MOSCAD - MOTOROLA'S STATE OF THE ART SCADA SYSTEM.

LIST OF FEATURES AND BENEFITS.

Motorola has developed MOSCAD, the next generation SCADA system, intended for use in the most advanced systems. The following are the most important features and benefits characterizing the MOSCAD:

LOCAL INTELLIGENCE: The MOSCAD Remote Terminal Unit (RTU) is built with powerful microprocessor and software, and permits controls and decisions without the need for constant and real time intervention of the master central computer. Each RTU can act as a **stand - alone unit** to execute local functions based on status, conditions and values from local and remote sources, or as a **regional central** to communicate messages from other units. These features assures the **reliable** operation of SCADA system, even in cases when sudden communication or other problem occur between the RTUs and the central computer.

32 BIT CPU: Motorola's powerful **16/32 bit 68302** microprocessor with 16 MHz clock allows fast and real time processing of all the RTU tasks, and communication with the network at the same time. The Motorola **68882 Mathematical co-processor** is an optional (future) upgrade for the MOSCAD, and makes the RTU capable of performing very complicated and high speed mathematical calculations.

COMMUNICATION PORTS: The RTU is equipped with several communication ports, allowing **any combination** of communications through Conventional and/or Trunk Radio network, Microwave, Fiber optics, Data network, Wire lines, RS-232 , RS-485 and other media **as required by the customers.** The MOSCAD RTU can simultaneously perform efficient communication via these ports with the other RTUs in the network or with the central computer.

COMMUNICATION RATE: The system is designed for communication rates **up to 19200 bps** trough the RS-232 and RS-485 serial ports. Lower baud rates (1200 - 4800 bps) are used to match the capability of various Motorola radio communication equipment in use,(trunked radio, conventional radio, FSK, Direct FM etc.) and the **actual quality** of the channel. Built in line modems operate in the range of 300 - 2400 bps.

RADIO NETWORK : An important feature of the MOSCAD is, that in case of sudden communication problem in the network, any of the RTU's can be remotely assigned to function as a regional "Node RTU" utilizing **"Peer to Peer" and "Store and Forward"** features.

A unique software mechanism is provided to assure the data throughput even in case of problems resulted from receiving data at the same time from more than one source.

The computer interface to the radio network is done through an **FIU** (Front Interface Unit) or MCP-M (Motorola Communication Processor for Modbus) or MCP-T (Motorola Communication Processor for TCP/IP) .

REMOTE PROGRAMMING: Except for the basic RTU configuration, which is done **locally,** the Application programs, Database and I/O functions of any RTU can be **remotely programmed** with the Programming Tool Box. This can be done from the central computer location or from field RTU in the network.

This powerful feature allows **Uploading** of Database and Programs to a higher hierarchy or **Downloading** Database or Programs to a lower hierarchy in the SCADA system.

NETWORK OPERATION: The MOSCAD family is a new generation system with expansion in mind. The RTU network is capable of direct interfacing to wireline communication, fiber optic data links, microwave systems and other networks. A MOSCAD system can be integrated with various paging systems, to send alpha - numerical alarms to the maintenance teams, wherever they are.

REMOTE DIAGNOSTICS: To help maintenance persons identify operational problems, the MOSCAD units incorporate **self diagnostic** software routines. By combining the remote programming with the remote diagnostics capabilities, frequent **site visits** by maintenance personnel can be **eliminated.** The software/ hardware remote diagnostics of a remote site can be performed from the central computer location or any other RTU location in the network.

LOCAL DIAGNOSTICS: Local **fault detection** in a specific RTU can be done by examining the LED matrix on the front panel of each I/O or the CPU module. To perform additional more **extended local diagnostics**, one can connect to the RTU a portable computer (compatible with IBM PC) loaded with the standard "Programming Tool Box" software.

MDLC PROTOCOL: The MOSCAD family utilizes **MDLC** (Motorola Data Link Communication), a very advanced protocol for all the data signalling in the network. The protocol was developed by Motorola, and is based on the **OSI** model published by **ISO**. The MDLC protocol supports all the seven communication layers, adapted for SCADA systems.

While other protocols (such as **HDLC**) usually support only the two lower layers of the OSI standard, MDLC was specially developed for **radio use**, permitting large volumes of data to be transferred between RTU's and the Central by using advanced packet transmission techniques. By means of flexible data frames in the MDLC protocol, the receiving site is able to request retransmission of only the **missing or incorrect** frames. This allows **air time usage to be reduced** to minimum, by not repeating frames which were already correctly received.

SYSTEM MODULARITY: A simple MOSCAD system consists of a single RTU with one CPU and one or more I/O modules connected to a IBM PC as a central.

Later, this basic pilot (or trial) system may be expanded with hundreds of new RTUs, in order to allow controlling of thousands of different points in a large SCADA system. Each of the computers in the system may be optionally upgraded with a second Hot - Standby central computer to enhance the reliability at the system level.

RTU MODULARITY: All the processing capabilities, the memory and the communication ports are included in the CPU module. The other modules provide digital and analog I/O features. Such modular construction allows you to configure each RTU to meet the precise requirements of the sensors or control functions and permits future expansion as the application or the system expands.

Thanks to such modularity, the field maintenance person may replace the faulty module with any identical **off the shelf** I/O or CPU module, and simply perform its configuration. Use of

standard modules makes the MOSCAD solution very cost effective.

FAST EVENT CAPTURE: To make the MOSCAD fit to variety of electric utility applications, the RTU can be equipped with software, capable to handle even **short fleeting alarms** with resolution of 1 msec and up. The data is time tagged to enable tracking sequences of events, causing **avalanche of reports** to the central SCADA.

This feature is especially important for electric applications such as circuit breakers monitoring etc., since short period events might cause major damage if the cause of problem isn't isolated.

POLLING AND CONTENTION: Efficient reporting by the RTU to the central computer is one of the key features in any the advanced SCADA system. The MOSCAD RTU is designed to transmit data upon two main types of reporting concepts:

- Periodical **interrogation** (polling) initiated by the central to update the central's database on all the parameters or only the changed parameters **(report by exception)**, and confirm unchanged parameters. Intermittent polling is possible as well.
- **Contention** , initiated by the RTU, is an "interrupt message" to the central that a change of data has occurred. As a result the central computer may initiate **priority interrogation** of the RTU and request the information on the change. The nature of the contention is, that the RTU must find out that the shared channel is available prior to the transmission.

The optional mix of these reporting modes will going to ensure immediate and effective reporting between the RTUs placed in the remote sites and the control center.In case of data changes, which are out of the normal range or value, the RTU will initiate alarm reporting via contention.

APPLICATION GENERATOR: Powerful applications may easily be defined by using symbolic ladder logic. The task is even easier by using the SCADA

Application development software to allow **local intelligence** and on line decision logic. This powerful feature is performed with the use of the Programming Tool Box software.

ENVIRONMENTAL CONDITIONS: The RTUs are designed to operate over a wide temperature range - 30 over to 60 deg C at 95 % relative humidity. Standard NEMA 4 outdoor enclosure is used, therefore it can operate reliable for many years in almost any severe climate.

I/O PROTECTION : To match the industry standards, all the I/O modules' inputs and outputs are protected. Digital inputs, Analog inputs and Analog outputs are **optically isolated** according to IEEE SWC standards. Digital outputs are equipped with electrically energized or magnetically latched relays in order to reduce current consumption. Optical isolation between the analog inputs is provided as well.

ANALOG MEASUREMENTS: The analog inputs and outputs are designed to match variety of industry standards, including 4-20 mA @ 250 Ohm, +/- 1 mA @ 4 kOhm or +/- 5 V @ 10 kOhm. In all these **inputs** the analog signal is measured in resolution of **13 bits** (12 bits plus sign). The analog outputs in the I/O modules are designed to provide accuracy of 12 bits (11 bits plus sign).

POWER SUPPLY : The uninterrupted operation of the MOSCAD RTU is assured by the **dual power supply**. The site RTU is normally powered from the AC mains power, while the operation of the RTU is backed up by **rechargeable battery** installed in the RTU enclosure. The battery can supply the required power for up to 24 hours (depend on the size of the battery the RTU configuration and the frequency of transmissions). A solar panel to charge the battery may be provided as an accessory.

In addition, the CPU memory is backed up by **3 V Lithium battery**, capable to continue running the Real time clock and hold the data in the RAM for a minimum 3 months of accumulated time, during up to **10 years**.

MECHANICAL ASSEMBLY: The MOSCAD RTU was designed with maintenance in mind. Special plastic material and a sophisticated design allow the assembly of the modules and the cabinet without using even one screw, washer or nut. All modules are equipped with "snap-in" arrangement to make maintenance easy and simple. All modules are equipped with quality connectors and wire connection strips in order to allow easy installation and **convenient maintenance**.

QUALITY : The MOSCAD RTU utilizes **advanced manufacturing technologies** and surface mounted (SMD) components. The RTU modules utilize custom LSIs to reduce the total component count to increase the overall reliability.

The **Quality** at Motorola is a matter of principle and overall concept, and it became one of the important features of the products and systems we sell. The **Six Sigma** quality level means that during the RTU's production less than four components or operation per one million may fail. This level of quality, results in **reliable operation** and customer satisfaction for years to come.

COMPUTER CONTROL: The central computer in a MOSCAD system may utilize the IBM PC computer with high resolution color monitor. The SCADA Application software supports either character graphics or pixel graphic display. Both technologies allow highly detailed visual display data.

For the MOSCAD system, Motorola is now implementing the most advanced versions of the Intellution software, the **FIX/ DMACS** the Wonderware **Intouch** package or P.C Soft **Wizcon** software package. This software packages, in combination with the MCP-M (Motorola Communication Processor for Modbus) or MCP-T (Motorola Communication Processor for TCP/IP) in the central and the MOSCAD RTU are making a real, powerful and "performance per cost" competitive system. **In large SCADA systems,** the MOSCAD may interface with the DIGITAL computers running the software under the VMS or Windows NT. operating system. In some systems the central computer may be upgraded with a **Hot-Standby** backup computer.

FACTORY SUPPORT: These advanced communication solutions and the availability of data networks worldwide allow the factory support personnel to perform **remote diagnostics** of the system.

In case of trouble, the field serviceman may work together with the system operator or maintenance person working from other location, to perform system diagnostics and also communicate at the same time.