



Leakage current compensation in networks with servo-drives
and frequency inverters

Instruction manual

Compensation
of operational
leakage currents
up to 500 mA
(RMS)!

Increases the
operational safety
of the system

Use of a residual
current circuit
breaker with
a limit of
30 mA or higher
according to
DIN VDE 0100-530
possible



IP
20



EPA 
www.epa.de

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

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

Phone: +49 6181 9704 0

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

We would like to thank our academic advisers at the Hochschule Emden/Leer University of Applied Sciences for their outstanding support:

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Prof. Dr.-Ing. Thomas Dunz

M.Sc. Dipl.-Ing. Rolf Andreas Rasenack



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1 Important basic information

1.1 Publication details

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LEAKCOMP® HP eco
LEAKCOMP® HP eco ext
Device version: HW 3.0 / SW 2.37

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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, start-up 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. Because 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.

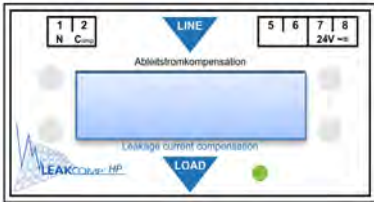
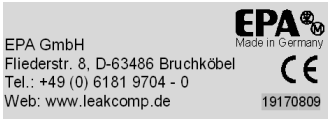
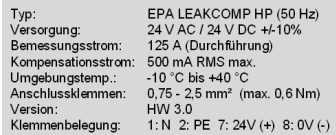
The absence of such marking does not mean that a name is free within the meaning of brand and trademark law.

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
▲ IMPORTANT NOTE	Draws your attention to the handling and impact of safety information.
▲ 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.
	Draws your attention to possible damage to property and other important information.
	Electrician

1.7 Marking on the product

Illustration	Description
	<p>Front cover: <i>LED power indicator, function keys and multi-function display (only HP), status LED (only HP eco + HP eco ext)</i> <i>labelling of connection terminals 24 V, COMP and N</i> <i>Flow direction diagrams (from LINE to LOAD),</i> LEAKCOMP® HP logo, label in German and English, company logo</p>
	<p>Address label: <i>Manufacturer's address, company logo, serial number, CE mark</i></p>
	<p>Nameplate: <i>Type designation</i> <i>Supply voltage</i> <i>Rated current</i> <i>Compensation current</i> <i>Ambient temperature</i> <i>Conductor cross-section and max tightening torque for the connection terminals</i> <i>Version</i> <i>Terminal assignment</i></p>

1.8 CE mark

The CE mark is on the device's nameplate.



The device complies with the relevant essential requirements of all applicable EU directives.

1.9 Declaration of Conformity

SO 5.2.3-05



Konformitätserklärung

Declaration of Conformity

Dokument Nr.: CEK1602003
 Document No.:

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

Produktbezeichnung: Aktive Ableitstromkompensation
 Product description: Active leakage current compensation

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

Typenbezeichnung: LEAKCOMP® HP, LEAKCOMP® HP eco, LEAKCOMP® HP eco ext
 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, 02.02.2016
 Place and date of issue:



Unterschrift: Dipl.-Ing. (FH) Thorsten Pemsel ^{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 / Funktion: Managing Director



1.10 Product description

The EPA **LEAKCOMP® HP** is used for the compensation of capacitive leakage currents with frequencies* of 150 Hz, 450 Hz, 750 Hz and 1050 Hz.

The leakage current compensation unit **LEAKCOMP® HP** is generally used in electrical systems in which three-phase frequency inverters and/or servo controllers (with B6 bridge rectifiers) are to be operated on residual current circuit breakers.

The **LEAKCOMP® HP** compensates for the leakage currents occurring in the system during operation, preventing unwanted tripping of residual current devices caused by excessively high leakage currents. Leakage currents and true fault currents are rigorously differentiated, and there is no compensation of fault currents.

As display elements, the **LEAKCOMP® HP **** has a multi-coloured LCD multi-function display and a green LED. The LED indicates whether the unit is ready for operation. If the display colour changes to red, either the leakage current is above the compensation range or an error has occurred (see also section titled "*Troubleshooting*"). The multi-function display shows a direct leakage current measurement, indicating both the actual leakage current (I_LEAK) and the compensated leakage current (I_COMP) (see section titled "*Start-up*").

Keys can be used to switch the leakage current display from a numeric to a graph format (see section titled "*Start-up*"). A brief change in the colour of the display to blue indicates that the so-called "buster" function for leakage current peaks has been activated (for example when inverters are switched on or off).

IMPORTANT NOTE

The **LEAKCOMP® HP** may only be operated in conjunction with an AC/DC-sensitive type B or B+ residual current circuit breaker (e.g. EPA RCCB).

The RMS value shown on the **LEAKCOMP® HP**** display is the total leakage current, which means that frequencies* outside 150 Hz, 450 Hz, 750 Hz and 1050 Hz are also measured. A high value can be caused for example by 50 Hz or high-frequency leakage currents (kHz range).

Successful compensation is not indicated by the LED. This can be checked using either the display functions or an additional differential current measurement.

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).

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

** **LEAKCOMP® HP eco** and **eco ext** do not have an LCD multi-function display.

1.11 Delivery contents

1.11.1 LEAKCOMP® HP

<p>Leakage current compensation unit LEAKCOMP® HP</p> <p>EPA Article No.: 50275561</p>	 <p>The image shows a white plastic enclosure for the LEAKCOMP HP unit. The front panel features a green LCD display showing '0.766 A' and '0.000 A'. To the right of the unit is a plus sign followed by a blue and white manual or brochure with the EPA logo at the bottom.</p>
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1.11.2 LEAKCOMP® HP eco

<p>Leakage current compensation unit LEAKCOMP® HP eco</p> <p>EPA Article No.: 50275608</p>	 <p>The image shows a white plastic enclosure for the LEAKCOMP HP eco unit. The front panel has a green LCD display and a green indicator light. To the right of the unit is a plus sign followed by a blue and white manual or brochure with the EPA logo at the bottom.</p>
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1.11.3 LEAKCOMP® HP eco ext

<p>Leakage current compensation unit LEAKCOMP® HP eco ext</p> <p>EPA Article No.: 50275633</p>	 <p>The image shows a white plastic enclosure for the LEAKCOMP HP eco ext unit. The front panel features a green LCD display, a green indicator light, and a circular port. To the right of the unit is a plus sign followed by a blue and white manual or brochure with the EPA logo at the bottom.</p>
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1.12 Optional accessories

1.12.1 Power supply

Switching power supply
 24V DC, 0.63 A, 15 W
 Dimensions:
 25 x 93 x 56 mm
 Weight: 0.1 kg
 EPA Article No.: DIV10604



▲ IMPORTANT NOTE

The power consumption of the **LEAKCOMP® HP** depends on the required compensation current. We therefore recommend one switching power supply for each **LEAKCOMP® HP**. At least 0.5 A (at 24V DC) should be available for each **LEAKCOMP® HP** unit.

The switching power supply is not included in delivery and must be ordered separately where required.

1.12.2 Accessories for the **LEAKCOMP® HP eco ext**

Current transformer
LW-SK10000-70
 Diameter: 70 mm
 Dimensions
 130 x 33 x 110 mm
 Weight: 0.25 kg

EPA Article No.: 50275490



Connection cable
LW-DAT
 Cable length: 2 m

EPA Article No.: 50275417

▲ IMPORTANT NOTE

The current transformer and connection cable are not included in delivery and must be ordered separately where required.

Current transformers with diameters ranging from 25 to 210 mm are available on request.

2 Safety instructions

2.1 Intended use of the unit

2.1.1 Area of application

AC/DC-sensitive residual current circuit breakers (RCCBs) are increasingly used in industrial applications. 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 and its tripping. The residual current circuit breaker cannot distinguish between the operational leakage currents and true fault currents.

The EPA **LEAKCOMP® HP** is generally used in systems in which variable-speed drives (in particular three-phase servo or frequency inverters with B6 bridge rectifier circuits) are to be operated on type B or B+ residual current circuit breakers (RCCB) or residual current devices (RCD). The **LEAKCOMP® HP** reduces the leakage currents occurring in the system during operation, preventing unwanted tripping of residual current circuit breakers caused by excessively high leakage currents.

The device compensates for leakage currents with frequencies* of 150 Hz, 450 Hz, 750 Hz and 1050 Hz.

There is no compensation for fault currents (for example due to insulation faults).

NOTE

High leakage currents outside the frequencies* of 150 Hz, 450 Hz, 750 Hz and 1050 Hz or with a very high amplitude can still trip the residual current circuit breaker.

Where this is the case, EPA also offers suitable solutions (see leakage current reduction filters at www.epa-filter.de).

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

Continued on next page

Continued

2.1.2 Inadmissible operating conditions

▲ CAUTION

The **LEAKCOMP® HP** may only be used under the conditions and for the purposes for which it was designed.

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 and measuring accuracy of the device.

External mechanical loads are not allowed.

▲ DANGER

The **LEAKCOMP® HP** should be operated only in conjunction with an AC/DC-sensitive type B or B+ residual current circuit breaker.

When operating in conjunction with electronic equipment such as frequency inverters or servo controllers, the maximum frequency of the output network (rotating field frequency) should not exceed 130 Hz¹⁾.

Continuous operation with a fixed output frequency* (rotating field frequency) of 150 Hz or 450 Hz, 750 Hz and 1050 Hz is not allowed.

For operation of the output-side network above an operating frequency of 130 Hz¹⁾, the frequency bands from 130 Hz to 170 Hz²⁾, 430 Hz to 470 Hz³⁾, 730 Hz to 770 Hz⁴⁾ and 1030 Hz to 1070 Hz⁵⁾ must be passed quickly.

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

¹⁾ 160 Hz

²⁾ 160 Hz to 200 Hz

³⁾ 520 Hz to 560 Hz

⁴⁾ 880 Hz to 920 Hz

⁵⁾ 1240 Hz to 1280 Hz

Continued on next page

Continued

⚠ IMPORTANT NOTE

The device is **not** suitable for

- The reduction of operational 50 Hz leakage currents at single-phase devices (servo or frequency inverters)
- The reduction of operational leakage currents for the purpose of compliance with normative maximum limits for leakage currents (e.g. 3.5 mA limit for mobile devices)
- The reduction of leakage currents outside the frequencies* 150 Hz, 450 Hz, 750 Hz and 1050 Hz
- The reduction of very high leakage current peaks during switching on and off
- Use on type AC, A or F residual current circuit breakers
- Systems with power regeneration
- Potentially explosive atmospheres

2.2 Requirements for personnel

⚠ WARNING

Installation and work on the **LEAKCOMP® HP** 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, start-up 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.

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

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 is restored to a safe state in the event that 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

To avoid electric shock, take appropriate precautions.

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

⚠ CAUTION

The unit is supplied with 24 V (AC or DC). Higher voltages can destroy the device.

Surge voltages between the "COMP" and "N" terminals can destroy the device.

An excessively high current through the transducer, for example as a result of a wiring error, can destroy the device.

⚠ IMPORTANT NOTE

A fixed, low-impedance connection is required between the compensation output COMP and the protective earth conductor (PE). Compensation can be switched on and off by interrupting the conductor at the COMP connection.

The LEAKCOMP® *HP* should only be used in TN-S networks.

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

2.5 Follow the operating instructions

▲ IMPORTANT NOTE

Please read this manual carefully. It contains important information on operating the **LEAKCOMP® HP** leakage current compensation unit.

The **LEAKCOMP® HP** has been tested exhaustively and was shipped in perfect condition and safe for use. To ensure that this remains the case, 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® HP** 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 (L1 / L2 / L3 / N / PE)
Rated voltage	200...480 VAC \pm 10%, 3-phase
Rated frequency ¹⁾	50 Hz \pm 1%
Rated current	LEAKCOMP® HP: \leq 125 A LEAKCOMP® HP eco: \leq 125 A LEAKCOMP® HP eco ext: $>$ 125 A
Power supply	24 V AC / DC (\pm 10%) 0.5 A
Power loss	$<$ 15 W
Compensation frequencies ¹⁾	150 Hz, 450 Hz, 750 Hz, 1050 Hz
Compensation current	LEAKCOMP® HP / HP eco ext: Max. 500 mA rms LEAKCOMP® HP eco: Max. 300 mA rms
Dimensions	L: 91 mm W: 89 mm H: 59 mm
Weight	Approx. 400 g
Ambient temperature	Operation: +10..40°C, storage: -25..+55°C, transport: -25..+70°C
Degree of protection	IP 20
Mounting / fitting	On DIN EN 50022 mounting rail, position as required
Connections ²⁾	Terminal assignment: Neutral conductor connection (N): 1 Compensation feedback (COMP): 2 Power supply (24 V): 7 + 8 Transducer (LW-SK): 5 + 6 Conductor cross-section: 0.75 - 1.5 mm ² Max tightening torque: 0.6 Nm
Transducers	LEAKCOMP® HP / LEAKCOMP® HP eco: Internal transducer: \varnothing 25 mm (max 4 x 25 mm ²) LEAKCOMP® HP eco ext: External transducer: \varnothing optionally 25 to 210 mm
Indications	LEAKCOMP® HP / HP eco / eco ext: LED power indicator, green LEAKCOMP® HP: Multi-function LCD display or LEAKCOMP® HP eco / eco ext: Status LED, multi-coloured
Function keys	4 keys (not available on LEAKCOMP® HP eco / eco ext)
EMC	EN 61326-1, EN 55011 Class A
Conformity	CE, RoHS (2011/65/EU)

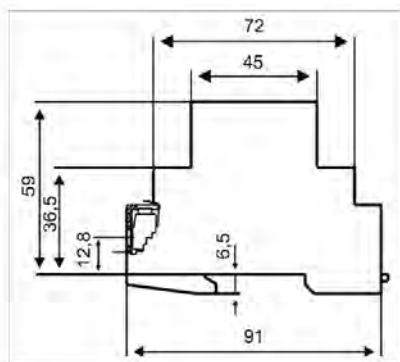
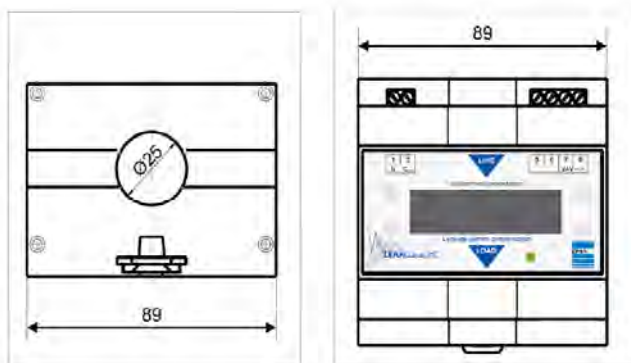
¹⁾ Also available as 60 Hz version; compensation frequencies 180 Hz, 540 Hz, 900 Hz and 1260 Hz

²⁾ From hardware version HW 3.0 with connection for **LEAKWATCH**

3.2 Dimensions

All dimensions are specified in mm.

CAD files can be downloaded from our website www.EPA.de.



4 Function

4.1 Functional description

Operational leakage currents (frequencies of 150 Hz, 450 Hz, 750 Hz and 1050 Hz)* are detected by the **LEAKCOMP® HP** and compensated in a special, patent-protected process. This means that the residual current circuit breaker is no longer affected by operational leakage currents. True fault currents continue to be detected by the residual current circuit breaker in accordance with its specifications.

WARNING

The **LEAKCOMP® HP** should be operated only in conjunction with a type B or B+ residual current circuit breaker.

As display elements, the **LEAKCOMP® HP** has a multi-coloured LCD multi-function display and a green LED.

The LED indicates whether the unit is ready for operation. It indicates the presence of an adequate voltage supply.

The multi-function display shows a direct leakage current measurement, indicating both the actual and compensated leakage current. The keys can be used to switch the leakage current display from a numeric to a bar graph display.

A brief change in the colour of the display to blue indicates that the buster function for leakage current peaks has been activated (for example when inverters are switched on or off).

The hardware and software version is displayed briefly when the device is switched on (firmware SW2.35 and higher).

If the display colour changes to red, either the leakage current is outside the compensation range or an error has occurred (see also section titled "*Troubleshooting*").

NOTE

Successful compensation is not indicated by the LED. This can be checked using either the display functions or an additional differential current measurement.

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).

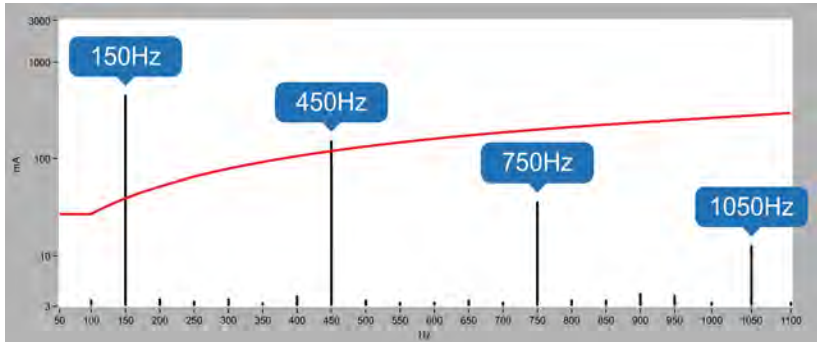
The **LEAKCOMP® HP eco / eco ext.** versions do not have a display.

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

4.2 Leakage current with and without the LEAKCOMP[®] HP

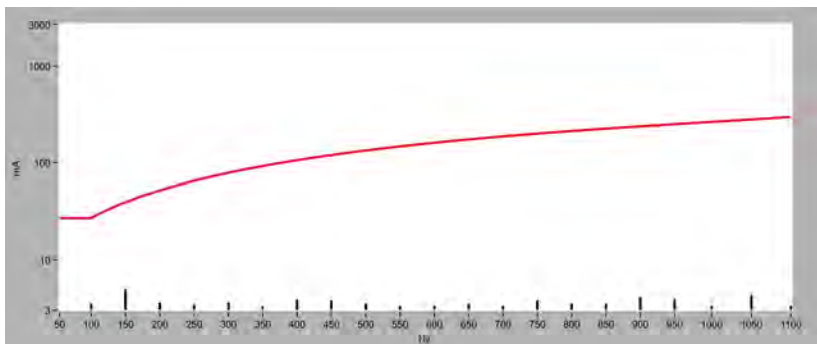
Examples of the frequency components of the leakage current using a Fourier analysis with inverters in operation, measured with the EPA LEAKWATCH.

4.2.1 Leakage current without the LEAKCOMP[®] HP



The tripping threshold (red line) for the residual current circuit breaker (here EPA RCCB1 with 30 mA) is significantly exceeded at 150 Hz.* The residual current circuit breaker would detect an excessively high differential current and be tripped.

4.2.2 Leakage current with the LEAKCOMP[®] HP



With the leakage current compensation unit LEAKCOMP[®] HP (50 Hz version), the tripping threshold (red line) for the residual current circuit breaker (here EPA RCCB1 30 mA) is no longer exceeded. The residual current circuit breaker is no longer tripped by the operational leakage currents.

* 180 Hz bei 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz und 1260 Hz

4.3 Switch compensation on and off

Compensation can be switched off by interrupting the conductor at the *COMP* connection.

4.4 Display leakage current with and without compensation

NOTE

The display of leakage current applies only to the **LEAKCOMP® HP** (with multi-function display) and is not relevant for the models **LEAKCOMP® HP eco / eco ext.** At the 60 Hz version the frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz are shown on the display.

The multi-function display shows a direct leakage current measurement, indicating both the actual leakage current (L) and the compensated leakage current (C). The key at the bottom left can be used to switch between the two (C / L).



The key at the top left (G / N) can be used to switch the leakage current display from graph (G) to numeric (N).



4.5 Shut down

To shut down the **LEAKCOMP® HP**, switch off the power supply and remove / switch off the conductor at the *COMP* connection.

4.6 Analyse residual current circuit breaker utilisation

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).



5 Delivery, internal transport, unpacking

5.1 Delivery

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

All **LEAKCOMP® HP** units are factory-tested, shipped in perfect condition and safe for use.

▲ 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

Please keep the original packaging and operating instructions.
Check the unit for external damage.



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 store the **LEAKCOMP® HP** properly.

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

6.3 Transport

Always transport the **LEAKCOMP® HP** 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

To avoid electric shock, take appropriate precautions.

DANGER

The **LEAKCOMP[®] HP** should 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[®] HP** is designed for mounting on a rail in accordance with DIN 50022. A minimum distance of approx. 20 mm from adjacent assemblies should be maintained (heat).

The device should be mounted firmly into the distribution board.

The housing of the **LEAKCOMP[®] HP** should not be opened.

WARNING

High load currents can overload or destroy the sensitive hardware.

The level of the leakage currents to be compensated should not exceed the value indicated in the specification.

Ideally, the **LEAKCOMP[®] HP** is positioned directly behind the residual current circuit breaker.

A fixed, low-impedance connection is required between the compensation output *COMP* and the protective earth conductor (PE). Compensation can be switched off by interrupting the conductor at the *COMP* connection.

Connect the **LEAKCOMP[®] HP** supply voltage, neutral conductor and conductor at the *COMP* connection to the marked terminals. Note that the maximum tightening torque is 0.6 Nm.

No load (frequency inverters) should be connected when the **LEAKCOMP[®] HP** is switched on because a self-test is first carried out before the unit is ready for compensation of leakage currents (see section titled "Start-up").

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® HP** operates independent of position and is designed for mounting on a top-hat rail in accordance with DIN 50022.

It operates in three-phase networks with a TN-S system (L1/L2/L3/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

The **LEAKCOMP® HP** is supplied by a separate 24 V power supply unit (see section titled “*Technical data*”). The connection is made at terminals 7 and 8.

The polarity (+/-) is irrelevant.

The neutral conductor (N) is connected to terminal 1 and the protective earth conductor (PE) to terminal 2.

Terminals 5 and 6 do not need to be connected. From hardware version HW 3.0, an EPA **LEAKWATCH** measuring unit for leakage current analysis can be connected to measure the uncompensated leakage current.

▲ IMPORTANT NOTE

The **LEAKCOMP® HP** is positioned in the direction of current flow directly behind the residual current circuit breaker.

All conductors required to operate the system except the protective earth conductor (and cable shields) are run through the cable duct on the **LEAKCOMP® HP**.

Metallic cable sheathing (e.g. individual shielding) in the duct area must be removed.

Ensure that the direction of energy flow is correct (see connection diagram).

The maximum tightening torque for the terminals is 0.6 Nm.

The power supply to the **LEAKCOMP® HP** (by a separate 24 V power supply unit) must be interrupted when the residual current circuit breaker is tripped.

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Continued

NOTES

All conductors required to operate the system except the protective earth conductor (and cable shields) are run through the cable duct on the **LEAKCOMP® HP** or external transducer for the **LEAKCOMP® HP eco ext.**

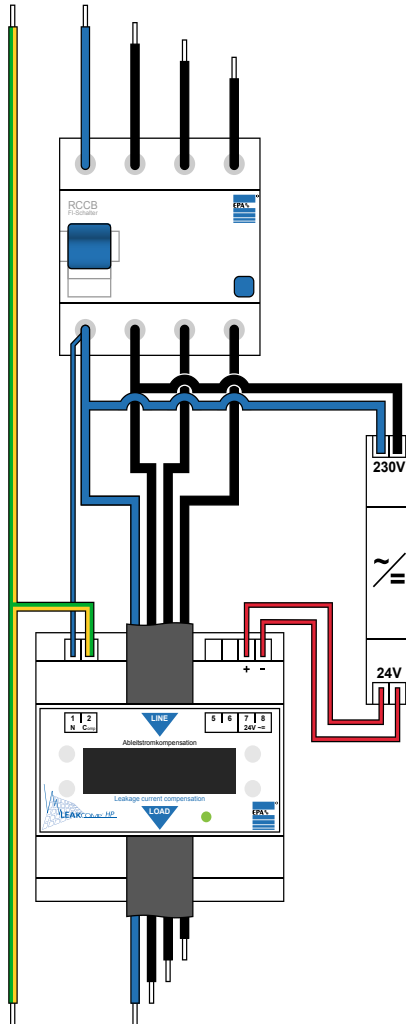
Ensure that the direction of energy flow is correct (see section titled “*Connection conditions*”).

Metallic cable sheathing (e.g. individual shielding) in the duct area must be removed.

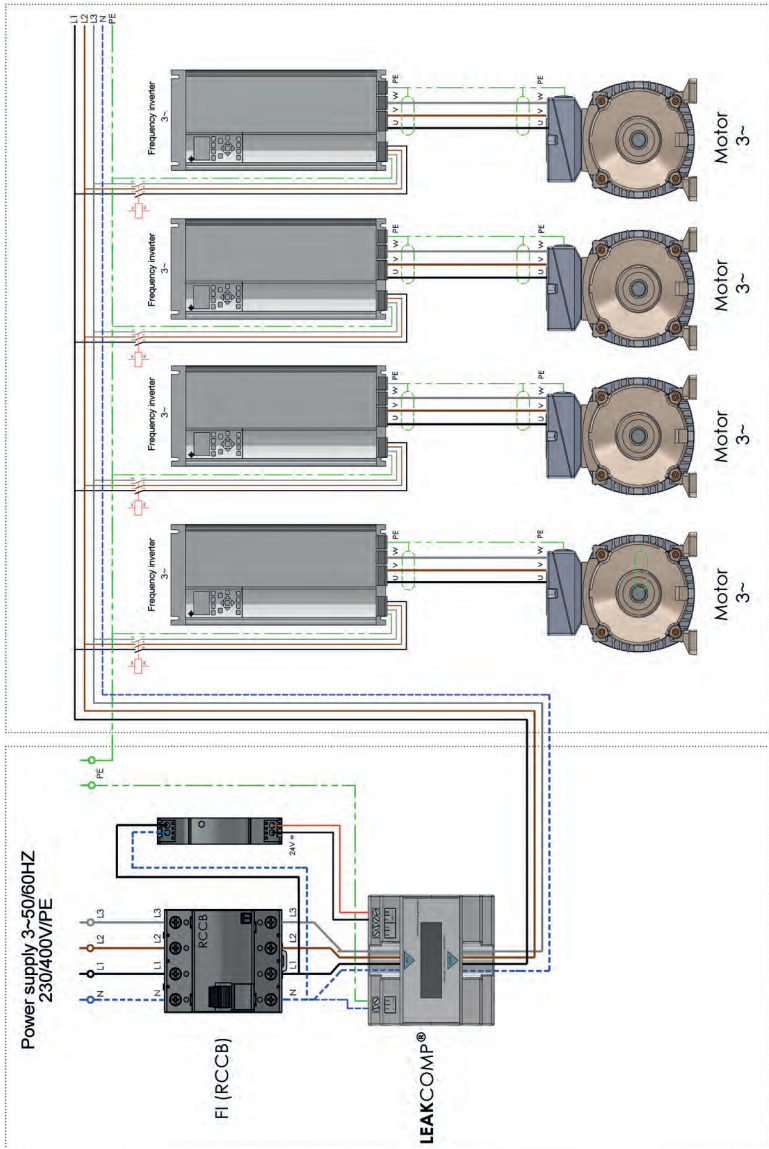


7.3 Wiring diagram

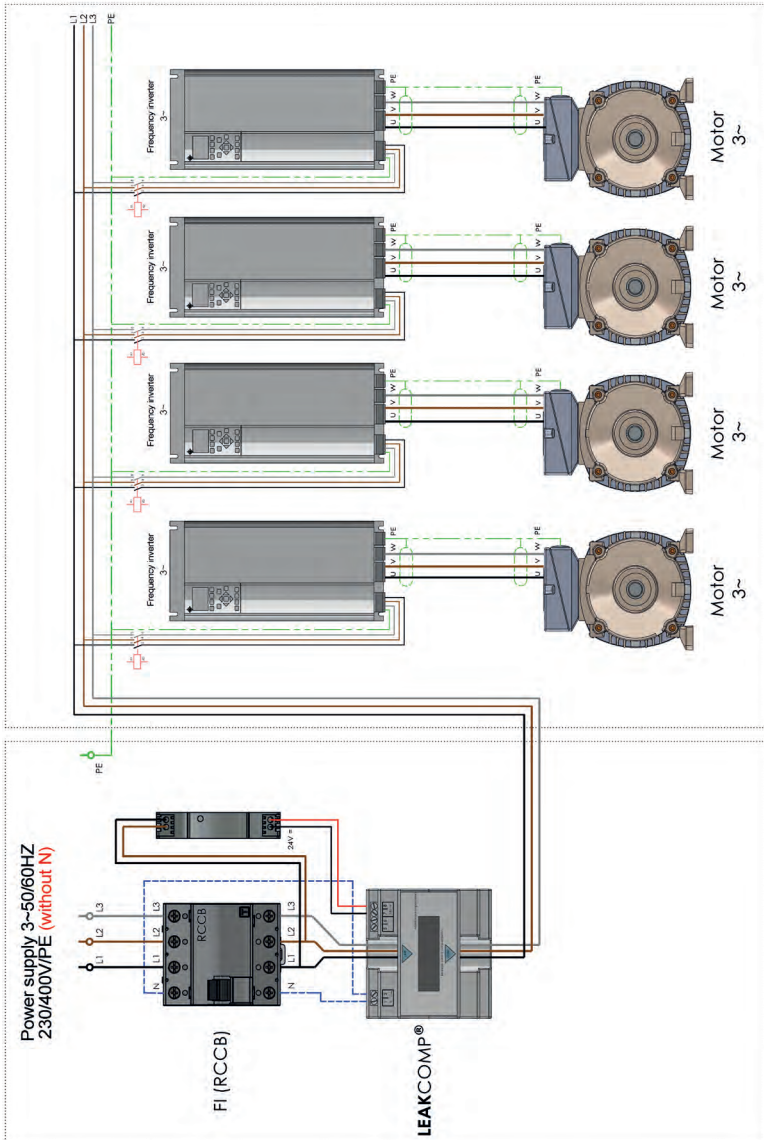
Schematic representation of the wiring of the **LEAKCOMP® HP** with an EPA RCCB AC/DC-sensitive residual current circuit breaker.



7.4 Connection diagram example 1 (with neutral conductor)



7.5 Connection diagram example 2 (without neutral conductor)



8 Start-up / Operation

8.1 Display / LED on power on

When the supply voltage is switched on, the unit performs a self-test.
Once the power supply has been established, the RUN LED turns green.

NOTE

The **LEAKCOMP® HP eco** and **LEAKCOMP® HP eco ext** models do not have a multi-function display. For these models, visualisation is by means of the status LED.
The illustrations below are examples and may not show the actual values or may differ from version to version. At the 60 Hz version the frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz are shown on the display.

LEAKCOMP® HP:

When the device is switched on, a start screen is displayed for about 2 seconds, which also displays the hardware and software version (SW 2.35 and higher).

LEAKCOMP® HP eco / eco ext:

When the device is switched on, the status LED turns blue for about 2 seconds.

The unit now performs a self-test and checks for any connection errors (see section titled "Error messages").

LEAKCOMP® HP



LEAKCOMP® HP eco / eco ext

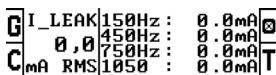


IMPORTANT NOTE

During the self-test, no consumers (frequency inverters) should be switched on. No compensation for leakage currents takes place at this point.

When the self-test is complete, the display switches to standard display mode:

LEAKCOMP® HP



LEAKCOMP® HP eco / eco ext



The **LEAKCOMP® HP** is now ready for operation and the connected frequency inverters can be connected one by one.

Pressing the key with the lamp symbol (see section titled "Function keys") brings up the start screen again.

8.2 Display / LED colours

8.2.1 Background colour / status LED white

LEAKCOMP® HP

G	I_LEAK	150Hz :	2.0mA	Ⓢ
	7,0	450Hz :	3.0mA	
C	mA RMS	750Hz :	1.0mA	T
		1050 :	1.0mA	

LEAKCOMP® HP eco / eco ext



The leakage currents to be compensated are small enough that operation of the frequency inverters would be possible even without compensation by the **LEAKCOMP® HP**, i.e. well below the 30 mA tripping threshold for the residual current circuit breaker. This might be the case when only one or two frequency inverters are in use.

8.2.2 Background colour / status LED blue

LEAKCOMP® HP

G	I_LEAK	150Hz :	122.0mA	Ⓢ
	253,0	450Hz :	97.0mA	
C	mA RMS	750Hz :	23.0mA	T
		1050 :	11.0mA	

LEAKCOMP® HP eco / eco ext



Each time one or more frequency inverters is switched on, the background colour of the display changes briefly to dark blue:

This signals a “buster” event, which means that for a period of a few milliseconds, the unit switches to a special mode of operation which also compensates for irregular leakage currents that occur as a result of pulse-like charging currents generated when a frequency inverter is switched on, preventing the residual current circuit breaker from being switched off unnecessarily. This function can be activated only once within each 300 ms period, so as not to interfere with the protective function of the breaker. The display colour switches back to default mode.

8.2.3 Background colour / status LED green

LEAKCOMP® HP

G	I_LEAK	150Hz :	122.0mA	Ⓢ
	253,0	450Hz :	97.0mA	
C	mA RMS	750Hz :	23.0mA	T
		1050 :	11.0mA	

LEAKCOMP® HP eco / eco ext



The leakage currents to be compensated are within the normal operating range of the **LEAKCOMP® HP**, i.e. between approx. 30 mA to 300 mA at 150 Hz to 1050 Hz* without an excessive component of PWM-frequency leakage currents at 4 kHz to 16 kHz. The four nominal frequencies** (150 Hz, 450 Hz, 750 Hz and 1050 Hz) are fully compensated and a “buster” operation is carried out when additional consumers are switched on.

* 60 Hz version: 180 Hz to 1260 Hz

** 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

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8.2.4 Background colour / status LED yellow

LEAKCOMP® HP

G	I_LEAK	150Hz	: 172.0mA	C
		450Hz	: 127.0mA	
		750Hz	: 43.0mA	
		1050	: 11.0mA	
C	mA RMS			T

LEAKCOMP® HP eco / eco ext



The leakage currents to be compensated in the range of 150 Hz to 1050 Hz are less than 400 mA rms and are fully compensated, but there is a high leakage current load on the residual current circuit breaker due to high currents in the PWM frequency range above 4 kHz. Their effective value is already twice as high as that of the fundamental leakage current frequency of 150 Hz.

This operating state occurs mainly where long cable lengths between the inverter and motor are used, and is intensified as the PWM frequency increases, in particular at 12 or 16 kHz. In this case, a short-term leakage current peak could lead the **LEAKCOMP® HP** to mistakenly detect a consumer switch-on pulse and trigger an unnecessary buster operation. The buster function is therefore deactivated in this operating state.

In this case, we recommend the use of special RFI filters with a leakage current-reducing effect at frequencies in the PWM range of the inverter (4 kHz to 16 kHz), for example EPA *NF-DAR* or EPA *NF-KC-DAR*.

8.2.5 Background colour / status LED purple

LEAKCOMP® HP

G	I_LEAK	150Hz	: 23.0mA	C
		450Hz	: 12.0mA	
		750Hz	: 8.0mA	
		1050	: 3.0mA	
C	mA RMS			T

LEAKCOMP® HP eco / eco ext



The unit is in test mode. Compensation is switched off during this mode (see section titled “*Display modes / function keys – Function key 4*”).

You can therefore expect all devices / frequency inverters operated on the residual current circuit breaker to be switched off.

NOTE

Test mode applies only to the **LEAKCOMP® HP** (with multi-function display) and is not relevant for the models **LEAKCOMP® HP eco / eco ext**

The display / status LED may also turn purple if untypical leakage currents are detected (see section titled “*Troubleshooting*”).

8.2.6 Background colour / status LED red

LEAKCOMP® HP

G	I	LEAK	150Hz	: 222.0 mA	Q
C	453,0		450Hz	: 107.0 mA	
			750Hz	: 83.0 mA	
	mA RMS		1050	: 41.0 mA	T

LEAKCOMP® HP eco / eco ext

The effective value of the four leakage current frequencies to be compensated in the range 150 Hz to 1050 Hz¹⁾ is over 400 mA, equivalent to over 80% of maximum unit performance. The **LEAKCOMP® HP** is therefore approaching its performance limit and switching on additional consumers is no longer recommended. If they are, full compensation nevertheless takes place up to 500 mA. With any further increase, the output stage of the device reaches its full conductance. This leads first to the discontinuation of compensation²⁾ of the 450 Hz, 750 Hz and 1050 Hz components, after which the 150 Hz³⁾ component is also no longer fully compensated. As a result, the residual current circuit breaker may be tripped.

The **LEAKCOMP® HP** is not switched off until the thermal overload that occurs after long-term overload; even then, however, there is no damage to the unit.

▲ IMPORTANT NOTE

The background colour may also change to red in the event of an incorrect connection.

For more information, see the section titled "*Troubleshooting*".

Always avoid continuous operation in this state.

¹⁾ 60 Hz version: 180 Hz to 1260 Hz

²⁾ 60 Hz version with frequencies of von 540 Hz, 900 Hz und 1260 Hz

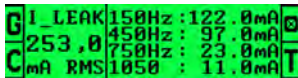
³⁾ 60 Hz version: 180 Hz

8.3 Display modes / function keys

NOTE

This section applies only to the **LEAKCOMP® HP** (with multi-function display) and is not relevant for the models **LEAKCOMP® HP eco / eco ext**

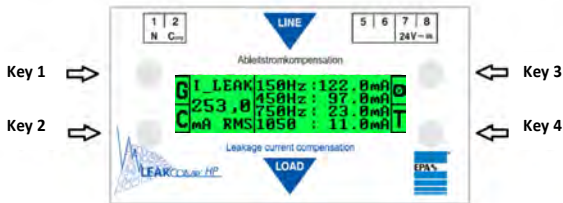
8.3.1 Display of the leakage current



Five values are displayed.

The four operating frequencies* for the leakage currents that actually occur in the load circuit, of 150 Hz, 450 Hz, 750 Hz and 1050 Hz, are displayed numerically.

There is also a larger display of the effective value of the total leakage current in the frequency range up to approx. 10 kHz. The display range is 0 to 999 mA, accurate to 1 mA (the decimal place is 0).



The letters G, C and T and the lamp symbol refer in each case to the function of the adjacent membrane key on the front panel of the unit.

The two left keys (1 + 2) can be used to choose between four leakage current display formats.

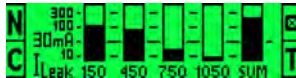
When the **LEAKCOMP® HP** is switched on, the “Numeric leakage current” format is always displayed.

* 60 Hz version with frequencies of 180 Hz, 540 Hz, 900 Hz, and 1260 Hz

8.3.2 Function key 1 (G / N): Switch between numeric or graph display format for leakage current



Use the “G” (for “graphic”) key to switch to a bar graph display.



The five display values for the leakage current described above (“I_Leak”) are now displayed in the form of five logarithmically calibrated bars, which can be easier to read from a greater distance. Key 1 is now marked with the letter “N” (for “numeric”). Pressing key 1 returns to the numeric display.

8.3.3 Function key 2 (C / L): Switch between compensated and uncompensated display format for leakage current

Pressing these keys does not affect the function of the **LEAKCOMP[®] HP** in any way.

Numeric display of compensated leakage current

Pressing key 2 (“C” for “compensated current”) switches the display to the effective remaining leakage current components, taking into account the compensation effect of the **LEAKCOMP[®] HP** (display switches from “I_LEAK” to “I_COMP”).



The values are displayed in the same way as for the absolute leakage currents, but accurate to 0.1 mA only in the range 0 to 99.9 mA.

Key 2 is now labelled “L” for “leakage current” and resets the display to standard mode (numeric absolute leakage current).

Key 2 therefore allows you to switch the leakage current display between *real* and *compensated*.

You can also use the “G” key (for “graphic”) to switch to a bar graph display for the compensation result, as described in the following section.

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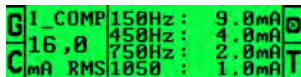
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Graph display of compensated leakage current



The five values described above for the compensated leakage current ("I_COMP") are now also displayed in the form of five logarithmically calibrated bars.

Pressing key 1 ("N") returns to the numeric display.



8.3.4 Function key 3 (☉): Brighten the display / show the start screen

If none of the keys are pressed after switching on the **LEAKCOMP[®] HP**, the display is automatically dimmed in stages over a period of approximately 1 minute to a brightness of 10% in order to extend the life of the backlight and reduce the thermal energy output in the housing.

In very bright conditions, this can make it difficult to read. Pressing key 3 (lamp symbol ☉) resets this cycle and restores the full display brightness for 1 minute. This is also done when keys 1 or 2 are pressed to change the display format.

Pressing and holding key 3 brings up the start screen.



8.3.5 Function key 4 (T): Test mode / switch off compensation

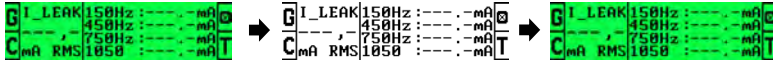
Key 4 interrupts compensation for testing purposes.

It may sometimes be necessary to test the function of the residual current circuit breaker or the compensation effect of the **LEAKCOMP[®] HP** (for example for initial / repeat tests or to test breaker tripping). For this purpose, the compensation function of the **LEAKCOMP[®] HP** can be switched off with this key.

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To activate test mode, press and hold the T key down for a period of more than 3 seconds. As soon as you press the key, the display starts flashing bright and dark once a second.

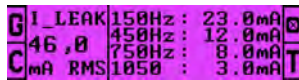


If you release the T key within approx. 3 seconds, no further action is taken.

If the key is held down continuously, the compensation function is activated and only switched off again when the T key is pressed again (before software version SW 2.37, compensation is switched off only for a period of approx. 6 seconds).

In case the existing leakage currents (this will normally be the case) should load the residual current circuit breaker beyond its characteristic curve limits, it will trip if working properly.

If the **LEAKCOMP[®] HP** power supply is independent of the breaker, the background colour of the display will turn purple for as long as the function is interrupted:



If the display is set to “Compensated leakage current (I_{Comp})” mode, the values displayed will rise drastically if the residual current circuit breaker is not tripped, precisely because compensation is no longer taking place.

Pressing the T key again resets the **LEAKCOMP[®] HP** back to normal operation (automatically after 6 seconds before SW 2.37).

⚠ WARNING

You can expect all devices / frequency inverters operated on the residual current circuit breaker to be switched off when compensation is switched off.

If the **LEAKCOMP[®] HP** is operated with a power supply behind the residual current circuit breaker (recommended), it will of course also adjust its function.

9 Troubleshooting

9.1 Error messages

NOTE

Section 9.1.3 and 9.1.4 apply only to **LEAKCOMP® HP** (with multi-function display) and are not relevant for the models **LEAKCOMP® HP eco / eco ext**.

9.1.1 Leakage current present when switched on

The **LEAKCOMP® HP** must be wired to ensure that it receives its supply voltage before the installed frequency inverters are switched on.

If this is not the case and leakage current can be measured as soon as the unit is switched on, the unit cannot perform its function correctly and the self-test and comparison carried out after switch-on also cannot be completed correctly.

The **LEAKCOMP® HP** detects the leakage current signal during the self-test and displays the following error message indicating that there is a wiring error.

LEAKCOMP® HP



LEAKCOMP® HP eco / eco ext



The internal sequence control system is then stopped and the display remains unchanged until the supply voltage is switched off.

The unit will not work correctly until the switch-on sequence is corrected, with the **LEAKCOMP® HP** in first place.

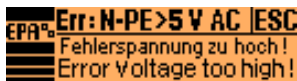
This does not normally cause a defect in the device; this state is also not stored and therefore does not need to be deleted with a RESET.

9.1.2 AC voltage present between N and PE when switched on

Similar to the process described above, the **LEAKCOMP® HP** checks during the self-test whether an AC voltage of more than 5 V AC can be measured between the N and PE conductors in the circuit configuration. If this is the case, proper leakage current compensation is not possible.

Because a defect in the **LEAKCOMP® HP** can occur in the event of increased voltage between the neutral and protective earth conductors, an error message to that effect is displayed after the test:

LEAKCOMP® HP



LEAKCOMP® HP eco / eco ext



In this case, there is an installation problem in the entire system wiring that must be resolved before operating the **LEAKCOMP® HP**.

This does not normally cause a defect in the device; this state is also not stored and therefore does not need to be deleted with a RESET.

You can use the “ESC” key to continue operation at your own risk (does not apply to eco models).

Please first measure the voltage between the neutral and protective earth conductors.

⚠ WARNING

In the event of lasting higher voltage (>10 V) between the neutral and protective earth conductors or terminals *N* and *COMP*, a defect in the **LEAKCOMP® HP** can occur.

9.1.3 Permanent switch-off or reactivation of the buster function

The **LEAKCOMP[®] HP** is shipped with the buster function activated, i.e. compensation of leakage currents at the moment a frequency inverter is switched on. However, it may be necessary to block this function for some applications. An example of this might be a drive system that generates very high leakage current values in the frequency range above 4 kHz (usually due to long motor cables) and whose current peaks can no longer be distinguished from switch-on current pulses when measured.

In such cases, the buster function can be shut down permanently as follows: Press keys 1 and 2 (which are otherwise used to change the display format) simultaneously when switching on the **LEAKCOMP[®] HP** and keep them held down while the start screen is displayed. The following appears on the display after about 2 seconds:



When you release the two keys, the display colour changes and shows the “*BUSTER ON*” status:



The keys now have the following function:

Key 4: Permanently deactivate buster function; display background red, status “*BUSTER OFF*”



Key 3: Activate buster function; display background green, status “*BUSTER ON*”



The keys can be pressed as often as required until key 2 (*EXIT*) is used to close the menu.

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Key 2: Exit menu; display first shows start screen and after 2 seconds

Operating mode display:



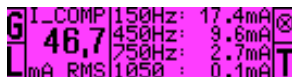
▲ IMPORTANT NOTE

The selected mode is now permanently stored in the **LEAKCOMP[®] HP** internal EEPROM and is retained when the unit is switched back on.

This setting can, if needed, be changed every time the unit is switched on.

9.1.4 Detection of untypical leakage currents

The **LEAKCOMP[®] HP** has a range of monitoring functions. If leakage currents that are not typical for inverters are detected (e.g. fault currents with a 150 Hz component)*, the display background turns purple for a few milliseconds or, if occurring frequently, the display may flash or be permanently lit in purple:



In this case, we recommend conducting a leakage current analysis to determine the cause (for example with EPA **LEAKWATCH**).

Please also check the software version (see start screen). An update to the device software may help to resolve the problem.

▲ IMPORTANT NOTE

When the display colour is purple, compensation may be deactivated. This can cause the breaker to be tripped.

* 60 Hz version: fault currents with a 180 Hz component

9.2 Identify and eliminate faults

Fault/error message	Possible cause(s)	Remedy
Green LED / display off	No supply voltage	Connect power supply
Residual current circuit breaker tripping although the LEAKCOMP[®] HP is in use	N wiring error – Neutral conductor tapped before residual current circuit breaker	Check wiring and tap N before residual current circuit breaker
	Cable duct wiring error – Direction of flow incorrect	Check and change the direction of flow of the cables in the duct
	Cable duct wiring error – PE also run through duct	Run the PE conductor and the shields past the duct
	Fault current due to insulation fault	Correct insulation fault
	Incorrect residual current circuit breaker type	Use type B residual current circuit breaker (e.g. EPA RCCB2)
	High current peaks when switching consumers on or off	Switch drives on and off one after the other
	Impedance at connection between COMP and protective earth conductor too high	Reduce cable length between COMP terminal and protective earth conductor
	High leakage current at 50 Hz (or 60 Hz)	Use low leakage current or 4-wire RFI filter (e.g. EPA NF-KC-LL, NF-4)
	Network asymmetries due to power regeneration by inverters	Use an additional line reactor (e.g. EPA3N)
Display blue	High leakage currents in the range of the inverter switching frequency	Use additional RFI filters to reduce high-frequency leakage currents (e.g. EPA NF-KC-DAR)
	"Buster" active	Brief leakage current peaks (e.g. inverters switched on)

Fault/error message	Possible cause(s)	Remedy
Display purple	Untypical leakage current detected	Conduct leakage current analysis (e.g. with EPA LEAKWATCH)
	Test mode active	Press function key 4 (T) to stop test mode
Display red	Increased voltage between N and COMP terminals due to potential difference between neutral and protective earth conductor	Check installation; check distance to N-PE bridge (TN-C system before RCCB)
	Leakage current already present during initialisation of LEAKCOMP® HP	Switch on consumers only after initialisation of LEAKCOMP® HP
	Leakage current over 300 mA	Reduce leakage current
Display too dark	Dimmer function active	Press one of the four keys
Display blank	Display in sleep mode	Press one of the four keys

9.3 Service address

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10 Maintenance

10.1 Inspection and maintenance

When used as intended, the **LEAKCOMP® HP** is maintenance-free.

▲ IMPORTANT NOTE

Inspection or maintenance of the **LEAKCOMP® HP** may 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.

Always follow the accident prevention regulations.

10.2 System testing / repeat testing

For system testing / repeat testing, the **LEAKCOMP® HP** can be switched to test mode. You can activate test mode by pressing the test key "T" on the **LEAKCOMP® HP** (see section titled "*Function keys*")

▲ 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.

Testing of the tripping of the residual current circuit breaker using the test key "T" on the **LEAKCOMP® HP** is not a replacement for the required function test with the test key on the residual current circuit breaker or for other tests. These tests must be carried out separately.

▲ IMPORTANT NOTE

Compensation is switched off when test mode is activated, which in some circumstances can lead to tripping of the residual current circuit breaker.

11 Repairs

▲ IMPORTANT NOTE

The **LEAKCOMP® HP** 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® HP** 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.



Alle Angaben ohne Gewähr auf Richtigkeit und Genauigkeit.

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