ø12 A2 Series Miniature Control Units

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

- Available in enclosed (IP40) and waterproof (IP65), and oiltight types.
- 12-mm mounting holes
- All series have terminals on the same plane.
- UL recognized, CSA certified

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)

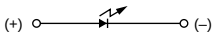
Weight

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

Specifications

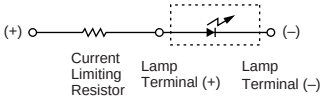
Operating Temperature		–25 to +55°C (no freezing)
Storage Temperature		–30 to +80°
Operating Humidity		45 to 85% RH (no condensation)
Contact Resistance		50 mΩ maximum (initial value)
Insulation Resistance		100 MΩ minimum (500V DC megger)
Dielectric Strength	Switch Unit	Between live and dead metal parts: 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		Operating extremes: 5 to 55 Hz, amplitude 0.75 mm
Shock Resistance		Damage limits: 500 m/s^2 (50G) Operating extremes: 200 m/s^2 (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		Enclosed (IP40) Waterproof, dust-tight (IP65)

LED Lamp Ratings (LAD-S Type)

Type 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% 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.



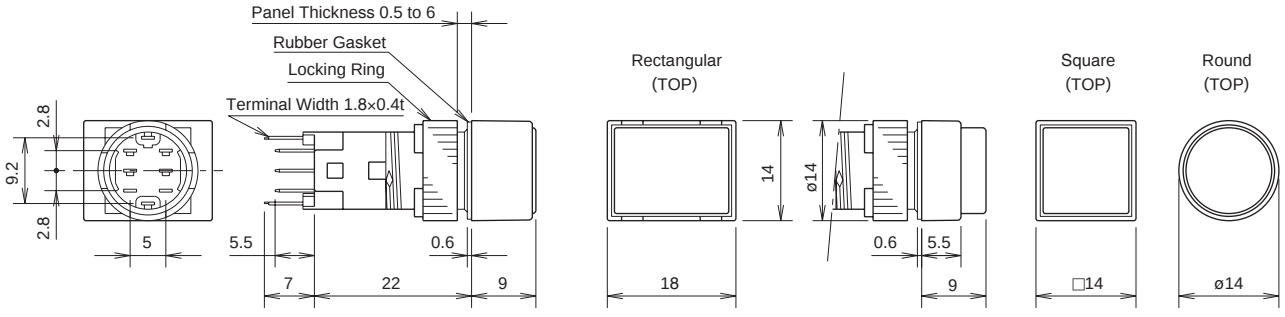
AL2 LED Illuminated Pushbuttons & Pilot Lights

Shape	Operation Type	Contact	Type No. IP40	Type No. IP65	② Lens Color Code	LED Lamp Type No., Rated Current (External Resistor Recommended Value)
Round AL2M  Marking plate size: ø10 mm Engraving area: ø8.2 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL2M-M11②	AL2M-M11P②	Specify a color code in place of ② in the Type 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-M21②	AL2M-M21P②		
	Maintained	SPDT	AL2M-A11②	AL2M-A11P②		
		DPDT	AL2M-A21②	AL2M-A21P②		
	Pilot Light	—	AL2M-P1②	AL2M-P1P②		
Square AL2Q  Marking plate size: □10 mm Engraving area: □8.2 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL2Q-M11②	AL2Q-M11P②		
		DPDT	AL2Q-M21②	AL2Q-M21P②		
	Maintained	SPDT	AL2Q-A11②	AL2Q-A11P②		
		DPDT	AL2Q-A21②	AL2Q-A21P②		
	Pilot Light	—	AL2Q-P1②	AL2Q-P1P②		
Rectangular AL2H  Marking plate size: 10 × 14 mm Engraving area: 8.2 × 12.2 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL2H-M11②	AL2H-M11P②		
		DPDT	AL2H-M21②	AL2H-M21P②		
	Maintained	SPDT	AL2H-A11②	AL2H-A11P②		
		DPDT	AL2H-A21②	AL2H-A21P②		
	Pilot Light	—	AL2H-P1②	AL2H-P1P②		

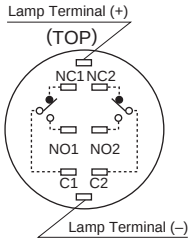
- LED lamps do not have a current-limiting resistor. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged.
- External current-limiting resistor is not necessary when an optional socket with built-in resistor is used (see page 27).
- AP2M series pilot lights (round bezel only) with built-in current-limiting resistors are also available.

LED Lamp Internal Circuit (+) (–)

Dimensions



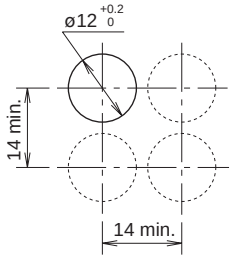
Terminal Arrangement



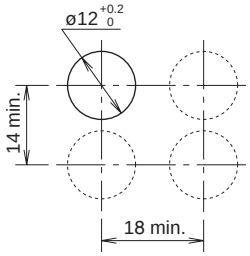
SPDT has NC1, NO1, and C1 only.

Mounting Hole Layout

• Round/Square Units



• Rectangular Units



Note: Determine mounting centers to ensure easy operation.

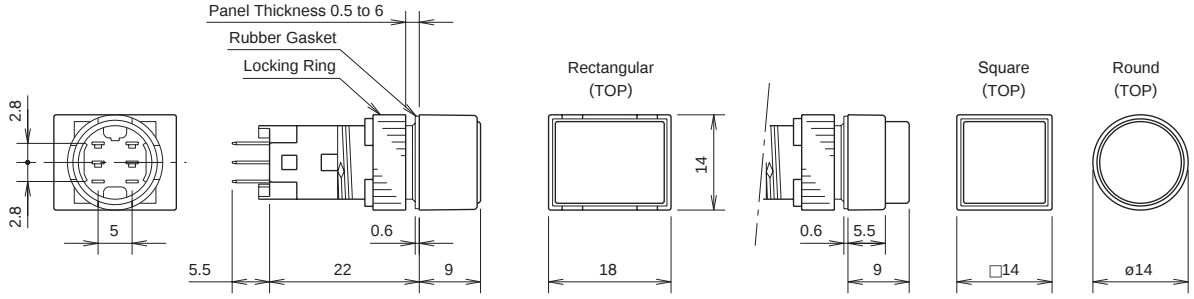
All dimensions in mm.

AB2 Pushbuttons

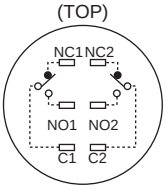
Shape	Button Type	Operation Type	Contact	Type No. IP40	Type No. IP65	Color Code ①②
Round AB2M 	Button	Momentary	SPDT	AB2M-M1①	AB2M-M1P①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	AB2M-M2①	AB2M-M2P①	
		Maintained	SPDT	AB2M-A1①	AB2M-A1P①	
			DPDT	AB2M-A2①	AB2M-A2P①	
	Illumination Lens	Momentary	SPDT	AB2M-M1L②	AB2M-M1PL②	A: amber G: green R: red W: white Y: yellow
			DPDT	AB2M-M2L②	AB2M-M2PL②	
		Maintained	SPDT	AB2M-A1L②	AB2M-A1PL②	
			DPDT	AB2M-A2L②	AB2M-A2PL②	
Square AB2Q 	Button	Momentary	SPDT	AB2Q-M1①	AB2Q-M1P①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	AB2Q-M2①	AB2Q-M2P①	
		Maintained	SPDT	AB2Q-A1①	AB2Q-A1P①	
			DPDT	AB2Q-A2①	AB2Q-A2P①	
	Illumination Lens	Momentary	SPDT	AB2Q-M1L②	AB2Q-M1PL②	A: amber G: green R: red W: white Y: yellow
			DPDT	AB2Q-M2L②	AB2Q-M2PL②	
		Maintained	SPDT	AB2Q-A1L②	AB2Q-A1PL②	
			DPDT	AB2Q-A2L②	AB2Q-A2PL②	
Rectangular AB2H 	Button	Momentary	SPDT	AB2H-M1①	AB2H-M1P①	B: black G: green R: red S: blue W: white Y: yellow
			DPDT	AB2H-M2①	AB2H-M2P①	
		Maintained	SPDT	AB2H-A1①	AB2H-A1P①	
			DPDT	AB2H-A2①	AB2H-A2P①	
	Illumination Lens	Momentary	SPDT	AB2H-M1L②	AB2H-M1PL②	A: amber G: green R: red W: white Y: yellow
			DPDT	AB2H-M2L②	AB2H-M2PL②	
		Maintained	SPDT	AB2H-A1L②	AB2H-A1PL②	
			DPDT	AB2H-A2L②	AB2H-A2PL②	

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

Dimensions



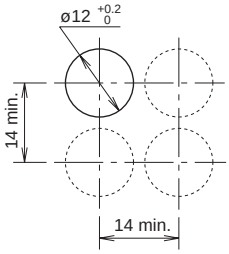
Terminal Arrangement



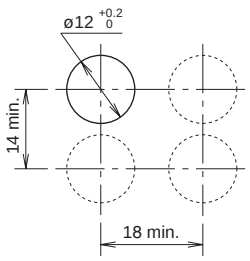
SPDT has NC1, NO1, and C1 only.

Mounting Hole Layout

• **Round/Square Units**



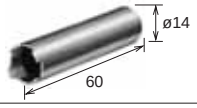
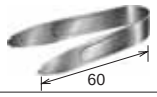
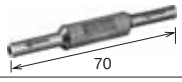
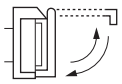
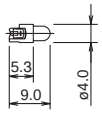
• **Rectangular Units**



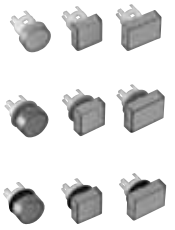
Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

Accessories

Shape	Material		Type No.	Ordering Type No.	Package Quantity	Dimensions (mm)
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. • Tighten the locking ring to a torque of 0.78 N·m maximum.
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 28 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 28 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 28 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 29. • Operating temperature: –10 to +55°C • Material Front part: Elastomer (transparent) Rear part: Polypropylene (black) • See page 29 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
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	

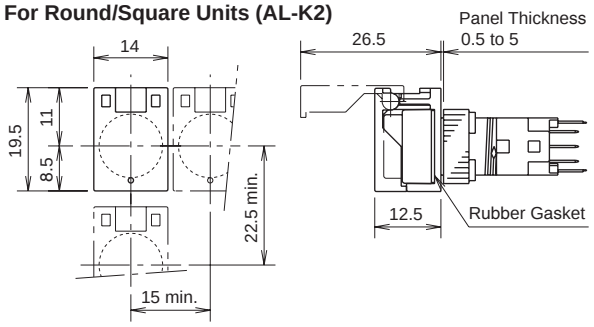
Maintenance Parts

Shape	Specification		Type No.	Ordering Type 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 Type 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 Type 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		

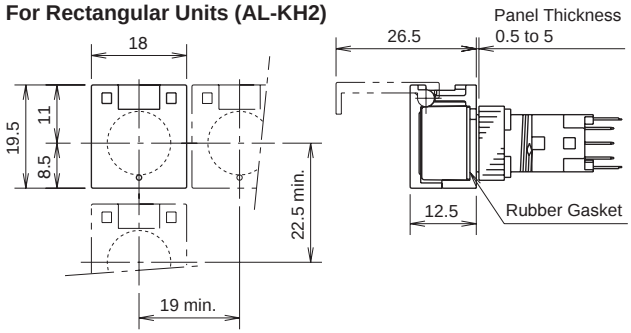
Dimensions

• Switch Guard

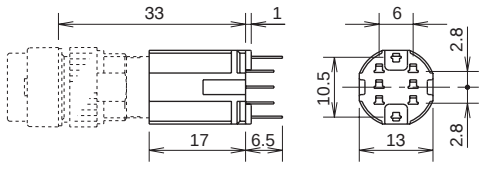
For Round/Square Units (AL-K2)



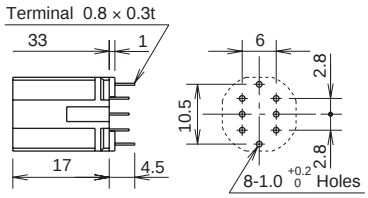
For Rectangular Units (AL-KH2)



• Socket (AL-C2, AL-C2V, AL-C2□)



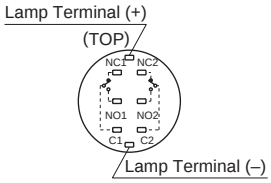
Solder Terminal Type (AL-C2)

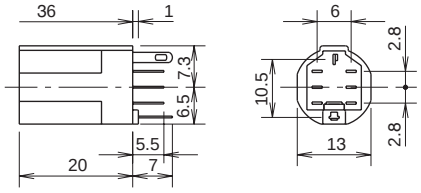


PC Board Terminal (AL-C2V)

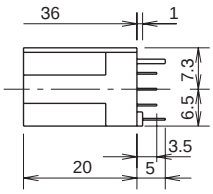
Panel Cut-out Bottom View

Terminal Arrangement

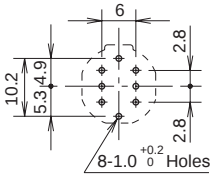




Solder Terminal Type with Built-in Resistor (AL-C2□)



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



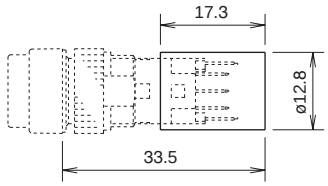
Panel Cut-out Bottom View

All dimensions in mm.

Dimensions

• Terminal Cover

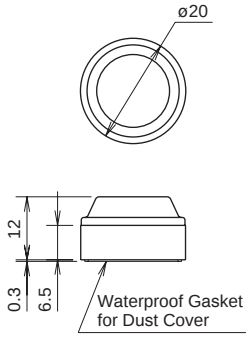
(AL-V2)



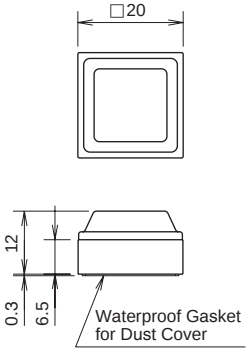
Note: When wiring the terminals, insert the lead wires into the terminal cover holes before soldering.

• Dust Cover

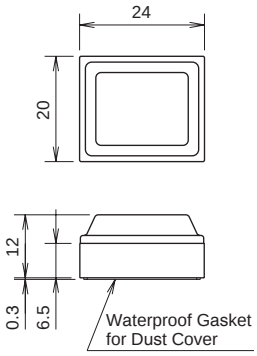
For Round Units (AL-D2)



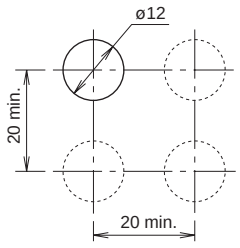
For Square Units (AL-DQ2)



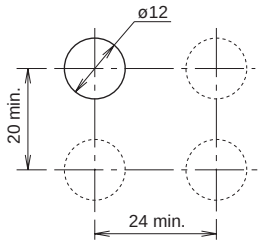
For Rectangular Units (AL-DH2)



Mounting Hole Centers (Round Units, Square Units)



(Rectangular Units)



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

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.

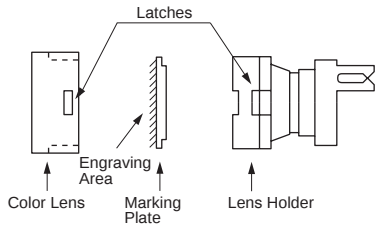
Operating Instructions

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.

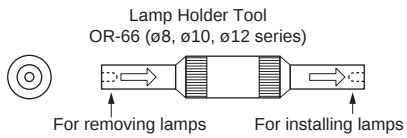
Replacing the LED Lamp

• 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 type 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 type 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 Type Units

IP65 type 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.

ø10 A1 Series Miniature Control Units

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

- Bright and clear LED illumination.
- 10-mm mounting holes
- All series have terminals on the same plane.
- UL recognized, CSA certified

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)

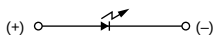
Weight

Weight (approx.)	AL1M-M11: 3g
	AL1M-P1: 3g
	AB1M-M1: 3g

Specifications

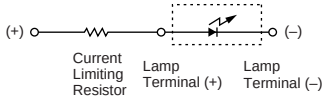
Operating Temperature		–25 to +55°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Contact Resistance		50 mΩ maximum (initial value)
Insulation Resistance		100 MΩ minimum (500V DC megger)
Dielectric Strength	Switch Unit	Between live and dead metal parts: 2,000V AC, 1 minute Between 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		Operating extremes: 5 to 55 Hz, amplitude 0.75 mm
Shock Resistance		Damage limits: 500 m/s^2 (50G) Operating extremes: 200 m/s^2 (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		Enclosed (IP40)

LED Lamp Ratings (LAD-S Type)

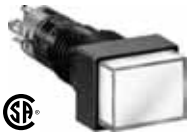
Type No.	LAD-SA	LAD-SG	LAD-SR	LAD-SY
Lamp Base	Exclusive for A series control units			
Forward Current (If)	20 mA			
Forward Voltage (Vf) (nominal)	2.2V	2.1V	1.7V	2.2V
Reverse Voltage (Vr)	4V			
Illumination Color	A	G	R	Y
LED Lamp Color	Amber Clear	Yellow Diffused	Red Clear	Yellow Clear
Applicable Lens 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% 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

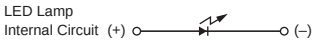
- LED lamps do not have a current-limiting resistor, and external resistors of recommended values for each voltage must be provided. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged. Because no protection diode is contained, ensure the correct polarity is observed.



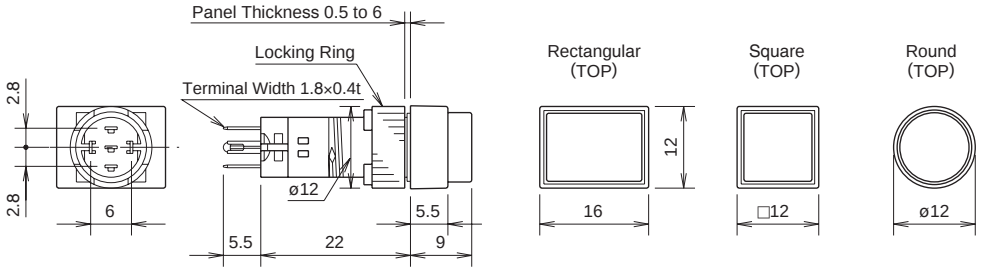
AL1 LED Illuminated Pushbuttons & Pilot Lights

Shape	Operation Type	Contact	Type No. IP40	② Lens Color Code	LED Lamp Type No., Rated Current (External Resistor Recommended Value)
Round AL1M  Marking plate size: ø8.5 mm Engraving area: ø7 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL1M-M11②	Specify a color code in place of ② in the Type 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
	Maintained	SPDT	AL1M-A11②		
	Pilot Light	—	AL1M-P1②		
Square AL1Q  Marking plate size: □8.5 mm Engraving area: □7 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL1Q-M11②		
	Maintained	SPDT	AL1Q-A11②		
	Pilot Light	—	AL1Q-P1②		
Rectangular AL1H  Marking plate size: 8.5 × 12.5 mm Engraving area: 7 × 11 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL1H-M11②		
	Maintained	SPDT	AL1H-A11②		
	Pilot Light	—	AL1H-P1②		

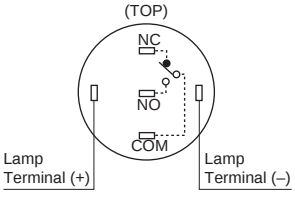
- LED lamps do not have a current-limiting resistor. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged.
- AP1M series pilot lights (round bezel only) with built-in current-limiting resistor are also available.



Dimensions

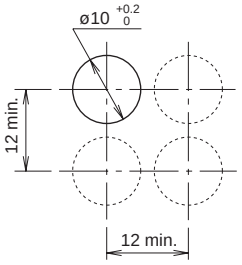


Terminal Arrangement (bottom view)

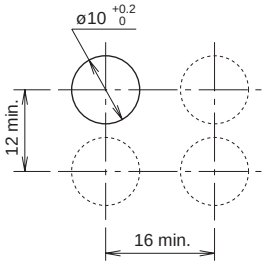


Mounting Hole Layout

• Round/Square Units



• Rectangular Units



Note: Determine mounting centers to ensure easy operation.

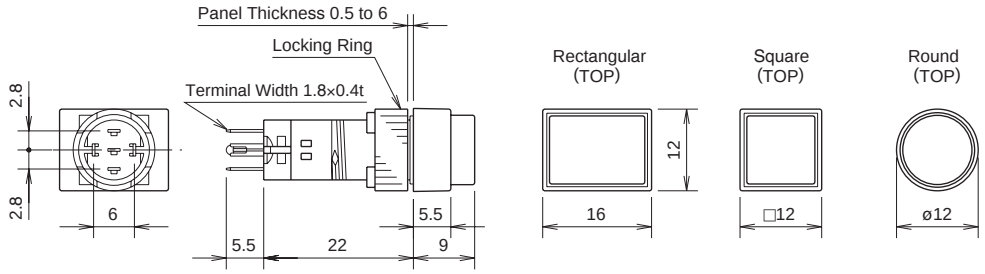
All dimensions in mm.

AB1 Pushbuttons

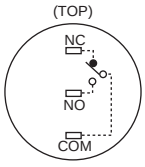
Shape	Button Type	Operation Type	Contact	Type No. IP40	Color Code ①②
Round AB1M 	Button	Momentary	SPDT	AB1M-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB1M-A1①	
	Illumination Lens	Momentary	SPDT	AB1M-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB1M-A1L②	
Square AB1Q 	Button	Momentary	SPDT	AB1Q-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB1Q-A1①	
	Illumination Lens	Momentary	SPDT	AB1Q-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB1Q-A1L②	
Rectangular AB1H 	Button	Momentary	SPDT	AB1H-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB1H-A1①	
	Illumination Lens	Momentary	SPDT	AB1H-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB1H-A1L②	

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

Dimensions



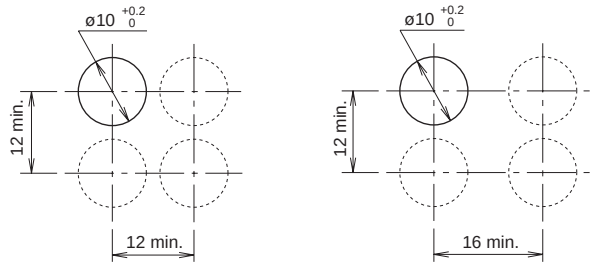
Terminal Arrangement (bottom view)



Mounting Hole Layout

• **Round/Square Units**

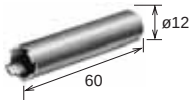
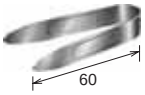
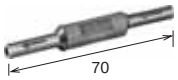
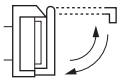
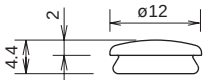
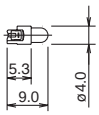
• **Rectangular Units**



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

Accessories

Shape	Material		Type No.	Ordering Type No.	Package Quantity	Dimensions (mm)
Locking Ring Wrench 	Metal (nickel-plated brass)		MT-003	MT-003	1	• Used to tighten the locking ring when installing the A1 control units into a panel. • Tighten the locking ring to a torque of 0.29 N·m maximum.
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-K1	AL-K1	1	• Used to protect pushbuttons from inadvertent operation. • See page 35 for dimensions.  (remains 90° open)
		For rectangular unit	AL-KH1	AL-KH1	1	
Socket 	Solder Terminal		AL-C1	AL-C1	1	• Snaps on the rear of the A1 series control units. (see page 35 for dimensions)
	PC Board Terminal		AL-C1V	AL-C1V	1	
Terminal Cover 	Nylon		AL-V1	AL-V1PN10	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.
Mounting Hole Plug 	Nitryl rubber (black)		AL-B1	AL-B1PN05	5	• Degree of protection: IP65 
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	Lens color: Green — LED color: yellow diffused
				LAD-SGPN10	10	
	Illumination color: red		LAD-SR	LAD-SR	1	Lens color: Red — LED color: clear red
				LAD-SRPN10	10	
	Illumination color: yellow		LAD-SY	LAD-SY	1	Lens color: White/ Yellow — LED color: yellow clear
				LAD-SYPN10	10	

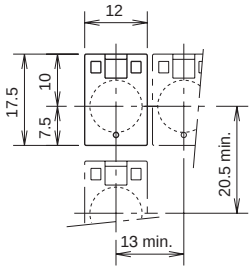
Maintenance Parts

Shape		Type No.	Ordering Type No.	Package Quantity	Color Code ①②
Marking Plate 	Round	AL1M-W	AL1M-WPN05	5	• White
	Square	AL1Q-W	AL1Q-WPN05		
	Rectangular	AL1H-W	AL1H-WPN05		
Lens Unit 	Round	AL1M-LK1-②	AL1M-LK1-②PN02	2	Specify a color code in place of ② in the Type No. A (amber), G (green), R (red) W (white), Y (yellow)
	Square	AL1Q-LK1-②	AL1Q-LK1-②PN02		
	Rectangular	AL1H-LK1-②	AL1H-LK1-②PN02		
Button Unit 	Round	AB1M-BK1-①	AB1M-BK1-①PN02		Specify a color code in place of ① in the Type No. B (black), G (green), R (red) S (blue), W (white), Y (yellow)
	Square	AB1Q-BK1-①	AB1Q-BK1-①PN02		
	Rectangular	AB1H-BK1-①	AB1H-BK1-①PN02		

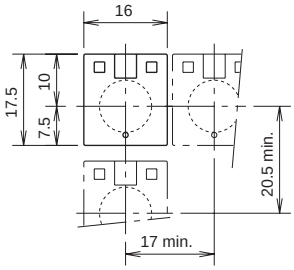
Dimensions

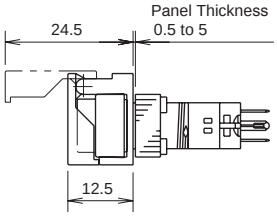
• Switch Guard

For Round/Square Units (AL-K1)

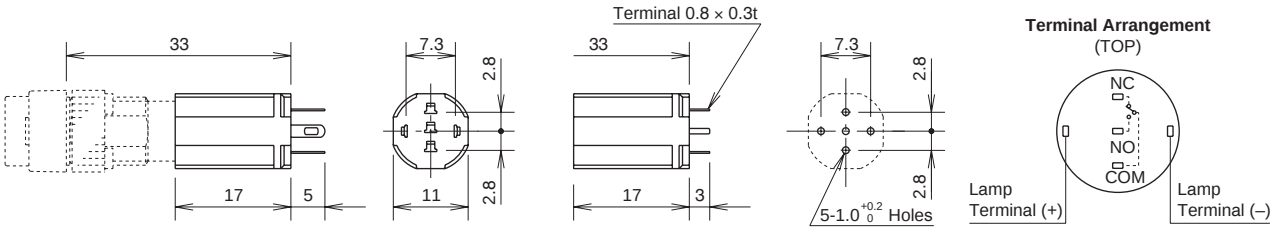


For Rectangular Units (AL-KH1)





• Socket (AL-C1, AL-C1V)



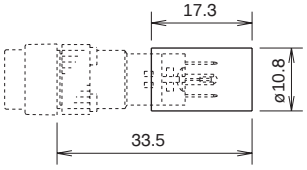
Solder Terminal (AL-C1)

PC Board Terminal (AL-C1V)

(PC Board Terminal Mounting Hole Layout)

(Bottom View)

• Terminal Cover



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

All dimensions in mm.

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.

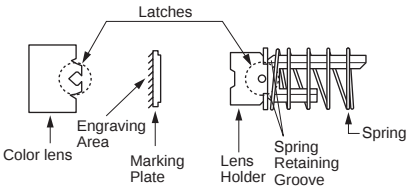
Operating Instructions

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.



Note: Make sure that the spring is inserted in the correct direction. The base of spring must fit the groove in the holder.

• 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.

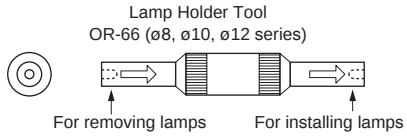
Replacing the LED Lamp

• 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 into a panel, use the optional locking ring wrench (MT-003) to tighten the locking ring. Do not use pliers. Tightening torque must not exceed 0.29 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 type 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 type units in an environment subject to oil, water or dust accumulation.

• 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.

ø8 A8 Series Miniature Control Units

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

- Bright and clear LED illumination.
- 8-mm mounting holes
- All series have terminals on the same plane.
- UL recognized, CSA certified

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.)	AL8M-M11: 2g
	AL8M-P1: 2g
	AB8M-M1: 2g

Specifications

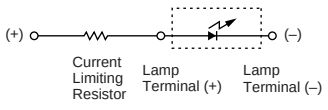
Operating Temperature		–25 to +55°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Contact Resistance		50 mΩ maximum (initial value)
Insulation Resistance		100 MΩ minimum (500V DC megger)
Dielectric Strength	Switch Unit	Between live and dead metal parts 2,000V AC, 1 minute Between terminals 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		Operating extremes: 5 to 55 Hz, amplitude 0.75 mm
Shock Resistance		Damage limits: 500 m/s^2 (50G) Operating extremes: 200 m/s^2 (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		Enclosed (IP40)

LED Lamp Ratings (LAD-S Type)

Type 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% 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

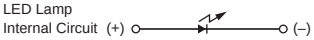
- LED lamps do not have a current-limiting resistor, and external resistors of recommended values for each voltage must be provided. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged. Because no protection diode is contained, ensure the correct polarity is observed.



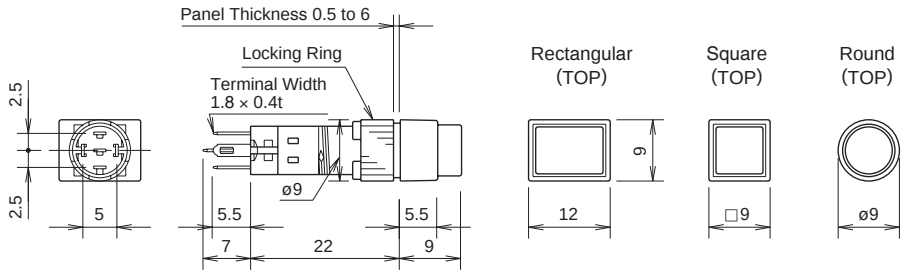
AL8 LED Illuminated Pushbuttons & Pilot Lights

Shape	Operation Type	Contact	Type No. IP40	② Lens Color Code	LED Lamp Type No., Rated Current (External Resistor Recommended Value)
Round AL8M  Marking plate size: ø6 mm Engraving area: ø4.5 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL8M-M11②	Specify a color code in place of ② in the Type 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
	Maintained	SPDT	AL8M-A11②		
	Pilot Light	—	AL8M-P1②		
Square AL8Q  Marking plate size: □6 mm Engraving area: □4.5 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL8Q-M11②		
	Maintained	SPDT	AL8Q-A11②		
	Pilot Light	—	AL8Q-P1②		
Rectangular AL8H  Marking plate size: 6 × 9 mm Engraving area: 4.5 × 7.5 mm (Depth: 0.5 mm max.)	Momentary	SPDT	AL8H-M11②		
	Maintained	SPDT	AL8H-A11②		
	Pilot Light	—	AL8H-P1②		

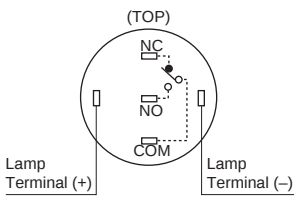
- LED lamps do not have a current-limiting resistor. Connect a current-limiting resistor in series, otherwise LED lamps will be damaged.
- AP8M series pilot lights (round bezel only) with built-in current-limiting resistor are also available.



Dimensions

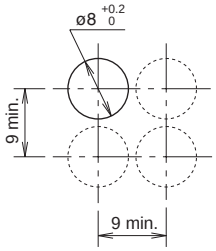


Terminal Arrangement

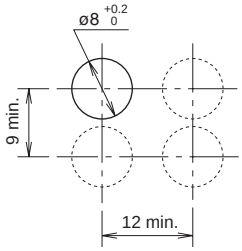


Mounting Hole Layout

• Round/Square Units



• Rectangular Units



Note: Determine mounting centers to ensure easy operation.

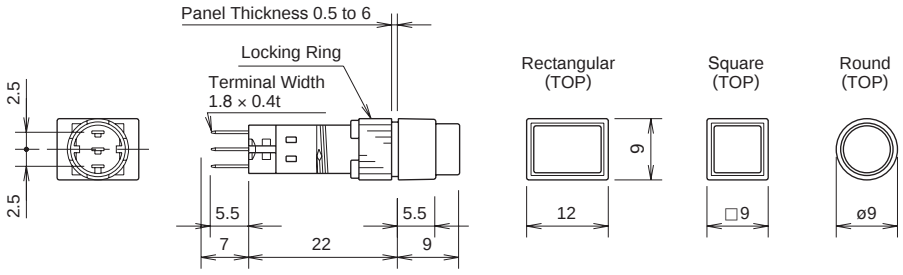
All dimensions in mm.

AB8 Pushbuttons

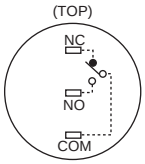
Shape	Button Type	Operation Type	Contact	Type No. IP40	Color Code ①②
Round AB8M 	Button	Momentary	SPDT	AB8M-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB8M-A1①	
	Illumination Lens	Momentary	SPDT	AB8M-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB8M-A1L②	
Square AB8Q 	Button	Momentary	SPDT	AB8Q-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB8Q-A1①	
	Illumination Lens	Momentary	SPDT	AB8Q-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB8Q-A1L②	
Rectangular AB8H 	Button	Momentary	SPDT	AB8H-M1①	B black G: green R: red S: blue W: white Y: yellow
		Maintained	SPDT	AB8H-A1①	
	Illumination Lens	Momentary	SPDT	AB8H-M1L②	A: amber G: green R: red W: white Y: yellow
		Maintained	SPDT	AB8H-A1L②	

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

Dimensions

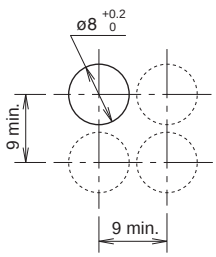


Terminal Arrangement (bottom view)

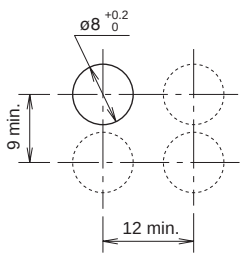


Mounting Hole Layout

• **Round/Square Units**



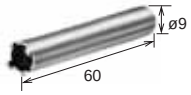
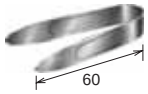
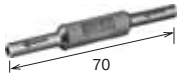
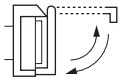
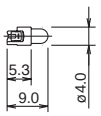
• **Rectangular Units**



Note: Determine mounting centers to ensure easy operation.

All dimensions in mm.

Accessories

Shape	Material		Type No.	Ordering Type No.	Package Quantity	Dimensions (mm)
Locking Ring Wrench 	Metal (nickel-plated brass)		MT-004	MT-004	1	• Used to tighten the locking ring when installing the A8 series control units into a panel. • Tighten the locking ring to a torque of 0.29 N·m maximum.
Lens Removal Tool 	Stainless Steel		MT-101	MT-101	1	• Used to remove the lens and button.
Lamp Holder Tool 	Rubber		OR-66	OR-66	1	• Used to remove and install the LED lamps.
Switch Guard 	90° open	For round/ square Unit	AL-K8	AL-K8	1	• Used to protect pushbuttons from inadvertent operation. • See page 41 for dimensions.  (remains 90° open)
		For rectangular unit	AL-KH8	AL-KH8	1	
Socket 	Solder Terminal		AL-C8	AL-C8	1	• Snaps on the rear of the A8 series control units. (see page 41 for dimensions)
	PC Board Terminal		AL-C8V	AL-C8V	1	
Terminal Cover 	Nylon		AL-V8	AL-V8PN10	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.
Mounting Hole Plug 	Nitryl rubber (black)		AL-B8	AL-B8PN05	5	• Degree of protection: IP65
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	Lens color: Green — LED color: yellow diffused
				LAD-SGPN10	10	
	Illumination color: red		LAD-SR	LAD-SR	1	Lens color: Red — LED color: clear red
				LAD-SRPN10	10	
	Illumination color: yellow		LAD-SY	LAD-SY	1	Lens color: White/ Yellow — LED color: yellow clear
				LAD-SYPN10	10	

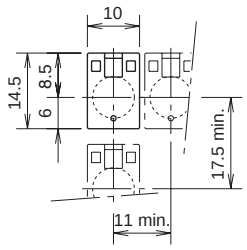
Maintenance Parts

Shape		Type No.	Ordering Type No.	Package Quantity	Color Code ①②
Marking Plate 	Round	AL8M-W	AL8M-WPN05	5	• White
	Square	AL8Q-W	AL8Q-WPN05		
	Rectangular	AL8H-W	AL8H-WPN05		
Lens Unit 	Round	AL8M-LK1-②	AL8M-LK1-②PN02	2	Specify a color code in place of ② in the Type No. A (amber), G (green), R (red) W (white), Y (yellow)
	Square	AL8Q-LK1-②	AL8Q-LK1-②PN02		
	Rectangular	AL8H-LK1-②	AL8H-LK1-②PN02		
Button Unit 	Round	AB8M-BK1-①	AB8M-BK1-①PN02		Specify a color code in place of ① in the Type No. B (black), G (green), R (red) S (blue), W (white), Y (yellow)
	Square	AB8Q-BK1-①	AB8Q-BK1-①PN02		
	Rectangular	AB8H-BK1-①	AB8H-BK1-①PN02		

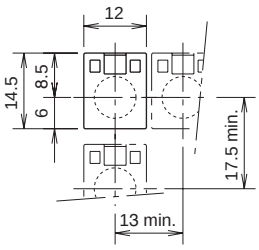
Dimensions

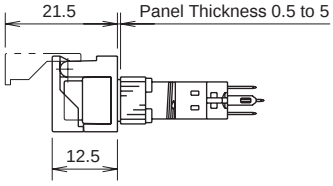
• Switch Guard

For Round/Square Units (AL-K8)

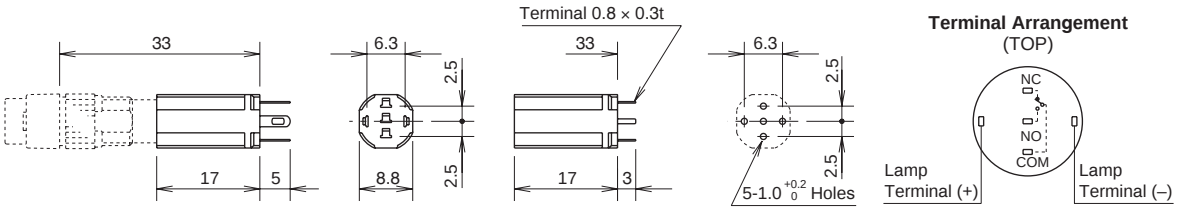


For Rectangular Units (AL-KH8)



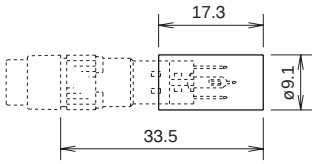


• Socket (AL-C8, AL-C8V)



Solder Terminal (AL-C8) | **PC Board Terminal (AL-C8V)** | **(PC Board Terminal Mounting Hole Layout)** | **(Bottom View)**

• Terminal Cover (AL-V8)



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

All dimensions in mm.

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 size to meet the voltage and current requirements. Failure to tighten terminal screws may cause overheating and create a fire hazard.

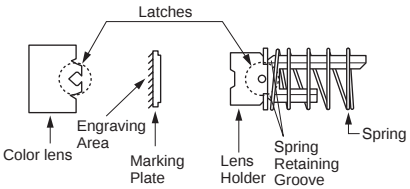
Operating Instructions

Replacement of Lens and Marking Plate

• Removal

Remove the operator (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.



- **Note: Make sure that the spring is inserted in the correct direction. The base of spring must fit the groove in the holder.**

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.

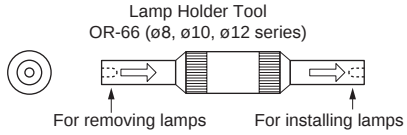
Replacing the LED Lamp

• 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-004) to tighten the locking ring. Do not use pliers. Tightening torque must not exceed 0.29 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 type is recommended when using lead-free solder. When soldering, do not touch the enabling switch 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 a 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 of 5V DC 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 type units in an environment subject to oil, water or dust accumulation.

• 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.