ø12 A2 Series Miniature Control Units

Short 22-mm-long body miniature control unit series with bright LED illumination face and snap-action switching.

- Degree of protection: IP40 and IP65 (IEC 60529)
- All series have terminals on the same plane.
- UL recognized, CSA certified

Applicable Standards	Mark	File No. or Organization
UL508		UL Recognition File No. E55996
CSA C22.2 No.14		CSA File No. LR 21451

Contact Ratings (Contact Block)

Rated Insulation Voltage		250V		
Rated Thermal Current		3A		
Operating Voltage (AC/DC)		24V	110V	220V
AC 50/60 Hz	Resistive Load	–	1.0A	0.5A
	Inductive Load	–	0.7A	0.5A
DC	Resistive Load	1.0A	0.2A	–
	Inductive Load	0.7A	0.1A	–
Contact Material		Silver		

- Minimum applicable load: 5V AC/DC, 3 mA (applicable range may vary with operating conditions and load types)

Weight

Weight (approx.)	AL2M-M11: 4g
	AL2M-P1: 4g
	AB2M-M1: 4g

Specifications

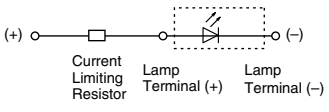
Operating Temperature		–25 to +55°C (no freezing)
Storage Temperature		–30 to +80°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Contact Resistance		50 mΩ maximum (initial value)
Insulation Resistance		100 MΩ minimum (500V DC megger)
Dielectric Strength	Switch Unit	Between live and dead metal parts: 2,000V AC, 1 minute Between terminals of different poles: 2,000V AC, 1 minute Between terminals of the same pole: 1,000V AC, 1 minute Between contact and lamp terminals: 1,500V AC, 1 minute
	Illumination Unit	Between live part and ground: 2,000V AC, 1 minute
Vibration Resistance		Damage limits, Operating extremes: 5 to 55 Hz, amplitude 0.75 mm
Shock Resistance		Damage limits: 500 m/s² (50G) Operating extremes: 200 m/s² (20G)
Mechanical Durability (minimum operations)		Momentary: 200,000 operations Maintained: 100,000 operations
Electrical Durability (minimum operations)		Momentary: 100,000 operations Maintained: 50,000 operations (Switching frequency 1200 operations/h)
Degree of Protection		IP40, IP65 (IEC 60529)

LED Lamp Ratings (LAD-S)

Built-in LED Part No.	LAD-SA	LAD-SG	LAD-SR	LAD-SY
Lamp Base	Exclusive for A series control units			
Forward Current (If)	20 mA			
Forward Voltage (Vf) (nominal)	2.2V	2.1V	1.7V	2.2V
Reverse Voltage (Vr)	4V			
Illumination Color	A	G	R	Y
LED Lamp Color	Amber Clear	Yellow Diffused	Red Clear	Yellow Clear
Applicable Lens Color	Amber	Green	Red	Yellow and White
Base Plastic Color	Red			
LED Lamp Life (reference value)	Approx. 50,000 hours (The illuminance reduces to 50% of the initial intensity when used on complete DC.)			
Operating Voltage & External Current-limiting Resistor (recommended value) (Note)	5V DC: 150Ω, 1/2W 6V DC: 200Ω, 1/2W 12V DC: 510Ω, 1W 24V DC: 1.1 kΩ, 1W			
Internal Circuit				

Note: When LED lamps are used on voltages other than the above, external resistor value R is determined by the following formula:
R = (operating voltage – Vf) / If

- LED lamps do not have a current-limiting resistor, and external resistors of recommended values for each voltage must be provided. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged. Because no protection diode is contained, ensure the correct polarity is observed.



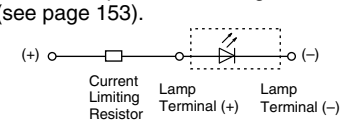
A2 Series Illuminated Pushbuttons & Pilot Lights ø12

Illuminated Pushbuttons & Pilot Lights

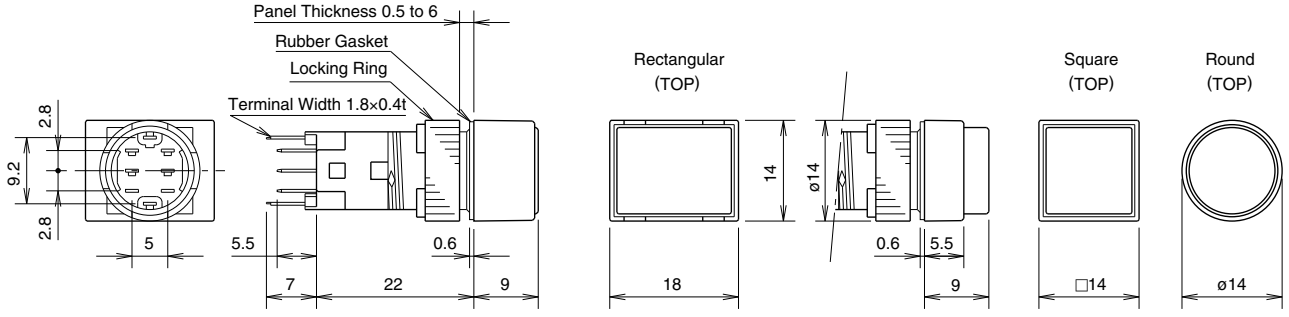
Package Quantity: 1

Shape	Operation	Contact	Part No. IP40	Part No. IP65	② Lens Color Code	LED Lamp Part No., Rated Current (External Resistor Recommended Value)
Round AL2M 	Momentary	SPDT	**AL2M-M11**②	**AL2M-M11P**②	Specify a color code in place of ② in the Part No. A: amber G: green R: red W: white Y: yellow	A: LAD-SA G: LAD-SG R: LAD-SR W/Y: LAD-SY Rated Current: 20 mA 5V DC: 150Ω, 1/2W 6V DC: 200Ω, 1/2W 12V DC: 510Ω, 1W 24V DC: 1.1 kΩ, 1W
		DPDT	**AL2M-M21**②	**AL2M-M21P**②		
	Maintained	SPDT	**AL2M-A11**②	**AL2M-A11P**②		
		DPDT	**AL2M-A21**②	**AL2M-A21P**②		
	Pilot Light	—	**AL2M-P1**②	**AL2M-P1P**②		
Square AL2Q 	Momentary	SPDT	**AL2Q-M11**②	**AL2Q-M11P**②		
		DPDT	**AL2Q-M21**②	**AL2Q-M21P**②		
	Maintained	SPDT	**AL2Q-A11**②	**AL2Q-A11P**②		
		DPDT	**AL2Q-A21**②	**AL2Q-A21P**②		
	Pilot Light	—	**AL2Q-P1**②	**AL2Q-P1P**②		
Rectangular AL2H 	Momentary	SPDT	**AL2H-M11**②	**AL2H-M11P**②		
		DPDT	**AL2H-M21**②	**AL2H-M21P**②		
	Maintained	SPDT	**AL2H-A11**②	**AL2H-A11P**②		
		DPDT	**AL2H-A21**②	**AL2H-A21P**②		
	Pilot Light	—	**AL2H-P1**②	**AL2H-P1P**②		

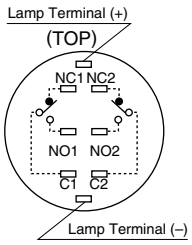
- LED lamps do not have a current-limiting resistor. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged.
- External current-limiting resistor is not necessary when an optional socket with built-in resistor is used (see page 153).
- AP2M series pilot lights (round bezel only) with built-in current-limiting resistors are also available.



Dimensions



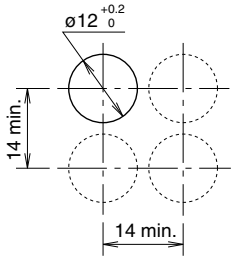
Terminal Arrangement



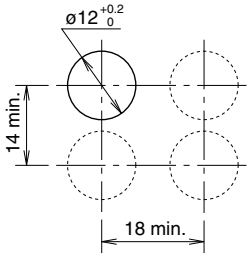
SPDT has NC1, NO1, and C1 only.

Mounting Hole Layout

Round/Square Units



Rectangular Units



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

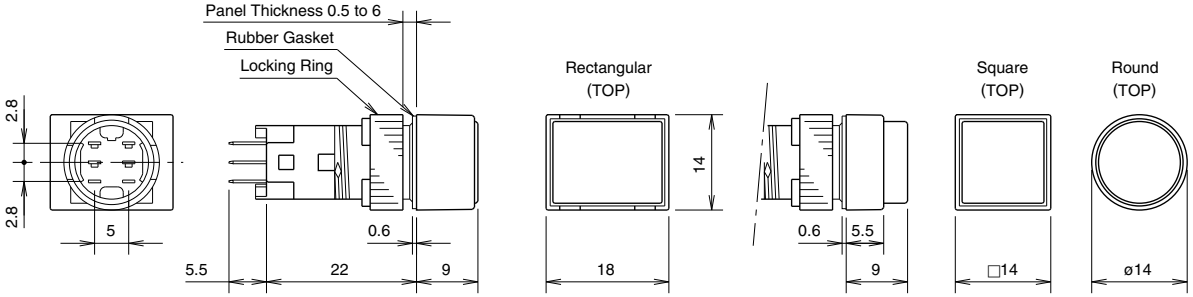
Pushbuttons

Package Quantity: 1

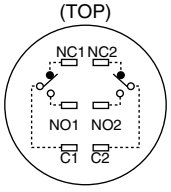
Shape	Button Style	Operation	Contact	Part No. IP40	Part No. IP65	Color Code ①②
Round AB2M 	Button	Momentary	SPDT	**AB2M-M1**①	**AB2M-M1P**①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	**AB2M-M2**①	**AB2M-M2P**①	
		Maintained	SPDT	**AB2M-A1**①	**AB2M-A1P**①	
			DPDT	**AB2M-A2**①	**AB2M-A2P**①	
	Lens	Momentary	SPDT	**AB2M-M1L**②	**AB2M-M1PL**②	A: amber G: green R: red W: white Y: yellow
			DPDT	**AB2M-M2L**②	**AB2M-M2PL**②	
		Maintained	SPDT	**AB2M-A1L**②	**AB2M-A1PL**②	
			DPDT	**AB2M-A2L**②	**AB2M-A2PL**②	
Square AB2Q 	Button	Momentary	SPDT	**AB2Q-M1**①	**AB2Q-M1P**①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	**AB2Q-M2**①	**AB2Q-M2P**①	
		Maintained	SPDT	**AB2Q-A1**①	**AB2Q-A1P**①	
			DPDT	**AB2Q-A2**①	**AB2Q-A2P**①	
	Lens	Momentary	SPDT	**AB2Q-M1L**②	**AB2Q-M1PL**②	A: amber G: green R: red W: white Y: yellow
			DPDT	**AB2Q-M2L**②	**AB2Q-M2PL**②	
		Maintained	SPDT	**AB2Q-A1L**②	**AB2Q-A1PL**②	
			DPDT	**AB2Q-A2L**②	**AB2Q-A2PL**②	
Rectangular AB2H 	Button	Momentary	SPDT	**AB2H-M1**①	**AB2H-M1P**①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	**AB2H-M2**①	**AB2H-M2P**①	
		Maintained	SPDT	**AB2H-A1**①	**AB2H-A1P**①	
			DPDT	**AB2H-A2**①	**AB2H-A2P**①	
	Lens	Momentary	SPDT	**AB2H-M1L**②	**AB2H-M1PL**②	A: amber G: green R: red W: white Y: yellow
			DPDT	**AB2H-M2L**②	**AB2H-M2PL**②	
		Maintained	SPDT	**AB2H-A1L**②	**AB2H-A1PL**②	
			DPDT	**AB2H-A2L**②	**AB2H-A2PL**②	

• Specify a color code in place of ① or ② in the Part No.

Dimensions



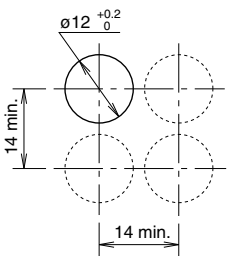
Terminal Arrangement



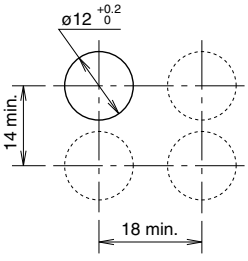
SPDT has NC1, NO1, and C1 only.

Mounting Hole Layout

Round/Square Units



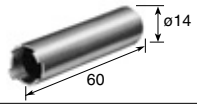
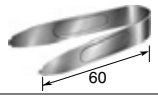
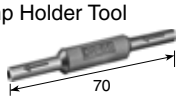
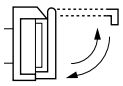
Rectangular Units



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

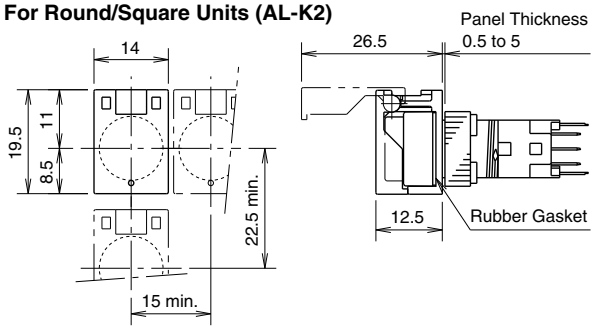
Accessories

Shape	Material		Part No.	Ordering Part No.	Package Quantity	Remarks
Locking Ring Wrench 	Metal (nickel-plated brass)		**MT-002**	**MT-002**	1	• Used to tighten the locking ring when installing the A2 control units into a panel.
Lens Removal Tool 	Stainless Steel		**MT-101**	**MT-101**	1	• Used to remove lens and button.
Lamp Holder Tool 	Rubber		**OR-66**	**OR-66**	1	• Used to remove and install LED lamps.
Switch Guard 	90° open	For round/ square unit	**AL-K2**	**AL-K2**	1	• Degree of protection: IP40 • Used to protect pushbuttons from inadvertent operation. • See page 154 for dimensions.  (remains 90° open)
		For rectangular unit	**AL-KH2**	**AL-KH2**	1	
Socket 	Solder Terminal		**AL-C2**	**AL-C2**	1	• Snaps on the rear of the A2 series control units. (see page 154 for dimensions)
	PC Board Terminal		**AL-C2V**	**AL-C2V**	1	
Socket with Built-in Resistor 	Solder Terminal	5V DC	**AL-C21**	**AL-C21**	1	Socket Bottom Color: Blue • A current limiting resistor is contained, eliminating the need for external resistors. • When using the socket with a built-in resistor, make sure that the continuous current is 1A maximum and the operating temperature is –25 to +40°C. In collective mounting, keep center-to center-spacing of 20 mm or more between adjacent units in consideration of built-in resistor heating. • See page 154 for dimensions.
		6V DC	**AL-C22**	**AL-C22**	1	Green
		12V DC	**AL-C23**	**AL-C23**	1	Yellow
		24V DC	**AL-C24**	**AL-C24**	1	Red
	PC Board Terminal	5V DC	**AL-C21V**	**AL-C21V**	1	Blue
		6V DC	**AL-C22V**	**AL-C22V**	1	Green
		12V DC	**AL-C23V**	**AL-C23V**	1	Yellow
		24V DC	**AL-C24V**	**AL-C24V**	1	Red
Terminal Cover 	Nylon		**AL-V2**	**AL-V2PN10**	10	• When wiring the terminals, insert the lead wires into the terminal cover holes before soldering. • Terminal cover is not attached and must be ordered separately.
Dust Cover 	For round units		**AL-D2**	**AL-D2**	1	• When mounting the control units with the dust covers installed, refer to mounting hole layout on page 154. • Operating temperature: –10 to +55°C • Material Front part: Elastomer (transparent) Rear part: Polypropylene (black) • See page 154 for dimensions and mounting hole layout.
	For square units		**AL-DQ2**	**AL-DQ2**	1	
	For rectangular units		**AL-DH2**	**AL-DH2**	1	
Mounting Hole Plug 	Nitryl rubber (black)		**AL-B2**	**AL-B2PN05**	5	• Degree of protection: IP65

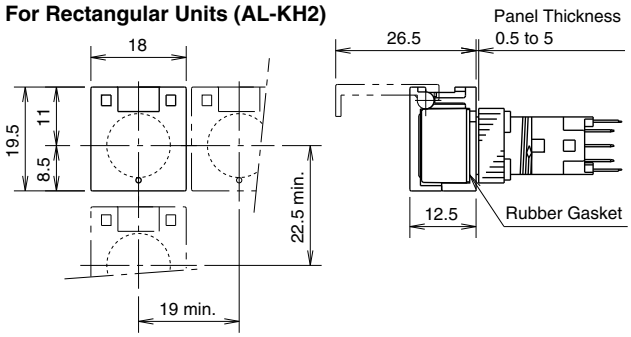
Dimensions

Switch Guard

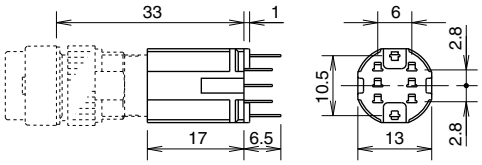
For Round/Square Units (AL-K2)



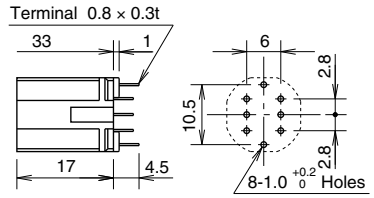
For Rectangular Units (AL-KH2)



Socket (AL-C2, AL-C2V, AL-C2□)



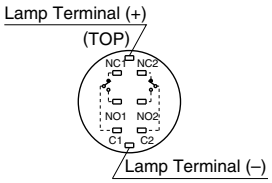
Solder Terminal (AL-C2)

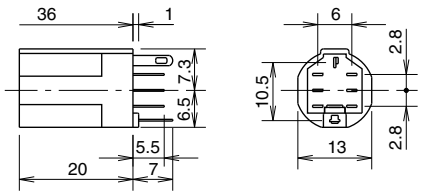


PC Board Terminal (AL-C2V)

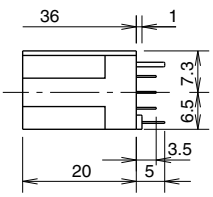
Panel Cut-out Bottom View

Terminal Arrangement

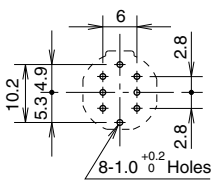




Solder Terminal with Built-in Resistor (AL-C2□)

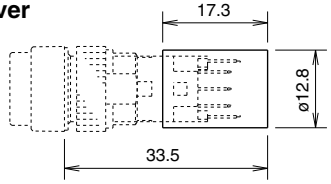


PC Board Terminal with Built-in Resistor (AL-C2□V)



Panel Cut-out Bottom View

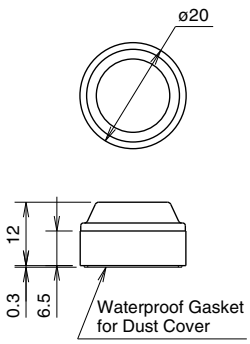
Terminal Cover (AL-V2)



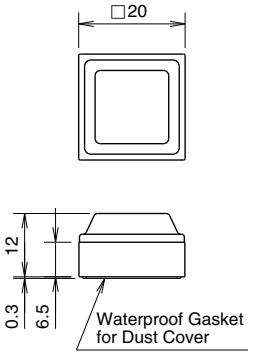
Note: When wiring the terminals, insert the lead wires into the terminal cover holes before soldering.

Dust Cover

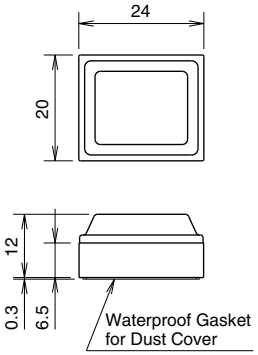
For Round Units (AL-D2)



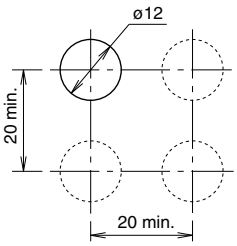
For Square Units (AL-DQ2)



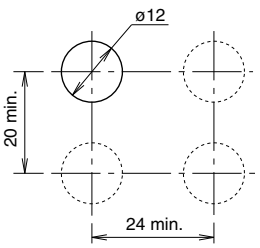
For Rectangular Units (AL-DH2)



Mounting Hole Centers (Round Units, Square Units)



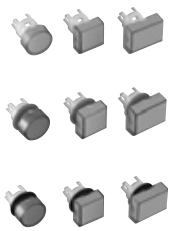
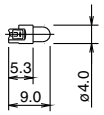
(Rectangular Units)



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

Maintenance Parts

Shape	Specification		Part No.	Ordering Part No.	Package Quantity	Color Code ①②		
Marking Plate 	Round		**AL2M-W**	**AL2M-WPN05**	5	White		
	Square		**AL2Q-W**	**AL2Q-WPN05**				
	Rectangular		**AL2H-W**	**AL2H-WPN05**				
Lens Unit 	For IP40 units	Round	**AL2M-LK1-②**	**AL2M-LK1-②PN02**	2	• Specify a color code in place of ② in the Part No. A: amber G: green R: red W: white Y: yellow		
		Square	**AL2Q-LK1-②**	**AL2Q-LK1-②PN02**				
		Rectangular	**AL2H-LK1-②**	**AL2H-LK1-②PN02**				
	For IP65 illuminated pushbuttons	Round	**AL2M-LK2-②**	**AL2M-LK2-②**	1			
		Square	**AL2Q-LK2-②**	**AL2Q-LK2-②**				
		Rectangular	**AL2H-LK2-②**	**AL2H-LK2-②**				
	For IP65 pilot lights	Round	**AL2M-LK3-②**	**AL2M-LK3-②**				
		Square	**AL2Q-LK3-②**	**AL2Q-LK3-②**				
		Rectangular	**AL2H-LK3-②**	**AL2H-LK3-②**				
Button Unit 	For IP40 pushbuttons	Round	**AB2M-BK1-①**	**AB2M-BK1-①PN02**	2	• Specify a color code in place of ① in the Part No. B: black G: green R: red S: blue W: white Y: yellow		
		Square	**AB2Q-BK1-①**	**AB2Q-BK1-①PN02**				
		Rectangular	**AB2H-BK1-①**	**AB2H-BK1-①PN02**				
	For IP65 pushbuttons	Round	**AB2M-BK2-①**	**AB2M-BK2-①**	1			
		Square	**AB2Q-BK2-①**	**AB2Q-BK2-①**				
		Rectangular	**AB2H-BK2-①**	**AB2H-BK2-①**				
LED Lamp  Current-limiting resistor is not contained.  All dimensions in mm.	Illumination color: amber		**LAD-SA**	**LAD-SA**	1	Lens color	Amber	LED color: amber clear
				LAD-SAPN10	10			
	Illumination color: green		**LAD-SG**	**LAD-SG**	1		Green	LED color: yellow diffused
				LAD-SGPN10	10			
	Illumination color: red		**LAD-SR**	**LAD-SR**	1		Red	LED color: clear red
				LAD-SRPN10	10			
	Illumination color: yellow		**LAD-SY**	**LAD-SY**	1		White/ Yellow	LED color: yellow clear
				LAD-SYPN10	10			

Safety Precautions

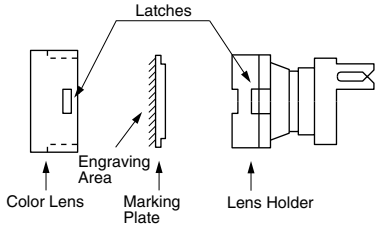
- Turn off the power to A series control units before starting installation, removal, wiring, maintenance, and inspection of the control units. Failure to turn power off may cause electrical shocks or fire hazard.
- To avoid burning your hand, use the lamp holder tool when replacing lamps.
- For wiring, use wires of a proper gauge to meet the voltage and current requirements. Failure to tighten terminal screws may cause overheating and create a fire hazard.

Operating Instructions

Replacement of Lens and Marking Plate

Removal

Remove the lens assembly (color lens, marking plate, lens holder, and spring) by holding the color lens recesses with the Lens Removal Tool (MT-101) and pulling it out. Remove the marking plate by disengaging the latches between the color lens and lens holder.
The marking plate must be engraved on the front side as shown below.



Installation

Place the marking plate on the lens holder in the correct direction, and press the color lens onto the lens holder to engage the latches. Put the spring on the lens holder and insert the lens holder into the housing in the correct direction.

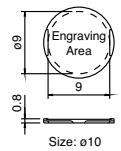
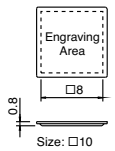
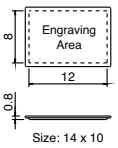
Installing Non-illuminated Button

Non-illuminated pushbuttons contain a marking plate like illuminated units. Be sure to install the marking plate when replacing the button.

Marking

For A series illuminated pushbuttons, legends and symbols can be engraved on the built-in marking plates, or printed film can be inserted under the lens.

Marking Plate & Engraving Area

Lens	Round	Square	Rectangular
Built-in Marking Plate	 Size: ø10	 Size: □10	 Size: 14 x 10
	• Engraving must be made on the engraving area less than 0.5mm deep. • The marking plate is made of white acrylic resin.		

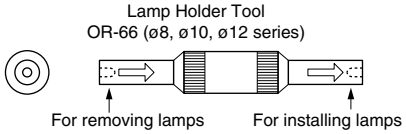
Replacing the LED Lamp

Removal

Use the lamp holder tool (OR-66) to remove lamps. Do not use pliers.

Installation

Use the lamp holder tool (OR-66) to install lamps. Note the correct side of the tool for removal or installation.



Panel Mounting

When mounting the control units onto a panel, use the optional locking ring wrench (MT-002) to tighten the locking ring. Do not use pliers. Tightening torque must not exceed 0.78 N·m. Excessive tightening will damage the locking ring.

Wiring

Solder the terminal at 350°C within 3 seconds using a 60W soldering iron. Sn-Ag-Cu is recommended when using lead-free solder. When soldering, do not touch the control unit with the soldering iron. Also ensure that no tensile force is applied to the terminal. Do not bend the terminal or apply excessive force to the terminal.
Use non-corrosive rosin flux.

Installing the Socket

Install the socket on the control unit with the TOP markings on the control unit and the socket placed in the same direction.

Operating Voltage of LED Lamps

The operating voltage is measured at complete DC. When using a pulsating voltage such as a full-wave rectification voltage, keep peak currents within the forward current If. Peak currents exceeding the If may shorten the LED lamp life.

Other Notes

Close Proximity Mounting

When mounting pilot lights or illuminated pushbuttons collectively or lighting them continuously, heat may cause the ambient temperature to rise above the rated operating temperature. When the mounting panel is not made of metal or when the control units are mounted in an enclosed panel, provide for ventilation or lower the operating voltage.

Replacement of Buttons (Illuminated/Non-illuminated)

Do not replace buttons of maintained action units while the button is in the locked position. Replacing the button in the locked position may damage the internal mechanism. Be sure to release the button before replacing.

Operating and Storage Environment

1. Make sure that the operating/storage temperature and humidity are within the ratings.
2. Do not use enclosed units (IP40) in an environment subject to oil, water or dust accumulation. In such an area, use the waterproof/oiltight units (IP65).

Microswitch Contacts

Do not connect NO and NC contacts of the microswitch to different voltages or different power sources to prevent a dead short-circuit.

IP65 Units

IP65 units are evaluated by conventional cutting and cooling oils, and can not be used with some special oils. Contact IDEC for resistance against special oils.