

## Knob Potentiometer With Switch



### FEATURES

- **P16S** - version for military, professional and industrial applications (cermet): 1 W at 40 °C
- **PA16S** - version for professional audio applications (conductive plastic): 0.5 W at 40 °C
- Compact (integrated)
- Detent and electric cut off at beginning of travel
- 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 knobs and marking on request
- Test according to CECC 41000 or IEC 60393-1
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### LINKS TO ADDITIONAL RESOURCES

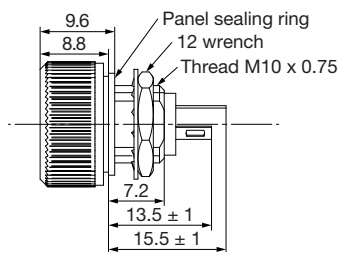
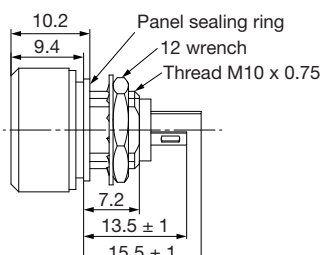
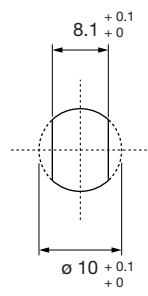
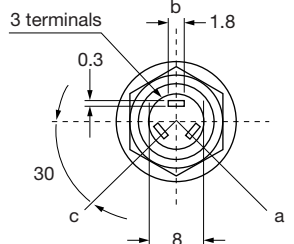
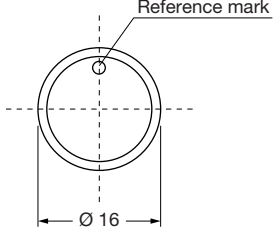


The P16S is a revolutionary concept in panel mounted potentiometers. This unique design consists of a knob driving and incorporating a cermet potentiometer. Only the mounting hardware and terminals are situated on the back side of the panel reducing to a minimum the required clearance.

### QUICK REFERENCE DATA

|                         |                                                   |
|-------------------------|---------------------------------------------------|
| Multiple module         | No                                                |
| Switch module           | Yes                                               |
| Detent module           | Yes                                               |
| Special electrical laws | A: linear, L: logarithmic, F: reverse logarithmic |
| Sealing level           | IP 67                                             |
| Lifespan                | 10K cycles (switch), 50K cycles (track)           |

### DIMENSIONS in millimeters (± 0.5 mm)

|                                                                                                                                             |                                                                                                                                             |                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P16SNP</b><br>Thickness nut 2 mm<br>washer 1.5 mm<br> | <b>P16SNM</b><br>Thickness nut 2 mm<br>washer 1.5 mm<br> | <b>PANEL CUTOUT</b><br><br>Panel thickness max.: 3 mm |
|                                                          |                                                          |                                                                                                                                            |



| ELECTRICAL SPECIFICATIONS                    |                  |                                        |                                              |
|----------------------------------------------|------------------|----------------------------------------|----------------------------------------------|
|                                              |                  | P16S                                   | PA16S                                        |
| Resistive element                            |                  | Cermet                                 | Conductive plastic                           |
| Electrical travel                            |                  | $220^\circ \pm 10^\circ$               | $220^\circ \pm 10^\circ$                     |
| Power rating chart                           |                  |                                        |                                              |
| Circuit diagram                              |                  |                                        |                                              |
| Taper                                        |                  |                                        |                                              |
| Resistance range                             | linear law       | 22 $\Omega$ to 10 M $\Omega$           | 1 k $\Omega$ to 1 M $\Omega$                 |
|                                              | logarithmic laws | 100 $\Omega$ to 2.2 M $\Omega$         | 470 $\Omega$ to 500 k $\Omega$               |
| Standard series e3                           |                  | 1 - 2.2 - 4.7 and on request 1 - 2 - 5 | 1 - 2.2 - 4.7                                |
| Tolerance                                    | standard         | $\pm 20\%$                             | $\pm 20\%$                                   |
|                                              | on request       | $\pm 10\%$                             | $\pm 10\%$ (1 k $\Omega$ to 100 k $\Omega$ ) |
| Power rating                                 | linear           | 1 W at $+40^\circ\text{C}$             | 0.5 W at $+40^\circ\text{C}$                 |
|                                              | logarithmic      | 0.5 W at $+40^\circ\text{C}$           | 0.25 W at $+40^\circ\text{C}$                |
| Temperature coefficient (typical)            |                  | $\pm 150$ ppm                          | $\pm 500$ ppm                                |
| Dielectric strength (RMS)                    |                  | 2500 V                                 | 2500 V                                       |
| Limiting element voltage (linear law)        |                  | 350 V                                  | 350 V                                        |
| Contact resistance variation                 |                  | 3 % R <sub>n</sub> or 3 $\Omega$       | 2 % R <sub>n</sub> or 3 $\Omega$             |
| End resistance (typical)                     |                  | 1 $\Omega$                             | 1 $\Omega$                                   |
| Insulation resistance (500 V <sub>DC</sub> ) |                  | 10 <sup>6</sup> M $\Omega$             | 10 <sup>6</sup> M $\Omega$                   |

**MECHANICAL SPECIFICATIONS**

|                                   |                 |
|-----------------------------------|-----------------|
| Mechanical travel                 | 300° ± 5°       |
| Operating torque                  | 2 Ncm typical   |
| End stop torque                   | 25 Ncm maximum  |
| 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                              |                  |

**SWITCH ELECTRICAL AND MECHANICAL SPECIFICATIONS**

|                                                |                                                                             |             |
|------------------------------------------------|-----------------------------------------------------------------------------|-------------|
| ON / OFF switch                                | Actuation in counter clockwise position (between terminal a and terminal b) |             |
| Switching current                              | P16S                                                                        | 100 mA max. |
|                                                | PA16S                                                                       | 1 mA max.   |
| Switch actuation torque                        | 3 Ncm typical                                                               |             |
| Switch actuation travel                        | 30° ± 5°                                                                    |             |
| Dielectric strength terminal to terminal (RMS) | 1000 V                                                                      |             |
| Insulation resistance between contacts         | 10 <sup>6</sup> MΩ                                                          |             |
| Switch mechanical endurance                    | 10 000 cycles                                                               |             |
| 1 cycle                                        | ON-OFF-ON                                                                   |             |

**Note**

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

**MARKING**

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

**PACKAGING**

- Carton box of 20 pieces

**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.

**STANDARD RESISTANCE ELEMENT DATA**

| STANDARD RESISTANCE VALUES | P16S CERMET         |              |                         |                     |              |                         | PA16S CONDUCTIVE PLASTIC |              |                         |                     |              |                         |
|----------------------------|---------------------|--------------|-------------------------|---------------------|--------------|-------------------------|--------------------------|--------------|-------------------------|---------------------|--------------|-------------------------|
|                            | LINEAR TAPER        |              |                         | LOGARITHMIC TAPER   |              |                         | LINEAR TAPER             |              |                         | LOGARITHMIC TAPER   |              |                         |
|                            | MAX. POWER AT 40 °C | MAX. VOLTAGE | MAX. CUR. THROUGH WIPER | MAX. POWER AT 40 °C | MAX. VOLTAGE | MAX. CUR. THROUGH WIPER | 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                      | 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                    |                          |              |                         | 0.25                | 10.8         | 23.1                    |
| 1K                         | 1                   | 31.6         | 31.6                    | 0.5                 | 22.4         | 22.4                    | 0.5                      | 22.4         | 22.4                    | 0.25                | 15.8         | 16                      |
| 2.2K                       | 1                   | 46.9         | 21.3                    | 0.5                 | 33.2         | 15.1                    | 0.5                      | 33.2         | 15.1                    | 0.25                | 23.5         | 11                      |
| 4.7K                       | 1                   | 68.5         | 14.6                    | 0.5                 | 48.5         | 10.3                    | 0.5                      | 48.5         | 10.3                    | 0.25                | 34.3         | 7                       |
| 10K                        | 1                   | 100          | 10                      | 0.5                 | 70.7         | 7.07                    | 0.5                      | 70.7         | 7.07                    | 0.25                | 50           | 5                       |
| 22K                        | 1                   | 148          | 6.74                    | 0.5                 | 105          | 4.77                    | 0.5                      | 105          | 4.77                    | 0.25                | 74           | 3.4                     |
| 47K                        | 1                   | 217          | 4.61                    | 0.5                 | 153          | 3.26                    | 0.5                      | 153          | 3.26                    | 0.25                | 108          | 2.3                     |
| 100K                       | 1                   | 316          | 3.16                    | 0.5                 | 224          | 2.24                    | 0.5                      | 224          | 2.24                    | 0.25                | 158          | 1.6                     |
| 220K                       | 0.56                | 350          | 1.59                    | 0.5                 | 332          | 1.51                    | 0.5                      | 332          | 1.51                    | 0.25                | 235          | 1.1                     |
| 470K                       | 0.26                | 350          | 0.75                    | 0.26                | 350          | 0.74                    | 0.26                     | 350          | 0.74                    | 0.25                | 343          | 0.7                     |
| 1M                         | 0.12                | 350          | 0.35                    | 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                   |                     |              |                         |                          |              |                         |                     |              |                         |

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

| ORDERING INFORMATION                                                                                                                                                         |   |                                                                                                                                                        |   |   |                                                                   |   |                                             |   |                                                                              |   |   |                        |   |                                                      |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------|---|---------------------------------------------|---|------------------------------------------------------------------------------|---|---|------------------------|---|------------------------------------------------------|--|--|--|
| P                                                                                                                                                                            | 1 | 6                                                                                                                                                      | S | N | P                                                                 | 2 | 2                                           | 3 | M                                                                            | A | B | 1                      | 5 |                                                      |  |  |  |
| MODEL                                                                                                                                                                        |   | STYLE                                                                                                                                                  |   |   | OHMIC VALUE                                                       |   | TOLERANCE                                   |   | TAPER                                                                        |   |   | PACKAGING CODE         |   | SPECIAL NUMBER                                       |  |  |  |
| P16S = cermet<br><br>PA16S = 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<br>for ohmic value range see electrical specification |   | M = ± 20 %<br><br>On request:<br>K = ± 10 % |   | A = linear<br>L = clockwise logarithmic<br>F = inverse clockwise logarithmic |   |   | B15 = box of 20 pieces |   | (If applicable)<br>Given by Vishay for custom design |  |  |  |
| SPECIAL NUMBER FOR KNOB MARKING                                                                                                                                              |   |                                                                                                                                                        |   |   |                                                                   |   |                                             |   |                                                                              |   |   |                        |   |                                                      |  |  |  |
| 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 |   |                                                                                                                                                        |   |   |                                                                   |   |                                             |   |                                                                              |   |   |                        |   |                                                      |  |  |  |

| KNOB STYLES        |                                                                                     |                                                                                       |
|--------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| STYLE              | EXAMPLE IMAGES                                                                      |                                                                                       |
| NP = black plastic |  |  |
| WP = white plastic |  |  |
| BP = blue plastic  |  |  |

| <b>KNOB STYLES</b>  |                                                                                   |                                                                                     |
|---------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| STYLE               | EXAMPLE IMAGES                                                                    |                                                                                     |
| RP = red plastic    |  |  |
| YP = yellow plastic |  |  |
| 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                            |

| SPECIAL NUMBER | MARKING         | EXAMPLE IMAGES                                                                    |                                                                                   | AVAILABILITY FOR PLASTIC KNOB | AVAILABILITY FOR METALLIC KNOB |
|----------------|-----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------|--------------------------------|
| F6             | Fan             |  |  | Yes                           | Yes                            |
| F7             | Temperature     |  |  | Yes                           | Yes                            |
| F8             | Volume          |  |  | Yes                           | Yes                            |
| (Special code) | Other on demand |  |  | On request                    | On request                     |

**PART NUMBER DESCRIPTION** (for information only)

|             |           |              |             |          |         |             |         |                |
|-------------|-----------|--------------|-------------|----------|---------|-------------|---------|----------------|
| <b>P16S</b> | <b>NP</b> | <b>22 kΩ</b> | <b>20 %</b> | <b>A</b> |         | <b>BO20</b> |         | <b>e3</b>      |
| MODEL       | STYLE     | OHMIC VALUE  | TOLERANCE   | TAPER    | SPECIAL | PACKAGING   | SPECIAL | LEAD (Pb)-FREE |

**ACCESSORIES**

|                                              |                                                                        |
|----------------------------------------------|------------------------------------------------------------------------|
| Additional Accessories (to order separately) | <a href="http://www.vishay.com/doc?51051">www.vishay.com/doc?51051</a> |
|----------------------------------------------|------------------------------------------------------------------------|

**RELATED DOCUMENTS**

| APPLICATION NOTES                                                 |                                                                        |
|-------------------------------------------------------------------|------------------------------------------------------------------------|
| Potentiometers and Trimmers                                       | <a href="http://www.vishay.com/doc?51001">www.vishay.com/doc?51001</a> |
| Guidelines for Vishay Sfernice Resistive and Inductive Components | <a href="http://www.vishay.com/doc?52029">www.vishay.com/doc?52029</a> |
| Capabilities and Custom Options                                   | <a href="http://www.vishay.com/doc?48493">www.vishay.com/doc?48493</a> |



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