

# Industrial Automation Catalog Section - U906

Switches & Pilot Devices

AP Series Miniature Switches  
& Pilot Devices

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Due to continuous product improvements, specifications are subject to



Switches & Pilot Devices

## AP Series Miniature Pilot Lights

Series Model	AP6	AP2	AP1	AP8
<b>Mounting Hole Diameter</b>	Ø 5/8" (16mm)	Ø 31/64" (12mm)	Ø 13/32" (10mm)	Ø 21/64" (8mm)
<b>Appearance</b>				
<b>See Page</b>	A-32			
<b>Operator Type</b>	Pilot Lights			
<b>Lens Shape and Size</b>	Flat & Dome Ø 0.702" (18mm)	Flat & Dome Ø 0.546" (14mm)	Flat & Dome Ø 0.468" (12mm)	Flat & Dome Ø 0.382" (9.8mm)
<b>Light Source</b>	LED (with built-in current limiting resistor)			
<b>Lens Colors</b>	Amber, Green, Red, White, Yellow			
<b>Voltages</b>	6, 12, 24V AC/DC (full voltage); 120, 240V AC (with transformer); 110V DC (with DC-DC converter).		6, 12, 24V AC/DC (full voltage)	
<b>Rated Current</b>	6V DC/33mA 12V DC/11mA 24V DC/11mA	6V DC/33mA 12V DC/22mA 24V DC/11mA	6V DC/18mA 12V DC/11mA 24V DC/12mA	6V DC/18mA 12V DC/11mA 24V DC/12mA
<b>Degree of Protection</b>	Waterproof/Oiltight/Corrosion Resistant: IP65			Enclosed/ Dustproof: IP40
<b>Termination</b>	.110" Solder/Quick Connect	Solder Tab		
<b>Approvals</b>	UL Recognized File No. E68961		CSA Certified File No. LR48366	

- 1. Only AP6 accepts .110" quick-connect.
- 2. AP2 and AP6 compatible with snap-on transformers.
- 3. All units are one-piece pilot lights with non-replaceable LED lamp.
- 4. All units include built-in current limiting resistor and reverse polarity protection diode.

## General Information

### Information About LED Lamps

Light-emitting diodes (LEDs) are P–N junction semiconductors with mechanisms called “junction electro-luminescence.” Application of direct current results in radiation or emission of a monochromatic light.

Different semiconductor materials produce different wavelengths of light as shown below:

Specifications	Green	Gallium Phosphide (GaP)	5600 Å
	Yellow	Gallium Arsenide Phosphide (GaAsP)	5800 Å
	Amber	Gallium Arsenide Phosphide (GaAsP)	6300 Å
	Red	Gallium Arsenide Phosphide (GaAsP)	6600 Å
	Infrared	Gallium Arsenide (GaAs)	9000 Å



#### Advantages of Using LEDs

- LEDs are used when heat generated by incandescent lamps would damage nearby equipment or interfere with a precision process. This is particularly advantageous when multiple lights are grouped.
- LEDs can operate at low temperatures which would cause incandescent lamps to fail, since glass cracks during rapid cooling.
- LEDs consume 50 times less power than incandescent lamps, thereby reducing energy consumption.
- LEDs last 500 times longer than incandescent lamps. LEDs average a million hours (114 years) while incandescent lamps average 2000 hours.
- LEDs do not generally “blow out” unless subjected to a severe overvoltage. They exhibit a half-life type dimishment in brightness over time. After 50,000 hours (6 years) of use, IDEC LEDs will retain approximately half of their original intensity.
- IDEC’s SUPERBRIGHT LEDs have high visibility.
- LEDs require little or no maintenance because of long life and high reliability.

#### IDEC Recommendations

For optimum results, especially when using switches and pilot lights in operating environments which are conducive to overheating, use IDEC LED illuminated units. Transformers are available for use with incandescent illuminated units, which operate at lower voltages to avoid overheating.

**When IDEC’s L-120L lamp is used, make sure ambient temperatures do not exceed 30°C (86°F). If a lamp from another supplier is used, it should be rated for less than 1.8 watts (15mA at 120V AC), with ambient temperatures as stated above.**

### Information About Incandescent Lamps

Filament-type incandescent lamps operate within the following parameters.

Light output and life expectancy depend on operating voltage. Light output varies to the 3rd or 4th power of the voltage. Life expectancy varies inversely to the 12th power of voltage. In other words, over-voltage of 5% reduces life expectancy by 50%. Under-voltage of 5% doubles life expectancy at the price of light output efficiency.

Inrush current (initial current through the filament) has an adverse effect on life expectancy. Cold resistance (room temperature) will have a more detrimental effect than hot resistance to inrush current. Life expectancy of incandescent lamps can be maximized by reducing occurrences of cold resistance to inrush current.

Continued intermittent flashing will significantly reduce life expectancy. When using an incandescent lamp with a tungsten filament, flashing will not reduce life expectancy as long as light output does not exceed that of steady burning.

When an incandescent lamp must withstand shock and vibration, use low voltage/high amperage (5–6V/60–120mA) lamps. These lamps have a short, thick filament with a high resonant frequency.

Provide cooling by using a heat sink, particularly when multiple incandescent lamps are grouped or when air circulation is limited. Make sure ambient temperatures do not exceed 100°C (212°F) for maximum life of incandescent lamps.

## Comparison: LED vs. Incandescent Lamps

	<i>Superbright LEDs</i>	<i>Incandescent</i>	
<b>Characteristics</b>	<b>Heat Dissipation</b>	Very Low	High
	<b>Life Expectancy</b>	Very Long	Short
	<b>Reliability</b>	Very High	Low
	<b>Mechanical Strength</b>	Not Susceptible	Susceptible to Shock/Vibration
	<b>Maintenance Required</b>	Negligible	Frequent
	<b>Operation at Low Temps.</b>	Possible	Not Possible
	<b>Inrush Current</b>	Negligible	Very Large
	<b>Voltage Effects on Life</b>	Insignificant	Significant
	<b>Brightness</b>	Slightly Less	Slightly More

## Ordering Information

1. IDEC offers assembled and sub-assembled switches and pilot lights for your convenience. In some cases there is a cost difference, with sub-assembled units costing slightly less. Since assembled units are custom made to your order, a couple of days for assembly is added to delivery . To minimize delivery or inventory requirements, it is recommended that switches and pilot lights be ordered as sub-components.
2. When ordering pilot lights or illuminated pushbuttons, make sure to specify the color code in place of the asterisk in the part number, (LED or incandescent lamp included). Spare lamps can be ordered and are listed with sub-assembly components.
3. Accessories, such as locking ring wrench, lens removal tool, and lamp holder, are available to make installation and assembly easier. IDEC recommends using these accessories and is not responsible for damage as a result of using the wrong tool.
4. Marking plates are available for switches and pilot lights which feature a flat lens. Printed mylar (not included) can also be inserted under lens for labeling purposes.
5. Nameplates are available for TW, 7/8" (22mm), HW 7/8" (22mm), and TWTD series, Ø1-13/64" (30mm). For prompt delivery, order standard legends. Custom engraving is also offered for an additional charge.

## Installation and Operation

1. Use the appropriate lamp holder to remove or install LED or incandescent lamps. Using pliers will damage the lamp.
2. When mounting switches and pilot lights into a panel, use locking ring wrench. Using pliers or tightening excessively will damage the locking ring.
3. A series, 21/64" (8mm), can be mounted on a panel 0.019" (0.5mm) to 0.236" (6mm) thick.
4. LW 7/8" (22mm), TW, 7/8" (22mm), and TWTD series, Ø1-13/64" (30mm), feature an adjustment ring for mounting on a panel 0.038" (1mm) to 0.236" (6mm) thick. Using a nameplate or an anti-rotation ring adds 0.031" (0.8mm) to the panel thickness.
5. When applicable, solder terminals within 20W/5sec or 260°/3sec without exerting external force to the terminals. Use a non-corrosive resin liquid flux.
6. The operating voltage for LED units represents a complete DC value. When using a pulsing voltage, such a full-wave rectification, keep peak currents within the forward current  $I_f$ . Peak currents exceeding  $I_f$  may shorten the life of the LED lamp.
7. To avoid a short circuit, never connect NO and NC contacts to different voltages or power sources.
8. Optimum performance of TW and TWTD illuminated pushbuttons, selector switches, and pilot lights is obtained with IDEC LED and incandescent lamps.
9. For maximum life of incandescent lamps (approximately 2000 hours), use within the rated operating voltage. If it is necessary to use a higher voltage, keeping ambient temperature below 30°C (86°F) will help prolong the life of an incandescent lamp.



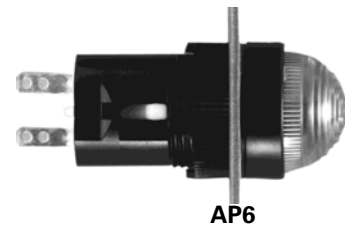
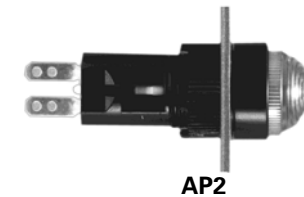
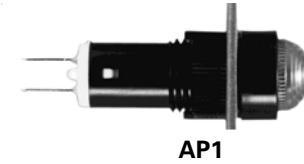
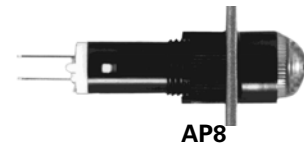
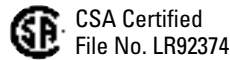
*If excessive voltage is applied (over 50V), the lamp may blow and the lens holder may pop out.*

**AP Series — Miniature Pilot Lights**

## Miniature Pilot Lights with Super Bright LEDs

Key features of AP series include:

- Long service life, low maintenance
- Space saving miniature style
- Dome or flat lens models
- Built-in current-limiting resistor and reverse polarity protection diode
- Five illumination colors: red, green, amber, yellow, and white
- AC adaptor (120V AC and 240V AC) and DC-DC Converter (110V DC) options on 12mm and 16mm units



<b>Specifications</b>	<b>Lamp</b>	Built-in LED with current limiting resistor
	<b>Operational Voltage</b>	6, 12, 24VDC (full voltage), 110/120, 220/240VAC, (transformer) 110VDC (with converter)
	<b>Current Ratings</b>	AP8: 6VDC/18mA, 12VDC/11mA, 24VDC/12mA AP1: 6VDC/18mA, 12VDC/11mA, 24VDC/12mA AP2: 6VDC/33mA, 12VDC/22mA, 24VDC/11mA AP6: 6VDC/33mA, 12VDC/11mA, 24VDC/11mA
	<b>Operating Temp.</b>	-20°C to +50°C
	<b>Operating Humidity</b>	45 to 85% RH
	<b>Insul. Resistance</b>	100MΩ min. (500V DC megger) Between live and dead parts
	<b>Rev. Withstand Voltage</b>	AP2: 100V Other Series: 200V
	<b>Solder Terminal</b>	Soldering 260°C maximum (5 sec.)
	<b>Degree of Protection</b>	AP8: IP40 (dusttight) Other Series: IP65 (oiltight)




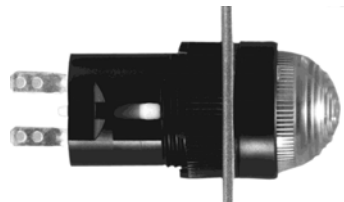
<b>Optional Adaptors/Converters</b>		<b>AC Adaptor</b>	<b>DC-DC Converter</b>
	<b>Applicable Units</b>	AP2 & AP6 ( with 6V LED only)	
	<b>Operating Voltage</b>	110/120VAC 50/60 Hz 220/240VAC 50/60 Hz	110V DC (90 to 140V DC)
	<b>Power Consumption</b>	1.6 VA maximum	1W maximum
	<b>Insulation Voltage</b>	250 V AC	140V DC
	<b>Insulation Resistance</b>	10MΩ min. (500V DC megger) Between live and dead parts	
	<b>Dielectric Strength</b>	2,000V AC, 1 minute Between live/dead parts 2,000V AC, 1 minute Between terminals	2,000V AC, 1 minute Between live/dead parts 1,500V AC, 1 minute Between terminals



Available as one piece only (replacement lenses and LEDs are not available).

## Miniature Pilot Lights (Assembled)

### Part Numbers: AP Miniature Pilot Lights


Appearance	Lens Style	Operating Voltage	Part Numbers
AP8 Series - Ø 21/64" (8mm) 	Dome	6V DC 12V DC 24V DC	AP8M266-② AP8M211-② AP8M222-②
	Flat	6V DC 12V DC 24V DC	AP8M166-② AP8M111-② AP8M122-②
AP1 Series - Ø 13/32" (10mm) 	Dome	6V DC 12V DC 24V DC	AP1M266-② AP1M211-② AP1M222-②
	Flat	6V DC 12V DC 24V DC	AP1M166-② AP1M111-② AP1M122-②
AP2 Series - Ø 31/64" (12mm) 	Dome	6V DC 12V DC 24V DC	AP2M266-② AP2M211-② AP2M222-②
	Flat	6V DC 12V DC 24V DC	AP2M166-② AP2M111-② AP2M122-②
AP6 Series - Ø 41/64" (16mm) 	Dome	6V DC 12V DC 24V DC	AP6M266-② AP6M211-② AP6M222-②
	Flat	6V DC 12V DC 24V DC	AP6M166-② AP6M111-② AP6M122-②

#### ② Color Code

Color	Code
Amber	A
Green	G
Red	R
White	W
Yellow	Y


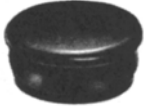
- 1. In place of ②, specify the color code.
- 2. For dimensions, see page A-34
- 3. For accessories, see page A-33.

### Part Numbers: Optional AC Adaptors and DC-DC Converters (for AP2 and AP6 only)

Appearance	Style	Voltage	Part Numbers	
			Used with AP2 Series	Used with AP6 Series
 Secondary Voltage = 6V	AC Adaptor	110/120V AC 220/240V AC	AP2-0126D AP2-0246D	AP6-0126D AP6-0246D
	DC-DC Converter	110V DC (90-140V DC)	AP2-016DD	AP6-016DD

- 1. Optional AC adaptors and DC-DC converters snap onto the back of AP2 or AP6 pilot lights.
- 2. AC Adaptors and DC-DC Converters step down to 6V.
- 3. For dimensions, see page A-28.

## Accessories — AP Series

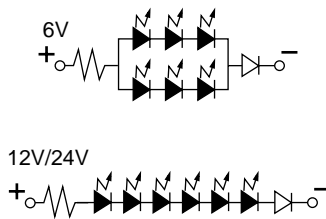
Appearance	Description	Used With	Part Number
Locking Ring Wrench 	Made of metal. Used for tightening plastic locking ring during installation. Tightening torque should not exceed 3kgf-cm	Ø 5/8" (16mm) units	MT-001
		Ø 31/64" (12mm) units	MT-002
		Ø 13/32" (10mm) units	MT-003
		Ø 21/64" (8mm) units	MT-004
Mounting Hole Plug 	Made of rubber. Fills unused mounting holes to provide IP65 protection	Unused 21/64" (8mm) panel cutouts	AL-B8
		Unused 5/8" (16mm) panel cutouts	AL-B6



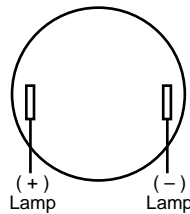
## Schematics — AP Series

### IDEC's Superbright LED"

#### Equivalent Circuit



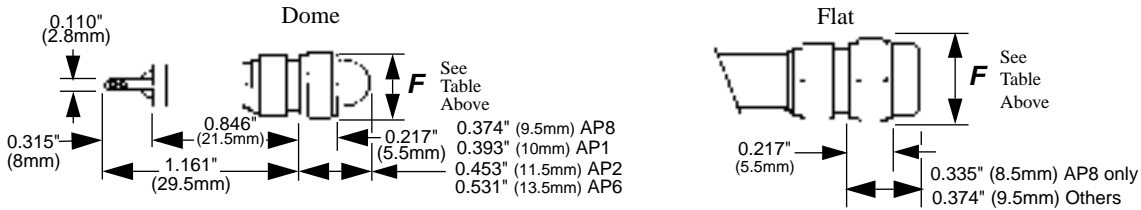
#### Pilot Lights



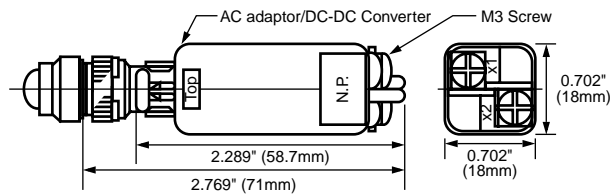
## Dimensions — AP Series

### Pilot Lights (AP Series)

Style	AP8		AP1		AP2			AP6		
	Flat	Dome	Flat	Dome	Flat	Dome	w/ Adaptor or Converter	Flat	Dome	w/ Adaptor or Converter
<b>Panel Cut-out</b>	Ø 0.319" (+0.0118, -0) 8.1mm (+0.3, -0)		Ø 0.398" (+0.0118, -0) 10.1mm (+0.3, -0)		Ø 0.480" (+0.0118, -0) 12.2mm (+0.3, -0)			Ø 0.638" (+0.0118, -0) 16.2mm (+0.3, -0)		
<b>Outside Dimension</b>	Ø 0.386" (9.8mm)		Ø 0.472" (12mm)		Ø 0.551" (14mm)			Ø 0.709" (18mm)		□ 0.709" (18mm)



### AP2 Series with AC adaptor or DC-DC Converter



### AP6 Series with AC adaptor or DC-DC Converter

