

Customer : ALPS ELECTRIC EUROPA GmbH

No. F3853647M

Date : Nov. 18, 1994

Attention :

Your ref. No :

Your Part. No : STEC16B02

SPECIFICATIONS

ALPS :

MODEL EC16B24202
(WITH DETENT)

Spec. No. :

Sample No. : F3853647M

RECEIPT STATUS

RECEIVED

By. Date

Signature

Name

Title

ALPS ELECTRIC CO., LTD.

HEAD OFFICE
1-7, YUKIGAYA-OHTSUKA-CHO.
OHTA-KU, TOKYO 145 JAPAN

DSG'D *Y. Saitoh*

APP'D *M. Saitoh*

ENG. DEPT. DIVISION

Sales

SPECIFICATIONS

1. THIS SPECIFICATIONS APPLY TO EC16B24202 ROTARY ENCODERS.

2. CONTENTS OF THIS SPECIFICATIONS.

4LE21630
LE2160C

3. MARKING

· MARKING ON ALL UNITS
EIA DATE CODE

4. REMARKS

· FURNISH PACKAGE
NUT: 1, WASHER: 1
· NOTES

· This unit uses polycarbonate. To be careful for using this unit in such violent gas atmospheric condition as ammonia, amine, alkaline aqueous solution, aromatic hydrocarbon, keton, ester, alkyl hydrocarbon, etc.
· Marking ⇒ in specifications shows standard and condition for application.

1. 一般事項 General

1-1 適用範囲 SCOPE

この仕様書は主として電子機器に用いる微小電流回路用16形薄形ロータリーエンコーダに適用する。
This specification applies to 16mm size low-profile rotary encoder (incremental type) for microscopic current circuits, used in electronic equipment.

2-1 標準状態 Standard atmospheric conditions

測定は特に指定のない限り、次の状態で行なう。
Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

温度 Ambient temperature : 15°C to 35°C
 相対湿度 Relative humidity : 25% to 85%
 気圧 Air pressure : 86kPa to 106kPa

但し、疑義を生じた場合は、次の標準状態で行なう。

If there is any doubt about the results, measurements shall be made within the following limits:

温度 Ambient temperature : 20 ± 1°C
 相対湿度 Relative humidity : 63% to 67%
 気圧 Air pressure : 86kPa to 106kPa

1-3 使用温度範囲

Operating temperature range : -10°C to +70°C

1-4 保存温度範囲

Storage temperature range : -40°C to +80°C

2. 構造 Construction

2-1 寸法 Dimensions

添付組立図による。
Refer to attached drawing.

3. 定格 Rating

3-1 定格電圧

Rated voltage : D.C. 5V

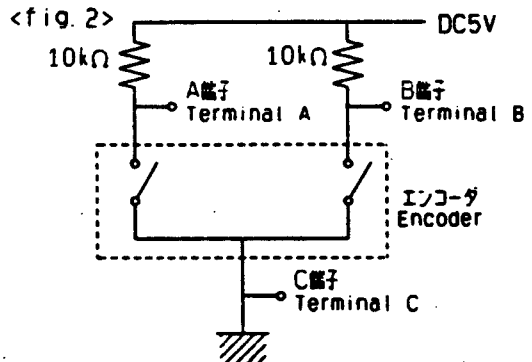
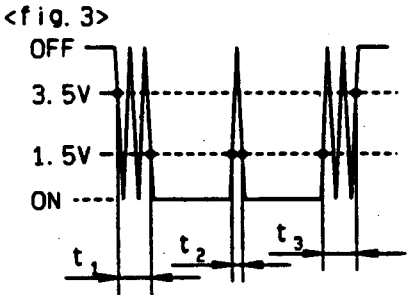
3-2 最大定格電流 (抵抗負荷)


Maximum operating current (resistive load)

各リード Each lead : 0.5mA
 コモンリード Common lead : 1mA

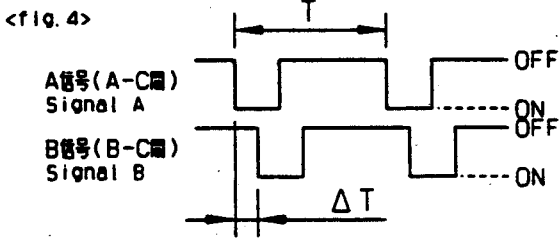
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| | | | | | ALPS ALPS ELECTRIC CO., LTD. | | | | |
| | | | | | APPD. | CHKD. | DSGD. | TITLE ROTARY ENCODER | |
| | | | | | June 27 '94 | Jun. 27 '94 | June 27 '94 | 回線形エンコーダ | |
| | | | | | S. Sakai | R. Yamazaki | T. Suzuki | DOCUMENT NO. | |
| SYMB | DATE | APPD | CHKD | DSGD | 4 L E 2 1 6 3 0 (1/7) | | | | |


4. 電気的特性 Electrical characteristics

| 項目 Item | 条件 Conditions | 規格 Specifications | | | | | | | | | | | | | |
|---|---|--|--------------|----------------|---------------|------------------------------|-----------|------------------------------|-----------|-------------------|------------------------------|-----------|------------------------------|-----------|---|
| 4-1 出力信号 Output signal format | <p><Fig 1></p> <table border="1"> <thead> <tr> <th>回転方向 Shaft rotational direction</th> <th>信号 Signal</th> <th>出力波形 Output</th> </tr> </thead> <tbody> <tr> <td rowspan="2">時計方向 C. W.</td> <td>A(A-C端子間) A(Terminal A-C)</td> <td>OFF ON</td> </tr> <tr> <td>B(B-C端子間) B(Terminal B-C)</td> <td>OFF ON</td> </tr> <tr> <td rowspan="2">反時計方向 C. C. W.</td> <td>A(A-C端子間) A(Terminal A-C)</td> <td>OFF ON</td> </tr> <tr> <td>B(B-C端子間) B(Terminal B-C)</td> <td>OFF ON</td> </tr> </tbody> </table> | 回転方向 Shaft rotational direction | 信号 Signal | 出力波形 Output | 時計方向 C. W. | A(A-C端子間) A(Terminal A-C) | OFF ON | B(B-C端子間) B(Terminal B-C) | OFF ON | 反時計方向 C. C. W. | A(A-C端子間) A(Terminal A-C) | OFF ON | B(B-C端子間) B(Terminal B-C) | OFF ON | <p>A, B 2信号の位相差出力とし、詳細は<fig. 1>の通りとする。 (破線はクリック付きの場合のクリックの位置を示す。)</p> <p>2 Phase-different signals (Signal A, signal B) Details shown in <fig. 1>. (The broken line shows detent position of with-detent type.)</p> |
| 回転方向 Shaft rotational direction | 信号 Signal | 出力波形 Output | | | | | | | | | | | | | |
| 時計方向 C. W. | A(A-C端子間) A(Terminal A-C) | OFF ON | | | | | | | | | | | | | |
| | B(B-C端子間) B(Terminal B-C) | OFF ON | | | | | | | | | | | | | |
| 反時計方向 C. C. W. | A(A-C端子間) A(Terminal A-C) | OFF ON | | | | | | | | | | | | | |
| | B(B-C端子間) B(Terminal B-C) | OFF ON | | | | | | | | | | | | | |
| 4-2 分解能 Resolution | 1回転で出力されるパルス数 Number of pulses in 360° rotation. | 各相 24パルス/360° 24 pulses/360° for each phase | | | | | | | | | | | | | |
| 4-3 スイッチング特性 Switching characteristics | <p>下記測定回路<fig. 2>を用い、回転角を360°・S⁻¹の速さで回転し測定する。 Measurement shall be made under the condition as follows. 1) Shaft rotational speed : 360°・S⁻¹ 2) Test circuit : <fig. 2></p> <p><fig. 2></p>  <p><fig. 3></p>  <p>(注記) コードON状態 : 出力電圧が1.5V以下の状態を言う。 コードOFF状態 : 出力電圧が3.5V以上の状態を言う。 (note) Code-ON area : The area which the voltage is 1.5V or less. code-OFF area : The area which the voltage is 3.5V or more.</p> | <p>$t_1, t_3 \leq 3\text{ms}$</p> | | | | | | | | | | | | | |
| 1) チャタリング Chattering | <p>コードのOFF→ON及びON→OFFの際の、出力1.5V~3.5Vの通過時間にて規定する。 Specified by the signal's passage time from 3.5V to 1.5V or from 1.5V to 3.5V of each switching position (code OFF→ON or ON→OFF).</p> | <p>$t_1, t_3 \leq 3\text{ms}$</p> | | | | | | | | | | | | | |

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| | | S. Sakai | Y. Yamazaki | T. Suzuki |
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| June 27 '94 | | June 27 '94 | June 27 '94 | ROTARY ENCODER 回転エンコーダ |
| DOCUMENT NO. | | | | |
| 4 L E 2 1 6 3 0 | | | | (2/7) |

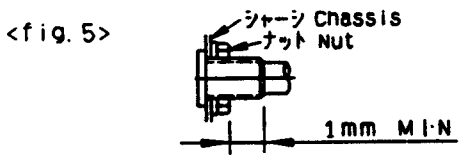
OR

| 項目 Item | 条件 Conditions | 規格 Specifications |
|---|---|--|
| 2) ぶれ/イズ (バウンス) Sliding noise (Bounce) | コードONの部分の1.5V以上の電圧変動時間とし、チャタリング t_1 , t_2 両者との間に1mS以上の1.5V以下のON部分を有するものとする。また、ぶれ/イズ間に1.5V以下の電圧変動が1mSある場合は、別のぶれ/イズと判断する。 Specified by the time of voltage change exceed 1.5V in code-ON area. When the bounce has code-ON time less than 1mS between chattering (t_1 or t_2), the voltage change shall be regarded as a part of chattering. When the code-ON time between 2 bounces is less than 1mS, they are regarded as 1 linked bounce. | $t_2 \leq 2mS$ |
| 3) ぶれ/イズ Sliding noise | コードOFFの部分の電圧変動 The voltage change in code-OFF area. | 3. 5V以上 3. 5V MIN |
| 4-4 位相差 Phase-difference | 定速(クリックなしの状態)で操作軸を回転する。 Measurement shall be made under the condition which the shaft is rotated in constant speed (without detents). <fig. 4>  | <fig. 4>において $\Delta T = 0.15T \pm 0.1T$ In <fig. 4> |
| 4-5 耐電圧 Dielectric strength | 端子-軸受間にA. C. 50V1分間印加する。 A voltage of 50V A. C. shall be applied for 1min between individual terminals and bushing. | 絶縁破壊のないこと。 without arcing or breakdown. |
| 4-6 絶縁抵抗 Insulation resistance | 端子-軸受間にD. C. 50V印加する。 Measurement shall be made under the condition which a voltage of 50V D. C. is applied between individual terminals and bushing. | 端子-軸受間に710MΩ以上 Between individual terminals and bushing: 10MΩ MIN. |

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| June 27 '94 | | Jun. 27 '94 | | June 27 '94 | | 回形エンコーダ | | | |
| S. Sakai | | Y. Yamazaki | | T. Suzuki | | DOCUMENT NO. | | | 4 L E 2 1 6 3 0 (3/7) |
| SYMB | DATE | APPD | CHKD | DSGD | | | | | |

5. 機械的性質 Mechanical characteristics


| 項目 Item | 条件 Conditions | 規格 Specifications |
|--|--|--|
| 5-1 全回転角度 Total rotational angle | | 360° (エンドレス) 360° (Endless) |
| 5-2 クリックトルク Detent torque | (クリック付きのみ適用) (Applied for with-detent type) | 3~20mN・m (30.6~204gf・cm) |
| 回転トルク Rotational torque | (クリックなしのみ適用) (Applied for without-detent type) | 10mN・m MAX. (102gf・cm MAX.) |
| | | 但し、-10°C~+5°Cでは、軸が回転すること。 Shaft rotatable at -10°C~+5°C. |
| 5-3 クリック点数及び位置 Number and position of detents | (クリック付きのみ適用) (Applied for with-detent type) | 24点クリック 24 detents (ステップ角度 15° ± 3°) (Step angle: 15° ± 3°) |
| 5-4 軸の押し引き強度 Push-pull strength of shaft | 軸の押し及び引き方向に80N(8.16kgf)の静荷重を10秒間加える。(セット実装状態) Push and pull static load of 80N shall be applied to the shaft in the axial direction for 10S. (After installing) | 軸の振動、著しい回転ムラ、ガタ等の異常がなく電気的性質を満足すること。 Without damage to, or excessive play in shaft. No excessive abnormality in rotational feeling. And electrical characteristics shall be satisfied. |
| 5-5 端子強度 Terminal strength | 端子先端の任意の方向に3N(0.31kgf)の静荷重を10秒間加える。 A static load of 3N shall be applied to the tip of terminals for 10S in any direction. | 著しいガタ及び接触不良を生じないこと。 Without excessive play in terminals or poor contact. |
| 5-6 軸ガタ Shaft wobble | 軸先端から5mmの位置に50mN・m(0.51kgf・cm)の曲げモーメントを加える。 A momentary load of 50mN・m shall be applied at the point 5mm from the tip of the shaft in a direction perpendicular to the axis of shaft. | 0.7×L/30mm-D以内 0.7×L/30mm-D MAX. (Lは取付長さで比例計算する。) (1: Shaft length) |
| 5-7 軸のスラスト方向ガタ Shaft play in axial direction | 軸に5N(0.51kgf)の押し引き荷重を加える。 Push and pull static load of 5N shall be applied to the shaft in the axial directions. | 0.4mm-D以内 0.4mm-D MAX. |
| 5-8 軸の垂直押し強度 Side thrust strength of shaft | 軸先端から5mmの位置に30N(3.06kgf)の静荷重を10秒間加える。 A load of 30N shall be applied at the point 5mm from the tip of the shaft in a direction perpendicular to the axis of shaft. | 著しいガタ及び、曲がりのないこと。 又、機械的に異常のないこと。 Without excessive play or bending in shaft. No mechanical abnormality. |
| 5-9 軸受ネジ締付強度 Bushing nut tightening strength | <fig. 5>を満足するように締付る。 Tighten the nut according to <fig. 5> | 1N・m(10.2kgf・cm)以下にて使用のこと。 Tightening torque to be no greater than 1N・m. |



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| | | | | | S. Sakai | R. Yamazaki | T. Suzuki | DOCUMENT NO. |
| | | | | | | | | 4LE21630 (4/7) |

| | 項目 Item | 条件 Conditions | 規格 Specifications |
|------|--|---|--|
| 5-10 | はんだ耐熱 Resistance to soldering heat | 7項の「はんだ付け条件」による。 Specified by the clause 7 "Soldering conditions". | はんだ付け後、電気的性能を満足すること。また、著しいガタ等機械的に異常のないこと。 Electrical characteristics shall be satisfied. No mechanical abnormality such as a excessive play. |

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| | | | | | June 27 '94 | Jun. 27 '94 | June 27 '94 | 回転エンコーダ |
| | | | | | S. Sakai | K. Yamazaki | T. Suzuki | DOCUMENT NO. |
| SYMB | DATE | APPD | CHKD | DSGD | 4 L E 2 1 6 3 0 (5/7) | | | |

OR

6. 耐久性能 Endurance characteristics.

| 項目 Item | 条件 Conditions | 規格 Specifications |
|-----------------------------|--|--|
| 6-1 寿命性能 Rotational life | 無負荷で軸を $360^{\circ} \cdot 5^{-1}$ の速さで、100,000回回転動作を行う。 The shaft of encoder shall be rotated to 100,000 cycles at a speed of $360^{\circ} \cdot 5^{-1}$ without electrical load, after which measurements shall be made. | チャタリング $t_1, t_2 \leq 5mS$ バウンス $t_3 \leq 3mS$ その他、初期規格を満足すること。 Chattering $t_1, t_2 \leq 5mS$ Bounce $t_3 \leq 3mS$ Except above items, specifications in clause 4.1~4.6 and 5.1~5.3 shall be satisfied. |
| 6-2 耐湿特性 Demo heat | 温度 $40 \pm 2^{\circ}C$ 、湿度90~95%の恒温湿槽中に 240 ± 10 時間放置後、常温、常湿中に1.5時間放置する。 The encoder shall be stored at a temperature of $40 \pm 2^{\circ}C$ with relative humidity of 90% to 95% for $240 \pm 10H$ in a thermostatic chamber. And then the encoder shall be subjected to standard atmospheric conditions for 1.5H, after which measurements shall be made. | 初期規格を満足すること。 Specifications in clause 4.1~4.6 and 5.1~5.3 shall be satisfied |
| 6-3 耐熱特性 Dry heat | 温度 $80 \pm 3^{\circ}C$ の恒温槽中に 240 ± 10 時間放置後、常温、常湿中に1.5時間放置する。 The encoder shall be stored at a temperature of $80 \pm 3^{\circ}C$ for $240 \pm 10H$ in a thermostatic chamber. And then the encoder shall be subjected to standard atmospheric conditions for 1.5H, after which measurements shall be made. | 初期規格を満足すること。 Specifications in clause 4.1~4.6 and 5.1~5.3 shall be satisfied. |
| 6-4 耐寒特性 Cold | 温度 $-40 \pm 3^{\circ}C$ の恒温槽中に 240 ± 10 時間放置後、常温、常湿中に1.5時間放置する。 The encoder shall be stored at a temperature of $-40 \pm 3^{\circ}C$ for $240 \pm 10H$ in a thermostatic chamber. And then the encoder shall be subjected to standard atmospheric conditions for 1.5H, after which measurement shall be made. | 初期規格を満足すること。 Specifications in clause 4.1~4.4.6 and 5.1~5.3 shall be satisfied. |
| 6-5 耐落下性 Free falling | 60cmの高さより製品の任意の方向からビニルを張ったコンクリートの床上に自由落下させる。 The encoder shall be fallen freely at any posture from 60cm height to the concrete floor covered with vinyl-tile, after which measurement shall be made. | 著しい変形、破損等がなく初期規格を満足すること。 (但し、端子部の変形は除く。) No excessive deformation or damage. (Except the deformation of terminals.) And specifications in clause 4.1~4.6 and 5.1~5.3 shall be satisfied. |
| 6-6 耐振性 Vibration | 10~55~10HZと変化する振動(1周期1分/振幅1.5mm)をX、Y、Z、各方向に2時間加える。 The following vibration shall be applied to the encoder, after which measurement shall be made: The entire frequency range, from 10Hz to 55Hz and return to 10Hz, shall be transversed in 1 min. Amplitude(total excursion): 1.5mm. This motion shall be applied for a period of 2H in each of 3 mutually perpendicular axes (A total of 6H). | 初期規格を満足すること。 Specifications in clause 4.1~4.6 and 5.1~5.3 shall be satisfied. |

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| | | | | | ALPS ALPS ELECTRIC CO., LTD. | | | | |
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| | | June 27 '94 | June 27 '94 | June 27 '94 | | | | | |
| | | S. Sakai | Y. Masaki | T. Suzuki | DOCUMENT NO. | | | | |
| SYMB | DATE | APPD | CHKD | DSGD | 4 L E 2 1 6 3 0 (6/7) | | | | |

7. はんだ付け条件 Soldering conditions

7-1 手はんだの場合 Manual soldering

温度300°C以下、時間3秒以内

Bit temperature of soldering iron : 300°C or less.
Application time of soldering iron : within 3s.

7-2 ティップはんだの場合 Dip soldering (カント端子のみ適用 For printed wiring only.)

使用基板 : t1. 6片面銅箔基板

Printed wiring board: Single-sided copper clad laminate board with thickness of 1.6mm

フラックス : 比重0.82以上のフラックスを用い発泡式フラクサーにて発泡面高さ、基板厚の半分を目安とし、かつ基板表面にフラックスの浸入がないこと。

Flux:

- Specific gravity: 0.82 or more.
- Flux shall be applied to the board using a bubble foaming type fluxer.
- The board shall be soaked in the flux bubble only to the middle of its thickness.
- Flux shall not come into contact with the component side surface.

プリヒート : 基板表面温度100°C以下、時間2分以内

Preheating:

- Surface temperature of board: 100°C or less.
- Preheating time: within 2 min.

はんだ : 温度260°C以下、時間3秒以内

Soldering:

- Solder temperature: 260°C or less.
- Immersion time: within 3s.

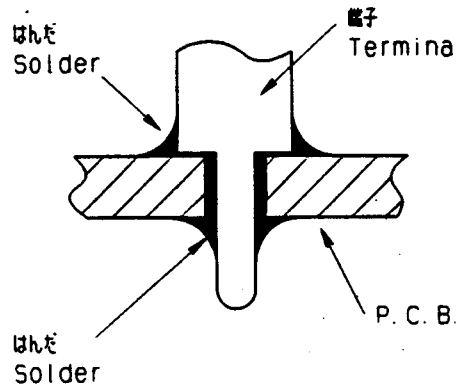
以上の工程を1回または2回通過する。


Apply the above soldering process for 1 or 2 times.

B. はんだ付け時のご注意事項 Note for soldering method. (カント端子のみ適用 For printed wiring only.)

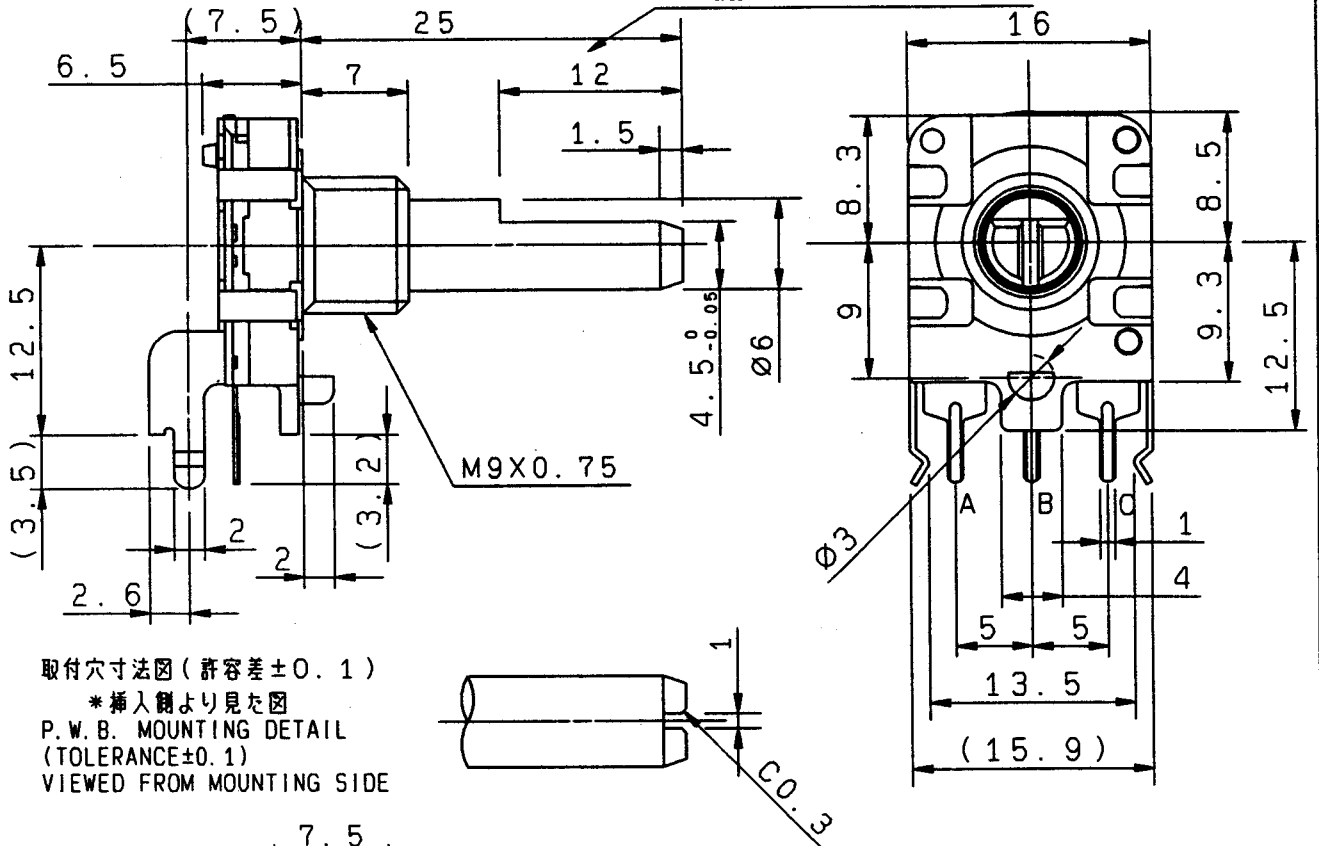
下図のようにP. C. B. の上面にはんだ付けをする配線は、お避けください。

Please avoid soldering on upper surface (the component side surface) of the PC board as shown below.

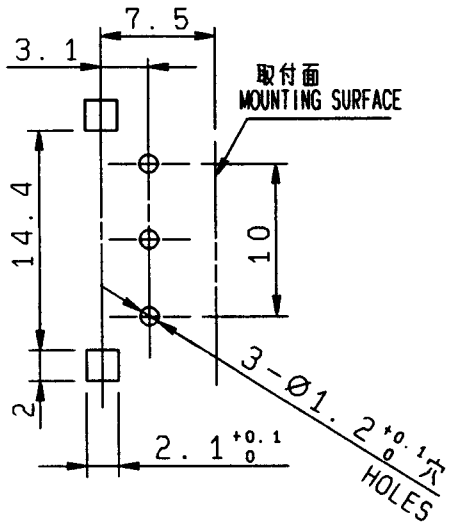


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| | | | | |  ALPS ELECTRIC CO., LTD. | | | |
| | | APPD. June 27 '94 <i>S. Takai</i> | CHKD. Jan 27 '94 <i>R. Yamazaki</i> | DSGD. June 27 '94 T. Suzuki | TITLE ROTARY ENCODER 回転エンコーダ | | | |
| | | | | | DOCUMENT NO. 4 L E 2 1 6 3 0 (7/7) | | | |
| SYMB | DATE | APPD | CHKD | DSGD | | | | |

この間は $\phi 6_{-0.05}^0$
 $\phi 6_{-0.05}^0$ WITHIN THIS LENGTH



取付穴寸法図 (許容差 ± 0.1)
 *挿入側より見た図
 P.W.B. MOUNTING DETAIL
 (TOLERANCE ± 0.1)
 VIEWED FROM MOUNTING SIDE



軸色調: 黒
 SHAFT COLOR: BLACK

| 指定なき部分の許容差 TOLERANCES UNLESS OTHERWISE SPEC | |
|--|---------------|
| $L \leq 10$ | ± 0.3 |
| $10 < L < 100$ | ± 0.5 |
| $100 \leq L$ | ± 0.8 |
| 角度 ANGULAR DIMENSION | $\pm 5^\circ$ |

| | | | | | | | |
|--------------------------------|------|----------------------|-----------|---------------|--------------|------------------|---------|
| | | | | 24マス | | L=25 立形 フリック付 | |
| PART NO. | NAME | MATERIAL NAME / CODE | | FINISH | | | |
| ALPS ELECTRIC CO., LTD. | | | | | | | |
| | | DSGD. セツケ11 | | SCALE | | | |
| | | Y. OHYA | '94-09-05 | 2:1 | | | |
| | | CHKD. | | TITLE | | | |
| | | M. SATO | '94-09-05 | 16形薄形エンコーダ組立図 | | | |
| | | APPD. | | UNIT | DOCUMENT NO. | | |
| SYMB | DATE | APPD | CHKD | DSGD | R, ARASAWA | '94-09-05 | LE2160C |

B6523

To : ALPS ELECTRIC EUROPA GmbH

1995

Subject

The improvement of bushing quality in 16mm size rotary low-profile encoder.

Gentlemen

We greatly appreciate your favor to us and we would like to inform you that we intend to improve bushing quality.

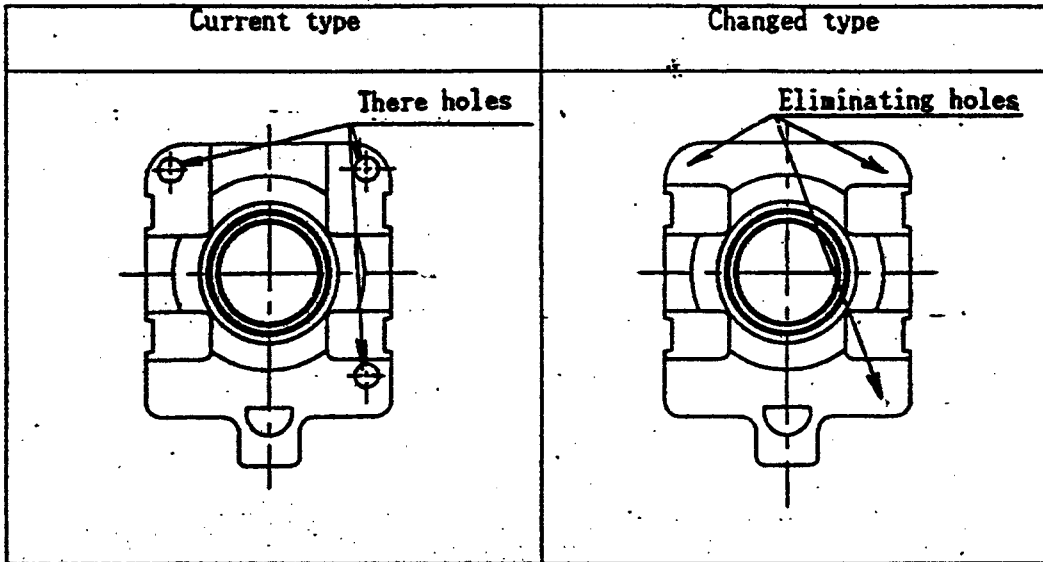
Notes

1. Applicable part numbers.

Please refer to the attached list.

2. The purpose of changing.

Eliminating three holes in the bushing, to eliminate burr at the holes. There is no changes of mounting position and outward form dimension by this changing.



3. Effective date

ALPS Japan factory: August 1995 by running change.

ALPS Malaysia factory: September 1995 by running change.

ALPS ELECTRIC CO.,LTD

Tomio Shiraishi

T. SHIRAISHI
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MECHATRONIC DEVICES DIVISION 2