BRITISH STANDARD

BS 9131 N001 to 016:1974

Incorporating Amendment Nos. 1, 2, 3, and 4

Detail specification for

Lead-screw actuated wirewound or non-wirewound preset potentiometers — Rectangular and square forms, container sealed, actuating device insulated from resistive element, slipping clutch at each end of travel — Full assessment level

UDC 621.39.03:621.316.82

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 39 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date of issue	Comments
2090	September 1976	
3094	January 1980	
3814	April 1982	
4679	April 1985	Indicated by a sideline in the margin

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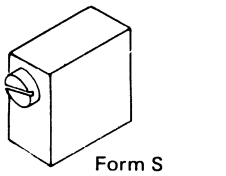
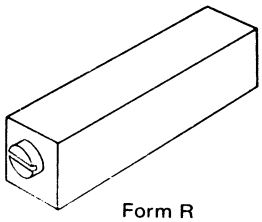
ELECTRONIC COMPONENTS OF ASSESSED QUALITY: DETAIL SPECIFICATIONS (See Table 3)	
 Form S series outlines  Form R series outlines For individual details see Table 3 and Appendix A	LEAD-SCREW ACTUATED PRESET POTENTIOMETERS, RECTANGULAR AND SQUARE FORMS FULL ASSESSMENT CONSTRUCTION: CONTAINER SEALED RESISTIVE ELEMENT: WIREWOUND OR NON-WIREWOUND ACTUATING DEVICE: INSULATED FROM RESISTIVE ELEMENT SLIPPING CLUTCH: AT EACH END OF TRAVEL

For ordering information see Clause **6**.

1 Ratings and characteristics

Table 1

Rated dissipation at 70 °C	Limiting element voltage d.c. or a.c. r.m.s.	Isolation voltage d.c. or a.c. peak	
		Normal	Low air pressure
W	V	V	V
0.25	200	300	200
0.5	200	300	200
0.75	315	450	300
1.0	315	450	300

Resistance range	The range of values available in each style will be given in the Qualified Products List (BS 9002).
Resistance values	The preferred values are 1.0, 2.2, and 4.7 in each decade. Other values should not be used in new designs.
Selection tolerance	Wirewound ± 10 % or ± 5 %. Non-wirewound ± 20 %, ± 10 % or ± 5 %.
Climatic category	55/125/21 or 55/155/56
Maximum slider current	50 mA
Rotational noise	Wirewound 55/125/21 and 55/155/56 $\leqslant$ 100 Ω None-wirewound 55/125/21 $\leqslant$ 5 Ω or ± 5 % whichever is greater. Non-wirewound 55/155/56 $\leqslant$ 3 Ω or 3 % whichever is greater.
Limits of resistance change after 1 000 h endurance	55/125/21: $\Delta R \leqslant$ 3 % 55/155/56: $\Delta R \leqslant$ 2 %
Effective operating turns	See Appendix A
Temperature characteristic of resistance (+ 20 °C to + 70 °C)	± 0.25 % (t.c. ± 50 p.p.m./°C) ± 0.5 % (t.c. ± 100 p.p.m./°C) ± 0.75 % (t.c. ± 150 p.p.m./°C) ± 1.25 % (t.c. ± 250 p.p.m./°C) ± 2.5 % (t.c. ± 500 p.p.m./°C)
Bump severity	390 m/s^2 for 4 000 ± 10 bumps
Vibration severity	10 Hz to 500 Hz; 0.75 mm or 98 m/s^2.

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Low air pressure severity	8.5 kPa (85 mbar[a])
Maximum starting torque	35 mN m
Resolution (Wirewound styles only)	See subclause **7.1**

[a] 1 mbar = 100 Pa = 100 N/m^2.

2 Derating

Potentiometers covered by this specification are derated linearly from 100 % rated dissipation at 70 °C to zero dissipation at 155 °C or 125 °C. The dissipation at temperatures below 70 °C is the rated dissipation. When mounted in conditions which severely limit circulation of air around the potentiometer (i.e. when stacked) further derating may be necessary.

3 Marking

The marking of the component and package shall be in accordance with **1.1.6** of BS 9130. The marking of the terminations shall be in accordance with one of the methods given in **1.1.3.23** of BS 9130.

4 Related documents

BS 2011, *Methods for the environmental testing of electronic components and electronic equipment.*

BS 2488, *Schedule of preferred numbers for the resistance of resistors and capacitance of capacitors for telecommunications equipment.*

BS 6001, *Sampling procedures and tables for inspection by attributes.*

BS 9000, *General requirements for electronic components of assessed quality.*

BS 9002, *Qualified products list.*

BS 9130, *Potentiometers of assessed quality: Generic data and methods of test.*

5 Terminology

5.1
lead-screw actuated potentiometer

those potentiometers which have a multi-turn actuating device which is insulated from the moving contact and from the resistance element

5.2
effective operating turns

the number of turns which are required on the actuating device to move the moving contact across the resistance element between the points at which terminal resistance is measured

5.3
slipping clutch

that form of construction which allows continuous rotation of the actuating device after the moving contact has reached either end of the resistance element

5.4
cycle of operation

one cycle of operation = one traverse of the resistive element and return

6 Ordering information

Orders for potentiometers covered by these specifications shall contain the following information:

Style [see Table 3], including

1) Detail specification number
2) Resistance value
3) Selection tolerance
4) Temperature characteristic.

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7 Additional information (not for inspection purposes)

7.1 Resolution (for wirewound styles only) — for use as in Table 2

Rated resistance	10 Ω	22 Ω	47 Ω	100 Ω	220 Ω	470 Ω	1 kΩ	2.2 kΩ	4.7 kΩ	10 kΩ	22 kΩ	47 kΩ	100 kΩ
Form	**Resolution** (%)												
Square	1.6	1.3	1.2	0.8	0.8	0.6	0.5	0.4	0.3	0.3	0.2	0.2	—
Rectangular	2.0	1.5	1.2	1.0	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.2

7.2 Resistance law. Potentiometers covered by this detail specification are nominally linear.

8 Certified test records

Certified test records shall be prepared in accordance with **1.1.11** of BS 9130 and shall be presented in the format in Appendix C to BS 9000-1.

9 Inspection requirements

9.1 Where drying is called for, Procedure 1 of BS 9130:1972 shall be used.

9.2 There shall be a satisfactory balance between high, low and critical values in the sample taken. See Appendix A of BS 9130.

9.3 Throughout this schedule, the unit of product shall be one potentiometer.

9.4 Where a subgroup contains more than one test, the tests shall be carried out in the order given.

9.5 Samples submitted to tests marked as "(D)" shall not be accepted for release under BS 9000 (see **2.6.5** of BS 9000-1).

9.6 For the purpose of insulation resistance or voltage proof tests:

1) Components designated as "mounted by body" (see Appendix A) shall be mounted as in **1.2.4.2** of BS 9130.

2) Components designated as "mounted by terminations" shall be tested whilst mounted by their terminations on a printed wiring board, irrespective of whether any holes exist which could permit mounting by the body.

Inspection	**BS 9130 reference and conditions of test**	**Performance requirements**
GROUP A	(To be applied on a sampling basis (lot-by-lot) Subgroups A3 and A4 are not applicable	
Subgroup A0	*100 % Inspection*	
Resistance *a* to *c*	**1.2.4.3.2**	Shall be within the selection tolerance
Subgroup A1	*Inspection level I, AQL 1.5 %*	
Visual inspection	**1.2.2**	As in BS 9130
Subgroup A2	*Inspection level S-4, AQL 4.0 %*	
Resistance *a* to *b*	**1.2.4.3.3**	As in Table 2, Code D
Resistance *b* to *c*	**1.2.4.3.4**	As in Table 2, Code D
Continuity	**1.2.4.2**	As in BS 9130
Rotational noise	**1.2.4.13.2**	As in Table 2, Code F
Voltage proof	**1.2.4.10**	As in BS 9130
Subgroup A5	**1.1.11** Attributes information for subgroup A2 without reference to the parameter for which rejection was made	

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Inspection	BS 9130 reference and conditions of test		Performance requirements
GROUP B		(To be applied on a sampling basis lot-by-lot) subgroups B3 to B7 are not applicable	
Subgroup B1		*Inspection level S-2, AQL 4.0 %*	
Dimensions (gauging)	**1.2.3.1**		As in Appendix A
Effective operating turns		See **5.2** of this document	As in Appendix A
Subgroup B2 (D)		*Inspection level S-2, AQL 4.0 %* Potentiometers with different types of termination shall not be considered as being structurally similar for the purposes of this subgroup. Different termination configurations, e.g. in-line or staggered, may be considered as structurally similar	
Robustness of terminations	**1.2.6.1**	Tensile (1 kg load) Bending (0.5 kg load)	
Measurements			
Visual examination			As in BS 9130
Resistance			ΔR: $\leqslant$ 1 % + 0.05 Ω
Solderability		Method 1. Temperature: 230 ± 10 °C (components mounted by terminations) 270 ± 10 °C (components mounted by body)	
	1.2.6.3.2	Terminations shall be fitted with a thermal screen 1.5 mm thick and shall be immersed to the underside of that screen	As in BS 9130
Measurements			
Visual examination			As in BS 9130
Sealing	**1.2.6.2.2**	Test Qc Method II; 85 °C to 90 °C	As in BS 2011
Mechanical endurance (potentiometers)	**1.2.7.1**	Room temperature No load 200 cycles at 4 ± 1 cycles/minute	
Final measurements			
Visual examination			As in BS 9130
Resistance			As in Table 2, Code B
Starting torque			$\leqslant$ 35 mN m
Rotational noise, Method B			As in Table 2, Code G
Subgroup B8			
CTR information	**1.1.11**	Attributes information for subgroup B2, without reference to the parameter for which rejection was made	

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Inspection	BS 9130 reference and conditions of test		Performance requirements
GROUP C		(To be applied on a sampling basis at three monthly intervals) subgroup C5 not applicable	
Subgroup C1		*Sample size 13* *Accept 1/Reject 2*	
Starting torque	**1.2.5.1**		⩽ 35 mN m
Thrust and pull	**1.2.5.5.3**	5.0 N. Pull not applicable	
Measurements			
Resistance			As in Table 2, Code J
Slipping clutch	**1.2.5.3.2**		As in BS 9130
Subgroup C2		*Sample size 13* *Accept 1/Reject 2*	
Temperature characteristic of resistance	**1.2.4.12**	+ 20 °C to + 70 °C cycle only	As in Table 2, Code A
Subgroup C3 (D)		*Sample size 13* *Accept 2/Reject 3*	
(i)		*7 specimens*	
Robustness of terminations	**1.2.6.1**	Tensile (1 kg load) Bending (0.5 kg load)	As in BS 9130
Measurements			
Visual examination			As in BS 9130
Resistance			ΔR: ⩽ 1 % + 0.05 Ω
Resistance to soldering heat	**1.2.6.3.3**	At 1.5 ± 0.5 mm from the point of emergence of the terminations from the body, with a thermal screen	
Measurements			
Resistance *a* to *c*			ΔR: ⩽ 1 % + 0.05 Ω
Resistance *a* to *b*			As in Table 2, Code E
Resistance *b* to *c*			As in Table 2, Code E
(ii)		*Other 6 specimens*	
Change of temperature	**1.2.6.4**		
Measurements			
Resistance			ΔR: ⩽ 1 % + 0.05 Ω
Voltage ratio $\frac{V_{ab}}{V_{ac}}$			As in Table 2, Code H
Bump	**1.2.6.6**	4 000 ± 10 bumps total at room temperature Mounting as in vibration	
Measurement			
Resistance			ΔR: ⩽ 1 % + 0.05 Ω
Vibration	**1.2.6.5**	Procedure B4 10 to 500 Hz Duration 6 h 0.75 mm: 98 m/s^2 Body mounted by normal means as given in Appendix A Flexible leads shall be clamped at a distance 25 ± 5 mm from the point of emergence from the body	

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Inspection	BS 9130 reference and conditions of test		Performance requirements
Subgroup C3 (ii) (cont'd)			
Measurements			As in Table 2, Code H
Voltage ratio $\frac{V_{ab}}{V_{ac}}$			ΔR: $\leqslant$ 1 % + 0.05 Ω
Resistance			
(iii)		*Samples (i) and (ii) combined*	
Climatic sequence	**1.2.6.8**	Procedure 1 of BS 1011-2 Z/ABDM Drying Procedure I of **1.2.4.1**	
Final measurements			
Starting torque (cold)			$\leqslant$ 50 mN m
Voltage proof (low air pressure)			As in BS 9130
Isolation voltage			As in Table 1
Visual examination			As in BS 9130
Resistance			As in Table 2, Code B
Insulation resistance			As in Table 2, Code C
Continuity			As in BS 9130
Starting torque			$\leqslant$ 35 mN m
Voltage proof			As in BS 9130
After extended recovery (-/-/21 components only)			
Insulation resistance			> 100 MΩ
Subgroup C4 (D)		*Sample size 13* *Accept 1/Reject 2*	
Electrical endurance at 70 °C	**1.2.7.4**	1 000 h duration	
Final measurements			
Visual examination			As in BS 9130
Resistance			As in Table 2, Code B
Insulation resistance			> 100 MΩ
Rotational noise, Method B			As in Table 2, Code G
Continuity			As in BS 9130
Subgroup C6			
CTR information	**1.1.11**	Attributes information shall be given for subgroups C1, C2, and C3 without reference to the parameter for which rejection was made. Measurements information shall be given for the change of resistance in subgroup C4	

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Inspection	BS 9130 reference and conditions of test		Performance requirements
GROUP D		To be applied on a sampling basis, at three-yearly intervals	
Subgroup D1 (D)		*Sample size 13* *Accept 1/Reject 2*	
Damp heat (steady state)	**1.2.6.9**	Duration 21 days or 56 days (See Table 3)	
After conditioning			
Isolation voltage			As in Table 1
Final measurements			
Visual examination			As in BS 9130
Resistance			As in Table 2, Code B
Insulation resistance			As in Table 2, Code C
Continuity			As in BS 9130
Starting torque			⩽ 35 mN m
Rotational noise, Method B			As in Table 2, Code G
Voltage proof			As in BS 9130
After extended recovery (-/-/21 components only)			
Insulation resistance			> 100 MΩ
Subgroup D2 (D)		*Sample size 13* *Accept 1/Reject 2*	
Electrical endurance (at upper category temperature)	**1.2.7.5**	1 000 h duration. No load. The mounting requirements may be ignored	
Final measurements			
Visual examination			As in BS 9130
Resistance			As in Table 2, Code B
Subgroup D3		*Sample size 13* *Accept 1/Reject 2*	
Temperature characteristic of resistance	**1.2.4.12**		As in Table 2, Code A, as appropriate
Subgroup D4		*Sample size 13* *Accept 1/Reject 2*	
Dimensions (detail)	**1.2.3.2**		As in Appendix A
Subgroup D5 (D)		*Sample size 13* For CTR purposes only (The sample may be that subjected to the last subgroup C4, and extended to 8 000 h)	
Electrical endurance at 70 °C	**1.2.7.4**	Duration 8 000 h Measurement of resistance at 2 000 h, 4 000 h and 8 000 h	

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Inspection	BS 9130 reference and conditions of test	Performance requirements
Subgroup D6 (D) Mechanical endurance *Final measurements* Visual examination Resistance *a* to *c* Resistance *a* to *b* Resistance *b* to *c* Starting torque Continuity Rotational noise, Method B Voltage proof	*Sample size 13* *Accept 1/Reject 2* **1.2.7.1** Room temperature 6 specimens loaded between terminations *a* and *c* 7 specimens unloaded 200 cycles at 4 ± 1 cycles per minute	 As in BS 9130 As in Table 2, Code B As in Table 2, Code E As in Table 2, Code E ⩽ 35 mN m As in BS 9130 As in Table 2, Code G As in BS 9130
Subgroup D7 CTR information	**1.1.11** Attributes information shall be given for subgroups D1, D3 and D4 without reference to the parameter for which rejection was made Measurements information shall be given for the change of resistance in subgroups D2, D5, and D6	

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Table 2 — Test requirements

Code	Wirewound						Non-wirewound					
	55/125/21			55/155/56			55/125/21			55/155/56		
	ΔR %			ΔR %			ΔR %			ΔR %		
A	– 55/20 °C	20/70 °C	20/125 °C	– 55/20 °C	20/70 °C	20/166 °C	– 55/20 °C	20/70 °C	20/125 °C	– 55/20 °C	20/70 °C	20/155 °C
	0.375	0.25	0.525	0.375	0.25	0.675	0.375	0.25	0.525	0.375	0.25	0.675
	0.750	0.50	1.050	0.750	0.50	1.350	0.750	0.50	1.050	0.750	0.50	1.350
	1.125	0.75	1.575	1.125	0.75	2.025	1.125	0.75	1.575	1.125	0.75	2.025
	1.875	1.25	2.625	1.875	1.25	3.375	1.875	1.25	2.625	1.875	1.25	3.375
	3.750	2.50	5.250	3.750	2.50	6.750	3.750	2.50	5.250	3.750	2.50	6.750
B	$\Delta R \leqslant 3\ \% + 0.1\ \Omega$			$\Delta R \leqslant 2\ \% + 0.1\ \Omega$			$\Delta R \leqslant 3\ \% + 0.1\ \Omega$			$\Delta R \leqslant 2\ \% + 0.1\ \Omega$		
C	> 10 MΩ			> 100 MΩ			> 10 MΩ			> 100 MΩ		
D	$\leqslant 2\ \Omega$ or 5 %						$\leqslant 3\ \Omega$ or 3 %			$\leqslant 2\ \Omega$ or 3 %		
E	$\leqslant 3\ \Omega$ or 5 %						$\leqslant 5\ \Omega$ or 3 %			$\leqslant 3\ \Omega$ or 3 %		
F	$\leqslant 100\ \Omega$						$\leqslant 5\ \Omega$ or 5 %			$\leqslant 3\ \Omega$ or 3 %		
G	$\leqslant 500\ \Omega$						$\leqslant 10\ \Omega$ or 10 %			$\leqslant 5\ \Omega$ or 5 %		
H	$\Delta \frac{V_{ab}}{V_{ac}}$ $\leqslant 2\ \%$ Plus resolution (see subclause **7.1**)						$\Delta \frac{V_{ab}}{V_{ac}}$ $\leqslant 2\ \%$					
J	ΔR $\leqslant 2\ \%$ Plus resolution (see subclause **7.1**)						ΔR $\leqslant 2\ \% + 0.1\ \Omega$					

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Table 3 — Selection chart of styles and detail specifications

Rated dissipation at 70 °C	Resistive element	Climatic category	Style (See Note 1)	
			Detail specification No. BS 9131 N ...	Outline no. (see Note 2 and Appendix A)
W 0.25	Wirewound	55/155/56	001	(see Note 3)
		55/125/21	002	(see Note 3)
	Non-wirewound	55/155/56	003	(see Note 3)
		55/125/21	004	S01, S02, S03
0.5	Wirewound	55/155/56	005	(see Note 3)
		55/125/21	006	(see Note 3)
	Non-wirewound	55/155/56	007	(see Note 3)
		55/125/21	008	R06, R07, R08, R09
0.75	Wirewound	55/155/56	009	S04, S05, S06
		55/125/21	010	S01, S04, S05, S06, S07, S08
	Non-wirewound	55/155/56	011	(see Note 3)
		55/125/21	012	(see Note 3)
1.0	Wirewound	55/155/56	013	R01, R02, R04
		55/125/21	014	S09, S10
	Non-wirewound	55/155/56	015	R01, R02, R03, R05
		55/125/21	016	R01, R02, R03, R05 S09, S10

NOTE 1 The style reference comprises the detail specification number and the corresponding outline number in Appendix A.
NOTE 2 The form of the potentiometer case is indicated as:
R — rectangular
S — square
NOTE 3 No preferred standard dimensions are currently available. This detail specification number has been reserved for a future issue. However, see **A.3.2** of this publication.

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