

# Computer Controlled High Precision Resistance Decade

Models 1422 IEC, 1423 IEC, 1424 IEC,  
1422 RS232, 1423 RS232, 1424 RS232

Code:	1422 E
Manufacturer:	burster
Delivery:	ex stock
Warranty:	12 months
Issue:	1.10.2001



- Ranges from 10 x 0,01  $\Omega$  to 10 x 100 000  $\Omega$
- Error tolerance 0,01 %
- Resistor material: ZERANIN®
- Temperature coefficient  $\leq$  2 ppm/K
- Long-term stability < 0,01 % over years

## Application

A prime feature of the high-precision resistance decades is the design, fulfilling a host of functions. Meeting a whole range of requirements in practice they are used as

- 6-stage high-precision resistance decade
- 2 x 3-stage high-precision resistance decade
- 2 variable normal resistors
- Scalers with random-setting divider ratio

## Computer Control

Each of the 3 versions - model 1422, 1423 or 1424 - is also available with computer control. IEEE488 and RS232 interfaces are available. The RS232 version is easily extended to RS485 or RS422. The stepping motors used do not alter the known high long-term stability and reproducibility of the decades with computer control either.

## Description

Highest precision, temperature and long-term consistency are characteristic features of the described high-precision resistance decade. Many years of experience, tried-and-tested technology and the use of field-proven materials guarantee the high level of precision.

The decade resistors consist of low-capacity and low-inductance wire wound of Zeramin. The low temperature coefficient of this material, the low error tolerance of the resistors and the long-term stability achieved through careful artificial ageing are the guarantee for reliable conformity with the technical specifications for this decade resistor.

A specially developed precision stepping switch with high-quality contact materials and optimal brush construction guarantee very good reproducibility. The contacts are self-cleaning and virtually free of thermoelectric power. All 6 decade resistor stages are contained in an attractive 19" casing. The casing acts as screen against electrostatic interference. It is conductively connected to the earth socket on the front panel. Electrical connection of the decade resistor to the screen is possible with a connecting link.

The two sub-decades  $R_{D1}$  and  $R_{D2}$  are arranged so that they can be operated independently. An insulated plug-in link joins the two sub-decades together to form a six decade resistor. This makes the decade resistors suitable for universal applications. Very low zero-sequence resistance has been achieved by circuit optimization. This very low zero-sequence resistance is divided again if only one decade section is being used.

## Technical Data

Zero Resistance Box:	
Complete Resistance Box	$\leq 11 \text{ m}\Omega (9 \pm 2 \text{ m}\Omega)$
Partial Box $R_{D1}$	$\leq 5 \text{ m}\Omega (4 \pm 1 \text{ m}\Omega)$
Partial Box $R_{D2}$	$\leq 6 \text{ m}\Omega (5 \pm 1 \text{ m}\Omega)$
Error tolerance:	0.01 % in the main steps, see also table below
Calibration:	in Ohm absolute at 23 °C
Resistance material:	Zeranin®
Temperature coefficient of the individual resistances:	$\leq 2 \text{ ppm/K}$
Winding structure:	subdivided coils due to Chaperon
Long-term stability:	$< 0.01 \%$ over years
Power dissipation:	0.4 W ( $\leq 500 \text{ V}$ )/individual resistance = 4 W/each decade
Operating voltage:	max. 500 V ( $\leq 0.4 \text{ V}$ )
Test voltage:	2 kV <sub>eff</sub> /50 Hz
Design and construction:	according to DIN 43783, part 1 and VDE 0871/B
Switching arrangement:	short - circuiting between two neighbouring contacts in the switching process
Switching positions:	gradation =12, limited to 11 steps
Contact material:	Ag - plated on ECU, slider pack: of solid Ag
Operating moment:	approx. 0,1 Nm
Housing:	19", 2 HE
Dimensions (length by height by depth):	445 x 90 x 285[mm]
Weight:	approx. 3,2 kg; ca. 12 kg IEC-Bus-version or RS232

## Tolerances, Charges

Value	Resistance tolerance %	Rated current mA
10 x 0.01 $\Omega$	$\pm 2$	2000
10 x 0.1 $\Omega$	$\pm 0.5$	2000
10 x 1 $\Omega$	$\pm 0.05$	600
10 x 10 $\Omega$	$\pm 0.01$	200
10 x 100 $\Omega$	$\pm 0.01$	60
10 x 1 k $\Omega$	$\pm 0.01$	20
10 x 10 k $\Omega$	$\pm 0.01$	6
10 x 100 k $\Omega$	$\pm 0.01$	2

## Controlled via Interface

The mentioned excellent technical specifications for the high-precision resistance decade boxes are not affected by the IEC-Bus/RS232-control.

The decade resistor operates as talker and listener, making it also possible for the computer to read a manually set resistance value. The resistance decade always sends 6 characters (ASCII-code 0 - A) for this purpose, whereby all non-required conducting positions are filled with zeros.

If a computer set value is changed by hand in remote-control operation, it is immediately corrected by the decade resistor control. With the IEC-Bus versions an SRQ-call is made to the computer if this does not take place within 3s for any reason whatsoever.

If manual adjustment is required, a local command (GTL) from the computer is necessary at first.

The resistance decade always seeks the optimal path for adjustment whilst avoiding the decade position "000000" (short-circuit).

## IEC-Bus Version

The IEC-Bus is connected by 24-pole plug-in connector meeting IEEE488 standards. The coding of the device address and various clearing signals are made through an 8-way DIL switch. The resistance decade is given a device address of "8" and the clearing signal "CR LF" at the factory.

The IEC-Bus-controlled decade resistors can also be operated in the "PP1" (parallel poll) mode.

## RS232/485-Version

The RS232 is connected by a 25-pole Mini-D socket. The baud rate can be switched from 9600 to 4800. ANSI x 3.28 is used as transmission protocol.

Data format 8 data bit 1 stop bit are non-changeable. The parity bit can be selected from "no, even, odd". RS485 and RS422 transmission can be easily achieved through replugging internal jumpers. This makes the decade addressable and busable. The address is set by DIL switch.

Auxiliary power: 220 V  $\pm$  10 %, 50/60 Hz  
Power consumption: passive approx. 18 VA, active approx. 132 VA

## DKD Calibration Certificate

burster präzisionsmeßtechnik maintains a calibration station which is affiliated to the Deutsche Kalibrierdienst (DKD). Supervised by the Physikalisch-Technische Bundesanstalt (PTB) of Braunschweig, the calibration station at burster's is authorized to issue Calibration Certificates.

The Calibration Certificate shows altogether 60 values for the resistance in 10 switch positions of each decade and the inherent relative uncertainty. As experience has shown, the relative uncertainty in the upper decades amounts to only 1/3 to 1/20 of the respective error tolerance. More precise knowledge of resistance values thus means a veritable increase in value of the instrument.

## Proprietary Calibration Certificate

Please refer to DKD Calibration, but the accuracy is reduced.

**Wiring possibilities**

High-precision resistance decade with 6 stages

10 x (0,01 + 0,1 + 1 + 10 + 100 + 1000) Ω	<b>1422</b>
10 x (0,1 + 1 + 10 + 100 + 1k + 10 k) Ω	<b>1423</b>
10 x (1 + 10 + 100 + 1 k + 10 k + 100 k) Ω	<b>1424</b>

Precision divider with adjustable ratios

$R_{D2}$			$R_{D1}$			
10x1k	10x100Ω	10x10Ω	10x1Ω	10x0,1Ω	10x0,01Ω	<b>1422</b>
10x10k	10x1k	10x100Ω	10x10Ω	10x1Ω	10x0,1Ω	<b>1423</b>
10x100k	10x10k	10x1k	10x100Ω	10x10Ω	10x1Ω	<b>1424</b>

Connector pins 2 - 5: complete decade with  $R_{D1} + R_{D2}$   
 Connector pins 2 - 1(4) - 5: divider  $R_{D1} : R_{D2}$   
 Earthing link (on demand) from 2 to 3

Housing

Two variable resistance standards

0,01 Ω - 11,1 Ω and 10 Ω - 11,1 kΩ	<b>1422</b>
0,1 Ω - 111 Ω and 100 Ω - 111 kΩ	<b>1423</b>
1 Ω - 1110Ω and 1 kΩ - 1110 kΩ	<b>1424</b>

Two separate high precision decades

$R_{D2}$			$R_{D1}$			
10x1k	10x100Ω	10x10Ω	10x1Ω	10x0,1Ω	10x0,01Ω	<b>1422</b>
10x10k	10x1k	10x100Ω	10x10Ω	10x1Ω	10x0,1Ω	<b>1423</b>
10x100k	10x10k	10x1k	10x100Ω	10x10Ω	10x1Ω	<b>1424</b>

Connector pins 1 - 2: decade 1 with  $R_{D1}$   
 Connector pins 4 - 5: decade 2 with  $R_{D2}$   
 Earthing link (on demand) from 2 to 3

Housing

**Order Information**

Model 142  -

Resistance range		
10 x 0,01 Ω ... 10 x 1000 Ω		2
10 x 0,1 Ω ... 10 x 10 kΩ		3
10 x 1 Ω ... 10 x 100 kΩ		4
decade IEC-Bus version		- IEC
decade RS232/RS485 - version		- RS232

**DKD Calibration Certificate**

Order code 14DKD - Order code decade  
 i.e. 14DKD - 1422-RS232

**Proprietary Calibration Certificate**

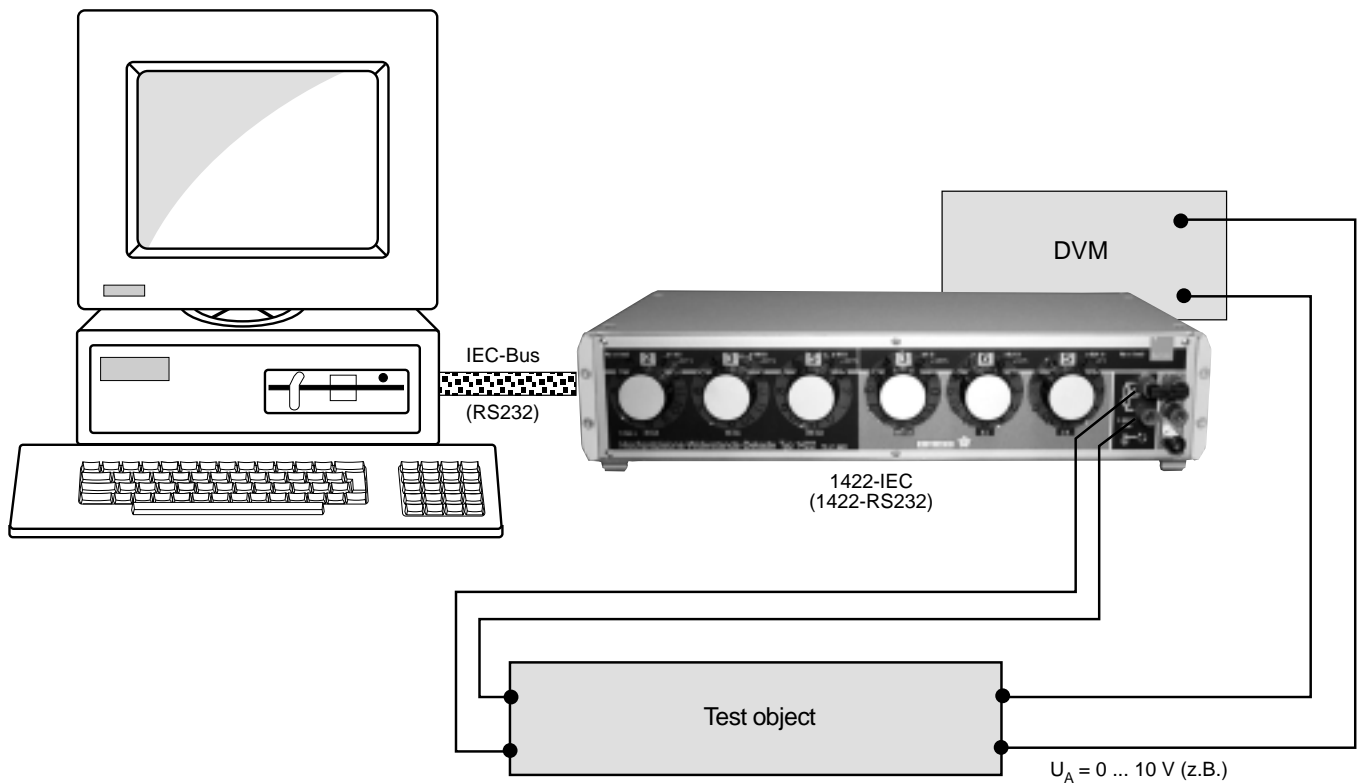
Order code 14WKS - Order code decade  
 i.e. 14WKS - 1423 IEC

**Accessories**

Included in delivery are a connecting link to bridge the decade input with the housing and an insulated plug - in link for connecting decade  $R_{D1}$  with decade  $R_{D2}$  (1 - 4).

1 pair of mounting angles for installation in a 19"- rack.

**Model 1492-V001**



### Application Example

#### Computer-Controlled Testing of a Pt 100 amplifier

- The program queries the scanner to be simulated (i. e. Pt 100. Pt 500 etc.).
- Input of temperature values in °C.
- The program calculates the corresponding resistance value and sets decade.
- The output of the test object is measured.
- Evaluation by the computer (i. e. documentation).

#### Further Applications for 1422-IEC and 1422-RS232 Decades

- Controllable load resistance for automatic bridge compensation
- Controllable voltage divider for precision voltage settings etc.
- Automatic testing of ohmmeters
- Automatic testing of i.e. Pt 100 thermometers (temperature simulation)