



TECHNICAL NOTES OF TSS – THYRISTOR SURGE SUPPRESSOR

Why apply the thyristor surge protectors in the circuit?

Thyristor surge protectors, also known as semiconductors Arrestor. As we all know, the unit and the system often encounter transient voltage and surge, resulting in damage of unit and system, the causes of damage is semiconductor devices (including diodes, transistors, controllability silicon and integrated circuits, etc.) were destroyed or breakdown. Therefore, in order to enhance the reliability of unit and system, we should take measures to prevent the transient voltage and surge:

- ① For unit and system grounding, the land of system unit (public side) and the ground should be separated, subsystem should have independent public terminal. The transmission of data or signals among each subsystem requires electrical reference of the ground. Grounding line (surface) should afford large currents, such as several hundred amperes.
- ② Key components in the unit and system (such as computer monitors, etc.) should use Thyristor surge protectors, voltage transient and surge are passed to subsystem and the earth through protection devices.
- ③ For important and expensive unit and system, combination of several transient voltage surge protection devices is applied, which is a multi-level protection circuit.

What's the reason for Voltage Transient and Surge ?

There are mainly four reasons:

- ① The connection and disconnection of home appliances power grid, will lead to a very short time voltage pulse, which belongs to emotional voltage transient. There is also capacitive voltage transient, for example, the power supply bureau parallel connect the capacitors to compensate large electric inductive load during daytime. But in the evening due to a significant reduction of industrial electricity consumption, electric power grids changed from inductive load into resistor , since the cut off of capacitors will cause capacitance transient voltage, and no need for compensation.
- ② electrostatic discharge, the human contact and vibration of plastic MOS devices storage boxes will cause a large number of static electricity.
- ③ nuclear explosions will have a powerful electromagnetic pulse, which leads to high inductive voltage.

DV Tecnologia Company Group



④ Lightning is a nature phenomena. However, the unit damaged is not directly affected by lightning strike, but indirectly affected through the cable lines. Electricity discharge insider the clouds and discharge between clouds is 10 times higher than direct lightning, radiation field for this discharge is perpendicular to the ground, therefore, the scope is very wide, like a piece of electrode in the plate capacitors, pulse coupling to the underground cables through capacitor, then spread to the input / output terminal of the unit.

What is the working principle of the thyristor surge protector?

Thyristor surge protection device is a two-way symmetric SCR tube, using short circuit launch as PNP cathode structure, in normal status, the thyristor is closed, the current in the discharge tube is very small (μA), can be considered as "turn off", and the current flows to the protected circuit. But once the surge occurred and the surge voltage is higher than the turn voltage V_{BO} , there will be a low voltage high current circuit in the discharge tube, or in the status of "short circuit". Then all the surge current will be released through thyristor, and voltage imposed in the protected circuit is the same value on the thyristor, thereby protect the circuit. When the surge current weakened to lower than holding current I_H , the tyristor return to closed status.

What are the main parameters of thyristor surge protectors?

① breakdown voltage V_{DRM} and turn voltage V_{BO} : they can meet requirement of precise and stable voltage control.

For example : WEOS4-80/270A series products, $V_{DRM} = 270\text{V}$, $V_{BO} = 350\text{V}$.

② Turn current I_{BO} and Holding current I_H : As long as the Holding current is higher than the greatest short-circuit signal current value in the thyristor, the thyristor can withstand the surge and automatically return to former condition. The larger turn current will ensure thyristor not mislead the circuit. In general, $I_H \geq 120\text{ mA}$.

③ peak pulse current I_{PP} : The pros and cons of the Thyristor is evaluated through the largest pulse current, the shorter time the current flows through the circuit, the greater the pulse current will be, for example: $10\text{ A}/2\text{ s}$, $100\text{ A}/1\text{ ms}$. Usually the testing condition of the definded pulse waveform is : pulse rise time $t_r = 10\mu\text{s}$, pulse delay time $t_p = 1000\mu\text{s}$, recorded as $10/1000\text{ us}$. Under the situation of $10/1000\text{ us}$, the I_{PP} is divided into three grades: 50 A , 80 A , 100 A .

④ current rate of increase of di / dt and voltage rise rate dv / dt : Generally speaking, Surge interference is very short, which requires a rapid discharge capacity. The greater the current rate of increase, the higher thyristor current and the shorter for discharge time will be. High voltage rise rate ensure that thyristor will not be affected by the capacitance displacement current

"FORNECENDO TECNOLOGIA EM COMPONENTES ELETRO-ELETRÔNICOS"

Rua Dr. Dante Costa, 35 - Vila Arapuá - São Paulo - SP - Brasil - 04257-220 - Tel/Fax: (11) 2352-2010
dvtecnologia@dvtecnologia.com.br - www.dvtecnologia.com.br

DV Tecnologia Company Group



triggered by effective pulse signal , which may mislead the circuit , which in turns ensure the normal work of protected equipment.

What' application of Thyristor surge protectors?

Thyristor protector is widely applied in Modems, POS systems, fax machines, analog and digital line cards, PBX systems, digital set-top boxes, subscriber line interface circuit, telephone, telecommunications equipment and other users, network equipment.

"FORNECENDO TECNOLOGIA EM COMPONENTES ELETRO-ELETRÔNICOS"

Rua Dr. Dante Costa, 35 - Vila Arapuá - São Paulo - SP - Brasil - 04257-220 - Tel/Fax: (11) 2352-2010
dvtecnologia@dvtecnologia.com.br - www.dvtecnologia.com.br