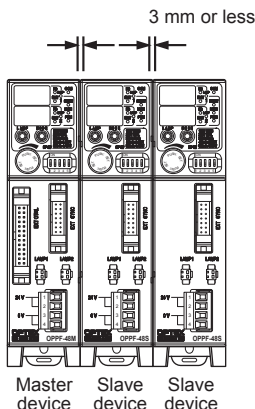
When these versions are used together with old versions, the response time will be that of the old versions.

• Conventional response time • Master device: 5 to 13 ms • Slave device: 20 to 60 ms

When new versions are used together with old versions, fix the devices in place so they are in close contact with each other, and then turn them ON.

Particular Notes

To ensure the stability of infrared communication, the units should basically be in close contact with each other and, at worst, the gap between them should not exceed 3 mm. The installation of the units should be made onto DIN rails to avoid any change in the gaps.



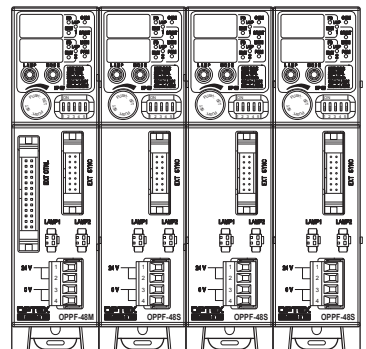
Assignment of Station Numbers

The station numbers to be designated by the external parallel input and serial communication are assigned sequentially starting at the left-hand side device.

	Master device	Slave device #1	Slave device #2	Slave device #3
LAMP1	0	2	4	6
LAMP2	1	3	5	7

* If you install four or more slave devices in sequence after the master device, the station numbers will not be assigned correctly.

When installing another slave device to the right of slave device #3, ensure there is a space of at least 10 mm between the devices to disable the infrared communication.

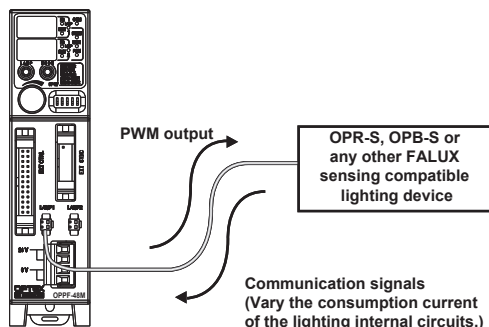


Differences from Conventional Models

With the OPFF series, connecting a FALUX sensing-compatible lighting device makes it possible to communicate with it to read the LED brightness and internal temperature of the device, in addition to the power supply for the lighting.

The communication does not require any dedicated cable. Communication signals are superimposed on two wires connected to the lighting device.

Any lighting device without FALUX sensing capability may also be connected as before.



To drive the internal circuits of the lighting device, a voltage of approximately 6 V is applied while the lamp is unlit. (LED will not illuminate with the 6 V voltages.)

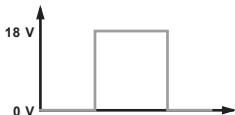
Conventional PWM output



PWM output of OPFF



Conventional strobe output

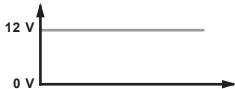


Strobe output of OPFF



In addition, since communication signals are superimposed, the lamps will not be in a state of direct current lighting even under the 100% duty condition.

Conventional PWM output (at maximum duty)



PWM output of OPFF (at maximum duty)



PWM Mode

Where the DSW4 (LAMP1) or DSW5 (LAMP2) is set OFF, the system will work in the PWM mode. Use the value setting dial to set the brightness value (0 - 999). The maximum capacity for connectible lighting equipment is a total of 48 W for 2 channels. (The maximum is 30 W per channel.)

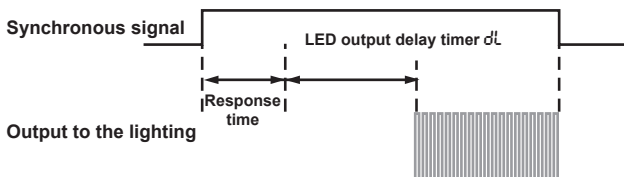
- PWM lighting by external trigger

The start of lighting is the value found by adding dL , the LED output delay timer setting, to the response times shown below.

- Input response time: With 24 V input: 5 μ s, with 5 V input: 44 μ s

In that case, the delay time from the rise of the trigger input to the actual emission of light will vary as shown below depending on the tFL filter time setting.

- Filter time 1 μ s: 0.8 - 1.0 μ s
- Filter time 5 μ s: 4 - 5 μ s
- Filter time 25 μ s: 20 - 25 μ s
- Filter time 100 μ s: 80 - 100 μ s

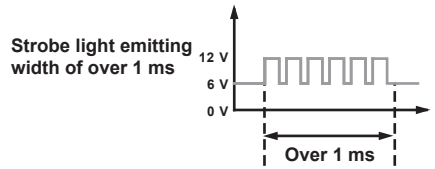
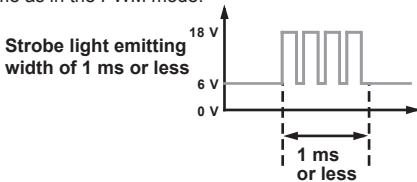


Strobe Mode

When the DSW4 (LAMP1) or DSW5 (LAMP2) is set ON, the equipment will work in the strobe mode. Use the value setting dial to set the brightness value (0 - 999).

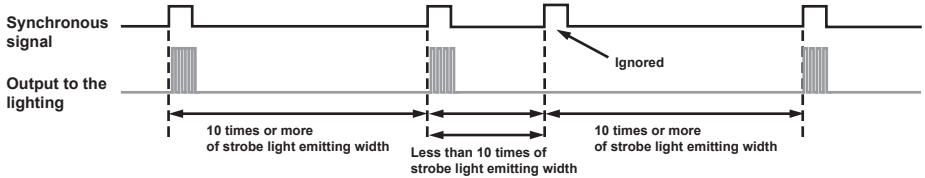
The strobe light emitting width is specified with the PRM settings Stb (strobe light emitting width) and Stu (strobe light emitting width unit). ($10\ \mu\text{s}$ to $9.99\ \text{ms}$ in units of $10\ \mu\text{s}$, $1\ \text{ms}$ to $999\ \text{ms}$ in units of $1\ \text{ms}$)

- When the strobe light emitting width is $1\ \text{ms}$ or less, the lighting device is driven with a high voltage of $18\ \text{V}$ to illuminate the LEDs at a brightness that is approximately three times higher than the conventional brightness. In that case, the maximum capacity of the lighting device connectable to each lamp is $24\ \text{W}$.
- When the strobe light emitting width exceeds $1\ \text{ms}$, the lighting device is driven with a standard voltage of $12\ \text{V}$. In that case, the maximum capacity for connectable lighting equipment is a total of $48\ \text{W}$ for 2 channels, which is the same as in the PWM mode.



In the $18\ \text{V}$ driven strobe mode, for the purpose of protecting the LEDs, no synchronous input is accepted until a length of time equal to 10 times the strobe light emitting width elapses.

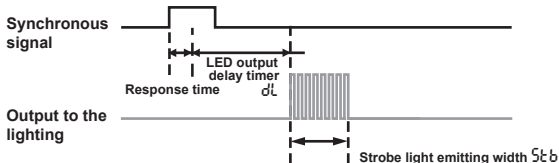
There is no such restriction for the case of driving with $12\ \text{V}$.



- Strobe lighting by external trigger

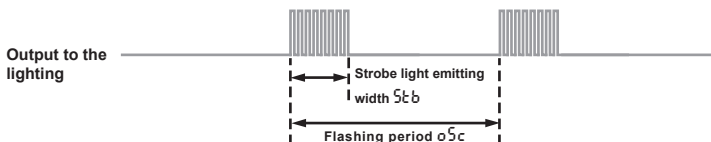
When the DSW1 is set ON, the lighting may be controlled by the external synchronous input.

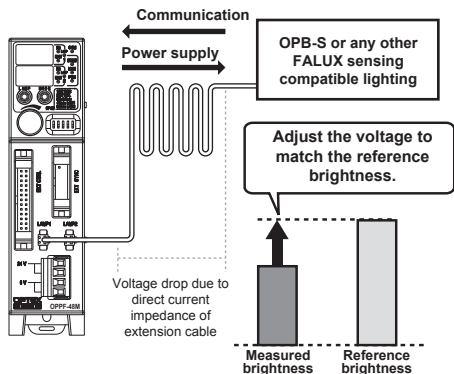
In that case, since the lighting control signal and the PWM are mutually synchronized, there will be no variation in the number of output pulses for all lighting-ups.



- Strobe lighting by internal automatic trigger

When the DSW1 is set OFF, it will flash at a period of the setting oSc . The restriction on the duty cycle works in the same way as in the case of external triggering.





Overview

A FALUX sensing-compatible lighting device senses the brightness of LED lighting with its built-in photo-diode. It accurately monitors the brightness not only in the case of continuous lighting but also in any situation of less frequent flashing.

If the monitored brightness exceeds 999, the last three digits are displayed. For example, any monitored brightness of 1000 - 1099 is shown as 000 - 099. If the monitored brightness is 1100 or over, only the last three digits are shown flashing.

The feedback function compares the measured brightness with the reference brightness recorded in the lighting device and fine-adjusts the output voltage to control the brightness to match the reference value.

Furthermore, in addition to the brightness, the internal temperature is measured in the lighting device and monitored by the power supply unit.

Through RS232 communication, the monitored values may be read.

* If a lighting device that does not support sensing is connected, light may be emitted for one pulse even when the brightness control value is 0.

Lighting devices whose LEDs light due to the 6 V output for communication are automatically recognized immediately after lighting, and then the signal's 6 V output is shut down. In this situation, "b-" is displayed for the monitoring mode. The automatic shut down is reset when the power is turned OFF.

There are some devices on which the automatic shut down described above does not activate and faint lighting occurs due to the 6 V for communication. In this situation, set the PRM setting Fb to cPb in order to turn OFF the 6 V output for communication.

Usage (1)

Detecting the Drop in the Brightness to Generate an Alarm (without feedback)

Use the PRM settings to set Fb to off and off/off to the lower limit value/upper limit value (%) of the monitored brightness at which to generate an alarm. Note that setting the upper limit value to 0 will be judged as meaning there is no upper limit.

When the alarm's upper or lower limit is exceeded, the feedback error output turns ON.

Example) To generate an alarm when the monitored brightness decreases to less than 10% of the value at the time of factory shipment: bR = 90 (%)

Example) To generate an alarm when the monitored brightness exceeds the value at the time of factory shipment by 10%: bRH = 110 (%)

If the cable for the lighting device is long, the actual brightness will be reduced due to the component of direct current impedance. Through the monitoring menu, check the monitored brightness against the brightness control value. Where the brightness control value and monitored value are 500 and 450, respectively, for example, the brightness is already decreased to 90% (= 450/500). If you wish to release an alarm at a brightness further 10% lower than that, set a value of 81% (= 90% x 90%) as the monitored brightness lower limit value for alarm.

For the release of the alarms, FBERR1 or FBERR2 output or ERR output of the master device is used.

Usage (2)

Feedback Function

Use the PRM settings to set Fb to on.

The output voltage will be adjusted to maintain the reference brightness appropriate for the brightness control value.

- PWM mode: 11 to 18 V

- Strobe mode: 16 to 22 V (with 12 V output: 11 to 18 V)

Generally, extending the lighting cable will actually decrease the brightness of the lighting due to the decreased voltage by the direct current component and also due to the dull waveform attributable to the inductance component and capacity component. If you actually extend the cable to 10-15 meters and use a lighting device of a relatively large capacity, the brightness may sometimes decrease to a half level or even lower. The feedback function will effectively work to compensate for the voltage drop by the direct current impedance.

When the target brightness is not reached even if the voltage is adjusted, the feedback error output turns ON. However, if the monitored brightness alarm has been set, it will be given priority.

Feedback error output will turn ON if the feedback function is used (Fb=on) with a lighting device that does not support FALUX sensing. As such, ensure that the feedback function is turned OFF (Fb=cPb) when using a lighting device that does not support FALUX Sensing.

Set bRL/bRH to the lower limit value/upper limit value (%) of the monitored brightness at which you want to generate an alarm (optional).

Note that setting the upper limit value to 0 will be judged as meaning there is no upper limit.

Pressing the LAMP button in the monitoring mode makes it possible to view the voltage compensation rate (%).

For example, if the voltage is compensated to 15 V, the displayed value will be 15/12=125%. Shown below are variation ranges.

- PWM mode: 88 - 144%

- Strobe mode: 82 - 113% (in case of 12 V output: 88 - 144%)

Notes about the Use of the Monitoring and Feedback Functions

The monitoring and feedback functions may not work in the following cases.

- The monitored brightness cannot reflect any smear of the lens or diffuse plate of the lighting device.
- If the brightness control value is less than 50, the feedback function is automatically turned OFF.
- When the pulse width for the external lighting control input is very small (about 2 μ s or less), the lit time will become extremely short and, therefore, it will not be possible to perform normal brightness monitoring.
- If the cable to the lighting device is long and the capacity of the device is large, the communication with the device may be disabled. In that case, decrease the PWM frequency to 50 or 20.
- If the communication with the lighting device is unstable due to noises, take anti-noise measures, such as protecting the lighting device cable with shield cover (shield gasket etc.)

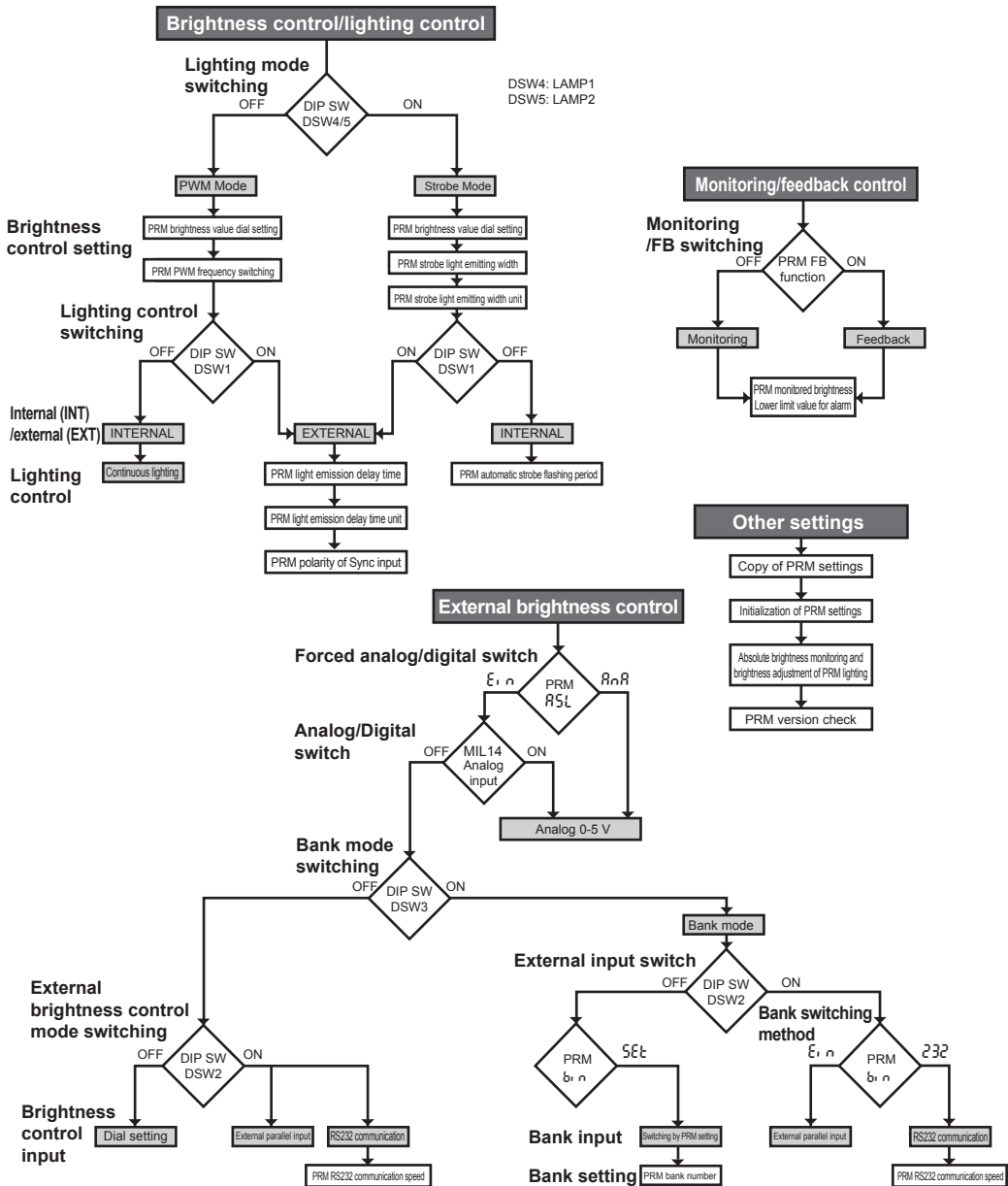
Shown below are operating conditions for the monitoring and feedback.

- Where the external synchronous input is used and the lit time is short, it may take a long time for the feedback actions to converge. The monitoring of the brightness requires at least 8 flashing actions. In case of continuous lighting, it requires 100 ms or more of lit time. Where the lighting device has been replaced, the targeted level of brightness is not achieved immediately after a significant change in the brightness control value. Therefore, the restoring to its normal state is accelerated by temporarily performing continuous lighting (DSW1 = OFF).
- The monitored brightness alarm action requires a minimum of 24 flashes or 300 ms or more of lit time.
- When the powering OFF is done after a minimum of 160 flashes or 2 seconds or more of lit time, a feedback-compensated output voltage is saved in memory. Upon the next powering ON, the device is lit in the same state as before the powering OFF.
- The period of updating the brightness by the communication between the lighting device and power supply unit is 21 ms. The period for the temperature is 105 ms.

Setting Procedures

Operation Flow Charts

For each setting, see the flowcharts shown below.



Setting Procedures

Setting the Brightness Control Values

Besides the dial-based setting, the methods of setting the brightness control value include the use of external signal input.

The external signal input is selectable from the three methods of parallel input, RS232 communication and analog input.

- Brightness control by dial → Operations for Each Mode on p7
- Brightness control by external parallel input → Inputs and Outputs on p16
- Brightness control by RS232 communication → RS232 Communication on p18
- Brightness control by analog input → Inputs and Outputs on p16

With the brightness control values set in the banks in advance, the value may be switched with less amount of input. The registration of the values may be done on up to 16 banks.

The bank switching measure is selectable from three methods, including PRM setting, external parallel input and RS232.

- Bank switching through PRM setting: → List of PRM Setting Items on p15
- Bank switching through external parallel input: → Inputs and Outputs on p16
- Bank switching through RS232 communication: → RS232 Communication on p18

		DIP SW		PRM				EXT CTRL MIL26-pin					EXT SYNC MIL14-pin	
		DSW2	DSW3	Setting b ₁ n	Setting b ₁₀ o	Setting b ₁₅ f	Setting R _{SL}	D0-D3 input	D4-D9 input	WR input	L0-L2 input	RS232	ANALOG input	AIN1,2 input
1	Brightness control value setting by dial	OFF	OFF	---	---	---	Ε ₁ n	---	---	---	---	---	OFF	---
2	Designation of brightness control value through external parallel input	ON	OFF	---	---	---	Ε ₁ n	Last ... bits of brightness control value 4bit	First ... bits of brightness control value 6bit	When writing	Designate station no.	---	OFF	---
3	Designation of brightness control value through RS232 communication	ON	OFF	---	---	---	Ε ₁ n	---	---	---	---	EVO command	OFF	---
4	Designation of brightness control value through analog input	---	---	---	---	---	Forced switch R _{nn}	---	---	---	---	---	ON	0 - 5 V applied
5	Designation of brightness control value by bank switching through PRM setting	OFF	ON	5Εε	Bank designated by 0 - 15	Brightness control values of banks	Ε ₁ n	---	---	---	---	---	OFF	---
6	Designation of brightness control value by bank switching through external parallel input	ON	ON	Ε ₁ n	---	Brightness control values of banks	Ε ₁ n	Bank number	---	---	Designate station no.	---	OFF	---
7	Designation of brightness control value by bank switching through RS232 communication	ON	ON	23ε	---	Brightness control values of banks	Ε ₁ n	---	---	---	---	Bn, BNO command	OFF	---

* About the bank switching

- Bank numbers are common to the external parallel input and RS232 communication. The bank numbers are deleted upon powering OFF.
- The bank numbers by the PRM setting are set separately from those for the parallel input and RS232 communication. The bank numbers are retained despite any powering OFF.

List of PRM Setting Items

A long press on the mode button on the operation panel causes the transition to the "PRM setting mode."

Indication	Name	Range	Initial value	Unit	LAMP1,2	Description
5εb	Strobe light emitting width	1 - 999	100	10 μs/1 ms	Individual	Sets the strobe's light emitting time. This is valid in the strobe mode (DSW4/5). You can change the unit with setting 5εu.
5εu	Strobe light emitting width unit	10u, 1	10u	-	Individual	The value 10u sets the strobe light emitting width unit to 10 μs and the value 1 sets the unit to 1 ms. The light emitting widths that can be set are 10 μs to 9.99 ms and 1 ms to 999 ms, respectively.
o5c	Automatic strobe flashing period	1 - 250	250	1 ms	Common	Sets the flashing period of strobe that work in the strobe mode and continuous lighting (DSW1 = OFF). When the flashing period is set to a value that is shorter than the strobe light emitting width, if the period is reached when the strobe light emitting is being performed continually, the period will be cancelled and the trigger will be received in the subsequent period.
dεL	LED output delay timer	0 - 999	0	10 μs/1 ms	Individual	The device may be switched by the setting dεu. Becomes valid with the external lighting control (DSW1 = ON).
dεu	Unit of LED output delay timer	10u, 1	10u	-	Individual	The value of 10u sets the unit of the LED output delay timer at 10 μs and the value 1 at 1 ms. The delay time ranges that can be set are 0 - 9.99 ms and 0 - 999 ms, respectively. Becomes valid with the external lighting control (DSW1 = ON).
εFL	Filter time factor for Sync input selection	1u, 5u, 25u, 100	1u	μs	Common	Designates the time for filtering to remove noises of the synchronous inputs. The input delay times are 0.8 - 1.0 μs, 4 - 5 μs, 20 - 25 μs, and 80 - 100 μs, respectively. Becomes valid with the external lighting control (DSW1 = ON).
εPL	Polarity of Sync input	Po5, nεG	Po5	-	Individual	Po5: While the synchronous input is ON (electric current passing), the lighting device is illuminated. In the strobe mode, the device will be lit with the rise of a pulse. nεG: While the synchronous input is OFF, the lighting device is illuminated. In the strobe mode, the device will be lit with the fall of a pulse. Becomes valid with the external lighting control (DSW1 = ON).
bRL	Monitored brightness lower limit value for alarm	0 - 200	0	%	Individual	If the brightness of the lighting device being monitored falls lower than the lower limit or becomes higher than the upper limit, which are percentages of the brightness level at the time of factory shipment, the feedback error output (FBERR1/2) turns ON. When you select this setting, the current monitored value (%) is displayed on the upper monitor and the lower limit/upper limit setting (%) is displayed on the lower monitor. If the extension cable for the lighting device is long, a reduced brightness value will be displayed due to the component of direct current impedance, so keep this in mind when setting the upper and lower limits.
bRH	Monitored brightness upper limit value for alarm	0 - 255	0	%	Individual	Also, the initial values of the alarm upper and lower limits are 0. When F ₃ is set to on, the feedback error output turns ON if the target brightness is not reached even if the voltage is adjusted. If F ₃ is set to on and the monitored brightness alarm has been set, the alarm judgment will be given priority.

Indication	Name	Range	Initial value	Unit	LAMP1,2	Description
F_b	Feedback Function	oFF, o_n, cPb	oFF	-	Individual	This function is to adjust the voltage applied to the lighting device so the brightness of the lighting device being monitored matches the brightness control value when a lighting device that supports FALUX sensing is connected. Voltage can be varied in a range of 11 - 18 V in the normal mode and 16 - 22 V in the strobe mode. If the targeted brightness cannot be achieved despite any adjustment of the voltage, the feedback error output turns ON. However, if the monitored brightness alarm has been set, it will be given priority. Feedback error output will turn ON if the feedback function is used (Fb=on) with a lighting device that does not support FALUX sensing. As such, ensure that the feedback function is turned OFF (Fb=cPb) when using a lighting device that does not support FALUX Sensing. When the brightness control value is less than 50, the feedback function automatically turns OFF. cPb: Turns OFF the supplying of 6 V communication voltages to the lighting device. The value is selected for models on which the supplying of 6 V causes the lighting device to light up.
Pf_r	PWM frequency switching	$20, 50, 100, 99, 98, 97, F \emptyset$	100	kHz	Common	Sets the PWM frequency. If the extension cable to the lighting device is long, the capacity of the device is large, and the brightness control value is also large, the communication between the power supply and the lighting device may be broken. In that case, decrease the PWM frequency to 50 or 20. Also, when using the same PWM frequency to light a lighting device that has multiple inputs, flickering may occur due to the interference between PWM outputs. The OPPF master device has a function that automatically makes fine adjustments to the PWM frequency. To prevent the flickering that occurs due to the interference between PWM outputs when linked slave devices are used with the OPPF master device PWM frequency set to the initial value of 100, the slave device PWM frequencies are automatically adjusted to 99, 98, and 97 in order. When the master device PWM frequency is a value other than 100, this automatic adjustment is not performed. Note that the automatic adjustment is not performed when only multiple OPPF slave devices are being used to perform lighting, so set all the OPPF units to different PWM frequencies. If you want to fix all the outputs to 100, specify F10 (fixed to 100 kHz) for this setting on all the connected OPPF units.
b_n	Bank switching method	$\varepsilon_n, 232, 5\emptyset t$	ε_n	-	Individual	Selects the method of bank switching. Valid in the bank mode (DSW3 = ON). ε_n : By using the external parallel input (D0-D3) of the master device, designates a binary value in ON/OFF state to switch the bank. Powering OFF causes the bank number to return to 0 (zero). Valid in the external brightness control and bank mode (DSW2 = ON, DSW3 = ON). 232: Through the use of RS232 of the master device, switches the bank by a communication command (BNO). Powering OFF causes the bank number to return to 0 (zero). Valid in the external brightness control and bank mode (DSW2 = ON, DSW3 = ON). 5\emptyset t: Selects a bank number by the setting bno. Valid in the bank mode (DSW3 = ON) without external brightness control (DSW2 = OFF).
bno	Bank number	$0 - 15$	0	-	Individual	Switches the bank in accordance with this setting. Displayed only when $b_n = 5\emptyset t$ in the bank mode (DSW3 = ON). Valid in the bank mode (DSW3 = ON) without external brightness control (DSW2 = OFF).
$b0$	Brightness control value of bank 0					
$b1$	Brightness control value of bank 1					
$b2$	Brightness control value of bank 2					
$b3$	Brightness control value of bank 3					
$b4$	Brightness control value of bank 4	$0 - 999$	0	-	Individual	Capable of designate, for each bank, the brightness control value to be used in bank switching. With the currently selected bank, rotating the volume dial to change the brightness control value changes this setting as well. If you do not want to change this setting, we recommend that you lock the dial operation. (See "Operations for Each Mode" on page 7.) Valid in the bank mode (DSW3 = ON).
$b5$	Brightness control value of bank 5					
$\vdots$	$\vdots$					
$b15$	Brightness control value of bank 15					* The bank 0 brightness control value in the bank mode is the same as the brightness control value in the normal mode.
$bP5$	RS232 communication speed	$oFF, ^48, 96, 192, 384, 576, 115$	96	-	Common	Sets the RS232 communication speed of master device. (Only master device displays the value) oFF: Terminates the communication function. ^48: Communication at 4,800 bps. ^36: Communication at 9,600 bps. 82: Communication at 19,200 bps. 384: Communication at 98,400 bps. 576: Communication at 57,600 bps. 115: Communication at 115,200 bps.
$R5L$	Forced analog/digital switch	ε_n, RnR	ε_n	-	Common	Selects the external analog brightness control switch. ε_n : The EXT SYNC analog brightness control switch input is followed. RnR: The analog brightness control is forcibly switched to. When analog brightness control is enabled, turning the brightness control dial will display "RnR."
$cP5$	Copy of settings	$no, Y\emptyset5$	no	-	Common	Copies the settings of the master device's LAMP1 into LAMP2 of the master device and LAMP1 and LAMP2 of slave devices. (Displayed is the value for master device only.) Select "Y\emptyset5" to write the settings.
i_n	Initialization of the settings	$no, Y\emptyset5$	no	-	Common	Initializes the brightness control values and all the PRM settings of LAMP1 and LAMP2 to the factory shipped state. Select "Y\emptyset5" to write the settings.
brt	Absolute brightness monitoring and brightness adjustment of the lighting intensity	$0 - 999$	-	-	Individual	While ordinary brightness monitoring displays the relative brightness of the lighting device against the level at the factory shipment, this displays the relative brightness in comparison with the reference value that depends on the lighting device model. (Brightness reflecting individual differences) When you select this setting, the monitored brightness is shown in the upper monitor and the brightness control value in the lower monitor. By adjusting the brightness control value, the brightness can be matched to the targeted level.
dUr	Display version	-	-	-	Common	Displays the software version of the user interface.
PUr	Controller version	-	-	-	Common	Displays the software version (1-2 digits) and logic version (3rd digit).
LUr	Lighting device version	-	-	-	Individual	Displays the software version of the lighting device connected.
εnd	Termination of the setting menu	-	-	-	Common	Terminates the display of settings and returns to the display of brightness control value.

■ Bank-related settings are displayed only where the DSW3 bank mode is ON.

■ The versions are displayed only when the dial has been turned with the LAMP button held pressed.

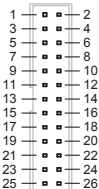
Inputs and Outputs

List of Input and Output Functions

- Master device MIL 26 pin connector EXT CTRL

Pin number	Name	Input & output	Signal name	Details
1	D0	Input	Brightness control bit 0/ bank switching 0 (LSB)	In case of the external brightness control (DSW2 = ON) and not in the bank mode (DSW3 = ON), each corresponds to the 0th to 3rd bit when switching the brightness control value through the external parallel input. In case of the external brightness control (DSW2 = ON) and in the bank mode (DSW3 = ON), the bank number may be designated.
2	D1	Input	Brightness control bit 1/ bank switching 1	
3	D2	Input	Brightness control bit 2/ bank switching 2	
4	D3	Input	Brightness control bit 3/ bank switching 3	
5	D4	Input	Brightness control bit 4	Input for switching the brightness control value through external parallel input. Each corresponds to 4th to 9th bit. The value is designated on a binary basis. Valid in case of the external brightness control (DSW2 = ON) and not in the bank mode (DSW3 = ON).
6	D5	Input	Brightness control bit 5	
7	D6	Input	Brightness control bit 6	
8	D7	Input	Brightness control bit 7	
9	D8	Input	Brightness control bit 8	
10	D9	Input	Brightness control bit 9	
11	L0	Input	LAMP switching 0	Designates the LAMP station number as the object of external brightness control or bank switching. With the master device, LAMP1 is selected by setting OFF the L2, L1 and L0 and LAMP 2 selected by the combination of L2 and L1 = OFF and L0 = ON.
12	L1	Input	LAMP switching 1	
13	L2	Input	LAMP switching 2	
14	WR	Input	Brightness control value writing	By turning ON this input, the brightness control value may be written. In case of using bank numbers, it is not necessary to use this.
15	COMINA	-	Input COM	Common terminal for inputs. Inputs can be turned ON by applying 5 to 24 V between each input and this common terminal. (No polarity)
16	COMOUTA	-	Output COM	Common terminal for outputs. Upon turning ON of the output, electric current will flow from the output to this common terminal. (With PNP type, the direction is reversed.)
17	ERR	Output	Error output (FB, overcurrent)	Turns ON upon occurrence of a feedback error, monitored brightness alarm activation, LED over heat or the activation of over current protection of the lighting device. Where slave devices are connected, if any of such slave devices releases an error, this output will turn ON as well. (The reflection of the error state of slave devices involves a delay of up to 250 ms.)
18 - 23	-	-	-	-
24	TXD	Output	Serial TXD	Output transmitted by RS232.
25	RXD	Input	Serial RXD	Input received by RS232.
26	SG	-	Serial GND	Common terminal for RS232.

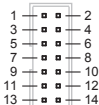
MIL 26
Pin connector



- Master device/slave device MIL 14 pin connector EXT SYNC

Pin number	Name	Input & output	Signal name	Details
1	SYNC1	Input	LAMP1 synchronous input	In case of the external lighting control (DSW1 = ON), LAMP1 stays ON while this input is ON. The polarity can be switched by iPRC of the PRM setting. In the strobe mode (DSW4 = ON), LAMP1 turns ON with the rise of this input.
2	SYNC2	Input	LAMP2 synchronous input	In case of the external lighting control (DSW1 = ON), the LAMP2 will be lit while this input is ON. The polarity can be switched by iPL of the PRM setting. In the strobe mode (DSW5 = ON), LAMP2 turns ON with the rise of this input.
3	COMINB	-	Input COM	Common terminal for inputs. Inputs can be turned ON by applying 5 to 24 V between the synchronous input or the analog brightness control switching input and this common terminal. (No polarity)
4	COMOUTB	-	Output COM	Common terminal for outputs. Upon turning ON of an output, electric current will flow from the output to this common terminal. (With PNP type, the direction is reversed.)
5	OVC	Output	Over current error	If any of the lighting devices LAMP1 and LAMP2 fall into a state of over current, this output turns ON.
6	FBERR1	Output	LAMP1 feedback error	Stays ON while the feed back error exists or the monitored brightness alarm is activated with LAMP1.
7	LON1	Output	LAMP1 outputting	Stays ON while the LAMP1 is output.
8	FBERR2	Output	LAMP2 feedback error	Stays ON while the feed back error exists or the monitored brightness alarm is activated with LAMP2.
9	LON2	Output	LAMP2 outputting	Stays ON while the LAMP2 is output.
10	ANALOG	Input	Analog brightness control switching input	When this input is turned ON, the brightness may be controlled by the voltage of analog inputs AIN1 and AIN2. LAMP1 and LAMP2 cannot be switched individually. Applying 5 to 24 V between this input and 3 COMINB will turn ON analog brightness control. RSt. in the PRM settings can also be used to forcibly switch to analog brightness control.
11	AIN1	Input	LAMP1 analog input	Analog input for LAMP1. The voltage range of 0 - 5 V corresponds to the brightness control value range of 0 - 999.
12	5V	Output	Service 5 V output	5 V output to be used for analog input
13	AIN2	Input	LAMP2 analog input	Analog input for LAMP2. The voltage range of 0 - 5 V corresponds to the brightness control value range of 0 - 999.
14	ACOM	-	Analog common	Common terminal for analog input.

MIL 14
Pin connector



Timing Chart

Shown below are the timing charts for the brightness control value setting and the bank switching in the external parallel input.

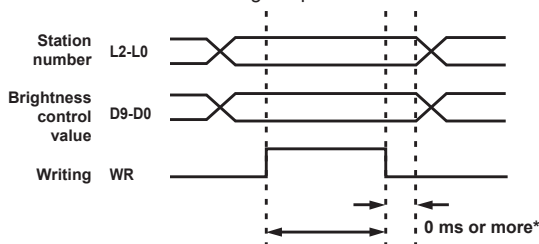
Brightness value setting

After the WR state kept ON for a predetermined period of time, the brightness control value is written.

* Do not change the value before the write signal being turned OFF.

The brightness control value of the external parallel input is converted into 999 when it is in the range of 1000 - 1023.

Turning the power OFF deletes all the brightness control settings.



Lighting device setting	Station number	L0	L1	L2
Master device LAMP1	0	OFF	OFF	OFF
Master device LAMP2	1	ON	OFF	OFF
Slave device #1 LAMP1	2	OFF	ON	OFF
Slave device #1 LAMP2	3	ON	ON	OFF
Slave device #2 LAMP1	4	OFF	OFF	ON
Slave device #2 LAMP2	5	ON	OFF	ON
Slave device #3 LAMP1	6	OFF	ON	ON
Slave device #3 LAMP2	7	ON	ON	ON

* D9 - D0 inputs for the designation of the brightness control values are in binary format.

2.9 ms or more (for master device)
16 ms or more (for slave device)

Response time

The switching will occur in the following time from the brightness control value writing (WR).

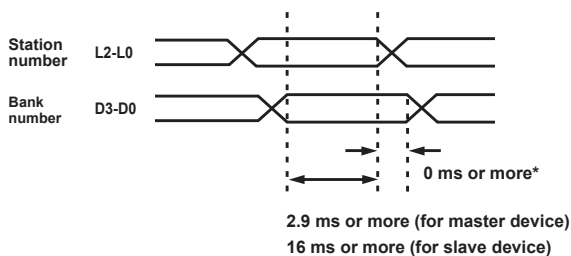
- Master device: 1.1 to 2.8 ms
- Slave device (#1, 2, or 3): 5.7 to 14.8 ms (When the input is applied within 250 ms from the previous parallel input: 5.7 to 7.4 ms)

Bank switching

The value is written when the bank number has been input for a predetermined period of time.

* Do not change the bank signal value before the station number signal is switched.

After the bank switching operation, maintain the bank signal so that the currently specified station number value does not change.



Bank number designation	D0	D1	D2	D3
Bank 0	OFF	OFF	OFF	OFF
Bank 1	ON	OFF	OFF	OFF
Bank 2	OFF	ON	OFF	OFF
Bank 3	ON	ON	OFF	OFF
Bank 4	OFF	OFF	ON	OFF
Bank 5	ON	OFF	ON	OFF
Bank 6	OFF	ON	ON	OFF
Bank 7	ON	ON	ON	OFF
Bank 8	OFF	OFF	OFF	ON
Bank 9	ON	OFF	OFF	ON
Bank 10	OFF	ON	OFF	ON
Bank 11	ON	ON	OFF	ON
Bank 12	OFF	OFF	ON	ON
Bank 13	ON	OFF	ON	ON
Bank 14	OFF	ON	ON	ON
Bank 15	ON	ON	ON	ON

About the bank switching

- Bank numbers are common to the external parallel input and RS232 communication.
- The bank numbers are deleted upon powering OFF.
- Bank numbers by the PRM setting are set separately from those of parallel input or RS232 communication.
- The bank numbers are retained despite any powering OFF.

Response time

The switching will occur in the following time from the bank input.

- Master device: 1.1 to 2.8 ms
- Slave device (#1, 2, or 3): 5.7 to 14.8 ms (When the input is applied within 250 ms from the previous parallel input: 5.7 to 7.4 ms)

RS232 Communication

RS232 communication is performed using the pins 24 through 26 of the MIL 26 pin connector.

Baud rate	9,600 bps (initial value). Changeable in the PRM setting change mode. (OFF / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200)
Data length	8bit
Stop bit	1bit
Parity	None
Flow control	None

Station number	Master device	Slave device#1	Slave device#2	Slave device#3
LAMP1	0	2	4	6
LAMP2	1	3	5	7

Request command (transmitted by the external device)

0	1	2	3	4	5	6	7	8	9	10	11	12
Header '@'(40H)	Station number '0' - '7'	Command 'A' - 'Z', '0' - '9' 3 bytes			Write or read '0000' - '9999' or 'R'(52H) Variable length in a range of 1 - 4 bytes				Checksum '00' - 'FF' or '**'(2AH,2AH)		Delimiter 'CR+LF' (0DH,0AH)	

Response command (transmitted by OPPF)

0	1	2	3	4	5	6	7	8	9	10	11	12
Header '@'(40H)	Station number '0' - '7'	Command 'A' - 'Z', '0' - '9' 3 bytes			Write or read 'W'(57H) or '0000' - '9999' Variable length in a range of 1 - 4 bytes				Checksum '00' - 'FF'		Delimiter 'CR+LF' (0DH,0AH)	

* If the command length is less than 3 characters, it is padded with blank(s) (20H) at the trailing end. (Example: 'FB..')

* The character 'H' as part of 'xxH' signifies a hexadecimal value. The value '20H' equals to 32 in decimal.

Checksum

The transmission data are added as binary (header + station number + command + Write or read) and the last eight bits are reversed (the one's complement is obtained). Then, the two-digit hexadecimal number is stored as the checksum.

When skipping the calculation of the checksum, '**' (2AH, 2AH) may be sent out in place of the checksum.

Batch reception of request commands

The OPPF can receive up to eight request commands from external devices as a batch.

Therefore, it is possible to write the brightness control values for eight devices with the transmission of a single command.

The response commands from the OPPF are returned in order to each station number after the predetermined response time.

Example) Writing brightness control values for four channels (station number 0: 100, station number 1: 200, station number 2: 300, and station number 3: 400)

Request command: @0EVO100**<CR+LF>@1EVO200**<CR+LF>@2EVO300**<CR+LF>@3EVO400**<CR+LF>

Response command: @0EVOW4E<CR+LF>@1EVOW4D<CR+LF>@2EVOW4C<CR+LF>@3EVOW4B<CR+LF>

When the response command cannot be received

- Communication speeds or any other settings are wrong.
- Wiring connections are incorrect as for the serial transmission and reception.
- Wrong command has been transmitted.
- Checksum mismatches.

Shown above are some of the possible causes.

Check the communication speed settings and then try the transmission of @0EVOR**<CR+LF> (40H, 30H, 45H, 56H, 4FH, 52H, 2AH, 2AH, 0DH, 0AH).

When the response command has been received

A response command is transmitted if the serial communication is successfully established, irrespective of the successful or unsuccessful result of writing or reading.

In case of successful completion, a response command is transmitted in response to the request command.

Upon any failure, a response command of the same contents as the request command is transmitted.

However, if the variable length section of the request command contains any value that is invalid for the input, the variable length part is converted to '9999' for transmission.

When you want to receive the serial data part with a fixed length

You can use the 5dL command to receive the serial data part with a fixed length.

With the initial value, the length is variable, so use this command to switch to the fixed length mode.

In the fixed length mode, the read data section in the response command is four right-justified digits. If the number of digits of actual data is insufficient, the data is padded with zeros.

The "R" for reading becomes the left-justified "R□□□" and the "W" for writing completion becomes the left-justified "W□□□."

The writing data in the request command can be received whether it has a fixed or variable length.

Turning the power OFF returns the setting to variable length (the initial value).

Example) Variable length: @0EVOR → Fixed length: @0EVOR□□□□

Variable length: @0EVO555 → Fixed length: @0EVO5555

Response time

The setting will be switched in the following period of time from the completion of a command receipt.

- Master device: 1.1 to 2.8 ms
- Slave device #1, 2, or 3): 5.7 to 14.8 ms (When the input is applied within 250 ms from the previous parallel input: 5.7 to 7.4 ms)

The time from the completion of the reception of a command to the start of the transmission of the response command is shown below.

- Master device: 0.33 to 0.74 ms
- Slave device #1: 8.5 to 17.6 ms (* When the command is transmitted within 250 ms from the previous command transmission: 8.5 to 9.2 ms)
- Slave device #2: 11.8 to 20.9 ms (* When the command is transmitted within 250 ms from the previous command transmission: 11.8 to 12.5 ms)
- Slave device #3: 15.1 to 24.2 ms (* When the command is transmitted within 250 ms from the previous command transmission: 15.1 to 15.8 ms)

List of Commands

When writing data, the data are once written locally for comparison with those read from the EEPROM. If they differ from each other, the data are written onto the EEPROM.

* If the command length is less than 3 characters, it is padded with blank(s) (20H) at the trailing end. (Example: 'FB..')

	Contents	Data	
		Read ('R')	Write (data)
EVO	External brightness control *1)	0 - 999	Same as shown left
STB	Strobe light emitting width	1 - 999	Same as shown left
STU	Strobe light emitting width unit	0, 1 : 10 μ s / 1 ms	Same as shown left
OSC	Automatic strobe flashing period	1 - 250	Same as shown left
LCT	Lighting device illumination control *2)	0: Not lit, 1: Lit	Same as shown left
DL..	LED output delay timer	0 - 999	Same as shown left
DLU	Unit of LED output delay timer	0, 1 : 10 μ s / 1 ms	Same as shown left
TFL	Filter time factor for Sync input selection	0 - 3 : 1 μ s / 5 μ s / 25 μ s / 100 μ s	Same as shown left
TPL	Trigger input polarity	0, 1 : $\overline{Po5}$ / $n\overline{E5}$	Same as shown left
ASL	Analog input switching	0: Depends on the external analog switching input, 1: Forced analog input	Same as shown left
BAL	Monitored brightness lower limit value for alarm	0 - 200	Same as shown left
BAH	Monitored brightness upper limit value for alarm	0 - 255	Same as shown left
MON	Reading the monitored value *3)	0 - 2047	None
FB..	Feedback Function	0 - 2 : $\overline{oFF}$ / on / cPb	Same as shown left
FBR	Reading the feedback compensation rate	0 - 2047 : permillage of output voltage compensation	None
PFR	PWM frequency switching	0 - 6 : 20 / 50 / 100 / 99 / 98 / 97 / F10	Same as shown left
BIN	Bank switching method *4)	0 - 2 : $\overline{E}$, n / 232 / $5Et$	Same as shown left
BNO	Bank number *5)	0 - 15 (bank number currently selected)	0 - 15 (Change the bank number currently selected)
Bn..	Setting/reading the brightness control value of bank n *6)	0 - 999	Same as shown left
LAB	Absolute brightness monitoring *3)	0 - 4095	None
TMm	Reading the temperature *7)	-99 - 255 (°C)	None
SDL	Serial data section data type specification *8)	0: Variable length, 1: Fixed length	Same as shown left

*1) Valid when the external brightness control (DSW2 = ON) is enabled. The external brightness control value is not saved on the EEPROM. (The external brightness control value returns to 0 [zero] when the power turns OFF.)

*2) Valid in the external lighting control mode (DSW1 = ON). The lighting device illumination control is not saved on the EEPROM. (It returns to not lit when the power turns OFF.)

*3) When the MON or LAB command is used to call a monitored value when no lighting devices are connected or a lighting device that does not support sensing is connected or when the brightness control value is 0, the response is "0."

*4) 0 : $\overline{E}$, n (external parallel)/1 : 232 (RS232 communication)/2 : $5Et$ (PRM setting change mode)

*5) In case of reading, the bank number currently being used is returned. (Whatever may be the bank switching method.)

In case of writing, the following two conditions must be met for overwriting.

- External bank switching (DSW2 = ON / DSW3 = ON)
- " 232 (RS232 communication)" for the bank switching method

In addition, the bank number as changed by the RS232 communication (external parallel) is not saved on the EEPROM. (The bank number returns to 0 (zero) upon powering ON/OFF.)

*6) The character 'n' is to be replaced with a bank number. Bank 0 translates to "B0.." and bank 10 to "B10."

In case the bank number is a single digit number, pad it with 20H (blank) for the last digit.

*7) The character 'm' is to be replaced with a character 0 through 2. Character 0 represents the temperature of the lighting device, 1 the temperature of LAMP1 control circuit board of the power supply unit, and 2 the temperature of LAMP2 control circuit board of the power supply unit.

In case of TM1 and TM2 commands, any one station number is designated for each of the devices. Therefore, @0TM1R** and @1TM1R** return the same results.

When the TM0 command is used to read the temperature when no lighting devices are connected or a lighting device that does not support sensing is connected, the response is "00."

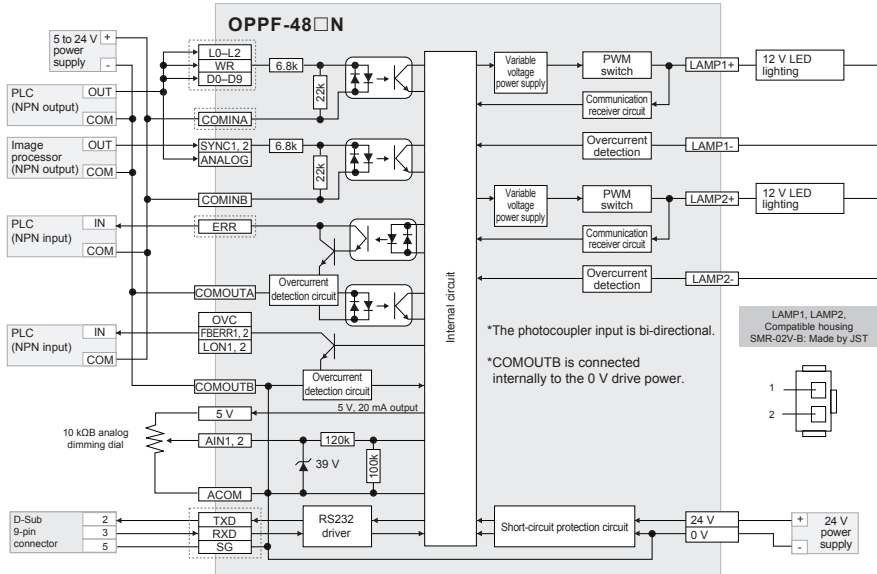
*8) Specify 0 or 1 for the station number. Turning the power OFF returns the setting to variable length (the initial value).

Circuit Diagram

Standard Type

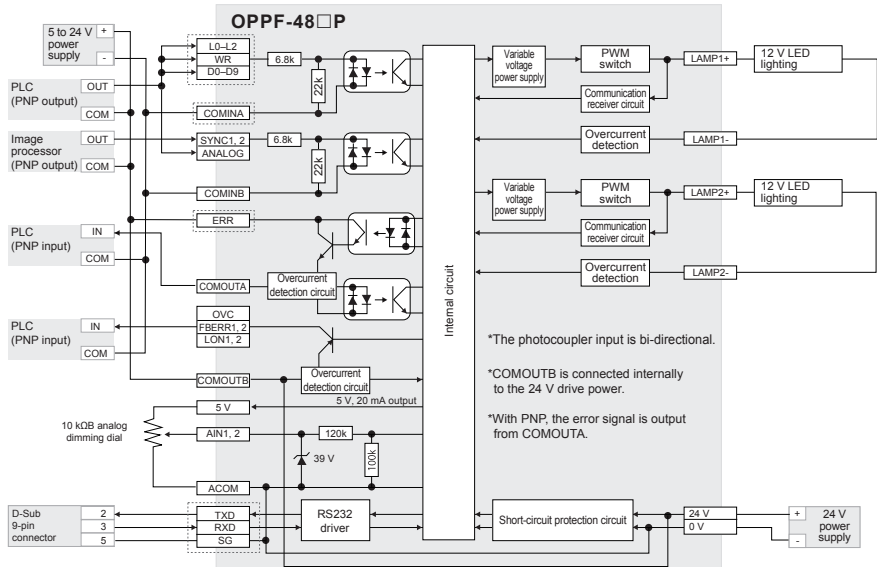
NPN type

: Master device only



PNP type

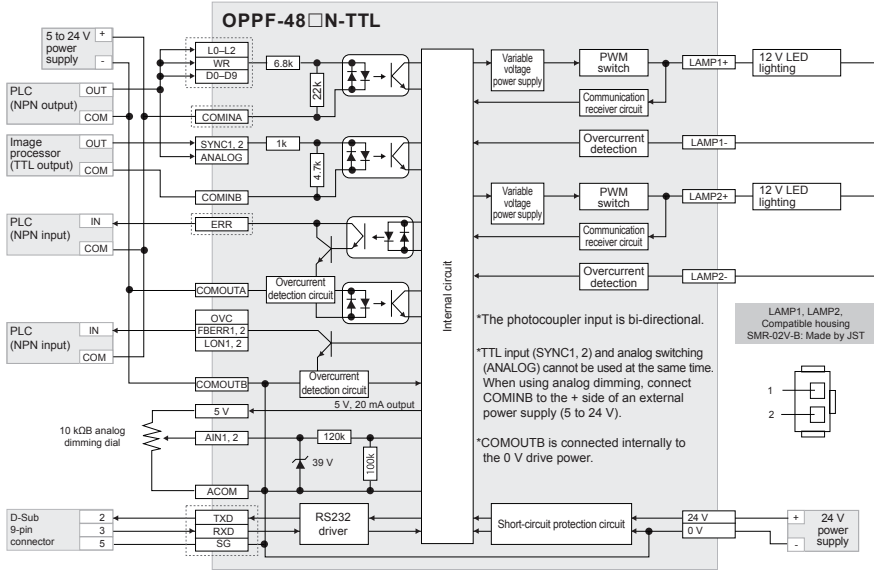
: Master device only



Illumination Control TTL Type

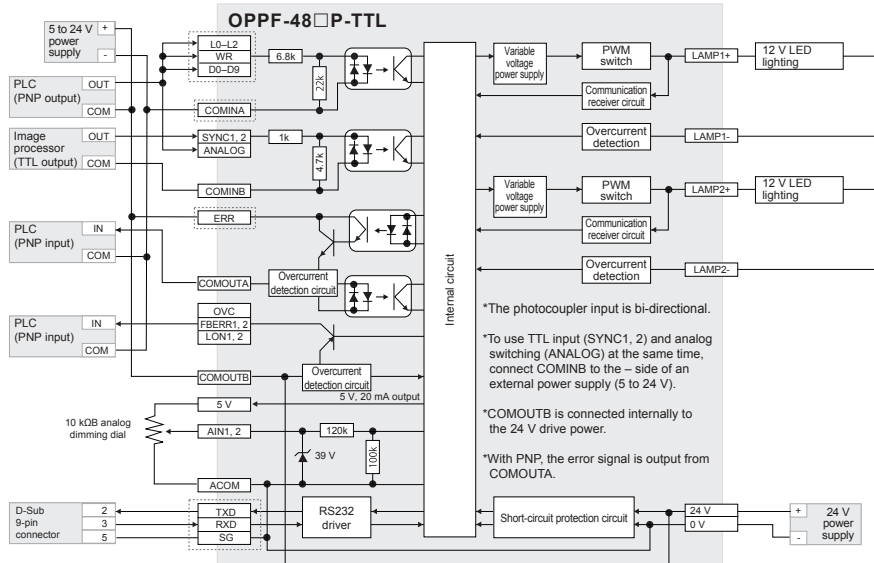
NPN type

Master device only



PNP type

Master device only



Troubleshooting

Symptom	Check items
Does not power ON.	- Is the power cable properly connected? Is the capacity of the 24 VDC power supply sufficient? - Is there any deficiency with the 24 VDC input voltage? - Is the polarity of the 24 VDC input correct? - Is there any wrong polarity for the transmission of power across units? - Isn't there any transition wiring through the power connector that is not connected to a unit?
Lighting device does not illuminate.	- Are the connectors of the lighting device properly connected? - Isn't the brightness control value set at 0? - Isn't the unit set in the external lighting control mode (DSW1 = ON)? - Isn't the LED output over current error?
Unable to control the brightness.	- Isn't it in a locked state? Unlock it. (See "Operations for Each Mode" on page 7 for the unlocking method.) - Isn't the unit set in the external brightness control mode (DSW2 = ON)? - Is the analog brightness control not set to ON or is the forced analog/digital switch not set to RnR?
Unable to change the settings.	- Isn't it in a locked state? Unlock it. (See "Operations for Each Mode" on page 7 for the unlocking method.) - Is there any wrong designation of station number for the external control?
Erroneously illuminates or the lighting flickers.	- Are the connectors of the external control cable properly connected? - Any wiring from the same power supply as with the inverter, motor or any other motive power devices may cause malfunctions. - Bundling the cables together with high voltage cords and motive power lines may cause malfunctions. - When only using multiple slave devices, adjust the PWM frequency. - If lighting devices without sensing functions erroneously illuminate, set Fb (the feedback function) to cPb.
The lighting is dim.	- It may indicate the degradation of the lighting device. In the monitoring mode, compare the brightness control value and the monitored value. - Isn't the READY indicator on the operation panel flashing in red? If the internal temperature of the power supply unit exceeds 105°C, the lighting output is limited to a one fourth level. In the monitoring mode, press the LAMP button and the dial at the same time to check it.
The lighting flickers.	- Are the lighting connectors securely inserted? - Turn OFF the feedback function as a trial.
Does not respond to the synchronous input.	- Are the connectors properly connected? - Are the signals being properly sent out from the signal output devices? - Any wrong designation of station number? - Are the connections correctly made in accordance with the NPN or PNP type? - For the brightness control setting and bank switching in case of the external parallel input, the states of DSW2 and DSW3 must be set the same for both master and slave devices.
The communication setting is disabled between the master and slave device or between slave devices.	- Is the gap between units 3 mm or less? - Is there anything to block the infrared communication ports between devices?
Error occurs with monitoring and feedback.	- When the pulse width for the external lighting control input is very small (about 2 μs or less), the lit time will become extremely short and, therefore, it will not be possible to perform normal brightness monitoring. - If the cable to the lighting device is long and the capacity of the device is large, the communication with the device may be disabled. In that case, decrease the PWM frequency to 50 or 20.
Wrong value is written through the parallel input.	- Isn't there any wrong wiring connection? - Isn't there any error in the station number, brightness control value and the input terminals? - Isn't there any noncompliance with the instructions of the timing charts?
Unable to communicate by RS232.	- Are the baud rates the same between the input/out devices and OPFF? - Is the wiring properly connected for the serial transmission and reception? - Is the transmitted command correct? - Is the checksum value correct? Examine the communication speed settings and then try the transmission of @0EVOR**<CR+LF> (40H, 30H, 45H, 56H, 4FH, 52H, 2AH, 2AH, 0DH, 0AH).

Error Display on the Operation Panel

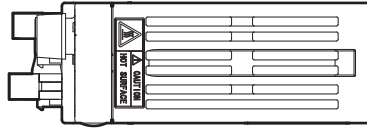
ULtLo	Displayed if the 24 VDC supply voltage has dropped to 18 V or lower.	-b-	Displayed in the monitoring mode when communication with a lighting device that does not support sensing is shut down automatically. The communication shut down is reset when the power is turned OFF.
PocErr	Communication error of the internal circuit. It is attributable to some failure.		
RnRRnR	Displayed if the dial is turned when the analog/digital switch input is applied.		
oFFoFF	Displayed when the lighting device is turned OFF by a long press of the LAMP button.		

Indicator

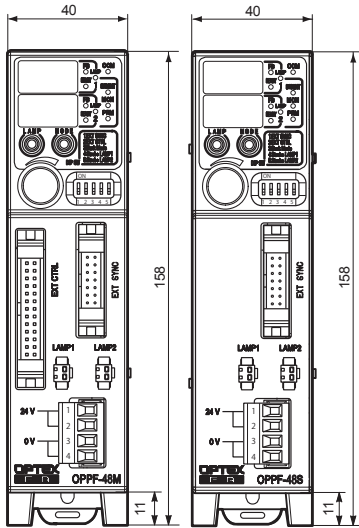
- LED for READY state**
Flashing red: LED output over current or LED over heat
Unlit: 24 VDC input voltage insufficient
- LED for FB (feedback) state**
Flashing orange: FB error or alarm on monitored brightness
Lit red: communication with the lamp terminated
- LED for COM state of infrared communication between master and slave**
Flashing red: communication error (slave only)
Lit red: communication shut down (slave only)
Unlit: no communication underway

Dimensions

Top view



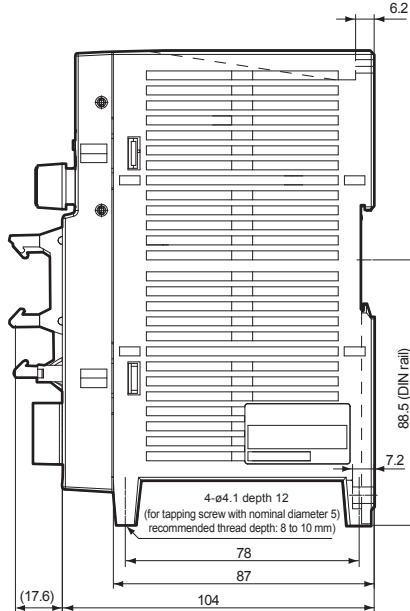
Front view



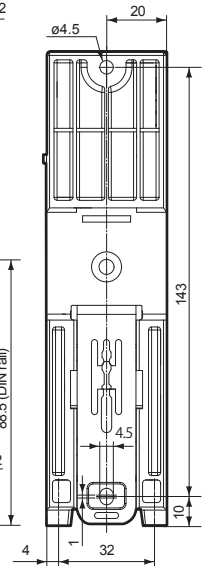
Master device:
OPPF-48M□
OPPF-48M□-TTL

Slave device:
OPPF-48S□
OPPF-48S□-TTL

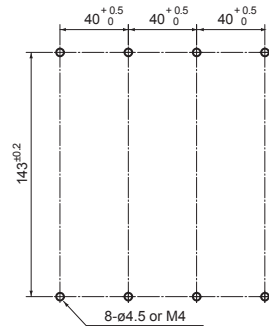
Side view



Rear view



Holes for Screw mounting
(for 4 units connected)



Specifications

Model	OPPF-48MN	OPPF-48MP	OPPF-48SN	OPPF-48SP
Type	Master device NPN output	Master device PNP output	Slave device NPN output	Slave device PNP output
Power supply voltage	24 VDC $\pm 10\%$			
Current consumption	PWM mode — Feedback OFF: Max. 2.9 A, Feedback ON: Max. 4.0 A Strobe mode — Feedback OFF: Max. 5.0 A, Feedback ON: Max. 5.7 A			
Illumination output	2 channels			
Connectable lighting	PWM mode: Max. 48 W (2 ch total) *Max 30 W/ch, Strobe mode: Max. 24 W (per channel)			
Illumination output voltage	PWM mode: 12 VDC (standard), Strobe mode: 18 VDC (standard)			
Illumination output current	PWM mode: Max. 4.0 A (2 ch total), Strobe mode: 8.0 A (per channel)			
Dimming method	PWM dimming, Frequency: 20/50/100/99/98/97 kHz 1,000 steps *Common for PWM mode and strobe mode			
Strobe	Luminescence width: 10 μ s to 9.99 ms (10 μ s steps) or 1 ms to 999 ms (1 ms steps) *12 VDC driving when exceeding 1 ms Flash cycle limit at 18 VDC: 10% Duty (10 times or more the pulse width cycle required)			
Monitoring	Lighting brightness monitor / Lighting internal temperature monitor, Monitor brightness alarm lower limit value setting Update cycle per communication between lighting and power supply, Received light amount: 21 ms, Temperature: 105 ms			
Feedback	Voltage variable method — PWM mode: 11 to 18 VDC Strobe mode: 16 to 22 VDC, Accuracy: $\pm 1.5\%$ or less (typ.) *This specification is for reference only and is not a guarantee of the performance of this product.			
Input	External illumination control $\times 2$, Analog dimming select $\times 1$, Parallel dimming input $\times 10$ (bank select $\times 4$ shared), Parallel dimming writing input $\times 1$, Channel select input $\times 3$		External illumination control $\times 2$, Analog dimming select $\times 1$	
	ON voltage: 5 V or more, OFF voltage: 1.2 V or less, Max. input voltage: 30 V Illumination control input response time (actual value) With 24 V input (OFF $\rightarrow$ ON: 5 μ s, ON $\rightarrow$ OFF: 60 μ s), With 5 V input (OFF $\rightarrow$ ON: 44 μ s, ON $\rightarrow$ OFF: 41 μ s) Input resistance: 6.8 k Ω , insulated; Other input response time: 1.1 to 14.8 ms			
Analog input	0 to 5 V, Input resistance: 220 k Ω , Non-insulated			
Output	Lighting overcurrent error output $\times 1$, Feedback warning output $\times 2$, Lighting illumination output $\times 2$ Open collector, Max. 100 mA / 30 VDC, Residual voltage 1.0 V max.			
	Lighting overcurrent / internal temperature abnormal / feedback error output $\times 1$ Open collector, Max. 100 mA / 30 VDC, Residual voltage 1.5 V max.		—	
Communication interface	RS232: 1 ch, Baud rate: 4,800/9,600/19,200/ 38,400/57,600/115,200		—	
Master–slave communication	Infrared communication method — RS232 from master device to slave device, External input control (dimming, bank selection), Transmission from slave device to master device (error information, RS232 reading), Setting copy function Communication cycle: Approx. 15 ms (equivalent response time for controlling slave device with RS232, external input)			
Lighting output protection circuit	Overcurrent			
Signal output protection circuit	Overcurrent			
Other protective functions	Power supply internal temperature monitoring (PWM output cut to 1/4 at 105°C) Lighting internal temperature monitoring, Lighting brightness lower limit alarm			
Ambient temperature/humidity	0 to 45°C / 35 to 85% RH (no condensation)			
Storage temperature/humidity	-20 to 70°C / 35 to 95% RH (no condensation)			
Vibration resistance	10 to 55 Hz; amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions			
Shock resistance	Approximately 10 G, 3 times in each of the X, Y, and Z directions			
Insulation resistance	500 VDC, 10 M Ω or more			
Material	Polycarbonate			
Weight	385 g		375 g	
Protection rating	IP20 (IEC 60529: 1989 / A1: 1999 + A2: 2013)			
Applicable regulations	EMC (2014/30/EU) / RoHS (2011/65/EU, MIIT Order No.32)			
Applicable standards	EN 61000-6-2: 2005 / AC: 2005, EN 55011: 2009 / A1: 2010 (EN 55011 testing was performed with the lighting cable passed through shielded tubing grounded to FG.)			
Accessories	Instruction manual			

Model	OPPF-48MN-TTL	OPPF-48MP-TTL	OPPF-48SN-TTL	OPPF-48SP-TTL
Type	Master device NPN output	Master device PNP output	Slave device NPN output	Slave device PNP output
Input	Illumination control input (TTL)	ON voltage: 2 V or more, OFF voltage: 0.9 V or less Max. input voltage: 16 V, Input resistance: 1 kΩ, Insulated Response time (actual value) — 5 V: 5 μs (OFF → ON) / 75 μs (ON → OFF) 3 V: 8 μs (OFF → ON) / 70 μs (ON → OFF) 2 V: 20 μs (OFF → ON) / 60 μs (ON → OFF)		
	Other inputs	ON voltage: 5 V or more, OFF voltage: 1.2 V or less, Max. input voltage: 30 V Input resistance: 6.8 kΩ, insulated; Response time (actual value): 1.1 to 14.8 ms		

● Please note that specifications are subject to change without prior notice for product improvement purposes.