

7 **Technical Data**

7.1 General

Measuring frequency	28.6 kHz
Protection class	II
Protection degree	IP 54
Resistance measuring range	0 Ohm ... 50 Ohm (display > 50 Ohm)
Measuring tolerance	+/- (20% + 1 digit)
Operating temperature range	-20°C ... +55°C
Display	128 x 64 Pixel, illuminated
Buttons	Membrane keyboard, 6 buttons
Power supply Tester	1 accumulator Li-Ion type PA-LH201.K01.R001 or 3 batteries / accumulators size AA; preferred batteries LiFeS2, type <i>Energizer Ultimate Lithium L91</i> or accumulators NiMH with minimum 2200 mAh
Power supply Generator	1 accumulator Li-Ion type PA-LH201.K01.R001 or 3 batteries / accumulators size AA; preferred batteries LiFeS2, type <i>Energizer Ultimate Lithium L91</i> or accumulators NiMH with minimum 2200 mAh
Dimensions transport case	420 x 320 x 160 mm
Weight (accessory included)	6 kg

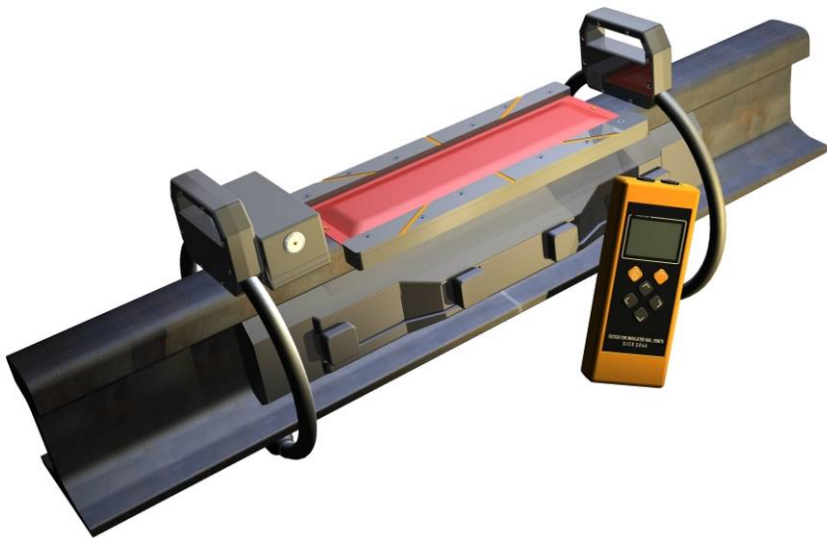
7.2 Inspection

It is recommended to have the device inspected every 2 years.

Tester for Insulated Rail Joints

SICO 2046

M A N U A L



6 Failures

The correct functioning of the unit is inspected regularly. Information about failures will be shown in the display.

Further possible failures and their causes:

Failure	Solution	Page
Unit can not be switched on.	Check the batteries for charging and the contacts for cleanliness.	10
Unit does not display data during measuring.	Check the tester's connecting plug for fouling and check if the cables going to the sensor possibly are broken.	13

In any case of failures not being listed above, please contact the manufacturer.

5 Measurement

5.1 Display of Measuring Results

Display	Explanation	Causes
xxx Ohm	Normal display of measuring result	
Weak signal	Insufficient measuring signal at measuring position	<ul style="list-style-type: none">• Wrongly placed generator• Weak power supply of generator• High-resistance track configuration
Joint OK	The joint is not faulty. But an exact result can not be determined. *)	Simultaneous contact of a strong alternating voltage signal on the intact joint; mostly caused by a track circuit.
Joint faulty	The joint is faulty. But an exact result can not be determined. *)	Simultaneous contact of a strong alternating voltage signal on a short-circuited joint, mostly caused by a track circuit.
Display without content	The determination of a measuring result is not possible. *)	<ul style="list-style-type: none">• Simultaneous contact of strong alternating voltage signals on the joint, without the definite statement about the joint being faulty or intact• Device is faulty

*) The measuring procedure can not give an exact value. By connecting an outer bypass on the insulated rail joint (cf. fig. 3.3) it might be possible to determine the joint's resistance result exactly.

5.2 Storing Results

Measuring results or limit values can be stored permanently in the device. After the affirmation with the corresponding key, you can enter, change or take over the respective data. That applies to name, position and joint identification "IsolD".

Take over the displayed data by selecting "Store value" and confirm with ✓. Change the data by moving the cursor to the respective position and confirm with ✓. After entering the new data (cf. 4.3 Data Entry), select "Store value".

You can store up to 15 measuring results in the tester. When storing the 16th result, the oldest result will be overwritten.

5.3 View Measuring Results

You can open the stored protocols and view the data on the display. Select the single measuring results with the cursor. If the entry of a name, place or a joint identification is too long, two dots appear behind the shortened word. E.g. JOHN CITIZEN will be "JOHN CITI..". Select the respective measurement with ✓ and the data will be shown in full length on the display. A further affirmation with ✓ leads you back to the short version.


Dear customer,


Thank you for choosing the Tester for Insulated Rail Joints SICO 2046. You have purchased a high quality technical device used in the industrial field. We hope that all of your expectations are met and that we are able to support your work.

This product was designed, produced and tested with due care and according to the applicable European Standards. If the device is yet not working correctly under the conditions given in this operating manual, please contact the manufacturer:

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 Signal Concept GmbH confirms the conformity of the device according to the directives given by the European Parliament and Council 2014/30/EU (EMC-Directive), 2006/42/EC (Machinery Directive), 2014/35/EU (Low Voltage Directive), 85/374 EEC (Product Liability Directive), 2011/65/EU (RoHS Directive) and 2012/19/EU (WEEE Directive).

 Signal Concept GmbH holds a Quality Management (DIN EN ISO 9001:2015), which is checked annually by TÜV Rheinland as accredited organization.

This manual serves as an introduction to your new device. Please read it carefully for your own protection. Furthermore, it enables you to use all functions properly. Please follow all directions and hints to avoid accidents with persons and damages of the device.

The manual is part of the device. The user has to keep it until the disposal of the device. When handing the device to other users, the manual must be given too.

Document no.:	2046 B	Copyright © 2025, Signal Concept GmbH
Version:	1.3	All rights reserved. All data, properties and descriptions given in this operating manual may be changed at any time without giving notice.
Date:	02.07.2025	For the latest version please visit www.signalconcept.com

Accessory

Included in the delivery are the following parts. Please check if all of these components were supplied. If parts are missing or damaged, please contact your reseller.

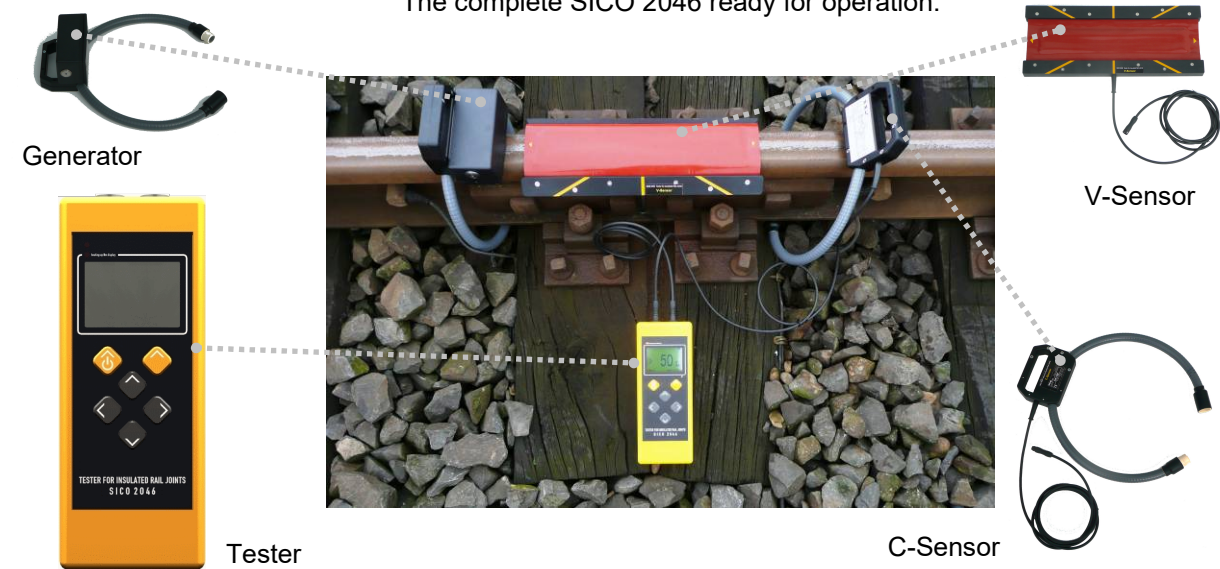
Pieces	Item name	Order number
	Insulated Rail Joint Tester SICO 2046 containing	105021
1	SICO 2046 Tester	105001
1	SICO 2046 V-Sensor	105002
1	SICO 2046 C-Sensor	105031
1	SICO 2046 Generator	105041
1	SICO 2046 Test resistor 33 Ω with test probes	105005
2	Accumulator Li-Ion PA-LH201.K01.R001	105010
1	SICO 5007 Charger for Lithium-Ion Cells type PA-LH201.K01.R001, manual included	105050
1	SICO 2046 Protector for tester	105006
1	SICO 2046 Transport case	105007
1	SICO 2046 Manual	105008
1	SICO 2046 Acceptance test certificate 3.1 to BS EN 10204	On request

Optional Accessory

Item	Order number
Adapter for Charger SICO 5007	105051

OVERVIEW

The complete SICO 2046 ready for operation.



LED indication

LED condition	Function	Explanation
Flashes once shortly	Self test	When switching-on the tester
Two long flashes	Heating is deactivated.	After self-test
Flashes in short intervals	Display is preheated	The tester is yet not ready for operation! The flashing frequency lowers with rising display temperature.
Flashes in wide intervals	Display is heated.	The tester is now ready for operation.
Permanently illuminated	Preheating was cancelled and display is heated.	Depending on temperature the display is well, badly or non-readable.

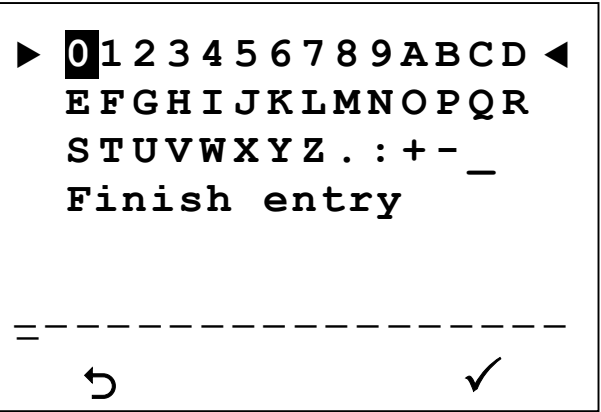
4.3 Data Entry

To enter data you have to use the cursor. User names, joint identification or any other data is entered via the window shown on the right-hand side.

The selected character flashes in the upper part. With the four arrow buttons the characters are selected. After the affirmation with the selected character is displayed on the bottom line. The underline moves to the next position.

In case of entering a wrong character you can delete it with . To cancel the entry before you have confirmed the first character press .

To finish or cancel the entry move the cursor to the line „Finish entry“. Pressing stores the entry, pressing cancels the entry.



4.4 Shutdown the Unit

Push this button for at least 3 seconds to switch off the device. A shutdown is always possible.








4 Functions

4.1 Settings

In the menu “Settings” you can set

- Time / date,
- Contrast,
- Brightness, or
- Language.

4.1.1 Time / Date

The display shows date and time. If you wish to update them, press the button “set”. First, you set the *day* with the arrow buttons  and . Affirm the day with . Afterwards you set *month*, *year*, *hour* and *minute* in the same manner. Choose the categories with the arrow buttons  and . The entry ends with the affirmation  or cancel it with .

4.1.2 Language

You can choose from the following languages:

- German,
- English,
- French,
- Dutch, and
- Spanish.

4.1.3 Queries

After selecting this menu item the serial number, the present software version and the date of the last calibration are shown.

4.2 Display Heating

LC-Displays are hardly readable at temperatures below -20°C. Therefore, the SICO 2046 display is equipped with a display heating. The display is preheated at temperatures below -15°C or the heating works on low power at temperatures between 0°C and -15°C. The heating activity is indicated by a LED (upper left in the display). Preheating can be stopped by pressing any key (except the power switch).

Content

Accessory 4

Content 5

1 Safety Instructions 6

2 Working Principle 7

2.1 Overview of the Single Parts 7

2.1.1 Tester 7

2.1.2 V-Sensor 8

2.1.3 C-Sensor 8

2.1.4 Generator 8

2.1.5 Test Resistor 9

2.2 Used Icons 9

2.3 Structure 10

2.4 Power Supply 10

2.5 Maintenance 11

2.6 Transport and Storage 12

3 Start-up 13

3.1 First Steps 13

3.2 Start-up 14

3.3 Test the Functioning of the Device 16

3.4 Positioning the C-sensor 17

4 Functions 20

4.1 Settings 20

4.1.1 Time / Date 20

4.1.2 Language 20

4.1.3 Queries 20

4.2 Display Heating 20

4.3 Data Entry 21

4.4 Shutdown the Unit 21

5 Measurement 22

5.1 Display of Measuring Results 22

5.2 Storing Results 22

5.3 View Measuring Results 22

6 Failures 23

7 Technical Data 24

7.1 General 24

7.2 Inspection 24

1 Safety Instructions

The Tester for Insulated Rail Joints SICO 2046 is to be used exclusively according to the description in this manual. Otherwise, the protection given by the tester can be limited.

! Warning !

- To avoid the damage of persons or products, mind the following guidelines:
- Consider the valid guidelines for working on railway facilities when operating the tester SICO 2046.
- Before using the SICO 2046 make sure that the concerning track is not used by trains during the measurement. Allow enough time for removing all parts from the track.
- Do not use a damaged tester. Before using the tester, check the housing for outer damages.
- Check accessories concerning visible insulation faults. Before using the tester, replace damaged accessory.
- Do not use the tester in environments with explosive gases, steam or dust.
- Do not use the tester when it shows a malfunction. The protective devices could be affected. In case of doubt send the tester to the manufacturer or to a company authorized by the manufacturer for checking.
- The manufacturer or a company authorized by the manufacturer are the only ones being responsible for repairing.
- Voltages higher than 42 V occur at some parts inside the tester. For that reason do not start or run the tester while it is opened.
- Qualified professionals only may use the tester.
- Do not drop or shock the tester.
- The V-sensor is equipped with powerful magnets. Do not store objects with magnetic strips (discs, cash cards etc.) nearby. There is risk of damaging their magnetic strips.
- Lithium Ion accumulators are to be stored and transported well protected against shunt fault.

Disposal

Electric and electronic devices must not be given to the general rubbish, since they mostly contain noxious elements. Instead, dispose them at the collecting points for special waste.

The C-sensor shall only be bent around the rail or the joint and must not include further conductors.

C O R R E C T



Fig. 3.8 C-sensor looped around rail and joint

Avoid the assembly shown in the picture below, because insulation faults on the sleeper could distort the measuring results.



Fig. 3.9 C-sensor located next to the sleeper

The C-sensor shall only be looped around the rail or the joint and must not include further conductors.

C O R R E C T



Fig. 3.6 C-sensor looped around rail and joint

W R O N G



Fig. 3.7 C-sensor looped around rail and a conductor

2 Working Principle

The Tester for Insulated Rail Joints SICO 2046 detects reliably insulation faults in insulated rail joints.

It has outstanding characteristics:

- Contactless measurements avoid trouble with rust on the track's surface and electric damage of the device
- The resistance is determined following Ohm's law and measured directly on the rail joint, which avoids typical measuring mistakes caused by parallel loads like transformers, earth electrodes
- Parallel loads, which normally would disturb or stop resistance measurements, contribute to determine the exact measuring result
- There is no need to deactivate track circuits, which are relevant for the insulated rail joint

The measurement procedure is a combination of a contactless voltage and a simultaneous contactless current measurement. The contactless feeding of measuring signals embedded in the system is done with the generator, which avoids damages caused by track voltage.

Generator and C-sensor have plug sockets, which help to remove them quickly from the rail in case of an approaching train. The same applies to the magnetic bottom of the V-sensor.

The extensive preparation of the measurement in comparison to common methods is justified with the completely new quality of resistant determination on insulated rail joints.

Note: LC-displays work according to temperature. Regarding its function, the display is specified to -20°C. Yet an impairment of the readability and a decreasing update speed in extreme temperatures can not be excluded.

2.1 Overview of the Single Parts

2.1.1 Tester

The tester is the main part of the system SICO 2046. It has a graphic display which reports instructions for the user, measurement data as well as warnings and failure notes.

The user operates the unit with the six buttons below the display. The first two buttons below the display have variable functions. The four buttons in the center are used for navigation. The power switch (left upper button) starts the device after a short press. A longer press on the button will shutdown the running unit.

On the upper side of the housing are two sockets to connect the C-sensor (left socket) and V-sensor (right socket). The user can't miss the correct socket since they are of different makes.



Fig. 2.1 Tester

2.1.2 V-Sensor

The V-sensor supplies the measuring unit with the voltage result of the tested insulated rail joint. To get reliable measuring results, please put the V-sensor flatly and centrally on the joint with the contacts to the rail. Magnets in the V-sensor help to have a permanent mechanical contact to the rail. Take off the V-sensor by pulling one of the two plastic bars on the side.

Do not pull or carry the V-sensor on its cable!

2.1.3 C-Sensor

The C-sensor supplies the measuring unit with the current result of the tested insulated rail joint. To get reliable measuring results, please bind the coil around the rail and close it entirely. You can disconnect the two ends by pulling them apart.

Do not pull or carry the V-sensor on its cable! Do not bend the sensor's flexible parts unnecessarily.

2.1.4 Generator

The generator supplies the measuring object with energy. To receive reliable test results, please bind the coil around the rail and close it entirely. The generator has a button to switch it on and off. The automatic shut-down mode helps saving energy and applies after some minutes without acting. After the start the LED in the button flashes as long as the frequency is balanced automatically. The generator is ready for measurements when the LED lights up constantly. A continually flashing LED indicates an error.

Do not bend the generator's flexible parts unnecessarily!

3.4 Positioning the C-sensor

The C-sensor must be located before the next conductor branches off.

C O R R E C T



Fig. 3.4 C-sensor located before the next conductor branching off

W R O N G



Fig. 3.5 C-sensor located behind the next conductor branching off

3.3 Test the Functioning of the Device

Before carrying out measurements with the SICO 2046, always test if it's working correctly.

- Select an insulated rail joint, which has a value of >50 Ohm.
- Contact both test probes of the test resistor to the rail head directly on the left and right side of the V-sensor.

Contacting the test resistor:

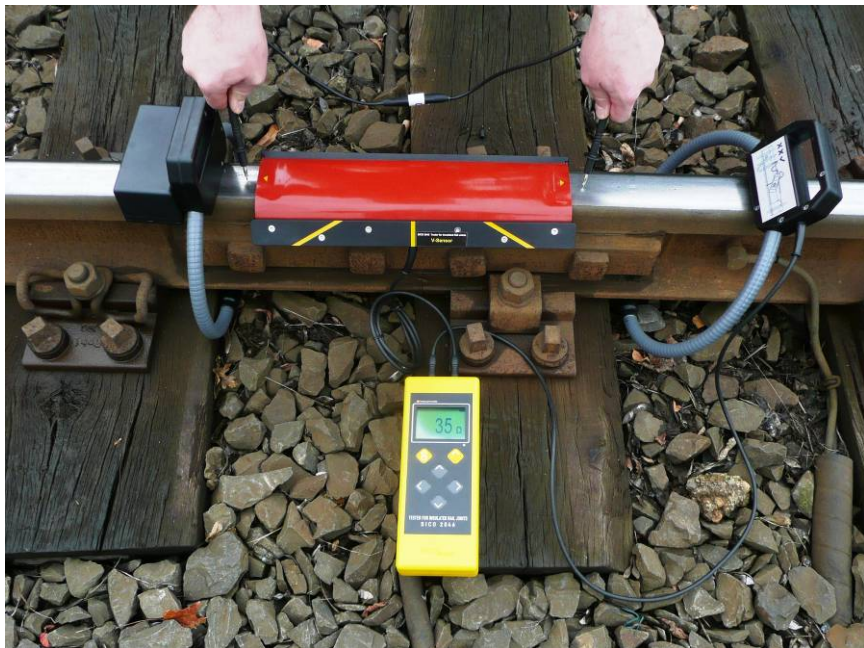


Fig. 3.3 Contacting the test resistor 33 Ohm

When measuring with the test resistor the result has to be between 27 Ohm and 39 Ohm. If the result deviates from the given norms, a conductor branching off the rail could be the cause. Please mention how to place the C-sensor in a correct position (cf. chapter 3.1 First Steps and 3.4 Positioning the C-sensor). Another cause could be a faulty device. If so, please contact the manufacturer.

Before repairing or changing a faulty joint the manufacturer recommends to test the device on another insulated rail joint, which has a value of >50 Ohm, concerning its proper function. If the result of the faulty joint still is <10 Ohm, the joint is definitely faulty and has to be repaired or replaced.

Note: The test resistor's value is 33 Ohm and therefore can influence relevant track circuits of the insulated joint just insignificantly. A transition into an occupied condition of the track circuit is excluded.

2.1.5 Test Resistor

The delivery includes a test resistor, which proves the correct display of the measuring result. According to the instructions in chapter 3.3 Test the Functioning of the Device, the user can prove the whole measuring unit concerning inaccuracy or defects.

2.2 Used Icons

The Insulated Measuring Device SICO 2046 operates menu-driven. The functions of the two keys directly located under the display are always shown in the display. The four keys (arrow keys) in the center serve for navigating the menu, for cursor control or for changing the displayed values:

✓	Confirm entry
↶	Back (one level back in the menu)
←	Delete character
↑	Selection, up
↓	Selection, down
←	Selection, left
→	Selection, right

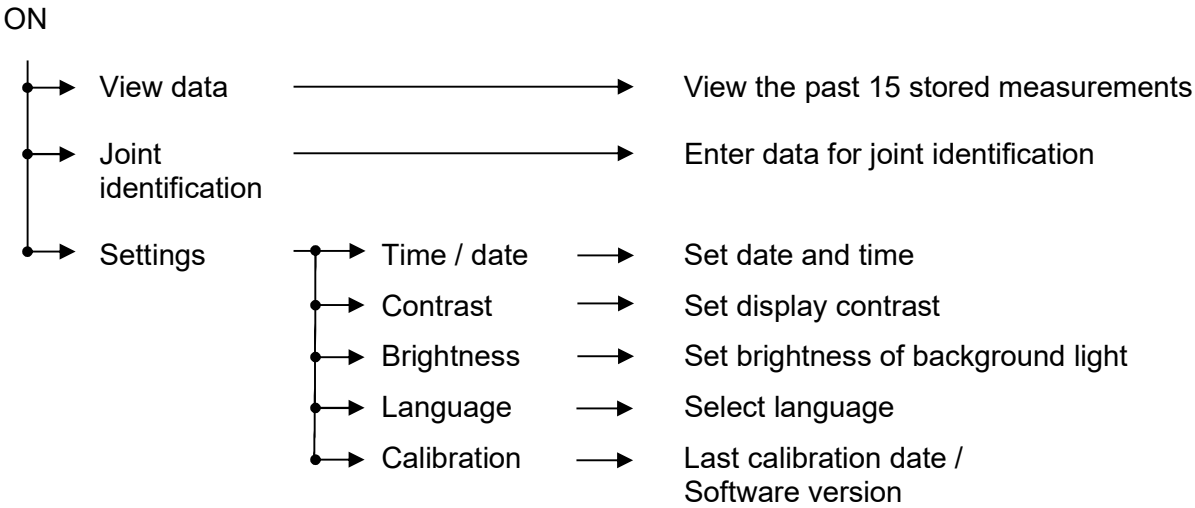
Following big icons can flash in the display:

👆	Automatic shutdown mode (see 2.4 Power Supply)
🔋	Under voltage, (see 2.4 Power Supply), Change batteries!

2.3 Structure

Press “Menu” to enter the main menu.

Press the arrow keys to select a certain menu item. The upper right button (✓) confirms the selection. The upper left button (↶) cancels the selection or leads you to the next higher level.



2.4 Power Supply

- Tester: 1 accumulator Li-Ion, type PA-LH201.K01.R001or
3 batteries / accumulators size AA (cf. chapter 7Technical Data)
- Generator: 1 accumulator Li-Ion, type PA-LH201.K01.R001or
3 batteries / accumulators size AA (cf. chapter 7Technical Data)

Attention!

Do not replace the supplied accumulator Li-Ion, type PA-LH201.K01.R001 for other or similar accumulators.

For charging the supplied Li-Ion accumulators PA-LH201.K01.R001 only use the Charger for Lithium-Ion Cells type PA-LH201.K01.R001 SICO 5007 (included in delivery).

Primary cells must not be recharged (risk of explosion).

Tester and generator each have their own power supply. Both are electrically separated.

The **Tester** is supplied with energy by one of the above mentioned power supply variants. Instead of the Li-Ion accumulator you can use AA-cells in form of batteries or accumulators with a voltage range of 1.2 ... 1.5 V, preferred are the types mentioned in chapter 7 Technical Data. A battery icon in the upper left corner of the display informs about the battery condition. If batteries are low, a notice appears in the display. Open the battery compartment, which is located on the tester’s backside, with a coin. The tester has an automatic shutdown mode to avoid unintentional discharge.

Therefore, the interpretation of the measuring result is clear. But against expectations, if you have difficulties interpreting the result, please contact the manufacturer, who will be pleased to help you.

The display of the measuring result is in Ohm. A statement regarding a faulty insulation joint is given when the resistance is – according to a widespread convention – **10 Ohm**. In rare cases only, where extensive signal amplitudes (e.g. of an audio frequency track circuit) occur during the joint test, the Tester for Insulated Rail Joints SICO 2046 determines the condition of the joint in form of a qualitative statement. Instead of displaying the resistance value in Ohm, the result is given as a statement: “Joint OK” or “Joint faulty”.

If this statement is insufficient, the exact measurement can be carried out with a parallel short circuit to the joint.



Fig. 3.2 SICO 2046 with parallel short circuit

Summary of the Measuring Procedure

- Connect V- and C-sensor with tester
- Place all parts around the insulated rail joint as shown in the picture on page 4
- Switch on generator and tester
- View measuring result
- Switch off generator and tester and take them off the rail (the tester is switched off by pressing the button for 3 sec)
- To protect the sensitive contact membrane of the V-sensor’s bottom, keep the V-sensor on the magnet holding plate in the transport case when not using it.

Note: If the tester displays a weak signal or a transient result, the signal of the generator is insufficient to reach the tester. It can get necessary to additionally connect rail-rail-short circuits (cf. fig. 3.2).

If possible a direct contact between C-sensor coil and a branching off conductor (bent aside) should be avoided to exclude disturbing near field couplings.

Note: Please contact the manufacturer if you are confronted with a complicated configuration about an insulated joint to be tested.

Incidentally, the direction in which the handle of the two coils are pointing is irrelevant. They can either be placed on the rail head or pointing to the side (cf. fig. 3.1).



Fig. 3.1 Assembly SICO 2046 on rail

3.2 Start-up

The testing unit of the Insulated Rail Joint Tester SICO 2046 is switched on by pressing shortly on the power switch. After haven't used the device for a longer period you will be asked to set the time.

As long as the generator is not switched on, without accumulator, faulty or in rare cases wrongly placed, the tester will inform you about a "weak signal". In case of doubt, please contact the manufacturer.

The generator is switched on by pressing the button located on the side. You can recognize a running generator by the permanently shining yellow LED. A short flashing of the LED signalizes an almost empty accumulator. Tester and generator have an automatic shutdown mode to enable long-term availability which depends on the battery charge condition also. The generator shuts down automatically after 5 minutes, since the taken power of the compact batteries is very high.

Now the measuring result is displayed on the tester. Despite the technological complex principle, the result bases on the classic measuring method following Ohm's law. In comparison with classic dipolar measurements, the SICO 2046 is independent from often occurring parallel loads since it records voltage and current equivalents separately on the location of the insulated joint.

When inserting the Li-Ion accumulator for the first time or changing completely discharged batteries you might have to set date and time. Therefore, never keep the tester without power supply for more than one day.

The **Generator** is supplied with energy by one of the above mentioned power supply variants. Instead of the Li-Ion accumulator you can use AA-cells in form of batteries or accumulators with a voltage range of 1.2 ... 1.5 V, preferred are the types mentioned in chapter 7 Technical Data.

Open the battery compartment with a coin.

The generator has an automatic shutdown mode to avoid unintentional discharge.

Note: Please keep in mind that alternatively used NiMH accumulators lack capacity in extreme cold temperatures. In this case, we recommend carrying normal batteries (LiFeS₂, size AA) with you, e.g. *Energizer Ultimate Lithium L91*. For the best possible measurement carry them in the warmer pockets of your clothing and do not insert them in tester and generator before you have reached the measuring site.

Under voltage detection:

If the tester's battery is low, the battery icon will show up at the display's left upper corner. Measurements are still realizable for a certain time. We recommend changing the batteries after the present measurement.

To avoid an exhaustive discharge of the batteries, the display's battery icon flashes at a certain battery voltage. The unit will shut down automatically. Please change the batteries immediately!

Date and time will remain.

Automatic shutdown mode:

The unit has an automatic shutdown mode to enable long-term availability which depends on the battery charge condition also. When not pressing a button within five minutes, a flashing icon appears in the display. Next, the unit shuts down automatically when not pressing a button within a minute.

Note: Please remove batteries from the battery compartment when you plan to store the device for a longer period. Afterwards you have to set time and date again.

2.5 Maintenance

It is recommended to clean the device after use with a damp, solvent-free cloth. Please care for sediments on the bottom of the V-sensor, which could influence the measuring accuracy.

2.6 Transport and Storage

To protect the tester from dust and dirt as well as from shakes, use the supplied transport case.



Fig. 2.2 Transport case with insulated rail joint tester

Please consider to never bending the V-sensor, never loading it with heavy weight and never putting it on rough surfaces. Do not damage its sensitive bottom (area with contacts) with stiff or sharp objects. During transport the V-sensor has to be placed on the magnet holding plate in the transport case.

Storage should be in a cool and dry place.

3 Start-up

Your SICO 2046 will work correctly when you follow the steps in this manual and mind the notes.

3.1 First Steps

After a short preparation you can start working with the device. The description of the assembly follows the picture on page 4.

Attention!

Thanks to the new measuring principle you do not need to disconnect the electric connections of the insulated rail joint!

- Connect the plugs of V- and C-sensor with sockets of the tester.
- Place the V-sensor in the middle of the insulated rail joint. Markers on the upside assist you in finding the correct position – in case of square joints and inclined joints.

Attention!

It is impossible to distinguish the middle of inclined joints (30°) when watching from the side. Please inform you about the middle of the joint before putting down the device.

- Place C-sensor and generator on both sides of the insulated rail joint.
- Loop generator and C-sensor around the rail and fasten them. It could be necessary to remove some gravel stones from the rail.
- Generally, you can select each side to place generator and C-sensor.

But, please mention the following notes to secure a reliable result of the measurement:

- Keep a minimum distance of 35 cm between generator and C-sensor to avoid unwanted direct magnetic coupling, which might lead to measuring faults.
- All parts of the device must be placed in one section - including the insulated rail joint - where no conductor branches off the rail. Please mind the notes in chapter 3.4 Positioning the C-sensor!
- If you can not avoid such a branch on at least one side, the generator must be placed on the side of the branch.
- If there is no space to place generator and C-sensor in one section, you can also place them with a larger distance from each other and on one side of the V-sensor. Please consider the rules above mentioned. If necessary you can place generator or C-sensor in the next section. But mention that the measuring result can be distorted by insulation faults of the embedded section by meaning of an electric branch.

Please consider that the branch subject should be handled with careful attention since it could cause significant faults. A non-consideration leads to measuring results following Ohm's law and Kirchhoff's current law.

In many cases you can relocate a branching off conductor temporarily to place the coils electrically correct.