PRC
PRODUCT-CATALOG

PRECISION RESISTOR CO., INC.

Designer & Manufacturer of Custom Wire Wound Precision Electrical Components Since 1932

DISCOVER WHY TOP ENGINEERS ACROSS THE GLOBE CONSISTENTLY RELY ON PRC'S WIRE WOUNDS

LEAD-FREE Pb RoHS COMPLIANT

WIDEST RANGE OF SIZES, STYLES, OHMIC VALUES, TOLERANCES & TEMPERATURE COEFFICIENTS WITH UNPARALLELED PRECISION

MasterCard VISA

10601 75th St. N. Largo, FL. 33777-1421 U.S.A
Tel. 727-541-5771 Fax. 727-546-9515
Url: www.precisionresistor.com
Email: sales @precisionresistor.com

MADE IN THE U.S.A.

ENGINEERS & DESIGNERS

PRECISION RESISTOR'S MISSION STATEMENT

To continue a tradition ... with competitively priced, high quality, 100% USA produced custom precision fixed wire wound resistors, sensors and shunts for critical applications and to serve the needs of our customers who utilize these products.

PRC's product catalog contains all detailed information including complete electrical & mechanical description of our special-purpose resistance devices and demonstrates how these unique concepts for precision wire wounds will benefit you in today's hi-tech world as a design engineer

What Precision Means To You:

1. BETTER FLEXIBILITY FOR CUSTOM ENGINEERING
PRC's precision wire wounds are ideal for short run development projects as well as long production runs that are needed in a hurry. Set-ups and tooling are easier to assemble than other resistor types and specs can be quickly transferred from the model shop and laboratory to the production floor.

2. BUY ONLY WHAT YOU NEED
Why buy 50 pieces or more, if all you need are a few resistors for tests or a dozen parts to complete your requirement? Small quantity lots or high volume production quantities are accurately checked 100% to assure specified limits and delivered on time to meet critical schedules.

3. LARGE SELECTION
Widest range of values anywhere! You can specify any resistance value or decimal part of an ohm from 0.001Ω to 10MegΩ with tolerances to ±0.005% and TCR's to 0±1 ppm/°C. Also, shown are temperature-sensitive resistors and compensators to +6000 ppm/°C. as well as a complete line of four-terminal thru-hole and SMD precision sub-miniature current shunts.

4. LOW VALUE/LOW TCR COMBINATIONS
PRC's extremely low values to 1 milliohm and TCR ±15 ppm/°C. provide better load-stability. This means the quality to resist permanent change is designed into the parts from the start for dependable and repeatable measurements piece-to-piece.

5. HIGH SURGE CURRENT HANDLING CAPABILITIES
Many other resistor types on the market require at least 2 or more parts to equal the power and overload capabilities of 1 PRC resistor. That's why the 3 and 5 watt precision shunt values are so popular.

6. COMMERCIALLY PURE COPPER TERMINALS
Why copper? Because of its excellent current carrying capacity. No material is better suited for precision parts than commercially pure copper. That is, oxygen-free, high conductivity, low resistivity, hot-tinned copper terminals. Hot-tinned rather than electro-tin plated terminals because they offer better wetting characteristics and longer shelf life. Beware of copper clad or other materials that have a strong magnetic attraction and exhibit a high EMF especially when specifying low value precision resistors. Another reason engineers want commercially pure copper is because of its low resistivity.

7. LOW THERMAL EMF VS. COPPER
All PRC resistors (especially low values) have low EMF (<0.3 to 1.5 microvolts per deg. C.) with respect to the copper terminals. Many low value tin oxide and other general-purpose power resistors in the industry have thermocouple errors as large as 100 microvolts per deg. C., which degrade circuit performance. Try to avoid thermal gradients that could cause a large temperature difference across the resistor and specify resistors with low EMF construction.

8. TIME-PROVEN SERVICE
PRC's precision/power resistors are the choice of engineers and designers because of their reasonable costs and time-proven heavy-duty service. Reliability and dependable quality year-after-year are "the real value" of precision wire wound resistors.

If you are looking for stable quality components specifically designed for repetitive & predictable applications then review this easy-to-specify brochure and select exactly what you need. Let our 70+ years of invaluable experience in resistor design and manufacturing work for you. We are very confident that you too can ***"profit from Precision."***

PRC
ISSUE NO. 42

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CONTENTS

Page Number & Brief Description

PURCHASING INFORMATION

Please specify (where they apply) ...

Quantity
Resistance value
Resistance tolerance
Current/Special lead size
TCR Char./Stability specs
PRC type or wattage rating
Temperature span of operation

Special Testing
Custom marking
Delivery requirements
Qualification standards
Overload requirements
Certification requirements
Bulk or tape and reel packaging

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PRC FACTS

When you need "the ultimate in Precision" consider these facts:

1. TOLERANCE, TCR & AMBIENT TEMPERATURE as One Spec

The TCR and temperature are also vital factors when specifying very accurate resistors and must be part of the equation.

Resistance Tolerance is expressed as (±) plus or minus percent of the nominal value (ohms) required. (All PRC resistors are calibrated and tested within specified limits at 25°C unless otherwise noted.)

TCR - We know there is no TCR (Temperature Coefficient of Resistance) without a change in temperature. That is, no proportional change in resistance without a change in the ambient or some self-generated temperature shift resulting from an excitation of power. This variation in resistance with respect to the change in temperature is expressed in parts per million (ppm), Percent (%) or in ohms/ohm … per °C

For Example: The TCR for 0±5ppm, also expressed as ±0.000005Ω or ±0.0005% per degree C. as with all TCRs at PRC, is calculated between +25°C. and +100°C using the industry standard formula on page 9 … unless otherwise noted. Therefore, a 1000Ω 5ppm resistor is multiplied by 0.000005Ω or 0.005Ω change/°C

Temperature - is the measure of heat or cold of an object or substance and directly related to the TCR and tolerance. Since the TCR char. is the variation in resistance above or below room ambient (23°C or 25°C) or a span that includes both, it is essential with close resistance tolerances and low TCR requirements, to specify the temperature span of operation and treat all the surrounding conditions affecting the resistor as "one-spec."

2. WHY'S STABILITY SO IMPORTANT?

Stability is the quality to resist permanent change, and must be designed into the parts from the start. It is very difficult to stabilize or condition a general-purpose resistor and be confident that it will meet a critical application. All stability specs at PRC are designed for precise requirements even if you specify ±1% resistance tolerances.

3. EXTRA POWER … When You Need It!

PRC's precision power resistors are noted for the surge current handling and overload capabilities. However, all catalog ratings are based upon standard ±1% resistance tolerances at +25°C or +125°C depending upon the resistor type. Derating is required for higher temperatures and closer tolerances. Please refer to the derating curves for each type resistor. Usually a larger part or a lower TCR will help, but heat is heat and must be carried off in some manner.

4. LVS SHUNT is PRC's "crown jewel" for SURFACE MOUNT CURRENT SENSING

The LVS on page 6 as well as the PLV 4-lead version on page 7 are ideal in voltage drop applications and for accurate current-sensing requirements … because of their stability and flexibility. These unique parts not only offer lower values with closer tolerances, but also lower TCR's (10ppm) … over a wider temperature span. The low TCR feature provides better thermal stability for more dependable measurements under load conditions. In addition, PRC's shunt values provide low EMF with respect to the tinned copper terminals. Thermal effects, EMF and dissimilar metals become part of the resistance readings of low values. Specify low EMF and try to avoid thermal gradients that could cause a large temperature difference across a critical part. Obviously, the more information we have, the better we are able to match parts to your specifications.

5. PRC INTERESTING FACT

One of the shunt values we tested was a ten milliohm, 10-watt part (PLV10AL 0.01Ω ±1%) that developed over 30 amperes under full load. Because of its aluminum oxide rectangular case and special low TCR element, the resistance change (under load) was less than ±0.1% … and there was virtually no measurable EMF. Now that is a breakthrough!

We certainly were impressed with the results ... and we are confident we can help you in a similar manner.

6. PRC OFFERS THESE FEATURES:

1. Wide variety of shapes & sizes
2. Measurable and predictable voltage/temperature relationship piece-to-piece.
3. Low value/close tolerance combinations.
4. Low TCRs
5. High temperature insulation.
6. Single-joint 4-terminal construction to eliminate lead-out and contact resistance.
7. Assorted diameters of pure copper leads for high current-carrying capacities and lower resistance per circular mil foot.

7. YOU CAN CUSTOM DESIGN YOUR OWN LOW VALUE PRECISION SHUNT

That's right, you can design, test and fine-tune engineering samples so they perform like a precision instrument. Try a few of our shunts today, because many of the popular values are in-stock for immediate delivery. Better yet, if we don't have exactly what you need in stock, special engineering samples will be manufactured to your specs quickly … and at no cost!

(CONTINUED ON PAGES 5-7)

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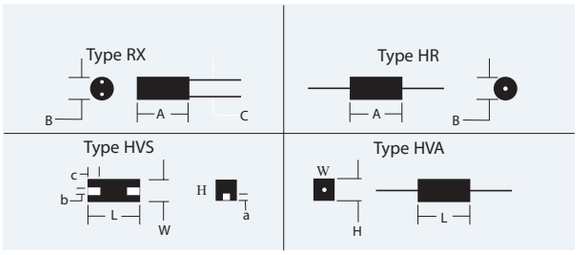
HR/HVA/HVS- ULTRA PRECISION



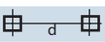
How Can the Ultra-Precision Series Help You?

Values ..... from 0.1Ω thru 10 Megohms
Tolerances ..... ±0.01% (Std.) … to ±0.005%
TCR Char ..... 5ppm (Std.) … to 0±1ppm/°C
Greater Stability ..... to ±0.001%/year
Temperature ..... -65°C to +145°C

ELECTRICAL & PHYSICAL SPECIFICATIONS

PRC Type	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res.Tol.	Max. Volts	(A) Length mm ±1.57	(A) Length (ins) ±.062″	(B) Diameter mm ±.787	(B) Diameter (ins) ±.031″	Standard Space C	(ETP/OFHC) * Tinned Copper Leads Diam. Max.	Tinned Copper Leads Length t (±.125″)	Resistance (Ω) Min.	Max. Standard	Max. Special
PRINTED CIRCUIT														
RX255N	RBR71	RB71	.25W	100V	7.92	(.312”)	6.35	(.250”)	.200”	.025”	1”	0.1	100K	150K
RX258N	——	——	.33W	300V	12.7	(.500”)	6.35	(.250”)	.200”	.025”	1”	0.1	250K	350K
RX378N	——	RB70	.5W	200V	12.7	(.500”)	9.53	(.375”)	.200”	.032”	1”	0.1	301K	500K
AXIAL LEAD													t = 2” Leads on MIL-Styles	
HR103	——	——	.1W	50V	5.08	(.200”)	2.54	(.100”)	——	.020”	1.5”	1.0	10K	20K
HR175N	——	——	.2W	100V	7.92	(.312”)	3.96	(.156”)	——	.020”	1.5”	0.1	80K	100K
HR186N	——	——	.2W	150V	9.53	(.375”)	4.75	(.187”)	——	.025”	1.5”	0.1	100K	150K
HR188N	RBR74	——	.25W	150V	12.7	(.500”)	4.9	(.193”)	——	.025”	1.5”	0.1	125K	200K
HR256N	RBR56	RB56	.25W	200V	9.53	(.375”)	6.35	(.250”)	——	.032”	1.5”	0.1	127K	350K
HR258N	RBR55	RB55	.33W	300V	12.7	(.500”)	6.35	(.250”)	——	.032”	1.5”	0.1	226K	500K
HR2512N	RBR54	RB54	.5W	300V	19.05	(.750”)	6.35	(.250”)	——	.032”	1.5”	0.1	511K	1 MEG
HR3114N	RBR76	——	.5W	300V	20.62	(.812”)	7.92	(.312”)	——	.032”	1.5”	0.1	600K	1.5 MEG
HR3712N	RBR53	RB53	.66W	300V	19.05	(.750”)	9.53	(.375”)	——	.032”	1.5”	0.1	750K	2 MEG
HR3716N	RBR52	RB52	1W	600V	25.4	(1.000”)	9.53	(.375”)	——	.032”	1.5”	0.1	1.5 MEG	3 MEG
HR5016N	RBR57	RB57	1.5W	600V	25.4	(1.000”)	12.7	(.500”)	——	.032”	1.5”	0.1	2 MEG	5 MEG
HR5024N	——	RB58	2W	900V	38.1	(1.500”)	12.7	(.500”)	——	.032”	1.5”	0.1	3.01 MEG	7.5 MEG
HR5032N	——	RB59	2.5W	1200V	50.8	(2.000”)	12.7	(.500”)	——	.032”	1.5”	0.1	5.11 MEG	10 MEG

LEAD MOUNTED & SURFACE MOUNTED

PAD LAYOUT 

*Commercially pure copper (electrolytic tough pitch/oxygen-free high conductivity

PRC TYPE AXIAL	PRC TYPE SMD	Max. Watts	Max. Volts	H mm / ins.	L mm / ins.	W mm / ins.	a	b	c	d	Lead Dia. 1″L Min.	Resistance (Ω) Min.	Resistance (Ω) Max.
HVA1	HVS1	0.2W	100V	3.30 / .130”	9.14 / .360”	3.18 / .125”	.075”	.075”	.100”	.260”	.020”	0.1	75K
HVA2	HVS2	0.25W	150V	6.35 / .250”	9.78 / .385”	5.72 / .225”	.125”	.112”	.100”	.310”	.025”	0.1	150K
HVA3	HVS3	0.5W	250V	6.35 / .250”	12.7 / .500”	6.35 / .250”	.100”	.112”	.100”	.425”	.031”	0.1	500K
HVA5	HVS5	1.0W	600V	7.87 / .310”	15.88 / .625”	7.87 / .310”	.075”	.112”	.100”	.551”	.031”	0.1	1MEG

ENGINEERING DATA:

RESISTANCE AND TOLERANCES

You can select any ohmic value or decimal part of an ohm with tolerances to ±0.005% 10Ω min. required for ±0.01% tol.

TCR CHARACTERISTIC

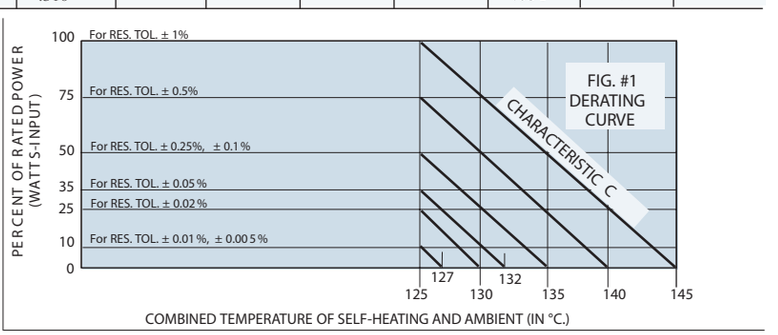
Standard: 0±5ppm/°C (100Ω and above); 0±15ppm/°C. (values below 100Ω) - calculated between +25°C. and +100°C. (Please specify temperature span of operation.)
Special: to 0±1 ppm°C. - matching to 0±0.5 ppm°C.

POWER VS. AMBIENT TEMP.

All Ultra resistors are designed for full load based upon ±1% res. tol. - providing the ambient temp. - plus the temp. rise due to self-heating does not exceed +125°C. Derated to zero power at +145°C. see Fig. 1.

STABILITY

To ±0.001% / yr. at 25°C. (no load).



THERMAL EMF VS. COPPER TERMINALS

< ±3 microvolts per degree C.

INDUCTANCE

Non-inductive balanced reverse pi windings are standard on HR and RX. Special on HVS & HVA.

PROTECTIVE SEAL

Stress free base coat and epoxy case. Solder heat and solvent resistant.

MARKING (Identification)

PRC symbol, type, value and tolerance.

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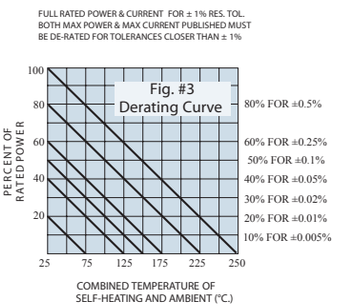
ISSUE NO. 42

LVS/PVS - CURRENT SENSING

How LVS/PVS Shunts Will Benefit You:

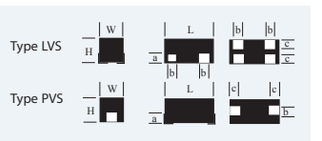
SMD current-sensing ..... to 15 amperes
Ohmic/voltage drop tolerances ..... to ±0.005%
Values ..... from 1 miliohm to 100KΩ
TCR Char. ..... 15ppm (Std.) to 0±10ppm/°C
Temperature Span ..... -65 to +250°C (@ 1%)
For closer tolerances, see Fig. # 3 De-rating Curve



Precautionary Statement applies to all SMDs /SMTs

*Not to be exposed to temps above 150°C for ±0.1% Tol. And 125°C for tolerances closer than ±0.1% without prior heat testing qualification approval procedures.

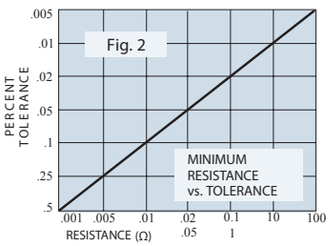
Re-flow solder methods not recommended closer than ±0.25%



PRC's unique "single joint" design on the 4-tab LVS Series makes tab I.D. academic so you may select the pair closest to the top as your sense leads & the bottom pair for the current leads or vice versa

ELECTRICAL & PHYSICAL SPECIFICATIONS

PRC TYPE	Max. Watt Amp	PAD LAYOUT	DIMENSIONS ± .787 MM (.031") H mm ins.	L mm ins.	W mm ins.	a mm ins.	b mm ins.	c mm ins.	d mm ins.	e mm ins.	Max. Res. (Ω)	Std. Min. Res. @ Max. Watts / Special Min. Res. @ Derated Watts
PVS1	1W 3A	PVS1	3.30 .130"	9.14 .360"	3.18 .125"	1.91 .075"	1.91 .075"	2.54 .100"	6.60 .260"		5K	.111Ω @ 1W / .001Ω @ .009 W
LVS2	2W 8A	LVS2	6.35 .250"	9.78 .385"	5.72 .225"	3.18 .125"	2.84 .112"	2.54 .100"	4.90 .193"	3.81 .150"	100	.03Ω @ 2W
PVS2		PVS2							7.87 .310"		15K	.001Ω @ 0.064W
LVS3	3W 15A	LVS3	6.35 .250"	12.7 .500"	6.35 .250"	2.54 .100"	2.84 .112"	2.54 .100"	6.99 .275"	4.70 .185"	100	.013Ω @ 3W
PVS3		PVS3							10.8 .425"		50K	.001Ω @ 0.225W
LVS5	5W 15A	LVS5	7.87 .310"	15.88 .625"	7.87 .310"	1.91 .075"	2.84 .112"	2.54 .100"	8.08 .318"	6.10 .240"	100	.022Ω @ 5W
PVS5		PVS5							14.0 .551"		100K	.001Ω @ 0.22W



1. RESISTANCE AND TOLERANCES
You can select any ohmic value or decimal part of an ohm from 0.001Ω to 100KΩ with microhm/microvolt accuracies to ±0.005% see Fig. 2 above.

2. TCR CHARACTERISTICS
0±15 ppm/°C.(std.) Please specify temperature span of operation. Add LTC in the part # for TCR 0±10ppm/°C. to +150°C.

3. STABILITY VS. TIME
to ±0.001%/yr. at 25°C. (no load)

4. PRECISION POWER
Standard Min. Res. @ Max. Watts based upon ±1% resistance tolerances at 25°C. (please see end column above). Derating is required for higher temperatures, closer tolerances and lower resistance values please see Fig. # 3 at top of page.

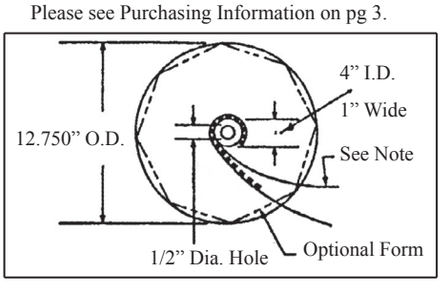
ENGINEERING DATA:

5. PROTECTIVE SEAL
Rectangular solvent-resistant epoxy case offers excellent thermal transfer to base.

6. TERMINALS
Solderable "hot-tinned" pure copper (ETP/OFHC) tab terminals and low EMF construction reduces thermal effects usually associated with low value resistors.

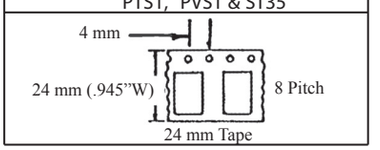
7. SMT "Carrier Tape" PACKAGING
per IEC 286-3 (EIA 481):

Please see Purchasing Information on pg 3.

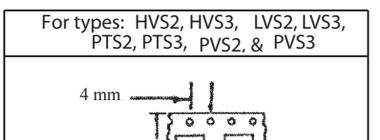


Note: Skin packed to tape with polyfilm

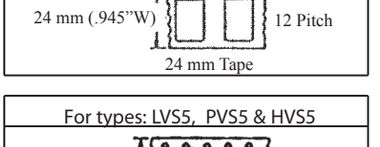
For types: HVS1, PRC100T, PTS1, PVS1 & ST35



For types: HVS2, HVS3, LVS2, LVS3, PTS2, PTS3, PVS2, & PVS3



For types: LVS5, PVS5 & HVS5



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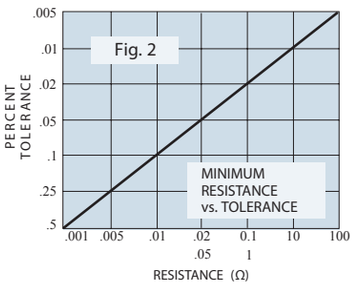
ISSUE NO. 42
REVISED 11-2-12. SUPERSEDES ANY AND ALL PREVIOUS PUBLISHED ARTICLES

PLV SHUNTS

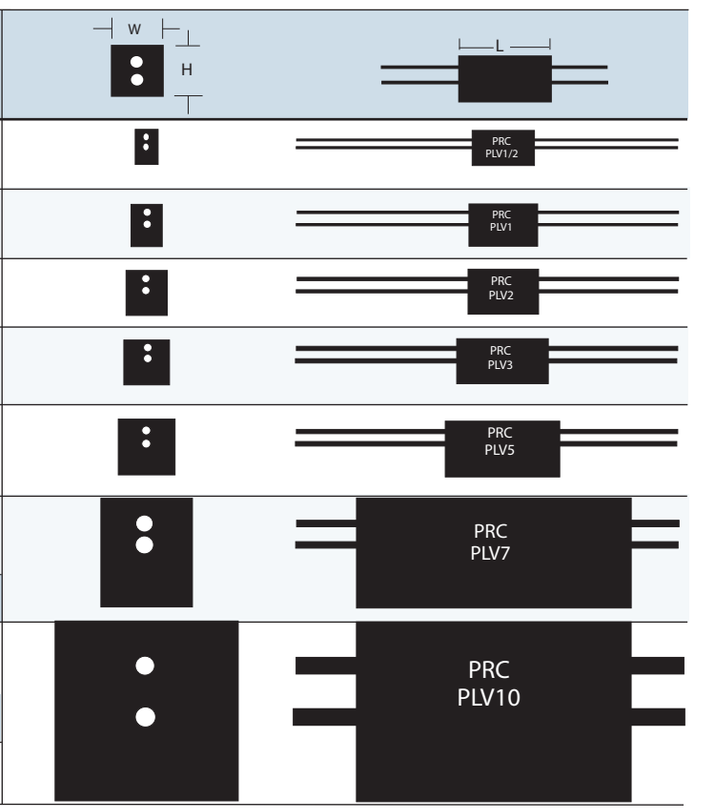


How You Can Profit From PLV Shunts:

Variable lead sizes ..... for current-sensing to 45 Amps
Resistance values ..... to 0.001Ω
Voltage drop or ohmic tolerances ..... to ±0.005%
TCR characteristics .....15ppm/°C (std.) to 10 ppm/°C
Temperature Span ..... -65 to +275°C @ 1% tolerance
For closer tolerance see Derating Curve Fig. 3

ELECTRICAL & PHYSICAL SPECIFICATIONS

PRC Type	Max. Rating Watts / Amps	Body Dimensions ±.787mm (.031") (H) mm / ins.	(L) mm / ins.	(W) mm / ins.	1" L * Lead Diam. Tinned Copper	Std. Min. Res @ Max. Watts / Special Min. Res @ Derated Power
PLV ½	0.5W / 3A	4.95 / .195"	8.64 / .340"	3.18 / .125"	.028" #21 AWG	.055Ω @ 0.5W / .001Ω @ 0.009W
PLV 1	1W / 5A	5.97 / .235"	9.53 / .375"	4.32 / .170"	.028" #21 AWG	.04Ω @ 1W / .001Ω @ 0.025W
PLV 2	2W / 8A	6.35 / .250"	9.78 / .385"	5.72 / .225"	.028" #21 AWG	.03Ω @ 2W / .001Ω @ 0.64W
PLV 3	3W / 15A	6.35 / .250"	12.7 / .500"	6.35 / .250"	.032" #20 AWG	.013Ω @ 3W / .001Ω @ .225W
PLV 5	5W / 15A	7.87 / .310"	15.88 / .625"	7.87 / .310"	.032" #20 AWG	.022Ω @ 5W / .001Ω @ .225W
PLV 7	7W / 18A	12.7 / .500"	38.1 / 1.500"	12.7 / .500"	.036" #19 AWG	.022Ω @ 7W / .001Ω @ .324W
PLV7AL	7W / 38A	12.7 / .500"	38.1 / 1.500"	12.7 / .500"	To # 10 AWG	.001Ω @ 1.444W
PLV10	10W / 20A	25.4 / 1.000"	38.1 / 1.500"	25.4 / 1.000"	.040" #18 AWG	.025Ω @ 10W / .001Ω @ 0.4W
PLV10AL	10W / 45A	25.4 / 1.000"	38.1 / 1.500"	25.4 / 1.000"	To # 8 AWG	.001Ω @ 2W



*Precision 4-Lead design eliminates contact and lead-out resistance. 2 concentrically located current leads and 2 offset potential leads.

Suffix letters "AL" = Aluminum Case

ENGINEERING DATA:

1. RESISTANCE VS. TOLERANCE
You can select any value from 1 milliohms to 100Ω. Please refer to Fig. #2 for Resistance vs. Tolerance ratios.

2. TCR: 0±15 ppm/ °C (Std.)
Specify - LTC for 0±10ppm to +150°C

3. POWER & CURRENT RATINGS
Full power ratings are based upon ±1% res. tols. at 25°C. Derating is required for closer tolerances, higher temperatures (Fig. #3) and lower values. Refer to Std. Min. Res. @ Max. watts in above column.

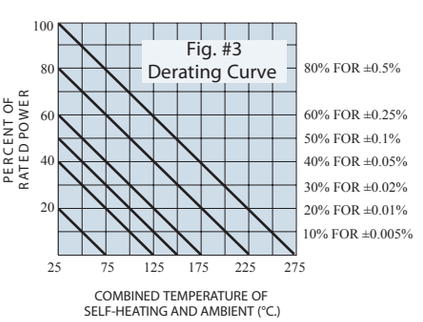
4. STABILITY
To ±0.001%/yr. at 25°C (no load).

5. TERMINALS
All PLVs have solderable "hot-tinned" pure copper wire leads. Higher current-carrying capacity leads to #8 AWG are available for full power ratings on values below the Std. Min. Res. listed.

6. PROTECTIVE ENCAPSULATION
PLVs are sealed in high temp/solvent resistant epoxy. Epoxy/aluminum cases are available on 7 watt & 10 watt sizes.

7. MARKING
PRC symbol, type ohmic value and tolerance. Custom marking is available.

FULL RATED POWER & CURRENT FOR ± 1% RES. TOL. BOTH MAX POWER & MAX CURRENT PUBLISHED MUST BE DE-RATED FOR TOLERANCES CLOSER THAN ± 1%



PRC
ISSUE NO. 42

PRECISION RESISTOR CO., INC.
10601 75TH Street North, Largo, Florida 33777-1421 U.S.A.
Tel: 727-541-5771 Fax: 727-546-9515
Email: sales@precisionresistor.com
Web Site: http://www.precisionresistor.com

MORE PRC FACTS

You can achieve dramatic results with PRC's Compensators:

1. LINEAR COMPENSATION
PRC's type PT/ST (+) TCR Char. 3500ppm/°C. linear tracking temperature sensitive resistors help you develop the desired compensation for true RMS measurements… and can offset errors in dB output circuits.

2. TOLERANCE ON +3500ppm/°C.
>±100ppm/°C. from +25°C. to +100°C.

For example: if you are looking for a systems offset of +3350 to +3450ppm/°C. … try a few engineering samples of our (std.) off-the-shelf compensators. We are confident you can achieve dramatic results. The element wire used on our type PT/STs, as a rule, is very close to +3350ppm/°C. at 25°C. and lower that +3450ppm/°C at 100°C Please refer to the corresponding tracking chart - Fig #4 on pg. 9

3. OFF-THE-SHELF / IMMEDIATE DELIVERY
Thru-hole and SMD designs are available for evaluation and tests. Ask about our PT styles (or the type AT35) for your wire lead terminals required. Also, if you have plans for SMT … our type ST35 is a drop-in replacement for the thru-hole part with interchangeable specs.

4. CUSTOM COMPENSATORS
Remember - we can customize any of our compensators to your specs in any ohmic value with pure metals, available alloys or composite windings. All of which are extremely linear, reasonably priced and delivered quickly.

5. TRACKING CHART
Constant temperature oil bath computer tracking charts are available to match your temperature span and behavior specs exactly.

(Continued on Pg. 9)

Attributes of the ***extremely versatile*** PRC100 Series include:

1. THE PRC100 (Std. Reference):
A PLATINUM ALTERNATIVE
Like a platinum RTD, the PRC100 Std. is 100Ω at 0°C. ±0.12% with a TCR of +3850 ppm/°C. that meets the theoretical curve of platinum as defined by the IEC Standard, pub. 751 (per DIN Std. 43760, Class B) alpha = 0.00385 ohm/ohm/°C. Please refer to the chart and equations on Pg. 10.

2. CRITICAL FACT TO REMEMBER:
Always use a consistent Base Temperature of Zero (0)°C in the platinum and PRC100 equations.

For example: The nominal resistance of a platinum RTD and the PRC100 Std. is 100Ω at Base 0°C. Then, if we use +100°C as the other reference point, the TCR is calculated to be very close to +3850 ppm/°C The base temperature is important in this situation because the TCRs of all other resistance alloys are usually calculated between Base +25°C and +100°C. Any other reference points and resistance values in the TCR equations will give you a result other than the TCR expected.

Platinum is generally offered in two grades: the Standard American Reference Grade of 0.003923 ohm/ohm/°C and the DIN of 0.003850 ohm/ohm/°C. We have selected the DIN Standard for our PRC100 (Std. Reference) to demonstrate our capability and the flexibility of this design for custom high quality special-purpose sensors.

3. THE PRC100 STD. REFERENCE SERIES IS IN STOCK & READILY AVAILABLE
The Standard 100Ω reference is offered in an assortment of physical sizes for thru-hole, SMD, and probe applications. If you need a few pieces or several thousand of any of the PRC100 configurations, we can usually ship them directly from our stock.

4. DO YOU NEED HIGH QUALITY "CUSTOM" SENSORS?
If you do, the PRC100 Custom Series is actually more versatile than a platinum RTD, because you can select any ohmic value and tolerance that you need, and adjust the TCR characteristic ... if you want a slightly higher or lower ohms change per degree C.

Let us know your exact particulars and we will custom manufacture the part to your specs and send you a sample together with a computer-tracking chart at no charge.

(Continued on Pgs 10-11)

ISSUE NO. 42

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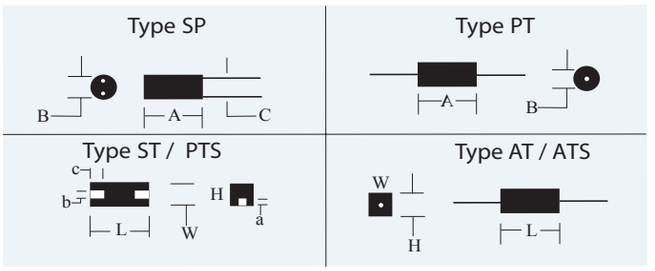
COMPENSATORS



How Can You Benefit From Our Custom Compensators?

1000 Ω 3500 PPM Compensators ..... are in stock.
Thru-hole or SMD ..... it's your choice!
Low RMS Noise ..... for A/D conversions.
Linear Tracking ..... from -65 to +150°C.
Custom Values & TCRs ..... for high or lower ΩΔ/°C.

AXIAL & PROBE SPECIAL-PURPOSE COMPENSATOR/SENSORS

AXIAL LEAD & PROBE DESIGN TEMPERATURE SENSING	PRC Type	Power Rating	Body Dimensions ± .787mm (.031") Length mm	Length (Ins.)	Diameter mm	Diameter (Ins.)	Lead Length 1.5" ± 0.125" Max. Diam.	Maximum Resistance (Ω) for "Custom" +TCR Characteristics: +1400 ppm/°C	+3500 ppm/°C	+3930 ppm/°C	+4500 ppm/°C	+6000 ppm/°C
AXIAL	PT052	.02 W	6.86	(.270")	1.78	(.070")	.020"	1500	1K	25	500	100
	PT073	.05 W	8.43	(.332")	2.54	(.100")	.020"	2500	2K	50	600	200
	PT094	0.1 W	10.03	(.395")	3.18	(.125")	.025"	6K	5K	100	1500	500
	PT146	0.25 W	13.21	(.520")	4.75	(.187")	.028"	20K	10K	500	5K	2K
PROBE	SP073	0.05 W	8.43	(.332")	2.54	(.100")	.020"	2500	2K	50	600	200
	SP094	0.1 W	10.03	(.395")	3.18	(.125")	.025"	6K	5K	100	1500	500
	SP146	0.25 W	13.21	(.520")	4.75	(.187")	.028"	20K	10K	500	5K	2K

RECTANGULAR AXIAL & SURFACE MOUNT SPECIAL-PURPOSE COMPENSATOR/SENSORS

ATS-AXIAL	PTS-SMD	PRC TYPE AXIAL	PRC TYPE SMD	POWER RATING	H mm. in.	L mm. in.	W mm. in.	a mm. in.	b mm. in.	c mm. in.	d mm. in.	ATS 1" Leads Diameter	Maximum Resistance (Ω) for "Custom" +TCR Characteristics: +1400 ppm/°C	+3500 ppm/°C	+3930 ppm/°C	+4500 ppm/°C	+6000 ppm/°C
		ATS1	PTS1	.05W	3.30 / .130	9.14 / .360	3.18 / .125	1.91 / .075	1.91 / .075	2.54 / .100	6.60 / .260	.020"	2500	2K	50	600	200
		ATS2	PTS2	.1W	6.35 / .250	9.78 / .385	5.72 / .225	3.18 / .125	2.84 / .112	2.54 / .100	7.87 / .310	.025"	6K	5K	100	1500	500
		ATS3	PTS3	.25W	6.35 / .250	12.7 / .500	6.35 / .250	2.54 / .100	2.84 / .112	2.54 / .100	10.8 / .425	.031"	20K	10K	500	5K	2K

RECTANGULAR AXIAL & SMD 1K 3500 PPM COMPENSATORS

PAD LAYOUT	PRC Type	Max. Volts Watts	H mm ins.	L mm ins.	W mm ins.	a	b	c	d	e (1"L.)
	AT35	100 V 0.1 W	3.30 / .125"	9.14 / .360"	3.18 / .125"	——	——	——	——	.020"
	ST35					.075"	.075"	.100"	.260"	——

ENGINEERING DATA:

1. ALL STANDARD 1000 Ω ± 1% TOLERANCE +3500 PPM COMPENSATORS ARE IN STOCK

Special: Any value from 1Ω to 50KΩ. Tolerances to ±0.05%.

2. TCR CHARACTERISTICS AVAILABLE

+80 ppm/°C +3930 ppm/°C
+140 ppm/°C +4300 ppm/°C
+400 ppm/°C +4500 ppm/°C
+1400 ppm/°C +5000 ppm/°C
+3500 ppm/°C +6000 ppm/°C

*** TC TOLERANCE WINDOW ± 5%**
Calculated between +25°C. & +100°C.

$$TCR = \frac{\Delta R \times 10^6}{R_o \times \Delta t}$$

R_o = Original resistance at reference temp.
ΔR = Change in resistance at test temp. from resistance at reference temp.
Δt = Difference between test and reference temp. in degrees.

3. COMPENSATORS VS. POWER

PRC's positive TCR resistors are used to offset negative ambient temperature changes or counter self-generating shifts in resistance with an excitation of power to 0.25 watt at +125°C (Derated to zero watts at +150°C)

4. STABILITY ENSURES LONGER SHELF-LIFE

Standard: ±0.05% per year at 25°C. w/ no load.
Special: < ±0.01% per year at 25°C. w/ no load.

5. PROTECTIVE SEAL

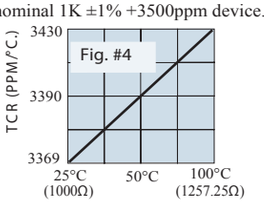
Standard: Conformal silicone or epoxy case.
Special: Thermal conductive insulating coatings.
Un-coated components are also available upon request.

6. MARKING

PRC symbol, type, resistance value, tolerance and TCR characteristics, physical size permitting.

7. RES/TEMP CURVE & EQUATION

For nominal 1K ±1% +3500ppm device.



e.g. 1000Ω at 25°C. is 1257.25Ω at +100°C.

$$TCR = \frac{R@100°C - R@25°C}{R@25°C \times 75} \times 10^6$$

$$TCR = \frac{1257.25 - 1000}{1000 \times 75} \times 10^6$$

TCR = +3430ppm/ °C or 3.4ΩΔ/°C

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ISSUE NO. 42
REVISED 11-10-11. SUPERSEDES ANY AND ALL PREVIOUS PUBLISHED ARTICLES.

PRC100 CHART

Temp Deg. C.	Value in Ohms	T.C. in PPM	Avg. Ohms Chg/Deg. C.
-40	84.916	3770	-0.3771
-39	85.291	3771	-0.3772
-38	85.665	3772	-0.3773
-37	86.04	3772	-0.3773
-36	86.414	3773	-0.3774
-35	86.789	3774	-0.3775
-34	87.164	3775	-0.3776
-33	87.54	3775	-0.3776
-32	87.915	3776	-0.3777
-31	88.29	3777	-0.3778
-30	88.666	3777	-0.3778
-29	89.042	3778	-0.3779
-28	89.418	3779	-0.378
-27	89.794	3780	-0.3781
-26	90.17	3780	-0.3781
-25	90.546	3781	-0.3782
-24	90.92299	3782	-0.3783
-23	91.3	3782	-0.3783
-22	91.676	3783	-0.3784
-21	92.053	3784	-0.3785
-20	92.43	3784	-0.3785
-19	92.807	3785	-0.3786
-18	93.185	3786	-0.3787
-17	93.56199	3787	-0.3788
-16	93.94	3787	-0.3788
-15	94.318	3787	-0.3788
-14	94.695	3789	--0.379
-13	95.073	3790	-0.3791
-12	95.45201	3789	-0.379
-11	95.83	3790	-0.3791
-10	96.208	3791	-0.3792
-9	96.587	3792	-0.3793
-8	96.96499	3793	-0.3794
-7	97.344	3794	-0.3795
-6	97.723	3795	-0.3796
-5	98.102	3796	-0.3797
-4	98.481	3797	-0.3798
-3	98.861	3796	-0.3797
-2	99.24	3800	-0.3801
-1	99.62	3799	-0.38
0	100		
1	100.379	3789	0.3789
2	100.759	3795	0.3795
3	101.139	3796	0.3796
4	101.52	3799	0.3799
5	101.9	3800	0.38
6	102.281	3801	0.3801
7	102.661	3801	0.3801
8	103.042	3802	0.3802
9	103.423	3803	0.3803
10	103.804	3804	0.3804
11	104.185	3804	0.3804
12	104.566	3805	0.3805
13	104.948	3806	0.3806
14	105.329	3806	0.3806
15	105.711	3807	0.3807
16	106.093	3808	0.3808
17	106.475	3808	0.3808
18	106.857	3809	0.3809
19	107.239	3809	0.3809

Temp Deg. C.	Value in Ohms	T.C. in PPM	Avg. Ohms Chg/Deg. C.
20	107.621	3810	0.381
21	108.004	3811	0.3811
22	108.386	3811	0.3811
23	108.769	3812	0.3812
24	109.152	3813	0.3813
25	109.535	3814	0.3814
26	109.918	3814	0.3814
27	110.301	3815	0.3815
28	110.684	3815	0.3815
29	111.068	3816	0.3816
30	111.451	3816	0.3816
31	111.835	3817	0.3817
32	112.219	3818	0.3818
33	112.603	3819	0.3819
34	112.987	3819	0.3819
35	113.372	3820	0.382
36	113.756	3821	0.3821
37	114.14	3821	0.3821
38	114.525	3822	0.3822
39	114.91	3823	0.3823
40	115.295	3823	0.3823
41	115.68	3824	0.3824
42	116.065	3825	0.3825
43	116.45	3825	0.3825
44	116.836	3826	0.3826
45	117.221	3826	0.3826
46	117.607	3827	0.3827
47	117.993	3828	0.3828
48	118.379	3828	0.3828
49	118.765	3829	0.3829
50	119.151	3830	0.383
51	119.538	3830	0.383
52	119.924	3831	0.3831
53	120.311	3832	0.3832
54	120.697	3832	0.3832
55	121.084	3833	0.3833
56	121.471	3834	0.3834
57	121.858	3834	0.3834
58	122.246	3835	0.3835
59	122.633	3836	0.3836
60	123.02	3836	0.3836
61	123.408	3837	0.3837
62	123.796	3838	0.3838
63	124.184	3838	0.3838
64	124.572	3839	0.3839
65	124.96	3839	0.3839
66	125.348	3840	0.384
67	125.737	3841	0.3841
68	126.125	3841	0.3841
69	126.514	3842	0.3842
70	126.903	3843	0.3843
71	127.292	3843	0.3843
72	127.681	3844	0.3844
73	128.07	3845	0.3845
74	128.459	3845	0.3845
75	128.849	3846	0.3846
76	129.238	3847	0.3847
77	129.628	3847	0.3847
78	130.018	3848	0.3848
79	130.408	3849	0.3849

Temp Deg. C.	Value in Ohms	T.C. in PPM	Avg. Ohms Chg/Deg. C.
80	130.798	3849	0.3849
81	131.188	3850	0.385
82	131.579	3851	0.3851
83	131.969	3851	0.3851
84	132.36	3852	0.3852
85	132.751	3853	0.3853
86	133.142	3853	0.3853
87	133.533	3854	0.3854
88	133.924	3854	0.3854
89	134.315	3855	0.3855
90	134.707	3856	0.3856
91	135.098	3856	0.3856
92	135.49	3857	0.3857
93	135.882	3858	0.3858
94	136.274	3858	0.3858
95	136.666	3859	0.3859
96	137.058	3860	0.386
97	137.45	3860	0.386
98	137.843	3861	0.3861
99	138.235	3862	0.3862
100	138.628	3862	0.3862
101	139.021	3863	0.3863
102	139.414	3864	0.3864
103	139.807	3864	0.3864
104	140.2	3865	0.3865
105	140.593	3866	0.3866
106	140.987	3866	0.3866
107	141.381	3867	0.3867
108	141.774	3867	0.3867
109	142.168	3868	0.3868
110	142.562	3869	0.3869
111	142.956	3869	0.3869
112	143.351	3870	0.387
113	143.745	3871	0.3871
114	144.14	3871	0.3871
115	144.534	3872	0.3872
116	144.929	3873	0.3873
117	145.324	3873	0.3873
118	145.719	3874	0.3874
119	146.114	3875	0.3875
120	146.51	3875	0.3875
121	146.905	3876	0.3876
122	147.301	3877	0.3877
123	147.696	3877	0.3877
124	148.092	3878	0.3878
125	148.488	3879	0.3879
126	148.884	3879	0.3879
127	149.281	3880	0.388
128	149.677	3881	0.3881
129	150.073	3881	0.3881
130	150.47	3882	0.3882
131	150.867	3882	0.3882
132	151.264	3883	0.3883
133	151.661	3884	0.3884
134	152.058	3884	0.3884
135	152.455	3885	0.3885
136	152.852	3886	0.3886
137	153.25	3886	0.3886
138	153.648	3887	0.3887
139	154.045	3888	0.3888
140	154.443	3888	0.3888
141	154.841	3889	0.3889
142	155.24	3890	0.389
143	155.638	3890	0.3890
144	156.036	3891	0.3891
145	156.435	3892	0.3892
146	156.834	3892	0.3892
147	157.232	3893	0.3893
148	157.631	3893	0.3893
149	158.031	3894	0.3894
150	158.43	3895	0.3895

RESISTANCE TEMPERATURE CHARACTERISTIC (Rt)

Rt is defined by IEC standard, pub. 751:
alpha = 0.00385 ohm/ohm/°C.

... For range -40°C to 0°C:
Rt = $R_0[1+At+Bt^2 +C(t-100°C)t^3]$
....For range 0°C to +150°C:
Rt = $R_0(1+At+Bt^2)$
where the constants in these equations are:
A = 3.79782×10^{-3}
B = 6.502×10^{-7}
C = 4.3735×10^{-12}

$Rt = R_0[1+At+Bt^2]$
$Rt = 100 [1+ (3.79782x10^{-3} \times 100) + (6.502x10^{7} \times 100^2)]$
$Rt = 100 [1 + .379782 + .006502]$
$Rt = 100 \times 1.386284$
$Rt = 138.628\Omega$ @ 100°C
$Rt = R_0[1 +At +Bt^2+C(t-100)t^3]$
$Rt = 100[1+ (-.1519128) + (.00104032) + (.00003918656)]$
$Rt = 100 \times .8491667$
$Rt = 100[1 +(3.79782 \times 10^{-3} \times -40) + (6.502x\ 10^{-7} \times -40^2) + (4.3735 x10^{-12} \times (-40-100) \times -40^3)]$
$Rt = 84.916\Omega$ @ -40°C

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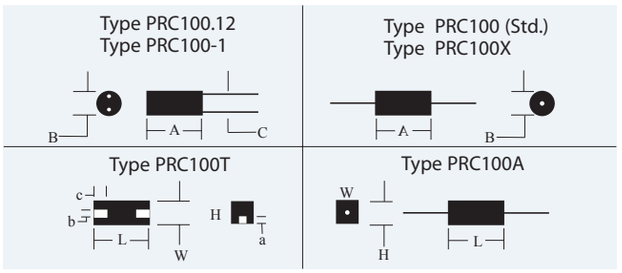
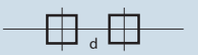
PRC100 SENSORS



What The PRC100 Means To You:

The PRC100 Custom Series is more than a platinum alternative because of its versatility.

The PRC100 (Std. Reference) ..... 100Ω at 0°C. ±0.12% with an average sensitivity of 0.00385 ohm/ohm/°C is in-stock for immediate delivery.

PAD LAYOUT 

RECTANGULAR AXIAL & SMD 100 SENSORS

BODY DIMENSIONS ± .787mm (.031")

PRC Type	Power Rating	Max. Volts	H mm ins.	L mm ins.	W mm ins.	a	b	c	d	e (1"L) ± 0.125"	RESISTANCE & TOL @ 0°C	RTC (0°C to +100°C)
PRC100A PRC100T	0.1W	100V	3.18 .125"	9.14 .360"	3.18 .125"	.075"	.075"	.100"	.260"	.020"	100Ω ±0.12%	+3850 ppm/°C.

PRC100 (STD. REFERENCE) 100 OHMS IN-STOCK

PRC Type	Power Rating	BODY DIMENSIONS ± .787mm (.031") LENGTH A	BODY DIMENSIONS ± .787mm (.031") DIAMETER B	LEADS (Tinned Copper) ± 0.125"	RESISTANCE & TOL @ 0°C	RTC (0°C to +100°C)
PRC100X	0-.04W	.275"	.113"	.023"D x 1.0"L	100Ω ±0.12%	+3850 ppm/°C.
PRC100 (Std.)	0-.25W	.600"	.188"	.029"D x 1.4"L	100Ω ±0.12%	+3850 ppm/°C.
PRC100.12	0-.1W	.450"	.156"	.023"D x .63"L	100Ω ±0.12%	+3850 ppm/°C.
PRC100-1	0-.25W	.600"	.188"	.023"D x .63"L	100Ω ±0.12%	+3850 ppm/°C.

ENGINEERING DATA:

1. RESISTANCE AND TOLERANCE

PRC100 (Std. Reference): 100Ω at 0°C
±0.12% (or ±0.3°C) and 138.50Ω at +100°C
±0.22% (or ±0.8°C) per DIN 43760, Class B.

PRC100 (Custom Series): You can select any value from 50Ω to 5 Kilohms in tolerances from 1/4 DIN (±0.03%) to 2 x DIN (±0.24%).

2. RESISTANCE TEMPERATURE CHARACTERISTIC (Rt)

Rt is defined by IEC Standard, pub. 751:
alpha = 0.00385 ohm/ohm/°C*

... for range -40°C. to 0°C:

$Rt = R_O [1+At+Bt^2 + C(t-100°C)t^3]$

... for range 0°C. to +150°C:

$Rt = R_O (1+At+Bt^2)$

Where the constants are:

$A = 3.79782 \times 10^{-3}$
$B = 6.502 \times 10^{-7}$
$C = 4.3735 \times 10^{-12}$

Fixed points are in degrees Celsius, R_O = 0°C
The other (Ref.) temperature is + 100°C, but any temperature can be used in the equation with respect to Base 0°C. The PRC100 Std. Ref. follows a well-defined theoretical curve and linear slope from Base 0°C proving that most reference points are calculable within very close tolerances (Ratio = Rt/R_O).

3. STABILITY OF CALIBRATION

All PRC100 sensors are closely matched and repeatable part-to-part. They are able to consistently reproduce output readings consecutively at the same temperature reference points ... under the same conditions and in the same direction.

4. STABILITY (R_O) VS. TIME

The change in the original resistance (R_O) at 0° C after 10 cycles to +150°C is less than ±0.1°C or ±0.038% max. Shelf life stability is ± 0.002%/yr. at 25°C (no load).

5. POWER RATINGS VS. AMBIENT TEMPERATURE RANGE

The PRC100 is ideal as a compensator to offset drift or negative self-generating changes in resistance as a result of an excitation of power to 0.25 watt at +125°C to zero power at +150°C.

6. THERMAL TIME CONSTANT

The time required for the PRC100 sensor to indicate 63.2% of a new impressed temperature from a step change of 0°C to +100°C can be customized to < 1 second

* Theoretical curve and slope are based upon values of the International Practical Temperature Scale (IPTS-68 & 90).

7. PRC100 (Std. Ref.) CONSTRUCTION

Wire: Ni, Co, Mn & Fe.
Substrate: Epoxy or ceramic form.
Terminals: Solderable hot-tinned copper.
Protective Seal: Moisture and solvent resistant epoxy.

8. MARKING (Std. Reference)

PRC100X
PRC100A
PRC100T
PRC100
±0.12%
TC.385%

PRC100.12
TC.385%
PRC100-1
±0.12%
TC.385%

9. CUSTOM APPLICATIONS

PRC100 (Custom) Series Sensors are available in any ohmic value with TCRs from +3000ppm to +4000ppm/°C in 50ppm steps with the same linear tracking characteristics as the Std. Ref.

Custom Marking: e.g:
1K ohms = PRC1000
10K ohms = PRC10000, etc.

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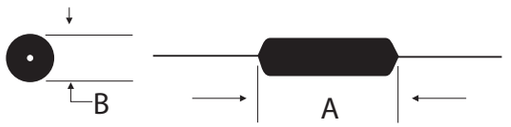
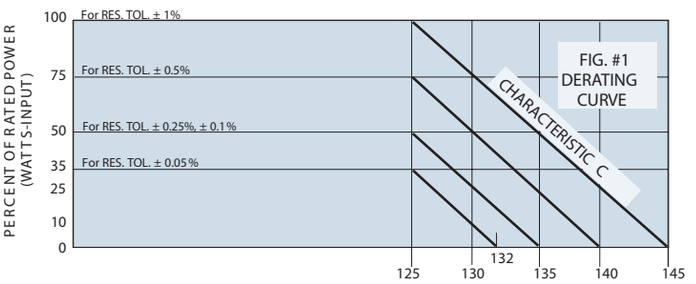
SX - HIGH PRECISION



Series Attributes Include:

Values ..... from 0.01Ω to 6 MΩ
Tolerances ..... to ±0.05%
TCR Characteristic ..... 0±10 ppm/°C.
Temperature..... -55°C. to +145°C.

The Widest Range of Custom Precision Wire Wounds You'll Find Anywhere!



ELECTRICAL & PHYSICAL SPECIFICATIONS		$P = \frac{E^2}{R}$	$E = \sqrt{PR}$	(A) Length		(B) Diameter		Lead Length 1.5" ± 0.125" Max. Diam.	Resistance (Ω)		
INDUCTIVE	NON-INDUCTIVE	Max. Watts	Max. Volts	mm ±1.57	(ins) ±.062"	mm ±.787	(ins) ±.031"		Min.	Max. Standard	Max. Special*
SX030	SX030N	.03W	25V	5.59	(.220")	1.27	(.050")	.020"	1.0	3K	5K
SX062	SX062N	.04W	35V	6.86	(.270")	2.03	(.080")	.020"	1.0	17K	30K
SX063	SX063N	.05W	50V	8.43	(.332")	2.03	(.080")	.020"	0.1	20K	50K
SX072	SX072N	.06W	45V	6.86	(.270")	2.29	(.090")	.020"	0.1	25K	35K
SX073	SX073N	.07W	65V	8.43	(.332")	2.29	(.090")	.020"	0.1	30K	65K
SX093	SX093N	.1W	85V	8.43	(.332")	2.29	(.115")	.025"	0.1	35K	75K
SX094	SX094N	.1W	100V	10.03	(.395")	2.29	(.115")	.025"	0.1	50K	100K
SX095	SX095N	.125W	125V	11.61	(.457")	2.29	(.115")	.025"	0.1	60K	180K
SX105	SX105N	.166W	165V	11.61	(.457")	3.3	(.130")	.025"	0.1	75K	210K
SX123	SX123N	.166W	165V	8.43	(.332")	3.68	(.145")	.025"	0.1	40K	120K
SX106	SX106N	.2W	200V	13.21	(.520")	3.3	(.130")	.025"	0.1	100K	280K
SX124	SX124N	.2W	200V	10.03	(.395")	3.68	(.145")	.025"	0.1	50K	160K
SX143	SX143N	.2W	200V	8.43	(.332")	4.06	(.160")	.028"	0.1	50K	130K
SX154	SX154N	.25W	250V	10.03	(.395")	4.47	(.176")	.028"	0.1	100K	200K
SX155	SX155N	.25W	250V	11.61	(.457")	4.47	(.176")	.028"	0.1	100K	300K
SX156	SX156N	.33W	330V	13.21	(.520")	4.47	(.176")	.028"	0.1	140K	400K
SX174	SX174N	.33W	330V	10.03	(.395")	4.83	(.190")	.028"	0.1	130K	220K
SX175	SX175N	.33W	330V	11.61	(.457")	4.83	(.190")	.028"	0.1	135K	350K
SX158	SX158N	.5W	500V	16.38	(.645")	4.47	(.176")	.028"	0.1	450K	600K
SX177	SX177N	.5W	500V	14.78	(.582")	4.83	(.190")	.028"	0.1	400K	540K
SX185	SX185N	.5W.	500V	11.61	(.457")	5.26	(.207")	.028"	0.01*	135K	360K
SX186	SX186N	.5W	500V	13.21	(.520")	5.26	(.207")	.028"	0.01*	150K	480K
SX188	SX188N	.6W	600V	16.38	(.645")	5.26	(.207")	.028"	0.01*	450K	720K
SX2210	SX2210N	.8W	800V	19.56	(.770")	6.10	(.240")	.032"	0.1	511K	1.1 MEG
SX3110	SX3110N	1W	1000V	19.56	(.770")	8.43	(.332")	.032"	0.1	750K	1.6 MEG
SX2812	SX2812N	1.25W	1000V	22.73	(.895")	7.62	(.300")	.032"	0.1	1 MEG	1.8 MEG
SX3114	SX3114N	1.33W	1000V	25.91	(1.020")	8.43	(.332")	.032"	0.1	1.25 MEG	2 MEG
SX3712	SX3712N	1.5W	1000V	22.73	(.895")	11.10	(.437")	.032"	0.25	1.5 MEG	2.5 MEG
SX3716	SX3716N	2W	1250V	29.08	(1.145")	11.10	(.437")	.032"	0.5	2 MEG	3.5 MEG
SX3724	SX3724N	3W	1250V	41.78	(1.645")	11.10	(.437")	.032"	0.5	3 MEG	5 MEG
SX3730	SX3730N	5W	1500V	51.31	(2.020")	11.10	(.437")	.032"	0.5	4 MEG	6 MEG

*0.01Ωto 0.1Ω and maximum special resistance values available in non-standard physical sizes -0+.062"
tCommercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity).

ENGINEERING DATA:

1. RESISTANCE AND TOLERANCE
Select any ohmic value or decimal part of an ohm desired with tolerances to ±0.05%.

2. TEMPERATURE COEFFICIENT OF RESISTANCE ALSO KNOWN AS T.C.R.
Standard: 0±10ppm/°C (100Ω and above).
0±15ppm/°C (values below 100Ω).
For specific TCRs to ±1ppm/°C see page 5.
Refer to page 9 for TCRs to +6000ppm/°C.

3. STABILITY VS. TIME CHARACTERISTICS
To ±0.005%/year at +25°C. with no load.

4. POWER RATINGS VS. AMBIENT TEMP. AND RESISTANCE TOLERANCE
Full power ratings are based upon standard ±1% resistance tolerances. Derating is required for higher temperatures and closer resistance tolerances.
Max Temperature for SX Coating: +145°C.

5. INDUCTANCE
The standard type SX resistors are inductively wound. Non-inductive windings are available - add suffix letter "N" in the part number.

6. TERMINALS
Standard: Solderable hot-tinned pure copper leads.

7. PROTECTIVE COATING
Solvent resistant silicone/epoxy seal.

8. MARKING
PRC symbol, type, value and tolerance.

PRECISION RESISTOR CO., INC.
10601 75TH Street North, Largo, Florida 33777-1421 U.S.A.
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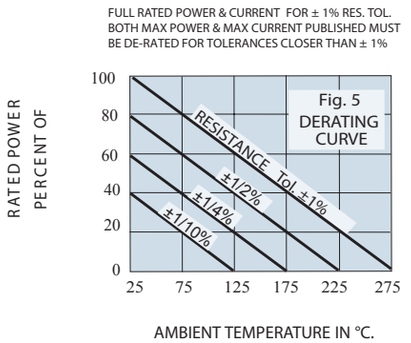
ISSUE NO. 42
REVISED 5-24-12. SUPERSEDES ANY AND ALL PREVIOUS PUBLISHED ARTICLES.

SM - PRECISION POWER

Profit from Precision Power SM Series

Sub-miniature high values ..... to 4 Megohms
Tolerance ..... to ±0.1%
TCR Characteristic ..... 0+10ppm/°C
High voltage rating ..... to 1250 Volts
Low EMF construction ..... Vs. copper leads



ELECTRICAL & PHYSICAL SPECIFICATIONS

TWO (2) TERMINAL	PRC TYPE	RW Styles MIL R-26	Max Power Rating (Watts)	*Min. Allowable Resist.* (Ohms)	Resist. ($R=E^2/P$)	*Max. Allowable Resist.* (Ohms)	Max. Voltage Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	Lead Length 1.5" ± 0.125" Max. Diam.
			For higher resistance values (at max. rated voltage) decrease max. power rating ($P=E^2/R$) For lower resistance values (at max. rated power) decrease max. voltage rating ($E=\sqrt{PR}$) *Resistance values based upon max. power and max. voltage.									
PRC 041	SM041	———	0.125W	1.0	5K	10K	25V	6.35	(.250")	1.52	(.060")	.020"
PRC 062	SM062	———	0.25W	1.0	17K	30K	65V	6.35	(.250")	2.03	(.080")	020"
PRC 063	SM063	———	0.5W	0.1	24K	50K	110V	7.92	(.312")	2.03	(.080")	.020"
PRC SM 094	SM094	RW70	1W	0.1	40K	80K	200V	10.31	(.406")	2.92	(.115")	.025"
PRC SM 076	SM076	———	1.125W	0.1	53K	180K	245V	12.7	(.500")	2.29	(.090")	.020"
PRC SM 156	SM156	———	1.5W	0.1	90K	400K	375V	13.49	(.531")	4.47	(.176")	.028"
PRC SM 1711	SM1711	———	2W	0.1	225K	900K	670V	20.62	(.812")	4.83	(.190")	.028"
PRC SM 186	SM186	RW69	3W	*0.025	80K	480K	500V	12.7	(.500")	5.26	(.207")	.028"
PRC SM 177	SM177	RW79	3W	0.1	80K	540K	500V	14.27	(.562")	4.83	(.190")	.028"
PRC SM 228	SM228	———	3W	*0.02	120K	720K	600V	15.88	(.625")	6.10	(.240")	.032"
PRC SM 2812	SM2812	RW74	5W	*0.02	200K	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
PRC SM 3114	SM3114	RW67	6.5W	0.1	154K	1.5 MEG	1000V	25.4	(1.000")	8.43	(.332")	.032"
PRC SM 3726	SM3726	RW78	10W	*0.07	156K	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

* 0.02 Ω to 0.1Ω and maximum resistance values available in non-standard physical sizes 0 to +.0625".
All low value 2-terminal designs are calibrated and tested at mid-point on lead unless otherwise specified.

ENGINEERING DATA:

1. RESISTANCE RANGE
PRC's sub-miniature type SM "precision power" resistors offer the widest range of ohmic values anywhere.
You can select any value or decimal part of an ohm from 0.02Ω to 4 Megohms.

2. CUSTOM TOLERANCES
±1%(Std.), ±0.5%, ±0.25%, ±0.1%

3. TCR CHARACTERISTIC
Standard: 0±10ppm/°C for 100Ω and above and 0±15ppm/°C below 100Ω.
For specific TCRs to ±1ppm/°C see page 5.
Refer to page 9 for TCRs to +6000ppm/°C.
***Must Specify Temp. Span of Operation.**

4. VOLTAGE RATING
DC Voltage or Peak Voltage:
The type SM's high operating voltage winding patterns eliminate dangerous crossovers and potential problems usually associated with standard style bobbins and mandrel designs. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula: $E=\sqrt{PR}$.

5. PRECISION POWER RATINGS
All standard ±1% tolerance type SM resistors are designed for continuous full load operation at +25°C. Derated to zero wattage at +275°C (see Fig. #5 above).

6. INDUCTANCE
Standard: Inductively wound
Special: Non-inductive winding is available, simply add suffix letter "N" to the end of part number.

7. TERMINALS
Standard: Solderable hot-tinned pure copper leads.

8. PROTECTIVE SEAL
SM resistors are coated in a tough solvent resistant high-temperature silicone formulation … with indelible marking.

PRC
PRECISION RESISTOR CO., INC.
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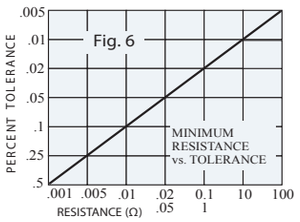
ISSUE NO. 42
REVISED 5-24-12. SUPERSEDES ANY AND ALL PREVIOUS PUBLISHED ARTICLES.

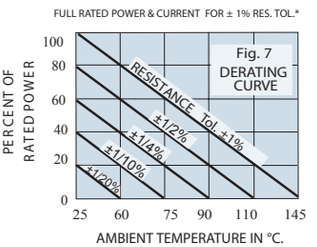
SM-4 - 4 WIRE LOW VALUE



TYPE ***SM-4*** FOUR TERMINAL SERIES AT A GLANCE:

Shunt Values ..... from 0.015Ω (at full power)
Lower Shunt Values ..... to 0.001Ω (derated watts)
Tolerances ..... to ±0.005%
TCR Characteristic ..... 0±15ppm/°C
Stability ..... to ±0.005%/year

***BOTH MAX POWER & MAX CURRENT PUBLISHED MUST BE DE-RATED FOR TOLERANCES CLOSER THAN ± 1%**



±0.02%, 0.01%, 0.005% = 10% Published to +50°C Maximum Power

ELECTRICAL & PHYSICAL SPECIFICATIONS

Precise low-value repeatability. Eliminates lead-out and contact resistance. "Single joint" design makes lead identification academic.

PRC Type	Max. Rating Watts / Amps	Body Dimensions ± 0.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	Std. Lead Space ±0.50"	1.4"L* Lead Diam. ±.001"	Standard Min. Resistance @ Max. Watts Ω	Standard Min. Resistance @ Max. Watts W	Special* Min. Resistance* @ Derated Power Ω	Special* Min. Resistance* @ Derated Power W	FOUR (4) TERMINAL
SM155-4	1.25 W / 10A	13.21	(.520")	5.08	(.200")	.150"	.0285"	.015 @ 1.25W		.001 @ .1W		PRC SM 155-4
SM186-4	2.5 W / 10A	16.5	(.650")	6.35	(.250")	.150"	.0285"	.025 @ 2.5W		.001 @ .1W		PRC SM 186-4
SM228-4	3W / 10A	19.69	(.775")	7.11	(.280")	.150"	.0285"	.03 @ 3W		.001 @ .1W		PRC SM 228-4
SM2212-4	4W / 12A	26.04	(1.025")	7.11	(.280")	.150"	.0285"	.028 @ 4W		.001 @ .14W		PRC SM 2212-4
SM2812-4	5W / 15A	26.04	(1.025")	9.52	(.375")	.180"	.032"	.02 @ 5W		.001 @ .22W		PRC SM 2812-4
SM3724-4	7.5 W / 15A	45.72	(1.800")	11.10	(.437")	.243"	.032"	.03 @ 7.5W		.001 @ .22W		PRC SM 3724-4

* Heavier current carrying capacity leads are available for low resistance - full power applications. Refer to Type PLV for custom millivolt drop requirements.

ENGINEERING DATA:

1. RESISTANCE AND TOLERANCE

Standard: Any ohmic value or decimal part of an ohm desired from 0.015Ω to 100Ω with tolerances to ±0.005%.
Special: From 0.001Ω through 0.015Ω with tolerances to ±0.1%. Please see Fig. 6 Resistance Vs. Tolerance ratios above.

2. TCR CHARACTERISTICS

Standard: 0±15 ppm/°C. between 25 & 100°C.

3. STABILITY VS. TIME CHARACTERISTICS

To ±0.001% per year at +25°C. with no load.

4. SOLVENT RESISTANCE COATING

… with indelible marking.

5. POWER & CURRENT RATING

The Standard Minimum Resistance at full power (see above column) is based upon ±1% resistance tolerance at +25°C. Derating is required for lower res. values, closer tolerances and higher temperatures. Please refer to Fig. # 7 at top of the page.

6. TWO-TERMINAL VS. FOUR-TERMINAL (Kelvin)

Two-terminal resistors are generally used for high ohmic values, where the effects of lead-out resistance and contact resistance are minimal. Allow approximately ±0.001 ohm per inch for the lead-out resistance on 2-Wire designs. However, on low values where lead resistance can be part of a very accurate measurement, the adder may be eliminated by using a 4-terminal device, because 4-Wire circuits will only indicate the voltage drop across the resistor.

7. FOUR TERMINALS

PRC's type SM-4 has four solderable hot-tinned copper wire leads. Lead identification is academic because of its single-joint construction. However for uniformity, while observing the PRC marking on the body of the resistor, select the 2 leads closest to the top for your sense leads and the other two as the current leads.

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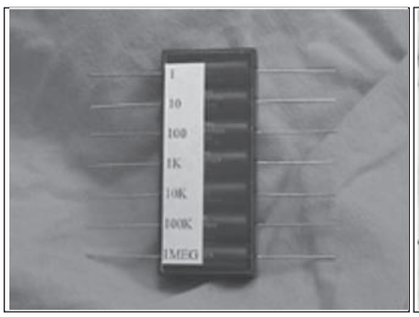
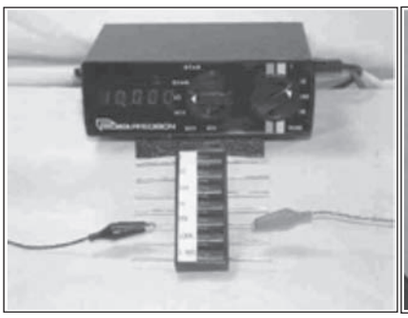
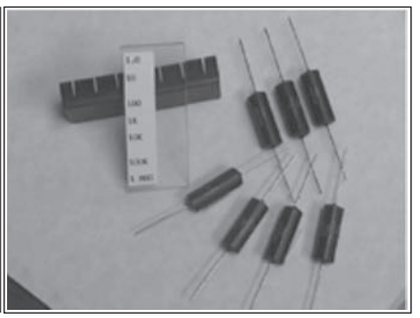
ISSUE NO. 42
REVISED 11-10-11. SUPERSEDES ANY AND ALL PREVIOUS PUBLISHED ARTICLES.

DIGITAL MULTIMETER CALIBRATOR

The MC-7 Digital Multimeter Calibrator is a packaged group of seven (7) High-Precision resistors part # HR3716N, with ohmic values ranging from 1.0Ω to 1Megohm - used in the verification and adjustment of the resistance function of 3½ and 4½ digital multimeters. To your advantage, the MC-7 is always in-stock … ready for delivery.







FOR YOUR CONVENIENCE

The seven (7) resistors are contained in a plastic case with the leads extending through the sides - ready to go to work.

VALUES & TOLERANCES

1Ω 0.02%
10Ω 0.02%
100Ω 0.01%
1KΩ 0.01%
10KΩ 0.01%
100KΩ 0.01%
1MEGΩ 0.01%

HR3716N PHYSICAL SPECS:

Length ..... 25.40mm (1.00")
Diameter ..... 9.53mm (.375")
Leads ..... 0.032" dai X 1.0" long

D.C. mV METER SHUNT

What Type MS means to you:

Resistance Value ..... from 0.001Ω to 100Ω
Tolerances ..... to ±0.005%
TCR Characteristics .....to±10ppm/°C
Temperature Span ..... -65 to +275°C
DC Current ..... to 50 Amps Max.
2 & 4 Terminals for power or current-sensing

Type MS-40

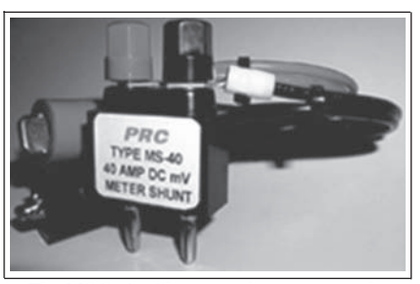
(0.001Ω ±0.5% shunt) lets you quickly test current up to 40 Amps with a standard multimeter.

PHYSICAL SPECS:

Length ..... 1.50"
Height ..... 2.00"
Width ..... 0.65"
Terminals ..... 0.75"
(Center-to-center)

Input/Output Conversion Chart

1 Amp = 1mV
2 Amps = 2mVs
5 Amps = 5mVs
7 Amps = 7mVs
10 Amps = 10mVs
20 Amps = 20mVs
30 Amps = 30mVs
40 Amps = 40mVs



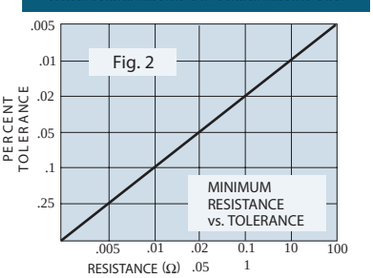
The MS Series Shunts can be custom-made for 50mV & 100mV applications. The values below are typical values for the 50mV shunts using the Volt Drop Method :

Ω (R)	Current (I)	Watts (P)
0.001	50A	2.50W
0.002	25A	1.25W
0.003	16.7A	0.83W
0.004	12.5A	0.62W
0.005	10A	0.5W
0.006	8.3A	0.42W
0.007	7.14A	0.36W
0.008	6.25A	0.31W
0.009	5.5A	0.28W
0.010	5A	0.25W
0.020	2.5A	0.125W
0.025	2A	0.1W
0.030	1.67A	0.08W
0.040	1.25A	0.06W
0.050	1A	0.05W
0.100	0.5A	0.025W
0.200	0.25A	0.0125W
0.250	0.2A	0.01W
0.500	0.1A	0.005W
1.00	0.05A	0.0025W

OHM'S LAW FORMULAS

I = (E/R), (P/E), ($\sqrt{P/R}$) P = (E^2/R), (EI), (I^2R)
R = (E/I), (E^2/P), (P^2/I) E = (IR), (P/I), ($\sqrt{PR}$)

Min. Resistance Vs. Resistance Tol.



ENGINEERING DATA:

1. POWER RATINGS: 10 WATTS MAXIMUM
   All resistance values at full power are based upon ±1% resistance tolerance at 25°C. Derating is required or higher temperatures and/or closer tolerances.
2. RESISTANCE AND TOLERANCES:
   0.001Ω to 100Ω in any specified value or decimal part of an ohm - to ±0.005% - see Fig. 2 (Min. Resistance vs. Resistance Tolerance).
3. TCR CHARACTERISTICS:
   to 0±10 ppm/°C
4. TERMINALS:
   Heavy-duty commercially pure copper test leads match current rating of shunt selected. Also Four(4) low EMF copper terminals are available for very accurate current-sensing applications.
5. MARKING:
   PRC symbol, type, resistance, value, tolerance and terminal. Custom marking, if specified.
   e.g. MS-40A = 0.001Ω (to 40 amps).

PRC
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