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OPT-DPA2012E

Light Source Controller User Manual



OPT Machine Vision Tech Co.,Ltd.

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Caution and Warning

 Caution and Warning	
	This product should be connected to AC100-240V power supply. Please ensure that the power switch controller is off when plugging in/out the power to prevent against electric shock.
	Please read the manual carefully in advance and strictly follow the instructions when operating the product.
	In case of any abnormal situation, please contact us and never disassemble the product by yourself.
	Please ensure that this product is well grounded to prevent electric shock.
	Do not stare directly into the light emitted from the LED since it does harm to your eyes. If a matched object is used, please take care not to let reflected light to enter your eyes.

Document Version Description

Version	Modification Date	Modification Explanation
V1.0.0	2018.10.5	First release
V1.0.1	2020.8.18	1. Revise the Software Operation Instructions chapter as the OPTControllerDEMO V3.4 description. 2. Add the Document Version Description paragraph

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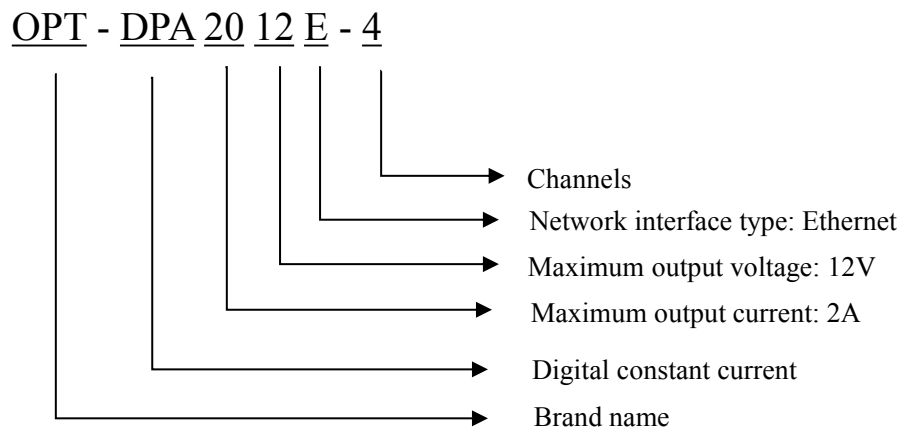
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1. Product Introduction

1.1 Overview

First of all, thank you for choosing OPT products. The model of this controller is: OPT-DPA2012E , which is a current-type digital controller, which is applied to the light source with rated voltage below 12V and current within 10mA-2A. It has the following functions: 256-level brightness adjustment, multi-channel simultaneous communication, normal trigger, high intensity trigger, programmable trigger, pulse width trigger can be set, automatic detection of rated current of light source, manual setting of maximum output current, 100M Ethernet communication , RS232 communication.

1.2 Selection Guide



1.3 Model Classification

Model	Number of channels	Compatible Light
OPT-DPA2012E-4	4	10mA - 2A 12V

1.4 Notice For Accessories Selection

1. Network Cable Selection:

Shipped standard network cable: six types, pure copper, 3 meters in length

Precautions for self-purchased network cable: Category 6 (including Category 6) and above, made of pure copper; length within 50 meters

2. Precautions for buying a switch or router: choose a well-known brand such as Netgear, the best rate is 100Mbps (Including 100Mbps) and above ,The following models are available:

Router: Netgear WGR614 (150Mbps)

Switch: Netgear FS308 (8-port 100M)

1.5 Shipping Standard List

Item	Model specifications	Image	Quantity
Controller	DPA2012E-4		1
Power cord	National standard L = 1.8 m		1
Serial cable	Direct connection L = 1.8 m		1
Network cable	Six pure copper L = 3m		1
Trigger connector	3.81-5PIN		1

1.6 Performance Parameters

Item	Parameter	Description
Input voltage	AC100-240V 50/60Hz	
Input current	1.8A/115VAC 1A/230VAC	
Lighting Mode	Continuous / Strobe	Set by working mode switch or DEMO software
Auto Sensing Of Light Rated Current	Connect with 10mA-2A 12V light source	Set via DEMO software
Manual Setting Of Maximum Output Current	10mA - 2A can be set	Set via DEMO software
Intensity Control	256-level brightness adjustable	Adjusted via front panel encoder or DEMO software
Short Circuit Protection	Yes.	When the controller output is short-circuited, the corresponding channel short-circuit protection is started, the corresponding channel is closed and the digital tube displays Er2 error message
Overcurrent protection	Yes.	When the output current of the corresponding channel of the controller is greater than 110% of the set value, the overcurrent protection of the corresponding channel is started, the corresponding channel is closed and the digital tube displays Er1 error message.
Triggering	Level	
Normal Trigger Mode	256 intensity levels settable	
Normal Pulse Width Trigger Time Units	1 μ s/10 μ s/1ms/100ms	Setup via DEMO software
Normal Pulse Width Trigger	1 μ s - 30s	Setup via encoder or DEMO software
High Intensity Trigger Mode	Single channel output at 2A	
High Intensity Pulse Width Trigger	0.01-5.00ms	Setup via encoder or DEMO software
Programmable trigger mode	Support up to 32 programmable steps	Brightness, pulse width, and trigger source can be set
Response time	$\leq 20\mu$ s	

Item	Parameter	Description
Trigger response frequency	$\leq 20\text{KHz}$	
Output Power	24W/CH	Total output does not exceed 48W
Communication	RS232 / Ethernet	
Standby Power Consumption	$\leq 5\text{W}$	Input 220V
Hi-Pot Test	AC1500V 1Min	Leakage current<10mA
Insulation	DC500V	Insulation resistance>20M Ω
Operating Temperature	-5℃-50℃	
Dimensions(mm) (L×W×H)	91×132×170mm	See dimension diagram for details
Weight (Kg)	0.84	

1.7 Error Code Description

Code	Description	Display	Solution
Er0	No LED connected	"Er0"	Connect an LED light
Er1	Overcurrent protection	"Er1"	Remove the error and restart
Er2	Short Circuit Protection	"Er2"	Remove the error and restart
Er3	Overvoltage protection	"Er3"	Remove the error and restart
Er4	Communication error between driver board and main board	"Er4"	Return to OPT for repair
Er5	Communication error between display board and main board	"Er5"	Return to OPT for repair

Note: The digital tube displays "----" when the controller is turned on, and the corresponding value will be displayed after the controller is turned on.

1.8 Mode Switch Setting

Mode	Working mode switch 1	Working mode switch 2
Continuous	ON	ON
Auto sensing of light rated current once	ON	OFF
Normal trigger	OFF	ON
High intensity trigger	OFF	OFF

Note:

- (1) DPA2012E-4 controller can only connect 12V light source.
- (2) When manually setting the maximum output current, never connect a light source with a current less than the setup maximum output current value to prevent the current from being mismatched and damaging the light source.
- (3) Automatically detection mode: when switching to this mode, the controller will automatically detect the rated current of the light source again.

2. Operation Instructions

2.1 Panel Description

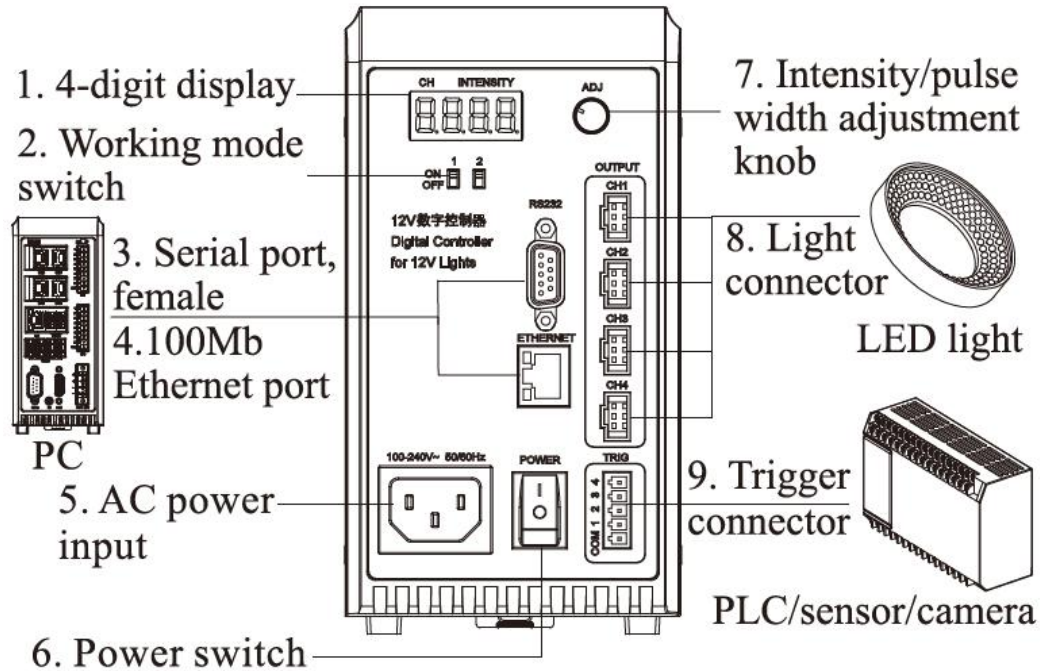


Figure 2.1 Panel Description Diagram

No.	Interface	Description
1	4-digit display	The first digit from the left is the current operation channel, and the last three digits are the corresponding values of the current operation
2	Working mode switch	Function switching, refer to the "1.8 Mode Switch Setting" chapter for details
3	Serial port ,female	Communicate with PC equipment via RS232
4	100Mb Ethernet port	Communicate via Ethernet and PC devices
5	AC power input	Input AC100 - 240V 50 / 60Hz
6	Power switch	Power on/off the controller
7	Encoder	Adjust the value of each channel, press the encoder, the digital tube flashing bit is the selected bit, then press it to select the next, clockwise rotation increases the value, counterclockwise rotation decreases the value.

No.	Interface	Description
8	Light source interface	A total of 4 light sources output, each channel can be independently controlled
9	Trigger port	Connect external trigger signal source for synchronous strobe work, trigger pulse width can be set

2.2 Connection Steps

Step 1 Connect the light source to the controller (refer to Figure 2.1)

Step 2 If external trigger control is required, please connect the external trigger signal source to the trigger port of the controller.

Step 3 Connect the power (AC100-240V), press the red power switch button "-", "O" protrudes, When the light is on and the digital tube displays the channel value, it means that it is powered on.

Step 4 If you need to control the controller with a PC device, please use the RS232 data cable or network cable to connect to the PC device in the shutdown state, and then use the DEMO program provided by our company or the program written by your company to control it. When operating in RS232 mode/Ethernet mode, the parameters of each channel can still be set manually, that is, both the host computer and the controller can set the parameters without the need for mode conversion.

2.3 Brightness Setting

1. Manual Mode

(1) Press the encoder switch, the first digit tube starts flashing, indicating that you can select the channel that brightness needs to be set. Rotate the encoder channel clockwise increases the channel position, rotate the encoder channel counterclockwise decreases the channel position.

(2) After selecting the channel position, press the encoder switch again and the second digit tube starts flashing, indicating that the current channel brightness value can be adjusted to 100 digits. Rotate the encoder clockwise increases the value, rotate the encoder counterclockwise decreases the value.

(3) After adjusting the hundredth digit of the brightness value, press the encoder switch again. The third digit tube starts flashing, indicating that the tenth digit of the current channel brightness value can be adjusted. Rotate the encoder clockwise increases the value, rotate the encoder counterclockwise decreases the value

(4) After adjusting the tenth digit of the brightness value, press the encoder switch again. The forth digit tube starts flashing, indicating that the single digit of the current channel brightness value can be adjusted. Rotate the encoder clockwise increases the value, rotate the encoder counterclockwise decreases the value.

After adjusting the single digit of the brightness value, press the encoder switch again. The digital tube stop flashing indicates that the brightness value has been set and saved.

2.DEMO software setting method

Refer to the "3.Software Operation Instructions" chapter for more details.

2.4 Trigger Function

This series of controller has three trigger modes: normal trigger, high intensity trigger, programmable trigger and four trigger polarities: rising edge trigger, falling edge trigger, Positive follow trigger mode and Negative follow trigger mode, and the default rising edge trigger. See the table below for details.

Trigger mode	Trigger polarity
Normal trigger mode	Rising edge trigger
	Falling edge trigger
	Positive follow trigger mode
	Negative follow trigger mode
High intensity trigger mode	Rising edge trigger
	Falling edge trigger
	Positive follow trigger mode
	Negative follow trigger mode
Programmable trigger mode	Rising edge trigger
	Falling edge trigger

2.4.1 Trigger Mode Description

1. Normal trigger mode

Every time trigger, the channel corresponding to the trigger port of the controller will output a fixed signal, which is composed of the brightness level and the trigger pulse width value, where the brightness level can be set from 0 to 255, and the pulse width trigger can be modified by setting the pulse width trigger value and the normal trigger time unit, which can be set within 1 μ s-30s. For the specific setting method, please refer to the "1.8 Mode Switch Settings" and "3.1 Software Function Description" chapters.

2. High Intensity Trigger Mode

Every time trigger, the channel corresponding to the trigger port of the controller will output a fixed signal, which is output as a single channel 2A, and the pulse width trigger can be set from 0.01 to 5.00ms. Refer to the "1.8 Mode Switch Settings" and "3.1 Software Function Description" chapters for specific setting methods.

3. Programmable trigger mode

Switch to programmable trigger mode via DEMO. Programmable trigger mode uses the idea of programming to allow the trigger mode to write a trigger process according to actual needs. Each step in the trigger process can set the brightness and pulse width trigger of each channel to different values, and there is only one trigger source can trigger this step. The controller will cycle through the steps in the flow chart. Before using the programmable trigger mode, the flow chart must be set in advance. The flow chart needs to set the trigger signal source, brightness value and pulse width trigger, and the trigger signal source is selected from 1 to 4. In normal trigger mode, the brightness value can be set from 0 to 255, and the pulse width trigger can be set from 0 μ s to 30s. In the high intensity mode, the brightness value defaults to 255, the brightness setting is

invalid, and the pulse width trigger can be set from 0 to 9.99ms. For the specific setting method, please refer to the "3.2 Programmable Trigger Software Operating Instructions" chapter.

For example, in a product inspection occasion, the camera needs to take pictures in 4 times, and the light source output parameters required for each picture are different. Among them, the light source output parameters required for each picture are shown in Table 2.1, and the corresponding timing diagram is shown in the figure 2.2 If the traditional trigger mode is used for control, the brightness level and pulse width trigger of the light source of each channel need to be reset each time a picture is taken, which greatly increases the response time of the controller. In the same situation, in the programmable mode, you can divide 4 shots into 4 steps. In each step, the output parameters of each channel light source are set according to the conditions in the table, and each step only needs a trigger source to control 4 channel output, the controller cyclically executes each step according to the preset light source output parameters. Since the light source output parameters required for each step of taking pictures by the camera are pre-set, the time required for setting the parameters is saved, and the response time of the controller is greatly reduced.

Table 2.1

Steps	Trigger source	Brightness level				Pulse width trigger			
		CH 1	CH 2	CH3	CH4	CH1	CH 2	CH3	CH4
1	1	250	50	250	50	400	100	400	100
2	2	200	150	200	150	300	200	300	200
3	3	150	200	150	200	200	300	200	300
4	4	50	250	50	250	100	400	100	400

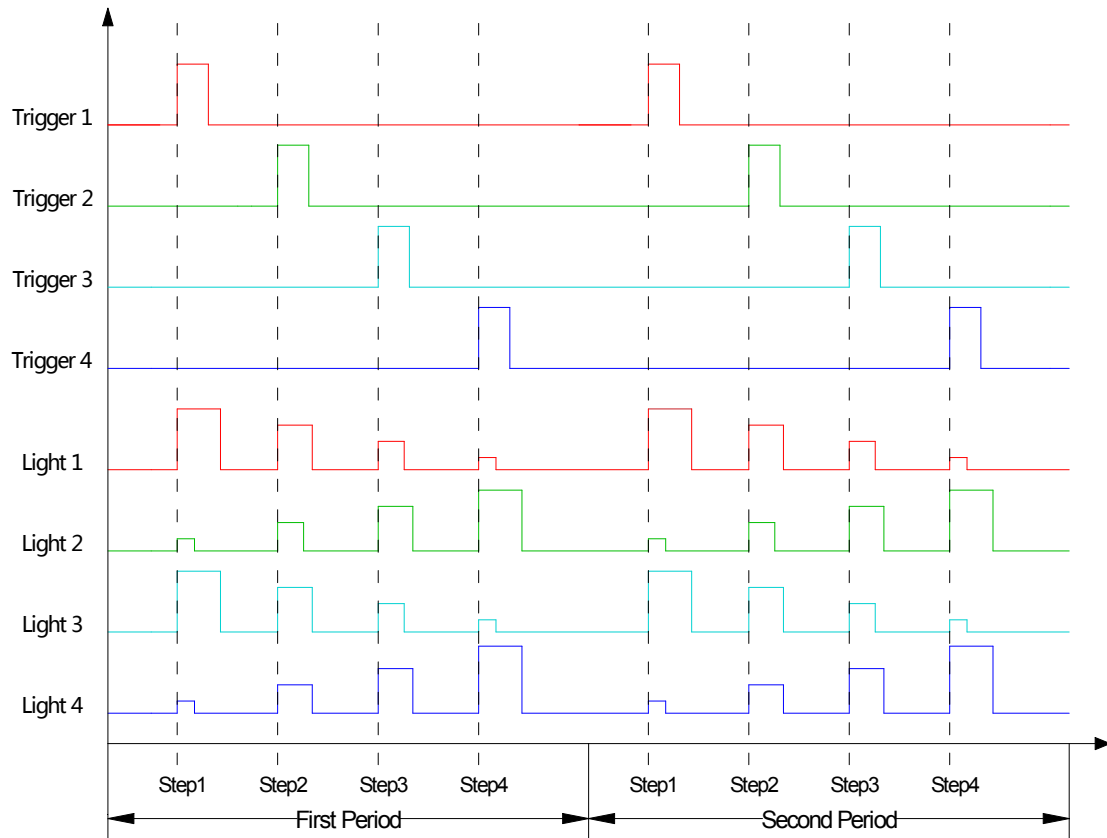


Figure 2.2

Notes:

- (1) Trigger is the trigger signal, Light is the light source output signal;
- (2) The above figure shows the timing diagram of four processes in the programmable trigger mode. The trigger signal sources are Trigger1, Trigger2, Trigger3, and Trigger4.

2.4.2 Sequence Reference Diagram of Response Time

1. Rising Edge Trigger

Illuminating time is equal to the set trigger pulse width. Trigger pulse width set via DEMO or adjustment key. Refer to Figure 2.3.

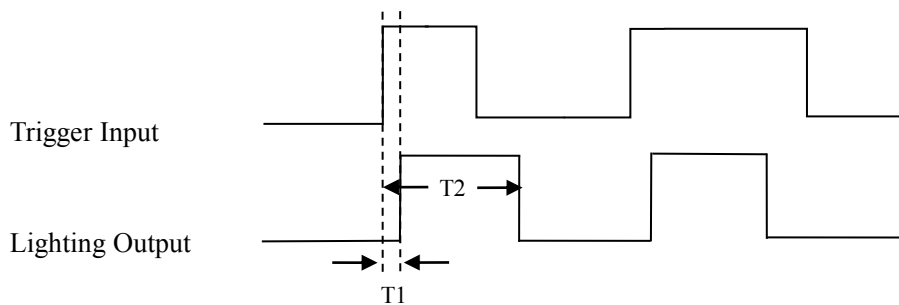


Figure 2.3

2. Falling Edge Trigger

Illuminating time is equal to the set trigger pulse width. Trigger pulse width set via DEMO or adjustment key. Refer to Figure 2.4.

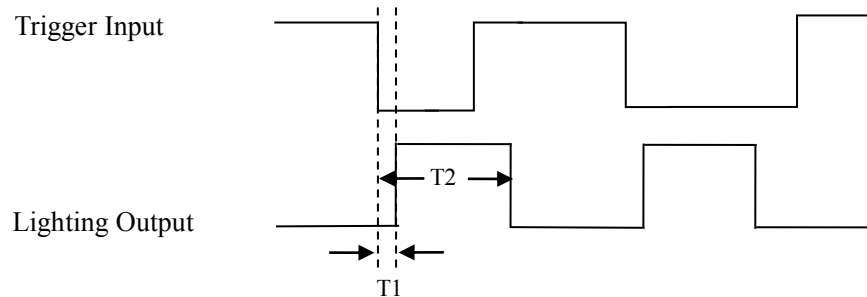


Figure 2.4

3. Positive follow trigger mode

When the trigger signal is high level, illuminating time is equal to pulse width of high level. Refer to Figure 2.5.

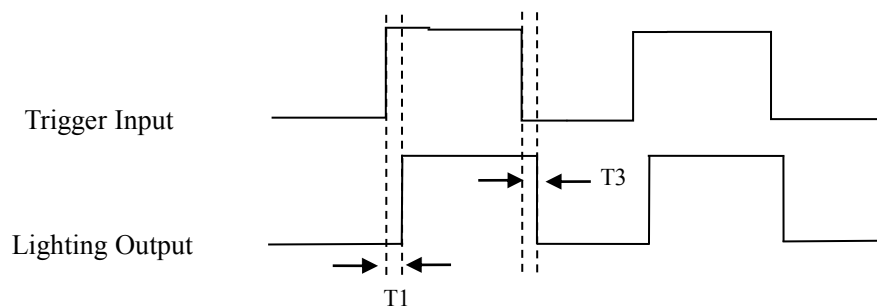


Figure 2.5

4. Negative follow trigger mode

When trigger signal is low level voltage, illuminating time is equal to low level pulse width. Refer to Figure 2.6.

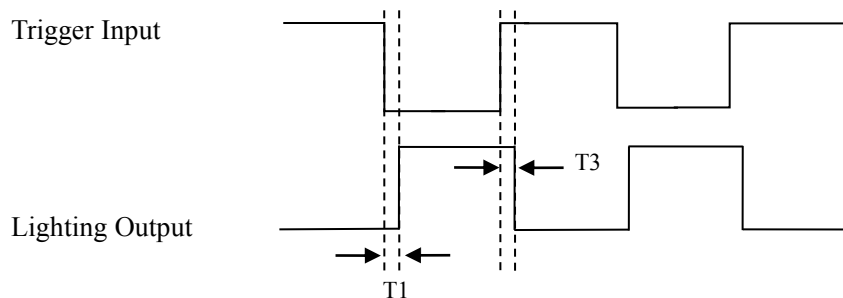


Figure 2.6

Notes:

- (1) T1 is the open response time, T2 is the pulse width trigger, and T3 is the closed response time.
- (2) Normal trigger: $T1 \leq 20\mu s$; $T3 \leq 10\mu s$; T2 can be set in the range between $1\mu s$ -30s.
- (3) High Intensity Trigger: $T1 \leq 20\mu s$; $T3 \leq 10\mu s$; T2 can be set in the range between 0.01-5.00 ms.

2.4.3 Trigger Wiring Diagram

There are 4 trigger ports. COM is the common port (as shown in the figure below). It contains two-way optocoupler isolation. It is low level when the input voltage is 0-2V, and is high level when the input voltage is 5-24V.

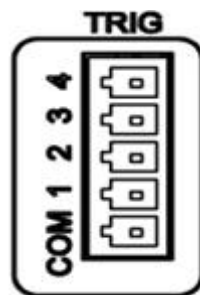
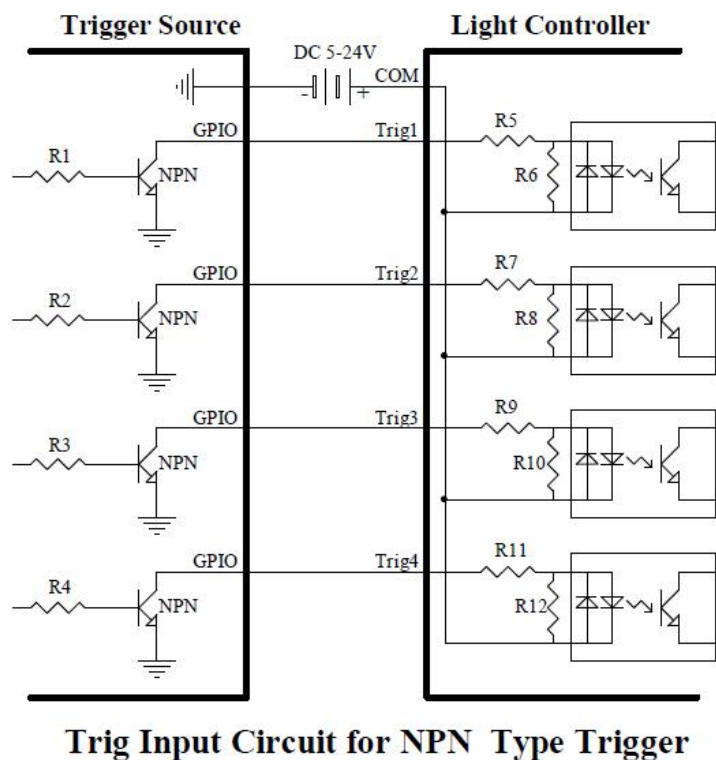


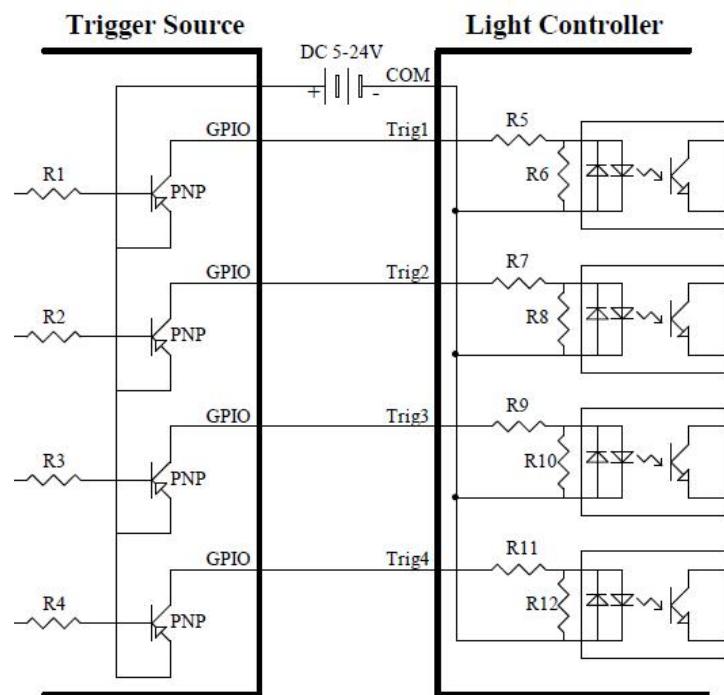
Figure 2.7

Two types of trigger wiring diagrams are given below:

1. NPN trigger type:



2.PNP trigger type:



Trig Input Circuit for PNP Type Trigger

3. Software Operation Instructions

3.1 Software Function Description

No.	Function	Description	The Corresponding Interface
1	Set Intensity	Function: Set the output brightness level of the light source Channel: The channel for which the brightness level needs to be set (parameter 0 represents all channels) Parameter: 0-255	Short / long command function
2	Read Intensity	Function: read the output brightness level of the light source Channel: The channel that needs brightness level reading Parameter: None	Short command function
3	Turn On Channel(s)	Function: Turn on the corresponding channel Channel: The channel that needs to be opened (parameter 0 means all channels) Parameter: None	Short / long command function
4	Turn Off Channel(s)	Function: Turn off the corresponding channel Channel: The channel that needs to be closed (parameter 0 represents all channels) Parameter: None	Short / long command function
5	Set Normal Trigger Time Unit	Function: set the time unit of normal trigger pulse width Channel: The channel for which the time units need to be set (parameter 0 represents all channels) Parameter: 0: 1 μ s 1: 10 μ s 2: 1ms 3: 100ms	Short command function
6	Read Normal Trigger Time Unit	Function: read the time unit of normal trigger Channel: The channel that needs to read the time unit Parameter: None	Short command function
7	Set Normal Trigger Width	Function: set the output pulse width of normal trigger Channel: The channel for which the pulse width trigger needs to be set (parameter 0 represents all channels) Parameter: 1-999	Short / long command function

No.	Function	Description	The Corresponding Interface
8	Read Normal Trigger Width	Function: read the output pulse width of normal triggers Channel:The channel that needs pulse width trigger reading Parameter:None	Short command function
9	Set High Intensity Trigger Width	Function: Set trigger width of the High Intensity Trigger Mode Channel: The channel that need to be set High intensity trigger width (0 means total channels) Parameter:1-500(unit 10 μ s)	Short / long command function
10	Read High Intensity trigger Width	Function: Read trigger width of the High Intensity Trigger Mode Channel: The channel that need to be read High intensity trigger width Parameter:None	Short command function
11	Set Maximum Current	Function: set the maximum output current value of the channel Channel: channel for which the maximum current needs to be set (parameter 0 represents all channels) Parameter: 1 - 200 (unit 10mA)	Short / long command function
12	Read Maximum Current	Function: read the maximum output current value of the channel Channel: channel that needs to read the maximum current Parameter:None	Short command function
13	Read Channel State	Function: Get channel state for corresponding channel Channel: The channel that need to be get channel state Parameter:None	Short command function
14	Software Trigger	Function: each time a command is sent, the time the light source is on is the set value. Channel: channel that needs software trigger (parameter 0 means all channels) Parameter: 1-3000 (unit 10ms)	Short / long command function
15	Read Property	Function: Read corresponding property for controller Channel:None Parameter: 1:Read Model	Advanced setting function

No.	Function	Description	The Corresponding Interface
		2:Read Firmware Version	
16	Read Serial Number	Function: Read serial number for controller Channel:None Parameter:None	Advanced setting function
17	Read IP Config	Function: Read IP configuration which will return message with IP address, sub-net mask and default gateway. Channel:None Parameter:None	Advanced setting function
18	Set Trigger Polarity	Function: Set trigger polarity for trigger mode Channel:channel that needs software trigger (parameter 0 means all channels) Parameter:0:Positive follow trigger mode 1:Negative follow trigger mode 2:Falling edge trigger 3:Rising edge trigger	Advanced setting function
19	Read Trigger Polarity	Function: Read trigger method for trigger mode Channel: channel that needs software trigger Parameter:None	Advanced setting function
20	Enable CheckSum	Function: Enable checksum Channel:None Parameter: 0:Disable 1:Enable	Advanced setting function
21	Enable Respond	Function: Enable return value Channel:None Parameter: 0:Disable 1:Enable.	Advanced setting function
22	Set Load Detection Mode	Function: Set load detection mode Channel: channel that needs software trigger (parameter 0 means all channels) Parameter:0:Detect Automatically 1:Set Manually	Advanced setting function
23	Enable Power Off Backup	Function: Enable power off backup, the data will be saved when the power is turned off. Channel:None Parameter: 0:Disable 1:Enable	Advanced setting function

No.	Function	Description	The Corresponding Interface
24	Enable DHCP	Function: Enable DHCP Channel:None Parameter: 0:Disable 1:Enable	Advanced setting function
25	Auto Sensing Of Light Rated Current Once	Function: Auto Sensing Of Light Rated Current Once Channel:None Parameter:None	Advanced setting function
26	Set Working Mode	Function: Set working mode Channel:None Parameter: 0:Continuous Mode 1:Normal trigger mode 2:High Intensity Trigger Mode 3:Set the working mode on panel	Advanced setting function
27	Read Working Mode	Function: Read working mode Channel:None Parameter:None	Advanced setting function
28	Set Keepalive Parameters	Function: Set keep-alive parameter Channel:None Parameter0:KeepAlive_time Parameter1:KeepAlive_interval. Parameter2:KeepAlive_probes.	Advanced setting function
29	Enable Keepalive	Function: Enable keep-alive Channel:None Parameter: 0:Disable 1:Enable	Advanced setting function
30	Read Channels	Function: Read channel amount Channel:None Parameter:None	Advanced setting function
31	Read Keepalive Switch States	Function: Read the keep-alive switch state for Ethernet communication Channel:None Parameter:None	Advanced setting function
32	Read Continuous Keepalive Time	Function: Read continuous keep-alive time for Ethernet communication Channel:None Parameter:None	Advanced setting function
33	Read Delivery Interval Time Of Prop Packet	Function: Read delivery interval time of Probe Packet for Ethernet communication Channel:None Parameter:None	Advanced setting function

No.	Function	Description	The Corresponding Interface
34	Read Delivery Time Of Prop Packet	Function: Read delivery times of Probe Packet for Ethernet communication Channel:None Parameter:None	Advanced setting function
35	Read Output Board Version	Function: Read the output board vision of controller Channel:None Parameter:None	Advanced setting function
36	Read Load Detection Mode	Function: load detection mode reading Channel: need to read the channel of load detection mode Parameter:None	Advanced setting function
37	Set Boot State	Function: Set boot protection for corresponding channel output Channel: The corresponding channel for setting boot protection (0 means total channels). Parameter: 0:Set general light 1:Set general close	Advanced setting function
38	Read Module Boot State	Function: Read model boot state for corresponding channel Channel: The corresponding channel for reading boot protection. Parameter:None	Advanced setting function

3.2 Programmable Trigger Software Operating Instructions

No.	Function	Operation Instruction	The Corresponding Interface
1	Read Step Count	Click the "Programmable Trigger Setting" button, select the corresponding channel group, select "Read Step Count" in the function option, and then click the "Apply" button.	Programmable Trigger Function
2	Set Trigger Mode	Click the "Programmable Trigger Setting" button, select the corresponding channel group, and select "Set Trigger Mode" in the function option. Then, select corresponding trigger mode in the parameter and click "Apply" button; the parameter include two trigger modes: General Trigger Mode and Programmable Trigger Mode.	Programmable Trigger Function

No.	Function	Operation Instruction	The Corresponding Interface
3	Read Trigger Mode	Click the “Programmable Trigger Setting” button, select the corresponding channel group, select “Read Trigger Mode” in the function option and then click “Apply” button. Status bar will return the corresponding trigger mode.	Programmable Trigger Function
4	Set Current Step Index	Click the “Programmable Trigger Setting” button, select corresponding channel group, select “Set Current Step Index” in the function option, write the step number parameter in the parameter options (the range is greater than or equal to 1 and less than or equal to the total number of steps in the programmable trigger table), and then click the "Apply" button.	Programmable Trigger Function
5	Read Current Step Index	Click the “Programmable Trigger Setting”, select corresponding channel group, select “Read Current Step Index” in the function option, and then click the “Apply” button.	Programmable Trigger Function
6	Reset Current Step Index	Click the "Programmable Trigger Setting" button, select the corresponding channel group, select "Reset Current Step Index" in the function option, and then click the "Apply" button.	Programmable Trigger Function
7	Add Programmable Trigger Step	Click the "Programmable Trigger Setting" button, select the corresponding channel group, select the position where the programmable trigger step needs to be inserted, click the "+" button on the interface, and insert a programmable trigger step in the upper line of the selected programmable trigger option, and then set the trigger source and trigger pulse width parameter.	Programmable Trigger Function
8	Delete Programmable Trigger Step	Click the "Programmable Trigger Setting" button, select the corresponding channel group, select the position where the programmable trigger step needs to be deleted, and click the "-" button on the interface to delete the selected programmable trigger step.	Programmable Trigger Function

No.	Function	Operation Instruction	The Corresponding Interface
9	Write Programmable Trigger Table	Click the "Programmable Trigger Setting" button, select the corresponding channel group, set the programmable trigger table to be written, and click the "write" button.	Programmable Trigger Function
10	Read Programmable Trigger Table	Click the "Programmable Trigger Setting" button, select the corresponding channel group, and then click the "Read" button.	Programmable Trigger Function
11	Import Programmable Trigger Table	Click the "Programmable Trigger Setting" button, select the corresponding channel group, click the "Import" button, select the file location where the programmable trigger table needs to be uploaded, and click "Open" to import the selected programmable trigger table.	Programmable Trigger Function
12	Export Programmable Trigger Table	Click the "Programmable Trigger Setting" button, select the corresponding channel group, click the "Export" button, select the file location where the programmable trigger table needs to be saved, modify the name of the programmable trigger table, and click "Save".	Programmable Trigger Function
13	Clear Status Bar	Click the "Programmable Trigger Setting" button, select the corresponding channel group, and then click the "Clear" button.	Programmable Trigger Function

Note:

For specific software operation instructions, please refer to the "V3.4 Controller DEMO Operation Instructions" document

3.3 User Programming Manual

In order to facilitate the secondary development of customers, our company provides a program development package for this controller. For details on how to use this program development package, please read the user programming manual provided by our company in detail.

4. Installation Instructions



No.	Interface	Description
1	Mounting screw holes	Screw hole mounting
2	DIN rail slot	Standard DIN rail mounting

4.1 DIN Rail Mounting Way

Mounting steps (Figure 1):

- (1) First, snap the DIN rail slot position 1 on the back of the controller to the guide rail.
- (2) Then push the lower end of the controller hardly to make position 2 snap onto the rail.

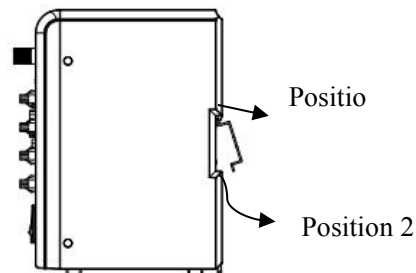


Figure 1 Mounting steps

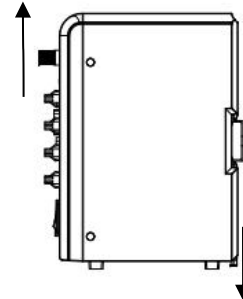


Figure 2 Removal steps

2, Removal steps (Figure 2):

- (1) First, pull the lower end of the controller.
- (2) Push up and remove the controller.

4.2 Screw Hole Mounting Way

Mounting steps (Figure 3):

1. First, lock the fixed plate on the controller.
2. Then fix the screws on the fixed plate to fix the controller.
3. Lock the fixed plate to the installed equipment or instrument.

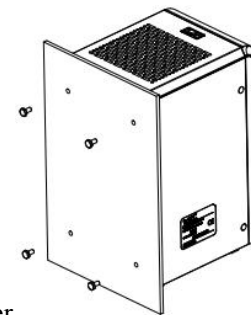


Figure 3 Screw Hole Mounting

4.3 Mounting Dimensions

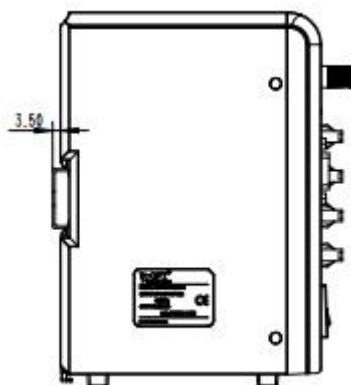


Figure 4 DIN Rail Mounting Dimensions

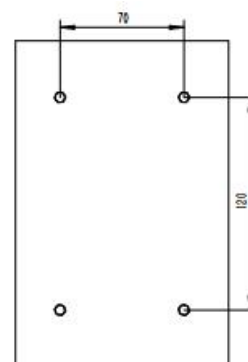


Figure 5 Screw Hole Mounting Dimensions

5.Dimension Diagram

Mechanical Parameters

DPA2012E-4

