R&S®RT-ZC31
Current Probe
User Manual

1801494902
Version 02

ROHDE&SCHWARZ
Make ideas real

This manual describes the following R&S products:

- R&S®RT-ZC31, Current Probe (1801.4932.02)
- R&S®RT-ZA13, Probe Power Supply (1409.7789.02)

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1801.4949.02 | Version 02 | R&S®RT-ZC31

The following abbreviations are used in this manual: R&S®RT-ZC31 is abbreviated as R&S RT-ZC31.

Contents

1 Notes on Safety

Thank you for purchasing the R&S RT-ZC31 current probe.

To obtain maximum performance from the device, please read this manual first, and keep it handy for future reference.

WARNING

Risk of physical injury

This device is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety before shipment. However, mishandling during use could result in injury or death, and damage to the device. Be certain that you understand the instructions and precautions in the manual before use.

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

DANGER

Risk of fatal injury

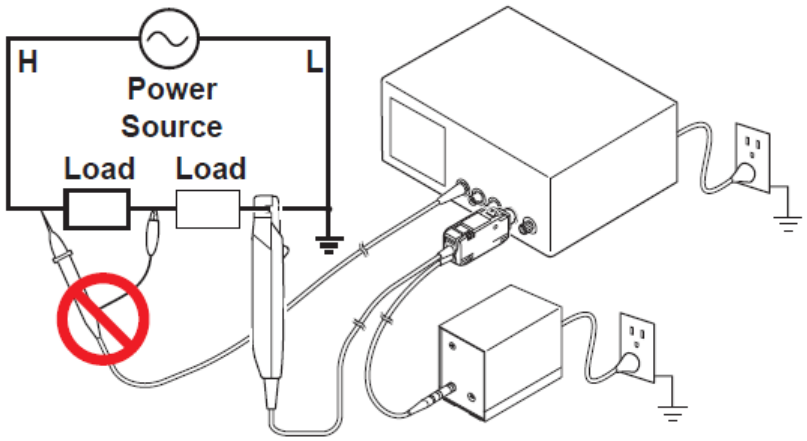
- To avoid electric shock, do not remove the device's cover. The internal components of the device carry high voltages and may become very hot during operation.
- To avoid electric shock and short circuits, never attach the clamp to bare, unisolated conductors.
  Make sure to measure at a location on an insulated wire where the insulation is sufficient for the circuit voltage.

- Be careful to avoid damaging the insulation surface while taking measurements.
- Refer to the derating characteristics when measuring current that includes a high-frequency component and never measure any current that exceeds the rated current. Use with high frequencies or strong magnetic fields may cause the device to become abnormally hot, resulting in fire, equipment damage, or burns.
- To prevent fire or damage of the measurement target and device as well as burns, exercise caution concerning the following when measuring high-frequency currents or currents that contain high-frequency components:
  - Eddy current loss may cause heating of the sensor head.
  - Dielectric heating may cause heating of cord insulation and other materials.
- Connect the probe only to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Never connect it to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- Be sure to observe all operating precautions for the oscilloscope and other instruments to which this device is connected.

DANGER

Risk of fatal injury

- This device is made for use with the R&S RT-ZA13 probe power supply.
- When using a measurement instrument that does not provide isolation between its input terminals and chassis or other input terminals, please pay attention to the following points. If a signal is applied to an input terminal other than that to which this device is connected, do not connect the ground-side terminal to any nonground potential. Otherwise, short-circuit current flows through the R&S RT-ZA13 probe power supply, or this device from the ground terminal, which could cause an electrical accident or damage.



WARNING

Shock hazard

To avoid shock and short circuits, turn off all power before connecting the device.

Do not allow the device to get wet, and do not take measurements with wet hands. This may cause an electric shock.

To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots, and a safety helmet.

NOTICE

Risk of instrument damage

- To avoid damage to the device, protect it from vibration or shock during transport and handling, and be especially careful to avoid dropping.
- To avoid damage to the device, do not place the device on an unstable table or an inclined place. Dropping or knocking down the device can cause injury or damage to the device.
- Do not store or use the device where it could be exposed to direct sunlight, high temperature, humidity, or condensation. Under such conditions, the device may be damaged and insulation may deteriorate so that it no longer meets its specifications.
- Do not store or use the device near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)
- Do not store or use the device near HF power supply units.
- Before using the device the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your dealer or R&S representative.
- This device is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- The sensor head is a precision assembly including a molded component, a ferrite core, and a Hall effect element. It may be damaged if subjected to sudden changes in ambient temperature, or mechanical strain or shock, and therefore great care should be exercised in handling it.
- Do not apply a static electricity or other source of high voltage to the sensor. Doing so may damage the internal Hall elements and circuitry of the sensor.
- The mating surfaces of the sensor head are precision, and should be treated with care. If these surfaces are scratched, performance may be impaired.
- Do not place foreign objects between the mating faces of the sensor head, insert foreign objects into the gaps of the sensor head, or touch the mating faces. Doing so may worsen the performances of the sensor or interfere with clamping action.
- While the POWER LED is on, keep the core section of the sensor closed, except when clamping it onto the conductor to be measured. The mating surface of the core section can be scratched while it is open.

- Keep the sensor head closed when not in use, to avoid accumulating dust or dirt on the mating core surfaces, which could interfere with clamp performance.
- Avoid stepping on or pinching the cable, which could damage the cable insulation.
- Keep the cable well away from heat sources, as bare conductors could be exposed if the insulation melts.
- Do not obstruct the ventilation holes on the sides and bottom of the terminator, as it could overheat and be damaged, or cause a fire.

Strong electromagnetic fields

Correct measurement may be impossible in the presence of strong magnetic fields, such as near transformers and high-current conductors, or in the presence of strong electromagnetic fields such as near radio transmitters.

2 Product Description

2.1 Product Overview

The R&S RT-ZC31 is a clamp-on current probe that features high current-detection sensitivity and broad frequency band. The probe uses three current ranges to detect current waveforms from a few hundred µA to 50 A.

By clamping on the conductor to be measured, the current waveform is captured easily without interrupting the electric circuit.

2.2 Key Features

- The sensor head has a clamp design that makes it possible to easily observe current waveforms while current continues to flow through the conductor being measured.
- Three current measurement ranges: 0.1 V/A, 1 V/A, and 10 V/A.
- You can observe low-current waveforms at the high sensitivity of 10 V/A.
- LED warnings indicate overload and unlocked sensor head.
- Broadband frequency characteristics DC to 120 MHz.
- Demagnetization and automatic zero adjustment functions make it easy to get ready for measurement.

2.3 Inspecting the Contents

- Inspect the package for damage.
  Keep the package and the cushioning material until the contents have been checked for completeness and the device has been tested.
  If the packaging material shows any signs of stress, notify the carrier and your Rohde & Schwarz service center. Keep the package and cushioning material for inspection.
- Inspect the probe.

If there is any damage or defect, or if the R&S RT-ZC31 current probe does not operate properly, notify your Rohde & Schwarz service center.

- Inspect the accessories.
  If the contents are incomplete or damaged, notify your Rohde & Schwarz service center.

The following accessories are delivered with the probe:

- User manual
- Carrying case
- R&S RT-Zxx data sheet
- Calibration certificate
- Documentation of calibrated values

2.4 Description of the Probe

2.4.1 Probe Overview

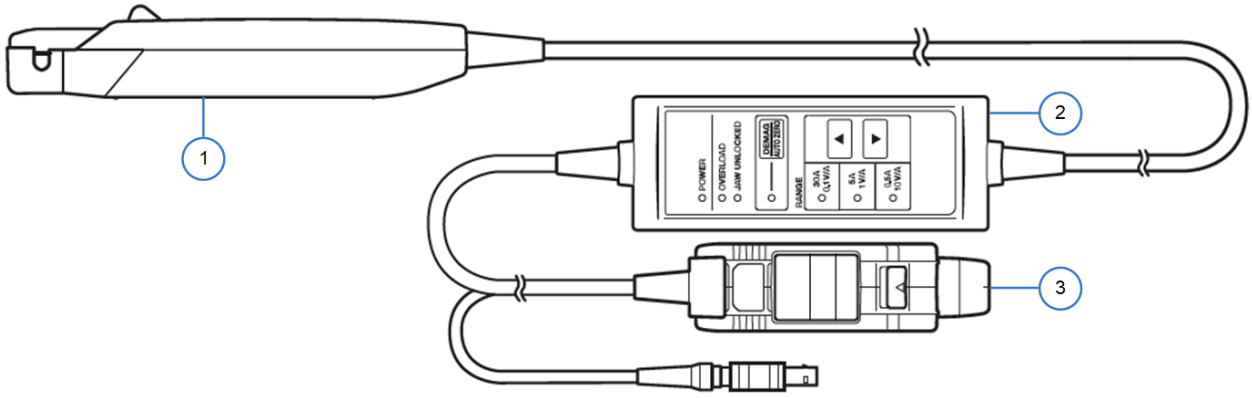


Figure 2-1: Probe overview

1 = Sensor
2 = Junction box
3 = Termination unit

2.4.2 Termination Unit

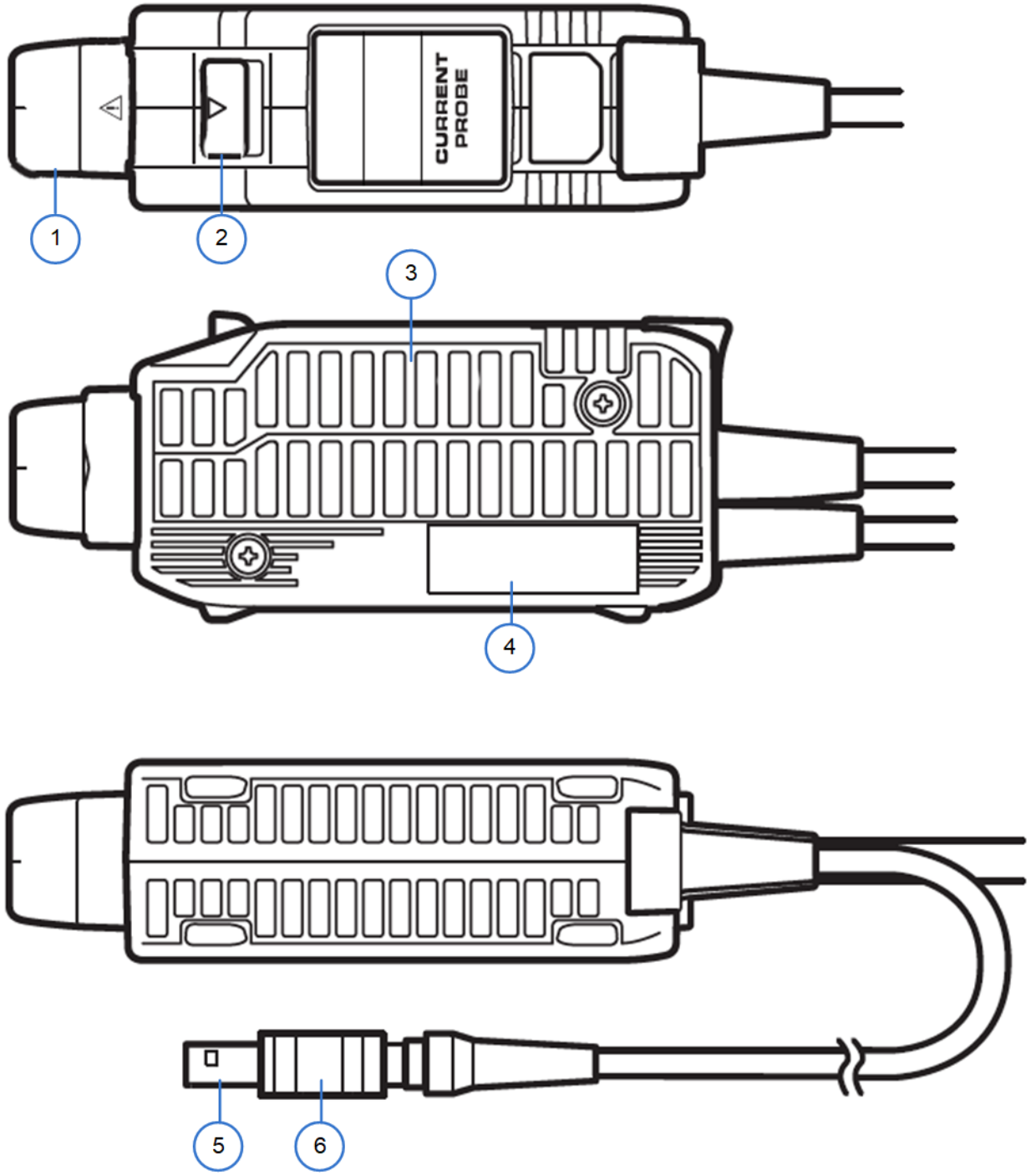


Figure 2-2: Termination unit overview

1 = Output terminal
2 = Unlock lever
3 = Ventilation holes

4 = Serial number
5 = Power plug
6 = Shell

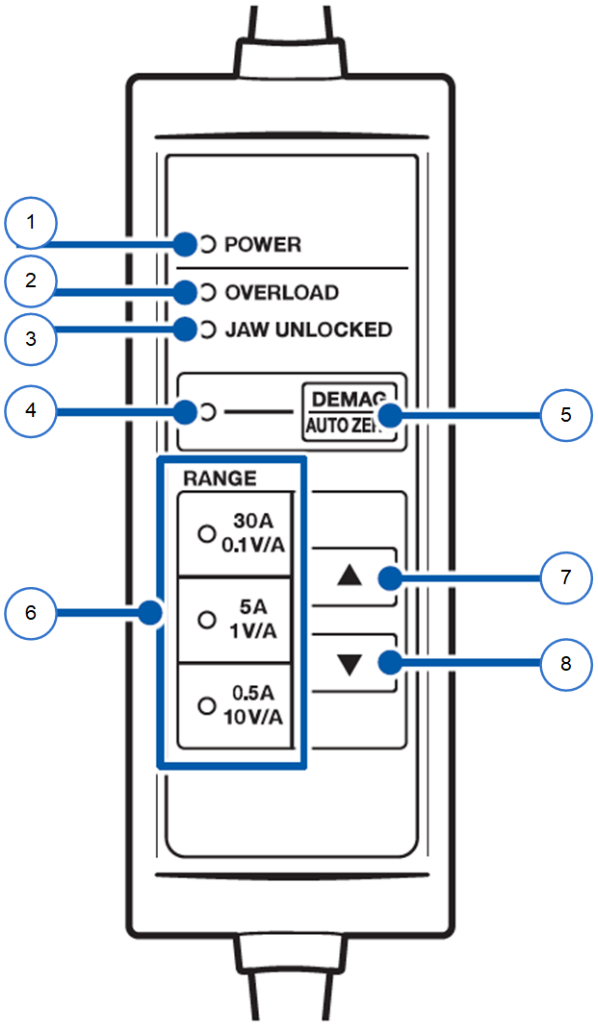
Unlock lever
The lock mechanism keeps the clamp closed.

Vents
The vents are on the sides and bottom. Do not clog them.

Power plug
Connect the plug to the R&S RT-ZA13 probe power supply receptacle to supply power to the sensor.

Shell
Pull on the power plug while simultaneously pulling this shell to disconnect the plug.

2.4.3 Junction Box (Keys, LEDs)



1 = POWER LED
2 = OVERLOAD LED
3 = JAW UNLOCKED LED
4 = DEMAG/AUTO ZERO LED
5 = DEMAG/AUTO ZERO key
6 = RANGE LEDs
7 = ▲(Higher range) key
8 = ▼(Lower range) key

POWER LED
The POWER LED turns green (lighting up continuously) when the device is energized. It flashes rapidly if a checksum error has occurred.

OVERLOAD LED (red light)

Shows the overload status of the system. The following states are defined:

Color	State
Flashes three times	Indicates that demagnetizing or automatic zero adjustment cannot be performed.
Fast flashing red	Indicates that an overload state is detected, the device has entered protection mode or a checksum error has occurred.

JAW UNLOCKED LED (red light)

The JAW UNLOCKED LED turns red (lighting up continuously) if the sensor head is not locked.

Color	State
Lights red	The upper jaw is unlocked.
Flashes three times	Indicates that demagnetizing or automatic zero adjustment cannot be performed.
Fast flashing red	Indicates that the device has entered protection mode or a checksum error has occurred.

DEMAG / AUTO ZERO LED (orange light)

Color	State
Flashes slowly	Demagnetization or automatic zero adjustment has not yet been performed
Lights orange	Demagnetization and automatic zeroadjustment are in execution
No light	Demagnetization and automatic zero adjustment has been completed
Lights red	The upper jaw is unlocked.
Flashes three times	Indicates that demagnetizing or automatic zero adjustment cannot be performed.
Fast flashing	Indicates that the device has entered protection mode or a checksum error has occurred.

DEMAG/AUTO ZERO key

Performs demagnetization and zero adjustment.

Press this key long (approx. 1 sec.) for demagnetization and zero adjustment.

Press this key short (within 0.5 sec.) for a zero adjustment only.

Demagnetization and zero adjustment cannot be performed in the following circumstances:

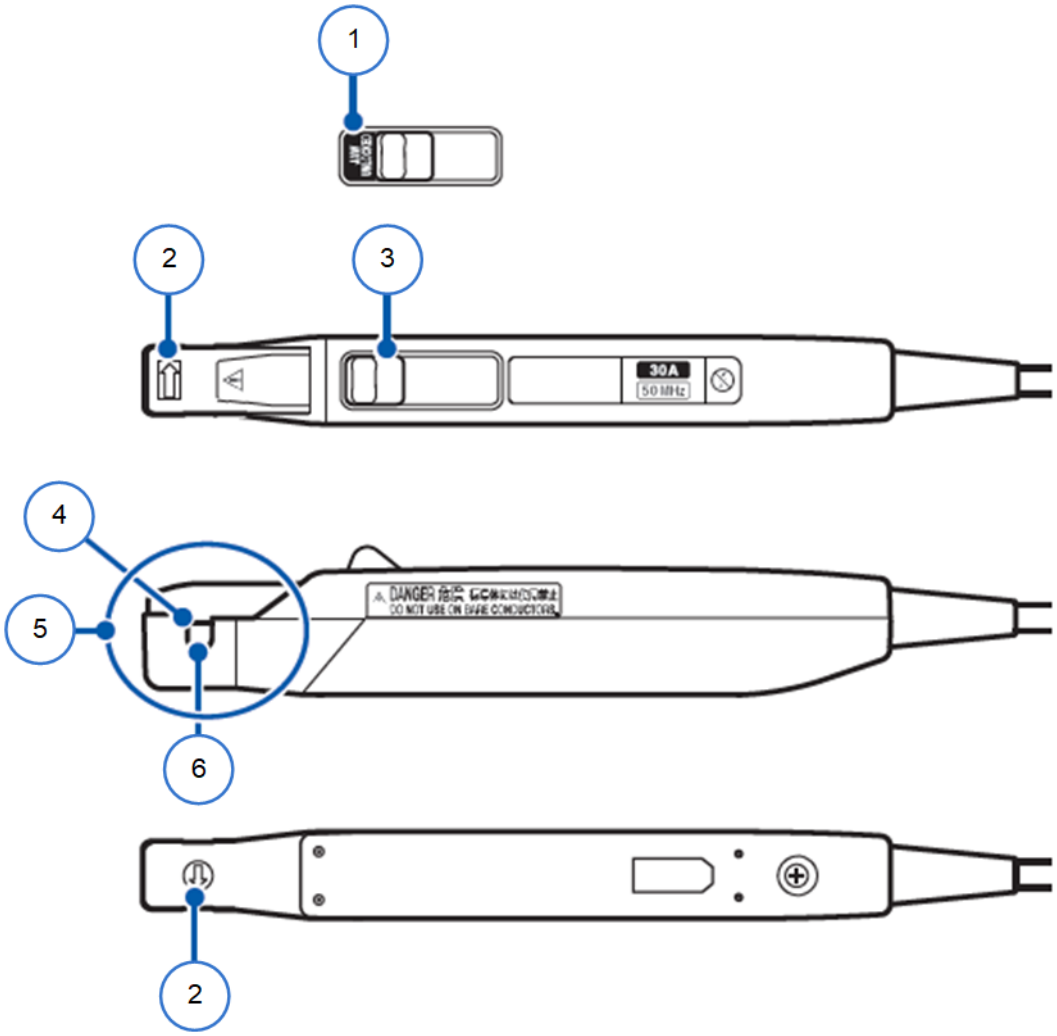
- The sensor head is unlocked (JAW UNLOCKED LED is lit up)
- During an overload condition (the OVERLOAD LED is flashing)
- When a measured current is detected

(Higher range) key / (Lower range) key
Switch over to a next higher / lower current range.

RANGE LEDs (green lights)

Color	State
Lights green	The current range is chosen.
Fast flashing	Indicates that the device has entered protection mode or a checksum error has occurred.

2.4.4 Sensor



1 = JAW UNLOCKED indicator
2 = Current direction indicator
3 = Opening lever
4 = Sensor aperture
5 = Jaws
6 = Sensor head

JAW UNLOCKED indication
If the sensor head is unlocked, you can see this indication on the probe.

Current direction indication
Clamp the device to the conductor so that the direction in which the current being measured is flowing matches the arrow.

Opening lever
Operating lever for opening the sensor head. Always use this lever to open the sensor head.

Sensor aperture
A conductor to be measured has to pass through this aperture.

Sensor head
The sensor head clamps on the conductor being measured, and carries out the actual current measurement.

3 Measuring Procedure

3.1 Preparing the Measurement

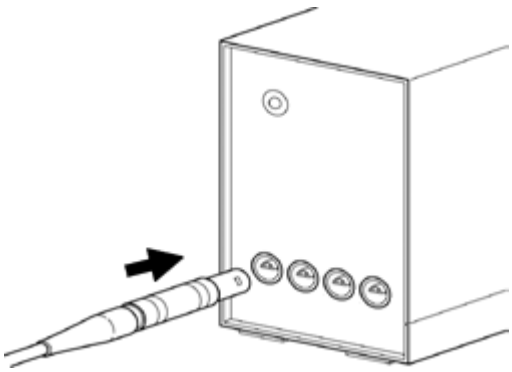
NOTICE

Voltage check

When using a different power supply than the R&S RT-ZA13 probe power supply, before turning on the power, make sure that the voltage of the used power supply matches the supply voltage indicated in the data sheet "R&S RT-Zxx high voltage and current probes".

- The output of this device is terminated internally. Use a high impedance input of the measuring instrument. With an input impedance of 50 Ω, accurate measurement is not possible.
- If using BNC-banana plug adapters or similar to connect to input terminals other than BNC connectors, make sure the polarity is correct.
- Turn the collar until it clicks, and check that it is locked securely.

1. Have the R&S RT-ZA13 probe power supply, and an oscilloscope or waveform measuring instrument ready.
2. Turn off the power switch. Connect the power cord.
3. Connect the power plug of the R&S RT-ZC31 to the power receptacle of the R&S RT-ZA13 probe power supply.



4. Check that the conductor being measured is not clamped when supplying power to the R&S RT-ZC31. When power is turned on, a demagnetizing waveform is initially applied to the output. This is intentional in the design, and not a fault.

5. Turn on the power switch R&S RT-ZA13 probe power supply. Ensure that the front panel power indicator lights.

   The POWER LED lights up in green and the DEMAG/AUTO ZERO LED is slowly flashing in orange.

6. Connect the output connector of the R&S RT-ZC31 to one of the BNC input connectors of the oscilloscope. Turn the collar until it clicks, and check that it is locked securely.

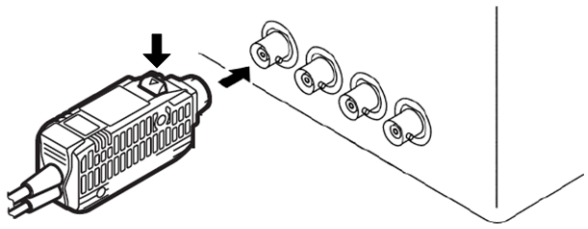


Figure 3-1: Oscilloscope inputs

   The current waveform of the measured conductor is output at a constant rate (1 V/A).

7. Configure the probe connection at the oscilloscope. Make sure to set the following:
   - Vertical unit = Ampere
   - Coupling = DC
   - Termination = 1 MΩ
   - Manual Gain = 1 V/A

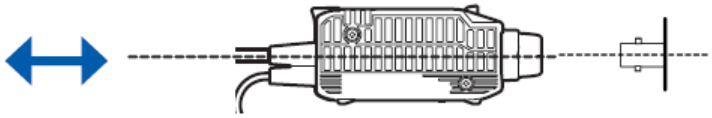
   Alternatively, select "Predefined probe" = R&S RT-ZC31 if this selection is available on the instrument.
   The procedure depends on the used instrument and is described in the oscilloscope's user manual. Supported oscilloscopes are listed in the R&S RT-Zxx data sheet.

8. When disconnecting the output connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable can damage the terminator.

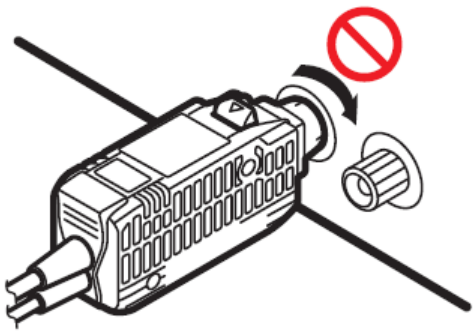
NOTICE

Risk of instrument damage

- Check that the conductor being measured is not clamped when supplying power to the device. A demagnetizing waveform may be generated when power is supplied, causing damage to components connected to the circuit being measured.
- To avoid damaging the terminator, keep it oriented in a straight line relative to the waveform measurement instrument when connecting and disconnecting it.



- To avoid damaging the output connector, pull the unlock lever toward you and then pull the connector out and away from the waveform measurement instrument.
- To avoid damaging the output connector of the terminator, or the BNC input terminal's locking mechanism on the waveform measuring instrument, do not rotate when both terminals are connected. Ensure that connections are not subject to stress.

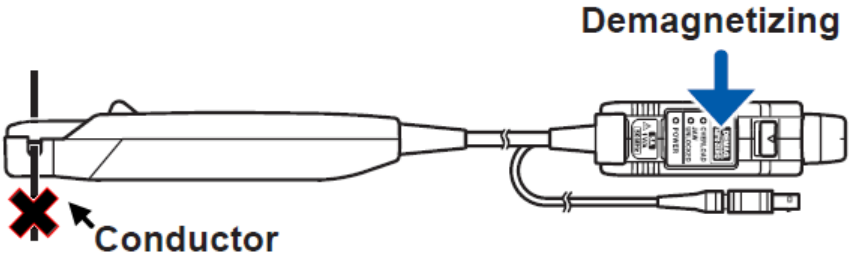


3.2 Demagnetizing and Zero Adjustment

NOTICE

Risk of circuit damage

- Do not demagnetize while the R&S RT-ZC31 is clamping a conductor to be measured. Demagnetizing causes current to flow into the conductor, which may damage parts in the circuit to be measured.



- Check that the conductor being measured is not clamped when supplying power to the R&S RT-ZC31. When power is turned on, a demagnetizing waveform is initially applied to the output. This is intentional in the design, and not a fault.

During demagnetization (DEMAG / AUTO ZERO LED lit), the device outputs a demagnetization waveform (which attenuates over time) from its output terminal. This waveform, which appears on a waveform measuring instrument, may be asymmetric along the horizontal axis. However, this does not represent a device malfunction.

Do not move the sensor during demagnetization or automatic zero-adjustment. Disturbance (such as external magnetic fields and temperature changes) may prevent demagnetization or automatic zeroadjustment from being completed normally.

1. With the waveform measuring instrument input at ground, adjust the waveform to the zero position.
2. Connect the R&S RT-ZC31 current probe. Configure the oscilloscope as described in Chapter 3.1, "Preparing the Measurement", on page 18.

3. Wait for at least 30 minutes after starting the power supply to the device before executing demagnetization and automatic zero-adjustment. Otherwise the offset voltage may increase due to the heat generation of the device.
4. Make sure that there is no conductor in the sensor aperture.
5. Press the opening lever until the JAW UNLOCK indication disappears. Ensure that the sensor head is properly closed.
6. Press and hold the DEMAG/ AUTO ZERO key for about 1 second. Zero-adjustment is performed after demagnetization.
   The process takes about 20 seconds. During demagnetizing, a demagnetizing waveform is shown on the oscilloscope. The positive and negative components of this waveform may be asymmetrical.
   Note: If the DEMAG/AUTO ZERO LED continues flashing instead of turning off when the DEMAG/AUTO ZERO key is pressed, demagnetization and zero adjustment did not complete normally.

To halt demagnetization or automatic zero-adjustment in the middle of its execution

► Pull the unlock lever toward you to unlock the upper jaw.
After you halt demagnetization or automatic zeroadjustment, re-execute demagnetization and automatic zero-adjustment before taking a measurement.

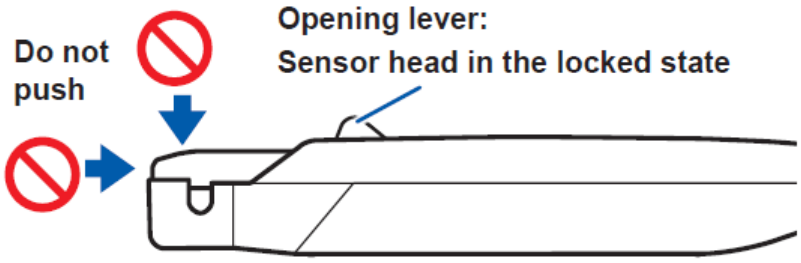
To execute automatic zero-adjustment alone (without executing demagnetization)

► Press the DEMAG / AUTO ZERO key momentarily. Do not hold down the key.

NOTICE

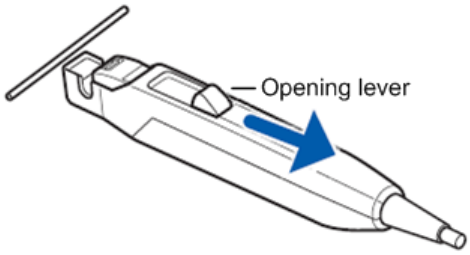
Risk of instrument damage

When opening the sensor head, always operate the opening lever. Subjecting the sensor head to force from the directions shown in the figure while it is locked may damage the clamping mechanism.

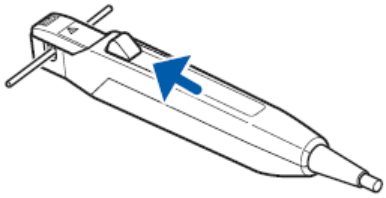


3.3 Connecting the Probe to the DUT

1. Check that the system is safe, and that the preparations described in the preceding sections have been carried out.
2. Pull the sensor opening lever, so that the sensor head opens.



3. Align the sensor so that the current direction indication matches the direction of current flow through the conductor that you measure. The conductor should be in the center of the clamp aperture because the measurement may be affected by the position within the clamp aperture of the conductor being measured.
4. Press the opening lever until the JAW UNLOCKED indication disappears. Check, if the sensors head is properly closed. The JAW UNLOCKED LED turns off.



If the sensor head is not properly closed, accurate measurement is not possible.

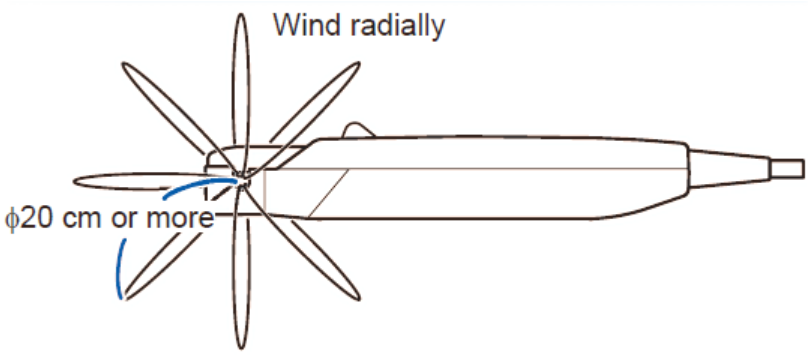
5. Check the LEDs on the junction box:
   a) POWER LED and one of RANGE LEDs light up: no error
   b) OVERLOAD LED blinks rapidly: the probe has detected measurement current in excess of the level defined for the current range. See Table 4-1.
   If you use the 30 A range, immediately remove the sensor from the conductor.
   If you use the 0.5 A range or 5 A range, switch to a higher current range.
   c) Any other LEDs light up or blinks: there is a different error. See Chapter 4.2, "LED Display Errors", on page 37.

6. Press ▼ or ▲ key to choose the current range.
   Choose a current range with a maximum peak current higher than the peak value of a current to be measured.
   If the peak value of the current exceeds the maximum peak current of the chosen current range, the output waveform is saturated, preventing you from correctly observing the current waveform.
   The following table shows the recommended current ranges for each of the levels of currents to be measured.

Electric current level	Recommended current range (output rate)
±5 A to ±50 A	30 A (0.1 V/A)
±0.5 A to ±5 A	5 A (1 V/A)
±1 mA to ±0.5 A	0.5 A (10 V/A)

Measuring low currents

- To measure DC or low-frequency current, multiple windings may be used to increase relative sensitivity (10 windings multiplies the measured current by a factor of 10). However, in this case, the windings should be made radially, with a diameter of at least 20 cm.



- Cord placement and the act of clamping the probe onto the conductor being measured may trigger load fl uctuations, affecting the observed waveform.

NOTICE

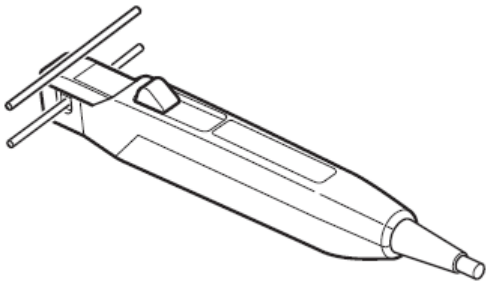
Risk of instrument damage due to continuous input current

- The maximum continuous input range is based on heat that is internally generated during measurement. Always keep the input current below this level. Exceeding the rated level may result in damage to the probe.
- The maximum continuous input range varies according to the frequency of the current being measured. Refer to the data sheet "R&S RT-Zxx high voltage and current probes".
- The device may sustain damage from self-heating even at current levels that are lower than the maximum rated current. The maximum rated current is a recommended value that assumes sine-wave input under standard conditions. Self-heating may happen if the ambient temperature increases or the measurement current waveform contains other frequency components.
- If the input current exceeds a certain level, generated heat activates a built-in safety function that blocks normal output. If this happens, remove the input immediately (remove the sensor from the conductor being measured, or reduce the input current to zero). Wait until the sensor has had sufficient time to cool before resuming operation.
- Even if the input current does not exceed the rated continuous maximum current, continuous input for an extended period of time may result in activation of the safety circuit to prevent damage resulting from heating of the sensor.

NOTICE

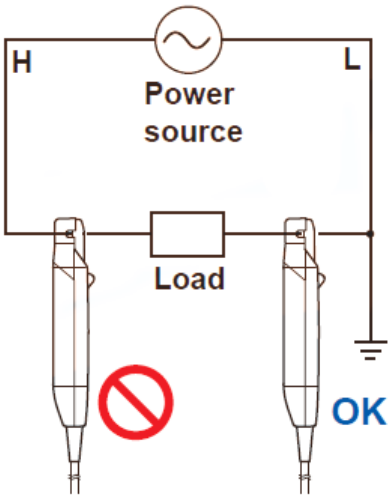
Risk of instrument damage due to continuous input current

- At high ambient temperatures, the built-in safety circuit may activate at current input levels below the rated continuous maximum current.
- Continuous input of current exceeding the rated maximum or repeated activation of the safety function may result in damage to the device.
- Current measurement exceeding approx. 1 kHz may result in temperature rise on the sensor-head. This is attributed to excitation loss that cannot be prevented due to natural physical principles. Be careful to avoid injury, electric shock due to short-circuits, or damage to the device that may be caused by the increased temperature.
- Do not place any unclamped conductor with an electric current of a frequency of 10 kHz or more near the sensor head. Current flowing in the conductor nearby may heat up the sensor head and cause its temperature to rise, leading to damage to the sensor. For example, when one side of a go-and-return conductor is clamped and the other side is also placed near the sensor head as shown in the diagram, even if the electric current is lower than the consecutive maximum current, electric currents in both sides will heat up the sensor and raise the temperature, thereby causing damage to the sensor.



- Immediately after powering on, this device may be subject to an appreciable offset drift due to the effect of self-heating. To counteract this, allow the device to warm up for about 30 minutes before carrying out measurements.
- When performing continuous measurements, it is necessary to be aware that the offset voltage drifts, depending on factors such as the ambient temperature.
- Under certain circumstances, oscillation may occur while the power supply is on. This does not indicate a malfunction. Oscillation can be stopped and operation restored to normal by opening and closing the sensor head.
- Depending on the amplitude and frequency of the current being measured, the sensor head may emit a resonant sound. This sound may also occur during demagnetizing operation, but it does not represent a malfunction or device failure.
  If foreign matter is adhered to the facing surfaces on the sensor head so that a slight gap exists between the upper and lower sensors, the sensor head may also emit a resonant sound. Remove any foreign matter using the cleaning method described in this manual.
  An increase in the volume of the resonant sound during use may indicate that the gap between the upper and lower sensors has increased. Since the sensor characteristics may change, it is recommended to calibrate the device.

At high frequencies, common mode noise may affect measurements taken on the high voltage side of circuits. If this occurs, reduce the frequency range of the waveform measuring instrument, or clamp onto the low-voltage side of the circuit, as appropriate.



After you measured a current that exceeds the maximum rated current value of each current range, the sensor heads have been magnetized, causing incorrect current measurements. Reexecute the demagnetization and automatic zeroadjustment.

3.4 Disconnecting the Probe from the DUT

Once measurement has completed:

1. Pull the opening lever toward you. Remove the device from the conductor that you measure.
2. Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.

   The upper jaw is locked in place and the JAW UNLOCKED LED goes out.
3. Disconnect the terminator from the waveform measurement instrument.
4. Turn the R&S RT-ZA13 probe power supply POWER switch off.

5. Remove the power plug of the device from the R&S RT-ZA13 probe power supply.
6. Unplug the R&S RT-ZA13 probe power supply power cord from the electrical outlet.

NOTICE

Risk of instrument damage

- To prevent wire breaks, do not pull on the cord to disconnect the output connector from the waveform measurement instrument. Always grip the terminator and pull the unlock lever toward you before disconnecting the connector.
- When disconnecting the device, grip the power supply plug's shell. Do not pull on cords to prevent wiring breaks in the device's power cord or damage to R&S RT-ZA13 probe power supply.

3.5 How to Measure Current Accurately

Retracting and extending the upper jaw can cause an offset voltage of several millivolts. Perform the steps described below to accurately measure a current.

1. Hold down the DEMAG / AUTO ZERO key on the junction box for about 1 second.

   ZERO LED lights up, and demagnetization and automatic zero-adjustment start. After the completion, the DEMAG / AUTO ZERO LED goes out.
2. Wait for about 5 minutes for the fluctuation of the offset voltage to stabilize.
3. Operate the opening lever of the sensor back and forth to retract and extend the upper jaw 4 or 5 times.
4. Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.

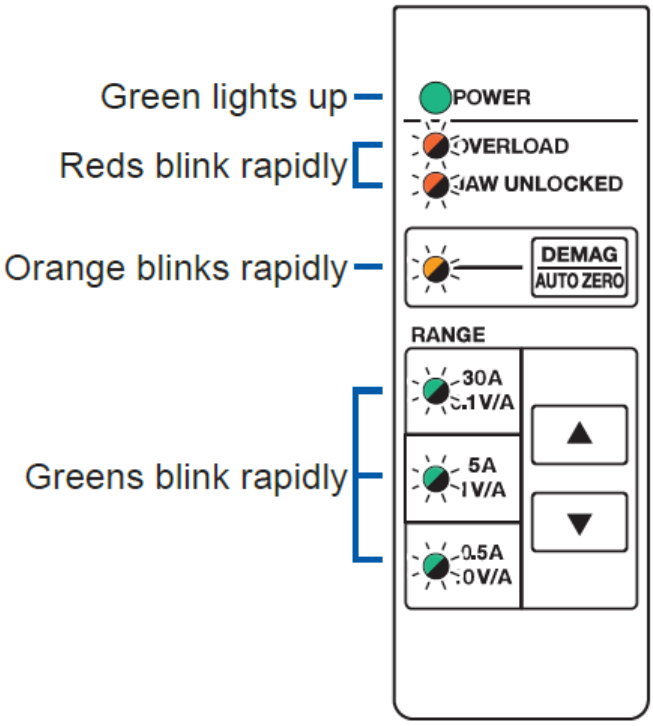
   The upper jaw is locked with the upper and lower sensor heads arranged in position relative to each other. The JAW UNLOCKED LED goes out.
5. Momentarily press the DEMAG / AUTO ZERO key on the junction box. (Do not hold down the key).

The DEMAG / AUTO ZERO LED lights up, and automatic zero-adjustment is performed alone. After the completion, the DEMAG / AUTO ZERO LED goes out.

6. Measure a current.

3.6 Protection Mode

To protect the device against self-generated heat, it enters protection mode when the temperature of the junction box exceeds a specified level.



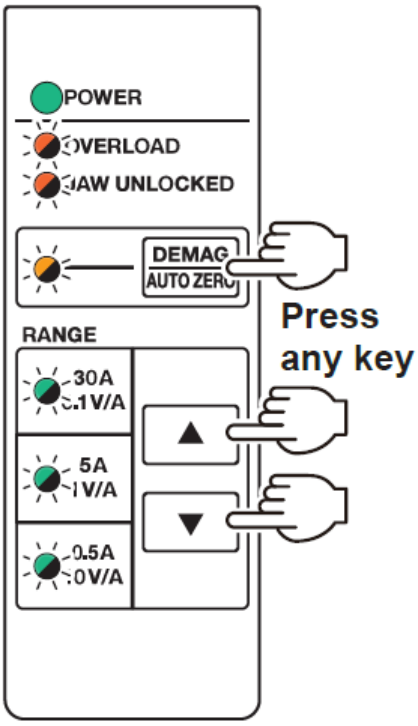
In protection mode, the device cannot correctly measure any current. Moreover, you cannot switch the current ranges. If the device has entered protection mode, recalibrate it because internal components may have been subjected to thermal stress.

To exit the protection mode

1. Pull the opening lever toward you. Remove the device from the conductor that you measure.
2. Slide the opening lever toward the lower jaw until the JAW UNLOCKED indicator is hidden.

3. Wait for a while to let the junction box cool down to a normal temperature.
4. Press any key.

   One of the RANGE LEDs (of the range used before the device entered protection mode) lights up and the device gets back to normal.
   The DEMAG / AUTO ZERO LED blinks slowly, which indicates demagnetization and automatic zero-adjustment are required.



3.7 Typical Characteristics

All the characteristics shown in this section are typical for R&S RT-ZC31.

3.7.1 Frequency Characteristics

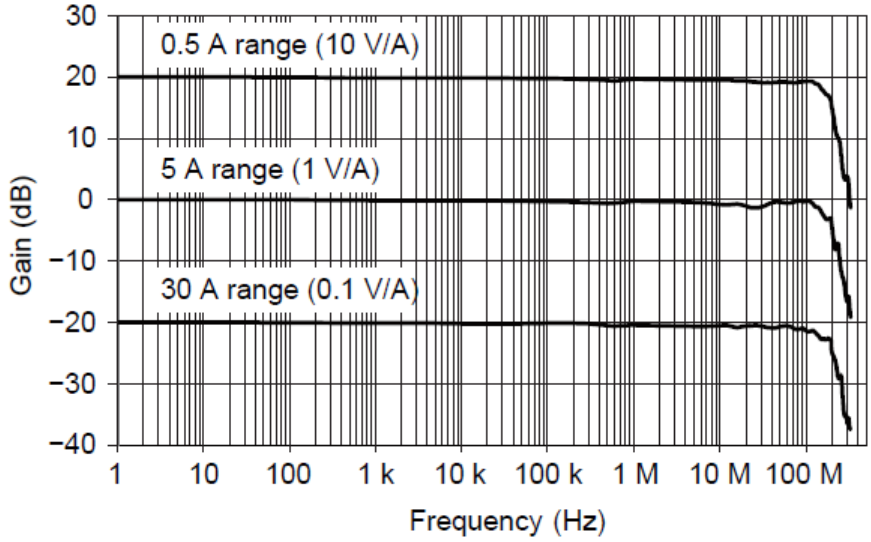


Figure 3-2: Frequency characteristics

3.7.2 Frequency Derating Curve

Fig. 3-3 shows the derating curves with a sine-wave current input. If the ambient temperature rises or the current being measured contains high-frequency components, the device temperature rises, and thus its continuously inputtable current value and frequency lowers.

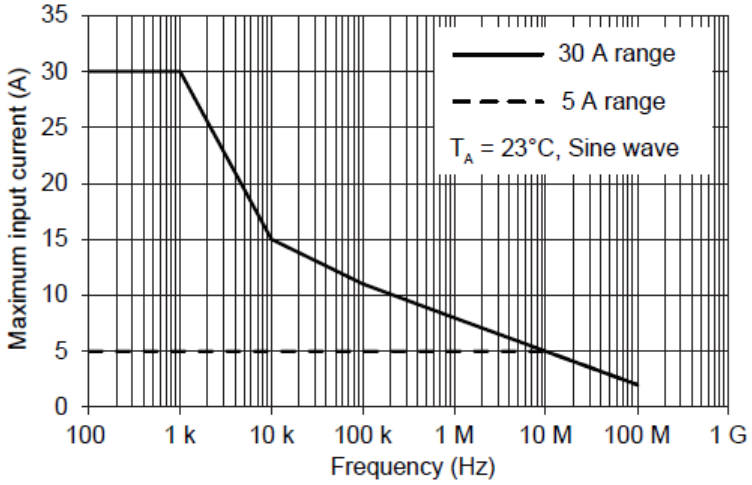


Figure 3-3: Frequency derating curve

3.7.3 Input Impedance

The current probe inserts a load in the circuit to be measured as shown in fig. 3-4. In particular, take this characteristic into account when measuring a high-frequency current.

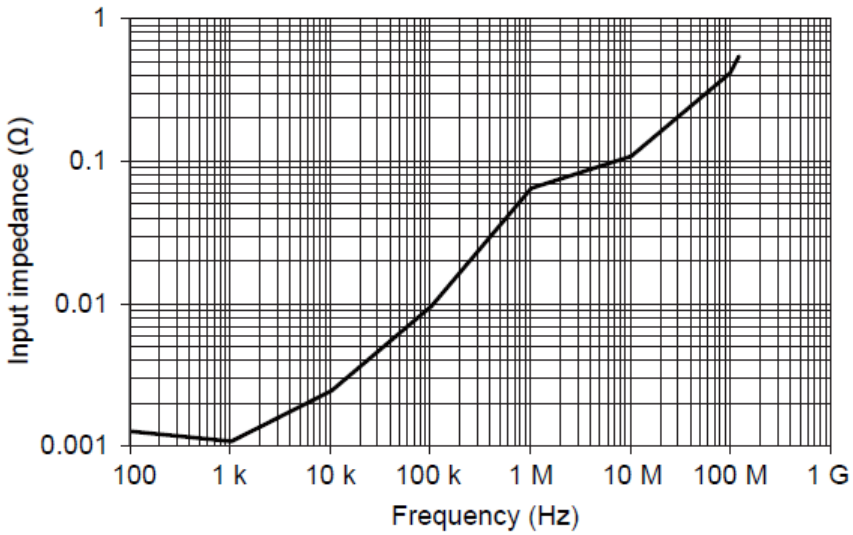


Figure 3-4: Input impedance as a function of frequency

3.7.4 Consumption Current

Fig. 3-5 shows the current consumption of the current probe drawn from the power supply versus the input current in the 30 A range.

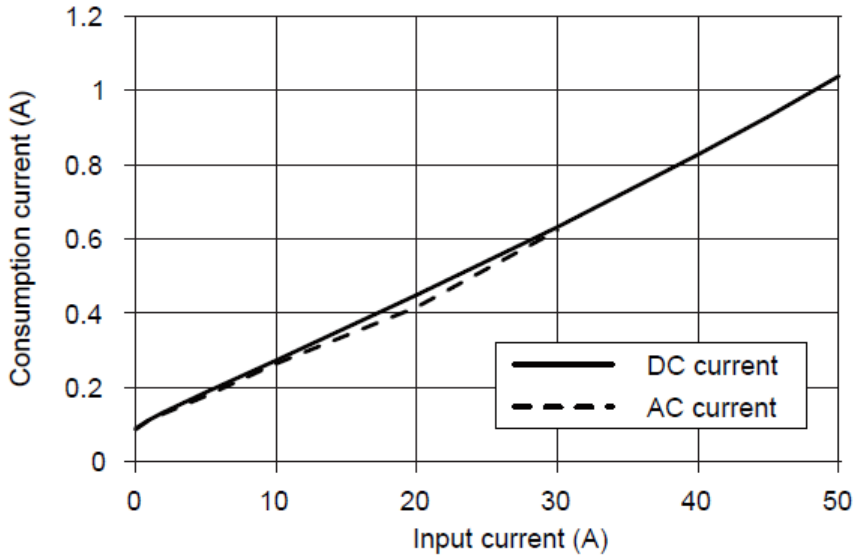
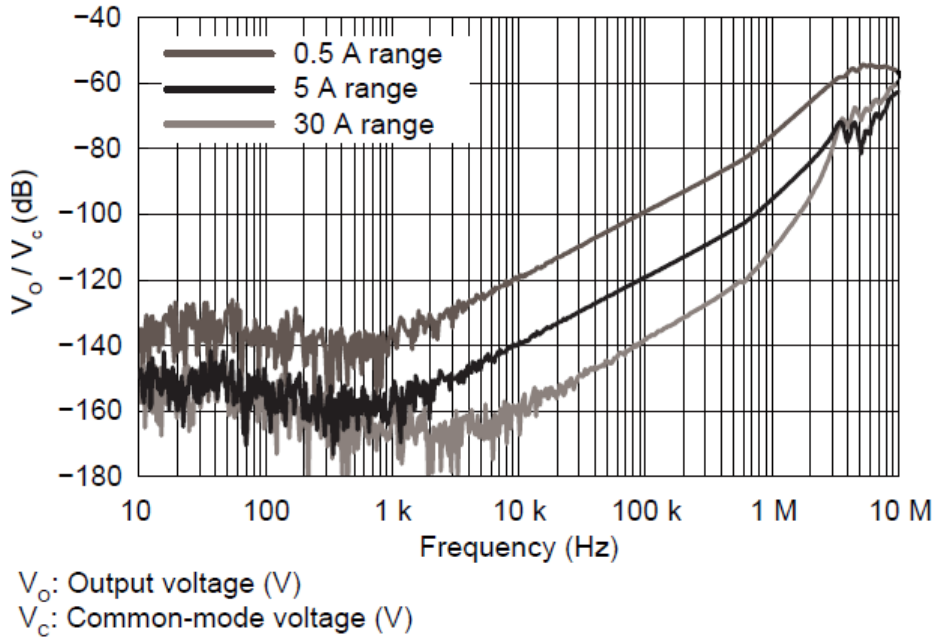


Figure 3-5: Consumption current (with the specified 30 A range)

3.7.5 Influence of Common-Mode Voltage

Fig. 3-6 shows the ratio of a common-mode voltage applied to the conductor being measured and the resulting output voltage.



V_o: Output voltage (V)
V_c: Common-mode voltage (V)

Figure 3-6: Influence of common-mode voltage

4 Troubleshooting

If damage is suspected, observe the information in the following chapter before returning for servicing.

4.1 Possible Device Errors

No waveform is displayed on the host waveform measuring instrument

1. Re-execute demagnetization and automatic zeroadjustment.
2. Make sure that the input coupling of the waveform measuring instrument is set to DC.

If the issue has not been resolved, the device may be malfunctioning. Send the device for repair.

A resonant sound is emitted from the sensor heads

The sensor head may emit a resonant sound depending on the amplitude and frequency of the current being measured. Such a sound may also be emitted during demagnetization. This, however, does not affect the measurement accuracy.

The resonant sound emitted from the sensor heads becomes louder

The gap between the upper and lower sensor heads may have increased. Calibrate the device because the gap may adversary affect the measurement accuracy.

Demagnetization and automatic zero-adjustment cannot be performed /

Demagnetization or automatic zero-adjustment has not been completed normally

Under some conditions, demagnetizing and automatic zero-adjustment cannot be performed or cannot be completed normally:

- The upper jaw is unlocked.
- An overload has been detected.

- A current exceeding 0.5 A rms has been detected.

If you observe this, implement the remedy described in Table 4-1. Then repeat the demagnetization and automatic zero-adjustment, see Chapter 3.2, "Demagnetizing and Zero Adjustment", on page 21.

If demagnetization or automatic zero-adjustment is not completed normally, even with the sensor not clamped around any conductor and the upper jaw locked in place, the device can be damaged. Send the device for repair.

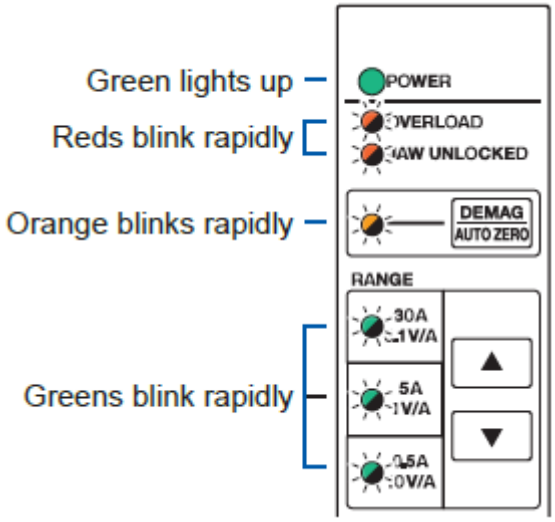
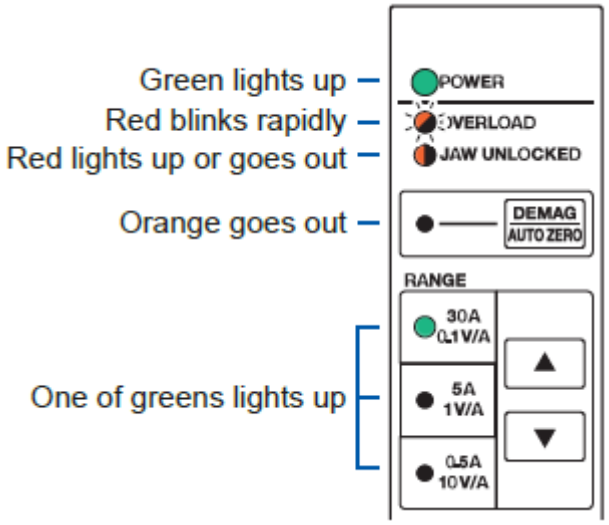
The waveform outputted during the demagnetization is asymmetric along the horizontal axis

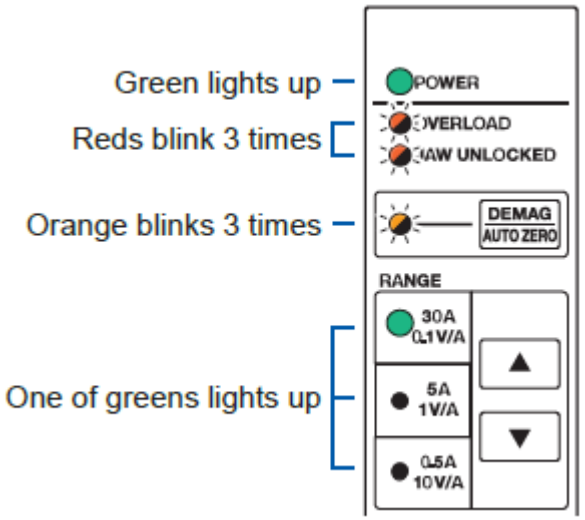
This does not represent a device malfunction. After demagnetization and automatic zero-adjustment are completed, make sure that the zero position on the waveform measuring instrument is appropriate.

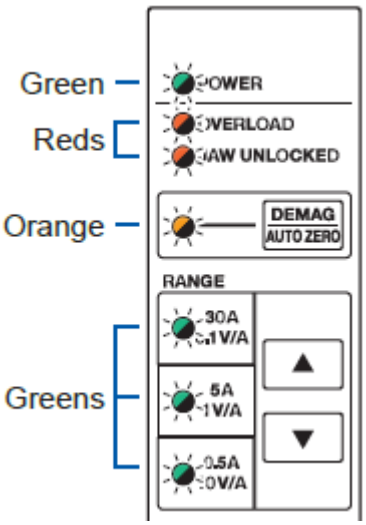
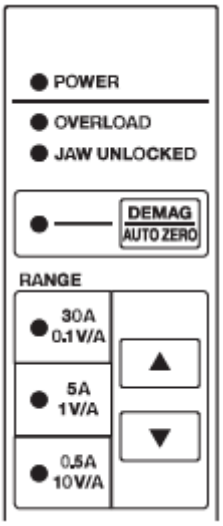
4.2 LED Display Errors

You can determine the nature of an error by observing the device's LED. The following table explains possible error indications and their cause.

Table 4-1: LED errors

Error state	Meaning
	**Protection mode** A temperature anomaly has been detected and the device has entered protection mode. Remove the device from the conductor being measured immediately. Allow the device to cool under conditions of no input and then press the DEMAG/AUTO ZERO key. The device returns to its state when it was turned on. Start measurement after performing demagnetization and zero adjustment again. We recommended you to calibrate the device since internal components may have been subject to stress.
	**Overload** The input current exceeding the specified level of each current range is detected. If you use the 30 A range, immediately remove the sensor from the conductor being measured. If you use the 0.5 A range or 5 A range, switch to a higher current range. The instrument may not be able to properly detect overload states immediately after the current range has changed. The currents for which an overload state can be detected are DC and sine waves with frequencies of 45 Hz to 66 Hz. The device is unable to detect the currents listed below as an overload state. • Currents that exceed the defined level on a momentary basis • High-frequency currents that exceed the defined level Although external magnetic fields may cause the OVERLOAD LED to blink while the upper jaw is retracted, this does not indicate an issue with the device

<table>
<tr><th>Error state</th><th colspan="2">Meaning</th></tr>
<tr><td rowspan="5"> 
</td><td colspan="2">Demagnetizing / automatic zero-adjustment unavailable
This issue occurs when the DEMAG/ AUTO ZERO key is pressed under the circumstances described in the table below.
Demagnetization and automatic zero adjustment cannot be performed. Perform demagnetization and zero adjustment again after implementing the remedy described below.</td></tr>
<tr><td>Circumstances</td><td>Remedy</td></tr>
<tr><td>When the JAW UNLOCKED LED is lit up</td><td>Lock the sensor head. (Press the opening lever until the JAW UNLOCKED indicator turns off.)</td></tr>
<tr><td>When the OVERLOAD LED is flashing</td><td rowspan="2">Remove the device from the conductor being measured.</td></tr>
<tr><td>When a current of 0.5 A (RMS) or greater has been detected</td></tr>
</table>

Error state	Meaning
All LEDs blink rapidly. 	**Checksum error** An internal CPU malfunction (checksum error) has occurred. Send it to the service center for repair.
No LEDs light up. 	**Malfunction** The device has malfunctioned. Send it to the service center for repair.

5 Maintenance and Service

If service or calibration is needed, contact your Rohde & Schwarz service center. Return a defective product to the Rohde & Schwarz service center for diagnosis and exchange.

5.1 Cleaning

1. Discharge any static electricity at your hands before cleaning the facing surfaces of the sensor head.

   Thus, you ensure that no high voltage caused by static electricity is applied to the product. Application of a high voltage can damage the internal Hall elements or circuitry. You can attract static electricity to your hands by touching a nearby metal object.

2. Clean the outside of the product using a soft cloth moistened with either distilled water or isopropyl alcohol. Keep in mind that the casing is not waterproof.

   Note: Do not use cleaning agents. Solvents (thinners, acetone), acids and bases can damage the labeling or plastic parts.

3. Dry the product completely before using it.

5.2 Contacting Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:

Figure 5-1: QR code to the Rohde & Schwarz support page

5.3 Returning for Servicing

Use the original packaging to return your R&S RT-ZC31 to your Rohde & Schwarz service center. A list of all service centers is available on:

www.services.rohde-schwarz.com

If you cannot use the original packaging, consider the following:

1. Use a sufficiently sized box.
2. Protect the product from damage and moisture (e.g. with bubble wrap).
3. Use some kind of protective material (e.g. crumpled newspaper) to stabilize the product inside the box.
4. Seal the box with tape.
5. Address the package to your nearest Rohde & Schwarz service center.

5.4 Calibration Interval

The recommended calibration interval for R&S RT-ZC31 current probe is one year. For servicing, send the probe to your nearest Rohde & Schwarz service center (see Chapter 5.3, "Returning for Servicing", on page 42).

5.5 Discarding the Product

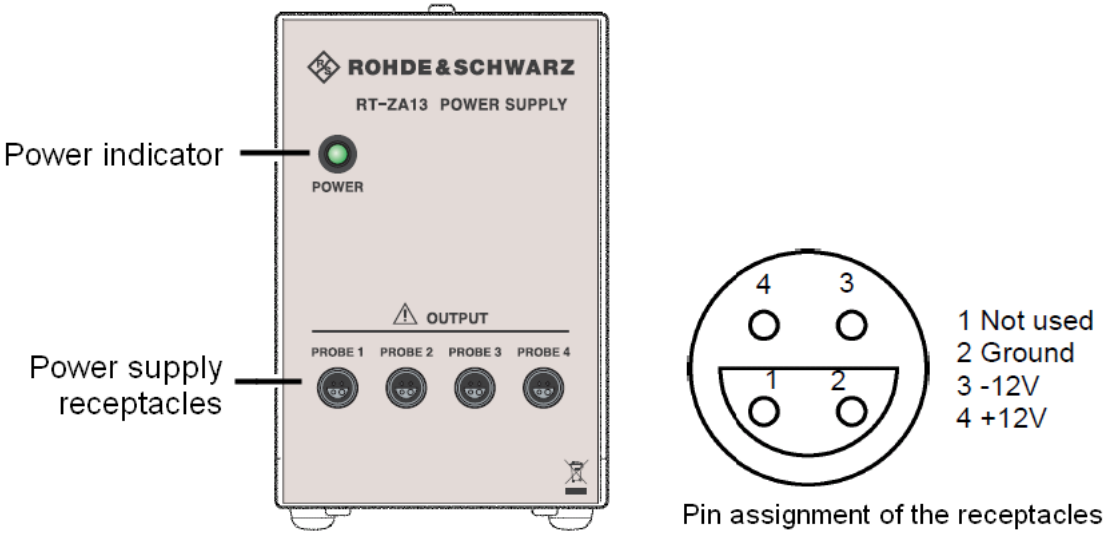
Handle and dispose the product in accordance with local regulations.

6 R&S RT-ZA13 Probe Power Supply

This unit is a special-purpose power supply for the current probes.

You can connect up to four current probes to the power supply.

Front view



Pin assignment of the receptacles

Rear view