OMRON

Color Mark Sensor

E3S-DC□□Series

INSTRUCTION SHEET

Thank you for selecting an OMRON product. This sheet primarily describes precautions required in installing and operating the product.
- A specialist who has the knowledge of electricity must treat the product.
- Please read this manual carefully, and use it correctly after thoroughly understanding the product.
- Please keep this manual properly for future reference whenever it is necessary.

The following notice applies only to products that carry the CE mark:
Notice:
This is a class A product. In residential areas it may cause radio interference, in which case the user may be required to take adequate measures to reduce interference.

CE ◇ IO-Link

* 9 5 3 9 3 9 8 - 0 B *

PRECAUTIONS ON SAFETY

● Meanings of Signal Words

⚠ WARNING | Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death.Additionally there may be significant property damage.

● Warning Indications

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purpose.	🚫
Do not use the product with voltage in excess of the rated voltage. Excess voltage may result in malfunction or fire.	⚠
Never use the product with an AC power supply. Otherwise, explosion may result.	⚠
Be sure to tighten the external lens until it reaches the chassis.	⚠

PRECAUTIONS FOR SAFE USE

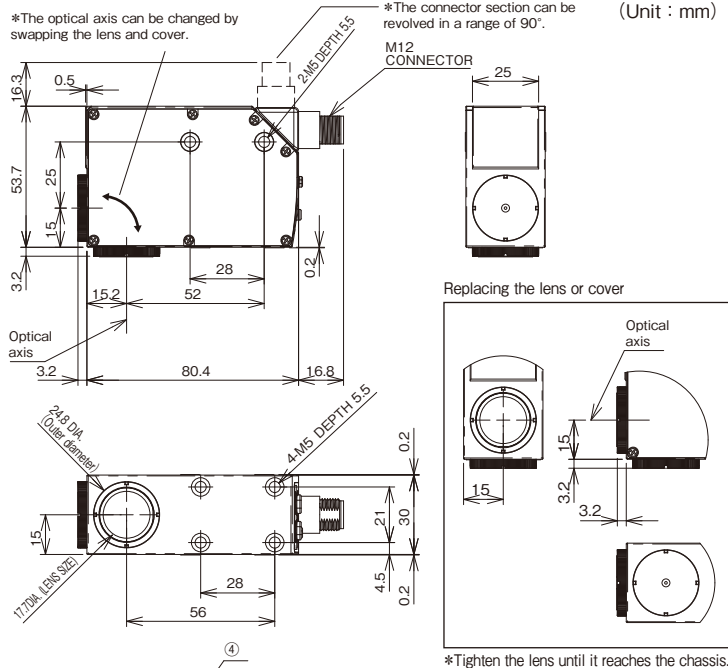The following precautions must be observed to ensure safe operation of the product.
· Do not install the product in the following locations.
 (1) Locations subject to direct sunlight
 (2) Locations subject to condensation due to high humidity
 (3) Locations subject to corrosive gas
 (4) In the place where vibration or shock is directly transmitted to the product.
· Do not use the product in environments subject to flammable or explosive gases.
· Do not use the product in any atmosphere or environment that exceeds the ratings.
· Do not pull on the cable with excessive strength.
· Do not attempt to disassemble, repair, or modify the product in any way.
· Do not use the product with the main unit damaged.
· Be sure that before making supply the supply voltage is less than the maximum rated supply voltage. (30V DC)
· Do not apply any load exceeding the ratings.
· Do not short the load. Otherwise damage or fire may result.
· Connect the load correctly.
· Do not use the product under a chemaical or an oil environment without prior evaluation.
· Though this is type IP67, do not use in the water, rain or outdoors.
· Do not use thinner, alcohol, or other organic solvents. Otherwise, the optical properties and degree of protection may be degraded.
· When disposing of the product, treat it as industrial waste.
· UL Standard Certification
 1. Ambient temperature rating marked on the device or in the installation instructions.
 2. The model number of the accessory cable assembly that shall be used: Recognized XS2F-D4 Series and/or Recognized XS2W-D4 Series by Omron. The cable assembly model numbers may be individually itemized.
 3. External overcurrent protection of 1A for 26AWG, 2A for 24AWG, or 3A for 22AWG wire shall be provided for cable protection.
 4. When XS2F-D4 (connectors on one end only) cable assembly models are marked per item 2 above that have wires (or cores) less than 24AWG (0.2mm^2), the instructions shall also include that those cables are for connection to terminal blocks and are not for field splicing.
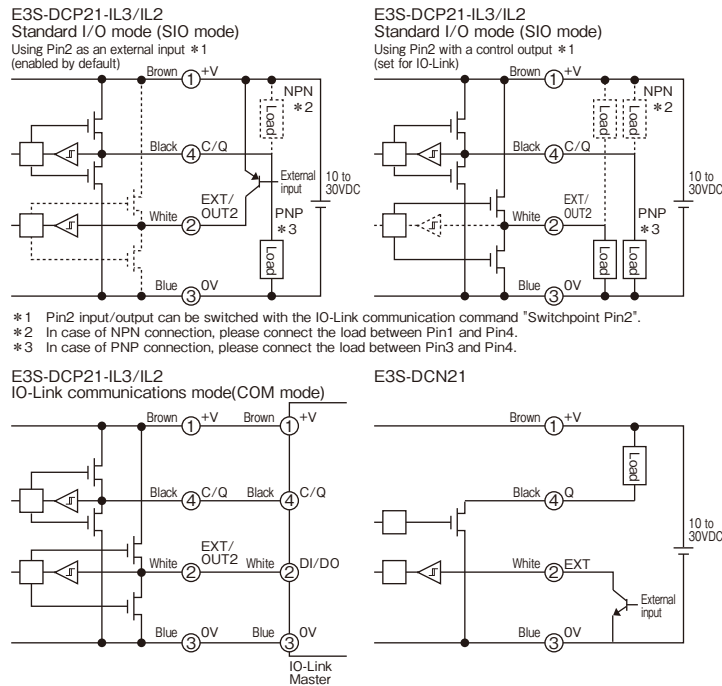
PRECAUTIONS FOR CORRECT USE

· Note that the water-resistant function is impaired if installing the photoelectric sensor by hitting it with a hammer and so on.
· If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable.
· To extend a cord in the standard I/O mode, use a cable of 0.3mm^2 or more and keep the length 100m or less. Keep the length 20m or less if using the sensor in the IO-Link mode.
· Apply a screw tightening torque of 2.0N・m or less.
· If a commercial switching regulator is used, ground the FG (frame ground) terminal.
· The Sensor will be able to detect objects 100 ms after the power supply is tuned ON. Start using the Sensor 100 ms or more after turning ON the power supply.If the load and the sensor are connected to separate power supplies,be sure to turn ON the sensor first.
· Do not press the button with anything sharp such as a screwdriver because it might be damaged.
· Output pulses may occur when the power supply is turned OFF. We recommend that you turn OFF the power supply to the load or load line first.
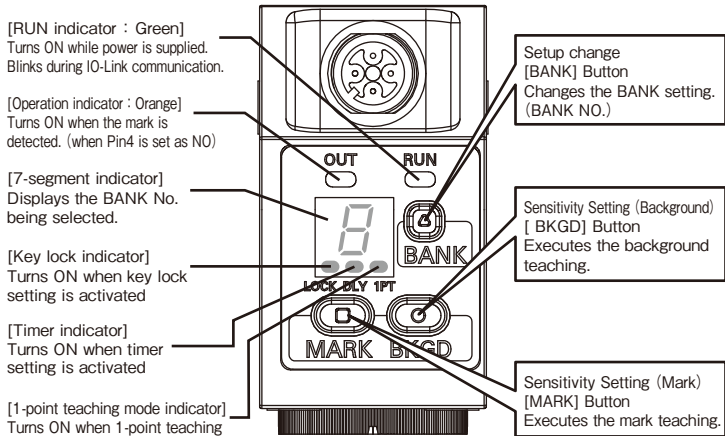
1 Installation

1-1 Dimensions

※The optical axis can be changed by swapping the lens and cover.
※The connector section can be revolved in a range of 90°. (Unit : mm)

M12 CONNECTOR

Replacing the lens or cover
※Tighten the lens until it reaches the chassis.

OMRON adaptive connector cord: XS5F / XS5W series
XS2F / XS2W series

PIN No.	E3S-DCP21-IL3 E3S-DCP21-IL2	E3S-DCN21	
①	+V	+V	EXT : External input
②	EXT *	EXT	Q : Control output
③	0V	0V	C : IO-Link communications
④	C/Q	Q	

* It can be set as the control output with IO-Link.

1-2 Input/Output Circuit Diagram

E3S-DCP21-IL3/IL2
Standard I/O mode (SIO mode)
Using Pin2 as an external input ＊1
(enabled by default)

E3S-DCP21-IL3/IL2
Standard I/O mode (SIO mode)
Using Pin2 with a control output ＊1
(set for IO-Link)

＊1 Pin2 input/output can be switched with the IO-Link communication command "Switchpoint Pin2".
＊2 In case of NPN connection, please connect the load between Pin1 and Pin4.
＊3 In case of PNP connection, please connect the load between Pin3 and Pin4.

E3S-DCP21-IL3/IL2
IO-Link communications mode(COM mode)
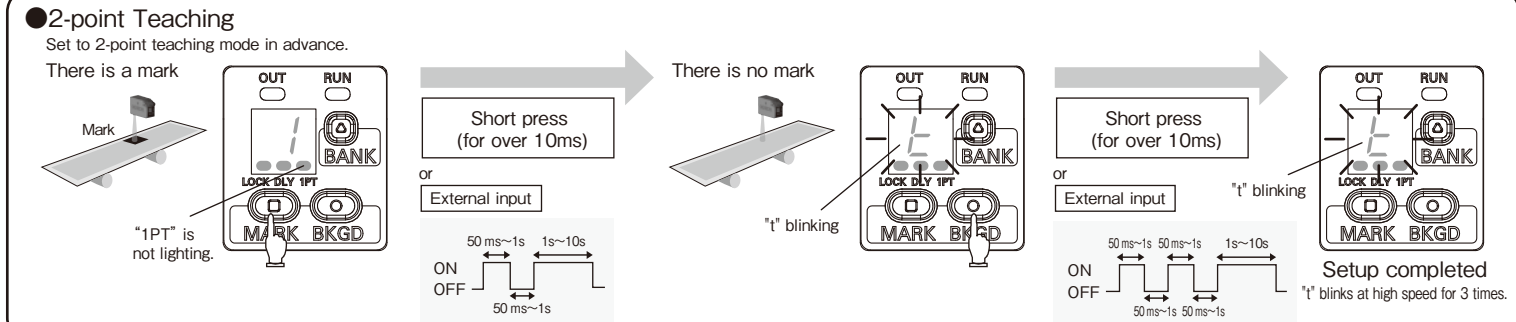
E3S-DCN21

IO-Link Master

2 Settings

For E3S-DCP21-IL3/IL2, setting can be performed with IO-Link communication. Refer to the separate index list
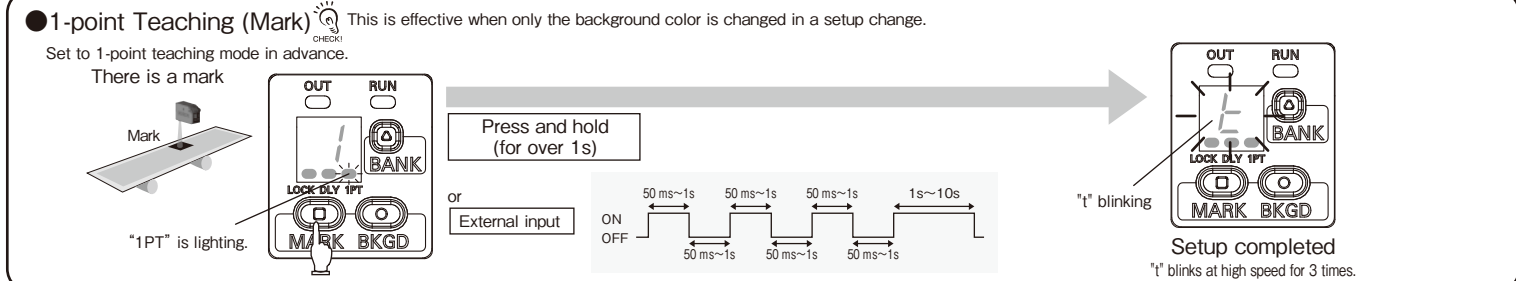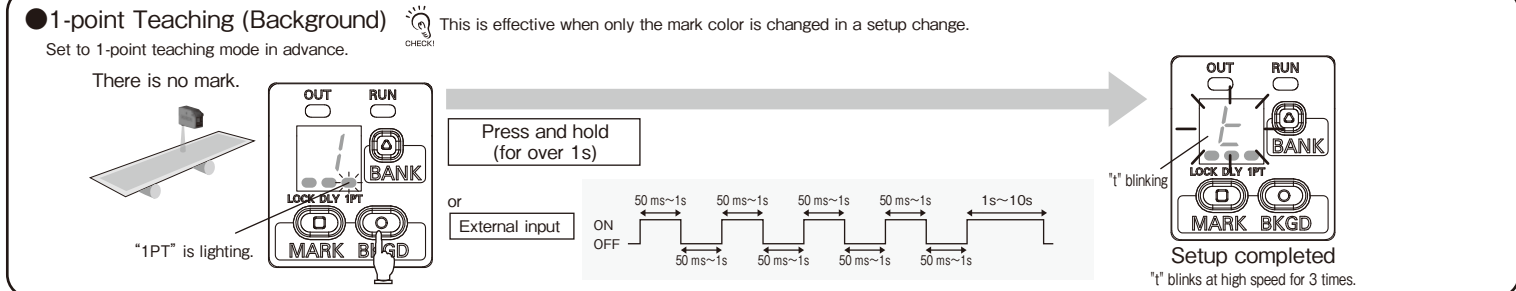
2-1 Setting and Display Overview

[RUN indicator : Green]
Turns ON while power is supplied.
Blinks during IO-Link communication.

[Operation indicator : Orange]
Turns ON when the mark is detected. (when Pin4 is set as NO)

[7-segment indicator]
Displays the BANK No. being selected.

[Key lock indicator]
Turns ON when key lock setting is activated

[Timer indicator]
Turns ON when timer setting is activated

[1-point teaching mode indicator]
Turns ON when 1-point teaching mode.

Setup change [BANK] Button
Changes the BANK setting. (BANK NO.)

Sensitivity Setting (Background) [BKGD] Button
Executes the background teaching.

Sensitivity Setting (Mark) [MARK] Button
Executes the mark teaching.

2-2 Operation mode

Operation mode	Description	Response time (Max.)
2-point teaching mode (Enabled as default)	This mode can be suited for identifying 2 colors. The most stable emission color for the detection is automatically set by performing teaching.	50μs
1-point teaching mode	This mode can be used suited identifying 1 color among multiple colors. Judges with 3 colors of RGB.	150μs

2-point teaching mode ⇄ 1-point teaching mode

Press and hold MARK and BKGD for 1s or more.

"1PT" is lighting. "1PT" is not lighting.

2-3 Teaching

①Detecting if there is a mark

●2-point Teaching
Set to 2-point teaching mode in advance.

There is a mark → Short press (for over 10ms) or External input → There is no mark → Short press (for over 10ms) or External input → Setup completed

"1PT" is not lighting.

ON / OFF 50 ms~1s 1s~10s
"t" blinking

ON / OFF 50 ms~1s 50 ms~1s 50 ms~1s 1s~10s
"t" blinks at high speed for 3 times.

②Detecting only the certain-colored mark

●1-point Teaching (Mark)
This is effective when only the background color is changed in a setup change.
Set to 1-point teaching mode in advance.

There is a mark → Press and hold (for over 1s) or External input → Setup completed

"1PT" is lighting.

ON / OFF 50 ms~1s 50 ms~1s 50 ms~1s 1s~10s
"t" blinking
"t" blinks at high speed for 3 times.

③Detecting only the certain-colored background

●1-point Teaching (Background)
This is effective when only the mark color is changed in a setup change.
Set to 1-point teaching mode in advance.

There is no mark. → Press and hold (for over 1s) or External input → Setup completed

"1PT" is lighting.

ON / OFF 50 ms~1s 50 ms~1s 50 ms~1s 50 ms~1s 1s~10s
"t" blinking
"t" blinks at high speed for 3 times.

④Adjusting the setup using a moving mark without stopping the line

●Automatic Teaching
This is possible by external input or IO-Link only.
Automatic multi-teaching is more stable than automatic single-teaching.
Set to 2-point teaching mode in advance.

The mark is passing. → Setup completed

"1PT" is not lighting.

Multi-teaching
External input ON / OFF 1s ~ 10s
Teaching time
Teaching is completed when the mark has passed seven times within 60s.
50ms~1s

Single-teaching
External input ON / OFF 1s ~ 10s
50ms ~ 1s
Teaching time
Teaching is completed when the mark has Passed one time within 60s.

"t" blinking
"t" blinks at high speed for 3 times.

③ Convenient Setting Features

> **CHECK!** For E3S-DCP21-IL3/IL2, setting can be performed with IO-Link communication. Refer to the separate index list

3-1 Preventing Malfunction

● **Key Lock Function** Switches enable/disable for the button input.

> **CHECK!** The key lock can be deactivated with the same steps.

Press and hold (for over 3s) → "LOCK" is lighting

3-2 Delaying the output time

● **Off-delay** Sets the delay time until the output is turned OFF.

> **CHECK!** The Off-delay can be deactivated with the same steps.

Press and Hold both (for 1 sec. or longer) → "DLY" is lighting.

Sensing object: Mark / Background
Output: ON / OFF — 10ms

3-3 Using multiple settings separately for change-over etc.

● **BANK switching** Up to 9 (9 BANKs) of the configuring operation modes and teaching results can be saved and these settings can be switched.

Button operation

A BANK is being selected. — 7-segment indication blinking — 7-segment indication blinking

Short press (less than 1s) — Short press (less than 1s) — After 2s → Switching completed

*BANKs 1-9 can be set up by pressing the button in order.

or External input — Input pulse for the number of times of BANK number setup.

(Ex.) Set to BANK 3

ON / OFF
50ms~1s 50ms~1s 50ms~1s
50ms~1s 50ms~1s The BANK is determined after 1s or more.
→ Switching completed

> **CHECK!** Settings of key lock, off-delay and others are common to each BANK.

3-4 Initializing settings of each BANK

● **BANK Reset** Initialize the settings of the BANK selected(Initialization for each BANK)

Change to the desired BANK to be initialized. — A BANK is being selected. 7-segment indication blinking — Setup completed

Short press (less than 1s) — Press and Hold both (for 1 sec. or longer)

3-5 Factory-default

● **Factory-default** Initialize all settings to the Factory-default. (Initialization for all BANKs)

Initialization confirmation screen — 7-segment indication blinking — 7-segment indication blinking — Initialization completed

Press and Hold both (for 1 sec. or longer) — Press and Hold both (for 1 sec. or longer)

④ Maintenance

4-1 Error Display

Error Name / Display*	Cause	Remedy
Internal communication error — Blinking alternately — E-5PC	An error has occurred on the system.	Start up the sensor again. If the error occurs again, replace the sensor.
EPPROM system area data error — Blinking alternately — E-595	Reading out or writing in the internal data has failed	Start up the sensor again. If the error occurs again, replace the sensor.
EPPROM user setup area data error — Not lighting / Blinking — E-dAt	Reading out or writing in the internal data has failed	Start up the sensor again. If the sensor is not recovered, initialize the setting.
Output short circuit detection error — Blinking / Not lighting — E-oUt	Over current flowing to the control output	Check wiring and connection of the connector again.
IO-Link communications no response error — Continuous operation / Not lighting	Communications with the IO-Link master has failed.	Check the connection with the IO-Link master.
Teaching error — Continuous operation — E-tCH	Teaching has failed.	Put the workpiece in the detection area and try teaching again.

*Letters are displayed in order by the 7-segment indication.

4-2 Ratings and Specifications

Model		E3S-DCP21-IL3	E3S-DCP21-IL2	E3S-DCN21
Input-output method		Push-pull output, input/output (selectable with IO-Link and "input" is set as default)		NPN output, input
Sensing distance		10±3mm		
Spot size (reference)		1×4mm		
Light source		RGB LED		
Power supply voltage		10 to 30VDC (including 10% ripple (p-p))		
Current consumption		960 mW max. (Reference: Power supply voltage 24V, Current consumption 40mA max.)		
Control output		Load current: 100mA max. (30V DC max.)		
External input		High: +V to +V-1.5V, within -1mA / Low: 1.5V to 0V, within +1mA		
Operation configuration		High when mark is detected.		ON when mark is detected.
Protection circuit		Power supply reverse polarity protection, output short-circuit protection and output incorrect connection protection		
Response time		Operate or reset : 50μs max. for each (2-point teaching mode) / Operate or reset : 150μs max. for each (1-point teaching mode)		
Sensitivity adjustment		Teaching method		
Ambient illumination		Incandescent lamp: 3,000 lx max.		
Ambient temperature		Operating:-10 to +55℃, Storage:-25 to +70℃ (no freezing and condensation)		
Ambient humidity		Operating:35 to 85%RH, Storage:35 to 95%RH		
Insulation resistance		20MΩ min.(at 500VDC)		
Dielectric strength		1000 VAC 50/60 Hz 1min		
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude or 100 m/s² 2 hours each in X, Y, and Z directions		
Shock resistance		500m/s² 3 times each in X, Y, and Z directions		
Degree of protection		IEC60529 : IP67		
Connection method		M12 4-pole Connector type (M12, 4-pin)		
Indicator		Operation indicator (Orange), RUN indicator (Green), 7-segment indicator (White), Key lock indicator (White), Timer indicator (White), 1-point teaching mode indicator (White)		
Material	Case	Diecast zinc (nickel-plated brass)		
	Lens	PMMA		
	Lens cover	ABS		
	Display	ABS		
	Button	Elastomers		
	Connector	Diecast zinc (nickel-plated brass)		
Accessories		Instruction Sheet, Compliance Information Sheet		
Major IO-Link functions ([ ]: factory shipment setting)		· Operation mode switching between NO and NC　[NO] · Timer function of the control output and timer time selecting function (Select a function from disabled, ON delay, OFF delay, one-shot or ON/OFF delay .)　[Disabled] (Select a timer time of 1-5000ms)　[10ms] · Selecting function of ON delay timer time for instability (0 (disabled)-1000ms)　[Disabled] · Monitor output function (PD output indicating a relative detection quantity) · Energizing time read-out function (unit: h) · Initialize the settings function "Restore the factory settings"		—
IO-Link communications specification	IO-Link specification	Ver.1.1		—
	Transmission speed	E3S-DCP21-IL3 : COM3 (230.4kbps) E3S-DCP21-IL2 : COM2 (38.4kbps)		—
	Data length	PD size : 8byte		—

4-3 Time Chart

E3S-DCP21-IL3/IL2 (Push-pull output)

> **CHECK!** Inversion of operational logic, output delay and input/output can be switched with IO-Link communication.

Output mode	NO/NC setting *It can be switched in IO-Link	Time Chart
Standard I/O mode (Pin2 Output Settings)	NO *Default	Sensing object: Background / Mark; RUN indicator (Green): Lighting; Operation indicator (Orange): Not Lighting / Lighting; Pin4 output (NO): LOW / HIGH; Pin2 output (NO): LOW / HIGH; Load current (PNP connection): OFF / ON; Load current (NPN connection): ON / OFF
	NC	Sensing object: Background / Mark; RUN indicator (Green): Lighting; Operation indicator (Orange): Lighting / Not Lighting; Pin4 output (NC): HIGH / LOW; Pin2 output (NC): HIGH / LOW; Load current (PNP connection): ON / OFF; Load current (NPN connection): OFF / ON
IO-Link mode (Pin2 Output Settings)	NO *Default	Sensing object: Background / Mark; RUN indicator (Green) (1sec cycles Flashing); Operation indicator (Orange): Not Lighting / Lighting; Pin4 output (NO) (IO-Link communications); Pin2 output (NO): LOW / HIGH
	NC	Sensing object: Background / Mark; RUN indicator (Green) (1sec cycles Flashing); Operation indicator (Orange): Lighting / Not Lighting; Pin4 output (NC) (IO-Link communications); Pin2 output (NC): HIGH / LOW

E3S-DCN21 (NPN output)

	Time Chart
Sensing object	Background / Mark
RUN indicator (Green)	Lighting
Operation indicator (Orange)	Not Lighting / Lighting
Pin4 output (NO)	OFF / ON
Load current	OFF / ON