KUSAM-MECO®
An ISO 9001:2008 Company

HIGH VOLTAGE MULTIFUNCTION PHASING STICK

Model - PC7K / PC11K / PC22K / PC33K / PC44K

This NEW "PC" range of High Voltge Multifunction Phasing Stick are :all - in - one,a Phase Comparator with colour code scale indication, a Voltage Detector with Neon Indication & a Scaled analog Voltmeter. They are available in five models for applications up to 44 kV systems(6.6kV,11kV, 22kV, 33kV & 44 kV). These Dual Poles instruments incorporate modern, high quality glass fibre front end,composite polyurethane main body molding to give tough and very light weight construction and superior Safety features. They have analogue Colour Coded Dual Scales and Neon indication.

They are VDE0681part 5 compliant and IEC1243 - 2. They are practical and efficient.Because of their multifunction capabilites, you do not need to buy separate instruments, you can therefore stay within your budget without compromise.

They are supplied complete with instruction manual. They are housed in a superb High quality modern Plastic Case with shock absorbing foam . They are suitable for indoor and outdoor use (in dry weather).

They do not require dismantling or re-assembling and do not have any user's assembled parts, so eliminating the risks of assembly mistake and accidents during High Voltage Work. In a breakdown situation they are lighter than any other sticks available in the market today. The indicator has been screened for high immunity to interference fields. They determine the voltage and positively identify phases up to 44kV.

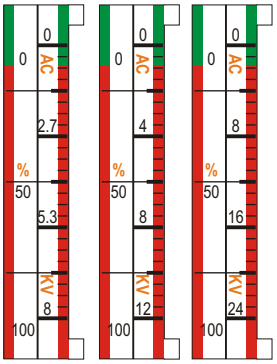
Fiberglass is of hot stick quality and tested to IEC specs(100kV / 300mm for 1min). All front end (resistors) are encapsulated. These analog Multifunction phasing Sticks are ideally suited for testing of grounded or ungrounded systems. Important applications include checking voltage fuses,testing for correct phase connections, and for absence of high voltage on de-energized lines or apparatus. The dual scale read direct(no multiplier)in kV AC or in % of full scale and colour coded(Green = in phase; Red = out of phase). A Bright neon is included on the scale for easy visibility indoor and it has dual purpose.

They are equipped with two fixed - length poles connected by a strong flexible, insulated cable.Hand guards are standard on all models. They are easy to handle, light weight,well insulated and designed to ensure maximum operator safety.

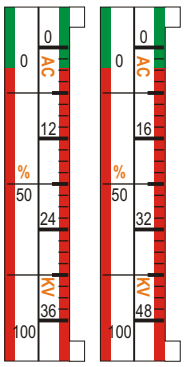
SPECIAL FEATURES:

- Dual Colour Code Scale (%,Vac).
- Measure and test Phase to Earth.
- DC version available.(Optional)
- Suitable for indoor and outdoor use.
- Light weight Robust & Compact.
- Carry Case included.
- Neon indicator lit when >1200 Vac.
- High Quality Fibreglass wound Rod.
- Measure Phase to Phase.
- Current is limited to ±1 mill - ampere.
- Designed to Exceed VDE 0681 part 5.
- Compare between Phases.
- Self powered operation - No Battery.
- High immunity to interference fields.
- Voltage colour code - O-Y-G-B-R.
- Meets IEC 61481 : 2001

SCALES



PC 7k PC 11k PC 22k



PC 33k PC 44k

SPECIFICATIONS

Electrical	PC 7K	PC 11K	PC 22K	PC 33K	PC 44K
System Voltage	6.6 kV	11 kV	22 kV	33 kV	44 kV
Full Scale Voltage	8 kV	12 kV	24 kV	36 kV	48 kV
Maximum Voltage	9 kV	15 kV	30 kV	40 kV	55 kV
Total Resistance	4.48 MΩ	6.78 MΩ	10.82 MΩ	19.68MΩ	26.8 MΩ
Response time	<1 Sec	<1 Sec	<1 Sec	<1 Sec	<1 Sec
Neon Threshold	1.2 kV	1.2 kV	1.2 kV	1.2 kV	1.2 kV
Neon Lit Fully@	1.5 kV	1.5 kV	1.5 kV	1.5 kV	1.5 kV

Mechanical	PC 7K	PC 11K	PC 22K	PC 33K	PC 44K
Length of Handle	775 mm	775 mm	775 mm	775 mm	775 mm
Length Front End	400mm	400mm	500mm	665mm	820 mm
Total length	1.175M	1.175M	1.275M	1.440M	1.595M
Total Weight	2.1Kg	2.1Kg	2.2Kg	2.4Kg	2.5Kg
Handle Material	Composite Material with Polyurethane				
Front End	Fibre Glass Wound Tubing				

ENVIRONMENTAL

Operating Temperature	-25°C to 55°C
Operating Humidity	20 to 96%RH

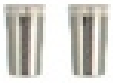
Recommended to use High Voltage gloves & insulating met for additional safety.

OPTIONAL ACCESSORIES :

Piercing Tip 40mm (Optional) TER-40mm

Piercing Tip 70mm (Optional) TER-70mm

Right Angle Adaptors It can be semi-disconnected for storage into the case. (Optional)- sold by pair PC-160



ADP-PCXXK (Optional)

TER-213 100mm TER-213 60mm TER-213 40mm (Optional)

All Specifications are subject to change without prior notice

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G-17, Bharat Industrial Estate, T. J. Road, Sewree (W), Mumbai - 400 015. INDIA.
Sales Direct.: 022 -2 4156638, **Tel. :** 022-24124540, 24181649, **Fax :** 022 - 24149659
Email : kusam_meco@vsnl.net, **Website :** www.kusamelectrical.com

KUSAM-MECO

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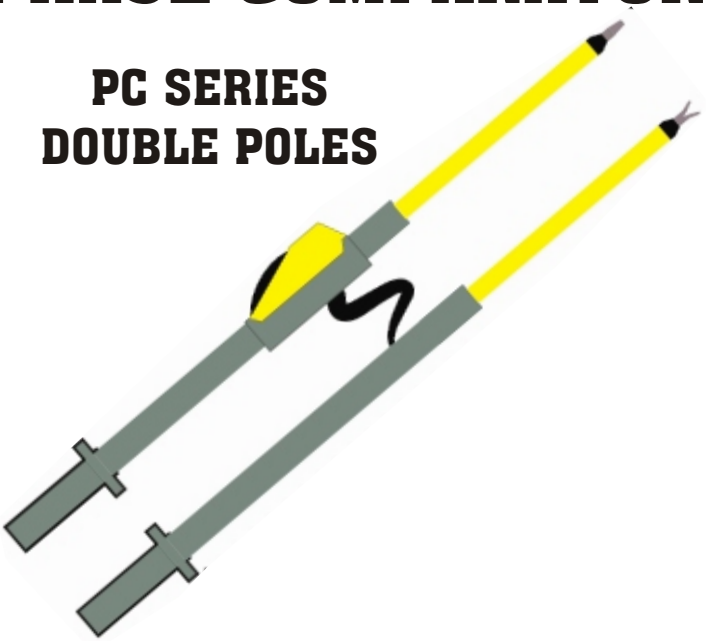
HIGH VOLTAGE PHASE COMPARATORS

PC SERIES DOUBLE POLES



Model	System Voltage	Full Scale
PC7k	6.6KV	8KV
PC11k	11KV	12KV
PC22k	22KV	24KV
PC33k	33KV	36KV
PC44k	44KV	48KV

OPERATION MANUAL

INDEX PAGE

SAFETY RULES

- Only Personnel who are fully **trained** in the use of High Voltage Phase Comparators should use this equipment.
- Be aware that the system that it will be used on are powered from high voltages which are **lethal**.
- Before use, ensure that the Phase Comparators and any accessories are **clean**, free from cracks or deep scores, and are properly secured together.
- Only the proper rated Phase Comparators must be used. Ensure that the Phase Comparator is **properly rated for the voltage** of the system under test.
- **Test** the operation of **the Phase Comparator before and after** each test.
- Do not allow any part of the Phase Comparator except the contact electrodes to come in contact with energized or earthed items.
- **Safe Working distance** must always be observed.
- **Safety** insulated **Gloves and protective clothing** and glasses must be wear when using the Phase comparator.
- The Phase Comparator must only be **handled by one person Only.**
- Do **not** insert the Phase Comparator **beyond it's limit mark** into the apparatus under test. **The Limit mark is the red band**.
- The Phase Comparator should **not be used as a synchronising Device or a voltage detector**.
- The Interconnecting **lead/cord must not** be allowed to **come within** 100mm (**10cm**) **of the** hand guard and must not be touched while testing.
- Before using the Phase Comparator in the testing of factory assembled swtichgear, the **manufacturer of the switchgear must be consulted** as the suitability of the Phase Comparator in such testing.
- **Always check for Phase Presence before testing between Phases. Ensure that voltage is present on both phases before testing between phases.**
- The Phase Comparators are not to be subjected to a constant voltage for a period longer than 1 minute in every five minutes.

GENERAL DESCRIPTION

- The range of high Voltage Phase Comparators have been designed to **comply and exceeds** the requirements of **VDE0681Part5**.
- The Phase Comparators are double poles devices which are **used to determine the correct Phase Relationship between two energized conductors of the Same nominal Voltage and Frequency**.
- Models are available to cover systems voltages from **1kV to 44kV** 50/60Hz.
- For other systems voltage, please contact the factory.
- All models may be used indoor and outdoors in **dry weather only.**

PRINCIPLE OF OPERATION

- The PC range of Phase Comparators is a resistive devise which comprise mainly of resistors, a neon and a panel meter. The Phase Comparator draw current from the circuit or source under test.
- The Phase Comparator consist of two inter-connected poles (the master pole with the panel meter and the slave pole).
- The Master pole carries the panel meter with the color coded scale and the integral neon light indicator.
- The color coded scale indicates “in-phase/out-of-phase” band on the scale. (Green = in-phase; Red=out-of-phase).
- The Neon light lit up when the voltage between the poles is greater than ±1.2kV ±1.5kV.
- If two energized conductors are out-of-phase and a contact electrode is touched onto each pole, current will flow between the conductors through the resistors (resistors are inside the fiberglass front end in each pole) in the poles and the interconnecting lead/cord. This will cause the neon to lit and the panel meter’s indicator to move into the out-of-phase area (Red).
- If two energized conductors are in-phase and a contact electrode is touched onto each pole, current will not flow between the conductors through the resistors in the poles and the interconnecting lead/cord. This should not cause the neon to lit and the panel meter’s indicator to move. The indicator will stay into the in-phase area (Green).
- **Ensure that voltage is present on both phases before testing between phases.**

PROVING THE PHASE COMPARATORS

- **Before and after** using a Phase Comparator and accessories, a functional test should be performed on the Phase Comparator as it is to be used on the source or circuit to Test.
- A **High Voltage Insulation tester can be used** for this purpose.
- When using a High Voltage Insulation tester, the Phase Comparator will indicate the voltage generated by that H.V. Insulation tester.
- Please note that H.V. Insulation testers are generating DC voltage and have polarity.
- The PC range of Phase Comparators are using a ½ bridge rectifier and current only pass one way into the panel meter. However, the neon must lit both ways.
- When proving with a DC source as with a H.V. Insulation tester, the poles must be tested for both polarity to confirm that the panel meter only show voltage in one way, but confirm that the neon indicates both polarity.
- The reading on the High Voltage Insulation tester also indicate the total value of the resistor chain and is also a good indication that the circuit is still correct and in good condition (See specifications).
- A **Proving Unit** can also be used if a High Voltage Insulation Meter is not available. The Proving unit does not indicate how many mega ohms are in the front end or if the circuit is still in good condition or not. The Proving unit only output a DC voltage of 5kVdc.

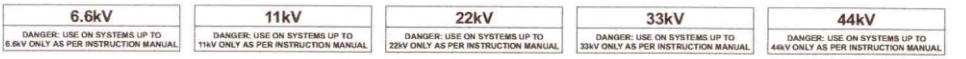
LIMIT MARK

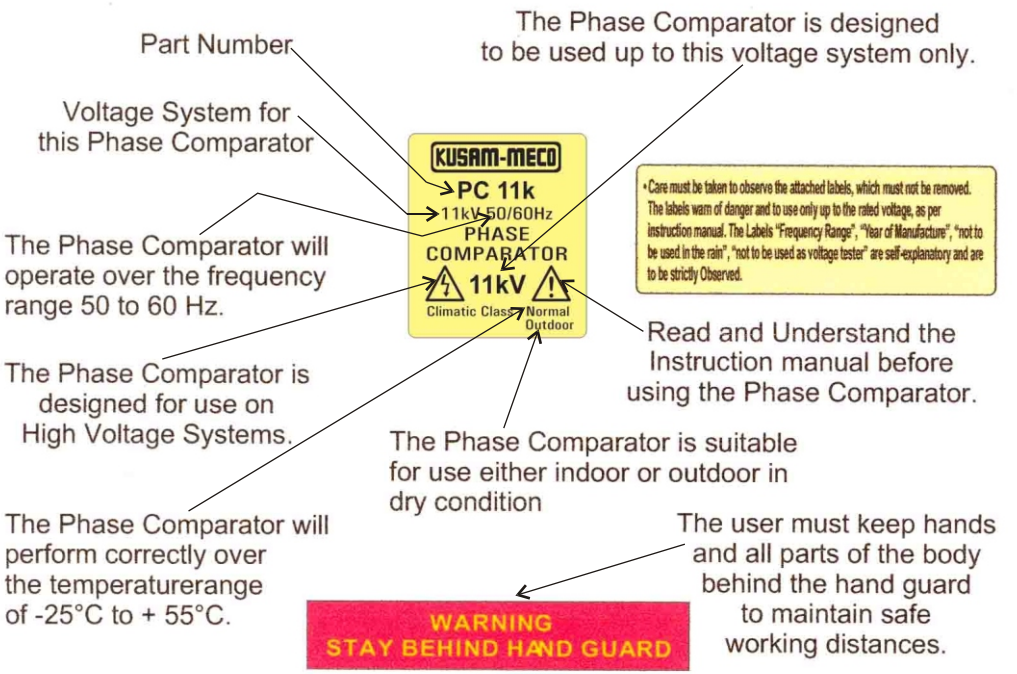
- Each Phase Comparator has two poles.
- Each pole has a front end which is in Fiberglass tubing.
- Each pole has an Handle section.
- At the junction between the handle section and the front end section, there is a **RED BAND** which **is the limit mark**.
- By definition, this mark, or the **Red Band, indicates the physical limit to which the poles of the Phase Comparators may be inserted between live components or may touch them**.

LABELS AND MARKING

- The following labels must be present on the Master Pole.

- The following labels must be present on BOTH Poles.





RANGE OF MODELS

- Models are available to cover system voltages from 1kV to 44kV @50 or 60Hz.
- Contact the factory for information on models suitable for other voltages.
- The following models are available as standard instruments:

Model N°	System Voltage Voltage	Full Scale Voltage	Maximum Voltage	Display Type
PC7k	6.6kV	8kV	9kV	Neon & Panel Meter
PC11k	11kV	12kV	15kV	Neon & Panel Meter
PC22k	22kV	24kV	30kV	Neon & Panel Meter
PC33k	33kV	36kV	40kV	Neon & Panel Meter
PC44k	44kV	48kV	55kV	Neon & Panel Meter

INSTRUCTION FOR USE

- Before using the Phase Comparator, clean the Front End (FiberGlass) with a polymer polishing.
- All models do not require batteries and are being signal driven (current taken from the source or circuit under test) and do not require arming. However, **it is recommended that a functional test be carried out using an High Voltage Insulation tester** or a proving unit.
- To prove the Phase Comparator, set the voltage on the Proving unit or on the High Voltage Insulation tester, to suit the model of Phase Comparator. Turn the test ”ON” or the proving unit “ON”. The Neon should lit (if the voltage if high enough) and the indicator should move nearest the voltage measured.
- Reverse the poles of the Phase Comparator and check that an out-of-phase indication is given.
- They are **no user serviceable parts** on our range of Phase Comparators. Should the Phase Comparator become damaged, faulty or, suspect in any form, please consult with your nearest distributor to return it to the factory.
- There must be galvanic contact between the test electrodes and the part of the installation under test and, no other part of the phase Comparator, except the electrodes, should be in contact with energized or earthed parts, in order to ensure accuracy of the display.

OPERATION

To determine the correct phase relationship between two energized conductors, the following procedure should be followed:

- First, **Check that each Phase to be compared is individually energized**.
  1. With one handle held in each hand, touch one bare conductor (first phase which will be compared later) with one contact electrode and touch the earth with the other contact electrode.
  2. The Neon will operate and the meter pointer will indicate the Red out-of-phase band indication which indicate that this phase is energized. The voltage scale will indicate the voltage phase-to-Earth or/and the percentage of the full scale.
  3. Repeat the operation 1 and 2 with the other bare conductor (the other phase to be compared later) so that it is known that both Conductors are energized.
- Now, you should know if both conductors are energized because you will have read the voltage Phase-to-Earth of both conductors.
- If both phases are not energized, then, the remedial action will have to be carried out before proceeding to the next stage of the Test.
- **Compare the Phases.**
- If both Phases are energized (after checking between Phase and Earth that they are energized) proceed to compare between the phases.
- Now touch each bare conductor (each phase to compare) with a contact Electrode.
- If the conductors (Phases) are **in-phase**, the **neon will not lit** and the **meter pointer will not operate** or the meter pointer **will stay in the Green** band.
- If the conductors (Phases) are **out-of-phase**, the **neon will lit** and the **meter pointer will operate** or the meter pointer **will go in the Red** band.

SPECIFICATIONS

Electrical

EMC	Meets BS EN 50081-1
	BS EN 50082-1
Exceeds	DIN VDE 0681Part 5
Exceeds	IEC1243-2

	PC7k	PC11k	PC22k	PC33k	Pc44k
Total Resistance	±3.95M	±6.78M	±13.5M	±20.1M	±27M
Response time	<1Sec	<1Sec	<1Sec	<1Sec	<1Sec
Neon Threshold	1.2kV	1.2kV	1.2kV	1.2kV	1.2kV
Neon Lit Fully @	1.5kV	1.5kV	1.5kV	1.5kV	1.5kV

Mechanical

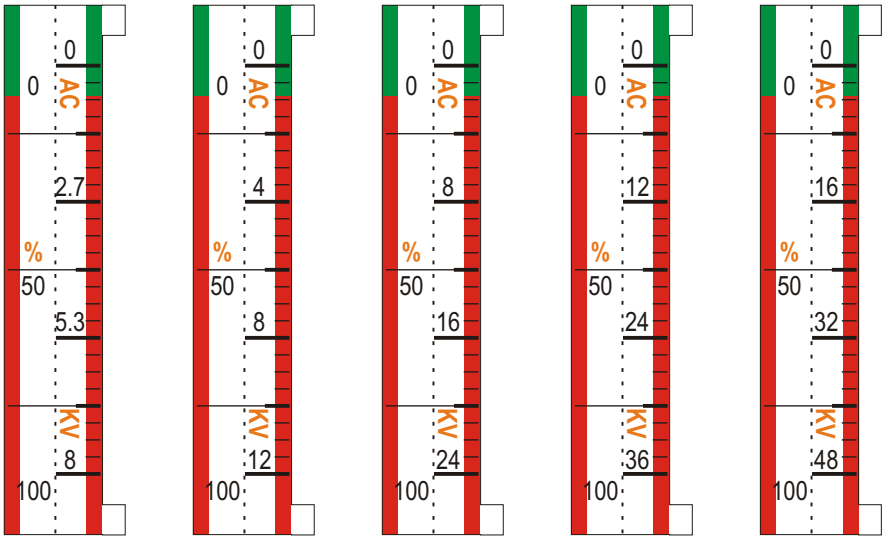
	PC7k	PC11k	PC22k	PC33k	Pc44k
Lenght of Handle	765mm	765mm	765mm	765mm	765mm
Lenght of Front End (Fiberglass)	340mm	340mm	460mm	610mm	760mm
Total Lenght	1.1M	1.1M	1.275M	1.395M	1.425M
Total Weight	±1.2kG	±1.2kG	±1.3kG	±1.4kG	±1.5kG
Handle Material	Composite Material with Polyurethane Front End				
Material	Fiber Glass Wound Tubing				

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 IEC 1010 Clause 8.2
Deflection: the contact electrodes must not deflect by more than 150mm when loaded at the electrode by 10N.
Connection Lead.Cord Strenght: each pole connection to withstand 10000 swing with 10N Load applied and a vertical pull with 200N applied.

Environmental

Operating temperature:-25ºC to +55ºC
Operating Humidity: 20 to 96% RH.

SCALES



PC 7k PC 11k PC 22k PC 33k PC 44k

Special Scales and configuration can be manufactured on a case by case basis. Contact the factory with your requirements.

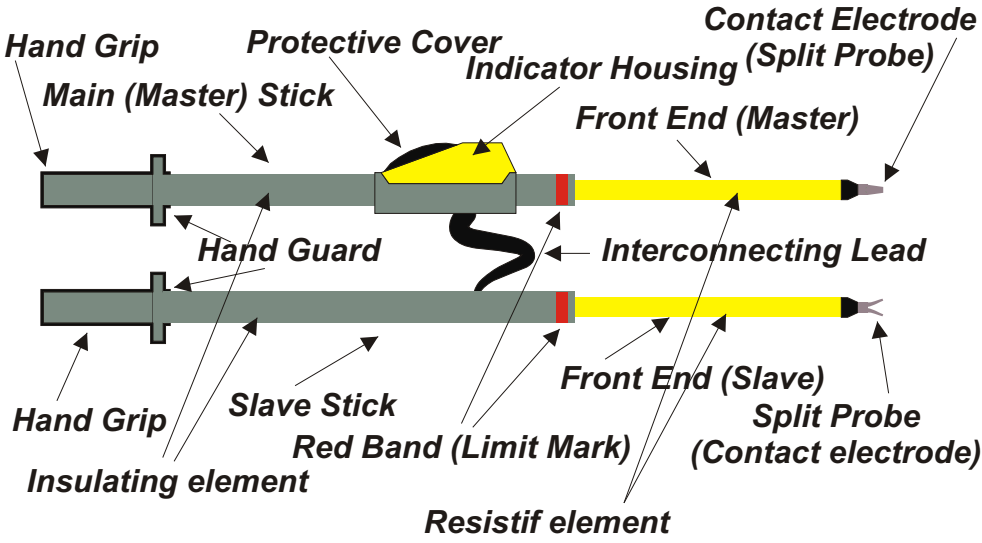
DIRECTIONS FOR USE

It is the user's responsibility to ensure that only competent personnel, with the necessary knowledge and training to work with high voltage, use and handle this equipment.

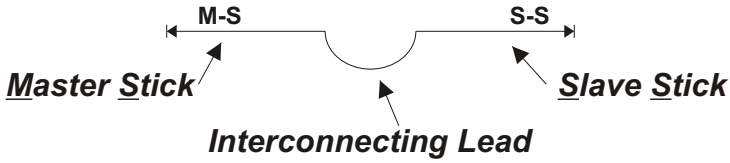
Before using the Phase Comparators, it is recommended to check them with an High Voltage Insulation tester (if possible a variable one).

For Phasing, it must be ensured that both feeders are in a live condition, of the same voltage and in a stable state, before commencing the phasing tests.

The Phase Comparators comprises of two interconnected parts; these are the Master Stick, containing the indicator housing. The second stick is referred to as the slave.

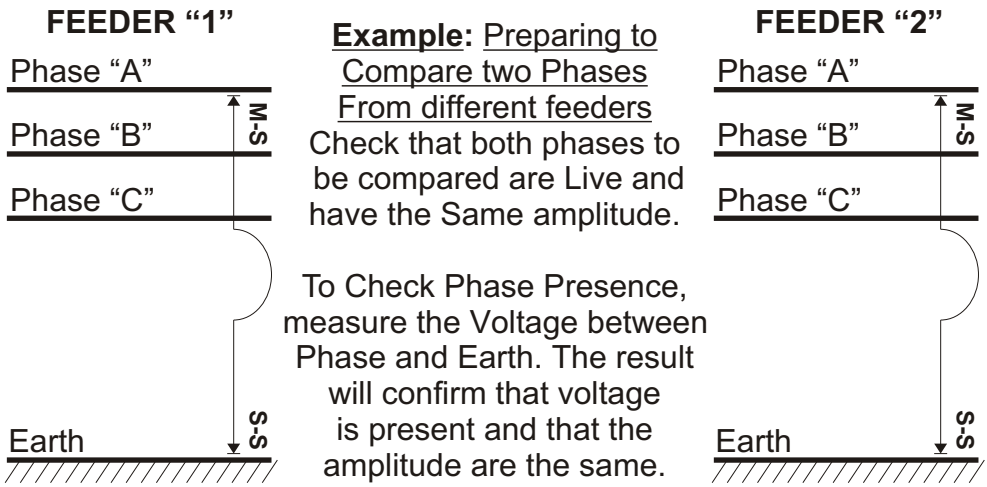


REPRESENTATION FOR EXPLANATION PURPOSE



TESTING FOR PHASE PRESENCE

Before doing the Phase Comparison test, you must ensure that the feeders to be compared are live.



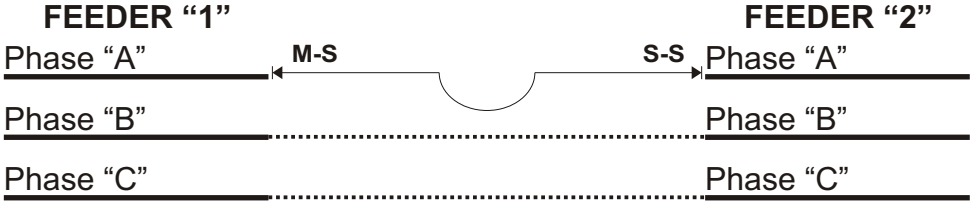
Example: Preparing to Compare two Phases From different feeders

Check that both phases to be compared are Live and have the Same amplitude.

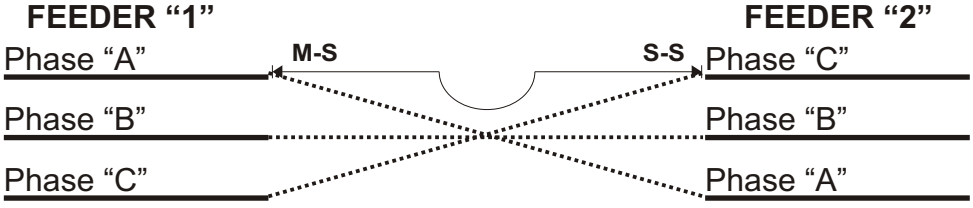
To Check Phase Presence, measure the Voltage between Phase and Earth. The result will confirm that voltage is present and that the amplitude are the same.

TESTING FOR PHASING

No Indication - Neon OFF (does not lit) = IN PHASE



Indication - Neon ON (does lit) = OUT OF PHASE



Note that the links must be arranged so that the phases are connected in Phase, as indicated by the dotted lines.

Do Not Use Phasing Sticks unless you have been fully trained In High Voltage work and understand the system fully.

CARE AND MAINTENANCE

- ***Storage***: The Phase Comparator and it's accessories should be stored in the propietary carrying case/bag when not in use.

- ***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.

- ***Cleanliness***: Dirt can cause surface tracking and it's therefore necessary to keep the Phase Comparator and its accessories clean by washing them in mild detergent solution. All part should be cleaned with the appropiate liquid.

- ***Mechanical Damage***: If surface scratches or dents can easily be seen by the naked eye, then the equipment should be returned to the factory of your nearest distributor for repairs since these blemishes act as traps for dirt and moisture. Mechanical damage would also necessitate the return of the equipment to the manufacturer.

- ***Recalibration and Proof Testing***: Every twelve months the Phase Comparator and it's accessories should be rechecked. This would include checking the threshold level of the neon, voltage prrof testing in factory or accredited laboratory and pressure testing of the panel meter housing.

Please note that there are no internal user replaceable parts.

The Phase comparator must always be clean and dry before use and during use. Please store the Phase Comparator in a dry Place.

NOTES

We exceeded the safety specifications wherever possible. However, we can't be held liable for misuse or bad manipulation.
We simplified the Phase Comparators by not having any parts to assembled on site. There is no user serviceable parts or user assembled part in our Phase Comparators.
Only the tip (contact electrode) has to be screwed on the Front end of each pole. They generally do not need to be removed by the user. For other kind of tips and contact electrodes, contact the factory or you nearest distributor.
Getting regular training on your High Voltage equipment and on the electrical network / grid you are working on is a good practice and will help in keeping you safe.
Always make a sketch before proceeding with testing High Voltage and ensure you are fully in control of the testing and understand fully what is going on. Failure to do so can result in fatal accidents.

KUSAM-MECO

G-17, Bharat Industrial Estate, T.J. Road,
Sewree(W), Mumbai-400 015. (INDIA)
Sales Direct: 91-22-24156638 **Tel:** 2412 4540, 2418 1649
Fax: 91-22-2414 9659 **Email :** kusam_meco@vsnl.net
Website: www.kusam-meco.co.in, www.kusamelectrical.com

LIMITED WARRANTY

Each “KUSAM-MECO” product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under properuse, within the guarantee period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you.

This warranty extends only to the original buyer or end-user customer of a “KUSAM-MECO” authorized dealer.

This warranty does not apply for damaged IC’s, fuses, disposable batteries, carrying case, test leads, or to any product which in KUSAM-MECO’s opinion, has been misused, altered neglected, contaminated or damaged by accident or abnormal conditions of operation or handling.

“KUSAM-MECO” authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of “KUSAM-MECO”.

“KUSAM-MECO” warranty obligation is limited, at option, for free of charge repair, or replacement of a defective product which is returned to a “KUSAM-MECO” authorized service center within the warranty period.

THIS WARRANTY IS BUYER’S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE. “KUSAM-MECO” SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE WHATSOEVER.

All transaction are subject to Mumbai Jurisdiction.

KUSAM-MECO

G-17, Bharat Industrial Estate, T.J. Road, Sewree(W), Mumbai-400 015. (INDIA)
Sales Direct: 91-22-24156638 **Tel:** 2412 4540, 2418 1649 **Fax:** 91-22-2414 9659
Email : kusam_meco@vsnl.net **Website:** www.kusamelectrical.com ,
www.kusam-meco.co.in