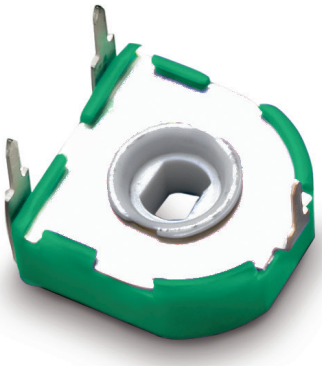
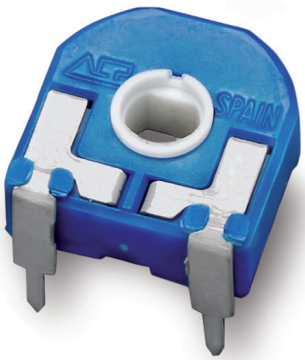
# CAR14

Carbon Potentiometers CAR

# CER14

Cermet Potentiometers CER



# CARBON – CAR 14

This product family born as an alternative to the CA14 series when curved designs appear. Housing shape has been modified in order to set the product properly.

CAR14, carbon potentiometers with plastic housing and Ingress Protection rating type IP 54 (high level of protection against dust and also against water splashing), according to IEC 60529. Plastic materials can be self-extinguishable according to UL 94 V-0 under request.

Through-hole configuration is available; for SMD version, please, inquire. Terminals and collector are normally manufactured in tinned brass, although versions with steel terminals are also available under request. Terminals for through-hole models can be provided straight or crimped, which helps hold the component to the PCB during soldering.

Tapers can be linear, log and antilog; special tapers can also be studied.

Potentiometers can be manufactured in a wide range of possibilities regarding:

-Resistance value.
-Tolerance.
-Tapers / variation laws.
-Pitch.
-Positioning of the wiper (standard is at 50% rotation).
-Housing and rotor color.
-Mechanical life.
-Self-extinguishable plastic parts according to UL 94 V-0.

**Applications**

CAR14 is mainly used in control applications in different markets:

-Electronic household appliances, heating, ventilation and air conditioning (HVAC) equipment, thermostats.
-Automotive: HVAC controls, lighting regulation (position adjustment and sensing), dimmers, seat heating controls.
-Industrial electronics: multimeters, oscilloscopes, time relays, measurement and test equipment.

# CERMET – CER14

This product family born as an alternative to the CA14 series when curved designs appear. Housing shape has been modified in order to set the product properly.

CER14, cermet potentiometers with plastic housing and Ingress Protection rating type IP 54 (high level of protection against dust and also against water splashing), according to IEC 60529. Plastic materials (housing and rotor) are self-extinguishable according to UL 94 V-0. ACP's cermet potentiometers have better thermal stability, allow for higher thermal dissipation and withstand higher temperatures than carbon potentiometers.

Through-hole configuration is available; for SMD version, please, inquire. Terminals and collector are normally manufactured in tinned brass, although versions with steel terminals are also available under request. Terminals for through-hole models can be provided straight or crimped, which helps hold the component to the PCB during soldering.

Tapers can be linear, log and antilog; special tapers can also be studied.

Potentiometers can be manufactured in a wide range of possibilities regarding:
-Resistance value.
-Tolerance.
-Tapers / variation laws.
-Pitch.
-Positioning of the wiper (standard is at 50% rotation).
-Housing and rotor color.
-Mechanical life.

**Applications**

CER14 is used in applications where either the operating temperature is high, or where the applications requires product with excellent ohmic value stability:

-Electronic appliances: boilers, water heaters.
-Automotive: climate controls, position sensors.
-Industrial electronics: multimeters, oscilloscopes, time relays, measurement and test equipment.

# CAR14 CER14 HOW TO ORDER

EXAMPLE: **CAR14NV12,5-10KA2020 10DT SNP PI WT-14117-BA**

EXAMPLE: **CER14NV12,5-10KA2020 10DT SNP PI WT-14117-BA-V0**

| Standard features | | | | | | | | Extra features | | | | | | | Assembled accessory | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Series | Rotor | Model | Packg. | Ohm value | Taper | Tol. | Life | Track | Detents | Snap in | Housing | Rotor | Wiper | Lin. | Assembly | Ref # | Color | Flam. |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | 16 | | |
| CAR14/CER14 | N | H2,5 | | - 10K | A | 2020 | | | 10DT | SNP | | | PI | | WT | 14117 | -BA | -V0 |

| **Standard configuration:** | **CAR14 Through-hole** | **CER14 Through-hole** |
|---|---|---|
| Dimensions: | 14mm | |
| Protection: | IP 54 (dust-proof)<br>On request: Self-extinguishable, to meet UL 94 V-0 | |
| Substrate: | Carbon technology | Cermet |
| Color: | Blue housing + white rotor | Brown housing + white rotor |
| Packaging: | Bulk | |
| Wiper position: | at 50% ±15º | |
| Terminals: | Straight, without crimping. | |
| Marking: | Resistive value marked on housing. Others on request. | |

**Customized products:** A drawing is requested when ordering a customized product. Series, rotor, model and total resistive value are indicated before the code that includes all special specifications. Example: CAR14PH2,5-10K CODE C00111.

### 1 - Series

■ CAR14 ■ CER14

### 2 - Rotors

| B | D | E | F | G | K | M | N | P | T | X | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|

### 3 - Model and pitch

| | |
|---|---|
| V15 | VR15 |

### 4 - Packaging

| | Trough-hole |
|---|---|
| Bulk | (blank)...(1) |

(1) If blank, bulk packaging is implied.

### 5 - Resistance value

| 100Ω | 200Ω | 220Ω | 250Ω | 470Ω | 500Ω | 1KΩ | 2KΩ | ... | 500KΩ | 1MΩ | 2MΩ | 2M2Ω | 4M7Ω | 5MΩ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 200 | 220 | 250 | 470 | 500 | 1K | 2K | | 500K | 1M | 2M | 2M2 | 4M7 | 5M |

Other resistive values available on request.

### 6 - Resistance law / taper

| | |
|---|---|
| Lin - Linear | A |
| Log - Logarithmic | B |
| Antilog - Antilogarithmic | C |
| - Special tapers have codes assigned: | CODE YXXXXX |

### 7 - Tolerance

| ±20% | ±30% | +50%,-30% | ±10% | ±5% |
|---|---|---|---|---|
| 2020 | 3030 | 5030 | 1010 | 0505 |

### 8 - Operating Life (Cycles)

| | |
|---|---|
| Standard (1.000 cycles) | (leave blank) |
| Long life: LV + the number of cycles. ex: LV10 for 10.000 cycles. (others on request) | LVXX: ex: LV10 |

### 9 - Cut Track – Open circuit.

| | |
|---|---|
| Open circuit at beginning of track, fully CCW | PCI |
| Open circuit at end of track, fully CW | PCF |

### 10 - Detents (DT)

| | |
|---|---|
| One detent at the beginning | DTI |
| One detent at the end | DTF |
| X number of detents | XDT: 10DT |

For this product: Only available under request

### 11 - Terminals

| | |
|---|---|
| SNAP IN P | SNP |
| Shorter tip of terminal, TPXX, where XX is tip length (under request) | TPXX, ex: TP30 |
| Steel Terminals | SH |

### 12 - Housing

| | |
|---|---|
| **Color:** For colors other than standard: -See color chart below- | CJ-color, ex., red: CJ-RO |

### 13 - Rotor

| | |
|---|---|
| **Color:** For colors other than standard: -See color chart below- | RT-color; ex., blue: RT-AZ |

| *** Self-extinguishable property, V0, for housing and rotor:** | |
|---|---|
| By default, carbon is non self-extinguishable, cermet is Self-extinguishable: | (blank) |
| For carbon: self-extinguishable property can be added. V0 means housing and rotor are V0. If only the housing needs to be V0, then CJ-V0. | V0<br>CJ-V0, RT-V0 |
| If only rotor: RT-V0 | |

### 14 - Wiper

| | |
|---|---|
| **Wiper position** (Standard: 50% ± 15º) | (leave blank) |
| Initial or CCW | PI |
| Final or CW | PF |
| Others: following clock positions; at 3 hours: P3H | PXH, ex: P3H |
| **Wiper torque** (Standard: <2.5Ncm, for detents: <3.5) | (leave blank) |
| Low torque, < 1.5Ncm | PGB |

### 15 - Linearity

| | |
|---|---|
| Not controlled | (leave blank) |
| Independent linearity controlled & below x%, for example, 3%: LN3% | LNx%; ex: LN3% |
| Absolute linearity controlled & below x% | LAx% |

Other features could be available on request, please, ask.

### 16 - Potentiometers with assembled accessories

| | |
|---|---|
| Assembled from terminal side | WT |
| Assembled from collector side | WTI |
| Accessory Reference<br>See list of shafts and thumbwheels available | -XXXXX<br>Example: 14117 |
| Color of shaft or thumbwheel | -YY Example, white: BA |
| Non self-extinguishable. Self-extinguishable according to standard UL 94 (-V0 in box 17 modifies only the accessory, please, note.) | (leave blank)<br>-V0 |

**For ordering spare accessories:**

| | |
|---|---|
| Accessory reference - color- flammability.<br>Ex. 14117-AZ-V0 is a blue self-extinguishable 14117 thumbwheel | XXXX-YY-V0 |

### Color chart for rotor, housing and accessories

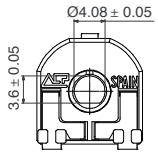
| Black(1) | White | Neutral | Transp. | Red | Green | Yellow | Blue | Grey | Brown |
|---|---|---|---|---|---|---|---|---|---|
| NE | BA | IN | TA | RO | VE | AM | AZ | GS | MR |

(1) black is not an option for housings.

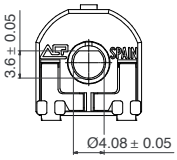
## Rotors

Rotors are drawn in their standard positioning, 50% of rotation. Alternative delivery positioning can be requested. Accessories in this catalogue are designed for N, Z and T rotors, unless otherwise stated.

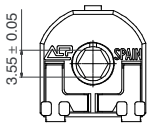
### B



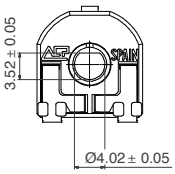

### D



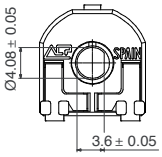

### E



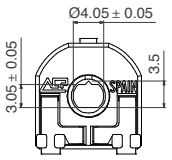

### F



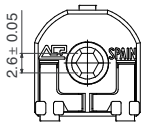

### G



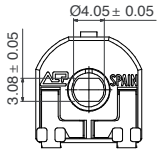

### K



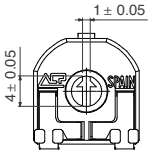

### M



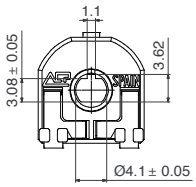

### N



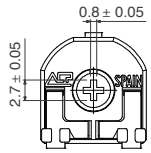

### P



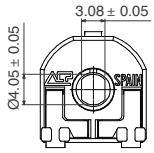

### T




### X



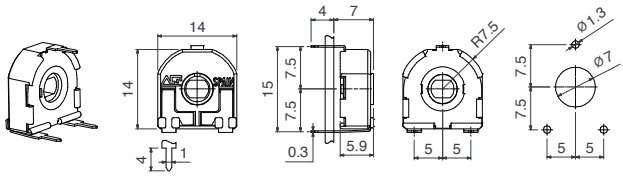

### Z



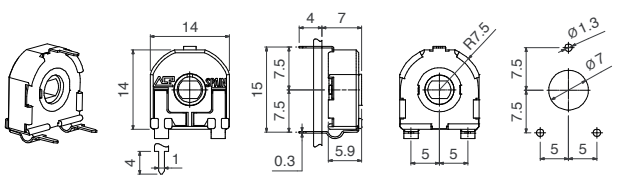

## Models

All models shown here have the most common rotor for 14mm potentiometers: the N rotor. Different rotors are available from the menu above.

### V15



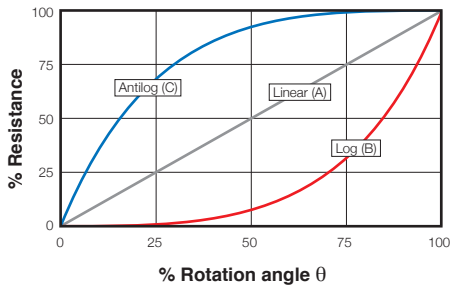

### VR15



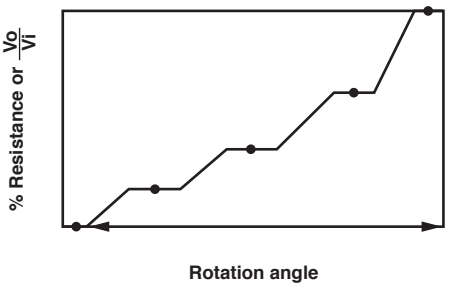

## Tapers

The standard taper is linear (A). Log (B) and Antilog (C) tapers are also available, as well as special tapers according to customer's specifications. For example, a special taper can be matched with a potentiometer with detents (click effect), to guarantee a value in a specific position – see "detents" section.-

### REGULAR TAPERS




### SPECIAL TAPERS

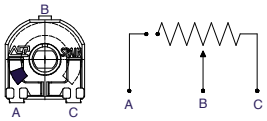



CAR14 CER14

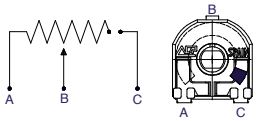
## Potentiometers with cut track

The cut track is an area with very high resistive value, resulting in an open circuit. It is widely used in lighting applications.
Mechanical life with cut track needs to be confirmed.
PCI = Cut at initial position, when the potentiometer is turned fully counter clockwise.
PCF = Cut at final position, when the potentiometer is turned fully clockwise.
Other positions are available on request.

**PCI**




**PCF**

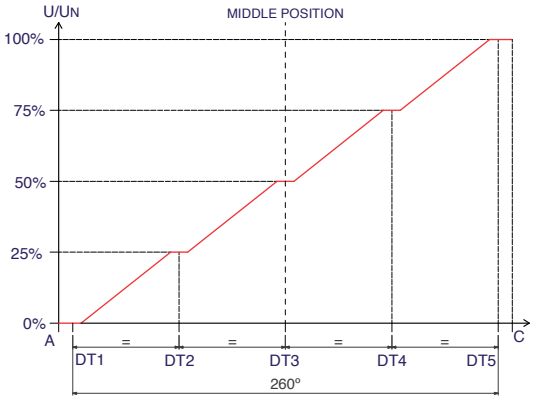


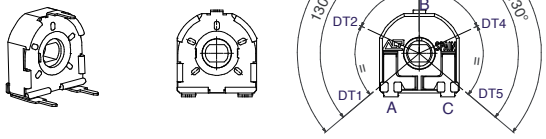

## Potentiometers with detents

ACP's patented detent (DT) feature is especially suitable for control applications where the end user will turn a knob inserted in the potentiometer. Detents can be used to add a click feeling to the turning of the potentiometer or to control the position in which the wiper is placed, assuring a particular output value with a narrow tolerance.

Detents can be light or strong, or even a combination of different feelings. They can be evenly distributed along the angle (standard) or tailored to match customers' request. They can also be combined with special tapers: constant value areas, open circuit zone, different slopes, etc. One common example is a potentiometer with detents and matching non-overlapping voltage values in specific angular positions used to feed in a voltage value to a microprocessor:

**Example of 5T with control of value in each DT.**



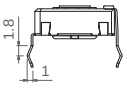

Our patented design with two wipers has improved the performance of these potentiometers, giving them more stable electrical parameters, improved reliability and Contact Resistance Variation (CRV) and narrower tolerances for detent positioning.

For this product, detents are only available under request.

## Terminals

By default, terminals are always straight, as shown on the "models" section. ACP can provide crimped terminals (with snap in, "SNP" or "SNR") to better hold the component to the PCB during the soldering operation.

**SNP**

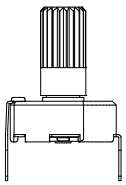



Shorter terminal tips are only available under request.

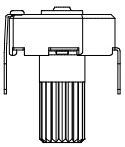
## Possibilities for insertion of accessories

Accessories can be mounted on potentiometers through either the front side (WT) or the collector side (WTI). For the specific angular position of shafts with planes, a drawing with the exact position is requested.

### WT



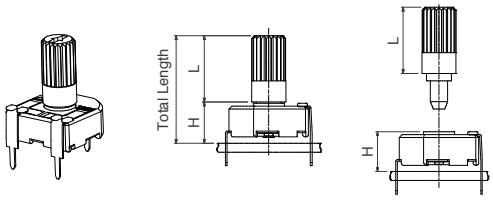
### WTI



## Shafts

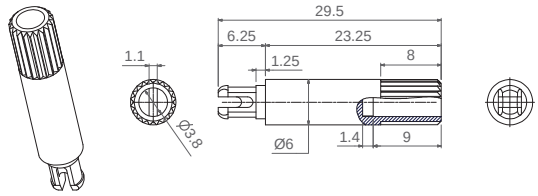
Shafts are available in different colors (color chart in “how to order” section) and with self-extinguishable property, according to UL 94 V-0, under request. ACP can study special shaft designs.
Shafts can be sold separately or delivered already mounted on the potentiometer at ACP.
When a shaft is mounted, the distance from the top of the potentiometer to the top of the shaft is marked with “L” in the table below, as shown in the drawings:

### V potentiometer + shaft

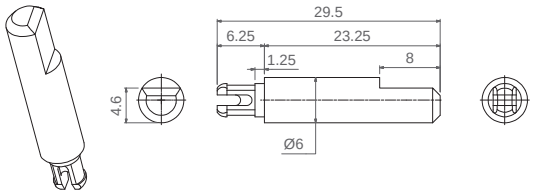



| Shaft | 14042 | 14065 (For E rotor) | 14117 | 14056 | 14081 | 14187 | 14251 | 14067 | 14008 | 14015 | 14066 | 14084 | 14250 | 14072 | 14073 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **L Dimension** | 7.05 | 11.50 | 11.70 | 12.25 | 18.25 | 18.75 | 18.75 | 27.75 | 23.25 | 23.25 | 23.50 | 23.50 | 25.00 | 31.75 | 38.50 |

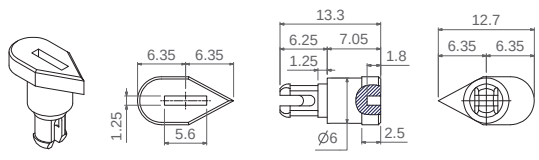
### 14008



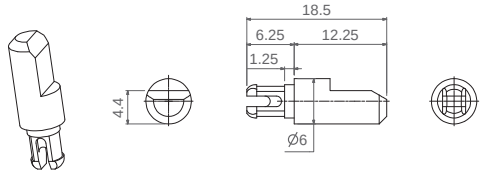

### 14015



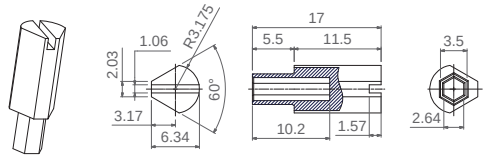

### 14042



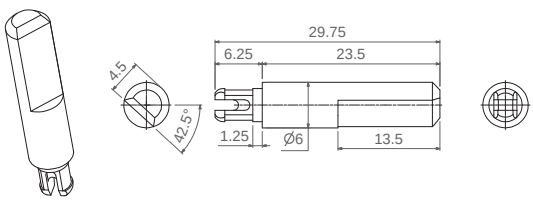

### 14056



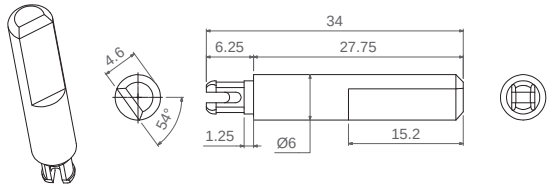

### 14065 (Designed for E rotor)



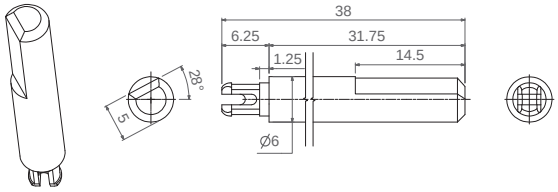

### 14066



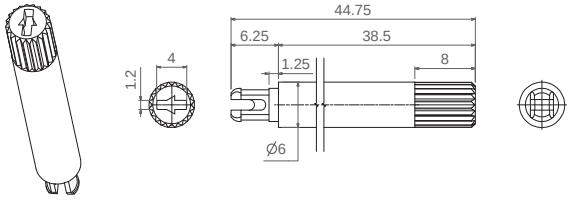
## 14067



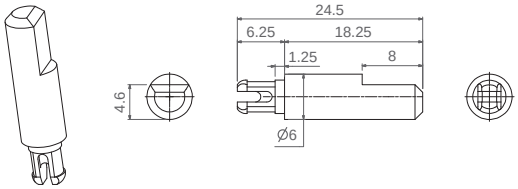

## 14072



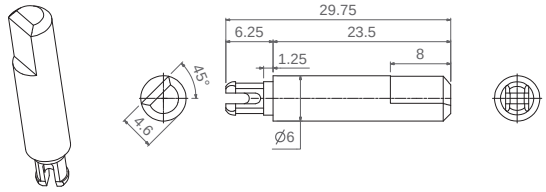

## 14073



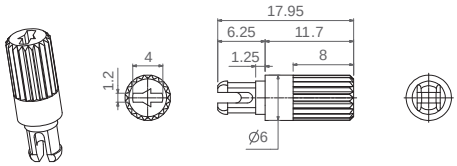

## 14081



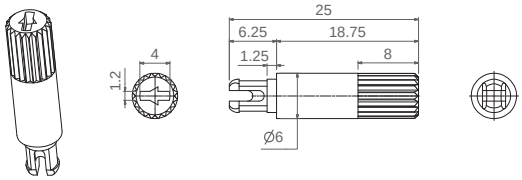

## 14084



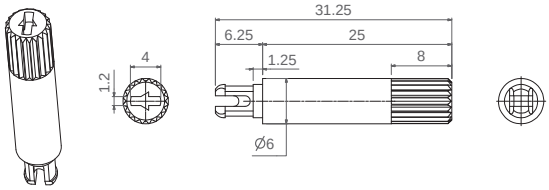

## 14117



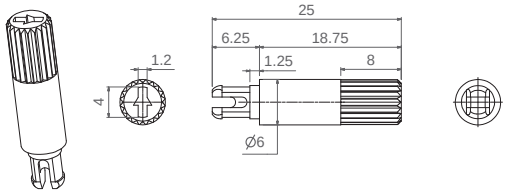

## 14187




## 14250



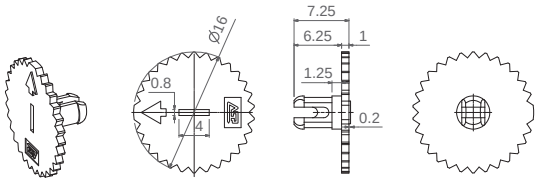

## 14251



## Thumbwheel

Thumbwheels are available in different colors (color chart in “how to order” section) and with self-extinguishable property according to UL 94 V-0, under request.
Thumbwheels can be mounted on the potentiometers at ACP or sold separately. ACP can study special thumbwheel designs.

**14003**




## Packaging

**Bulk packaging:**

| Potentiometer model | With shaft or thumbwheel inserted? | Pieces per small box (150 x 100 x 70) | Pieces per bigger box (250 x 150 x 70, CG on description) |
|---|---|---|---|
| V15 - VR15 | None, only potentiometers. | 200<br>150 for models with* | 700 |
| | 14003, 14117, 14042, 14056, 14065 | 100 | 400<br>350 for models with* |
| | 14008, 14015, 14066, 14067, 14072, 14073, 14081, 14084, 14187, 14250. | 75 | To be determined. |

For models with * and an inserted accessory, please, inquire about the quantity per box in that case.
Optional box 140x140x70 is available on request.

## Electric Specifications

These are standard features; other specifications and out of range values can be studied on request.

| | CAR14 Through-hole | CER14 Through-hole |
|---|---|---|
| Range of resistance values*<br>Lin (A)<br>Log (B) Antilog (C) | <br>100Ω ≤ Rn ≤ 5MΩ<br>1 KΩ ≤ Rn ≤ 2M2Ω | <br>100Ω ≤ Rn ≤ 5MΩ<br>1 KΩ ≤ Rn ≤ 2M2Ω |
| Tolerance*<br>Rn < 100Ω:<br>100Ω ≤ Rn ≤ 100KΩ<br>100K< Rn ≤ 1MΩ:<br>1MΩ < Rn ≤5MΩ:<br>Rn > 5MΩ: | <br>+50%, -30% (out of range)<br>±20%<br>±20%<br>±30%<br>+50%, -30% (out of range) | <br>-<br>±20%<br>±20%<br>±30%<br>- |
| Variation laws | Lin (A), Log (B), Antilog (C). Other tapers available on request | |
| Residual resistance | Rn ≤ 400Ω ≤ 2Ω; Rn > 400Ω 5*10-3* Rn | ≤2Ω |
| CRV - Contact Resistance Variation (dynamic) | Lin (A) Electrical Angle 245º±20º ≤ 3%Rn.<br>Other tapers, please inquire | |
| CRV - Contact Resistance Variation (static) | Lin (A) Electrical Angle 245º±20º ≤ 5%Rn.<br>Other tapers, please inquire | |
| Maximum power dissipation**<br>Lin (A)<br>Log (B), Antilog (C) | at 50ºC<br>0.25W<br>0.13W | at 70º C.<br>0.7W<br>0.30W |
| Maximum voltage<br>Lin (A)<br>Log (B), Antilog (C) | <br>250VDC<br>200VDC | |
| Operating temperature | -25ºC … +70ºC (up to +120ºC, inquiry) | -40ºC … +90ºC (+125ºC on request) |
| Temperature coefficient<br>100Ω ≤ Rn ≤ 10KΩ<br>10KΩ < Rn ≤ 5MΩ | <br>+200/ -300 ppm<br>+200/ -500 ppm | <br>±100 ppm<br>±100 ppm |

* Out of range ohm values and tolerances are available on request, please, inquire.
** Dissipation of special tapers will vary, please, inquire.

## Mechanical Specifications

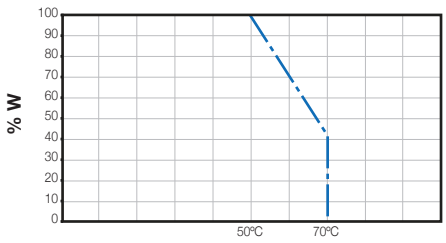
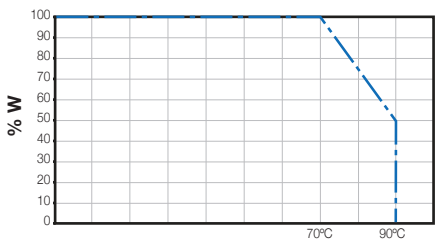
| | CAR14 Through-hole | CER14 Through-hole |
|---|---|---|
| Resistive element | Carbon technology | Cermet |
| Angle of rotation (mechanical) | 265º ± 5º | |
| Angle of rotation (electrical) | 245º ± 20º | |
| Wiper standard delivery position | 50% ± 15º | |
| Max. stop torque | 10 Ncm | |
| Max. push/pull on rotor | 50 N | |
| Wiper torque* | <2.5 Ncm<br>Potentiometers with detents: <3.5 Ncm | |
| Mechanical life | 1.000 cycles (many more available on request, please, inquire) | |

* Stronger or softer torque feeling is available on request.

## Test results

The following typical test results (with 95% confidence) are given at 23ºC ±2ºC and 50% ±25% RH.

| | CAR14 Through-hole | | CER14 Through-hole | |
|---|---|---|---|---|
| | **Test conditions** | **Typical variation of Rn** | **Test conditions** | **Typical variation of Rn** |
| Damp heat | 500 h. at 40°C and 95% RH | +5%, -2% | 500 h. at 40°C and 95% RH | ±2% |
| Thermal cycles | 16 h at 85ºC, plus 2 h at –25ºC | ±2.5% | 16 h at 90ºC, plus 2 h at –40ºC | ±2% |
| Load life | 1.000 h. at 50°C | +0%; -5% | 1.000 h. at 70°C | ±2% |
| Mechanical life | 1.000 cycles at 10 c.p.m. and at 23°C ± 2°C | ±3% | 1.000 cycles at 10 c.p.m. and at 23°C ± 2°C | ±2% |
| Storage (3 years) | 3 years at 23°C ± 2°C | ±3% | 3 years at 23°C ± 2°C | ±1% |

| | CAR14 Through-hole | CER14 Through-hole |
|---|---|---|
| Power derating curve: |  |  |

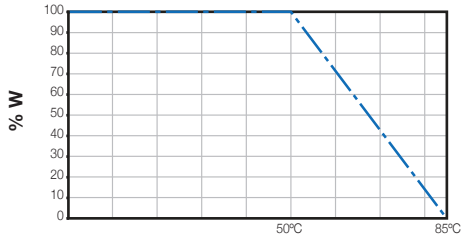


## For temperatures out of range

The normal operation temperature for a carbon ACP potentiometer is -25ºC to +70ºC. When the temperature goes up to 85ºC, the following variations should be observed:

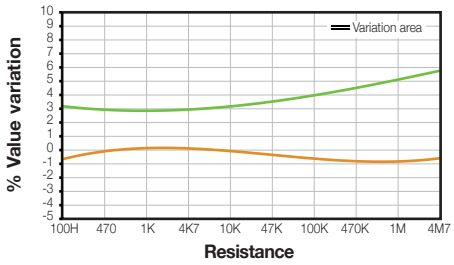
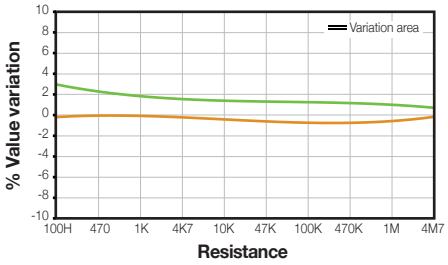
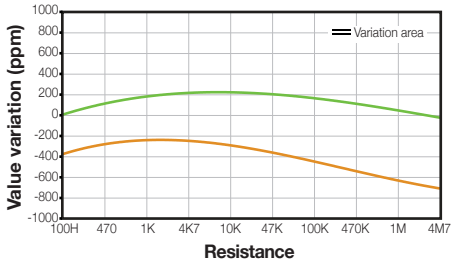
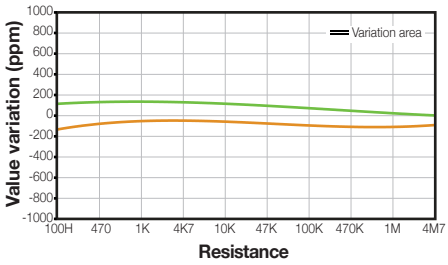
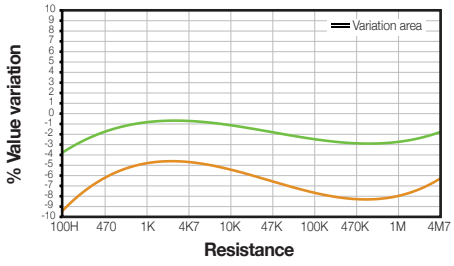
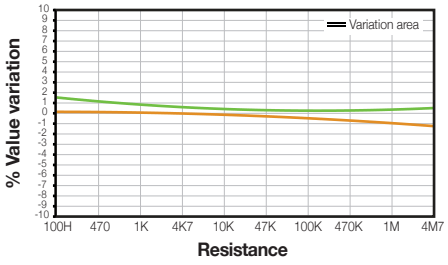
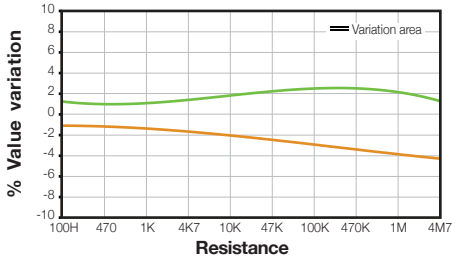
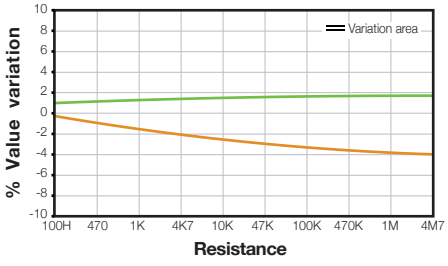
| | | | | |
|---|---|---|---|---|
| Load life | 1.000 h. at 50ºC | +0%; -6% | 1.000 h. at 85ºC | +0%; -15% |

The power derating curve to consider is:





Representation of the typical variation of nominal resistance (with 95% confidence) throughout the ohm value range:

| | CAR14 Through-hole | CER14 Through-hole |
|---|---|---|
| Damp heat |  |  |
| Temperature Coefficient |  |  |
| Load life |  |  |
| Mechanical life |  |  |