Control of electricity distribution networks

System RC1

The efficient and reliable control of electricity distribution networks

'Information System RC1' is a sophisticated microcontroller based system, utilizing the latest technology, specifically designed for the needs of electricity boards. It was designed to specification, with the aid of consultants from the electricity board, based upon their needs. Hence the system satisfies all the operational requirements for efficient, reliable, control and monitoring of electricity networks. This incorporates monitoring both the state of the grid and of the electricity consumption, allied with fully automatic archiving of data and network control.

Reliability and flexibility

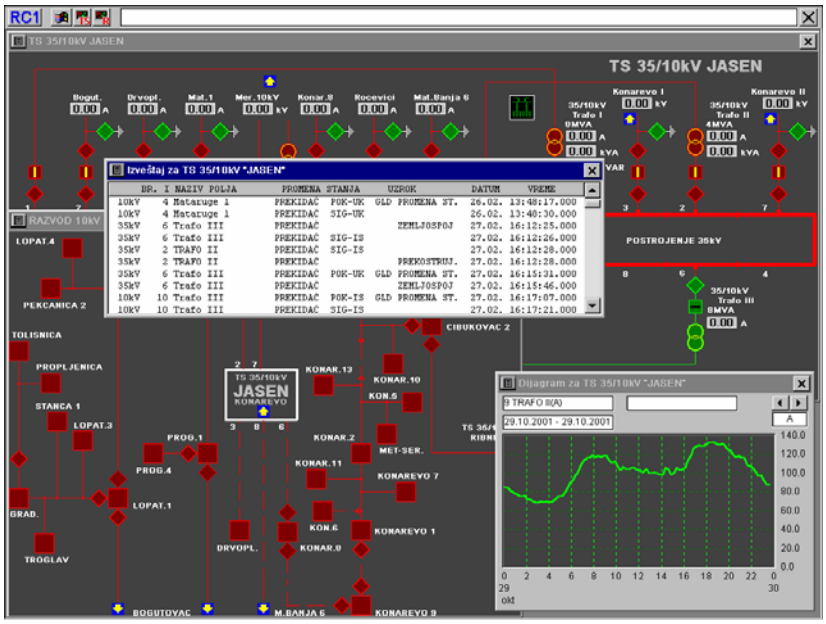
The two main features of System RC1 in terms of applications are reliability of the control and transfer of collected data, and system flexibility. Reliability is achieved using multiple checks of the data and command transfer lines. Flexibility of the system is realized using a modular approach. This enables optimisation of the system to suit customers' needs, allied with a simple and cost effective system expansion path, whilst fulfilling specific customer requirements that may not be available within the current system.

In-house design and manufacture of product

From the construction of each module, to entire software support, the system is entirely in-house designed and built by our team at SRC SOFT. This factor has important advantages for the long-term support, maintenance and upgrade of the system.

System RC1

System features:



Automated central control and monitoring of all the important parameters within an electricity network, using a computer located at the control centre.

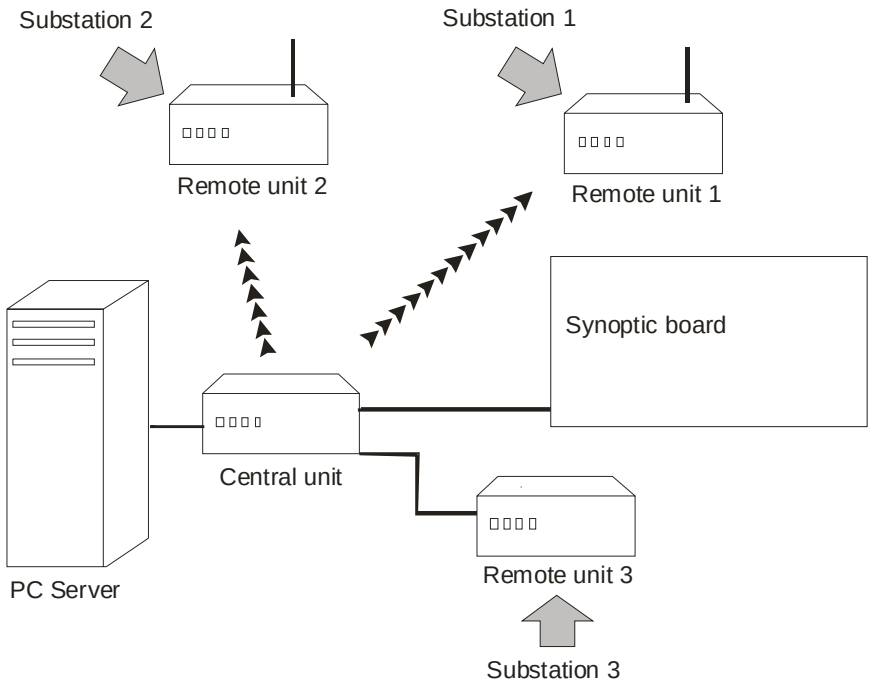
System RC1 enables data acquisition and monitoring of the entire network, including:

- Presenting the state (readout) of the entire network (110kV, 35kV, 10kV and schematic diagram of one phase) on a computer screen.
- Presenting the state of the network on the synoptic board.
- Automatic data measurement and acquisition, related to overload of all sub-station lines, every 15 minutes. These measurements are shown on the computer.
- Archiving of all measured data on the computer for a minimum of one year.
- Presenting of data, related to the daily consumption at individual measurement points, using spreadsheets and charts.
- Automatic and instant reporting of any change in the network, both in terms of change of status (readout) of the network and critical levels of consumption on the lines, sending a warning message to the computer operator in the remote computer centre, as well as data processing and immediate printing of data.
- Centralised control of the network using a computer, which can remotely turn ON/OFF every switch in the network.
- A real time clock in each sub-station, synchronised with the remote computer in the control centre, enabling reporting of events with an accuracy of 1 ms. This can be of vital importance during event analysis.
- The facility to obtain the status (readout), or consumption in any of the controlled sub-stations, at the request of an operator, at any given moment.
- Capability to store measurement data in remote station; to be used in case of failure of transmission lines.
- Utilisation of existing communication systems, currently used by the electricity grid (radio-communication or telephone links), for data transfer and control; to avoid additional investment in the communication infrastructure.
- Analysis and processing of stored data, printing of shift reports, as well as instantaneous data regarding network status.

Hardware description

System components

- Personal computer
- Central unit
- Remote unit
- Interface equipment
- Communication links
- Synoptic board



Connections

The sub-stations communicate with the central station using radio link, signal line (telephone wire), optics or GSM modem. This link is bi-directional to enable both monitoring and control of the remote equipment.

Operation

The central station checks the validity of received messages and informs the computer of any possible communication errors (with the remote unit). All changes in the system are communicated from the remote units to the central units, which then passes on the data to the computer to be processed, archived and presented graphically. In addition, a synoptic board can be connected to the central unit, to enable important information to be made available to all involved members of staff. In addition to the link with the central unit, the remote unit has the facility to be connected to a PC, to obtain information in case of central unit failure.

Input/output capacity

The central unit provides up to 2048 output signals for connection to the synoptic board (each signal corresponds to one element of the network). Data acquisition and station control are carried out using remote units which enable:

- Recording of up to 2048 input signals in real time with resolution of 1 ms.
- Measurement of up to 256 analogue signals (current, voltage, power).
- Controlling up to 256 switches.
- Recording of up to 256 signals from electricity meters

It is important to emphasise that a universal power supply module powering up the central and remote units has been developed. This module generates supply from the sub-station batteries (110V d.c.). This eliminates the need for an expensive backup power supply unit in case of a.c. supply failure.

System support package

Program RCELDIS

This software package runs on a PC in the central station and acts as the program support for the entire system. It enables the integration of all system capabilities and centralisation of the network control. Program RCELDIS enables recording of the network status in parallel with the synoptic board at several levels, from the highest voltages to the schematic diagram of one phase a sub-station and the 10kV network. It is possible to simultaneously monitor and control several remote elements of the network.

Alarms and change of status

The program records all alarms from remote units and performs automatic change of state of the network, in addition to providing an audible alarm. Changes of status and alarms are recorded permanently in the PC and hard copy printouts of the relevant data are provided. These changes and alarms are recorded in a form of a standard report, which can later be analysed.

Measurements

Measured data received from the remote stations is stored regardless of the current program activity and can be processed later. The instantaneous measurements are displayed adjacent to their respective sub-station symbol on the display. Measured data for any day (for a selected item) can be shown as a diagram, or be printed out as a spreadsheet or a chart.

Implementation

It is important to point out that System RC1 can be implemented in stages, to match the requirements and capabilities of the user. This means that the package can be employed without additional hardware if the only aim is storing and analysing results, or this can be the first step in implementing a complete system. System RC1 with all its functions can be implemented on a part of the network , allowing for subsequent and seamless connection of the rest of the system. The system can accommodate the expansion of the network, as new sub-stations are built or other parts of network are developed. Additional functions in terms of both hardware or software modifications can be implemented at the customer’s request.

Should there be a requirement by the customer for a third party design and interfacing of the sub-stations for the control system, SRC SOFT can offer a complete design service. In addition to the system itself, this comprehensive service would include, initial survey of current installation, and building of the complete interfacing cabinet.