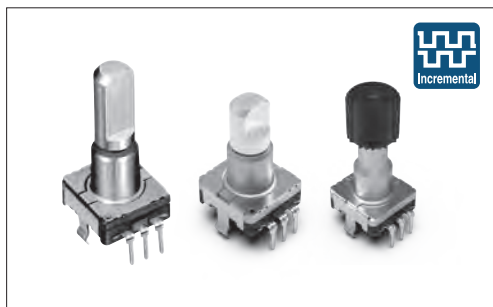


Compact and highly reliable type available in many varieties



### Typical Specifications

| Items                       | Specifications                                     |
|-----------------------------|--|
| Output signal               | Two phase of A, B<br>Self-return switch<br>(EC111) |
| Rating                      | 10mA 5V DC   |
| Operating life              | 15,000 cycles                                      |
| Operating temperature range | -40°C to +85°C                                     |

### Product Line

| Structure          | Shaft configuration | Length of the shaft (mm) | Torque (mN·m)       | Number of detent    | Number of pulse    | Push-on switch | Travel of push-on switch (mm) | Minimum order unit (pcs.) |          | Product No.         | Drawing No.         |                     |         |                     |                     |                     |
|--------------------|---------------------|--------------------------|---------------------|---------------------|--------------------|----------------|-------------------------------|---------------------------|----------|---------------------|---------------------|---------------------|---------|---------------------|---------------------|---------------------|
|                    |                     |                          |                     |                     |                    |                |                               | Japan                     | Export   |                     |                     |                     |         |                     |                     |                     |
| Vertical           | Flat                | 20                       | 10±7                | 18                  | 9                  | Without        | —                             | 1,200                     | 2,400    | <b>EC11E09204A4</b> | 1                   |                     |         |                     |                     |                     |
|                    |                     |                          |                     |                     |                    |                |                               |                           |          | <b>EC11E15204A3</b> |                     |                     |         |                     |                     |                     |
|                    |                     |                          |                     |                     |                    |                |                               |                           |          | <b>EC11E1820402</b> |                     |                     |         |                     |                     |                     |
|                    |                     |                          |                     |                     |                    |                |                               |                           |          | 10±7                | 36                  | 18                  | 9       | With                | 0.5                 | <b>EC11E09244BS</b> |
|                    |                     |                          | <b>EC11E15244G1</b> |                     |                    |                |                               |                           |          |                     |                     |                     |         |                     |                     |                     |
|                    |                     |                          | <b>EC11E18244AU</b> |                     |                    |                |                               |                           |          |                     |                     |                     |         |                     |                     |                     |
|                    |                     |                          | <b>EC11E09244AQ</b> |                     |                    |                |                               |                           |          |                     |                     |                     |         |                     |                     |                     |
|                    |                     |                          | 10±7                | 30                  | 15                 | 9              | With                          |                           |          | 1.5                 | <b>EC11E15244B2</b> | 2                   |         |                     |                     |                     |
|                    |                     | <b>EC11E18244A5</b>      |                     |                     |                    |                |                               |                           |          |                     |                     |                     |         |                     |                     |                     |
|                    |                     | 15                       |                     |                     |                    |                |                               | 10±7                      | 30       |                     | 15                  |                     | Without | —                   | <b>EC11N1520401</b> | 3                   |
|                    |                     |                          |                     |                     |                    |                |                               |                           |          |                     |                     |                     |         |                     | 20                  | 30                  |
|                    |                     | 20                       | 30                  | 15                  | 15                 | Without        | —                             | <b>EC11N1525404</b>       | 3        |                     |                     |                     |         |                     |                     |                     |
|                    |                     |                          |                     |                     |                    |                |                               | 20                        | 30       | 15                  | 15                  | With                | 0.5     | <b>EC11N1524403</b> | 4                   |                     |
|                    |                     | 20                       | 30                  | 15                  | 15                 | With           | 1.5                           |                           |          |                     |                     |                     |         | <b>EC11N1525405</b> | 4                   |                     |
|                    |                     |                          |                     |                     |                    |                |                               | Less shaft wobble         | Serrated | 25                  | 12±7                | 30                  | With    | 1.5                 | 1,000               | 2,000               |
|                    |                     | 8.5±5                    | Without             | <b>EC11M1575403</b> | 6                  |                |                               |                           |          |                     |                     |                     |         |                     |                     |                     |
| Self-return switch | Flat                | 15                       | 3 to 30             | Without             | Self-return switch | Without        | —                             | 1,200                     | 2,400    | <b>EC1110120005</b> | 7                   |                     |         |                     |                     |                     |
|                    |                     | 20                       |                     |                     |                    |                |                               |                           |          | With                | 0.5                 | <b>EC111012010H</b> | 8       |                     |                     |                     |
|                    |                     |                          |                     |                     |                    |                |                               |                           |          |                     | 1.5                 | <b>EC1110120201</b> |         |                     |                     |                     |

### Note

Other varieties are also available. Please inquire.

### Packing Specifications


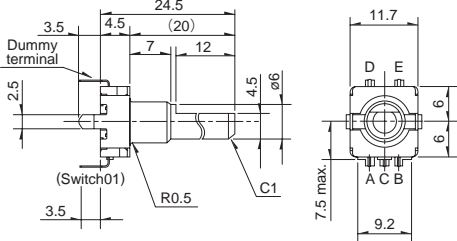
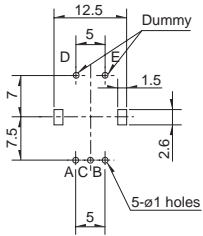

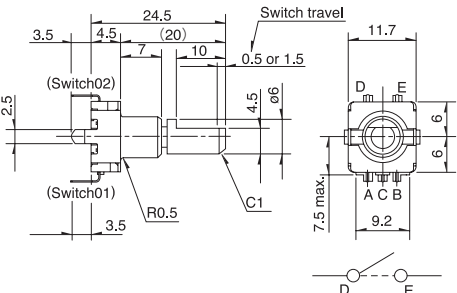
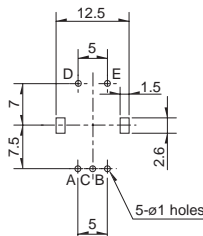

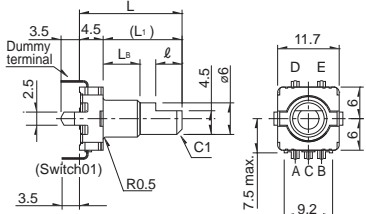
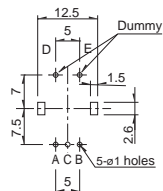

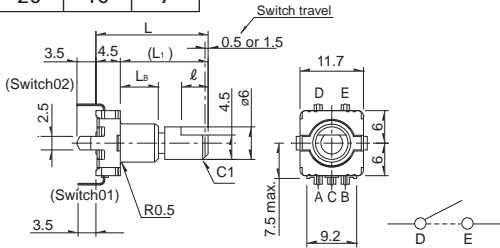
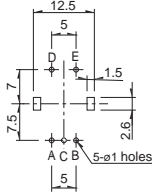

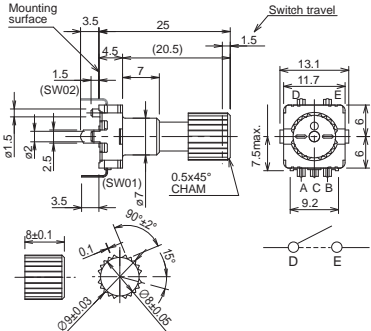
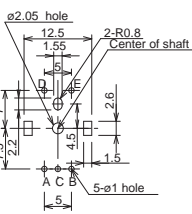
Tray

| Product No.        | Number of packages (pcs.) |                        | Export package measurements (mm) |
|--------------------|---------------------------|------------------------|----------------------------------|
|                    | 1 case /Japan             | 1 case /export packing |                                  |
| <b>EC11E/EC11N</b> | 1,200                     | 2,400                  | 540×360×254                      |
| <b>EC11M</b>       | 1,000                     | 2,000                  |                                  |
| <b>EC111</b>       | 1,200                     | 2,400                  | 507×363×216                      |

Refer to P.250 for product varieties.  
Refer to P.251 for switch specifications.  
Refer to P.275 for soldering conditions.

Dimensions

Unit:mm

| No.  | Photo   | Style  | PC board mounting hole dimensions<br>(Viewed from mounting side)                      |                |                |   |      |    |   |   |      |    |    |   |   |
|------|---|--|---|----------------|----------------|---|------|----|---|---|------|----|----|---|---|
| 1    |  <p><b>EC11E Vertical</b></p>  |    |    |                |                |   |      |    |   |   |      |    |    |   |   |
| 2    |  <p><b>EC11E Vertical with push-on switch (travel 0.5mm / 1.5mm)</b></p>  |   |    |                |                |   |      |    |   |   |      |    |    |   |   |
| 3    |  <p><b>EC11N Vertical</b></p>  | <table border="1" data-bbox="539 1048 810 1137"> <thead> <tr> <th>L</th> <th>L<sub>1</sub></th> <th>L<sub>B</sub></th> <th>ℓ</th> </tr> </thead> <tbody> <tr> <td>19.5</td> <td>15</td> <td>7</td> <td>5</td> </tr> <tr> <td>24.5</td> <td>20</td> <td>10</td> <td>7</td> </tr> </tbody> </table>  | L   | L <sub>1</sub> | L <sub>B</sub> | ℓ | 19.5 | 15 | 7 | 5 | 24.5 | 20 | 10 | 7 |  |
| L    | L <sub>1</sub>  | L <sub>B</sub>   | ℓ   |                |                |   |      |    |   |   |      |    |    |   |   |
| 19.5 | 15  | 7  | 5   |                |                |   |      |    |   |   |      |    |    |   |   |
| 24.5 | 20  | 10   | 7   |                |                |   |      |    |   |   |      |    |    |   |   |
| 4    |  <p><b>EC11N Vertical with push-on switch (travel 0.5mm / 1.5mm)</b></p> | <table border="1" data-bbox="539 1406 810 1496"> <thead> <tr> <th>L</th> <th>L<sub>1</sub></th> <th>L<sub>B</sub></th> <th>ℓ</th> </tr> </thead> <tbody> <tr> <td>19.5</td> <td>15</td> <td>7</td> <td>5</td> </tr> <tr> <td>24.5</td> <td>20</td> <td>10</td> <td>7</td> </tr> </tbody> </table>  | L   | L <sub>1</sub> | L <sub>B</sub> | ℓ | 19.5 | 15 | 7 | 5 | 24.5 | 20 | 10 | 7 |  |
| L    | L <sub>1</sub>  | L <sub>B</sub>   | ℓ   |                |                |   |      |    |   |   |      |    |    |   |   |
| 19.5 | 15  | 7  | 5   |                |                |   |      |    |   |   |      |    |    |   |   |
| 24.5 | 20  | 10   | 7   |                |                |   |      |    |   |   |      |    |    |   |   |
| 5    |  <p><b>EC11M Vertical with push-on switch (travel 1.5mm)</b></p>         |    |  |                |                |   |      |    |   |   |      |    |    |   |   |

Encoders

Metal Shaft

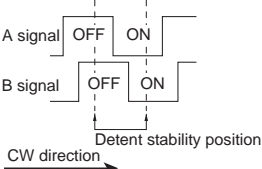
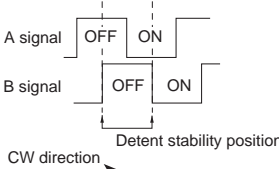
Insulated Shaft

Through Shaft Type

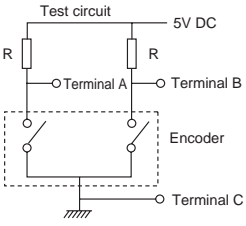
Ring Type



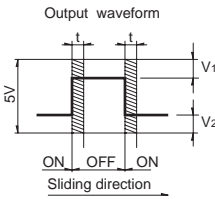
Output Wave

| EC11E, EC11N, EC11M  | EC11E   |
|--|---|
| <p>EC11E 30 detents, 15 pulse<br/>EC11N, EC11M</p>  | <p>Detent stability position cannot be specified for B signal<br/>EC11E 18 detents 9 pulse<br/>EC11E 36 detents 18 pulse</p>  |

Sliding Noise



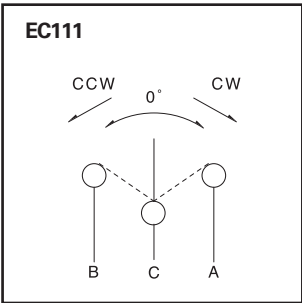
Measurement condition : Rotation speed 360°/s t : Masking time to avoid chattering



**EC11E/EC11N/EC11M**

$V_1=V_2=1.5V$  max.  
At R = 5k $\Omega$   
Chattering : 3ms max.  
Bounce : 2ms max.

Circuit Diagram



Encoders  
Metal Shaft  
Insulated Shaft  
Through Shaft Type  
Ring Type

# 1 1 mm Size Metal Shaft Type / Product Varieties

In addition to the Product Line, we accommodate the following specifications. Combinations not included in the Product Line are treated as semi-standard products.

## ■ Shaft Dimensions

### 1. Single-shaft Type

#### 1) Serrated Type

Unit:mm

**EC11 (Except EC11M)**  
**Style (Shaft diameter:  $\phi 6$ )**

● Detailed dimensions

| $L_1$ | $L_B$ | $l_1$ | $l_2$ | $S_1$ |
|-------|-------|-------|-------|-------|
| 20    | 7     | 6     | 1     | 7     |
| 25    | 10    | 10    | 2     | 11    |

---

**EC11M**  
**Style (Shaft diameter:  $\phi 9$ )**

● Detailed dimensions

| L  | $L_1$ | $L_B$ |
|----|-------|-------|
| 18 | 13.5  | 5     |
| 25 | 20.5  | 7     |
| 28 | 23.5  | 10    |

#### 2) Flat Type

Unit:mm

**EC11**  
**Style (Shaft diameter:  $\phi 6$ )**

● Detailed dimensions

| $L_1$ | $L_B$ | $l$     |
|-------|-------|---------|
| 15    | 5     | 7       |
| 15    | 7     | 5 (6)   |
| 20    | 7     | 10 (12) |
| 25    | 10    | 12      |

※1 Does not comply with EC111

Values in parentheses apply to products without push-on switch.

#### 3) Slotted Type

Unit:mm

**EC11**  
**Style (Shaft diameter:  $\phi 6$ )**

● Detailed dimensions

| $L_1$ | $L_B$ |
|-------|-------|
| 15    | 7     |
| 20    | 7     |
| 25    | 10    |

### Notes

1. Shaded areas in shaft type details indicate specifications included in the product lineup on P.246
2. Other varieties are also available. Please inquire.

# 1 1 mm Size Metal Shaft Type / Switch Specifications

## 1. EC11E/EC11N/EC111 Series

|                        |                       |   |         |
|------------------------|-----------------------|---|---------|
| Switch type            |                       | Momentary push switch   |         |
| Contact arrangement    |                       | Single pole and single throw (Push-on)                          |         |
| Travel (mm)            |                       | 0.5±0.3   | 1.5±0.5 |
| Operating force        |                       | 6 <sup>+2.5</sup> <sub>-2</sub> N                               | 4±2N    |
| Operating life         |                       | 20,000 times  |         |
| Electrical performance | Rating                | 0.1A 5V DC (500μA 5V DC min. ratings)                           |         |
|                        | Contact resistance    | 100mΩ max. for initial period, 200mΩ max. after operating life. |         |
|                        | Insulation resistance | 100MΩ min. 250V DC  |         |
|                        | Voltage proof         | 300V AC for 1 minute or 360V AC for 2 second                    |         |

## 2. EC11M Series

|                        |                       |   |  |
|------------------------|-----------------------|---|--|
| Switch type            |                       | Momentary push switch   |  |
| Contact arrangement    |                       | Single pole and single throw (Push-on)                          |  |
| Travel (mm)            |                       | 1.5±0.35  |  |
| Operating force        |                       | 5±2N  |  |
| Operating life         |                       | 20,000 times  |  |
| Electrical performance | Rating                | 0.15A 5V DC (500μA 5V DC min. ratings)                          |  |
|                        | Contact resistance    | 100mΩ max. for initial period, 200mΩ max. after operating life. |  |
|                        | Insulation resistance | 100MΩ min. 250V DC  |  |
|                        | Voltage proof         | 300V AC for 1 minute or 360V AC for 2 second                    |  |

Encoders

Metal Shaft











Insulated Shaft

Through Shaft Type

Ring Type

# Encoders

## List of Varieties

| Type                               |  | Metal shaft   |  |   |         |   |         |   |         |   |                         |         |  |
|------------------------------------|--|---|--|---|---------|---|---------|---|---------|---|-------------------------|---------|--|
|                                    |  | 9mm size  |  | 11mm size   |         |   |         |   |         |   |                         |         |  |
| Series                             |  | EC09E   |  | EC11E   |         | EC11N   |         | EC11M   |         | EC111   |                         |         |  |
| Photo                              |  |  |  |  |         |  |         |  |         |  |                         |         |  |
| Output                             |  | Incremental (Two phase A and B )  |  |   |         |   |         |   |         | Self-return switch  |                         |         |  |
| Shaft types                        |  | Single-shaft  |  |   |         |   |         |   |         |   |                         |         |  |
| Control part orientation           |  | Vertical  |  |   |         |   |         |   |         |   |                         |         |  |
| Number of pulse / Number of detent |  | 15/30   |  | 9/18<br>15/30<br>18/36  |         | 15/30   |         | 15/30<br>15/without   |         | —   |                         |         |  |
| Features                           |  | —   |  | —   |         | —   |         | Less shaft wobble   |         | —   |                         |         |  |
| Dimensions (mm)                    |  | W   |  | 9.5   |         | 11.7  |         |   |         |   |                         |         |  |
|                                    |  | D   |  | 12  |         |   |         |   |         | 13  |                         |         |  |
|                                    |  | H   |  | 4.5   |         |   |         |   |         |   |                         | 5       |  |
| Operating temperature range        |  | -40°C to +85°C  |  |   |         |   |         |   |         |   |                         |         |  |
| Operating life                     |  | 15,000 cycles   |  |   |         |   |         |   |         |   |                         |         |  |
| Automotive use                     |  | ●   |  | ●   |         | ●   |         | ●   |         | ●   |                         |         |  |
| Life cycle (availability)          |  |  |  |  |         |  |         |  |         |  |                         |         |  |
| Electrical performance             |  | Rating  |  | 10mA 5V DC  |         |   |         |   |         |   |                         |         |  |
|                                    |  | Max./min. operating current (Resistive load)                                      |  | 10mA /1mA   |         |   |         |   |         |   |                         |         |  |
|                                    |  | Insulation resistance   |  | 100MΩ min. 250V DC  |         |   |         |   |         |   |                         |         |  |
|                                    |  | Voltage proof   |  | 300V AC for 1 minute or 360V AC for 1s  |         | 300V AC for 1 minute or 360V AC for 2s  |         |   |         |   |                         |         |  |
| Mechanical performance             |  | Rotational torque (Without detent)  |  | —   |         | —   |         | 8.5±5mN·m   |         | 3 to 30mN·m   |                         |         |  |
|                                    |  | Detent torque   |  | 8±5mN·m   |         | 10±7mN·m  |         |   |         | 12±7mN·m  |                         | —       |  |
|                                    |  | Push-pull strength  |  | 100N  |         |   |         |   |         |   |                         |         |  |
| Shaft configuration                |  | Flat  |  | Flat, Slotted, Serrated   |         | Flat  |         | Serrated  |         | Flat, Slotted, Serrated   |                         |         |  |
| Terminal type                      |  | Insertion   |  |   |         |   |         |   |         |   |                         |         |  |
| Switch Specifications              |  | Switch type   |  | Push-on switch  |         |   |         |   |         |   |                         |         |  |
|                                    |  | Contact arrangement   |  | Single pole and single throw (Push-on)  |         |   |         |   |         |   |                         |         |  |
|                                    |  | Travel (mm)   |  | 0.5±0.3   | 1.5±0.5 | 0.5±0.3   | 1.5±0.5 | 0.5±0.3   | 1.5±0.5 | 1.5±0.35  | 0.5±0.3                 | 1.5±0.5 |  |
|                                    |  | Operating force (N)   |  | 6 $\pm$ $\frac{2.5}{2}$   | 4±2     | 6 $\pm$ $\frac{2.5}{2}$   | 4±2     | 6 $\pm$ $\frac{2.5}{2}$   | 4±2     | 5±2   | 6 $\pm$ $\frac{2.5}{2}$ | 4±2     |  |
|                                    |  | Rating  |  | 10mA 5V DC (1mA 5V DC min. ratings)   |         | 0.1A 5V DC (500μA 5V DC min. ratings)   |         |   |         |   |                         |         |  |
|                                    |  | Contact resistance  |  | 100mΩ max. for initial period; 200mΩ max. after operating life.                   |         |   |         |   |         |   |                         |         |  |
|                                    |  | Operating life  |  | 10,000 times  |         | 20,000 times  |         |   |         |   |                         |         |  |
| Page                               |  | 244   |  | 246   |         |   |         |   |         |   |                         |         |  |

|                               |     |
|-------------------------------|-----|
| Encoders Soldering Conditions | 275 |
| Encoders Cautions             | 276 |

### Notes

- Indicates applicability to all products in the series.

## Reference for Manual Soldering

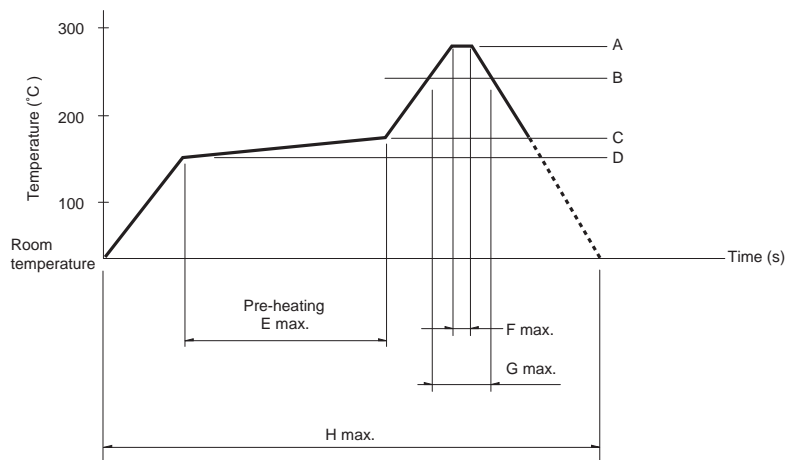
| Series   | Tip temperature | Soldering time | No. of solders |
|--|-----------------|----------------|----------------|
| EC05E, EC09E, EC10E, EC111, EC11E, EC11M, EC11N, EC12D, EC12E, EC18A, EC21A, EC28A, EC35A, EC35AH, EC40A, EC50A, EM11B, EC21C, EC28C, EC35CH | 350°C max.      | 3s max.        | 1 time         |

## Reference for Dip Soldering

| Series   | Preheating                    |              | Dip soldering         |                | No. of solders |
|--|-------------------------------|--------------|-----------------------|----------------|----------------|
|  | Soldering surface temperature | Heating time | Soldering temperature | Soldering time |                |
| EC09E, EC111, EC11E, EC11M, EC11N, EC18A, EC21A, EC28A, EC35A, EC35AH, EC50A | 100°C max.                    | 2 min. max.  | 260±5°C               | 5±1s           | 2 times max.   |
| EM11B  | 100°C max.                    | 1 min. max.  | 260°C max.            | 3s max.        | 2 times max.   |
| EC10E, EC12D, EC12E  | 100°C max.                    | 1 min. max.  | 260±5°C               | 3±1s           | 2 times max.   |
| EC40A  | 110°C max.                    | 1 min. max.  | 260°C max.            | 10s max.       | 1 time         |

## Example of Reflow Soldering Condition

Temperature profile



| Series        | A              | B          | C     | D     | E           | F  | G          | H         | No. of reflows |
|---------------|----------------|------------|-------|-------|-------------|----|------------|-----------|----------------|
| EC05E         | 250°C min.     | 230°C min. | 180°C | 150°C | 60s to 120s | —  | 30s to 40s | —         | 2 times max.   |
| EC21C         | 230°C to 245°C | 220°C      | 200°C | 150°C | 60s to 120s | —  | 25s to 60s | 300s max. | 1 time max.    |
| EC28C, EC35CH | 260°C          | 230°C      | 180°C | 150°C | 2 min. min. | 3s | 40s        | 230s max. | 1 time max.    |

### Notes

1. When using an infrared reflow oven, solder may sometimes not be applied. Be sure to use a hot air reflow oven or a type that uses infrared rays in combination with hot air.
2. The temperatures given above are the maximum temperatures at the terminals of the encoder when employing a hot air reflow method. The temperature of the PC board and the surface temperature of the encoder may vary greatly depending on the PC board material, its size and thickness. Ensure that the surface temperature of the encoder does not rise to 250°C or greater.
3. Conditions vary to some extent depending on the type of reflow bath used. Be sure to give due consideration to this prior to use.



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