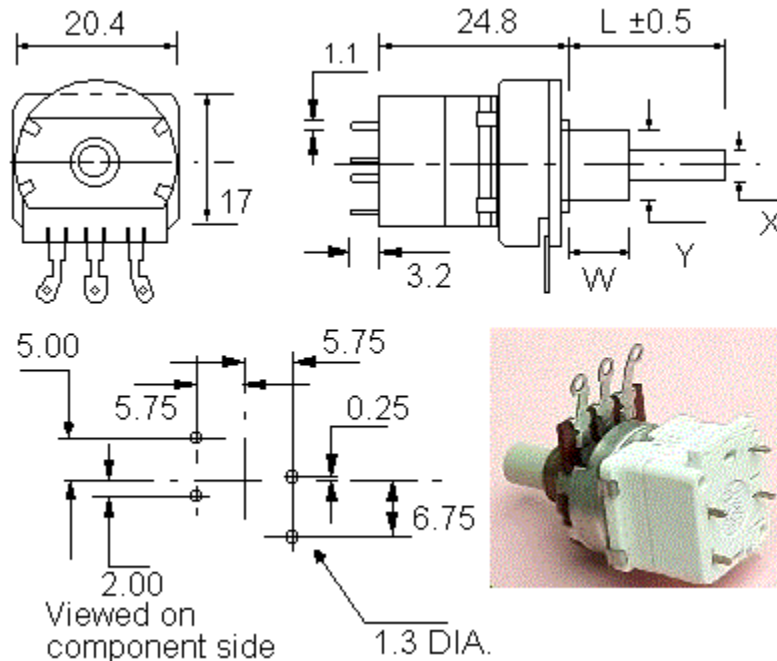


## OW20BU/B4PC2S

**B4PC1S – 4 Amp Double Pole (Single Throw) Switch**  
**PC – For Printed Circuit**  
**OW – Ordinary Wiring (recommended for soldering)**



- W Mounting Height
- Y Mounting Diameter
- X Spindle Diameter
- L Spindle Length
  
- A Initial Termination
- S Wiper (or moving contact) termination
- E End Termination

## Switch Technical Data

### 4A Contact Rating:

- 4A/250Vac 10A/12Vdc
- Surge rating (0.01 seconds): 80A
- Switch contacts: Silver tin oxide
- Contact gap: 2mm (Micro disconnection of switch - micro separation of contacts)

### Common Features:

Housing material: Glass filled polyester (UL 94 VO)

Initial contact resistance: 20 milliohms

Insulation resistance: 50,000 Megohms

Life (operations at full load): 10,000 minimum

Operating temperature: -25°C to +70°C

Operating torque for SPST/SPDT: 1.5 - 3 cNm

Operating torque for DPST/DPDT: 3.0 - 6 cNm

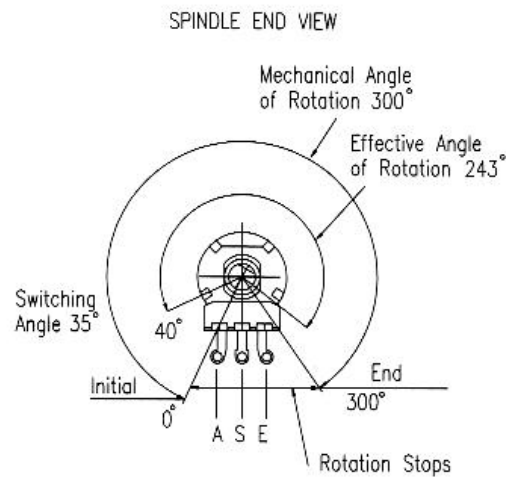
Mechanical rotation: 300°

Proof voltage: 3kV minimum

### Certification:

The rotary switch module is Certified by UL International Demko A/S to EN61058-1 with Cenelec Certification Agreement (CCA) and the 1A contact rating is only available when mounted on the ECO potentiometer. **NOTE** This is a European and NOT an American certification.

Please note the 'Change Over' rotary switches are not certified.



Total mechanical and effective electrical angles of rotation of potentiometers with rotary switch

---

## Technical Data

Rated Power Dissipation @40°C for P20 potentiometers:

0.4W linear law

0.2W nonlinear law

Conductive polymer (plastic) track (over twice the life of carbon tracks)

Effective rotation: 243° nominal

Operating Torque: 0.4 – 1.5 cN.m

Permissible Axial Spindle Load: 100 N (5 Sec. maximum)

Permissible Torque at End Stop: 80 cN.m

Rotation angle: 300° ±5°

Rotational torque of spindle can be made high or low

The potentiometer terminals are marked A, S and E.

Life Expectancy of >20,000 cycles (tested at 30 times per minute)

Insulation Resistance: >= 4 Gohms

Rated Resistance: E3 Series

Optional: E6 Series

Linear Law: 1K – 1M (±10%)

Nonlinear Law: 4K7 – 470K

---

## ELECTRICAL SPECIFICATION COMMON TO ALL POTENTIOMETERS

Conductive polymer (plastic) track (over twice the life of carbon tracks)

Life Expectancy of >20,000 cycles (tested at 30 times per minute)

Insulation Resistance: >= 4 Gohms

Rated Resistance: E3 Series

- Optional: E6 Series
- Linear Law: 1K - 1M
- Nonlinear Law: 4K7 - 470K

Tolerance on Rated Resistance: ± 20%

- Optional Tolerance on 1K - 1M: ± 10%

Resistance Laws (Taper):

- Linear: A
- Nonlinear: B - Log (Audio) or C - Antilog (Reverse Audio)
- Other laws: Please refer to Sales office

## ROTARY SWITCH TERMINALS

### Layout

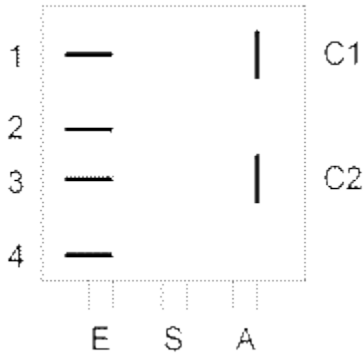
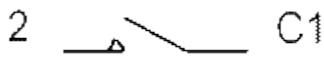
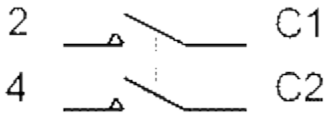


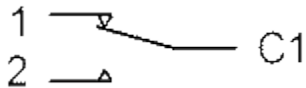
Diagram as viewed on the rear of the switch module:  
 (Potentiometer terminals at the bottom)



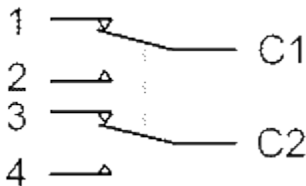
SPST - Single pole (1S), Single throw (On-Off)



DPST - Double pole (2S), Single throw (On-Off)



SPDT - Single pole (1S), Double throw (CH)  
 (**NOT** certified)

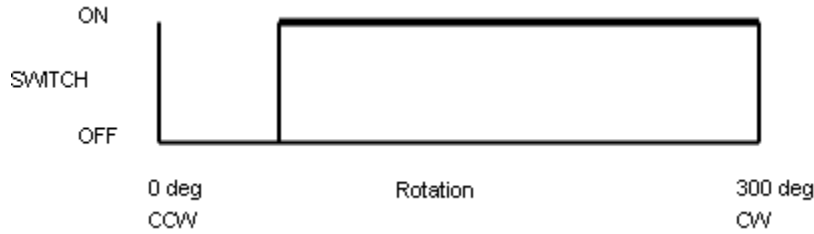


DPDT - Double pole (2S), Double throw (CH)  
 (**NOT** certified)

### Notes

1. Moving contact(s) shown when the potentiometer shaft is in a counterclockwise (CCW) position.
2. 'Ordinary Wiring'(OW) or 'Printed Circuit'(PC) terminals can be requested on the switch.
3. Terminals 1 and 3 are only fitted for the Double Throw ('CH' or Changeover) versions which are **NOT** approved nor certified.

## ROTARY SWITCH FUNCTIONS



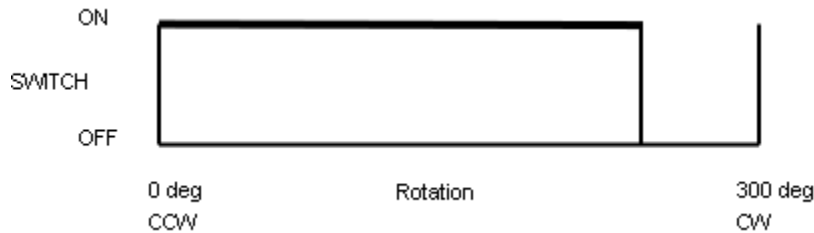
**Standard** (1A or 4A contact

ratings)  
N/O normally OPEN Switch  
Contacts normally OPEN;  
CLOCKwise rotation to CLOSE contacts



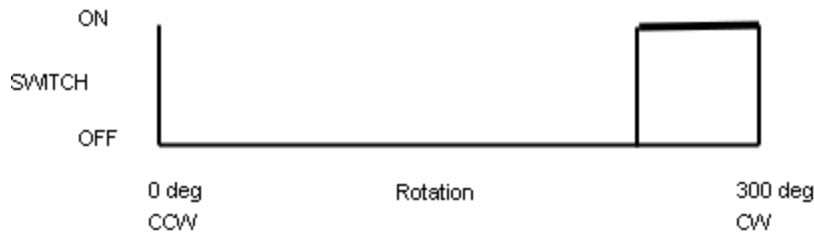
**Option 1** (4A contact rating only)

N/C normally CLOSED Switch  
Contacts normally CLOSED;  
CLOCKwise rotation to OPEN contacts



**Option 2** (4A contact rating only)

REVERSED N/O normally OPEN Switch  
Contacts normally OPEN at fully clockwise position;  
ANTI-clockwise rotation to CLOSE contacts



**Option 3** (4A contact rating only)

REVERSED N/C normally CLOSED Switch  
Contacts normally CLOSED at fully clockwise position;  
ANTI-clockw

## ELECTRICAL SPECIFICATION UNIQUE TO P20 POTENTIOMETERS

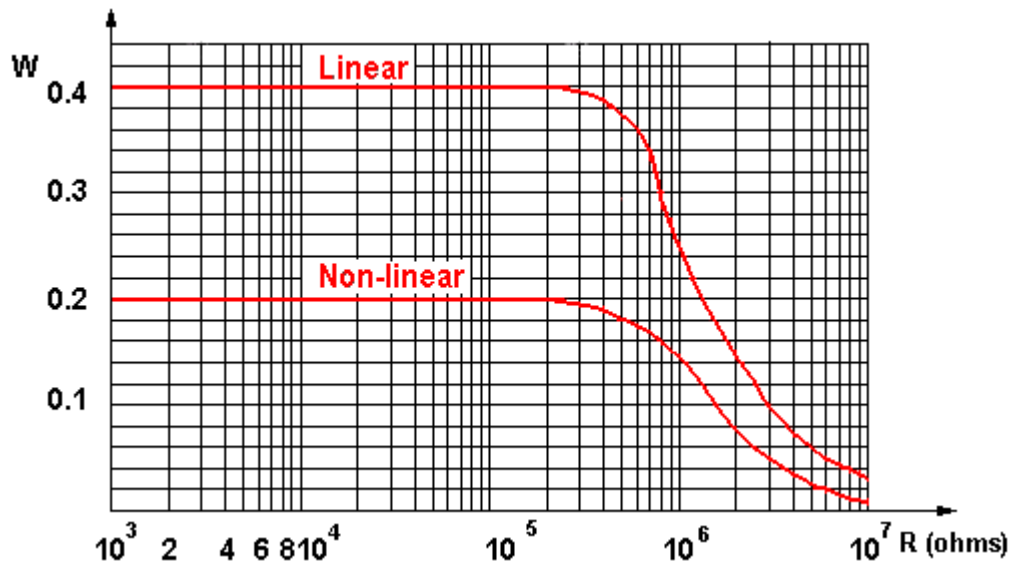
Effective rotation:

- Without a switch: 256° nominal
- With switch: 243° nominal
- With rotary switch: 243° nominal

Rated Power Dissipation @40°C for P20 potentiometers:

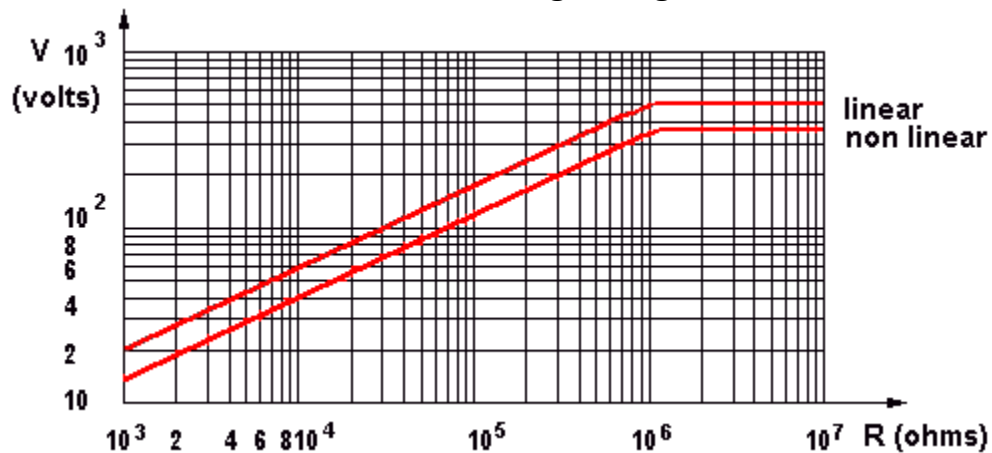
- 0.4W linear law
- 0.2W nonlinear law

### P20 power dissipating curve



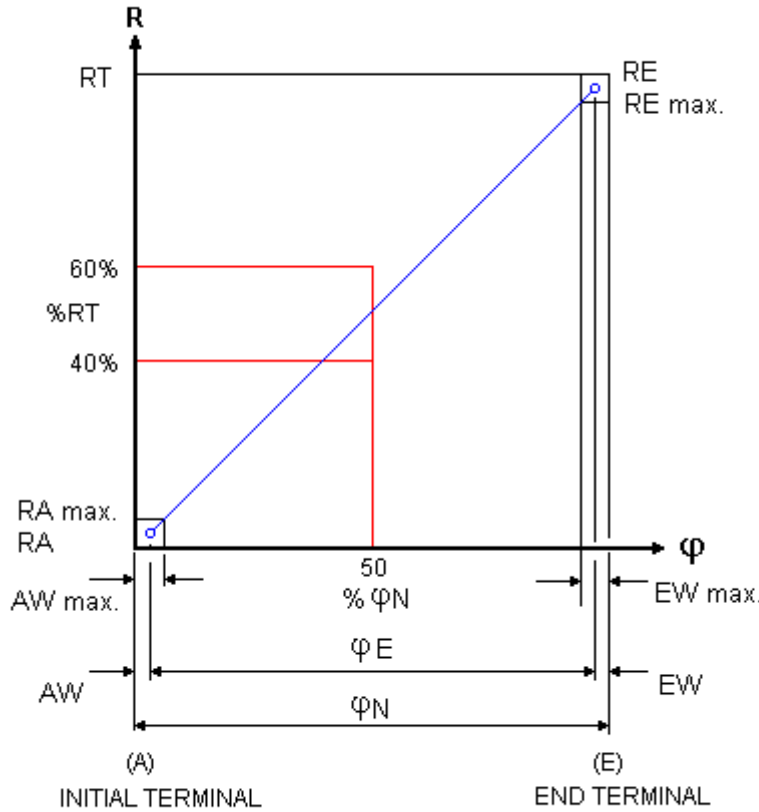
Limiting Element Voltage: 500 V DC for 20mm potentiometers

### P20 maximum working voltage curve



Insulating Voltage: 1000 V AC for 20mm potentiometers

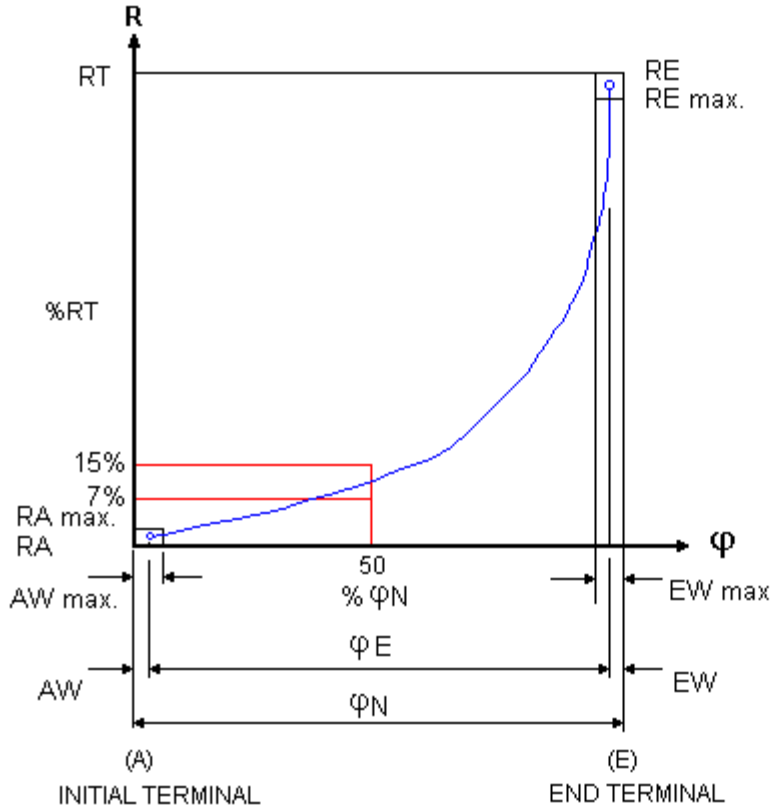
### Resistance law A - Linear



- AW ..... Initial Path ..... AW max. 12%  $\phi_N$
- EW ..... Final Path ..... EW max. 12%  $\phi_N$
- Ra ..... Initial Stop Value .....  $\leq 1 \cdot 10^{-3} RN$  (Minimum 2 ohms)
- RA ..... Hop-on Resistance .....  $\leq 1\% RN$
- Re ..... End Stop Value .....  $\leq 1 \cdot 10^{-3} RN$  (Minimum 2 ohms)
- RE ..... Hop-off Resistance .....  $\leq 1\% RN$
- RN ..... Rated Resistance
- RT ..... Effective Resistance
- $\phi$  ..... Rotation Angle
- $\phi E$  ..... Effective Electrical Angle of Rotation
- $\phi N$  ..... Effective Mechanical Angle of Rotation



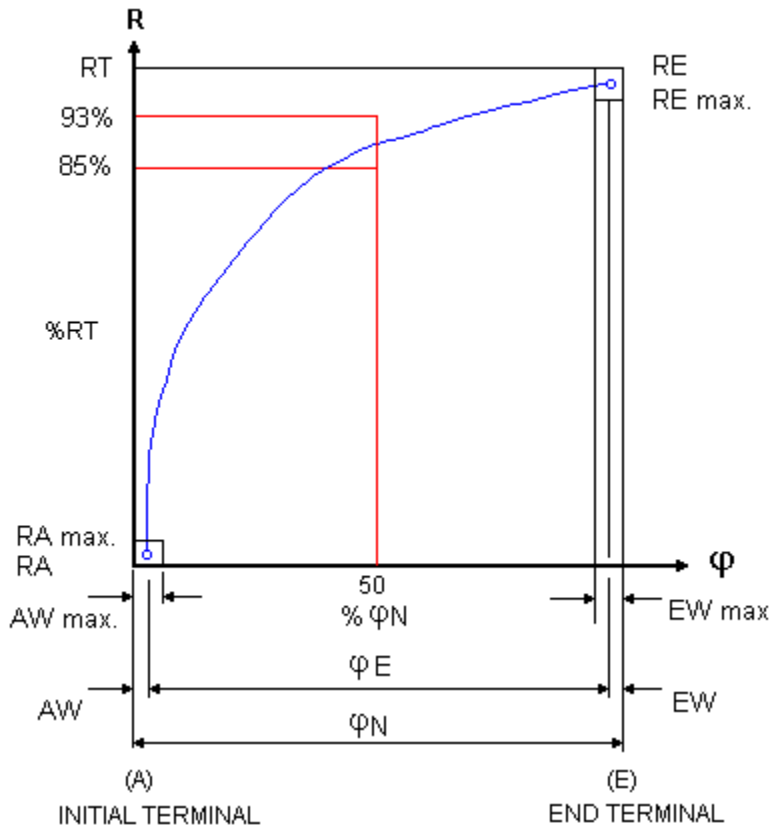
### Resistance law B – Log (Audio)



|          |  |  |
|----------|--|--|
| AW       | Initial Path                           | AW max. 10% $\phi N$   |
| EW       | Final Path                             | EW max. 10% $\phi N$   |
| Ra       | Initial Stop Value                     | $RN \leq 10K \leq 1.10^{-3} RN$ (Minimum 2 ohms)<br>$RN > 10K \leq 2.10^{-4} RN$ (Minimum 10 ohms) |
| RA       | Hop-on Resistance                      | $RN \leq 10K$ 5% RN<br>$RN > 10K$ 0.15% RN   |
| Re       | End Stop Value                         | $RN \leq 100K \leq 2.10^{-2} RN$<br>$RN > 100K \leq 1.10^{-2} RN$                                  |
| RE       | Hop-off Resistance                     | $RN \leq 10K < 1\% RN$<br>$RN > 10K$ 0.5% RN   |
| RN       | Rated Resistance                       |  |
| RT       | Effective Resistance                   |  |
| $\phi$   | Rotation Angle                         |  |
| $\phi E$ | Effective Electrical Angle of Rotation |  |
| $\phi N$ | Effective Mechanical Angle of Rotation |  |



### Resistance law C – Antilog (Reverse Audio)



|          |  |  |
|----------|--|--|
| AW       | Initial Path                           | AW max. 10% $\phi N$   |
| EW       | Final Path                             | EW max. 10% $\phi N$   |
| Ra       | Initial Stop Value                     | $RN \leq 100K \leq 2.10^{-2} RN$<br>$RN > 100K \leq 1.10^{-2} RN$                                  |
| RA       | Hop-on Resistance                      | $RN \leq 10K < 1\% RN$<br>$RN > 10K 0.5\% RN$  |
| Re       | End Stop Value                         | $RN \leq 10K \leq 1.10^{-3} RN$ (Minimum 2 ohms)<br>$RN > 10K \leq 2.10^{-4} RN$ (Minimum 10 ohms) |
| RE       | Hop-off Resistance                     | $RN \leq 10K 5\% RN$<br>$RN > 10K 0.15\% RN$   |
| RN       | Rated Resistance                       |  |
| RT       | Effective Resistance                   |  |
| $\phi$   | Rotation Angle                         |  |
| $\phi E$ | Effective Electrical Angle of Rotation |  |
| $\phi N$ | Effective Mechanical Angle of Rotation |  |

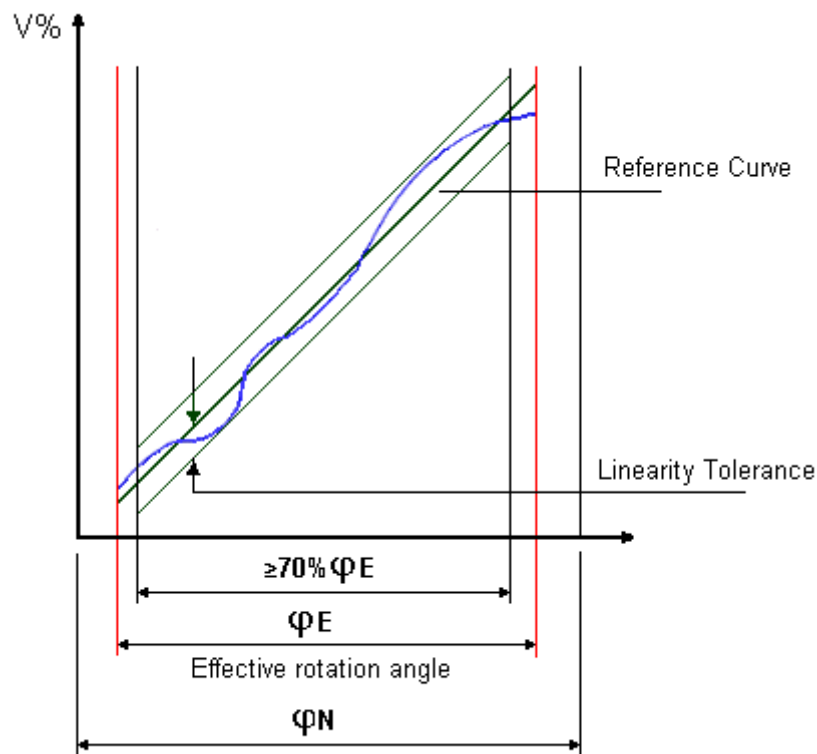
## Linearity

As a basis of assessing Linearity Tolerance the independent method is the most practical, permitting as it does, the reference curve to be aligned as near as possible to the actual output curve. This avoids the use of the theoretical starting and finishing points, it is normal for the customer to realign the achieved curve with series trimmers at each end of the device if required.

Linearity Tolerance is 4% over the Nominal Resistance range of 1K $\Omega$  to 1M $\Omega$ . The Linearity Tolerance is measured on at least 70% of the effective rotation range.

Note. In the case of Terminal and Zero-based linearity, both present constraints which increase the manufacturing difficulty and in consequence have an adverse effect on the product's price and availability.

### Potentiometer linearity

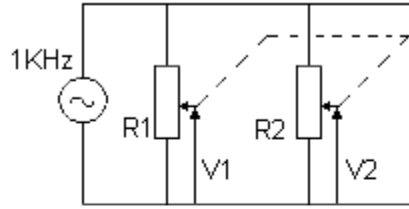


#### Matching Tolerance (For Tandem Stereo Potentiometers)

Tandem Potentiometers have two identical resistor units with the same variation law. The mismatching of the two resistor units, expressed in dB, is measured by the difference between the attenuations introduced by each resistor unit at various points of travel.

- Law A: 4 dB at Attenuation range 0 - 20 dB
- Law B and C: 3 dB at Attenuation range 0 - 20 dB

### Matched Tolerance for Stereo

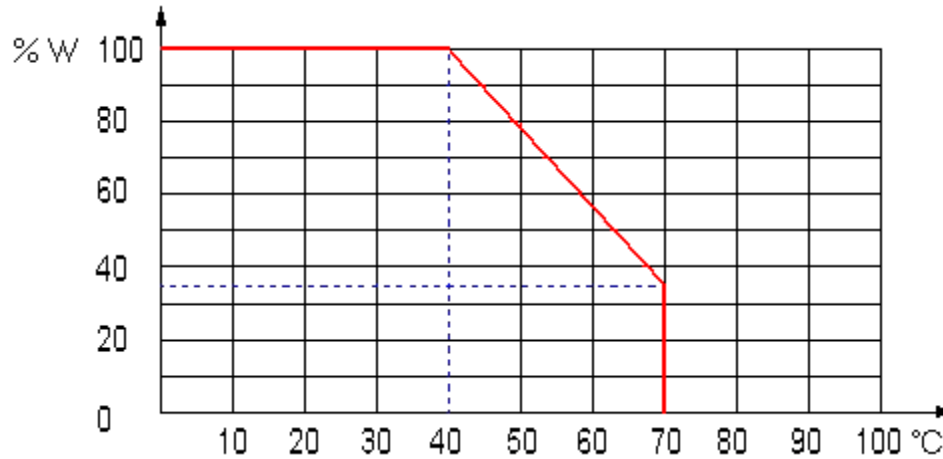


| LAW   | ATTENUATION RANGE | MATCHING TOLERANCE * |
|-------|-------------------|----------------------|
| A     | 0 - 20dB          | 4dB                  |
| B & C | 0 - 20dB          | 3dB                  |

$$*Matching\ Tolerance = 20\ Log\ \frac{V1}{V2}$$

*Operating Temperature: -25°C to +70°C*

### Temperature Derating Curve



*Temperature Coefficient of Resistance: +300 -500 ppm*

---

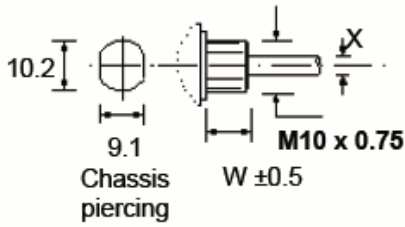
## Components

### P20 Bush Housing (Mounting)

The P20 bushes are available in metal or nylon; with three thread options; and with or without a locating feature:

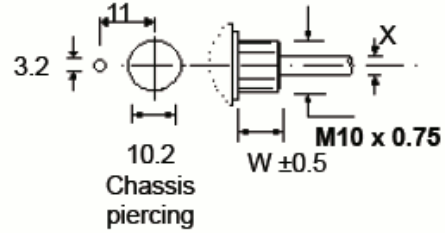
- Diecast Zinc Alloy
  - M10 x0.75mm pitch (Type C)
  - M10 x0.75mm pitch, **with locator** (Type CEBS)
  - 9.52mm x32tpi (Type CBS)
  - 9.52mm x32tpi, **with locator** (Type CBSL)
  - M7 x0.75mm pitch (Type CG)
- Glass Filled Nylon
  - M10 x0.75mm (Type CP)

DIECAST ZINC ALLOY



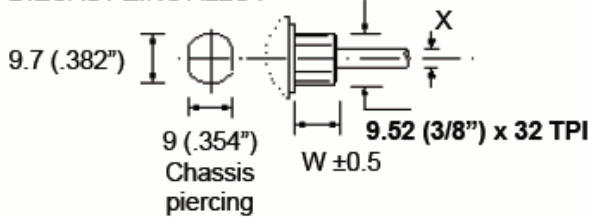
| Type C (without locator) |   |
|--------------------------|---|
| X (mm)                   | 6 |
| W (mm)                   | 9 |

DIECAST ZINC ALLOY



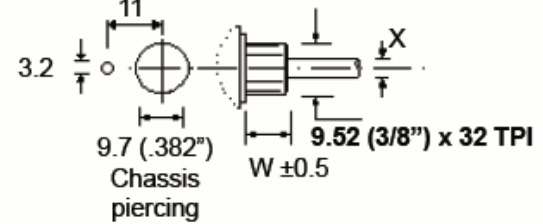
| Type CEBS (with locator) |   |
|--------------------------|---|
| X (mm)                   | 6 |
| W (mm)                   | 9 |

DIECAST ZINC ALLOY



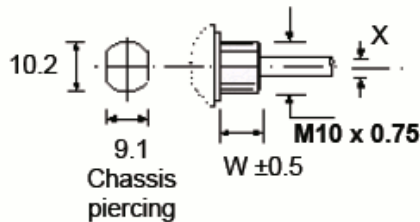
| Type CBS (without locator) |         |         |
|----------------------------|---------|---------|
| X (mm)                     | 6       | 6.35    |
| W (mm)                     | 8 or 12 | 8 or 12 |

DIECAST ZINC ALLOY



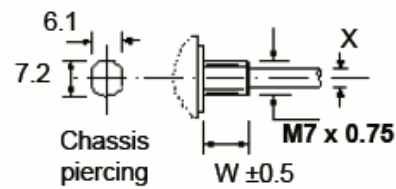
| Type CBSL (with locator) |      |      |
|--------------------------|------|------|
| X (mm)                   | 6.35 | 6.35 |
| W (mm)                   | 8    | 12   |

GLASS FILLED NYLON



| Type CP (GFN) |         |         |
|---------------|---------|---------|
| X (mm)        | 6       | 6.35    |
| W (mm)        | 7 or 10 | 7 or 10 |

DIECAST ZINC ALLOY



| Type CG (without locator) |   |
|---------------------------|---|
| X (mm)                    | 4 |
| W (mm)                    | 6 |

---

## P20 Spindles

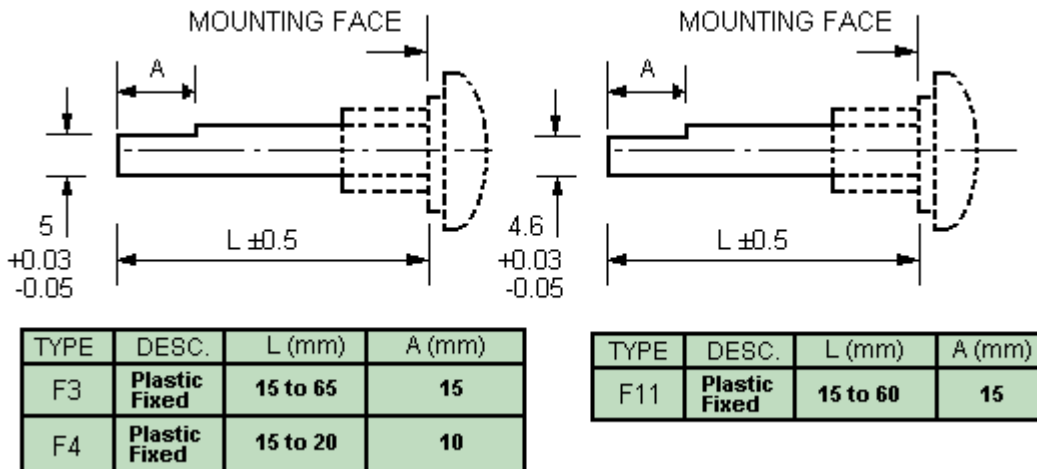
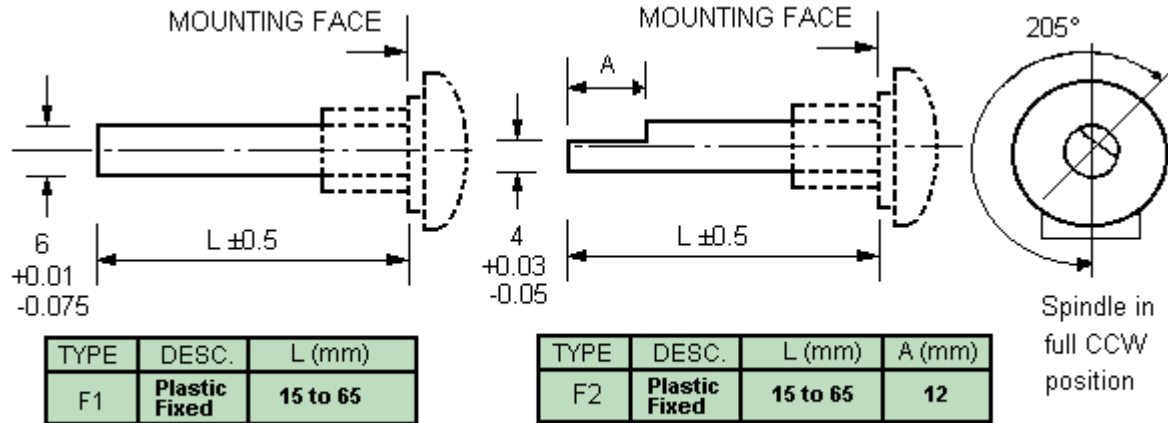
The P20 spindles are plastic and fixed i.e. not removable, unless otherwise stated and they are available in three diameters:

- 6.0mm Diameter
  - Cylindrical (Type F1)
  - 4.0 x 12mm Flat (Type F2)
  - 5.0 x 15mm Flat (Type F3)
  - 5.0 x 10mm Flat (Type F4)
  - 4.6mm x 15mm Flat (Type F11)
- 4.0mm Diameter
  - Cylindrical (Type F21)
  - 3.0 x 8.5mm Flat (Type F22)
  - 3.0 x 13.5mm Flat (Type F23)
  - Cylindrical (Type M21 - Metal)
  - 3.0 x 8.5mm Flat (Type M22 - Metal)
  - 3.0 x 13.5mm Flat (Type M23 - Metal)
- 6.35mm Diameter
  - Cylindrical (Type F41)
  - 5.5 x 10mm Flat (Type F42)
  - 5.5 x 15mm Flat (Type F43)
- Splined Spindle - 6.0mm dia. 18 teeth
- Dual Concentric
  - Flatted/Slotted (Type M15 - Metal)
  - Cylindrical (Type M16 - Metal)

### 6.0mm Diameter Spindles

Note: \*Specials to customer's specification up to 65mm.

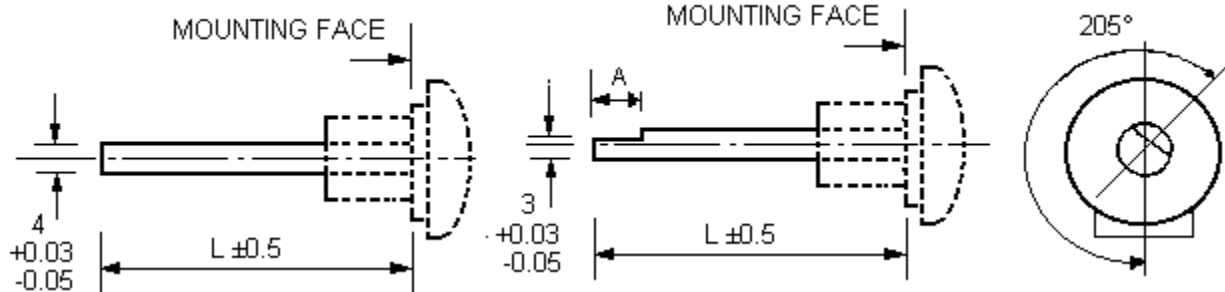
REMOVABLE SPINDLES, similar in specification to 'fixed' spindles are supplied separate from the potentiometer. These can be indefinitely taken in and out and their holding strength is >1kg.



#### 4.0mm Diameter Spindles

Note: The orientation of the flat as illustrated is for plastic spindles only.

For metal spindles, unless specified on the order, the orientation may be different on each potentiometer type.



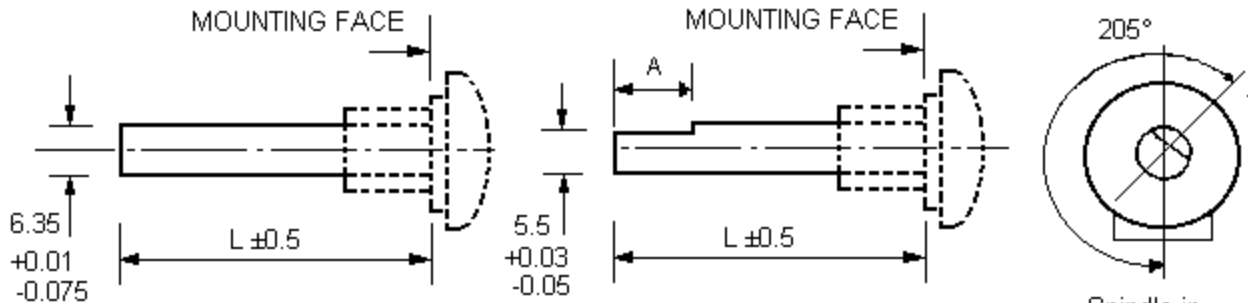
| TYPE | DESC.         | L (mm)  |
|------|---------------|---------|
| F21  | Plastic Fixed | 8 to 65 |
| M21  | Metal Fixed   | 8 to 65 |

| TYPE | DESC.         | L (mm)   | A (mm) |
|------|---------------|----------|--------|
| F22  | Plastic Fixed | 11 to 60 | 8.5    |
| M22  | Metal Fixed   | 11 to 60 | 8.5    |
| F23  | Plastic Fixed | 16 to 60 | 13.5   |
| M23  | Metal Fixed   | 16 to 60 | 13.5   |

Spindle in full CCW position

#### 6.35mm Diameter Spindles

Note: \*Specials to customer's specification up to 65mm.



| TYPE | DESC.         | L (mm)   |
|------|---------------|----------|
| F41  | Plastic Fixed | 15 to 65 |

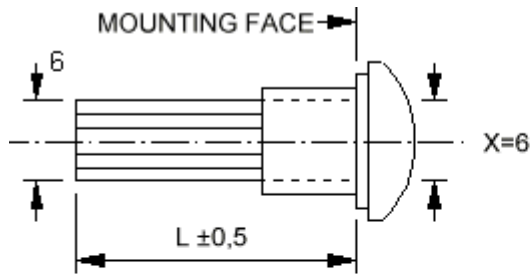
| TYPE | DESC.         | L (mm)   | A (mm) |
|------|---------------|----------|--------|
| F42  | Plastic Fixed | 15 to 20 | 10     |
| F43  | Plastic Fixed | 20 to 60 | 15     |

Spindle in full CCW position

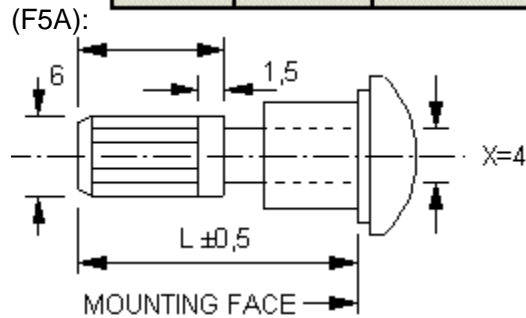
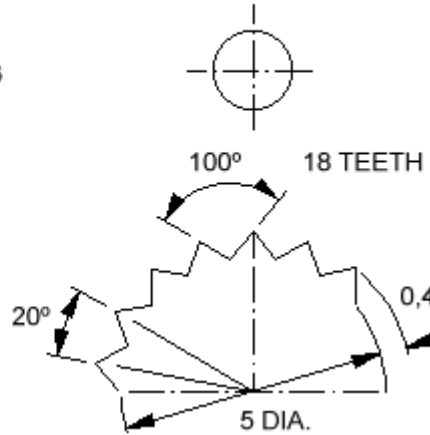


**Splined Spindle - 6.0mm dia. 18 teeth**

A splined form is available on the 6.0mm diameter P20 plastic spindle (F5) or alternatively a 6mm 'Splined Adaptor' (8,7mm long) can be fitted on a 4mm dia. Spindle



| TYPE | DESC.         | L (mm) |
|------|---------------|--------|
| F5   | Plastic Fixed | 19     |



| TYPE | DESC.         | L (mm) |
|------|---------------|--------|
| F5A  | Plastic Fixed | 16-36  |

