
Redundant System Design

Why redundant system design

Electrical controls are built using a whole bunch of sub-systems which all have a certain potential of failure. To provide safety of the system in case of a single sub-system failure, safety relevant sub-systems are built redundant (double). The two sub-systems working on the same task are cross-checked to make sure, that both systems work fine. Two redundant systems do not add much to safety, if failure of one system is not detected.

Therefore, redundancy, cross-check and safety relevance are part of safety class 3 design concept also referred to in international standardization document DIN-EN 954-1.

Standard redundant components

The concept of redundancy is a central feature built-in Truninger magnet system controls. All safety relevant sub-systems are built according to the safety class 3 standard. The following sub-systems are covered:

- Two power sources, mains and backup battery. Backup battery capacity is designed to maintain safe operation for at least 20 minutes.
- Two current sensors and two associated cross-checked signal processing units. Failure of one sensor will be detected and trigger a switch over to battery operation and system lock (magnet can be switched Off but no more On).
- Two power switches, one dedicated to mains power, one dedicated to battery power. Failure of power electronics IGBT (transistors) will cause the second current loop to take over and also lock the magnet system. Both power switches are checked in every load cycle.
- Two controllers built in different hard and software. Any failure of the SmartPick™ main controller will hand over the control task to the slave controller SafePick™. Also here, both controllers are checked continuously by each other.
- Two low voltage power sources. Each of the two controllers is equipped with individual low voltage power sources. Such power sources are cross-checked and both are battery backed up.

Optional redundant components

Most often, the power lines from the controller to the magnet are considered safe and therefore not built redundant. However, in some harsh environments, cables and cable drums can not be considered safe.

If required, total redundancy can be achieved building up two independent electric power circuits to the magnet. Two independent cables, two cable drums, two electric coils in the magnet and two power supplies PowerPick™ build up such independent electric power circuits. Even a short cut at any location of one circuit will not stop this system from operating.

Example

Below is a typical gantry crane installation with an integrated, total redundancy coil magnet system:

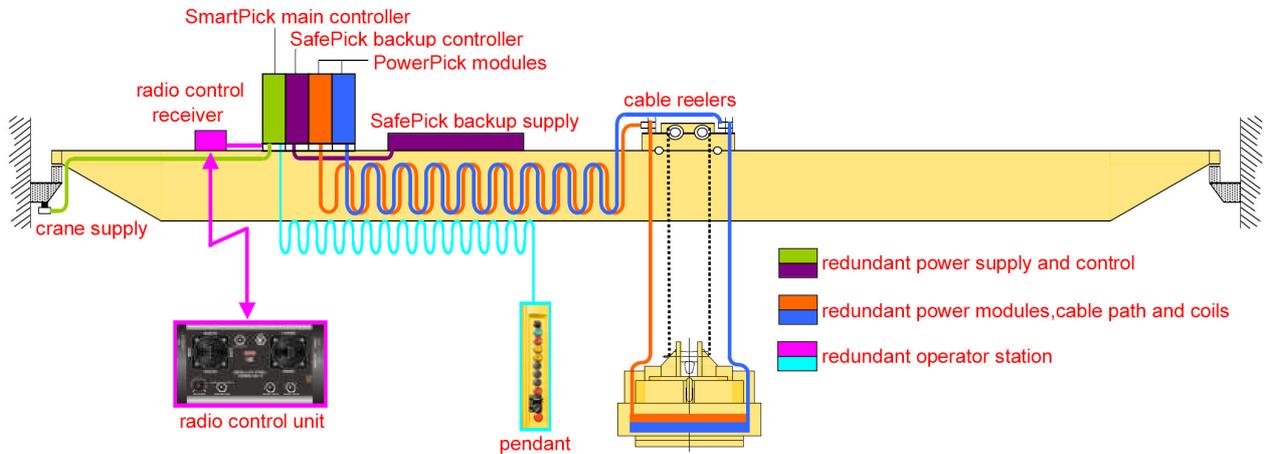


Figure 1: Magnet system with total redundancy electrical system

The redundant components are:

- Two PowerPick modules.
- Two sets of flat cables.
- Two cable reelers
- Two independent coils inside the magnet.

This arrangement forms two completely independent end-to-end power circuits which guarantees safety of the load even in the event of partial or complete failure of one circuit.

Also a redundant operator control sub-system ensures that the magnets may be operated from a backup pendant if the radio control unit or radio receiver are faulty.