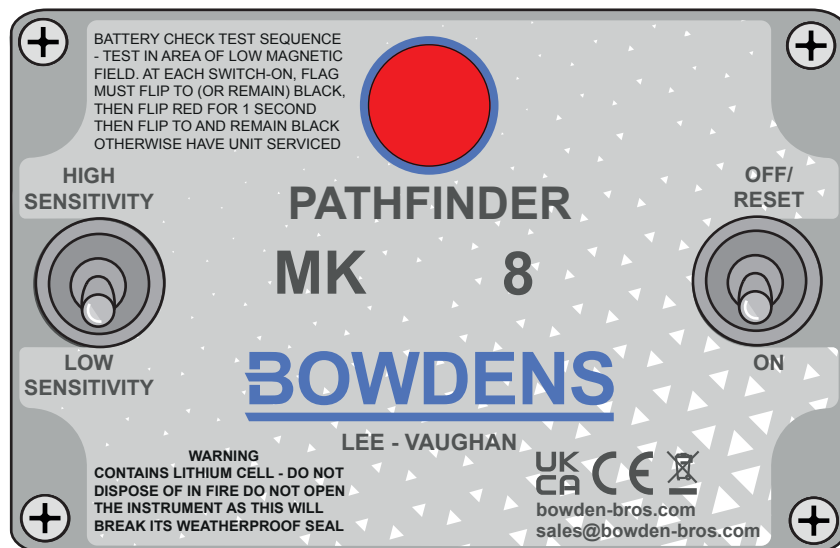


# **BOWDENS**

## **RIGHTWAY PATHFINDER MK 8**



**PORTABLE EARTH FAULT INDICATOR FOR  
OVERHEAD LINE NETWORKS**

## 1.0 OVERVIEW

The highly successful portable MK8 Pathfinder is used as a linesman or fault repair team's tool to localize either an earth fault or a phase to phase fault on an 11 or 33KV overhead line. The Portable FPI can be strapped to a clean pole at eye level and after re-energising the line, will tell the operator whether the fault is beyond that pole. With a number of units, a sometimes hard to find fault can be pin pointed very quickly. A battery test facility is built into the switch on routine. It comprises of a grey Polycarbonate case with a clear front viewing panel. The unit seal is to IP67 although it is not designed to be left out for very long periods of time. An elasticated strap captured in two side mounted loops is used to hold the instrument in position on an overhead line pole. The Pathfinder is not voltage dependant, and so can be used on 6.6 to 66KV lines so long as it is a radial system, and of suitable construction. It will operate on three phase or single phase, or indeed on SWER (single wire earth return) lines. Alternatively a nylon buckle strap can be provided. The micro-chip controlled electronics is powered by a Lithium Thionyl Chloride Battery with a service free life of up to 10 years, dependant on usage. Locations to avoid putting Pathfinder are termination poles with cables going to ground, transformer poles, tee off poles, poles in close proximity to another HV line of any voltage, poles with either LV or earth wire under-build, or any heavy magnetic influence.

## 2.0 MODEL FEATURES

- Integral and Factory Changeable Lithium Battery- Up to 10 Years Life
- Responds to Phase/Earth and Phase/Phase Faults
- Auto Battery Test Facility
- Sensitivity Switch
- Identifies Permanent, Transient and Intermittent Faults
- Helps to Identify Faulty Cable sections in OHL Networks
- Helps to indicate OHL Transformer Winding Faults
- Modern PIC selection allows zero standing current when alarmed and reduced current demand when listening, with associated improvement in battery life.

## 3.0 OPERATION

When the MK8 is in position the following instructions must be followed:

Switch on the instrument. This action automatically checks the battery. If it is healthy the flag indicator will first register black, before flipping over to red for around one second, and then resetting to black again so long as you are not standing in an area of high electro-magnetic field (in close proximity to a PC or fluorescent lights). This indicates that the unit is ready to sense fault current. This testing must be carried out in an area of low field strength i.e. not near a transformer or a motor that will cause the instrument to indicate red. Any other behaviour on the part of the flag shows that the instrument is not serviceable.

The MK8 should be mounted on a clean intermediate pole symmetrically below the line conductors and about five metres below the lowest conductor. An elasticated strap or nylon buckle strap is provided to wrap around the pole and hook over metal hoops on either side of the instrument case. Alternatively, the MK8 can be laid on a convenient hedgerow or held by an operator below the line.

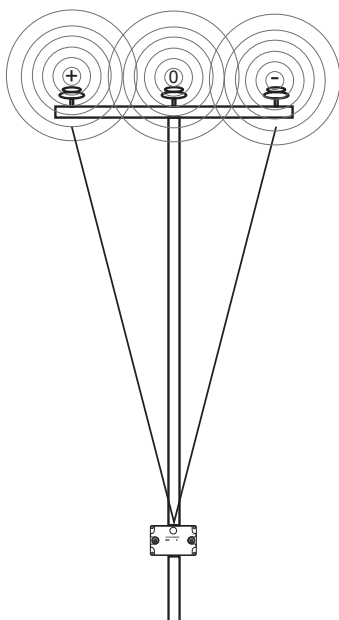
Select the sensitivity switch to high or low. Set at high it will respond to a current of 14 Amps at five metres and fault levels up to 150 MVA. At low it will respond to 70 Amps of current at five metres and fault levels above 150 MVA, as a general rule. When selecting sensitivity, thought must be given to anticipated fault levels, so for a suspected fault near to the source, where the fault level is high, then low sensitivity should be used. For more remote faults with some distance from the source, high sensitivity should be used. For faults with a very low current value the Pathfinder can be moved up the pole to make it more sensitive. The relationship is linear, so at four metres on high sensitivity it will respond to a current of 11 Amps.

Attempt to re-energize the line. If the circuit trips, note which Pathfinders have flipped their indicators to Red. The faulty section of line lies between the last Pathfinder to flag red and the first instrument not to flag.

At the instant the line is re-energized onto a sustained fault, the Pathfinder reacts by desensitizing its circuits for a period of 35 milli-seconds. This prevents mag inrush and other switching effects from causing incorrect operation of the Instrument. If the fault current is sustained beyond this period the indicator will flip to 'red' and remain in that condition until reset manually.

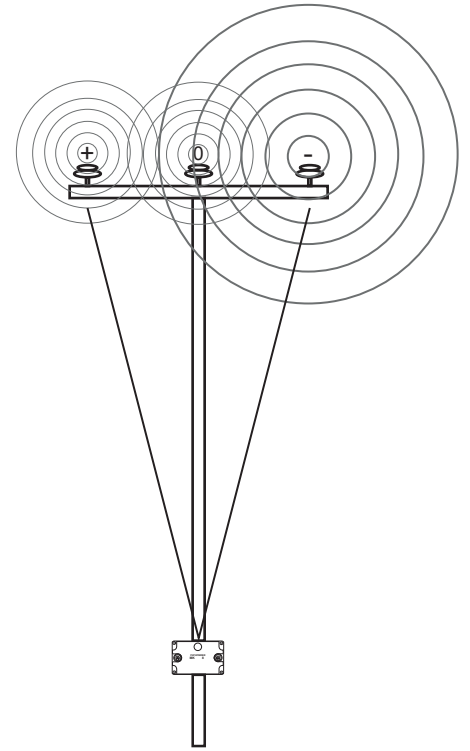
Pathfinders may be left out on a live network to chase a transient fault, and will respond when the fault occurs, leaving the flags tripped on those instruments under the fault path, until reset manually. Pathfinders are sensitive to the electro-magnetic field generated by the fault condition in the overhead line. Anything that might interfere with the integrity of that field must be avoided, so the MK8 should NOT be mounted on poles with transformers or with auto re-closers installed. Be aware of influences from other HV or LV lines in the vicinity which may distort the field. Pathfinders can be re-deployed again to narrow down the area of the search.

### 3.1 SENSING ELECTRO-MAGNETIC FIELD



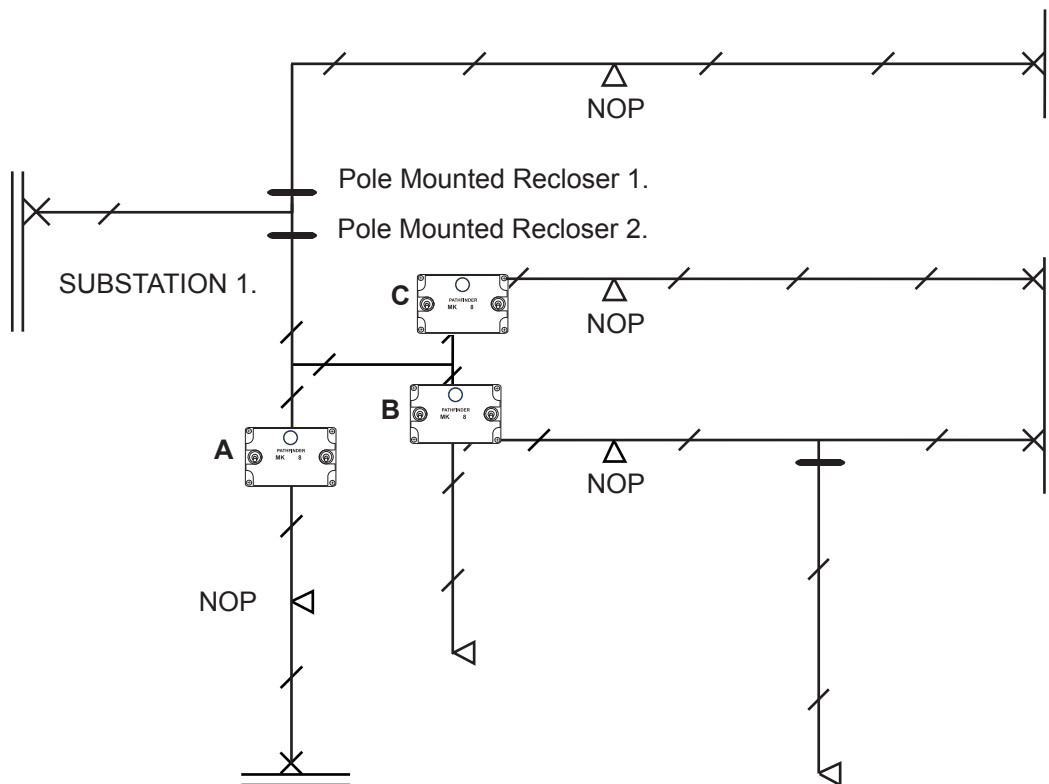
On an HV overhead line each conductor will radiate an electro-magnetic field. Due to the phase separation one field will be in a positive direction, the other in a negative direction, and the third at zero. Therefore the field will be balanced, only the load imbalance on the phases giving rise to any residual field. As we move away from the line the physical separation of the conductors becomes less of an influence and at ground level, about five metres from the conductors the residual field is insignificant.

If an earth fault occurs on one conductor it has a strong effect on the electro-magnetic field which can be detected by the MK8 fault passage indicator. If a phase to phase fault occurs the fault current values may be higher, but the electro-magnetic influence is less than for an earth fault. However, we rotate the detection coil to 30° from the horizontal in Pathfinder which increases its response to the phase to phase fault, whilst retaining almost the same response to earth faults.

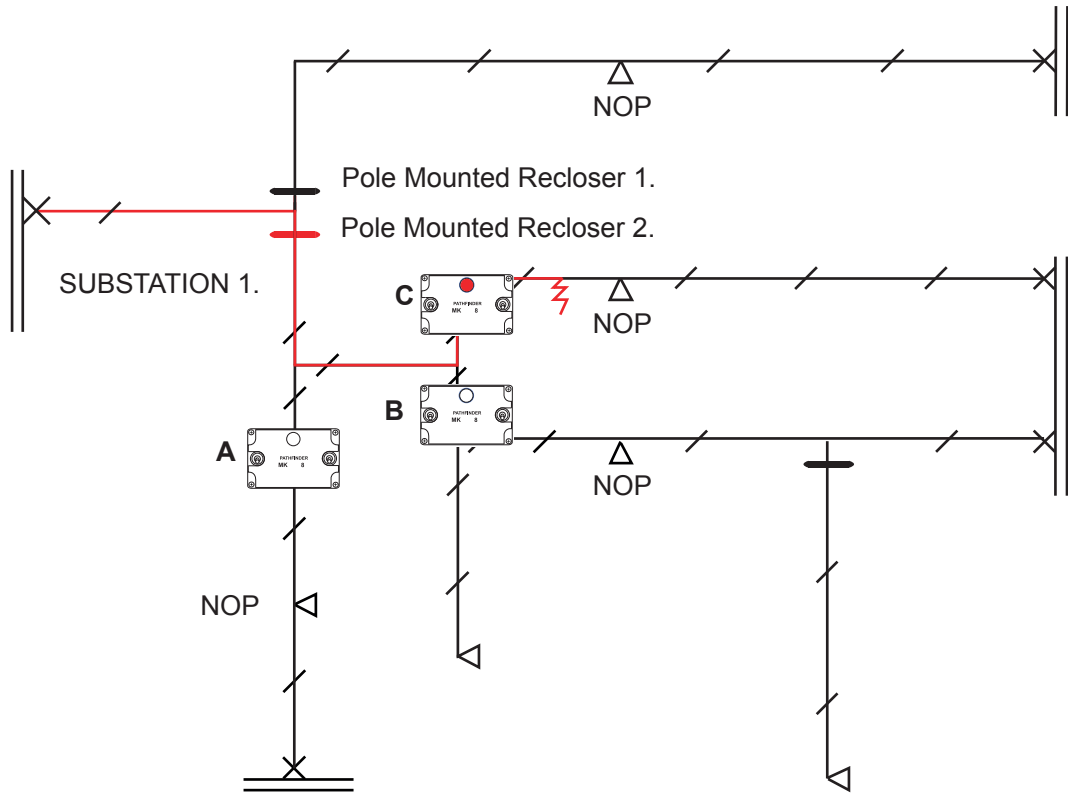


### 3.2 FAULT FINDING

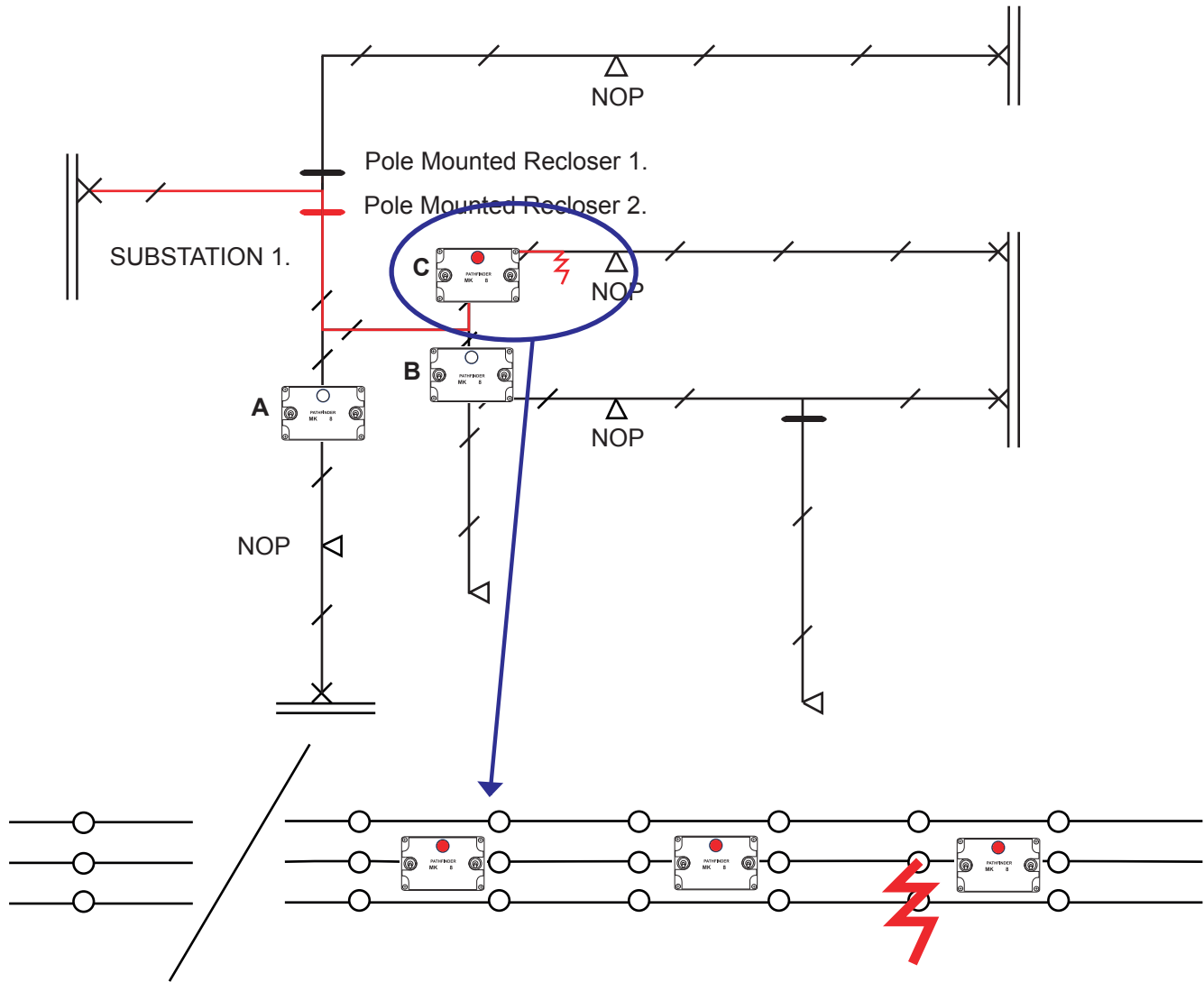
On an overhead HV network we are getting repetitive tripping at PMAR 2. MK8 Pathfinders are deployed at points A, B & C to find out which leg of the network has the transient fault.



When the fault occurs PMAR two trips. The MK8 at C flags. The instruments at A and B do not trip. We know that the fault lies between the MK8 at C and the Normally Open Point (NOP).



Trying to locate a fault due to a cracked insulator can be very difficult. The MK8's can be re-deployed down the main line a few poles apart to divide the network up into the smallest sections.



## **4.0 POWER SUPPLY**

The MK8 is powered from a Lithium Thionyl Chloride 3.6V and 2.6AH. The battery calculations support a ten year life under normal usage. During a service, the battery, which is soldered onto the PCB, will be changed if necessary, the unit re-calibrated, and the enclosure re-sealed to ensure a full IP67 rating. It is very important that the instrument is switched off after every field outing to prevent shortening its life.

## **5.0 ROUTINE TESTING**

Functional testing is carried out on 100% of all manufactured units before shipping.

## **6.0 SPECIFICATION**

Dimensions: 120 mm x 80 mm x 60 mm (length over mounting bracket 150 mm)

Weight: 380 grams

Mounting: Hand-held or attached to pole with an elastic strap, or nylon buckle strap.

Enclosure: Polycarbonate sealed to IP67

Trip Level: High-14 Amps at five metres. Low- 70 Amps at five metres. Linear if moved closed to the conductors.

Battery/Longevity: SAFT LS14500 - up to 10 years life under normal usage

Trip Delay: 50msecs nominal

Reset: Manual with ON/OFF switch

Battery Test: With ON/OFF routine.

Temperature Range: -20° to +60°C

Usage: Up to 10 years life under normal usage

VERSION 2.0

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