

Bushing Monitoring System

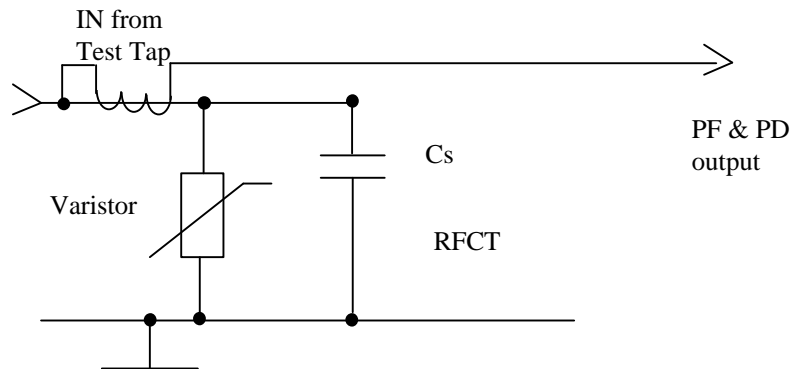
All vendors using capacitor tap as a point for connecting bushing monitoring system. The bushing manufactures designed the grounding of capacitor tap very durable and reliable. The bushing sensors for on-line monitoring must be very reliable. In the case of loosing the grounding circuit the voltage up to 17 kV can be appear on the measuring circuits.

The main purposes of using sensors are:

- protect test personal from electric shock in the case of the open test tap circuit;
- protect test tap from overvoltage in the case of open test tap circuit;
- provide reliable current output from the test tap.

Mainly there are three different types of bushing sensors:

1. Capacitor type sensor (patented by Cutler-Hammer)

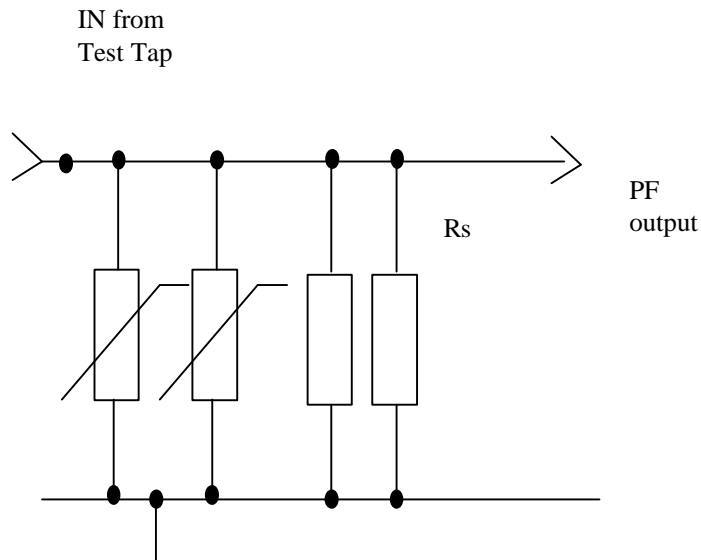


In the case of 500 kV bushing that has C_1 capacitance equal to 300 pF the output voltage when the test tap circuit is open will not exceed:

$$U_{out} = \frac{U \cdot C_1}{\sqrt{3} \cdot C_s} = \frac{500 \cdot 10^3 \cdot 300 \cdot 10^{-12}}{\sqrt{3} \cdot 1.08 \cdot 10^{-6}} = 80V$$

This sensor has two levels protection, the first one is capacitor that reduces output voltage to the safe level and the second one the varistor that protects from spikes coming from overhead line.

2. Resistor type sensor (ZTZ patent pending)

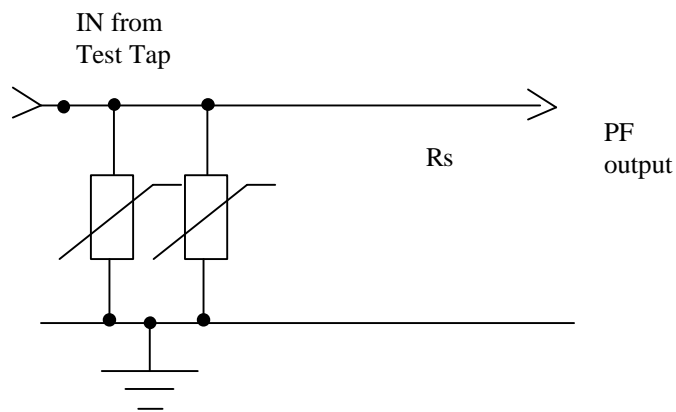


In the case of 500 kV bushing that has C1 capacitance equal to 300 pF the output voltage will not exceed:

$$U_{out} = \frac{U \cdot w \cdot C1 \cdot Rs}{\sqrt{3}} = \frac{500 \cdot 10^3 \cdot 314 \cdot 300 \cdot 10^{-12} \cdot 2000}{\sqrt{3}} = 54V$$

This sensor has two levels protection, the first one are resistors that reduce output voltage to the safe level and the second one MOV surge arrestors that protect from spikes coming from overhead line.

3. MOV arrestors sensor



This sensor has only one level of protection. In the case of open circuit all voltage is applied to the arrestors. The safety margins depends on how long the arrestors can withstand applied voltage. When the arrestors fail the high voltage up to 17 kV will appear on the measuring device and also at the terminal cabinets