PD2 Single Channel Series Instruction Guide
Control Unit for LED Light Units
PD2-1012(A)/1024(A)/3012(A)/3024(A)/5012(A)/5024(A)

1. Safety Precautions

***Read this instruction guide before using the product.**

Thank you for purchasing a CCS product. To properly use the product, please read this instruction guide before use and keep it for your future reference. Be sure to pay special attention to the information marked with "⚠ Warning" and "⚠ Caution". The information is provided to prevent injury from electric shock and other accidents.

⚠ Warning	Indicates incorrect usage may result in serious injury or death.
⚠ Caution	Indicates incorrect usage may result in injury or equipment damage.

⚠ Warning

(1) Always use one of the following power cords for the PD2-3012(A), PD2-3024(A), and PD2-5012(A), PD2-5024(A).
100 to 120V range: SVT or SJT type, AWG18, length: 3m max. , dielectric strength: 125V min. (Note: This power cord is required for compliance with UL)
200 to 240V range: H05VV-F type, AWG18, length: 3m max. , dielectric strength: 250V min. (Note: This power cord is required for compliance with EU)

(2) Plug in or unplug the power cord after turning OFF the power supply. Otherwise it may result in fire or electric shock. Plug the power cord directly into the wall socket.
Please use the product within electricity voltage/current specifications. Otherwise it may cause fire and/or electric shock.
Please unplug the power cord when connecting or disconnecting the product and peripherals.
Do not damage or place heavy objects on power cord. There are risks of damaging the cord, which may result fire or electric shock.

(3) If the product is damaged, turn it OFF, unplug the power cord from the wall socket, and contact CCS. Continued usage of the product may result in fire or electric shock.

(4) Follow the operating procedures stipulated for the product in this instruction guide. Failure to do so may result in diminished protection capabilities.

(5) The product operates at a power supply voltage of 100 to 240V AC. The supplied power cord, however, is for use with 100V. If the product is to be used at 200V or above, use a 200V power cord for the 30 and 50W models.

(6) For mounting products in system racks or cases, do not insert M3 type screws more than 6mm. (PD2-1012(A)/1024(A):2mm). Doing so may cause short-circuit to internal components.

(7) Do not disconnect power cord or disassemble product while operating. Doing so may result in electric shock.

(8) Do not touch the terminals, plugs, or switches with wet hands. Doing so may result in electric shock.

(9)	There are fan ventilation holes on the PD2-5012/5024 Power Supply Unit. Install the Power Supply Unit so that the ventilation holes are not obstructed. (A clearance of 50 mm min. is recommended around the ventilation holes.) Insufficient ventilation may result in fire due to heat buildup inside the Unit.
(10)	Ground the power supply. Ground the FG terminal of 10W models with 0.5 to 1.25mm^2 wires (AWG20 to AWG16) wire if there is a possibility that an operator might touch the power supply unit and a metallic frame with a different electrical potential at the same time. If the frame is not grounded and has electric potential, it is better to connect the FG terminal of the product to the FG terminal of the frame. (Use a 3-prong AC power cord with a ground terminal to ground 30 and 50W models.) 
(11)	If smoke appears, the product becomes abnormally hot, unusual smells or sounds are generated, or any other abnormality occurs, stop using the product immediately and turn OFF the power. 

⚠ Caution	
(1)	The products become very hot during use. For this reason, do not use them in a closed space. If it is necessary to use them in a closed space, provide sufficient cooling in the form of fans or other cooling devices.
(2)	Install products in following locations: - On a flat and stable locations with minimal vibration - Well-ventilated places with minimal dust. - Places free from any water, oil, liquid, chemical, or steam. - Places free from corrosive or combustible gas. - Places away from water faucets, boilers, humidifiers, air conditioners, heaters, or stoves. - Places that are not subject to sudden temperature changes. - Places where products can be grounded. 
(3)	Observe the following items for the Power Supply: - Always provide dedicated electric power source with stable voltage. Sharing the electric power source with power devices, such as inverters, motors, and so on, may cause product to malfunction. - Disconnect the power plug when the product is not to be used for an extended period of time. - Do not place the power cord near a heat-generating device, and do not allow the power cord to be scratched. - Do not touch the power cords or connect peripheral devices during lightning. This may result in electric shock. 

2. Overview

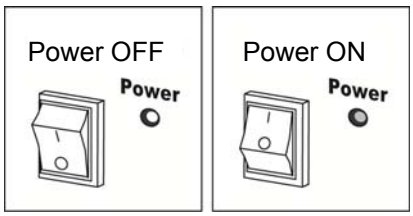
This power supply is for exclusive usage with LED lighting made by CCS.

1. Light intensity can be controlled in internal mode from the intensity control knobs on the front panel of the product or in external mode using a PLC, microcomputer, or other device.
2. The external ON/OFF control is available in product.
3. Product models can supply the following power specifications.
   PD2-1012(A): 12V DC, 0.79A (9.5W)
   PD2-1024(A): 24V DC, 0.38A (9W)
   PD2-3012(A): 12V DC, 2.3A (28W)
   PD2-3024(A): 24V DC, 1.16A (28W)
   PD2-5012(A): 12V DC, 3.83A (46W)
   (1-channel: 30W max.)
   PD2-5024(A): 24V DC, 1.92A (46W)
   Do not exceed the maximum wattage for the total number of circuits.

3. Operating Procedure

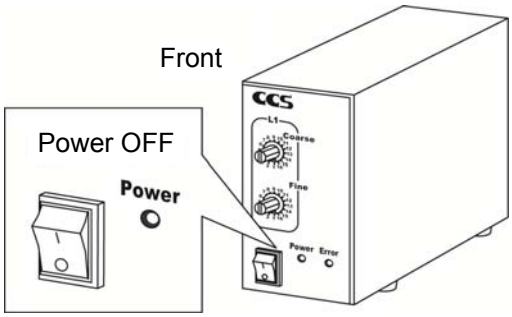
Turning the power ON/OFF

O side of the power switch is OFF.
The power is ON when | side is pressed.
(The power lamp will be illuminated)



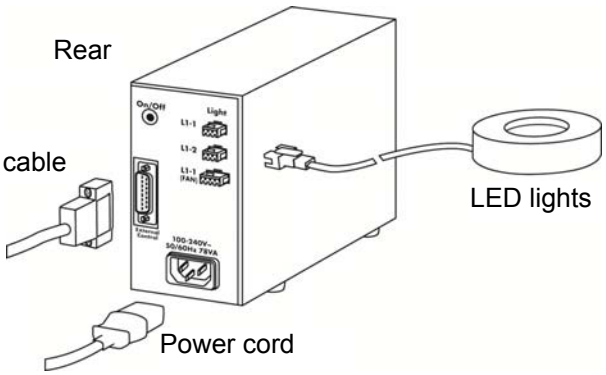
Turning ON lighting

1. Check the power supply is turned OFF.



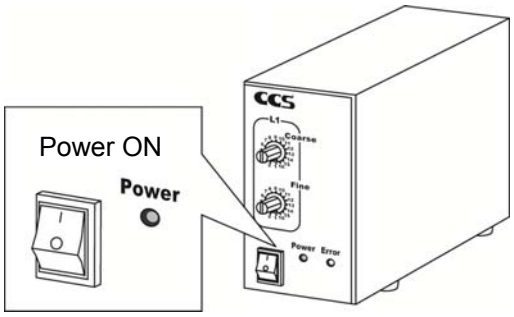
Note:
The illustration shows the PD2-3012(A)/24(A). All other models operate the same way.

2. Connect the LED lights to the power supply.
3. Plug the power cord of the power supply into a wall socket.
4. Connect an external control cable if it is the case to use external control.

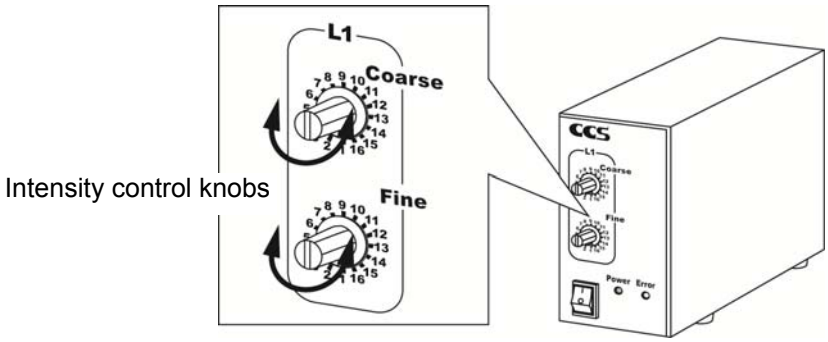


Note: There are fan ventilation holes on the PD2-5012/5024 Power Supply Unit. Install the Power Supply Unit so that the ventilation holes are not obstructed. (A clearance of 50 mm min. is recommended around the ventilation holes.)

5. Turn the power ON.
(The power lamp will be illuminated)

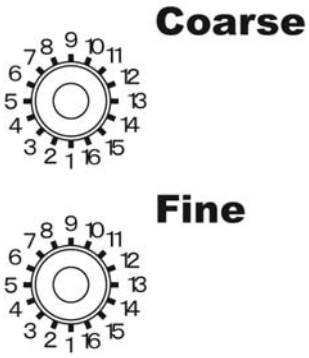


6. Use the intensity control knobs to set light intensity.



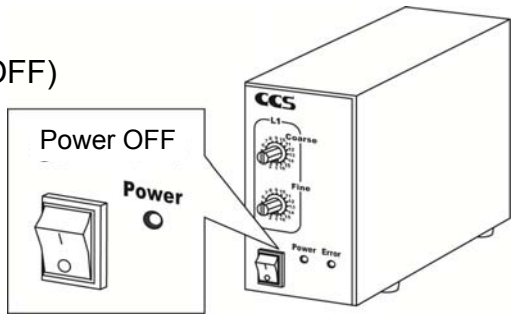
Adjusting lighting intensity

1. Turn the intensity control knobs on the front panel of the product to set the lighting intensity.
   Each knob controls light intensity in 16 steps.
   With 16 fine steps for every coarse step (16 steps), the result is up to 256 steps of extremely fine.



Turning OFF lighting

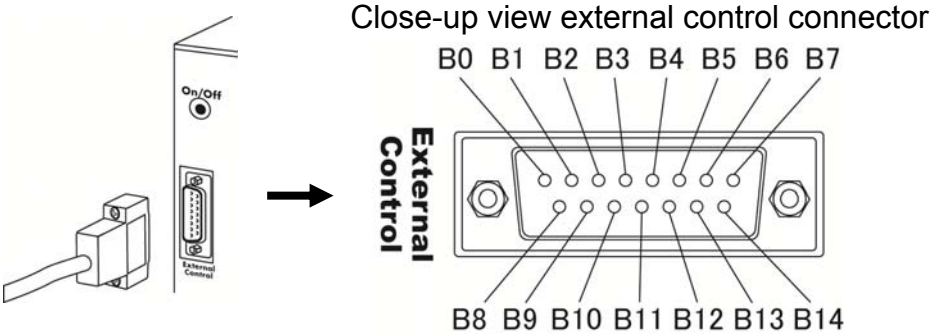
1. Turn the power OFF.
   (The power lamp will be turned OFF)



External control

External control

1. A Dsub terminal is provided on the rear panel of the product for external control.
   The product can be controlled externally using parallel bit control.



2. Pin bit arrangement for external control terminals

Bit	B0	B1	B2	B3	B4	B5	B6	B7	B9	B9	B10	B13
Structure	Light intensity bit (0 to FF)								EXT	WR	ON	OCP

A driver IC or an open collector outputs a signal to each terminal and the external control signals are input to the product at CMOS level.

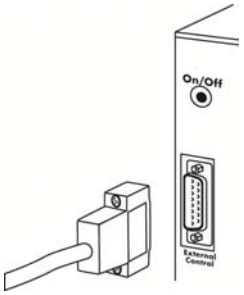
3. Optional external control cable is manufactured by CCS.

4. The product support the following types of external control.

- External and manual light intensity control selection
- Setting light intensity data
- Lighting ON/OFF control
- Overcurrent protection signal monitoring

External control

1. Connect the external control cable to the power supply.
(Also connect the lighting and any other devices.)



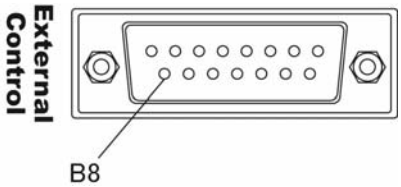
Power supply (rear view)

External control cable

2. Input the desired control signal from the external control cable.

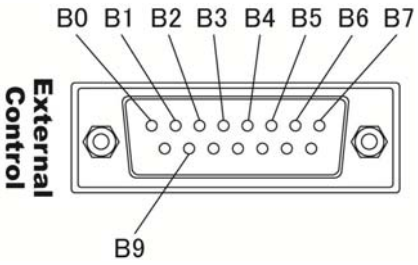
1) External and manual light intensity control selection

Set bit B8 of the Dsub external control connector to Low to set the product to external control mode. Adjusting the light intensity from the front panel is disabled in this mode. Set bit B8 to High to enable light intensity from the front panel and disable externally controlled light intensity.
B8 is active low (i.e., it is valid at 0 V).



2) Setting light intensity data

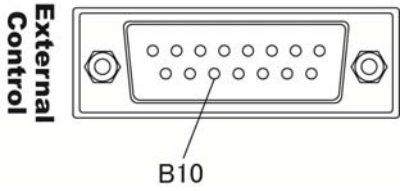
Set the 8 bits from B0 to B7 as well as B9 to control light intensity. Specify up to 256 steps using bits B0 to B7 and send the write signal to write bit B9 to write the light intensity data to the product. Keep the write signal Low(L) for at least 300µs to write the data, and switch the signal back to High(H) after the minimum write time has elapsed to stop writing data.
Note: Light intensity settings are enabled only as long as the power supply remains ON and will be lost when the power supply is turned OFF.

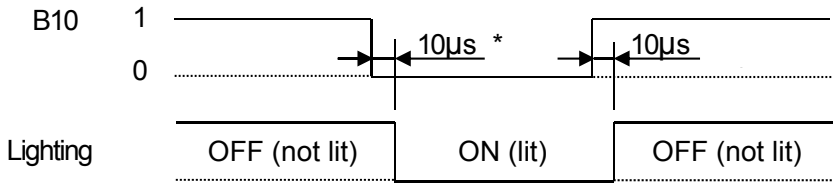


steps	B7 [MSB]	B6	B5	B4	B3	B2	B1	B0 [LSB]	Light intensity(%)	Coarse	Fine
1	H	H	H	H	H	H	H	H	0.4	1	1
2	H	H	H	H	H	H	H	L	0.8	1	2
3	H	H	H	H	H	H	L	H	1.2	1	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
19	H	H	H	L	H	H	L	H	7.6	2	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
254	L	L	L	L	L	L	H	L	99.2	16	14
255	L	L	L	L	L	L	L	H	99.6	16	15
256	L	L	L	L	L	L	L	L	100.0	16	16

3) Lighting ON/OFF control

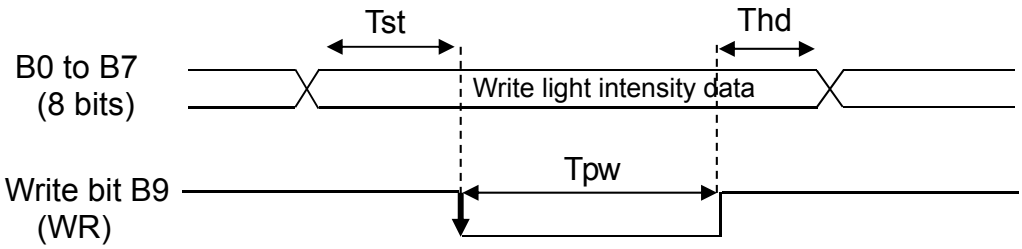
After you have selected the light intensity level, use the ON/OFF signal at bit B10 to control when the lighting turns ON and OFF.





*The delay is 10 µs when the light intensity is 100%. If the light intensity is less than 100%, there may be a delay of up to 30 µs.

Write sequence

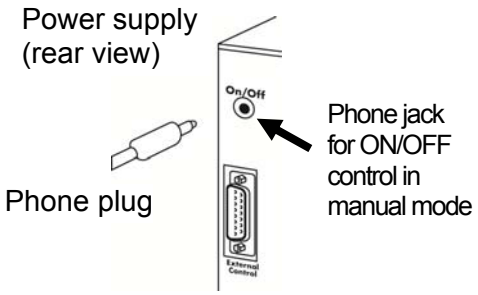


Tst ≧ 100µs
Tpw ≧ 300µs
Thd ≧ 100µs

1. Light intensity data (B0 to B7) is output in negative logic (Low: **L**)
2. The write bit is output (data is written when the write signal is fall edge).
   Keep the write signal High after the data is written.

Manual ON/OFF control

1. In manual mode, the external ON/OFF control is available for the illuminator.

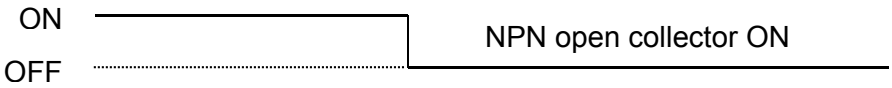


2. Insert the phone plug into the phone jack to send the ON/OFF control signal for manual control.

   Note: Control is limited strictly to turning lighting ON and OFF.

   Note: This option is not available when light intensity is externally controlled.

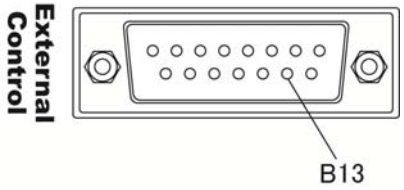
Phone jack (Ø3.5) signal line



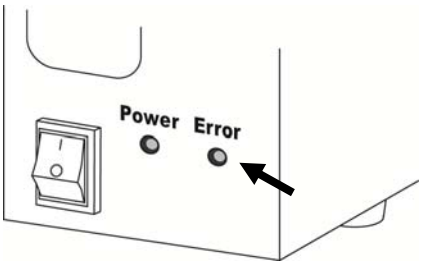
Overcurrent protection

Overcurrent protection output

The overcurrent protection output is a monitoring signal that becomes active when overcurrent is detected. It is output from bit B13. Output circuit is an open collector, with negative logic (active Low).



The product output stops if lighting current consumption (total of all channels) exceeds 107% of the rated current consumption. Also, the error indicator lamp on the front panel of the power supply will light and output cannot be resumed until the power supply is restarted.



4. Connectors

1. Output connectors: SM connectors (JST)

Pin number	12V output	24V output	12V with fan	24V with fan
1	OUT + (12V)	OUT + (24V)	NC	OUT + (24V)
2	OUT -	NC	OUT + (12V)	NC
3		OUT -	OUT -	OUT -
4			Fan GND	Fan GND
Connector	SMP-02V-BC	SMP-03V-BC	SMP-04V-BC	SMP-04V-BC

With fan: Output connector for lighting L1 (FAN)

2. External control connectors: 15-pin D-sub plug with M2.6-mm screws

Use a shielded cable of 3 m or less for the control line.

Pin number	Signal
1	Light intensity B0 (LSB)
2	Light intensity B1
3	Light intensity B2
4	Light intensity B3
5	Light intensity B4
6	Light intensity B5
7	Light intensity B6
8	Light intensity B7 (MSB)
9	External control (INT/EXT) B8
10	Light intensity data write (WR) B9
11	ON/OFF control (ON) B10
12	-
13	-
14	Overcurrent protection (OCP) B13
15	Signal GND

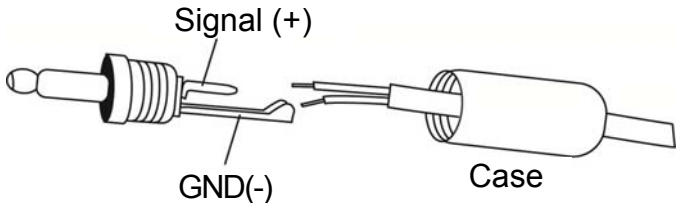
Optional cable: External control cable (cable length: 3m, with one side of the cable cut)
Please read instruction guide using optional cable.

3. Phone jack (Ø3.5) for manual ON/OFF control

Lighting can be turned ON and OFF manually when the phone plug is inserted into the phone jack. The LED lights will turn ON when the signal is connected to ground and will turn OFF when the signal is disconnected from ground.

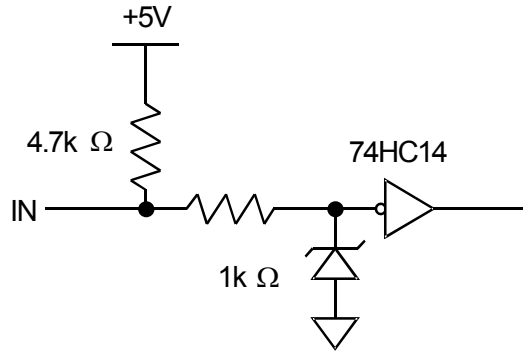
Phone plugs

	Terminal	Signal
1	Inside	ON/OFF signal
2	Outside	GND



Contact your nearest CCS representative if you need to extend the control signal cable or operate in an extremely noisy environment. Cables should not be extended more than 3 m. Potentially harmful noise may be eliminated by installing a 0.01 to 0.1- μ F capacitor between the signal and ground to ensure proper operation of this product. Phone plugs are not included with the power supply kit, but optional 3-m cables with plugs are available.
Note: Please read instruction guide using optional cable.

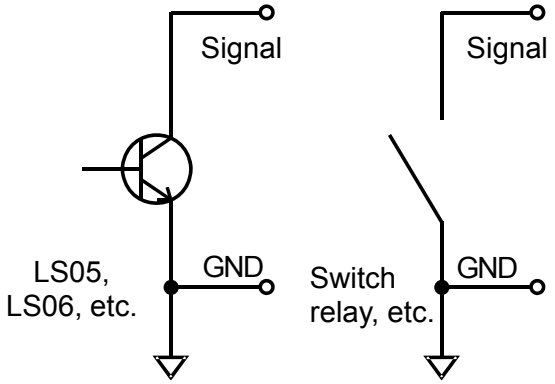
5. PD2 input circuit (negative logic)



Light intensity data: B0 to B7
Control signals: EXT, WR, and ON,
MANUAL DIMMING ON
Output using a driver IC or NPN open collector
The 24V output of the PLC cannot be input as it is.
(Maximum allowable input voltage: 5.5V)

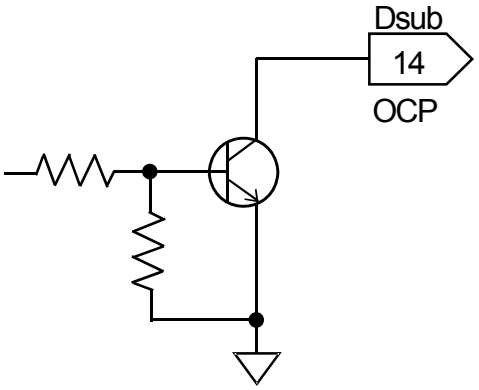
PD2 side:
1V max. at low level (0.8V max. is recommended)
High level: 3.5V min. (4V min. is recommended)

6. Recommended control signal drive circuits: Open collector, photo-coupler, photo-MOS relay



When using the PD2 in a noisy environment, we recommend that you isolate the signal and ground lines from the control unit with photo-couplers or photo-MOS relays. Any element that supplies around 10mA can be used to drive the circuit.

7. PD2 overcurrent protection signal output circuit (open collector)

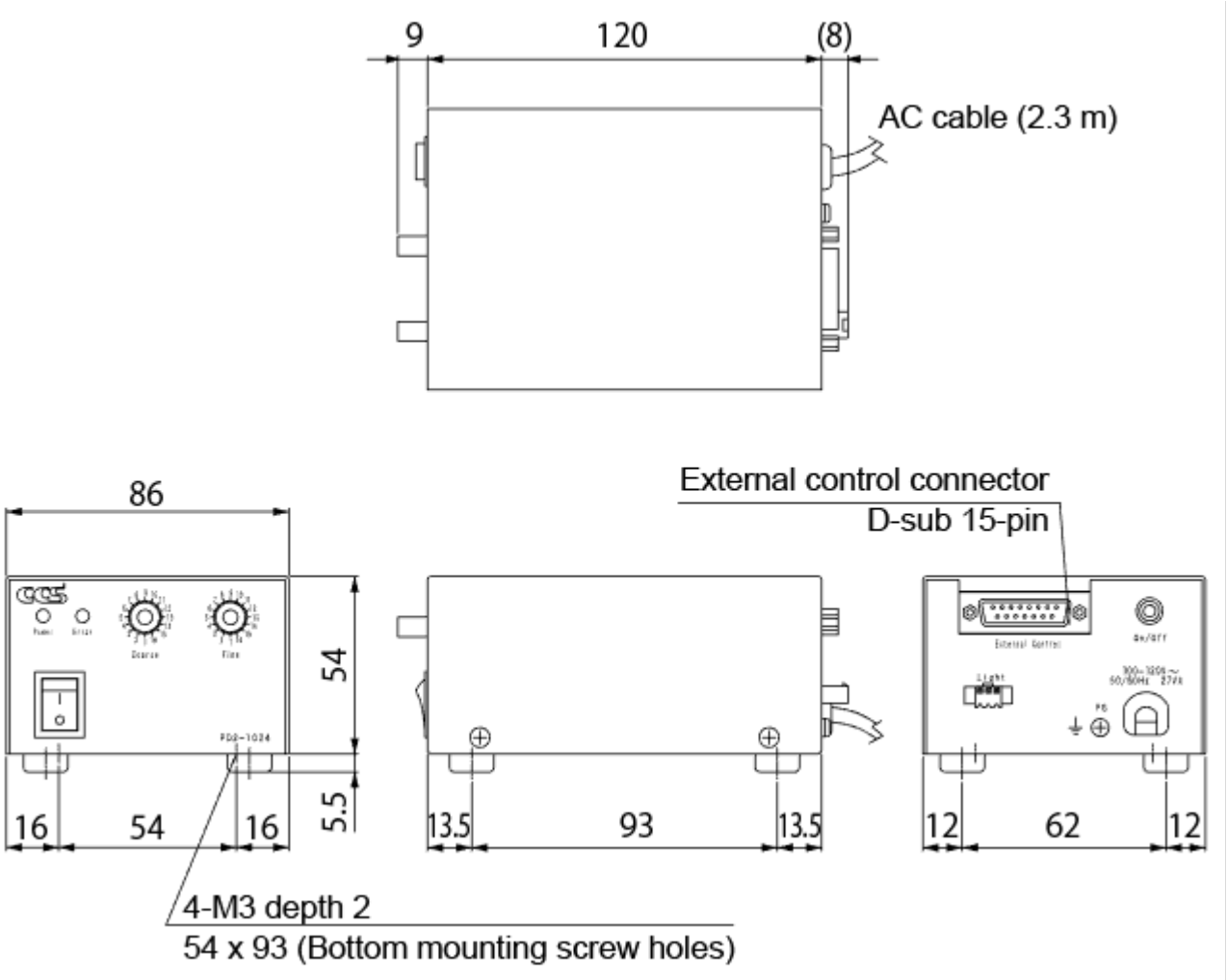


Output transistor
V_{CEO}: 50V
Ic: 100mA
Max. current capacity: 100mA

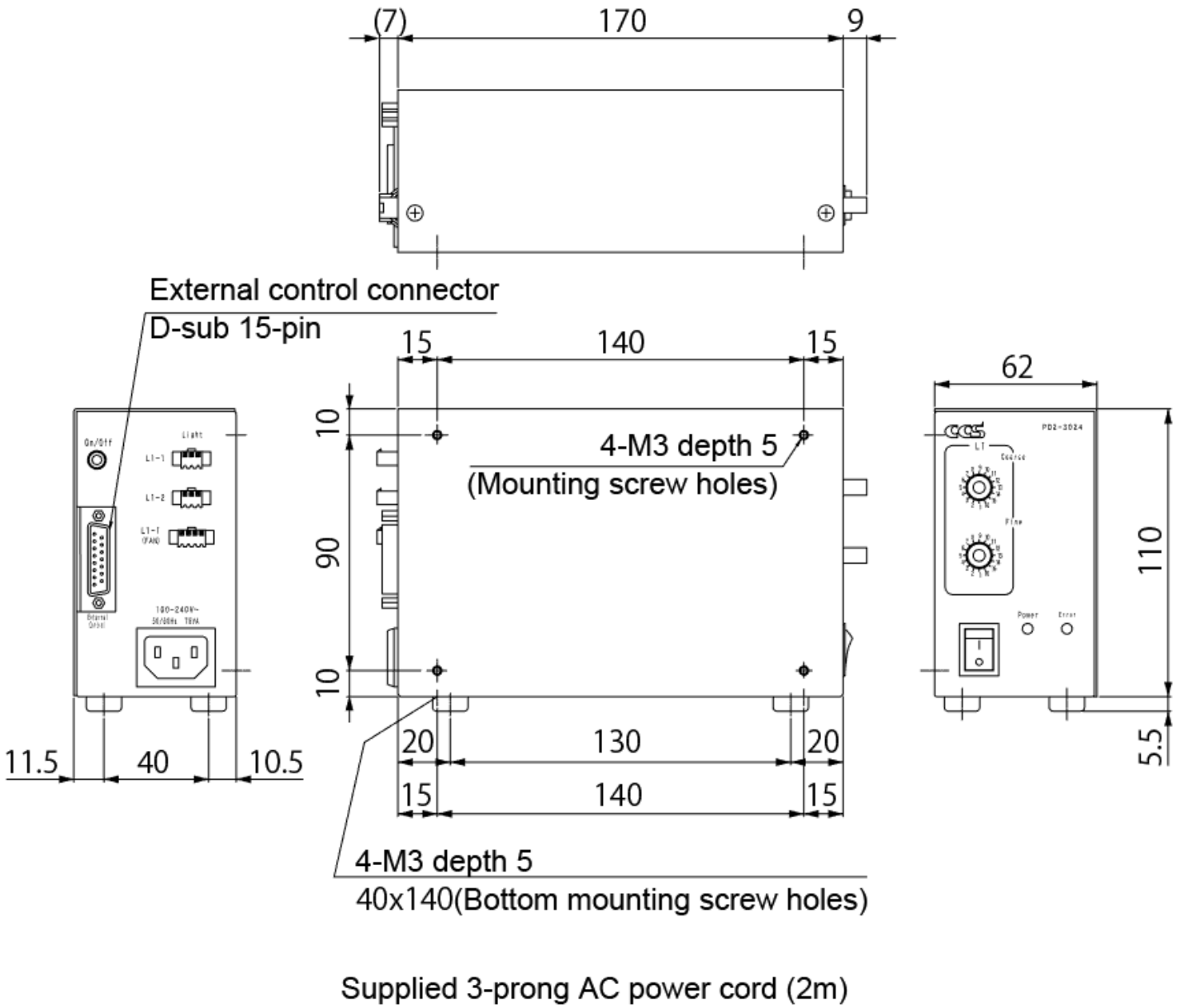
We recommend usage at a load of 24 V, 20 mA or lower.

8. Dimensional Diagrams (mm)

PD2-1012(A)/1024(A)

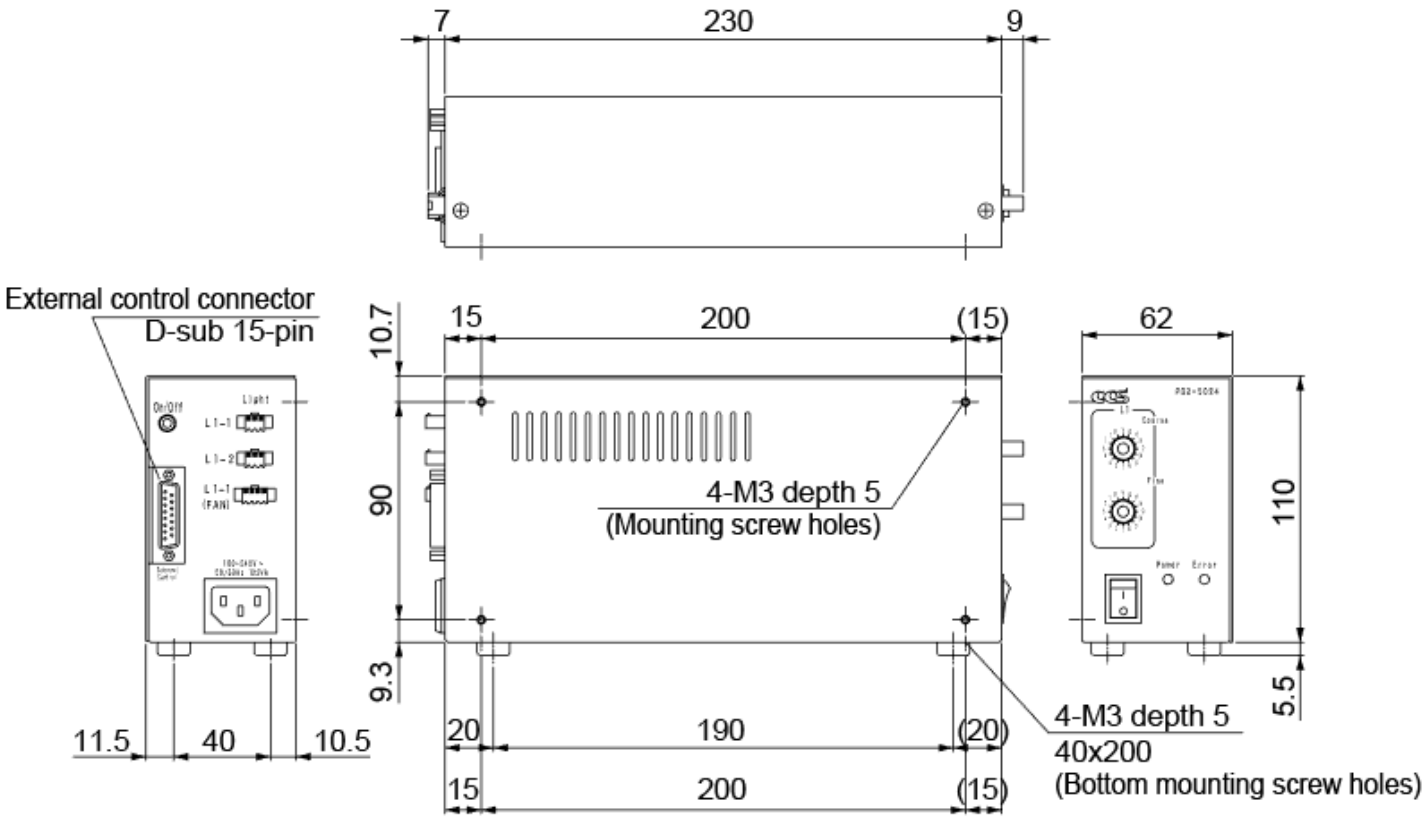


PD2-3012(A)/3024(A)



Supplied 3-prong AC power cord (2m)

PD2-5012(A)/5024(A)



Supplied 3-prong AC power cord (2m)

9. Specifications

Product name		Control Unit for LED Light Units					
Model		PD2-1012(A)	PD2-1024(A)	PD2-3012(A)	PD2-3024(A)	PD2-5012(A)	PD2-5024(A)
Lighting method		Constant lighting					
Drive method		Constant-voltage system					
Light control method		PWM control					
No. of channels		1chanel					
Applicable illumination (rating)		12V 9.5W	24V 9W	12V 28W	24V 28W	12V 46W (1-connector: 30W max.)	24V 46W
PWM frequency		62.5KHz					
Light control	Manual	Use of the intensity control knobs on the front panel (Coarse, Fine)(Each 16 steps)					
	External	Input in negative logic (B0 to B7), Manual/External control (NT/EXT), The write bit (WR), Lighting ON/OFF (ON)					
Error detection display		The Error indicator lamp on the front panel is lit when overcurrent is detected.					
Error detection output		External control connector 14 pin (OCP): Open collector ON when overcurrent is detected.					
Over current protection *1)		Operates at 107% min. Automatically reset, or manually reset by turning power OFF then ON again.					
Input voltage (rating)		100 to 120V AC		100 to 240V AC			
Input voltage (range)		85 to 132V AC		85 to 264V AC			
Power consumption (typ.)		27VA		78VA		122VA	
Frequency		50/60Hz					
Inrush current (typ.)		15A (at 100V AC) Note: From a cold start					
Ground leakage current		3.5mA max. (132V AC, 60Hz, with no load)		3.5mA max. (264V AC, 60Hz, with no load)			
Output voltage (rating)		12V DC	24V DC	12V DC	24V DC	12V DC	24V DC
Output current (rating)		0.8A	0.4A	2.3A	1.1A	3.8A	1.9A
External control (input)	Insulation	Non-insulated with power supply for illuminator.					
	Circuit	Internally pulling up to +5V power supply by resistance (4.7kΩ) HS-CMOS input					
Dielectric strength (input-output, input-FG)		1500V AC for one minute 10mA cutoff current 500V DC, 20MΩ min.					
Operating temperature and humidity		Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)					
Storage temperature and humidity		Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)					
Vibration resistance		Acceleration: 19.6 m/s^2, frequency: 10 to 55 Hz, cycles: 3 minutes, for 1 hour each in X, Y, and Z directions					
Cooling method		Natural air cooling				Forced air cooling	
Altitude		2000m max.					
Protective ground		Class I					
Pollution level		Pollution level II					
Over voltage category		Category II					
CE marking		EMC standard compatible with EN 61326-1 Class A		Safety standard conform to EN 61010-1 EMC standard conform to EN 61326-1 Class A			
Input connector	AC iput			3-pin, EN 60320-1-certified, C14-type connector x 1 L type terminal, N type terminal, PE type terminal			

<table>
<tr><td rowspan="9">Output connector</td><td rowspan="5">Lighting output</td><td>PD2-1012(A)</td><td colspan="6">SMP-02V-BC (socket) (JST)x1 1 pin: Out+ (12V), 2 pin: Out-</td></tr>
<tr><td>PD2-3012(A)
PD2-5012(A)</td><td colspan="6">SMP-02V-BC (socket) (JST)x2 1 pin: Out+ (12V), 2 pin: Out-</td></tr>
<tr><td>PD2-1024(A)</td><td colspan="6">SMP-03V-BC (socket) (JST)x1 1 pin: Out+ (24V), 2 pin: NC, 3 pin: Out-</td></tr>
<tr><td>PD2-3024(A)
PD2-5024(A)</td><td colspan="6">SMP-03V-BC (socket) (JST)x2 1 pin: Out+ (24V), 2 pin: NC, 3 pin: Out-</td></tr>
<tr><td rowspan="4">Lighting output with Fan</td><td>PD2-3012(A)
PD2-5012(A)</td><td colspan="6">SMP-04V-BC (socket) (JST)x1
1 pin: NC, 2 pin: Out+ (12V), 3 pin: Out-, 4 pin: Fan GND</td></tr>
<tr><td>PD2-3024(A)
PD2-5024(A)</td><td colspan="6">SMP-04V-BC (socket) (JST)x1
1 pin: Out+ (24V), 2 pin: NC, 3 pin: Out-, 4 pin: Fan GND</td></tr>
<tr><td rowspan="2">External control connector</td><td>Manual ON/OFF control</td><td colspan="7">J-86 Phone jack (Ø3.5) mfd. by Teishin electric mfg. ×1
Center: signal line, Sleeve: GND</td></tr>
<tr><td>External control</td><td colspan="7">15-pin D-sub plug with M2.6mm screws x1</td></tr>
<tr><td colspan="9"><table>
<tr><td>Number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Structure</td><td>B0</td><td>B1</td><td>B2</td><td>B3</td><td>B4</td><td>B5</td><td>B6</td><td>B7</td></tr>
<tr><td>Number</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td></td></tr>
<tr><td>Structure</td><td>INT/EXT</td><td>WR</td><td>ON</td><td>-</td><td>-</td><td>OCP</td><td>GND</td><td></td></tr>
</table></td></tr>
<tr><td colspan="2">Dimensions</td><td colspan="3">86x120x54mm (WxDxH) not including protrusions such as connectors, knobs, legs, etc.</td><td colspan="3">62x170x110mm (WxDxH) not including protrusions such as connectors, knobs, legs, etc.</td><td>62x230x110mm (WxDxH) not including protrusions such as connectors, knobs, legs, etc.</td></tr>
<tr><td colspan="2">Material, coating, surface processing</td><td colspan="7">Steel plate t1.0, paint color N3 (leather-tone finish), T75-70L(5PB7/6)</td></tr>
<tr><td colspan="2">Weight</td><td colspan="3">700g max.</td><td colspan="3">1100g max.</td><td>1300g max.</td></tr>
<tr><td colspan="2">Accessories</td><td colspan="3">Instruction guide x1,
Optional Cable List x1</td><td colspan="4">2-m long 3-prong AC power cord x1
Instruction guide x1, Optional Cable List x1</td></tr>
<tr><td colspan="2">Miscellaneous</td><td colspan="3">Power cord length: 2m</td><td colspan="4"></td></tr>
</table>

*1: Do not short-circuit positive and negative output terminals.

10. Care and Handling

⚠ Warning

- Turn OFF the Power Supply and unplug it from the wall socket before handling.

⚠ Caution

- Do not scratch the unit by handling it with a hard object.
- Do not let water or cleanser enter the unit.
- Do not use cleansers or chemical agents other than those listed below.

For cleaning, dampen a soft cloth with diluted neutral cleanser, wring out the cloth, and gently wipe off the unit. Use another soft cloth to wipe the unit dry.

- Contents of this Instruction Guide may be changed without prior notice.
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Ask any product queries to the following address or to your nearest CCS representative.

CCS Inc.

Headquarters Shimodachiuri-agaru, Karasuma-dori, Kamigyo-ku,Kyoto 602-8011 Japan

Phone : +81-75-415-8284 Fax : +81-75-415-8278 E-mail : intlsales@ccs-inc.co.jp

Use our website to find your nearest CCS representative. http://www.ccs-grp.com/mvad/

Descriptions in this instruction guide are based on information available as of May 2018.

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