User Guide to Safety

3129 Series Phase Detector

HIOKI

Did you know that common phase checkers and detectors pose electric shock and short-circuit hazards?

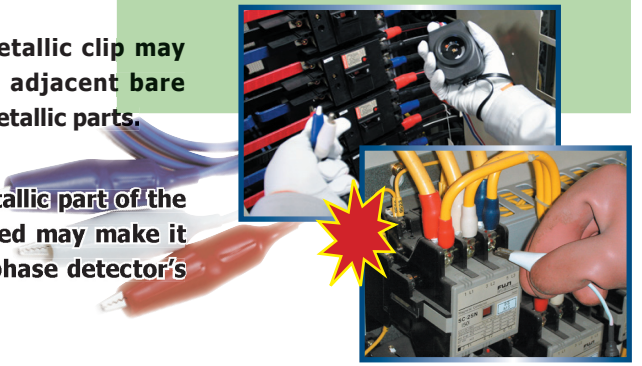
The traditional phase detection approach known as direct voltage input lets you detect voltage only by clipping the instrument's metallic clips to the exposed metallic parts of electrical conductors and breakers.

This means:

The phase detector's metallic clip may come into contact with adjacent bare conductors or exposed metallic parts.

This also means:

The small size of the metallic part of the conductor being measured may make it difficult to connect the phase detector's metallic clips



Although certain direct voltage input type phase detectors incorporate fuses into the voltage cables, these instruments rely upon the same phase detection method—connection to the exposed metallic part of an electrical conductor—and fail to eliminate electric shock and short-circuit hazards.

Technicians involved in performing electrical work and checking wires have called for the development of a safe phase detector that bypasses the danger and fear caused by the need to make a connection to the exposed metallic parts of an electrical conductor.

The HIOKI 3129-10 is rated CAT IV 600V – the Top of Its Class

Introducing The SAFEST Approach to Phase Sequence Testing:

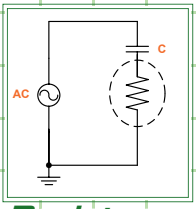
Non-metallic contact phase detectors like the **HIOKI 3129** have debuted in the market in recent years in response to these calls, offering unmatchable advantages and dramatically improving safety for technicians involved in performing electrical work and checking wires.

Advantage 1 *Similar to voltage detectors, non-metallic contact phase detectors like the HIOKI 3129 use voltage clips without exposed metal that employ the principle of electrostatic induction.*

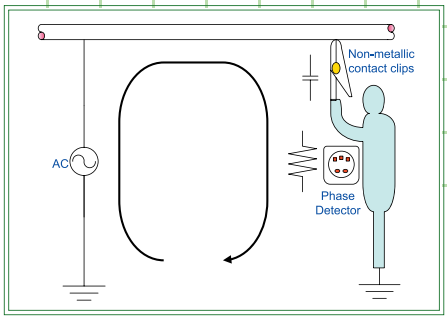
Advantage 2 *Phase sequence can be checked by simply clamping the clip around the insulation of the conductor being measured. This prevents the danger of the technician coming into contact with the metallic part of either the phase detector or the conductor being measured.*

How does it work?

Metal non-contact type phase detectors employ the principle of **electrostatic induction**. Electrostatic induction refers to the phenomenon whereby an **electric current** is induced in an object by an outside electrical current with which the object is not in direct contact. When a phase detector that operates on the principle of electrostatic induction is used, a closed circuit is formed through the slight capacitance of the electrical conductor (hot line), voltage probe (phase detector), person, and ground. An extremely small current flows through this closed circuit (see figure below). This **slight current is converted into a voltage** by the high resistance inside the phase detector. Non-metallic contact phase detectors determine the phase sequence **from voltage waveforms** for each of three phases obtained in this way. The capacitance C in the figure is determined by the distance d between the electrode in the voltage clip and the electrical conductor (which are separated by the thickness of the voltage clip's resin and the wire's insulation), the dielectric constant ε of the wire's insulation, and the area A of the surface parallel to the electrode in the voltage clip and the electrical conductor. This relationship is expressed by the equation $C = \varepsilon A/d$ and indicates that the capacitance varies according to the object being measured.



Resistance design of the HIOKI 3129 Series



Non-contact phase detectors offers safe and correct phase detection based on the basic understanding that a closed circuit is formed between the conductor, detecting device and the operator with reference to the earth.

Check for Hot Wires Before Detecting for Phase Sequence!

Checking whether wires are hot (voltage detection) before performing phase detection is essential when using a non-metallic contact phase detector. As described in the technical abstract, non-contact phase detectors require that each phase be hot due to their use of the principle of electrostatic induction with the conductor to detect phase, so open phase situations are not proper for detecting correct phase sequence. Make sure each phase is hot and that there are no open phases before phase detection. A voltage detector is typically used to perform this task, the convenience of non-contact phase detectors with built-in voltage detection functionality is becoming more and more common. (It should be noted that voltage detection functionality is intended as an add-on to the phase detector's primary purpose and that using it as a dedicated voltage detector should be avoided).

Extra-wide Clips Lets You Clamp Onto the Thickest of Conductors

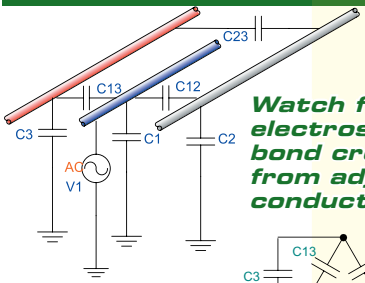
The HIOKI 3129 Series offer voltage clips that are designed to have no exposed metallic parts. HIOKI's advanced clamp sensor manufacturing and resin welding technologies are unchallenged and allows us to offer super insulating performance in current clamp sensors and producing high quality voltage clips with no exposed metallic parts. Non-contact type phase detector voltage clips such as these are designed to accommodate AWG 2/0 to 1500 KCMIL wires (wire diameters from approximately 10 to 40 mm, including insulation.)

Non-contact phase detectors are the SAFEST way to detect phase sequence especially in high voltage environments where work safety is of utmost concern.

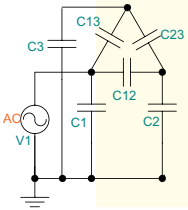
When using a non-contact phase detector:

- ⚠ Exercise caution regarding open phases
- ⚠ Check for faulty wiring connections
- ⚠ Stay clear of coaxial cable target conductors

When an electrical conductor is open-phase, capacitive coupling with the adjacent conductor (hot wire) induces a voltage in the open-phase conductor. Under these conditions, the phase detector will react to the induced voltage and determine that the wire is hot, regardless of its open-phase status. Apart from open-phase issues, faulty wiring connections may cause two of the three phases other than the N wire to have the same phase. In instances such as this where there is a special wiring problem, the phase detector will be *unable* to correctly determine the phase sequence. Finally, the non-contact type phase detectors cannot be used with coaxial cables (cable surrounded by metallic shielding) because the metallic shielding interrupts the closed circuit that would otherwise be formed due to capacitive coupling. In each of these cases, the phenomena in question occur as a result of the instrument's use of the principle of electrostatic induction, and these special circumstances demand attention when using a metal non-contact type phase detector.



Watch for electrostatic bond created from adjacent conductors



Non-metallic contact phase detectors are designed to give top priority to the safety of technicians involved in electrical work and wiring checks. Within high voltage environments such as power utilities, the advantages of this type of phase detector are indispensable because it brings about maximum protection for the field technician, protecting them from unnecessary danger and contributing to efficient productivity and enhanced safety at the workplace.

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