

Leakage current compensation for single-phase devices

Instruction manual

Fixed value
compensation of
50 Hz operational
leakage currents
at 5 / 10 mA

Can be used on
RCCBs with a
rated fault current
 $I_{\Delta n} = 30 \text{ mA}$
or higher
according to
DIN VDE 0100-530



EPA 
www.epa.de

Thank you for choosing the **LEAKCOMP® 1C** leakage current compensation unit from EPA.

If you have any technical questions, please give us a call:

Phone: +49 (0)6181 – 9704 – 0

For the latest information on this product, visit www.leakcomp.de and www.epa.de.

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1 Important basic information

1.1 Publication details

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HW 1.2

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1.2 Target group

This documentation is intended for qualified personnel as defined in IEC 60364.

Qualified personnel are persons who have the appropriate qualifications for the work to be performed during the installation, assembly, startup and operation of the product.

1.3 Liability

The common names, trade names, descriptions of goods and other designations used in this publication may be legally protected even if not specifically marked as such (for example as trademarks). EPA GmbH accepts no liability or warranty for their free availability.

The illustrations and text were compiled with the utmost care. Nevertheless, errors cannot be excluded.

The publication is provided without guarantee.

The information it contains is provided solely for the purpose of customer information and contains no representations or binding warranties. Binding statements are possible only in response to specific inquiries.

The contents of this instruction manual are accurate at the date of printing. Since it is under continuous development, the manufacturer reserves the right to change the specification of the product and its performance data as well as the contents of this instruction manual, in both technical and commercial terms, without prior notice. The current version is available at www.LEAKCOMP.de or www.EPA.de.

Liability of the company EPA GmbH for any damage resulting from incorrect use of this instruction manual or incorrect, erroneous or inappropriate installation or adjustment is excluded. Interruptions to operation, loss of profit as well as loss of information and data or consequential damages are excluded insofar as liability is not mandatory in accordance with the law on product liability or in cases of intent, gross negligence or breach of fundamental contractual obligations.

1.4 General equal treatment

EPA GmbH is aware of the importance of language with respect to the equal rights of women and men and makes every effort to take this into account. To ensure better readability, however, it was necessary to abstain from the consistent use of differentiated formulations.




1.5 Registered trademarks

Brand names and trademarks are the property of their respective owners and are not generally marked as such in this manual.



The absence of such marking does not mean that a name is free within the meaning of brand and trademark law.

1.6 Symbols and signal words

The following symbols and signal words are used in this documentation to indicate hazards and important information:

Symbol/signal word	Meaning
	Warning of hazardous electrical voltage
⚠ DANGER	Draws your attention to a hazardous situation that will result in serious injury or death if not avoided.
⚠ WARNING	Draws your attention to a hazardous situation that may result in serious injury or death if not avoided.
⚠ CAUTION	Draws your attention to a hazardous situation that may result in minor to moderate injury if not avoided.
IMPORTANT NOTE	Draws your attention to the handling and impact of safety information.
NOTE	Draws your attention to the handling and impact of safety information.
	Draws your attention to possible damage to property and other important information.
	The installation must be carried out by a qualified electrician (IEC 60417-6182).

1.7 Marking on the product

Illustration	Description
	<p>LED displays</p> <p>Blue LED: Status display (RUN) Red LED: Error display (ERROR)</p> <p>Terminal assignment</p> <p>Mains connection (phase and neutral conductor): L / N Protective earth conductor / compensation: PE Compensation selection 5 mA or 11 mA: C1 / C2</p>
	<p>Type plate</p> <p>Manufacturer's details and technical data</p>

1.8 CE mark

The CE mark is on the device nameplate.



The device complies with the relevant essential requirements of all applicable EU directives. The declaration of conformity can be found in the chapter "Declaration of conformity".

1.9 EMC Limit Class

LEAKCOMP® 1C meets the limit values for emitted interference according to DIN EN 55011 / CISPR 11 Class B Group 1. The interference immunity corresponds to DIN EN 61000-6-2.

The device is classified in accordance with DIN EN 61326-1 (VDE 0843-20-1) and is suitable for use in residential, business and commercial areas as well as in industrial environments.

1.10 Declaration of Conformity

SO 5.2.3-05 

Konformitätserklärung
Declaration of Conformity

Dokument Nr.: CEK1708005
Document No.

Hersteller: EPA GmbH, Fliederstraße 8, 63486 Bruchköbel, Germany
Manufacturer

Produktbezeichnung: Ableitstrom-Festkompensation
Product description: Leakage current fixed-compensation

Produktgruppe: Elektrische Mess-, Steuer-, Regel- und Laborgeräte
Product category: Electrical equipment for measurement, control and laboratory use

Typenbezeichnung: LEAKCOMP® 1C
Type / Model

Die Produkte sind in Übereinstimmung mit den folgenden Richtlinien.
The products are in accordance with the following directives:

Niederspannungsrichtlinie 2014/35/EU vom 26. Februar 2014
Low-Voltage Directive 2014/35/EC as of February 26, 2014

EMV-Richtlinie 2014/30/EU vom 26. Februar 2014
EMC Directive 2014/30/EC as of February 26, 2014

Bei der Fertigung und Prüfung der Produkte wurden die folgenden Normen zur Anwendung gebracht:
The products have been manufactured and tested in accordance with the following standards:

Sicherheitsbestimmungen: DIN EN 61010-1:2011-07, VDE 0411-1:2011-07
Safety requirements

EMV-Anforderungen: DIN EN 61326-1:2013-07, VDE 0843-20-1:2013-07
EMC requirements

Ort, Datum: Bruchköbel, 30.08.2017
Place and date of issue



Unterschrift: Dipl.-Ing. (FH) Thorsten Pensele ^{1) 2) 3)}
Signature

¹⁾ Bevollmächtigter zur Ausstellung dieser Erklärung im Namen des Herstellers /
Authorized representative to issue this declaration in the name of the manufacturer

²⁾ Bevollmächtigter zur Zusammenstellung der technischen Unterlagen /
Authorized representative for compilation of technical documents

³⁾ Funktion: Geschäftsführer / Function: Managing Director



1.11 Product description

There is an increasing use of residual current circuit breakers in industry for personal safety and fire protection. Modern components used in automation technology generate leakage currents when the system is operating. These so-called "operational" leakage currents are interpreted by the RCDs as differential currents and thus often lead to unreliable operating states or to their complete shutdown. The residual current circuit breaker cannot distinguish between the operational leakage currents and true fault currents.

The EPA **LEAKCOMP® 1C** compensates capacitive currents with a frequency of 50 Hz, which occur due to EMC filtering of single-phase consumers (such as those that occur with power supplies, frequency converters, UPSs, lamps, mains filters, etc.)

The **LEAKCOMP® 1C** leakage current compensation unit is used in electrical plants, machines or devices that cause 50 Hz leakage currents and are to be operated on residual current circuit breakers (RCCBs).

The **LEAKCOMP® 1C** compensates for the leakage currents occurring with single-phase consumers during operation preventing inadvertent or 'nuisance' tripping of residual current devices caused by excessively high 50 Hz leakage currents. The device works with all common RCCBs of the types A, F, B and B+ (ideally with short-term delay; a suitable type must be chosen according to the regulations!).

The size of the 50-Hz-compensation current is set at 5 mA and can be increased to 11 mA via a jumper. If the compensation current is not sufficient to compensate for the leakage current, additional **LEAKCOMP® 1C** devices can be connected in parallel.

The **LEAKCOMP® 1C** has two LED indicators.

The blue LED functions as the operating display and indicates the presence of the power supply and fault-free operation. Reversed phase and neutral conductors, high neutral conductor voltage (potential difference between neutral and protective earth conductor) or the absence of the protective earth conductor on the **LEAKCOMP® 1C** is indicated by the red LED.

IMPORTANT NOTE

Along with 50 Hz leakage currents, leakage currents of other frequencies can also occur that are not compensated by the **LEAKCOMP® 1C**. EPA also offer a suitable solution for these cases.

For leakage current measurement with analysis of the utilisation of the residual current circuit breaker, we recommend using the leakage current analysis system EPA **LEAKWATCH** (more information at www.leakwatch.de).

1.12 Delivery contents

Leakage current compensation unit
LEAKCOMP® 1C

EPA Article No.:
50275675



Operating manual
LEAKCOMP® 1C

EPA Article No.:
50275681



2 Safety instructions

2.1 Intended use of the unit

2.1.1 Area of application

The EPA **LEAKCOMP® 1C** compensates capacitive currents with a frequency of 50 Hz that occur due to EMC filtering of single-phase consumers.

The **LEAKCOMP® 1C** leakage current compensation unit is used in electrical plants, machines or devices that cause 50 Hz leakage currents and are to be operated on residual current circuit breakers (RCCBs).

The **LEAKCOMP® 1C** compensates for the leakage currents occurring with single-phase consumers during operation preventing inadvertent or 'nuisance' tripping of residual current devices caused by excessively high 50 Hz leakage currents. The device works with all common RCCBs of the types A, F, B and B+ (ideally with short-term delay; a suitable type must be chosen according to the regulations!).

IMPORTANT NOTE

Operational leakage currents can accept frequencies \neq 50 Hz and cause a malfunction of the residual current device.

Continued on next page

Continued

2.1.2 Inadmissible operating conditions

⚠ DANGER

To prevent overcompensation, it is important that the **LEAKCOMP® 1C** is always switched on and off together with the leakage current generator.

Overcompensation is inadmissible, i.e. the compensation current must not be higher than the leakage current.

A stand-alone operation without a leakage current generator is not permissible.

⚠ CAUTION

The **LEAKCOMP® 1C** must only be used under the conditions and for the purposes for which it was designed (see also "Intended use" chapter).

Particular attention should be paid to the safety instructions and the technical data setting out the ambient conditions.

Operational safety is not guaranteed in the event of modification or improper use.

High voltage differences between the neutral conductor and the protective earth conductor can overload or destroy the device.

Strong electromagnetic fields can affect the function of the device.

External mechanical loads are not allowed.

IMPORTANT NOTE

The device is **not** suitable for:

- The reduction of \neq 50 Hz leakage currents,
- The reduction of 150 Hz operational leakage currents on three-phase devices (servo or frequency inverters),
- The reduction of operational leakage currents for the purpose of compliance with maximum permitted limits for leakage currents (e.g. 3.5 mA limit for mobile devices) in compliance with EN 50178 and 10 mA limit for machines in compliance with EN 60204-1),
- The reduction of leakage currents higher than those specified for the device,
- Use on AC-type residual current circuit breakers (prohibited in Germany!),
- Systems/machines with power regeneration.
- Potentially explosive atmospheres.

2.2 Requirements for personnel

⚠ WARNING

Installation and work on the **LEAKCOMP® 1C** may only be carried out by qualified personnel.



Qualified personnel as defined by this instruction manual are electricians who are familiar with the installation, assembly, startup and operation of the device, with the hazards involved, and who, based on their technical training, are also familiar with the relevant standards and provisions.

Repairs may only be carried out by authorised repair centres. Unauthorised tampering can lead to property damage and will void the warranty provided by EPA GmbH.

2.3 Responsibility:

⚠ WARNING

Electronic devices are never fail-safe. The installer and/or operator of the machine or system is responsible for ensuring that the system/machine is restored to a safe state if the device fails or the residual current device is tripped.

The safety requirements for electrical controllers are set out in DIN EN 60204-1; VDE 0113-1 "Safety of machinery" in the section titled "Electrical equipment of machines". These provisions ensure the safety of persons and machines as well as the maintenance of the functional capability of the machine or system and must be observed.

2.4 Connection

⚠ WARNING of hazardous electrical voltage

Risk to life from electric shocks! Death or serious injury!

To avoid electric shock, take appropriate precautions.

Follow the accident prevention regulations for electrical systems and equipment when carrying out all work.

⚠ WARNING

Terminals C1 and C2 are intended solely for controlling the **LEAKCOMP® 1C**. These must not be used for any other purpose.

The potential at terminals C1 and C2 is at level N (neutral conductor) of the mains voltage. For safety reasons, the relay contacts (if used) must therefore have a dielectric strength of at least 230 VAC, and the connecting cables/jumpers at C1 and C2 must be insulated accordingly.

⚠ CAUTION

The device must be supplied with the voltage specified in the technical data. Higher voltages higher can destroy the device.

Surge voltages between the terminals can destroy the device.

The device must be fixed firmly into place while the power supply is disconnected and no parts are live.

The **LEAKCOMP® 1C** must have a fixed, low-impedance connection with the protective earth conductor (PE).

The **LEAKCOMP® 1C** must only be used in TN-S networks.

2.5 Following the operating instructions

IMPORTANT NOTE

Please read this manual carefully. It contains important information about the installation and operation of the **LEAKCOMP® 1C**.

The **LEAKCOMP® 1C** has been subjected to extensive testing and left the factory in a technically and operationally safe condition. To maintain this condition, the user must follow the safety instructions in this manual.

We assume no liability for damage caused by failure to follow these instructions.

This manual is an integral part of the product and is valid only for the **LEAKCOMP® 1C** leakage current compensation unit manufactured by EPA GmbH.

Please pass this manual on to the system operator/end customer/service technician so that it is available when required.

Keep these operating instructions and all other applicable documents in a safe place to ensure that they are available when required.

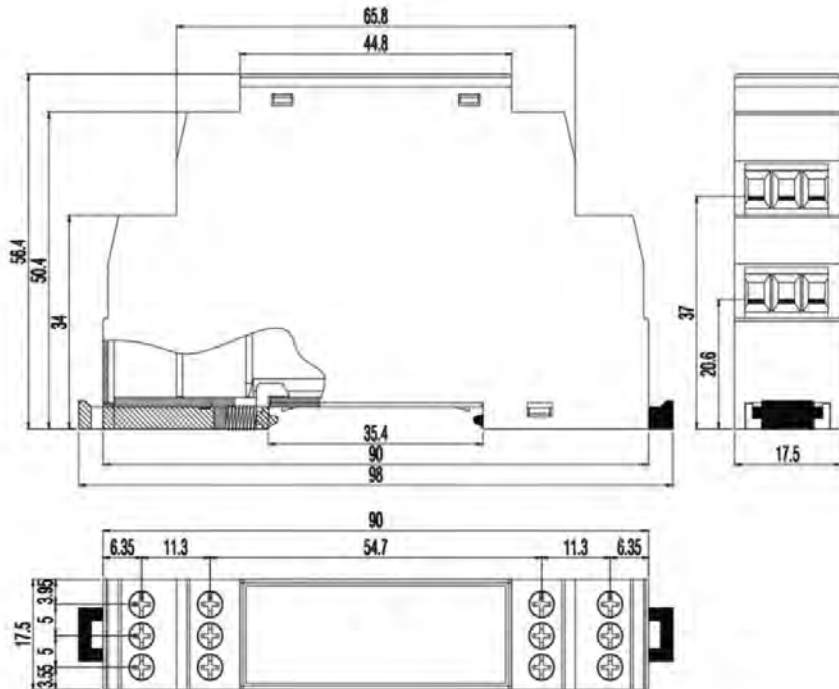
This is a translation of the original German instruction manual.

3 Technical data

3.1 Rating

Network configuration	TN-S system (L / N / PE)
Rated voltage	230 VAC $\pm 10\%$, single phase
Rated frequency	50 Hz $\pm 1\%$
Compensation frequency	50 Hz $\pm 1\%$
Compensation current	max. 11 mA (RMS) selectable: 5 mA or 11 mA (with jumper C1-C2)
Power loss	<2 VA
Ambient temperature	Operation: -10...+40°C Storage: -20...+75°C Transport: -20...+75°C
Rel. humidity	<80%, without condensation
Atmospheric pressure	70..106 kPa
Dimensions	17.5 x 90 x 56.4 mm
Weight	Approx. 65 g
Mounting / fitting	on DIN EN 50022 mounting rail, position as required
Connections	Mains connection: L N Protective earth conductor / compensation connection: PE Selection of compensation current 5 / 11 mA: C1 C2 Cable cross-section: max. 2.5 mm ² (14 AWG) massive max. 1.5 mm ² (16 AWG) flexible with sleeve Max. tightening torque 0.8 Nm
Displays	Blue LED: Operating/status display (<i>RUN</i>) Red LED: Error display (<i>ERROR</i>)
Protection class	IP20
Direct contact protection	DGUV V3 (BGV A3)
Flammability	UL94 V-0
Housing material	PA
EMV	EN 61326-1, EN 55011 (Class B), EN 61000-6-2
Safety	EN 61010-1
Conformity	CE, RoHS (2011/65/EU)

3.2 Dimensions



All dimensions are specified in mm. Tolerance ± 1 mm. Subject to change.
 Current CAD files can be downloaded at www.epa.de.

4 Function

4.1 Functional description

Initial situation

There is an increasing use of RCDs for personal safety-and fire protection purposes. The modern components used in automation technology (such as frequency inverters, RFI filters, switching power supplies, shielded motor cables etc.) generate leakage currents when the system is operating. These so-called "operational" leakage currents are interpreted by the protective devices as differential currents and therefore often lead to unreliable operating states in the residual current device or the complete shutdown of the system. The residual current circuit breaker cannot distinguish between the operational leakage currents and true fault currents.

Application

To prevent the unwanted tripping of the residual-current circuit breaker (RCCB), a device is needed that can compensate for capacitive leakage currents with a frequency of 50 Hz. The leakage current compensation device **LEAKCOMP® 1C** was specially developed for this purpose (compensation current selectable 5 or 11 mA). It is used in electrical systems or machines in which (mostly single-phase) devices with an integrated EMC filter are connected to residual current devices (RCDs) or residual current circuit breakers (RCCBs) with rated residual currents of $I_{\Delta n} = 30$ mA or higher (according to DIN VDE 0100-530).

LEAKCOMP® 1C

The **LEAKCOMP® 1C** compensates for operational leakage currents occurring in the system/machine and thus prevents the inadvertent or unwanted tripping of RCDs caused by excessively high 50 Hz leakage currents.

This functionality is available for all common RCCBs of the types A, F, B and B+ (short-time delayed [STD] versions are recommended). The size of the 50-Hz-compensation current is set at 5 mA and can be increased to 11 mA via a jumper. If the compensation current is not sufficient to compensate for the leakage current, additional **LEAKCOMP® 1C** devices can be connected in parallel.

The **LEAKCOMP® 1C** has two LED indicators.

The **blue LED** functions as the operating display and indicates the presence of the power supply and fault-free operation.

The **red LED** indicates a device fault. The following faults are detected:

- Reversal of the phase and neutral conductors
- Lack of protective earth conductor
- High neutral conductor voltage

4.2 Analysis of RCCB utilisation

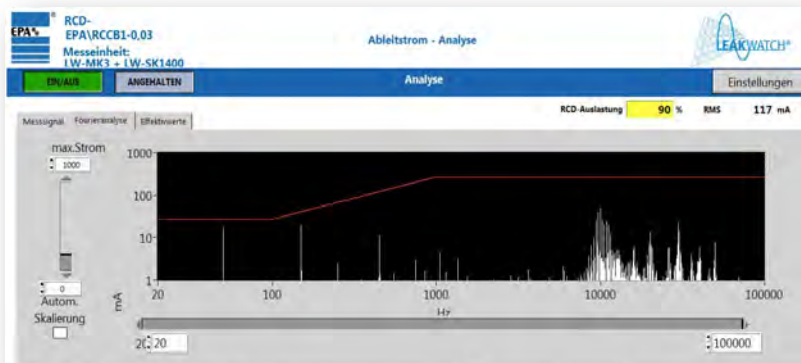
For leakage current measurement with an analysis of the RCCB utilisation, we recommend using the leakage current analysis system EPA **LEAKWATCH** (more information at www.leakwatch.de).



LW-NETBOOK



LW-SET-MZ

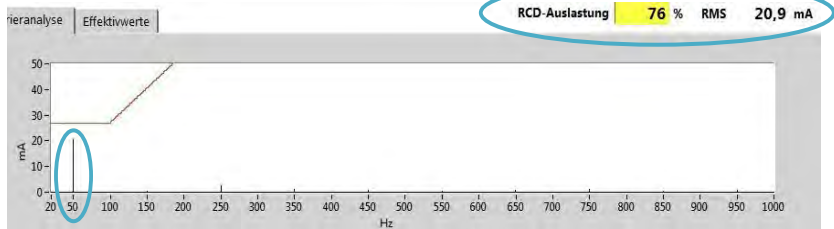


LW-Soft

4.3 Comparing leakage current with and without the **LEAKCOMP® 1C**

Below is an example of a Fast Fourier Transformation (FFT) for determining the frequency and amplitude of the leakage current. A commercial single-phase switching power supply with integrated EMC mains filter was measured. The red line shows the tripping threshold of a 30 mA RCCB (here EPA RCCB1).

4.3.1 Leakage current without the **LEAKCOMP® 1C**

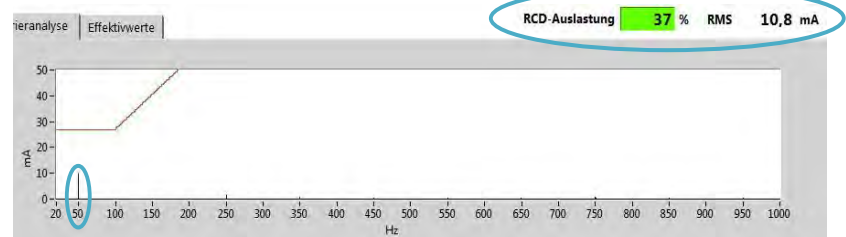


The measured 50 Hz leakage current in this example is 20.9 mA and the utilisation of the RCCB is 76%.

Since a 30 mA residual current device can already trigger normatively at 15 mA (50% of the rated residual current $I_{\Delta n}$), this value must be viewed with a critical eye. To ensure that the RCCB works reliably, the leakage current at 50 Hz should be less than 15 mA, if possible.

► The RCCB cannot work reliably! Tripping due to the high 50 Hz leakage current is very likely.

4.3.2 Leakage current with the **LEAKCOMP® 1C**



The measured 50 Hz leakage current in this example is 10.8 mA and the utilisation of the RCCB is 37%.

With the **LEAKCOMP® 1C**, the 50 Hz leakage current is reduced to 10.8 mA and is thus below the possible tripping threshold of 15 mA (50% of the rated fault current $I_{\Delta n}$).

► The RCCB cannot work reliably! No further tripping due to the 50 Hz leakage current.

5 Delivery, internal transport, unpacking

5.1 Delivery

For the components included in delivery, please refer to the section titled "*Delivery contents*".

All LEAKCOMP® **1C** have been subjected to extensive testing and have left the factory in a technically and operationally safe condition.

▲ WARNING

Read the operating instructions carefully before use.

5.2 Internal transport

The device must be protected against external influences for transport (knocks, vibration, temperature, dirt etc.). The transport conditions are set out in the section titled "*Storage and transport*".

5.3 Unpacking

IMPORTANT NOTE

Check the unit for external damage.

Please keep the original packaging and operating instructions.

6 Storage and transport

6.1 Ambient conditions

Storage	-25°C to +55°C (EN 60721-3-1, 1K3)
Transport	-25°C to +70°C (EN 60721-3-1, 2K3)
Moisture and humidity	Condensation not allowed, relative humidity ≤ 80%
Soiling	Pollution degree 2 (EN 50178)

⚠ CAUTION

Damage possible

Risk of damage to the unit from improper storage or transport.

NOTE

If the unit has been transported at extreme temperatures, it requires an acclimatisation period of at least 2 hours before operation.

Strong vibrations, knocks, shocks and soiling (liquids and solid foreign bodies) must be avoided at all times as they can cause damage to the unit.

6.2 Storage

Always ensure that the **LEAKCOMP® 1C** is stored in a correct and proper manner.

The unit must be stored in a dry, enclosed space.

6.3 Transport

Where possible, transport the **LEAKCOMP® 1C** properly in its original packaging.

The packaging included in delivery can be used for transport.

7 Installation

7.1 Safety instructions for installation

⚠ DANGER



Warning of hazardous electrical voltage!

Risk to life from electric shocks! Death or serious injury!

Take appropriate precautions to prevent electric shocks.

⚠ DANGER

The **LEAKCOMP® 1C** must only be installed by an authorised and qualified specialist who is familiar with the relevant safety provisions.

Work in hazardous proximity to electrical systems should only be performed under the instruction of a responsible electrician and not carried out alone.

Follow the accident prevention regulations for electrical systems and equipment when carrying out all work.

Installation should only be carried while the power supply is disconnected and no parts in the system are live.

The **LEAKCOMP® 1C** is designed for mounting on a rail in accordance with DIN 50022.

The device must be firmly installed in the distribution board.

The housing of the **LEAKCOMP® 1C** must not be opened.

⚠ WARNING

To prevent overcompensation, it is important that the **LEAKCOMP® 1C** is always switched on and off together with the leakage current generator.

An overcompensation is inadmissible, i.e. the compensation current must not be higher than the leakage current.

Continued on next page

Continued

⚠ WARNING

The **LEAKCOMP® 1C** must be connected in parallel to the "leakage generator".

The protective conductor (PE) must be connected to the protective conductor terminal (PE) of the device with a fixed, low-impedance connection.

The **LEAKCOMP® 1C** must only be used in TN-S networks.

IMPORTANT NOTE

When tightening the terminals, the maximum tightening torque of 0.8 Nm must not be exceeded.

7.2 Installation conditions**⚠ WARNING**

Follow the safety instructions in the section titled "Safety" and note the technical data in the section titled "*Technical data*".

7.2.1 Operating conditions

The **LEAKCOMP® 1C** operates independently of position and is designed for mounting on a top-hat rail in accordance with DIN 50022.

It is designed for single-phase TN-S networks (L/N/PE).

Ambient conditions

Operation	+10°C to +40°C
Moisture and humidity	Without condensation, relative humidity ≤ 80%
Installation altitude	≤ 2000 m above sea level
Soiling	Pollution degree 2 (EN 50178)

7.2.2 Connection conditions

⚠ WARNING of hazardous electrical voltage**Risk to life from electric shocks! Death or serious injury!**

To avoid electric shock, take appropriate precautions.

Follow the accident prevention regulations for electrical systems and equipment when carrying out all work.

⚠ WARNING

The internal control voltage at terminals C1 and C2 is intended solely for controlling the **LEAKCOMP® 1C**. It must not be used for any other purpose!

The potential of the control voltage is on level N of the mains voltage.

For safety reasons, the connecting cables must therefore have a dielectric strength of at least 230 VAC and the jumpers at C1 and C2 must be insulated accordingly.

⚠ CAUTION

The device must be supplied with the voltage specified in the technical data. Higher voltages higher can destroy the device.

The device must be fixed firmly into place while the power supply is disconnected and no parts are live.

Improper wiring can destroy the device.

7.3 Connections

7.3.1 Power supply

On the **LEAKCOMP® 1C**, a phase (L), the neutral conductor (N) and the protective earth conductor (PE) must be connected in parallel to the electrical installation.

When selecting the phase, it must be ensured that it also supplies the "leakage current generator", as compensating is impossible otherwise.

The phase and neutral conductor must be properly connected and must not be reversed. Reversed phase and neutral conductors is indicated by the red LED (*ERROR*).

7.3.2 Compensation connection

The compensation connection (PE) on the **LEAKCOMP® 1C** must be connected to the protective conductor in a permanent and low-resistance manner. If the connection is removed, this is indicated by the red LED (*ERROR*).

7.3.3 Control connection

The magnitude of the compensation current can be selected with a jumper between control terminals C1 and C2.

If terminals C1 and C2 are open, the compensation current is 5 mA RMS.

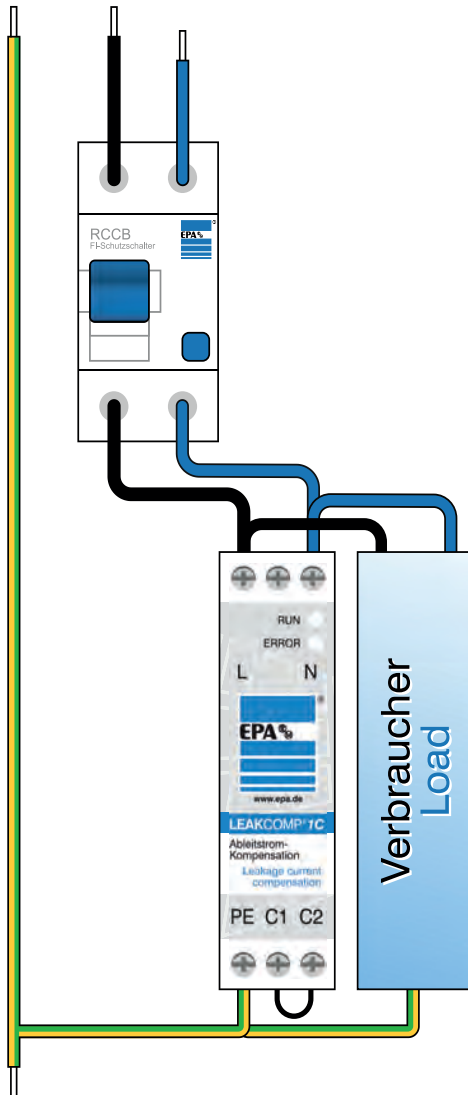
If terminals C1 and C2 are connected (jumper provided from factory), the compensation current is 11 mA RMS.



7.4 Wiring diagram

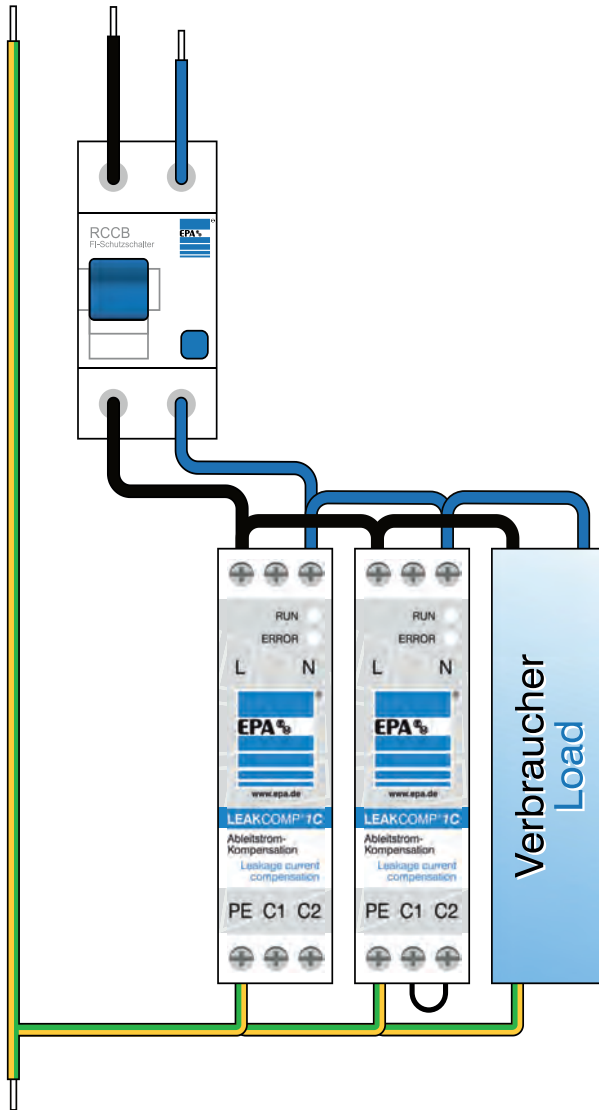
7.4.1 Standalone operation

Wiring the LEAKCOMP® 1C to an RCCB.



7.4.2 Parallel operation

Wiring of two **LEAKCOMP® 1C** operated in parallel to an RCCB.



8 Startup / Operation

⚠ DANGER

To prevent overcompensation, it is important that the **LEAKCOMP® 1C** is always switched on and off together with the leakage current generator.

An overcompensation is inadmissible, i.e. the compensation current must not be higher than the leakage current.

IMPORTANT NOTE

The level of the compensation current (5 mA or 11 mA) must be selected before commissioning the **LEAKCOMP® 1C**.

To successfully deploy the **LEAKCOMP® 1C**, it is necessary to first identify the devices that are responsible for the leakage current and thus for tripping the RCCB. In addition, the level of the leakage current before and after using the **LEAKCOMP® 1C** should be measured in order to determine whether the compensation was successful (see chapter "Comparing leakage current with and without the **LEAKCOMP® 1C**").

8.1 Switching on

When the supply voltage is switched on, the device first carries out a self-test, which detects and if necessary corrects the correct assignment of the phase (*L*) and neutral conductors (*N*) and the presence of the protective earth conductor (*PE*).

If phase and neutral are reversed or the protective earth conductor is missing, the **red LED** flashes.

If too high of a potential difference between the neutral and protective earth conductor is identified, then this is also detected by the **LEAKCOMP® 1C** and indicated by a flashing **red LED**.

The **blue LED** serves as an operating display. A pulsating **blue LED** indicates that the mains voltage is present, as well as proper connection of the phase, neutral conductor and protective earth conductor and fault-free operation.

8.2 Switch compensation on and off

Compensation can be switched on and off by interrupting the conductor *PE* at the compensating line.

8.3 Shutdown

To shut down the **LEAKCOMP® 1C**, disconnect the power supply to terminals *L* and *N*.

8.4 LED display elements

The **LEAKCOMP® 1C** has two colour LED indicators.



Display	Status
Blue LED	Fault-free operation
Red LED	Phase and neutral reversed
Red LED	Protective earth conductor not connected
Red LED	High potential difference between neutral and protective earth conductor

8.5 Setting the compensation current

The **LEAKCOMP® 1C** provides fixed compensation, meaning that the compensation current is set to a fixed value for the respective application.

With an optimal compensation current level, the resulting 50 Hz leakage current is almost zero.

The level of the compensation current can be selected with a jumper between terminals *C1* and *C2*. If terminals *C1* and *C2* are open, the compensation current is 5 mA RMS. If a jumper is provided between *C1* and *C2* (from factory), the compensation current is 11 mA RMS.

Compensation current	Control terminals <i>C1</i> and <i>C2</i>
5 mA	open
11 mA	bridged

8.6 Further increasing the compensation current

If the compensation current is not sufficient to compensate for the leakage current, additional **LEAKCOMP® 1C** devices can be connected in parallel.

Using a second **LEAKCOMP® 1C** it is possible to generate 16 mA or 22 mA compensation currents.

You must still ensure that no overcompensation occurs.

9 Troubleshooting

9.1 Blue LED remains off

The blue LED serves as an operating display. A pulsating *blue LED* indicates that the mains voltage is present, as well as proper connection of the phase (*L*), neutral conductor (*N*) and protective earth conductor (*PE*) and fault-free operation.

- ➔ Make sure that the phase, neutral and protective earth conductors are correctly connected and the mains supply between phase and neutral conductor is present.



9.2 Red LED is flashing

9.2.1 Incorrect phase allocation

When the supply voltage is switched on, the device first carries out a self-test, which detects and if necessary corrects the correct assignment of the phase (*L*) and neutral conductors (*N*). If phase and neutral are swapped, the red LED flashes.

- ➔ Ensure that the phase and neutral are connected correctly and not reversed.



9.2.2 Protective earth conductor missing

The proper connection of the protective earth conductor to the *PE* terminal is determined during the self-test of the **LEAKCOMP® 1C**. The compensation current can only flow if the protective earth conductor is connected to the compensation connection of the device. If the protective earth conductor is not connected to the *PE* terminal on the **LEAKCOMP® 1C**, the red LED flashes.

- ➔ Make sure the protective earth conductor is firmly connected to the compensation connection on the **LEAKCOMP® 1C** with low resistance.

9.2.3 Neutral conductor voltage

If too high of a potential difference between the neutral and protective earth conductor is identified, then this is also detected by the **LEAKCOMP® 1C** and indicated by a flashing red LED.

- ➔ Please measure the voltage between the neutral and protective earth conductors with a suitable measuring device. If there is voltage between the neutral and protective earth conductors, there is an installation problem with the system wiring that must be dealt with before the starting the **LEAKCOMP® 1C**. This does not generally cause a defect in the device.

WARNING

In the event of a permanently raised voltage (>10V) between the neutral and protective earth conductors or terminals *N* and *COMP*, a defect may occur in the **LEAKCOMP® 1C**.

9.3 RCCB trips

The RCCB may trip if the compensation current is set either too high or too low.

An optimal ratio of compensation current to leakage current is required for safe operation at the RCCB. This must be checked metrologically.

Along with 50 Hz leakage currents, leakage currents of other frequencies can also occur that are not compensated by the **LEAKCOMP® 1C** (e.g. 150 Hz or leakage currents in the kHz range). EPA also offer a suitable solution for these cases.

We recommend measuring the leakage current on the output side of the RCCB. The leakage current analysis system EPA **LEAKWATCH** (further information at www.leakwatch.de) can be used to measure the leakage current and analyse the utilisation of the RCCB.

9.4 Service address



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9.5 Fault detection and rectification

Fault/error message	Possible cause(s)	Remedy
RCCB trips, despite the use of the LEAKCOMP® 1C .	Wiring error – neutral conductor tapped before residual current circuit breaker	Check wiring and tap N after residual current circuit breaker
	Compensation current is too low	Increase compensation current; Insert jumper C1-C2; Switch additional LEAKCOMP® 1C (s) in parallel
	Compensation current is too high	Reduce compensation current; Remove jumper C1-C2;
	50 Hz leakage current due to insulation fault	Correct insulation fault
	High leakage current at 150 Hz	Compensate leakage current of three-phase inverter (e.g. EPA LEAKCOMP® HP)
	EMC filter /mains filter with high leakage current	Use low-leakage current filters (e.g. EPA NF-1ph-FSE)
	High leakage currents in the range of the inverter switching frequency	Use additional mains filters to reduce high-frequency leakage currents (e.g. EPA NF-DAR, NF-KC-DAR)
	Leakage current too high (with unknown frequency)	Carry out a leakage current analysis (e.g. with EPA LEAKWATCH)
Red LED is flashing	Phase and neutral reversed	Check assignment of phase and neutral conductor on LEAKCOMP® 1C and change wiring if necessary
	No protective conductor connection	Check for presence of protective earth conductor and ensure a low-resistance connection to the compensation terminal
	High neutral conductor voltage	Check voltage between neutral and protective earth conductor and eliminate potential difference, if any
Both LEDs are off	No power supply	Check voltage supply at terminals L and N
	Device defective	Send the LEAKCOMP® 1C to EPA

10 System inspection and maintenance

WARNING

These tests must be carried out by a qualified electrician who is competent to carry out the tests, has experience of testing and possesses a knowledge based on the testing of comparable systems.

For the initial test of electrical systems and stationary equipment, the requirements of the standard DIN VDE 0100-600 "Low-voltage electrical installations – Part 6: Verification" must be met.

For the repeat test of electrical systems and stationary equipment, the requirements of the standard DIN VDE 0105-100 "Operation of electrical installations – Part 100: General requirements" must be met.

Always follow the accident prevention regulations.

IMPORTANT NOTE

When used as intended, the **LEAKCOMP® 1C** is maintenance-free. Inspection or maintenance should only be carried out by qualified electricians.

Unless explicitly described in these operating instructions, modifications to the device may only be carried out by EPA or persons authorised by EPA.

11 Repairs

IMPORTANT NOTE

The **LEAKCOMP® 1C** can be damaged or destroyed if the instructions are not followed.

Repairs may only be carried out by EPA or repair centres authorised by EPA. Unauthorised tampering can lead to property damage and will void the warranty provided by EPA.

The housing should not be opened.

12 Disposal

IMPORTANT NOTE

The **LEAKCOMP® 1C** is a device intended for commercial use. These devices should not be disposed of at municipal collection points for electrical appliances. The devices contain electronic components and must be disposed of properly. If you have any questions, please contact us.



All information without liability for correctness and accuracy.

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