

## Knob Potentiometer



The P16 is a revolutionary concept in panel mounted potentiometers. This unique design consists of a knob driving and incorporating a cermet potentiometer. Only the mounting hardware and terminals are situated on the back side of the panel reducing to a minimum the required clearance.

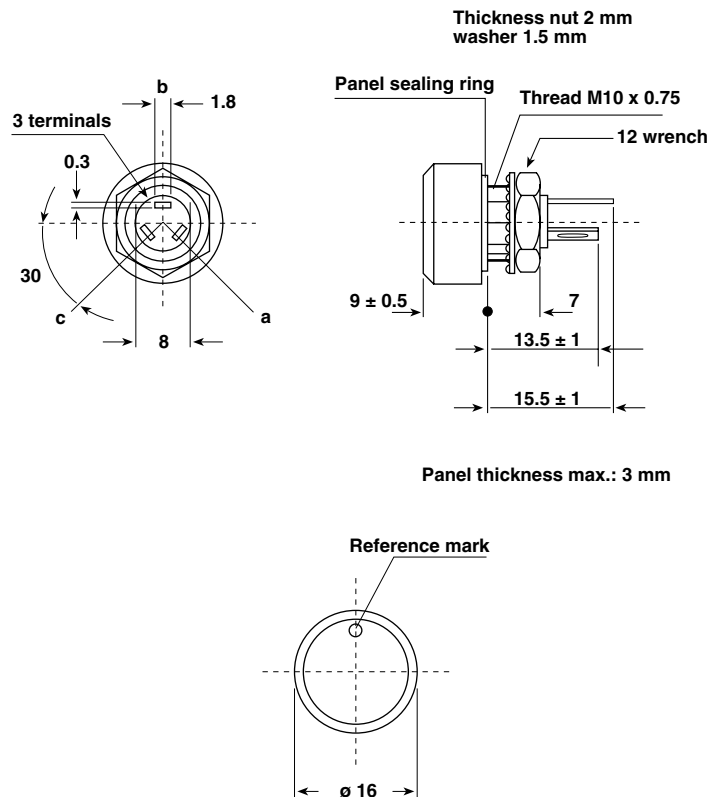
### FEATURES

- 1 W at 40 °C
- Test according to CECC 41300
- **P16** - version for professional and industrial applications
- **PA16** - version for professional audio applications
- Compact (integrated)
- Minimum clearance required
- Safety in use due to good insulation:  $> 10^4 \text{ M}\Omega$  500 V<sub>DC</sub>
- High dielectric strength: 2500 V<sub>RMS</sub>
- Fully sealed and panel sealed
- Metallic or plastic knob options
- Cermet or conductive plastic

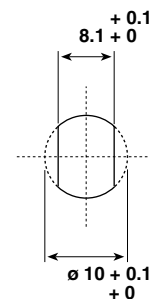


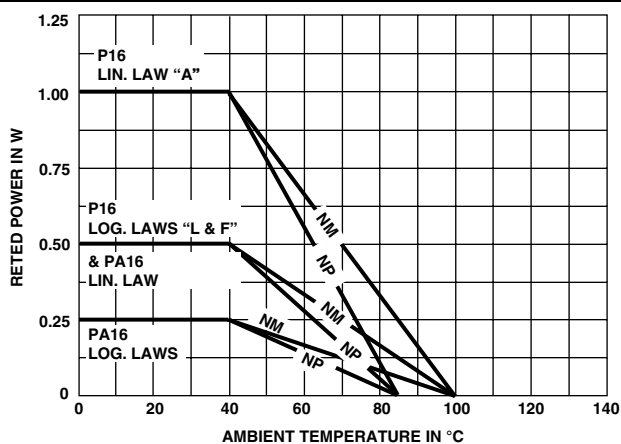
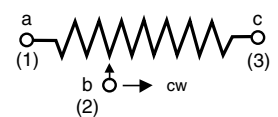
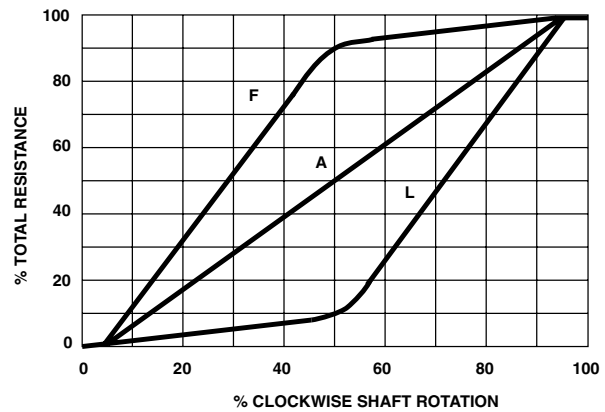
### DIMENSIONS in millimeters ( $\pm 0.5 \text{ mm}$ )

#### P16 - PA16



#### PANEL CUTOUT



| ELECTRICAL SPECIFICATIONS             |                                                                                     |                                       |
|---------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|
|                                       | P16                                                                                 | PA16                                  |
| Resistive Element                     | cermet                                                                              | conductive plastic                    |
| Electrical Travel                     | 270° ± 10°                                                                          | 270° ± 10°                            |
| Power Rating Chart                    |   |                                       |
| Circuit Diagram                       |   |                                       |
| Resistance Laws                       |  |                                       |
| Resistance Range                      | linear law<br>22 Ω to 10 MΩ<br>logarithmic laws<br>100 Ω to 2.2 MΩ                  | 1 kΩ to 1 MΩ<br>470 Ω to 500 kΩ       |
| Standard Series E3                    | 1 - 2.2 - 4.7 and on request 1 - 2 - 5                                              | 1 - 2.2 - 4.7                         |
| Tolerance                             | standard<br>± 20 %<br>on request<br>± 10 %                                          | ± 20 %<br>± 10 % (1 kΩ to 100 kΩ)     |
| Power Rating                          | linear<br>1 W at + 40 °C<br>logarithmic<br>0.5 W at + 40 °C                         | 0.5 W at + 40 °C<br>0.25 W at + 40 °C |
| Temperature Coefficient (Typical)     | ± 150 ppm/°C                                                                        | ± 1000 ppm/°C                         |
| Dielectric Strength (RMS)             | 2500 V                                                                              | 2500 V                                |
| Limiting Element Voltage (Linear Law) | 350 V                                                                               | 350 V                                 |
| Insulation Resistance (500 VDC)       | ≥ 10 <sup>4</sup> MΩ                                                                | ≥ 10 <sup>4</sup> MΩ                  |
| Contact Resistance Variation          | 3 % R <sub>n</sub> or 3 Ω                                                           | 2 % R <sub>n</sub> or 3 Ω             |
| End Resistance (Typical)              | 1 Ω                                                                                 | 1 Ω                                   |
| Insulation Resistance (500 VDC)       | 10 <sup>6</sup> MΩ                                                                  | 10 <sup>6</sup> MΩ                    |

**MECHANICAL SPECIFICATIONS**

|                                        |                 |
|----------------------------------------|-----------------|
| Mechanical Travel                      | 300° ± 5°       |
| Operating Torque                       | 2 Ncm typical   |
| End Stop Torque                        | 25 Ncm maximum  |
| Max. Tightening Torque of Mounting Nut | 250 Ncm maximum |
| Unit Weight                            | 4.5 g typical   |

**ENVIRONMENTAL SPECIFICATIONS**

|                   |                                   |                     |
|-------------------|-----------------------------------|---------------------|
|                   | <b>Metallic Knob</b>              | <b>Plastic Knob</b> |
| Temperature Range | - 40 °C to 125 °C                 | - 40 °C to 85 °C    |
| Climatic Category | 40/100/56                         | 40/85/56            |
| Sealing           | sealed container and panel sealed |                     |
| Protection Grades | IP67                              |                     |

**MARKING**

- VISHAY trademark
- Ohmic value
- Tolerance (in %)
- Resistance law
- Manufacturing date

**PACKAGING**

- Carton box of 20 pieces

**CONTROL KNOB**

Black metallic knob (NM).

Black plastic knob (NP).

For white and blue color see ordering information.

Other dimensions, shapes, colors of control knobs are manufactured on request - please consult VISHAY.

Other reference marks (shapes, colours) and legends can be printed on plastic knob on request - please consult VISHAY.

**P16 STANDARD RESISTANCE ELEMENT DATA**

| STANDARD RESISTANCE VALUES | LINEAR LAW          |              |                         | LOG LAW             |              |                         | TYP. TCR<br>- 40 °C<br>+ 85 °C |
|----------------------------|---------------------|--------------|-------------------------|---------------------|--------------|-------------------------|--------------------------------|
|                            | MAX. POWER AT 40 °C | MAX. VOLTAGE | MAX. CUR. THROUGH WIPER | MAX. POWER AT 40 °C | MAX. VOLTAGE | MAX. CUR. THROUGH WIPER |                                |
| Ω                          | W                   | V            | mA                      | W                   | V            | mA                      | 10 <sup>-6</sup> /°C           |
| 22                         | 1                   | 4.69         | 213                     | 0.5                 | 7.1          | 71                      | ± 150                          |
| 47                         |                     | 6.85         | 146                     |                     |              |                         |                                |
| 100                        |                     | 10           | 100                     |                     |              |                         |                                |
| 220                        |                     | 14.8         | 67.4                    |                     |              |                         |                                |
| 470                        |                     | 21.7         | 46.1                    |                     |              |                         |                                |
| 1K                         |                     | 31.6         | 31.6                    | 0.5                 | 10.5         | 48                      |                                |
| 2.2K                       |                     | 46.9         | 21.3                    |                     |              |                         |                                |
| 4.7K                       |                     | 68.5         | 14.6                    |                     |              |                         |                                |
| 10K                        |                     | 100          | 10                      |                     |              |                         |                                |
| 22K                        |                     | 148          | 6.74                    |                     |              |                         |                                |
| 47K                        |                     | 217          | 4.61                    | 0.5                 | 15.3         | 32.6                    |                                |
| 100K                       | 1                   | 316          | 3.16                    |                     |              |                         |                                |
| 220K                       | 0.56                | 350          | 1.59                    |                     |              |                         |                                |
| 470K                       | 0.26                | 350          | 0.75                    |                     |              |                         |                                |
| 1M                         | 0.12                | 350          | 0.35                    |                     |              |                         |                                |
| 2.2M                       | 0.05                | 350          | 0.16                    | 0.056               | 350          | 0.16                    |                                |
| 4.7M                       | 0.02                | 350          | 0.07                    |                     |              |                         |                                |
| 10M                        | 0.01                | 350          | 0.012                   |                     |              |                         |                                |

**PA16 STANDARD RESISTANCE ELEMENT DATA**

| STANDARD<br>RESISTANCE<br>VALUES | LINEAR LAW                                                                          |                 |                                  | LOG LAW                                                                               |                 |                                  | TYP.<br>TCR<br>- 55°C<br>+ 125 °C |     |
|----------------------------------|-------------------------------------------------------------------------------------|-----------------|----------------------------------|---------------------------------------------------------------------------------------|-----------------|----------------------------------|-----------------------------------|-----|
|                                  | MAX.<br>POWER<br>AT<br>40 °C                                                        | MAX.<br>VOLTAGE | MAX.<br>CUR.<br>THROUGH<br>WIPER | MAX.<br>POWER<br>AT<br>70 °C                                                          | MAX.<br>VOLTAGE | MAX.<br>CUR.<br>THROUGH<br>WIPER |                                   |     |
| Ω                                | W                                                                                   | V               | mA                               | W                                                                                     | V               | mA                               | ppm/°C                            |     |
| 470                              |  | 22.4            | 22.4                             |  | 10.8            | 23.1                             | ± 1000                            |     |
| 1K                               |                                                                                     | 0.5             | 22.4                             |                                                                                       | 15.8            | 16                               |                                   |     |
| 2.2K                             |                                                                                     | 33.2            | 15.1                             |                                                                                       | 23.5            | 11                               |                                   |     |
| 4.7K                             |                                                                                     | 48.5            | 10.3                             |                                                                                       | 34.3            | 7                                |                                   |     |
| 10K                              |                                                                                     | 79.7            | 7.07                             |                                                                                       | 50.0            | 5.0                              |                                   |     |
| 22K                              |                                                                                     | 105             | 4.77                             |                                                                                       | 74              | 3.4                              |                                   |     |
| 47K                              |                                                                                     | 153             | 3.26                             |                                                                                       | 108             | 2.3                              |                                   |     |
| 100K                             |                                                                                     | 224             | 2.24                             |                                                                                       | 158             | 1.6                              |                                   |     |
| 220K                             |                                                                                     | 0.5             | 332                              |                                                                                       | 1.51            | 235                              |                                   | 1.1 |
| 470K                             |                                                                                     | 0.26            | 350                              |                                                                                       | 0.74            | 0.25                             |                                   | 343 |
| 1M                               | 0.12                                                                                | 350             | 0.35                             |                                                                                       |                 |                                  |                                   |     |

| PERFORMANCE         |                                                   |                                                                                          |                                           |
|---------------------|---------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------|
| TESTS               | CONDITIONS                                        | TYPICAL VALUES AND DRIFTS                                                                |                                           |
|                     |                                                   | $\Delta R_T/R_T$ (%)                                                                     | $\Delta R_{1-2}/R_{1-2}$ (%)              |
| Load Life           | 1000 h at Pn<br>90°/30° cycle at + 40 °C          | ± 5 %<br>Insulation resistance: > 10 <sup>4</sup> MΩ<br>Contact res. variation: < 2 % Rn | -                                         |
| Long Term Damp Heat | 56 days<br>40 °C, 93 % HR                         | ± 2 %<br>Insulation resistance: > 10 <sup>4</sup> MΩ                                     | ± 1 %                                     |
| Shock               | 50 g at 11 ms<br>3 successive shocks<br>in 3 axes | ± 0.2 %                                                                                  | ± 0.5 %                                   |
| Vibration           | 10 - 55 Hz<br>0.75 mm or 10 g<br>during 6 h       | ± 0.2 %                                                                                  | $\Delta V_{1-2}/\Delta V_{1-3} \pm 0.5$ % |
| Rotational Life     | 50 000 cycles                                     | ± 5 %<br>Contact res. variation: < 2 % Rn                                                | -                                         |

| SAP ORDERING INFORMATION                                          |                                                                                                                                                |   |   |                                                                                   |   |   |                                                          |                                                                                                   |   |   |                                     |   |                                                               |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------------------------------------|---|---|----------------------------------------------------------|---------------------------------------------------------------------------------------------------|---|---|-------------------------------------|---|---------------------------------------------------------------|
| P                                                                 | 1                                                                                                                                              | 6 | N | P                                                                                 | 2 | 2 | 3                                                        | M                                                                                                 | A | B | 1                                   | 5 |                                                               |
| MODEL                                                             | STYLE                                                                                                                                          |   |   | OHMIC VALUE                                                                       |   |   | TOLERANCE                                                | TAPER                                                                                             |   |   | PACKAGING CODE                      |   | SPECIAL NUMBER                                                |
| <b>P16</b> =<br>Cermet<br><br><b>PA16</b> =<br>Conductive plastic | <b>NM</b> : Metallic black<br><b>NP</b> : Plastic black<br><b>WM</b> : Metallic white<br><b>WP</b> : Plastic white<br><b>BP</b> : Plastic blue |   |   | <b>223</b> = 22 kΩ<br>for ohmic value<br>range see<br>ELECTRICAL<br>SPECIFICATION |   |   | <b>M</b> = ± 20 %<br><br>on request<br><b>K</b> = ± 10 % | <b>A</b> : Linear<br><b>L</b> : Clockwise logarithmic<br><b>F</b> : Inverse clockwise logarithmic |   |   | <b>B15</b> =<br>Box of<br>20 pieces |   | (if applicable)<br>given by<br>VISHAY<br>for custom<br>design |

| PART NUMBER DESCRIPTION (for information only) |       |       |           |       |         |           |         |                   |
|------------------------------------------------|-------|-------|-----------|-------|---------|-----------|---------|-------------------|
| P16                                            | NP    | 22 kΩ | 20 %      | A     |         | BO20      |         | e3                |
| MODEL                                          | STYLE | VALUE | TOLERANCE | TAPER | SPECIAL | PACKAGING | SPECIAL | LEAD<br>(Pb)-FREE |



### Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.