MOTOROLA

Motorola's
MOSCAD Fault Management
System Planner

Fault & Configuration Management of 2-way Communication & Infrastructure Equipment

Supplement to MOSCAD SYSTEM PLANNER
R4-11-003E June 1996

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1. Definition of this Supplement

This document is intended to be a supplemental reference to the MOSCAD System Planner R3-11-03D. It is designed to expand on how to apply the MOSCAD family of products to the Fault Management Application (alarm monitoring, control and diagnostics of Motorola's 2-way communication systems) both large and small.

2. General Overview of Network Management

Network Management (NM) is the process of controlling a complex data network so as to maximize its efficiency and productivity. The NM should collect data automatically, process that data, then present it to the system users; engineers and systems operators. The data should be used to operate the network, analyze the flow of data, offer system solutions and handle pre-defined alarm situations automatically. The system should provide reports to the engineers and the operators, these reports will help in administering the network. Network Management consists of the following five functional areas described by the acronym ***FCAPS***.

- **F**ault Management
- **C**onfiguration Management
- **A**ccounting Management
- **P**erformance Management
- **S**ecurity Management

These five management areas were defined by a joint committee of the **International Organization for Standards (ISO) & International Electro-technical Commission (IEC) Network Management forum (ISO/IEC 7498-4:1989)**. There are several Motorola groups (RNSG, CIG, IDEN, etc.) developing products to provide these overall areas of Network Management for each of their respective infrastructures. The MOSCAD Product Group is working very closely with two of the groups (**RNSG & CIG**) providing an interface for the MOSCAD Fault Management capabilities.

The MOSCAD Fault Management solution centers around the areas of Fault and Configuration as they pertain to RNSG infrastructure. The remainder of this document will describe these capabilities in more detail. However, a very brief description of the RNSG & CIG products are provided below.

Motorola's Radio Network Solutions Group (RNSG) has developed a product called the FullVision™ Integrated Network Manager (INM). FullVision™ INM (for SmartZone™, OmniLink systems & Motorola's System Support Center) is based on Hewlett-Packard's OpenView Network Node Manager software application and a Motorola developed middleware application running under HP-UX operating system on an HP workstation computer. FullVision™ INM provides a centralized view of the fault condition of an entire communications network via sub-system topology maps; supports auto-discovery of Motorola and approved third party internetworking equipment and supports fault reporting from Motorola Proxy and third party Simple Network Management Protocol (SNMP) based agents.

Motorola's Cellular Infrastructure Group (CIG) has developed a product called the UNO Network Management Center (NMC). UNO NMC applications are based on the SUN/Solstice platform, uses PMI (Portable Management Interface) in order to direct management activities with the MIS (Management Information Server) that serves as a repository of management data and functions. The SUN/Solstice platform also includes the OSI/CMIP protocol stack that allows the NE agents to exchange data and execute functions with the MIS.

Network Management Protocols

An industry-wide standard set of Network Management Protocols has been developed to help extract the necessary information from all network devices and network sites. There are many NM protocols, the most common and most currently in use are the Simple Network Management Protocol (SNMP V1.0) and the Common Management Information Protocol (CMIP). The MOSCAD Gateway supports SNMP V1.0. A protocol converter is used with UNO NMC.

3. General MOSCAD Fault Management System Overview

Motorola RNSG 2-way communication systems for city, county or state Wide Area Network (WAN) Radio Systems, whether VHF, UHF, 800MHz, 900MHz (or other); Astro, Smartzone, Smartnet, or advanced conventional, single-site or simulcast, require the ability to monitor and control various segments of RF site equipment, infrastructure/backbone network equipment as well as on-site environmental and security equipment. The interface to these many items may be by RS-232 connections or by discrete binary or analog inputs and outputs. Such a Fault & Configuration Management system should provide the end-user and/or Motorola service facility a tool to efficiently maintain the daily integrity of the communications infrastructure and backbone network. Motorola's MOSCAD Fault Management is the perfect tool and solution for such a Fault & Configuration system requirement. MOSCAD allows for complete and efficient communications infrastructure integrity and the flexibility to adapt to any system requirement. MOSCAD provides the complete interface and real-time monitoring and control of RF sites equipped with various configurations and quantities of Microwave radios, Base-Stations (Quantar, Quantro & MSF-5000), comparators, channel banks, RF networks, and other site support devices. Motorola's MOSCAD has, and is, being utilized to provide alarm monitoring, control and diagnostics on a variety of communication infrastructure systems. MOSCAD Fault management products and systems are standard Motorola solutions which are manufactured to meet Motorola's 6-Sigma standard of quality.

Typically, Motorola's **MOSCAD Fault Management** systems can be described in three main levels, the Network Management Level, Element Manager Level, and the Element Level (refer to figure 1). Typical components of MOSCAD Fault Management are, but not limited to: Master Central, MOSCAD Front End Processor (FEP) and MOSCAD Remote Terminal Units (RTU's). The Master Central, FEP and the RTU(s) constitute the skeleton of a MOSCAD system (refer to figure 2 also). The Master Central component of MOSCAD is available in two tiers, a Low-Tier Master Central (LTMC) and the Graphic Master Central (GMC). The LTMC and GMC utilize a MOSCAD Front End Processor (FEP) to bridge between the central and the field RTU's (refer to figure 1). The MOSCAD SNMP Gateway is used for transporting data to the Network Management level. The next page provides a brief overview of each of the three levels.

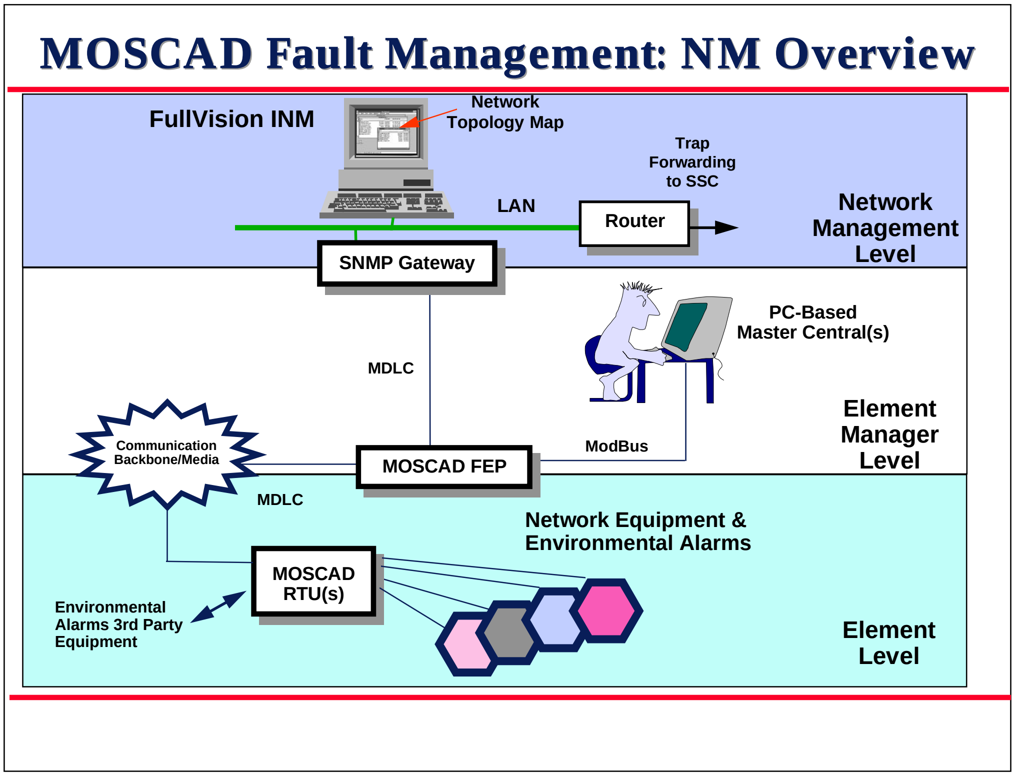


Figure 1.

3.1 Network Management Level

In most RNSG systems (single-site, SmartNet, Conventional, etc), this level may not always exist. This level will exist (with the FullVision INM) typically in SmartZone & OmniLink systems for RNSG solutions. This level is a high level management platform provided by RNSG, CIG or others (i.e. FullVision INM, UNO NMC, etc.). The MOSCAD SNMP Gateway provides the interface to this level, via SNMP V1.0.

3.2 Element Manager Level

This level is a mid level management platform. This level consists of the MOSCAD Fault Management Master Central. The Element Manager Level supports the following tasks:

- Discover the problem
- Isolate the problem
- Notify the operator(s) of the problem
- Fix the problem (auto recovery, if possible)
- Independent management of the Element level without impeding Network Mgmt level.

As mentioned above, the Master Central component of MOSCAD is available in two tiers, a Low-Tier Master Central (LTMC) and the Graphic Master Central (GMC). The Element Manager level is where the detailed site alarm information is brought for collection, storage, historical retrieval, display and printing. The Master Central can be used for administrative purposes, however, it is intended for the more technical and “corrective action” purposes of maintaining the communications system. One or more Master Centrals interface to a co-located MOSCAD Front End Processor (FEP) to bridge the Element Manager Level and the Element Level. The Master Centrals are described in more detail in section 5.

3.2.1 MOSCAD SNMP Gateway

Depending on the type of infrastructure (typically SmartZone & OmniLink), the Element Manager Level can also support the MOSCAD SNMP Gateway to bridge to the Network Management Level. The SNMP Gateway provides the capability to forward SNMP traps to Motorola’s FullVision Integrated Network Manager. The SNMP Gateway forwards traps to FullVision. These traps currently consist of a **subset** of remote site alarms from three areas (microwave, TeNSr & Environmental alarms). This subset consists of alarming information for microwave radios (California Microwave, Harris Farinon & Alcatel), Premisys (TeNSr) channel banks and environmental alarms (site power, site security and site lighting). The alarms are a subset of each device. The microwave radio alarms for all three vendors will be condensed into three alarms (SPU Status, MUX Status & Radio Status). The Premises channel bank alarms will consist of one (1) common alarm per TeNSr card. The environmental alarms will consist of three common alarms (Security Status, Light Status & Power Status). For more details, refer to the OmniLink 3.5 System Planner (R4-8-1008), section 10. All detailed remote site alarming information for each device is provided via the MOSCAD Graphic Master Central (GMC).

3.3 Element Level

The Element Level is where environmental alarms and RF components are located. The heart of the Element Level is the MOSCAD Remote Terminal Unit (RTU) which collects the various inputs, outputs and analog signals via a variety of Input/Output (I/O) modules. In addition, the MOSCAD RTU serially interfaces to RF devices and is able to emulate (speak) their native protocol, allowing the MOSCAD to not only monitor alarms, but to configure and change parameters as well. The MOSCAD takes advantage of its interface capabilities to serially interface to the local digital M/W radio service channel or the TeNSr channel Bank SRU port. The MOSCAD can also interface to a leased-line Telco modem, dial-up Telco modem and/or RF. This allows the MOSCAD to communicate over the digital backbone to the Element Manager Level and/or another MOSCAD site.

Typical components of MOSCAD Fault Management: Master Central, MOSCAD Front End Processor (FEP) and MOSCAD Remote Terminal Units (RTU's).

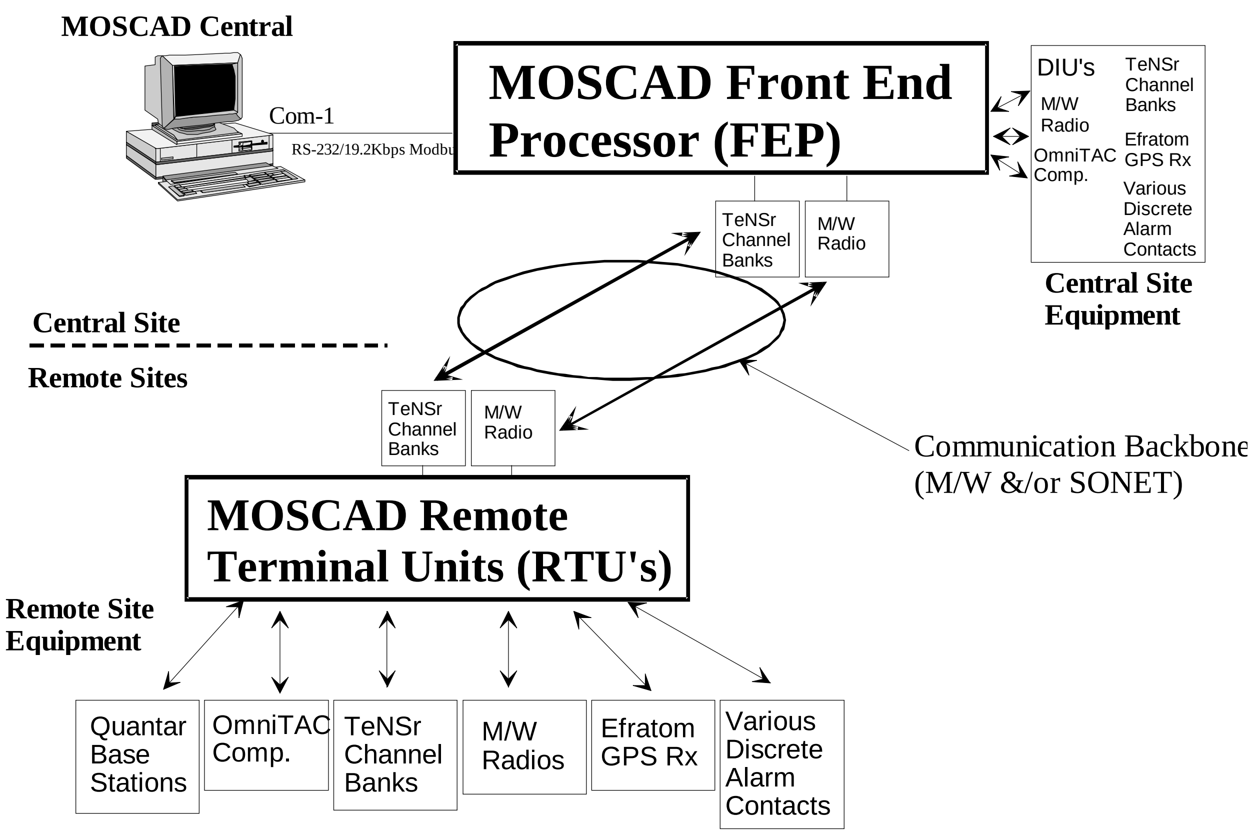


Figure 2: The following drawing shows typical components of MOSCAD Fault Management.

4. General MOSCAD Features

Some of the distinct advantages of the Motorola MOSCAD solution are described in the paragraphs that follow. All are standard MOSCAD product and system features.

MDLC Protocol: MOSCAD uses the MDLC protocol, a highly sophisticated communications protocol that is based on the Open System Interconnection (OSI) model recommended by the International Organization for Standardization (ISO). MDLC includes all 7-layers of the OSI model. This protocol is designed for optimal operation in data systems which operate with diverse communications media such as radio, RS-232, RS-485, and LAN. In addition, MDLC has sophisticated recovery procedures to ensure a high degree of end-to-end data transmission safety and data integrity.

Store & Forward: MOSCAD incorporates a *Store & Forward* capability which allows any system RTU to become an intelligent tandem processing node to provide optimum use of the existing communications network. This capability ensures that all messaging is managed properly under simultaneous contention situations regardless of the communications medium.

Contention Reporting: MOSCAD takes advantage of contention reporting for true "Change of State" operation. Alarms may be reported as soon as they occur without the need to wait for the next polling cycle, an action particularly attractive when operating upon shared two-way radio communications media.

Remote Programming: MOSCAD may be programmed either locally by direct cable connection or remotely from any other MOSCAD RTU (peer-to-peer) in the system. The process application may be downloaded into the MOSCAD RTU and the runtime performance monitored via data upload for source level debugging of the application. The MOSCAD monitoring network may be remotely reconfigured during future phases or when infrastructure equipment changes. MOSCAD also allows for service dial-up access to the system so that all these features are available to/from a completely off-site location. Remote programming will eliminate the need to travel to the site, a major advantage during the development and implementations stages as well as after system acceptance.

Modular Input/Output: MOSCAD offers a large selection and capacity of Input/Output (I/O) modules to meet the needs of virtually any application. Modularity provides easy plug-in connection for future site expansion.

Direct Connection to Quantar: MOSCAD allows for the monitoring and diagnostics of a Quantar base stations through a serial connection. Each MOSCAD CPU module is capable of serially interfacing to eight (8) Quantars. This feature allows the operator to individually select each and every Quantar from the central Graphs Workstation.

Direct Connection to Premisys (TeNSr): MOSCAD allows for the monitoring and diagnostics of the Premisys TeNSr channel banks through a serial connection. This feature allows the operator to individually select each and every channel bank on demand from the central Graphics Workstation.

Communications Redundancy: MOSCAD allows for the optional *Link Redundancy*. The MOSCAD RTU can be configured with a secondary communications path (i.e. radio or fiber-optic) to the Central. Should the primary link fails, the MOSCAD system can automatically route data over the alternate path. The MOSCAD system will continually verify link availability and report any failures to the central.

Interconnection with Intrac Systems: MOSCAD provides for a migration plan to include existing Intrac systems into the overall communications monitoring system.

Interconnection with other MOSCAD Systems: MOSCAD allows for the monitor, control, and diagnostics of other State, County, and City MOSCAD-based systems. These include but are not limited to:

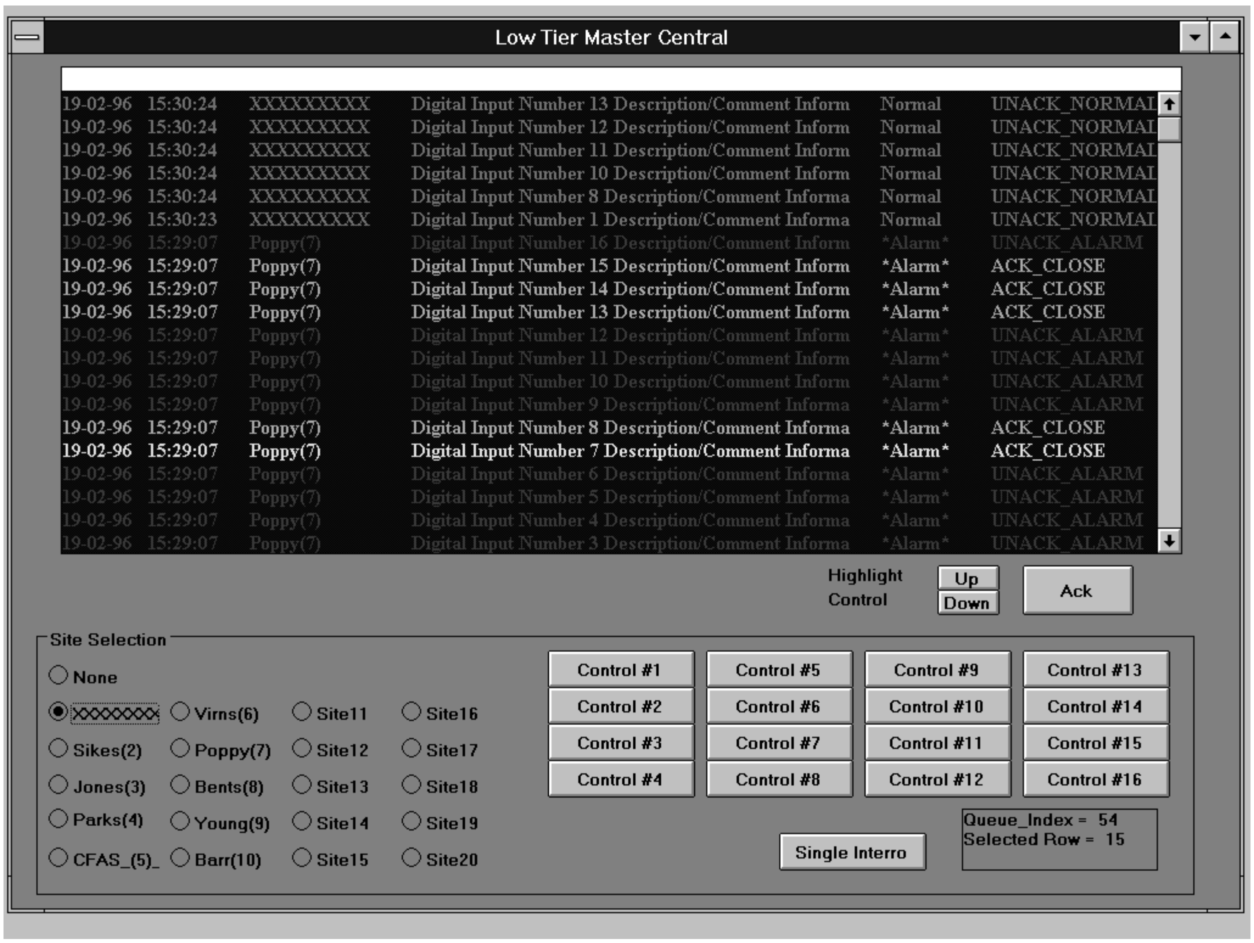
- Fresh and Waste Water SCADA systems.
- Electric Utility DA/DSM and AMR systems.
- Emergency Notification Systems (siren control).
- Fire Station Dispatch.

5. Overview of MOSCAD Master Centrals

5.1. Low-Tier Master Central (LTMC)

The Low-Tier Master Centrals (LTMC) is a limited function, text-based software package allowing simple text readouts of system alarms and status. The LTMC interfaces to a co-located MOSCAD Front End Processor (FEP). ModBus protocol running at 19.2K bps is the RS-232 communication protocol between the FEP and the LTMC. Information on the health of the MOSCAD (self diagnostics) is maintained and available at the LTMC. RTU site alarms, communication status, and RTU AC power status are routed back to the LTMC via the FEP.

The LTMC is intended for use in systems with twenty (20) CPUs, approximately ten (10) RTU sites or less. Each RTU will accept up to 32 dry contact inputs and 16 dry contact outputs (analog inputs NOT supported). Also, except for California Microwave CM-6 radios, RS232 device interface is NOT supported. All system alarms parameters are time stamped by the central and displayed on the PC monitor; a printer may be added for hard copy record keeping. The alarm and control information format that is displayed on the screen is depicted below. This is an example of the LTMC operator display.



Engineering services are normally provided to configure the Low Tier Master Central (LTMC) database and generate the text-based screens as well as configure remote access PCAnywhere package (if applicable). Services will also include the programming of the MOSCAD FEP application as well as the MOSCAD RTU application. Operator training is provided to a Motorola system engineer (during staging in Schaumburg) who will in turn train the end-user. Services DO NOT include CCSI staging costs, on-site implementation, or project management (all which will need to be provided by the field).

5.2. Graphic Master Central (GMC)

The Graphic Master Central (GMC) is a Microsoft Windows NT based PC with a Graphical User Interface (GUI) software package to allow viewing and controlling of the entire system. One or more GMC's connect into MOSCAD system via a co-located MOSCAD Front End Processor (FEP). ModBus protocol running at 19.2K bps is the RS-232 communication protocol between the FEP and the GMC. The graphic display and database software package is an off-the-shelf solution from Wonderware called InTouch, a Windows NT application. This software package resides on each GMC. The custom graphic screens depict current system status where the user can easily navigate from a macroscopic system view down to the individual site details. All system alarms, Change of States (COS), and controls are time stamped, stored in the alarm history file, and printed for hard copy record keeping. History files allow for retrieval of important information at all times.

5.2.1. Graphic Work Station (GWS)

MOSCAD also provides the capability for a local LAN-based Graphic Work Stations (GWS) with identical custom graphics as the GMC. MOSCAD can also provide the capability of a remote dial-up GWS (see Note-1 below). The GWS(s) use the same InTouch graphics application and custom display files but are reliant on the GMC databases for MOSCAD Remote Terminal Unit (RTU) information update and control. Real-time system alarms, status and control are provided to the local GWS via a physical LAN link interfacing to the GMC. Also, real-time system alarms, status and control are provided to the remote access GWS via a physical dial-up modem link interfacing to the GMC. Wonderware NetDDE for Windows is the communication protocol for this type of system operation. If the custom screens for the GMC are modified, added or deleted, then the local or remote GWS computers would require similar software updates as well.

5.2.2. GMC Paging Option

The GMC also provides the optional capability of **Alphanumeric** alarm paging. The paging package is an industry standard Windows-based paging software package known as WIN911 from Specter Instruments. WIN 911's **Alphanumeric** feature uses an internal modem and can dial up any Motorola or equal RCC and send descriptive alarm messages on alphanumeric capable pagers (pagers not provided).

5.2.3. GMC Redundant Operation

The system is capable of supporting multiple central computer locations. Redundant central computers operate as fully functioning nodes with each computer capable of the full set of alarm and control capabilities.

All GMC's share the same site related information and controls allowing for complete redundant operation. Information on the health of the MOSCAD (self diagnostics) is maintained and available at the GMC. All central computers at all sites continuously monitor and process all incoming information from the RTU's. However, only one central computer location is designated to be "On-line". The primary task of the "On-line" central computer is to run the automatic interrogation sequence and update all other active central computers. In the event that the "On-line" central computer/FEP should fail, a second computer/FEP pair will assume the duties of the failed "On-line" computer/FEP pair. This process will continue until no active central computer locations exist. The fail-over priority level of the central locations (default "On-line location, etc.) is a parameter that may be set within the application. Conditions that constitute a central computer fail include failed MOSCAD hardware at the location or failed ModBus communication between the central computer and the MOSCAD hardware.

5.2.4. GMC Security

Security on the GMC will be based on a users login name and password. These functions are provided with the Wonderware InTouch software package and will be implemented based on a list of users and access levels. A Logon screen will be provided that will allow a user to logon to the system by entering their access name and password. When no user is logged on, no information will be displayed on the screen and no controls will be able to be sent. The audible alarm will still sound even if no user is logged on. If a user forgets to logoff, the system will automatically log the person off after 30 minutes (this time is configurable).

5.2.5. GMC Alarm and Report Printers

The GMC can have up to two printers connected to the computer; one for printing all alarms (standard) and the other **(optional)** for various custom reports defined by the end user. The alarms print out at the time the alarm is detected by the central. Logon/Logoff information is also reported on the printer allocated for alarm printing. GMC reports (if required) must be clearly defined and quoted separately.

5.2.6. GMC Graphic Screens

The GMC node will be programmed to provide several layers of screens depending on the preference of the customer. The first layer will typically consist of a single operator screen called a System Overview Screen. The information is in tabular or map form showing the site locations and is push button selectable . The second screen layer will typically display an individual site in tabular/graphic form and again push button selectable. A third layer of screens will be the individual site component itself (Quantar, Microwave, RF Network, other site support equipment, etc), showing all status information for the particular System component. A final layer would break down the "other" site alarms. A System Health Screen will also be provided to give MOSCAD system related status information such as internal RTU Status. Also available from the system health screen are communication statistics relative to number of COS (changes of state), retry percentage, and polling frequency. A Logon screen will be provided to allow a user to enter in a User Name and Password. The final screen to be provided is an alarm/logon summary. The alarm summary screen will provide a list of any outstanding alarms and unacknowledged alarms that have returned to normal.

5.2.7. GMC Screen Navigation

The following is a typical alarm navigation procedure. If an alarm occurs at a particular site the system overview screen will indicate a flashing alarm condition for that site. The operator will then pull up the Site Screen for the alarming system component. By locating the flashing system component, the operator can determine the affected equipment. Finally, the operator will pull up the System Component screen to determine the alarming item and acknowledge the incoming alarm condition. The System Health screen will be accessed though the System Overview screen. Access will be available to the Alarm Summary screen from any of the other screens.

6. MOSCAD Front End Processor (FEP)

The MOSCAD FEP is the bridge between the Central (Low-Tier & GMC) and the MOSCAD RTU network, via the communication backbone. The MOSCAD FEP is interfaced to the communication backbone via the Premisys TeNSr SRU port for all leased-T1 or Fiber backbone systems. In a Microwave system, the FEP can instead interface to the M/W radio service channel via RS-232 (up to 9.6Kbps) communication port(s) of the MOSCAD CPU. MOSCAD will communicate over the backbone using the MOSCAD's seven layer MDLC protocol operating at up to 9.6Kbps. MDLC is a Motorola protocol designed in accordance with the Open System Interconnection (OSI) model recommended by the International Organization for Standardization (ISO).

A MOSCAD Front End Processor (FEP) is required for each Central (LTMC or GMC). The FEP is an applications specific device dedicated to RTU interrogation and to the routing of data messages to/from the Central(s) as well as maintaining a real-time database of the MOSCAD system. After interrogating an RTU and upon receipt of a change of state (COS) message, the alarm is processed by the FEP and then routed to the Centrals, which in turn route the data to the display, internal storage files and all peripheral devices. Controls may also be sent to equipped RTU sites, either individually or via group command.

The MOSCAD FEP, which is co-located with the Central(s), consist of at least one (1) series 400 CPU housed in a 19" rack mount, DC to DC converter (-48vdc or -24vdc to +12vdc) and one of four 8 slot motherboard configurations (1 CPU + 7 I/O, or 3 CPU + 5 I/O, or 4 CPU + 4 I/O or 8 CPU NO I/O). If the FEP site requires local I/O, the proper I/O modules need to be added to accommodate the I/O requirement while keeping in mind the physical module limit of each 19" rack (CPU & I/O modules are covered in the MOSCAD System Planner as well as in the MOSCAD R3 sheets). In the event the CPU & I/O requirement exceed the limit, additional 19" racks are available as an option. Each CPU has three (3) communication ports (1 RS-485 and 2 RS-232 ports). One port of the MOSCAD CPU's is dedicated to a TeNSr SRU port or M/W radio service channel via an RS-232 port and another RS-232 port will be connected to the M/W diagnostic port (if applicable), both running at 9.6Kbps. Another MOSCAD CPU is dedicated to the RS-232 interface of the Central (LTMC & GMC) via ModBus protocol running at 19.2Kbps. This CPU is also dedicated to the local I/O modules (if applicable). Additional CPU's can be added to interface to other site RF equipment for serial alarm monitoring (Quantars, TeNSr, DIU's, Comparators, Efratom GPS, etc). All local CPU's are interconnected via RS-485 (port 1A) by the use of a RS-485 junction box. Each junction box can accommodate up to seven (7) CPU's. In the event there are more than 7 CPU, multiple RS-485 junction boxes are used.

7. The MOSCAD Programming ToolBox

The MOSCAD FEP(s) & RTU(s) are programmed via a DOS-based software package known as the MOSCAD Programming ToolBox. Each MOSCAD can be programmed locally or remotely (dial-up) via an IBM compatible laptop computer. The MOSCAD CPU will be required to have an external auto-answer modem for remote ToolBox access. The ToolBox does NOT have a Graphic User Interface (GUI) for these local or remote dial-in devices, therefore, the user must be experienced/trained with the ToolBox application for this mode of system operation. These remote dial-in links are also used for System maintenance and upgrades by means of the ToolBox upload/download capability.

8. MOSCAD Remote Terminal Unit (RTU)

The MOSCAD RTU, consists of a single series 400 CPU housed in a 19" rack mount, DC to DC converter (-48vdc or -24vdc to +12vdc) and one of four 8 slot motherboard configurations (1 CPU + 7 I/O, 3 CPU + 5 I/O, 4 CPU + 4 I/O and 8 CPU NO I/O). If the RTU site requires local I/O, the proper I/O modules need to be added to accommodate the requirement while keeping in mind the physical module limit of each 19" rack (CPU & I/O modules are covered in the MOSCAD System Planner as well as in the attached R3 sheets). In the event the CPU & I/O requirement exceed the limit, additional 19" racks can be added as an option. Each CPU has three (3) communication ports (1 RS-485 & 2 RS-232 ports). A MOSCAD CPU is dedicated to the Premisys TeNSr SRU port or M/W service channel via RS-232 port and another RS-232 port will be connected to the M/W diagnostic port (if applicable), both running at 9.6Kbps. Additional CPU's can be added to interface to other site RF equipment for serial alarm monitoring (Quantars, TeNSr, DIU's, Comparators, Efratom GPS, etc). All local CPU's are interconnected via RS-485 (port 1A).

The MOSCAD RTU is responsible for monitoring field devises/equipment such as Microwave radios, Base Stations, RF comparators, and other site support equipment. A list of these devices are listed in a later section. Depending on the site alarm density for status and control points, the RTU may consist of multiple panels. The hardware I/O modules consist of various combinations which are described in the MOSCAD system planner.

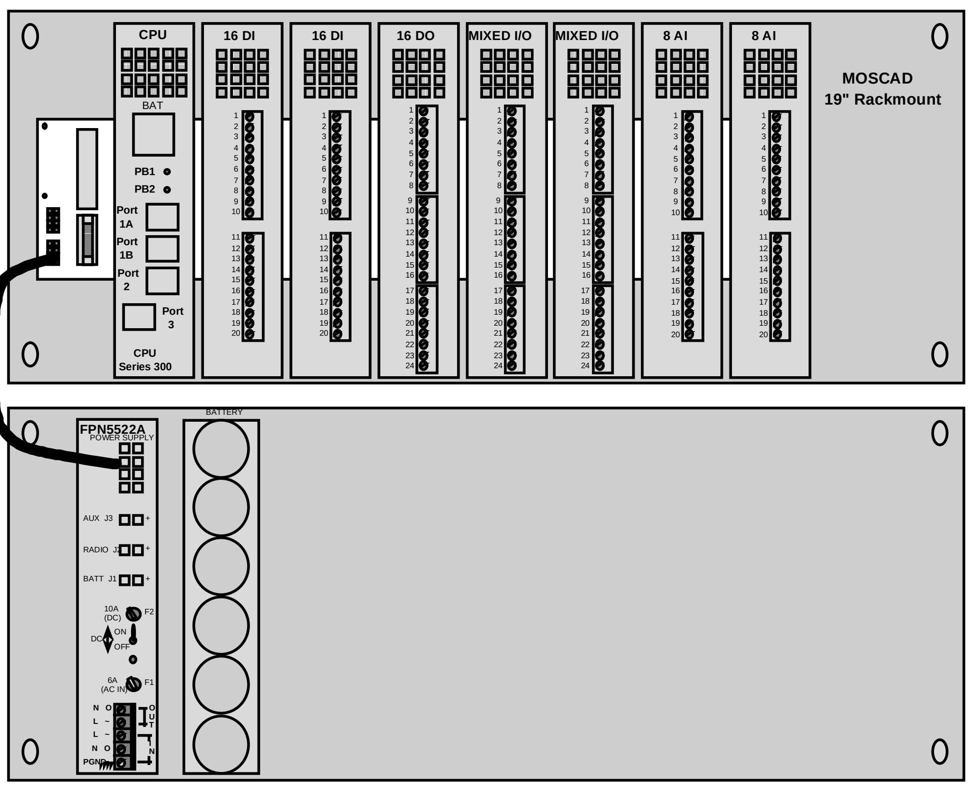


Figure 3: Typical MOSCAD 19" Rack Configuration

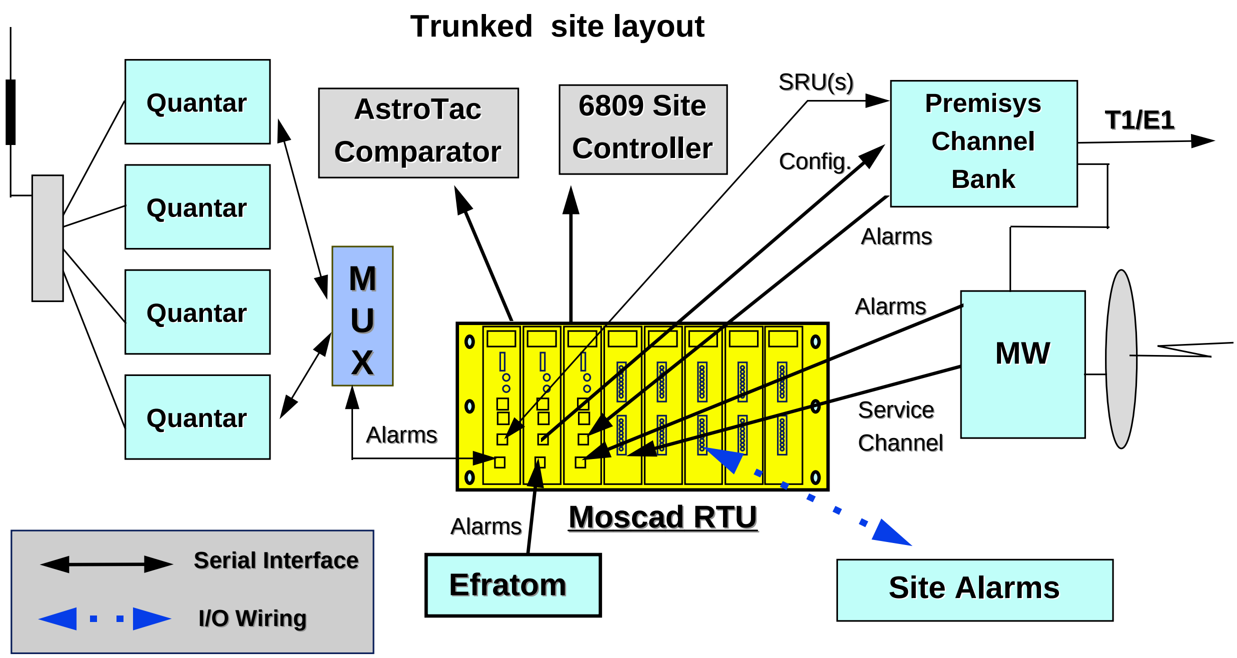


Figure 4: Typical Trunked Site

9 MOSCAD FEP & RTU Components

The MOSCAD configuration varies slightly from site to site depending on the density of equipment at the site. There are 4 different rack mount motherboard configurations for the sites as depicted in the site table.

19" Rack Mount 8-slot Motherboards:

1. The standard motherboard holds one (1) for CPU & up to seven(7) I/O modules.
2. The second type of motherboard for CPU's only is a DC only type since it will hold up to eight (8) CPU's (NO I/O).
3. The third type of motherboard holds three (3) CPU's & five (5) I/O modules. The first two CPU's operate as RS-232 interface only, isolated from the I/O bus. The third slot CPU will be connected to the I/O (up to five remaining slots for I/O).
4. The fourth type of motherboard holds four (4) CPU's and four (4) I/O modules. The first 3 CPU's operate as RS-232 interface units only while the fourth CPU supports the I/O bus as well (up to four remaining slots for I/O).

Power Supply

Three different power supplies are available.

1. -48VDC to +12 VDC converter will mount to the back side of the 19" panel via 4 threaded inserts.
2. -24VDC to +12 VDC converter will mount to the back side of the 19" panel via 4 threaded inserts.
3. 115VAC to +12 VDC (3 Amp) Power Supply with 5AH battery backup. This unit will mount on a separate 19" panel.

Below is a table referencing the configuration for motherboards..

	MOSCAD MB CONFIG.							
19" MOSCAD MB configurations.	**Slot 1**	**Slot 2**	**Slot 3**	**Slot 4**	**Slot 5**	**Slot 6**	**Slot 7**	**Slot 8**
Standard 1-CPU/7-I/O	CPU	I/O	I/O	I/O	I/O	I/O	I/O	I/O
8-CPU's	CPU	CPU	CPU	CPU	CPU	CPU	CPU	CPU
3-CPU/5-I/O	CPU	CPU	CPU	I/O	I/O	I/O	I/O	I/O
4-CPU/4-I/O	CPU	CPU	CPU	CPU	I/O	I/O	I/O	I/O

10. Protocols and Data Rates

The system will utilize a combination of different protocols throughout the seamless data radio network. The protocols used are the following:

1. ModBus for the InTouch Graphic Master Central to MOSCAD FEP Interface.
2. MDLC for the MOSCAD FEP/RTU/CPU inter-communications.
3. ACU for the CAL-MIC microwave radio RS-232 alarm interface.
4. Scan Channel for Harris Farinon microwave radio alarm interface.
5. MCS-11 for Alcatel microwave radio alarm interface.
6. ASCII for the Quantar RS-232 interface.
7. ASCII for the Premisys TeNSr RS-232 interface.
7. NetDDE for Windows for local LAN-based GWS or Remote dial-up GWS Configuration.

Data rates change throughout the system. The data rates used will be based on the selected media and protocols. The various data rates utilized are:

1. 19,200 bps for the RS-232 ModBus link between the FEP & GMC
2. 19,200 bps for the local RS-485 CPU-to-CPU
3. 9,600 bps for MOSCAD MDLC over Cal-Mic microwave service channel
4. 9,600 bps for MOSCAD/ACU interface to Cal-Mic microwave alarms
5. 9,600 bps for MOSCAD MDLC over Alcatel microwave service channel
6. 9,600 bps for MOSCAD/MCS-11 Polling Engine to Alcatel microwave alarms
7. 2,400 bps for MOSCAD MDLC over Harris Farinon microwave service channel
8. 9,600 bps for MOSCAD/Scan Channel interface to Harris Farinon microwave alarms
9. 9,600 bps for MOSCAD MDLC site RTU to Master FEP Modem link
10. 9,600 bps for MOSCAD MDLC dial-in links
11. 9,600 bps between GMC and Remote dial-up GWS modem link
12. 10Mbps between LAN-based GMC and LAN-based GWS

11. Summary of Field Device Interfaces

Equipment Currently being interfaced.	***Specific Model***	***Interface:***
1. Basestation / Repeater.	Quantar/Quantro	Serial interface to RSS port using “C compiled” Flash file in MOSCAD CPU providing limited RSS.
2. Basestation / Repeater.	Quantar/Quantro	Serial interface to RSS port using “C compiled” Flash file in MOSCAD CPU providing FULL Remote RSS functionality.
3. Basestation / Repeater.	MSF-5000 & PURC-5000	Discrete interface using MOSCAD I/O modules interfacing via WildCard option.
4. Console Equipment.	Classic Button & LED Control Panel	CTI board/ModBus Interface
5. Microwave Equipment.	CAL-MIC (California Microwave) UltraStar & Telestar/CM-6 M/W Radios	Serial interface to the radio diagnostic port using “C compiler” of MOSCAD CPU. Serial interface to the radio service channel to send & receive MDLC data.
6. Microwave Equipment.	Harris Farinon Microwave Radios	Serial interface to the radio diagnostic port using “C compiler” of MOSCAD CPU. Serial interface to the radio service channel to send & receive MDLC data.
7. Microwave Equipment	Alcatel M/W Radio	Service channel & diagnostic using “C” compiled flash file
8. Premisys Channel Bank Equipment	Premisys TeNSr Channel Bank (C.B.)	Serial interface to SRU port to send /receive MDLC data
9. Premisys Channel Bank Equipment	Premisys TeNSr C.B.	Serial Alarm Diagnostic interface.
10. Premisys Channel Bank Equipment	Premisys TeNSr C.B.	Remote Configuration.
11. Efratom GPS Receiver	Efratom GPS Receiver	Serial Alarm Diagnostic interface.
12. Consoles Equipment	Gold Series Elite Consoles	InTouch NT Graphic Work Station (GWS) coexisting with Gold Series Elite NT PC.
13. Smartzone Controller	Smartzone Controller	Discrete interface using MOSCAD Input modules interfacing to 32 alarm port.
14. Comparators	AstroTac / AstroTac-3000	Serial Interface
15. Digital Interface Unit	Astro DIU	Serial Interface
Equipment interfaces currently under development		
16. Consoles Equipment	Central Electronics Bank	Under development
17. Consoles Equipment	AEB	Under development
18. Trunking Controller	6809	Under development
19. SNMP Agent	HP Openview/Sun Solstice	Under development

Summary of Element Level Environmental Alarms

The following are various site equipment alarms collected via MOSCAD I/O modules. **MOSCAD is not limited to these alarms, the following are just examples.**

Site Environmental Alarms	***Site Environmental Alarms***
Remote Site Intrusion	Tower Indications/Alarms
Remote Site Smoke Alarm	Dehydrator Fail
Building Temperature Alarm	Channel Bank Auxiliary Indication/Alarms
Building Humidity Alarm	Battery Charger Alarms
AC Failure	DACS Major/Minor Alarms
AC Arrestor Failure	Trunking System Auxiliary Alarms
Generator Status/Alarms	DIU Major/Minor Alarms
UPS Status/Alarms	Zone Controller Auxiliary Indications/Alarms
Trunked Data Channel Bank Auxiliary I/O	Underground Sensors

12. California Microwave (Cal-Mic) Microwave Radio Interface
Telestar (Ultrastar) and CM-6 Microwave Radio Alarm and Control Unit (ACU) Interface

General Description:
The following relate to the Telestar (Ultrastar) and CM-6 models of Cal-Mic radios only. In a Telestar/CM-6 radio, the Alarm & Control Unit (ACU) provides the means to monitor performance of the radio and automatically correct poor performance using methods such as switching transmitters and receivers or activating Automatic Power Control (APC). The ACU, in conjunction with the Local Display Unit (LDU) Interface Panel (LDU available on Telestar only), also provides the means for an operator to local monitor alarms, performance values and error related counters as well as to manually control such functions as switching and loopbacks. A second device that can be provided with the radio is the Status and Control Extender (SCE). This device is a Telestar/CM-6 product designed to convert Telestar/CM-6 radio parameters and control capabilities into a format compatible with external alarm Remote Terminal Units (RTU). This format utilizes discrete contact closures and relay outputs. Motorola's MOSCAD replaces the SCE and interfaces directly to the ACU, eliminated the need for the SCE, external I/O, wiring, and integration.

In general, one (1) MOSCAD CPU port communicates with the Telestar/CM-6 ACU via a serial RS-232 interface. Through this interface, all the available Telestar/CM-6 alarm and control capabilities are integrated into the local CPU's database to be reported back to the MOSCAD Central computer. The communication path between microwave hops and subsequently back to the central computer are done through the integrated overhead channel (digital, RS-232) on the radio itself. This requires a second MOSCAD CPU port, hence a single MOSCAD CPU is required for each Cal-Mic radio.

The advantages of this configuration are numerous. The need for an external serial to digital converter (SCE) is eliminated. By eliminating this box, the need for wiring the SCE to I/O on a RTU also disappears. This results in a direct cost savings on a per radio basis. In loop configurations, the need for external bridging devices, as well as loopswitch relays for the SCADA communications, is also eliminated.

Implementation Specifics:
For every Telestar/CM-6 2 radio in a particular system, a single MOSCAD CPU (Series 300) is dedicated to handle the interface to the radio. A single flash file is downloaded to the CPU to support all alarm, performance, and control abilities. The MOSCAD based ACU protocol implementation supports only the default Status and Control Extender (SCE) configuration. This default cannot be changed via the Local Display Unit (LDU) on the Telestar/CM-6 Radio. Table 1 shows the default radio alarm, performance, and control features supported. Limited communication diagnostic information is also supported in the interface (number of frames received, number of acknowledgment frames, number of frames received with CRC errors, and number of frames received with length errors). The function codes supported in the ACU protocol include UNIT STATUS (ALARM and PERFORMANCE objects) and DBREAD (CONTROL and UNIT PRESENT objects).

Table 1

Alarms	Indications	Performance	Controls
RF PSU Fail (A/B)	TX A/B Online (MUX-TXU)	Bit Error Rate (BER) A	TX A/B/Auto/Lock (MUX-TXU)
TXU Fail (A/B)	RX A/B Online (MUX-SYNDES)	Bit Error Rate (BER) B	RX A/B/Auto/Lock (MUX-SYNDES)
RXU Fail (A/B)	TX A/B Online (SYNDES-MUX)	Valid Frames*	TX A/B/Auto/Lock (SYNDES-MUX)
SP PSU Fail (A/B)	RX A/B Online (ATDE-DEMOD)	Bad CRC*	RX A/B/Auto/Lock (ATDE-DEMOD)
MOD Fail (A/B)		BAD Length*	
DEMOD Fail (A/B)		Acks Received*	
ATDE Fail (A/B)			
MUX Fail (A/B)			
SYNDES Fail (A/B)			

ACU Fail (A/B)			
SCU Fail (A/B)			
OWU Fail (A/B)			
ACU->MOSCAD Comm Fail			
SUMM Fail A			
SUMM Fail B			

* Communication Performance information from MOSCAD

Table 1 Alarm Definitions

TXU
The Transmitter Unit (TXU) receives an IF signal and converts it to a regulated RF signal

RXU
The Receiver Unit (RXU) accepts an input signal at the RX frequency and converts it to a IF signal

OWU
The Order Wire Unit (OWU, optional radio feature not included on all radios) works in conjunction with the Service Channel Unit (SCU) and an external hand-set to provide orderwire service over properly equipped radio equipment.

SCU
The Service Channel Unit (SCU, optional radio feature not included on all radios) provides access to four auxiliary 64 kbps channels

ATDE
The Adaptive Time Domain Equalizer (ATDE, optional radio feature not included on all radios) is used to improve the dispersive fade margin (DFM) of hops with excessive multipath activity.

SYNDES
The Synchronizer/Desynchronizer (SYNDES) is the DS1 interface module. It receives up to 12 DS1 channels and presents them to the MUX. It also receives data from the MUX and transmits up to 12 DS1 channels.

MUX
The Multiplexer (MUX) multiplexes/demultiplexes several low bit rate channels into/from a high speed data stream.

DEMOD
The Demodulator (DEMOD) forms the complementary function to the upstream modulator.

MOD
The Modulator (MOD) generates the modulated IF signal of the Telestar/CM-6 radio.

ACU
The Alarm and Control Unit (ACU) supervises the operation of the Telestar/CM-6 radio system. It collects alarm and status information from each module in the system and, base on this input, performs protection switching.

SPPSU
The Signal Processing Power Supply Unit (SPPSU) converts battery voltage into regulated outputs that supply power to the SP shelf of the Telestar/CM-6 radio.

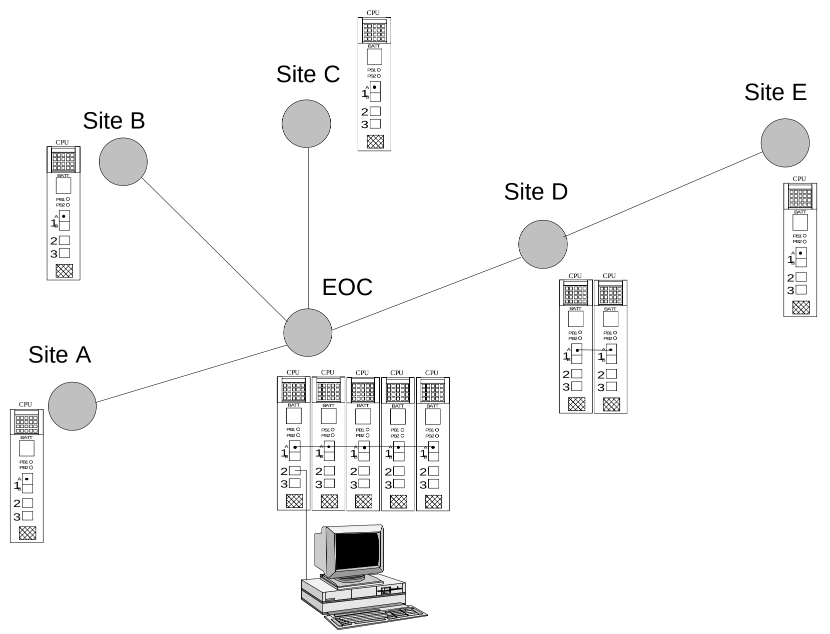
RFPSU
The Radio Frequency Power Supply Unit (RFPSU) converts battery voltage into regulated outputs that supply power to the RF shelf of the Telestar/CM-6 radio.

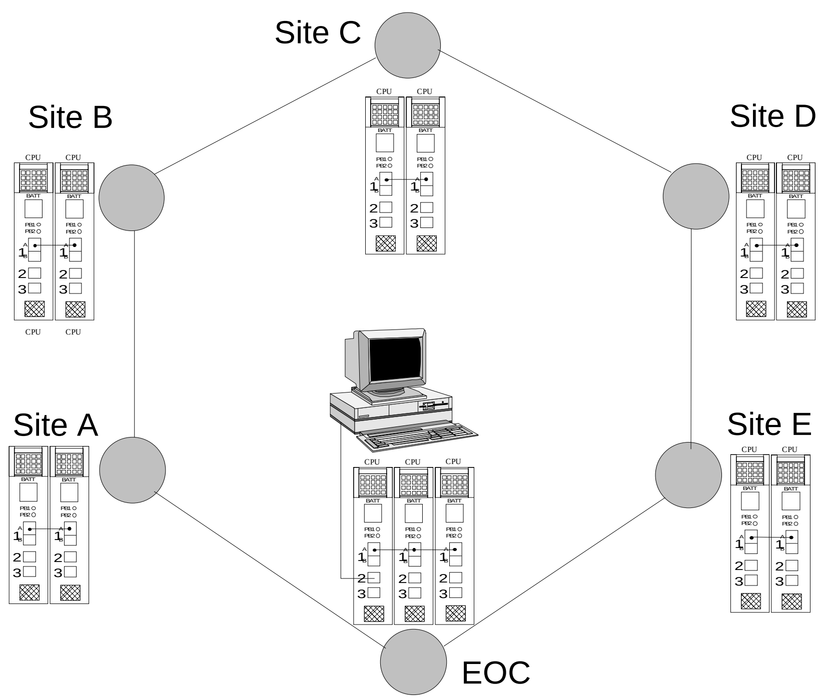
ACU-MOSCAD COMM STATUS
The ACU-MOSCAD Communication monitors the communication between the MOSCAD CPU module and the Telestar/CM-6 radio.

SUMMARY A
A protected radio (typical in a star configuration) has completely duplicate modules. In the event of a module failure, the Summary A alarm will be transmitted to the central computer if the A side of a module has failed. For example, if the A side of the TXU has failed, the central will receive the TXU alarm and the Summary A alarm, alerting an operator that it is the A side TXU that has failed.

SUMMARY B
A protected radio (typical in a star configuration) has completely duplicate modules. In the event of a module failure, the Summary B alarm will be transmitted to the central computer if the B side of a module has failed. For example, if the B side of the TXU has failed, the central will receive the TXU alarm and the Summary B alarm, alerting an operator that it is the B side TXU that has failed.

Figure 5: Examples of a Cal-Mic STAR and LOOP configuration. One (1) MOSCAD CPU is required for each CAL-MIC M/W radio. Each CPU has 2 serial ports. One CPU port is dedicated to the radio ACU port and acts as a local polling engine for each radio. The second CPU port is dedicated to the M/W radio service channel port to send & receive MDLC data. Both connections are RS-232 running at 9.6Kbps. A separate CPU at the central site is dedicated to interface to the central computer (RS-232 running at 19.2Kbps).





13. Alcatel Microwave Radio Interface

MOSCAD has the capability to interface to the Alcatel MDR-5000, MDR-6000 & MDR-7000 series of microwave radios. There are two (2) types of serial interfaces which provide two different purposes. One is a serial interface to the Alcatel MCS-11 alarm channel, for monitoring alarms. The second is a serial interface to the microwave radio overhead service channel to link sites to allow transmission of alarms. Each channel, although completely separate, function as a party-line mode operation.

The Alcatel MDR-6000 series radios contain an alarming protocol known as MCS-11. The MCS-11 protocol is a synchronous, RS-422, bit oriented protocol, which makes it difficult to interface to (not impossible). The MOSCAD interface to the Alcatel MCS-11 alarm channel is accomplished with a separate Alcatel product known as the Alcatel Polling Engine. On one end, the Polling Engine provides the proper protocol emulation and interface to the radio, and on the other end, it provides the proper protocol and interface to a MOSCAD CPU. The following MDR-6000 alarms are monitored in each radio and are defined as RDS, RAS & RCDI alarms.

RDS Point Definitions

SCAN POINT	DESCRIPTION	POINT TYPE	SCAN POINT	DESCRIPTION	POINT TYPE
1	A Common Loss	alm	33	A Path Distortion	status
2	A Power Supply	alm	34	A Channel Fail	alm
3	A RF XMT PWR	alm	35	A Radio Frame Loss	alm
4	undefined		36	A Eye Closure	alm
5	undefined		37	A Radio DADE	alm
6	A ATPC High PWR	alm	38	A DS1 Demux ALM	alm
7	A DS1 Mux ALM	alm	39	A AGC Status	status
8	A DS1 Input ALM	alm	40	A Sync Loss	alm
9	B Common Loss	alm	41	B Path Distortion	status
10	B Power Supply	alm	42	B Channel Fail	alm
11	B RF XMT PWR	alm	43	B Radio Frame Loss	alm
12	undefined		44	B Eye Closure	alm
13	undefined		45	B Radio DADE	alm
14	B ATPC High PWR	alm	46	B DS1 Demux ALM	alm
15	B DS1 Mux ALM	alm	47	B AGC Status	status
16	B DS1 Input ALM	alm	48	B Sync Loss	alm
17	A XMT On Line	status	49	A RCV On Line	status
18	undefined		50	undefined	
19	XMT Override	status	51	A DS1 On Line	status
20	A ATPC Active	status	52	RCV Override	status
21	Previous Section	status	53	undefined	
22	Switch Off Normal	alm	54	undefined	
23	Command Path Fail	alm	55	A ATPC Down Command	status
24	Controller ALM	alm	56	A ATPC Up Command	status
25	B XMT On Line	status	57	B RCV On Line	status
26	undefined		58	undefined	
27	B ATPC Active	status	59	B I/O On Line	status
28	undefined		60	I/O Override	status
29	DS1 Loopback Line 1-4	status	61	undefined	
30	DS1 Loopback Line 5-8	status	62	B ATPC Down Command	status
31	DS1 Loopback Line 9-12	status	63	B ATPC Up Command	status
32	DS1 Loopback Line 13-16	status	64	undefined	

RAS Point Definitions

SCAN POINT	**DESCRIPTION**	**POINT TYPE**	**LOW**	**HIGH**	**SCALE FACTOR**
1	A PA Voltage	status	0.0	9.99	.01
2	B PA Voltage	status	0.0	9.99	.01
3	undefined				
4	undefined				
5	A ATPC	status	0.0	9.99	.01
6	B ATPC	status	0.0	9.99	.01
7	undefined				
8	undefined				
9	undefined				
10	undefined				
11	A RCVR LO Phase Lock	status	0.0	9.99	.01
12	B RCVR LO Phase Lock	status	0.0	9.99	.01
13	A AGC	status	0.0	9.99	.01
14	B AGC	status	0.0	9.99	.01
15	A Battery Voltage	status	00.0	99.9	0.1
16	B Battery Voltage	status	00.0	99.9	0.1
17	A Radio Errors	status	000	999	1
18	B Radio Errors	status	000	999	1
19	A Radio Errored Seconds	status	000	999	1
20	B Radio Errored Seconds	status	000	999	1
21	undefined				
22	undefined				
23	undefined				
24	undefined				

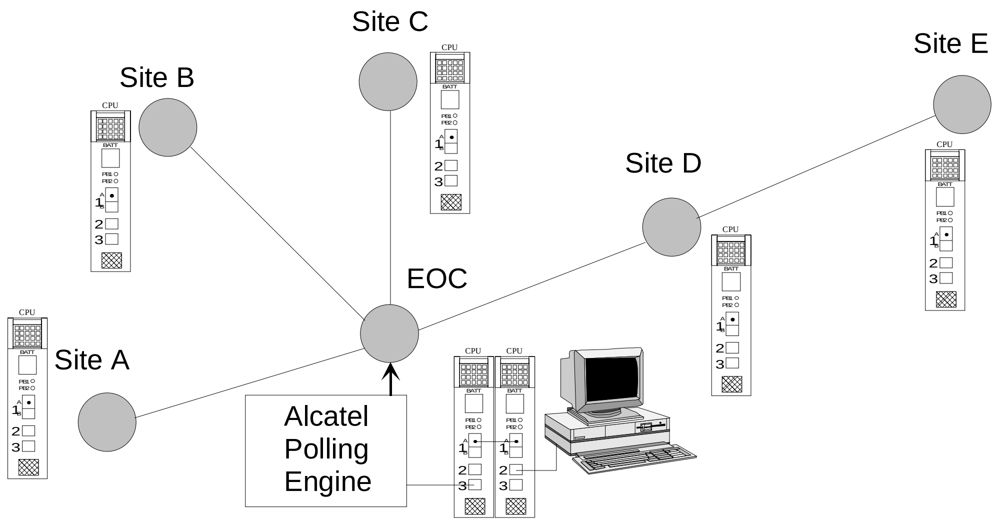
RCDI Point Definitions

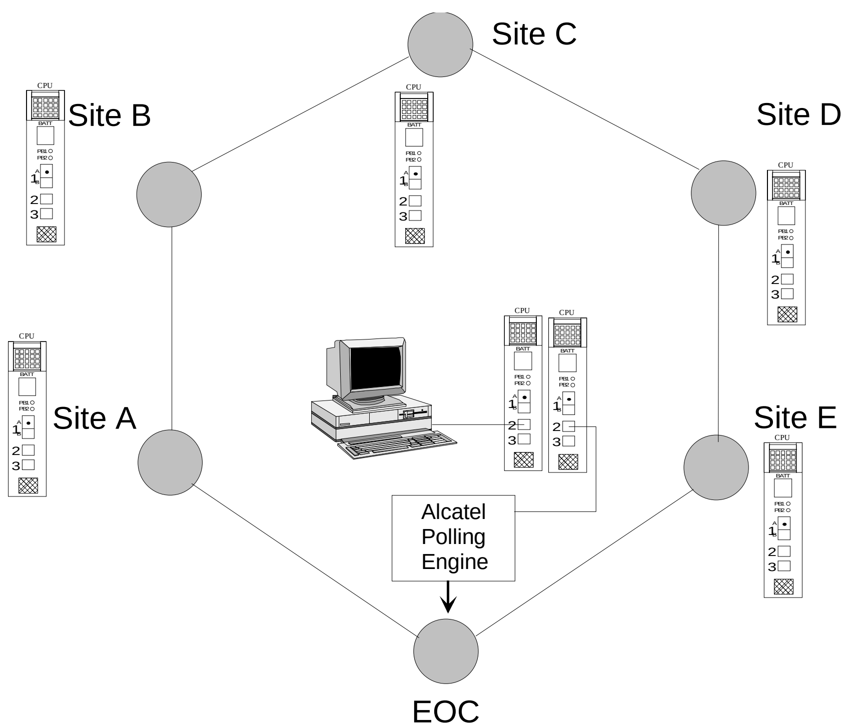
SCAN POINT	DESCRIPTION Function A	Function B	Comments
1	A XMTR On	Loopback DS1-5	See Note 1 below
2	B XMTR On	Loopback DS1-6	“
3	A RCVR On	Loopback DS1-7	“
4	B RCVR On	Loopback DS1-8	“
5	A I/O On	Loopback DS1-9	“
6	B I/O On	Loopback DS1-10	“
7	ATPC HI	Loopback DS1-11	“
8	ATPC LOW	Loopback DS1-12	“
9	Loopback DS1-1	Loopback DS1-13	“
10	Loopback DS1-2	Loopback DS1-14	“
11	Loopback DS1-3	Loopback DS1-15	“
12	Loopback DS1-4	Loopback DS1-16	“
13	User Defined #1	User Defined #4	“
14	User Defined #2	User Defined #5	“
15	User Defined #3	User Defined #6	“
16	Function “A”	Function “B”	Point 16 has two states only

Note 1: Points 1-15 have two functions. When point 16 is in the off state then points 1-15 have the function “A” effect on the radio equipment. When point 16 is in the on state then points 1-15 have the function “B” effect on the radio equipment. (I.E. To switch RCVR B on, point 16 must be off and then point 4 can be turned on. To force a loopback on DS1-10 you would have to turn point 16 on and then turn point 6 on. To remove the loopback from DS1-10 you would have to turn point 16 on and then turn point 6 off.)

Figure 6: Examples of an Alcatel STAR and LOOP configuration. One (1) MOSCAD CPU is required at the central site to interface to the Alcatel M/W radio's diagnostic port via a separate Alcatel Polling Engine (PE). This

one PE acts as the diagnostic polling engine for the entire M/W radio system. The connection between the CPU and PE is RS-232 running at 9.6Kbps. The connection between the PE and the M/W is RS-422 running 64Kbps and talks the radio's native protocol (MCS-11). The second CPU at the central is dedicated to the M/W radio service channel port to send & receive MDLC data and to interface to the central computer. At the remote sites, one CPU per two M/W radios is required to interface to the M/W radio service channel port to send & receive MDLC data. The service channel connection is RS-232 running at 9.6Kbps. The computer connection is RS-232 running at 19.2Kbps.





14. Harris Farinon Microwave Radio Interface

MOSCAD has the capability to interface to the Harris Farinon family of microwave radios. The currently supported models are the DVM-45, DVM-8T and the Megastar. In the event a different model radio is required, please contact the Product group. There are two (2) types of serial interfaces which provide two different purposes. One is a serial interface to the Harris "Scan Channel" alarm channel, for monitoring alarms. The second is a serial interface to the microwave radio overhead service channel to link sites to allow transmission of alarms. Each channel, although completely separate, function as a party-line mode operation.

The Harris Farinon DVM-45, DV-8T and Megastar radios contain an alarming protocol known as the Scan Channel. The Scan Channel protocol is an asynchronous, RS-232, byte oriented protocol, which MOSCAD easily emulates. The MOSCAD interface to the Harris alarm channel is accomplished with a dedicated MOSCAD CPU. The MOSCAD CPU acts as Polling Engine. Each radio also has eight (8) dry-contact alarms that the MOSCAD also monitors which are not part of the serial alarming, and require MOSCAD Digital Inputs. The following alarms are monitored in each respective radio.

<u>Harris Farinon MEGASTAR Alarms:</u>

Serial Alarms:		Serial Global Alarms	Discrete Alarms
OCS1 Receiver	IS3 2 Decoder 1 Sig	Minor	DI #1
OCS2 Receiver	IS3 2 Decoder 2 Sig	Major	DI #2
Slot 1 Orderwire	IS3 Loopback	Mux	DI #3
Slot 2 Orderwire	SPU Controller	SPU	DI #4
Overhead Fuse	SPU Fan	Radio	DI #4
Power Supply 1	SPU Fuse	Comm Stat	DI #5
Power Supply 2	Overhead		DI #6
Demodulator 1	Mux Interface		DI #7
Demodulator 2	Alarm Display		DI #8
Decoder 1	Radio 1 Rx PLS		
Decoder 2	Radio 1 Tx PLS		
Modulator 1	Radio 1 Tx Switch		
Mod 1 IS3 1 Input	Radio 1 Controller		
Mod 1 IS3 2 Input	Radio 1 IF Amp		
Mod 1 Output	Radio 1 LNC		
Modulator 2 Output	Radio 1 Fan		
Mod 2 IS3 1 Input	Radio 2 Rx PLS		
Mod 2 IS3 2 Input	Radio 2 Tx PLS		
Mod 2 Output	Radio 2 Tx Switch		
IS3 1	Radio 2 Controller		
IS3 Decoder 1 Sig	Radio 2 IF Amp		
IS3 Decoder 2 Sig	Radio 2 LNC		
IS3 1 loopback	Radio 2 Fan		
IS3 2			

Harris Farinon DVM-8T Alarms:

Serial Alarms:		Serial Global Alarms	Discrete Alarms
Receiver A	DVI	Minor	DI #1
Receiver B	Radio/Modem Tx A1	Major	DI #2
Receiver A Standby	Radio/Modem Tx A2	Mux	DI #3
Receiver B Standby	Radio/Modem Rx A1	SPU	DI #4
M2X A	Radio/Modem Rx A2	Radio	DI #4
M2X B	A1/A2 Minor	Comm	DI #5
M12/M22 A1	A1/A2 Major		DI #6
M12/M22 A2	Radio Tx A1 Lock		DI #7
M12/M22 A3	Radio Tx A2 Lock		DI #8
M12/M22 A4	Radio Rx A1 Lock		
M12/M22 B1	Radio Rx A2 Lock		
M12/M22 B2	Radio Tx B1 Lock		
M12/M22 B3	Radio Tx B2 Lock		
M12/M22 B4	Radio Rx B1 Lock		
M12 Standby	Radio Rx B2 Lock		
M22 Standby	Vent		
LSS A	Transmitter PA Fan		
LSS B	Remote Sync A		
DC-DC 1	Remote Sync B		
DC-DC 2	System Comm		
Protection			

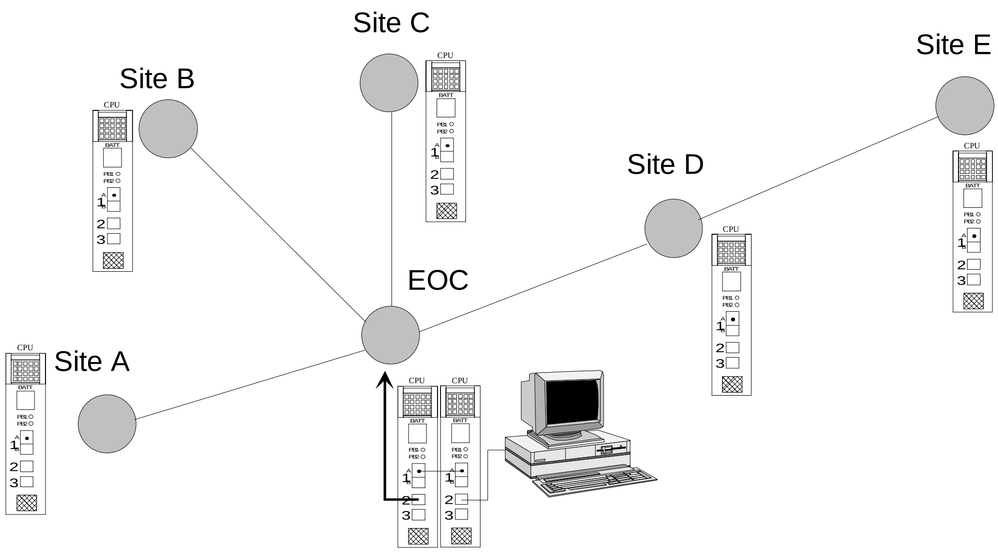
Harris Farinon DVM-45 Alarms:

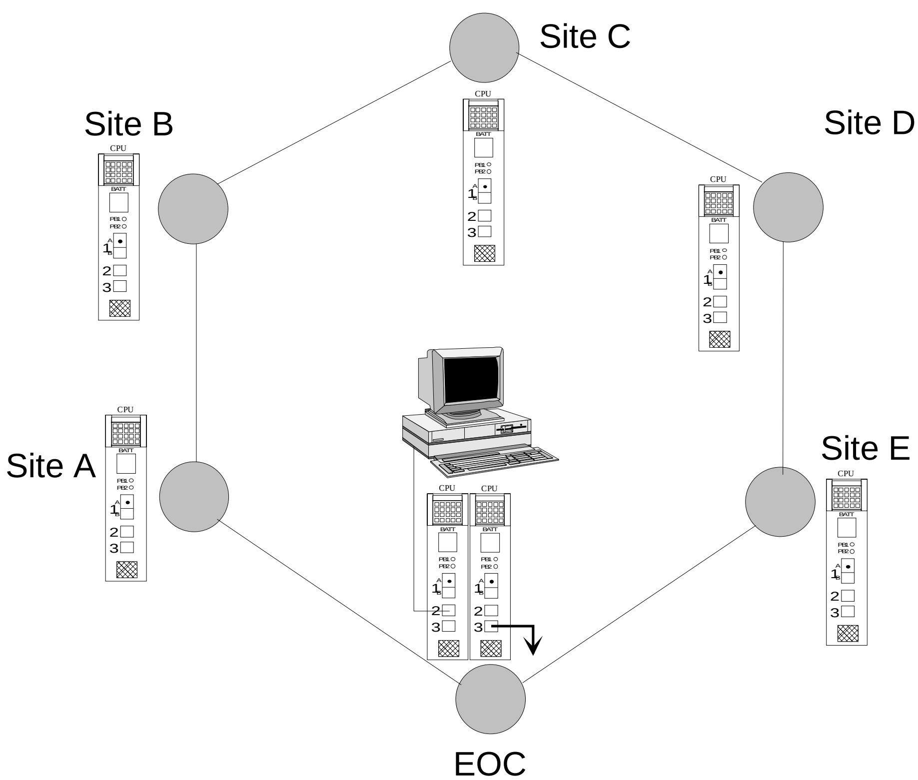
Serial Alarms:			Global Alarms:
Receiver A	Protection	Radio Tx B1	Minor
Receiver B	DVI	Radio Tx B2	Major
Receiver A Standby	Radio/Modem Tx A1	Radio Rx B1	Mux
Receiver B Standby	Radio/Modem Tx A2	Radio Rx B2	SPU
M2X A	Radio/Modem Rx A1	Modem Tx B1	Radio
M2X B	Radio/Modem Rx A2	Modem Tx B2	Comm
M2X Standby	Modem Tx A1	Modem Rx B1	
M12/M22 A1	Modem Tx A2	Modem Rx B2	
M12/M22 A2	Modem Rx A1	PA Pwr B2	
M12/M22 A3	Modem Rx A2	Online Modem B Loopback	
M12/M22 A4	PA Pwr A2	Offline Modem B Loopback	
M12/M22 B1	Online Modem A Loopback	Radio Tx B Lock	
M12/M22 B2	Offline Modem A Loopback	Radio Rx B Lock	
M12/M22 B3	Radio Tx A Lock	Modem B Comm Equip	
M12/M22 B4	Radio Rx A Lock	Radio/Modem B Protection	
M12 Standby	Modem A Comm Equip	Rx B1 Fault	
M22 Standby	Radio/Modem A Protection	Rx B2 Fault	
LSS A	Rx A1 Fault	Radio/Modem B Minor	
LSS B	Rx A2 Fault	Radio/Modem B Major	
DC-DC 1	Radio/Modem A Minor	Vent	
DC-DC 2	Radio/Modem A Major		

Discrete Alarms:

DI #1	DI #5
DI #2	DI #6
DI #3	DI #7
DI #4	DI #8

Figure 7: One MOSCAD CPU is required at the central site to interface to the Harris M/W radio's diagnostic port (Scan Channel). This one CPU acts as the diagnostic polling engine for the entire M/W radio system. This connection is RS-232 running at 9600bps and talks the radio's native protocol (Scan Channel protocol). The second CPU at the central is dedicated to the M/W radio service channel port to send & receive MDLC data and to interface to the central computer. At least one CPU per remote site is required to interface to the M/W radio service channel port to send & receive MDLC data. The service channel connection is RS-232 running at 2400 bps. The computer connection is RS-232 running at 19.2Kbps.





15. Quantar Interface

The MOSCAD is capable of interfacing to the Quantar/Quantro basestation in two different modes. The interface is serial, RS-232 and requires a dedicated MOSCAD CPU port, with an RS-232 MUX. They are as follows:

Alarm interface via RSS port	- used to monitor alarms (up to 8 stations per CPU)
Remote RSS via RSS port	- used to remotely configure station(s)

15.1 Alarm Summary via RS232

The MOSCAD CPU will interface to the Quantar via the RSS port. Each MOSCAD CPU will interface to up to eight (8) Quantars via a RS-232 MUX. Each MOSCAD CPU has two RS-232 ports, each accommodating one RS-232 MUX. Each RS-232 MUX has one RS-232 input port and four (4) RS-232 output ports.

The Quantar interface software in the MOSCAD will poll each attached Quantar, using RAP mode, continuously for the most critical information, including:

a) Full Power status (Full or Low or Inactive)
b) Forward Power (in watts, integer)
c) Reflected Power (in watts, integer)
d) VSWR (ratio of Forward to Reflected power, as calculated by the Quantar, integer)

Note: Each of the above RAP commands are individually/separately executed by the local MOSCAD CPU. The MOSCAD equipment requires approximately 1 second to complete each command. Effectively, each of the four status's will be polled every four seconds. These four RAP commands cannot be performed while the station is in the "Front Panel Mode". Once every 3 minutes, the Quantar will be placed in Front Panel Mode (FPM), where a complete dump of its current operating status will be retrieved. Please note that the RAP mode information cannot be polled for when the Quantar is in FPM. The Quantar station remains 100% operational while the station is in FPM.

Information to be retrieved while in FPM includes:
a) Time Stamp of the station clock (updated every 5 seconds)
b) Current Channel status (1 to n)
c) Power Line Failure status (Normal or Fail)
d) Power Line status (On or Off)
e) Station Control Module status (Normal or Fail)
f) PA Diagnostics status (Normal or Fail)
g) PA Test status (On or Off)
h) Receiver Diagnostics status (Normal or Fail)
i) Receiver status (Active or Inactive)
j) Receiver Synthesizer status (Lock or Unlock)
k) Transmitter Synthesizer status (Lock or Unlock)
l) Wireline Diagnostics status (Normal or Fail) - Reported by exception if the status is different

Available Quantar control commands, via RAP mode (RSS Port), include:
a) Access Disable (On or Off)
b) Select Channel (1 to n)
c) Set PTT (Key or Dekey)
d) Set PA Test Mode (On or Off)

Analog Information
a) Transmit Power Output(Watts)
b) Reflected Power Output(Watts)
c) VSWR

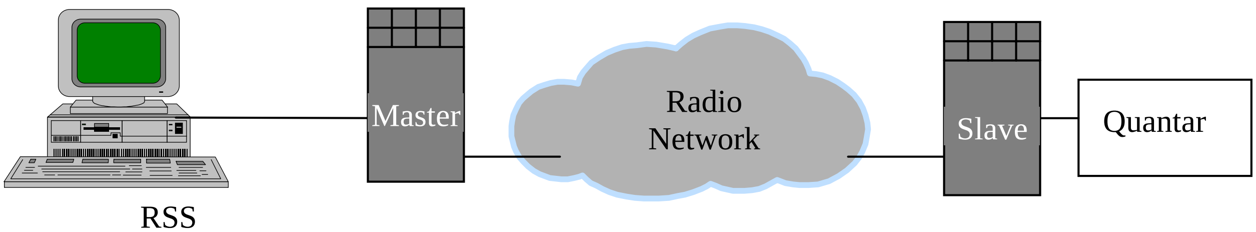
15.2 Terminal Mode (Remote RSS Configuration)

Overview
The Terminal application enables transferring data between two devices, e.g.. PC and a Base Station, through MOSCAD. For example, a PC running RSS may configure a Radio remotely.

The Terminal application is a 'C' program which is being downloaded to the MOSCAD flash memory using the Standard ToolBox Downloader, and runs as a part of the MOSCAD software.

The intent of this document is to describe the way that MOSCAD (V3.70+) should be setup, in order to use the Terminal application for transferring user data transparently through the supported media by MOSCAD.

The following diagram illustrates a simple use of this application:

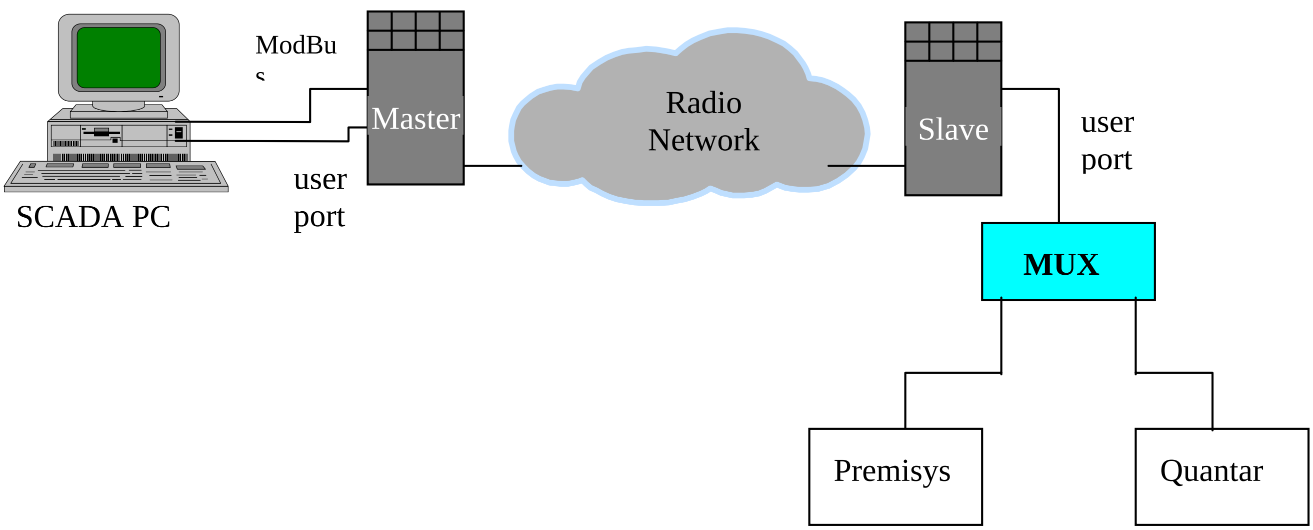


The MOSCADs and their Terminal application are used as a bridge between the PC and the Quantar Base Station. Using this setup the RSS on the PC can communicate with the Quantar remotely through the MDLC network.

The Terminal application should be setup to act as a MASTER or a SLAVE. As a MASTER, it can establish a session with a specified remote for data exchange. The SLAVE is the Remote MOSCAD which is connected to the Remote device.

The Slave MOSCAD can be connected to multiple devices with or without a Multiplexer.

The following diagram illustrates the use:



As seen in the above figure, one of the MASTER ports is defined as ModBus protocol for the SCADA use, and the other port is used by the RSS program for Remote RSS.

The Multiplexer box (MUX) enables connecting up to 4 devices to the same User-Port, which means up to 8 devices can be managed by a single CPU. The presence of this is optional..

Specs

Max User-Ports	: 2 without MUX, 8 with MUX
Data Rates	: 1200 .. 19,200 bps
User-Port Flow-Control	: RTS/CTS or XON/XOFF

Run-Time

After downloading the appropriate files to the MASTER and SLAVE MOSCADs, and after you have setup your system, you can use a VT-100 terminal emulator (like PROCOMM, PCPLUS, HyperTerminal) to establish a connection between two MOSCADs.

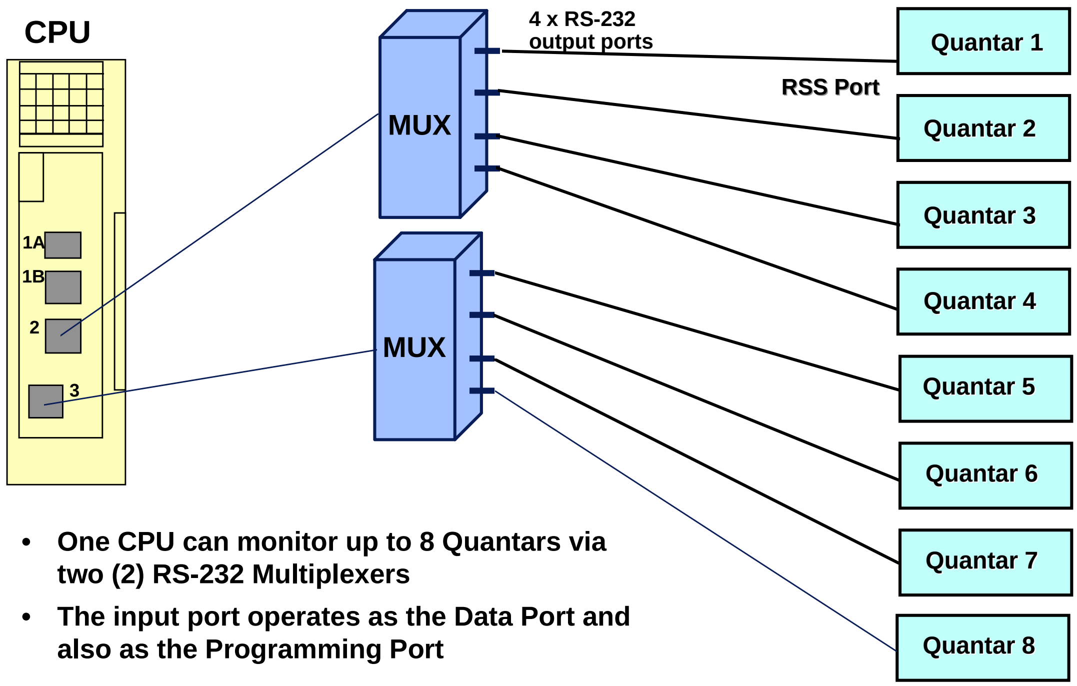
CPU Configuration / Physical Connection for Master

The MOSCAD - Quantar for remote configuration interface will be achieved by connecting port 2 or 3 (RJ-45) of a Series 300 CPU with the RSS port (DB-9) on the Quantar basestation (via the MOSCAD uses an RS232 MUX).

One MOSCAD Series 300 CPU will be used to interface to up to eight (8) Quantar basestations. Ports 2 and 3 of the MOSCAD CPU module will be used to interface to separate remote Quantar basestations. Port 3 on the MOSCAD CPU module will need to be equipped with an ASYNC RS-232 board.

The MOSCAD provides the qualified technician the capability to remotely configure the Quantar basestation that are connected to the MOSCAD network. This is done from a separate laptop computer running the proper RSS.

Figure 8: MOSCAD-Quantar Interface



16. AstroTac Interface Summary via RS232 (under development)

The MOSCAD will connect to each AstroTac via its RSS port and will require a dedicated MOSCAD RS-232 port. Each MOSCAD CPU will interface to up to two (2) AstroTacs. The MOSCAD will, for all practical purposes, be in a “listen-only” mode, where it will continuously monitor for any alarm messages that the AstroTac transmits. Alarm messages will then be converted to native MOSCAD data format for transmission to the control center. *Major* alarms will be transmitted and enunciated individually. *Minor* alarms will be grouped into one logical device alarm for transmission to, and annunciation at, the control center. The designation of each alarm as either *major* or *minor* will be made during the Detailed Design Review.

The following Major Alarms will be individually monitored by the MOSCAD:

a) RSS Port Communication
b) Front Panel Mode Validity (Valid or Invalid)
c) Station Control Module (Fail or Okay)
d) RX Fail (Normal or Fail)
e) RX Lock (Unlock or Okay)
f) Wireline Fail (Normal or Fail)
g) Wireline On (Off or On)
h) AC Power (Okay or Fail)

17. AstroTac-3000 Interface Summary via RS232 (under development)

The MOSCAD will connect to each AstroTac-3000 via its RSS port and will require a dedicated MOSCAD RS-232 port. Each MOSCAD CPU will interface to up to two (2) AstroTacs. The MOSCAD will, for all practical purposes, be in a “listen-only” mode, where it will continuously monitor for any alarm messages that the AstroTac-3000 transmits. Alarm messages will then be converted to native MOSCAD data format for transmission to the control center. *Major* alarms will be transmitted and enunciated individually. *Minor* alarms will be grouped into one logical device alarm for transmission to, and annunciation at, the control center. The designation of each alarm as either *major* or *minor* will be made during the Detailed Design Review.

The following Major Alarms will be individually monitored by the MOSCAD:

a) Infra Port Disabled
b) Wireline Board n Failed (provides board number)
c) Modem Failure (Failed or Cleared)
d) Link Failure Alarm
e) Link Failure Alarm Cleared
f) Excessive CRC Errors Detected

18. DigiTac Interface Summary via I/O

The MOSCAD will monitor the DigiTac Comparator via dry contact closures (MOSCAD Digital Inputs (DI)). The DigiTac alarm indications are:

a) Channel n Fail (1 through 8 on each chassis) - bi-directional
b) Disable Channel n (1 through 8 on each chassis) - uses same connection as a)

19. SpectraTac Interface Summary via I/O

The MOSCAD will monitor and control the SpectraTac Comparator via dry contact closures (MOSCAD Digital Inputs (DI) and Digital Outputs (DO). MOSCAD can poll the SQMs on a periodic basis (determined during the detailed design phase) and if one or more SQMs are in an Un-Squelch state for a pre-defined period of time an internally generated alert is sent to the Graphic Master Central. The system operator can then initiate a poll to identify the specific SQM(s). Once the specific SQM(s) are identified a command is initiated to disable the SQM(s). There is also an option which allows the MOSCAD RTU to disable the SQM locally. The system operator will have the ability to place SQMs back in service via a SQM enable command. A SQM Poll Command can be initiated at any time by the system operator from the Graphic Master Central.

The SpectraTac alarm indication is:
a.) SQM indication of Channel Squelch or Un-Squelch.

The SpectraTac control output:
a.) SQM Disable (Operator or RTU initiated)
b.) SQM Enable

Graphic Master Central Command:
a.) Poll Comparator SQMs

20. Astro Digital Interface Unit (DIU) Interface Summary via RS232

The Astro **Digital Interface Unit** (**DIU**) might generate up to 104 different alarms, and send an appropriate alarm message to the terminal interface port, when an alarm occurs. The alarm message is free format text.

The MOSCAD CPU, running the DIU application (a “C” application), is plugged into the DIU terminal interface port and polls the received alarms. **Alarm List:**
(Note: Spelling errors in the messages are a unique feature of this Israeli product.)

APP_FATAL_ERROR	(1)(F) Problem with sys calls
APP_WLI_SET_ERR	(2)(F) Could not set wireline
APP_TRC_GET_EVE	(3)N / A
APP_BASE_GET_EVE	(4)N / A
APP_ATTEN_SET_ERR	(5)(F) Could not set attenuator
APP_ILEGAL_MSG	(6)(F) Unexpected inner task message
APP_ILEGAL_EVENT	(7)N / A
EMC_KEY_ERROR	(8)(W) Encryption key error
APP_MATRIX_SET_ERR	(9)(F) Could not set analog matrix
DSP_VSELP_ERROR	(10)(W) Timeout getting vselp from DSP
DSP_VSELP_NUM_ERR	(11)(W) Wrong vselp number from DSP
EMC_VSELP_ERROR	(12)(W) Timeout getting vselp from EMC
EMC_VSELP_NUM_ERR	(13)(W) Wrong vselp number from EMC

EMC_ESYNC_ERROR	(14)(W) Esync error
INFRA_END_ERROR	(15)(W) Error sending STOP (no CTS)
INFRA_DB_ERROR	(16)(F) Cannot update infara-structure DataBase
INFRA_SEND_ERROR	(17)(W) Error sending Data (no CTS)
BASE_START_ERROR	(19)(F) Fail to receive start message
WRONG_MODE_REQ	(21)(W) Got an unknown RECEIV mode from infrastructure
BAD_PRESYNC	(22)(W) Bad pre-esync received
DSP1_SET_PAR_ERR	(24)(F) Bad communication with DSP1
EMC_SET_PAR_ERR	(25)(F) Bad communication with EMC
INFRA_GET_VSLP_ERR	(26)(W) Timeout getting vselp from infrastructure
INFRA_VSELP_NUM_ERR	(27)(W) Wrong vselp number from infrastructure
INFRA_ESYNC_ERROR	(28)(W) Timeout getting esync from infrastructure
NO_EMC_BOARD	(29)(W) EMC is not installed
EMC_PREESYNC_ERROR	(30)(F) Could not get ESYNC from EMC
DSP2_SET_PAR_ERR	(31)(F) Bad communication with DSP2
APP_MIC_SEL_ERR	(32)(W) Operator board problem
APP_OPERATOR_ERROR	(34)(W) Operator board problem
FT_NOTFOUND_ERROR	(35)(W) Undefined function tone
ESTABLISH_LINK	(36)(I) Start Link establishment process
MISS_STOP	(37)(W) Missing STOP in analog
SEND_SABM	(38)(I) Sending SABM frame
SEND_UA	(39)(I) Sending UA frame
RCV_SABM	(40)(I) Receive SABM frame
RCV_UA	(41)(I) Receive UA frame
ESTABLISH_LINK_FAIL	(42)(W) Link establishment failed
ESTABLISH_LINK_OK	(43)(I) Link establishment O.K
LINK_FAILURE	(44)(W) Link failure
ANALOG_TIMEOUT	(45)(W) Analog timeout
LINK_DEGRAGATION	(46)(W) Link Degradation (TOD)
MODEM_BIT_FAILED	(47)(W) Modem Self-Test Failed
MODEM_BIT_PASSED	(48)(I) Modem Self-Test Passed
REMOTE_LINK_FAILURE	(49)(W) Link failure on remote modem
NEW_ESYNC_RECEIVED	(50)(W) A non expected Esync was received
INB_MODE_CHANGED_NO_ACTIO N	(51)(I) Mode change detected
EMC_NOT_AUTHOR	(52)(W) FIPS authorization Denied
EMC_KEY_ZERO	(53)(W) All Key Zeroized
CRC_ERR_CNT	(54)(W) CRC-Errors counter critical value
ZC_UNKNOWN_CMD	(55)(W) Unknown Command from ZC
INB_MODE_CHANGED	(57)(W) Mode upgrade/downgrade
INB_KEY_CHANGED_NO_ACTION	(58)(I) Key change detected
INB_KEY_CHANGED	(59)(W) Key number update
EMC_TIMEOUT_ERROR	(60)(W) EMC status timeout
BAD_RS_ESYNC	(61)(W) Could not correct Esync
ESTABLISH_DCC_LINK	(62)(I) Start RNC Link establishment process
SEND_DCC_SABM	(63)(I) Sending SABM frame to RNC
SEND_DCC_UA	(64)(I) Sending UA frame to RNC
RCV_DCC_SABM	(65)(I) Receive SABM frame from RNC
RCV_DCC_UA	(66)(I) Receive UA frame from RNC

ESTABLISH_DCC_LINK_FAIL	(67)(W) Link establishment with RNC failed
ESTABLISH_DCC_LINK_OK	(68)(I) Link establishment with RNC O.K
DCC_LINK_FAILURE	(69)(W) RNC Link faiure
DCC_REMOTE_LINK_FAILURE	(70)(W) RNC Link faiure on remote modem
INB_KEY_MISMATCH	(71)(W) Invalid Key Detected During Call
INB_MODE_MISMATCH	(72)(W) Invalid Mode Detected During Call
INB_FORMAT_MISMATCH	(73)(W) Radio Signal Format Does Not Match Trnk Msg
RECEIVE_READY_MISSING	(74)(W) No Receive Ready from Base
BASE_HLM_DOWN	(75)(W) HLM: DIU-Base link is down
BASE_HLM_UP	(76)(I) HLM: DIU-Base link is up
CONSOLE_HLM_DOWN	(77)(W) HLM: DIU-Console link is down
CONSOLE_HLM_UP	(78)(I) HLM: DIU-Console link is up
ACIM_LINK_DOWN	(79)(W) ACIM link is down
ACIM_LINK_UP	(80)(I) ACIM link is up
DIU_RESET	(81)(I) DIU reset occured
MAIN_BATTERY_FAIL	(82)(W) DIU Main Battery Failure
MAIN_BATTERY_OK	(83)(I) DIU Main Battery OK
EMC_BATTERY_FAIL	(84)(W) DIU EMC Battery Failure
EMC_BATTERY_OK	(85)(I) DIU EMC Battery OK
BASE_HLM_AND_SECURE_DN	(86)(W) HLM Link down + secure operation failure
BASE_HLM_AND_V24_DN	(87)(W) HLM Link down + V.24 Link Down
KVL_LOAD_OK	(88)(I) Keyload from KVL pass
INB_MODE_REJECTED	(89)(W) Inbound SDU is rejected
POWER_UP_TEST_FAIL	(90)(I) A Critical Power-Up Test was detected
ALL_TYPES_LINK_FAILURE	(91)(I) Link with base is down
ALL_TYPES_SECURE_OP_ERR	(92)(I) Secure operation failure
KEY_INDEX_OUT_OF_RANGE	(93)(I) Key/Index out of range
DOWN_FOR_SERVICE	(94)(I) DIU Down for service
BACK_TO_BUSINESS	(95)(I) DIU Back to Business
HLM_INTERNAL_WARNING_CNSL	(96)(W) HLM CONSOLE task got unexpected message
HLM_INTERNAL_WARNING_BASE	(97)(W) HLM BASE task got unexpected message
MODEM_RESET_ENCOUNTERED	(98)(W) Modem Reset Encountered
SEND_XID_COMMAND	(99)(I) Sending XID Command to Base
SEND_XID_RESPONSE	(100)(I) Sending XID Response to Base
RCV_XID_COMMAND	(101)(I) Receive XID Command from Base
RCV_XID_RESPONSE	(102)(I) Receive XID Response from Base
NO_RECEIVE_READY_FROM_DCC	(103)(W) No Receive Ready from RNC
EMC_LOGIN_OK	(104)(W) FIFS Login succeeds

MOSCAD to DIU Cable Connections

The connectors used are RJ-45 (8 pin telephony connectors).

The cable is not symmetric; the MOSCAD end must be connected to the MOSCAD, and the DIU end to the DIU. The reverse will not work.

Pin numbering on the connector to the MOSCAD is the reverse of standard pin numbering. Hold the connector so that flat side is toward you and the pins are pointing up; the MOSCAD pin numbering is from left to right.

MOSCAD (as DTE) (pins numbered as on MOSCAD)	**DIU** (DCE) (standard numbering)
8 (TX)	2 (RX)
7 (RX)	7 (TX)
5 (GND)	1 (GND)

21. Premisys (TeNSr) Interfaces Summary via RS232

The MOSCAD is capable of interfacing to the Premisys TeNSr channel bank in three different ways and for three different reasons. The interfaces are all serial, RS-232 and require a dedicated MOSCAD CPU port. They are as follows:

TeNSr Sub Rate Unit (SRU) Port	- used to link sites (one per site)
TeNSr Computer Port	- used to monitor alarms (one per TeNSr)
TeNSr Terminal Port	- used to configure the channel bank (one per TeNSr)

21.1 Premisys (TeNSr) Sub Rate Unit (SRU) Interface via RS232

The MOSCAD RTU can use the TeNSr SRU port as a means to link remote sites to the central site. The is normally done (or suggested) with a digital microwave service channel. However, when microwave is not present or for design reasons, an SRU port is used (refer to figure 6). One MOSCAD CPU Port is required for each Premisys TeNSr Sub Rate Unit (SRU) port. Each SRU is associated with a T1/E1 path. Each CPU has 2 serial ports. Hence, one CPU can support up to two (2) SRU ports. The CPU to SRU interface is RS-232 running at 9.6Kbps. A separate CPU at the central site is dedicated to interface to the central computer (RS-232 running at 19.2Kbps).

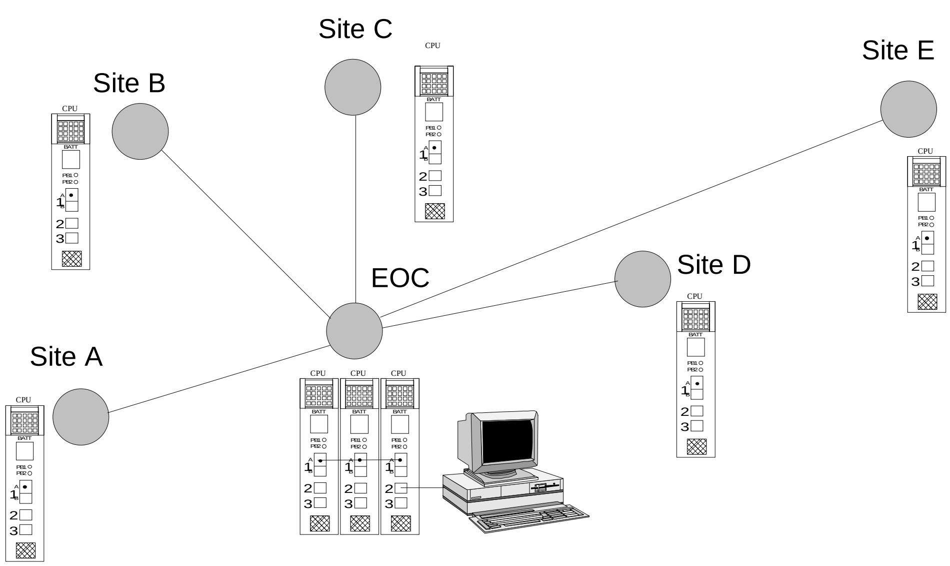


Figure 9

21.2 Premisys (TeNSr) Alarm Interface Summary via RS232

Background
Motorola has integrated alarm reporting of the Premisys TeNSr devices (IMACS/600 and IMACS/800) into the MOSCAD Fault Management System. Integrating this and other 3rd party devices is made possible through a flexible and modular MOSCAD solution.
Specifications
CPU Configuration / Physical Connection
The MOSCAD - TeNSr interface will be achieved by connecting port 2 or 3 (RJ-45) of a Series 300 CPU with the female DB9 RS232 Computer Port on the TeNSr interface card (the following Premisys interface card models are equipped with a DB9 serial computer port: IF 8920, IF 8921, IF 8926, IF 8927).

One MOSCAD Series 300 CPU will support 2 TeNSr devices. Port 2 and port 3 will each handle one channel bank separately (the MOSCAD CPU must be equipped with an RS232 ASYNC board in the port 3 position).
Upon alarm conditions, the TeNSr will automatically report appropriate alarm strings out of the TeNSr interface card computer port at 9600 bps (8 bit, no parity, 1 stop bit). *Note: Alarm reporting must be activated in the TeNSr on a per alarm basis. The TeNSr must also be configured to report alarms through the interface card serial port. This alarm configuration may be performed by connecting to the TeNSr's RS232 control terminal interface port on the interface card with a VT100 terminal.*

TeNSr (DTE)			MOSCAD (DCE)
DB9 Female	Function	Direction	RJ-45
1	DCD	To DTE	3
2	RxD	To DTE	8
3	TxD	From DTE	7
4	DTR	From DTE	6
5	GND	both	5
6	DSR	To DTE	2
7	RTS	From DTE	4
8	CTS	From DCE	1
9	-	-	-

TeNSr - MOSCAD CPU Interface Pin Out
(Same as ToolBox Adapter - FLN8259)

Alarm Reporting
MOSCAD RTU Functionality
MOSCAD CPUs actively monitoring TeNSr devices will be referred to as Remote Terminal Units (RTU). The MOSCAD RTU will remotely monitor TeNSr alarms through the interface discussed earlier in this document. Upon receiving ASCII alarm strings from the TeNSr, the RTU will store the event in RAM**.** The TeNSr Alarm History table can store up to 250 events. Upon logging 250 alarm events, the TeNSr Alarm History table will roll over and resume logging succeeding alarms at the top of the table (Ind 0).

The MOSCAD will connect to each Premisys channel bank via its alarm (Computer) port and will require a dedicated MOSCAD RS-232 port. The MOSCAD will, for all practical purposes, be in a "listen-only" mode, where it will continuously monitor for any alarm messages that the Premisys channel bank transmits. Alarm messages will then be converted to native MOSCAD data format for transmission to the control center. *Major* alarms will be transmitted and enunciated individually. *Minor* alarms will be grouped into one logical device alarm for transmission to, and annunciation at, the control center. The designation of each alarm as either *major* or *minor* will be made during the Detailed Design Review. Displayed in Figures 10 and 11 are the Wonderware Operator Interface screens. Figure 10 displays the front and back of the TeNSr. Located on each used slot in the TeNSr is an alarm indicator box. Upon receiving an alarm, the corresponding alarm indicator will blink red. By clicking the mouse on the appropriate slot, TeNSr alarm summary will be displayed, figure 11.

Wonderware Central

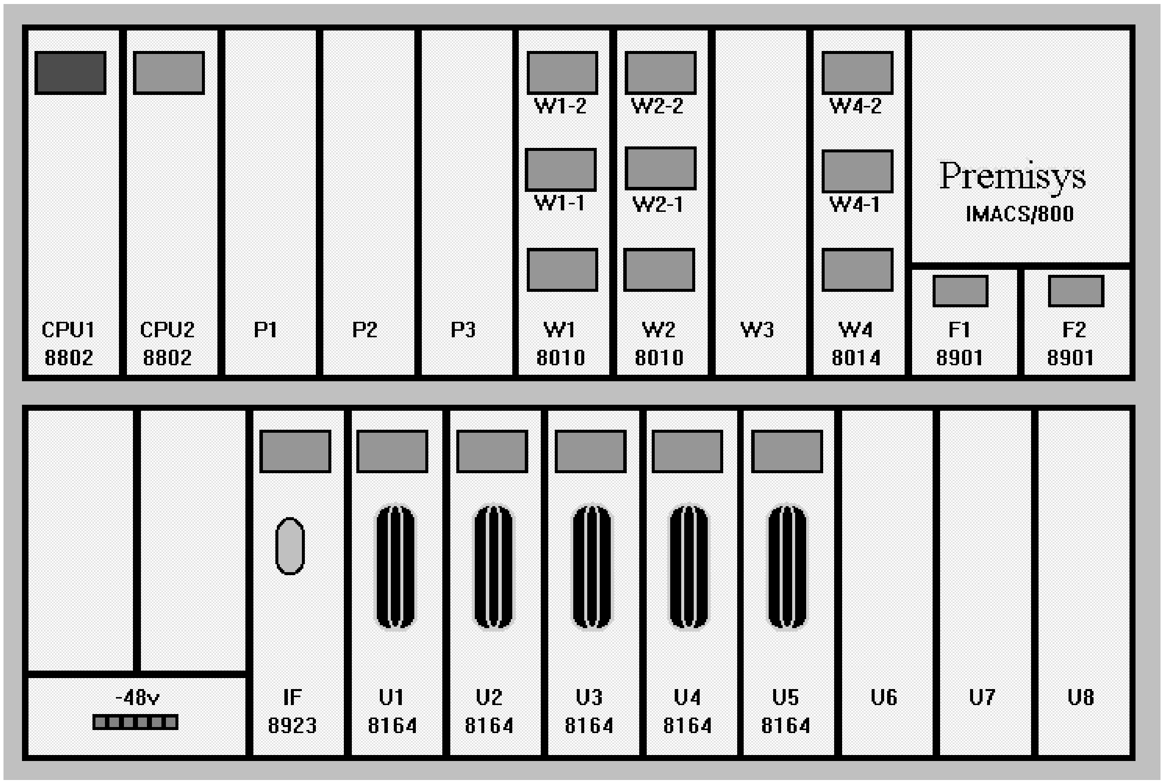
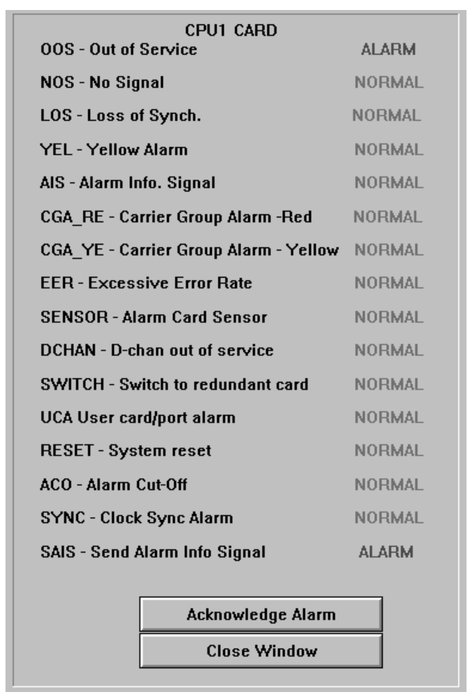


Figure 10. Premisys TeNSr Front/Back View

Figure 11. Premisys Alarms



TeNSr alarms available through MOSCAD are detailed in Table 4 below.

MOSCAD Alarm Index	**Filter**	**Alarm**	**Description**
0	**OOS**	Out of Service	The card, power supply or ringing generator is faulty or has been removed from the unit.
1	**NOS**	No Signal	Incoming WAN signal is lost.
2	**LOS**	Loss of Synchronization	Frame alignment is lost.
3	**YEL**	Yellow Alarm	The system has received a Yellow Alarm signal from a remote device. Usually received when the device loses WAN signal or synchronization.
4	**AIS**	Alarm Information Signal	The system has received a Blue Alarm signal from a remote device. Usually received when the remote or intermediate device has a major failure.
5	**CGA_RED**	Carrier Group Alarm - Red	The local incoming WAN signal has a serious problem and trunk conditioning is started. After receiving a RED alarm (NOS or LOS) for 2-3 seconds, the system initiates the appropriate trunk conditioning sequence and sends a Yellow alarm to the remote device.
6	**CGA_YEL**	Carrier Group Alarm - Yellow	The system has initiated trunk conditioning in response to a Yellow Alarm from a remote device. After 2-3 seconds, the system initiates the appropriate trunk conditioning sequence.
7	**EER**	Excessive Error Rate	The error rate measured by the system has exceeded the threshold set on the WAN card.
8	**SENSOR**	Alarm Card Sensor	The Alarm Card sensor has received an alarm indication from an attached device.
9	**DCHAN**	D-chan Out of Service	If the network side D channel looses contact with the user side, an alarm message will be generated. The alarm message will show the slot # and D channel # where the problem exists.
10	**SWITCH**	Switch to Redundant Card	The primary card has failed and the system has switched to the redundant card.
11	**UCA**	User Card/Port Alarm	One or more active ports on a user card are not working properly. Voice ports will show an alarm for excessive signaling transitions and data ports will show an alarm for exceeding the data error threshold.
12	**RESET**	System Reset	The system has been reset by either loss of power or by system software upgrade.
13	**ACO**	Alarm Cut -Off	The ACO option forces you to manually clear certain alarms. Without this option, self-correcting alarms might not be noticed. When the ACO option is set to report, ACO alarms will be generated for all Major alarms.
14	**SYNC**	Clock Sync Alarm	The SYNC alarm is generated when either the primary or secondary external clock source is lost. This alarm is in addition to the condition that lost the clock source (CGA_RED or OOS).
15	**SAIS**	Send Alarm Info Signal	The SAIS alarm is generated when the local system unit is transmitting AIS bits (a blue alarm).

Table 1. TeNSr Alarm Descriptions

TeNSr slot assignments available through MOSCAD are detailed in Table 5 below.

MOSCAD Slot Index	Slot Name	Available Alarms	Slot Description
0	C 1	OOS, SWITCH, RESET	CPU cards: One card required in either slot.
1	C 2		
2	P 1	OOS, SWITCH (8870 only), DCHAN (8840 only)	Resource cards: ISDN-PRI (8840), ADPCM (8870)
3	P 2		
4	P 3		
5	F 1	OOS, SWITCH	AC or DC power supplies
6	F 2		
7	I F - 1	OOS, ACO	Interface card: Provides all communications connections to the system.
8	W1	OOS, SWITCH	WAN cards: Manage flow of traffic through network.
9	W 1 - 1	NOS, LOS, YEL, AIS, SAIS, SYNC, CGA_RED, EER, CGA_YEL	WAN Plug-in modules: DSX/CEPT, CSU.
10	W 1 - 2		
11	W 2	OOS, SWITCH	WAN cards: Manage flow of traffic through network.
12	W 2 - 1	NOS, LOS, YEL, AIS, SAIS, SYNC, CGA_RED, EER, CGA_YEL	WAN Plug-in modules: DSX/CEPT, CSU .
13	W 2 - 2		
14	W 3	OOS, SWITCH	WAN cards: Manage flow of traffic through network.
15	W 3 - 1	NOS, LOS, YEL, AIS, SAIS, SYNC, CGA_RED, EER, CGA_YEL	WAN Plug-in modules: DSX/CEPT, CSU.
16	W 3 - 2		
17	W 4	OOS, SWITCH	WAN cards: Manage flow of traffic through network.
18	W 4 - 1	NOS, LOS, YEL, AIS, SAIS, SYNC, CGA_RED, EER, CGA_YEL	WAN Plug-in modules: DSX/CEPT, CSU.
19	W 4 - 2		
20	U 1	OOS, UCA, SENSOR (8401 and 8402 only)	User cards: Alarm (8401, 8402), E&M, FXO, FXS, B7R, BRI, DS0-DP,. FRAD, HSU, OCU-DP, SRU.
21	U 2		
22	U 3		
23	U 4		
24	U 5		
25	U 6		
26	U 7		
27	U 8		

Table 2. TeNSr Slot Descriptions.

21.3 Premisys (TeNSr) Configuration Interface via RS232

Remote TeNSr Configuration (refer also to section 15.2)
CPU Configuration / Physical Connection for Master
The MOSCAD - TeNSr for remote configuration interface will be achieved by connecting port 2 or 3 (RJ-45) of a Series 300 CPU with the Terminal Port (RJ-45) on the TeNSr interface card (the following Premisys interface card models are equipped with a RJ-45 terminal port: IF 8920, IF 8921, IF 8926, IF 8927). Table 6 below displays the interconnect required for this connection.

One MOSCAD Series 300 CPU will be used to interface to two slave (remote) TeNSr devices. Ports 2 and 3 and the MOSCAD CPU module will be used to interface to separate remote TeNSr devices. Port 3 on the MOSCAD CPU module will need to be equipped with an ASYNC RS-232 board.

One MOSCAD Series 300 CPU will used to interface to the master CPU. Port 2 and port 3 will each handle one VT100 connection. Port two is programmed to manage a local connection. Port three is programmed to manage a dial-up connection. The MOSCAD CPU must be equipped with an RS232 ASYNC board in the port 3 position).

The MOSCAD port (2 or 3) has several parameter that need to be configured in order for the interface to function properly. The configuration Table is found in the MOSCAD application in Table 1 of the User Tables. Table 7 on the next page explains the function of each of the parameters.

Central Computer Operation:
Once the master and slave configurations, network, application, and TERMINAL.FLS have been loaded and the MOSCAD interconnect is functional the operator can use the central computer to remotely configure the TeNSr channel banks that are connected to the MOSCAD network. The following steps will outline a typical connection.

Maximize the VT-100 Terminal icon. Press the F2 key on the key board. The terminal will prompt the user for the Site ID of the remote with which it is to be connected. Enter the Site ID and press ‘Enter’. The terminal will prompt the user on which port of the remote CPU is the channel bank connected (1,2 or 3). Enter the correct port number and press ‘Enter’. Messages “Communicating with Remote. Please wait...” and “Established connection with remote unit” will appear on the terminal. Hit ‘Enter’ and the connection to the remote TeNSr will be completed. The operator can navigate through the screens as if the connection was made locally to the channel bank. Once the operator has completed the session with the channel, they should exit all the way out of the channel bank menus and press F3 which will disconnect the master CPU from the remote.
Press the F2 key to connect to the next remote TeNSr unit.

22. Efratom GPS Rubidium Interface Summary via RS232

The MOSCAD will monitor each GPS/Rubidium Standard via RS-232 interface as well as dry contact closures (Digital Input module).

The three GPS/Rubidium dry contact alarm indications are:
a) Rb Lock Loss
b) AC Power Loss
c) RF Fault

The RS-232 interface monitors the actual "state" of the GPS unit; the states are:
a) Locked to GPS
b) Free Running
c) Rb Unlock
d) Warm Up Ended
e) Warm Up

Under normal operation the unit should be "Locked to GPS".

23. MOSCAD Interface to MSF 5000 & PURC 5000 Base Stations

23.1 Introduction

Depending on the station application their are two suggested, “standard” options for fault management interface to the MSF 5000™ and PURC 5000™ base station. Both options are based on the use of the standard base station WildCard module (options C232,C233, or QLN2914 Field Modification Kit; TRN9754 - WildCard Module). The WildCard module is installed in the Expansion Tray of the base station.

The WildCard Module provides the system with the capability of controlling external devices, and also has the ability to process inputs from the same or other external devices. The WildCard Module is used to signal an external device, via the forward WildCard function (FWC). Each WildCard has a total of four (4) total FWC outputs in the form of transistor outputs. This is the functionality that is used for the fault management interface. The WildCard Module is programmed via the setting of jumpers to detect specific bits on the MUXbus of the station. For the fault management interface, the jumpers are set to detect the alarm bits available on the MUXbus.

The aforementioned options and associated MUXbus addresses are listed below. Consult the WildCard Installation Manual for the required jumper settings to map these outputs.

23.2 Option 1 - Conventional Station

23.2.1 Table 1 -What To Order

Model	Qty	Description
QLN2918	1	Expansion Tray
QLN2914	1	WildCard Field Modification Kit
TLN4151	1	Field Installed Relay Kit

23.2.2 Table 2 - Applicable Alarms

Alarm Description	MUXbus Address	MUXbus Designation
Battery Overvoltage *	12, D3	RW4 OVG
Synthesizer Unlock	12, D2	RW3 SYN
PA Fail	12, D1	RW2 PA
Battery Revert/AC Fail *	12, D0	RW1 BAT

* Only Applicable if Battery Backup is used

23.3 Option 2 - Trunked Station; Hot Standby Configuration; Data Station; Full Diagnostics Option (X34)

23.3.1 Table 1 -What To Order

Model	Qty	Description
QLN2918	1	Expansion Tray
QLN2914	2	WildCard Field Modification Kit
TLN4151	2	Field Installed Relay Kit

23.3.2 Table 2 - Applicable Alarms

Alarm Description	MUXbus Address	MUXbus Designation	WildCard
Battery Overvoltage *	12, D3	RW4 OVG	WC 1
Synthesizer Unlock	12, D2	RW3 SYN	WC 1
PA Fail	12, D1	RW2 PA	WC 1
Battery Revert/AC Fail *	12, D0	RW1 BAT	WC 1
Main/Standby Sys Failure**	13, D3	MAINSTBY	WC 2
Low Forward Power ***	13, D2	RW7	WC 2
High Reflected Power ***	13, D1	RW6	WC 2
TSTAT Failure ***	13, D0	RW5	WC 2

* Only Applicable if Battery Backup is used
** Only Applicable if Main / Standby, i.e. redundant station configuration is used
*** Only Applicable if Wattmeter element is present in station. This is supplied as a standard feature with a Trunked station, Data Station or if the station was ordered with the Full Diagnostics Option (X34).

24. Polling /Messaging Methodology

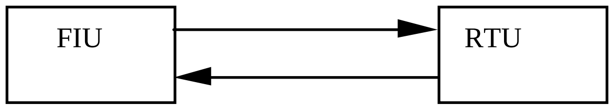
In the following text a "byte" is comprised of 8 bits for Asynchronous communications. The two primary modes of communications for the system is **"polling"** (also known as interrogation) and RTU **"messaging"** (COS-Change of State). System commands/controls and system synchronization signaling are less significant relative to "polling" and RTU "messaging" traffic volumes and will not be part of the analysis.

The RTU **messaging** originates with the RTU sending its data based on a pre-defined "Change of State" criteria; the packet size is about 120 bytes. The FEP responds with an "Ack" to the RTU consisting of about 28 bytes.

The **polling** mode is initiated by the FEP with a "interrogation" packet consisting of about 120 bytes. The RTU would respond with an "Ack" and the "message"(data) consisting of about 28+120 bytes on the average. The FEP would confirm reception of the message with an "ACK" to the RTU plus the "interrogation" for the next RTU (28+120 bytes).

Note: 20 bytes of each session is associated with the MDLC header.

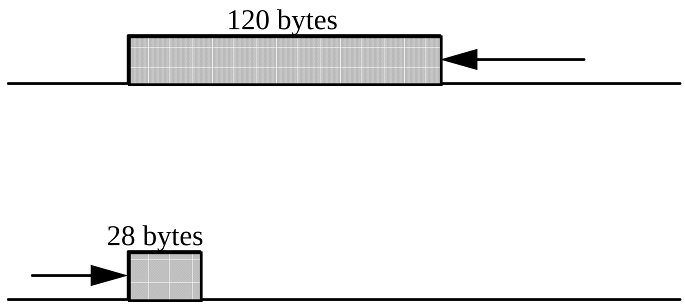
The transactions can be illustrated as follows:



Messaging

Message from RTU(COS)

FIU Ack to RTU Message

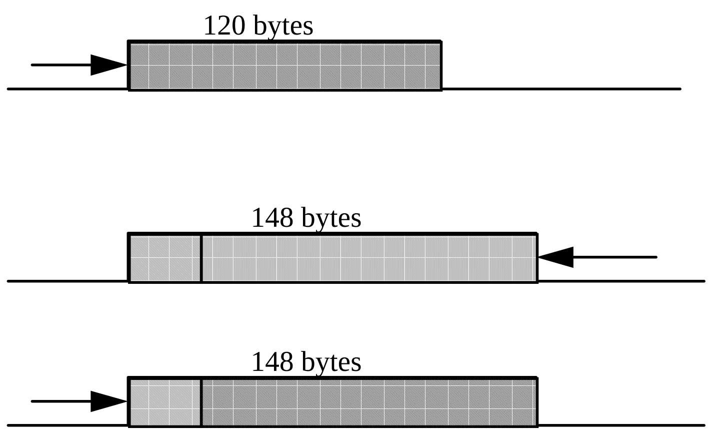


Polling

Interrogation by FIU

Acknowledge
& Response from
RTU

Acknowledge
& Next Interrogation
by FIU; etc.



25. Installation/Connectivity

All MOSCAD RTU/FEP hardware is 19" rack mount compatible. The MOSCAD RTU's are mounted on single 19" x 12" panels as mentioned in the site configuration table. When used, the DC to DC converter is mounted on the rear section of the panel. In the event the RTU is required to be powered by AC power, then a second 19" x 12" panel is provided for each RTU. **Ensure that proper grounding is provided since the MOSCAD operates on negative ground and microwave equipment operates on positive ground.** An RS-485 junction box is mounted on a separate 19" bracket. Due to the fact that cable length will vary site to site, equipment to equipment, the cable is to be cut to length at the time of integration, thus the cabling where noted will not be supplied with the equipment. System Engineering and/or Project Management should ensure that CCSI provides all services for staging (i.e. computer setup, RTU rack installation, cables and cabling, I/O wiring diagrams, I/O wiring, etc.).

Please note that CCSI costs are required to stage in Schaumburg and are not the responsibility of the MOSCAD Product Group.

<u>Systems that DO NOT stage in Schaumburg:</u>
Project Management should ensure to provide all services required to field install all equipment. This is not part of the MOSCAD quote. It is the responsibility of PM to inventory the equipment ordered, unbox and setup computer and computer peripherals, unbox, setup and mount all MOSCAD FEPs/RTUs, provide rack space, cabling and cable, wire I/O, etc. If any portion stages in Schaumburg, then CCSI needs to be involved.

<u>System that DO stage in Schaumburg:</u>
Project Management should ensure that CCSI provides all services required to stage the MOSCAD portion in Schaumburg along with the radio system. This is not part of the MOSCAD quote. It is the responsibility of PM/CCSI to inventory the equipment ordered, unbox and setup computer and computer peripherals, unbox, setup and mount all MOSCAD FEPs/RTUs, provide rack space, cabling and cable, wire I/O, etc.

The engineering services provided by the MOSCAD Product Group are for central programming, graphic screen generation, FEP and RTU programming, system implementation during staging, ATP and operator training.

26. MOSCAD OPERATOR Training Overview

The training related to the MOSCAD Fault Management system is conducted by the Motorola Fixed Data organization and is segmented and structured to target operator personnel. If additional training is required, additional sessions and pricing can be established.

Class Name	Class Size	Timing	Duration
Operator Training	Minimum of 4 to a maximum of 8	Post Infrastructure Acceptance	1 Day (possibly 2 groups if 8 people)

26.1 Operator Training (Typical) :

The operator training is targeted for personnel involved with the operation of the system from the Central location(s). A custom user manual provided by the Motorola Fixed Data Product group will be supplied to each participant. The items typically covered are as follows:

- Getting Started
  - First Display
  - System Title Window
  - Help Windows
  - Log In

- System Security

- System Operations
  - Screen Navigation
  - Maps

- Alarm Processing
  - Alarm States
  - Unacknowledged
  - Acknowledged
  - Return to normal

- Site Interrogation
  - Manual Interrogation
  - Auto Interrogation

- Alarm History
  - Alarm Summary
  - Alarm History File Archiving

- System Overview/Walkthru
  - RTU Messaging
  - Central Interrogations
  - Communication Media
  - System I/O
  - Protocols and Data Rates

- Graphics Master Central Maintenance
  - System Shutdown/Restart
  - Backup Procedures
  - System Clock
  - Backup Data Format and Layout

27. Year 2000 Compliance

There has been concern regarding possible problems for some computing systems when the year changes to 2,000. The following summary reflects the status of our Fixed Data and OEM software products as of August 30, 1997.

27.1 Motorola MOSCAD

1. MOSCAD RTU firmware V3.47 and later supports to year 2079.
2. MOSCAD ToolBox (DOS, WIN 3.1X, WIN 95 and WIN NT) supports to year 2037.

27.2 Wonderware's InTouch

Wonderware has provided the following information on their products:

1. Versions earlier than 5.6 are not supported and there are no plans to provide compliance.
2. Version 5.6 is not compliant, however an upgrade will be available to provide compliance.
3. Version 5.6b for WIN 3.11 and WIN 95 is compliant. However, SPC option (not used by Motorola) requires a work-around solution.
4. Version 6.0b for WIN NT is fully supported and tested for compliance. (Version 6.0 has problems unrelated to year 2000.)

Authorization to release this information has been obtained from Wonderware. Authorization for further distribution has been requested but not yet obtained.

27.3 MICROSOFT

Wonderware has provided the following information on Microsoft products;

1. WIN 3.11 will have a problem with file dates. Instead of having the year rollover from 12/31/99 to 1/1/00; WIN 3.11 will use the next ASCII character after 9 (:). Hence January 1, 2000 will become "1/1/:0".

2. MS-DOS 6.22 can not be changed into the year 2,000. Also there is an issue with starting DOS after the start of year 2,000. If the computer is shut down before midnight and restarted after midnight, it will adjust the year to 1980.

3. Some additional details on specific products.

* WIN 3.X and WIN 95 both support a year to 2108.
* WIN NT (with FAT16) support a year to 2108.
* WIN NT (with NTFS) support a year into future centuries.
* Excel 95 with a year notation of "YY" supports a year to 2019.
* Excel 95 with a year notation of "YYYY" supports a year to 2078.
* Excel with a year notation of "YY" will support a year to 2029 in the next version.
* Excel with a year notation of "YYYY" will support a year to 9999 in the next version

28. Index of Acronyms

MOSCAD	- MOtorola SCADa
MDLC	- Motorola Data Link Communications protocol
RNSG	- Radio Network Systems Group
ELB	- Equipment List Builder
MS	- Microsoft
M/W	- MicroWave
I/O	- Input/Output
APT	- Advanced Products Team
FEP	- Front End Processor
RTU	- Remote Terminal Unit
CCSI	- Customer Center for System Integration
SSC	- System Support Center
GMC	- Graphic Master Central
GWS	- Graphic Work Station
GIU	- Graphical User Interface
MMI	- Man Machine Interface
LTMC	- Low-Tier Master Central
SRU	- Premisys (TeNSr) Sub Rate Unit
TeNSr	- Telecommunications Network Server (Premisys channel bank)
DI	- Digital Input
DO	- Digital Output
AI	- Analog Input
AO	- Analog Output
COS	- Change of State
RSS	- Radio Service Software
SNMP	- Simple Network Management Protocol
CMIP	- Common Managament Information Protocol
MCP-S	- Motorola Communication Processor for SNMP (SNMP Gateway)
MCP-T	- Motorola Communication Processor for TCP/IP (TCP/IP Gateway)