

# New Product

# CONTACT

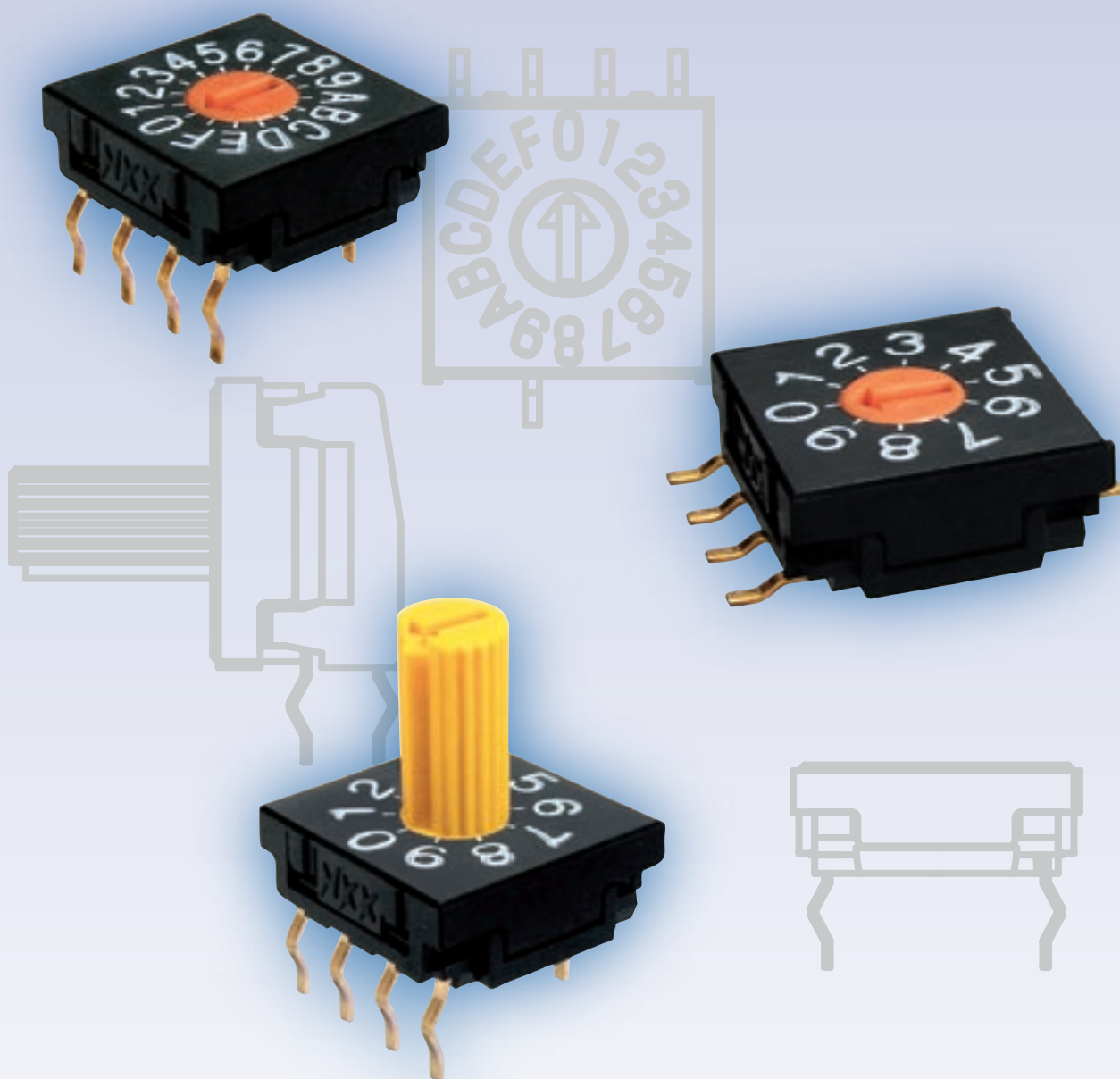
No.105



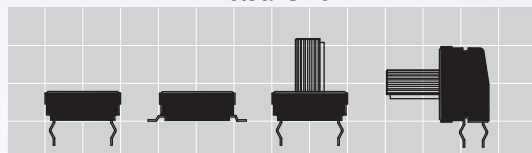
Lead-free/Industry's Thinnest DIP Rotary Switch

Through-hole mount type **Series FRO1**

Surface mount type **Series FRO2**



Actual Size



FRO1 with AT4180

Creator of a comfortable environment between people and switches  
**Nihon Kaiheiki Ind. Co., Ltd.**

# Industry's Thinnest\* DIP Rotary Switch

# Series FRO1 / Series FRO2

● **Highly Cost Effective**

● **Lead-free**

**Environmentally Friendly**

- Suited to lead-free solder processing applications because of heat resistant resin materials.
- Components and packaging materials meet RoHS Directive of March 31, 2004, restricting use of hazardous materials such as lead, cadmium, mercury, hexavalent chromium, PBB, and PBDE.

**Only 3.8mm Thick\***

Switch body is totally molded and the thinnest in the industry.  
(\* Nikkai Research as of Apr. 22, 2004)

**Heat resistant resin**

Use of heat resistant resin allows vapor phase and infrared convection reflow soldering.

**Gull-wing Terminals**

Shape of terminals provides mechanical stability during soldering and simplifies solder joint inspection. (Series FRO2)



**Crimped Terminals**

Through-hole terminal shape ensures secure PCB mounting and prevents dislodging during wave soldering. (Series FRO1)

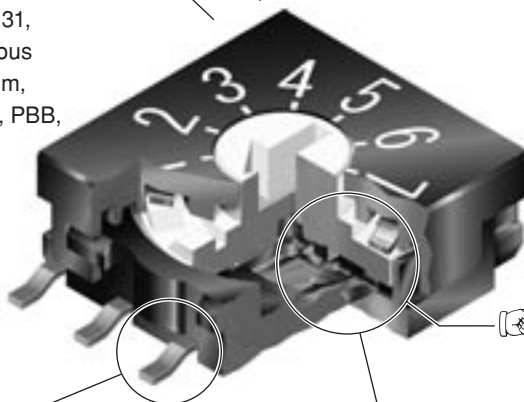


**Highly Reliable Contacts**

Cam activated movable contact ensures contact stability. Use of gold contacts ensures high reliability. (Patent Pending)

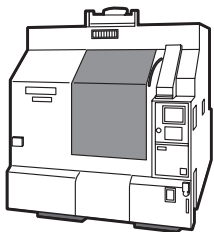
**Smooth and Crisp Actuation**

Actuator mechanism with spring provides a crisp actuation feedback.

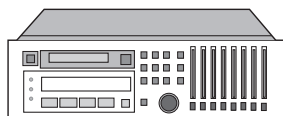


**► Applications**

FA equipment, Office equipment, Wireless equipment, Professional video cameras, Control panels, Telecommunications, Electronic measurement, Consumer electronics, Gaming equipment and more.



FA equipment



Consumer electronics



Office equipment

**► Available**

May 10, 2004

## ► General Specifications

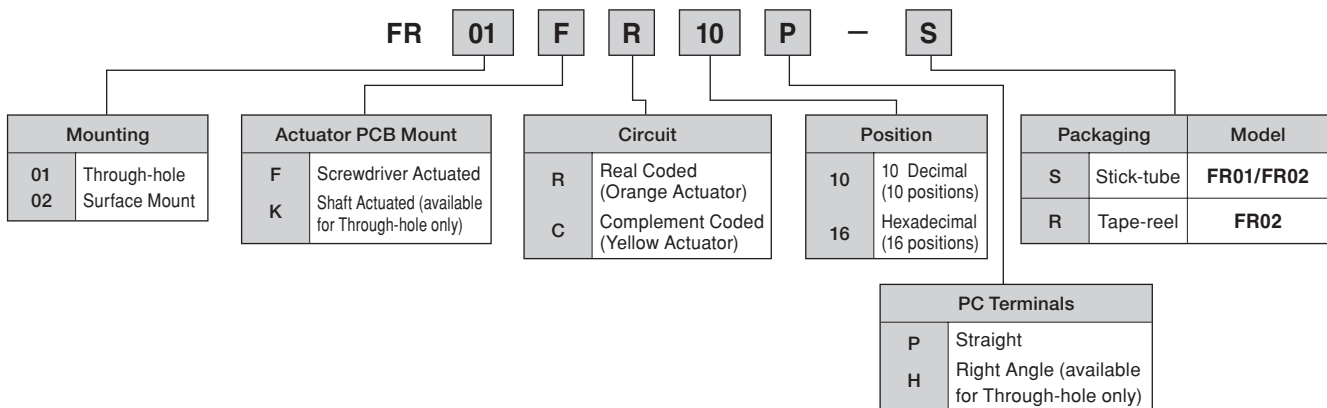
Switch Specifications	
Electrical Capacity	Switching Rating: 100mA @ 5V DC Nonswitching Rating: 100mA @ 50V DC
Contact Resistance	100mΩ or less (at 20 mV, 10 mA) (Contacts not including conductor resistance show 30 mΩ or less.)
Insulation Resistance	1GΩ max. at 250V DC
Dielectric Strength	250 V AC for one minute min.
Mechanical Life	10,000 detent operations min.
Electrical Life	10,000 detent operations min.
Operating Temp. Range	-25 to +85°C
Soldering Time & Temperature	FR01/FR02 manual soldering 4 seconds max @ 390°C max FR01 solder pot 6 seconds max @ 265°C max (preheat 40 seconds max @ 110°C max) FR02 reflow see page 7

## Truth Tables (Circuits & Positions)

Actual position ● = on		10 Decimal										16 Hexadecimal															
		0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
<b>R</b> Real Coded Model Number: FR01FR, FR01KR, FR02FR	1		●		●		●		●		●		●		●		●		●		●		●		●		●
	2			●	●			●	●					●	●			●	●				●	●			●
	4					●	●	●	●						●	●	●	●					●	●	●	●	
	8									●	●									●	●	●	●	●	●	●	●
<b>C</b> Complement Coded Model Number: FR01FC, FR01KC, FR02FC	1	●		●		●		●		●		●		●		●		●		●		●		●		●	
	2	●	●			●	●			●	●			●	●			●	●			●	●			●	
	4	●	●	●	●					●	●	●	●					●	●	●	●					●	
	8	●	●	●	●	●	●	●	●					●	●	●	●	●									●

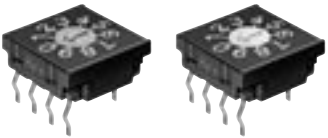
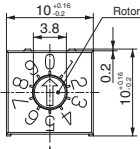
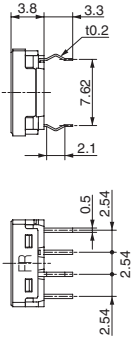
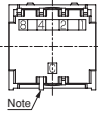
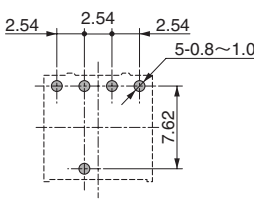
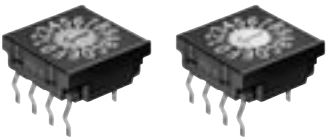
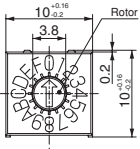
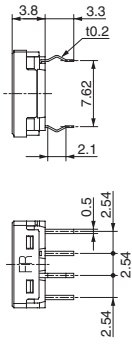
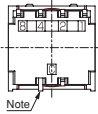
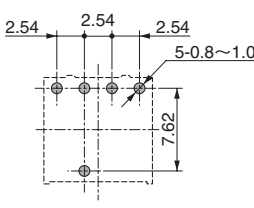
Terminal numbers are actually on switch

## ► Part Number Structure



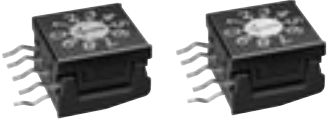
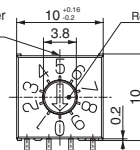
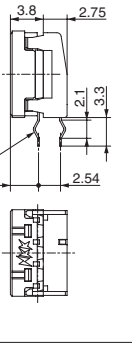
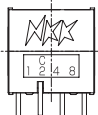
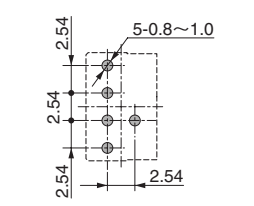
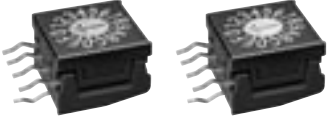
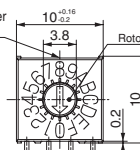
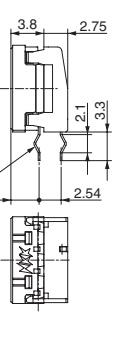
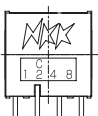
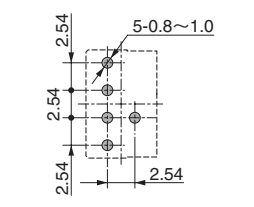
► Screwdriver Actuated DIP Rotary

Straight PC Terminals

<p><b>FR01FR10P</b> (Real Coded)</p> <p><b>FR01FC10P</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01FR10P</b> Yellow : <b>FR01FC10P</b></p>		 <p>Note : Although there is no terminal, conductive area of common.</p>	<p><b>Footprint</b> (Top view of PC board)</p> 
<p><b>FR01FR16P</b> (Real Coded)</p> <p><b>FR01FC16P</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01FR16P</b> Yellow : <b>FR01FC16P</b></p>		 <p>Note : Although there is no terminal, conductive area of common.</p>	<p><b>Footprint</b> (Top view of PC board)</p> 

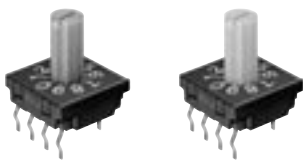
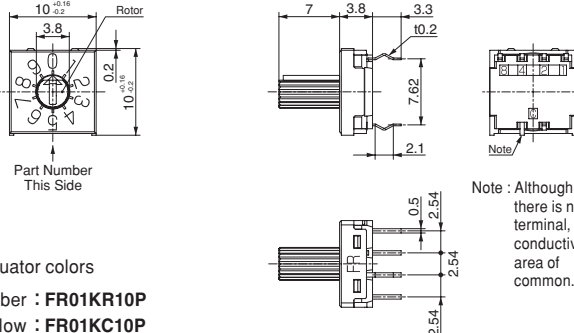
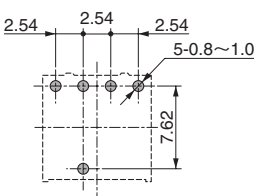
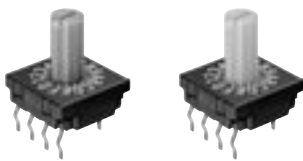
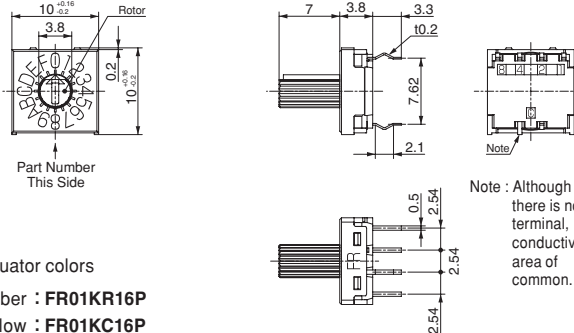
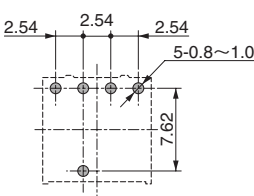
► Screwdriver Actuated DIP Rotary

Right-angle PC Terminals

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<p><b>FR01FR16H</b> (Real Coded)</p> <p><b>FR01FC16H</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01FR16H</b> Yellow : <b>FR01FC16H</b></p>			<p><b>Footprint</b> (Top view of PC board)</p> 

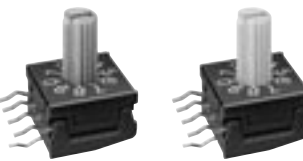
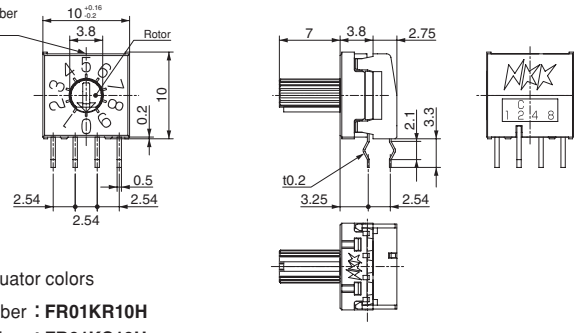
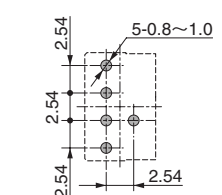
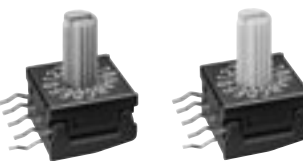
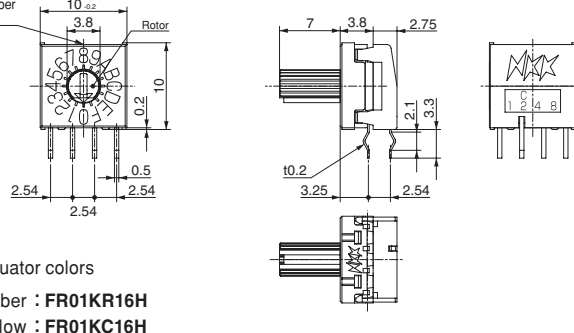
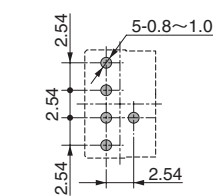
▶ Shaft Actuated DIP Rotary

Straight PC Terminals

<p><b>FR01KR10P</b> (Real Coded)</p> <p><b>FR01KC10P</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01KR10P</b> Yellow : <b>FR01KC10P</b></p> <p>Note : Although there is no terminal, conductive area of common.</p>	<p><b>Footprint</b> (Top view of PC board)</p> 
<p><b>FR01KR16P</b> (Real Coded)</p> <p><b>FR01KC16P</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01KR16P</b> Yellow : <b>FR01KC16P</b></p> <p>Note : Although there is no terminal, conductive area of common.</p>	<p><b>Footprint</b> (Top view of PC board)</p> 

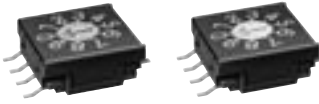
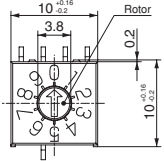
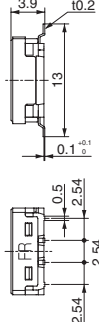
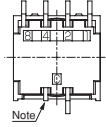
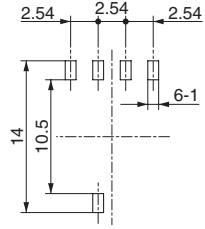
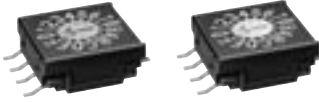
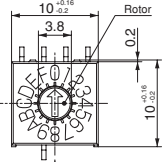
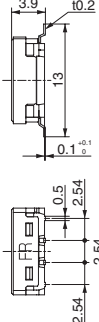
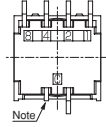
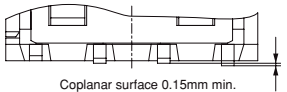
▶ Shaft Actuated DIP Rotary

Right Angle PC Terminals

<p><b>FR01KR10H</b> (Real Coded)</p> <p><b>FR01KC10H</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01KR10H</b> Yellow : <b>FR01KC10H</b></p>	<p><b>Footprint</b> (Top view of PC board)</p> 
<p><b>FR01KR16H</b> (Real Coded)</p> <p><b>FR01KC16H</b> (Complement Coded)</p> 	 <p>Part Number This Side</p> <p>Actuator colors Amber : <b>FR01KR16H</b> Yellow : <b>FR01KC16H</b></p>	<p><b>Footprint</b> (Top view of PC board)</p> 

► Screwdriver actuated DIP Rotary

Surface Mount Terminals

<p><b>FR02FR10P</b> (Real Coded)</p> <p><b>FR02FC10P</b> (Complement Coded)</p> 	 <p>10<sup>+0.16</sup>/<sub>-0.22</sub> 3.8 0.2 10<sup>+0.16</sup>/<sub>-0.22</sub> Rotor Part Number This Side</p>  <p>3.9 10.2 13 0.1<sup>+0.1</sup>/<sub>-0.1</sub> 0.5 2.54 2.54</p>  <p>Note: Although there is no terminal, conductive area of common.</p>	<p><b>Footprint</b> (Top view of PC board)</p>  <p>2.54 2.54 2.54 14 10.5 6-1</p>
<p><b>FR02FR16P</b> (Real Coded)</p> <p><b>FR02FC16P</b> (Complement Coded)</p> 	 <p>10<sup>+0.16</sup>/<sub>-0.22</sub> 3.8 0.2 10<sup>+0.16</sup>/<sub>-0.22</sub> Rotor Part Number This Side</p>  <p>3.9 10.2 13 0.1<sup>+0.1</sup>/<sub>-0.1</sub> 0.5 2.54 2.54</p>  <p>Note: Although there is no terminal, conductive area of common.</p>	<p><b>Coplanar Surfaces</b></p>  <p>Coplanar surface 0.15mm min.</p>

► Packaging

FR01 models are packaged in stick-tubes (50 pieces per tube).

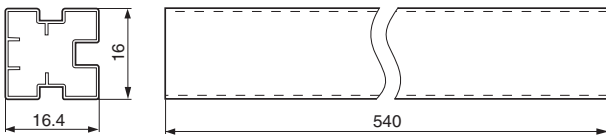
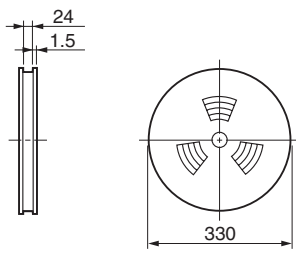
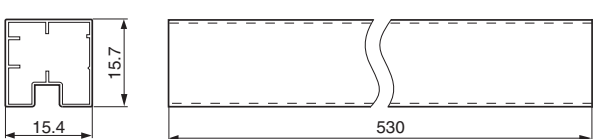
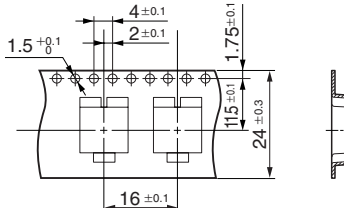
FR02 models are available in tubes (50 pieces per tube) or on a tape-reel (500 pieces per reel).

Packaging specification code :

Stick-tube packaging : **-S**

Tape-reel packaging : **-R**

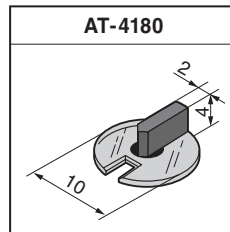
When ordering, please add the packaging code at the end of the product name. When tape-reel packaging is selected, please order by the packaging unit.

Stick-Tube Packaging	Tape-Reel Packaging
<p>FR01FR10P-S, FR01FC10-S, FR01FR16P-S, FR01FC16-S FR01KR10P-S, FR01KC10-S, FR01FR16P-S, FR01FC16-S FR02FR10P-S, FR02FC10-S, FR02FR16P-S, FR02FC16-S</p>  <p>16.4 16 540</p>	<p>FR02FR10P-R, FR02FC10-R, FR02FR16P-R, FR02FC16-R</p>  <p>24 1.5 330</p>
<p>FR01FR10P-S, FR01FC10-S, FR01FR16P-S, FR01FC16-S FR01KR10P-S, FR01KC10-S, FR01FR16P-S, FR01FC16-S</p>  <p>15.4 15.7 530</p>	 <p>4±0.1 2±0.1 1.75±0.1 115±0.1 24±0.3 16±0.1 1.5±0.1</p>

## ▶ Accessories

### Snap-in Knob AT4180

The optional accessory AT4180 allows position setting without screwdriver. The window in the knob indicates the position setting clearly.



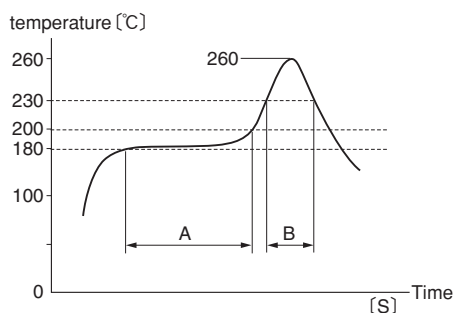
### AT4180

Install knob after mounting on PC board with reflow. When mounting, align slit in the knob with arrow on the actuator. Installation force should not exceed 29.4N max. Knob should not be removed once mounted, because the fitting will loosen.

## ▶ Operating Instructions

### Soldering

1. Manual Soldering : 4 seconds max @ 390°C max
2. Reflow Soldering :  
Infrared reflow recommended, see temperature profile below.



Part Number	Time	Preheat	Reflow
<b>FR02</b>		120 sec	60 sec

Depending on the material and thickness of the PC board, surface temperatures may vary. Do not let temperature exceed 260°C. If your process exceeds the infrared reflow soldering limits shown in the graph above, contact the factory for further information.

3. During the soldering process, set the switch to the position listed below :

**FR02FR10P, FR02FR16P** : 0 position  
**FR02FC10P** : 7 position  
**FR02FC16P** : F position

### Washing

The FR devices are not washable. Alcohol based washing fluid should be used to clean flux after soldering on the PC board.

### Installation

Avoid mechanical stress on the terminals after soldering.

\* Note : Specifications are subject to change without notice.

