AUTOMATIC SYSTEM FOR THE CONTROL OF THE INSULATION DEFICIENCIES IN BRANCHES OF MEDIUM POWER (SALDI)

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INTRODUCTION

The automatic system for the control of the insulation deficiencies in the branches of middle ranged power allows the visualizing on the screen of a computer, placed in the commanding room of the energetic dispatcher, of the route of the shortcut flow almost immediately after the occurrence of the incident. This supposes the existence in some points of the branch of some indicators of shortcomings connected to a system GSM of communication with the central point of dispatcher. The system traces selectively the problem raising cables, connected to the transforming centres or the feeding points from the networks of medium power.

GENERAL CONSIDERATIONS

The assurance of the continuity grade in the feeding with electrical energy of the customers, forseen in the agreement provisions, cannot be done without the existence of a screen system of the distribution electric networks.

The reduction of the damages, following the shortcutings in the feeding with electrical power, depends mainly on the exactiness that one get the believable informations regarding the place of creation of an insulation shortcut in network. The closest informations are the most useful ones, as they were gotten near the moment of the shortcut.

The screen visualizing of the shortcut track of flow is a less valorized solution, but represents an essential matter, near the automatic distribution, in the general system of leading and supervising SCADA of the energetical processes.

The informations regarding the shortcut area is of a great importance in the effort of the staff to abandon the method ‘of trial and error’. The present method of detecting the shortcut place is difficult, supposes repeated and long interruptions, departures of the intervention team, high waste of fuel, early worn out of the switches and of the networks. The screen visualizing of the shortcut track has as an end the visualization on the screen of a computer, placed in the commanding room of the power dispatcher, of the problem track of flow, in a short time after the occurrence of the incident.

Within the period of time from the moment of the insulation crack and to the stop through protection of the electrical line in the cable, the shortcut indicators mounted in the transforming positions catches the situations in whom the flow on the line of average power of cable, in the screen visualized time, exceeds the set threshold value. In an interval of time of maximum 20 seconds from the moment of starting the problem line, the problem catching indicators that had shown the exceeding of the set flow threshold will communicate through SMS having the central screen visualization point. When finishing the sending of the informations from the shortcut indicators to the central point of visualizing, the computer identifies in the data base the line that had problems following the shortcut, and attaches the information, the corresponding one, that belongs to each changing position in the line and shows on the screen the line coloured in red from source to the last indicator that seized the shortcut.

Meanwhile, the computer shows explicitely a written message in which is specified the section of cable, the shortcut cable, and the necessary methods for the insulation of the shortcut and the feeding of the good sections.

THE PRESENTATION OF THE SYSTEM

The automatic system for the pointing out of the shortcuts of insulation in the medium power cables, written SALDI, is composed of the following equipments:

- Local units of identifying, communication and signal of shortcut (UL)
- The screen visualizing central point of the unit (UPC).

The Local Unit

UL is placed inside the transformation positions in wall cabin, on the outside wall towards the cell of the medium power, being composed of a shortcut indicator mainly, a block having a minicontroller and a telefon GSM.

The block scheme of the local unit is the following:

Figure 1. The block scheme of the local unit
branches in which the treatment of the neutral is done through resistor, and all types of shortcuts are caught. But in case when the neutral of the branch is compensated with coil and insulated and can be signaled only the poliphased shortcuts and the doule cutdowns.

The translator of the magnetic field is mounted inside of the cell, at a distance greater than 40 cm from the rods of the medium power. The criterion of recognizing of the shortcut matter is the size of the shortcut flow, considerably greater than the maximum value of the task flow.

The system allows the specific signalization of two flow thresholds, the first being between 100-400 A and the second being between 600-1200 A, both of them can be set separately.

If there are suspicions, the dispatcher operator can each moment to interrogate the microcontroller of a local unit regarding the presence or the lack of the tension of 0,4 V in the transforming position, as well as the date and the hour and the flow stage of the last registered event – in the hypothesis in which the registered GSM was not received by the central point.

The functional state, the normal one, of the line is recognized through the following of the power presence of 220V-50 Hz from the transforming position, power that is the primary source of feeding the GSM.

In the following there is presented the block scheme and the functional elements of the shortcut indicator:

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- The displaying of the shortcut flow trace on the screen of the computer from the central point of the dispatcher takes place after an interval of time of mostly 20 seconds from the activation of the local optical and acoustical signalization and from the central point of the dispatcher becomes active.
- The optical activating of the shortcut indicator is the same with the activation of the entrance no. 2 of the microcontroller, that would generate the transmission of SMS to the central point with the message of ‘shortcut power level II at the point of change …’.
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- The activition of the signalizing in the case of producing a shortcut that gives a flow < 600 A needs the simultanous fulfilling of two conditions:
  - The increasing of the flow in one or more phases, over the threshold value established, between 100 and 400 A
  - The line to be put in function 2 seconds before at least, before the shortcut occurrence, a necessary condition for the fortifying of the shortcut indicator in accordance with the great oscillating values of the magnetizing flows that occur in the moment of connecting the electrical line.

The block of level comparisson (BC) will compare the value of the current in order to find the signal with the greatest level.

The block scheme and functional elements of SALDI:

- The block of signaling the shortcut (BS) is composed of three translators of magnetic field that have a linear setting sensibility, mounted in a tube cover screened in the electrical field.
- The translators are set on the rate of 50 Hz in order to avoid the effect of the superior dampers. The mounting BS in cell allows the positioning of each translator of magnetic field towards a phase (rod), at a distance that may vary between 40 and 90 cm. The three translators will offer three signals proportional to the intensity value of the magnetic field in the point of position.
- The block of amplifying BA will take the tree signals that will be individually amplified. At the exit of the block BA there will be found the signal with the greatest level.
- The block of level comparisson (BC) will compare the value of the signal with an established stage.
- The signalizing block (BS) assures the optical local signalizing of the exceeding of a level with an established flow.
- The activating of the signalizing in the case of producing a shortcut that gives a flow < 600 A needs the simultanous fulfilling of two conditions:
  - The increasing of the flow in one or more phases, over the threshold value established, between 100 and 400 A
  - The line to be put in function 2 seconds before at least, before the shortcut occurrence, a necessary condition for the fortifying of the shortcut indicator in accordance with the great oscillating values of the magnetizing flows that occur in the moment of connecting the electrical line.
  - The disapperance of the tension from the point of change, simultaneously with the disappearance of the shortcut effect at least, 0,5 seconds.

The optical activating of the shortcut indicator is the same with the activation of the entrance no.2 of the microcontroller, that would generate the transmission of SMS to the central point with the message of ‘shortcut power level II at the point of change …’.

The activating of the signalizing in case of producing a shortcut that generates a flow of > 600 A is not conditioned by the restriction that the line to be under function less 2 seconds before the occurrence of the shortcut.

![Block scheme and functional elements of SALDI](image)
The set level of the comparison block BC1 to be greater than the maximum value of the connecting flow of the line part from the upper part of the shortcut detector, in lack of a shortcut in this part. A setting value of the comparison block BC1 less than 600 A involves the risk of signalizing, local and at the dispatcher, at the connection of a line with an important magnetizing flow.

After the elimination of the shortcut and the reput of the cable under tension, the optical local signalizing is cancelled automatically after 10 seconds. In this interval of time the indicator is active. If the reput of line under tension (of the changing point) is not possible, the indicator will sign local an interval of time of 2 hours and then will automatically reset.

A third possibility of cancelling the local signalization is that of pushing a local reset switch.

From the energetically point of view ID is fed from an electrochemical source that is able to assure an autonomy of minimum 3 years. The consumption is of 1,2 mA on the period of optical signalizing and becomes void in the moment of the tension feeding in the point of change.

The main technical characteristics of ID:

- The sensitivity of the detection shortcut circuit 100-1200 A, adjustable on line. The recommended setting field for the ID sensitivity:
  - 100-250 A for level II of signalizing
  - 600-1000 A for level I of signalizing
- Optical local signalizing
- The displaying on the screen of the central unit of the section of cable affected by the incident.
- Time of switching of signalizing: 10 ms for 1,1 I threshold, 1000 ms for set I threshold.
- Time of cancelling the signalizing: 10 seconds from the refutation of online power on the screen visualized line in cable.
- Maximum consumption in signalizing from the electrochemical source: 1.2 Ma.
- The minimum length in signalizing of the electrochemical source: 3 years (approximately 200 hours of interruption of the tension in the point of change).
- Fiability in functioning within temperatures of -25° C and +50° C, maximum humidity of 100 %
- Without maintenance
- Simple mounting
- Does not affect the insulation level of the cell of medium tension where the operation of assembly is done
- ID allows the local testing with the help of a portable tester
- In order not to realize false actions, for shortcut flows less than 600 A, the activation of the signalizing is conditioned by the existence of the tension with less 2 seconds before of crash and the dissappearance of this simultaneously with the shortcut or at an interval of 0,5 seconds from the shortcut flow cancelling.

Central Point Unit of Screen Visualizing (UPC).

The screen visualizing central point unit has as a configuration an own computer and a system of communication GSM.

The dispatching software has a mode of stand-by in which the events are waited to come, or the action of the operator of interrogation of the local units, displaying in permanence the scheme of assisted monophase, indicating the trace of the shortcut flow and of the section of the deficiency plant, if it is the case.

At the events arrival (SMS), the mode software of communication asks the modem GSM and discharges the events. Those are identified as an origin source, as well as a mean of the even that triggered the alarm. The dispatcher operator is warned optically and acoustically, and the monophase scheme is brought up to date in accordance with informations about the way of the shortcut flow. The way of the shortcut flow is marked on the monophase scheme through a red line.

The system ALDI can automatically process the received informations from the translators of shortcut indicating the network section damaged or may achieve, at the order of the dispatcher operator, the checking of some switches for shortcuts. The function for manual checking of the state of the shortcut switches is useful in the cases in which SMS are not all received at the central point.

The exploitation expenses of a system based on SMS messages are very reduced because those messages are transmitted only in the deficiency situations. But in accordance with the beneficiary option, the system may assure a screen visualizing of the access in the positions of transformations, improving the securizing grade of some important plants for the distribution system of the electrical energy.

The system assures the total protection of the staff through the way of evaluating of the information regarding the primary shortcut flow, the translator of the magnetic field being insulated and at a distance from the rods of medium tension. SALDI can assure important advantages in the exploitation of the electrical networks. So, through the use of the automatic system for the localizing of the problems is achieved in this manner:

- The quick and simple catching of the shortcut section
- The quick feeding of the consumers
- An important reduction of the switches demanding and of the lines through the elimination of the deficiency connections necessary for the searching of the problem point. So the traditional method of searching is given up, through the connection on shortcut.
- Economy of time and fuel.
- Efficient use of the staff.

SALDI is designed for the electrical lines in cable with tension 6-35 kV and may be used in case of:

- Radial lines
- Lines with the neutral connected directly to the earth
- Lines with the neutral treated through resistor
- Lines with the insulated neutral – will detect only the deficiencies between phases and the double earth connections
- Lines with the neutral treated through reel, will detect only the deficiencies between the phases and the earth connections
- The closed cells or opened cells with bridge of rods

The application SALDI can be extended within the networks of air medium tension, with the next modifications:

- The translator of magnetic field is built up of two reels,
orthogonal reels, for the selecting of the informations about the horizontal compound and the vertical one of the intensity of the magnetic field in the point of mounting of the translator (2-3 m from the LEA).

- The mounting on the LEA pillar of a reduction of tension to constitute the source of operational tension for the feeding of GSM and as well as to offer informations regarding the presence of the tension on the electrical air line.

As the automatical system for the detecting of the problems dedicated for the electrical lines in cable, the system dedicated to the electrical air lines functions at the same scale of deficiencies.