

The Technical Note is pertinent to the Mentor/Quantum Family

Snubber Networks in DC Drives

SCRs (or thyristors) are usually considered to be reasonably robust devices, however there are circumstances or environments where they can malfunction. In a drive, normally an SCR is gated on by a fairly substantial, fast rising gate pulse. It is necessary for the pulse to be large enough and occur quick enough so that all sections of the semiconductor material are transformed to a conductive state before too much load current begins to flow through the device. If this does not happen, all the current will pass through a small area of the SCR creating too much resistive heating and the device can fail.

Disturbances in the power system supplying a drive, if severe enough, can also gate SCRs on. Unfortunately those disturbances are usually only barely able to gate an SCR. The SCR is said to have been gated on, or “misfired”, by “ dV/dt (a rapid voltage transition/spike across the device)”. If this happens, by the mechanism described above, the SCR may fail. For most industrial applications, the existence of isolation transformers, other loads, power factor correction capacitors, and power conditioning components in various other equipment distributed across the power lines, are usually sufficient to limit the magnitude and frequency (dV/dt) of disturbances that a drive would experience. A source of a power disturbance, that does cause trouble and is difficult/expensive to protect against, is often due to lightning. However occasionally it is caused by the starting of large AC motors, large arc welders, the switching of power factor correction cap banks, loose power terminals, or degrading or arcing high voltage insulators for example.

Extra protection can be provided for a drive by the addition of isolation transformers, line reactors, R-C snubbers, and peak voltage-limiting varistors (MOVs) on the line feeding a drive. Because often the occurrence of the highest levels of electrical noise are quite rare, and random, their characteristics are difficult to predict - so to answer the question of how much protection is enough, is very difficult to determine. For most applications no additional protection will ever be needed. For this reason, and because substantial protection components would be a fairly large percentage of the cost of smaller drives, they are not included as a standard feature in most drives. In large drives, where the cost of a single failure is high, they are more difficult to repair, and the ratio the drive's cost to the cost of the protection components is much higher, large R-C snubber and high energy varistors are included as standard in the drive. Nevertheless, for those larger drives, in the worst situation, additional protection and filtering may be needed.

Questions ?? Ask the Author

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