RESISTOMAT® for Fast Resistance Measurement in Automated Processes

Model 2329

Application
The RESISTOMAT® model 2329 is particularly suitable for fast measurements of low resistances in automated processes. Up to 50 measurements per second can easily be performed. The device complies with the latest CE guidelines and is designed for laboratory use as well as heavy-duty industrial applications.

A 2-fold and 4-fold comparator with switching outputs has been included for classification and selection; this feature is particularly useful for serial tests.

One special application involves the measurement of contact resistances (dry-circuit measurement); the load voltage in this case is limited to 20 mV in order to prevent fritting (DIN IEC 512). The RS232 (standard) and IEEE488, USB, Ethernet (option) computer interfaces allow the set-up of fully automatic testing stations. The PLC interface allows easy integration into your production process control.

Typical applications are resistance and conductivity measurements on:
- Fuses
- Airbag triggers
- Coils for the automobile industry and electrical engineering
- Plug-in contacts and switches
- Commutator welded joints
- Meter samples in cable manufacture
- Circuit-board conductors etc.

Description
The device operates on the basis of proven 4-wire technology which corrects any incoming line or contact resistances. The measurement lines are checked by an integrated cable rupture monitor.

Needless to say, the functions include temperature compensation for various test substances such as copper, brass, tungsten etc. Temperatures are measured by a Pt100 sensor or infrared sensor (pyrometer) with analog outputs or any temperature transmitter e.g. thermocouple.

For measuring test objects with low inductances, a special measurement input protection was developed to prevent voltage peaks from damaging the device when test objects are disconnected.

If objects need to be tested for several different parameters by an automatic measurement system, you can store up to 32 device settings such as measurement ranges, limiting values, temperature coefficients etc. These settings are called up via a bit pattern (5 bits). Naturally, all device settings can also be made via the RS232 (standard) or IEEE488, USB, Ethernet interfaces (option).

The integrated data logger can be used during serial measurements to store up to 20,000 measurement values which can be divided into 32 individual blocks. A digital filter is available for preselecting the measurement values to be stored. The evaluation menu of the stochastic data logger displays the maximum, minimum and average values as well as the standard deviation.

- Measurement range from 200 mΩ ... 200 kΩ
- Resolution up to 10 µΩ
- Measurement accuracy 0.03 % Rdg.
- Automatic measurement range selection
- Up to 50 measurements and evaluations per second
- Temperature compensation for all materials

- Thermovoltage compensation
- Dry-circuit measurement in accordance with DIN IEC 512
- Data logger for 20,000 measurement values
- RS232 and PLC interface standard (IEEE488, USB and Ethernet option)

Option with 6 channel switch system

Code: 2329 EN
Delivery: ex stock/2 weeks
Warranty: 24 months

Technical changes reserved -
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Display

200mΩ 100mA 60.4°C
0 5 Cont. AUTO R

102.29mΩ

DATA COMP EXTR PARA

Status line I
Measurement range, measurement current or 20 mV for dry-circuit measurements
Temperature with active temperature compensation or setpoint values with ∆% display

Status line II
Error status, the last device adjustment loaded, continuous or single measurement, manual or automatic range selection, measurement sequence R or Z

Measurement value field
The last value measured

Meaning of the function keys

Device and Documentation Software
The software model 2329-P001 is especially developed for the device setting as well as for the measurement value evaluation and provides following features:

► Full control of RESISTOMAT® model 2329
► Online display of the measured values (graphic or tabular)
► Direct storage of the measured values in ASCII files
► Read-in and storage of data logger values in ASCII files
► Data export in ASCII format to e.g. MS Excel

System Requirements
Processor: 80386 with co-processor or better
Graphic: Standard VGA 640*480, 256 colours (also monochrome LCD display)
Memory: min. 8 MB RAM
Hard disk: approx. 10 MB free memory
Relocation file: min. 15 MB
Operating system: Win 95, Win 98, Win 2000, WinNT 4.0, ME, XP
Interfaces: RS232, IEEE488, USB or Ethernet

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**Applications**

**Fuses 100 % tested**
Evaluation of the fuse production with device internal statistic program or externally via PC

**Coils 100 % tested**
The measurement happens in consideration of the temperature coefficient. For that purpose the surface temperature of the coil is measured with a pyrometer.

**PC-controlled tests with 6 channel switch**
Automatic 4-wire measurement for up to 6 test objects with the integrated switch box.

The channel selection is possible via rotary switch at the front panel or externally via PLC (3 bit), RS232, USB or IEEE 488 interface. With the relative low measurement current of 100 mA up to 10^8 switching cycles are possible.
Technical Data

Design

The device is easy to maintain and equipped with a robust metal housing. Easy accessibility of the individual modules and ideal servicing conditions are thus ensured. All the control elements are arranged clearly and logically on the front panel. The connection socket for test objects and the inputs/outputs for the interface, comparators, Pt 100 sensor (for temperature compensation) and control unit are located on the rear panel of the device.

### Measuring Range

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>Resolution</th>
<th>Measuring Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>200.00 mΩ</td>
<td>10 µΩ</td>
<td>100 mA</td>
</tr>
<tr>
<td>2.0000 Ω</td>
<td>100 µΩ</td>
<td>10 mA</td>
</tr>
<tr>
<td>20.000 Ω</td>
<td>1 mΩ</td>
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</tr>
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<td>10 Ω</td>
<td>10 µA</td>
</tr>
</tbody>
</table>

Measurement error (with the temperature compensation inactive):
- Up to 0.03 % of reading ± 2 counts
- Warm-up time: < 10 min. to attain the error tolerance range
- Max. voltage at the open terminals: ≤ 16 V
- Max. load voltage: ≥ 5 V
- Measurement connection: 4-wire technology for current and voltage measurement (Kelvin), ungrounded circuit, potential binding is possible either on the test object or the RESISTOMAT®.
- Measurement time: up to 50 measurements and evaluations per second, depending on the resolution and measurement mode in case of purely ohmic test objects.
- Measurement mode: continuous or single measurement
- Range selection: manual or automatic
- Dry-circuit measurement: in accordance with DIN IEC 512
- Temperature compensation: selection and adjustment of 10 different temperature coefficients
- Temperature measurement: via an external Pt 100 sensor or transmitter (pyrometer) with a voltage (0 ... 10 V) or current output (0 ... 20 mA), (4 ... 20 mA)
- Comparator: 2 or 4 limiting values, as required
- Data logger: the data logger has a memory capacity of 20 000 measurement values which can be divided into 32 blocks.

### General Data

- Display: 128 x 64 pixel, transflective LCD graphic display with adjustable contrast and background illumination
- Measurement value indication: selective 3 1/2 or 4 1/2 digit, LCD 15 mm high, measurement value display as absolute, Δ% or evaluation >>, >, =, <, <<
- Voltage supply: 230 V ± 10 % or 115 V ± 10 %
- Mains frequency: 47 - 63 Hz
- Power consumption: max. 25 VA
- Temperature drift: 20 ppm/K
- Ambient conditions: operation: +5 ... 40 °C, storage -10 ... 50 °C
- Potential binding: the measurement section is grounded internally; a switchover to external grounding is also possible
- Clock, data logger, adjustment: internal battery back-up
- Parameter entry: via keys or interfaces
- Weight: approx. 5 kg
- Housing dim. (H x W x D): 151 x 237 x 285 [mm] with handles D = 325 mm
- Device protection: EN 61010
- Protection class: IP 40

### Connections

- Rx input (test object): 5-pin Tuchel socket series C 70 BT 3015000 with bayonet lock
- Pt 100 sensor: 6-pin LEMO socket EGG. 1B. 306
- Analog I/O: 9-pin, subminiature D-plug
  - Temperature input 0 ... 10 V, 0 ... 20 mA, 4 ... 20 mA
  - Analog output 0 ... 10 V, scaling error ≤ 2,5 %
- Digital I/O: 37 pin, subminiature D socket
- PLC interface: ext. DC supply 20 V ... 24 V ... 30 V, pos. logic with current consuming PLC inputs
  - U1 = 15 V
  - Umax = 30 V
- 5 Bit for evaluation <<, <, =, >, >>
  - 1 Bit measure end
  - 1 Bit measure busy
  - 1 Bit measure error
  - 6 Bit for binary selection of the device setting
  - 4 Bit for control input
  - 3 Bit for control output
  - 1 Bit START/STOP each for measurement, comparator, data logger, min./max., printer

### Interface connections:

- RS232C interface:
  - 9-pole Subminiature D-socket
  - Baud rate: 300 - 38 400
  - Protocol: ANSI X 3.28-1976 subcategory 2.1, A3
  - SCPI command language, version 1995.0
  - data recording to a printer with RS232 interface is possible
- IEEE488 interface (optional):
  - 24 pole plug connection standardized for open collector output
  - (E1) SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, SCPI command language, version 1995.0

### Order Information

- RESISTOMAT® with RS232 interface
  - Model 2329
- RESISTOMAT® with RS232 and IEEE488 interface
  - Model 2329-V001
- RESISTOMAT® with RS232 interface and 6 channel switch system
  - Model 2329-V002
- RESISTOMAT® for the check of airbag igniters, measuring current < 10 mA, voltage load < 2 V
  - Model 2329-V001

### Accessories

- Measurement lead
  - Model 2329-K001
  - 4-pole, 1.5 m long shielded cable with banana plugs
- RS232 data transmission lead
  - Model 9900-K333
- USB Converter
  - Model 9900-K361
- Ethernet Converter
  - Model 9900-K453
- Pt 100 temperature sensor
  - Model 2392-V001
  - with 2.5 m shielded connection line and connection plug
- Pyrometer
  - Model 2328-Z001
- Device and documentation software
  - incl. data transmission cable model 9900-K333
  - Model 2329-P001
  - 37 pin plug for digital I/O interface
  - Model 9900-V165
- 9 pin socket
  - for analog I/O interface
  - Model 9900-V609
- 5 pin bayonet plug
  - for measurement input
  - Model 9900-V172
- Assembly set for 19" 3U rack mounting
  - Model 2329-Z004
- DKD/DAkkS Calibration Certificate
  - Model 2392-V001
- IEEE488 interface module
  - Model 2329-Z006
- WKS Calibration Certificate
  - Model 23WKS-2329
- Calibration resistors
  - see data sheet 2385 EN
  - Wire holding device for wires up to 2500 mm²
  - see data sheet 2381 EN
  - Calibration wires
  - see data sheet 1240 EN