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Superconducting magnet control system of JT-60SA

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The JT-60U is being upgraded to a full-superconducting tokamak referred as the JT-60 Super Advanced (JT-60SA) as one of the JA-EU broader approach projects. JT-60SA will use superconducting magnets to confine the plasma and achieve a plasma current with a typical flat top duration of 100 second in purely inductive mode. The JT-60SA refrigerator will provide supercritical helium at 4.4 K for the superconducting toroidal field and poloidal field magnets, 50 K for High Temperature Superconductor Current Leads, 80 K for Thermal Shields, and 3.7 K supercritical helium for the divertor cryopumps. During typical plasma discharge scenarios magnets currents have to be ramped and controlled, helium pressures and flow rates in the cooling loops of the coils and structures have to be adjusted and temperature stability of several components has to be supervised. In abnormal situations the magnet system has to be discharged quickly and brought to a safe condition. A supervising system called “magnet controller”is being developed to perform the different operation scenarios of the magnet system of JT-60SA.
One of the main control functions of the magnet controller is the smooth cool down of the magnet system. During the cool down, temperature differences between different sections of the magnet system and the structures have to be limited and the cooling requirements have to match the refrigerator´s capacity. Helium flow rates have to be split and distributed to the different JT-60SA loops in proportion to the their masses and specific heat capacities
In case of quench, the magnet controller triggers the ramp-down of the coil current by passing the quench signals from the quench detectors to the Supervisory Control System and Data Acquisition System (SCSDAS) and in parallel to the cryogenic system. In the contribution, the current status of the development of the magnet controller will be presented.

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