INTERNATIONAL STANDARD

IEC 60393-6-1

First edition
2003-05

Potentiometers for use in electronic equipment –

Part 6-1: Blank detail specification: Surface mount preset potentiometers – Assessment level E

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POTENTIOMETERS FOR USE IN ELECTRONIC EQUIPMENT –

Part 6-1: Blank detail specification: Surface mount preset potentiometers – Assessment level E

FOREWORD

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International Standard IEC 60393-6-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/1289/FDIS	40/1325/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Blank Detail Specification is to be used in conjunction with IEC 60393-1:1989 and IEC 60393-6:2003.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

POTENTIOMETERS FOR USE IN ELECTRONIC EQUIPMENT

Part 6-1: Blank detail specification: Surface mount preset potentiometers – Assessment level E

INTRODUCTION

Blank Detail Specification

A Blank Detail Specification is a supplementary document to the Sectional Specification and contains requirements for style, layout and minimum content of Detail Specifications. Detail Specifications not complying with these requirements are not to be considered as being in accordance with IEC Specifications nor are they to be so described.

In the preparation of Detail Specifications, the content of 1.4 of IEC 60393-6 is to be taken into account.

The numbers between square brackets on the first page correspond to the following information which is to be inserted in the position indicated.

Identification of the Detail Specification

[1] The “International Electrotechnical Commission” or the National Standard Organization under whose authority the Detail Specification is drafted.

[2] The IEC or National Standards number of the Detail Specification, date of issue and any further information required by the national system.

[3] The number and issue number of the IEC or national Generic Specification.

[4] The IEC number of the Blank Detail Specification.

Identification of the potentiometer

[5] A short description of the type of potentiometer.

[6] Information on typical construction (if applicable) for example: non-wirewound, lead-screw actuated.

[7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an annex to the Detail Specification.

[8] Application or group of applications covered and/or assessment level.

[9] Reference data on the most important properties, to allow comparison between the various potentiometer types.

[1]	IEC 60393-6-1-XXX [2] QC 410501XXXXXX
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH : [3]	IEC 60393-6-1 [4] QC 410501
	SURFACE MOUNT [5] PRESET POTENTIOMETERS
Outline drawing and dimensions: (··· angle projection) [7] (When necessary the dimensions may be given in annex to the Detail Specification)	Typical construction: [6]
Terminal connections:	Assessment level: E [8]
For [1] to [9], see the Introduction.	

Information on the availability of components qualified to this Detail Specification is given in the register of approvals.

[9]

Table 1 – Important properties

Style	Rated dissipation at 70 °C W	Limiting element voltage (DC or AC r.m.s.) V	Insulation voltage (DC or AC peak) V	
			Normal air pressure	Low air pressure

1 General data

1.1 Recommended method(s) of mounting (to be inserted)

(See 1.4.2 of IEC 60393-6).

1.2 Dimensions

(When necessary, the dimensions may be given in an annex to the Detail Specification).

All dimensions are in millimetres.

1.3 Ratings and characteristics

Resistance range[1]	... Ω to ... Ω
Tolerances on rated resistance	± ... %
Resistance law (if other than linear)	...
Temperature characteristic of resistance (20 °C to 70 °C)	$\Delta R/R \leq$ ... %
Temperature coefficient	$\alpha \leq$... 10^{-6}/K
Climatic category	-/-/-
Low air pressure	8 kPa
Limits of resistance change (after 500 h or 1 000 h electrical endurance test)	±(... *% R* + ... Ω)
Starting torque	... mN.m to ... mN.m
Total mechanical travel	... ± ... turns or ... °
Limiting moving contact current	... mA

1.3.1 Derating

Potentiometers covered by this Specification are derated according to the following curve:

(A suitable curve to be included
in the Detail Specification)

NOTE See also 2.2.3 of IEC 60393-6.

1.4 Normative references

Generic Specification: IEC 60393-1:1989, *Potentiometers for use in electronic equipment – Part 1: Generic specification*

Amendment 1 (1992)

Sectional Specification: IEC 60393-6:2003*, Potentiometers for use in electronic equipment – Part 6: Sectional specification: Surface mount preset potentiometers*

1.5 Marking

The marking of the component and package shall be in accordance with the requirements of 1.4.6 of IEC 60393-6.

The details of the marking of the component and package shall be given in full in the Detail Specification.

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[1] The preferred values are those of the E-series of IEC 60063 and/or the 1, 2, 5 series.

1.6 Ordering information

Orders for potentiometers covered by this Specification shall contain, in clear or in coded form, the following minimum information:

a) rated resistance and tolerance on rated resistance;

b) resistance law (if other than linear);

c) number and issue reference of the Detail Specification and style;

d) packaging instructions.

1.7 Certified records of released lots

Required/not required.

1.8 **Additional information** (not for inspection purposes)

(The Detail Specification may include information such as circuit diagrams, curves, drawings and notes needed for clarification of the Detail Specification).

1.9 Additional or increased severities or requirements to those specified in the Generic and/or Sectional Specification

NOTE Additions or increased requirements should be specified only when essential.

2 Inspection requirements

2.1 Procedures

2.1.1 For qualification approval, the procedures shall be in accordance with 3.2 of IEC 60393-6.

2.1.2 For quality conformance inspection, the test schedule (Table 2) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.3.1 of IEC 60393-6.

For the quality conformance inspection, the values representative of the whole approved range shall be tested within one year (Groups A, B and C only).

When drying is called for, Procedure I of 4.3 of IEC 60393-1 shall be used.

Table 2 – Test schedule for quality conformance inspection: lot-by-lot

Subclause number and test of IEC 60393-1 (see NOTE 1)	**D or ND**	**Conditions of test** (see NOTE 1)	**IL** (see NOTE 2)	**AQL** (see NOTE 2)	**Performance requirements** (see NOTE 1)
GROUP A INSPECTION (lot-by-lot)					
Subgroup A1	ND		II	4,0 %	
4.4.1 Visual examination					As in 4.4.1 of IEC 60393-1 As specified in 1.5 of this Specification
Subgroup A2	ND		II	1,0 %	
4.6 Element resistance					As in 4.6.3 of IEC 60393-1
Subgroup A3	ND		S-2	4,0 %	
4.4.2 Dimensions (gauging)					As specified in the Detail Specification
Subgroup A4	ND		S-3	1,0 %	
4.7 Terminal resistance		Resistance between a and b Resistance between b and c			$R \leq \ldots\ \Omega$ $R \leq \ldots\ \Omega$
4.5 Continuity					As in 4.5.2 of IEC 60393-1
4.15 Rotational noise		Method B:			$\leq \ldots\ \%\ R$ or $\ldots\ \Omega$ (whichever is the greater)
4.12 Voltage proof (insulated potentiometers only)		Method: Insulation resistance (normal air pressure)			As in 4.12.5 $\geq 100\ M\Omega$
GROUP B INSPECTION (lot-by-lot)					
Subgroup B1	D		S-2	1,5 %	
4.18 Starting torque					As specified in the Detail Specification
4.31 Sealing (if applicable)		Temperature: 85 °C to 90 °C			As in 4.31.3 of IEC 60393-1

Subclause number and test of IEC 60393-1 (see NOTE 1)	**D or ND**	**Conditions of test** (see NOTE 1)	**IL** (see NOTE 2)	**AQL**	**Performance requirements** (see NOTE 1)
Subgroup B2	ND		S-2	1,5 %	
2.1.3.4 of IEC 60393-6 Solderability		Aging (if applicable) Solder bath method Temperature: 235 °C ± 5 °C Duration: 2 s ± 0,5 s			As in 2.1.3.4 of IEC 60393-6
4.45 Solvent resistance of the marking (if applicable)		Solvent: Solvent temperature: ... Method 1 Rubbing material: cotton wool Recovery: ...			Legible marking

NOTE 1 Subclause numbers of tests and performance requirements refer to IEC 60393-1, except for some severities for environmental tests and limits of change in resistance or output ratio, which have to be taken from the relevant clauses of IEC 60393-6.

NOTE 2 Inspection levels and AQL´s are selected from IEC 60410.

NOTE 3 In this Table: D = destructive
ND = non-destructive
IL = inspection level
AQL = acceptable quality level } See IEC 60410

Table 3 – Test schedule for quality conformance inspection

Subclause number and test of IEC 60393-1 (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size & criterion of acceptability (see NOTE 2)			Performance requirements (see NOTE 1)
			p	*n*	*c*	
GROUP C INSPECTION (periodic)						
Subgroup C1	ND		3	8	1	
4.14 Temperature characteristic of resistance		Lower category temperature/20 °C				$\frac{\Delta R}{R} \leq \ldots$ %
		20 °C/70 °C				$\frac{\Delta R}{R} \leq \ldots$ %
		20 °C/Upper category temperature				$\frac{\Delta R}{R} \leq \ldots$ %
4.20 End stop torque		- For types fitted with end stops:				
		As specified in 4.20.1 of IEC 60393-1 Not less than five times the upper limit of the starting torque (unless otherwise stated by the Detail Specification)				As in 4.20.1 of IEC 60393-1
		- For types fitted with slipping clutches: As specified in 4.20.2 of IEC 60393-1				As in 4.20.2 of IEC 60393-1
4.22 Thrust and pull on spindle		Only the thrust shall be applied. The pull is not applicable				
		- **Half of the specimens:**				
		As specified in 4.22.2 of IEC 60393-1				As in 4.22.2 of IEC 60393-1
		Continuity				
		- **Remaining specimens**				
		As specified in 4.22.3 of IEC 60393-1				$\Delta \frac{U_{ab}}{U_{ac}} \leq \ldots$ %
		Output voltage ratio				
4.4.4 Total mechanical travel		- Lead-screw styles: Effective operating turns:				≥ 70 % of total mechanical travel
		- Rotary styles:				As specified in Detail Specification
4.4.6 Effective electrical travel		- Lead-screw styles:				≥ 70 % of the measured total mechanical travel
		- Rotary styles: ...				As specified in Detail Specification
Subgroup C2A	D		3	7		
Part of the sample of Subgroup C2						
1.4.2 of IEC 60393-6 Mounting		Substrate material: ...				
		Element resistance				$\Delta R \leq \pm(\ldots \% R + \ldots \Omega)$
2.1.3.2 of IEC 60393-6 Substrate bending test		Visual examination				No visible damage

Subclause number and test of IEC 60393-1 (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size & criterion of acceptability (see NOTE 2)			Performance requirements (see NOTE 1)
			p	*n*	*c*	
2.1.3.3 of IEC 60393-6 Resistance to soldering heat (not applicable to potentiometers which are not suitable for total immersion)		Visual examination				As in 2.1.3.3 of IEC 60393-6 No visible damage
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
		Resistance between a and b				$R \leq$ … Ω
		Resistance between b and c				$R \leq$ … Ω
4.44 Component solvent resistance (if applicable)		Solvent: …				See Detail Specification
		Solvent temperature: …				
		Method 2				
		Recovery: …				
4.31 Sealing (if applicable)		Temperature: 85 °C to 90 °C				As in 4.31.3 of IEC 60393-1
Subgroup C2B	D		3	6		
Other part of sample of Subgroup C2						
1.4.2 of IEC 60393-6 Mounting		Substrate material: …				
2.1.3.1 of IEC 60393-6 Shear		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
		Visual examination				No visible damage
4.34 Change of temperature		See NOTE 3				
		T_A = Lower category temperature				
		T_B = Upper category temperature				
		Visual examination				As in 4.34.5 of IEC 60393-1
		Output voltage ratio				
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
4.36 Bump (or shock) (see 1.4.5.2 of IEC 60393-6)		For mounting method see 1.1 of this Blank Detail Specification				
		Acceleration: 400 m/s^2				
		Number of bumps: 4 000				
		Visual examination				As in 4.36.3 of IEC 60393-1
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
4.37 Shock (or bump) (see 1.4.5.2 of IEC 60393-6)		For mounting method see 1.1 of this Blank Detail Specification				
		Pulse shape: half-sine				
		Acceleration: 500 m/s^2				
		Pulse duration: 11 ms				
		Visual examination				As in 4.37.3 of IEC 60393-1
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$

Subclause number and test of IEC 60393-1 (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size & criterion of acceptability (see NOTE 2)			Performance requirements (see NOTE 1)
			p	*n*	*c*	
4.35 Vibration		For mounting method see 1.1 of this Blank Detail Specification Frequency range: ... Hz to ... Hz Amplitude: 0,75 mm or acceleration 100 m/s^2 (whichever is the less severe) Sweep endurance Total duration: 6 h See NOTE 3 **Measurements during test** Electrical continuity (as specified in 4.35.4) **Final measurements** Visual examination Output voltage ratio Element resistance				There shall be no discontinuity > 100 µs As in 4.35.5 of IEC 60393-1 $\Delta\frac{U_{ab}}{U_{ac}} \leq$ ... % $\Delta R \leq \pm($ ... % R + ... Ω$)$
Subgroup C2 Combined sample of specimens of Subgroups C2A and C2B	D		3	13	2	
4.38 Climatic sequence						
- Dry heat		Visual examination				As in 4.38.2.2
- Damp heat, cyclic, Test Db, first cycle						
- Cold		Starting torque				... mN.m to ... mN.m
- Low air pressure		8 kPa Voltage proof (insulated potentiometers only)				As in 4.38.5.3 of IEC 60393-1
- Damp heat, cyclic, Test Db, remaining cycles						
- DC load		See NOTE 4				
- Insuation voltage		See NOTE 4				As in 4.38.8 of IEC 60393-1
- Final measurements		Visual examination Element resistance Insulation resistance (insulated potentiometers only) Continuity Starting torque Voltage proof (insulated potentiometers only)				As in 4.38.10.1 of IEC 60393-1 $\Delta R \leq \pm($ ... % R + ... Ω$)$ ≥ 100 MΩ As in 4.5.1 of IEC 60393-1 ... mN.m to ... mN.m As in 4.38.10.7 of IEC 60393-1

Subclause number and test of IEC 60393-1 (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size & criterion of acceptability (see NOTE 2)			Performance requirements (see NOTE 1)
			p	*n*	*c*	
Subgroup C3	D		3	8	1	
4.43.2 Electrical endurance at 70 °C		Duration: 500 h or 1000 h (as specified in Detail Specification)				
		- Loaded between a and c				
		Examination at 48 h, 500 h and 1000 h:				
		Visual examination				As in 4.43.2.6 1)
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
		- Loaded between a and b				
		Examination at 48 h, 500 h and 1000 h:				
		Visual examination				As in 4.43.2.6 1)
		Resistance between a and b				$\Delta R \leq \pm($ … % R + … Ω$)$
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
		All specimens				
		Examination at 500 h or 1000 h: (as specified in Detail Specification)				
		Insulation resistance (insulated potentiometers only)				≥ 1 GΩ
		Rotational noise, Method B:				≤ … % R or … Ω (whichever is the greater)
Subgroup C4	D		3	8	1	
4.40 Mechanical endurance (potentiometers)		Number of cycles:				As specified in the Detail Specification
		Rate:				
		- Rotary types: 5 to 10 cycles per minute				
		- Lead-screw types: …				
		Visual examination				As in 4.40.6 1)
		Element resistance				$\Delta R \leq \pm($ … % R + … Ω$)$
		Starting torque				… mN.m to … mN.m
		Rotational noise, Method B:				≤ … % R or … Ω (whichever is the greater)

Subclause number and test of IEC 60393-1 (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size & criterion of acceptability (see NOTE 2) *p*	*n*	*c*	Performance requirements (see NOTE 1)
GROUP D INSPECTION (periodic)						
Subgroup D1	D		12	8	1	
4.39 Damp heat, steady state		1) Subclause 4.39.2.1 of IEC 60393-1 1st group: 2 specimens 2nd group: 3 specimens 3rd group: 3 specimens				
		2) Subclause 4.39.2.2 of IEC 60393-1 1st group: 4 specimens 2nd group: 4 specimens				
		DC load (see NOTE 4)				
		Insulation voltage (see NOTE 4)				As in 4.39.4 of IEC 60393-1
		Final measurements				
		Visual examination				As in 4.39.6.1 of IEC 60393-1
		Element resistance				$\Delta R \leq \pm($ ... % R + ... $\Omega)$
		Insulation resistance (insulated potentiometers only)				≥ 100 MΩ
		Continuity				As in 4.5.1
		Starting torque				... mN.m to ... mN.m
		Rotational noise, Method B:				≤ ... % R or ... Ω (whichever is the greater)
		Voltage proof (insulated potentiometers only)				As in 4.39.6.8 of IEC 60393-1
Subgroup D2	D		36	8	1	
4.43.3 Electrical endurance at upper category temperature		Duration: 500 h or 1000 h (as specified in Detail Specification)				
		- Loaded between a and c				
		Examination at 48 h, 500 h and 1000 h:				
		Visual examination				As in 4.43.3.7 1) of IEC 60393-1
		Element resistance				$\Delta R \leq \pm($ ... % R + ... $\Omega)$
		- Loaded between a and b				
		Examination at 48 h, 500 h and 1000 h:				
		Visual examination				As in 4.43.3.7 1) of IEC 60393-1
		Resistance between a and b				$\Delta R \leq \pm($ ... % R + ... $\Omega)$
		Element resistance				$\Delta R \leq \pm($ ... % R + ... $\Omega)$
		All specimens				
		Examination at 500 h or 1000 h (as specified in Detail Specification)				
		Insulation resistance (insulated potentiometers only)				≥ .. GΩ

Subclause number and test of IEC 60393-1 (see NOTE 1)	**D or ND**	**Conditions of test** (see NOTE 1)	**Sample size & criterion of acceptability** (see NOTE 2)			**Performance requirements** (see NOTE 1)
			p	***n***	***c***	
Subgroup D3 4.4.3 Dimensions (detail)	ND		36	8	1	As specified in the Detail Specification
Subgroup D4 4.43 Electrical endurance at temperatures other than 70 °C (if applicable)	D	(This subgroup is only applicable if a derating curve other than those shown in 2.2.3 of IEC 60393-6 is claimed in the Detail Specification) Duration: 500 h or 1 000 h (As specified in Detail Specification) - Loaded between a and c Examination at 48 h, 500 h and 1 000 h: Visual examination Element resistance - Loaded between a and b Examination at 48 h, 500 h and 1 000 h: Visual examination Resistance between a and b Element resistance **All specimens** Examination at 500 h or 1 000 h: (as specified in the Detail Specification) Insulation resistance (insulated potentiometers only)	36	8	1	As in 4.43.1.6 1) of IEC 60393-1 $\Delta R \leq \pm($ … % R + … Ω) (as for subgroup C3) As in 4.43.1.6 1) of IEC 60393-1 $\Delta R \leq \pm($ … % R + … Ω) (as for subgroup C3) $\Delta R \leq \pm($ … % R + … Ω) ≥ 1 GΩ

NOTE 1 Subclause numbers of tests and performance requirements refer to IEC 60393-1, except for some severities for environmental tests and limits of change in resistance or output ratio, which have to be taken from the relevant clauses of IEC 60393-6.

NOTE 2 In this Table: *p* = periodicity (in months)
n = sample size
c = acceptance criterion (permitted number of defectives)
D = destructive
ND = non-destructive

NOTE 3 The requirements for preset potentiometers as described in 4.34.3 and 4.34.6 of IEC 60393-1 for "Change of temperature" and in 4.35.2 of IEC 60393-1 for "Vibration" apply.

NOTE 4 The DC load test and the insulation voltage test are considered as alternatives. The Detail Specification should indicate which test applies.

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tables, charts, graphs, figures.....
other .....

Q8 I read/use the: *(tick one)*

French text only ❑
English text only ❑
both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

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