

Control Unit for LED Light Units

PD3-3024-3-EI

With Ethernet communications

Instruction Guide

Thank you for purchasing a CCS product. To ensure proper use of the product, please read this Instruction Guide before use and keep it for your future reference.



This Control Unit is specifically designed to control the light intensity of CCS LED Light Units. It is mainly used to control LED Light Units that are used for machine vision and industrial inspections.

Features

- One Control Unit can individually control three different Light Units.
- The light intensity can be manually controlled with a dial on the front panel, or externally controlled using Ethernet.
- PWM control is used to control the light intensity at a frequency of 125 kHz.
- TCP/IP and UDP/IP Ethernet communications can be used for external control.
- External trigger inputs can be used to turn lights ON or OFF, or to strobe lights.
- The Control Unit can be used for CCS LED Light Units with a voltage of 24 V and a power consumption of up to 28 W.
The total power consumption of the connected Light Units must be 28 W or less.

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1 Important Information for Equipment Safety

— Read before Use —

This product has been designed with full consideration of safety. Incorrect usage of the product may result in fire, electric shock, or other serious damages. Observe the following precautions.

The following symbols are used in this instruction guide to indicate and classify the relative importance of warnings and cautions.

	WARNING	Indicates that incorrect usage may result in serious injury or death.		Caution	Indicates that incorrect usage may result in injury or property damage.
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The following symbols in the instruction guide indicate and classify the precautions.

PROHIBITED	DISASSEMBLY PROHIBITED	DO NOT TOUCH WITH WET HANDS	DO NOT SUBJECT TO MOISTURE	INSTRUCTED	UNPLUG
These symbols mean the prohibited action.				These symbols indicate actions that must be performed.	

WARNING	
Do not disassemble or modify the product. Doing so may result in fire or electric shock.	
Do not touch the plugs or switches with wet hands. Doing so may result in electric shock.	
Make sure that the product is free of moisture or any liquid. Doing so may result in fire or electric shock.	
Before connecting or disconnecting cables, make sure that the power source is turned OFF. Not doing so may result in fire or electric shock.	
Do not touch the power cords during lightning. This may result in electric shock.	
If an abnormal condition occurs, such as fuming, heat, smell, or noise, stop using the product immediately, turn OFF the power source and unplug the power cord. Not doing so may result in fire or electric shock.	

Caution	
Do not connect any Light Units other than CCS LED Light Units. Doing so may cause overcurrent and the device may overheat or ignite.	
Always use one of the following power cords. 100 to 120 V range: SVT or SJT, AWG18, length: 3 m max., dielectric strength: 125 V min. 200 to 240 V range: H05VV-F, AWG18, length: 3 m max., dielectric strength: 250 V min.	
Do not use user-made branch cables. Doing so may cause product failure.	
Plug the power cord directly into an AC outlet. Using a power strip or connecting many loads from one electrical outlet may cause fire or electric shock.	
Do not place the product in direct sunlight or in a high-humidity environment. Doing so may result in fire due to internal temperature rise.	
Do not bundle product cables with high-voltage lines or power lines. Allow leeway when installing the cables.	
Always place the product on a stable and flat location. Doing so may result in the product falling or toppling, which may cause malfunction, accidents, or bodily injury.	
Always ground the power cord. Not doing so may cause product failure due to static electricity destroying electrical components including those in the Light Unit.	
Do not drop the product or subject it to impact. Doing so may cause product failure.	
Use Light Units that are suitable for the product ratings. Exceeding the ratings may cause product failure.	
Do not bend cables or jam them between objects when wiring. Doing so may cause product failure.	
Make sure that the length of the extension cable for light output is no longer than 5 m. If the extension cable is longer than 5 m, the voltage will drop due to the DC resistance of the cable, and the light intensity will decrease.	
Do not intentionally short-circuit the positive and negative output terminals.	
Do not disconnect the power cord or disassemble the product during operation. Pulling on the cable may damage the cable and result in fire or electric shock.	
Do not wipe the product with volatiles such as paint thinner or benzene. Discoloration or deterioration of the product surfaces may occur.	
Before moving the product, disconnect all connection cables. Damaging the cables may result in fire or electric shock.	
Use a dry cloth to remove dust or other foreign matter from the electrodes. Failure to do so may result in fire.	
When mounting products in system racks or cases, do not insert the screws more than 5 mm. Doing so may cause short-circuits in internal components.	

2 Names and Functions of Parts

Setting Indicators

BRT lit: The light intensity can be set.
PLS lit: The lighting mode can be set.
LOCK lit: The settings are locked.

Channel Selection Switch

Selects L1, L2, or L3.

External Control Connector

Used for external control with Ethernet communications.

External Control Reset Switch

Pressed with a pointed object to reset all settings to their default values.

Manual/External Mode Selector

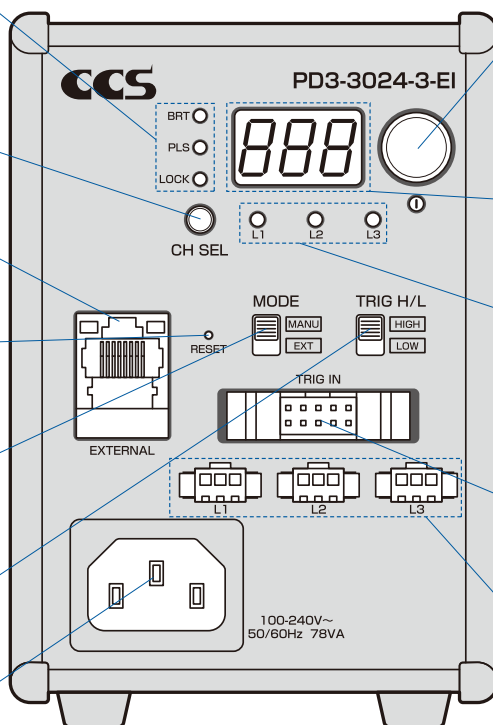
Selects manual (MANU) or external (EXT) control mode.

Trigger Logic Switch

Selects the logic of the trigger signal.

AC Inlet

Connects the power source to the Control Unit.



Setting Switch

Press: Switches between the light intensity setting and lighting mode setting.

Press for at least 2 seconds:
Locks the settings.

Rotate: Sets the light intensity or lighting mode.

Digital Window

Displays the setting of the light intensity or the setting of the lighting mode.

Channel Indicators

L1 lit: Lit when changing settings for Light Unit connected to output connector L1.

L2 lit: Lit when changing settings for Light Unit connected to output connector L2.

L3 lit: Lit when changing settings for Light Unit connected to output connector L3.

External Trigger Input Connector

Inputs the ON/OFF signal for ON/OFF Mode.
Inputs the trigger signal for Strobe Mode.

Output Connectors

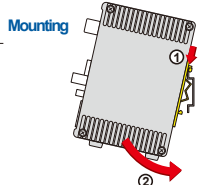
Supply power to the Light Units.

3 Installation

Mounting the Unit to DIN Rail

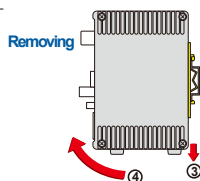
▶ Mounting to DIN Rail

Hook the tab on the upper part of the Unit on the DIN rail and press the Unit in the direction indicated by arrow 2 while pressing it in the direction indicated by arrow 1.



▶ Removing from DIN Rail

Press the Unit down in the direction indicated by arrow 3 and pull it out in the direction indicated by arrow 4.



Securing the Unit with Base Brackets (Optional, Sold Separately)

Always use Base Brackets (model: BK-PD3) when securing the Unit at its base. If it is secured without the Brackets, the Unit may be damaged.

1 Removing the Rubber Feet from the Bottom of the Unit

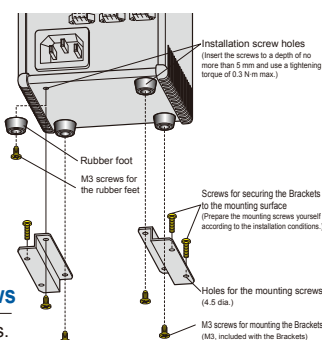
Remove the screws that hold the rubber feet in place using a Phillips screwdriver.

2 Securing the Brackets to the Base of the Unit

Secure the Brackets to the base of the Unit with the four screws that come with the Brackets.

3 Securing the Unit with Mounting Screws

Secure the Unit in place with mounting screws. The mounting screws must be provided by the user.



4 Connections

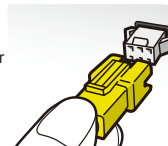


WARNING Before connecting the Control Unit, make sure that the main power source is turned OFF. Making connections with the power turned ON may result in a fire or electric shock.

Output Connectors (L1 to L3)

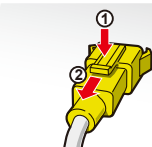
Connecting

Insert the connector to the Light Unit all the way in.



Removing

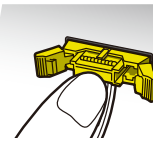
Press the lock and pull out the connector.



External Trigger Input Connector (TRIG IN)

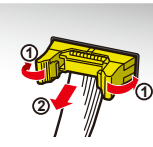
Connecting

Press the connector in until it locks in place.



Removing

Release the lock and remove the connector.

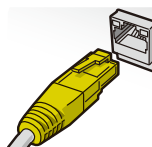


*An optional External Trigger Input Cable (EXCB2-M10-3) (sold separately) is available. In case using a self-made cable, cable length should be within 3 m at maximum.

External Control Connector (EXTERNAL)

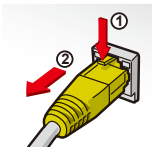
Connecting

Firmly insert the connector of the LAN cable.



Removing

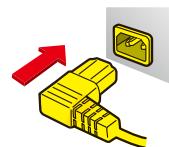
Press the lock and pull out the connector.



*The LAN cable must be provided by the customer. (Cable length should be within 30 m at maximum.)

This product recognizes either cross-cable or straight-cable automatically by auto-negotiation function. Please reboot the product when changing the cable.

AC Inlet



Connect the power cord to the Control Unit and the AC outlet. The Control Unit will turn ON when power is supplied from the main power source. When the Unit is ON, the digital window will light.

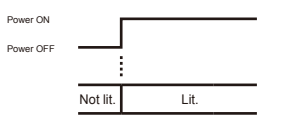
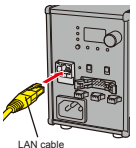
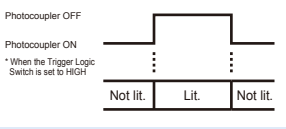

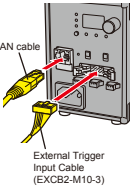
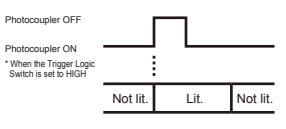

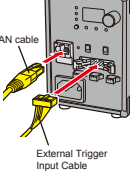
* The AC cord that is included with the Unit is for 100 to 120 VAC. We recommend using the following for 200 to 240 VAC. Cable: GTCE-3 x 1.0 mm² (manufactured by Kawasaki Electric Wire Company), Connector: KS-31AY (manufactured by Kawasaki Electric Wire Company)

5 What You Can Achieve with This Control Unit

Select the control mode and lighting mode from the following Application Guide and proceed to the indicated reference items.

*Data that has been set is retained even after the power is turned OFF with manual or external control.

Application Guide

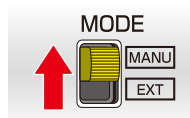
Control mode		MODE MANU EXT	Front panel operation	MODE MANU EXT	External control using a PLC or image process device
Lighting mode	Continuous Mode		The Light Units are always ON. 		To use external control in Continuous Mode, refer to items 1 , 2 , and 3 under 7 Control with External Signals . 
	ON/OFF Mode		The Light Units are turned ON or OFF according to the external trigger signal input.  * It is possible to turn LED light unit ON and OFF by Ethernet communications, too.	To use manual control in ON/OFF Mode, refer to items 1 , 2 , and 3 under 6 Manual Control and 8 Inputting the External Trigger . 	External trigger signal or Ethernet communications setting can be selected when using ON/OFF mode by external control. To use external trigger signal in ON/OFF mode, refer to items 1 , 2 , and 3 under 7 Control with External Signals and 8 Inputting the External Trigger . To use Ethernet communications setting in ON/OFF mode, refer to items 1 , 2 , 3 , and 5 under 7 Control with External Signals . 
	Strobe Mode		The Light Units are turned ON for a set time after the external trigger signal is input.  * When the Trigger Logic Switch is set to HIGH	To use manual control in Strobe Mode, refer to items 1 , 2 , 3 and 4 under 6 Manual Control and 8 Inputting the External Trigger . 	To use external control in Strobe Mode, refer to items 1 , 2 , 3 , and 4 under 7 Control with External Signals and 8 Inputting the External Trigger . 

6 Manual Control

- Make sure that the main power source is turned ON.
- Set items **1**, **2**, and **3** when using Continuous Mode or ON/OFF Mode.
- Set items **1**, **2**, **3**, and **4** when using Strobe Mode.

1 Setting the Manual/External Mode Selector to Manual

Set the Manual/External Mode Selector to MANU to set Manual Mode.



Check

Make sure that the LOCK setting indicator is not light and that the trigger logic switch is set to HIGH. Otherwise you may not be able to perform the rest of this procedure.

2 Selecting the Channel

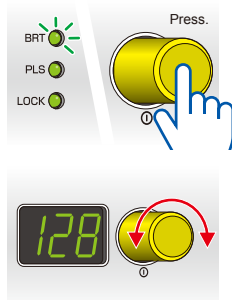
Press the channel selection switch to select the channel to set (L1 to L3). The channel indicators will change.



3 Setting the light Intensity

Press the setting switch to light the BRT setting indicator.

Turn the setting switch to set a value between 0 and 255. (Default setting: 255, Minimum: 000, Maximum: 255)
* The Light Units are light dimly at the minimum value.



4 Selecting the Lighting Mode

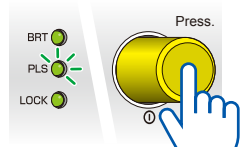
Press the setting switch to light the PLS setting indicator.

Turn the setting switch to select the lighting mode from Continuous Mode, ON/OFF Mode, or Strobe Mode.

(Default value: F00)

Continuous Mode

Turn the setting switch and set F00 to turn ON the Light Units continuously.



ON/OFF Mode (if the external trigger is not used, the Light Units are ON continuously.)

Turn the setting switch and set F00 to turn the Light Units ON and OFF. The Light Units are turned ON or OFF according to the external trigger signal input.



Strobe Mode (if an external trigger is not used, the Light Units are OFF.)

To flash the strobe, turn the setting switch and select a setting from F01 to F10 (strobe time of 40 μ s to 40 ms). The Light Units are turned ON for the period of time set on the setting switch after the external trigger signal is input.

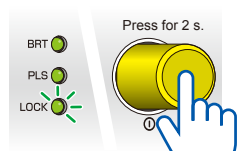


Digital Window	F00	F01	F02	F03	F04	F05	F06	F07	F08	F09	F10
Status	Continuous Mode ON/OFF Mode	40 μ s	80 μ s	120 μ s	200 μ s	600 μ s	1 ms	4 ms	10 ms	20 ms	40 ms

For details on the external trigger input, refer to 5. Inputting the External Trigger.

Locking Settings

When the setting switch is pressed for 2 seconds or longer, the lighting mode and light intensity settings are locked, and the LOCK setting indicator lights. (The set values can be viewed.) Pressing the switch again for 2 seconds or longer releases the lock.



Specifications for External Control

Sample of Alphanumeric Characters: ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789

Communications Specifications

Protocol layer	TCP/UDP protocol	IPv4 protocol	Standard	Ethernet
Specification	Standard RFC793, RFC768	Standard RFC791	IEEE802.3, IEEE 802.3u, IEEE 802.3x	Baud rate 10 Mbps/100 Mbps (Automatically detected.) Transmission medium 10BASE-T, 100BASE-TX

* The number of TCP connection (possible numbers to connect at same time) which PD3 correspond is "1"

Command Formats

Send Data

Function	Header	Channel specification	Instruction	Sent command	Checksum	Delimiter	Default
Light Intensity Setting	@	00 to 02 (Refer to Channel Specification.) FF: All channels (ON/OFF setting only).	F	000 to 255 (000: Minimum intensity, 255: Maximum intensity)	00 to FF (Refer to Checksum.)	<CR><LF>	000
Lighting Mode Setting			S	00 to 10 (Refer to Lighting Mode Settings.)			00
ON/OFF Setting			L	0: Not lit, 1: Lit			(Refer to annotation.)
Setting Status Check			M	---			---
Status Check (overcurrent check)		00 (fixed)	C	---			---
All Channel Initialization			R	---			---
IP Address			E01	000.000.000.000 to 255.255.255.255			192.168.000.002
Subnet Mask			E02	(Specify all digits, e.g., specify "192.168.000.005" instead of "192.168.0.5.")			255.255.255.000
Default Gateway			E03				192.168.000.001
Reply IP Address			E05				192.168.000.016
Reception Port Setting			E04	00000 to 65535			40001
Reply Port Setting			E06	(Specify all digits, e.g., specify "04561" instead of "4561.")			30001

* Specify all numbers in decimal format.

* Send a data within 4 seconds from 'Header' to 'Delimiter', otherwise time-out error occurs and command data will be rejected.

* When operating Ethernet communications and trigger signal input at same time in ON/OFF mode. When Trigger logic switch is at HIGH: if other controls setting to OFF setting, Light unit will be turned OFF. When Trigger logic switch is at LOW: if other controls setting to ON setting, Light unit will be turned ON.

* ON/OFF setting from Ethernet communications without regards to trigger logic switch, turned OFF at '0' and ON at '1'. Default setting for trigger logic switch is HIGH = '1' (ON) and LOW = '0' (OFF). ON/OFF setting will not be held after turning the power off.

Receive Data

Function	Header	Channel specification	Received command	Checksum	Delimiter
Light Intensity Setting	@	00 to 02 (Refer to Channel Specification.) FF: All channels (ON/OFF setting only).	OK	00 to FF (Refer to Checksum.)	<CR><LF>
Lighting Mode Setting			---		
ON/OFF Setting			F999.S99.L9		
Setting Status Check			00: Normal, 11: Error		
Status Check (overcurrent check)		00 (fixed)	O		
All Channel Initialization			N		
IP Address			01: Command error		
Subnet Mask			02: Checksum error		
Default Gateway			03: Set value out of range error		
Reply IP Address			---		
Reception Port Setting					
Reply Port Setting					

* There is no received data when timeout error occurs.

* Received command for setting status check (F999.S99.L9) F999=Light intensity setting (F000 to F255), S99=Lighting mode setting (S00 to S10), L9=ON/OFF setting (L0: Not lit / L1: Lit)

Channel Specification

Channel	L1	L2	L3
Set value	00	01	02

* Set values that are higher than 02 are not valid.

Lighting Mode Settings

Status	Continuous Mode or ON/OFF Mode	40 μs	80 μs	120 μs	200 μs	600 μs	1 ms	4 ms	10 ms	20 ms	40 ms
Digital window	F00	F01	F02	F03	F04	F05	F06	F07	F08	F09	F10
Set value	00	01	02	03	04	05	06	07	08	09	10

* Set values that are higher than 10 are not valid.

Checksum

The codes of the ASCII characters from the header to the send command are added, the lowest byte is converted to hexadecimal, and two characters are sent.

Example: Setting the Light Intensity of Channel 2 to 125

	Header	Channel	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Total
Character	@	0	1	F	1	2	5			
ASCII (hexadecimal)	40 hex	30 hex	31 hex	46 hex	31 hex	32 hex	35 hex	17F hex		

* The lowest byte (two characters) of 17F is taken, so the checksum is 7F.

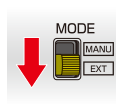
Setting Procedures

- Make sure that the main power source is turned ON.
- Set items 1, 2, and 3 when using Continuous Mode.
- Set items 1, 2, 3, and 5 when using ON/OFF Mode.
- Set items 1, 2, 3, and 4 when using Strobe Mode.

1 Setting the Manual/External Mode Selector to External

Set the Manual/External Mode Selector to EXT to set External Mode. The value set with external control is displayed on the digital window.

* Although it is possible to set the external control setting even the manual/external mode selector is set to manual mode, the setting will not be activated until the manual/external mode selector is set to external mode.



2 Setting Up the Network (Only Initially and When Settings Are Changed)

Set the Unit's IP address and the reply address. To enable the settings that were changed, cycle the power supply.

* If the IP address changes, do not forget to change the send destination of commands.

Item	Setting example	Send data
IP Address	192.168.3.2	@00E01192.168.003.00230CRLF
Subnet Mask	255.255.255.0	@00E02255.255.255.00035CRLF
Default Gateway	192.168.3.1	@00E03192.168.003.00131CRLF
Reception Port Setting	4561	@00E040456149CRLF
Reply IP Address	192.168.3.10	@00E05192.168.003.01033CRLF
Reply Port Setting	4562	@00E06045624CCRLF

Item	Receive data when OK	Receive data when NG
IP Address	@000EFCRLF	@00N014FCRLF (when there is a command error)
Subnet Mask		
Default Gateway		
Reception Port Setting		@00N0351CRLF (when there is a set value out of range error)
Reply IP Address		
Reply Port Setting		

3 Setting the Light Intensity

Specify the channel and set the light intensity.

Setting example	Send data	Receive data when OK	Receive data when NG
Setting the L3 light intensity to 75	@02F07584CRLF	@02OF1CRLF	@02N0151CRLF (when there is a command error)

4 Setting the Lighting Mode

Specify the channel and set the lighting mode.

Setting example	Send data	Receive data when OK	Receive data when NG
Setting the L2 lighting mode to 200 μs in Strobe Mode	@01S0458CRLF	@01OF0CRLF	@01N0352CRLF (when there is a set value out of range error)

5 To Set ON/OFF Signal in ON/OFF Mode

Specify the channel and set ON/OFF signal.

Setting example	Send data	Receive data when OK	Receive data when NG
To turn all light units OFF	@FFL048CRLF	@FFO1BCRLF	@FFN027CCRLF (When there is checksum error)

To Check the Setting Status

When checking the setting status, send the following command after specify the channel.

Setting example	Send data	Receive data when OK	Receive data when NG
To check the setting status of L1.	@00MEDCRLF	@00OF075.S04.L060CRLF (If Intensity=75, Strobe mode=200μs, Light unit=OFF)	@00N0250CRLF (When there is checksum error)

Checking the Unit Status

Send the following command to check the Unit status.

Setting	Send data	Receive data when OK	Receive data when NG
Checking the Unit status	@00CE3CRLF	@00O004FCRLF (normal)	@00N0351CRLF (when there is a set value out of range error)

Resetting the Light Intensity and Lighting Mode

To restore the external control setting to default value, send the following command.

Setting	Send data	Receive data when OK	Receive data when NG
All Channel Initialization	@00RF2CRLF	@00OEFCLRF	@00N014FCRLF (when there is a command error)

Initialize the Network Setting

If the IP address setting and others is incorrect, you will not be able to connect to the Control Unit. You will also not be able to reset the IP address and others. If that occurs, use a pointed object to press the external control reset switch on the front panel to reset all settings to their default values. To enable the reset settings, cycle the power supply



8 Inputting an External Trigger

Input Signal and Photocoupler

The input signal from the external trigger input connector can be used to control the photocoupler inside the Unit to turn the LED Light Units ON and OFF or to control strobe timing.

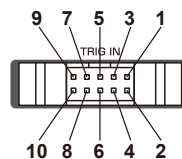
The operation depends on the setting of the trigger logic switch.

Trigger Logic Switch	Input signal	Photocoupler	ON/OFF Mode	Strobe Mode
HIGH	HIGH	OFF	Light Units ON	Light Units ON for the set time.
	LOW	ON	Light Units OFF	No change
LOW	HIGH	OFF	Light Units OFF	No change
	LOW	ON	Light Units ON	Light Units ON for the set time.

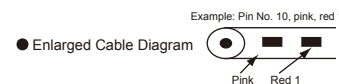
* When operating trigger signal input and Ethernet communications at same time in ON/OFF mode.
When Trigger logic switch is at HIGH: if either controls setting to OFF setting, Light unit will be turned OFF
When Trigger logic switch is at LOW: if either controls setting to ON setting, Light unit will be turned ON

Connector Layout

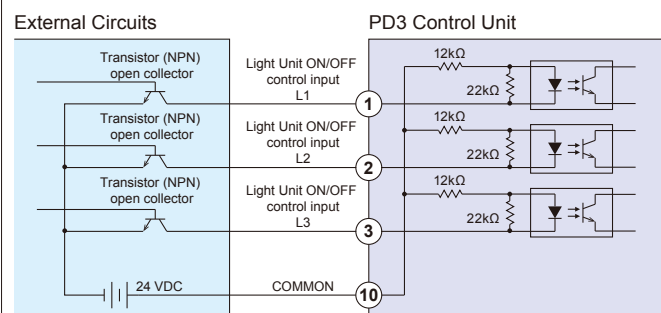
External Trigger Input Connector Plug



No.	Signal	Cable (EXCB2-M10-3)	Wire color	Marks
1	Light Unit ON/OFF control input (L1)	Orange	Black 1	
2	Light Unit ON/OFF control input (L2)	Orange	Red 1	
3	Light Unit ON/OFF control input (L3)	Gray	Black 1	
4 to 9	Not used.	---	---	---
10	COMMON+	Pink	Red 1	



External Trigger Signal Connection Example



Signal Specifications					
Rated input voltage	Maximum input voltage	ON voltage/ON current	OFF voltage/OFF current	ON/OFF response time	Input impedance
24 VDC	26.4 VDC	14.4 VDC min./3 mA max.	5 VDC max./1 mA max.	10 μs max.	12 kΩ (per terminal)

Setting Procedures

With the external trigger input connector pins 1 to 3, select the channels (L1 to L3) where you want to input an external trigger, and input the trigger.

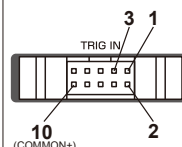
Trigger signals are input from the external trigger input connector in ON/OFF Mode and Strobe Mode in both Manual Mode or External Mode.

ON/OFF Mode

The Light Units are turned ON or OFF according to the external trigger signal input.

Strobe Mode

The Light Units are turned ON for the set time after the external trigger signal is input.



Trigger Input Sequence Diagram

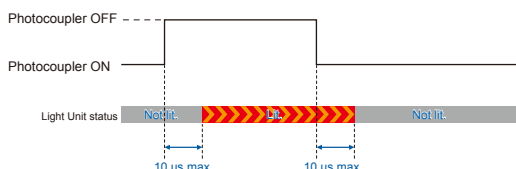
- If another trigger is input before the Light Unit turns OFF in Strobe Mode, the starting point of the reentered trigger is taken as the start time and the strobe light continues for the set time from that point.

ON/OFF Mode



● Trigger Logic Switch Set to HIGH

The Light Units turn ON when the photocoupler is OFF, and OFF when the photocoupler is ON.

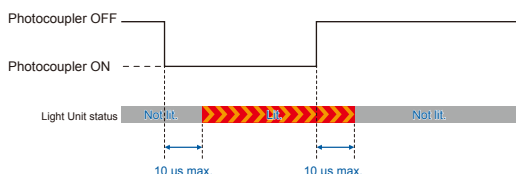


* The LED Light Unit will turn off by OFF signal sent by either trigger signal input or Ethernet communications.



● Trigger Logic Switch Set to LOW

The Light Units turn ON when the photocoupler is ON, and OFF when the photocoupler is OFF.



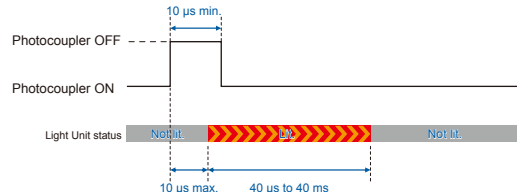
* The LED Light Unit will turn on by ON signal sent by either trigger signal input or Ethernet communications.

Strobe Mode



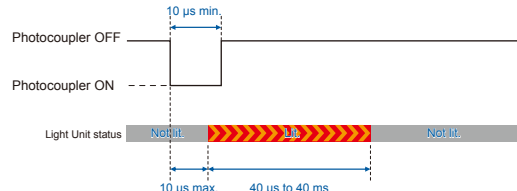
● Trigger Logic Switch Set to HIGH

From the point where the photocoupler goes OFF, the Light Units are turned ON for the set time (40 μs to 40 ms).



● Trigger Logic Switch Set to LOW

From the point where the photocoupler goes ON, the Light Units are turned ON for the set time (40 μs to 40 ms).



9 Troubleshooting

If the consumption current of Light Units exceeds 107% higher than the rated current, the overcurrent protection operates and stops the output. OCP will be displayed on the digital window.

Please check the rated current of Light Units and connect the Light Units under the rated current of this control unit.

Please press Setting Switch for over a second to reset the OCP error. (OCP error can be reset by rebooting.)



Error Output

When detecting the error during external control, command will be received as acknowledgement for checking status (over current confirmation) command "C".

* Immediately after the error, occurrence of an error will be noticed only one time by using UDP protocol. Notify data is the same as checking status (over current confirmation) command "C".

For details, refer to 7. Control with External Signals.

