

Knob Potentiometer



FEATURES

- 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}
- 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)
- Construction: fully sealed
- Professional grade
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



LINKS TO ADDITIONAL RESOURCES



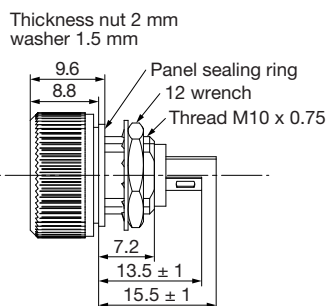
The P16 is a revolutionary concept in panel mounted potentiometers. This unique design consists of a knob driving and incorporating a cermet potentiometer. Only the mounting hardware and terminals are situated on the back side of the panel reducing to a minimum the required clearance.

QUICK REFERENCE DATA

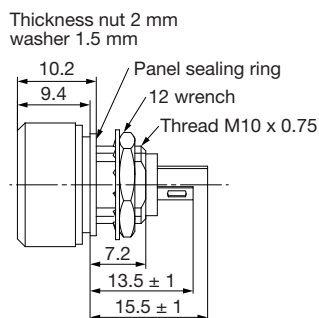
Multiple module	No
Switch module	Upgrade for switch version with P16S
Detent module	Yes
Special electrical laws	A: linear, L: logarithmic, F: reverse logarithmic
Sealing level	IP 67
Lifespan	200K cycles

DIMENSIONS in millimeters (± 0.5 mm)

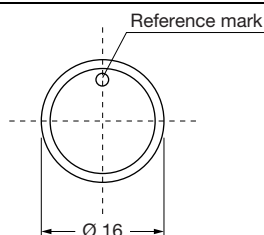
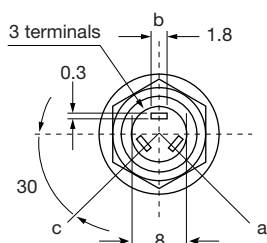
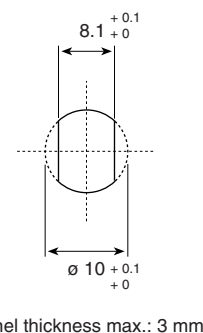
P16NP



P16NM



Panel Cutout





ELECTRICAL SPECIFICATIONS		
	P16	PA16
Resistive element	Cermet	Conductive plastic
Electrical travel	$270^\circ \pm 10^\circ$	$270^\circ \pm 10^\circ$
Power rating	Linear	1 W at +40 °C
	Logarithmic	0.5 W at +40 °C
Circuit diagram		
Taper		
Resistance range	Linear taper Logarithmic taper	1 kΩ to 1 MΩ 470 Ω to 500 kΩ
Standard series E3	22 Ω to 10 MΩ 100 Ω to 2.2 MΩ	1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard On request	± 20 % ± 10 % (1 kΩ to 100 kΩ)
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 % R _n or 3 Ω	2 % R _n 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

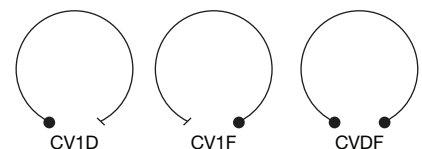
One detent in CCW position

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
	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
	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		
		$\Delta R_T/R_T$ (%)	$\Delta R_{1-2}/R_{1-2}$ (%)	OTHER
Electrical endurance	1000 h at rated power 90'/30' cycle at +40 °C	± 5 %	-	Insulation resistance: > 10 ⁴ MΩ Contact res. variation: < 2 % R _n
Damp heat, steady state	56 days 40 °C, 93 % HR	± 2 %	± 1 %	Insulation resistance: > 10 ⁴ MΩ
Mechanical endurance (no load)	200 000 cycles	± 2 %	-	Contact res. variation: < 3 % R _n Independent linearity: ≤ ± 5 %
Shock	50 g's at 11 ms 3 successive shocks in 3 directions	± 0.2 %	± 0.5 %	-
Vibration	10 Hz to 55 Hz 0.75 mm or 10 g's during 6 h	± 0.2 %	-	$\Delta V_{1-2}/\Delta V_{1-3} \leq \pm 0.5$ %

Note

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

OPTION RELATIVE TO APPLICATION

“K14” OPTION for AMS applications (avionics, military, and space)

“K17” OPTION for MEDICAL applications

Option guarantees:

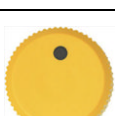
- Reinforced incoming inspection on raw material
- Traceability of all materials used in the composition of the product
- 50-year traceability (AMS market) / 20-year traceability (MEDICAL market)
- Customer information for any process or product modification having an impact on the function, mountability, shape or reliability of the product
- Periodic product monitoring
- Dedicated technical specification



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 PA16 = conductive plastic	NM = metallic black NP = plastic black WM = metallic white WP = plastic white BP = plastic blue RP = plastic red YP = plastic yellow			223 = 22 kΩ for ohmic value range see electrical specification			M = ± 20 % On request: K = ± 10 %		A = linear L = clockwise logarithmic F = inverse clockwise logarithmic			B15 = box of 20 pieces	(If applicable) Given by Vishay for custom design				
													SPECIAL NUMBER FOR OPTION				
													F1 = line marking F2 = 10 graduations marking F3 = 5 graduations marking F4 = gradient marking F5 = light marking F6 = fan F7 = temperature F8 = volume CV1D = detent in CCW position CV1F = detent in CW position 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

Potentiometers are delivered with accessories (nut, washer...)								
Additional Accessories (to order separately)						www.vishay.com/doc?51051		
Control knobs						www.vishay.com/doc?51101		

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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