Technical Paper

Capacitor Duty Thyristor Switches: Working Philosophy.
(TAS make TSCI / TSCC cap duty thyristor switch for LV application)

TAS make capacitor duty thyristor switches are primarily designed for switching On / Off the 3-phase 3-wire connected capacitor banks used for Power Factor improvement in electrical system. Normally, these switches would perform the operation of turn on or turn off the capacitor banks by receiving the command from Automatic PF correction controller or even seldom cases by manually operated switches.

The primary requirements that were felt necessary while designing this product are:

1) Accepting the ON or OFF command from PF correction controller for switching the capacitor bank connected to the switch.
2) While switching ON, the capacitor bank should experience near zero switching surge current. This is to be achieved by switching ON during the “zero differential voltage instant switch on”. (zero differential voltage is the voltage across the switch).
3) While switching OFF, the switch OFF should be at zero current switch off. This is for controlling the surge voltages that can be caused by inductors that are put in series with the capacitors.
4) While switching ON or OFF, the phase sequence of these actions should be mandatorily maintained so as to ensure the switch OFF state peak voltage appearing across the switching elements (thyristors) should be maintained at minimum level. (at most should be less than 70% of the maximum peak voltage handling capacity of the thyristors)
5) To provide the adequate protection to the components used in the unit so that any adversities appearing on the supply system should not cause any damage to them. i.e. high reliability to the unit. (supply voltage transients and supply current spikes that can flow through switches)
6) Ensuring protection to the PF correction system and even the electrical supply system in case of adequate Electrical Power Quality parameters are not within the recommended standards (International norms like IEEE-519)

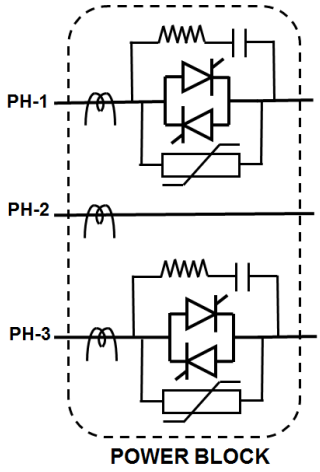
The secondary requirements that are added as design features in the said unit are:

1) Provide protection to the connected capacitor bank circuit. (Over current, Current Harmonics and Earth fault)
2) Self-monitoring of unit’s own health. (monitoring the health of thyristors and cooling system healthiness)
3) Display of the Current in all the three phases and average of three phase current of the conducting switch. This would ensure providing information about the capacitor health and right level of reactive power compensation provided to the user of the PF correction system.

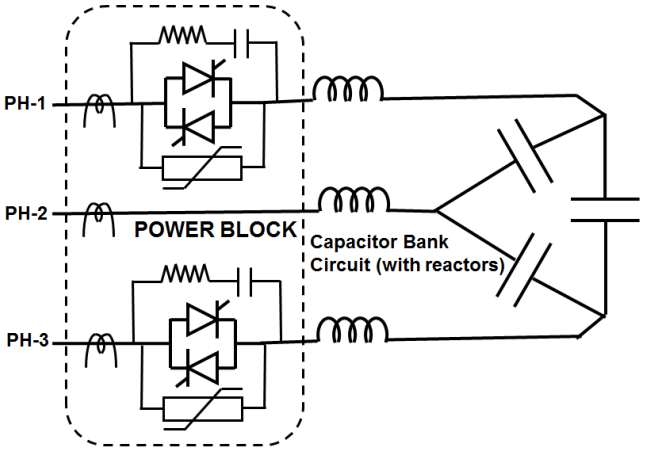
4) Provide alarm annunciation in case of switch detects any faults that are monitored by it.
5) Ensuring EMC / EMI (Electro-Magnetic Compatibility / Interference) standards are maintained as per specified International Standards.
6) Easy design for Serviceability and Manufacturing.

Functionality Block Diagrams:

Power Circuit:



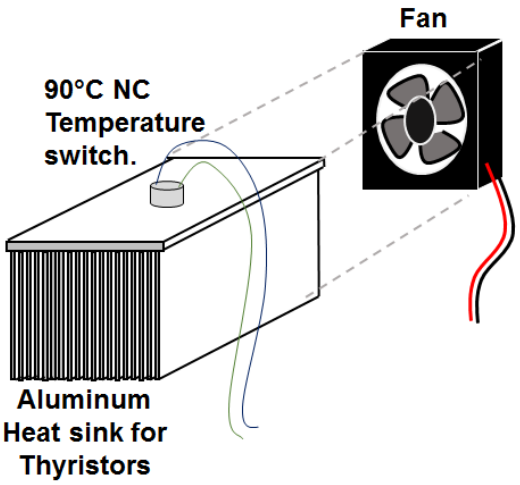
Power Block connected with Capacitor bank.



Bill of material:

- Thyristor module (connected back to back – AC current mode) – 2Nos.
- R-C Snubber circuit – 2Nos.
- Metal Oxide Varistor – 2Nos.
- Current transformer – 0.2VA rating – 3Nos.
- Copper Bus-bars with support – set as per rating.

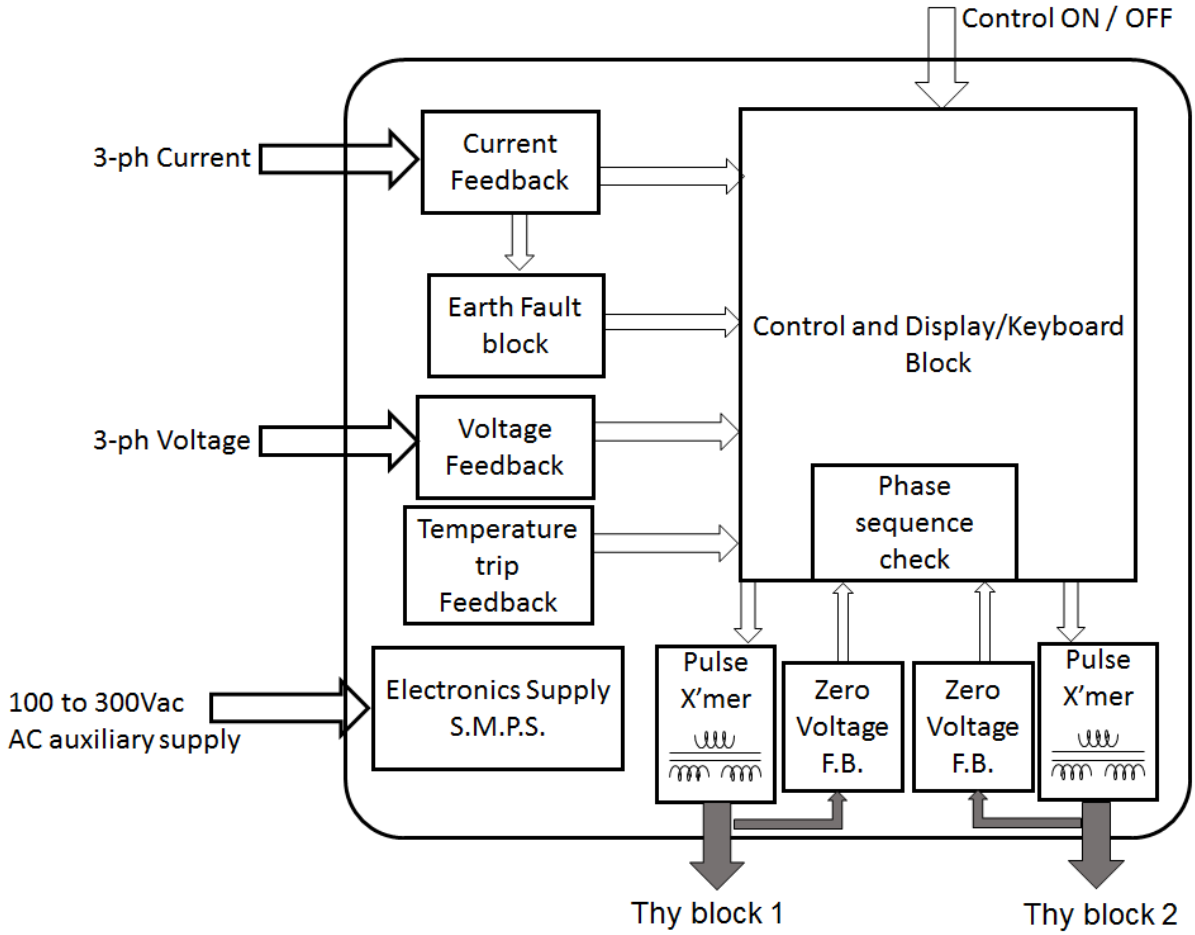
Cooling Block:



Bill of material:

- Aluminum Heat sink – Size as per rating.
- Temperature NC switch 90°C – 1No.
- Fan in suction mode mounted on Heat Sink – 1No or 2Nos as per rating.

Control Block:



Bill of Material:

- Electronic controller consisting of various Electronics blocks mainly controlled by Microprocessor based control block.

For details of every feature detailed functionality, please refer to the product operations manual.

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