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FEATURES AND UNIQUE BENEFITS OF THE MDLC PROTOCOL

Advanced SCADA systems require intelligent communication capabilities in order to assure the flexibility, expendability, reliability, and high performance of the system. In addition they require software controlled managing and maintenance of their communication network.

SCADA systems can only be justified if these provide cost benefits to the customers. This can be achieved by combining smart communications into the system, which result in faster, less costly, and safer operation and of the customers' facilities.

Motorola provides a solution to this challenge with its ACE3600 (Motorola SCADA) system and the MDLC (Motorola Data Link Communications) protocol. These liberates the system engineering and the programmers from technical constraints and complexities of the communications and allows them to concentrate on their application and system operation.

The MDLC communication protocol is based on the Open Systems Interconnection (OSI) 7 layers model published by ISO, which Motorola specifically adapted for SCADA and radio communications. This is the only available protocol for radio which comprises all the seven recommended layers. Here, every RTU may act as a Distributed Control Unit **(DCU)** and as a communications node serving other units.

The following is a list of unique MDLC features and benefits:

Application processes — The system engineers use the ACE3600 ToolBox in order to develop, maintain and modify their RTU application processes. They can then transfer the program via the MDLC protocol from-or-to all RTUs installed at the designated remote sites.

Variable length words — The MDLC provides the ACE3600 RTUs with very efficient communications methods, allowing to transmit variable length words (messages) between the RTUs and the RTUs and the SCADA centrals.

File Transfer — The MDLC protocol allows to upload and download all types of data including free format files. This can be directly performed between all the sites, i.e. between the RTUs and between the RTUs and the SCADA central.

Short Messages — The MDLC supports efficient transmission of short messages (bursts). This is done without actually creating a communications session (dialogue) between the transmitting and receiving sites (RTUs).

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Remote Diagnostics

The MDLC protocol provides the service technicians with an option to remotely perform diagnostics of the RTUs' hardware and software from any remote site (via an RTU) or from the central location.

Remote Calibration

The MDLC protocol also allows service technicians to perform calibration of the analog ports in all of the ACE3600 RTUs in the network from any remote site, via any RTU, or from the central location.

RTU to RTU links

The MDLC protocol supports direct RTU to RTU links for sending databases, local statuses and analog values. This can be done directly (or via any number of RTUs) which act as a communications node.

Process debugging

The MDLC protocol allows to remotely monitor and debug the local application programs running in the RTUs. If required, the local process in a certain RTU may be updated without actually disturbing the system's operation.

Error logging

Unusual / occasional events are logged in a local error logger in the RTU without the need to wait and catch it in the real time. The logged historical events may be later retrieved via the network for post analysis.

Error Correction

The MDLC protocol is equipped with a 32 Cyclic Redundancy Code **(CRC)** based acknowledge mechanism. Upon error detection, the receiving RTU asks the other side to resend only the damaged or missing frames, rather than the whole message frame.
In order to save computer time for the process, the CRC's word calculation is performed by hardware.

Statistical data

The MDLC allows remote access to each RTU (via the communications network) from any location, in order to obtain statistical data on the operation, events, parameters and processes at any of the designated sites.

Mixture of media

The MDLC protocol allows efficient combining (into the same data network) of several communication media such as radios, lines, microwave, fiber optics, while optimizing the overall performance of the system's operation.

Store and Forward

The MDLC protocol supports use of the ACE3600 RTUs in the network as repeaters for data transmission. These RTUs may perform "store and forward" function (for range extension) by reusing the same channel.

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Multiple centrals

The MDLC protocol supports network communications with any number of Master Control Centers (MCC), and sub control centers in hierarchial scheme. These MCCs may be linked to the network at any RTU location.

Data reliability

The MDLC protocol provides node-to-node as well as end-to-end data acknowledgement via any number of communication nodes (and media) between the RTUs and between the RTUs, and the SCADA central.

Multiple physical ports

The MDLC protocol supports multiple physical ports (radio, RS-232, etc.) in a single RTU, enabling simultaneous communication via more than one port. In the ACE3600 CPU, two out of its three ports can be used in this mode.

Multiple logical links

The MDLC protocol allows simultaneous communications of multiple sessions via the same physical port (Central-to-RTU and RTU-to-RTU sessions). Sessions sent via the different logical links do not interrupt each other.

Multiple addressing

The MDLC protocol supports: individual RTU addressing, system addressing for broadcasting the same message to a defined set of RTUs, a common address to all RTUs, and a spare address for future communication options.

Address recognition

In order not to waste valuable process time spent on checking addresses of messages not intended for that site, the MDLC supports initial address screening in hardware. This increase the overall throughput over the network.

Multitasking operation

The MDLC protocol support performance of several tasks (local processes and communications) without interrupting the normal operation of the RTU i.e. the local process and the control processes at other sites.

Protocol emulation

The ACE3600 allows emulation of other SCADA protocols. This will allow using the MDLC protocol a in combination with other SCADA systems by using of a Gateway or Bridge or Router connecting between various media.

Use of radio media

The MDLC protocol supports a wide variety of wireless and line media, including cellular (GPRS, 3G, 4G/LTE), conventional (VHF, UHF, 800 MHz and 900 MHz), trunked (800 MHz and 900 MHz), 900 MHz MAS, Unlicensed wireless Fiber optics, Line and Satellite. Any combination of

these and other physical channels may be integrated into a single data network.

Contention reporting The MDLC protocol supports event reporting in both polling and contention modes. In the latter the RTU contends for the channel and will send its message only when the channel is available (free). This results in significant reduction of air time loading.

Time tagging The MDLC protocol is suitable for electric Distribution Automation systems, since these require support for system-wide time synchronization (RTUs, communications and central) with an accuracy of up to 1 milliseconds.

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