Surge Arrester Testing with Improved Safety

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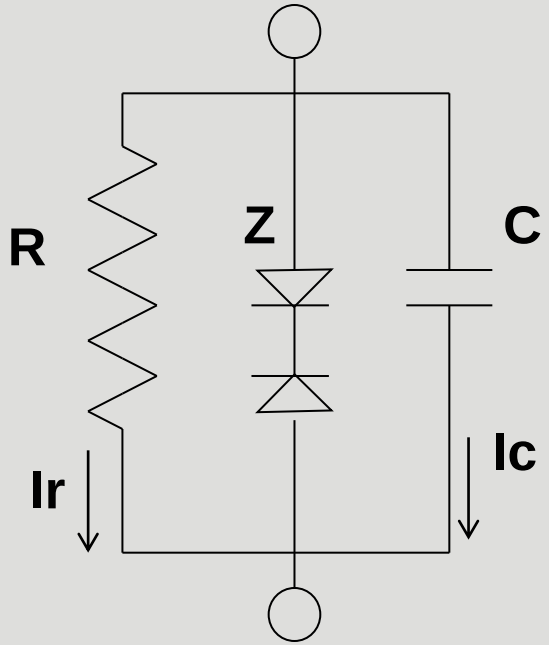
Testing of Surge Arrester

- Performance of SA depends on insulating property of ZnO
- Deterioration of insulating property increases leakage current
- Measurement of Resistive leakage current gives health of arrester



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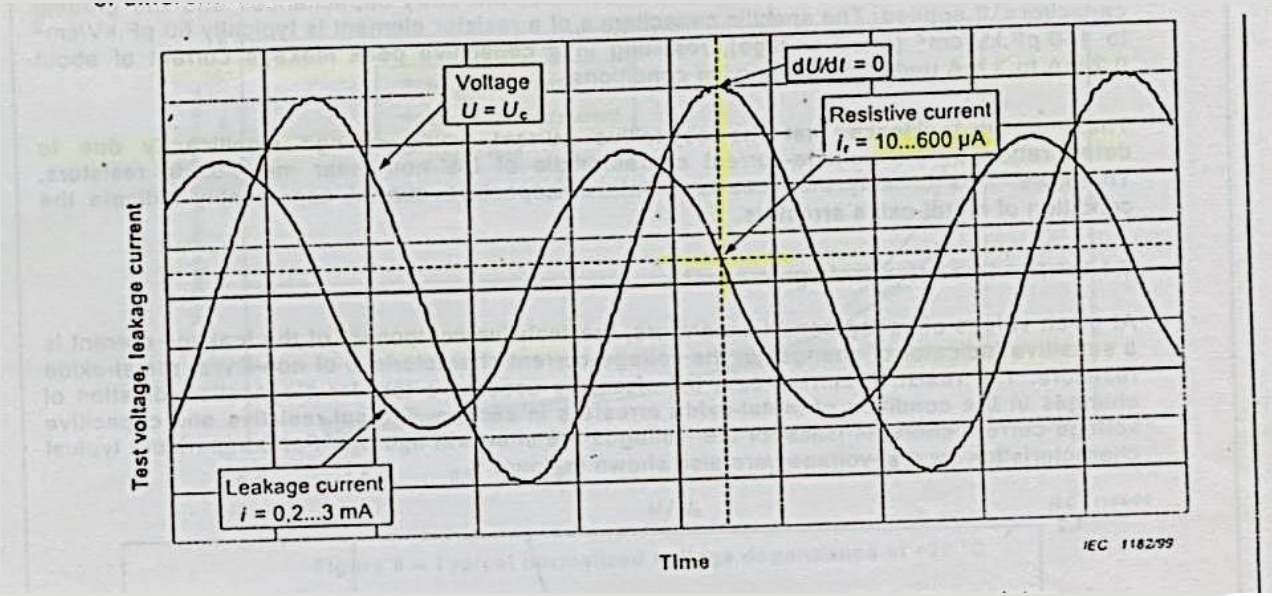
Resistive Current

- Actual Resistive Current
  - The resistive component under AC voltage is defined as the current level at the instant of voltage maximum (dv/dt = 0).
  - The measurement is possible in Lab condition only.



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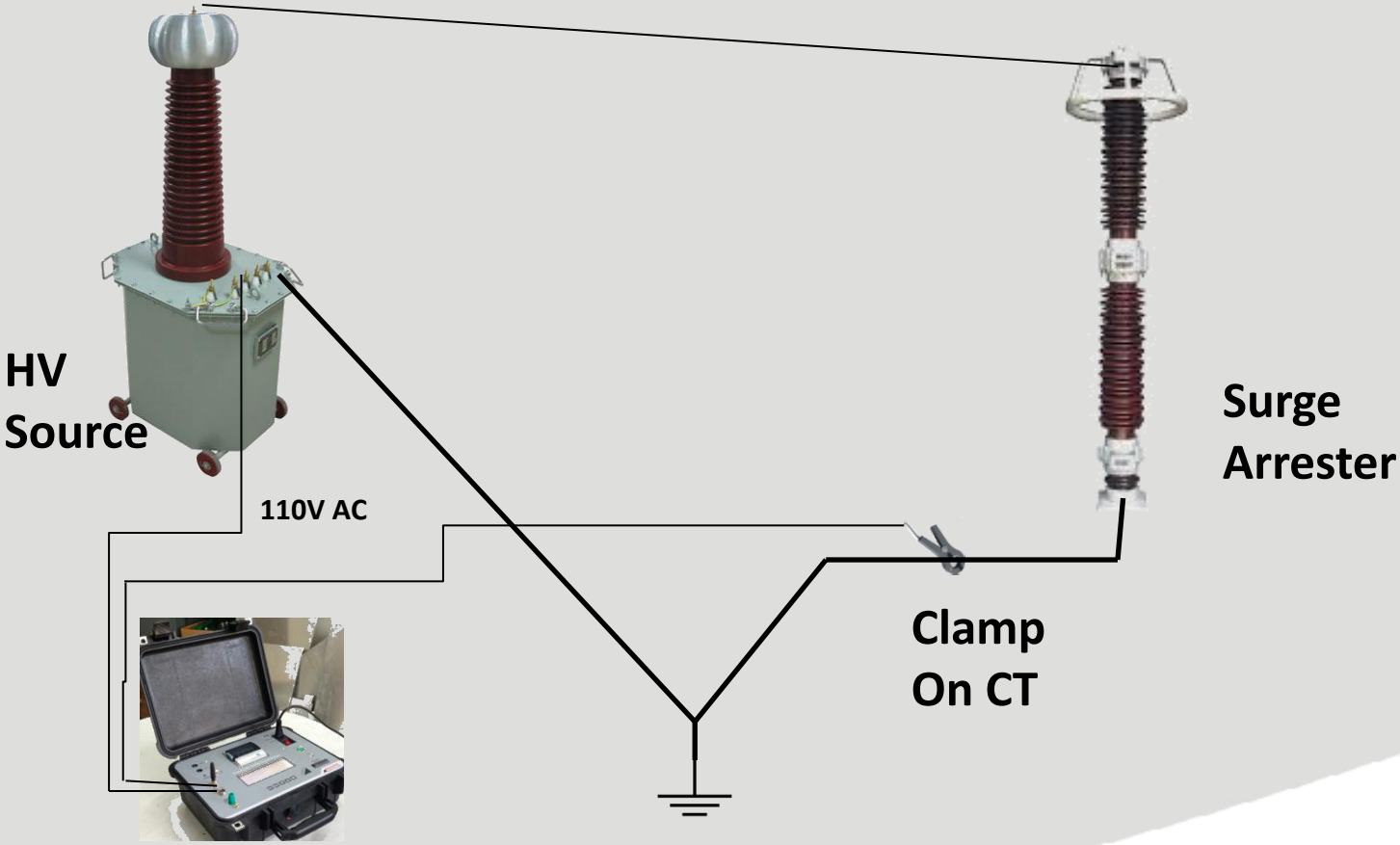
Resistive Current measurement



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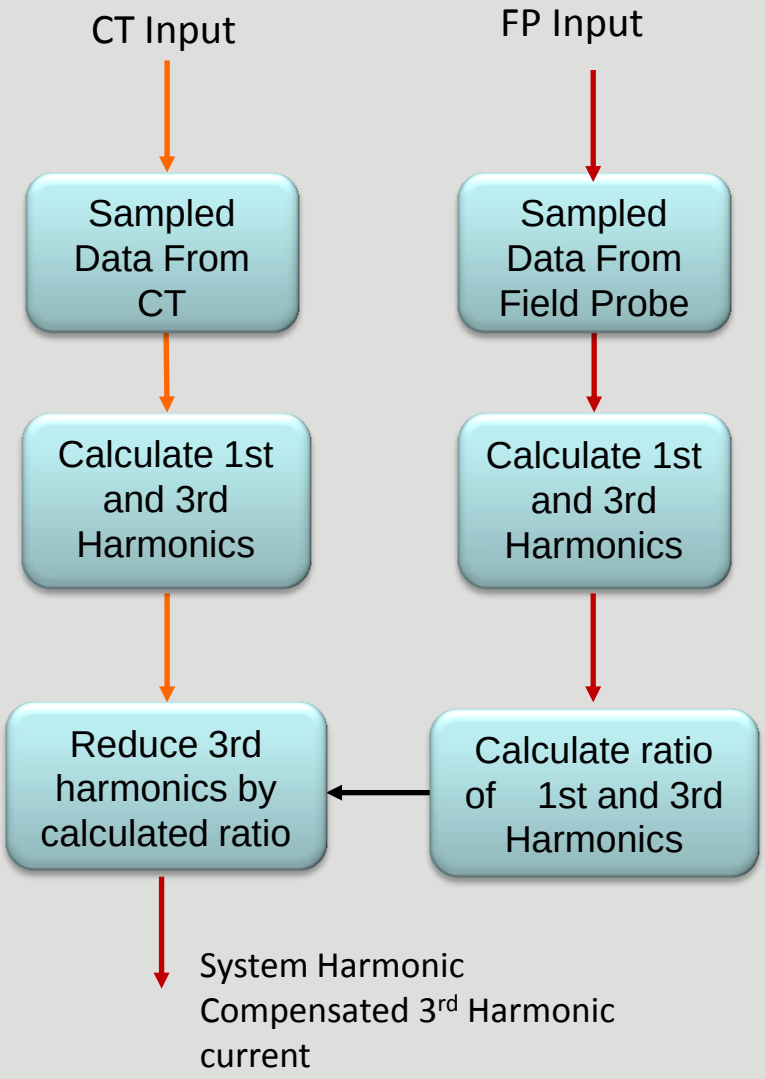
Third Harmonic Current Measurement

- Due to non-linear V/I characteristics of ZnO , harmonics are generated in leakage current.
- This harmonics component depends on resistive component of arrester.
- Due to increase in this resistive component, major increase in third order harmonic component is observed.
- The magnitude of third order harmonics in the leakage current can be used as indicator of resistive current.
- The measurement of harmonics in leakage current of arrester may considerably get influenced by the harmonics present in system voltage.
- To get correct results, effect of these system harmonics should be compensated.



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Problems in present Method

- Field probe needs to be placed at the bottom of arrester.
- Cable runs from field probe to instrument.
- Lifting the field probe up to the base of 765kV arrester can be dangerous.
- Especially in Railways, the height of arresters is small. Chances of accidents are more.
- CT out put is very small and it needs to be carried to instrument through long leads.
- Due to induced voltage, signal through cable can get affected

New Method

- To measure the system harmonics in safer way, wireless Field probe is proposed.
- Also the wire less CT unit is proposed.
- Base unit will receive signal from CT unit and Field Probe unit and show the final result

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Field Probe Unit

- Two parallel plates are placed near the base of LA, below the line.
- The difference of induced voltage on these plates will be proportional to system voltage
- Thus the nature of signal captured.
- The signal is processed in Field probe unit.
- No connection to earth.
- No cable coming from field probe to base measuring unit
- This gives more safety to operator.
- No need to lift the field probe at the base of arrester, It can be lifted up to 1 to 2 mtrs. below the base.

CT Unit

- The output signal of CT is immediately conditioned and brought to sufficient level.
- The signal is processed and harmonic analysis is done in CT unit it self.
- The final values of 1st and 3rd Harmonics are sent to base unit.
- Communication between CT and base unit is RF.
- No effect of induced voltage on data
- More stable reading.

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Field Results

- Field Trials of wireless measurement are conducted at 400kV as well as 765kV substation
- Results of 765kV reactor arresters

R Phase

I 3rd	I cor	I total
64	61	5637
65	63	5633
66	63	5625
66	63	5628
65	61	5631

Y Phase

I 3rd	I cor	I total
58	55	5669
57	55	5688
57	56	5690
55	55	5694
54	54	5691

B Phase

I 3rd	I cor	I total
26	24	6159
27	26	6160
25	24	6162
26	24	6161
25	24	6168

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Conclusion

- The third harmonic analysis is good tool for assessing the health of surge arresters.
- With the wired CT and field probe it is possible to achieve accuracy but is challenging especially in EHV substations.
- Raising the wired field probe up to base of arrester demands more cautious and careful action.
- The new method of wireless measurement using CT and field probe offers good accuracy in EHV substations and mainly ensures the safety of operator and instrument.