

Fully Sealed Container Cermet Potentiometers Submarine Applications



FEATURES

- High power rating 1.5 W at 70 °C
- Stainless steel shaft and bushing to endure sea salt water immersion
- Fully sealed IP68 on panel
- Tight temperature coefficient (± 75 ppm/°C typical)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

LINKS TO ADDITIONAL RESOURCES

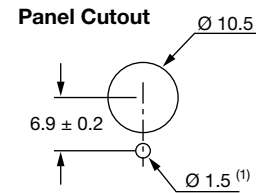
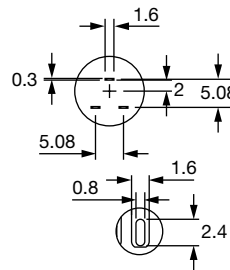
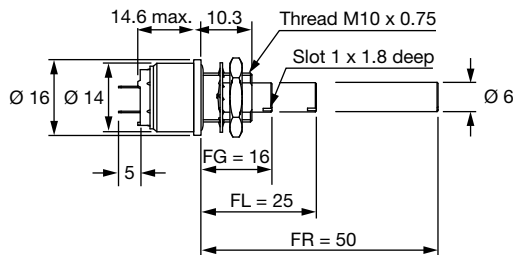


P13SM is designed for applications which need to set electrical parameters with an immersed potentiometer in deep water conditions up to 30 m (100 feet).

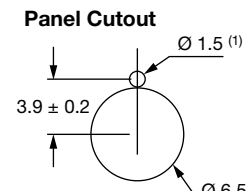
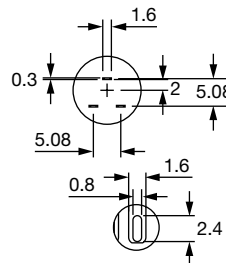
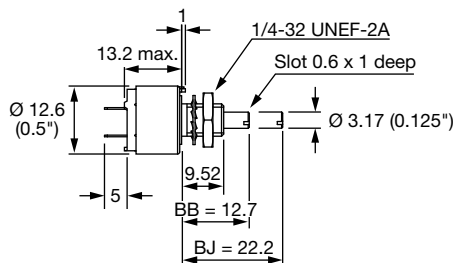
| QUICK REFERENCE DATA | |
|-------------------------|---|
| Multiple module | No |
| Switch module | n/a |
| Detent module | n/a |
| Special electrical laws | A: linear, L: logarithmic, F: reverse logarithmic |
| Sealing level | IP 68 |
| Lifespan | 25K cycles |

DIMENSIONS in millimeters (inches) ± 0.5 mm (± 0.02 ")

P13SM N



P13SM B



Note

(1) CAUTION: $\text{Ø } 1.5$ of panel cut out must not be fully through-hole

Undergoes European Quality Insurance System

| ELECTRICAL SPECIFICATIONS | |
|--|--|
| Resistive element | Cermet |
| Electrical travel | $270^\circ \pm 10^\circ$ |
| Resistance range | Linear taper: 22 Ω to 10 M Ω Logarithmic taper: 1 k Ω to 2.2 M Ω |
| Standard series E3 | 1, 2.2, 4.7, and on request 1, 2, 5 |
| Tolerance | Standard: $\pm 20\%$ On request: $\pm 10\%$ to $\pm 5\%$ |
| Taper | <p>The graph shows Total Resistance (%) on the y-axis (0 to 100) and Clockwise Shaft Rotation (%) on the x-axis (0 to 100). Three curves are shown: F (orange, logarithmic), A (blue, linear), and L (green, logarithmic).</p> |
| Circuit diagram | <p>The diagram shows a potentiometer with three terminals: (1) at the left end, (2) at the wiper, and (3) at the right end. An arrow labeled 'cw' indicates clockwise rotation.</p> |
| Power rating | <p> Linear: 1.5 W at 70 °C Logarithmic: 0.75 W at 70 °C </p> <p>The graph shows Power (W) on the y-axis (0 to 1.5) and Ambient Temperature (°C) on the x-axis (0 to 140). Two curves are shown: Linear taper A (blue) and Logarithmic taper L and F (orange). Both show a constant power rating up to 70 °C, after which it decreases linearly.</p> |
| Temperature coefficient (typical) | ± 150 ppm/°C For values $\geq 100 \Omega$ and in temperature range +20 °C to +70 °C, the typical temperature coefficient is ± 75 ppm/°C |
| Limiting element voltage (linear law) | 350 V |
| Contact resistance variation | 3 % R _n or 3 Ω |
| End resistance (typical) | 1 Ω |
| Dielectric strength (RMS) | 2000 V |
| Insulation resistance (300 V _{DC}) | 10 ⁶ M Ω |
| Independent linearity (typical) | $\pm 5\%$ |



| STANDARD RESISTANCE ELEMENT DATA | | | | | | | |
|----------------------------------|---------------------|----------------------|-------------------------|---------------------|----------------------|-------------------------|----------------------------------|
| STANDARD RESISTANCE VALUES | LINEAR TAPER | | | LOGS TAPED | | | TYPICAL TCR -55 °C +125 °C |
| | MAX. POWER AT 70 °C | MAX. WORKING VOLTAGE | MAX. CUR. THROUGH WIPER | MAX. POWER AT 70 °C | MAX. WORKING VOLTAGE | MAX. CUR. THROUGH WIPER | |
| Ω | W | V | mA | W | V | mA | ppm/°C |
| 22 | 1.5 | 5.74 | 261 | - | - | - | ± 150 |
| 47 | 1.5 | 8.4 | 177 | - | - | - | |
| 100 | 1.5 | 12.2 | 122 | - | - | - | |
| 220 | 1.5 | 18.2 | 82.6 | - | - | - | |
| 470 | 1.5 | 26.5 | 56.5 | - | - | - | |
| 1K | 1.5 | 38.7 | 38.7 | 0.75 | 27 | 27 | |
| 2.2K | 1.5 | 57.5 | 26.1 | 0.75 | 40 | 18 | |
| 4.7K | 1.5 | 84 | 17.9 | 0.75 | 59 | 12 | |
| 10K | 1.5 | 122.5 | 12.2 | 0.75 | 87 | 8.7 | |
| 22K | 1.5 | 182 | 8.26 | 0.75 | 128 | 5.8 | |
| 47K | 1.5 | 265 | 5.65 | 0.75 | 187 | 3.9 | |
| 100K | 1.22 | 350 | 3.5 | 0.75 | 273 | 2.7 | |
| 220K | 0.56 | 350 | 1.6 | 0.56 | 350 | 1.6 | |
| 470K | 0.26 | 350 | 0.74 | 0.26 | 350 | 0.74 | |
| 1M | 0.12 | 350 | 0.35 | 0.12 | 350 | 0.35 | |
| 2.2M | 0.05 | 350 | 0.16 | 0.05 | 350 | 0.16 | |
| 4.7M | 0.026 | 350 | 0.074 | - | - | - | |
| 10M | 0.012 | 350 | 0.035 | - | - | - | |

| MECHANICAL SPECIFICATIONS | | | |
|-----------------------------------|---------|---------------------------|-----------------------------------|
| Mechanical travel | Style B | 300° ± 5° | |
| | Style N | 310° ± 5° | |
| Operating torque (typical) | | 2 Ncm | 2.85 oz. inch |
| End stop torque | Style B | 35 Ncm max. | 3.1 lb inch max. |
| | Style N | 80 Ncm max. | 7.1 lb inch max. |
| Tightening torque of mounting nut | Style B | 80 Ncm min., 150 Ncm max. | 7 lb inch min., 13.3 lb inch max. |
| | Style N | 80 Ncm min., 250 Ncm max. | 7 lb inch min., 22.1 lb inch max. |
| Unit weight | | 8 g to 27 g | 0.3 oz. to 1 oz. |
| Terminals | | e3: pure Sn | |

| ENVIRONMENTAL SPECIFICATIONS | |
|------------------------------|---|
| Temperature range | -55 °C to +125 °C |
| Climatic category | 55 / 125 / 56 |
| Sealing | Fully sealed - container IP68 |
| Panel sealing | Immersion at 30 m (100 feet) in sea salt water or clear water |



| OPTIONS | |
|-------------------------------|--|
| Special feature command shaft | Length is measured from the mounting surface to the free end of the shaft. The screwdriver slot is aligned with the wiper within $\pm 10^\circ$. Special shafts are available, in accordance to drawings supplied by customers. We recommend that customers should not machine tool shafts, in order to avoid damage. Bending or torsion of terminals should also be avoided. |

| MARKING |
|--|
| Printed: <ul style="list-style-type: none"> • Vishay trademark • Part number (including ohmic value code, tolerance code and resistance law) • Manufacturing date • Marking of terminals a |

| PACKAGING |
|--|
| In box Packaging quantity depending on shafts: <ul style="list-style-type: none"> • Box of 5 pieces for shaft FR (code BO5) • Box of 10 pieces for shaft FG or FL (code BO10) • Box of 15 pieces for shaft BJ (code BO15) • Box of 25 pieces for shaft BB (code BO25) |
| Hardware: nuts, washer, and O-ring are separately supplied (not mounted on the potentiometer), in a small bag placed in the packaging. |

| 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' - ambient temperature 70 °C | $\pm 1 \%$ | - | Contact res. variation: < 3 % Rn |
| Climatic sequence | Phase A dry heat 125 °C Phase B damp heat Phase C cold -55 °C Phase D damp heat 5 cycles | $\pm 0.5 \%$ | $\pm 1 \%$ | - |
| Damp heat, steady state | 56 days 40 °C, 93 % HR | $\pm 0.5 \%$ | $\pm 1 \%$ | Dielectric strength: 1000 V Insulation resistance: > 10 ⁴ MΩ |
| Change of temperature | 5 cycles -55 °C at +125 °C | $\pm 0.5 \%$ | - | - |
| Mechanical endurance | 25 000 cycles | $\pm 3 \%$ | - | Contact res. variation: < 2 % Rn |
| Shock | 50 g's at 11 ms 3 successive shocks in 3 directions | $\pm 0.1 \%$ | $\pm 0.2 \%$ | - |
| Vibration | 10 Hz to 55 Hz 0.75 mm or 10 g's during 6 h | $\pm 0.1 \%$ | - | $\Delta V_{1-2}/V_{1-3} < \pm 0.2 \%$ |

Note

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



| ORDERING INFORMATION (Part Number) | | | | | | | | | | | | | | | | | |
|------------------------------------|---------|------|---------|-------|----|--------|---|---|---|---|--|--|---|--|--|--|--|
| P | 1 | 3 | S | M | N | F | L | S | 1 | 0 | 3 | M | A | E | | | |
| MODEL | BUSHING | | | SHAFT | | | SHAFT STYLE | OHMIC VALUE | | | TOLERANCE | TAPER | | SPECIAL | | | |
| P13SM | ∅ | L | Shaft ∅ | | ∅ | L | S = slotted On request: R = round F = flat D = custom | Linear law from 22 Ω to 10 MΩ Logarithmic law from 1 kΩ to 2.2 MΩ 103 = 10 kΩ | | | M = 20 % On request: K = 10 % J = 5 % | A = linear L = clockwise logarithmic F = inverse clockwise logarithmic | | E = locating peg or special code given by Vishay | | | |
| | N | 10 | 10.3 | 6 | BB | 3.17 | 12.7 | | | | | | | | | | |
| | B | 6.35 | 9.52 | 3.17 | BJ | 3.17 | 22.2 | | | | | | | | | | |
| | | | | | FG | 6 | 16 | | | | | | | | | | |
| | | | | | FL | 6 | 25 | | | | | | | | | | |
| | | | | | FR | 6 | 50 | | | | | | | | | | |
| | | | | | AP | Custom | | | | | | | | | | | |

| PART NUMBER DESCRIPTION (for information only) | | | | | | | | | | | | | |
|--|---------|---------|-------|-------------|-------|-----------|-------|---------|-----------|-------|---------|--|----------------|
| P13SM | N | E | FL | S | 10K | 20 % | A | | | BO10 | | | e3 |
| MODEL | BUSHING | SPECIAL | SHAFT | SHAFT STYLE | VALUE | TOLERANCE | TAPER | SPECIAL | PACKAGING | SHAFT | SPECIAL | | LEAD (Pb)-FREE |

| ACCESSORIES | |
|--|--|
| 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 |



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