THE NEW CONTROL FOR MAGNET SYSTEM OF KSRS

E. Kaportsev, A. Valentinov, Yu. Krylov, K. Moseev, N. Moseiko, RRC Kurchatov Institute, Moscow, Russia

Abstract

The running cycle of Kurchatov Synchrotron Radiation Source (KSRS) includes the injection of electrons with energy 80 MeV from the linear accelerator in the booster storage ring Siberia-1, the accumulation of a electron current up to 400 mA and, then, electron energy ramping up to 450 MeV with the subsequent extraction of electrons in the main ring, storage ring Siberia-2, and accumulation there up to 300 mA, and at last the energy ramping up to 2.5 GeV. [1]

Several years ago, a modernization of the current system of automated control systems (ACS) has started. Modernization has affected the most important parts of the system - the system of data collection and monitoring system. Used advanced solutions based on CAN and VME and modular complexes National Instruments.

This article describes some of the features of the most important part of the control system - the controller of the magnetic system and software management environment.

APPOINTMENT OF ACS

The existing automated control system (ACS) accelerator-storage complex (UNK) "Siberia" - synchrotron radiation source and center of collective use NRC "Kurchatov Institute" was established over 20 years ago on the basis of the control equipment in the CAMAC standard. Currently, there is an active modernization and replacement of outdated equipment with new, modern and more productive. [2]

The control apparatus of the new ACS with integrated processors, as well as acquired powerful servers, the operator's computer and network equipment has developed software (software) at all levels of the ACS.

The control system of the magnetic system is one of the most important parts of the ACS. So far, the management system used obsolete equipment in the CAMAC standard, as well as outdated transformer type current sources controlled by the analogue signal.

We have improved the management of the magnetic system, setting a new high-performance controller, and using a new, more accurate current sources, controlled by a digital signal on the CANOpen standard.

CONTROL OF THE MAGNETIC SYSTEM

The magnetic system is controlled by a controller NI cRIO-9081 (Figure 1). In the chassis of the controller is installed one discrete I/O module NI 9425 and two double-channel CAN module NI 9853. To control the high-current and the low-current magnets control module uses two CAN network. One CAN network connected to smart crate-controller K167 [3] and CAN-DAC power supply units of the quadrupole lens and bending magnets of the accelerator. The second network, connect the power supply control units of the correction magnets of the accelerator.

Smart crate-controller K167 used to translate commands transmitted from magnetic controller via the CAN bus system into CAMAC commands. Management of the high-current sources of bending magnets and quadrupole lenses is performed by using a 20-bit DAC-20. Measurement of currents on the buses is performed by means of 20-bit ADC 20. All these units are installed in the CAMAC crate. For transmitting diagnostic signals (interlocks, errors) used CEDAC20 units installed in the power supply cabinet.

To control the current sources of the electron beam orbit correction system uses specialized correction control units (CCU). These blocks have been specifically designed by our employees. CCU provides translation of commands transmitted from the controller of the magnetic system via the CAN bus into CANOpen command. Each CCU manages the 16 th power supplies developed by a third party specifically for the needs of Kurchatov Institute.

DAC and ADC management teams made directly via the CAN bus, ie, values of DAC and ADC values are transmitted via the CAN bus. The mechanism works as follows: during the execution mode (magnetization reversal, injection, energy recovery) is carried out pre-entry table the estimated current values in the controller's memory. Then, on command from the old system, a magnetic system controller begins to record currents in the DAC current sources corresponding channels. Recording is carried out simultaneously with the record values RF parameters of the system, connected to the old control system.

SYNCRONIZATION WITH OLD ACS.

To synchronize the operation of the controller of the magnetic system with the old control system, we using one channel of the controlled registers in the crate CAMAC, and one channel of discrete input NI9425. The operator selects the desired mode of operation using the appropriate snap-in of the CitectSCADA system [4]. This command is transmitted to the RF generator control system, as well as the program for calculating of currents table. After all preliminary calculations have been made, the controller of the magnetic system is commanded to start through the channel of the register, and the process entering the into the synchronous mode.

ISBN 978-3-95450-181-6

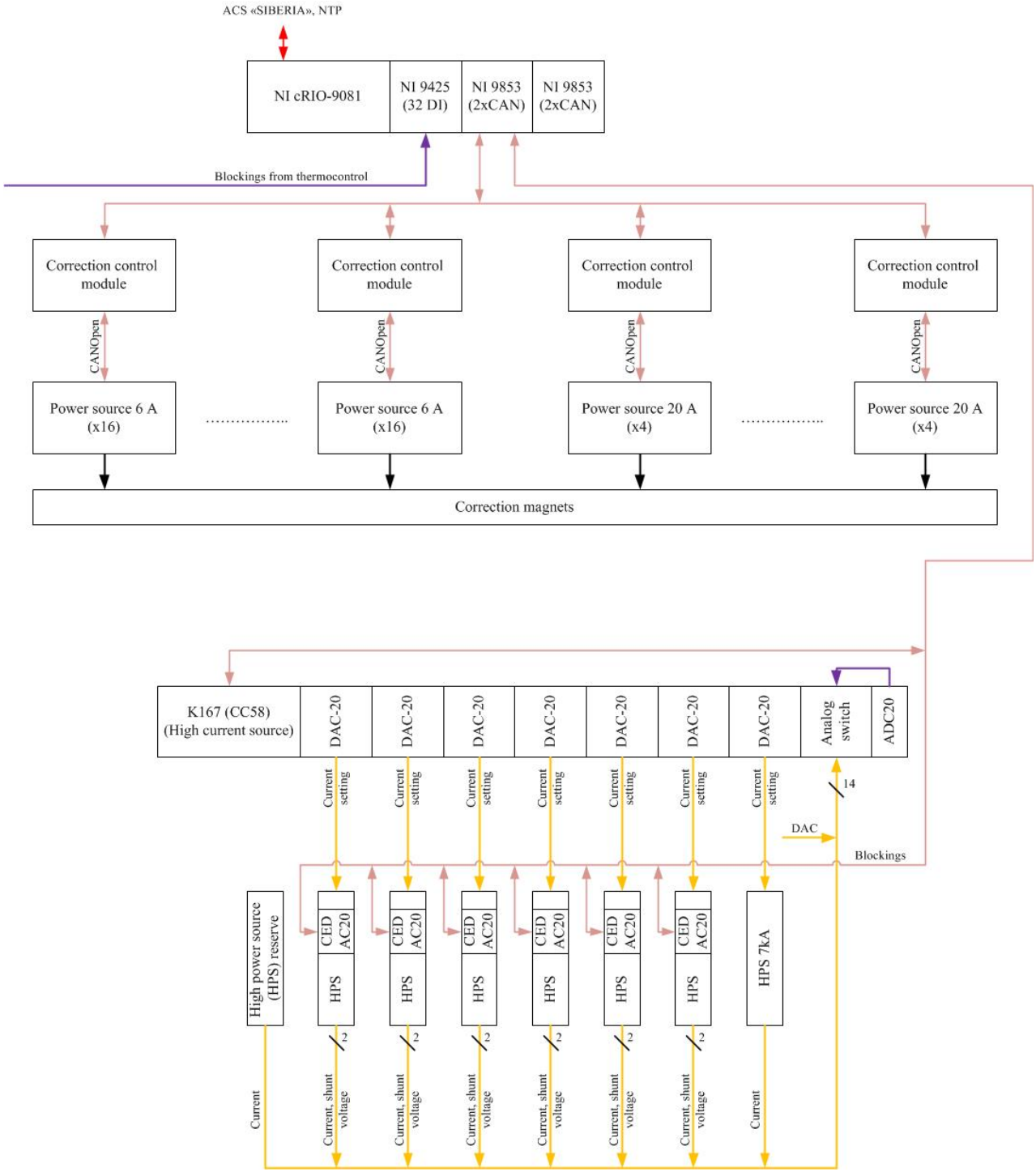

Figure 1: Block diagram of the magnetic system.

SOFTWARE

Low level Software of the magnetic system controller NI cRio-9081 is developed using an integrated development environment LabView (National Instruments). Management and integration of all the individual components of ACS is implemented by using CitectSCADA. The operator selects the desired screen form, in this case, "magnetic system", and make the necessary action - entry mode or manual control sources. Also here are displayed all the possible diagnostic and measuring channels are connected to the sources of supply of the accelerator magnets.

ISBN 978-3-95450-181-6

CONCLUSION

The new control system based on high-performance controller that allows you to simultaneously control the currents in power supplies, as well as to diagnose, measure currents on the buses, process the signals and blocking errors. In addition, this controller is modular, which allows to increase its capacity and number of controlled channels. It is planned to upgrade the RF generator control system, and the abandonment of the old system completely.

REFERENCES

[1] V.Korchuganov et al., The status of the facilities of Kurchatov's synchrotron radiation cource. Proceedings of RuPAC2014, Obninsk, Kaluga Region, Russia.

[2] E.Kaportsev et al., Modernization of the automated control system in the Kurchatov synchrotron radiation source. Proceedings of RuPAC XXIII, S.-Petersburg, Russia, 2012.

[3] L.Moseiko et al. INTELLECTUAL CRATE-CONTROLLER K167. Proceedings of RuPAC 2008, Zvenigorod, Russia.

[4] E.Kaportsev et al. Modernization of the automated control system in the Kurchatov synchrotron radiation source. Using SitectSCADA. Proceedeings of RuPAC XXXIV, Obninsk, Kaluga Region, Russia, 2014.

ISBN 978-3-95450-181-6