Power Converter Critical Functions

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Management of Energy Hazard

critical functions are related to the management of energy hazards in load circuits and converter;

Three key actions for energy hazard management;

1. Stop transferring energy between the mains supply and the converter
2. Stop transferring energy from the converter to load
3. Discharge stored energy in the converter and the load
Critical Actions: Switch Mode (IGBT)

- In cases the crowbar may **passively activate** when over-voltage conditions occur
- Smaller converters may leave **bridge enabled**, dissipating energy in the bridge ~10s of seconds vs crowbar ~100s of seconds
- Battery typically up to **40MJ** (11kWh)
- Machine protection system **not always present**, and decides itself whether to take action
crowbar / freewheel dissipates load energy, as well as output filter energy
- crowbar / freewheel enable is 400µs on 1600µs off **pulse train**
in cases enabling produces heat – if so, not enabled indefinitely (~100ms)
Fast Power Abort

Description: Provided by the external machine protection systems, indicating converter must stop immediately
- Powering Interlock Controller (PIC) // Quench Protection System (QPS)
- Warm Magnet Interlock Controller (WIC)

Latency: ≈ 50 microseconds

Triggers Functions: force SAFE CHAIN → Open
force VS RUN → False

External systems provide a contact contact closed, current, means FAST_PA is FALSE.

NB: interface up to 15V, current regulated 6 – 10mA
Open Circuit Breakers
Open circuit breakers, in certain conditions, preventing energy being transferred from the mains, pre-charge and pre-magnetisation systems, and from stored energy devices.

Force Voltage Source Stop
Stop transferring energy between converter and load.