CA14
Carbon Potentiometers CA

CE14
Cermet Potentiometers CE

Specifications on this catalog are for reference only, as they are subject to change without notice.

CARBON – CA14

14mm 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 and SMD configurations are available. 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.

ACP's potentiometers can be adjusted from either the front or the back, both in the horizontal and the vertical adjustment types. Thumbwheels and shafts can be ordered either separately or already inserted in the potentiometer.

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.
- Click effect (up to 38 detents available).
- Self-extinguishable plastic parts according to UL 94 V-0.

Applications

14mm potentiometers are 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 – CE14

14mm 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 and SMD configurations are available. Terminals and collector are 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.

ACP's potentiometers can be adjusted from either the front or the back, both in the horizontal and the vertical adjustment types. Thumbwheels and shafts can be ordered either separately or already inserted in the potentiometer.

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

- Resistance value.
- Tolerance.
- Tapers / variation laws.
- Pitch.
- Positioning of the wiper (the standard is at 50%).
- Housing and rotor color.
- Mechanical life.
- Click effect (up to 38 detents available).

Applications

14mm cermet potentiometers are 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.

CA14 ▣ CE14 ▣ HOW TO ORDER

EXAMPLE: **CA14NV12,5-10KA2020 10DT SNP PI WT-14117-BA**

EXAMPLE: **CE14NV12,5-10KA2020 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			
CA14/CE14	N	H2,5		- 10K	A	2020			10DT	SNP			PI		WT	14117	-BA	-V0

Standard configuration:	CA14 Through-hole	CA14 SMD	CE14 Through-hole and SMD
Dimensions:	14mm		
Protection:	IP 54 (dust-proof) On request: Self-extinguishable, to meet UL 94 V-0		
Substrate:	Carbon technology	Carbon technology, special for high temperature	Cermet
Color:	Blue housing + white rotor	Brown housing + grey rotor	Brown housing + white rotor
Packaging:	Bulk		
Wiper position:	at 50% ±15°		
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: CA14PH2,5-10K CODE C00111.

1 - Series

■ CA14 ■ CE14

2 - Rotors

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

3 - Model and pitch

H0	HC0	H2,5	H4	H5	HA5	HL5
VR12,5	V15	VJ15	(V15) ... CFF	V17,5	VD7,5	VD11

VA12,5   VL12,5

VSMD   VSMD ... CY

HSMD (Under request, not readily available)

4 - Packaging

	Trough-hole	SMD models
Bulk	(blank)...[1]	(blank)...[1]
T&R (Tape and 13" reel)	(N.A.)[2]	T&R
T&R (Tape and 15" reel)	(N.A.)[2]	T&R15

(1) If blank, bulk packaging is implied. (2) N.A., Not Applicable: Tape and Reel packaging is only available for SMD terminals.

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

Special detents are available on request: If you need to assign a voltage value to each detent, please inquire.

11 - Terminals

SNAP IN P	SNP
SNAP IN R	SNR
Shorter tip of terminal, TPXX, where XX is tip length (under request)	TPXX, ex: TP30

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
If only rotor: RT-V0	CJ-V0, RT-V0

14 - Wiper

Wiper position (Standard: 50% ± 15°)	(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 See list of shafts and thumbwheels available	-XXXXX 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) -V0

For ordering spare accessories:

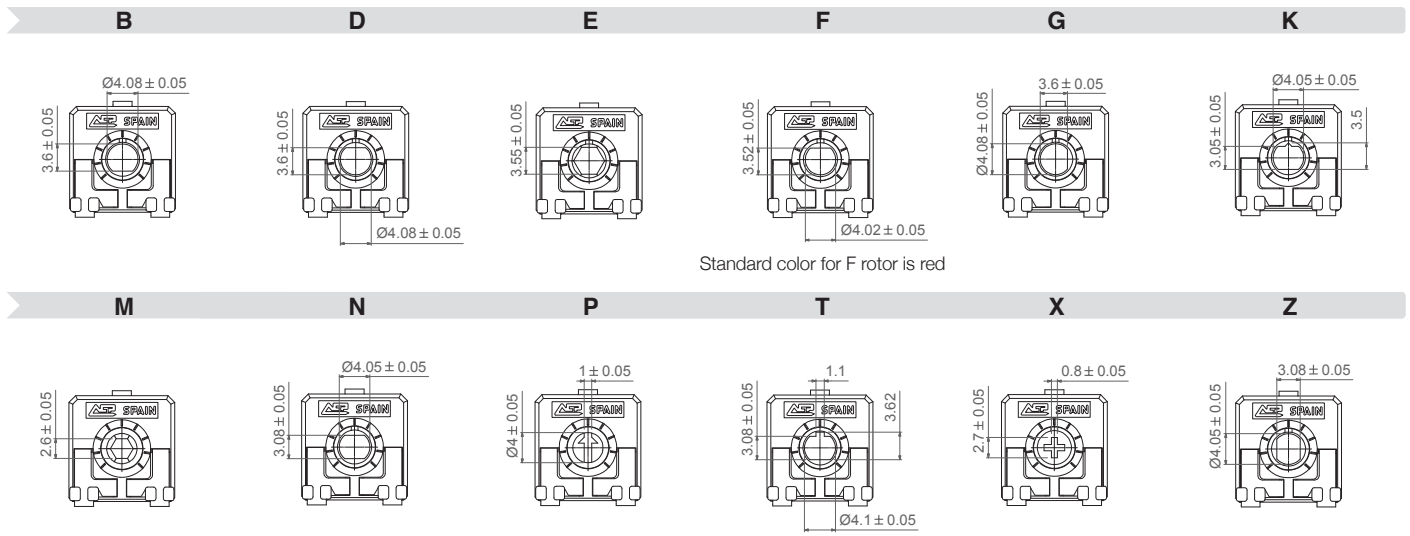| Accessory reference - color- flammability. Ex. 14117-AZ-V0 is a blue self-extinguishable 14117 thumbwheel	XXXX-YY-V0

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.

www.acptechnologies.com   Specifications on this catalog are for reference only, as they are subject to change without notice.
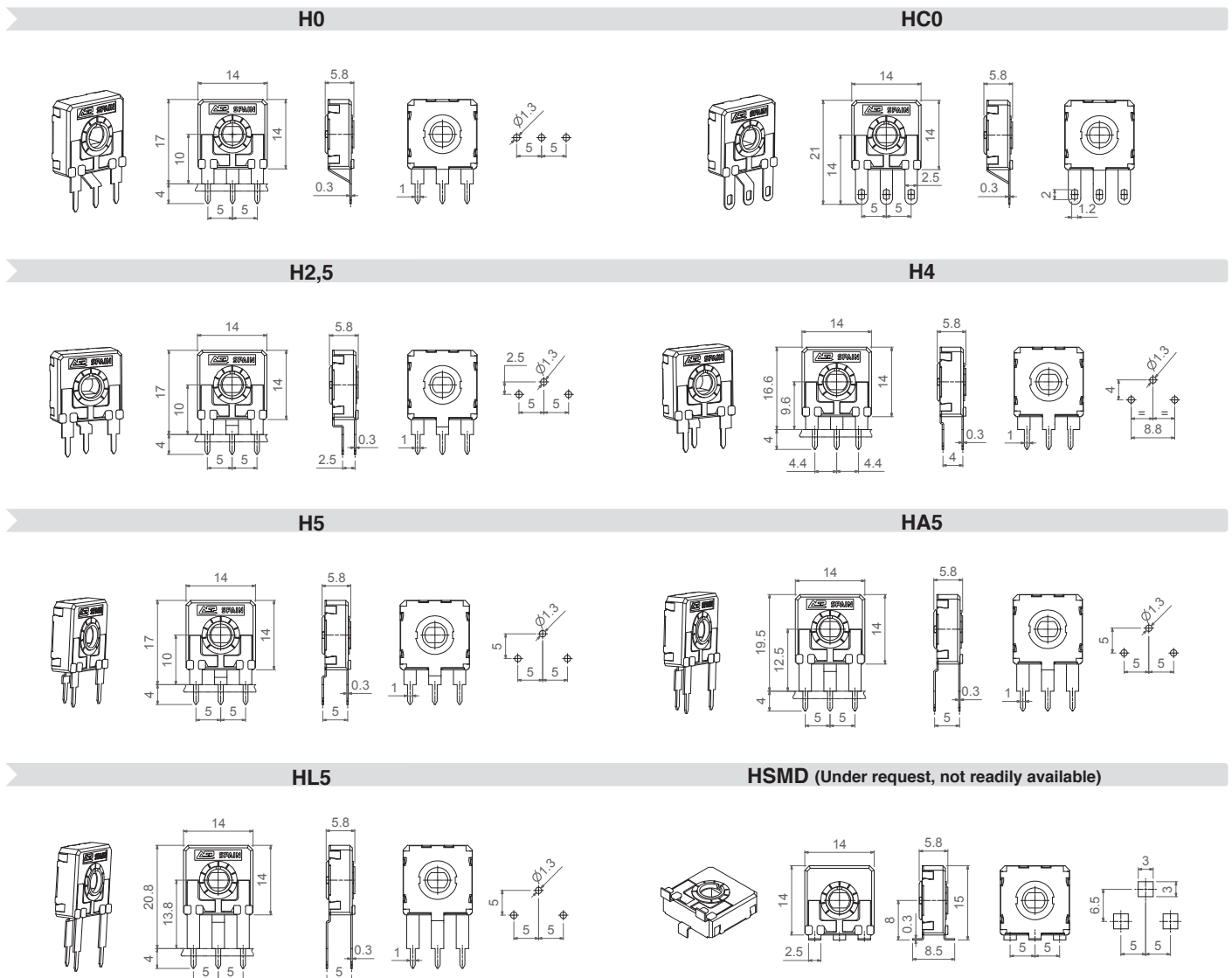
Rotors are drawn in their standard positioning, 50% of rotation. Alternative delivery positioning can be requested. Accessories in this catalogue are designed for N, Z and T rotors, unless otherwise stated.

B	D	E	F	G	K

Ø4.08 ± 0.05 (B)
3.6 ± 0.05 (B)

3.6 ± 0.05 (D)
Ø4.08 ± 0.05 (D)

3.55 ± 0.05 (E)

3.52 ± 0.05 (F)
Ø4.02 ± 0.05 (F)

3.6 ± 0.05 (G)
Ø4.08 ± 0.05 (G)

Ø4.05 ± 0.05 (K)
3.05 ± 0.05 (K)
3.5 (K)

Standard color for F rotor is red

M	N	P	T	X	Z

2.6 ± 0.05 (M)

Ø4.05 ± 0.05 (N)
3.08 ± 0.05 (N)

1 ± 0.05 (P)
Ø4 ± 0.05 (P)

1.1 (T)
3.08 ± 0.05 (T)
3.62 (T)
Ø4.1 ± 0.05 (T)

0.8 ± 0.05 (X)
2.7 ± 0.05 (X)

3.08 ± 0.05 (Z)
Ø4.05 ± 0.05 (Z)

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Models

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

H0

HC0

H2,5

H4

H5

HA5

HL5

HSMD (Under request, not readily available)

V12,5

VA12,5

VL12,5

VR12,5

V15

VJ15

V15...CFF

V17,5

VD7,5

VD11

VSMD

VSMD...CY

VSMD...CY WT-14003

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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

Antilog (C) Linear (A) Log (B)

% Resistance vs **% Rotation angle θ**

SPECIAL TAPERS

% Resistance or $\frac{Vo}{Vi}$ vs **Rotation angle**
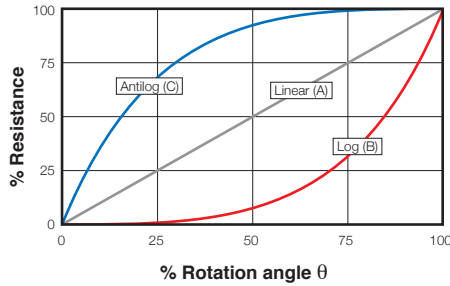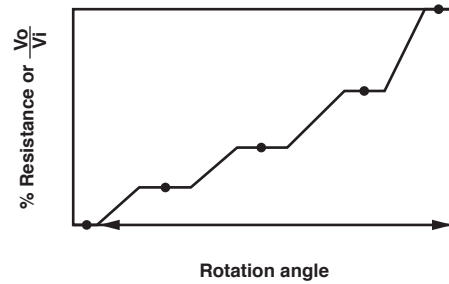
Potentiometers with cut track

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

A B C

PCF

A B C
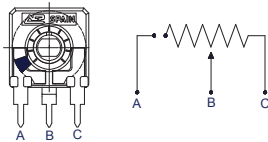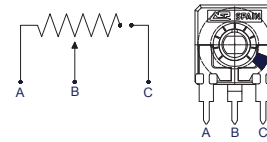
Potentiometers with detents

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 5DT with control of value in each DT.
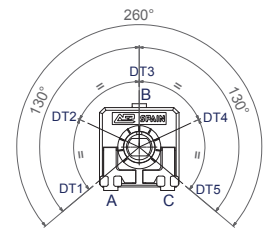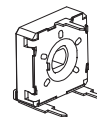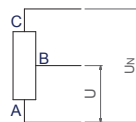
Examples of some potentiometers with detents:
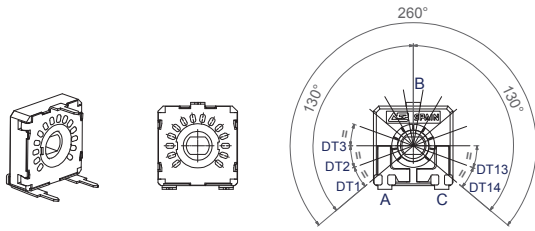
14DT	38DT
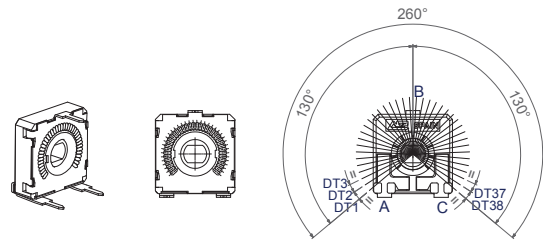
Number of standard detents (evenly distributed) already available. **Other configurations are available under request.**	1 (Initial, final or central), 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 17, 22, 27, 38.
Maximum number of detents for feeling only	38
Maximum number of detents when the voltage value in each detent is controlled and non-overlapping.	14

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 potentiometers with detents, mechanical life is also 1.000 cycles, if no additional cycles are mentioned. Up to 10.000 cycles are available. Please, indicate the number of cycles needed with LV (number of cycles), for example: LV10, for 10.000 cycles.

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.
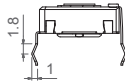
SNP	SNR
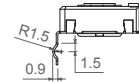
Also, there is an option of having shorter terminal tips:

Standard Terminal	Shorter terminal, for V12,5	Shorter terminal, TPXX (under request)
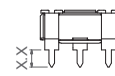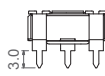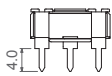
Possibilities for insertion of accessories

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 Front side	WTI Collector side	WT Front side	WTI Collector side
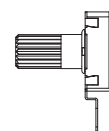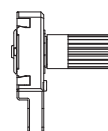
Shafts are available in different colors (color chart in "how to order" section) and with self-extinguishable property, according to UL 94 V-0, under request. ACP can study special shaft designs.

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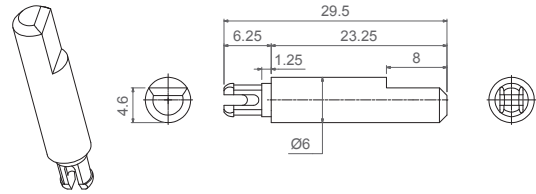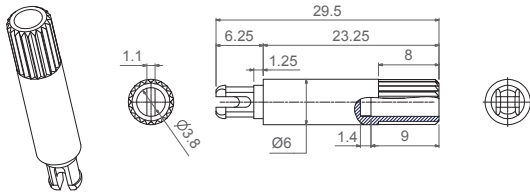
H potentiometer + shaft	**V potentiometer + shaft**
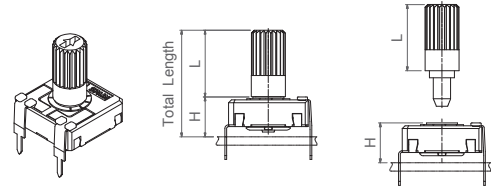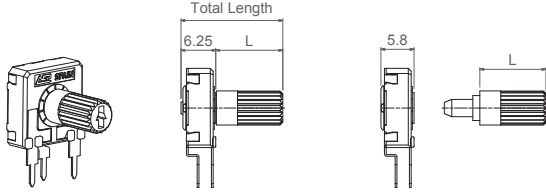
Shaft	14042	14065 (For E rotor)	14117	14056	14081	14187	14251	14067	14008	14015	14066	14084	14250	14072	14073
L Dimension	7.05	11.50	11.70	12.25	18.25	18.75	18.75	27.75	23.25	23.25	23.50	23.50	25.00	31.75	38.50

14008

14015

14042

14056
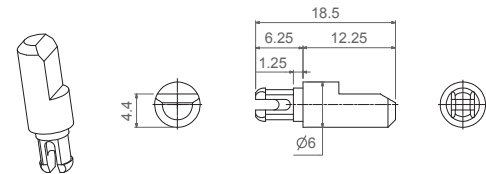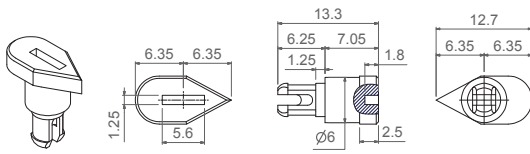
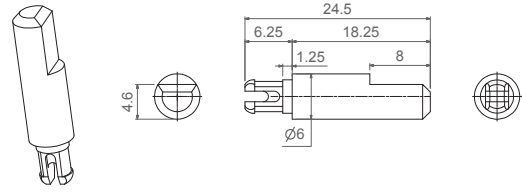### 14065 (Designed for E rotor)

14066

14067

14072

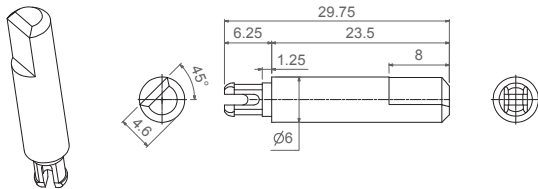

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Shafts

14073

44.75
6.25 38.5
1.25
8
1.2
4
Ø6

14081

24.5
6.25 18.25
1.25
8
4.6
Ø6

14084

29.75
6.25 23.5
1.25
8
45°
4.6
Ø6

14117

17.95
6.25 11.7
1.25
8
1.2
4
Ø6

14187

25
6.25 18.75
1.25
8
1.2
4
Ø6
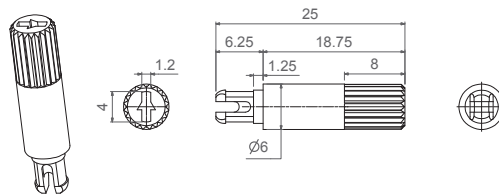
14250

31.25
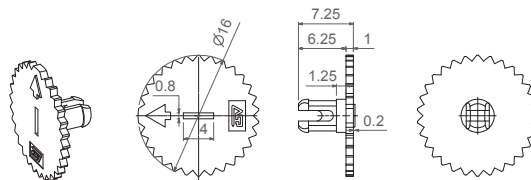6.25 25
1.25
8
1.2
4
Ø6

14251

25
6.25 18.75
1.25
8
1.2
4
Ø6
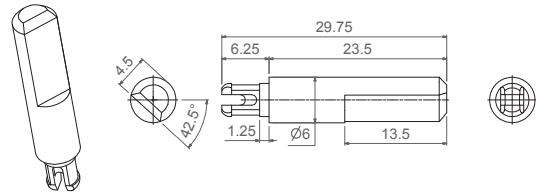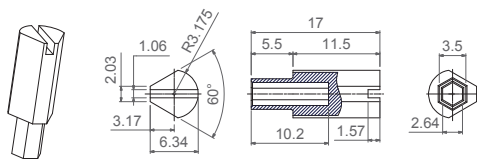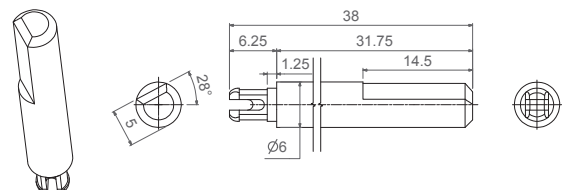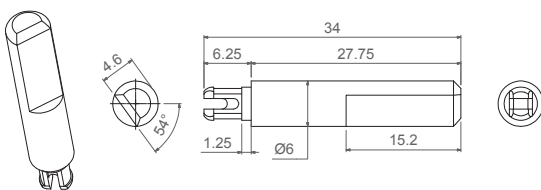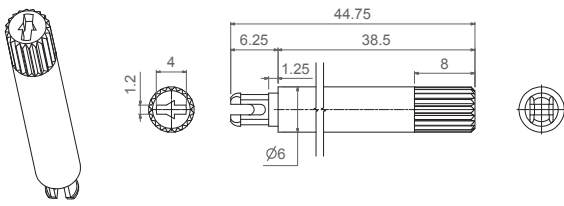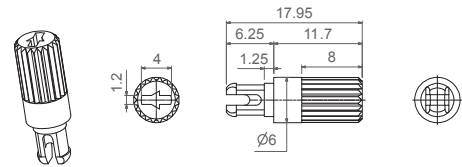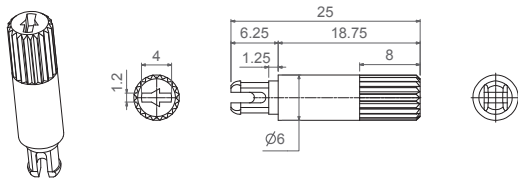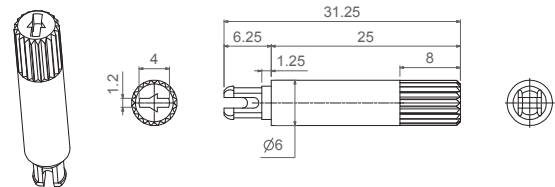
Thumbwheel

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

Ø16
0.8
4
7.25
6.25 1
1.25
0.2

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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)
H2,5 - H4 - H5- HA5- HL5- H0 HC0 - V12,5 - V15 - VA12,5 VL12,5 - VJ15 - V17,5* VD11* - VD7,5* - VR12,5	None, only potentiometers.	200 150 for models with*	700 600 for VJ15 - V17,5 - VD7,5 500 for VD11
	14003, 14117, 14042, 14056, 14065	100	400 350 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.

Tape & Reel packaging:

	With thumbwheel inserted?	13" Reel (Standard), with 24mm width tape	15" Reel, with 24mm width tape
VSMD	None, only potentiometers.	500 pcs per reel, 16mm step between cavities.	800 pcs per reel, 16mm step between cavities.
	14003	450 pcs per reel, 16mm step between cavities.	To be determined.
VSMD... CY	None, only potentiometers.	350 pcs per reel, 20mm step between cavities.	500 pcs per reel, 20mm step between cavities.
	14003	350 pcs per reel, 20mm step between cavities.	To be determined.
HSMD		To be determined	To be determined.

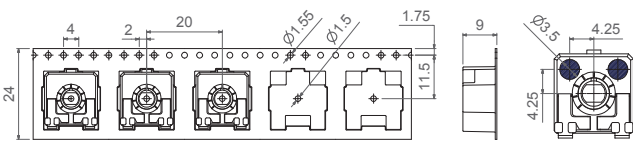The 13" reel is the standard. For the 15" reel, T&R15 is added to the description.
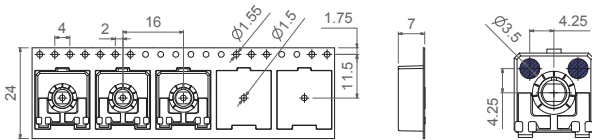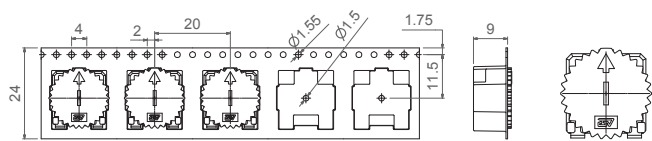
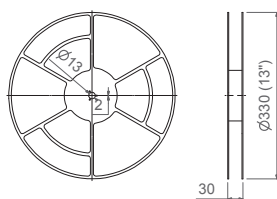| **VSMD-T&R**	**VSMD-T&R…WT-14003**
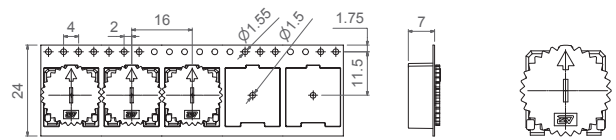
VSMD-T&R … CY	**VSMD-T&R…CY WT-14003**

13" Reel	**15" Reel**
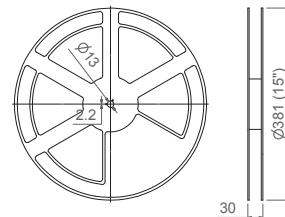
These are standard features; other specifications and out of range values can be studied on request.

	CA14 Through-hole	CA14 SMD	CE14 Through-hole and SMD
Range of resistance values*			
Lin (A)	100Ω ≤ Rn ≤ 5MΩ	100Ω ≤ Rn ≤ 1MΩ	100Ω ≤ Rn ≤ 5MΩ
Log (B) Antilog (C)	1 KΩ ≤ Rn ≤ 2M2Ω	1 KΩ ≤ Rn ≤ 1 MΩ	1 KΩ ≤ Rn ≤ 2M2Ω
Tolerance*			
Rn < 100Ω:	+50%, -30% (out of range)	-	-
100Ω ≤ Rn ≤ 100KΩ	±20%	±30%	±20%
100K< Rn ≤ 1MΩ:	±20%	±40%	±20%
1MΩ < Rn ≤5MΩ:	±30%	±50%	±30%
Rn > 5MΩ:	+50%, -30% (out of range)	-	-
Variation laws	Lin (A), Log (B), Antilog (C). Other tapers available on request		
Residual resistance	Lin (A), Log (B), Antilog (C) ≤ 5*10-3*Rn. Minimum value 2Ω		≤2Ω
CRV - Contact Resistance Variation (dynamic)	Lin (A) Electrical Angle 245°±20° ≤ 3%Rn. Other tapers, please inquire		
CRV - Contact Resistance Variation (static)	Lin (A) Electrical Angle 245°±20° ≤ 5%Rn. Other tapers, please inquire		
Maximum power dissipation**	at 50°C		at 70° C.
Lin (A)	0.25W		0.7W
Log (B), Antilog (C)	0.13W		0.30W
Maximum voltage			
Lin (A)	250VDC		
Log (B), Antilog (C)	200VDC		
Operating temperature	-25°C … +70°C (+85°C on request)		-40°C … +90°C (+125°C on request)
Temperature coefficient			
100Ω ≤ Rn ≤ 10KΩ	+200/ -300 ppm	+200/ -500 ppm	±100 ppm
10KΩ < Rn ≤ 5MΩ	+200/ -500 ppm	+200/ -1000 ppm	±100 ppm

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

	CA14 Through-hole	CA14 SMD	CE14 Through-hole and SMD
Resistive element	Carbon technology	Carbon technology	Cermet
Angle of rotation (mechanical)	265° ± 5°		
Angle of rotation (electrical)	245° ± 20°		
Wiper standard delivery position	50% ± 15°		
Max. stop torque	10 Ncm		
Max. push/pull on rotor	50 N		
Wiper torque*	<2.5 Ncm Potentiometers with detents: <3.5 Ncm		
Mechanical life	1.000 cycles (many more available on request, please, inquire)		

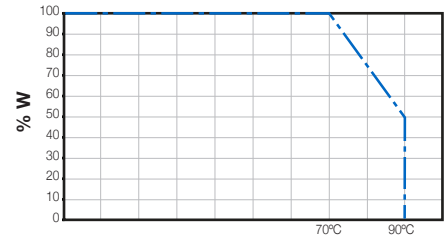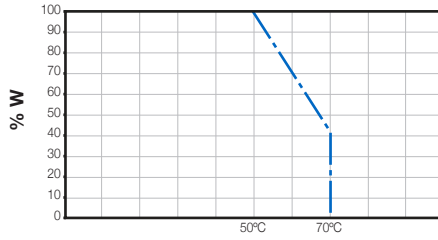* Stronger or softer torque feeling is available on request.

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

	CA14 Through-hole and SMD		CE14 Through-hole and SMD	
	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 85°C, plus 2 h at –25°C	±2.5%	16 h at 90°C, plus 2 h at –40°C	±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%
Soldering effect	2 seconds at 350°C	±1%	2 seconds at 350°C	±1%
Storage (3 years)	3 years at 23°C ± 2°C	±3%	3 years at 23°C ± 2°C	±1%

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Specifications on this catalog are for reference only, as they are subject to change without notice.

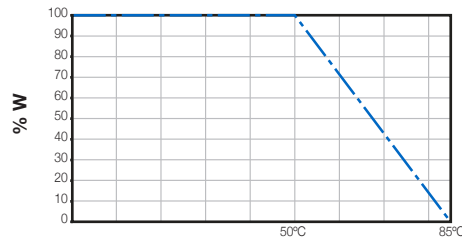| CA14 Through-hole and SMD	CE14 Through-hole and SMD

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:
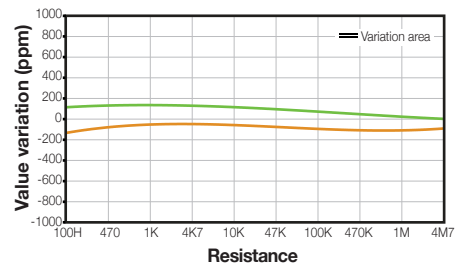
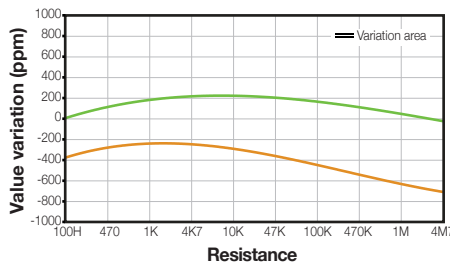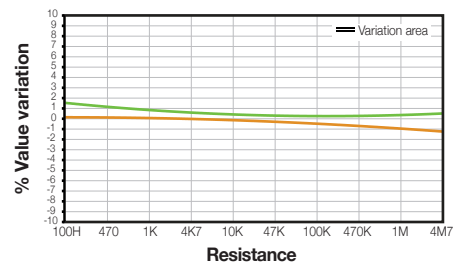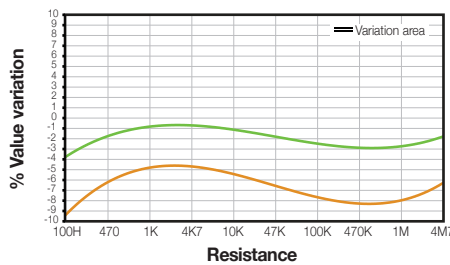| CA14 Through-hole and SMD	CE14 Through-hole and SMD

Damp heat
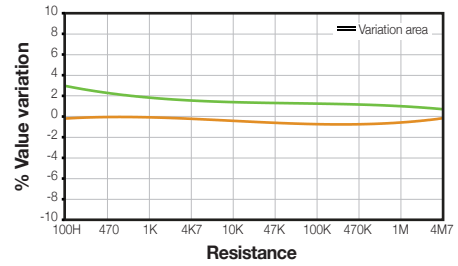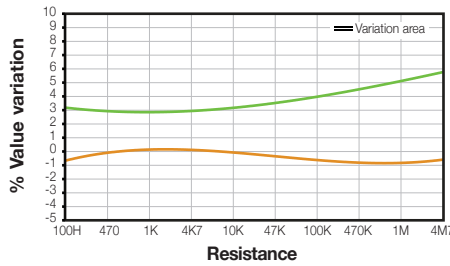
Temperature Coefficient

Load life

Mechanical life