Primary protection in equipment of DSLAM Regenerator (DAR)

Abstract

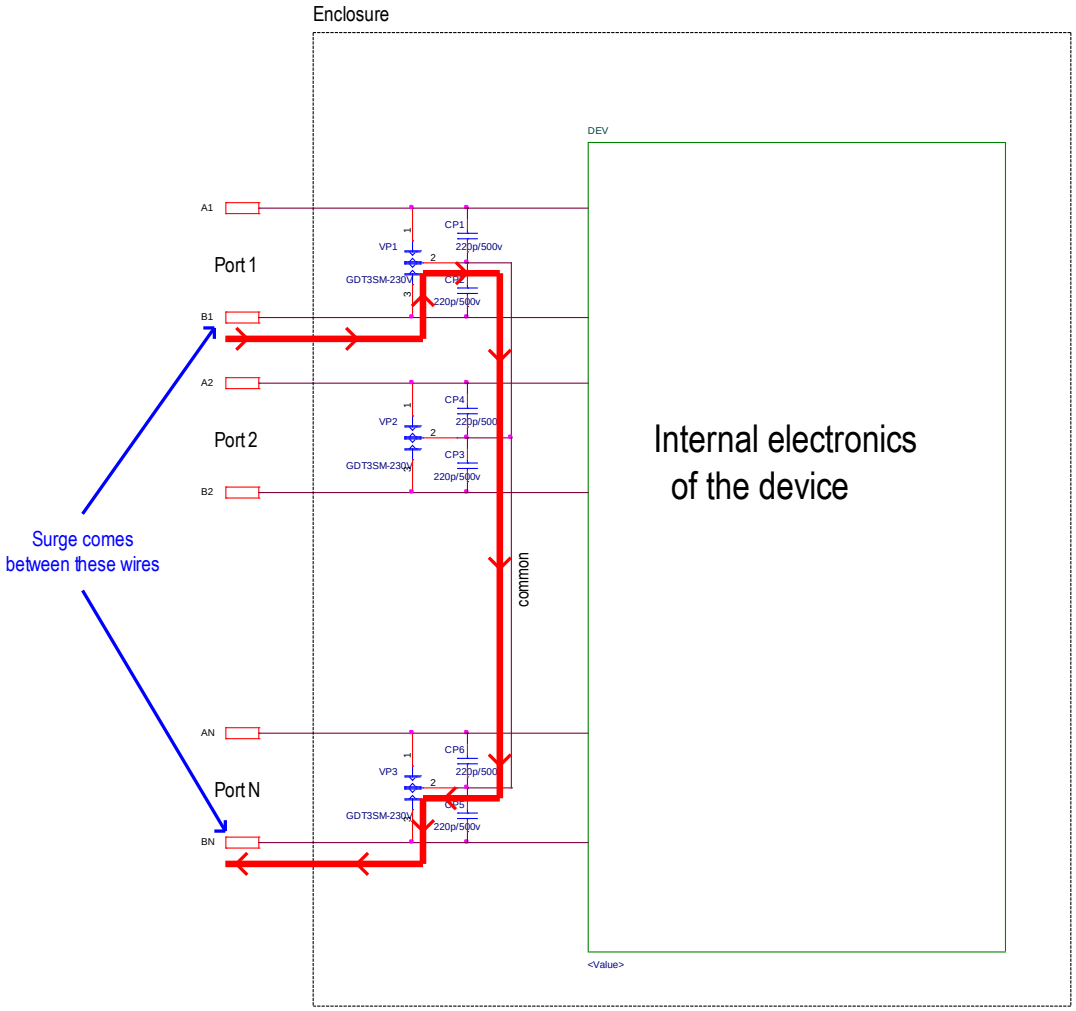
Many of our customers wanted to have a universal solution that could be dropped into any place in the network without extra infrastructural efforts.

Such a design would need to have good environmental protection, but also protection against electrical surges has to be implemented in a way that would be functional even without a good grounding source. This is essential since it can't be guaranteed that the optimal installation location has a reliable grounding point or that the existing ground will be good enough in the future.

Since the DSLAM regenerator doesn't require a grounding reference for its functions, such protection can be made trivial. Lab and field tests show that only equipment connected to ground needs surge protection, like a telephone exchange, DSLAM etc.

Protection mechanism

The protection mechanism of the DAR product is shown below:



On each network pair we employ a 3 pole Gas Surge Arrester just right next to the connector. A typical type is like the EPCOS T90-A420XSMD (http://www.epcos.com/inf/100/ds/t90420xsmdx2670t902.pdf).

The two outer pins go to the wires of the pair to be protected and the middle points of all used arresters are connected together. This connection is showed as 'common' on the above diagram. This common point is currently not connected to other circuitry.

So what happens when a surge is applied to the equipment?

The first observation is that since the equipment doesn't use any ground or earth reference for its normal functions, the surge can only come between its wire connections. The surge will flow into two arrester halves connected serially via a common connection. These arrester halves will trigger if the surge reaches the tripping point and short circuit the pair which dissipates the surge energy.

That is independently from how we apply the surge to the equipment, the arresters will act and the internal circuitry will see just a small surge until the arrester activates.

With the above arrester type the dynamic tripping point is 900~1000 Vpeak. With the serial connection that means internal circuitry may see up to 900~2000 Vpeak short surge during the initial 1~2 ms of the surge. The internal circuitry is designed so that secondary and ternary protecting elements can already handle this remaining surge.

The currently used arrester has >350 Vdc DC tripping point. This type was chosen not to activate in case of 230 Vac AC main cross condition.

The above schematic shows also 220pF capacitors next to the arresters. The function of these capacitors is to collect ESD charges during ESD tests, and prevent the arresters from tripping to ESD surges.

The above protection mechanisms were qualified in several equipment types according to ITU-T K.44/K.45 6 kV 10/700us surges.

Finally, we note that if a customer requires a grounding point anyways, then we can provide this by accessing the internal 'common' connection point. However we believe it will not improve the protection level.