HIGH VOLTAGE INSTRUMENTS LTD

T&R Test (Holdings) Ltd. Company

OPERATING AND MAINTENANCE MANUAL

Product: ***High Voltage Phase Comparators***

Type: ***E45 series***

MANUFACTURED BY:

High Voltage Instruments Ltd.

15-16 Woodbridge Meadows, Guildford, Surrey, GU1 1BJ, United Kingdom
Telephone: 01483 207428
email: sales@hvil.com

HVOM0009-G1

CONTENTS

HIGH VOLTAGE INSTRUMENTS LTD
T&R Test (Holdings) Ltd. Company

1	**SAFETY RULES**	**5**
2	**GENERAL DESCRIPTION**	**7**
2.1	GENERAL	7
2.2	PRINCIPLE OF OPERATION	7
2.3	PROVING	8
2.4	LIMIT MARK	8
2.5	LABELS	8
3	**RANGE OF MODELS**	**11**
3.1		11
4	**INSTRUCTIONS FOR USE**	**12**
4.1	PREPARATION	12
4.2	PROVING	12
4.3	OPERATION	12
5	**SPECIFICATIONS**	**14**
5.1	ELECTRIOCAL	14
5.2	MECHANICAL	17
5.3	ENVIROMENTAL	19
6	**CARE AND MAINTENANCE**	**20**
6.1	STORAGE	20
6.2	TRANSPORTING	20

6.3	CLEANLINESS	20
6.4	MECHANICAL DAMAGE	20
6.5	RECALIBRATION AND PROOF TESTING	20
6.6		21
7	**SPARES AND ACCESSORIES**	**22**
8	**LIMITED WARRANTY**	**23**
9.	**REVISION**	**25**

1 SAFETY RULES

1.1 Only personnel who are fully trained in the use of High Voltage Phase Comparators should use this equipment. The systems that it will be used on are powered from high voltages which can be lethal.

1.2 Before use ensure that the Phase Comparator and any accessories that are required for use are clean, free from cracks or deep scores, and are properly secured together.

1.3 Make certain that the Phase Comparator is properly rated for the voltage of the system under test..

1.4 Test the operation of the assembled Phase Comparator complete with accessories before and after each test (refer Section 4).

1.5 Do not allow any part of the Phase Comparator except the contact electrode to come in contract with energised or earthed items as this may affect results.

1.6 The Phase Comparator must never be used without its own handles.

1.7 Safe working distances must always be observed.

1.8 The Phase Comparator is to be handled by one person only.

1.9 Do not insert the Phase Comparator beyond its limit mark into the apparatus under test.

1.10 The Phase Comparator should not be used as a synchronising device or as a voltage detector.

1.11 The interconnecting lead/ cord must not be allowed to come within 100mm of the hand- guard.

REMEMBER

SAFETY IS NO ACCIDENT!

THIS TESTER SHOULD ONLY BE USED BY A COMPETENT,

SUITABLY TRAINED PERSON.

2 GENERAL DESCRIPTION

2.1 GENERAL

The HVIL range of High Voltage Phase Comparators have been designed to comply with the requirements of DIN VDE 0681 Part 5. They are double pole devices which are used to determine the correct phase relationship between two energised conductors at the same nominal voltage and frequency. Models are available to cover system voltages of 3.3 to 36kV 50/60 Hz. For other system voltages please consult with the factory. All models may be used indoors and outdoors in dry weather and should be operated by one person only.

2.2 PRINCIPLE OF OPERATION

A Phase Comparator is a resistive device that draws current from the source under test. It consists essentially of two inter-connected poles one of which carries an in-built indicator and each pole contains an equal value resistor chain. There are two types of indicator: the first consists of a flashing lamp with modulated buzzer and the second is an analogue meter with coloured in-phase/out-of-phase bands on the scale.

If two energised conductors are out-of-phase and a contact electrode is touched onto each, current will flow between the conductors through the resistor chain in the poles and the inter-connecting lead/cord. This will cause the lamp to flash and the buzzer to sound or the meter to show outof-phase. However, if the conductors are in-phase then no current will flow and no out-of-phase indication will be given.

Out-of-phase indication will be given for conductors whose phase angles are in range 60 to 300 degrees. However, if the phase

voltages are 15% or less than their nominal, out-of-phase indication will not be given.

2.3 PROVING

Before and after using a Phase Comparator and accessories a functional test should be performed on the assembled items.

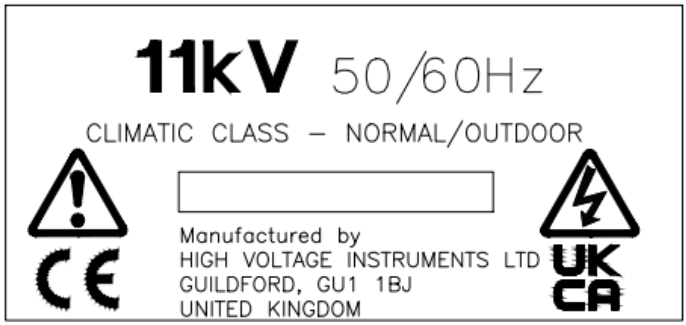
Against a known source by touching between Phase and Earth, this will give an out of Phase Indication

2.4 LIMIT MARK

At the junction of the indicator housing/coupling and the contact electrode extension, there is a red band which is the limit mark. By definition this mark indicates the physical limit to which the poles of the Phase Comparator may be inserted between live components or may touch them..

2.5 LABELS

2.5.1 Label 1 shown below is affixed to the indicator housing.



The information on it is as follows:

2.5.1.1 11kV

The Phase Comparator is designed to be used on 11kV voltage systems only. If a dual voltage was stated, eg. 11/33kV then the Phase Comparator can be used on either 11 or 33kV voltage systems.

2.5.1.2 50/60Hz

The Phase Comparator will operate over the frequency range 50 to 60Hz

2.5.1.3 CLIMATIC CLASS – NORMAL

The Phase Comparator will perform correctly over the temperature range -25°C to +55°C.

2.5.1.4 OUTDOOR

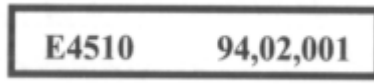
The Phase Comparator is suitable for use either indoor or outdoor in dry conditions.

2.5.1.5

Read and understand the instruction manual before using the Phase Comparator.

2.5.1.6

The Phase Comparator is designed for use on high voltage systems.



This panel carries the model number, the year and month of manufacture and serial number.

Label 2 above is affixed to the hand guard. It carries a warning that the user must keep hands and all parts of the body behind the hand guard to maintain safe working distances.

3 RANGE OF MODELS

3.1

Models are available to cover system voltages from 3.3 to 36kV 50/60Hz. The following models are covered in detail in this instruction manual. Consult the manufacturer for information on models suitable for other voltages.

Model No	System Voltage	Max. Voltage	Display Type
E4510	11kV	15kV	Lamp & Buzzer
E4530	33kV	40kV	Lamp & Buzzer
E4540	11kV	15kV	Meter
E4550	11/33kV	40kV	Meter

4 INSTRUCTIONS FOR USE

4.1 PREPARATION

Attach the bayonet fitting handles and the contact electrodes as required. Polish all plastic parts using the polymer polishing kit provided.

4.2 PROVING

All models do not require batteries and, being signal driven, do not require arming. However, it is recommended that a functional test be carried out to prove the unit is operational by touching one electrode to a Live Phase and the other to Earth an Out of Phase Indication should be obtained.

The Phase Comparator lamp and buzzer will operate or the meter pointer will move into the out-of-phase band depending on the display type.

4.3 OPERATION

To determine the correct phase relationship between two energised conductors the following procedure should be followed.

With one handle held in each hand touch one bare conductor with one contact electrode and touch earth with the other contact electrode. The lamp and buzzer will operate or the meter pointer will indicate in the red out- of- phase band depending on display type. This is repeated with the other conductor so that it is known that both conductors are energised. If, however, it is found that either conductor is de-energised then remedial action will have to be carried out before proceeding to the next stage of the test.

Now touch each bare conductor with a contact electrode. If the conductors are in-phase the lamp and buzzer will not operate or the meter pointer will indicate in the green in-phase band. However, if the conductors are out-of-phase the lamp and buzzer will operate or the meter pointer will indicate in the red out-of-phase band.

It is advisable to prove the Phase Comparator before and after each test - refer to section 4.2.

5 SPECIFICATIONS

5.1 ELECTRIOCAL

EMC Meets BS EN 50081-1

BS EN 50082-1

5.1.1 Phase Comparator

Contact Electrode Extension	11kV	11/33kV	33kV
Resistance (each pole)	3MΩ}±5%	9MΩ}±5%	9MΩ}±5%
Resistance (total)	6MΩ}±5%	18MΩ}±5%	18MΩ}±5%
Permissible Threshold	1.65 - 4.4kV	1.65 - 4.4kV	4.95 - 13.2kV
Voltage Setting Range	4.95 - 13.2kV		
Nominal Threshold Setting	3.3kV	3.3kV 9.9kV	9.9kV

Temperature Effect on Accuracy of Threshold Setting	±10% of measured value at ambient temperature

Visual Indication

Models E4510,30	Red lamp flashing at 4.5 Hz
Models E4540,50	Meter with pointer on green/red, in-phase, out-of-phase bands on scale

Audible Indication

Models E4510,30	Buzzer with 3.1kHz tone modulated at 4.5Hz>60dB/A at 1 metre
Models E4540,50	N/A

Response Time	<1 second
Spark Protection	The Phase Comparator will not be damaged as the result of spark discharge while making contact with the conductor under test
Bridging Protection	The Phase Comparator will not cause flashover or breakdown between live parts of an installation and earth
Leakage Current	Leakage current through each handle section will not exceed 0.2mA with 1.2 times the rated voltage applied to the contact electrodes
Connecting Lead	Double insulated 840mm/33'' long
Endurance	Withstands 5 consecutive tests with intervals, at 1.2 times the rated voltage without damage
Rating	The Phase Comparator may be applied continuously to the conductors under test

5.2 MECHANICAL

5.2.1 Phase Comparator

Insulation and Handle Assembly

Length	690mm/27.19''
Diameter (excluding hand guard)	32mm/3.75''
Material	PVC/Polycarbonate

Indicating Housing

Length	152mm/6''
Diameter (excluding handle and fixing socket)	96mm/3.75''
Material	ABS/Polycarbonate

Contact Electrode Extension

Length (11kV)	305mm/12''
Length (11/33 & 33kV)	605mm/23.75''
Diameter	21mm/0.81''
Material	PVC

Contact Electrode

Length	305mm/12''
Material	605mm/23.75''

Weight (less carrying bag)

Model E4510,40	1.7kg/3lbs 13oz
Model E4530,50	1.94kg/4lbs 6oz

Maximum Span

Model E4510,40	1.4m/4' 7''
Model E4530,50	1.7m/5' 7''
Grip Force	Less than 80N
Vibration Resistance	Tested in accordance with IEC 68-2-6
Drop Resistance	Tested in accordance with IEC 68-2-32
Bump	Tested in accordance with IEC 68-2-2
Impact	Tested in accordance with IEC1010 Clause 8.2
Deflection	The contact electrode must not deflect by more than 150mm when loaded at the electrode by 10N with handle clamped
Connecting Lead/Cord Strength	Each pole connection to withstand 10000 swings with 10N load applied and a vertical pull with 200N applied.

5.3 ENVIROMENTAL

Operating Temperature	-25 to +55°C / -13°F to +131°F
Operating Humidity	20 to 96% RH6

6 CARE AND MAINTENANCE

6.1 STORAGE

The Phase Comparator and its accessories should be stored in the proprietary carrying case/bag when not in use.

6.2 TRANSPORTING

When the equipment is in transit it should be stored in its carrying case/bag. Whilst the equipment has been designed for field use it should not be subjected to excessive bumps and shocks.

6.3 CLEANLINESS

Dirt can cause surface tracking and it is therefore necessary to keep the Phase Comparator and its accessories clean by washing them in mild detergent solution. All plastic parts should then be polished with the liquid polymer polish provided.

6.4 MECHANICAL DAMAGE

If surface scratches or dents can easily be seen by the naked eye, then the equipment should be returned to the manufacturer for repair since these blemishes act as traps for dirt and moisture. Mechanical damage to screw threads for example would also necessitate the return of the equipment to the manufacturer.

6.5 RECALIBRATION AND PROOF TESTING

Every twelve months the Phase Comparator and accessories should be rechecked. This should include checking the threshold level, voltage proof testing and pressure testing of the indicator housing. It is recommended that this be carried out by the manufacturer.

6.6

There are no internal user replaceable parts.

7 SPARES AND ACCESSORIES

7.1	Contact Electrode	CMH0110
7.2	Contact Electrode Extender Rod	Consult Factory
7.3	Bent End Adaptor	Consult Factory
7.4	Carrying Bag	CMP5023
7.5	Handle Assembly	DDC0203

8 LIMITED WARRANTY

High Voltage Instruments Ltd warrant instruments and test equipment manufactured by them to be free from defective material or factory workmanship and agree to repair or replace such products which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace the product, we will make a refund of the purchase price. Consult the Instruction Manual for instructions regarding the proper use and servicing of instruments and test equipment. Our obligation under this warranty is limited to repairing, replacing or making refund of any instrument or test equipment which proves to be defective within twelve months from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorised persons in any way so as, in our sole judgement, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence or accident or which have had the serial numbers altered, defaced or removed. Accessories, not of our manufacture used with this product, are not covered by this warranty. To register a claim under the provisions of this warranty, return the instrument or test equipment to

High Voltage Instruments Ltd,

15-16 Woodbridge Meadows

Guildford, GU1 1BJ, U.K.

Upon our receipt and inspection of the product we will advise you as to the disposition of your claim.

ALL WARRANTIES IMPLIED BY LAW ARE HEREBY LIMITED TO A PERIOD OF TWELVE MONTHS, AND THE PROVISIONS OF THE WARRANTY ARE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED.

The purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of the product by the purchaser, his employees, or others, and the remedies provided for in this warranty are expressly in lieu of any other liability High Voltage Instruments Ltd may have including incidental or consequential damages.

High Voltage Instruments Ltd reserve the right to discontinue models at any time, or change specification, price or design, without notice and without incurring any obligation.

9. REVISION

Product / Type:

File: HVOM0009

Author: D. Maxim

Issue / Date: G1/07.09.21

Modified By: DM

Checked By: M. Clancy	Date: 07.09.2021