

OPERATION MANUAL

RESISTOMAT® Model 2320-V001

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Präzisionsmessgeräte, Sensoren und Messsysteme
für elektrische, thermische und mechanische Größen



EG-Konformitätserklärung

EC-Declaration of Conformity according to EN ISO/IEC 17050-1:2004

Name des Herstellers: burster präzisionsmesstechnik gmbh & co kg
Manufacturer's Name:

Adresse des Herstellers: Talstr. 1-5
Manufacturer's Address: 76593 Gernsbach, Germany

erklärt unter alleiniger Verantwortung, dass das gelieferte Produkt
declares under sole responsibility that the product as originally delivered

Produktname: Batteriebetriebenes Milliohmmeter RESISTOMAT®
Product Name: Battery-Operated Milliohmmeter RESISTOMAT®

Modellnummer(n) (Typ): 2320
Models Number / Type:

Produktoptionen: Diese Erklärung beinhaltet obengenannte Produkte mit allen Optionen
Options: sowie für Akku-Pack mit Ladestation 2320-Z002
This declaration covers all options of the above product(s)
include Rechargeable battery pack with docking station and charger 2320-Z002

mit den folgenden europäischen Richtlinien übereinstimmt und entsprechend das CE-Zeichen trägt:
complies with the requirements of the following applicable European Directives, and carries the CE marking accordingly:

| | |
|----------------------------------|---|
| 2006/95/EC <i>Low Voltage</i> | Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen <i>Electrical Equipment designed for use within certain voltage limits</i> |
| 2004/108/EC <i>EMC</i> | Elektromagnetische Verträglichkeit <i>Electromagnetic Compatibility</i> |

Obengenannte Produkte entsprechen folgenden harmonisierten Normen:
Above named products conform with the following product standards:

| | | | |
|---|------------------------------------|--|--|
| Sicherheit: <i>Safety requirements:</i> | IEC 61010-1:2001 / EN 61010-1:2001 | Messkategorie 1 CAT 1 | Schutzklasse III; * <i>Safety class 3</i> |
| | | * Netzteil Ladestation 2320-Z002 <i>Docking station</i> | Schutzklasse 2 <i>Safety class 2</i> |

EMV Störaussendung: IEC/CISPR 11:2003 + A1:2004 + A2:2006 / EN 55011:2007 + A2:2007
EMC Generic emission:

EMV Störfestigkeit: IEC 61326-1:2005 / EN 61326-1:2006
EMC Generic immunity: Industrie Bereich
Industrial environment

Ergänzende Informationen: * Netzteil Ladestation 2320-Z002 = Schutzklasse 2
*Additional Information: * docking station = safety class 2*

Das Produkt wurde in einer typischen Konfiguration getestet.
The product was tested in a typical configuration.

Diese Konformitätserklärung betrifft alle nach Ausstellungsdatum ausgelieferten Produkte:
This DoC applies to above-listed products placed on the EU market after:

Gernsbach 09.07.2008 i.V. Alfred Großmann
Datum / date Quality Manager

Dieses Dokument ist entsprechend EN ISO/IEC 17050-1:2004 Abs. 6.1g ohne Unterschrift gültig / According EN ISO/IEC 17050 this document is valid without a signature.
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WARNING !

The apparatus shall be disconnected from all voltage sources before opened for any adjustable, replacement maintenance or repair.

Any adjustable, maintenance and repair of the opened apparatus under voltage shall be avoided and carried out only by a skilled person.

Make sure that only fuses with the required rate current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation and returned to our factory or Agent for rectification.

Milliohmmeter RESISTOMAT® Model 2320-V001



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1. Introduction

The RESISTOMAT® model 2320-V001 are accurate hand/portable digital Milliohmmeters for the measurement of resistance in the range $10 \mu\Omega$ to 4000Ω . They employ the four terminal resistance measurement method to eliminate the effect of load resistors errors. The measured values are displayed on a 4 digit LCD display; an overflow of the selected range is also indicated.

Simple push button selection of range required plus and auto range feature ensures the ohmmeter may be easily used by unskilled personnel, error and status warnings are illuminated when appropriate. The utmost care has been used to ensure that the ohmmeters will withstand an accidental mains voltage applied to the measuring terminals, but it is not recommended that voltage should be applied.

1.1 Application

The RESISTOMAT® model 2320-V001 is a universally applicable and easy to operate measurement device for low-ohmic resistances. The light and handy device in a stable IP54 plastic housing with membrane keypad is likewise suitable for use in service, laboratory or on the production floor. The power supply is done via built-in rechargeable battery packs or by standard batteries.

If need be, the temperature of samples can be measured and the sample resistance is subsequently compensated to fit the value at 20°C . This applies for samples with resistances depending on the sample's temperature. The temperature coefficients for copper and aluminium are included as standard. A third and fourth coefficient may be set individually for any given material to be measured.

The application range is manifold, such as measurement of:

- Resistance elements
- Plug connections
- Power rails
- Fuses
- Cable connections
- Transformers
- Electrical motors
- Cable and wire, any many more

1.2 Description

The 4 wire measurement configuration eliminates possible errors caused by test lead and contact resistance. This is the basis for resistance measurements in the $m\Omega$ range. The resistance value calculated in the current voltage method is then indicated on the large LCD display in $m\Omega$, Ω or $k\Omega$.

Single as well as permanent measurements are possible whereby the 6 measurement ranges can be selected in manual or automatic mode. The standard resistance value at 20 °C is calculated and displayed if the temperature compensation is active. The measured temperature may also be displayed directly.

Thermo voltages are eliminated by the bipolar current source and the calculation of the mean value (key AVE).

Low battery charge is informed through the LED "LOBAT". The battery pack can be replaced in a very simple manner. Recharging is done in an external station.

1.3 Handling inductive loads e.g. reactors, cables on reels, motors, coils, transformers

Safety instructions



- ▶ Before starting any measurement, make sure that the device under test does not carry an external voltage (e.g. mains voltage, voltage generated by a rotating motor etc.)
- ▶ Take care when handling inductive devices under test. By the physical nature of inductive devices, life-threatening voltages can be generated when the test current is disconnected.
- ▶ Dangerous induction voltages can occur if
 - the connectors are removed from the socket
 - the test current (measuring range) is changed or switched off (STOP)
 - the leads break



- the connections on the device under test are loose
- the instrument is switched off during the measurement
- the power fails during the measurement
- the test current changes for whatever reason
- a fuse blows.

▶ An inductive device under test must not be connected or disconnected in the START condition.

▶ **Always short-circuit the device under test before disconnecting.**

Protection circuit

The protection circuit is to be understood as an instrument protection.

The input voltage protection is designed for voltages up to 415_{rms}. Measurements with external voltage (e.g. 230 V_{rms} or 400 V_{rms}) at the test object are not possible.

Measuring

Do not press the button AVE when measure inductance test objects, because the magnetic field will be permanent changed due to the bipolar measurement current. In consequence you get instable or wrong measurement values.

2. Preparation for use

2.1 Unpacking the unit

The instrument weighs 0.8 kg and is packaged accordingly to protect against shock. Unpack the instrument carefully and verify if all items are included.

The normal delivery scope includes:

- 1 Milliohmmeter RESISTOMAT® model 2320-V001
- 1 pair of measurement leads
- 1 copy of this manual

Inspect the instrument carefully for any damages.

If you suspect that the instrument has been damaged during shipping, notify the shipping company immediately.

The packaging should be retained for examination by a representative of the manufacturer and/or the shipping company.

The RESISTOMAT® model 2320-V001 should be shipped only in its original packaging or in a packaging that is suitable to provide an equivalent degree of protection.

2.2 Switch-on the device

After switch-on the instrument performs a display checks. All indicators appear. The μ P checks all internal functions and PASS appears when all functions are ok. In the case that FAIL appears please send the instrument back to our service department.

After the self-test the RESISTOMAT® 2320-V001 performs an automatic zero point calibration and is in the standard measurement mode. It is now in the 4 k Ω range with manual range selection and display mode Rx.



Warning: The instrument must never be switched-on if it shows signs of damage during shipping.

2.3 Supply voltage

The device is operated with 5 AA alkaline batteries or 5 AA NiMHd rechargeable batteries (approx. 7.5 V).

2.4 Calibration

The meter was calibrated before shipping.

The calibration history of the instruments used for the calibration can be traced to the government standard in accordance with DIN ISO 9000ff.

The meter should be recalibrated after a period of about one year.

The calibration is performed using the key board, and should only be performed at the manufacturers premises. The calibration is described in chapter "Calibration".

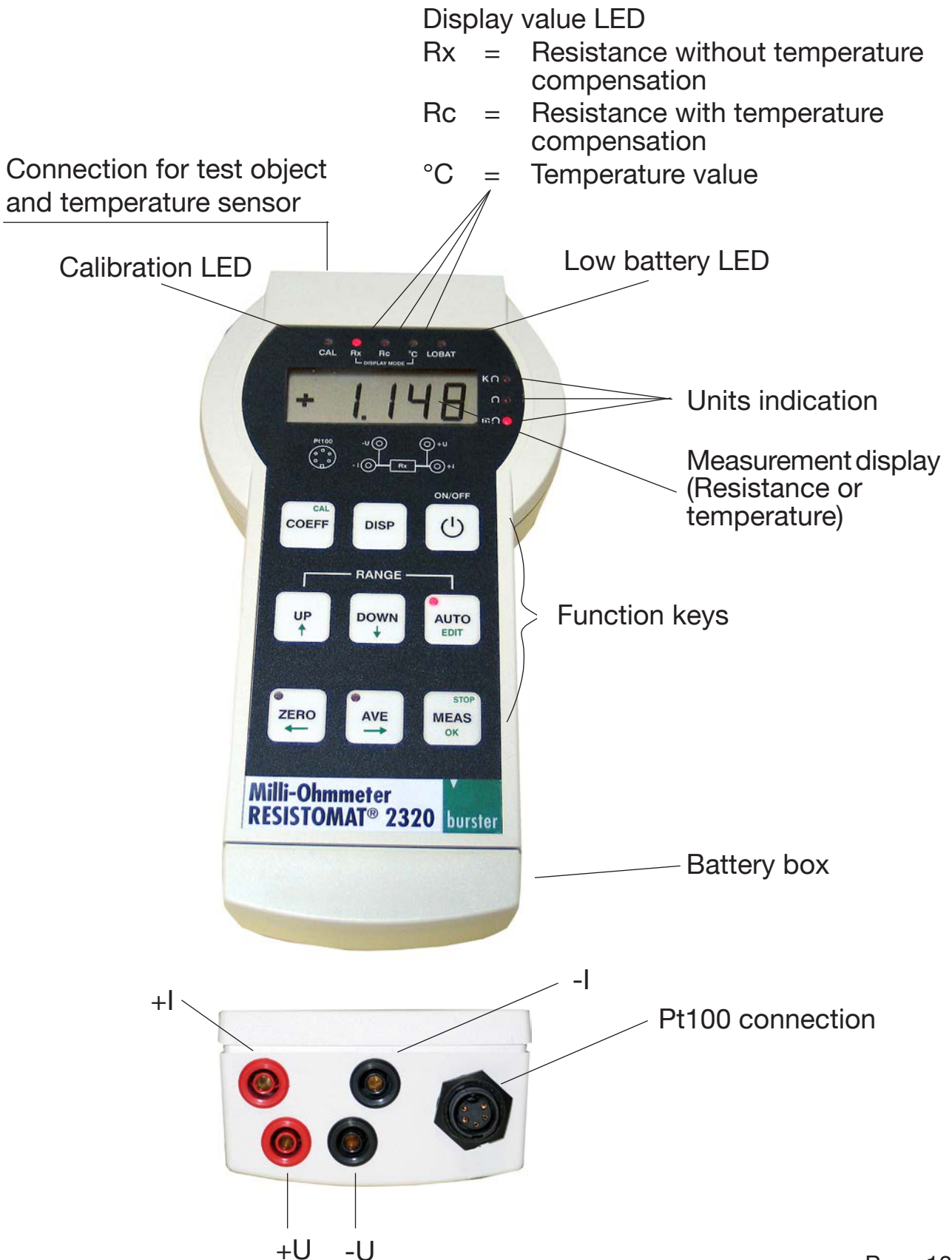
2.5 Storage

The storage temperature ranges in between - 20°C and 50°C.

If the device has been exposed to moisture during storage, ensure that it is completely dry on the inside and outside before commissioning it.

No other measures are required for commissioning after storage.

3. Description of Controls



Description of the keys



Switches unit ON and OFF



Change the measured value display
of Rx = Resistance measurement without temperature compensation
to Rc = Resistance measurement with temperature compensation
to °C = Temperature display



Selects temperature coefficient, Cu (coppers) and Al (aluminium) is fixed. Two further TCs can be defined by the user.



Select auto range mode.



Down key selects next lowest measuring range. It also decreases selected digit, used for setting coefficients and for entering calibration mode.



Up key selects next highest measuring range. It also increases the selected digit, used for setting coefficients and for entering calibration code.



Press once to initiate a new reading. Press and hold down key until long -BEEP- locks continuous mode.



Selects average measurement mode which measures with current in forward direction and the reverses current and takes a second reading the measured value displayed is the average of the two readings. Also acts as left key selects the next digit to the left flashing digit indicates the active one.



Internally shorts the current leads and nulls the reading eliminating errors due to emf in the measuring circuit. Also acts as left key select the next digit to the left flashing digit indicates the active one.

4. Measurement

Connect the resistance to be measured (R_x) to the measuring terminals in accordance with the diagram on the instrument panel. Select the range required. The LEDs to the left of the display will indicate the units $m\Omega$, Ω or $k\Omega$.

4.1 Auto-Zero

This function will zero any thermal emf - electro motive force (thermo voltage) within the measurement circuit. Connect to the R_x to be measured in the normal way, select the required measurement range and press ZERO. The current leads are shorted internally and any emf present in the R_x circuit measured by the potential leads (+U and -U). The 2320-V001 will then set the display to zero cancelling out this emf.

This function is suitable for use on inductive circuits and will be cancelled if another range is selected or the ZERO key is pressed again.

Whilst the input is protected against accidental application of mains voltage, 1 or 3 phase, care should be taken to avoid measuring on live circuits.

4.2 Over range

Over range will be indicated by the display reading „- - - -“.

4.3 Open circuit lead

OC will be displayed if the instrument detects that the lead resistance is too high. The + and -I terminals are checked for compliance voltage. This warning will also be displayed if the internal protection fuse is open circuit.

4.4 Connections

When making good quality measurements, it is important to ensure that all measuring leads are in good condition, and less 0.2Ω resistance. It should also be noted that some spade tags and crocodile clips can produce high thermal emfs when warmed, particularly nickel-plated brass types. This can cause problems when, for example, connecting too hot motor windings. The solution is to use plain copper or brass connections keeping them clean and oxide free.

4.5 Protection

Every effort has been made to protect the instrument against voltages being applied to the terminals. A large 1 Amp fuse fitted internally to the +I,-I measuring line.

The fuse fitted will interrupt up to 40,000 Amps. The P terminals are not fused and will withstand up to 415 V without damage to the instrument.

WARNING !

To replace the protection fuse, the rear instrument cover should be removed. The protection fuse is located on the main printed circuit board. Only replace with the correct fuse rating. Ensure that all measuring leads are disconnected before opening.

4.6 Temperature compensation

Automatic temperature compensation is available on the model 2320-V001, a Pt100 temperature sensor should be connected to the DIN socket next to the measuring terminals.

To activate this function press the **“DISP“** key. The Rc LED will light to show that the displayed value is the resistance compensated to 20 °C.

The temperature coefficients may be selected by pressing the **“COEFF“** key. Copper (CU= 3930 ppm/K) and Aluminium (AL= 4030 ppm/K) coefficients are pre-set and two user coefficients may also be entered.

Repeat pressing of the **“COEFF“** key toggles around these options.

The user coefficient can be set as follows:

Repeat pressing of the **“COEFF“** key, press **“AUTO“** (EDIT). The first digit flashes. With key **“UP (↓)“** or **“DOWN (↑)“** the digit is changeable. With the key **“ZERO (←)“** or **“AVE (→)“** the next digit flashes. With key **“MEAS (OK)“** the enter mode finishes.

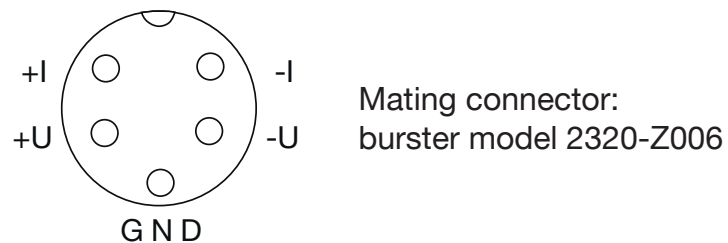
Temperature measurement

The model 2320-V001 can also be used as thermometer using a Pt100 temperature probe inserted into the socket next to the measuring terminals. Press the “**DISP**” key until the T LED lights the 2320-V001 will now display the temperature measured by the Pt100 sensor.

Measuring range: - 50 °C ... 150 °C (to 800°C possible)

Resolution: 0.1 °C

Connection diagram for Pt100 plug



View from solder pins
(rear) of plug

4.7 Auto-Zero

Selects average measurement mode which measures with current in forward direction and the reverse current and takes a second reading. The measured value displayed is the average of two readings. The thermo voltage is automatically eliminated. This measurement mode should not be used with inductive test objects.

4.8 Measurement time

In the standard measurement mode the measurement time is approx. 20 ms. In the AVE-Mode approx. 40 ms (ohmic test object).

5. Calibration

Competent and trained personnel should only carry this out. The calibration is made from the front panel and no mechanical adjustments are necessary.

Equipment required: Calibration resistors series 1240 with 20 mΩ, 200 mΩ, 2 Ω, 20 Ω, 200 Ω and 2 kΩ.

The Milliohmmeter 2320-V001 are designed to minimise all calibration. The carefully selected internal standards are used to given long term stability and minimal drift. However, for those wishing to adjust the ohmmeter, proceed as follows.

1. The ohmmeter should be placed in a temperature controlled environment for at least 2 hours before calibration.
2. Connect the calibration resistor with the instrument plugs +I, +U, -U, -I.
3. Press and hold the **CAL** button and switch on the unit.
 The display will show **CODE** for a few seconds an then „0000“ with a flashing curser on the first zero.
 The **calibration code 9252** must be entered using.
 The **UP** and **DOWN keys** increment or decrement the value, the next digit is selected using the other arrow keys, press **OK** to valid the code.
 Once the correct code number is validated the 2320-V001 will enter the calibration mode and the „**CAL**“ Led will lit.
 The display will be set at 0.0 with the first digit flashing, make a short circuit (zero) on the terminals and press **OK**.
 This will calibrate the zero reading on the first range.
 The display will then move on to show full scale on that range 4.000 again with the first digit flashing.
 Connect now the 2 kΩ calibration resistor and set with the arrow keys the actual value (see test certificate).
 Press **OK**.
 The instrument will then automatically move th the next range, proceed as above until all ranges are calibrated then press the **CAL** key to exit the calibration mode.

6. Maintenance and Customer Service

6.1 Maintenance

The RESISTOMAT® model 2320-V001 required by the user. Any repairs that may be needed must be performed only at the manufacturer's premises. Recalibration is recommended every 24 months.

6.2 Customer service

Queries: Please supply the serial number and software version when contacting the manufacturer with technical queries. Only then can the manufacturer find out the technical status of the equipment and hence provide help quickly. This information is displayed in the start-up menu.

Shipping instructions:

If the RESISTOMAT® needs to be returned for repairs, please note the following requirements for packing and shipping:

The warranty does not cover transportation damage caused by inadequate packaging. If you have a problem with the instrument, please attach a note summarizing the fault.

If you also include a name, department, fax number and your phone number and e-mail address for possible queries, this will help to speed up the process.

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6.3 Factory warranty

burster guarantees trouble-free operation of the instrument 24 months after delivery.

Any repairs required during this time will be made without charge.

Damage caused by improper use of the equipment is not covered by the warranty.

We also state explicitly that we do not accept liability for consequential damage.

The technical data can change at any time without notification.

6.4 Cleaning

Please do not use any cleaning agents that contain organic solvents or concentrated inorganic constituents. Thus never use acetone, toluene, xylene, benzene, ethanol, isopropyl alcohol, naphtha etc. Usually just a cotton cloth moistened with a mild soap solution is sufficient. Never use cleaning agents containing abrasives.

7. Changing the Battery

It's easy to change the battery.

To replace the battery cassette remove the battery cover from the base of the instrument by pressing in the two sides pulling downwards.



Once the battery cover is removed the battery cassette can be slid out, unclip the cassette by lifting the release tab and withdraw the unit.



After the central cross head screw at the battery pack is removed the batteries can be changed.

A faster possibility is to use a second battery pack.

Upon use of the rechargeable NiMHd battery pack model 2320-Z003 the battery pack can recharge at the external docking station and charger model 2320-Z002.

7.1 Disposal of batteries



As an end user, you are required by law (battery ordinance) to return all used batteries and rechargeable batteries; the disposal through household waste is prohibited. By buying the herein described device you are concerned by this law. Please dispose of your batteries and rechargeable batteries correctly. Hand them to waste disposal sites either at your premises or at our company or at any place where batteries/rechargeable batteries are sold.

8. Technical Data

Only value that include tolerances or limits are data covered by the warranty. Values that do not include tolerances are provided for information and do not come under the warranty.

The device has a portable, sturdy plastic housing according IP54. The operation is done via the membrane keypad. The connections for the sample and the Pt100 sensor are located at the backside of the device. The rechargeable battery pack is easily and quickly changeable without opening of the device.

| Measuring Range | Resolution | Measuring Current |
|-----------------|------------|-------------------|
| 40.00 mΩ | 10 μΩ | 100 mA |
| 400.0 mΩ | 100 μΩ | 10 mA |
| 4.000 Ω | 1 mΩ | 10 mA |
| 40.00 Ω | 10 mΩ | 10 mA |
| 400.0 Ω | 100 mΩ | 1 mA |
| 4.000 kΩ | 1 Ω | 100 μA |

Accuracy (with temp. comp. off):
 Range 4 Ω to 4 kΩ < ± 0.05 % Rdg. ± 1 count
 Range 400 mΩ < ± 0.05 % Rdg. ± 2 counts
 Range 40 mΩ < ± 0.05 % Rdg. ± 4 counts

Load voltage: approx. 2 V

Measuring time (for ohmic probes): approx. 20 ms

Measuring connection:
 4 wire technology, 4 mm ø safety terminals

Input protected:
 against inductive and external voltage up to 415 V_{eff}

Measurement mode: unipolar and bipolar

Zero compensation: via zero button

Range selection: automatically and manually

Temperature compensation:
 TC for copper and aluminium,
 plus two user specific coefficients

Temperature measurement: with external Pt100 sensor
 measuring range - 50 °C ... 150 °C
 resolution 0.1 °C
 accuracy 0.2 °C

Display: LCD display 15 mm high with error indicator

Indicator extent: 4000 counts

Power supply: with 5 AA batteries or 5 AA NiMHd Akkus
 rechargeable batteries in a changeable box

Period of operation (Akku):
 approx. 13 hours or 100 000 measurements
 (with NiMHd-1850 mAh)

Period of operation (Batteries):
 approx. 16 hours or 130 000 measurements
 (with Duracell-2800 mAh)

Battery check: LOBAT indicator

Temperature drift: < 30 ppm/°C

Operating temperature: 0 ... 23 ... 40 °C
 rel. humidity 80 % max,
 non condensing

Storage temperature: - 20 ... + 50 °C

Device safety: EN 61010-1, EMC-EN 61326

Protection class: IP54

Weight: 0.8 kg

Dimensions (H x W x D): 55 x 130 x 243 [mm]

Order Information

RESISTOMAT®
 incl. batteries and small KELVIN test tongs
 model 2320-Z007, cable length 1.20 m **Model 2320-V001**

Accessories

Pt100 sensor for plug-in **Model 2320-Z001**
 Rechargeable battery pack with external docking station and charger **Model 2320-Z002**
 Rechargeable battery pack square unit **Model 2320-Z003**
 Carrying bag **Model 2320-Z004**
 Pt100 sensor with cable length 2 m **Model 2320-Z005**
 5 pin connector for Pt100 input **Model 2320-Z006**
 KELVIN test tongs **Model 2320-Z007**
 Calibration set **Model 2320-Z008**
 DKD/DAkKS Calibration Certificate **Model 23DKD-2320-V001**
 WKS Calibration Certificate **Model 23WKS-2320-V001**

Kelvin measuring pliers and probes **see data sheet 2385 EN**
 Wire holding devices for wires up to 2500 mm2 **see data sheet 2381 EN**
 Calibration resistors **see data sheet 1240 EN**

Calibration set:
 The calibration set model 2320-Z008 consists of 3 calibration resistors series 1240 with the values 20 mΩ, 200 mΩ and 2 Ω. Every resistor is provided with a DKD/DAkKS Certificate. Measurement values and uncertainties in the certificate were found with standards and measurement devices regularly compared with governmental standards of the Federal Republic of Germany. This is proved in the certificate itself and is also marked on the resistance. For detailed information please refer to data sheet 1240 EN.

Application

Coil winding measurement on a motor



9. Appendix

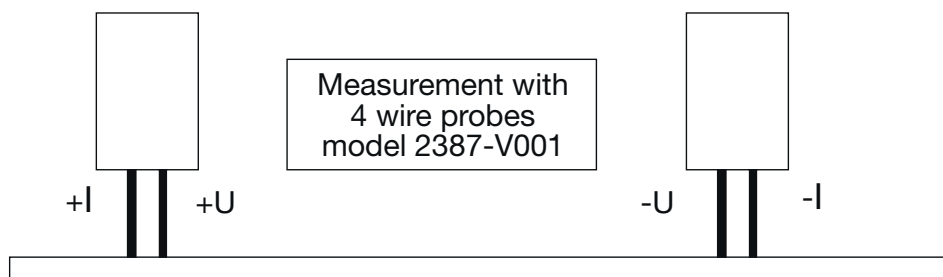
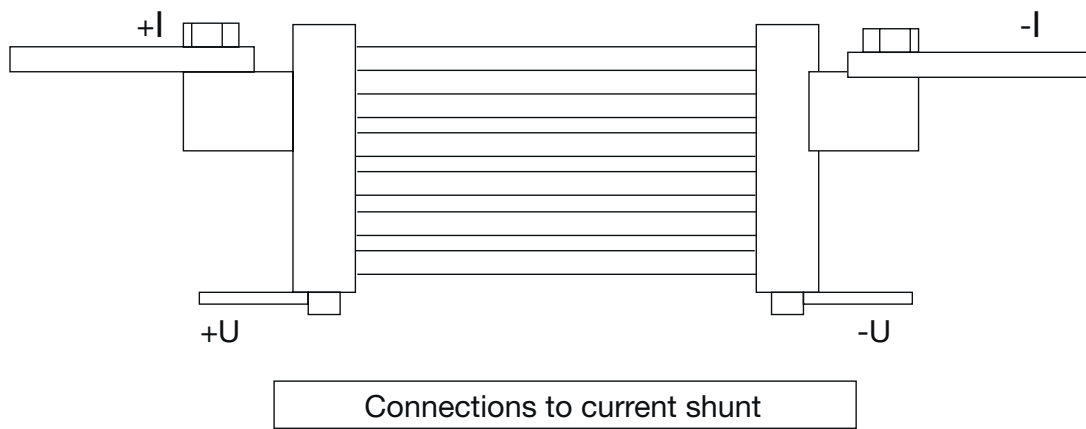
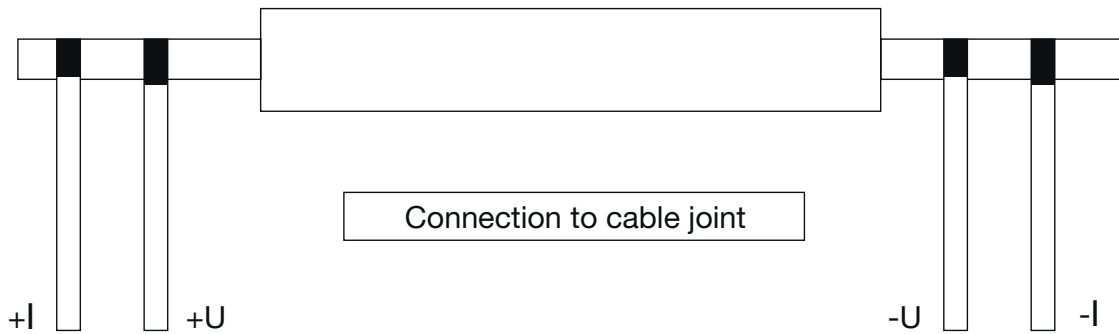
9.1 Status LED

| | |
|------------|--|
| CAL | Calibration mode has been initialised and the instrument is in calibration mode. |
| Rx | Indicates that the display is reading resistance in ohms. |
| Rc | Indicates that the display is reading the compensated resistance value in ohms. |

9.2 Error messages

| | |
|-------|---|
| ----- | Indicates that the measurement value is too high for the range selected. Select a higher range. |
| OC | Indicates that one of the measurement leads is open circuit. Check the lead connections ensuring that they are clean, free from oxide and securely connected. This error message will also appear if the current lead resistance is too high. |

9.3 Application of the 4 wire technology



9.4. Accessories

9.4.1 Pt100 sensor model 2320-Z001



9.4.2 Carrying bag model 2320-Z004

Carrying bag with strap and additional pocket for the measurement leads.



9.4.3 Battery charger model 2320-Z002



The battery charger model 2320-Z002 consists of the power supply and the NiMHd rechargeable battery pack.

Startup:

When the power supply is contacted to the mains the red LED “Power” lights and shows that charger is ready for use.

Insert the battery pack in the charger:

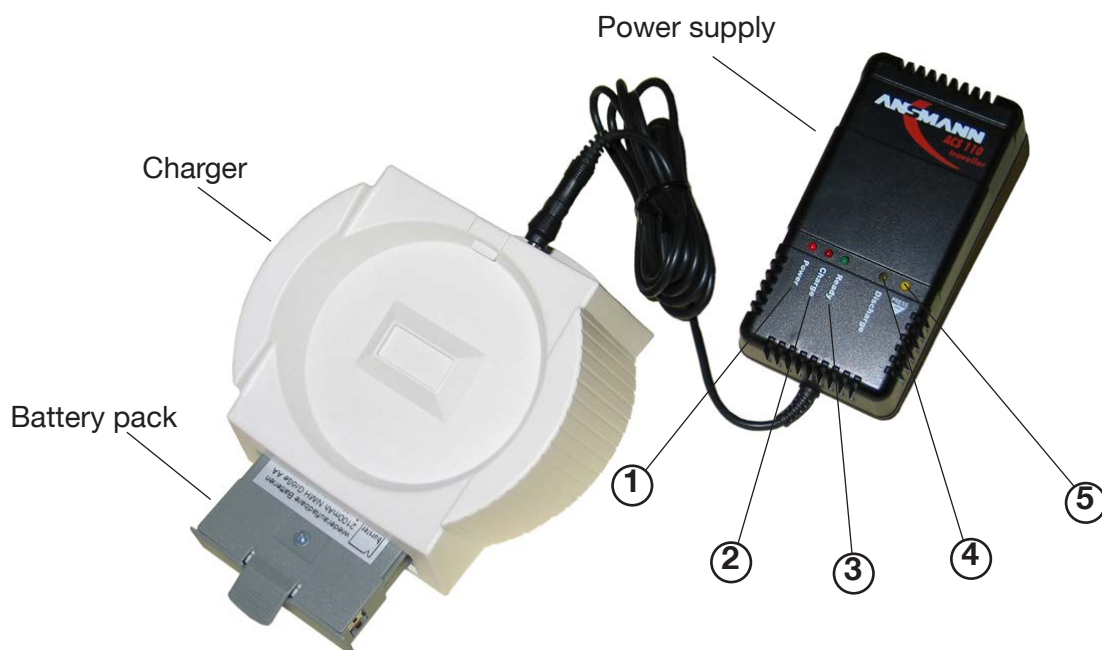
The red LED “Charge” lights and indicates the charging process. During the testing cycle the green LED “Ready” flashes also but goes off after ground 1 minute after the test phase is over. After termination of the quick-charge the charger switches on automatically to trickle charge. The red LED “charge” is off and the green LED “Ready” is constantly on for approx. 2 minutes. After around 2 minutes the indicator changes to green flashing. The battery pack can be removed at this time or left connected to keep topped up until use.

If the green LED “Ready” flashes immediately after connecting the battery pack and the red LED “Charge” lights up sporadically, this means that the polarity (+/-) at the charging cable is not set correctly (see figure 6). If both LEDs are still flashing after changing the polarity and the steady light “Ready” does not light permanently, the battery pack is defective and cannot be recharged at all. In this case the pack has to be replaced.

The optional discharging procedure can be started by pressing the button for discharging (5) for about 2 seconds. The yellow LED “Discharge” (4) lights and indicates the discharging procedure. During the first minute the green LED “Ready” (3) flashes but should turn off the test phase. After discharging, which can in some case last for several hours, the charger automatically switches over to quick-charging.

Technical data:

| | |
|-----------------|-----------------------------------|
| Mains voltage: | 100-240 V AC 50-60 Hz 17 VA |
| Output voltage: | 1.45-14.5 V DC max. 800 mA 9.6 VA |



Indicators

LED red „Power“ (1): Steady light shows that the charger is ready for use. It lights once the charger is plugged-in.

LED red „Charge“ (2): Steady light indicates the quick-charging process after connecting the battery pack.

LED green „Ready“ (3): Steady light indicates the battery pack is fully charged. After approx. 2 minutes it switches to flashing, which indicates trickle charging. Once the battery pack is connected, the testing cycle is initiated and the green LED flashes for ground 1 minute. If it carries on flashing and the red LED “Charge” does not light, it indicates that the battery pack is not connected properly or maybe has an incorrect polarity.

LED yellow „Discharge“ (4): Steady light indicates the discharging process after pressing the yellow button. The LED “Ready” flashes for around 1 minute indicating the testing cycle.

Controls and accessories

Discharge button (5): Press this button for about two seconds to start the optional discharging process of the battery pack.

Attention

Charge only nickel/cadmium (NiCd) or nickel/metal-hydride (NiMH) battery packs. Danger of explosion if other types of batteries are inserted.

Safety instructions



Do not attempt to open charger.
Keep the charger in a dry place (indoor use only).
In order to avoid the risk of fire and/or electric shock, the charger must be protected against high humidity and water.
Do not plug-in the charger if there are any signs of damage to the housing, mains, pins, cables or connectors. In case of a defect please return to an authorised service centre.
Keep the charger out of reach of children.
If the safety instructions are not followed, this may lead to damage to the charger or batteries or even to serious injury to the user.