PP12 Series, module-type carbon rotary control potentiometer

CRC12

FEATURES

- End stops
- Insulated actuating device
- Horizontal and vertical versions
- Rigid terminations, suitable for mounting on printed-circuit boards
- Midway detent.

APPLICATIONS

- These potentiometers are for general use in electronic circuits where continuous current and voltage adjustment are required, for example:
  - volume and speed control
  - light dimming.

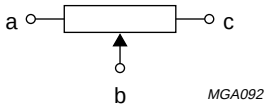

Fig.1 Terminal designation.

DESCRIPTION

The CRC12 carbon control potentiometer is a single type for general purposes. It comprises a carbon track screen printed onto a phenolic paper base, fixed in a plastic housing. The metallic slider is a multi-finger wiper and is mounted on a plastic rotor. The plastic housing is a glass-fibre filled polyamide case.

The potentiometer family can be divided into two groups:

1. Versions without spindle (see Figs 2, 3 and 4) are activated by snap-in devices. See Figs 6 and 7 for dimensions of the snap-in section and Table 2 for the overview of available devices.
2. Versions with integrated spindle; see Figs 10, 11, 12 and 13.

QUICK REFERENCE DATA

PARAMETER	VALUE
Resistance range (E3 series):	
linear law	470 Ω to 4.7 MΩ
logarithmic law	2.2 kΩ to 470 kΩ
reverse logarithmic law	2.2 kΩ to 470 kΩ
Resistance tolerance	±20%
Maximum dissipation (P_{max}) at T_{amb} = 40 °C:	
linear law	0.20 W
logarithmic law	0.10 W
reverse logarithmic law	0.10 W
Climatic category (IEC 68)	25/070/10

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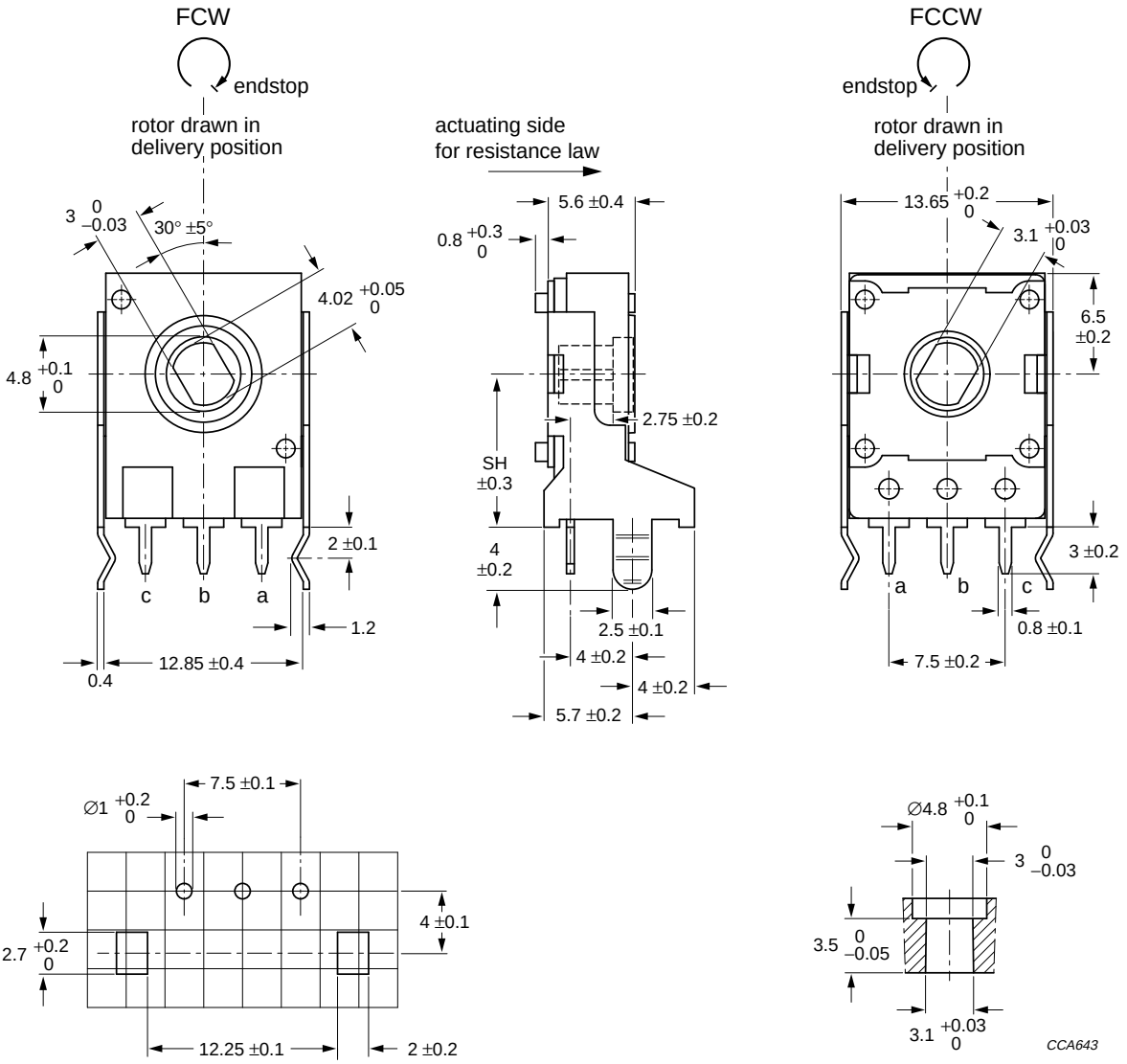
VERSION WITHOUT SPINDLE, SINGLE VERTICAL WITH BRACKET, SHORT TAGS



hole pattern in PCB viewed from component side

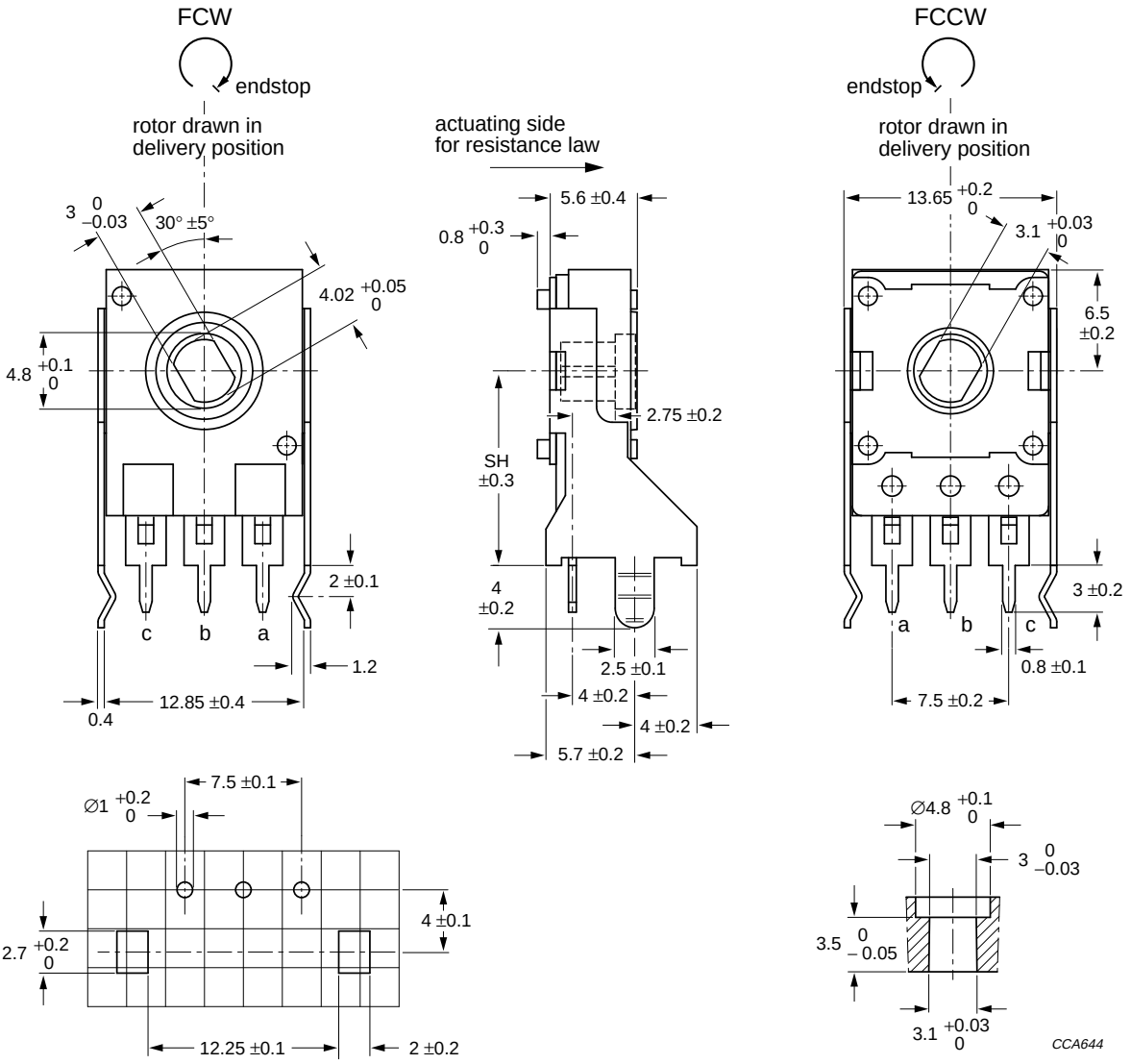
Dimensions in mm.

For dimension SH refer to Chapter “Composition of the catalogue number for potentiometers without spindle”.

Catalogue numbers: **23XX 505 000..** and **23XX 505 005..**

Fig.2 Version without spindle, single vertical with bracket, short tags.

VERSION WITHOUT SPINDLE, SINGLE VERTICAL WITH BRACKET, LONG TAGS



hole pattern in PCB viewed from component side

Dimensions in mm.

For dimension SH refer to Chapter “Composition of the catalogue number for potentiometers without spindle”.

Catalogue numbers: **23XX 505 001..** and **23XX 505 006..**

Fig.3 Version without spindle, single vertical with bracket, long tags.

PP12 Series, module-type carbon rotary control potentiometer

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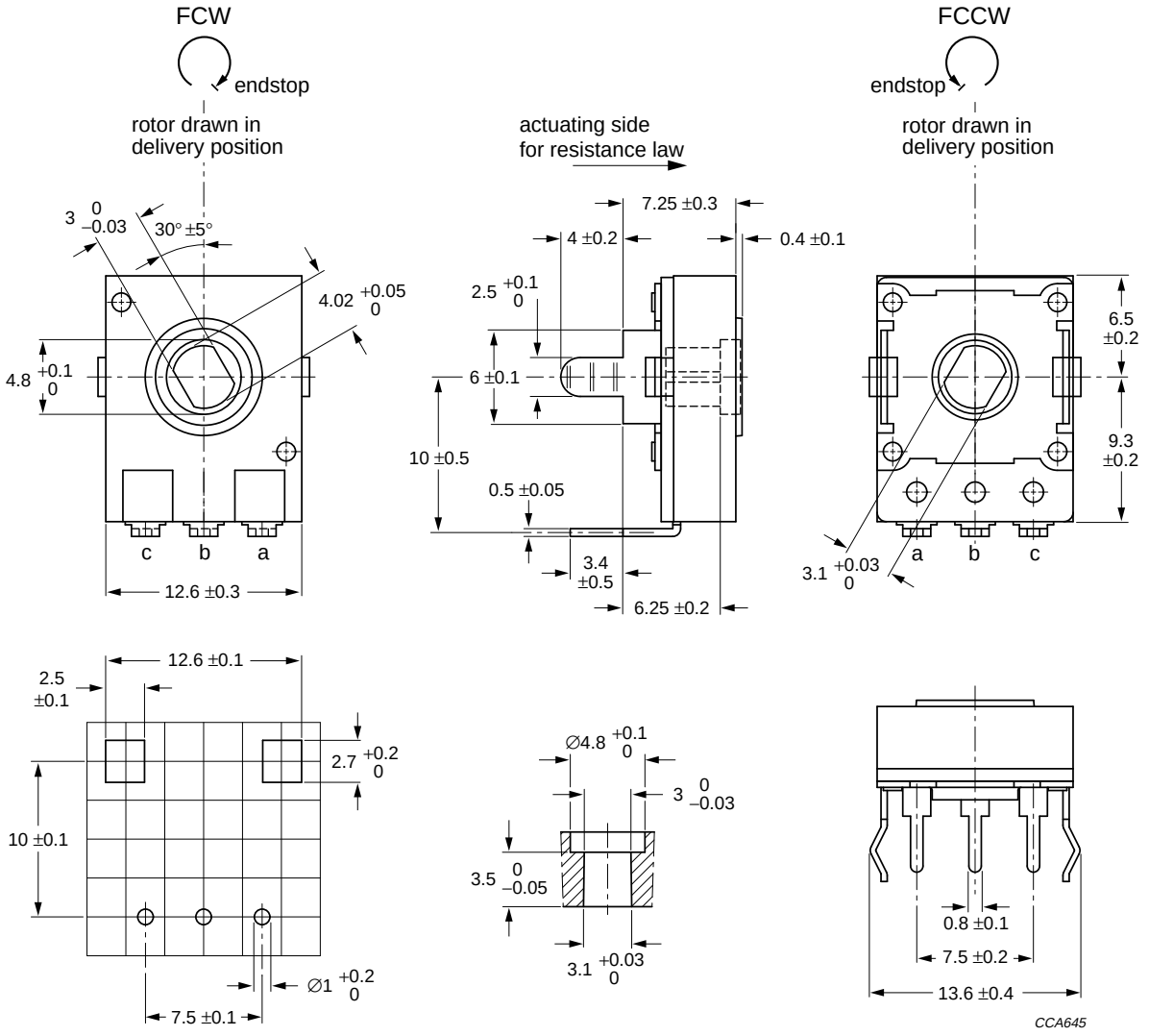
VERSION WITHOUT SPINDLE, SINGLE HORIZONTAL WITH BRACKET



hole pattern in PCB viewed from component side

Dimensions in mm.

Catalogue numbers: **23XX 505 003..** and **23XX 505 008..**

Fig.4 Version without spindle, single horizontal with bracket.

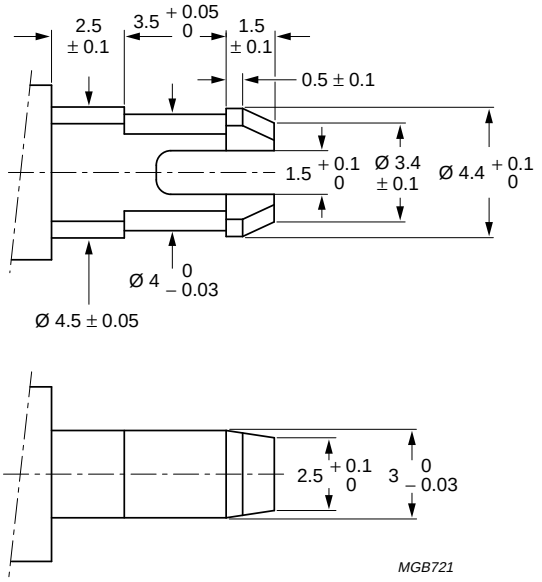
COMPOSITION OF THE CATALOGUE NUMBER FOR POTENTIOMETERS WITHOUT SPINDLE

CATALOGUE NUMBER 23XX 505 XXXXX				
3rd AND 4th DIGITS	**LAST 5 DIGITS**			
XX	**X**	**X**	**X**	**XX**
06 or 15, depending on manufacturing location	0 = without switch	0 = single module with bracket without spindle	code for tags and detent: 0 = vertical version, PCB tags, SH = 10 mm, no detent 1 = vertical version, PCB tags, SH = 12.5 mm, no detent 3 = horizontal version, PCB tags, no detent 5 = vertical version, PCB tags, SH = 10 mm, midway detent 6 = vertical version, PCB tags, SH = 12.5 mm, midway detent 8 = horizontal version, PCB tags, midway detent	resistance code (see Table 1)

Table 1 Resistance value and law

VALUE	UNIT	LAW		
		LINEAR	LOGARITHMIC	REVERSE LOGARITHMIC
470	Ω	03	–	–
1	kΩ	04	–	–
2.2	kΩ	05	25	45
4.7	kΩ	06	26	46
10	kΩ	07	27	47
22	kΩ	08	28	48
47	kΩ	09	29	49
100	kΩ	11	31	51
220	kΩ	12	32	52
470	kΩ	13	33	53
1	MΩ	14	–	–
2.2	MΩ	15	–	–
4.7	MΩ	16	–	–

ACTUATING DEVICE FOR POTENTIOMETERS WITHOUT SPINDLE



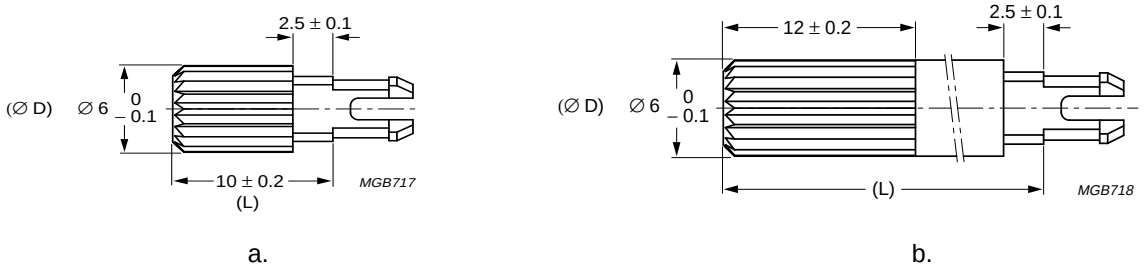
Dimensions in mm.

Fig.5 Dimensions for snap-in section of actuating device.

Table 2 Snap-in device 12NC; for dimensions see Figs 6 and 7

CATALOGUE NUMBER OF ACTUATING DEVICE 4322 046	DIMENSIONS (mm)	COLOUR	FIGURE
Knurled shaft			
20082	∅D × L = 6 × 10	black	6a
20092	∅D × L = 6 × 20	black	6b
20102	∅D × L = 6 × 30	black	6b
20112	∅D × L = 6 × 60	black	6b
Thumbwheel			
20122	∅D = 25.00	black	7a
20132	∅D = 30.75	black	7b
20142	∅D = 25.00	grey	7a
20152	∅D = 30.75	grey	7b
20162	∅D = 25.00	beige	7a
20172	∅D = 30.75	beige	7b

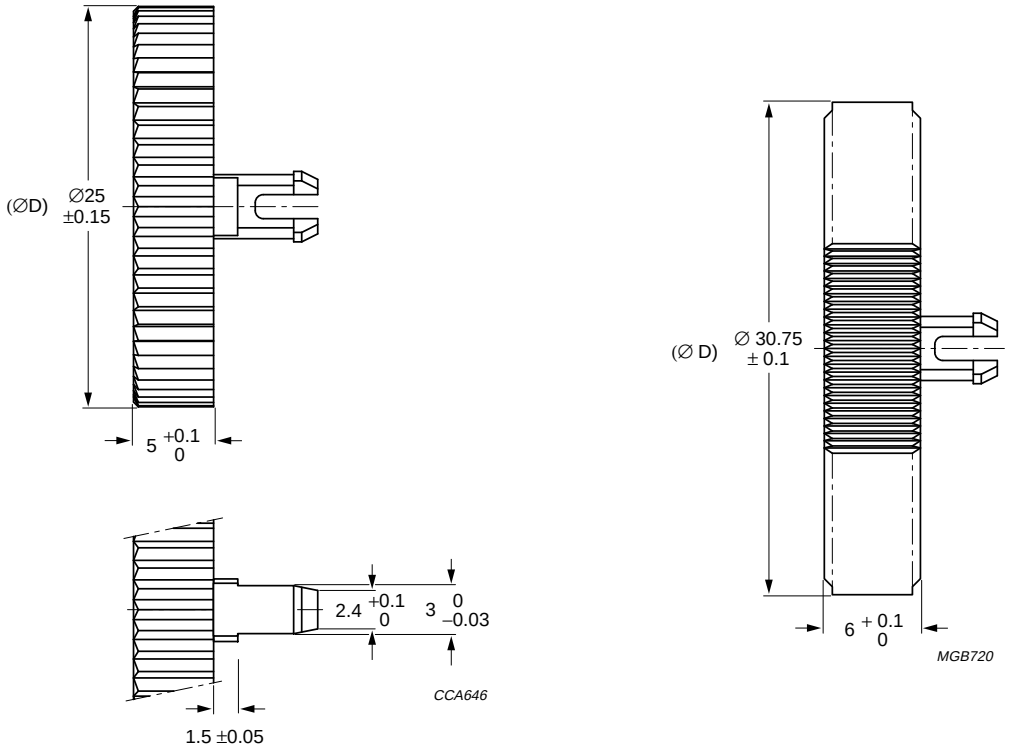
Outline details



a. b.

Dimensions in mm.

Fig.6 Small diameter plastic actuating devices.



a. b.

Dimensions in mm.

Fig.7 Thumbwheel actuating devices.

Table 3 Possible mounting side of the device; for dimensions see Figs 6 and 7

CATALOGUE NUMBER OF ACTUATING DEVICE 4322 046	DIMENSIONS (mm)	VERTICAL MODULES 23XX 505 001.. and 23XX 505 006..		HORIZONTAL MODULES 23XX 505 003.. and 23XX 505 008..	
		SIDE A; Fig.8	**SIDE B;** Fig.8	**SIDE A;** Fig.9	**SIDE B;** Fig.9
Knurled shaft					
20082	∅D × L = 6 × 10	yes	yes	yes; note 1	yes
20092	∅D × L = 6 × 20	yes	yes	yes; note 1	yes
20102	∅D × L = 6 × 30	yes	yes	yes; note 1	yes
20112	∅D × L = 6 × 60	yes	yes	yes; note 1	yes
Thumbwheel					
20122	∅D = 25.00	no	no	no	yes
20132	∅D = 30.75	no	no	no	yes
20142	∅D = 25.00	no	no	no	yes
20152	∅D = 30.75	no	no	no	yes
20162	∅D = 25.00	no	no	no	yes
20172	∅D = 30.75	no	no	no	yes

Note

1. If actuating can be performed through the printed-circuit board.

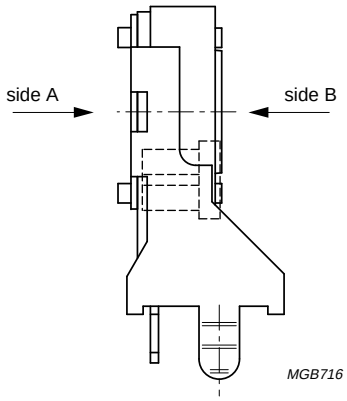


Fig.8 Actuating sides of the vertical module.

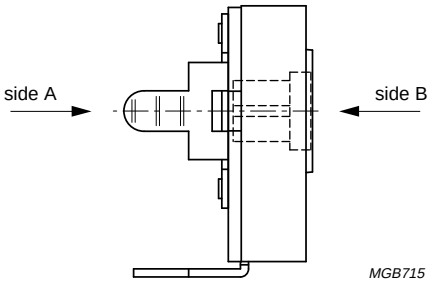
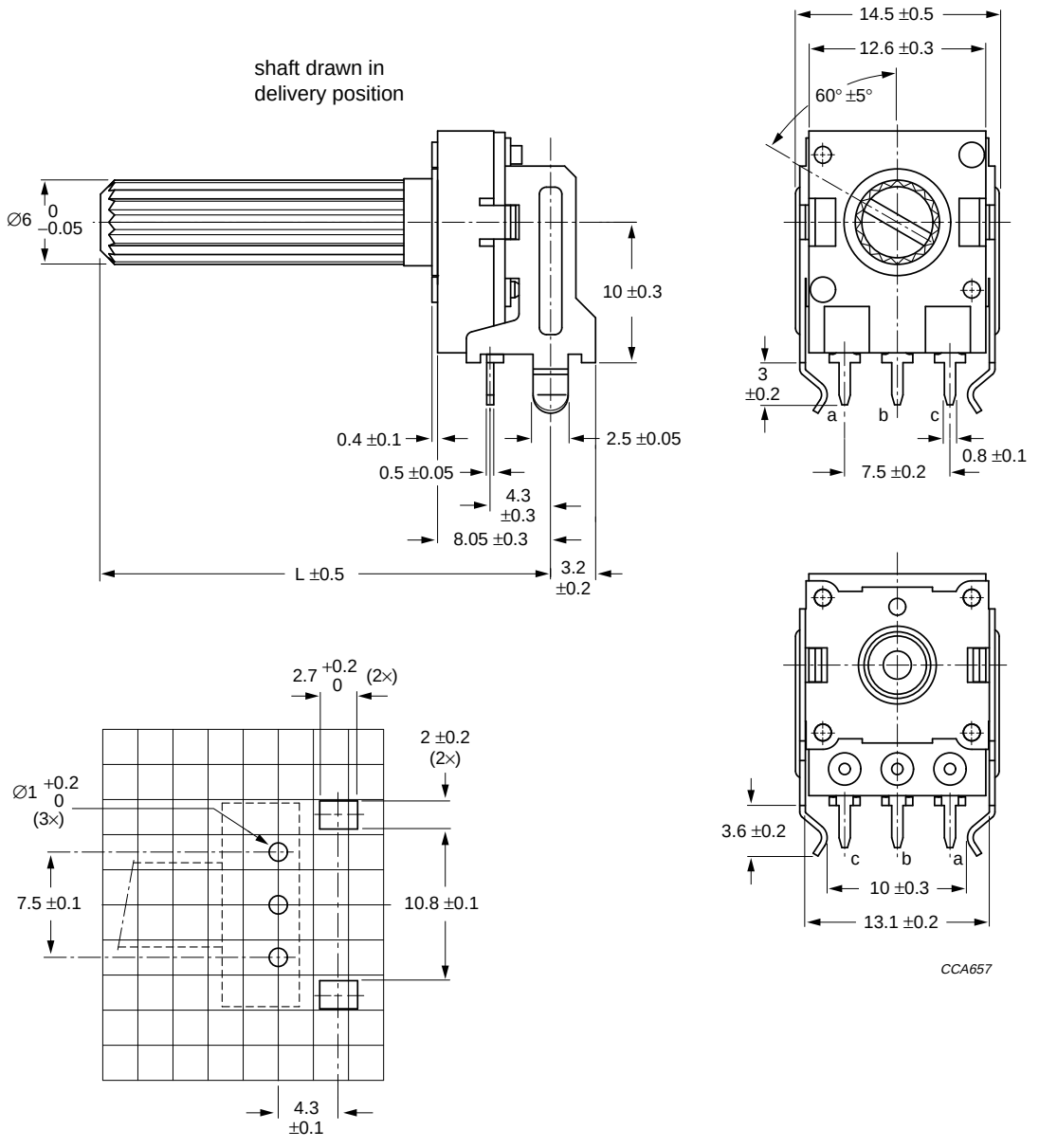


Fig.9 Actuating sides of the horizontal module.

VERSION WITH KNURLED SPINDLE, SINGLE VERTICAL

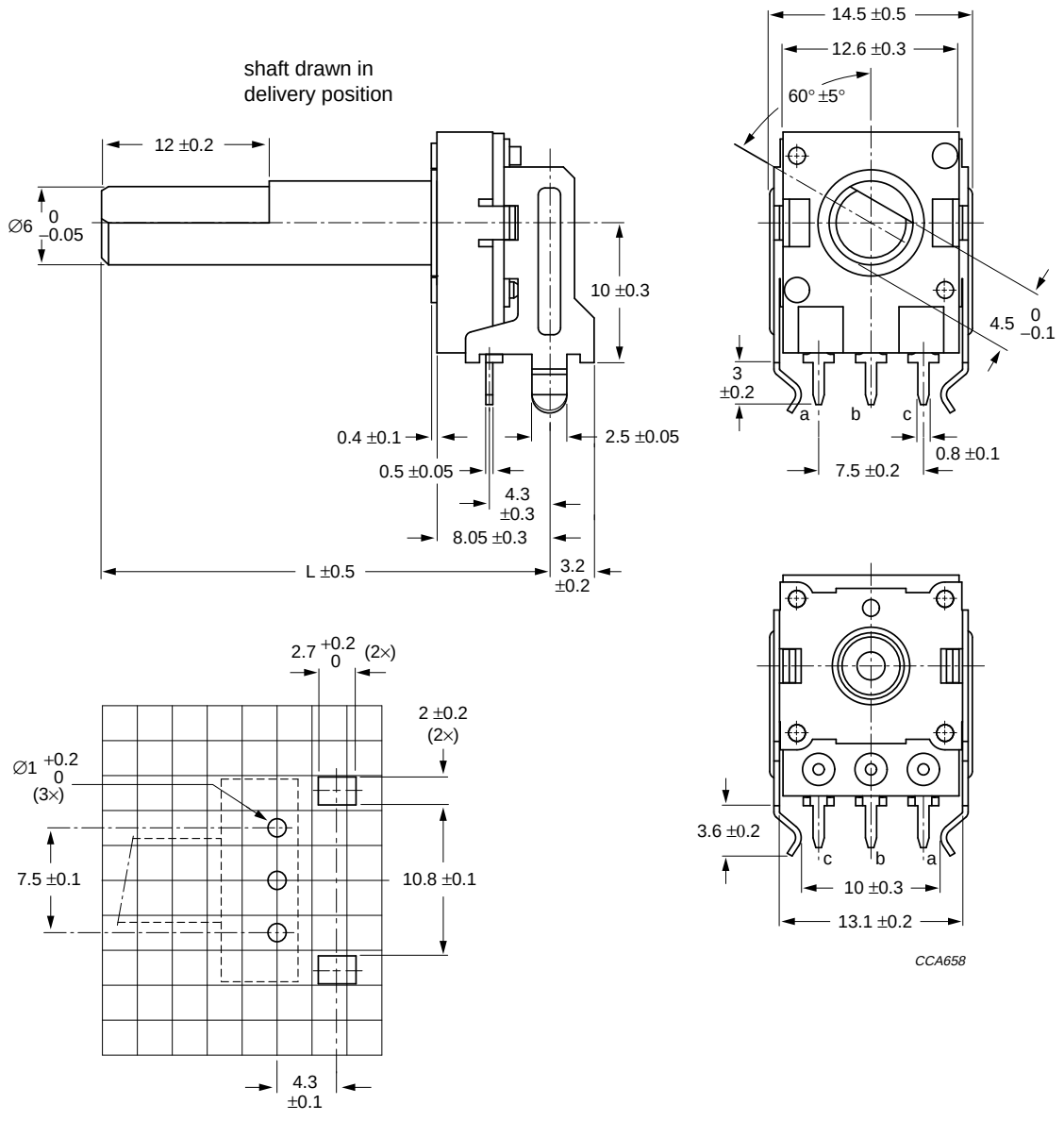


hole pattern in PCB viewed from component side

Dimensions in mm.
Catalogue numbers: **2306 505 0X0..** and **2306 505 0X5..**
where: **X = 1 to 4**

Fig.10 Version with knurled spindle, single vertical.

VERSION WITH FLAT SECTION SPINDLE, SINGLE VERTICAL

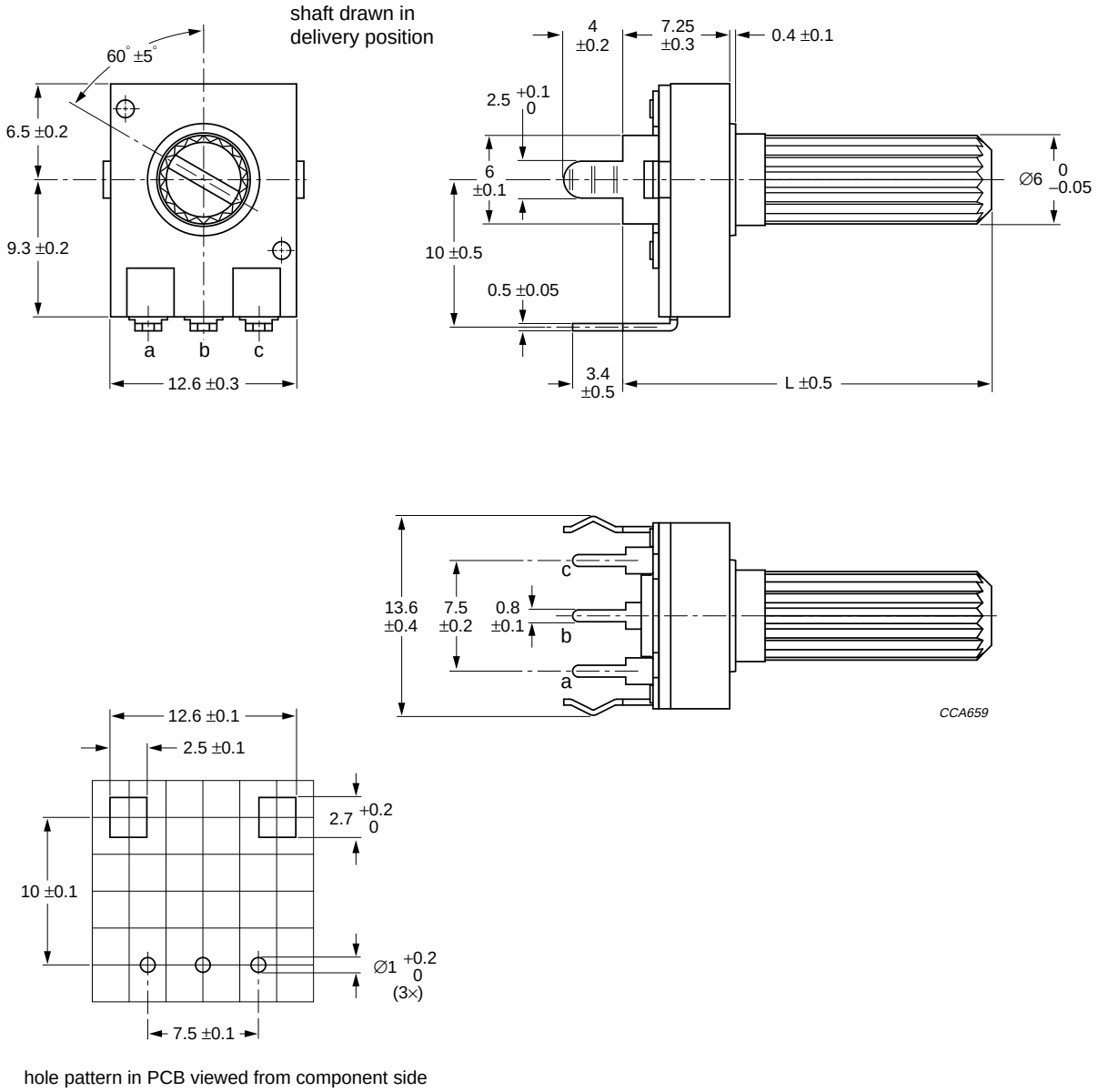


hole pattern in PCB viewed from component side

Dimensions in mm.
Catalogue numbers: **2306 505 0X0..** and **2306 505 0X5..**
where: **X = 6 to 9**

Fig.11 Version with flat section spindle, single vertical.

VERSION WITH KNURLED SPINDLE, SINGLE HORIZONTAL

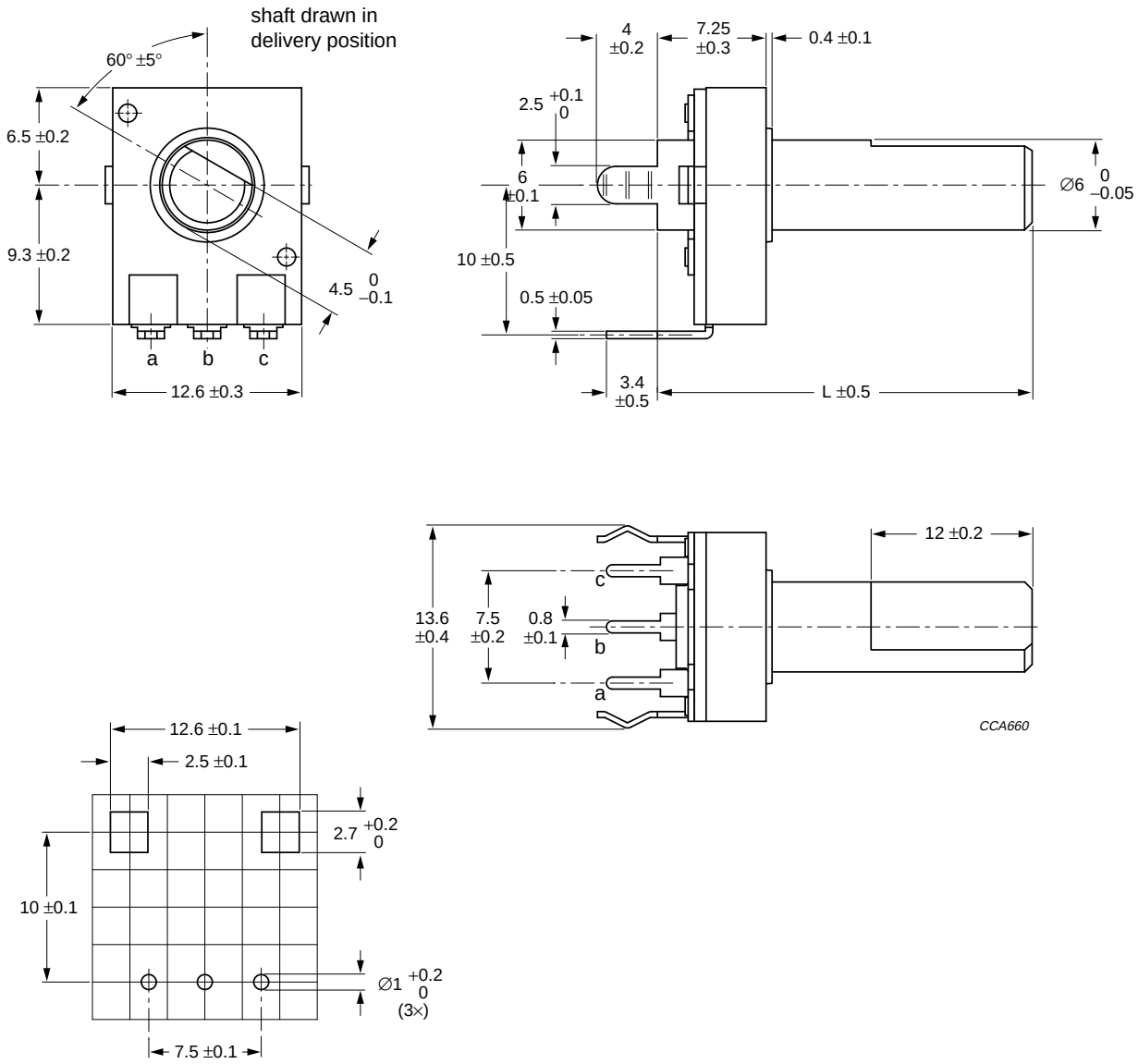


hole pattern in PCB viewed from component side

Dimensions in mm.
Catalogue numbers: **2306 505 0X3..** and **2306 505 0X8..**
where: **X = 1 to 4**

Fig.12 Version with knurled spindle, single horizontal.

VERSION WITH FLAT SECTION SPINDLE, SINGLE HORIZONTAL



hole pattern in PCB viewed from component side

Dimensions in mm.
Catalogue numbers: **2306 505 0X3..** and **2306 505 0X8..**
where: **X = 6 to 9**

Fig.13 Version with flat section spindle, single horizontal.

COMPOSITION OF THE CATALOGUE NUMBER FOR POTENTIOMETERS WITH SPINDLE

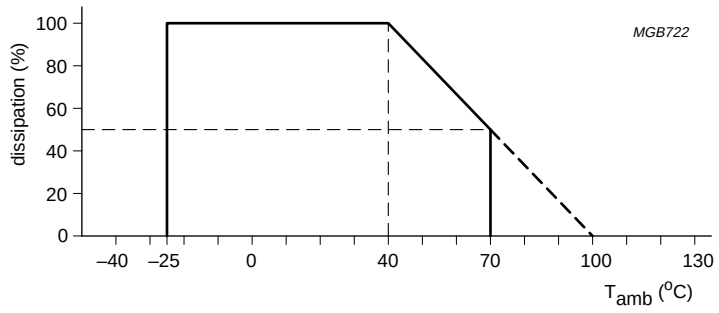
LAST 5 DIGITS OF CATALOGUE NUMBER 2306 505 XXXXX			
X	**X**	**X**	**XX**
0 = without switch	1 = single version; plastic spindle; L = 15 mm; knurled 2 = single version; plastic spindle; L = 20 mm; knurled 3 = single version; plastic spindle; L = 30 mm; knurled 4 = single version; plastic spindle; L = 40 mm; knurled 6 = single version; plastic spindle; L = 20 mm; flat 7 = single version; plastic spindle; L = 25 mm; flat 8 = single version; plastic spindle; L = 30 mm; flat 9 = single version; plastic spindle; L = 40 mm; flat	code for tags and detent: 0 = vertical version, PCB tags, SH = 10 mm, no detent 3 = horizontal version, PCB tags, no detent 5 = vertical version, PCB tags, SH = 10 mm, midway detent 8 = horizontal version, PCB tags, midway detent	resistance code (see Table 1)

ELECTRICAL RATINGS AND CHARACTERISTICS

Table 4 Initial and end residual resistance

LAW	RESISTANCE VALUE	INITIAL VALUE	RESIDUAL VALUE
Linear Logarithmic Reversed logarithmic	<2.2 kΩ	≤5 Ω	≤5 Ω
	≥2.2 kΩ < 22 kΩ		≤8 Ω
	≥22 kΩ < 100 kΩ		≤25 Ω
	≥100 kΩ < 220 kΩ	≤10 Ω	≤25 Ω
	≥220 kΩ < 1 MΩ		≤75 Ω

Derating



Dissipation in % of the dissipation at T_{amb} = 70 °C.

Fig.14 Maximum permissible dissipation as a function of ambient temperature.

Additional electrical data

PARAMETER	VALUE	UNIT
Isolation test voltage at 60 Hz for 1 minute	500	V
Insulation resistance (IEC 68; test C; 10 days):		
initially	>100	MΩ
after damp heat test	>100	MΩ
Contact resistance moving (CRM):		
linear law	≤4	% R_{ac}
logarithmic law	≤6	% R_{ac}
Contact resistance variation (CRV) in accordance with *"IEC 393-1 subclause 4.17"*:		
linear law	≤1	%
logarithmic law	≤2	%
Maximum attenuation:		
$R_{ac} \geq 22$ kΩ, all types	≥90	dB
$R_{ac} < 22$ kΩ, linear types	≥55	dB
$R_{ac} < 22$ kΩ, logarithmic and reverse logarithmic types	≥75	dB
Operating temperature range	–25 to +70	°C
Storage temperature range	–40 to +85	°C

Characteristic graphs

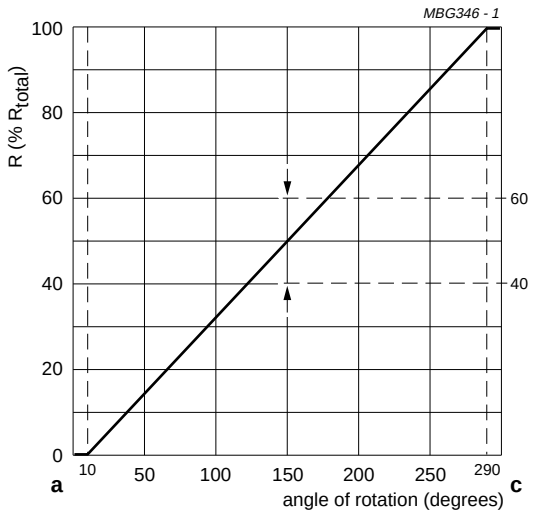


Fig.15 Linear law.

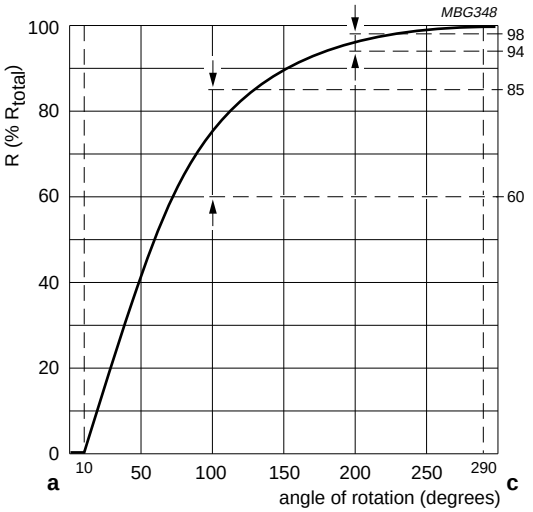


Fig.16 Logarithmic law.

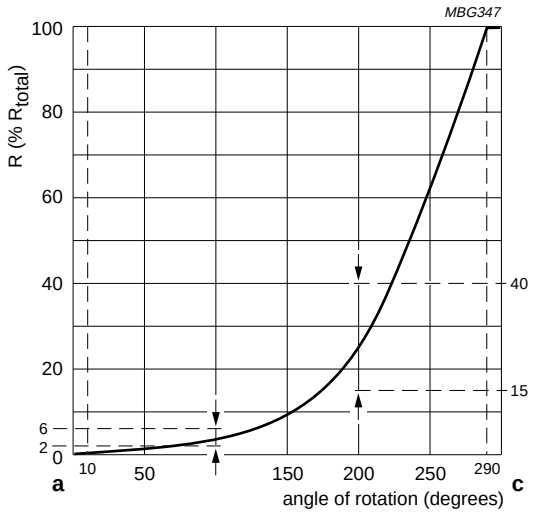


Fig.17 Reversed logarithmic law.

Limiting conditions

Table 5 The limiting conditions for slider current at a temperature of 40 and 70 °C

RESISTANCE NOMINAL VALUE	UNIT	RESISTANCE LAW	RATED ELEMENT DC VOLTAGE (V)		LIMITING SLIDER CURRENT (mA)	
			at 40 °C	at 70 °C	at 40 °C	at 70 °C
470	Ω	linear	9	6	20	14
1	kΩ		14	10	14	10
2.2	kΩ		21	14	9.5	6.7
4.7	kΩ		30	21	6.5	4.6
10	kΩ		44	31	4.5	3.2
22	kΩ		66	47	3.0	2.1
47	kΩ		97	68	2.0	1.5
100	kΩ		141	100	1.4	1.0
220	kΩ		210	148	1.0	0.7
470	kΩ		306	216	0.7	0.5
1	MΩ		447	316	0.4	0.3
2.2	MΩ		500	485	0.3	0.2
4.7	MΩ		500	500	0.2	0.15
2.2	kΩ	logarithmic/ reverse logarithmic	14	10	6.5	4.6
4.7	kΩ		21	15	4.6	3.3
10	kΩ		31	22	3.2	2.2
22	kΩ		47	33	2.1	1.5
47	kΩ		68	48	1.5	1.0
100	kΩ		100	70	1.0	0.7
220	kΩ		148	104	0.7	0.5
470	kΩ		216	153	0.5	0.3

MECHANICAL RATINGS AND CHARACTERISTICS

Table 6 Mechanical data

PARAMETER	VALUE	UNIT
Maximum axial force	60	N
Operating torque initial ratio (max./min.)	3 to 10 <2.5	mNm
Maximum permissible end-stop torque	400	mNm
Angle of rotation; see Fig.18	300 ±5	deg
Effective angle of rotation; see Fig.18	280 ±10	deg
Axial rotor/spindle play	≤0.2	mm
Maximum detent torque (peak)	≥1.5 × operating torque	mNm
Detent angle	10 ±2	deg

Rotation

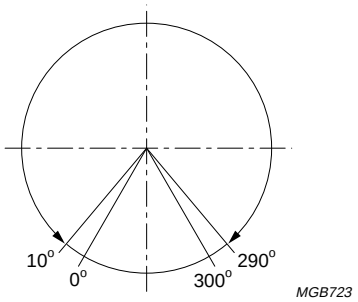


Fig.18 Angle of rotation.

Application remarks

The product is not suitable for wash-process by immersion.

The product should not be used in high humidity environments with continuous DC load between the resistor element and the metallic base parts.

POSITION OF ROTOR/SHAFT ON DELIVERY

The potentiometers are delivered with the rotor or spindle in the FCCW position, unless otherwise shown in Figs 2, 3 and 4.

TEST AND REQUIREMENTS

In these tables the tests can either be:
D = Destructive
ND = Non-destructive.

TEST/CONDITIONS OF TEST	D OR ND	PROCEDURE	PERFORMANCE
Sub-group B1	D		
Solderability: solder bath method in accordance with *"IEC 68-2-20"*, Test Ta, method 1: Temperature: 235 °C ±5 °C Immersion time: 2 ±0.5 s		visual examination	good tinning, shown by free flowing of the solder with wetting of the terminations
Sub-group C1	D		
Robustness of terminations: Test Ua: 20 N		visual examination element resistance	no damage $\Delta R_{ac}/R_{ac}$: ≤1%
Sub-group C3	D		
Mechanical endurance: Number of cycles: 10000 Rate: 10 to 17 cycles per minute		visual examination element resistance detent torque residual resistance from **a** to **b** and **b** to **c** contact resistance moving continuity	no damage $\Delta R_{ac}/R_{ac}$: ≤10% see Table 6 see Table 4 $\Delta R/R$: ≤4% (linear > 1 kΩ); $\Delta R/R$: ≤8% (others) smooth, unidirectional
Sub-group C4	D		
Electrical endurance at 70 °C: Duration: 1000 hours		visual examination element resistance insulation resistance detent torque continuity	no visual damage $\Delta R_{ac}/R_{ac}$: ≤10% ≥1 GΩ see Table 6 smooth, unidirectional
Sub-group D1	D		
Damp heat, steady state		visual examination element resistance insulation resistance detent torque continuity voltage proof	no visible damage $\Delta R_{ac}/R_{ac}$: ≤15% ≥50 MΩ see Table 6 smooth, unidirectional no flash-over
Sub-group D3	ND		
End-stop torque: 400 mNm		visual examination	no damage
Thrust and pull on the spindle: force: 25 N force: 50 N		 continuity visual examination detent torque	 smooth, unidirectional no damage see Table 6

TEST/CONDITIONS OF TEST	D OR ND	PROCEDURE	PERFORMANCE
Sub-group D4	D		
Resistance to soldering heat in accordance with *"IEC 68-2-20"*, Test Tb, method 1B: solder bath method		element resistance residual resistance from **a** to **b** and **b** to **c**	$\Delta R_{ac}/R_{ac}$: ≤2% see Table 4
Change of temperature –25 to +70 °C; 5 cycles		visual examination element resistance output voltage drift	no damage $\Delta R_{ac}/R_{ac}$: ≤3% $\Delta V_b/V_b$: ≤1%
Bump in accordance with *"IEC 68-2-29"*: Acceleration: 390 m/s^2; 4000 bumps		visual examination element resistance output voltage drift	no damage $\Delta R_{ac}/R_{ac}$: ≤2% $\Delta V_b/V_b$: ≤1%
Vibration in accordance with *"IEC 68-2-6"*: Frequency range: 10 to 55 Hz Amplitude: 0.75 mm or 98 m/s^2 whichever is less severe Sweep endurance: total duration 6 hours		visual examination element resistance output voltage drift	no damage $\Delta R_{ac}/R_{ac}$: ≤2% $\Delta V_b/V_b$: ≤1%
Sub-group D5	D		
Climatic sequence: dry heat damp heat, cyclic, first cycle; cold damp heat, cyclic, one cycle		 visual examination operating torque visual examination element resistance insulation resistance continuity voltage proof	 no damage ≤20 mNm no damage $\Delta R_{ac}/R_{ac}$: ≤10% ≥50 MΩ smooth, unidirectional no flash-over

ORDERING

Minimum and multiple ordering quantities to be agreed with logistics.

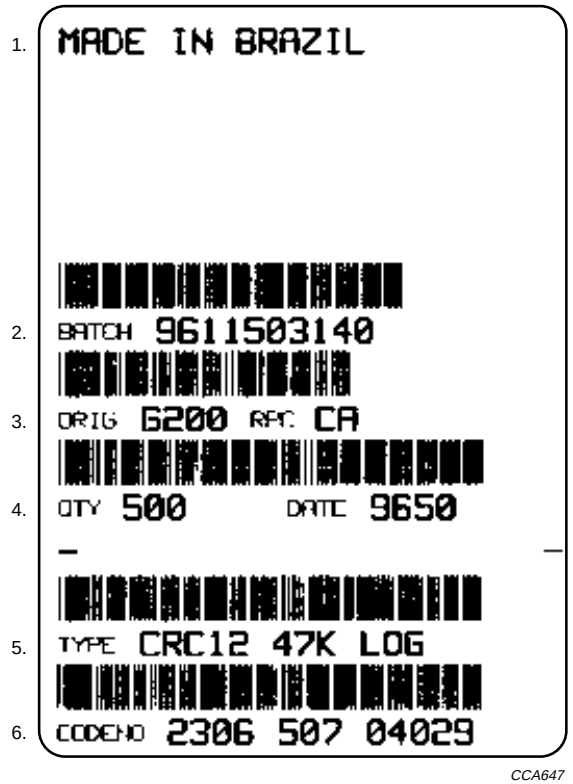
MARKING

The potentiometer is marked as follows:

- Rated resistance value (e.g. 100 K)
- Designation of resistance law (‘A’ for LINEAR law, ‘B’ for LOGARITHMIC law or ‘C’ for REVERSE LOGARITHMIC law)
- Production period (year and week code), for example: year 1996 = 96, week 50 = 50.

PACKAGING

Packaged in cardboard boxes with partitioning; 500 or 1000 units/box depending on the product size.



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LINE	MARKING EXPLANATION
1.	Country of origin
2.	Batch number
3.	Preference origin code and product centre
4.	Quantity per standard packing and production period
5.	Product description
6.	Catalogue number (12NC)

Fig.19 Packaging label (example).