

# FP - COMB 32

THREE PHASES  
EXTERNAL CDN

**User Manual**

4701030 | Version 2.0



# HAEFELY

Current and voltage – our passion

#### Revision History

Version	Date	Author	Remarks
2.0	08.03.2022	R.M.V	New format, new logos, chapters adapted

**WARNING:** Before taking the equipment into operation, be sure to read and understand fully the operating manual and instructions.

HAEFELY has a policy of continuing improvement on all their products. The design of this equipment will be subject to review and modification over its life. There may be small discrepancies between the manual and the operation of the equipment, particularly where software has been upgraded in the field.

Although all efforts are made to ensure that there are no errors in the manuals, HAEFELY accepts no responsibility for damage or loss that may result from errors within this manual. We retain the right to modify the functionality, specification or operation of the equipment without prior notice.

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# 1 Introduction

## 1.1 General

Thank you for choosing the Haefely FP-COMB 32. Please take a little time to read through this user manual and familiarize yourself with the instrument controls and some potential dangers.

We hope you have many productive years of operation from the FP-COMB 32 3 Phases External CDN.

### 1.1.1 Basic Device Information

The AXOS<sup>5</sup> and AXOS<sup>8</sup> compact immunity test systems integrate all of the best pieces of our stand alone test systems into one single economic solution. It combines Burst/EFT, Surge combination wave, Ringwave, Telecom Wave (10/700), AC/DC Dips & Interrupts, as well as Magnetic field along with an integrated single-phase coupling / decoupling network (CDN) into one compact test system. This allows a quick and completely automated testing environment to the most common IEC standards.

The FP-COMB 32 has been designed to power EUT with voltages up to 480V AC/DC and currents up to 32A. This three phase external CDN is able to couple Burst/EFT, Surge combination wave and Ringwave with the user friendly interface from AXOS5 and AXOS8. This CDN may also be used for single phase EUTs whose mains voltage exceeds 264VAC and currents above 16A or 220VDC and currents above 10A.

This unit covers a large range of standards which are listed in the following sections of this document.

## 1.2 Scope of Supply

The following accessories are included with the basic version of the FP-COMB 32 :

Qty	Description
1	FP-COMB 32
1	AC mains cable
1	EUT mains cable 32 A
1	EUT mains adapter 32 A
1	Surge cable to AXOS
1	EFT/Burst cable to AXOS
2	User manual
1	Calibration certificate



On receipt of the unit check that all items have been delivered. In the event of missing or damaged parts please contact your local sales representative stating the serial number, the type of the equipment and the sales order number.

## 1.3 Accessories and Options

Following additional accessories or spare material can be ordered separately:

Article	Part Number
1m cable Red/Black for Surge/Ringwave signals	4701031
1m SHV/SHV cable for Burst signal	0938371
1m 50 Ohms BNC cable for synchronization signal	0758941
1m SUB-D cable 37 conductors	0781424
1m Earth cable AXOS to FP-COMB 32	2513271
2m banana cable black	0781798
2m banana cable blue	0781799
2m banana cable green	0781800

Table 1-1: Accessories for FP-COMB 32



On receipt of the unit check that all items have been delivered. In the event of missing or damaged parts please contact your local sales representative stating the serial number, the type of the equipment and the sales order number.



Optional (for details see product data sheet on [www.haefely.com](http://www.haefely.com))

Article	Description	Part Number
PDP 8000	HV differential Probe 1000:1 for Surge	2499911
CP 101	Current Probe Model for Surge	2499931
Calibration	Accredited Calibration	2490926

Table 1-2: Article for FP-COMB 32

# 2 Glossary of Terms and Abbreviations

In the manual, the following conventions are used:



Indicates a hint or a matter of note - if it refers to a sequence of operations, failure to follow the instructions may result in measurement errors.



Indicates hazards. There is a risk of equipment damage or personal injury or death. Carefully read and follow the instructions. Be sure to follow any safety instructions given in addition to those for the site at which tests are being performed.

Wherever possible the corresponding standard (IEC, ANSI) definitions are used. The following abbreviations and definitions are used in this manual:

Abbreviation	Meaning
EUT	Equipment Under Test
CDN	Coupling Decoupling Network
HV	High Voltage
LED	Light Emitting Diode
IEC	International Electro-technical Committee
EN	European Norm
ANSI	American National Standards Institute
EMC	Electro Magnetic Compatibility
EMV	German equivalent of EMC
DEC	Decoupling network
PCD	Coupling / Decoupling module (Electrical circuit for transferring energy between networks with the minimum loss and that attenuates the Surge signal so that it does not cause undue interference to equipment other than the EUT)
STBY	Standby
HV DC	High Voltage Direct Current
Hybrid	Same as Combination
f.s.d.	full scale deflection

# 3 Safety

## 3.1 General



Safety is the responsibility of the user. Always operate the equipment in accordance with the instructions, always paying full attention to local safety practices and procedures.



This equipment must be operated only by trained and competent personnel who are aware of the dangers and hazards involved in high-voltage-testing and other HV-apparatus. HAEFELY accepts no liability for loss, damage, injury or death caused by the incorrect or unsafe operation of this equipment.

General Safety is the most important aspect when working on or around high voltage electrical equipment. Personnel whose working responsibilities involve testing and maintenance of the various types of high voltage equipment must have understood the safety rules in the manual and the associated safety practices specified by their company, national and regional regulations. Company, national or regional regulations must be fulfilled beyond HAEFELY recommendations.

This system produces hazardous voltages that can cause shocks, burns or death. It is the responsibility of the personnel to ensure that the system is operated in a safe manner.

HAEFELY and its sales partners refuse to accept any responsibility for consequential or direct damage to persons and/ or goods due to non-observance of instructions contained herein or due to incorrect use of the equipment.

### 3.1.1 Five basic safety regulations

At any entering or working with high voltage systems always consider the five basic safety regulations:



- 1) Disconnect mains!
- 2) Prevent reconnection!
- 3) Test for absence of harmful voltages!
- 4) Ground and short circuit!
- 5) Cover or close off nearby live parts!

After high voltage tests have been performed the first thing during entering high voltage parts are should be grounded. A manual ground rod has to be used. In some configurations a recurring voltage on capacitor can appear also after earthing. In these cases a second ground rod can help to reduce that risk.

### 3.1.2 Ground Connections

The ground connections between the different components of the system have to be made without forming loops (copper-foil or copper-braid) and in best case in star connection. The ground connection should be low inductive and able to carry the continuous short-circuit current.

### 3.1.3 Test Area



Never operate the system in an explosive environment or where flammable gases or fumes are exciting.

A good test area can enter a separate grounding. This ensures that no disturbances from surrounding machines enter the test field. It is necessary for the test field to have a lower grounding resistance than the surrounding building.

The test area has to be equipped with an adequate security circuit. Also an appropriate shielding and protection against the high voltage parts and terminals has to be installed.

In the test area minimum one manual ground rod has to be installed. It should be placed nearby the entrance of the test area.

### 3.1.4 Mains Connection



Connection of the system to a supply voltage outside the specified operating range will result in damage to the system along with the risk of injury and fire.

### 3.1.5 Cleaning and Maintenance



For cleaning and maintenance work it has to be ensured that all parts are disconnected from any mains supply. Always use grounding rods when entering the test area. Use the emergency stop.

Never open a cover or a case before having disconnected the power supply. Always pay full attention to the safety rules (especial on hazardous voltages).

Unauthorized opening of the equipment may damage the system or the EMC protection. It may also cause the equipment to be no longer compliant with the relevant standards and susceptibility requirements. If the equipment has been opened, the calibration can be rendered invalid.

HAEFELY and its sales partners accept no liability for loss, damage, injury or death caused by the incorrect or unsafe operation of this instrument.

### 3.1.6 Health Notes

This system produces hazardous voltages that can cause shocks, burns or death.

During operation high electric and magnetic fields can occur. The fields can affect to your health. Different measures can help here to reduce the risk (example: shielding against the fields, increase of the distance to the high voltage system, duration of the test, lower voltage/ current levels).

Some system configurations produce loud or monotonous noises. Different measures can help here to reduce the noise (example: acoustic shielding, ear protection, increase of the distance to the high voltage system, duration of the test, lower voltage/ current levels).

People with heart pacemakers should not be in the vicinity of the system during operation.

### 3.1.7 Device Particular safety notes



This warning sign is visible on the equipment. Meaning: This equipment should only be operated after carefully reading the user manual

Throughout the user manual, very important or helpful advice is presented in *italic font*.

Safety notices that must be heeded are printed in **bold type**.



Dangerous mains voltage or high voltages are present inside the FP-COMB 32.



The earth connection on the rear panel of the FP-COMB 32 must be connected to a good earth. If FP-COMB 32 is connected to mains without connection to earth, electrical shock may occur!



Remove all external connection cables before removing any covers.



The FP-COMB 32 should only be maintained by trained personnel.



Do not open any system modules, they contains no user replaceable parts.



When the unit is in operation, pacemaker users should not be in the vicinity.



Do not switch on or operate the FP-COMB 32 System if an explosion hazard exists. The system should be operated in a dry room. If condensation is visible the unit should be dried before operating.



Never touch the Equipment Under Test (EUT), when the FP-COMB 32 is operating. Establish a safety barrier around the test setup (It is possible to create a safety circuit using the pin 4 and pin 5 on the AXOS AUX connector. Refer to AXOS user manual for more details).



If any part of the FP-COMB 32 is damaged or it is possible that damage has occurred, do not switch on the unit. Example: transportation damage.



Before opening any units remove the mains power cord.



Before changing the mains fuse, remove the mains power cord.



Fuses should only be replaced with the same type and value.



This user manual is an integral part of the test system. Haefely Test AG and its sales partners refuse to accept any responsibility for consequential or direct damage to persons and/or goods due to non observance of instructions contained herein or due to incorrect use of the FP-COMB 32.



FP-COMB 32 does not have any "LINE ON/OFF" switch. Once mains voltage is connected to the "EUT supply input" (Rear panel), voltage is present at the EUT supply output on the front panel.



Before connecting the EUT, switch on FP-COMB 32 (switch on the rear panel). Make sure that the ventilators rotate. Supplying EUT without turning on FP-COMB 32 may damage the unit.



Never connect a supply voltage directly to the HI/COM surge inputs. This will damage the unit!!!

Table 3-1: Safety requirements FP-COMB 32

When a test is started on the AXOS the symbol in Figure 3-1: Safety sign is displayed on the screen:



Figure 3-1: Safety sign

## 3.2 Training and Education

The customer is responsible that the persons, which work with the system, are trained and educated in operation and safety for that. Only trained persons are allowed to work with the system. The training has to be repeated in regular intervals. The training has to be documented.

The safety is the responsible of the operators. When working on high voltage system, at least two persons must always be present, one of them bears responsibility for the system and the performed tests. The second person is the role of the safety observer.

Non-test related persons who are working in proximity to the area where testing is performed must be informed. Consistent visual and verbal signals should be agreed and followed.

**Operator:**

The person who makes the test, connections and operates the system. He must be able to have a clear view of the device under test and the area where the test is performed.

**Safety Observer:**

The person who is responsible for observing the performance of the test, seeing any safety hazard and giving warning to people.

# 4 Technical Data

## 4.1 Device General Specifications

Name	Value
Control Power	85V - 264V 50/60 Hz
Dimensions (W x H x D)	19" / 6U (45 x 29 x 49 cm)
Weight	45kg
AUX Interface	D-sub 37p for connection to AXOS
Sync. output	BNC, 0V – 15V AC

Table 4-1: General data

### 4.1.1 Surge

IEC / EN 61000-4-5 Edition 3 Surge Combination Wave	
Output Voltage	0.2 – 5.0kV $\pm 10\%$ for AXOS <sup>5</sup> 0.2 – 7.0kV $\pm 10\%$ for AXOS <sup>8</sup>
Polarity	Positive / negative / alternate
Voltage Rise Time	1.2us $\pm 30\%$
Voltage Duration	50us +10us/-10us for ANSI coupling paths 50us +10us/-15us for IEC Lx-Ly or Lx-N coupling paths 50us +10us/-30us for IEC Lx-PE coupling paths
Output Current	0.1 – 2.5kA $\pm 10\%$ for AXOS <sup>5</sup> 0.1 – 3.5kA $\pm 10\%$ for AXOS <sup>8</sup>
Current Rise Time	8us $\pm 20\%$ for ANSI 8us $\pm 20\%$ for IEC Lx-Ly or Lx-N coupling paths 2.5us $\pm 30\%$ for IEC Lx-PE coupling paths
Current Duration	20us $\pm 20\%$ for ANSI coupling paths 20us $\pm 20\%$ for IEC Lx-Ly or Lx-N coupling paths 25us $\pm 30\%$ for IEC Lx-PE coupling paths
Output Impedance	2 Ohms for ANSI coupling paths 2 Ohms for IEC Lx-Ly or Lx-N coupling paths 12 Ohms for IEC Lx-PE coupling paths
Phase Sync	0 – 359° with 1° steps or asynchronous mode
Counter preselect	1 – 1000



Counter	infinite 100000
Three Phase CDN	480V AC / 32A 480V DC / 32A
Impulse Trigger	automatic 10s – 100 minutes manual external trigger input

Table 4-2: Surge data

### 4.1.2 Ring Wave

Note: this feature is only available when FP-COMB 32 operates with AXOS<sup>8</sup>

IEC / EN 61000-4-12 Edition 2 & ANSI/IEEE C62.41 Ring Wave	
Output Voltage	0.2 – 7.0kV $\pm 10\%$
Polarity	Positive / negative / alternate
Voltage Rise time	0.5 $\mu\text{s}$ $\pm 30\%$
Voltage Frequency	100 kHz
Voltage Damping rate	0,4<peak1/peak2<1,1 0,4<peak3/peak2<0.8 0,4<peak4/peak3<0.8
Current Rise time	<1 $\mu\text{s}$
Output Impedance	12 Ohm, 30 Ohm selectable via AXOS' display
Phase Sync	0 – 359°with 1°steps or asynchronous mode
Counter preselect	1 – 1000
Counter	Infinite 100000
Three Phase CDN	480V AC / 32A 480V DC / 32A
Impulse Trigger	automatic 20s – 1 minutes manual external trigger input

Table 4-3: Ring Wave data

### 4.1.3 Burst

IEC / EN 61000-4-4 Edition 3 & ANSI IEEE C.37.90 EFT / Burst	
Output Voltage	0.2 – 5.0kV $\pm$ 10% for AXOS <sup>5</sup> and AXOS <sup>8</sup>
Polarity	Positive / negative / alternate
Rise Time	5.5ns $\pm$ 1.5ns for L1L2L3NPE coupling path
Impulse Duration	45ns $\pm$ 15ns for L1L2L3NPE coupling path
Burst Mode	normal continuous real random
Spike Frequency	1Hz – 1MHz
Burst Duration	10us – 1s
Burst Period	1ms – 10s
Test Time	1s– 1000 minutes
Three Phase CDN	480V AC / 32A 480V DC / 32A
Impulse Trigger	automatic manual external trigger input

Table 4-4: Burst data

## 4.2 Standards

The FP-COMB 32 fulfils the requirements of IEC 61010-1.

## 4.3 Standards covered by FP-COMB 32

Standard	Description	Test equipment
IEC/EN 61000-4-4	EFT/Burst	AXOS <sup>5</sup> and AXOS <sup>8</sup>
IEC/EN 61000-4-5	Surge Combination Wave	AXOS <sup>5</sup> and AXOS <sup>8</sup>
IEC/EN 61000-4-12	Ring Wave	AXOS <sup>8</sup> only
ANSI IEEE C.37.90	EFT/Burst	AXOS <sup>5</sup> and AXOS <sup>8</sup>

ANSI/IEEE C62.41	Ring Wave	AXOS <sup>8</sup> only
ANSI/IEEE C62.41	Surge Combination Wave	AXOS <sup>5</sup> and AXOS <sup>8</sup>

Table 4-5: basic standards covered by FP-COMB 32

For detailed test description of each particular norm please read IEC/EN standard carefully. This is the overall norm, many product norm consist further tests. Indeed, for many products the requirements will be described more detailed in the product norm. Note: Product norms will be partly fulfilled by the FP-COMB 32 as well. Please contact for further assistance your sales representative or HAEFELY directly.

## 4.4 General



*The equipment must not be subjected to:*

- Direct solar radiation
- Water ingress
- Dirty or dusty atmospheres
- Excessive vibration
- Electromagnetic interference

# 5 Assembling and Installation Guide

## 5.1 System Installation and Installation Area

### 5.1.1 Visual check

During transport FP-COMB 32 may be subjected to excessive shocks and vibrations, even though every care is taken by HAEFELY AG to provide suitable packaging. Before operating the unit, check for signs of mechanical damage. Damaged packing cases may be a sign of transport damage. Damage caused in transit must be reported to the shipping agent immediately.



***Persons with heart pacemakers must not be in the vicinity when the system is operating!***



***If damage to FP-COMB 32 or its charging unit can be seen or is suspected, do not apply any voltage!***

### 5.1.2 Installation



***All safety measures must be followed, as described in Table 3-1: Safety requirements FP-COMB 32***

### 5.1.3 Earth connection



***The "Earth Stud" on the back panel must always be connected to a solid earth before the "EUT Supply Input" is connected to power source. Cross section of connection must be at least 4mm squared.***

# 5.2 EUT Supply Input

## 5.2.1 AC EUT Supply

The "EUT Supply Input" is located on the rear panel of the FP-COMB32. The L1, L2, L3, N, PE connections are used to supply AC EUT Supply Input up to 480VAC/32A.

There are five banana-cables delivered with the standard accessories set:

- 3x black: line conductor
- 1x blue: neutral conductor
- 1x green: protection earth conductor

These banana cables shall be mounted on a suitable connection cable/connector.



The EUT Supply Input must be connected to power lines which are protected by a line safety switch equal or less 32A rated current and characteristic B or C.



Inside the FP-COMB 32, there are filter capacitors connected between lines and earth (For example L1- PE) and neutral and earth N-PE, as required by the standard.

These capacitors will cause a residual current, which will trip the residual current circuit breaker.

Hence, an isolation transformer needs to be inserted between main power supply and "EUT Supply Input" as shown in Figure 5-1: Transformer connection below.

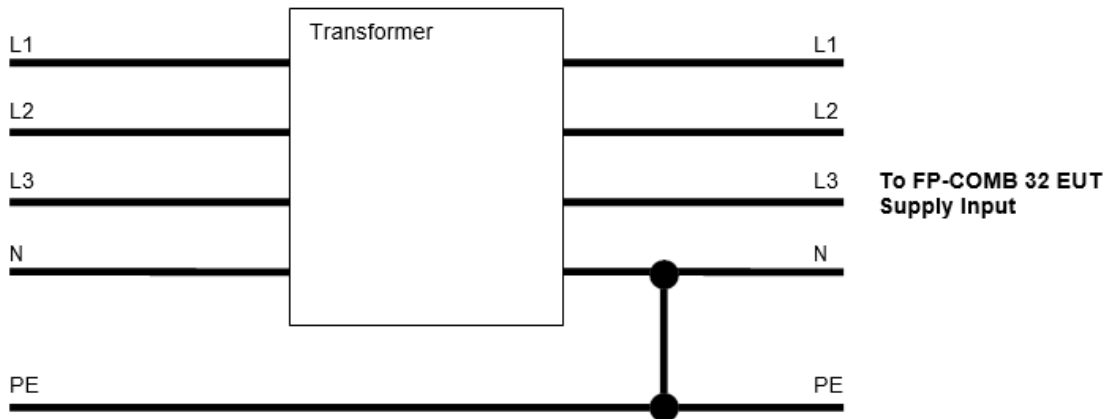


Figure 5-1: Transformer connection

Note: N and PE need to be connected as shown in the Figure 5-1: Transformer connection. This enables that a possible follow current from the mains can be delivered to the EUT.



All further equipment connected after the isolation transformer are not protected any more by the residual current circuit breaker.

## 5.2.2 DC EUT Supply

The "EUT Supply Input" is located on the rear panel of the FP-COMB32. The L1, N, PE connections are used to supply DC EUT Supply Input up to 480Vdc/32A. The warm point should be connected to L1 and the cold point should be connected to N. Earth remains connected on PE. Leave L2 and L3 unconnected.

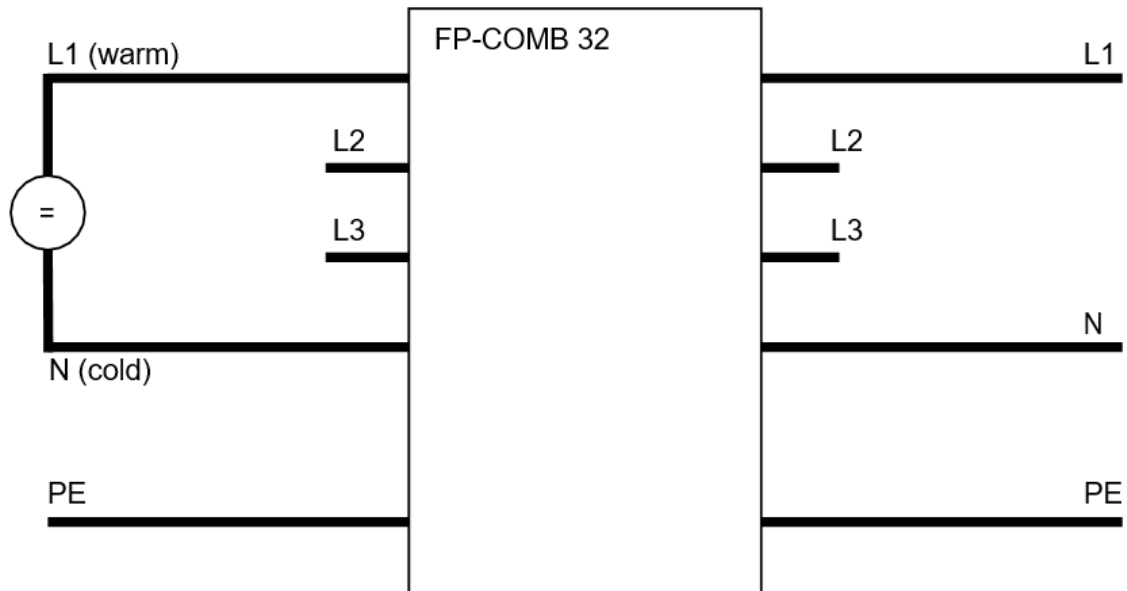


Figure 5-2: DC EUT supply connection



The EUT Supply Input must be connected to power lines which are protected by a line safety switch equal or less 32A rated current and characteristic B or C.

## 5.2.3 Connection to EUT

The L1, L2, L3, N and PE banana sockets on the front panel are the outputs of the Three Phase CDN. For power line testing, the EUT is connected here.

Five banana plugs (not delivered) are required to connect the EUT

- 3x black: line conductor
- 1x blue: neutral conductor
- 1x green: protection earth conductor

These banana plugs shall be mounted on a suitable connection cable.

# 6 Operating Instructions

## 6.1 Device Front Panel

The Figure 6-1: FP-COMB 32 front view shows the front view of the FP-COMB 32. In the Table 6-1: Description front view function is the detail description of every physical input and output.



Figure 6-1: FP-COMB 32 front view

Pos.	Function	Description
1	Power LED	LED is ON as long as CDN is powered (rear panel switch)
2	Active LED	LED is ON as long as a test using FP-COMB 32 is running
3	HI input for Surge/ Ringwave	Surge and Ringwave input for impulses delivered by AXOS <sup>5</sup> or AXOS <sup>8</sup>
4	COM input for Surge/ Ringwave	
5	Burst input	Burst input for impulses delivered by AXOS <sup>5</sup> or AXOS <sup>8</sup>
6	L1 output to EUT	Connection for EUT to the coupling/decoupling network
7	L2 output to EUT	
8	L3 output to EUT	
9	N output to EUT	
10	PE output to EUT	
11	PE	Connection to ground reference plane or the verification adapter
12	PE	

Table 6-1: Description front view function

## 6.2 Device back panel

The rear view of the FP-COMB 32 is shown in Figure 5-2. A detailed description of every input and output is written in the Table 6-2: Description rear view below the graphic.



Figure 6-2: FP-COMB 32 rear view

Pos.	Function	Description
1	L1 "EUT Supply Input" (direct connection of power supply via banana plug)	Direct connection of power supply to the EUT. It can either be connected to a DC power supply or to AC power supply. Awareness, the power supply should NOT be secured by a ground fault Switch. If yes please take 5.2.1 in consideration.
2	L2 "EUT Supply Input" (direct connection of power supply via banana plug)	
3	L3 "EUT Supply Input" (direct connection of power supply via banana plug)	
4	N "EUT Supply Input" (direct connection of power supply via banana plug)	
5	PE "EUT Supply Input" (direct connection of power supply via banana plug)	
6	"Link"	Data communication with AXOS to drive FP-COMB 32
7	"Sync"	Synchronization output signal for AXOS
8	Electrical grounding	The generator must always be connected to a reference earth before every use
9	Main power switch for FP- COMB 32	Switching on/off power supply

Table 6-2: Description rear view



## 6.3 Connections to AXOS<sup>5</sup> or AXOS<sup>8</sup>

Front view:

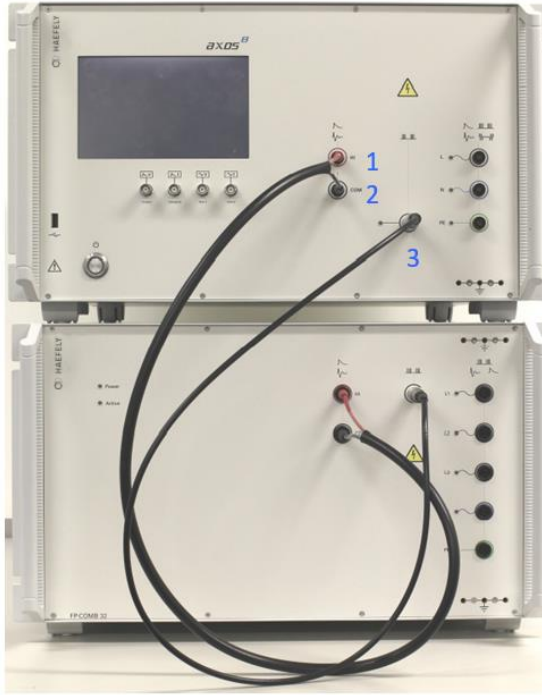


Figure 6-3: connection to AXOS - Front

Rear view:

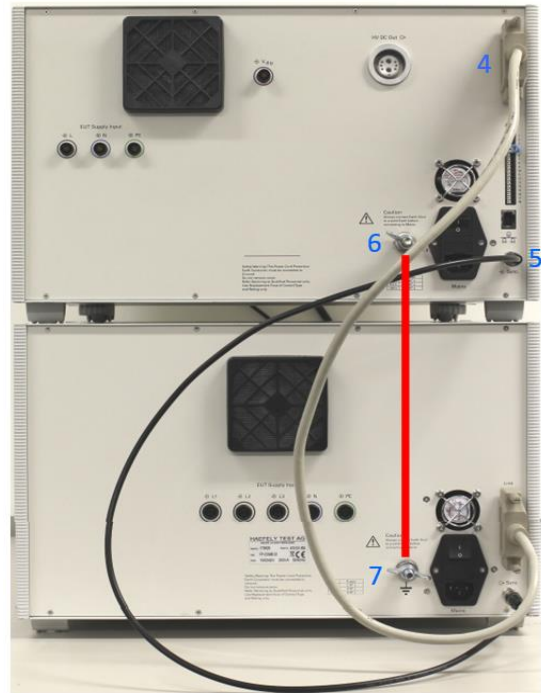


Figure 6-4: connection to AXOS - Rear

Pos.	Function	Description
1	HI Surge/Ringwave (RED)	Surge and Ringwave impulse link between AXOS and FP-COMB 32 using banana cables (1m)
2	COM Surge/Ringwave (BLACK)	
3	Burst SHV connector	Link for Burst impulses, SHV-SHV cable (1m)
4	Link Sub-D 37	Link for data/control of FP-COMB 32 (1m)
5	Sync	BNC cable for synchronization signal (1m)
6 & 7	Earth connections	Delivered grounding cable (1m), painted in red, most important connection

## 6.4 Surge

### 6.4.1 General information

Please read carefully this document and AXOS manual in detail before first use of the Surge generator. The short voltage impulse stays on the EUT during several  $\mu$ s. The peak voltage gets up to 7 kV. The generator fulfils the requirements according to the IEC 61000-4-5 norm.

In General waveforms are specified as open circuit voltage (OCV) and short circuit current (SCC). The Surge is applied directly from the AXOS surge outputs to FP-COMB 32's HI and COM inputs.

For a detailed description of this standard please read the topic "test instrumentation" in the IEC 61000-4-5 norm.

### 6.4.2 SURGE Menu

Test requirements must be achieved by the user according to the IEC 61000-4-5 norm. The safety standards as written in Table 3-1: Safety requirements FP-COMB 32 must be unconditionally fulfilled, when operating the FP-COMB 32.

Two menus in the AXOS surge application are specific to the FP-COMB 32. These menus will be described in the next sections.

For a detailed description of the surge application, please refer to the AXOS user manual.

#### 6.4.2.1 Output & Coupling Paths menu

In the "Output & Coupling Paths" menu the automatic 3 phase CDN FP-COMB 32 gets indicated automatically when connected. It can be then activated by selecting the appropriate radio button. An additional radio button permits user to select the IEC or ANSI mode.

The screenshot shows a dialog box titled "Output & Coupling Paths". It contains two main sections: "Output" and "Coupling Paths".

**Output Section:**

- Line
- Direct Output
- FP-SURGE 100M2
- FP-COMB 32

**Coupling Paths Section:**

- 1 Phase
- 2 Phases
- 3 Phases

**Mode Selection:**

- IEC
- ANSI

**Coupling Path Checkboxes:**

- L1 - N
- L2 - PE
- L2 - L3
- L2 - N
- L3 - PE
- L1 - L3
- L3 - N
- N - PE
- L1 - PE
- L1 - L2

**Buttons:**

- 
- 
- 
- 

Figure 6-5: Surge Coupling paths

The following table indicates the available coupling paths regarding the amount of phases selected:

Phases	Mode	Coupling Path		Coupling elements		Synchronization	
		HIGH	COM	Capacitor	Resistor	HIGH	COM
1 Phase	IEC	L1	N	18 uF	0 Ohm	L1	N
		L1	PE	9 uF	10 Ohm	L1	PE
		N	PE	9 uF	10 Ohm	N	PE
	ANSI	L1+N	PE	9 uF	0 Ohm	L1	PE
		L1	N	18 uF	0 Ohm	L1	N
		N	PE	9 uF	0 Ohm	L1	PE
		L1	PE	9 uF	0 Ohm	L1	PE
		N+PE	L1	9 uF	0 Ohm	N	L1
L1+PE	N	9 uF	0 Ohm	L1	N		
2 Phases	IEC	L1	N	18 uF	0 Ohm	L1	N
		L2	N	18 uF	0 Ohm	L2	N
		L1	PE	9 uF	10 Ohm	L1	PE
		L2	PE	9 uF	10 Ohm	L2	PE
		N	PE	9 uF	10 Ohm	N	PE
		L1	L2	18 uF	0 Ohm	L1	L2
	ANSI	L1+L2+N	PE	9 uF	0 Ohm	L1	PE
		L1	N	18 uF	0 Ohm	L1	N
		L2	N	18 uF	0 Ohm	L2	N
		N	PE	9 uF	0 Ohm	L1	PE
		L1	PE	9 uF	0 Ohm	L1	PE
		L2	PE	9 uF	0 Ohm	L2	PE
		L1+L2	N	9 uF	0 Ohm	L1	N
L1+L2	PE	9 uF	0 Ohm	L1	PE		
3 Phases	IEC	L1	N	18 uF	0 Ohm	L1	N
		L2	N	18 uF	0 Ohm	L2	N
		L3	N	18 uF	0 Ohm	L3	N
		L1	PE	9 uF	10 Ohm	L1	PE
		L2	PE	9 uF	10 Ohm	L2	PE
		L3	PE	9 uF	10 Ohm	L3	PE
		N	PE	9 uF	10 Ohm	N	PE
		L1	L2	18 uF	0 Ohm	L1	L2
		L2	L3	18 uF	0 Ohm	L2	L3
		L1	L3	18 uF	0 Ohm	L1	L3

ANSI	L1+L2+L3+N	PE	9 uF	0 Ohm	L1	PE
	L2	L1	18 uF	0 Ohm	L2	L1
	L3	L2	18 uF	0 Ohm	L3	L2
	L1	L3	18 uF	0 Ohm	L1	L3
	N	PE	9 uF	0 Ohm	L1	PE
	L1	PE	9 uF	0 Ohm	L1	PE
	L2	PE	9 uF	0 Ohm	L2	PE
	L3	PE	9 uF	0 Ohm	L3	PE
	L1+L2+L3	N	9 uF	0 Ohm	L1	N
	L1+L2+L3	PE	9 uF	0 Ohm	L1	PE

Figure 6-6: Surge Coupling Paths

Note: For DC applications user should select the radio button “1 phase”.

#### 6.4.2.2 Properties menu

In the figure below is the properties menu displayed.

Properties

EUT Fail

<u>Action</u>	<u>Source</u>						
<input type="radio"/> Ignore	<input checked="" type="checkbox"/> External (Pin11 on Aux)						
<input type="radio"/> Alarm (Sound & Warning)	<input type="checkbox"/> Line Current <input style="width: 80px;" type="text" value="3 A"/>						
<input checked="" type="radio"/> Test Stop	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; width: 50%;"><u>Peak Voltage</u></th> <th style="text-align: left; width: 50%;"><u>Peak Current</u></th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kV"/></td> <td><input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kA"/></td> </tr> <tr> <td><input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="7.50 kV"/></td> <td><input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="4.00 kA"/></td> </tr> </tbody> </table>	<u>Peak Voltage</u>	<u>Peak Current</u>	<input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kV"/>	<input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kA"/>	<input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="7.50 kV"/>	<input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="4.00 kA"/>
<u>Peak Voltage</u>	<u>Peak Current</u>						
<input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kV"/>	<input type="checkbox"/> Min. <input style="width: 80px;" type="text" value="0.00 kA"/>						
<input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="7.50 kV"/>	<input type="checkbox"/> Max. <input style="width: 80px;" type="text" value="4.00 kA"/>						
<input type="radio"/> Test Stop & Line Off							

Test End

Turn Line Off

Sound

Figure 6-7: Surge properties

The following table describes the different functions in more detail. The window is closed once settings are confirmed with the “OK” button.

Position	Description
External (Pin11 on Aux)	External condition (e.g. device or PLC signal), the position becomes 1 and causes an action (Ignore, Alarm, Test Stop or test stop & line off)
Line Current	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Peak voltage	It defines a range (min. and max.) for the peak voltage value of the surge waveform. If output impulse is outside the defined range, an action is triggered which can be: Ignore, Alarm, or Test Stop. This feature is used to set a possible “DUT Fail” criterion.
Peak current	It defines a range (min. and max.) for the peak current value of the surge waveform. If output impulse is outside the defined range, an action is triggered which can be: Ignore, Alarm, or Test Stop This feature is used to set a possible “DUT Fail” criterion.
Action: Ignore, Alarm, Test stop, Test stop & line off	Due to EUT fails, AXOS causes an action which can be: Ignore, Alarm, Test Stop. “Test stop & line off” is not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Turn Line off	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Sound	Acoustic signal when test ends

Table 6-3: Surge properties

#### **6.4.2.3 Line Synchronization AC**

To synchronize the ringwave signal with the main supply source it is necessary to adjust in the menu “Synchronization” and then “External Sync”. FP-COMB 32’s sync output has to be connected to AXOS’ sync input using the BNC cable delivered in the accessory kit. Further adjustments of the angle can be done in a range from 0°to 359°. However, if no power supply is connected to the EUT input at the rear view, it has to be entered “Async.”, otherwise it is impossible to get an impulse of AXOS.

#### **6.4.2.4 Phase order detection**

In the “Output & Coupling paths” menu can be selected for each IEC and ANSI mode if one, two or three phases are used to power the EUT.

- For one or two phases application, no error message is displayed if the phases are swapped.
- If the three-phase mode is selected FP-COMB 32 checks if the phases are connected in the right order and displays an error message if two phases are swapped. If this is the case swap any two phases at the “EUT supply input” on the rear panel and restart the test.
- For DC applications user should select the radio button “1 phase”.

# 6.5 Ring Wave

## 6.5.1 General Information

The ringwave feature is only available with AXOS8

FP-COMB 32 is able to couple Ringwave impulses in accordance to the IEC 61000-4-12 ed.2 and ANSI C62.41 norms. Test level up to 7 kV is defined. It can be selected between an impedance of 12 Ohm and 30 Ohm on AXOS' touch screen.

For a detailed description of the ringwave impulse please refer to the IEC 61000-4-12 ed.2 and ANSI C62.41 standards.

## 6.5.2 Ring Wave Menu

Test requirements must be achieved by the user according to the IEC 61000-4-12 norm. The safety standards as written in Table 3-1: Safety requirements FP-COMB 32 must be unconditionally fulfilled, when operating the AXOS.

Two menus in the AXOS ringwave application are specific to the FP-COMB 32. These menus will be described in the next sections.

For a detailed description of the ringwave application, please refer to the AXOS<sup>8</sup> user manual.

### 6.5.2.1 Output & Coupling Paths menu

In the "Output & Coupling Paths" menu the automatic 3 phase CDN FP-COMB 32 gets indicated automatically when connected. It can be then activated by selecting the appropriate radio button. An additional radio button permits user to select the IEC or ANSI mode.

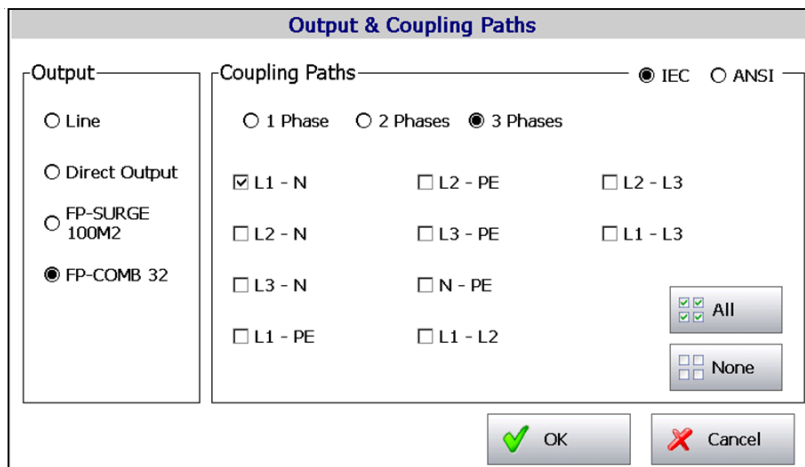


Figure 6-8: Ringwave Coupling paths

The following table indicates the available coupling paths regarding the amount of phases selected:

Phases	Mode	Coupling Path		Coupling elements		Synchronization	
		HIGH	COM	Capacitor	Resistor	HIGH	COM
1 Phase	IEC	L1	N	9 uF	0 Ohm	L1	N
		L1	PE	9 uF	0 Ohm	L1	PE
		N	PE	9 uF	0 Ohm	N	PE
	ANSI	L1+N	PE	9 uF	0 Ohm	L1	PE
		L1	N	9 uF	0 Ohm	L1	N
		N	PE	9 uF	0 Ohm	L1	PE
		L1	PE	9 uF	0 Ohm	L1	PE
		N+PE	L1	9 uF	0 Ohm	N	L1
L1+PE	N	9 uF	0 Ohm	L1	N		
2 Phases	IEC	L1	N	9 uF	0 Ohm	L1	N
		L2	N	9 uF	0 Ohm	L2	N
		L1	PE	9 uF	0 Ohm	L1	PE
		L2	PE	9 uF	0 Ohm	L2	PE
		N	PE	9 uF	0 Ohm	N	PE
		L1	L2	9 uF	0 Ohm	L1	L2
	ANSI	L1+L2+N	PE	9 uF	0 Ohm	L1	PE
		L1	N	9 uF	0 Ohm	L1	N
		L2	N	9 uF	0 Ohm	L2	N
		N	PE	9 uF	0 Ohm	L1	PE
		L1	PE	9 uF	0 Ohm	L1	PE
		L2	PE	9 uF	0 Ohm	L2	PE
		L1+L2	N	9 uF	0 Ohm	L1	N
L1+L2	PE	9 uF	0 Ohm	L1	PE		
3 Phases	IEC	L1	N	9 uF	0 Ohm	L1	N
		L2	N	9 uF	0 Ohm	L2	N
		L3	N	9 uF	0 Ohm	L3	N
		L1	PE	9 uF	0 Ohm	L1	PE
		L2	PE	9 uF	0 Ohm	L2	PE
		L3	PE	9 uF	0 Ohm	L3	PE
		N	PE	9 uF	0 Ohm	N	PE
		L1	L2	9 uF	0 Ohm	L1	L2
		L2	L3	9 uF	0 Ohm	L2	L3
		L1	L3	9 uF	0 Ohm	L1	L3

ANSI	L1+L2+L3+N	PE	9 uF	0 Ohm	L1	PE
	L2	L1	9 uF	0 Ohm	L2	L1
	L3	L2	9 uF	0 Ohm	L3	L2
	L1	L3	9 uF	0 Ohm	L1	L3
	N	PE	9 uF	0 Ohm	L1	PE
	L1	PE	9 uF	0 Ohm	L1	PE
	L2	PE	9 uF	0 Ohm	L2	PE
	L3	PE	9 uF	0 Ohm	L3	PE
	L1+L2+L3	N	9 uF	0 Ohm	L1	N
	L1+L2+L3	PE	9 uF	0 Ohm	L1	PE

Table 6-4: Ring Wave Coupling Paths

Note: For DC applications user should select the radio button “1 phase”.

### 6.5.2.2 Properties menu

In the Figure 7-2 below is the properties menu displayed. The Table 7-2 explains the function more detailed.

Properties

**EUT Fail**

<u>Action</u>	<u>Source</u>						
<input type="radio"/> Ignore	<input checked="" type="checkbox"/> External (Pin11 on Aux)						
<input type="radio"/> Alarm (Sound & Warning)	<input type="checkbox"/> Line Current <input style="width: 50px;" type="text" value="3 A"/>						
<input checked="" type="radio"/> Test Stop	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Peak Voltage</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Peak Current</u></th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kV"/></td> <td><input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kA"/></td> </tr> <tr> <td><input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="7.50 kV"/></td> <td><input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="4.00 kA"/></td> </tr> </tbody> </table>	<u>Peak Voltage</u>	<u>Peak Current</u>	<input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kV"/>	<input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kA"/>	<input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="7.50 kV"/>	<input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="4.00 kA"/>
<u>Peak Voltage</u>	<u>Peak Current</u>						
<input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kV"/>	<input type="checkbox"/> Min. <input style="width: 50px;" type="text" value="0.00 kA"/>						
<input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="7.50 kV"/>	<input type="checkbox"/> Max. <input style="width: 50px;" type="text" value="4.00 kA"/>						
<input type="radio"/> Test Stop & Line Off							

**Test End**

Turn Line Off

Sound

Figure 6-9: Ring Wave properties



The window gets closed, when confirming the “OK” button.

Position	Description
External (Pin11 on Aux)	External condition (e.g. device or PLC signal), the position becomes 1 and causes an action (Ignore, Alarm, Test Stop or test stop & line off)
Line Current	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Peak voltage	It defines a range (min. and max.) for the peak voltage value of the surge waveform. If output impulse is outside the defined range, an action is triggered which can be: Ignore, Alarm, or Test Stop. This feature is used to set a possible “DUT Fail” criterion.
Peak current	It defines a range (min. and max.) for the peak current value of the surge waveform. If output impulse is outside the defined range, an action is triggered which can be: Ignore, Alarm, or Test Stop This feature is used to set a possible “DUT Fail” criterion.
Action: Ignore, Alarm, Test stop, Test stop & line off	Due to EUT fails, AXOS causes an action which can be: Ignore, Alarm, Test Stop. “Test stop & line off” is not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Turn Line off	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Sound	Acoustic signal when test ends

Table 6-5: Ring Wave properties

### **6.5.2.3 Line Synchronization AC**

To synchronize the ringwave signal with the main supply source it is necessary to adjust in the menu “Synchronization” and then “External Sync”. FP-COMB 32’s sync output has to be connected to AXOS’ sync input using the BNC cable delivered in the accessory kit. Further adjustments of the angle can be done in a range from 0°to 359°. However, if no power supply is connected to the EUT input at the rear view, it has to be entered “Async.”, otherwise it is impossible to get an impulse of AXOS.

### **6.5.2.4 Phase order detection**

In the “Output & Coupling paths” menu can be selected for each IEC and ANSI mode if one, two or three phases are used to power the EUT.

- For one or two phases application, no error message is displayed if the phases are swapped.
- If the three-phase mode is selected FP-COMB 32 checks if the phases are connected in the right order and displays an error message if two phases are swapped. If this is the case swap any two phases at the “EUT supply input” on the rear panel and restart the test.
- For DC applications user should select the radio button “1 phase”.

# 7 Electrical Fast Transient Burst

## 7.1 General information

AXOS' Burst generator generates Electrical Fast Transient Bursts (EFT) as described in IEC 61000-4-4. The source impedance of the generator is 50 Ω. The burst is a common mode transient, coupled simultaneously to all selected paths with respect to ground.

Test requirements must be achieved by the user according to the IEC 61000-4-4 norm. The safety standards as written in capture Table 3-1: Safety requirements FP-COMB 32 must be unconditionally fulfilled.

## 7.2 Burst menu

For a detailed description of the burst application, please refer to the AXOS user manual. Two menus are FP-COMB 32 specific and will be described in the next sections.

### 7.2.1 Output & Coupling Paths menu

In Burst testing mode every line signal gets tested against GND. In the "Output & Coupling Paths" menu the automatic 3 phase CDN FP-COMB 32 gets indicated automatically when connected. It can be then activated by selecting the appropriate radio button. The coupling is in accordance to the IEC/ANSI standard.

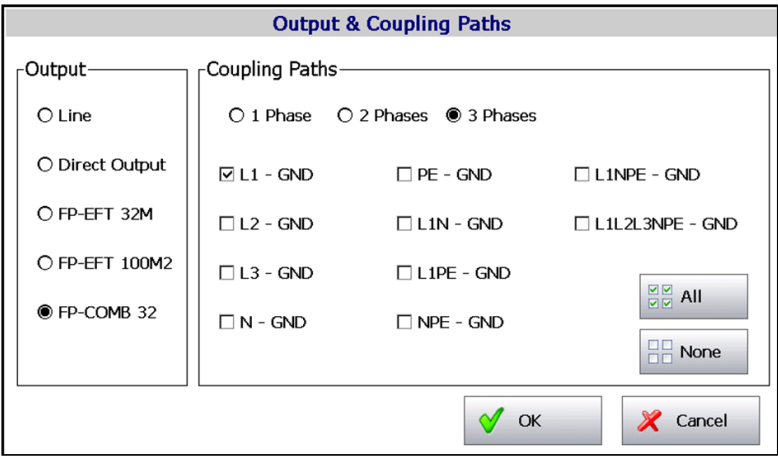


Figure 7-1: Burst Coupling paths

The following table describes the available coupling paths regarding the amount of selected phases in the “Output & Coupling Paths” menu.

Phases	Coupling Path		Coupling Capacitor	Synchronization	
				HIGH	COM
1 Phase	L1		33 nF	L1	GND
	N		33 nF	L1	GND
	PE		33 nF	L1	GND
	L1+N		33 nF	L1	GND
	L1+PE		33 nF	L1	GND
	N+PE		33 nF	L1	GND
	L1+N+PE		33 nF	L1	GND
2 Phases	L1		33 nF	L1	GND
	L2		33 nF	L2	GND
	N		33 nF	L1	GND
	PE		33 nF	L1	GND
	L1+N		33 nF	L1	GND
	L1+PE		33 nF	L1	GND
	N+PE		33 nF	L1	GND
	L1+N+PE		33 nF	L1	GND
3 Phases	L1		33 nF	L1	GND
	L2		33 nF	L2	GND
	L3		33 nF	L3	GND
	N		33 nF	L1	GND
	PE		33 nF	L1	GND
	L1+N		33 nF	L1	GND
	L1+PE		33 nF	L1	GND
	N+PE		33 nF	L1	GND
	L1+N+PE		33 nF	L1	GND
	L1+L2+L3+N+PE		33 nF	L1	GND

Table 7-1: Burst Coupling paths

Note: For DC applications user should select the radio button “1 phase”.

## 7.2.2 Properties menu

The next window shows the property window of the Burst waveform. Detailed description of each parameter can be read in the Table 7-2: BURST properties description .

Figure 7-2: BURST properties

Position	Description
External (Pin11 on Aux)	External condition (e.g. device or PLC signal), the position becomes 1 and causes an action (Ignore, Alarm, Test Stop or test stop & line off)
Line Current	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Action: Ignore, Alarm, Test stop, Test stop & line off	Due to EUT fails, AXOS <sup>8</sup> causes an action which can be: Ignore, Alarm, Test Stop. “Test stop & line off” is not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Turn Line off	Not available as long as FP-COMB 32 is selected in the “Output & Coupling Paths” menu.
Sound	Acoustic signal when test ends

Table 7-2: BURST properties description

After selection has been finished, the button “OK” must be confirmed and setting gets applied to the Burst generator.

### **7.2.3 Line Synchronization AC**

To synchronize the Burst/EFT signal with the main supply source it is necessary to adjust in the menu “Synchronization” and then “External Sync”. FP-COMB 32’s sync output has to be connected to AXOS’ sync input using the BNC cable delivered in the accessory kit. Further adjustments of the angle can be done in a range from 0° to 359°. However, if no power supply is connected to the EUT input at the rear view, it has to be entered “Async.”, otherwise it is impossible to get an impulse of AXOS.

### **7.2.4 Phase order detection**

In the “Output & Coupling paths” menu can be selected for each IEC and ANSI mode if one, two or three phases are used to power the EUT.

- For one or two phases application, no error message is displayed if the phases are swapped.
- If the three-phase mode is selected FP-COMB 32 checks if the phases are connected in the right order and displays an error message if two phases are swapped. If this is the case swap any two phases at the “EUT supply input” on the rear panel and restart the test.
- For DC applications user should select the radio button “1 phase”.

# 8 Troubleshooting

## 8.1 General

### 8.1.1 Introduction

This chapter describes the most common problems and describes how to remedy them. If you have difficulties in day-to-day work, check the common error messages in the next chapters. In case the malfunction can not be found there, please contact us. You should have the following information ready when you call:

- Model Number
- Serial Number
- Software version and options installed.

Measurement data and / or print screen will be of tremendous help for locating and solving problems.

## 8.2 Error Messages

In the menu is a short summary of specific possible alarm messages which can occur when operating the FP-COMB 32.

## 8.3 Troubleshooting

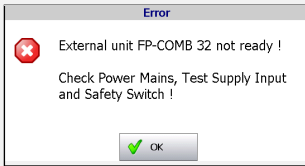
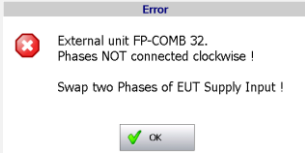
Alarm message	Possible cause	Action needed
	FP-COMB 32 is switched off Safety switch is open	Power FP-COMB 32 on Check safety switch
	Start test with wrong phase order	Swap two phases at the EUT supply input

Table 8-1: Error messages

For other messages please refer to the AXOS manual.

# 9 Service, Maintenance and Contact Information

HAEFELY has a worldwide network of representatives and local service points providing a wide range of services way beyond standard customer support for sales and after-sales inquiries.

Highly skilled and experienced customer support teams guarantee you seamless worldwide service for all our products. Their high level of knowledge is reinforced by continuous, comprehensive product and service training sessions in collaboration with the respective development and production areas as well as our quality management team. In addition to general hotline services, product application training, engineering consulting, assistance with spare parts, repairs and periodical maintenance, there is a wide range of calibration and upgrade services available for our customers all over the world.

## 9.1 Verification

In the next under captures are descriptions of our additional verification equipment for AXOS and FP-COMB 32. If further information required of any of the equipment, please either contact your sales representatives or the HAEFELY TEST AG technical support team directly.

### 9.1.1 Waveform OCV (Surge)

The HAEFELY PDP8000 is a differential impulse measurement probe that can be used to measure surge pulses. Two banana plug cables are provided as the High and Common inputs to the PDP8000, and a coaxial output is provided for connection to an oscilloscope. The divider ratio is 1000:1 and the PDP8000 is rated up to 8kV for surge, 690VAC or 400VDC. The two banana plug will be directly connected to “direct” or “line” output in the front view.



Figure 9-1: PDP 8000

### 9.1.2 Waveform SCC (Surge)

The current transformer is necessary to verify the SCC waveform. The outgoing BNC output creates the connection to the oscilloscope. The SCC gets displayed on the oscilloscope. It represents the signal in accordance to the IEC 61000- 4-5. Significant: Do not connect the “EUT Supply Input” with external power supply at the rear view, when using the current transformer. It can be directly purchased through the HAEFELY TEST AG or contact your sales representative.



Figure 9-2: Current transformer

### 9.1.3 Electrical fast transient/Burst

The HAEFELY EFT Verification Kit includes a 50  $\Omega$  and 1000  $\Omega$  attenuator as required in the IEC 61000-4-4 standard. The appropriate attenuator is fitted to the “Burst” coaxial output, and an oscilloscope is then connected to the output of the attenuator. For measuring the waveform at the output of the coupling filter, single phase and three phase adapters are available. NOTE: Be sure to disconnect mains power from the “EUT Supply Input” before connecting the measuring attenuators. Measuring attenuators are designed for burst voltages only and will be destroyed if subjected to AC/DC voltage.



Figure 9-3: EFT Verification Kit



### 9.1.4 Burst verification adapter

Additionally, an EFT verification adapter is available for testing of every single phase (L, N, PE front view from AXOS8). It gets connected with the PE pin and every single phase (L1, L2, L3, N, PE Figure 5-1). The BNC output of the burst adapter is then connected to the oscilloscope. Do not connect "EUT Supply Input" to power supply, when verification of burst output.

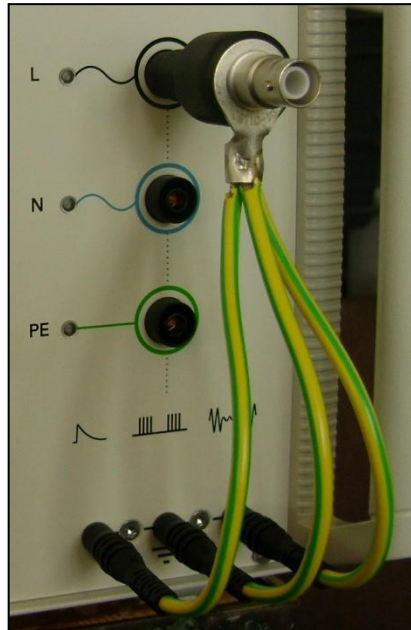


Figure 9-4: Burst verification adapter

## 9.2 Warranty Information

### 9.2.1 Guarantee period

The guarantee period is 24 months. It starts when the supplies leave the works or at the taking-over of the supplies and services should such taking-over have been agreed upon before, or, if the supplier undertakes the erection, upon completion thereof. If dispatch or taking-over or erection are delayed due to reasons beyond supplier's control, the guarantee period shall end not later than 18 months after supplier's notification that the supplies are ready for dispatch.

For replaced or repaired parts the guarantee period starts anew and lasts 6 months after replacement or completion of the repair or taking-over, but not longer than the expiry of a period being double to the guarantee period stipulated in the preceding paragraph.

The guarantee expires prematurely if the customer or a third party undertakes inappropriate modifications or repairs or if the customer, in case of a defect, does not immediately take all appropriate steps to mitigate the damage and give the supplier the possibility of remedying such defect.

### **9.2.2 Liability for defects in material, design and workmanship**

Upon written request of the customer, the supplier undertakes at its choice to repair or replace as quickly as possible any parts of the supplies which, before the expiry of the guarantee period, are proved to be defective due to bad material, faulty design or poor workmanship. Replaced parts shall become supplier's property. The supplier shall bear the costs of remedying the defective parts in its works. If the repair cannot be carried out in supplier's works, the customer shall bear the related costs to the extent exceeding the customary costs of transport, personnel, travelling, living, dismantling.

## **9.3 Maintenance**

Proper maintenance of your test equipment is crucial to its continued operation and can prevent malfunctions from bringing your production to a halt.

### **9.3.1 Cleaning the Instrument**

The instrument should be cleaned with a lint free cloth, slightly moistened using mild household cleanser, alcohol or spirits. Caustic cleansers and solvents (Trio, Chlorothene, etc.) should definitely be avoided. In particular, the protective glass of the display should be cleaned from time to time with a soft, moist cloth such as used by opticians.

## **9.4 Calibration**

When delivered new from the factory, the instrument is calibrated in accordance with the calibration report provided. A periodical calibration of the instrument every two years is recommended.

If you are experiencing any trouble with your equipment or are in need of calibration we can determine if someone should come onsite to your facility.

Calibration period of the FP-COMB 32 has to be determined by the user, and depends on the intensity of use and end user requirements. However, it is recommended every 2 years. The FP-COMB 32 is factory calibrated before shipped and supplied with the calibration certificate in accordance to ISO 9001 management standard. If required do contact HAEFELY for calibration in accordance to ISO 17025. It is done by one of the international calibration organizations.

## 9.5 Spare Parts

Basically, only original replacement parts can be used. HAEFELY can obtain original or equivalent replacement parts. For an efficient work, the customer support needs the following system specific information:

- Project number of the system
- Client's name
- System name plate information of the main components, which contain the replaceable part
- Detailed description of the component that has to be replaced, if possible with picture

## 9.6 Repair (RMA)

If you are experiencing any trouble with your equipment we can determine if someone should come onsite to your facility for further evaluation and repair or if the equipment should be sent to our factory.

Please note that any equipment that is being sent to the factory for evaluation, repair and or calibration, must have an **RMA (Return Material Authorization)** Number. Please download our easy to use RMA Form by simply clicking the blue RMA Request Form button on the right hand side of this page.

# 9.7 Support

## Software Updates

HAEFELY runs an Internet Update webpage where owners of our test instruments can download the latest firmware, software, manuals, related information etc.

The HAEFELY update page can be reached after log in:

<http://www.haefely.com/>

## Technical Support

If persistent problems or faulty operation should occur, please contact the Customer Support Department of HAEFELY or your local agent. The Customer Support Department can be reached at the following address found in chapter 9.8



We prefer contact via email. Then the case is documented and traceable.  
Also the time zone problems and occupied telephones do not occur.



Complete information describing the problem clearly helps us to help you:  
Failure description  
Used settings  
DUT type  
Firmware Version  
Serial Number  
MAC address  
Printouts, Pictures, ...

## 9.8 Addresses / Webpage


### 9.8.1 Europe Office

Haefely AG	
Birsstrasse 300   4052 Basel   Switzerland	
Phone	+ 41 61 373 4111
Fax	+ 41 61 373 4912
Sales E-Mail	<a href="mailto:sales@haefely.com">sales@haefely.com</a>   <a href="mailto:sales@tettex.com">sales@tettex.com</a>   <a href="mailto:emc-sales@haefely.com">emc-sales@haefely.com</a>
Service Phone	+41 61 373 4444
Service E-Mail	<a href="mailto:emc-support@haefely.com">emc-support@haefely.com</a>

### 9.8.2 China Office

Haefely AG Representative Beijing Office	
8-1-602, Fortune Street   No. 67, Chaoyang Road, Chaoyang District   Beijing, China 100025	
Phone	+ 86 10 8578 8099
Fax	+ 86 10 8578 9908
Sales E-Mail	<a href="mailto:sales@haefely.com.cn">sales@haefely.com.cn</a>

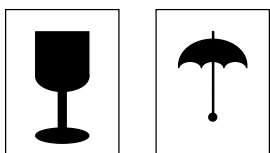
### 9.8.3 Webpage

Main Page	<a href="http://www.haefely.com">http://www.haefely.com</a>
Update Page	<a href="http://www.haefely.com">http://www.haefely.com</a>  Login (Log in required)

# 10 Transport and Storage

## 10.1 Transport and Packaging

The packing of the equipment provides satisfactory protection for normal transport conditions. Nevertheless, care should be taken when transporting the equipment. If return of the equipment is necessary, and the original packing crate is no longer available, then packing of an equivalent standard or better should be used.



Whenever possible protect the equipment from mechanical damage during transport with padding. Mark the container with the pictogram symbols „Fragile“ and „Protect from moisture“.

## 10.2 Storage

If the instrument is to remain unused for any length of time, it is recommended to unplug the mains lead. In addition, it is advisable to protect this high precision instrument from moisture and accumulation of dust and dirt with a suitable covering.

# 11 Disposal, Recycling and Onward Transfers

When the equipment reaches the end of its working life it can, if required, be disassembled and recycled. No special instructions are necessary for dismantling.

The instrument is constructed of metal parts (mostly aluminium) and synthetic materials. It might contain batteries (see the product specification). The various component parts can be separated and recycled or disposed of in accordance with the associated local rules and regulations.

# 12 Conformity



## Declaration of Conformity

Haefely AG  
Birsstrasse 300  
4052 Basel  
Switzerland

declares, under its sole responsibility, that the product here mentioned, complies with the requirements of the listed standards or other normative documents.

So, the product complies with the requirements of the EMC Directive 2014/30/EU, the Low Voltage Directive 2014/35/EU and the RoHS Directive 2011/65/EU.


Product: External 3 phases CDN – FP-COMB32

Description: The FP-COMB32 CDN is used to test 3 phases-powered EUT by coupling burst, surge and ringwave impulses from AXOS5 or AXOS8.

Standards: EN 61010-1:2010  
EN 61326-1:2013

Dr. Rolf Schmerling  
Quality Department Manager  
Haefely AG  
4052 Basel  
Switzerland

Basel, October 8<sup>th</sup>, 2019

  
(Signature)





# 13 Notes





## Global Presence

### Europe

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Current and voltage – our passion

