# Knob Potentiometer

## LINKS TO ADDITIONAL RESOURCES

3D Models | Capabilities and Custom Options | Videos

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

RoHS COMPLIANT

- Test according to CECC 41000 or IEC 60393-1
- **P16** - version for professional and industrial applications (cermet)

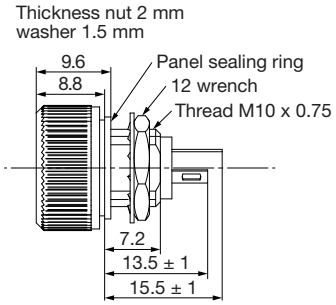
  1 W at 40 °C
- **PA16** - version for professional audio applications (conductive plastic)

  0.5 W at 40 °C
- Compact (integrated)
- High dielectric strength: 2500 $V_{RMS}$
- Fully sealed and panel sealed
- Blue, white, yellow, red, and black knob
- Several marking: dot, line, gradient, 5 graduations, 10 graduations, fan, light, volume, temperature
- Metallic or plastic knob options
- Custom knob and marking on request
- Detent option on request (haptic technology)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

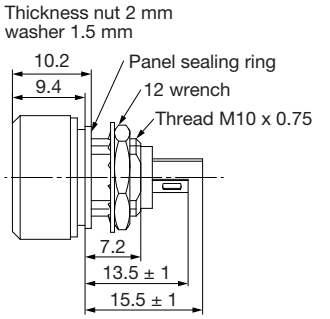
| QUICK REFERENCE DATA | |
|---|---|
| Multiple module | No |
| Switch module | Upgrade for switch version with P16S |
| Detent module | Yes |
| Special electrical laws | A: linear, L: logarithmic, F: reverse logarithmic |
| Sealing level | IP 67 |
| Lifespan | 50K cycles |

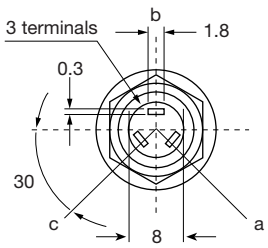
## DIMENSIONS in millimeters (± 0.5 mm)

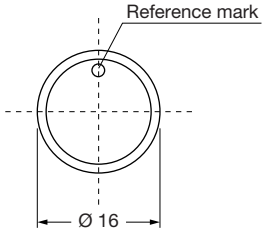
**P16NP**



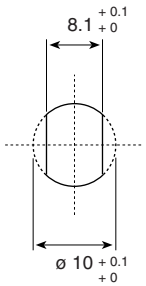

**P16NM**



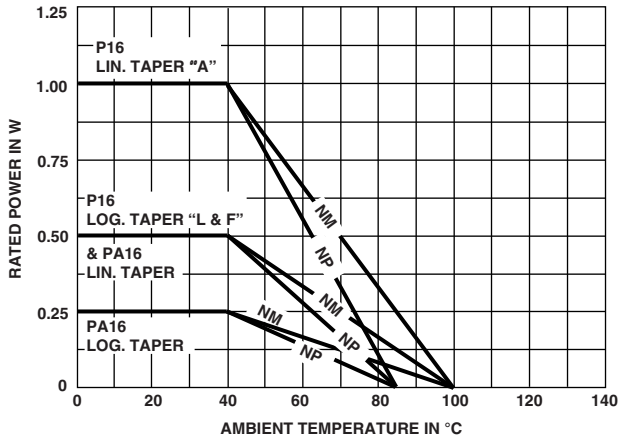
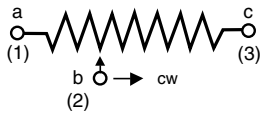
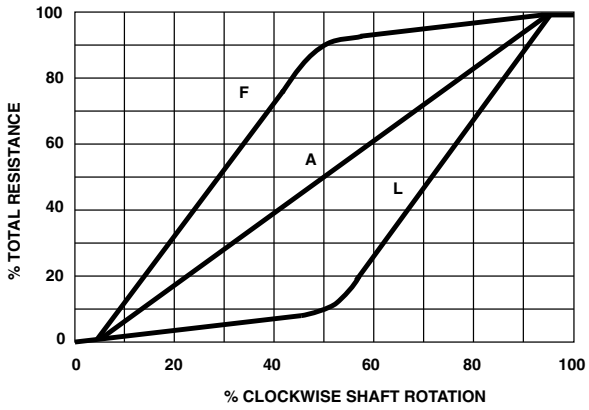




**Panel Cutout**




Panel thickness max.: 3 mm

| ELECTRICAL SPECIFICATIONS | | | |
|---|---|---|---|
| | | P16 | PA16 |
| Resistive element | | Cermet | Conductive plastic |
| Electrical travel | | 270° ± 10° | 270° ± 10° |
| Power rating chart | |  | |
| Circuit diagram | |  | |
| Taper | |  | |
| Resistance range | Linear taper | 22 Ω to 10 MΩ | 1 kΩ to 1 MΩ |
| | Logarithmic taper | 100 Ω to 2.2 MΩ | 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 | ± 20 % | ± 20 % |
| | On request | ± 10 % | ± 10 % (1 kΩ to 100 kΩ) |
| Power rating | Linear | 1 W at +40 °C | 0.5 W at +40 °C |
| | Logarithmic | 0.5 W at +40 °C | 0.25 W at +40 °C |
| Temperature coefficient (typical) | | ± 150 ppm/°C | ± 500 ppm/°C |
| Dielectric strength (RMS) | | 2500 V | 2500 V |
| Limiting element voltage (linear law) | | 350 V | 350 V |
| Contact resistance variation | | 3 % Rn or 3 Ω | 2 % Rn or 3 Ω |
| End resistance (typical) | | 1 Ω | 1 Ω |
| Insulation resistance (500 $V_{DC}$) | | $10^6$ MΩ | $10^6$ MΩ |

| MECHANICAL SPECIFICATIONS | |
|---|---|
| Mechanical travel | 300° ± 5° |
| Operating torque | 2 Ncm typical |
| End stop torque | 25 Ncm maximum |
| Max. tightening torque of mounting nut | 180 Ncm maximum |
| Unit Weight | 4.5 g typical |

| ENVIRONMENTAL SPECIFICATIONS | | |
|---|---|---|
| | METALLIC KNOB | PLASTIC KNOB |
| 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

- Ohmic value code, tolerance code and taper
- Manufacturing date code

## PACKAGING

- Carton box of 20 pieces

Hardware: nuts, washer, and O-ring are separately supplied (not mounted on the potentiometer), in a small bag placed in the packaging.

## CONTROL KNOB

Black metallic knob (NM).

Black plastic knob (NP).

For white, blue, red, and yellow color see “Ordering Information”.

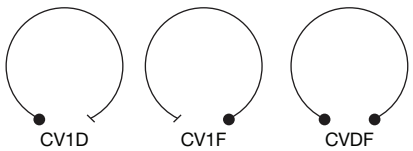
Other dimensions, shape, marking, colors of control knobs are manufactured on request - please consult Vishay.

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

## DETENT OPTION (haptic technology)

Detent option is a positive tactile feedback.
On request:
the detent mechanism is housed in the P16
Mechanical endurance: 10 000 cycles
One detent in CCW position (CV1D)
One detent in CW position (CV1F)
One detent in CW position and CCW position (CVDF)

Ordering information (special code):
CV1D
One detent in CCW position
CV1F
Detent in CW position
CVDF
Detent in CW position and CCW position



| P16 STANDARD RESISTANCE ELEMENT DATA | | | | | | |
|---|---|---|---|---|---|---|
| STANDARD RESISTANCE VALUES | LINEAR TAPER | | | LOG TAPER | | |
| | 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 |
| 22 | 1 | 4.69 | 213 | | | |
| 47 | 1 | 6.85 | 146 | | | |
| 100 | 1 | 10 | 100 | 0.5 | 7.1 | 71 |
| 220 | 1 | 14.8 | 67.4 | 0.5 | 10.5 | 48 |
| 470 | 1 | 21.7 | 46.1 | 0.5 | 15.3 | 32.6 |
| 1K | 1 | 31.6 | 31.6 | 0.5 | 22.4 | 22.4 |
| 2.2K | 1 | 46.9 | 21.3 | 0.5 | 33.2 | 15.1 |
| 4.7K | 1 | 68.5 | 14.6 | 0.5 | 48.5 | 10.3 |
| 10K | 1 | 100 | 10 | 0.5 | 70.7 | 7.07 |
| 22K | 1 | 148 | 6.74 | 0.5 | 105 | 4.77 |
| 47K | 1 | 217 | 4.61 | 0.5 | 153 | 3.26 |
| 100K | 1 | 316 | 3.16 | 0.5 | 224 | 2.24 |
| 220K | 0.56 | 350 | 1.59 | 0.5 | 332 | 1.51 |
| 470K | 0.26 | 350 | 0.75 | 0.26 | 350 | 0.74 |
| 1M | 0.12 | 350 | 0.35 | 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 RESISTANCE VALUES | LINEAR TAPER | | | LOG TAPER | | |
| | 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 |
| 470 | | | | 0.25 | 10.8 | 23.1 |
| 1K | 0.5 | 22.4 | 22.4 | 0.25 | 15.8 | 16 |
| 2.2K | 0.5 | 33.2 | 15.1 | 0.25 | 23.5 | 11 |
| 4.7K | 0.5 | 48.5 | 10.3 | 0.25 | 34.3 | 7 |
| 10K | 0.5 | 70.7 | 7.07 | 0.25 | 50.0 | 5.0 |
| 22K | 0.5 | 105 | 4.77 | 0.25 | 74 | 3.4 |
| 47K | 0.5 | 153 | 3.26 | 0.25 | 108 | 2.3 |
| 100K | 0.5 | 224 | 2.24 | 0.25 | 158 | 1.6 |
| 220K | 0.5 | 332 | 1.51 | 0.25 | 235 | 1.1 |
| 470K | 0.26 | 350 | 0.74 | 0.25 | 343 | 0.7 |
| 1M | 0.12 | 350 | 0.35 | | | |

| PERFORMANCE | | | | |
|---|---|---|---|---|
| TESTS | CONDITIONS | TYPICAL VALUES AND DRIFTS | | |
| | | $\Delta R_T/R_T$ (%) | $\Delta R_{1\text{-}2}/R_{1\text{-}2}$ (%) | OTHER |
| Electrical endurance | 1000 h at rated power<br>90'/30' cycle at +40 °C | ± 5 % | - | Insulation resistance: > $10^4$ MΩ<br>Contact res. variation: < 2 % Rn |
| Damp heat, steady state | 56 days<br>40 °C, 93 % HR | ± 2 % | ± 1 % | Insulation resistance: > $10^4$ MΩ |
| Mechanical endurance | 50 000 cycles | ± 5 % | - | Contact res. variation: < 2 % Rn |
| Shock | 50 *g*'s at 11 ms<br>3 successive shocks<br>in 3 directions | ± 0.2 % | ± 0.5 % | - |
| Vibration | 10 Hz to 55 Hz<br>0.75 mm or 10 *g*'s<br>during 6 h | ± 0.2 % | - | $\Delta V_{1\text{-}2}/\Delta V_{1\text{-}3} \leq \pm 0.5$ % |

**Note**

- Nothing stated herein shall be construed as a guarantee of quality or durability

## 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 |
|---|---|---|---|---|---|---|
| **P16** = cermet<br>**PA16** = conductive plastic | **NM** = metallic black<br>**NP** = plastic black<br>**WM** = metallic white<br>**WP** = plastic white<br>**BP** = plastic blue<br>**RP** = plastic red<br>**YP** = plastic yellow | **223** = 22 kΩ for ohmic value range see electrical specification | **M** = ± 20 %<br>On request:<br>**K** = ± 10 % | **A** = linear<br>**L** = clockwise logarithmic<br>**F** = inverse clockwise logarithmic | **B15** = box of 20 pieces | (If applicable) Given by Vishay for custom design |

| SPECIAL NUMBER FOR OPTION |
|---|
| **F1** = line marking<br>**F2** = 10 graduations marking<br>**F3** = 5 graduations marking<br>**F4** = gradient marking<br>**F5** = light marking<br>**F6** = fan<br>**F7** = temperature<br>**F8** = volume<br>**CV1D** = detent in CCW position<br>**CV1F** = detent in CW position<br>**CVDF** = detent in CW and CCW position |

## KNOB STYLES

| STYLE | EXAMPLE IMAGES | |
|---|---|---|
| NP = black plastic |  |  |
| WP = white plastic |  |  |
| BP = blue plastic |  |  |
| RP = red plastic |  |  |
| YP = yellow plastic |  |  |

| KNOB STYLES | | |
|---|---|---|
| **STYLE** | **EXAMPLE IMAGES** | |
| NM = black metal |  |  |
| WM = white metal |  |  |

## KNOB MARKING OPTIONS

Several marking options on the top face of the knob are available.

| SPECIAL NUMBER | MARKING | EXAMPLE IMAGES | | AVAILABILITY FOR PLASTIC KNOB | AVAILABILITY FOR METALLIC KNOB |
|---|---|---|---|---|---|
| - | Dot (standard) |  |  | Yes | Yes |
| F1 | Line |  |  | Yes | Yes |
| F2 | 10 graduations |  |  | Yes | Yes |
| F3 | 5 graduations |  |  | Yes | Yes |
| F4 | Gradient |  |  | Yes | Yes |
| F5 | Light |  |  | Yes | Yes |
| F6 | Fan |  |  | Yes | Yes |
| F7 | Temperature |  |  | Yes | Yes |

| SPECIAL NUMBER | MARKING | EXAMPLE IMAGES | | AVAILABILITY FOR PLASTIC KNOB | AVAILABILITY FOR METALLIC KNOB |
|---|---|---|---|---|---|
| F8 | Volume |  |  | Yes | Yes |
| (Special code) | Other on demand |  |  | On request | On request |

## PART NUMBER DESCRIPTION (for information only)

| P16 | NP | 22 kΩ | 20 % | A | | BO | | e3 |
|---|---|---|---|---|---|---|---|---|
| MODEL | STYLE | VALUE | TOLERANCE | TAPER | SPECIAL | PACKAGING | SPECIAL | LEAD (Pb)-FREE |

## ACCESSORIES

| | |
|---|---|
| Additional Accessories (to order separately) | www.vishay.com/doc?51051 |

## RELATED DOCUMENTS

| APPLICATION NOTES | |
|---|---|
| Potentiometers and Trimmers | www.vishay.com/doc?51001 |
| Guidelines for Vishay Sfernice Resistive and Inductive Components | www.vishay.com/doc?52029 |
| Capabilities and Custom Options | www.vishay.com/doc?48493 |

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