SENTINEL A[®] - Fault Passage Indicator

AMPEREMETRIC FAULT PASSAGE INDICATORS FOR OVERHEAD MV NETWORKS

Installed on poles of overhead lines, the **Overhead-Sentinel-A** range allows locating the fault arisen on the MV network, whether they are single phase to earth, multi-phase, transient or permanent. It allows identifying quickly the failing section of network, by suppling :

- A blinking light for the permanent fault.
- A counting of all events (transient or permanent).

The **Sentinel-A** is an amperemetric fault passage indicator (FPI) adapted to the MV overhead lines (fault current always higher than capacitive current) :

- Network with impedance earthing.
- Network with direct earthing.





> DESCRIPTION



Functioning

Amperemetric detection

The Overhead Sentinel-A measures the electromagnetic field and the electric field supplied by the

overhead line. The sensor integrated in the indicator provides an image of the residual current.

Other sensors provide an image of the line current flowing in the power grid and an image of the residual voltage.

Fault is detected when its value exceeds an adjustable threshold (homopolar residual current or phase current) for a fixed period.



> FAULT LOCALIZATION

Single phase earth faults

The single-phase earth faults are indicated with only one color light.

Only detectors located between the high voltage station and the defect flash. The fault is located on the network section between the last FPI whose flashes and the first whose is not flashing



Dual and multi-phase faults

They differ from other defects by double colors (alternating Red and Green). Only detectors located between the high voltage station and the defect flash. The fault is located on the network section between the last FPI whose flashes and the first whose is not flashing.





> SIGNALLING FAULTS

Flashing information

The information of the presence of a fault that led to the definitive trip of feeder is indicated locally by a LED.

The signalling is performed at a rate of one flash per second :

• Red flash in the event of a single-phase fault

• Alternately red flash and green flash in the event of a multi-phase fault or double fault to earth



Relay dedicated to remote control

Two relay outputs (dry potential free contacts) copy the light signalling. These contacts (NO) allow to bring back fault information to an external application.

These contacts are activated for 100 ms to the appearance of transient fault then, if the fault becomes permanent, the contacts are activated for the duration of the light signalling.

Relay of alarm « Equipment fault »

A third relay output provides to an external application, information on the correct operation of the fault passage indicator. Two dry contacts («normally open» and «normally closed») are activated from the loss of supply of the fault passage indicator (end of autonomy of the rechargeable element - ultra capacitor - end of battery life) or in the event of processor failure (watchdog).

It indicates that the detector is no longer operational :

the "NO" contact opens the "NC" contact closes

> HUMAN MACHINE INTERFACE

The Overhead-Sentinel-A, in addition with its functions of detection and signalling, counts and returns the number of transient faults, semi-permanent and permanent of different types (single phase and multi phase).

A « human-machine interface » consisting of a display and push buttons allows the user:

- Consultation of clear messages.
- Visualization of 3 fault counters.
- Configuration of different parameters and setting thresholds.





In option, a bluetooth radio remote control to access and configure the Overhead-Sentinel-A is available.

It is fitted with the same keyboard than the local keyboard of the detector. Of a range of about twenty meters, remote control provides access to the same menu as the local display. It facilitates the configuration and consultation counters :

- Without leaving the vehicle.
- In inaccessible places .
- When the detector is installed at more than 2 m high.

It uses standard batteries (2 LR06 alkaline AA 1.5V).

> INSTALLATION

The **Overhead-Sentinel-A** is designed to be installed on electric poles of overhead lines. The supports can be concrete, wood or metal.

The box is fixed to the pole height **between 3 m and 6 m** (5 m being the default position).

The height between the floor and the lowest of the line wire shall be **between 7 m and 14 m**.

The pole must be free of all vegetation high on a radius of 3 meters around the support.



Warning :

To maintain its sensitivity, the **Overhead-Sentinel-A** should not be installed :

• Less than 50 m from another MV line.

• Less than 200 m from HV line (<100kV) or railway.

• Less than 500 m from HV line (>100kV).

• Less than 50 m from an overheadunderground connection.



Warning :

The **Overhead-Sentinel-A** should not be installed in the following cases :

- On cross supports.
- On overhead-underground connection.
- \bullet On mix supports (with multiple networks HV, LV).



The Overhead-Sentinel-A must be installed at the center of the pole in the center of the overhead line :





Special case

For the use of **Overhead-Sentinel-A** on a double support, the detector must be installed on a crossbar between two poles.





> POWER SUPPLY

The **Overhead-SentineI-A** fault indicator is powered by ultra capacitor charged with solar panels. It does not require any replacement.

This version is equipped with a switch in order to turn off the current of the indicator if necessary.



Warning :

When commissioning, the ultra capacitor of the overhead Sentinel A indicator needs to be charged.

In order to do so, 2 solutions are available :

• Place the overhead Sentinel A in full sun for at least 2 hours before commissioning (depending on the weather)

• Use the quick charge with the micro USB connector :

- By plugging a standard phone charger (the charger must supply a voltage of 5 V and a current greater or equal to 500 mA). This charger could be connected to the power supply or on a 12 V cigarette lighter socket.

- By plugging the indicator on the USB interface of the PC (with a USB-A cable / micro USB)

Charging time will be about 20 minutes. While charging, a red flash lights up and turns off at the end of the process.

> OPERATION

Display of fault counters

The buttons " \uparrow " and " \downarrow " allow scrolling the display of 2 fault counters. Once these were read, the user has the ability to perform their reset.

In addition to the default counters, the **Overhead-Sentinel-A** indicates the time since the last increment of each counter. This additional information :

• allows to know, after the extinction of the signals, if the Overhead-Sentinel-A has seen the fault.

• provides assistance for preventive maintenance of the HV line. When an unusual increase in the number of transient faults occurs, the **Overhead-Sentinel-A** provides valuable information on the section of the HV network causing these transient faults. With fault counters and this time information, it is possible to know which fault passage indicators have seen these faults and so, to identify the fault location before it causes a definitive trip.

Example of using the fault counters to find the section causing transient faults. With timers, it is easy to identify the faulty section :





Fault display

While fault searching, the alphanumeric display can provide the operator, additional assistance by indicating clearly the type of fault, "multiphase", "double", or " phase ".

The fault is stored as long as the MV voltage is absent.

In the absence of fault, the **Overhead-Sentinel-A** indicates the presence or absence of MV voltage.



Charge level of the ultra-capacitor (depending on model)

Use this menu to check the charge level of the ultra-capacitor associated with photovoltaic panels.



Status of the fault passage indicator

The «fault passage indicator status» menu allows for a diagnosis in an event of equipment failure of **Overhead-Sentinel-A**.





> ELECTRICAL CHARACTERISTICS

MV NETWORK	OVERHEAD-SENTINEL-A	
Rated voltage U _N	Until 36 kV	
Rated frequency	50 Hz	
Detection of single- phase earth faults		
Detection principle	Amperemetric (threshold exceedance for a period)	
Phase current detection threshold	20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240 A	
Handling time	60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 280, 300, 400 ,500 ms	
Signalling	RED	
Detection of dual single phase faults		
Detection principle	Amperemetric (threshold exceedance for a period)	
Phase current detection threshold	250, 300, 350, 400, 450, 500, 600, 700 A	
Handling time	60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 280, 300, 400, 500 ms	
Signalling	RED and GREEN	
Detection of multi-phase faults		
Detection principle	Amperemetric (threshold exceedance for a period)	
Phase current detection threshold	250, 300, 350, 400, 450, 500, 600, 700 A	
Handling time	60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 280, 300, 400, 500 ms	
Signalling	RED and GREEN	
Time delays		
Before a fault is counted (T delay)	340 ms, 800 ms or 3 sec	
Before the indication of a permanent fault (T permanent)	1 sec, 10 sec, 20 sec ou 70 sec	
Voltage MV presence for «setting» the detection of single phase faults	5 sec	
MV voltage return for clearing the current fault	5 sec	
Indication		
External indicator light	High brightness flashing LEDs	
External contact	Closing dry contact	
Indication stopped		
Clearing the fault Through MV voltage return Voltage level Delay	0.5 Un 5 s	
Stop of signalling with fault ever stored Through a front panel pushbutton Automatically after a time delay	2h, 4h, 12h, 24h	

> ENVIRONMENTAL CONDITIONS

	NORMS	OVERHEAD-SENTINEL-A	
Mechanical			
Dimensions (W x H x D)		320 x 260 x 140 mm	
Protection rating	NF EN 60529 NF EN 62262	IP 54 IK 09	
Vibrations	NF EN 68068-2-6	Acceleration : 2g/ displacement : 0,15 mm (peak value) - 10 Hz to 500 Hz	
Climatical			
Operating temperature	NF EN 60068-2-1 NF EN 60068-2-2	- 25° C to + 55° C	
Storage temperature	NF EN 60068-2-14	- 40° C to + 70° C	
Relative humidity	NF EN 60068-2-3	Tests Ca - 93% à 40°C 96h closed box, 4h opened box	
Salt mist	NF EN 60068-2-11	178 h	
Dielectric strength			
Input voltage 12 V and dry contact ouputs compared to the box	CEI 60255-5	2 kV - 50 Hz (1 mn) 5 kV shock (1,2/50 μs)	
Electromagnetic			
Dampened oscillating waves	NF EN 61000-4-12	2.5 kV un common mode (100 kHz et 1 MHz) 1 kV in differencial mode (100 kHz et 1 MHz)	
Fast transients	NF EN 61000-4-4	4 kV on power circuits 2 kV on other circuits	
Shock waves	NF EN 61000-4-5	1 kV coupling between wires 2 kV coupling wire /ground	
Electrostatic discharges	NF EN 61000-4-2	Harshness 4 (8 kV contact discharge, 15 kV air discharge)	
Electromagnetic field-amplitude	NF EN 61000-4-3	10 V / m 27 MHz to 6 GHz	
Power supply			
Battery self-sufficiency		3 lithium batteries 13Ah format D (not included)	
External supply 12V DC		12 V + 30% - 10%	
Solar panels save by ultra-capacitor		2.5 V maintenance free (15 years)	

MEDIUM VOLTAGE DIVISION

CRDE, a society of Groupe CAHORS

ZI des Grands Camps - BP 9 46090 Mercuès - FRANCE Tél. +33 (0)5 65 30 38 10 Fax +33 (0)5 65 20 09 17

