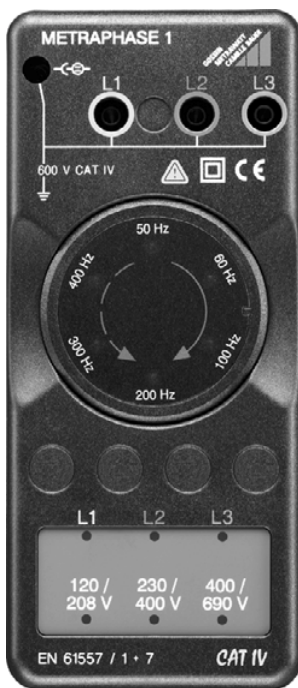


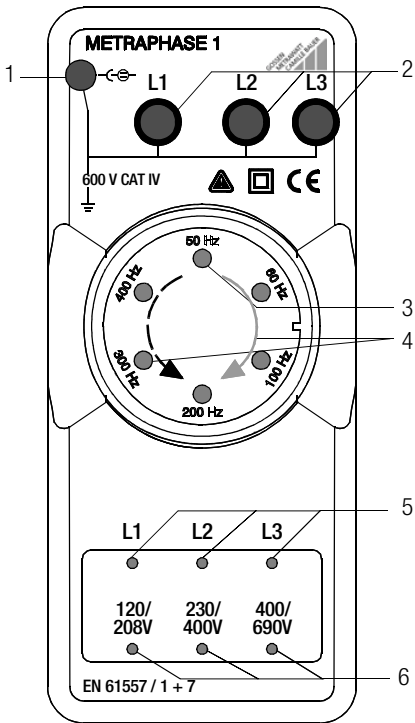
# METRAPHASE 1

## Phase Sequence Indicator

3-348-991-37

6/1.02





- (1) Connector socket for AC adapter
- (2) Connector sockets for phases L1 ... L3
- (3) **Rotation LEDs** for frequency display and direction of phase rotation
- (4) **Direction of Phase Rotation and Frequency**  
**Green arrow:** clockwise rotation;  
indicates correct phase sequence  
Illuminated green LEDs rotate clockwise.  
**Frequency:**  
Indicated by brief, red illumination of corresp. LED.  
**Dashed red arrow:** counterclockwise rotation;  
indicates incorrect phase sequence  
Illuminated red LEDs rotate counterclockwise.  
**Frequency:**  
Indicated by brief, green illumination of corresponding LED.
- (5) **Phase LEDs**, indicate voltage at L1 ... L3
- (6) **Voltage value LEDs**, indicate value of line-to-line voltage

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## 1 Safety Precautions

### General

The phase sequence indicator has been manufactured and tested in accordance with safety regulations IEC 61010-1 / DIN EN 61010-1 / VDE 0411-1. When used for its intended purpose, safety of the operator, as well as that of the instrument, is assured. Their safety is however not guaranteed if the instrument is used improperly or handled carelessly.

In order to maintain flawless technical safety conditions, and to assure safe use, it is imperative that you **read the operating instructions thoroughly and carefully before placing your instrument into service, and that you follow all instructions contained therein.**

### Repair and Parts Replacement

When the instrument is opened, voltage conducting parts may be exposed. The instrument must be disconnected from the measuring circuit or the device under test before maintenance or the replacement of parts.

### Fused Leads

This instrument is supplied with a set of fused leads rated Cat III 600 V. It is essential that fuses are replaced with those of the correct category/rating which is: 500 mA, 660 V with a 50 kA breaking capacity, fast acting ceramic.

The following safety precautions must be observed:

- The instrument may only be operated by persons who are capable of recognizing contact hazards and taking the appropriate safety precautions. Contact hazards exist anywhere, where voltages of greater than 30 V r.m.s. may occur.
- Avoid working alone when taking measurements which involve contact hazards. Be certain that a second person is present.
- Make certain that the measurement cables are in flawless condition, and that they do not suffer from damage to the conductors or their insulation. This applies to test probes and alligator clips as well.
- No measurements may be made with this instrument in electrical circuits with corona discharge (high-voltage).
- Measurements under moist ambient conditions are not permitted, nor are their results reliable.
- Use either the recommended batteries or the NA4/500 mains power pack.
- The instrument is not a voltmeter in the usual sense of the word: it only reads out voltages within the indicated ranges.

### Errors and Extraordinary Strains

If it may be assumed that the instrument can no longer be operated safely, it must be removed from service and secured against further use.

Safe operation can no longer be relied upon,

- if the instrument demonstrates visible damage,
- if the instrument no longer functions.

### Meanings of Symbols on the instrument



Warning concerning a point of danger  
(Attention: observe documentation)



Earth



Continuous, double or reinforced  
insulation



Indicates EU conformity

**CAT IV** The **maximum allowable voltage** between any given connector jack (1)/(2) and earth is equal to **600 V, category IV**.

## 2 General Description

The instrument provides for the following measurement and test functions:

- Phase sequence indicator
- Voltage display
- Frequency display

## 3 Initial Start-Up

### Batteries

The phase sequence indicator is delivered with 4 mignon cells installed and is ready for use. Before initial start-up, please refer to chapter 6.1 “Batteries”.

### Battery Test

If none of the LEDs light up after a voltage has been applied, or if they are only faintly illuminated, the batteries must be replaced.

### Mains Power Pack (accessory)

The instrument may also be powered with the mains power pack which is available as an accessory. The batteries need not be removed. The required supply voltage is matched to the mains voltage in the country of use. The mains power pack is suited for continuous operation. It generates a voltage of approximately 4.5 V with a maximum loading capacity of 600 mA. The molded plug at the mains adapter can be plugged directly into the mains outlet, into a splitting box or into the outlet at an extension cable. The miniature plug at the end of the power cable, which is also permanently connected to the power pack, is plugged into the appropriate socket (1) at the phase sequence indicator. Only the NA4/500 mains power pack may be connected to the instrument. The use of other power packs may result in electrical shock because these may not have been designed as 600 V CAT IV devices. No guarantee claims will be accepted if any mains power pack other than the NA4/500 is used.

### Automatic Activation

The instrument is activated automatically as soon as a voltage of at least 100 V is applied to any 2 measurement sockets.

### Automatic Shut-Down

The instrument is shut down automatically when zero voltage is applied in order to extend battery service life.

## 4 Operation

### 4.1 Voltage Display

Voltage is displayed by means of 3 red LEDs (6), each of which indicates a different nominal line voltage. The highest voltage which occurs between two phases is always displayed. Voltage is displayed for the following nominal values: 120 V/208 V, 230 V/400 V und 400 V/690 V.

#### Missing or Non-Connected Phase

If one of the phases has not been connected to the phase sequence indicator, or if one phase has not been wired, its potential at artificial neutral is too small and the corresponding phase LED does not light up. However, the voltage value LED which corresponds to line-to-line voltage is illuminated.

**Exception:** If no phase has been connected to terminal L1, the voltage value LED displays the next lowest voltage because the instrument is no longer provided with an internal reference point.



#### Attention!

The L1 jack at the METRAPHASE 1 must always be contacted first, in order to avoid erroneous measurements.

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### 4.2 3-Pole Connection

#### Symmetrical Clockwise Rotation

When a symmetrical, clockwise phase sequence is measured, phase LEDs L1, L2 and L3 are continuously illuminated and a green point of light (rotation LED) rotates around the display dial in the clockwise direction (at approx. 30 RPM).

#### Symmetrical Counterclockwise Rotation

Phase LEDs L1, L2 and L3 are also continuously illuminated for a symmetrical, counterclockwise phase sequence, but the color and the direction of the rotating point of light are changed: it rotates in the counterclockwise direction and is illuminated red.

#### Frequency Display

The appropriate frequency LED lights up briefly in red for a clockwise phase sequence at the moment the rotating point of light passes the corresponding position. The frequency LED lights up green for a counterclockwise phase sequence.

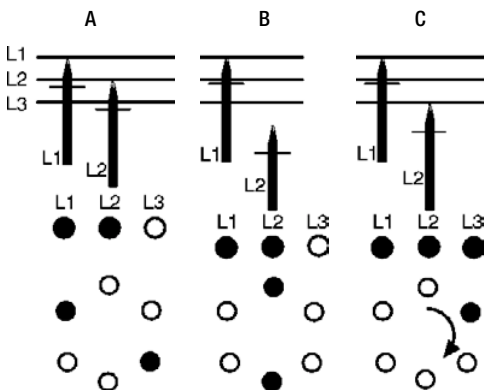
#### Devices Connected to N or PE

If one of the devices has been connected to N or PE with an asymmetrical phase sequence the phase LED for the incorrectly connected phase does not light up. Phase sequence direction is indicated in the same way as it is for symmetrical clockwise or counterclockwise phase sequences.

#### Wiring Incorrect

If wiring is incorrect, e.g. 2 x L1, ambiguous displays are likely to occur.

### 4.3 2-Pole Connection



The phase sequence indicator also allows for the determination of phase sequence direction with only 2 connector cables, as long as a line frequency of 50 or 60 Hz prevails:

- First connect terminal L1 to phase L1, and terminal L2 to phase L2 (see figure A). Phase LEDs L1 and L2, as well as the corresponding voltage value LED, light up red. The two LEDs for 100 and 400 Hz are also illuminated, which indicates that the instrument has synchronized itself to phases L1 and L2.
- Disconnect phase L2 from terminal L2 (see figure B). The two LEDs for 50 and 200 Hz light up during this intermediate stage.
- Now connect phase L3 to terminal L2 (see figure C). Phase LEDs L1 and L3 light up red. L2 is generated internally. Phase sequence direction and line voltage value are displayed.



#### Note!

Approximately 2 seconds are allowed for changing over from L2 to L3. If this time period is exceeded, the instrument is no longer able to maintain synchronization with the electrical system. This error is indicated by means of simultaneous illumination of the LEDs for 60, 100, 300 and 400 Hz. The LEDs for 100 and 400 Hz are then illuminated in order to indicate that 2-pole measurement has been resumed. The same display occurs if phase L2 is inadvertently reconnected instead of changing to phase L3.

## 5 Characteristic Values, Phase Sequence Indicator

### Line Frequency

Nominal Frequency	Display Range	Tolerance Band	Display
50 Hz <sup>1)</sup>	49.4 ... 50.7 Hz	49.2 ... 50.9 Hz	<b>50 Hz LED is active</b>
—	51.1 ... 57.9 Hz	50.9 ... 58.1 Hz	50 Hz and 60 Hz LEDs are active
60 Hz	58.3 ... 61.0 Hz	58.1 ... 61.2 Hz	<b>60 Hz LED is active</b>
—	61.4 ... 97.3 Hz	61.2 ... 97.5 Hz	60 Hz and 100 Hz LEDs are active
100 Hz	97.7 ... 102.8 Hz	97.5 ... 103 Hz	<b>100 Hz LED is active</b>
—	103.2 ... 195 Hz	103 ... 195.2 Hz	100 Hz and 200 Hz LEDs are active
200 Hz	195.4 ... 205.6 Hz	195.2 ... 205.8 Hz	<b>200 Hz LED is active</b>
—	206 ... 298.6 Hz	205.8 ... 298.8 Hz	200 Hz and 300 Hz LEDs are active
300 Hz	299 ... 303.4 Hz	298.8 ... 303.6 Hz	<b>300 Hz LED is active</b>
—	303.8 ... 395.3 Hz	303.6 ... 395.5 Hz	300 Hz and 400 Hz LEDs are active
400 Hz <sup>1)</sup>	395.7 ... 405.8 Hz	395.5 ... 406 Hz	<b>400 Hz LED is active</b>

<sup>1)</sup> < 50 Hz/> 400 Hz: both LEDs active

Total frequency range 15 ... 410 Hz

Total line voltage 100 ... 690 V

### 3 Phase ~Line Voltage

Nominal Line Voltage LED Display	Display Range L-L Voltage	Corresponding L-N Voltage
120/208V	180 ... 300 V	104 ... 173 V
230/400V	360 ... 470 V	208 ... 271 V
400/690V	530 ... 800 V	306 ... 462 V

### Phase Sequence Direction

Phase Direction	Phase Sequence	Display at Phase LEDs	Display at Rotation LEDs
<b>Clockwise</b>	<b>L1 - L2 - L3</b>	<b>L1 L2 L3 light up</b>	<b>green LED rotates in clockwise direction</b>
Counter-clockwise	L3 - L2 - L1	L1 L2 L3 light up	red LED rotates in counterclockwise direction
Asymmetrical	Lx - N/PE - Lx	connection with N/PE not indicated	green or red LED rotates clockwise or counterclockwise depending upon connection
Phase Missing	Lx - X - Lx	missing phase does not light up, the other 2 do light up	—



## Reference Conditions

Ambient Temperature	+23 °C ±2 K
Relative Humidity	45 ... 55 %
Battery Voltage	4.5 V ±0.25 V
Power Pack Voltage	4.5 V ±0.2 V
Line Voltage	230/400 V ±0.5 %
Line Frequency	50 Hz ±0.1 Hz
Line Voltage Waveshape	sine, deviation between effective and rectified value < 1 %

## Ambient Conditions

Storage Temperature	-25 °C ... +75 °C
Operating Temperature	-10 °C ... +50 °C
Relative Humidity	max. 75%, no condensation
Altitude	to 2000 m

## Power Supply

Battery	4 mignon cells, alkaline- manganese per IEC LR6 (4 x AA-Size) Or 4 mignon cells, zinc-carbon per IEC R6
Battery Voltage	4 V ... 6 V
Battery Service Life	approx. 100 hours with alkaline-manganese cells
Mains Power Pack (accessory)	NA4/500

## Electrical Safety

Protection Class	II per IEC 61010-1
Overvoltage Category	IV
Operating Voltage	600 V
Contamination Level	2
Test Voltage	5.55 kV

## Electromagnetic Compatibility

Interference Emission	IEC 61326-1
Interference Immunity	IEC 61326/A1

## Mechanical Design

Protection	housing: IP40, sockets: IP20 per DIN VDE 0470 Part 1/ EN 60529
Dimensions	84 mm x 195 mm x 35 mm
Weight	approx. 0.3 kg with batteries, without protective rubber cover

## 6 Maintenance

### 6.1 Batteries

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#### **Attention!**

Disconnect the instrument from the measuring circuit before opening to replace batteries.

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Before initial start-up and after any period of storage, make certain that no battery leakage has occurred. Inspect for battery leakage at regular intervals as well.

If battery leakage has occurred, the electrolyte from the batteries must be carefully and completely removed with a damp cloth, and the batteries must be replaced before the instrument is placed back into service.

If none of the LEDs light up after a voltage has been applied, or if they are only faintly illuminated, the batteries must be replaced.

The instrument requires four 1.5 V batteries in accordance with IEC or equivalent rechargeable batteries.

#### **Replacing the Batteries**

Lay the instrument onto its face, loosen both of the screws at the rear panel and lift out the housing base starting at the side at which the screws are located. The housing base and housing top are fastened together by means of snap hooks at the other side.

Replace the batteries in the battery holder with 4 new batteries.

Replace the housing base starting at the side with the snap hooks and make certain that they are properly engaged.

Refasten the housing base with the two screws.

Please dispose of depleted batteries in an environmentally sound fashion, for example at an appropriate collection depot.



#### **Note!**

The phase sequence indicator is not equipped with any fuses!

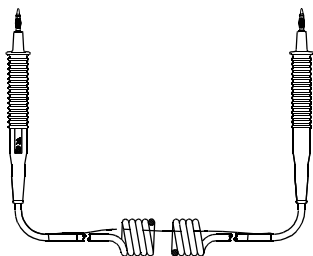
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### 6.2 Housing

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

## 7 Accessories (not included as standard equipment)

### METRASTART 1 (article no. M620B)



The meter start-up tester – double insulated coil cable with 2 test probes – generates a resistive load of  $705 \Omega$  which loads the energy meter with approximately 75 W at a line voltage of 230 V. Overload capacity: 440 V, 5 s.

We recommend the following operating sequence in order to avoid overheating of the measurement cable:

5 s measuring, 1 s pause,  
5 s measuring, 1 s pause,  
5 s measuring, 2 s pause;

This measuring sequence can be repeated 10 times and should then be followed by a one hour pause. The measurement cycle can then be started again from the beginning.

### Variable Plug Adapter Set (article no. Z500A)



Three self-retaining, contact-protected test probes for the connection of measurement cables with 4 mm banana plugs or with contact-protected plugs for 3.5 to 12 mm outlets, e.g. CEE outlets, Perilex outlets etc.

For example, the test probes fit into the square PE sockets at Perilex outlets. Maximum allowable operating voltage: 600 V per IEC 61 010.

### NA4/500 Mains Power Pack (article no. Z218A)

Installed Load                      230 V~/4.5 V, 600 mA

The mains adapter is designed for continuous operation and generates a minimal amount of heat. Make certain that the mains power pack is not covered in order to ensure effective convection cooling. Protect against moisture.

Country	Article No.
Germany	Z218A
North America	Z218C
Great Britain	Z218D

## **8 Repair and Replacement Parts Service DKD Calibration Lab and Rental Instrument Service**

When you need service, please contact:

GOSSEN-METRAWATT GMBH  
Service-Center  
Thomas-Mann-Strasse 20  
90471 Nuremberg, Germany  
Phone +49 911 86 02 - 410 / 256  
Fax +49 911 86 02 - 2 53  
e-mail [service@gmc-instruments.com](mailto:service@gmc-instruments.com)

This address is for Germany only. Abroad, our representatives or establishments are at your disposal.

## **9 Product Support**

When you need support, please contact:

GOSSEN-METRAWATT GMBH  
Product Support Hotline  
Phone +49 911 86 02 - 112  
Fax +49 911 86 02 - 709  
e-mail [vmp.info@gmc-instruments.com](mailto:vmp.info@gmc-instruments.com)

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