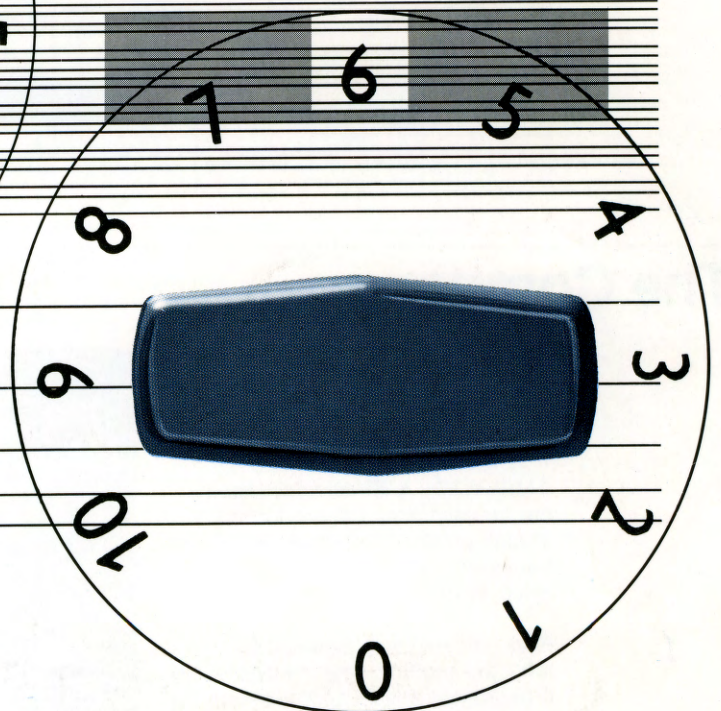
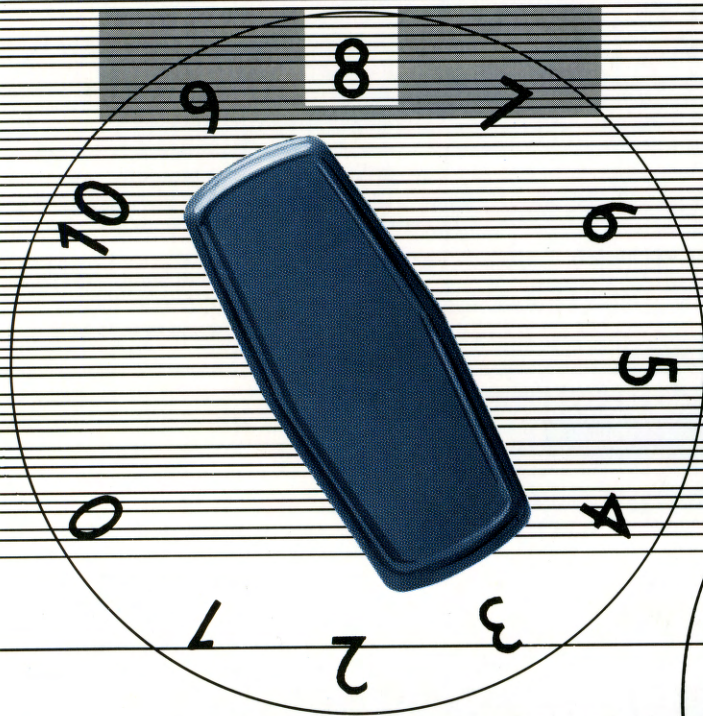


Decade Boxes

DANBRIDGE
DENMARK



RCL Decades Comprehensive Guide

DANBRIDGE
DENMARK

Wide choice of ranges, accuracy and resolution

Rugged mechanical design

No switch maintenance

Modern styled housing and in-line read-out

Professional Decades designed for long and trouble-free service

Applications

Comparator bridge standards.
"Substitution box" in circuit- and network-design.
Reference standard for calibration of instruments.
Repeatable variable in laboratory and test set-ups.
Training and education.

Terminals

Two terminals together with a separate earth terminal are provided.
Terminal spacing 19 mm ($\frac{3}{4}$ ").

Housing

Light-weight case in blue plastic coated aluminium with end castings and top panel finished in blue-grey and light-grey enamel.

Accuracy

To obtain factory approval and to comply with calibration procedures the accuracy of all units must be at least 40 % better than the figures stated in the specifications published. The accuracies stated in the specification of each instrument are guaranteed for one year, although they are usually maintained without difficulty for the entire life of the instrument. All Danbridge reference standards are regularly controlled by authorized bodies.

Test equipment is calibrated against these standards to ensure the highest possible level of reliability.

Decade Resistors

Decade Value Ω pr. step	H	G	F	E	D	C	B	A	O	Zero Resistance
	1 M	100 K	10 K	1 K	100	10	1	0.1	0.01	
PDR6 O PDR6 A										7 m Ω
Steps Max. Current			11 7 mA/ 500 V	11 20 mA	11 70 mA	11 0.2 A	11 0.7 A	11 1 A	11 1 A	
Accuracy % ± 2 m Ω			± 0.03	± 0.03	± 0.03	± 0.03	± 0.03	*	*	
DR4 O DR4 A DR4 B DR4 C DR4 D DR4 E										14 m Ω
DR5 O DR5 A DR5 B DR5 C DR5 D DR6 O DR6 A DR6 B DR6 C DR7 O DR7 B										18 m Ω
Steps Max. Current	10 500 V	10 3 mA/ 500 V	10 10 mA/ 500 V	10 30 mA	10 0.1 A	10 0.3 A	10 1 A	10 3 A	10 3 A	
Accuracy % ± 5 m Ω	± 1	± 1	± 0.1	± 0.1	± 0.1	± 0.1	± 0.3	*	*	

Decade Capacitors

Value	10 \times 1 μ F	10 \times 0.1 μ F	10 \times 10 nF	10 \times 1 nF	50— 1050 pF var.	Accuracy %
DK4A DK4AV DK4S DK4SV						2.5 2.5 \pm 10 pF ± 1 % at 10 \times 1 μ F 0.5 \pm 5 pF 0.5 \pm 10 pF

Decade Inductor

Value	10 \times 1 H	10 \times 100 mH	10 \times 10 mH	10 \times 1 mH
DI4				
Accuracy	0.5 %	0.5 %	0.5 %	1 %

Decade Attenuators

Value	10 \times 10 dB	10 \times 1 dB	10 \times 0.1 dB	Network
DA3H/D DA3T/D				Balanced Unbalanced
Accuracy	± 0.5 dB ± 0.01 dB Above 50 dB: add ± 0.1 dB			$f \leq 50$ kHz

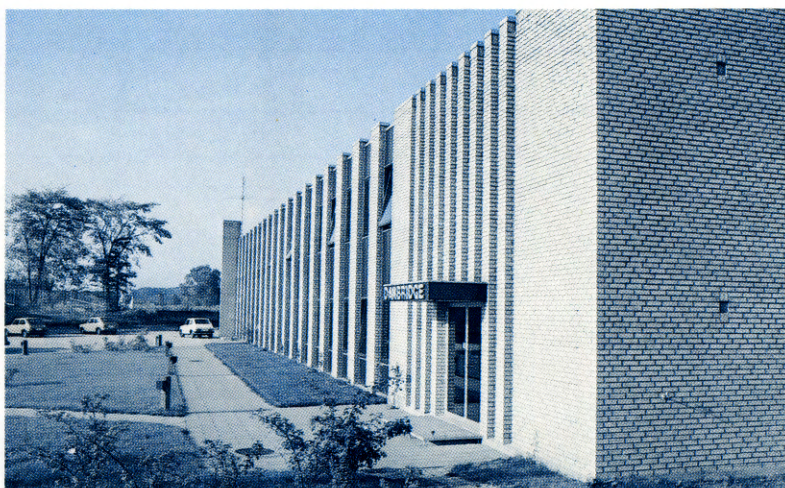
The Company

DANBRIDGE
DENMARK

DANBRIDGE A/S is a Danish registered company situated north of Copenhagen with a modern and well-equipped factory.

DANBRIDGE A/S has specialized in the development and production of high quality Component Test Equipment and R-C-L Decade Boxes since 1949.

Excellent specifications and attractive modern design have brought world-wide appreciation of the DANBRIDGE range of instruments throughout industry, research and education with the result that 95 % of our production is exported.



Decade Capacitors Type DK



General

These Decades use capacitors in the 1+2+2+5 values to constitute a decade. Decade capacitors with suffix S are mounted in totally sealed cans, stabilized by a special process ensuring high stability. Decade capacitors with suffix A are not stabilized and consequently their stability is not comparable to that of the S-types, but the accuracy of 2.5% makes the A-types suitable for general laboratory use. The additional suffix V indicates a variable air capacitor with a dial calibrated directly in pF. Calibration accuracy for DK4SV and DK4AV is shown in specification table.

Specifications

Zero Capacitance

Direct capacitance between terminals: Types DK4A — DK4S 10–20 pF. Capacitance with earth and nearest terminal interconnected: Types DK4A–DK4S 25–35 pF. The above values should be added to the dial readings for measurements. For types with suffix V no correction is required when used with the earth terminal connected to the nearest terminal. The direct capacitance is approx. 15 pF less than the indicated value.

Measuring Frequency

All data are measured at 1 kHz.

Switches

Each Decade is made up of 4 capacitors with values 1, 2, 2 and 5 units. These are connected as required by a 4 section wafer switch with high quality insulation and silver-plated double contacts.

Type	DK 4A	DK 4AV	DK 4S	DK 4SV
10×1 μF	PC	Var.	PC*)	Var.
10×0.1 μF	PC	PC	PS	PS
10×10 nF	PS	PS	PS	PS
10× 1 nF	PS	PS	PS	PS
50–1050 pF		Var.		Var.
Accuracy ±%	2.5	2.5	0.5*)	0.5
		+10pF	+5pF	+10pF

*) ±1% at 10×1 μF

PC: Polycarbonate-Capacitors.

Power Factor 2×10^{-3} approx.

Temperature Coefficient $+200 \times 10^{-6}$.

Dimensions

Height: 115 mm.

Width: 150 mm.

Depth: 325 mm.

Weight: 3 kg.

Max. AC Voltage:

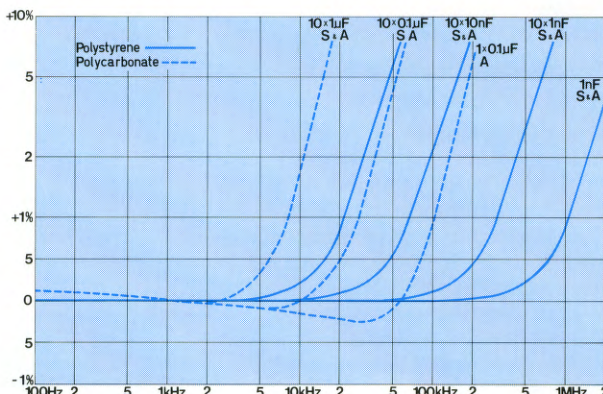
200 V.

Var.: Variable Air Capacitor

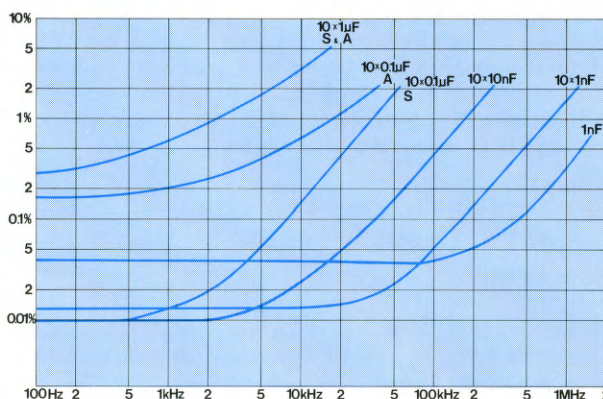
PS: Polystyrene-Capacitors.

Power Factor $2-5 \times 10^{-4}$.

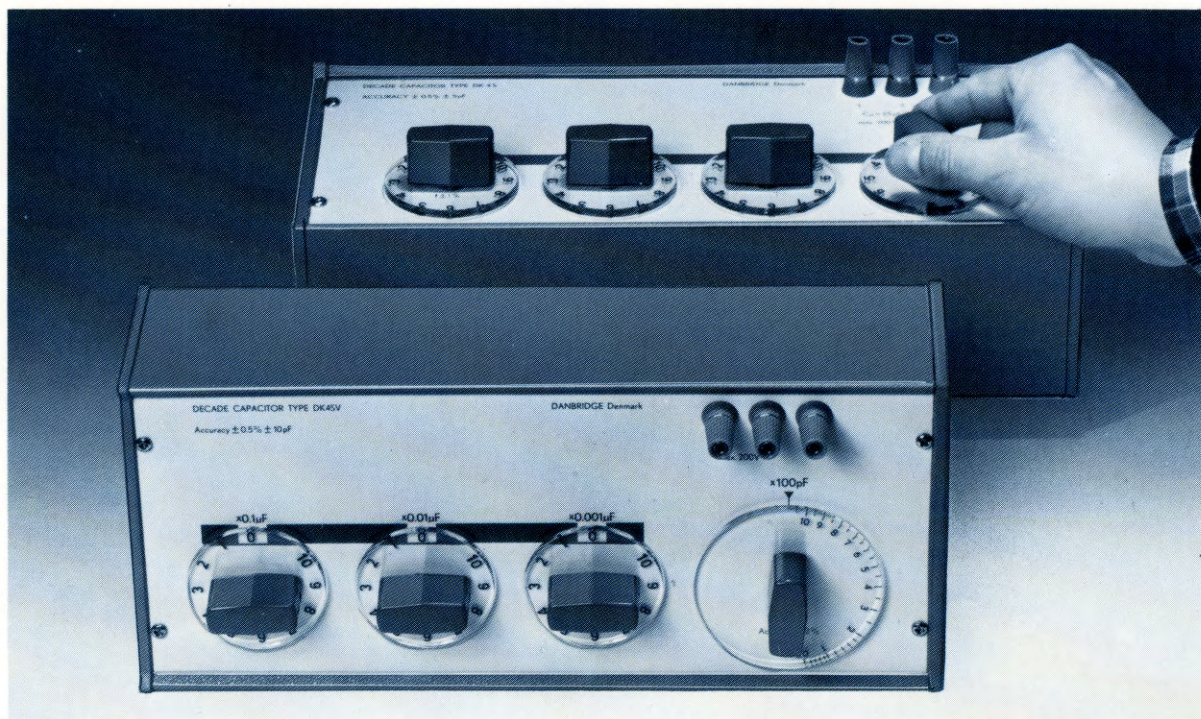
Temperature Coefficient -130×10^{-6} .



Change in capacitance with frequency for DK decade capacitors. Typical values.



Dissipation factor vs. Frequency for DK decade capacitors. Typical values.



Ferrite-Cored Decade Inductor Type DI 4

DANBRIDGE
DENMARK

General

The Type DI 4 Decade Inductor is ideal for laboratory use for determining circuit constants in wave filters, tuned circuits, etc. The accuracy and stability of the inductor allow its use as a secondary standard of inductance. The inductance coils used are wound on ferrite cores providing a high Q-value from the lower audio frequencies.

Specifications

Range

10×1 mH, 10 mH, 100 mH, and 1 H.

Temperature Coefficient

About $+100 \times 10^{-6}$ per °C.

Dissipation Factor

The curves in Fig. 1 show the dissipation factor as a function of frequency for the separate decades. The curves give average values for each decade. The actual values are relatively spread thus at high values in each decade the curve moves towards the curve for the next higher decade and vice versa for low values.

Maximum Current

For max. stability the alternating or direct current should be limited to 120 mA on the 1×100 mH setting with corresponding values for other settings as shown in the table Fig. 2.

Accuracy

10×1 mH: 1 %, 10×10 mH: ½ %, 10×100 mH: ½ %, and 10×1 H: ½ %.

Dimensions

Height: 162 mm.
Width: 385 mm.
Depth: 98 mm.
Weight: 3.8 kg.

Inductance Variation with Current

The curves in Fig. 2 show the percentage variation of inductance with direct and alternating current measured on the 1×100 mH setting.

Inductance Variation with Frequency

In case the effective series

inductance must be determined the percentage increase with frequency can be calculated from

$$\Delta L/L_0\% = L \cdot f^2 \cdot K$$

where L is inductance in Henries, f is Frequency in kHz and K is between 0.1 & 0.16 with the highest value for the intermediate decades.

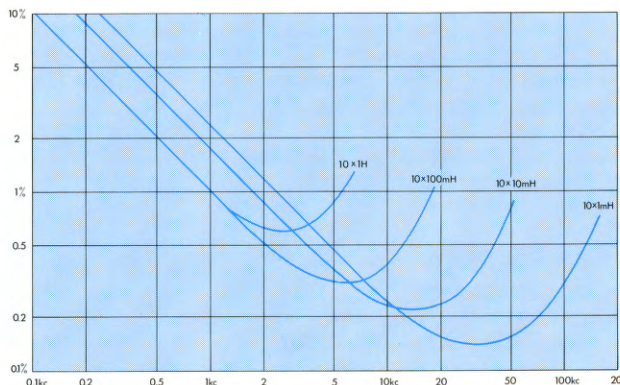


Fig. 1
Dissipation factor
as function of
frequency

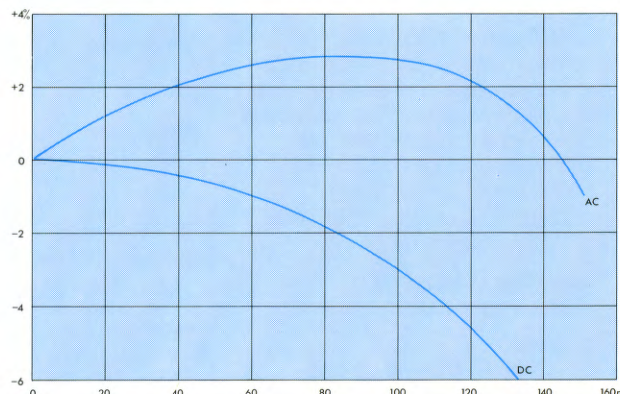


Fig. 2
Inductance
variation with
current for
100 mH coil

Multiplication Factors for Determining Inductance Variations and Maximum Current

Inductance setting	×1 H			×100 mH			×10 mH			×1 mH		
	1	2-4	5-10	1	2-4	5-10	1	2-4	5-10	1	2-4	5-10
Multiply current by	0.32	0.22	0.14	1	0.71	0.45	3.2	2.2	1.4	10	7.1	4.5



Decade Resistors Type PDR & DR

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DENMARK

Type PDR

Temperature Coefficient

Less than 0.002 % per °C between 15°–35°C.

Thermal EMF

About 1 µV per °C.

Stability

Stability of resistance value is normally better than 0.02 % per year.

Maximum Dissipation

0.5 W continuous per resistor. For short periods (about 1 minute) 1 W per resistor. These ratings correspond to a temperature rise of less than 40°C. The currents corresponding to the maximum dissipation of 0.5 W per resistor are marked on the top panel.

Switches

Wafer type switches with silver-plated contacts providing 8 contacts per position.

Type DR

Maximum Dissipation

Max. 1 W continuous for each resistor. For short periods (about 1 minute) the permissible dissipation is twice the above value.

Switches

Wafer type switches with silver-plated double contacts and high quality insulation.

General

Resistors below 100 kΩ are wire-wound on cards except the 0.01 Ω and 0.1 Ω Values, which use a hair-pin loop. Values from 1 Ω to 100 Ω use a non-inductive Ayrton-Perry winding.

Winding material is Manganin or low-TC Ni-Chrome alloy. The resistors are individually adjusted, carefully aged and checked several times during the production. For values of 100 kΩ and 1 MΩ selected high-quality metal-film resistors are used.

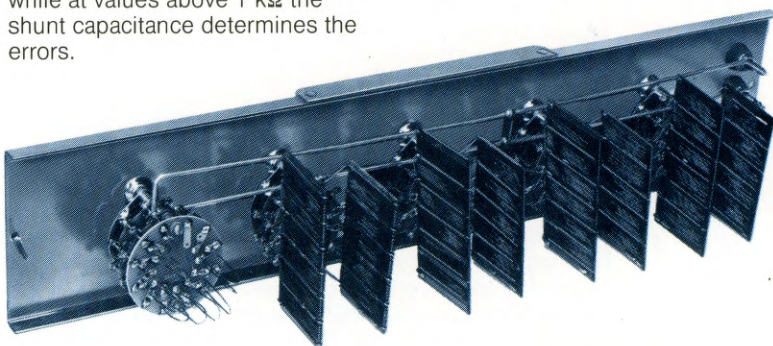
Frequency & Impedance Characteristics

On AC the errors caused by series inductance and shunt capacitance depend on the set resistance value, the number of decades and for high resistance values the method of connecting the shield terminal. At values approaching 10 Ω, series inductance is the controlling factor, while at values above 1 kΩ the shunt capacitance determines the errors.

Due to the varying factors which influence the errors, no accurate specifications can be stated, but the following table indicates the useful frequency range for various settings.

The values indicated in the table are the maximum frequencies for an impedance error of 1 %. The error is approx. proportional to frequency squared and a 10 % error will occur at about three times the indicated frequency.

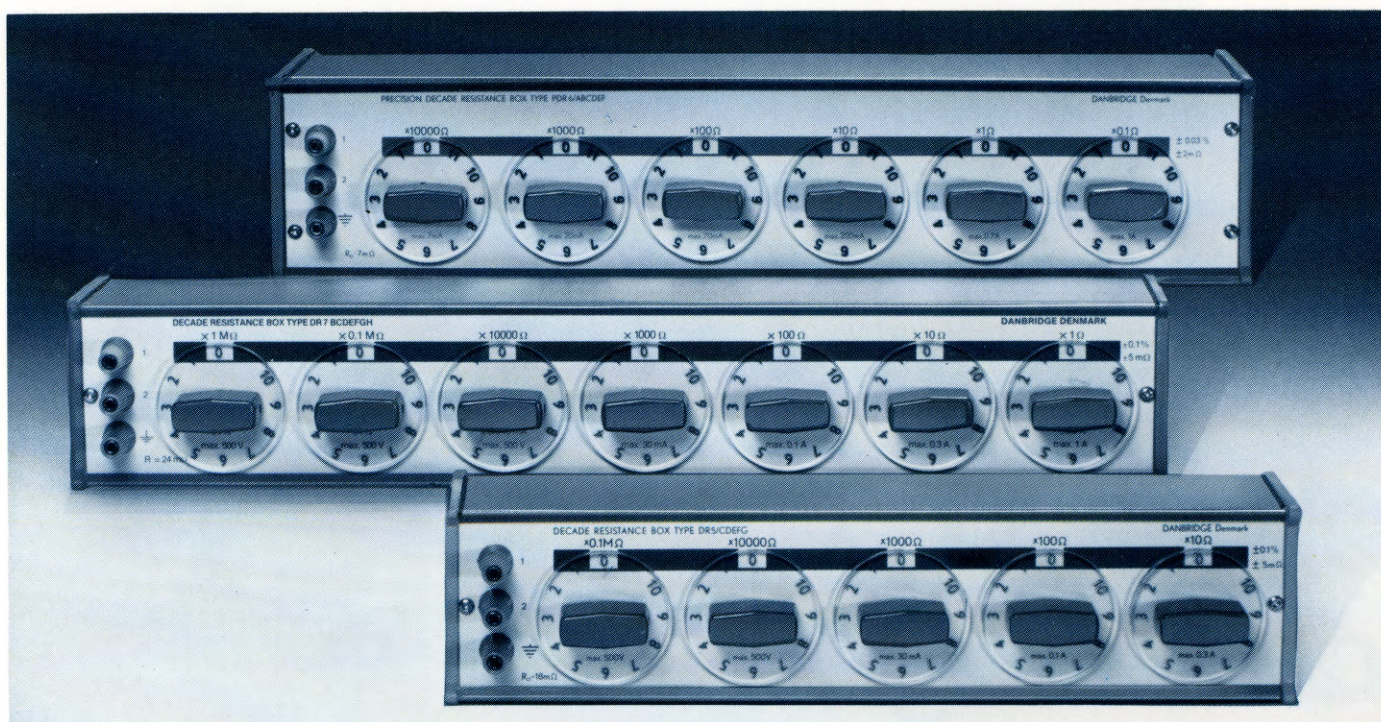
For values of 10 kΩ and above, the indicated frequencies are measured with the shield terminal connected to terminal 1. If the shield is floating, multiply the frequency by five in order to arrive at the same error.



Dimensions

Type	Height × Width × Depth mm	Weight kg
PDR6	160 × 460 × 97	2.5
DR4	117 × 300 × 85	1.3
DR5	117 × 365 × 85	1.5
DR6	117 × 425 × 85	1.7
DR7	117 × 490 × 85	1.8

Resistance setting	Frequency for ΔZ = 1 %	Frequency for ΔZ = 10 %
1 Ω	30 kHz	100 kHz
10 Ω	100 kHz	300 kHz
100 Ω	> 500 kHz	> 1 MHz
1 kΩ	500 kHz	> 1 MHz
10 kΩ	50 kHz	150 kHz
100 kΩ	5 kHz	15 kHz
1 MΩ	500 Hz	1.5 kHz
10 MΩ	50 Hz	150 Hz



Decade Attenuators Type DA3

DANBRIDGE
DENMARK

General

These instruments are designed to provide accurately known values of attenuation. Used for testing of communication circuits, amplifiers, filters, etc. they are designed as 4-terminal network with constant end equal values of input and output impedance at all settings. Both unbalanced T-networks and balanced H-networks are available. The lower Decades are designed as bridged T-networks, allowing practically noiseless switching for fine adjustment. The highest value Decade uses switched T-pads for the 5 lowest positions. On the 5 higher positions a further 5-unit pad is switched in series. The various sections of the highest value Decade pads are shielded mutually so that stray coupling is eliminated, and the attenuation accuracy is maintained over a wide frequency range.

Wafer type switches with silver-plated contacts are used requiring a minimum of attention over long periods.

The H-type pads consist of 2 T-pads with a common neutral lead brought out to separate terminals. The attenuators may thus be used with the common line floating or earthed. In the latter case one of the half-sections of the attenuator may be used as an unbalanced

T-network with a characteristic impedance half the value of that of the balanced network.

The individual resistors are manganin wire wound on cards with non-inductive windings for the lower values to reduce reactive effects. For values above 3.000 Ω high-stability carbon resistors are used.

Specifications

Switches

Wafer switches with silver-plated contacts.

Range

Two standard types are available, an unbalanced T-type and a balanced H-type. Decade values are 10 \times 0.1 dB, 10 \times 1 dB, and 10 \times 10 dB.

Impedance

The characteristic impedance of both types is 600 $\Omega \pm 1/2\%$ in both directions.

Accuracy

All resistors below 3.000 Ω are adjusted to $\pm 1/2\%$ except the series resistors on the lowest value Decade which are $\pm 1\%$. Resistors above 3.000 Ω are carbonfilm resistors with an accuracy of $\pm 2\%$ to $\pm 5\%$.

Attenuation accuracy at frequencies up to 50 KHz is $\pm 1/2\%$ of the indicated value ± 0.01 dB up to 50 dB. Above 50 dB add ± 0.1 dB.

At frequencies up to 300 kHz and attenuation settings up to 80 dB accuracy is $\pm 1\%$ of the indicated value ± 0.02 dB.

For type DA3H/D the accuracy is better than $\pm 1\%$ at all settings up to 300 kHz.

Input Dissipation

Max. 1 W.

Terminals

Two input and output screw terminals are provided with holes for 4 mm banana plugs. Terminal spacing 19 mm ($3/4"$). In the T-section type the shield is connected to a separate terminal which may be connected to common neutral terminal by a strap. In the H-types, the centre points of the sections are connected and brought out to a terminal which may also be connected to the shield.

Dimensions

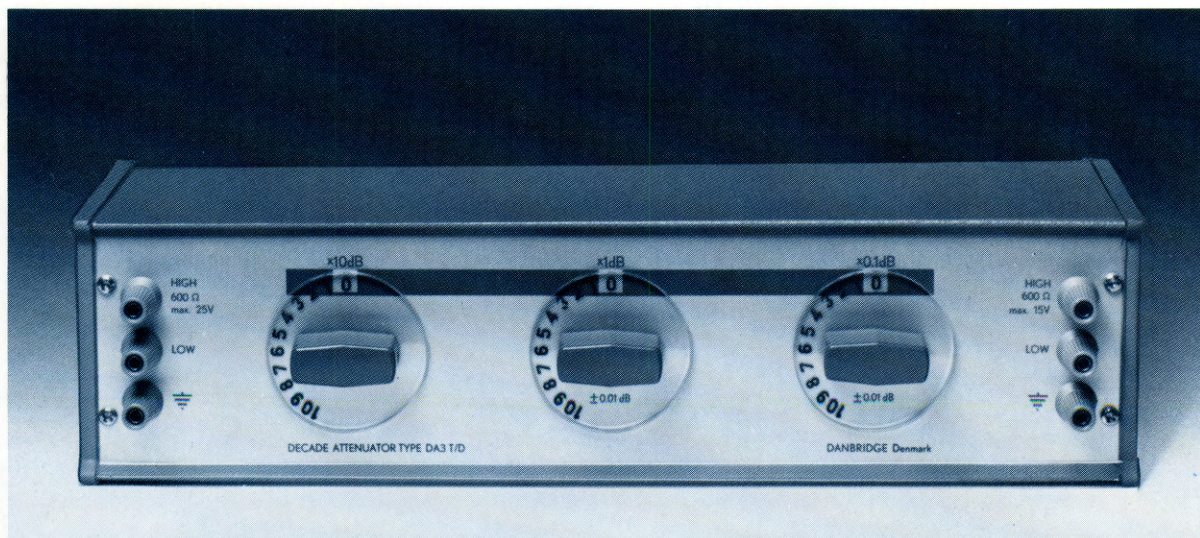
Height: 165 mm.

Width: 382 mm.

Depth: 98 mm.

Weight: 3.0 kg.

Type	Network	Range	Smallest Step
DA3T/D	Unbalanced T	111 dB	0.1 dB
DA3H/D	Balanced H	111 dB	0.1 dB



All specifications subject to changes without prior notice



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Danbridge Copenhagen

INTERNATIONAL PRICE LIST



MARCH 1990

COMPONENT TEST EQUIPMENT

<u>TYPE</u>	<u>CLR TESTERS</u>	<u>DKR.</u>
CT10	CLR Bridge 1 kHz - 111 Hz	19.900
CT10/JA	BNC Adaptor for external Jig for CT10	2.250
CT10R	CLR Bridge 1 kHz - 100 Hz or 120 Hz remote controlled via IEEE or RS232C	16.500
CT20	CLR Tester 10 kHz - 1 kHz - 100 Hz	42.500
CT20R	CLR Tester (Remote controlled)	35.500
CT20Z	CLR Tester (incl. Zener-Diode measurements)	46.500
CU1	Control Unit for CT20R	8.500
JIG20	Test Jig for CT20	3.380
CT30	CLR Tester 100 kHz - 10 kHz - 1 kHz	66.000
CT30R	CLR Tester (Remote controlled)	57.600
CU2	Control Unit for CT30R	8.500
JIG30	Test Jig for CT30	3.380

RESISTANCE BRIDGE

MBX	High Speed Resistance Bridge	55.000
JIG20	Test Jig for MBX	3.380
89332	Opto-coupler for limit output (option)	1.800

HIGH-VOLTAGE NON-DESTRUCTIVE INSULATION TESTERS

JP15	15 kV Portable Insulation Tester for external 12 V DC power only	13.400
JP15/U	15 kV Portable Insulation Tester for 110 - 240 V AC mains operation and 12 V DC operation and with space for an optional, rechargeable battery	15.400
JP15/UM	Universal Power Module for 110 - 240 V AC and 12 V DC with space for an optional, rechargeable battery	2.500
JP15/BM	Battery Module for JP15 (dry cells or NiCd cells only) less batteries	1.600
JP15/CB	Carrying Bag (optional) for all types of JP15	1.500
21001	12 V 2 Ah rechargeable, maintenance-free lead-acid battery (optional for JP15/U)	540
JP30A	30 kV Insulation Tester	20.600

ACCESSORIES

Rack-Mounting Kit for JP30A	170
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INTERNATIONAL PRICE LIST

MARCH 1990

R-C-L DECADES

<u>TYPE</u>	<u>RESISTORS</u>	<u>DKR.</u>
PDR6/O-E	Precision Decade Resistor	6.400
PDR6/A-F	Precision Decade Resistor	6.760
	Calibration Certificate for PDR6	1.350
DR4/O-C	Decade Resistor	2.800
DR4/A-D	Decade Resistor	3.070
DR4/B-E	Decade Resistor	3.140
DR4/C-F	Decade Resistor	3.120
DR4/D-G	Decade Resistor	3.080
DR4/E-H	Decade Resistor	2.960
DR5/O-D	Decade Resistor	3.380
DR5/A-E	Decade Resistor	3.580
DR5/B-F	Decade Resistor	3.740
DR5/C-G	Decade Resistor	3.640
DR5/D-H	Decade Resistor	3.580
DR6/O-E	Decade Resistor	3.980
DR6/A-F	Decade Resistor	4.220
DR6/B-G	Decade Resistor	4.300
DR6/C-H	Decade Resistor	4.040
DR7/O-F	Decade Resistor	4.590
DR7/B-H	Decade Resistor	4.840

ATTENUATOR

DA3H	Decade Attenuator, balanced	13.000
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CAPACITORS

DK4A	Decade Capacitor, 4 decades	4.400
DK4AV	Decade Capacitor, 3 decades + aircap	3.700
DK4S	Precision Decade Capacitor	10.300
DK4SV	Precision Decade Capacitor	8.600

INDUCTOR

DI4	Ferrite-cored Decade Inductor, 4 decades	9.500
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