



User Guide
for
Model 9000
Disturbance Monitoring Equipment

Version 1.0.4

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Revision History

VERSION	DATE	DESCRIPTION
1.0.0	08-16-2013	Initial Release
1.0.1	12-02-2014	Corrected alarm jumper configurations in Section 1.2.3
1.0.2	07-27-2016	Updated USI Logo
1.0.3	02-26-2018	Updated Event Power description in Section 1.1 and Digital Input voltage range Section 1.1.5
1.0.4	07-02-2019	Updated Calibration process and added Verification process in Section 2.3.7. Added note to Line Group Configuration in Section 3.1.3. Updated Routine Maintenance in Section 5.

Foreword:

This manual covers the Series 9000 Disturbance Monitoring Equipment (DME). The Series 9000 provides the user with significantly advanced capabilities in both hardware and software.

Series 9000 hardware features and benefits:

- Modular design provides greater reliability as each module operates independently.
- System design provides for unrestricted expandability.
- Units are interconnected via Ethernet (copper or fiber). Ethernet has been proven to be reliable, flexible, and easily distributed among distant locations.
- Each module is powered directly from the station battery. This feature eliminates the need to distribute lower voltages to other units.
- Each M9000 module contains IRIG-B circuitry to synchronize and time stamp data sampling. This feature eliminates the need to distribute TTL timing signals among units.
- IRIG-B input format is automatically detected. This feature accommodates modulated, un-modulated, and 1PPS inputs without the need for jumpers or connector pin programming.
- Each M9000 contains a dedicated processor. This feature provides distributed processing power throughout the system eliminating the bottle-neck of a single CPU.
- Each M9000 contains an embedded operating system. This feature provides reliable operation and a customized environment specific to the DME system requirements.
- The system has a fan-less design. Innovative component selection and thermal management techniques have eliminated the need for conventional forced-air cooling. Eliminating moving parts improves reliability.

Series 9000 software features and benefits:

DME System:

- DME system software launches and runs as a daemon for highly reliable operation. Each Module starts automatically at boot time and runs as a background process rather than being under the direct control of an interactive user.
- XML-based configuration file provides easy import/export of data files in other formats.
- Any calculated value can be exported to a Continuous Recording data file. This feature can be used to provide trend data for unique values.
- Fault data can be immediately pushed to the master-station via Ethernet. This feature makes fault data available for near real-time analysis.
- All calculated values (e.g. Continuous, Analog Trigger, PMU, etc.) are derived from full transient sampled data providing optimum resolution.
- *M9kScope*[®] feature provides real-time online viewing of waveforms and values, and calibration verification.
- Software summation of alarm outputs. This feature allows flexible alarm configurations.
- Logging of health monitoring values such as power supply voltages, temperatures, and calibration coefficients. This feature permits review of health data history.

Master-Station:

- Web-based Master-Station provides access from any network location. This feature allows the user interface to be served from a central location eliminating the need for version control by end users.
- User-based authentication. This feature provides logon access and privileges based on user name and password credentials.
- Encrypted communication (SSL, HTTPS, etc.). This feature provides a high level of security to data being transported.
- Master-Station maintains persistent communication with all Model 9000 systems simultaneously via Ethernet. This feature eliminates data retrieval delays.
- Real-time health monitoring of entire DME fleet. This feature generates and sends an immediate alert message if any alarm or communication error is detected at any module.
- Comprehensive analysis of all recorded data.

This manual covers software releases up to and including version 1.0.0.

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Section 1: M9000 SYSTEM ARCHITECTURE

The Model 9000 Disturbance Monitoring Equipment incorporates a Station-Master Computer, Station-Master Power Supply, M9000 modules, interfaces, and various optional accessories.

The M9000 modules and Station-Master Power Supply module run in an embedded [Linux](#) operating system. The Computer module runs with a Linux (Ubuntu Server) or in a Windows™ environment.

The Model 9000 and Station-Master Power Supply modules are powered directly from the substation DC battery system or from a typical secondary distribution AC voltage. The Station-Master Computer module is powered from the Station-Master Power Supply module.

A GPS clock receiver provides a time synchronization signal to each of the Model 9000 modules. This signal also synchronizes the sampled data coming from the M9000 modules.

Options include a display unit for local viewing of data, a keyboard with touchpad for local manual input, and other M9000 modules and units as required.

The Model 9000 [DME](#) system is designed to provide a powerful yet versatile solution for integrated transient fault recording ([DFR](#)), sequence of events recording ([SER](#)), dynamic disturbance recording ([DDR](#)), and synchronized phasor measurements ([PMU](#)). Some of the key features which set this device apart from others are:

- Continuous recording of any calculated value
- All values calculated using full transient sampled data
- Modular architecture to support centralized or distributed installations
- Embedded operating system for reliable and independent operation
- Fanless design for reduced maintenance and improved reliability
- Centrally located master server provides simultaneous communication among all M9000 modules with the Station-Master computer, and among all Station-Master computers
- Dynamic health monitoring and transfer of recorded data
- Secure interface with web-based master server via user-based authentication, strong password protection, and encrypted communications
- Automatic generation of system health, communication, and calibration reports



Figure 1-1 System Overview

1.1 Model 9000 Module

This section describes the architecture of the M9000 module. This module performs real-time data processing and communicates with the Station-Master computer. This is a required component of the DME system. A Model 9000 [DME](#) system can have multiple M9000 modules.

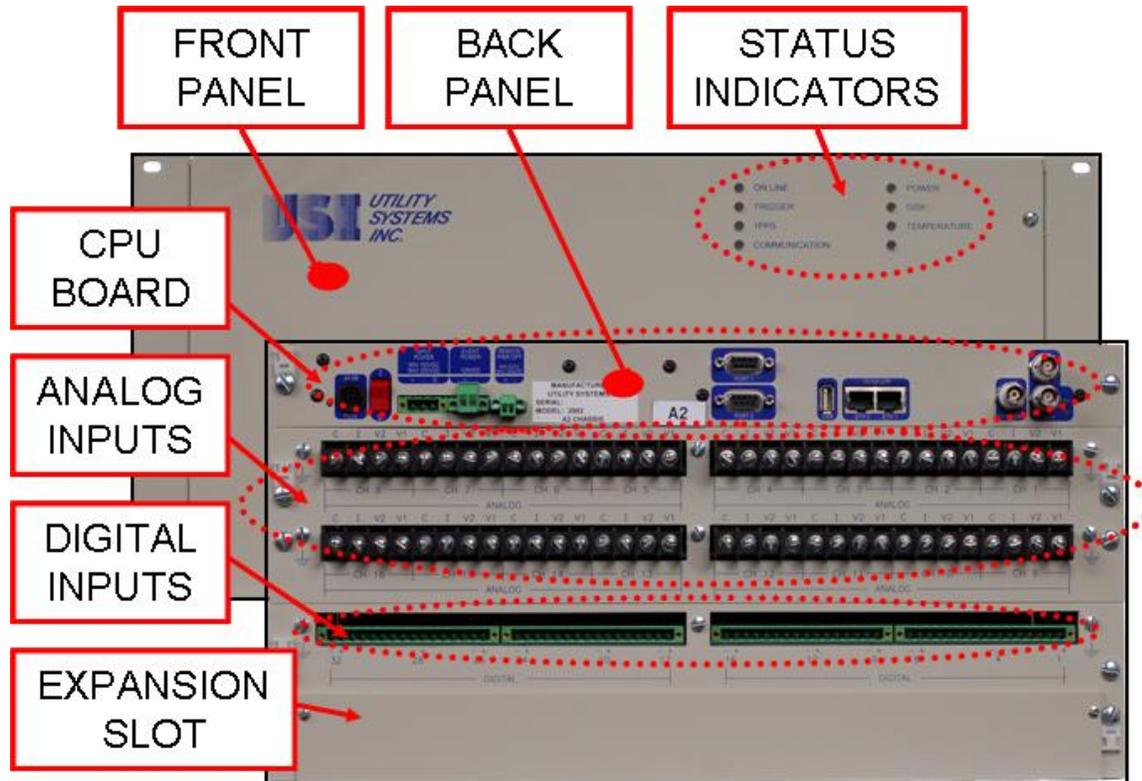


Figure 1-2 M9000 Module

The Model 9000 modules are typically housed in a standard [5U](#) (8.75inH x 13.25inD x 19inW) rack mount chassis. This unit contains a [CPU](#) board, a Backplane board, Analog and Digital Input boards, and a Front Panel [LED](#) board.

The CPU board acts as the central processing unit for this module. This board is connected to the analog and digital input boards through the Backplane board, and to the Front Panel LED board via ribbon cable. For complete details on this board including specifications, see Section [1.1.1](#).

The Backplane board is used to attach the Analog and Digital Input boards to the CPU board for the transfer of data, control signals, and power. For complete details on this board, see Section [1.1.3](#).

The Analog Input boards contain input voltage dividers, current shunts, surge protection, input-to-input isolation, and input-to-ground isolation. This board also contains precision instrumentation amplifiers, analog-to-digital converters, and a DC calibration reference for each analog input. For complete details on this board and its specifications, see Section [1.1.4](#).

The Digital Input board consists of voltage dividers, surge protection, input-to-input isolation, input-to-ground isolation, and an optocoupler for each digital input. For complete details on this board and its specifications, see Section [1.1.5](#).

The Front Panel LED board connects to the CPU board and indicates status of the M9000 module.

This board contains eight LEDs which display solid colors of red, green, or yellow and can also blink or warble to indicate various states of the M9000 module. Below are the status definitions for the M9000 module:

- **ON LINE**

This LED indicates the operational status of the M9000 module.

- ● Green:
This indicates a normal condition. The M9000 module processor has booted properly, the firmware is running, and the configuration file has been successfully applied.
- ● Yellow:
This indicates the M9000 module is in Internal Calibration mode. During this time, the recording and trigger functions are suspended.
- ● Red:
This indicates an alarm condition. The M9000 module is not recording.
- ● Off:
This indicates an alarm condition. The M9000 module is not recording. It is in the boot-up process or is powered off (see **POWER** below).

- **TRIGGER**

This LED indicates the condition of trigger limits.

- ● Green:
This indicates a trigger condition. A trigger condition means one or more analog measurements exceeded a trigger limit or one or more digital inputs transitioned to an abnormal value or state. This LED remains green until the Station-Master computer requests the triggered data.
- ● Yellow:
This indicates the M9000 module is transferring triggered data to the Station-Master computer. Once transfer is complete, the LED resets to Off.
- ● Off:
This indicates no trigger conditions are being processed.

- **1PPS**

This LED indicates status of the time synchronization.

- ● Green (Blinking):
This indicates a normal condition. Blinking green indicates the M9000 module is synchronized to the [IRIG](#) time source within a tolerance of one microsecond.
- ● Red (Blinking):
This is an alarm condition and indicates one of two conditions:
 - If the blue IRIG IN LEDs on the rear of the M9000 module ([Figure 1-3](#)) are ON, the module is synchronized but to a tolerance greater than one microsecond
 - If the blue IRIG IN LEDs on the rear of the M9000 module are OFF, the IRIG time signal is not detected.

- **COMMUNICATION**

This LED indicates the status of the [Ethernet](#) communication between the M9000 module and the Station-Master computer.

- ● Green:
This indicates a normal condition and indicates that communication with the Station-Master computer is normal.
- ● Yellow:
This indicates an alarm condition. The network link is good, but communication with the Station-Master database is down.
- ● Red:
This indicates an alarm condition. The network link to the Station-Master is down.

- **POWER**

This LED indicates the status of the M9000 module power supply voltages. These voltages have preset factory limits and are not field changeable.

- ● Green:
This indicates a normal condition. All power supply voltages are good.
- ● Red:
This indicates an alarm condition. One or more of the six power supply voltages are out of limits.

- **DISK**

This LED indicates the status of the M9000 module local storage.

- ● Green:
This indicates a normal condition; the disk free space is normal.
- ● Red:
This indicates an alarm condition. The disk free space is less than 20%.
- **TEMPERATURE**
This LED indicates the temperature status of the M9000 module
 - ● Green:
This indicates a normal condition, the DFR temperature is normal.
 - ● Red:
This indicates an alarm condition, the DFR temperature is either over or under the limit settings.
 - ● Yellow:
This indicates an alarm condition, the DFR temperature is OK but is within 10°C of the high limit.
- **(UNUSED)**
This LED is reserved for future use.

The rear panel of this module has the following features:

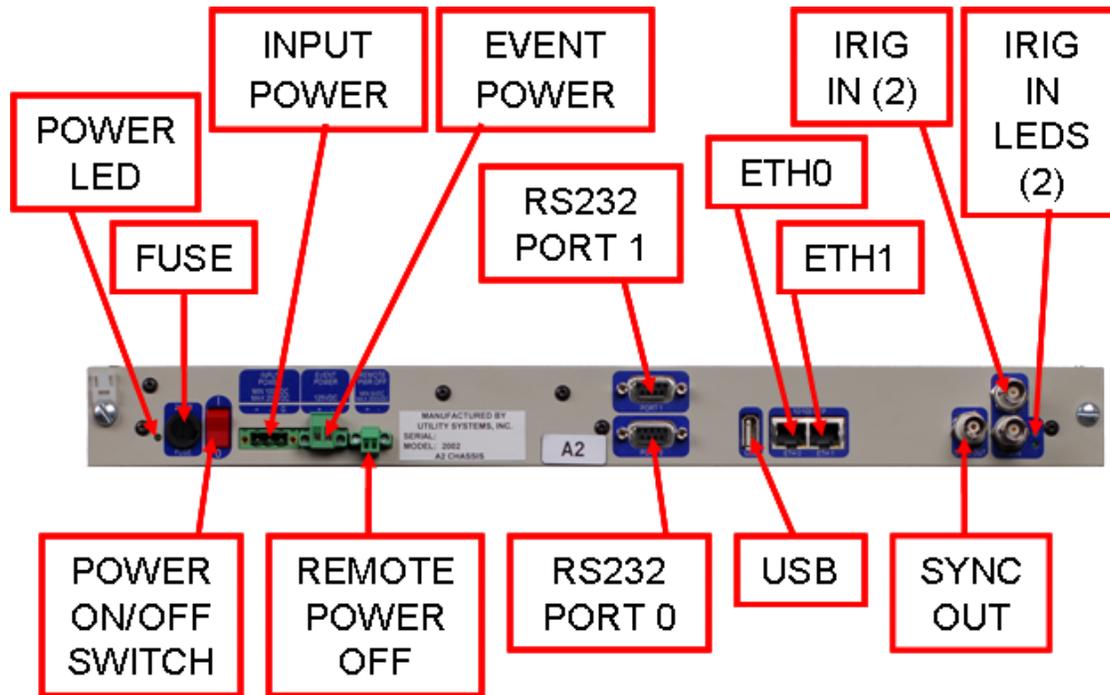


Figure 1-3 CPU 9000 Rear View

- Power Indicator**
This green LED indicates that the power switch is in the ON position and the fuse is good.
- Fuse**
This fuse protects the board from excessive input current.
- On / Off (1 / 0) Switch**
This switch is used to control power for this module.
- Input Power**
This connection is used to supply power to the module and is a required input. It accepts voltage from the station battery and provides isolation and surge protection. The standard input configuration is 125VDC or 120VAC. The input can also be factory configured to accept 250V or 48V DC input voltage.
- Event Power**
This optional connection is relevant only when the DAU chassis contains a Digital Input module. It serves two functions. One function is to monitor the presence of external Field Contact Voltage. The other function is to apply Field Contact Voltage to be supplied from the Digital Input terminals. Both input lines (+/-) pass through internal fuses and then routed to the digital input boards (see Section 1.1.5).

The monitoring function measures the potential across these two terminals and the system will indicate a Power alarm when it is below 40Vdc.

- **Remote Power Off**

This optional connection is used to control power to the module from a remote location. Applying a voltage between 5VDC and 200VDC to this input disables the DC output.

- **Ports 0 and 1**

Port 0 is used for low level communications to the CPU board. It is used only when updating the [Linux](#) file system or when performing advanced troubleshooting.

The Port 1 connection is not used.

- **USB**

This connection is not used.

- **ETH0 / ETH1**

These CAT5 connections are used for communication between the module and the Station-Master computer.

- **ETH2 / ETH3**

These optional fiberoptic LC type connections are used for communication between the module and the Station-Master computer.

- **SYNC OUT**

This connection provides a synthesized un-modulated IRIG signal.

- **IRIG IN**

These two BNC connections are electrically paralleled and act as an input to the module. They also allow the [IRIG](#) signal to be daisy-chain connected between modules. The module automatically detects whether the input is modulated or un-modulated.

- **IRIG IN LEDs**

The lower blue LED blinks to indicate IRIG activity. The upper blue LED blinks at one pulse per second (1PPS) when the M9000 module is synced to the IRIG input.

- **Analog Inputs (AI)**

These inputs accept AC or DC inputs. There are four input terminals labeled C, I, V2, and V1. These inputs are used as follows:

- V1:
This terminal is used for voltage inputs with full scale range from 41Vrms to 400Vrms.
- V2:
This terminal is used for voltage inputs with full scale range from 1.5Vrms to 40Vrms.

- I:
This terminal is used for direct current inputs and is rated for 15Arms continuous and 200Arms for two seconds.
 - C:
This terminal is the common reference for the analog input.
 - **Digital Inputs (DI)**
These inputs accept DC levels. Each input has two input terminals. These terminals are labeled either "+" and "-" (for Isolated or Internally Commoned applications) or "DI" and "Field Contact Voltage (+)" (for Internally Wetted applications) [see Section [1.1.5](#)]. These inputs are used as follows:
 - +:
This is the positive input terminal for the digital input.
 - -:
This is the return path for the digital input.
- OR
- DI:
These are the positive input terminals for the digital inputs.
 - Field Contact Voltage (+):
This provides wetting voltage to a dry relay contact.

1.1.1 Central Processing Unit (CPU) Board

The CPU board has an embedded [Linux](#)® operating system in which the M9000 software runs. This board is used to configure the analog and digital input boards, to store the digitized data from the analog and digital inputs, and to apply various algorithms to the data. The CPU board monitors the algorithm results and, when a trigger limit is exceeded, reports the trigger information to the Station-Master computer (see Section [1-3](#)). There is an [Ethernet](#) switch embedded in the CPU card which allows daisy-chain or star connections between the M9000 modules and the Station-Master. This board has various sections which perform the following M9000 functions:

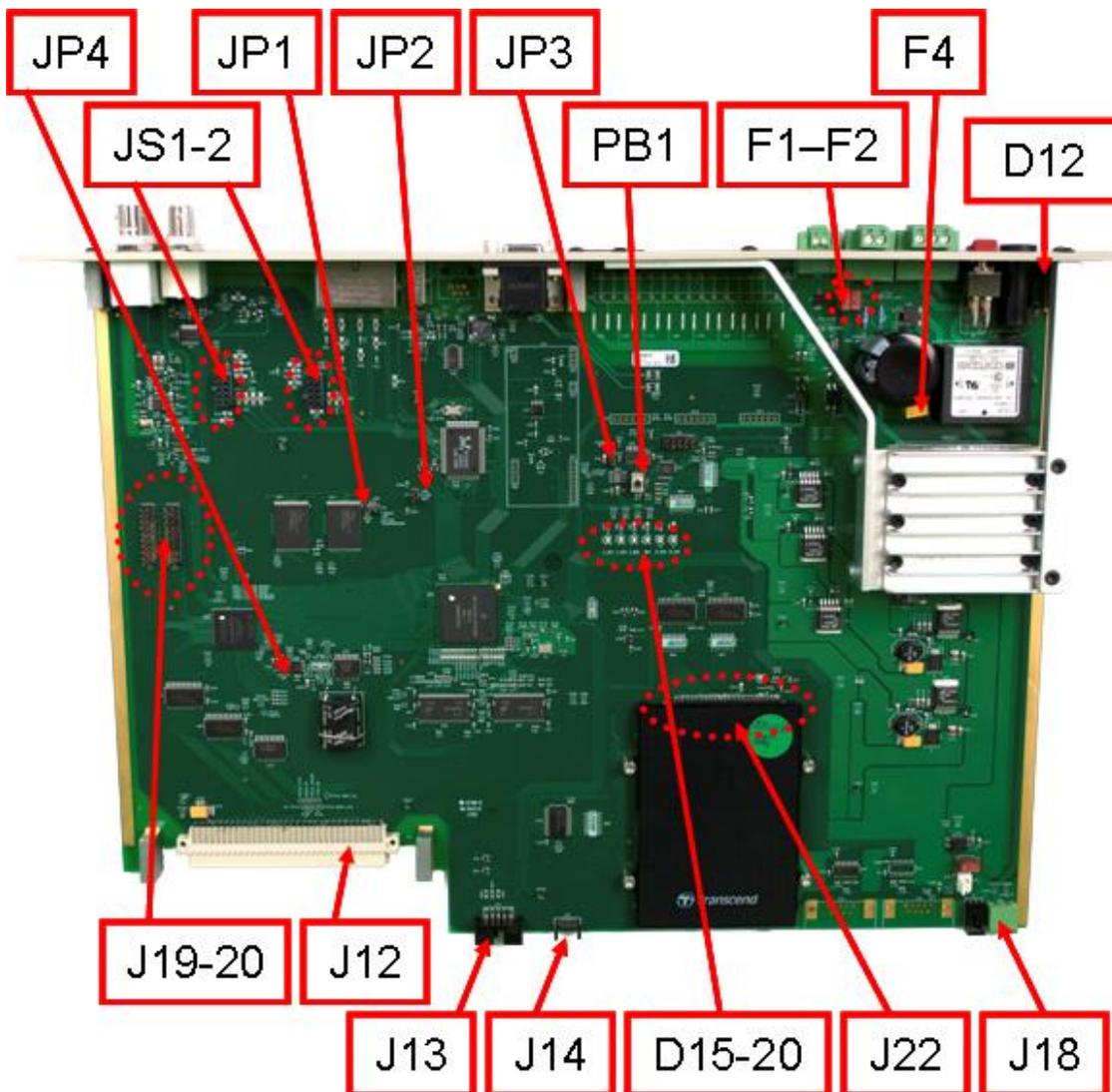


Figure 1-4 CPU 9000 Circuit Board

- **Connector Descriptions:**

These connectors are described below:

- JS1 – JS2:
These connectors are used to install the fiberoptic [Ethernet](#) daughter boards (see Section [1.1.2](#)).
- J12 – Analog / Digital Backplane Input:
This connection is where the digitized analog and digital inputs enter the [CPU](#) board to be processed. Through this connection, the CPU board also detects what boards are connected to the Analog / Digital Adapter board and alarms when it disagrees with the

M9000 configuration. The digitized signals are passed from the analog and digital input boards to the CPU board via the Analog/Digital Backplane board (Section 1.1.3). Power supply voltage is also supplied through this connector to power the analog and digital input boards.

- J13 – JTAG:
This connection is used by [USI](#) factory personnel for initial startup of the CPU board. This connection is not used in the field.
- J14 – LED Display Port:
This connection is used to communicate to the Front Panel LED board. Power supply voltage is also supplied through this connector to power the LED display board.
- J18 – Event Power:
This connection is used to supply field contact voltage to the digital input boards.
- J19 and J20 – TEST HEADERS:
These headers are used for bench testing.

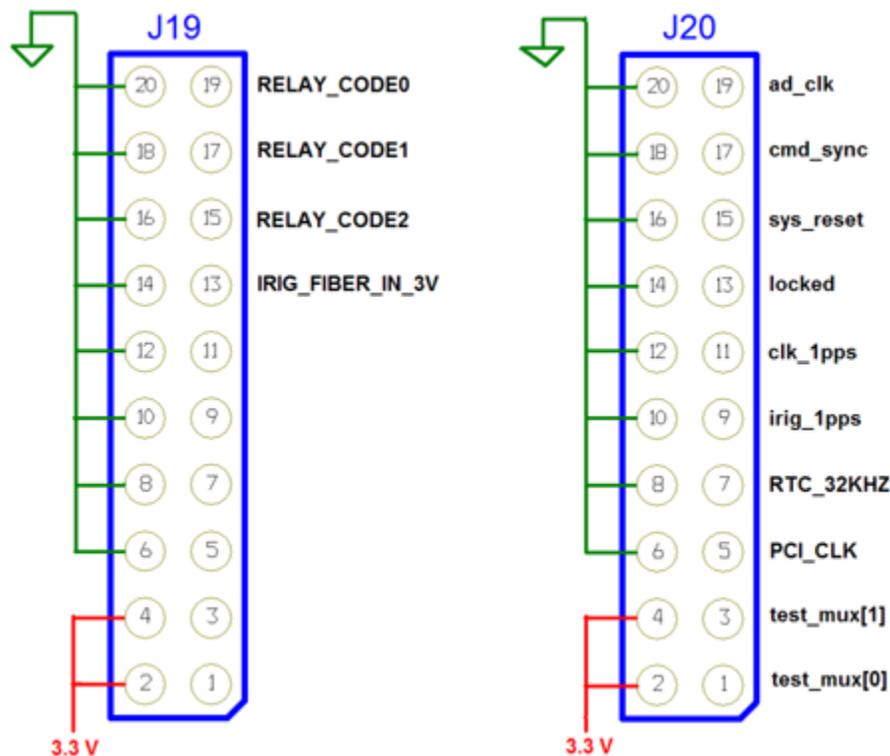


Figure 1-5 Test Headers - CPU 9000 Circuit Board

- J22 – Storage Drive Connector:
This connection is used to install non-volatile storage on the CPU board. The interface is 2.5in [PATA](#) format. This connection supports the installation of a solid state drive ([SSD](#)) or a rotating hard disk drive ([HDD](#)) and is used to store the M9000 module software. This

storage is also used to store data in the event of communication loss with the Station-Master computer.

- **Fuse and Pushbutton Descriptions:**

- F1 and F2:
Field contact voltage applied to the Event Power connector passes through these 1.25A SB fuses and is then routed to the event power connector J18. A cable connects the field contact voltage to the digital input boards (see Section [1.1.5](#)).
- F4:
Input power supply voltage applied to the Input Power connector passes through this 3A SB fuse.
- PB1:
This is a reset button for the CPU board and is used only for troubleshooting.

- **Jumper Descriptions:**

These jumpers are described below:

- JP1 – ENABLE LOW SECTOR PROGRAMMING: This jumper must be ON to allow the embedded [Linux](#) File System to be loaded into the CPU board flash memory. This jumper does not need to be ON after the file system is loaded, but is left so file system updates can be installed later.
- JP2 – LOW SECTOR BOOT: This jumper must be OFF for normal operation. Do not install a jumper unless instructed to do so by USI personnel.
- JP3 – DISABLE WATCH-DOG: This jumper must be OFF for normal operation. Do not install a jumper unless instructed to do so by USI personnel.
- JP4 – EEPROM WR: This jumper must be OFF for normal operation. Do not install a jumper unless instructed to do so by USI personnel.

- **LED Indicators:**

These indicators are described below:

- D12:
This LED indicates that the power switch is in the ON position and the fuse is good.
- D15 – D20:
These six LEDs indicate the presence of the power supply output voltages. Shown from left-to-right in the figure above these LEDs indicate 1.2V, 1.5V, 1.8V, 5.0V, 2.5V, and 3.3V respectively. These voltages provide power for the entire M9000 module. These LEDs are different colors intentionally to aid in differentiating between them. The color is no indication of normal or abnormal voltage. If the LEDs are illuminated, the voltage is normal.



Caution: The power supply employs a robust heat sink assembly for cooling the main DC-to-DC converter and to conduct heat from the CPU board to the rear panel (Figure 1.3). Loosening any of the fasteners of this assembly can result in equipment damage and failure.

1.1.2 Fiberoptic Ethernet Board

The Fiberoptic Ethernet board is an optional daughterboard to the CPU. There are three configurations of this board, each providing a different fiberoptic connector choice. Each configuration utilizes 1300nm fast [Ethernet](#) transceivers and operates with 62.5/125 mm or 50/125 mm multi-mode fiber. These connections are used when M9000 modules are separated by distances of up to 2000 meters.

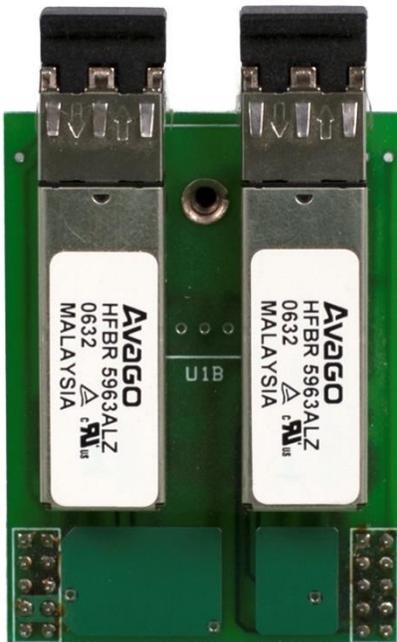


Figure 1-6 Fiberoptic Ethernet Board - LC Connector



Figure 1-7 Fiber optic Ethernet Board - SC Connector



Figure 1-8 Fiber optic Ethernet Board - ST Connector

1.1.3 Analog/Digital Backplane Board

This board interfaces the input control signals from the [CPU](#) board and the digitized output signals from the analog and digital input boards to the CPU board.

- **J1**
This connector attaches to J12 of the CPU board ([Figure 1-4](#)).
- **J2 – J5**
These connectors attach to CN1 of the analog input boards ([Figure 1-11](#)).
- **J6 – J9**
These connectors attach to CN3 of the digital input boards ([Figure 1-13](#) and [Figure 1-14](#)) via 20-pin ribbon cables.

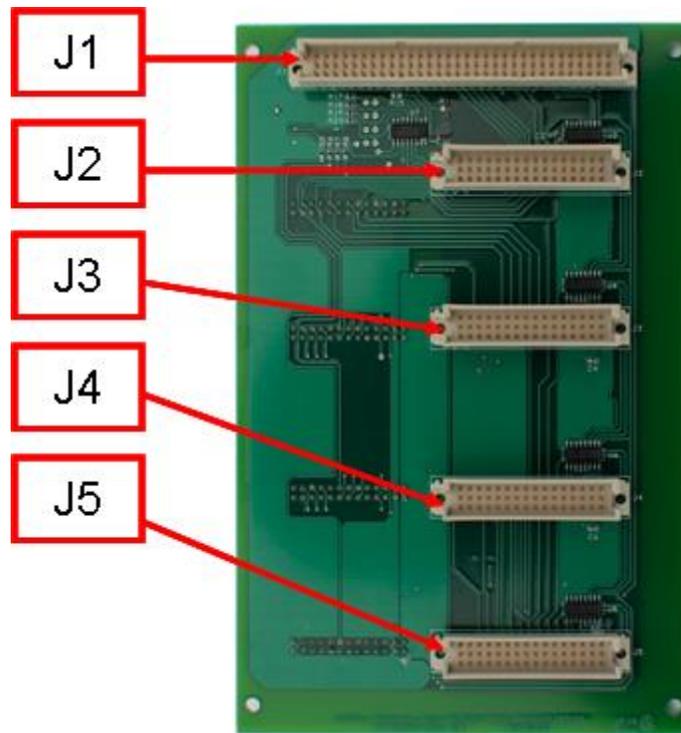


Figure 1-9 Analog/Digital Adapter Board – Back Side

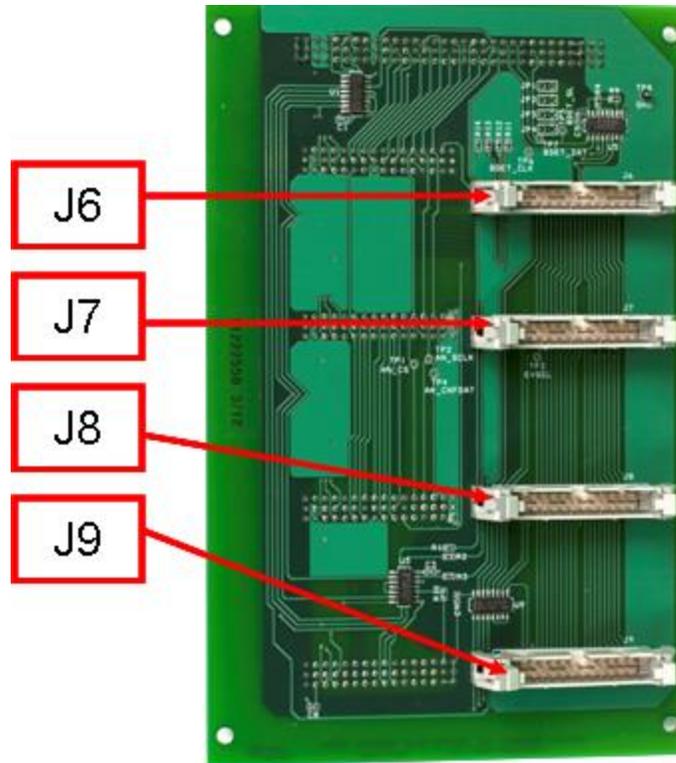


Figure 1-10 Analog/Digital Adapter Board – Front Side

1.1.4 Analog Input Circuitry

The analog input circuitry is used to measure and digitize signals on the analog input channels. It consists of input voltage dividers, current shunts, surge protection devices, precision instrumentation amplifiers, low-pass anti-aliasing filters, analog-to-digital converters, and a DC calibration reference for each analog input. The analog assembly has eight inputs which accept AC or DC voltage or current signals. Each input provides input-to-input isolation and input-to-ground isolation.

The board layout is arranged such that each input is in a self-contained section of the board for channel-to-channel isolation. Each channel has a 5200VDC digital [isolator](#) for protection between the field inputs and the equipment.

Two assemblies of this low pass filter board are available, each with a specific anti-aliasing cutoff frequency:

- **4.8kHz Low Pass Filter (USI Assembly #18724857)**
This is the default version which has a 4-pole Butterworth filter with 4.8kHz cut-off frequency.
- **10kHz Low Pass Filter (USI Assembly #18725598)**
This is an optional version which has a 4-pole Butterworth filter with 10kHz cut-off frequency.

The assembly has two terminal blocks labeled TB1 and TB2, three earth ground connection blocks, and one connector labeled CN1.

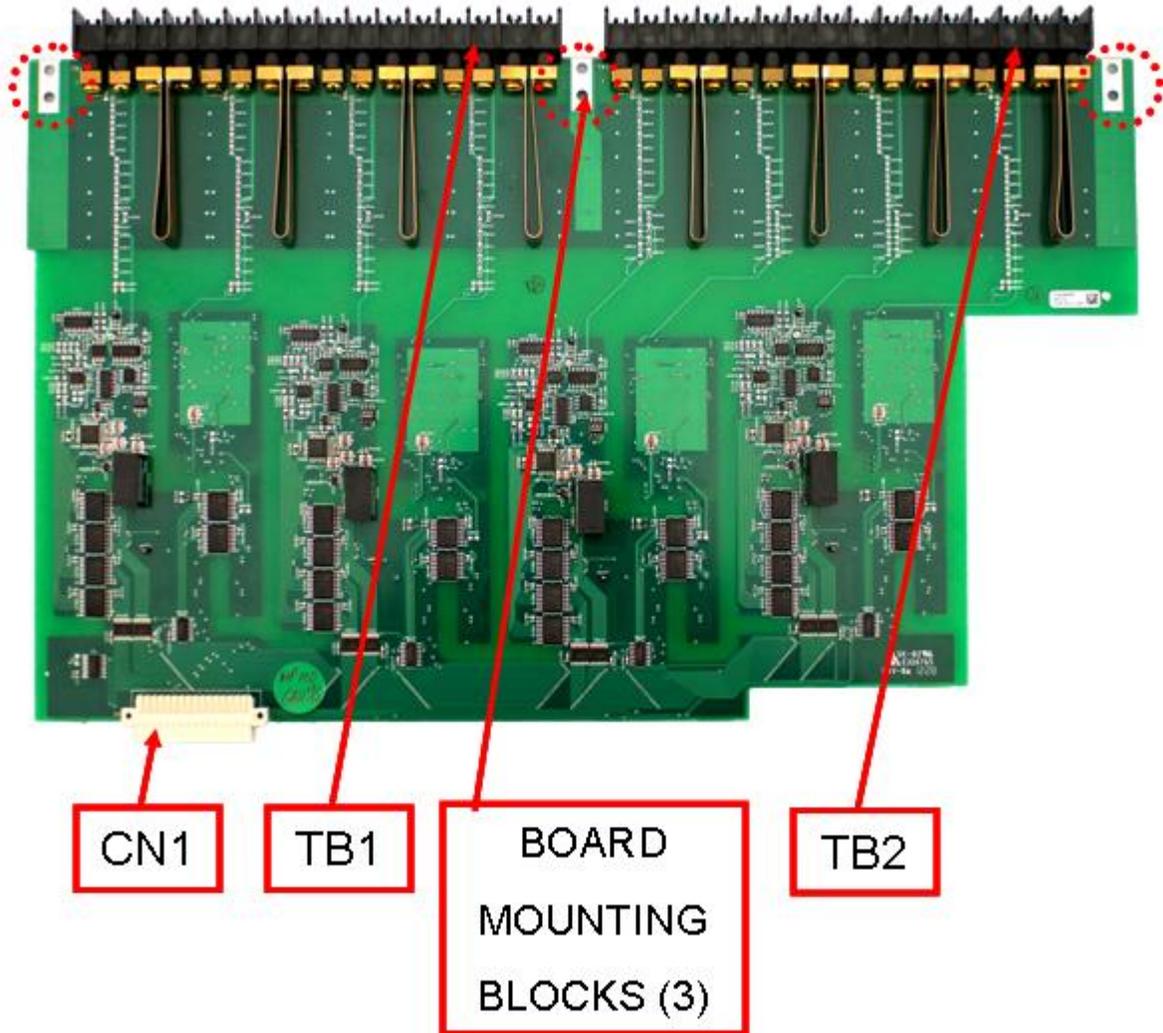


Figure 1-11 Analog Input Assembly

The terminal blocks protrude through the rear panel of the M9000 module and connect directly to the field CT and PT circuits.

The board mounting blocks are used to attach the board to the chassis rear panel and are also utilized as the electrical connection to ground the high-voltage surge suppression capacitors (See Warning immediately below).



Warning: Equipment damage will occur if joints are not mechanically tight. Surge capacitors must be grounded through mechanical joints between the circuit board mounting blocks and the chassis rear panel.

Connector CN1 attaches to the Analog/Digital backplane board. This connection provides the output path for digital data and also provides the path for power supply, internal gain and divider control, sample clock signals, and calibration signals from the [CPU](#) board.

1.1.5 Digital Input Circuitry

The Digital Input Circuitry is used to monitor digital status input signals. Several versions have evolved. They are described in the following sections.

The digital input is divided into two primary sections, High-Voltage and Low-Voltage. All generations of digital input assemblies have 32 inputs which accept DC field contact voltage. All generations also offer three input configurations.

Isolated:

This configuration provides channel-to-channel isolation. It is used to monitor contacts having voltage supplied by isolated station battery circuits.

Internally Commoned:

This configuration internally connects all the return terminals. It is used to monitor contacts having voltages supplied by a common station battery circuit.

Internally Wetted:

This configuration internally connects field contact voltage to one terminal of each input. It is used to monitor contacts not connected to a field contact voltage.

- **HIGH-VOLTAGE DIGITAL BOARD (FIRST GENERATION)**

This version is no longer used in new construction. It has been superseded by the second generation digital input assembly. This board utilizes precision voltage dividers to reduce the input levels and high voltage surge protection by-pass capacitors to attenuate incoming transient spikes. Standard input levels for this generation are 48VDC, 125VDC, and 250VDC. Custom input levels are available.

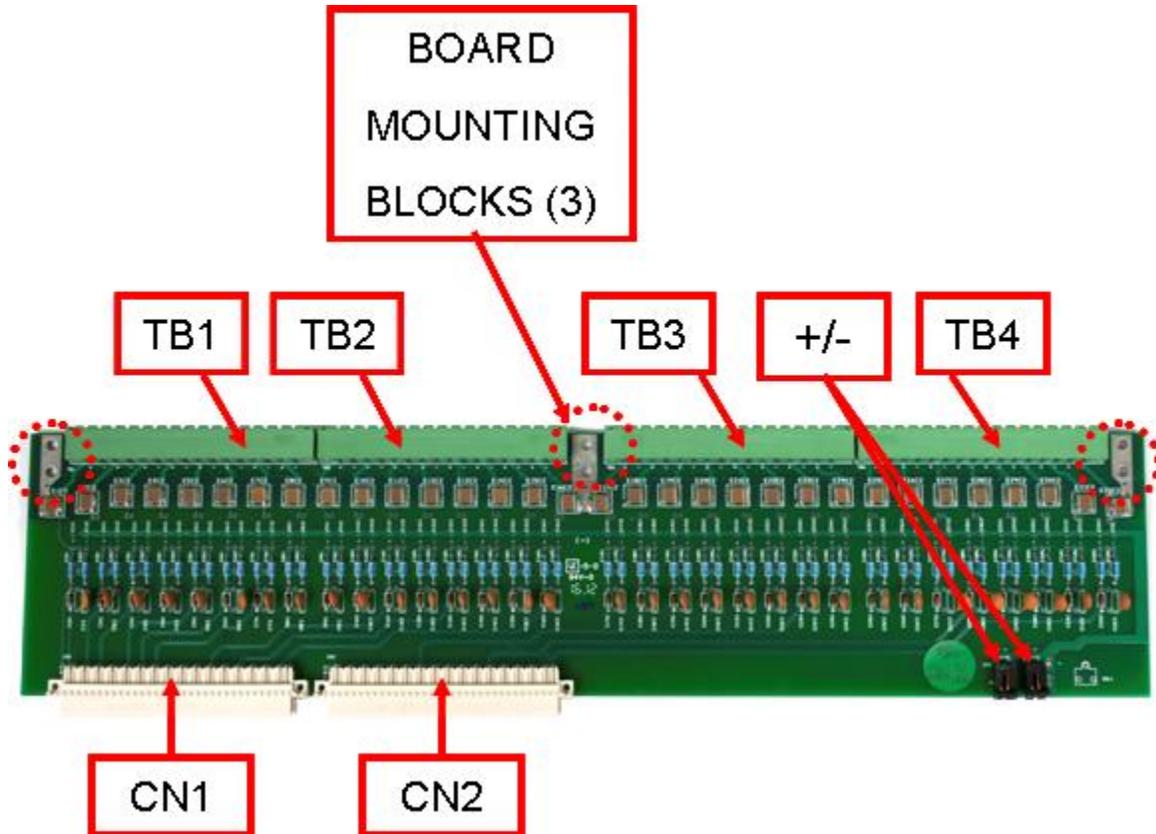


Figure 1-12 High-Voltage Digital Board (Single Board Assembly)

○ Connector Description:

These connector functions are described below:

- CN1 and CN2
These connect the surge protected and reduced level signals to the Low-Voltage Digital board.
- CN3 and CN4
These connectors supply field contact source voltage to the assembly via rear panel terminal block. They are parallel connected to allow daisy-chain connections to other High-Voltage Digital board assemblies within the chassis. This connection is required for internally commoned and internally wetted configurations only; it is not used for isolated configurations.
- EGL1
This connector is unused.
- TB1
This terminal block accepts input numbers one through eight.

- TB2
This terminal block accepts input numbers nine through 16.
- TB3
This terminal block accepts input numbers 17 through 24.
- TB4
This terminal block accepts input numbers 25 through 32.

Terminal blocks TB1 – TB4 protrude through the rear panel of the M9000 module and connected directly to the field status circuits.

The board mounting blocks are used to attach the board to the chassis rear panel and are also utilized as the electrical connection to ground the high-voltage surge suppression capacitors (See Warning immediately below).



Warning: Equipment damage will occur if joints are not mechanically tight. Surge capacitors must be grounded through mechanical joints between the circuit board mounting blocks and the chassis rear panel.

- **LOW-VOLTAGE DIGITAL BOARD (FIRST GENERATION)**

This generation is no longer used in new construction. It has been superseded by the second generation digital input assembly. This board contains optical isolators and is used to monitor the signals from the High-Voltage Digital board and provide digitized data to the CPU board.

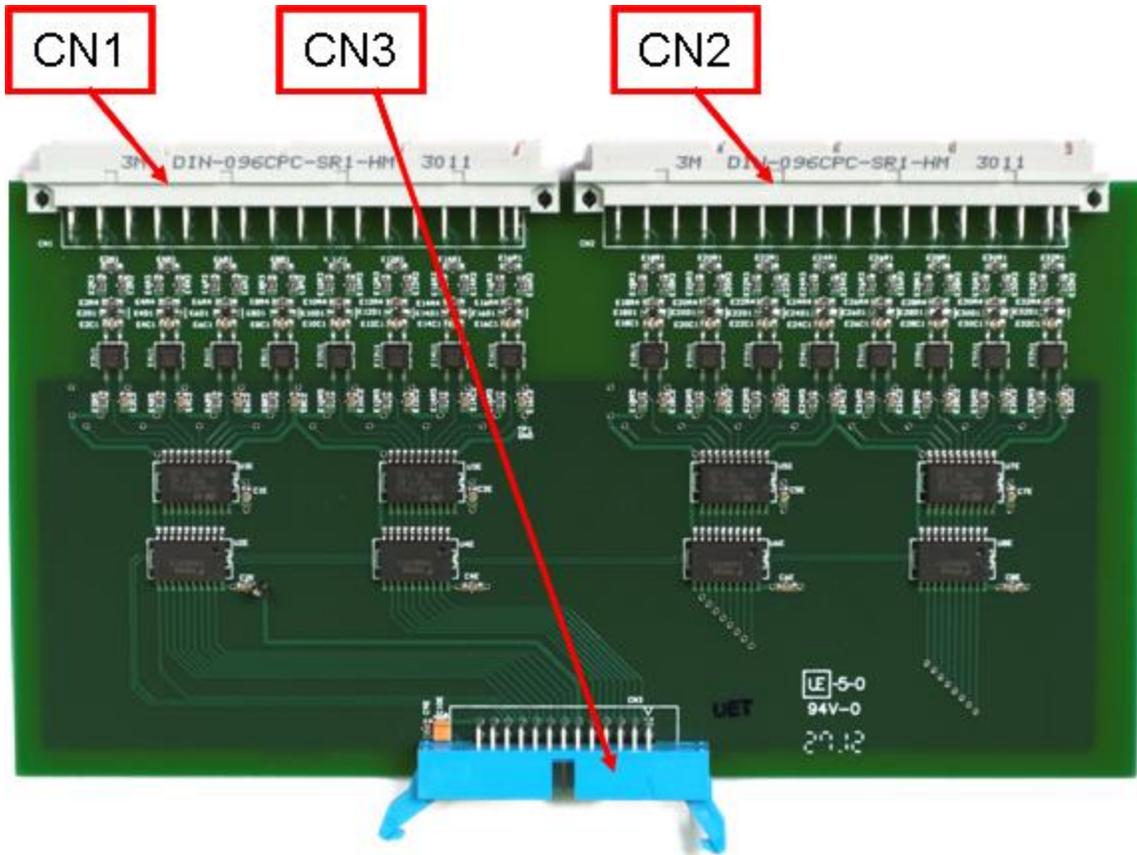


Figure 1-13 Low-Voltage Digital Board (First Generation)

- Connector Description:
These connector functions are described below:
 - CN1 and CN2
These connect the board inputs to the High Voltage Digital board.
 - CN3
This connects the sample clock signals from the CPU board and connects the digitized data output to the CPU board.
- **DIGITAL BOARD (SECOND GENERATION)**
This generation is used in new construction and is backward compatible. This board combines the voltage divider and surge suppression functions of the High-Voltage and optical isolation function of the Low-Voltage Digital boards into a single board assembly. The standard input range for this generation is 40VDC to 250VDC.

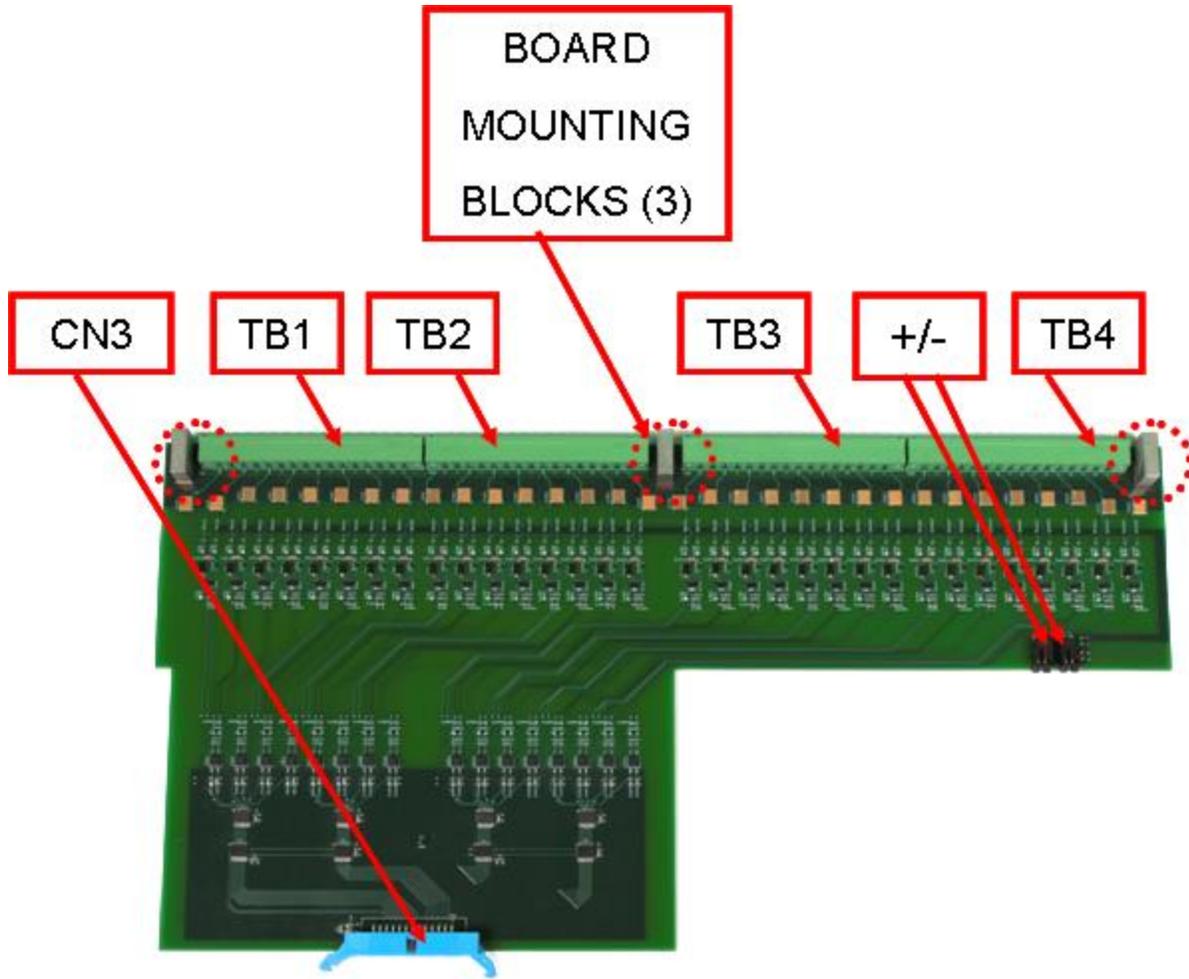


Figure 1-14 Digital Board (Second Generation)

- Connector Description:
These connector functions are described below:
 - CN3
This connects the sample clock signals from the DSP board and connects the digitized data output to the DSP board.
 - CN1 and CN2
These connectors supply field contact source voltage to the assembly via rear panel terminal block. They are parallel connected to allow daisy-chain connections to other High-Voltage Digital board assemblies within the chassis. This connection is required for internally commoned and internally wetted configurations only. This connection is not used for isolated configurations.
 - TB1
This terminal block accepts input numbers one through eight.

- TB2
This terminal block accepts input numbers nine through 16.
- TB3
This terminal block accepts input numbers 17 through 24.
- TB4
This terminal block accepts input numbers 25 through 32.

Terminal blocks TB1 – TB4 protrude through the rear panel of the M9000 module and are connected directly to the field status circuits. The board mounting blocks are used to attach the board to the chassis rear panel and to form the electrical ground connection for the high-voltage surge suppression capacitors.



Warning: Equipment damage will occur if joints are not mechanically tight. Surge capacitors must be grounded through mechanical joints between the circuit board mounting blocks and the chassis rear panel.

1.1.6 Front Panel LED Board

The LED board is mounted to the front panel of the M9000 module and is used to indicate its status. A 6-pin ribbon cable attaches the J1 connector to the CPU board (J14).

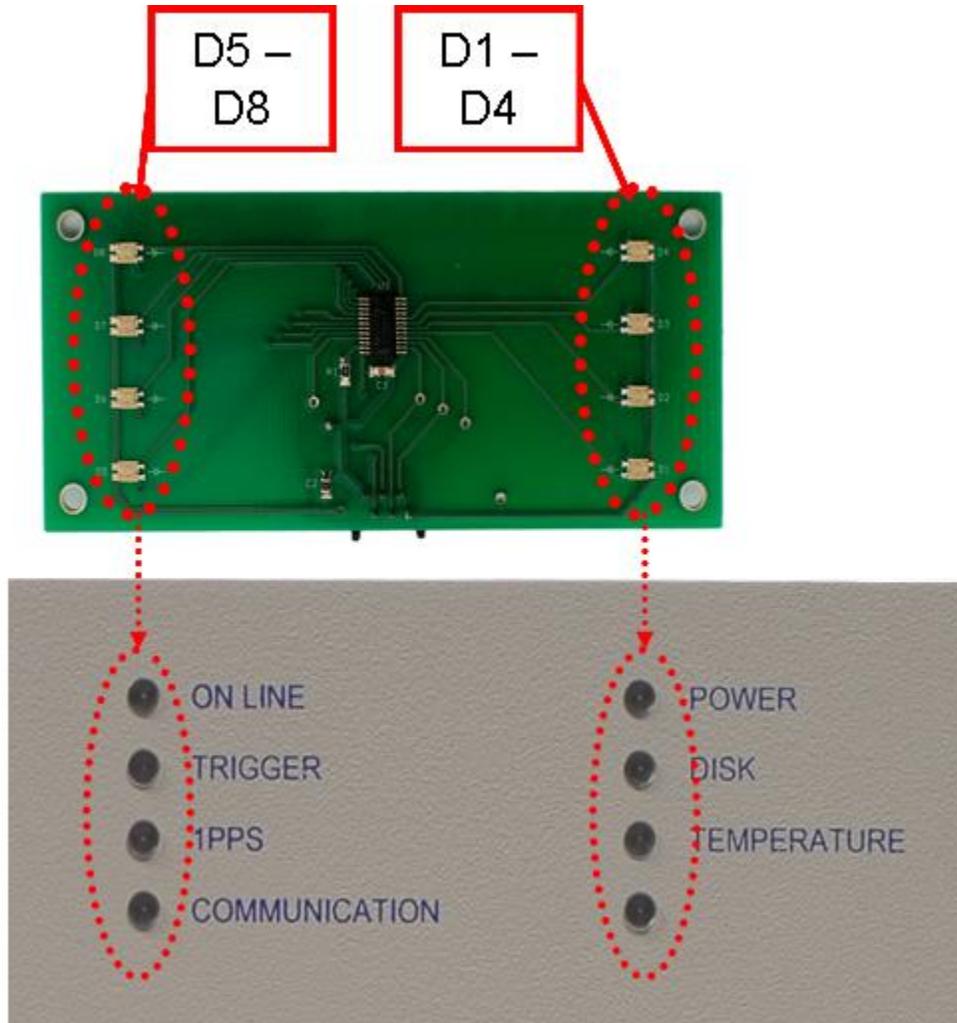


Figure 1-15 Front Panel LED Board –Front View

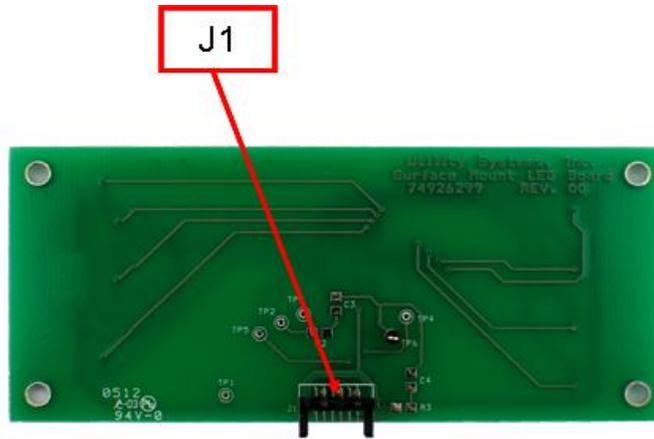


Figure 1-16 Front Panel LED Board – Back View

- This board contains eight LEDs which display solid colors of red, green, or yellow and can also blink or warble to indicate various states of the M9000 module.

1.2 Station-Master Power Supply/Alarm Module

This section describes the architecture of the Station-Master Power Supply/Alarm module. This module supplies power supply voltage to the Station-Master Computer and is a required component of the [DME](#) system.



Figure 1-17 Computer Power Supply and Alarm Module

This module is housed in a [1.5U](#) (2.625inH x 13.25inD x 19inW) rack mount chassis. This unit contains a power supply board, an Interface board, a Relay Output board, an [Ethernet](#) switch, and a Front Panel LED board.

This power supply unit can be factory configured to accept 250V, 125V, or 48V DC input voltage. The standard / default input configuration is 125VDC or 120VAC input. For details on the power supply board see Section [1.2.1](#).

The module is fanless by design and employs a robust heat sink assembly to cool the main DC-to-DC converter by conducting heat to the chassis base plate.

This module contains a watch-dog circuit to monitor the health of the Station-Master computer. This circuit will cycle the output power supply in the event of a Station-Master failure.

This module contains eight alarm relay outputs to provide DME system status to an alarm annunciator or SCADA.

The rear panel of this module has the following features:

- **8A SB Fuse**
This fuse protects the board from excessive input current.
- **On / Off (1 / 0) Switch**
This switch is used to control power for this module.
- **Input Power**
This connection is used to supply power to the module and is a required input. It accepts voltage from the station battery and provides isolation and surge protection. The standard input

configuration is 125VDC or 120VAC. The input can also be factory configured to accept 250V or 48V DC input voltage.

- **Remote Power Off**

This optional connection is used to control power to the M9000 module from a remote location. Applying a voltage between 5VDC and 200VDC to this input disables the DC-to-DC converter output which powers down the Station-Master computer.

- **Output Power**

This connection is used to supply power to the Station-Master computer.

- **ETH0**

This connection provides access to the DME system local network. This allows communication with the M9000 or Power Supply modules.

- **ETH1, ETH2**

These connections are used to connect the Power Supply module to the DME system local network. This is a required connection.

- **3A SB Fuse**

This fuse protects the board from excessive input current.

- **Alarm 1 - 8**

These connections provide status outputs for the DME system:

- Alarm 1:
This output indicates the status of the ON LINE indicator.
- Alarm 2:
This output indicates the status of the TRIGGER indicator.
- Alarm 3:
This output indicates the status of the CLOCK SYNC indicator.
- Alarm 4:
This output indicates the status of the COMMUNICATION indicator.
- Alarm 5:
This output indicates the status of the POWER indicator.
- Alarm 6:
This output indicates the status of the DISK indicator.
- Alarm 7:
This output indicates the status of the TEMPERATURE indicator.
- Alarm 8:
This output is reserved for future use.

- **Front Panel LEDs:**

The front panel of this module has eight LEDs which display solid colors of red, green, yellow or warble all three colors. These colors indicate the state of the overall DME system. The various states are described below:

- **ON LINE**

LED color indicates operational status of the DME system:

- ● Green
This is the normal condition. All modules of the DME system are **ON LINE**.
- ● Yellow
This is an alarm condition. The Station-Master computer can not communicate with all the M9000 modules. During this time the **COMMUNICATION** LED is red.
- ● Red
This is an alarm condition. The DME system is not recording.

- **TRIGGER**

LED color indicates condition of trigger limits of the DME system:

- ● Green
This is a trigger condition. A trigger condition means one or more analog measurements exceeded a trigger limit or one or more digital inputs transitioned to an abnormal value or state. This LED remains green until the Station-Master computer requests the triggered data.
- ●●● Warble (Green-Yellow-Red)
The Station-Master has requested the triggered data from all the M9000 modules. Once transfer is complete, the LED resets to Off.
- ● Off
No trigger conditions are being processed.

- **Clock Sync**

LED color indicates status of the time synchronization of the DME system:

- ● Green
This is the normal condition. All M9000 modules are synchronized to the [IRIG](#) time source within a tolerance of one microsecond.
- ● Yellow
This is a warning condition. All M9000 modules are synchronized to IRIG but an unsynced condition has occurred within the past 60 minutes.

- ●Red
This is an alarm condition. At least one of the M9000 modules is not synchronized.
- **COMMUNICATION**
LED color indicates status of communication between the M9000 module and the Station-Master computer:
 - ●Green
This is a normal condition. Communication with all M9000 modules is normal.
 - ●Red
This is an alarm condition. Communication with at least one M9000 module is down. During this time the **ON LINE** LED is yellow.
 - ●Off
This is an alarm condition. Communication with all M9000 modules is down. During this time the **ON LINE** LED is red.
- **POWER**
LED color indicates status of the power supply voltages of the DME system:
 - ●Green
This is a normal condition. Power supply voltages in all M9000 modules are normal.
 - ●Yellow
This is a warning condition. All power supply voltages are good but an alarm condition has occurred within the past 60 minutes.
 - ●Red
This is an alarm condition. At least one of the M9000 modules is in alarm condition.
- **DISK**
LED color indicates status of the storage for the DME system:
 - ●Green
This is a normal condition. Disk free space in all M9000 modules is normal.
 - ●Yellow
This is a warning condition. Disk free space in all M9000 modules is normal but an alarm condition has occurred within the past 60 minutes.

- ●Red
This is an alarm condition. Disk free space in at least one of the M9000 modules is less than 20%.
- **TEMPERATURE**
This LED indicates the temperature status of the M9000 module:
 - ●Green
This is a normal condition. Temperature in all M9000 modules is normal.
 - ●Yellow
This is a warning condition. Temperature is OK but in at least one of the M9000 modules is within 10°C of the high limit.
 - ●Red
This is an alarm condition. Temperature in at least one of the M9000 modules is over or under the set limit.
- **(UNUSED)**
This LED is reserved for future use.

1.2.1 Power Supply Board

The Power Supply board contains an input filter and a DC-to-DC converter which provides surge suppression, input power conditioning, and isolation for the Power Supply chassis and the Station-Master computer. This board is mounted to the base plate of the Power Supply module which serves as the heat-sink for the converter.

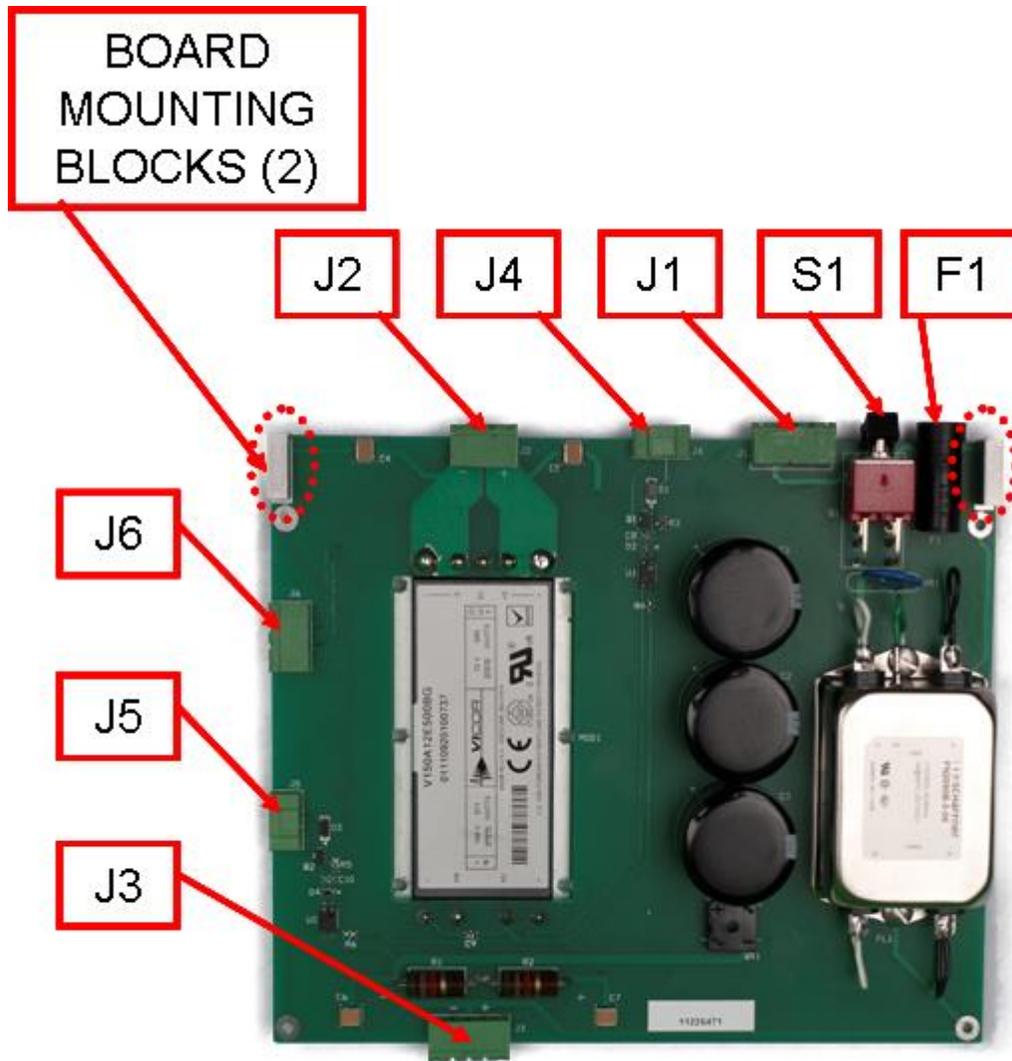


Figure 1-18 Power Supply Board

- **F1**
This 8-ampere slow-blow fuse protects the board from excessive input current.
- **S1**
This switch is used to control input power to the board.
- **J1**
This is the power supply input connection to the board.
- **J2**
This is the power supply output connection used to supply power to the Station-Master computer.

- **J3**
This connection is the output from the power supply board filter and is used to supply input voltage to the Interface board (see Section 1.2.2).
- **J4**
This is the remote control power down connection used to disable the power supply output from a remote location. Applying a voltage between 5VDC and 200VDC to this input disables the DC-to-DC converter output.
- **J5**
This is the watch-dog connection from the Interface board. It is used to disable the power supply board output in the event of a Station-Master problem.
- **J6**
This is the remote control power down connection for the Interface board. This connection is parallel to connector J4.
- **Board Mounting Blocks**
These blocks are used to attach the board mechanically to rear panel of the assembly. They also serve as the earth ground connection for the surge suppression capacitors.



Warning: Equipment damage will occur if joints are not mechanically tight. Surge capacitors must be grounded through mechanical joints between the circuit board mounting blocks and the chassis rear panel.

1.2.2 Interface Board

The Interface board contains an independent DC-to-DC converter to power this board, an embedded processor, and a watch-dog circuit. The board monitors health of the Station-Master computer and DME system and drives alarm output relays and front panel LEDs.

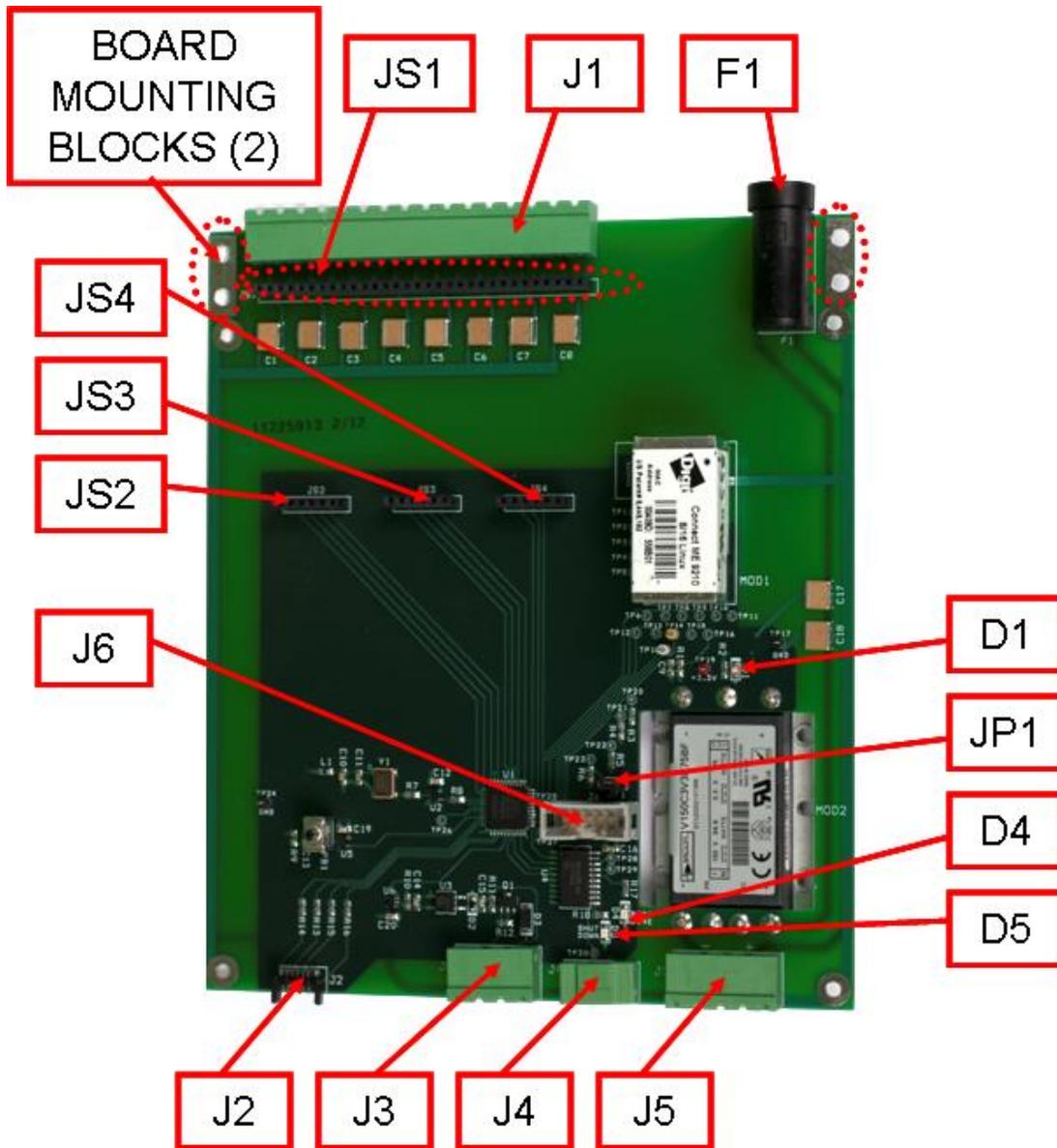


Figure 1-19 Interface Board

- **F1**
This 3-ampere slow-blow fuse protects the board from excessive input current.
- **J1**
This connection supplies the eight alarm output signals.
- **J2**
This connection is used to communicate to the Front Panel LED board. Power supply voltage is also supplied through this connector to power the LED display board.

- **J3**
This is the remote control power down input connection from the rear panel of the Power Supply module. This connects to J6 on the Power Supply board.
- **J4**
This connection provides the watch-dog output signal to the Power Supply board. This connects to J5 on the Power Supply board.
- **J5**
This connection is the input power supply connection from the Power Supply board. This connects to J3 on the Power Supply board.
- **J6**
This is the [JTAG](#) connector and is used by [USI](#) factory personnel for initial startup of the Interface board. This connection is not used in the field.
- **JS1 – JS4**
These are used to attached the Alarm Output board (see Section 1.2.3) to the Interface board.
- **D1**
This LED indicates output voltage from the DC-to-DC converter on the Interface board.
- **D4 (BOOT DONE)**
This LED indicates the Interface board processor has successfully booted and is operating normally. Illuminated is the normal condition.
- **D5 (SHUT DOWN)**
This LED indicates the watch-dog signal has been sent.
- **JP1**
These pins are shorted by factory personnel for initial startup of the Interface board. The normal state for this jumper is open.

1.2.3 Alarm Output Board

The Alarm Output board contains eight Form-C relays and is used to provide status signals of the overall DME system to an alarm annunciator or SCADA. This is a daughter-board which connects to the Interface board.

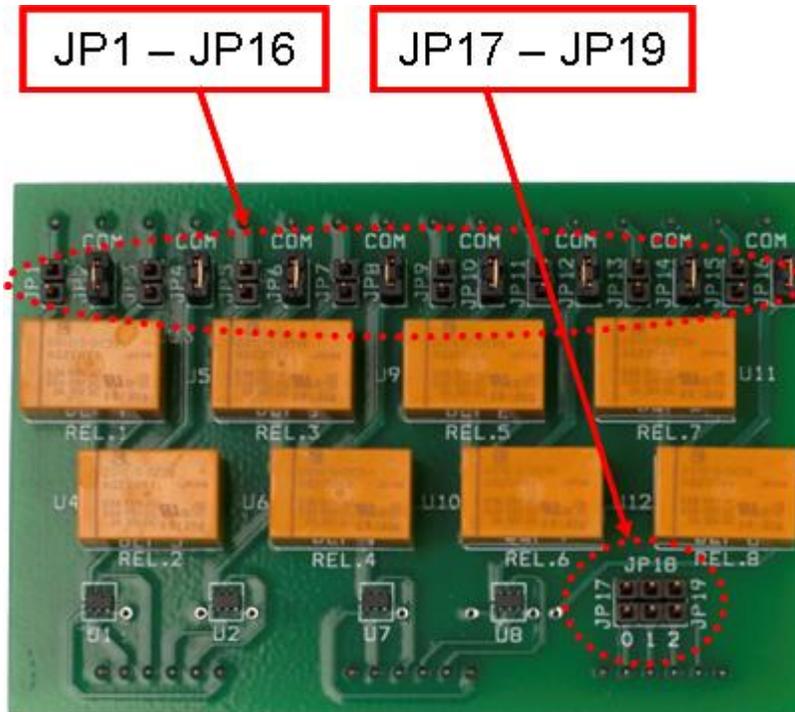


Figure 1-20 Alarm Output Board - Front View

- **JP1**
This jumper programs the output of relay one which is the ON LINE alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP2**
This jumper programs the output of relay one which is the ON LINE alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP3**
This jumper programs the output of relay two which is the TRIGGER alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP4**
This jumper programs the output of relay two which is the TRIGGER alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP5**
This jumper programs the output of relay three which is the CLOCK SYNC alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP6**
This jumper programs the output of relay three which is the CLOCK SYNC alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).

- **JP7**
This jumper programs the output of relay four which is the COMMUNICATION alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP8**
This jumper programs the output of relay four which is the COMMUNICATION alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP9**
This jumper programs the output of relay five which is the POWER alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP10**
This jumper programs the output of relay five which is the POWER alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP11**
This jumper programs the output of relay six which is the DISC alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP12**
This jumper programs the output of relay six which is the DISC alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP13**
This jumper programs the output of relay seven which is the TEMPERATURE alarm. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP14**
This jumper programs the output of relay seven which is the TEMPERATURE alarm. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP15**
This jumper programs the output of relay eight which is unused. Jumper these pins to configure this relay to be normally closed (close on alarm).
- **JP16**
This jumper programs the output of relay eight which is unused. Jumper these pins to configure this relay to be normally open (open on alarm).
- **JP17**
This jumper is not used.
- **JP18**
This jumper is not used.

- **JP19**
This jumper is not used.

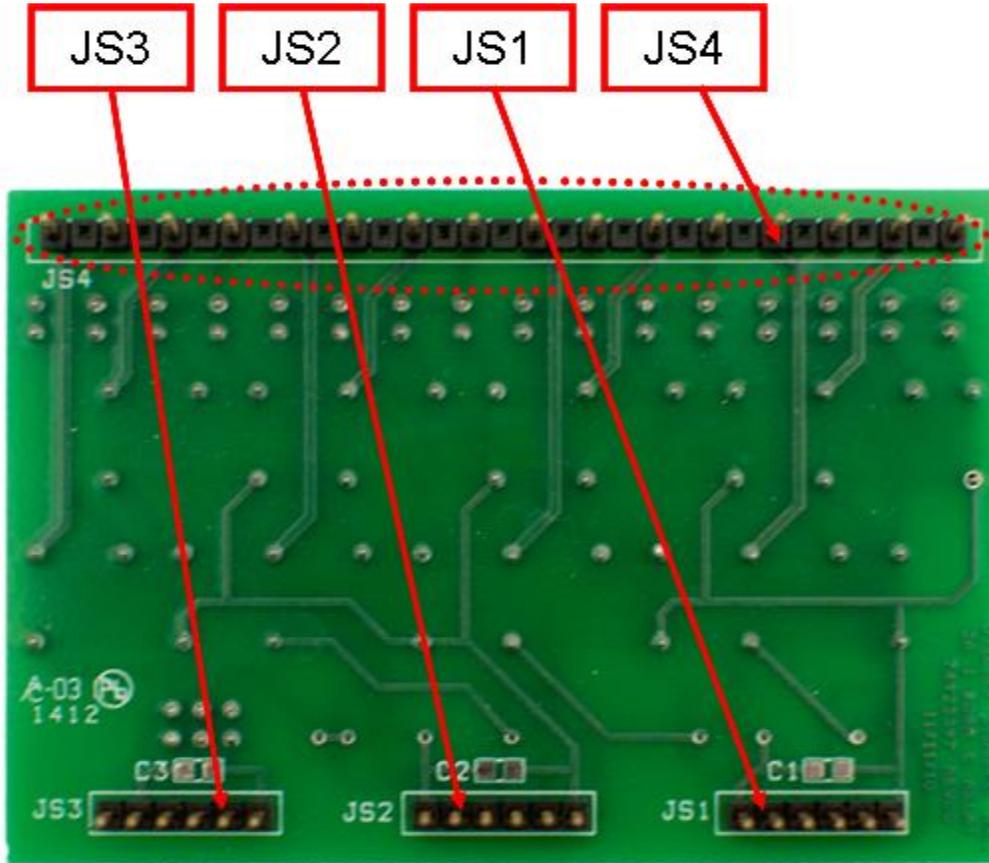


Figure 1-21 Alarm Output Board – Back View

- **JS1 – JS3**
These connections are the input connections and are also used to attach the Alarm Output board to JS1 – JS3 on the Interface board.
- **JS4**
These connections are the output connections and are also used to attach the Alarm Output board to JS1 – JS3 on the Interface board.

1.2.4 Ethernet Switch

This Ethernet switch is used to provide connections for ETH0 – ETH2 on the Station-Master Power Supply module and to connect the Interface board to the local DME system network. This is an un-managed [Ethernet](#) switch.



Figure 1-22 Ethernet Switch Module

1.3 Station-Master Computer

This section describes the architecture and functionality of the Station-Master computer. The Station-Master computer functions as the platform to run the DME system software, to provide non-volatile storage of settings and data, to communicate with the M9000 modules and with the web-based master server. This is a required component of the DME system.



Figure 1-23 Station-Master Computer– Front View



Figure 1-24 Station-Master Computer – Rear View

The Station-Master Computer is housed in a standard [3.5U](#) (6.125inH x 13.25inD x 19inW) rack mount chassis (Figure 1-24). At the time of the printing of this document, the standard specifications for this computer were:

- Fanless Industrial Embedded Controller
- Rugged Design for Shock/Vibration Protection
- Wide Operating Temperature (-40 ~ 70°C)
- Wide Range DC Power Input (10 ~ 28V)
- Intel® Core i5-520M (2.4GHz) CPU
- Intel® QM57 Chipset
- 8GB DDR3-1333MHz
- Onboard I/O and Expansion Slots (1 x PCIe x1, 1 x PCIe x8, 1 x Mini-card)
- Storage Slots (2 x 2.5" Bays for HD/SD Drives, 1 x PCI-e mSATA, 1 x CFAST Card Slot)
- Linux (Ubuntu Server) or Windows 7™ Embedded Standard 32bit
- 40GB Solid State Drive for OS (Standard)
- 1 TB Enterprise Hard Disk for data storage standard (Solid State Drive Optional)
- 4 x RJ-45 GbE ports (Fiber ports optional)
- 4 x USB 2.0 ports
- SVGA Display Port
- 56k Modem
- 3U (5.25 x 19-inch) Rack Mount Enclosure
- 5-Year Warranty

1.4 Optional Peripherals

These devices are not required for normal operation of the M9000 DME system.

1.4.1 GPS Receiver

A [GPS](#) receiver is used to provide an [IRIG-B](#) time code to the [DME](#) system. These devices are available from several manufacturers. Refer to regional standards to determine whether a satellite-synchronized time source is required. Refer to the manufacturers documentation for distance limitations on the antenna feed line and the receiver output lines.

1.4.2 Display

A display is used to provide a visual interface to the local DME system user. These devices are available from several manufacturers. This is an optional component of the DME system.

1.4.3 Keyboard – Touchpad Drawer

An optional keyboard/touchpad drawer is used to provide manual input to the DME system from the local user.

Section 2: USI M9000 Master Interface

This section covers the graphic user interface screens for the M9000 master station. The USI M9000 Master is a service which runs on a server and provides a web-based interface accessed through a web browser.

2.1 Login

This screen displays when a connection is established between the web server and a client. The login credentials entered here are used to determine the privileges given to the client requesting access.

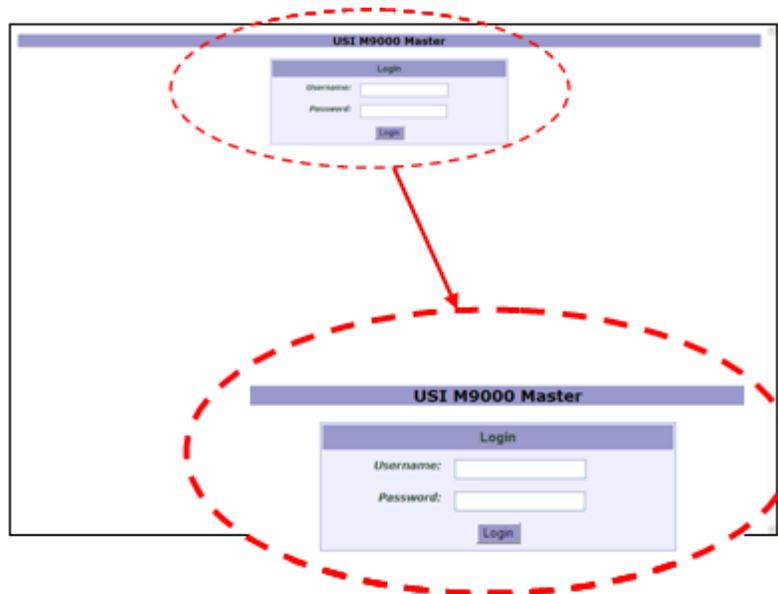


Figure 2-1 Login Window

- **Username**
This field is used to enter the user name being used to access the USI M9000 Master. Default users are “usi” and “guest”. The “usi” user allows full function access to all areas of the interface. The guest user allows access to view all areas of the interface, however privileges to create new configuration files, to save or send configuration files, and calibration and verification features are not allowed.
- **Password**
This field is used to enter the password being used to access the USI M9000 Master. The passwords for the two default users are as follows:
 - USI user password is “usi” (case sensitive)
 - Guest user password is “guest” (case sensitive)

2.2 M9000 Master Screen

This is the main screen from which all others are navigated.

The screenshot shows the 'USI M9000 Master' interface. At the top right, it displays 'User Name: usi | Station Name: Sandy Bog | Home | Logout'. Below this is a 'Stations' section with a dropdown menu set to 'Station Id: 1-Sandy Bog'. There are buttons for 'New', 'Edit', 'Trigger Now', and 'Health Monitor'. A search section includes 'Enter Start Date/Time' and 'Enter End Date/Time' fields with HH, MM, and SS spinners, along with 'Search' and 'Reset' buttons. A message states 'No Records matching criteria' with a checked 'Check for Auto Update' option. The main area is a table with the following data:

Event/Trigger Tripped	Fault ID	Station ID	Date-Time	Length	Header
E1 - Event 1	236	104022013	-23:58:45.612664	210	
E4 - Event 4	234	104022013	-02:31:17.941730	207	
E7 - Event 7	233	104012013	-23:49:55.539022	210	
E10 - Event 10	232	104012013	-23:49:44.260480	222	
E13 - Event 13	231	104012013	-23:45:13.387147	212	
E16 - Event 16	230	104012013	-23:44:42.987356	315	
	229	104012013	-20:24:04.024022	208	
	228	104012013	-20:24:03.954647	211	
	227	104012013	-20:23:58.853397	212	
	226	104012013	-19:24:39.732147	217	
	225	104012013	-17:54:51.017981	248	
	224	104012013	-17:54:50.647772	201	
	223	104012013	-17:54:50.209230	257	
	222	104012013	-17:46:27.690480	225	
	221	104012013	-17:46:17.368814	214	
	220	104012013	-17:45:48.041522	208	
	219	104012013	-17:45:13.622356	210	
	218	104012013	-17:41:21.414230	202	
	217	104012013	-17:41:20.526731	206	
	216	104012013	-17:41:19.599922	217	
	215	104012013	-17:40:52.827664	205	
	214	104012013	-17:40:49.029439	203	
	213	104012013	-17:40:14.799022	200	
	212	104012013	-17:40:14.481939	201	
	211	104012013	-17:40:10.584647	218	
	210	104012013	-17:40:10.162147	204	
	209	104012013	-17:40:08.131939	201	
	208	104012013	-17:40:07.095688	203	
	207	104012013	-17:38:56.341938	357	
	206	104012013	-17:38:45.709939	209	
	205	104012013	-17:38:43.871439	208	
	204	104012013	-17:38:13.294855	204	
	203	104012013	-17:37:35.387772	345	

Figure 2-2 USI M9000 Master

2.2.1 Header

This panel presents the user and station names and the available selections:

The diagram shows the header area of the USI M9000 Master screen. A red dashed oval highlights the top bar containing the title 'USI M9000 Master' and the user/station information 'User Name: usi | Station Name: Sandy Bog | Home | Logout'. A red arrow points from this oval to a larger red dashed oval below it, which contains a zoomed-in view of the user/station information: 'User Name: usi | Station Name: Sandy Bog | Home | Logout'.

Figure 2-3 USI M9000 Master – Header

- **User Name**
This field displays the name of the user logged into the USI M9000 Master server.
- **Station Name**
This field displays the name of the selected DME system.
- **Home**
This selection navigates to the home screen of the USI M9000 Master interface.
- **Logout**
This selection logs the user out and closes the master station server session.

2.2.2 Stations Panel

This panel features a drop-down list of available stations and four Function Select buttons:

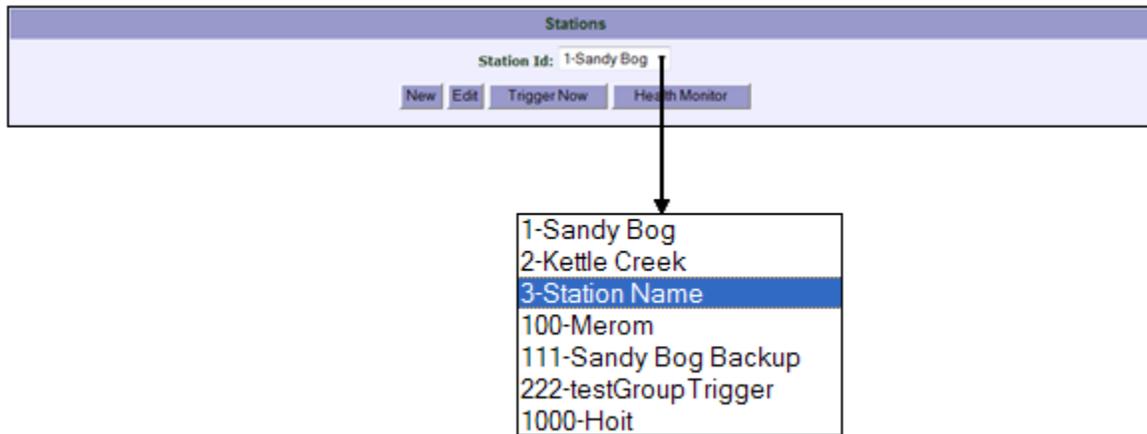


Figure 2-4 Stations Panel

- **Station ID**
Use this drop-down menu to display the list of available stations.
- **New**
Use the **New** button to create a configuration file for a new station.
- **Edit**
Use the **Edit** button to edit the configuration file of an existing station.
- **Trigger Now**
Use the **Trigger Now** button to initiate a manual recording on the selected station (see Section [3.3](#)).
 - The **Successfully triggered** message displays in blue when the **Trigger Now** function was successful.

- The **Unable to trigger** message displays in red when the **Trigger Now** function was unsuccessful.
- **Health Monitor**
Use the **Health Monitor** button to display the health monitor screen (See Section [3.4](#)).

2.3 Screen Tabs

This panel presents the screens available for selection:



Figure 2-5 Screen Tabs

- **DFR Data**
This screen tab displays a table of DFR data files.
- **SER Data**
This screen tab displays a table of stored SER data.
- **DDR Analog Data**
This screen tab displays a table of DDR analog data files.
- **DDR RMS Data**
This screen tab displays a table of DDR RMS data files.
- **Continuous Analog Data**
This screen tab displays a table of Continuous Analog data files.
- **Continuous Data**
This screen tab displays a table of Continuous data files.
- **Scope Data**
This screen tab displays the Scope toolbox.

2.3.1 DFR Data Screen

This screen tab displays a table of DFR data files for analysis:

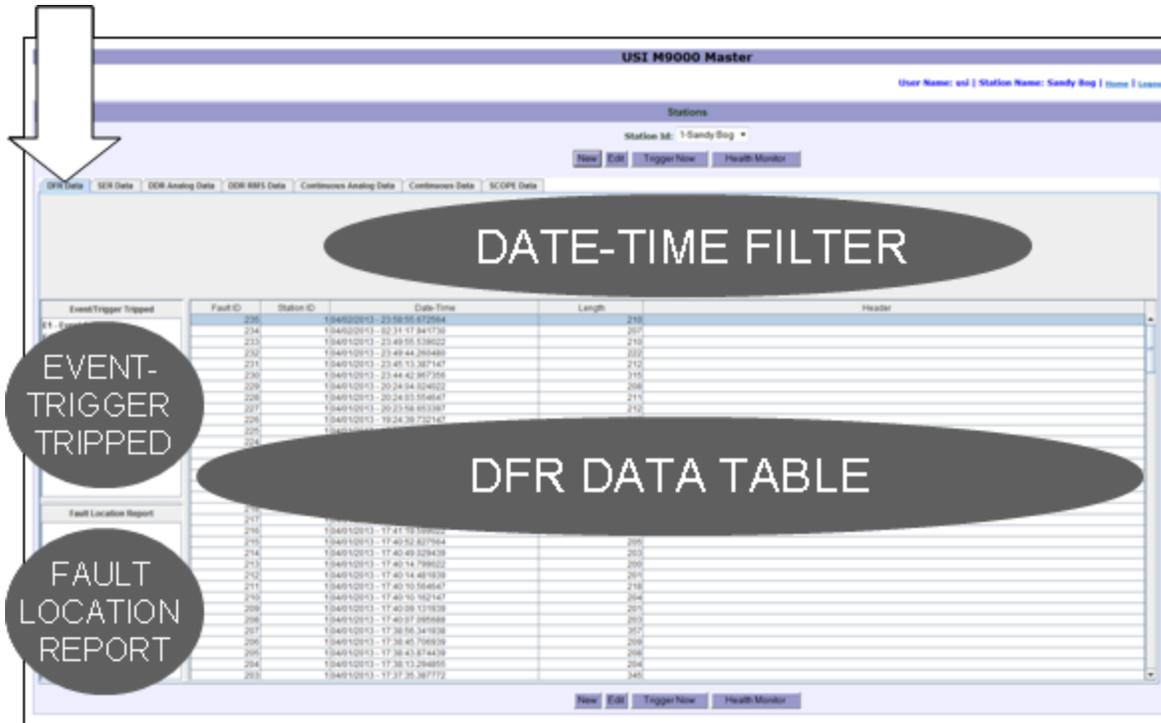


Figure 2-6 DFR Data Screen

- **Date-Time Filter**
This panel is used to select the records to be displayed in the Data table.

Enter Start Date/Time:  HH: MM: SS:

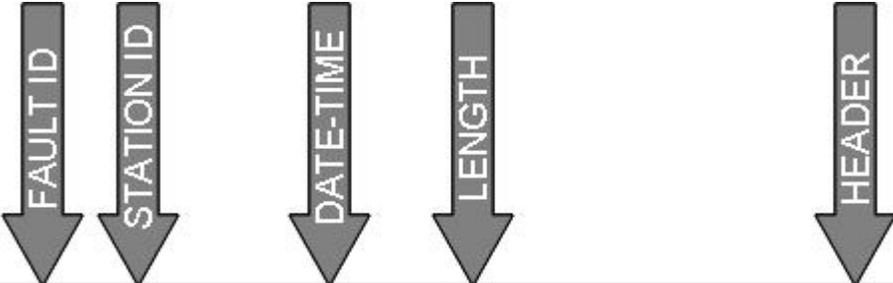
Enter End Date/Time:  HH: MM: SS:

No Records matching criteria

Check for Auto Update

Figure 2-7 Start/End Date/Time Entries

- **Enter Start Date/Time, End Date/Time:**
These fields are used to select the begin and end dates and times to be displayed on the DFR Data table.
 -  **Calendar button**
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.



Fault ID	Station ID	Date-Time	Length	Header
235	104020013	-23:58:55.672564	210	
234	104020013	-02:31:17.941730	207	
233	104012013	-23:49:55.539022	210	
232	104012013	-23:49:44.260480	222	
231	104012013	-23:45:13.387147	212	
230	104012013	-23:44:42.967356	315	
229	104012013	-20:24:04.024022	208	
228	104012013	-20:24:03.554647	211	
227	104012013	-20:23:58.653397	212	
226	104012013	-19:24:39.732147	217	
225	104012013	-17:54:51.017981	248	
224	104012013	-17:54:50.647772	201	
223	104012013	-17:54:50.209230	257	
222	104012013	-17:46:27.690480	225	
221	104012013	-17:46:17.368814	214	
220	104012013	-17:45:48.041522	208	
219	104012013	-17:45:13.622356	210	
218	104012013	-17:41:21.414230	202	
217	104012013	-17:41:20.526731	206	
216	104012013	-17:41:19.599022	217	
215	104012013	-17:40:52.827564	205	
214	104012013	-17:40:49.029439	203	
213	104012013	-17:40:14.799022	200	
212	104012013	-17:40:14.481938	201	
211	104012013	-17:40:10.564647	218	
210	104012013	-17:40:10.162147	204	
209	104012013	-17:40:09.131938	201	
208	104012013	-17:40:07.095688	203	
207	104012013	-17:38:56.341938	357	
206	104012013	-17:38:45.706939	209	
205	104012013	-17:38:43.874439	208	
204	104012013	-17:38:13.294855	204	
203	104012013	-17:37:35.387772	345	

View Fault

View DDR Analog Data

View DDR RMS Data

RIGHT CLICK MENU

Figure 2-9 DFR Data Table

- Fault ID:
This column displays the identification number associated with the records.
- Station ID:
This column displays the identification number associated with the selected DME system.
- Date-Time:
This column displays the date and time that each record was triggered.
- Length:
This column displays the length in milliseconds of each record.
- Header:
This column displays the contents of the COMTRADE header file. The header file stores comments about the record. To enter or edit the header content, left-click this cell and type the information to be stored.
- Right-click menu:
This menu displays the following selections. These selections open the COMTRADE Display window (see [Section 4](#)).

- View DFR Data
This displays the selected DFR data record.
- View DDR Analog Data
This displays the DDR analog data (point-on-wave) associated with the selected DFR record.
- View DDR RMS Data
This displays the DDR RMS data associated with the selected DFR record.



Note: Due to the extended length, a single DDR record may be associated with multiple DFR records. This right-click feature simplifies the search for relevant DDR data.

- **Event/Trigger Tripped**
This panel lists the abnormal analog and digital triggers for the selected DFR record. They are displayed in the sequence in which they became abnormal.

Event/Trigger Tripped
T3 - Trigger(T_A3 - 69kV Bus - C Phase Volts)
T8 - Trigger(T_A8 - USI Receptacle)
T129 - Trigger(T_A16 - USI Receptacle)
T130 - Trigger(T_A24 - USI Receptacle)
T131 - Trigger(T_A32 - USI Receptacle)

Figure 2-10 Event/Trigger Tripped

- **Fault Location Report**
This panel displays the following distance-to-fault results:

Fault Location Report
Line Name: 69kV-line
Type: CG
Duration: 41.213 Cycles
Distance: 0.000 Miles (0.000 Km)

Figure 2-11 Fault Location Report

- Line Name:
This displays the name of the affected line as assigned in the LineGroups page of the configuration file (see Section [3.1.3](#)).
- Type:
This displays the [fault type](#) determined by the fault location feature (e.g. ABC, AB, BC, CA, ABG, BCG, CAG, AG, BG, or CG).
- Duration:
This displays the time period of data used to determine fault location.
- Distance:
This displays the calculated distance to fault from the selected DME system. The distance is displayed in miles and kilometers.

2.3.2 SER Data Screen

This screen tab displays a table of SER data received from the selected DME system.

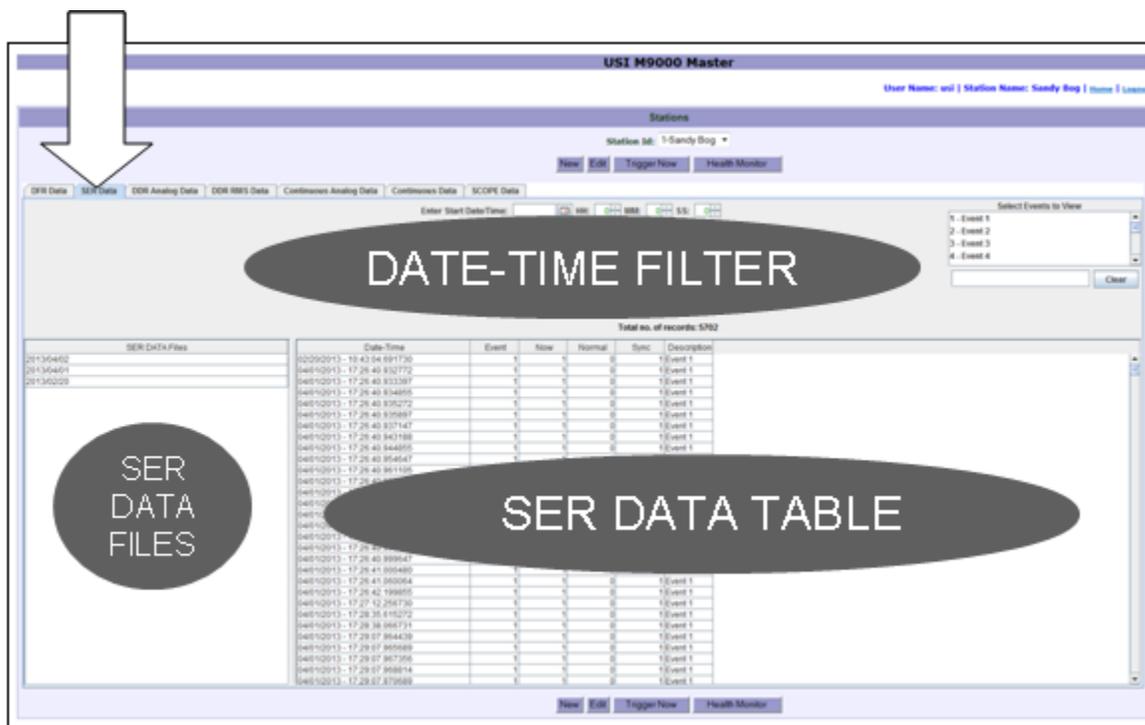


Figure 2-12 SER Data Screen

- **Date-Time Filter**
This panel is used to select the range of SER data to be displayed in the Data table.

The screenshot shows a web interface for entering start and end date/times. It includes two rows of input fields for HH, MM, and SS, each with a calendar icon. Below these are 'Search' and 'Reset' buttons. To the right is a 'Select Events to View' list with four items (Event 1-4) and a 'Clear' button. At the bottom, it says 'Total no. of records: 201'.

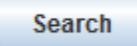
Figure 2-13 SER Data Screen Detail – Start/End Date/Time Entries

- Enter Start Date/Time, End Date/Time:
These fields are used to select the begin and end dates and times to be displayed on the SER Data table.

-  Calendar button
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.

March		2013					
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
09						1	2
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

Figure 2-14 Calendar Window

-  Up/Down buttons
These buttons are used to select times for the Start Time and End Time fields (HH=Hours, MM=Minutes, SS=Seconds).
 -  This button is used to search the SER data for events within the time period selected in the Date–Time Filter.
 -  This button is used to zero the entries in the Date-Time Filter.
- Select Events to View:
This sub-panel is used to select the digital inputs to be displayed on the SER Data table. All digital inputs are displayed on a scrolling list. Select inputs to display by Ctrl+Left-click or Shift+Left-click. The input numbers for the selected events display in the field to the left of the Clear button.

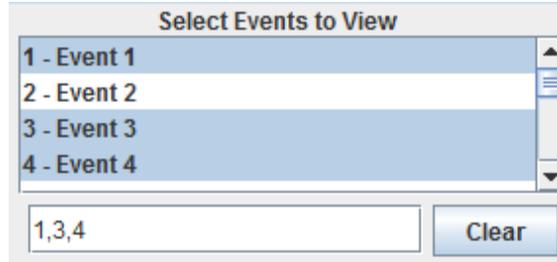


Figure 2-15 Select Events To View

- Clear This button is used to clear inputs in the Select Events to View sub-panel.
- SER DATA Files**

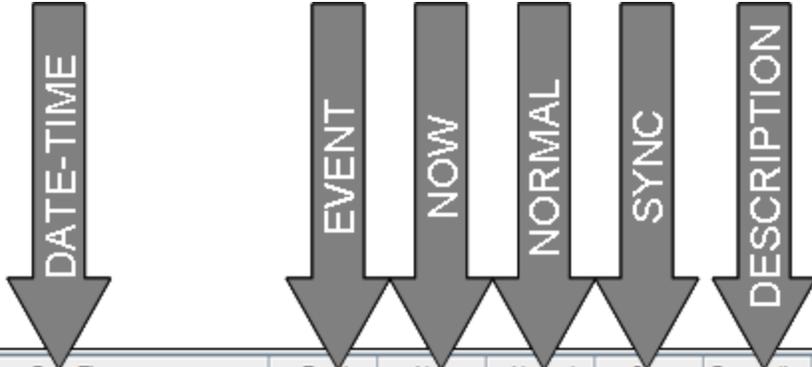
This panel displays a list of SER data files by date. Data files can be selected by Ctrl+Left-click or Shift+Left-click. SER data from the selected files is displayed in the SER Data table.

SER DATA Files
2013/04/02
2013/04/01
2013/02/20

Figure 2-16 SER Data Files List

- SER DATA Table**

This table displays the selected SER data files. The SER data can be sorted in ascending or descending order by clicking the header for one of the following columns:



Date-Time	Event	Now	Normal	Sync	Description
02/20/2013 - 10:43:04.691730	1	1	0		1 Event 1
04/01/2013 - 17:26:40.932772	1	1	0		1 Event 1
04/01/2013 - 17:26:40.933397	1	1	0		1 Event 1
04/01/2013 - 17:26:40.934855	1	1	0		1 Event 1
04/01/2013 - 17:26:40.935272	1	1	0		1 Event 1
04/01/2013 - 17:26:40.935897	1	1	0		1 Event 1
04/01/2013 - 17:26:40.937147	1	1	0		1 Event 1
04/01/2013 - 17:26:40.943188	1	1	0		1 Event 1
04/01/2013 - 17:26:40.944855	1	1	0		1 Event 1
04/01/2013 - 17:26:40.954647	1	1	0		1 Event 1
04/01/2013 - 17:26:40.961105	1	1	0		1 Event 1
04/01/2013 - 17:26:40.967147	1	1	0		1 Event 1
04/01/2013 - 17:26:40.969231	1	1	0		1 Event 1
04/01/2013 - 17:26:40.970272	1	1	0		1 Event 1
04/01/2013 - 17:26:40.971522	1	1	0		1 Event 1
04/01/2013 - 17:26:40.985688	1	1	0		1 Event 1
04/01/2013 - 17:26:40.993813	1	1	0		1 Event 1
04/01/2013 - 17:26:40.996105	1	1	0		1 Event 1
04/01/2013 - 17:26:40.999647	1	1	0		1 Event 1
04/01/2013 - 17:26:41.000480	1	1	0		1 Event 1
04/01/2013 - 17:26:41.060064	1	1	0		1 Event 1
04/01/2013 - 17:26:42.199855	1	1	0		1 Event 1
04/01/2013 - 17:27:12.256730	1	1	0		1 Event 1
04/01/2013 - 17:28:35.615272	1	1	0		1 Event 1
04/01/2013 - 17:28:38.066731	1	1	0		1 Event 1
04/01/2013 - 17:29:07.964439	1	1	0		1 Event 1
04/01/2013 - 17:29:07.965689	1	1	0		1 Event 1
04/01/2013 - 17:29:07.967356	1	1	0		1 Event 1
04/01/2013 - 17:29:07.968814	1	1	0		1 Event 1
04/01/2013 - 17:29:07.970689	1	1	0		1 Event 1

Figure 2-17 SER Data Table

- Date-Time:
This column displays the date and time that the event input changed state.
- Event:
This column displays the event input number on the DME system.
- Now:
This column displays the state of the event input (C=closed, O=open) at the displayed date and time.

- Normal:
This column displays the state as “N” (Normal) or “A” (Abnormal) for the state shown in the *Now* column. The normal state is defined by the Normal State setting in the configuration file (Section [3.1.5](#)).
- Sync:
This column displays “S” ([synced](#)) or “U” (un-synced) to indicate whether the DME system is synchronized with an [IRIG-B](#) satellite.
- Description:
This column displays the description of the event input. When the state of the event input is Normal, the **Normal Descriptor** as entered in the Configuration file (Section [3.1.5](#)) is displayed.

2.3.3 DDR Analog Data Screen

This screen tab displays a table of [DDR Analog](#) data received from the selected DME system.

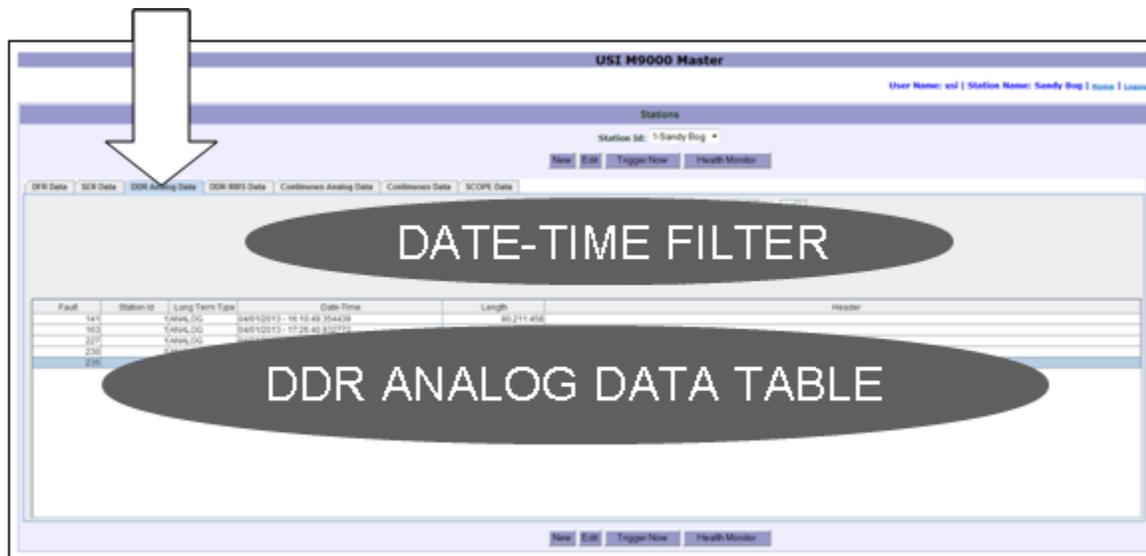


Figure 2-18 DDR Analog Data Screen

- **Date-Time Filter**
This panel is used to select the records to be displayed in the Data table.

Enter Start Date/Time:  HH: MM: SS:

Enter End Date/Time:  HH: MM: SS:

No Records matching criteria

Check for Auto Update

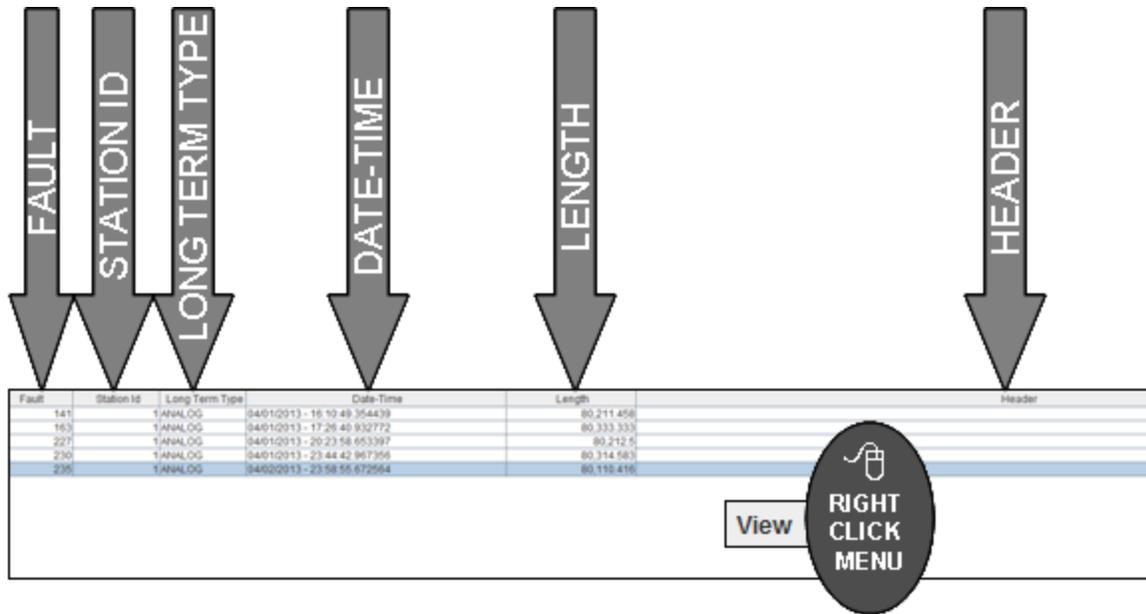
Figure 2-19 Start/End Date/Time Entries

- Enter Start Date/Time, End Date/Time:
These fields are used to select the begin and end dates and times to be displayed on the DDR Analog table.
 -  Calendar button
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.

March		▼		2013		▲	
Sun	Mon	Tue	Wed	Thu	Fri	Sat	
09					1	2	
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

Figure 2-20 Calendar Window

-  Up/Down buttons
These buttons are used to select times for the Start Time and End Time fields (HH=Hours, MM=Minutes, SS=Seconds).
 - This button is used to search the DDR Analog data for records within the time period selected in the Date-Time Filter.
 - This button is used to zero the entries in the Date-Time Filter.
- **DDR Analog Data Table**
This table displays the following DDR Analog record information.



Fault	Station Id	Long Term Type	Date-Time	Length	Header
141	1ANALOG	04010013 - 16 10 49 354439		80.211.458	
163	1ANALOG	04010013 - 17 26 40 932772		80.333.333	
227	1ANALOG	04010013 - 20 23 58 653397		80.212.5	
230	1ANALOG	04010013 - 23 44 42 967366		80.314.583	
236	1ANALOG	04020013 - 23 38 55 872664		80.119.416	

Figure 2-21 DDR Analog Data Table

- Fault:
This column displays the identification number associated with the records.
- Station ID:
This column displays the identification number associated with the selected DME system.
- Long Term Type:
This column displays the unit of measurement for the record.
- Date-Time:
This column displays the date and time that each record was triggered.
- Length:
This column displays the length in milliseconds of each record.
- Header:
This column displays the contents of the COMTRADE header file. The header file stores comments about the record. To enter or edit the header content, left-click this cell and type the information to be stored.
- Right-click menu:
This menu displays the following selections. These selections open the COMTRADE Display window (see [Section 4](#)).
 - View
This displays the selected DDR analog data (point-on-wave).

2.3.4 DDR RMS Data Screen

This screen tab displays a table of [DDR RMS](#) data received from the selected DME system.

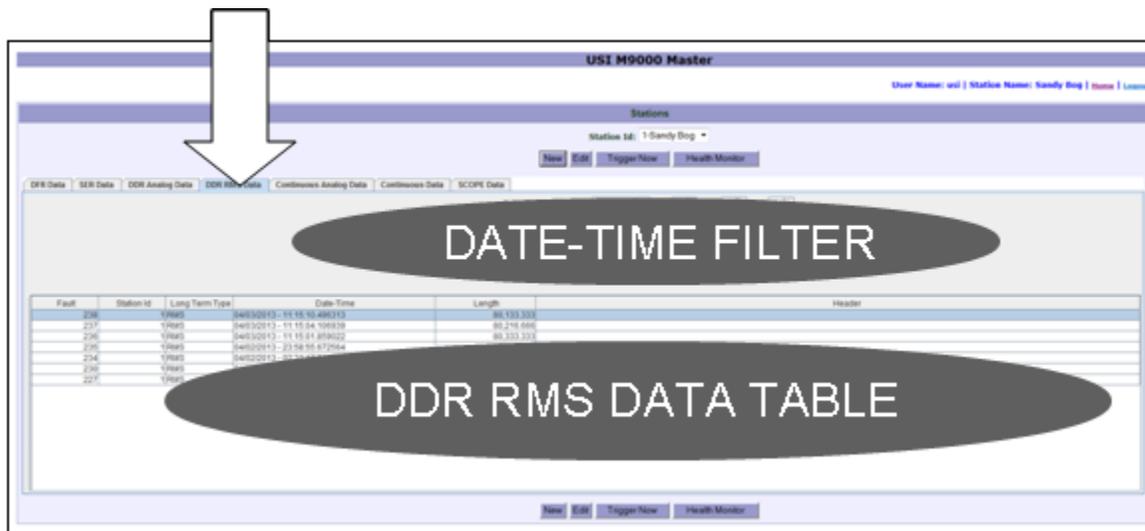


Figure 2-22 DDR RMS Screen

- **Date-Time Filter**
This panel is used to select the records to be displayed in the Data table.

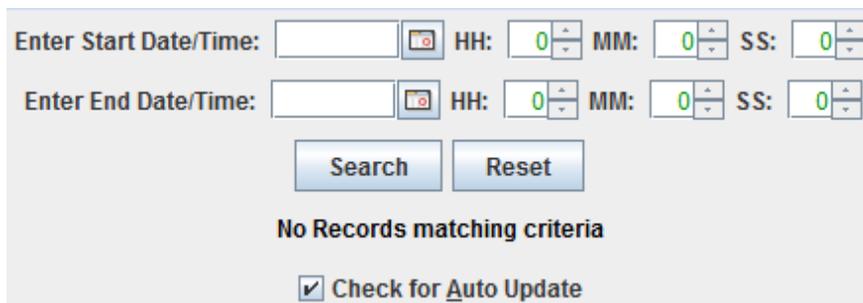


Figure 2-23 Start/End Date/Time Entries

- **Enter Start Date/Time, End Date/Time:**
These fields are used to select the begin and end dates and times to be displayed on the DDR RMS table.
-  **Calendar button**
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.

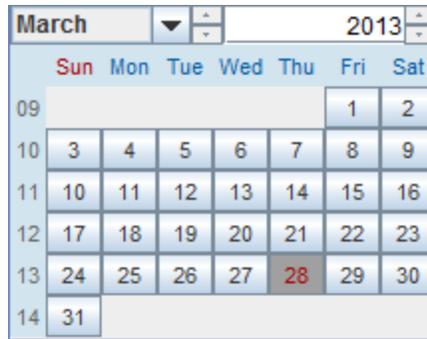
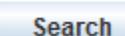
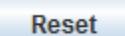


Figure 2-24 Calendar Window

-  Up/Down buttons
These buttons are used to select times for the Start Time and End Time fields (HH=Hours, MM=Minutes, SS=Seconds).
 -  Search This button is used to search the DDR RMS data for records within the time period selected in the Date-Time Filter.
 -  Reset This button is used to zero the entries in the Date-Time Filter.
- **DDR RMS Data Table**
This table displays the following DDR RMS record information.

Fault	Station ID	Long Term Type	Date-Time	Length	Header
238	1RMS		04032013 - 11:15:10 489313	80,133,333	
237	1RMS		04032013 - 11:15:04 109939	80,216,666	
236	1RMS		04032013 - 11:15:01 859922	80,333,333	
235	1RMS		04022013 - 23:58:55 672564	80,116,666	
234	1RMS		04022013 - 02:31:17 941730	80,190	
230	1RMS		04012013 - 23:44:42 967356	80,316,666	
227	1RMS		04012013 - 20:23:58 653397	80,216,666	

Figure 2-25 DDR RMS Data Table

- Fault:
This column displays the identification number associated with the records.

- **Station ID:**
This column displays the identification number associated with the selected DME system.
- **Long Term Type:**
This column displays the unit of measurement for the record.
- **Date-Time:**
This column displays the date and time that each record was triggered.
- **Length:**
This column displays the length in milliseconds of each record.
- **Header:**
This column displays the contents of the COMTRADE header file. The header file stores comments about the record. To enter or edit the header content, left-click this cell and type the information to be stored.
- **Right-click menu:**
This menu displays the following selections. These selections open the COMTRADE Display window (see [Section 4](#)).
 - **View**
This displays the selected DDR RMS data.

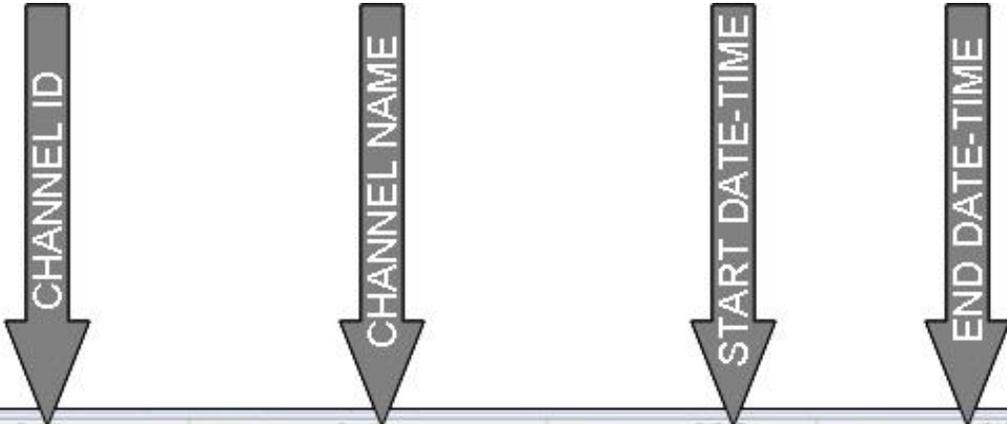
2.3.5 Continuous Analog Data Screen

This screen tab displays a table of Continuous Analog data available from the selected DME system. This data is retained in the DME storage drives for five days.



Figure 2-26 Continuous Analog Data Screen

- **Continuous Analog Data Table**
This table displays the following information:



Channel ID	Channel Name	Start Date/Time	End Date/Time
1	AnalogInputAnalog01	2013-05-28 10:11:34	2013-06-03 11:43:50
2	AnalogInputAnalog02	2013-05-28 11:03:13	2013-06-03 11:43:50
3	AnalogInputAnalog03	2013-05-28 11:03:13	2013-06-03 11:43:50
4	AnalogInputAnalog04	2013-05-28 11:03:13	2013-06-03 11:43:50
5	AnalogInputAnalog05	2013-05-28 11:03:13	2013-06-03 11:43:50
6	AnalogInputAnalog06	2013-05-28 11:03:13	2013-06-03 11:43:50
7	AnalogInputAnalog07	2013-05-28 11:03:13	2013-06-03 11:43:50
8	AnalogInputAnalog08	2013-05-28 11:03:13	2013-06-03 11:43:50
9	AnalogInputAnalog09	2013-05-28 11:03:13	2013-06-03 11:43:50
10	AnalogInputAnalog10	2013-05-28 11:03:13	2013-06-03 11:43:50
11	AnalogInputAnalog11	2013-05-28 11:03:13	2013-06-03 11:43:50
12	AnalogInputAnalog12	2013-05-28 11:03:13	2013-06-03 11:43:50
13	AnalogInputAnalog13	2013-05-28 11:03:13	2013-06-03 11:43:50
14	AnalogInputAnalog14	2013-05-28 11:03:13	2013-06-03 11:43:50
15	AnalogInputAnalog15	2013-05-28 11:03:13	2013-06-03 11:43:50
16	AnalogInputAnalog16	2013-05-28 11:03:13	2013-06-03 11:43:50
17	AnalogInputAnalog17	2013-05-28 11:03:13	2013-06-03 11:43:50
18	AnalogInputAnalog18	2013-05-28 11:03:13	2013-06-03 11:43:50
19	AnalogInputAnalog19	2013-05-28 11:03:13	2013-06-03 11:43:50
20	AnalogInputAnalog20	2013-05-28 11:03:13	2013-06-03 11:43:50
21	AnalogInputAnalog21	2013-05-28 11:03:13	2013-06-03 11:43:50
22	AnalogInputAnalog22	2013-05-28 11:03:13	2013-06-03 11:43:50
23	AnalogInputAnalog23	2013-05-28 11:03:13	2013-06-03 11:43:50
24	AnalogInputAnalog24	2013-05-28 11:03:13	2013-06-03 11:43:50
25	AnalogInputAnalog25	2013-05-28 11:03:13	2013-06-03 11:43:50
26	AnalogInputAnalog26	2013-05-28 11:03:13	2013-06-03 11:43:50
27	AnalogInputAnalog27	2013-05-28 11:03:13	2013-06-03 11:43:50
28	AnalogInputAnalog28	2013-05-28 11:03:13	2013-06-03 11:43:50
29	AnalogInputAnalog29	2013-05-28 11:03:13	2013-06-03 11:43:50
30	AnalogInputAnalog30	2013-05-28 11:03:13	2013-06-03 11:43:50
31	AnalogInputAnalog31	2013-05-28 11:03:13	2013-06-03 11:43:50
32	AnalogInputAnalog32	2013-05-28 11:03:13	2013-06-03 11:43:50

Figure 2-27 Continuous Analog Data Table

- **Channel ID:**
This column displays the input number for the analog channel in each row. The channels displayed in this table have been selected for [export](#) in the Analog Channel Configuration (see [Section 3.1.2](#)).
- **Channel Name:**
This column displays the description of the analog input channel as entered in the Analogs page of the DME configuration.
- **Start Date/Time:**
This column displays the beginning date and time of the recorded data.
- **End Date/Time:**
This column displays the ending date and time of the recorded data.

- **Date-Time Filter**

This panel is used to select a time-slice of continuous data to be displayed. To display this panel, select a row in the Continuous Analog Data table.

Enter Start Date/Time: :013-02-11  HH: 23  MM: 22  SS: 2 

Enter End Date/Time: :013-03-29  HH: 14  MM: 23  SS: 12 

Figure 2-28 Start/End Date/Time Entries

- Enter Start Date/Time, End Date/Time:
These fields are used to select the begin and end dates and times of the data time-slice to be displayed.



Caution: Selecting more than one minute of continuous analog waveform data can result in memory overflow requiring a browser restart.

-  Calendar button
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.

March		2013					
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
09						1	2
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

Figure 2-29 Calendar Window

-  Up/Down buttons
These buttons are used to select times for the Start Time and End Time fields (HH=Hours, MM=Minutes, SS=Seconds).
- This button is used to display the continuous data within the time period selected in the Date-Time Filter (see [Section 4](#)).
- This button is used to zero the entries in the Date-Time Filter.

2.3.6 Continuous Data Screen

This screen tab displays a table of Continuous Measurement data available from the selected DME system. This data is retained in the DME storage drives for 30 days.

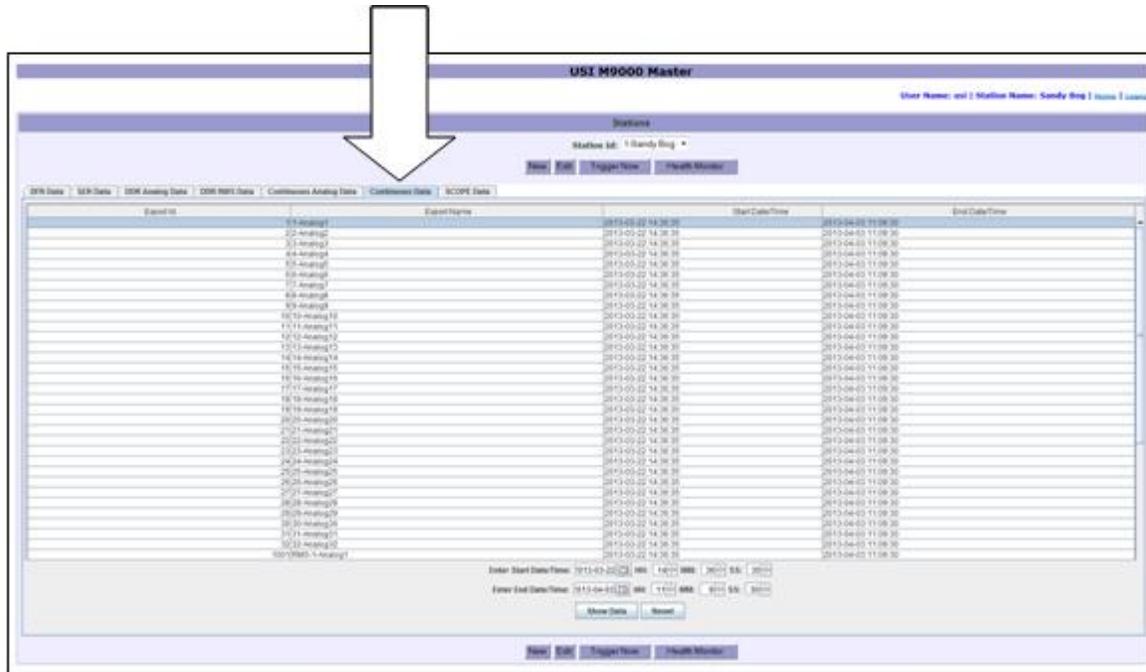
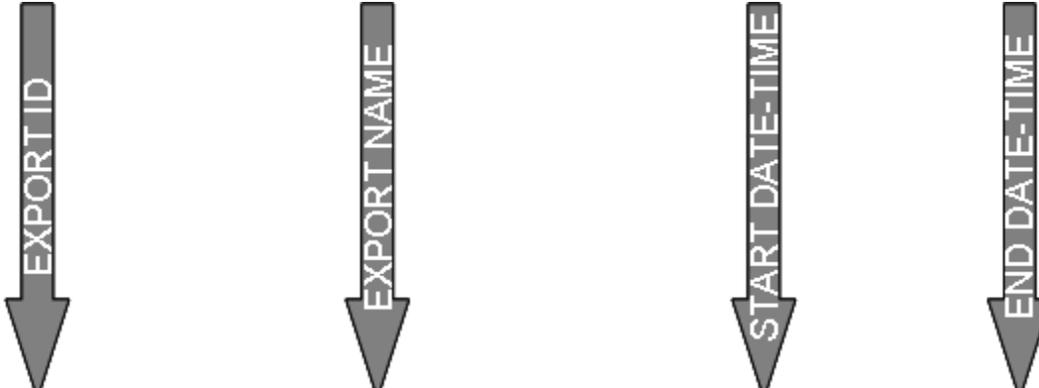


Figure 2-30 Continuous Data Screen

- Continuous Data Table**
 This table displays the following information:



ExportId	Export Name	Start Date/Time	End Date/Time
1-1-Analog1		2013-03-22 14:36:35	2013-04-03 11:09:30
2-2-Analog2		2013-03-22 14:36:35	2013-04-03 11:09:30
3-3-Analog3		2013-03-22 14:36:35	2013-04-03 11:09:30
4-4-Analog4		2013-03-22 14:36:35	2013-04-03 11:09:30
5-5-Analog5		2013-03-22 14:36:35	2013-04-03 11:09:30
6-6-Analog6		2013-03-22 14:36:35	2013-04-03 11:09:30
7-7-Analog7		2013-03-22 14:36:35	2013-04-03 11:09:30
8-8-Analog8		2013-03-22 14:36:35	2013-04-03 11:09:30
9-9-Analog9		2013-03-22 14:36:35	2013-04-03 11:09:30
10-10-Analog10		2013-03-22 14:36:35	2013-04-03 11:09:30
11-11-Analog11		2013-03-22 14:36:35	2013-04-03 11:09:30
12-12-Analog12		2013-03-22 14:36:35	2013-04-03 11:09:30
13-13-Analog13		2013-03-22 14:36:35	2013-04-03 11:09:30
14-14-Analog14		2013-03-22 14:36:35	2013-04-03 11:09:30
15-15-Analog15		2013-03-22 14:36:35	2013-04-03 11:09:30
16-16-Analog16		2013-03-22 14:36:35	2013-04-03 11:09:30
17-17-Analog17		2013-03-22 14:36:35	2013-04-03 11:09:30
18-18-Analog18		2013-03-22 14:36:35	2013-04-03 11:09:30
19-19-Analog19		2013-03-22 14:36:35	2013-04-03 11:09:30
20-20-Analog20		2013-03-22 14:36:35	2013-04-03 11:09:30
21-21-Analog21		2013-03-22 14:36:35	2013-04-03 11:09:30
22-22-Analog22		2013-03-22 14:36:35	2013-04-03 11:09:30
23-23-Analog23		2013-03-22 14:36:35	2013-04-03 11:09:30
24-24-Analog24		2013-03-22 14:36:35	2013-04-03 11:09:30
25-25-Analog25		2013-03-22 14:36:35	2013-04-03 11:09:30
26-26-Analog26		2013-03-22 14:36:35	2013-04-03 11:09:30
27-27-Analog27		2013-03-22 14:36:35	2013-04-03 11:09:30
28-28-Analog28		2013-03-22 14:36:35	2013-04-03 11:09:30
29-29-Analog29		2013-03-22 14:36:35	2013-04-03 11:09:30
30-30-Analog30		2013-03-22 14:36:35	2013-04-03 11:09:30
31-31-Analog31		2013-03-22 14:36:35	2013-04-03 11:09:30
32-32-Analog32		2013-03-22 14:36:35	2013-04-03 11:09:30
1001-RMS-1-Analog1		2013-03-22 14:36:35	2013-04-03 11:09:30

Figure 2-31 Continuous Data Table

- **Export ID:**
This column displays the identification number for the analog measurement in each row. The measurements displayed in this table have been selected for [export](#) in the Measurements Configuration (see [Section 3.1.4](#)).
- **Export Name:**
This column displays the description of the measurement as entered in the Measurements page of the DME configuration.
- **Start Date/Time:**
This column displays the beginning date and time of the recorded data.
- **End Date/Time:**
This column displays the ending date and time of the recorded data.
- **Date-Time Filter**
This panel is used to select a time-slice of continuous data to be displayed. To display this panel, select a row in the Continuous Data table.

Enter Start Date/Time: :013-02-11  HH: 23  MM: 22  SS: 2 

Enter End Date/Time: :013-03-29  HH: 14  MM: 23  SS: 12 

Figure 2-32 Start/End Date/Time Entries

- Enter Start Date/Time, End Date/Time:
These fields are used to select the begin and end dates and times of the data time-slice to be displayed.



Caution: Selecting more than ten minutes of continuous data can result in memory overflow requiring a browser restart.

-  Calendar button
This button displays the calendar window. This window is used to select dates for the Start Date and End Date fields.

March							2013
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
09						1	2
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

Figure 2-33 Calendar Window

-  Up/Down buttons
These buttons are used to select times for the Start Time and End Time fields (HH=Hours, MM=Minutes, SS=Seconds).
- This button is used to display the continuous data within the time period selected in the Date-Time Filter.
- This button is used to zero the entries in the Date-Time Filter.

2.3.7 Scope Data Screen

This screen is used to view live analog and digital inputs, to display measurement values, and to calibrate the analog inputs. It has four main sections: Chassis Selection, Waveform Panel, Status Panel, and Scope Panel.

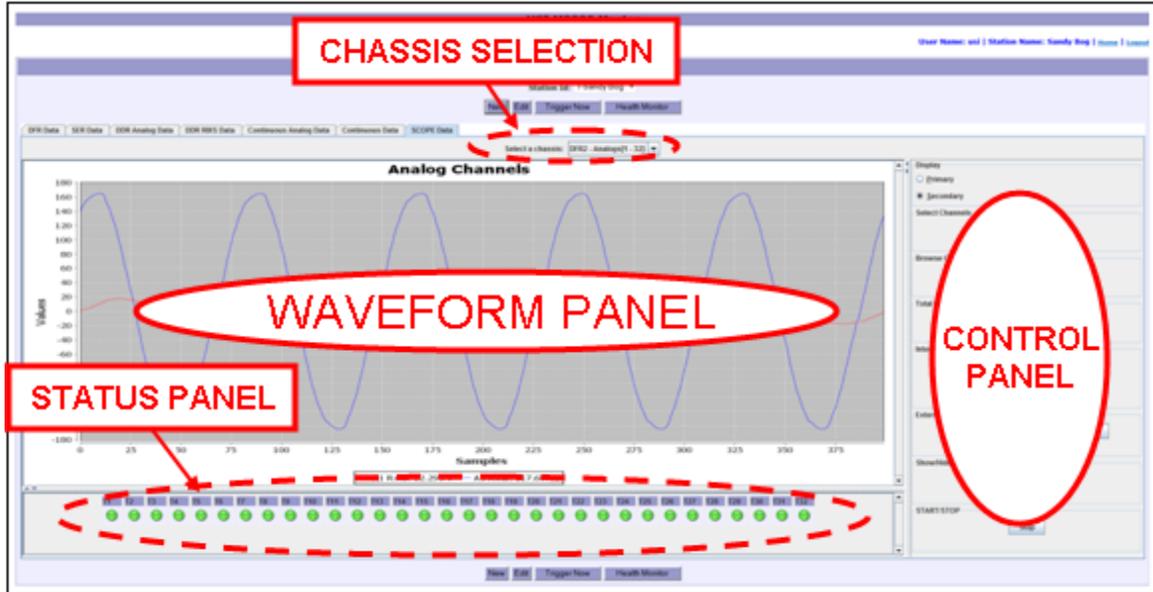


Figure 2-34 Scope Data Screen

- **Chassis Selection**

This selection restricts displayed data to inputs coming from a single chassis. This drop-down displays a list of chassis as defined in the configuration and is used to select a data source to be displayed.

Each chassis may have different analog and digital input configurations. The Scope Data screen adapts to the configurations of the selected chassis.



Note: The numbers displayed next to the listed chassis refer to the systems global input number for that chassis.

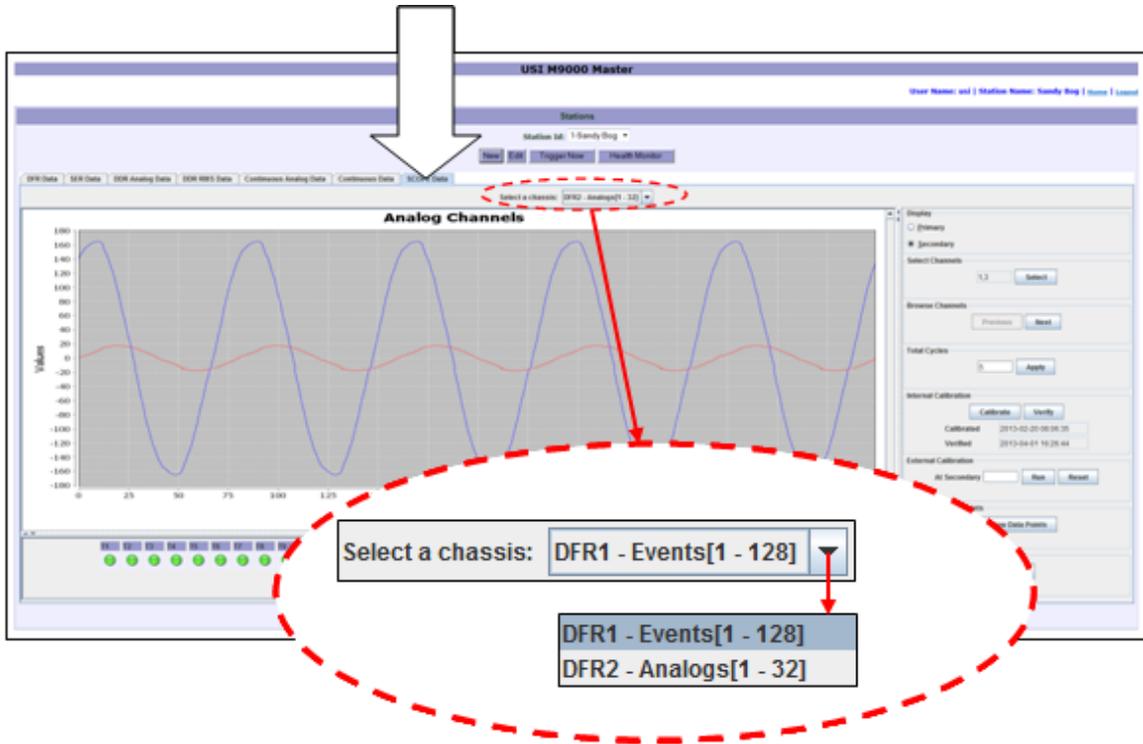


Figure 2-35 Select a chassis Drop-down

- **Status Panel**

This panel displays status of digital inputs and analog triggers monitored by the selected chassis using the following legend:

- **Red:**
This indicates an abnormal input as defined by the Event Normal State settings or the Measurement Trigger settings in the configuration.
- **Green:**
This indicates a normal input as defined by the Event Normal State settings or the Measurement Trigger settings in the configuration.

When the selected chassis has only digital inputs, the status panel expands to fill the screen (see Figure 2-36).



Note: Hover the mouse pointer over a status indicator to display its description.



Figure 2-36 Status Panel

- **Waveform Panel**

This panel plots data and displays the calculated meter values of the selected analog channels. It also provides the following features:

- X-Scale:
The values in this scale are the A-to-D sample numbers.
- Y-Scale:
The values in this scale are the sample magnitudes. This scale is auto-ranging.
- Zoom:
This feature is an X-Y zoom. To exercise this feature, left-click and drag a box around the area to zoom (zoom in by dragging left-to-right; zoom out by dragging right-to-left).



Note: Hover the mouse pointer over a meter value to display its description.

- **Scope Data Control Panel**

This panel provides the following controls:

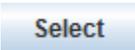
The image shows a software control panel with the following sections:

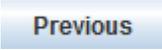
- Display:** Radio buttons for **Primary** (selected) and **Secondary**.
- Select Channels:** A text box containing '1' and a **Select** button.
- Browse Channels:** **Previous** and **Next** buttons.
- Total Cycles:** A text box containing '5' and an **Apply** button.
- Events:** A **Test...** button, an **Enable Transient** checkbox, and a text box for **Last Event Test** showing '2018-02-08 17:03:48'.
- Internal Calibration:** A **Calibrate...** button with a timestamp '2018-01-30 16:32:33', and a **Verify...** button with a timestamp '2018-02-08 17:06:17'.
- External Calibration:** A **Desired Value** text box, an **Offset Correction** checkbox, and **Apply** and **Reset** buttons.
- Show/Hide Data Points:** A **Show Data Points** button.
- START/STOP:** A **Stop** button.

Figure 2-37 Scope Data Control Panel

- Display:
These radio buttons determine the value displayed in the RMS meter window.
 - **Primary**
With this selection the value measured is multiplied by the CT/PT ratio saved in the analog channels configuration (see [Section 3.1.2](#)).

- Secondary
With this selection the meter displays the value injected into the back of the DME system.

- Select Channels:
This panel provides the following controls:
 - Channel Input Field
This field allows an input number to be entered.
 -  Select Button
This button displays a list of available analog channel descriptions to select from. Multiple channels can be selected by using Ctrl+Left-click or Shift+Left-click.

- Browse Channels:
This panel provides the following controls:
 -  Previous Button
This button decrements the analog channel number displayed in the Select Channels panel.
 -  Next Button
This button increments the analog channel number displayed in the Select Channels panel.

- Total Cycles:
This panel provides the following controls:
 - Cycle Input Field
This field allows the number of waveform cycles to be entered.
 -  Apply Button
This button applies the value entered in the entry field.

- Events:
This panel provides the following controls:
 -  Test... Button
This button displays the EventTest Confirmation window and is used to initiate the self-test routine. This function is intended to be exercised at any time for verification of all digital inputs.

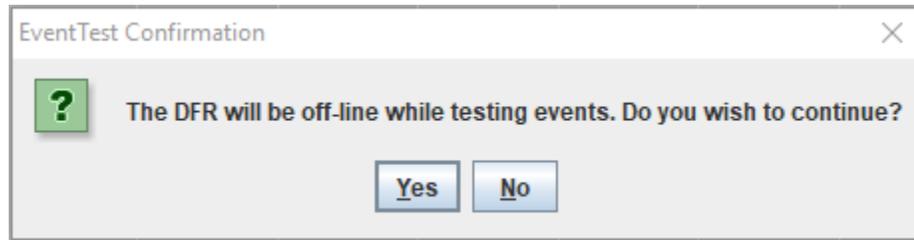


Figure 2-38 EventTest Confirmation Window

- **Yes** Yes Button
Selecting the **Yes** button activates the Event Self-test routine. This will test the functionality of all digital inputs. The test will switch, on and off, a DC test voltage embedded within each digital input channel and confirm each input reports open or closed accordingly. A Status window is then displayed to report Event Test details for review. The bottom of this window displays the OK button.



Warning:

The DME system will momentarily be off-line for the duration of this routine, typically 5 seconds or less.

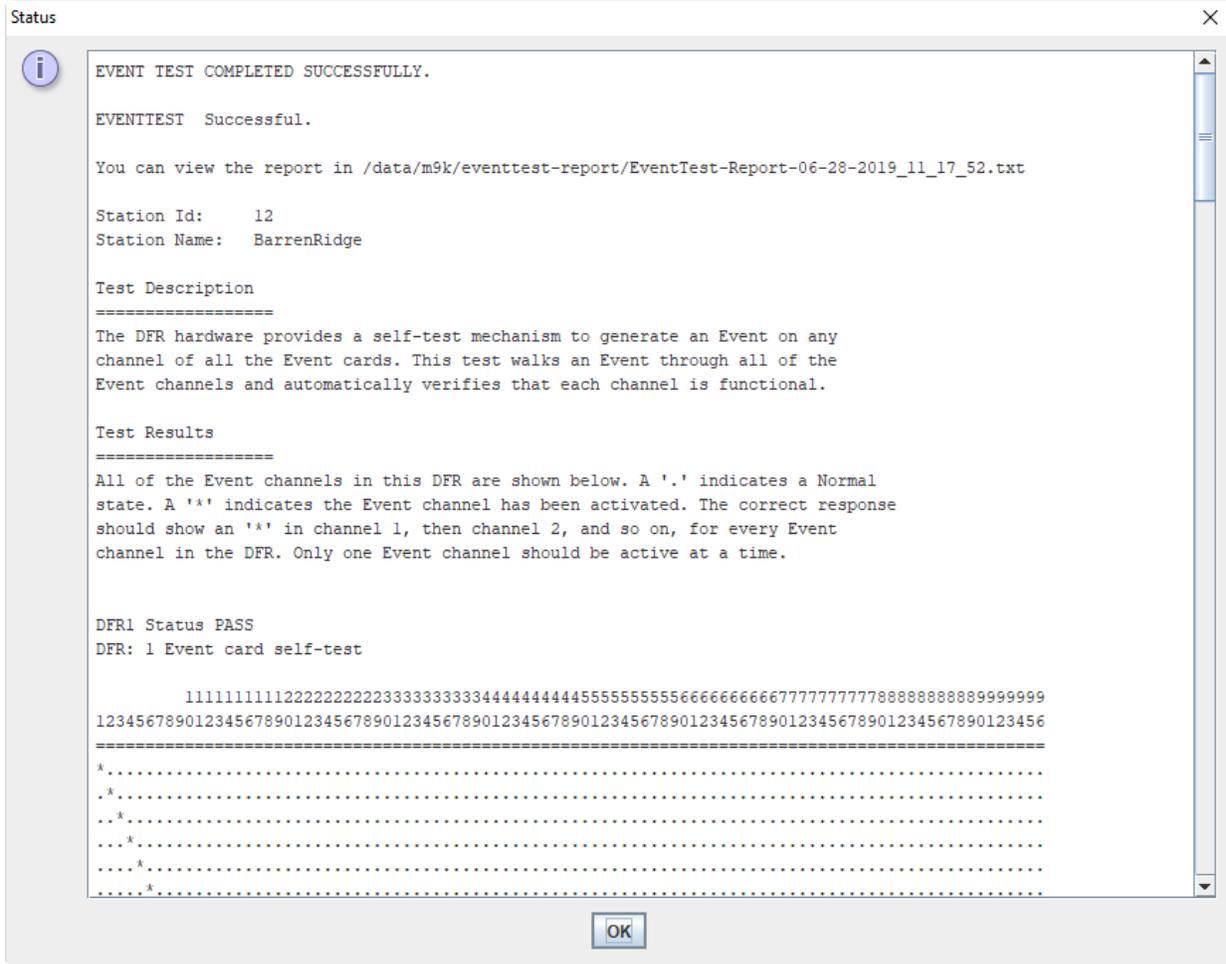


Figure 2-39 Event Test Report

-  **OK Button**
 This button acknowledges the results of the Event Test, stores the report for evidence of routine maintenance, and updates the Last Event Test field displayed in the Events panel. The report is stored at: /File System/data-m9k/eventtest-report.

-  **No Button**
 Selecting the **No** button closes the EventTest Confirmation window without performing the Event Self-test routine or taking the DME system off-line.

- Enable Transient**
 This checkbox is used to enable the digital input triggers and allow the self-test routine to generate DFR and SER data records, in addition to the self-test report.

- **Last Event Test**
This field is populated with the date and time that the Event Self-test report is acknowledged. This date and time are also displayed on the Health Monitor screen (See Section [3.4](#)).
- **Internal Calibration:**
This panel provides the following controls:

Calibrate Calibrate Button

This button displays the Calibration Confirmation window and is used to initiate the internal calibration routine for all analog inputs. This function is only intended to be exercised at the time of commissioning or a routine maintenance cycle of the system. For an arbitrary test of system calibration, the Verify button is recommended.

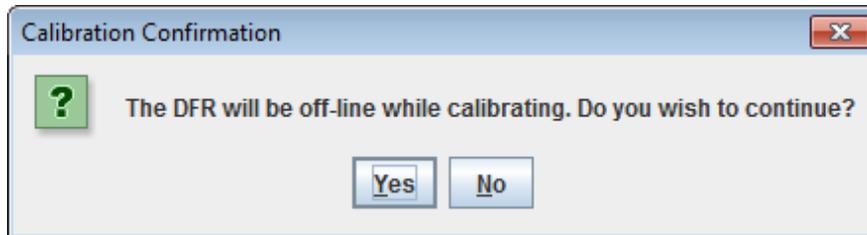


Figure 2-40 Calibration Confirmation Window

- **Yes** Yes Button
Selecting the **Yes** button activates the internal calibration routine. This routine calibrates all input ranges of all analog inputs. Calibration is done by comparing measurements from a precision reference source, embedded within each analog channel, with expected values. Corrective calibration coefficients are then calculated. A Success window is then displayed to report calibration details for each analog input for review. The bottom of this window displays the Apply and Cancel buttons.



Warning:

The DME system will be taken off-line for the duration of this routine, typically 45 seconds.

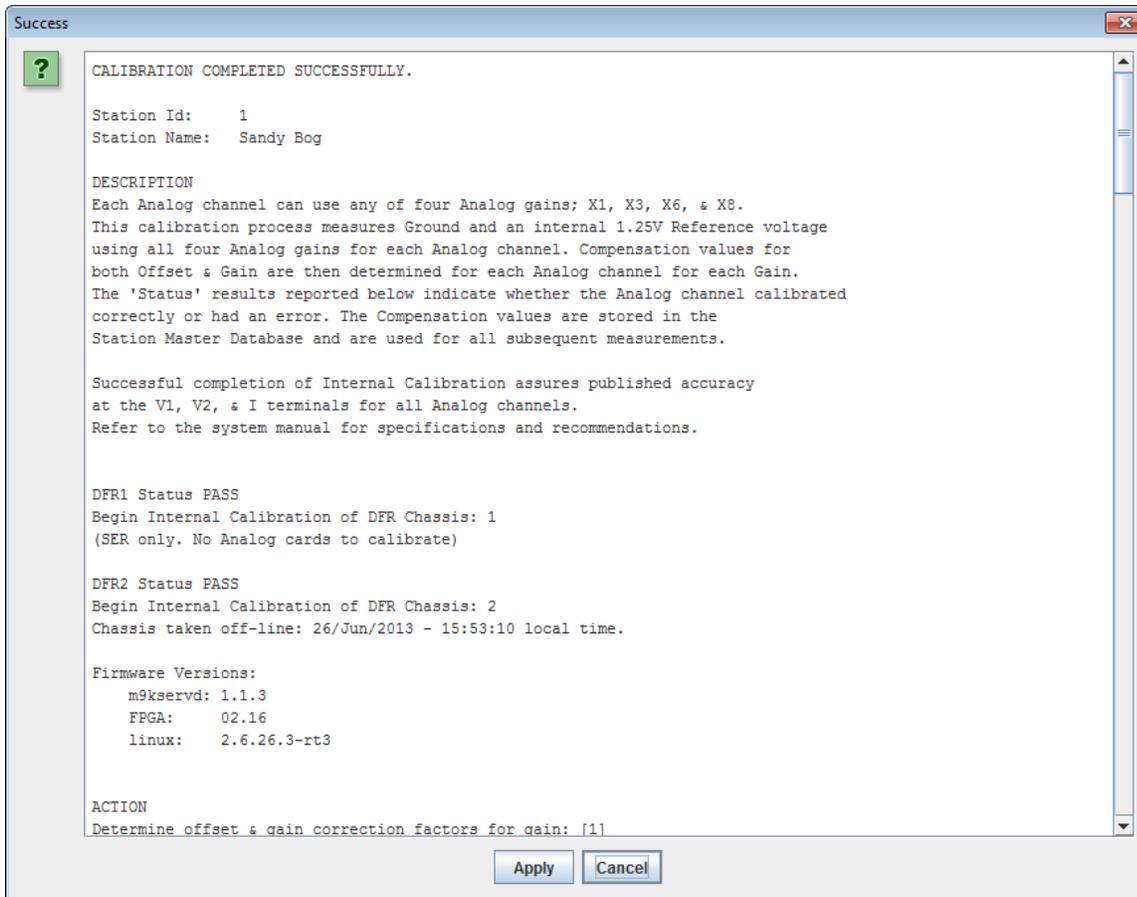


Figure 2-41 Calibration Report

-  **Apply Button**
 Click this button to apply the new calibration correction coefficients and save the Calibration Report. The report is stored at: /File System/data-m9k/calibration-report.
-  **Cancel Button**
 Click this button to discard the new calibration correction coefficients and to leave the previously applied calibration coefficients in effect.
-  **No Button**
 Selecting the **No** button closes the Calibration Confirmation window without performing the internal calibration routine or taking the DME system off-line.

- Verify** Verify Button
 This button displays the Calibration Confirmation window. This function is intended to be exercised at any time for an arbitrary verification of system calibration. This feature can be used to test that the calibration for all input ranges of all analog inputs has not changed by more than 0.25%. This is done by comparing calibration factors calculated during this routine, with calibration factors that were applied during the previous Internal Calibrate function.



Warning: The DME system will be taken off-line for the duration of this routine, typically 45 seconds.



Note: The Verify routine does not make any changes to the applied DME system calibration.

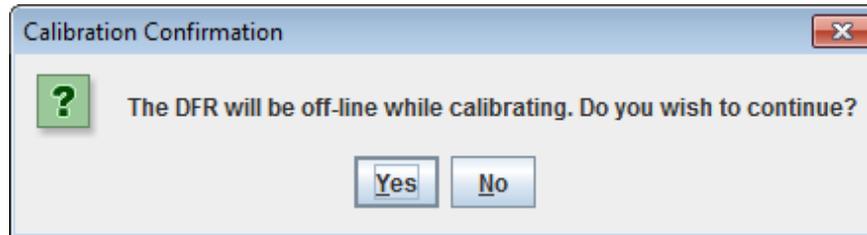


Figure 2-42 Calibration Confirmation Window

- Yes** Yes Button
 Selecting the **Yes** button activates the calibration verification routine. Upon completion, the verification status report is displayed.

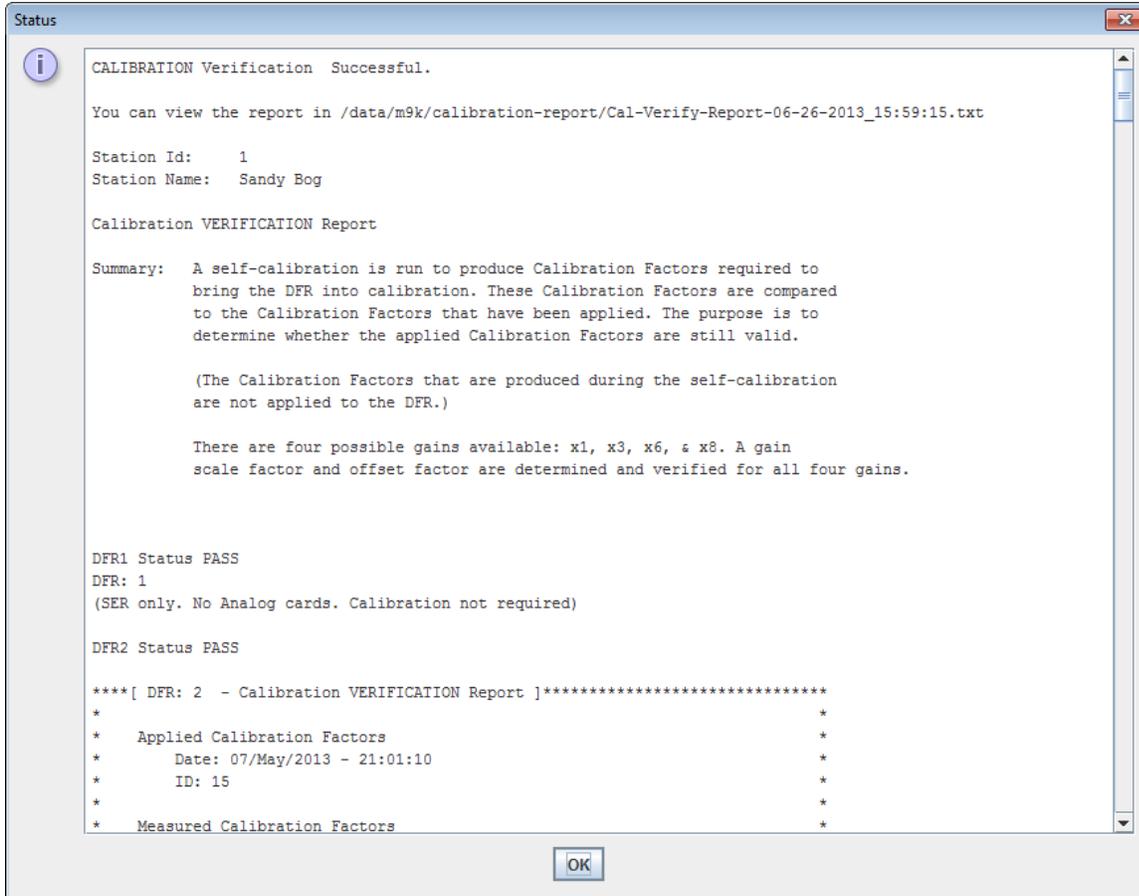


Figure 2-43 Verification Report

- OK** OK Button
 This button acknowledges the results of the Calibration Verification and stores the report for evidence of routine maintenance. This report is located at: /File System/data-m9k/calibration-report.

- No** No Button
 Selecting the **No** button closes the Calibration Confirmation window without performing the analog calibration verification routine or taking the DME system off-line.

- Calibrated Field**
 This field displays the date and time of the last calibration. This date and time are also displayed on the Health Monitor screen (See Section [3.4](#)).

- Verified Field**
 This field displays the date and time of the last calibration verification. This date and time are also displayed on the Health Monitor screen (See Section [3.4](#)).

- External Calibration:
This panel is used to calibrate selected analog channels to an externally applied signal. This function is only intended to be exercised when there is an external auxiliary device between the input of the DME System and the output of the device being monitored. This feature is used to calibrate out any inaccuracy of the auxiliary devices.



Caution: External calibration overwrites the internal calibration factors. A valid external calibration requires the use of a precision source and an accurate meter with certified calibration.

- **At Secondary Field**
This field is used to enter the value of the signal level applied to the auxiliary device connected to the selected analog channels.
- **Offset Correction**
This checkbox is used to compensate for a DC bias from an auxiliary device (e.g. Hall Effect Sensor). When this checkbox is selected, the External Calibration routine will also measure the DC bias present on the input and apply an offset coefficient to zero out the bias applied by the auxiliary device.
- **Run** Run Button
This button runs the external calibration routine. This feature measures the applied input signal and compares this reading to the value entered in the At Secondary field and then applies calculated calibration factors.



Note: When multiple channels are selected, external calibration will be applied to all.

- **Reset** Reset Button
This button displays the external calibration reset confirmation window. This feature is used to reset the external calibration for the selected analog channels reverting it back to the last applied internal calibration factors.

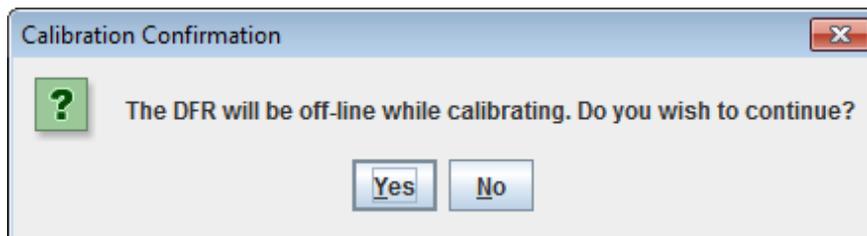


Figure 2-44 External Calibration Reset Window

- Yes** Yes Button
This button resets the external calibration factor for the selected analog channels.
- No** No Button
This button closes the External Calibration Reset window and retains the applied external calibration factor.



Note: When multiple channels are selected, an external calibrate reset will be applied to all.

- Show Data Points** Show/Hide Data Points:
This button is used to place or remove markers on the waveforms at the A-to-D converter sample points.
- Stop** Start/Stop:
This button enables the Scope feature to acquire and display real-time data on the waveform and status panels.

Section 3: Configuration

This section covers the screens and features of the system configuration user interface.

3.1 New Configuration Wizard

This subsection describes how to create a DME system configuration using the wizard tool. This tool provides screens to prompt for the required information in a convenient sequence. It also performs some automatic configuration assistance based on entries made during the wizard session.



Note: Once the wizard session is closed, all automatic configuration features are turned off. The Edit button must then be used to modify the DME configuration manually.

- **New Button**
This button is used to add a new DME station (see Section [2.2.2](#)). It opens the configuration wizard to the New Station Details page.

3.1.1 New Station Details Window

When the **New** button is pressed the New Station Details window is displayed. This window is used to input the parameters required to create a new configuration file. The required fields have a red asterisk next to the title.

New Station Details

Station ID*:
Station Name*:
Total Analog Channels*:
Total Digital Channels*:
Line Frequency: 60Hz ▾
Sample Rate(Transient): 1200 ▾
Sample Rate(Long Term): 1200 ▾
Global Export Rate: 60 ▾
Recording Device Id*: USI_M9000
Prefault Time(ms)*: 100
Postfault Time(ms)*: 100
Long Term Prefault Time(sec)*: 40
Long Term Postfault Time(sec)*: 40
Trigger Limit(ms)*: 10000
Chatter Limit for Triggers*: 20
Chatter Rate for Triggers*: 2.0
Ps: S ▾
PMU id*:
PMU Port*: 4712
PMU UDP Port*: 4713
PMU Stream Type: tcp ▾
PMU Phasor Mode: Rectangular ▾
PMU Data Rate: 60 ▾
PMU Status: Disable ▾

Figure 3-1 New Station Details Window

- **Station ID***
 This value is a unique DME system remote identification number. Typically, the first DME system is **Station ID# 1**; the second is **#2**, etc. However, this entry is restricted to a number previously unassigned and from one to four digits in length.
- **Station Name***
 This field is used to enter the alpha-numeric station name. The name is limited to 64 characters.
- **Total Analog Channels***
 This field is used to enter the number of analog input channels for the new system. Analog channels are available in multiples of eight.
- **Total Digital Channels***
 This field is used to enter the number of digital input channels for the new system. Digital channels are available in multiples of 32.



Note: The Model 9000 DME system has a distributed architecture. Analog and Digital channel counts entered above are the summation of all physical locations.

- Line Frequency**
 This drop-down menu is used to select the fundamental frequency of the power system. This selection will affect the choices for sample rates, export rate, and [PMU](#) data rate.

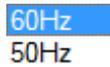


Figure 3-2 Line Frequency Drop-down Menu

- Sample Rate (Transient)**
 This drop-down menu is used to select the sample rate of the analog to digital converters. The list displayed is determined by the Line Frequency selection.

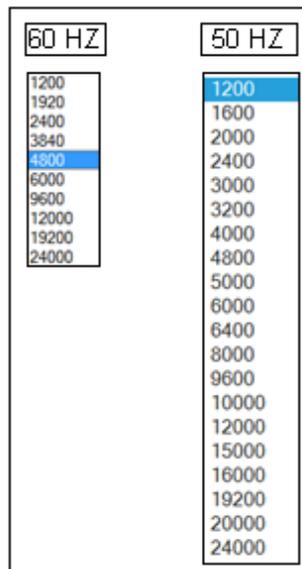


Figure 3-3 Transient Sample Rate Drop-down Menu

- Sample Rate (Long Term)**
 This drop-down menu is used to select the sample rate for the stored Long Term recordings. This selection also determines the export rate for continuous recorded analog data (see Section 3.1.2). The list displayed is determined by the Line Frequency selection.

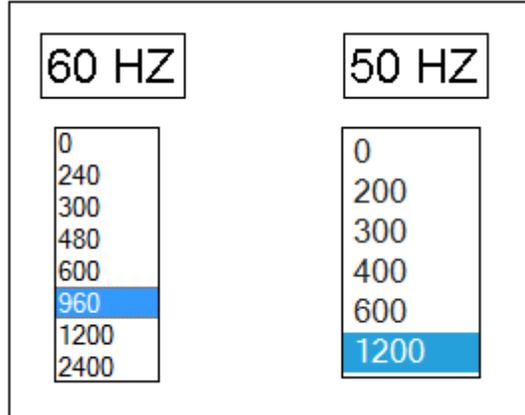


Figure 3-4 Long Term Sample Rate Drop-down Menu

- **Global Export Rate**

This drop-down menu is used to select the export rate for continuous recorded measurements (see Section 3.1.4). The list displayed is determined by the Line Frequency selection.

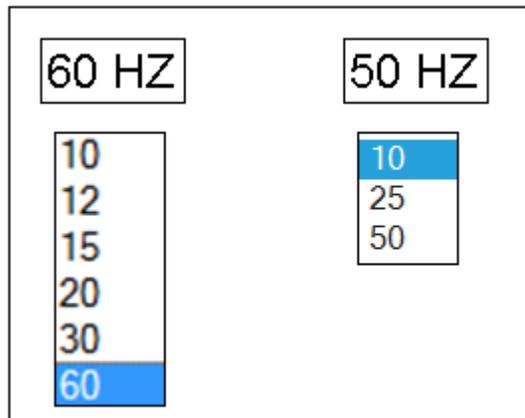


Figure 3-5 Global Export Rate Drop-down Menu

- **Recording Device ID***

COMNAMES is the naming standard used for all COMTRADE formatted data files. This field is used to assign the text which will be inserted into the **Device Identifier** field of the data file name.

This is a variable length field containing alpha-numeric characters and punctuation marks. Characters disallowed are: comma, question mark, quotation mark, forward slash, backward slash, less than, greater than, asterisk, pipe, and colon. The default entry automatically assigned to this field is **USI_M9000**.

- **Prefault Time (ms)***

This setting determines the period of prefault data that the DFR will record prior to the trigger event. This entry is in milliseconds. Transient record Pre-Fault can be set to a maximum of 10000. The default entry automatically assigned to this field is 100.

- Postfault Time (ms)***
 This setting determines the period of Post-Fault data that the DFR will record after the trigger event clears, or after the Fault Limit period has elapsed. This entry is in milliseconds. Transient record Post-Fault can be set to a maximum of 10000. The default entry automatically assigned to this field is 100.
- Long Term Prefault Time (sec)***
 This setting determines the period of prefault data that the DDR will record prior to the trigger event. This entry is in seconds.
- Long Term Postfault Time (sec)***
 This setting determines the period of Post-Fault data that the DFR will record after the trigger event clears, or after the Fault Limit period has elapsed. This entry is in seconds.



Note: The sum of Long Term Prefault and Long Term Postfault time is limited to 300 seconds. The total length of a Long Term (DDR) record is equal to (*Pre-Fault period*) + (*Post-Fault period*).

- Trigger Limit (ms)***
 This setting determines the time limit of any record. Transient Fault-Limit may be set for any value up to a maximum of 10000. This entry is in milliseconds.



Note: The total length of a fault record is equal to (*Pre-Fault period*) + (*Fault period*) + (*Post-Fault period*). If an analog or digital trigger should re-occur during the *Post-Fault period*, the fault record will be extended to contain the entire event in a single COMTRADE data file.

If a repeat fault occurs after the Post-fault + Pre-fault time period of the initial fault, it is recorded in a separate data file. If a repeat fault occurs before the Postfault + Prefault time period of the initial fault, the initial data file is extended.

The maximum length of a **Fault Record** in a re-trigger situation is 10 seconds.

- Trigger Chatter Filter**
 The filter employed uses two parameters to determine when a trigger should be automatically disabled—total triggers and trigger repetition rate. The filter can be customized for each analog and digital trigger.

The Chatter Limit parameter is a value which determines when a trigger will be disabled. The Chatter Rate parameter is a value which determines an acceptable number of triggers per second. The value for these two entries can be a whole or decimal number. These values can be modified for each discrete analog and digital trigger on the Measurements and Events pages (see [Sections 3.1.4](#) and [3.1.5](#)).

The filter works by accumulating the number of triggers that have occurred and then reducing this value by the Chatter Rate parameter each second. If the volume of triggers reaches the set Chatter

Limit, the trigger is disabled. The trigger is automatically re-enabled when the calculated value reaches zero.

- Chatter Limit for Triggers:*
This field is used to configure the default chatter limit. The default value is 20.
- Chatter Rate for Triggers:*
This field is used to configure the chatter rate limit. The default value is 2.0.



Note: For example: using the default values (20) for Chatter Limit and (2) for Chatter Rate and assuming a chattering trigger occurring at a rate of four per second, the trigger would be disabled after 10 seconds.

- **P/S**
This drop-down menu is used to select the level of the values entered into the configuration file as Pprimary or Ssecondary.



Figure 3-6 P/S Drop-down Menu

- **PMU ID***
This is a unique numeric value from one (1) to **65533** used to identify this PMU.
- **PMU Port***
This field is used to configure the port number used for TCP communications. The default port number is **4712**.
- **PMU UDP Port***
This field is used to configure the port number used for UDP communications. The default port number is **4713**.
- **PMU Stream Type**
This drop-down menu is used to select the protocol used for [PMU](#) data output streams, Transmission Control Protocol (TCP) or User Datagram Protocol (UDP).



Figure 3-7 PMU Stream Type Drop-down Menu

- **PMU Phasor Mode**
This drop-down menu is used to select the mode used for [PMU](#) data output streams, Rectangular or Polar. Rectangular mode streams phasor estimates as X and Y coordinates where X is the real value and Y is the imaginary value. Polar mode streams phasor estimates as a magnitude and angle.

Rectangular
Polar

Figure 3-8 PMU Phasor Mode Drop-down Menu

- **PMU Data Rate**
This drop-down menu is used to select the rate for the [PMU](#) data stream. The list displayed is determined by the Line Frequency selection.

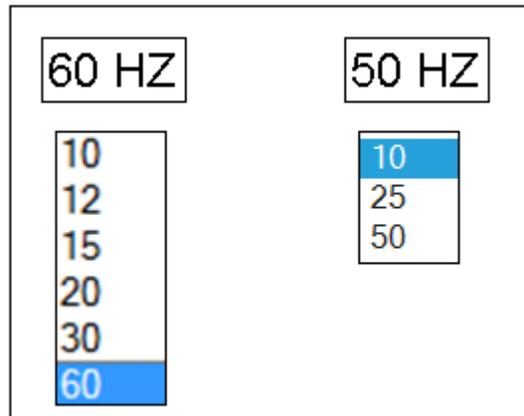


Figure 3-9 PMU Data Rate Drop-down Menu

- **PMU Status**
This drop-down menu is used to enable or disable the [PMU](#) feature.

Disable
Enable

Figure 3-10 PMU Phasor Mode Drop-down Menu

- **Back Button**
This button returns the display to the Home screen (Figure [2-2](#)).
- **Create Button**
This button creates a preview of the new configuration.

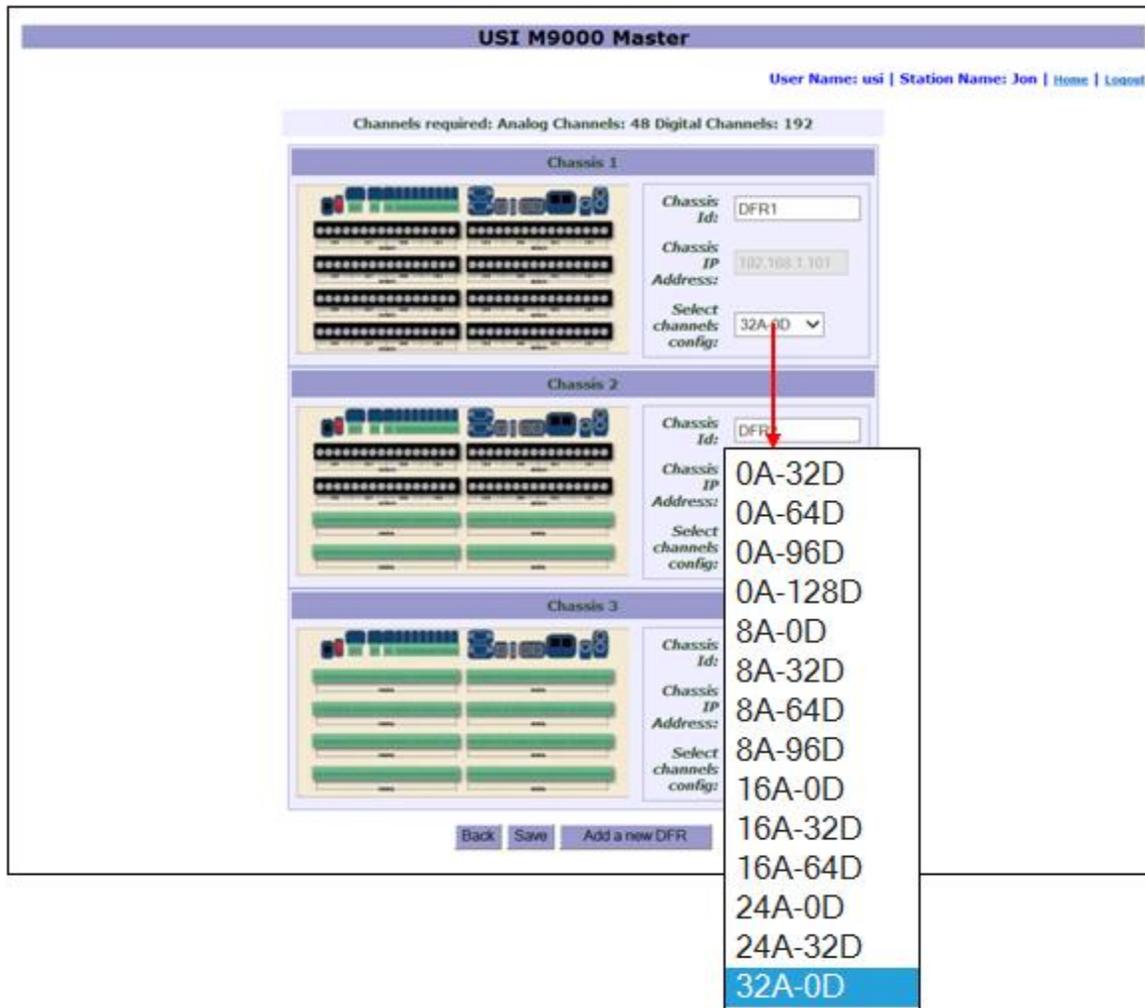


Figure 3-11 New Configuration Preview

A basic configuration for the DME system is automatically initiated based on the analog and digital inputs entered on the New Station Details screen ([Figure 3-1](#)). The chassis diagrams displayed show how the analog and digital inputs were distributed among the chassis. The example above displays a 48 analog channels and 192 digital channels DME system.

The M9000 DME system has a distributed architecture; its chassis may be physically located in several locations. To accommodate this type of installation, chassis configurations may need to be modified and additional chassis added using the following controls:

- Chassis ID:
This field displays the name assigned to each chassis. The default names are: DFR1 for chassis one, DFR 2 for chassis two, etc.
- Chassis IP Address:
This field displays the IP address assigned to this chassis on the DME network.



Note:

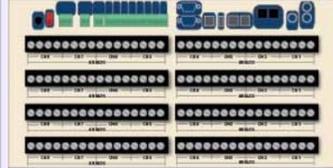
The DME network contains only the DME system chassis. This network is not used for remote access to the USI M9000 Master. There is a separate network connection for this purpose (Section 1.3).

- **Select Channels Config:**
This drop-down menu displays the combinations of analog and digital inputs which can be selected for each chassis. This menu is used to tailor each chassis to its physical location.
- **Back Button:**
This button returns the display to the New Station Details page.
- **Add a new DFR Button:**
This button adds a new chassis to the DME system configuration. Chassis ID and Chassis IP address are automatically assigned. The channel configuration is manually selected.
- **Save Button:**
This button saves and displays the chassis assignment portion of the DME system configuration (Figure 3-12).

USI M9000 Master

User Name: usi | Station Name: Jon | [Home](#) | [Logout](#)

Chassis



Id: DFR1

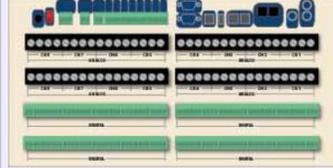
IPAddress: 192.168.1.101

Channels: 32A-0D

Analogs: [1 - 32]

Digitals: [Nil]

Chassis



Id: DFR2

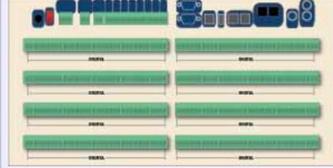
IPAddress: 192.168.1.102

Channels: 16A-64D

Analogs: [33 - 48]

Digitals: [1 - 64]

Chassis



Id: DFR3

IPAddress: 192.168.1.103

Channels: 0A-128D

Analogs : [Nil]

Digitals: [65 - 192]

Figure 3-12 Saved Chassis Configuration

- **Back** Button
This button returns the display to the New Configuration Preview page.
- **Configure** Button
This button saves the chassis portion of the DME configuration and displays the Analog Channels Configuration page (see Section 3.1.2).
- **Finish** Button
This button is used to finish the configuration wizard session. It saves the configuration to a file and returns the display to the Home screen (Figure [2-2](#)).

3.1.2 Analog Channels Configuration

This page is used to assign the parameters for each analog input channel. For reference, the channels are automatically grouped and labeled by chassis (e.g. DFR1, DFR2, etc.).

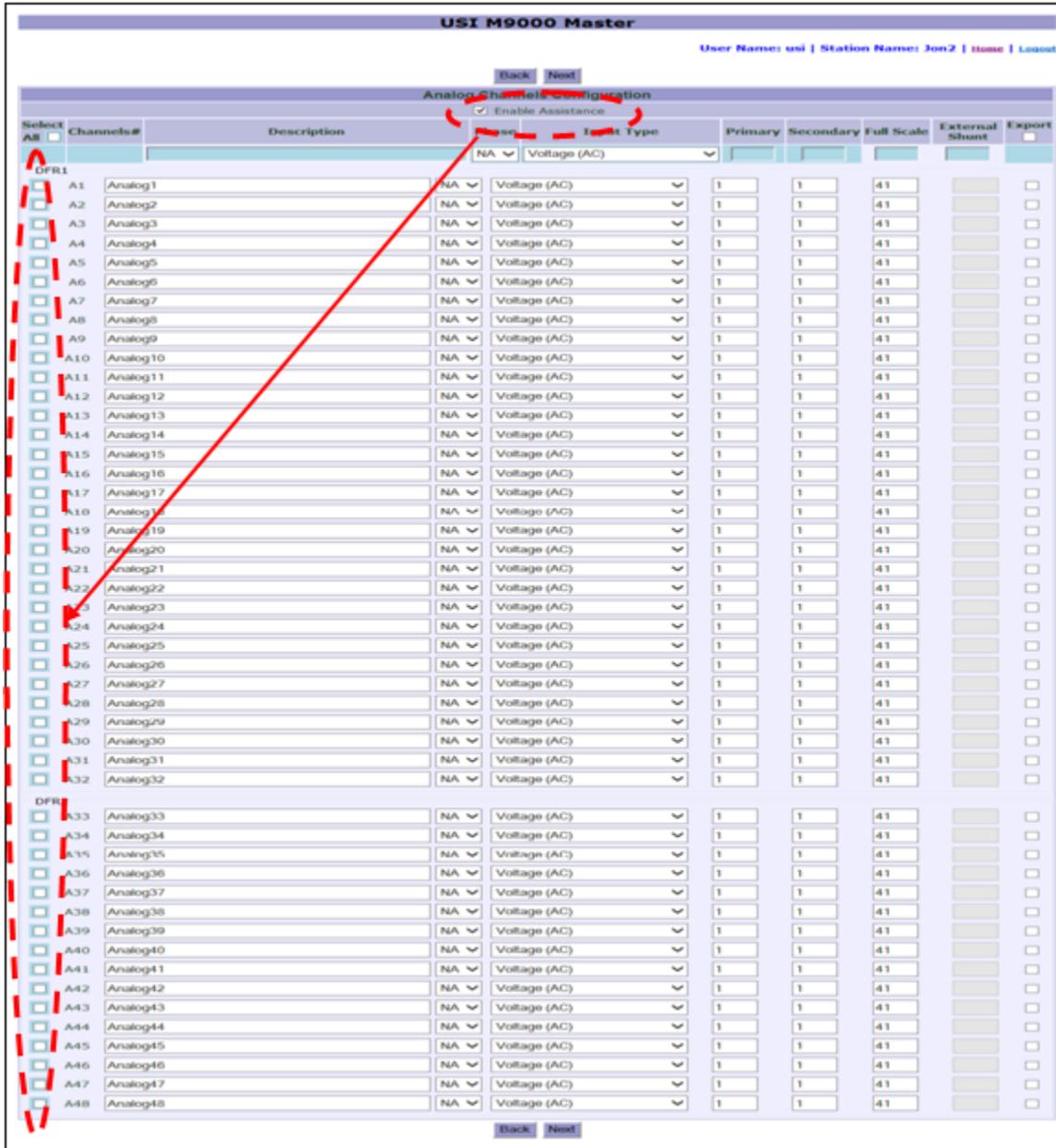


Figure 3-13 Configuration File – Analogs Page

- **Enable Assistance**

This checkbox is used to enable (☑) the Edit Assistance bar and **Select** column. This feature is used to modify multiple analog channels simultaneously. Use the check boxes in the **Select** column to choose the channels to be modified. Uncheck this box (•) to disable the feature.

- **Select Column**

The checkboxes (☑) in this column are used to select individual analog channels to be modified simultaneously using the Edit Assistance bar.

- **All**
Checking this box (All) will select all the analog input channels to be modified simultaneously using the Edit Assistance bar.
- **Channels#**
This column displays the analog channel number for each physical input.
- **Description**
This column displays the alpha-numeric description entered for each analog input. The description is limited to 64 characters.
- **Phase**
This column is used to select the input phase being monitored from the input source. This information will be used by the wizard tool to automatically assign these channels to a Line Group (see Section 3.1.3).

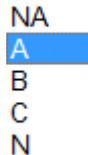


Figure 3-14 Phase Drop-down Menu

- NA:
This selection indicates Not Applicable.
 - A:
This selection indicates that the analog input being monitored is phase A of the power system.
 - B:
This selection indicates that the analog input being monitored is phase B of the power system.
 - C:
This selection indicates that the analog input being monitored is phase C of the power system.
 - N:
This selection indicates that the analog input is the neutral phase of the monitored circuit.
- **Input Type**
This drop-down menu is used to select the channel type for each analog input. This information will be used by the wizard tool to automatically assign these channels to a Line Group (see Section 3.1.3).

Voltage (AC)
 Current (AC-Internal Shunt)
 Current (AC-External Shunt)
 Voltage (DC)
 Current (DC-Internal Shunt)
 Current (DC-External Shunt)

Figure 3-15 Input Type Drop-down Menu

- Voltage (AC):
This selection indicates that the analog input is monitoring an AC voltage signal.
 - Current (AC-Internal Shunt):
This selection indicates that the analog input is monitoring an AC current signal measured by an internal current shunt.
 - Current (AC-External Shunt):
This selection indicates that the analog input is monitoring an AC current signal by measuring the voltage output of an external current shunt or an auxiliary current transformer device.
 - Voltage (DC):
This selection indicates that the analog input is monitoring a DC voltage signal.
 - Current (DC-Internal Shunt):
This selection indicates that the analog input is monitoring a DC current signal measured by an internal current shunt.
 - Current (DC-External Shunt):
This selection indicates that the analog input is monitoring a DC current signal by measuring the voltage output of a current shunt.
- **Primary**
This column is used to enter the number of turns on the primary of the measurement transformer.
 - **Secondary**
This column is used to enter the number of turns on the secondary of the measurement transformer.
 - **Full Scale**
This column displays the worst-case input level expected to be applied to the analog input terminals.



Note: Care should be taken when selecting full scale levels. Setting this value too low will result in clipping when the input signal exceeds this level; conversely, setting this value too high will result in reduced accuracy of low level readings.

- External Shunt**
 This column displays the value, in milliohms, of the external shunt resistor or the equivalent shunt value of an auxiliary current transformer device. The system uses these stored resistance values to convert sensed voltages to their equivalent line currents ($R = E / I$).
- Export**
 The checkboxes in this column are used to select the channels to be exported to Continuous Recorder data. Checking the box in the header of this column will select all the analog input channels.
- Back Button**
 This button returns the display to the New Station Details page.
- Next Button**
 This button advances the display to the Manage Line Groups page.

3.1.3 Line Groups Configuration

This page is used to categorize analog channels into groups (e.g. transmission lines, transformer taps, etc.). The wizard tool automatically initiates these groups using the following parameters as previously entered in the Analog Channels Configuration:

- Inputs contained within each individual chassis
- Descriptions
- Input Types (Volts or Amperes)
- Input Phase (A, B, C, or N)

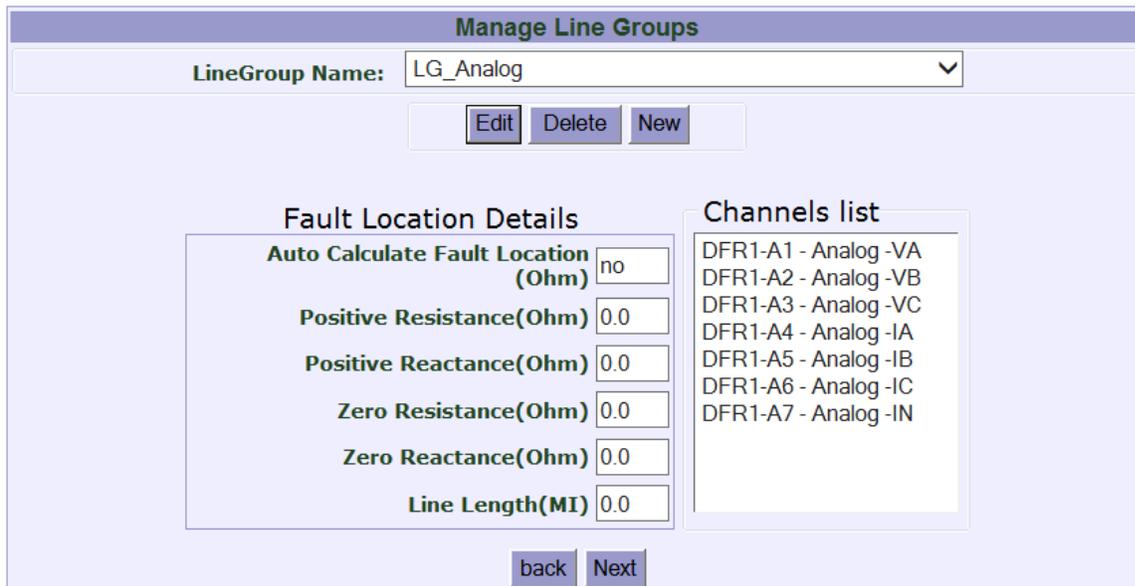


Figure 3-16 Manage Line Groups Page

- **Line Group Name**
This drop-down list displays the Line Groups automatically initiated by the wizard tool. Selecting a group from this list will display the channels assigned to the group.

- **Fault Location Details**
These following fields are disabled at this step in the wizard tool. They will be enabled for entries when the wizard steps to the Fault Location page (see Section 3.1.6).
 - Auto Calculate Fault Location:
 - Positive Resistance (Ohm):
 - Positive Reactance (Ohm):
 - Zero Resistance (Ohm):
 - Zero Reactance (Ohm):

- **Channels List**
This field displays the analog channels assigned to the selected group. The convention used to describe each channel is: Chassis ID, Channel #, Description, and Phase.

- **Edit Button**
This button displays the edit line group tool below. This is used to revise the Channels List for groups initiated by the wizard.

Figure 3-17 Configuration File – Edit Line Group

- Selected Channels:
This window displays the channels assigned by the wizard to the selected group.
- Available Channels:
This window displays a list of channels available to be manually assigned to the selected group.
 -  Button
This button is used to move selections from the Available Channels window to the Selected Channels window.
 -  Button
This button is used to move selections from the Selected Channels window to the Available Channels window.
-  Button:
This button discards changes made and returns the display to the previous screen.
-  Button:
This button stores changes made and returns the display to the previous screen.

- **Delete Button**

This button displays the message window below and is used to delete a Line Group.

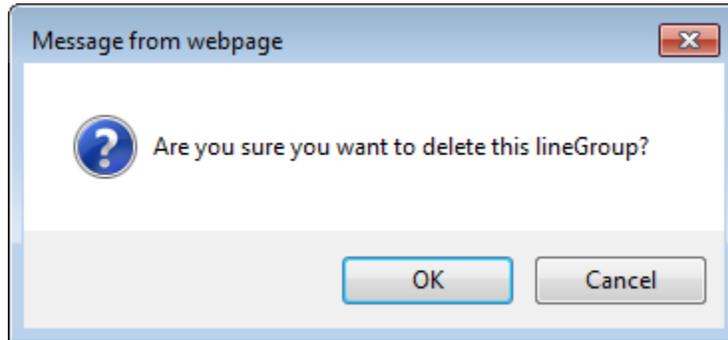


Figure 3-18 Delete Line Group Message Window

- **OK Button**
This button acknowledges the message and deletes the selected Line Group.
- **Cancel Button**
This button cancels the Delete function.
- **New Button**
This button is disabled at this step in the wizard tool. It will be enabled when the wizard steps to the Fault Location page (see Section [3.1.6](#)).
- **Back Button**
This button returns the display to the Analog Channels Configuration page.
- **Next Button**
This button advances the display to the Measurements Configuration page.

3.1.4 Measurements Configuration

This page is used to assign measurements to Analog Channels and Line Groups. These measurements can then be configured to trigger the DME system, to be exported to Continuous Recording, or to be streamed out as PMU data.

All algorithms are calculated using the full transient sample rate data.

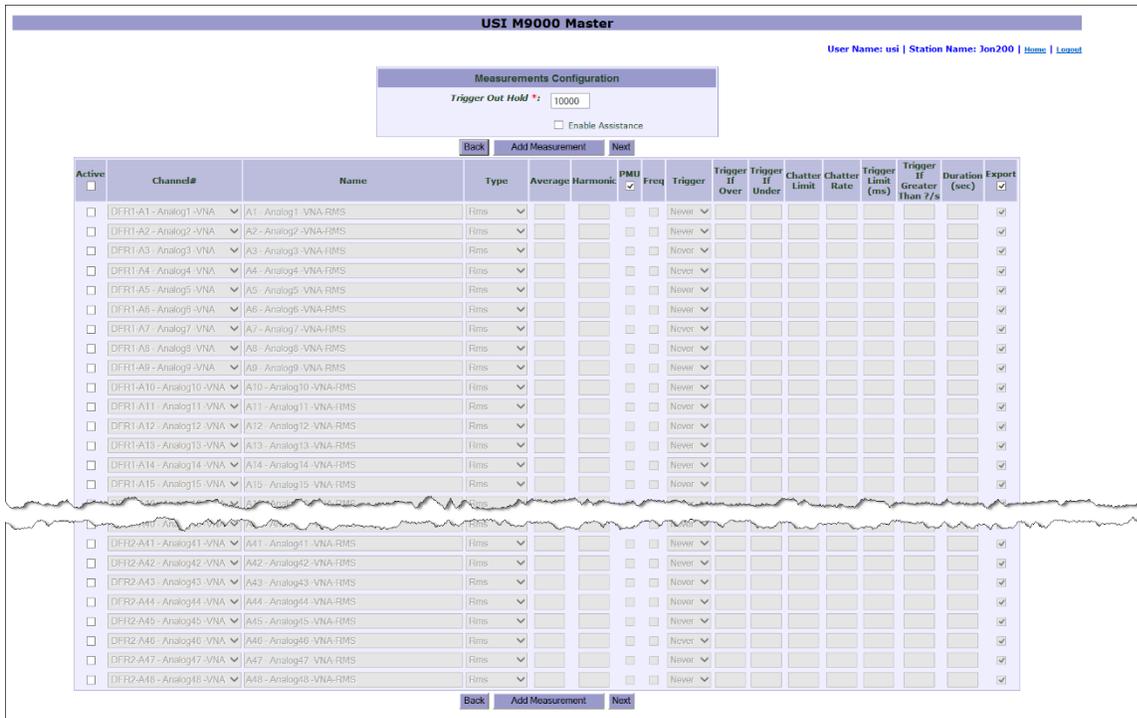


Figure 3-19 Measurements Configuration Page (Preview)

By default, the configuration wizard assigns an RMS measurement to all analog channels. However, these assignments are not confirmed until they are made active. Once the measurements are made active, each is given an ID number. After the new configuration is saved, an ID column displays these numbers.

- Trigger Out Hold ***
 This field is used to enter the period of time the Trigger output contact will be held in an alarm state (see Section 1.2 – Alarm 2). The number entered is in milliseconds.
- Enable Assistance**
 This checkbox is used to enable () the Edit Assistance bar and **Select** column. This feature is used to modify multiple analog channels simultaneously. Use the check boxes in the **Select** column to choose the channels to be modified. Uncheck this box (·) to disable the feature.
- Active**
 The checkboxes in this column are used to activate () or deactivate (·) the selected measurement. Selecting the checkbox in the column header activates or deactivates all measurements.

 **Note:** After the wizard process has been completed and the configuration saved, the checkboxes in the Active column are used to enable or disable an active measurement while preserving its properties.

USI M9000 Master

User Name: usi | Station Name: Jon200 | Home | Logout

Measurements Configuration

Trigger Out Hold #:

Enable Assistance

Active	Channel#	Name	Type	Average	Harmonic	PMU	Freq	Trigger	Trigger If Over	Trigger If Under	Chatter Limit	Chatter Rate	Trigger Limit (ms)	Trigger If Greater Than 2/s	Duration (sec)	Export
<input checked="" type="checkbox"/>	DFR1-A1 - Analog1 -VNA	A1 - Analog1 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A2 - Analog2 -VNA	A2 - Analog2 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A3 - Analog3 -VNA	A3 - Analog3 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A4 - Analog4 -VNA	A4 - Analog4 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A5 - Analog5 -VNA	A5 - Analog5 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A6 - Analog6 -VNA	A6 - Analog6 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A7 - Analog7 -VNA	A7 - Analog7 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A8 - Analog8 -VNA	A8 - Analog8 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A9 - Analog9 -VNA	A9 - Analog9 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR1-A10 - Analog10 -VNA	A10 - Analog10 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A11 - Analog11 -VNA	A11 - Analog11 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A12 - Analog12 -VNA	A12 - Analog12 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A13 - Analog13 -VNA	A13 - Analog13 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A14 - Analog14 -VNA	A14 - Analog14 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR1-A15 - Analog15 -VNA	A15 - Analog15 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR2-A41 - Analog41 -VNA	A41 - Analog41 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR2-A42 - Analog42 -VNA	A42 - Analog42 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR2-A43 - Analog43 -VNA	A43 - Analog43 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR2-A44 - Analog44 -VNA	A44 - Analog44 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR2-A45 - Analog45 -VNA	A45 - Analog45 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input type="checkbox"/>	DFR2-A46 - Analog46 -VNA	A46 - Analog46 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR2-A47 - Analog47 -VNA	A47 - Analog47 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DFR2-A48 - Analog48 -VNA	A48 - Analog48 -VNA-RMS	Rms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never							<input checked="" type="checkbox"/>

Figure 3-20 Measurements Configuration Page (Selected)

- Channel #**
 This column provides drop-down menus used to select an analog channel or line group to assign a measurement. The selected channel or group description is then displayed.



Note: Selection of analog channel or line group determines the measurement type selections (see **Type**, below).

- DFR2-A1 - Analog1 -VA
- DFR2-A2 - Analog2 -VB
- DFR2-A3 - Analog3 -VC
- DFR2-A4 - Analog4 -VN
- DFR2-A5 - Analog5 -VA
- DFR2-A6 - Analog6 -VB
- DFR2-A7 - Analog7 -VC
- DFR2-A8 - Analog8 -VN
- DFR2-A9 - Analog9 -VNA
- DFR2-A10 - Analog10 -VNA
- DFR2-A11 - Analog11 -VNA
- DFR2-A12 - Analog12 -VNA
- DFR2-A13 - Analog13 -VNA
- DFR2-A14 - Analog14 -VNA
- DFR2-A15 - Analog15 -VNA
- DFR2-A16 - Analog16 -VNA
- DFR2-A17 - Analog17 -VNA
- DFR2-A18 - Analog18 -VNA
- DFR2-A19 - Analog19 -VNA
- DFR2-A20 - Analog20 -VNA
- DFR2-A21 - Analog21 -VNA
- DFR2-A22 - Analog22 -VNA
- DFR2-A23 - Analog23 -VNA
- DFR2-A24 - Analog24 -VNA
- DFR2-A25 - Analog25 -VNA
- DFR2-A26 - Analog26 -VNA
- DFR2-A27 - Analog27 -VNA
- DFR2-A28 - Analog28 -VNA
- DFR2-A29 - Analog29 -VNA
- DFR2-A30 - Analog30 -VNA

Figure 3-21 Channel# Drop-down Menu

- **Name**
This column is used to enter the alpha-numeric description for each measurement and is limited to 64 characters.

The Model 9000 DME system does not limit the number of measurements that can be assigned to a single analog channel. This capability allows the user to apply multiple measurement algorithms to an analog channel or group.

For convenience, the wizard automatically generates a default Measurement Name. The default name is the Analog Channel description with the measurement type appended (see **Type** below). The default name can be modified manually.

 **Note:** Since multiple measurements can be assigned to a single analog channel, adding the measurement type to the measurement name helps differentiate between them during analysis.

- **Type**
This column provides drop-down menus used to assign a measurement type to the analog input or group. The list displayed is dependent on the **Channel #** selection. If a discreet analog channel is selected, the Channel Type list displays; if a Line Group is selected, the Group Type list displays (see Figure 3-22).

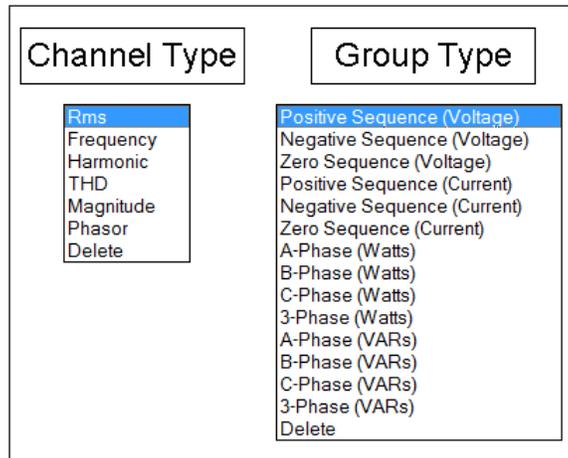


Figure 3-22 Measurement Type Drop-down Menu

- Channel Type List:
These measurements are displayed when a discreet analog channel is selected.
 - **RMS**
This selection assigns the RMS algorithm to the selected analog channel.

- Frequency
This selection assigns the Frequency algorithm to the selected analog channel.
- Harmonic
This selection assigns the Harmonic algorithm to the selected analog channel. The specific harmonic to be calculated is entered in the **Harmonic** column.
- THD
This selection assigns the Total Harmonic Distortion (THD) algorithm to the selected analog channel.
- Magnitude
This selection assigns the Magnitude algorithm to the selected analog channel. This algorithm calculates the magnitude of the pure fundamental signal. This value does not include any energy from harmonic distortion.
- Phasor
This selection assigns the Phasor algorithm to the selected analog channel.
- Delete
This selection completely removes the measurement.



Caution: Delete permanently removes all properties of the selected measurement.

- Group Type List:
These measurements are displayed when a Line Group is selected. The list below displays all group measurement types. The specific group selected may have a reduced list of choices based on the available channels and channel types within the group.
 - Positive Sequence (Voltage)
This selection assigns the Positive Sequence algorithm to the three-phase voltage channels in the selected group.
 - Negative Sequence (Voltage)
This selection assigns the Negative Sequence algorithm to the three-phase voltage channels in the selected group.
 - Zero Sequence (Voltage)
This selection assigns the Zero Sequence algorithm to the three-phase voltage channels in the selected group.
 - Positive Sequence (Current)
This selection assigns the Positive Sequence algorithm to the three-phase current channels in the selected group.

- **Negative Sequence (Current)**
This selection assigns the Negative Sequence algorithm to the three-phase current channels in the selected group.
- **Zero Sequence (Current)**
This selection assigns the Zero Sequence algorithm to the three-phase current channels in the selected group.
- **A-Phase (Watts)**
This selection assigns the single-phase real power algorithm to the A-Phase voltage and current channels in the selected group.
- **B-Phase (Watts)**
This selection assigns the single-phase real power algorithm to the B-Phase voltage and current channels in the selected group.
- **C-Phase (Watts)**
This selection assigns the single-phase real power algorithm to the C-Phase voltage and current channels in the selected group.
- **3-Phase (Watts)**
This selection assigns the three-phase real power algorithm to the A, B, and C-Phase voltage and current channels in the selected group.
- **A-Phase (VARs)**
This selection assigns the single-phase reactive power algorithm to the A-Phase voltage and current channels in the selected group.
- **B-Phase (VARs)**
This selection assigns the single-phase reactive power algorithm to the B-Phase voltage and current channels in the selected group.
- **C-Phase (VARs)**
This selection assigns the single-phase reactive power algorithm to the C-Phase voltage and current channels in the selected group.
- **3-Phase (VARs)**
This selection assigns the three-phase reactive power algorithm to the A, B, and C-Phase voltage and current channels in the selected group.
- **Delete**
This selection completely removes the measurement.



Caution: Delete permanently removes all properties of the selected measurement.

- **Average**

This column is used to enter the number of measurement values to be averaged together.

All M9000 algorithms have a data processing window of one power line cycle and a step size of one power line cycle. This results in one calculated value for every power line cycle.

Average calculates a rolling average of the specified number of values. The numbers entered in this column determine the window size in power line cycles for each average. The step size is always one power line cycle.

The output values from the **Average** algorithm can be exported to Continuous Recording, can be used to trigger the DME system, or can be streamed out as PMU data.

- **Harmonic**

This column is used only when the Harmonic measurement type is selected. It is used to enter the number of the harmonic for measurement (e.g. 2 or 3 or 10 for the second, third or tenth harmonic). The magnitude of this harmonic can be exported to Continuous Recording. It can also be used to trigger the DME system or streamed out as PMU data.

- **PMU**

The checkboxes () in this column are used to select measurements to be streamed out as PMU data in the IEEE C37.118 format. A PMU device must have a minimum of one **Phasor** measurement selected in this column. Other measurements selected in this column will be streamed out as an analog value in the PMU data stream.

- **Freq**

The checkboxes () in this column are used to select the frequency measurement to be used as the frequency reference for the PMU data stream. Only one frequency measurement can be selected in this column.



Note: If additional frequency values are desired, they can be selected in the PMU column to be streamed out as an analog value in the PMU data stream.

- **Trigger**

This column provides the drop-down menu to select a trigger mode for the measurement.

Disabled
 NormalToAbnormal
 AbnormalToNormal
 Either

Figure 3-23 Trigger Drop-down Menu

- Disabled:
 This selection inhibits the DFR trigger function. This is selected when the measurement is only being exported to Continuous data or output in the PMU data stream.

- Normal To Abnormal:
This selection enables the DFR trigger function to operate on a normal to abnormal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.
- Abnormal to Normal:
This selection enables the DFR trigger function to operate on an abnormal to normal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.
- Either:
This selection enables the DFR trigger function to operate on either a normal to abnormal transition or an abnormal to normal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.
- **Trigger If Over**
This column is used to enter the upper limits of the DFR trigger function for each measurement. If the measurement value is greater than this setting, a DFR and DDR record will initiate.
- **Trigger If Under**
This column is used to enter the upper limits of the DFR trigger function for each measurement. If the measurement value is less than this setting, a DFR and DDR record will initiate.
- **Trigger Chatter Filter**
The filter employed uses two parameters to determine when a trigger should be automatically disabled—total triggers and trigger repetition rate. The filter can be customized for each analog and digital trigger.

The Chatter Limit parameter is a value which determines when a trigger will be disabled. The Chatter Rate parameter is a value which determines an acceptable number of triggers per second. The values for these two entries can be whole or decimal numbers.

The filter accumulates the number of triggers that have occurred and then, once per second, reduces this value by the Chatter Rate parameter. If the accumulation of triggers reaches the Chatter Limit, the trigger is disabled. The trigger is automatically re-enabled when the accumulation of triggers returns to zero.

- **Chatter Limit**
This field is used to configure the chatter limit. The default value is 20.
- **Chatter Rate**
This field is used to configure the chatter rate limit. The default value is 2.0.



Note: For example: using the default values (20 for Chatter Limit and 2 for Chatter Rate) and assuming a trigger chattering at a rate of four per second, the trigger would be disabled after 10 seconds.

- Trigger Limit (ms)**
 This column is used to modify the time limit for each trigger operation. This setting is in milliseconds. Transient Fault-Limit may be set for any value up to a maximum of 10000. Each trigger can have a different trigger limit.
- Trigger If Greater Than ?/s**
 This column is used to enable a rate-of-change trigger. The trigger starts the fault recording process when the measured value exceeds this set limit. The default value is **0** (zero) which disables rate-of-change triggering.

Example:

Analog channel type is **Vac**

The trigger type is **RMS**

The *Trip If Greater Than ?/s* is **1.000**

Recording will begin if the RMS voltage rate-of-change exceeds one Volt per second.



Note: The rate-of-change trigger does not have to exceed the limit for an entire second. The Duration setting defines the time period in milliseconds over which the rate of change must occur before a recording is triggered. This period can be as short as one millisecond.

- Duration**
 This field displays the time period which a trigger must remain continuously abnormal before it will initiate a recording. The default setting is 0.000 seconds which initiates a recording instantly. This setting is applicable to all trigger types but is most often used in conjunction with a frequency or power measurement for disturbance-type triggers.
- Export**
 The checkboxes () in this column are used to enable values from the measurements to be exported to Continuous Recorder data. Values in the Continuous Recorder data will be retained for 30 days and then overwritten in a first in/first out (FIFO) order.
- Back** Button
 This button returns the display to the Manage Line Groups page.
- Add Measurement** Button
 This button is used to add additional measurements. By default, the wizard tool assigns RMS measurements to all analog input channels. If additional analog channel or group measurements are desired (e.g. Frequency, Phasor, Harmonic, etc), use this button to add them.
- Next** Button
 This button advances the display to the Event Channels Configuration page.

3.1.5 Event Channels Configuration

This page is used to assign the parameters for each digital input channel. For reference, the channels are automatically grouped and labeled by chassis (e.g. DFR1, DFR2, etc.).

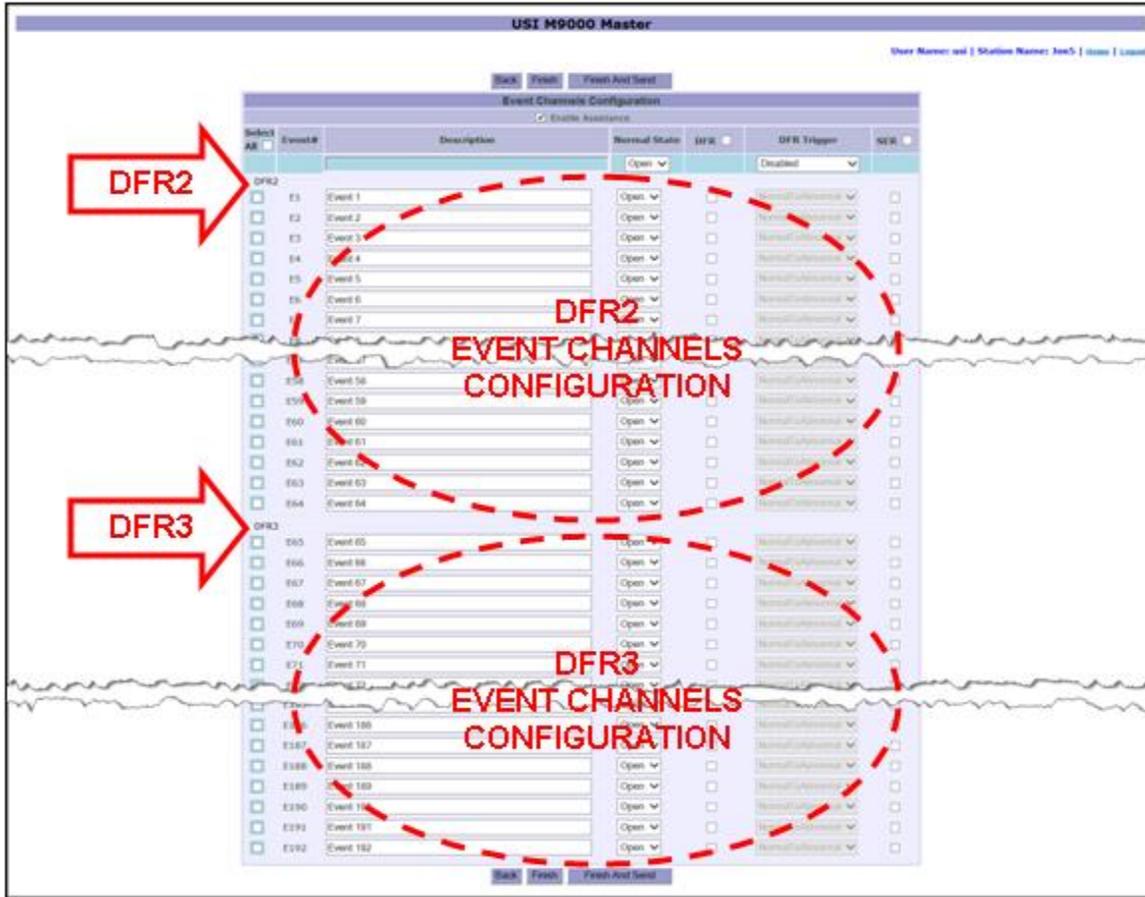


Figure 3-24 Event Channels Configuration Page

- **Enable Assistance**

This checkbox is used to enable () the Edit Assistance bar and **Select** column. This feature is used to modify multiple digital input channels simultaneously. Use the check boxes in the **Select** column to choose the channels to be modified. Uncheck this box () to disable the feature.

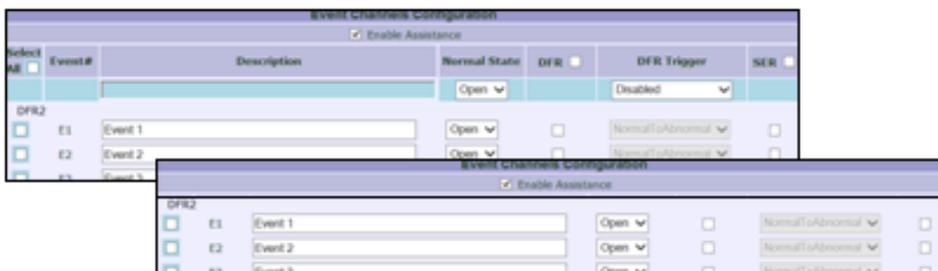


Figure 3-25 Assistance Bar - Enabled/Disabled

- **Select Column**

The checkboxes (☑) in this column are used to select digital channels for simultaneous modification using the Edit Assistance bar.

- All :

Check this box (All ☑) to select all the digital input channels to be modified simultaneously using the Edit Assistance bar.

- **Event#**

This column displays the digital channel number for each physical input.

- **Description**

This column displays the alpha-numeric description entered for each digital input. The description is limited to 64 characters.

- **Normal State**

This column provides the drop-down menu used to assign the normal state for the contact being monitored.

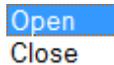


Figure 3-26 Normal State Drop-down Menu

- **DFR**

This checkbox is used to enable (☑) the selected digital channel as a DFR input. This configures the input to be recorded into DFR data files. Uncheck this box (•) to disable the feature.

- **DFR Trigger**

This column is active when the DFR feature is enabled for the selected input. It provides the drop-down menu to select a trigger mode for the digital input.

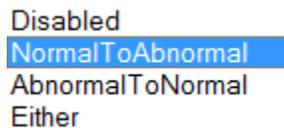


Figure 3-27 DFR Trigger Drop-down Menu

- Disabled:

This selection inhibits the DFR trigger function. It is selected when the measurement is being exported only to Continuous data or output in the PMU data stream.

- Normal To Abnormal:

This selection enables the DFR trigger function to operate on a normal-to-abnormal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.

- Abnormal to Normal:
This selection enables the DFR trigger function to operate on an abnormal-to-normal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.
- Either:
This selection enables the DFR trigger function to operate on either a normal-to-abnormal transition or an abnormal-to-normal transition. The normal and abnormal conditions are defined by the limits assigned in the **Trigger If Over** and **Trigger If Under** columns.
- **SER** ·
This checkbox is used to enable () the selected digital channel as an SER input. It configures the input to be recorded into SER data files. Uncheck this box () to disable the SER feature.

3.1.6 Manage Line Groups (Fault Location Details)

Entries on this page are used to assign transmission line parameters to each line group. These parameters are used by the DME system to calculate a fault location automatically.

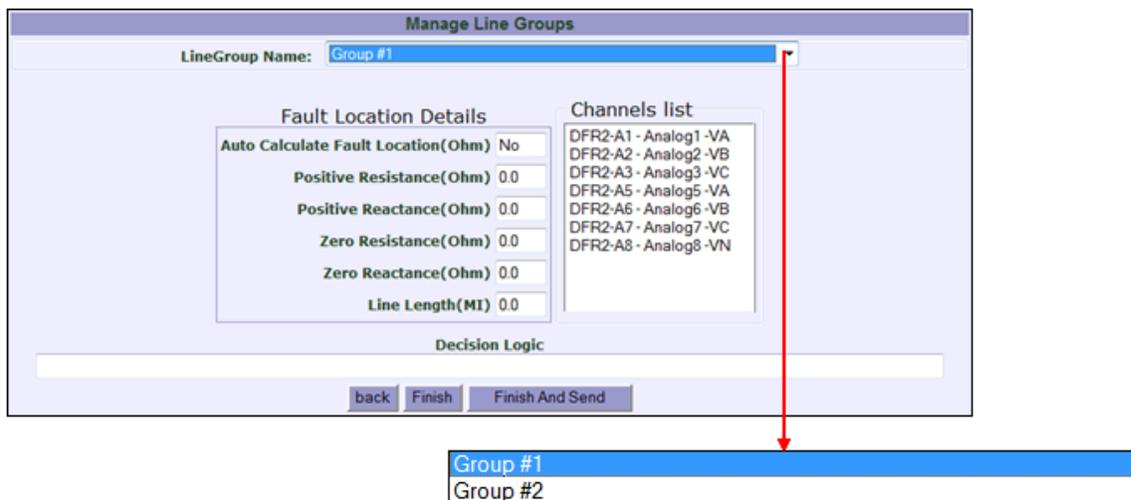


Figure 3-28 Configuration File – Fault Location Page

- **Line Group Name**
This drop-down list displays the line groups. Select a group from this list to edit or review.
- **Channels List**
This displays the analog channels assigned to the selected group.
- **Fault Location Details**
This displays the transmission line parameters to be used by the fault location feature.



Note: The Resistance, Reactance, and Line Length parameters entered should be overall Primary Values for the transmission line (i.e. not in per-unit).

- Auto Calculate Fault Location:
This drop-down menu is used to enable or disable fault location for the selected line group.
- Positive Resistance (Ohms):
This field is used to enter the positive sequence resistance value for the selected line.
- Positive Reactance (Ohms):
This field is used to enter the positive sequence reactance value for the selected line.
- Zero Resistance (Ohms):
This field is used to enter the zero sequence resistance value for the selected line.
- Zero Reactance (Ohms):
This field is used to enter the zero sequence reactance value for the selected line.
- Line Length (Mi):
This field is used to enter the line length value (in miles) for the selected line.

● **Decision Logic**

This field is used to create a Boolean equation of analog triggers and digital events. This equation determines whether a fault calculation is carried out, based on which triggers and events were abnormal during each DFR record. Left-click in this field to display the Decision Logic window.

If field is left empty, logic statement is interpreted as True.

Line group logic statements are limited to 200 characters. Spaces are legal characters and are ignored, but they count towards the 200 character limit.

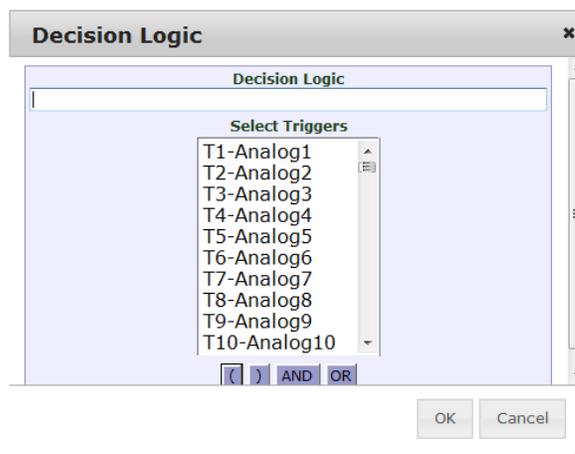


Figure 3-29 Configuration File – Fault Location Page – Decision Logic

○ Decision Logic Window:

This field displays the equation entered for the selected line group. The equation is constructed from the Select Triggers list using the operator buttons. Click on a trigger or event to enter it into the field.

▪ **Select Triggers**

This list displays all measurements with the trigger function enabled and all the digital inputs configured as DFR points. It is used to select inputs for the decision logic equation.

▪  **Button**

This button inserts an open parenthesis into the decision logic equation.

▪  **Button**

This button inserts a closed parenthesis into the decision logic equation.

▪  **Button**

This button inserts an AND operator into the decision logic equation.

▪  **Button**

This button inserts an OR operator into the decision logic equation.

▪  **Button:**

This button closes the Decision Logic window and displays the completed equation in the Decision Logic field.

▪  **Button:**

This button cancels entries made, closes the Decision Logic window and returns to the Manage Line Groups page.

●  **Back**

This button returns the display to the Event Channels Configuration page.

●  **Finish**

This button displays the message shown below. Click the  button to complete and save the new configuration. Click the  button to return to the wizard.

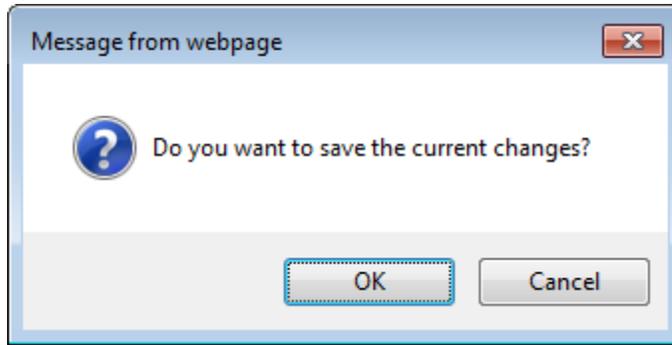


Figure 3-30 Finish Button Message window

- Finish And Send **Finish And Send**
 This button displays the message below.

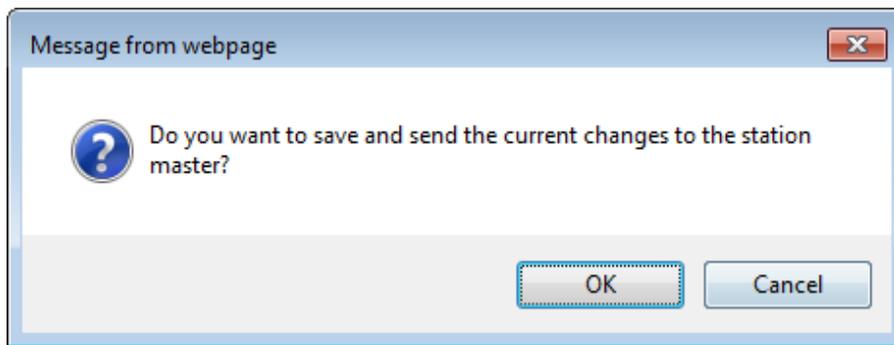


Figure 3-31 Finish And Send Message Window

Click the OK button to save and send the finished Configuration to the DME system. This returns to the Home page and displays the Configuration send successful message.

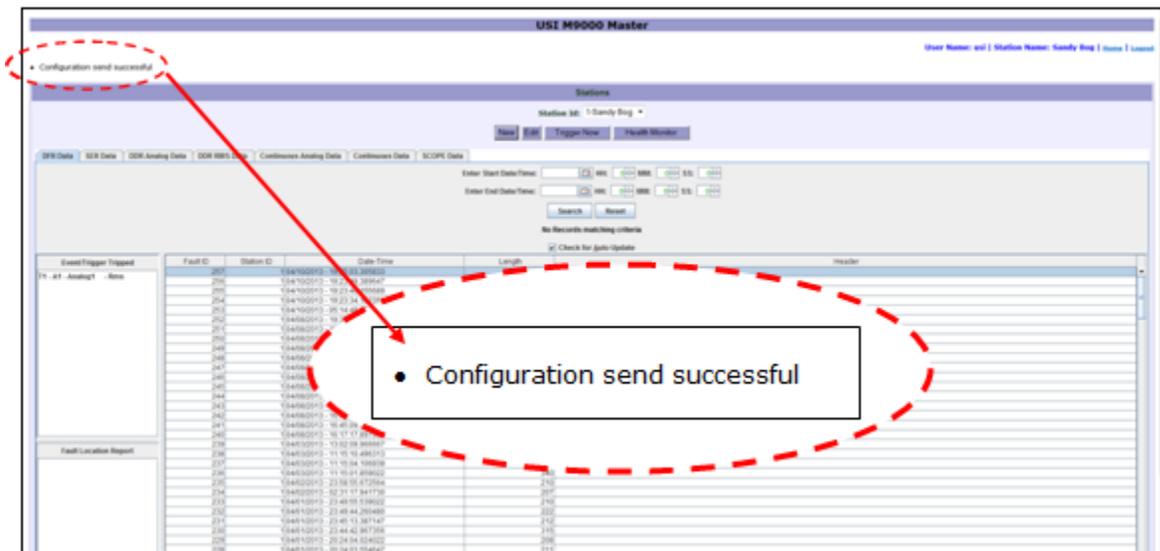


Figure 3-32 Configuration send successful message

Click the button to return to the wizard.



Note: Communication between the master station server and the DME system must be established for the **Send** function to succeed.

3.2 Configuration Editor

This section describes how to modify an existing DME system configuration to incorporate an upgrade or other system modification.

- **Edit Button**

This button displays the chassis configuration diagram for the selected DME system. This window provides the following tools to view or modify the DME system configuration:

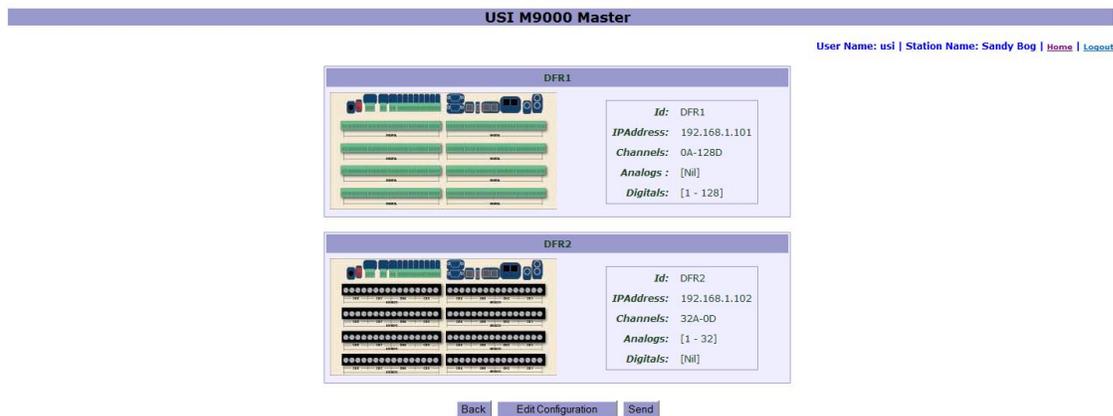


Figure 3-33 Edit Configuration

- **Back Button:**

This button returns the display to the Home page.

- **Edit Configuration Button:**

This button displays the Edit Station Details page. This page provides hyperlinks at the top of the screen to jump directly to any other configuration page. The pages displayed while in the configuration editor are identical to those displayed while in the new configuration wizard. Please refer to that section for details (see Section [3.1](#)).



Figure 3-34 Edit Configuration

- **Send Button:**
This button displays the message below. Click the **OK** button to save the configuration and send it to the DME system. Click the **Cancel** button to return to the configuration editor.

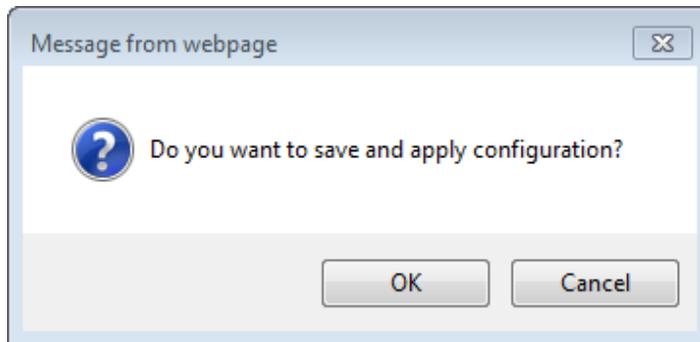


Figure 3-35 Edit Configuration

3.3 Trigger Now

This button **Trigger Now** is used to send a **Trigger** message to the DME system. This initiates a test operation of the system which generates DFR and DDR data records. After a successful trigger operation, new records will be displayed on the DFR and DDR data screens.

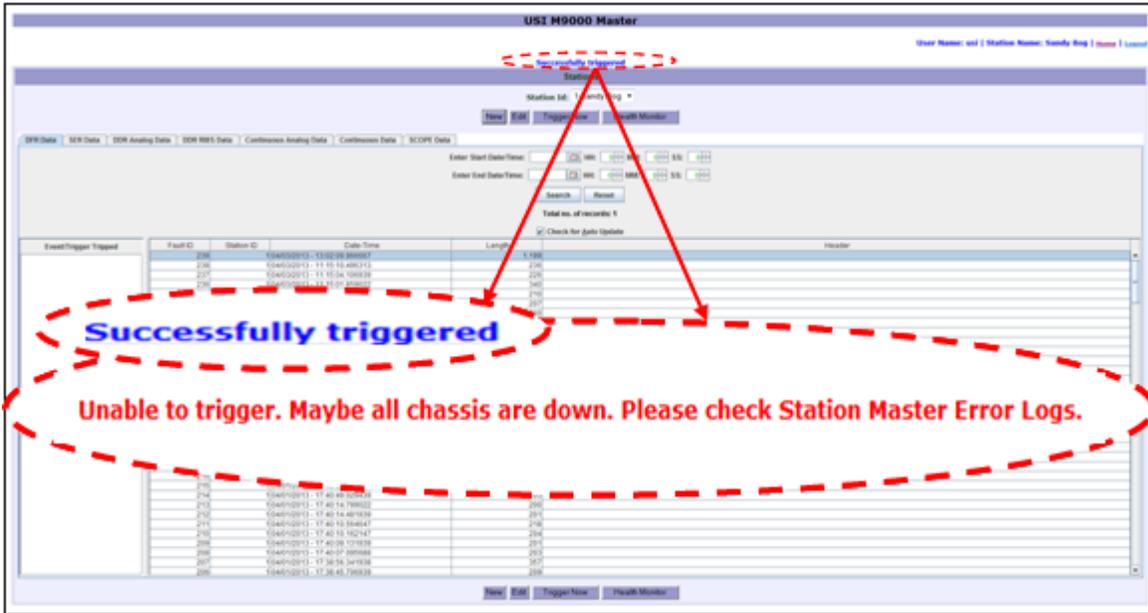


Figure 3-36 Trigger Now Messages

3.4 Health Monitor

This button **Health Monitor** displays the M9k Station Health screen. It is used to view the real-time health status of the DME system and all its modules.

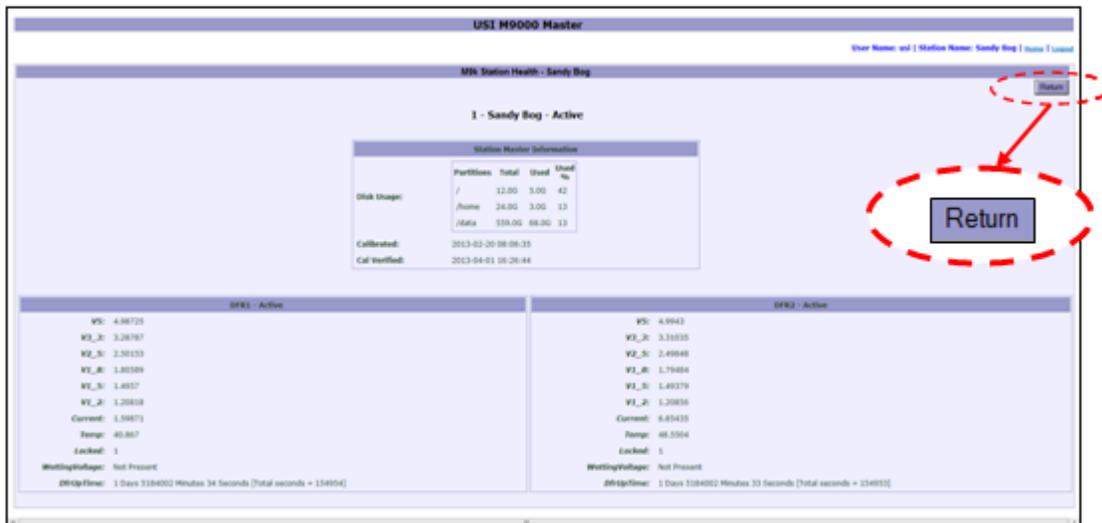


Figure 3-37 Health Monitor Screen

- **Station Master Information**
This portion of the screen displays health information about the Station Master computer.

- Disk Usage:
This displays the usage information for the non-volatile storage.
 - / (Root Level Directory)
This partition contains all the operation system files.
 - /home
This partition contains all personalized operation system settings, files and desktop.
 - /data
This partition contains all the DME system data files (e.g. DFR, SER, DDR, and Continuous data).

- Calibrated:
This date displayed indicates when the Internal Calibrate feature was executed (see Section [2.3.7](#)). Reports for this calibration are automatically recorded and stored at: /File System/data/m9k/calibration-report.

- Cal Verified:
This date displayed indicates when the Verify feature was executed (see Section [2.3.7](#)). Reports for this verification are automatically recorded and stored at: /File System/data/m9k/calibration-report.

- **DFR#**
This portion of the screen displays health information about each of the DME system chassis (DFRs).
 - Calibrated:
This indicates the status of the chassis analog channel calibration.
 - Yes
This indicates that the chassis is calibrated. All chassis with analog inputs display this status.
 - No
This indicates that the chassis is not calibrated. Chassis which only have digital inputs will display this status as they do not require calibration.

 - Power Supply:
Each power supply voltage has a factory preset tolerance and is not field adjustable. If this tolerance is exceeded an alarm output will occur. The following information is displayed (see Section [1.1.1](#) – D15-D20):
 - V5
This displays the on-board measurement of the five volt power supply. The factory preset tolerance for this voltage is +/- 0.2V.

- V3_3
This displays the on-board measurement of the 3.3 volt power supply. The factory preset tolerance for this voltage is +/- 0.1V.
 - V2_5
This displays the on-board measurement of the 2.5 volt power supply. The factory preset tolerance for this voltage is +/- 0.1V.
 - V1_8
This displays the on-board measurement of the 1.8 volt power supply. The factory preset tolerance for this voltage is +/- 0.1V.
 - V1_5
This displays the on-board measurement of the 1.5 volt power supply. The factory preset tolerance for this voltage is +/- 0.1V.
 - V1_2
This displays the on-board measurement of the 1.2 volt power supply. The factory preset tolerance for this voltage is +/- 0.1V.
 - Current
This displays the on-board measurement of the total current output provided by the power supply for this chassis. This value is for information purposes only and does not trigger an alarm.
- Temp:
This displays the on-board measurement of the temperature for this chassis.
 - Locked:
This displays the synchronization status of the IRIG decoder for this chassis. The number one displayed indicates the chassis is locked (synchronized) within one microsecond of IRIG. The number zero displayed indicates the chassis is not locked (un-synchronized). If the chassis IRIG decoder is unlocked, verify that an IRIG signal is present by viewing the IRIG IN LEDs (Figure [1-3](#)).
 - WettingVoltage:
This displays the presence of digital input wetting voltage. This is only required when field contact voltage is being provided by the chassis. If the chassis does not have digital inputs or the field contact voltage is provided externally, this voltage does not need to be present.
 - Present
This indicates field contact voltage for digital inputs is present.
 - Not Present
This indicates field contact voltage for digital inputs is not present.
 - DfrUpTime:
This displays a cumulative period of time each chassis has been in service.

- **Return Button**
This button returns the display to the Home page.

Section 4: COMTRADE Display

The USI M9000 Master interface offers a COMTRADE viewer tool for basic display and analysis of data files. For detailed analysis, the USIMaster application offers a robust Graphic Signal Processing package for COMTRADE data files.

The M9000 COMTRADE Display opens when a data file is selected. Double-click the desired record from the DFR, DDR, or Continuous Data screens to make a selection. When selection is made, data is displayed in a new browser window. Multiple records can be opened simultaneously, each in a new browser window.

This section describes the components of this display.

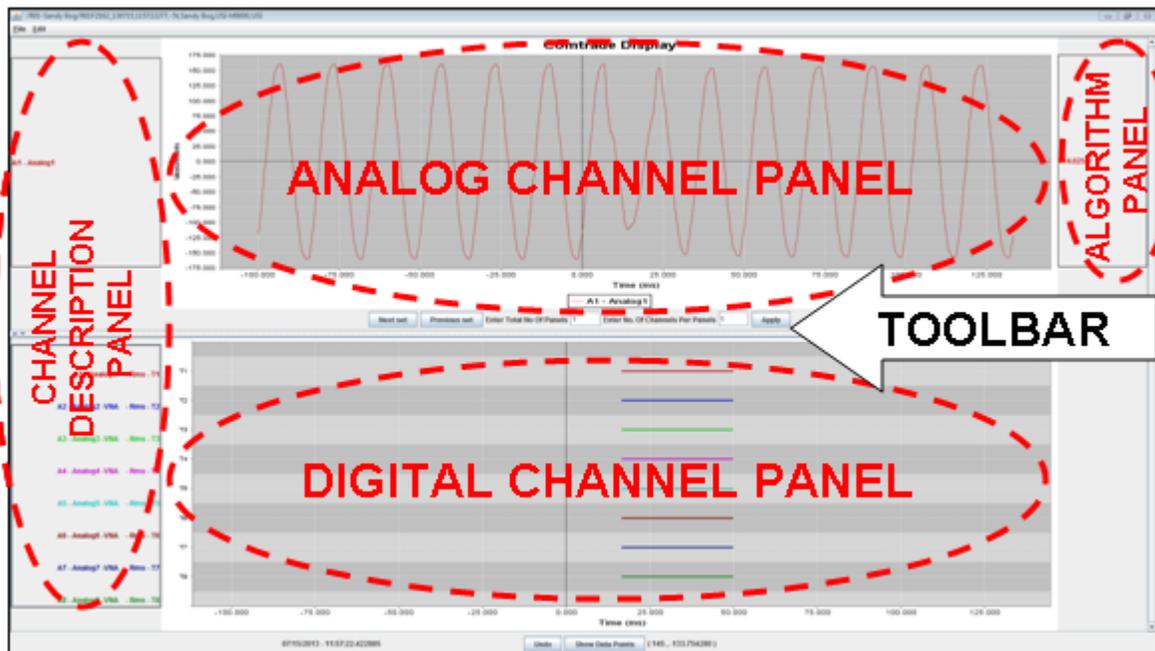


Figure 4-1 Comtrade Display Screen

4.1 Menu Bar

The menu bar offers the following selections:

- **File**
This menu offers the following selections:



Figure 4-2 Comtrade Display Screen – File Menu

- **Open:**
This selection displays the open window below. This window is used to browse to and select a new data file to be displayed in the COMTRADE Display. The hotkey for this function is Ctrl+O.

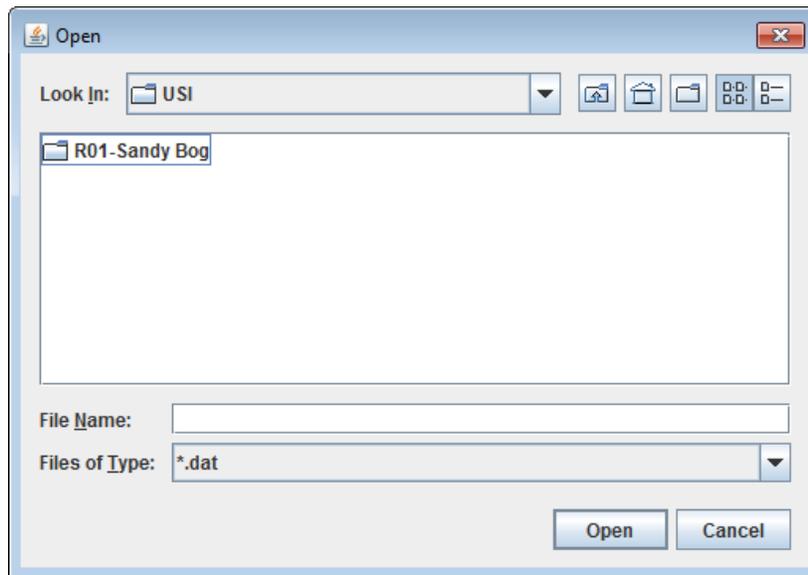


Figure 4-3 Open Window

- Select Channels To Display:
This selection displays the window below. This window is used to select the specific channels to display in the COMTRADE Display. Multiple selections can be made by Ctrl+Left-click or Shift+Left-click. The hotkey for this function is Ctrl+A.

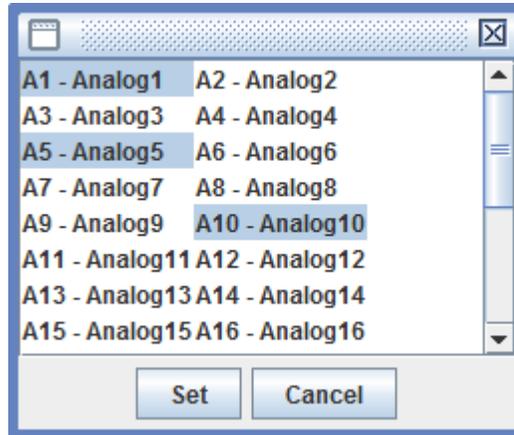


Figure 4-4 Select Channels To Display Window

-  Button
This button applies the selections and displays the channels in the COMTRADE Display window.
-  Button
This button cancels the selections and displays the original channels in the COMTRADE Display window.
- Reset to original display:
This selection resets all display modifications and returns to the original view. The hotkey for this function is Ctrl+R.
- Close:
This selection closes the COMTRADE Display browser window. The hotkey for this function is Ctrl+X.
- **Edit**
This menu offers the following selections:

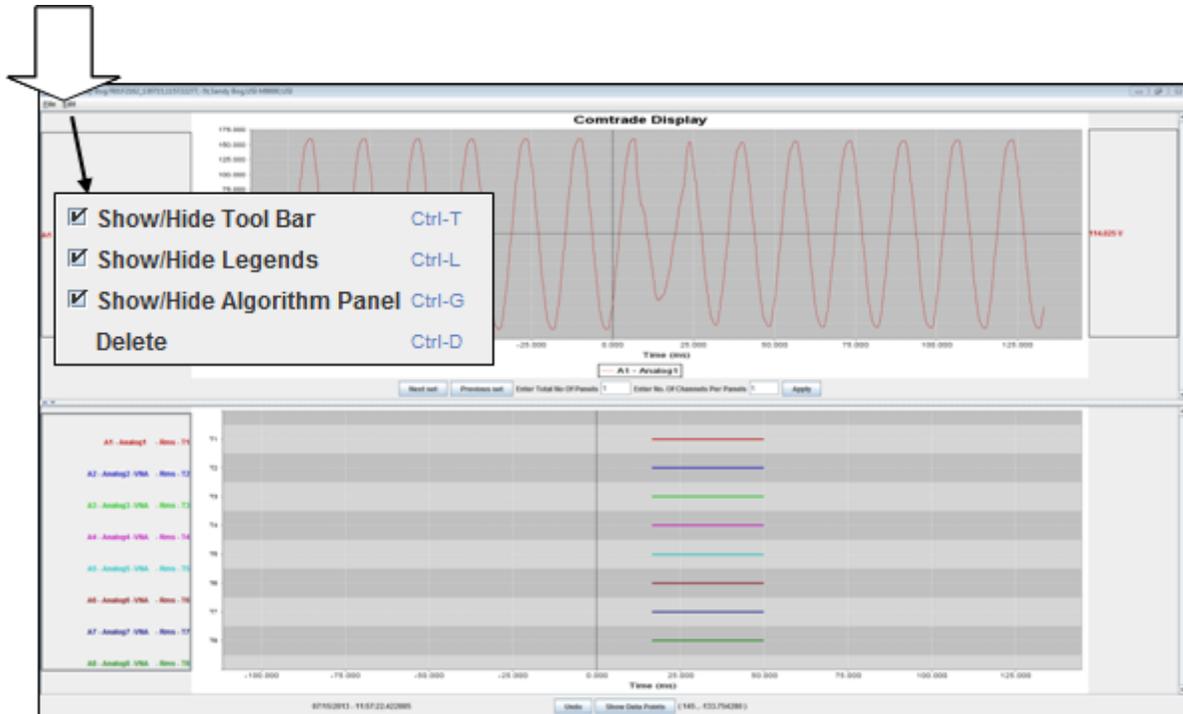


Figure 4-5 Comtrade Display Screen – Edit Menu

- **Show/Hide Tool Bar:**
This selection controls the display of the tool bar on the COMTRADE Display window. The hotkey for this function is Ctrl+T.
- **Show/Hide Legends:**
This selection controls the display of the analog channels legend on the analog panel. The hotkey for this function is Ctrl+L.
- **Show/Hide Algorithms Panel:**
This selection controls the display of the Algorithms panel on the COMTRADE Display window. The hotkey for this function is Ctrl+G.
- **Delete:**
This selection deletes the selected analog channel from the COMTRADE Display window. The hotkey for this function is Ctrl+D.

4.2 Channel Description Panel

This panel displays the description of all analog and digital channels plotted on the COMTRADE Display. The color of the description text matches the color of the corresponding channel plot.

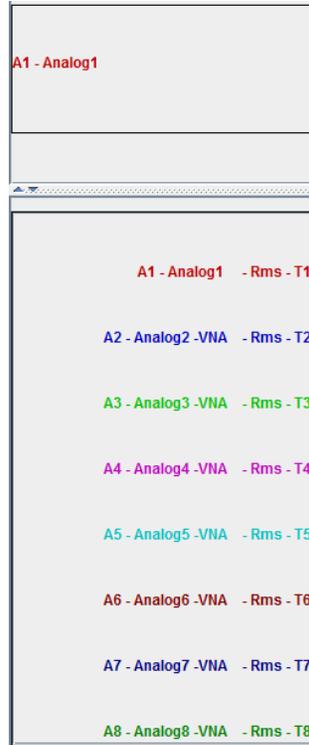


Figure 4-6 Channel Description Panel

4.3 Analog Channel Panel

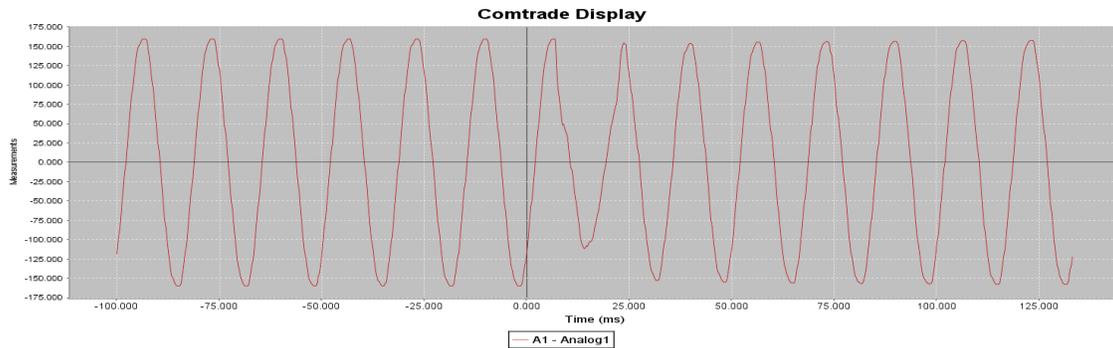


Figure 4-7 Analog Channel Panel

This panel displays the analog channels plotted on the COMTRADE Display. The number of channels plotted is controlled by the analog channel toolbar. Each graph is color-coordinated to match the corresponding information in the **Channel Description** and **Algorithm** panels.

To zoom in on the data displayed, left-click and drag the mouse from left to right. To undo all previous zooms, left-click and drag the mouse from right to left.

This panel can be maximized to full screen or minimized to be hidden by using the  up/down controller. This panel can also be manually sized by left-click and dragging the perforated line to the selected position.

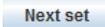
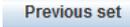
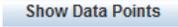
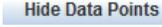
To copy a waveform from one analog panel to another, select the waveform by left mouse click. Right-click the selected waveform and drag and drop it into the destination panel.

4.4 Analog Channel Toolbar



Figure 4-8 Analog Channel Toolbar

This toolbar controls the display of analog channels plotted on the COMTRADE Display.

-  **Button**
This button advances the analog channel display to the next higher set of inputs.
-  **Button**
This button returns the analog channel display to the previous lower set of inputs.
- **Enter Total No Of Panels**
This field is used to enter the number of waveform panels to be displayed in the Analog Channel panel.
- **Enter No Of Channels Per Panel**
This field is used to enter the number of waveforms to be displayed in each panel of the Analog Channel panel.
-  **Button**
This button applies the number of panels and number of channels per panel settings to the Analog Channel panel.
-  **Button**
This button is used to undo waveforms copied from one waveform panel to another.
-  **Button**
This selection adds bullets on the waveforms showing the A-to-D converter sampling points. When this button is selected, the button label toggles to  .
-  **Button**
This selection hides the bullets on the waveforms and displays a clean graph. When this button is selected, the button label toggles to  .

4.5 Algorithm Panel

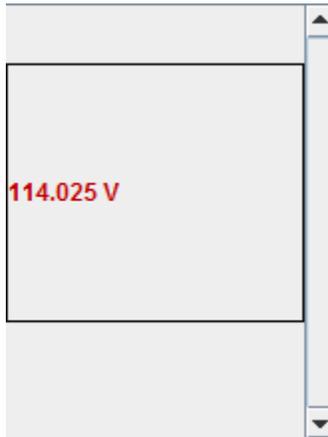


Figure 4-9 Algorithm Panel

This panel displays the RMS values for the waveforms displayed in the Analog Channel panel. The color of the value matches the color of the corresponding channel plot.

4.6 Digital Channel Panel

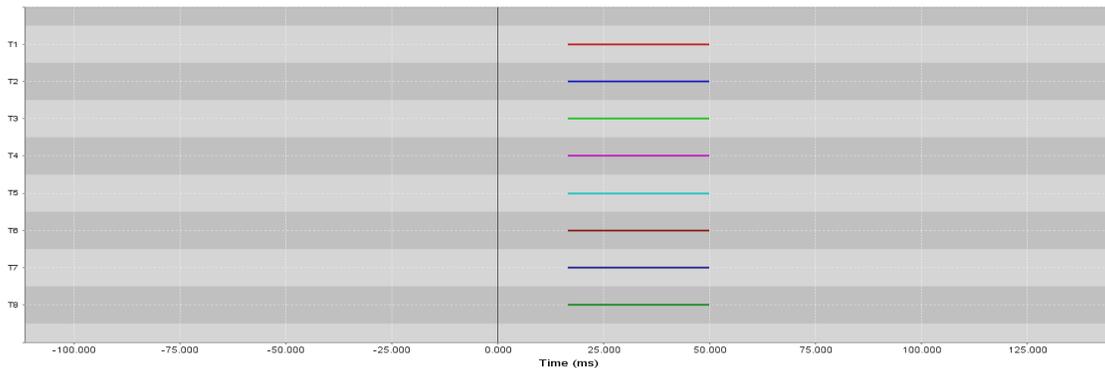


Figure 4-10 Digital Channel Panel

This panel displays the analog trigger and digital input graphs. All digital inputs and analog triggers that were abnormal during the displayed fault are shown here. They are displayed and plotted in the sequence in which they became abnormal. Each graph is color-coordinated to match the corresponding information in the **Channel Description** column.

This panel can be maximized to full screen or minimized to be hidden by using the  up/down controller. It can also be manually sized by left-click and dragging the perforated line to the selected position.

Section 5: MAINTENANCE

This section covers maintenance items which should be verified periodically.

5.1 MAINTENANCE ITEMS

The Model 9000 DME system was designed to reduce routine maintenance to a minimum. Items which require periodic function check or maintenance are listed below:

- **System Status Indicators & Alarm Outputs**

This item provides a verification of the system status indicators (see Section [1.1](#) and Section [1.2](#)) and a function check of the alarm output contacts (see [Section 1.2](#)).

- ON LINE:
This alarm output can be tested by powering off one of the M9000 modules. Once the alarm output activates, return power to the module to clear the alarm.
- TRIGGER:
This alarm output can be tested by using the Trigger Now feature in the user interface (see [Section 3.3](#))
- CLOCK SYNC:
This alarm output can be tested by disconnecting the IRIG input cable from the system (see [Figure 1-3](#)).
- COMMUNICATION:
This alarm output can be tested by disconnecting a network cable from one of the M9000 modules (see [Figure 1-3](#)).
- POWER:
This alarm output can be tested by powering off one of the M9000 modules. Once the alarm output activates, return power to the module to clear the alarm.
- DISK:
This alarm output can not be field tested.
- TEMPERATURE:
This alarm output can not be field tested.

- **Analog Inputs**

This item provides a verification of the analog inputs. This is done using the Scope feature of the user interface (see [Section 2.3.7](#)).

- Calibration:
The tools used for this item are listed below:
 - Internal Calibration
See the [Internal Calibration](#) section for details.

- **Verify**
See the [Verify](#) section for details.
 - **External Calibration**
See the [External Calibration](#) section for details.
- **Proper wave shape:**
Confirm that the wave shape and value displayed on the Scope Waveform Panel matches the applied signal.
- **Digital Inputs**
This item provides a verification of the digital inputs. This is done using the Scope feature of the user interface (see [Section 2.3.7](#)). Apply DC voltage to the digital inputs and verify operation in the [Status Panel](#).
- **Recorder Operation**
This item provides a verification of recorder operation. Use the following features to verify that new records are displayed in the DFR and DDR data screens (see [Section 2.3](#)), and that they present the proper data using the COMTRADE Display (see [Section 4](#)).
 - **Trigger Now Button:**
Use the Trigger Now button to initiate a DME system record (see [Section 3.3](#)).
 - **Analog Trigger:**
Apply a signal level which exceeds a trigger limit assigned to an analog measurement (see [Section 3.1.4](#)).
 - **Digital Trigger:**
Apply a DC voltage to a digital input with the DFR trigger or SER features enabled (see [Section 3.1.5](#)).
- **Storage Free Space**
Maintain minimum free space of 15% on each partition.
 - **Remove old DFR and DDR data files.**
These files are located at: /File System/data/m9k/faults.



Note: Solid State Drives (SSD) do not require defragmentation.



Note: This equipment does not require forced air cooling. There are no fans to be cleaned or air filters to be changed.

5.2 MAINTENANCE INTERVALS

The Model 9000 DME system was designed to reduce routine maintenance to a minimum. The intervals to perform maintenance items are covered below:

5.2.1 One Year

Perform these items annually:

- **Verify Analog Input Calibration**

Use the [Verify](#) feature to confirm internal calibration (see [Section 2.3.7](#)).

- **Verify Digital Input Operation**

Use the [Event Self-test](#) feature to confirm internal calibration (see [Section 2.3.7](#)).

- **Verify Recorder Operation**

Use the Trigger Now button to confirm recorder operation (see [Section 3.3](#)).

- **Verify Storage Free Space**

Archive and remove old data records from the recorder storage drives.

5.2.2 Five Year

Every five years perform all maintenance items (see [Section 5.1](#)).

Glossary

3

3I0

Acronym for Three-I-Zero. Abbreviation for inverse of Three-Phase Neutral Current

3-Phase (VARs)

Abbreviation for Three-Phase Reactive Power (Vr is an abbreviation for [VAR](#))

3-Phase (Watts)

Abbreviation for Three-Phase Real Power

5

5U

A rack unit or U (less commonly RU) is a unit of measure (standard rack specification as defined in EIA-310) used to describe the height of equipment intended for mounting in a 19-inch rack or a 23-inch rack (The 19-inch or 23-inch dimension refers to the width of the equipment mounting frame in the rack i.e. the width of the equipment that can be mounted inside the rack). One rack unit is 1.75 inches (44.45 mm) high. The rack unit is also specified as the unit of height in the Eurocard standard.

The size of a piece of rack-mounted equipment is frequently described as a number in "U". For example, one rack unit is often referred to as "1U", 2 rack units as "2U" and so on.

A typical full size rack is 44U, which means it holds just over 6 feet of equipment, and a typical half-height rack would be 18-22U, or around 3 feet high.

A

ANSI

Acronym for American National Standards Institute, a publisher of standards

ASCII

Acronym for American Standard Code for Information Interchange, an eight-bit character-based code

B

Baud (rate)

The unit for signaling rate of a communications circuit. It is equal to the number of transitions (voltage or frequency changes) that are made per second. Often used erroneously as equivalent to bits per second. Baud and bits per second are equivalent only at rates of 300/second and lower. A V.22bis modem generates 1200 bps at 600 baud. Baud was named after French engineer Jean Maurice Emile Baudot (1845-1903).

Binary

The binary numeral system, or base-2 number system, represents numeric values using two symbols, 0 and 1.

BMP

A graphics file in bitmap (bump) format; these files have a **.bmp** extension and can be sent to the Windows Clipboard

C

Ch

Abbreviation for Channel

COM

Abbreviation for Communication as in COM Port

COMTRADE

Acronym for Common Format for Transient Data Exchange. Source: IEEE Std C37.111-1999, *IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems*.

COMNAMES

Standardized file naming convention, part of IEEE Std C37.232, *IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems*.

CPU

Abbreviation for Central Processing Unit (or processor), the primary functional element of a computer.

CT

Acronym for Current Transformer

D

Daemon

A daemon is a computer program that runs as a background process, rather than being under the direct control of an interactive user. Systems often start daemons at boot time: they often serve the function of responding to network requests, hardware activity, or other programs by performing some task.

dB

Decibel, the unit of power-level comparison; technically, the base-10 logarithm of a ratio of two power levels

DDR

Acronym for Dynamic Disturbance Record, a subsystem of the DME. This record is created dynamically when a trigger condition is detected. It contains data for a longer period of time and at a lower sample rate than transient DFR records. These records are used to capture disturbances on the monitored inputs.

DDR Analog

This is a DDR record containing waveform data.

DDR RMS

This is a DDR record containing calculated RMS data.

Descripts

Abbreviation for Descriptions

DFR

Acronym for Digital Fault Recorder. A subsystem of the DME.

DFR/SER

Acronym for Digital Fault Recorder/Sequence of Events Recorder. Subsystems of the DME.

Disturbance

An unplanned event that produces an abnormal system condition.

DME

Acronym for Disturbance Monitoring Equipment (i.e. Digital Fault Recorder, Sequence of Events Recorder, and Disturbance Monitoring System)

DST

Acronym for Daylight Saving Time.

E

E-mail

Electronic mail routed over the Internet or Intranet. See [SMTP/POP3](#).

Ethernet

Ethernet is a family of computer networking technologies for Local Area Networks (LANs). It has been standardized as IEEE 802.3 and has been in use since the early 1980s. It has largely replaced the competing technologies: token ring, FDDI, and ARCNET.

EV#

Abbreviation for **Event Number**

F

Fault type

This identifies the type of fault as phase-to-phase (ABC, AB, BC, CA), or phase-to-phase-to-ground: (ABG, BCG, CAG), or phase-to-ground (AG, BG, or CG).

FID

Abbreviation for Fault Identification (ID) number

Freq

Abbreviation for Frequency. In this document, Frequency is used both as the power system line frequency (nominally 50 Hz or 60Hz) and as the sampling rate of the analog-to-digital converters.

G

GMT

Acronym for Greenwich Mean Time

GPS

Acronym for Global Positioning System. GPS is used to time synchronize the Disturbance Monitoring Equipment (DME).

H

HDD

Hard Disk Drive, a rotating magnetic disc data storage device

I

IEEE

Acronym for the Institute of Electrical and Electronics Engineers, a publisher of standards

IN#

Abbreviation for Input (Channel) Number

IP address

An Internet Protocol (IP) Address is a numerical label assigned to devices participating in a computer network that uses Internet Protocol (IP) for communication between its nodes.

IRIG-B

IRIG-B refers to a serial time code format. It is a timing signal transmitted at a 100 bps rate. IRIG-B sends Day of Year, Hour, Minute and Second data on a 1 KHz carrier. It

has a one-second update rate. IRIG is an acronym for Inter Range Instrumentation Group.

J

JPEG

Acronym for Joint Photographic Expert Group – a commonly used standard for digitizing photographic images

JTAG

Joint Test Action Group (JTAG) is the common name for the IEEE 1149.1 Standard Test Access Port and Boundary-Scan Architecture.

JTAG is widely used for IC debug ports. In the embedded processor market, essentially all modern processors implement JTAG. Embedded systems development relies on debuggers communicating with chips with JTAG to perform operations like single stepping and breakpointing.

K-L

LAN

Acronym for Local Area Network

LCD

Acronym for Liquid Crystal Display

LED

Acronym for Light-Emitting Diode, a solid-state light source.

Linux

A Unix-like computer operating system assembled under the model of free and open source software development and distribution. The defining component of Linux is the Linux kernel, an operating system kernel first released in 1991.

M

Magnetic Instrumentation, Inc.

The parent company of Utility Systems, Inc. (USI).

Max

Or Max. Abbreviation for Maximum

MIN

Abbreviation for Minimum

N-O

NC

Acronym for Normally Closed, describes a type of relay that has closed output contacts when de-energized (OFF state) and open output contacts when energized (ON state).

NO

Acronym for Normally Open, describes a type of relay that has open output contacts when de-energized (OFF state) and closed output contacts when energized (ON state).

Optocoupler

A four-terminal (sometimes five-terminal) electronic component used to couple signals from high voltage electrical systems to low voltage electronic systems while providing electrical isolation between the two. Also known as an optoisolator, it consists of a light source and a light detector separated by an optically-transparent insulator. Its simplest embodiment uses a light-emitting diode and a photodiode separated by a thick layer of clear plastic.

Oscillography

1. A record containing sampled waveform data.
2. The science of sensing, recording, displaying, and analyzing time-varying phenomena.

P

panel

An area on the Graphic Signal Processing screen.

PATA

Parallel ATA. See SATA.

PC

Personal Computer

PDC

Acronym for Phasor Data Concentrator.

Phasor

A phase vector (phasor) is a representation of a sine wave whose amplitude (A), phase (θ) and frequency (ω) are time invariant. Use of phasors simplifies certain calculations by eliminating time (frequency) terms and leaving only amplitude and phase.

Ping

Ping is a computer network administration utility used to test whether a particular host is reachable across an Internet Protocol (IP) network. It also measures the round-trip time for packets sent from the local host to a destination computer, including the time delay in the host computer interfaces.

Use of the ping utility is usually described as pinging a host computer.

PMU

Acronym for Phasor Measurement Unit.

POP3

POP3 is an abbreviation for Post Office Protocol Version 3. POP is an application-layer Internet standard protocol used by local E-mail clients to retrieve E-mail from a remote server over a TCP/IP connection. Version 3 (POP3) is the current standard.

PT

Acronym for Potential Transformer.

Q-R

RS-232

RS-232 (Recommended Standard 232) is a standard for serial binary single-ended data and control signals connecting between a Data Terminal Equipment (DTE) and a Data Circuit-terminating Equipment (DCE). It is commonly used in computer serial ports. The controlling standard is Electronic Industries Association (EIA) RS-232C (1969). Current revision is Telecommunications Industry Association TIA-232-F (1997). In the personal computer industry RS-232 has been largely replaced by the USB interface standard. Industrial equipment and programmable logic controllers (PLCs) still use the RS-232-C standard port.

RTC

Acronym for ReaTime Clock

S

Sag

A decrease between 0.1 and 0.9 per unit in RMS voltage or current at the power frequency, for durations from a half-cycle to one minute.

SATA

Serial Advance Technology Attachment (SATA) is a computer bus interface that connects host bus adapters to mass storage devices such as hard disk drives and optical drives. Serial ATA (SATA) replaces the older Parallel ATA (PATA), offering several advantages over the older interface: reduced cable size and cost (seven conductors instead of 40), faster data transfer through higher signaling rates, and more efficient transfer.

SATA host adapters and devices communicate via a high-speed serial cable over two pairs of conductors. In contrast, PATA used a 16-bit wide data bus with many additional support and control signals, all operating at much lower frequency.

Screen

A visual display on a computer monitor is called a screen. *USIMaster*® is viewed on a family of screens, such as: System Configuration screen, Graphic Signal Processing (GSP) screen, USI Master Station screen, etc.

SER

Acronym for Sequence of Events Recorder, a type of Disturbance Monitoring Equipment used in the USI Disturbance Monitoring System.

Shunt

A resistive device that provides an output voltage proportional to circuit current.

Single Ended

Or 1-ended (q.v.). A type of distance-to-fault calculation.

SMTP/POP3

Abbreviation for Simple Mail Transfer Protocol/Post Office Protocol Version 3. SMTP is an Internet standard for E-mail transmission across Internet Protocol (IP) networks (see TCP/IP). User-level applications typically use SMTP for transmission of E-mail messages and POP3 (q.v.) for reception of E-mail messages.

SSD

Acronym for Solid State Drive, an electronic data storage unit with no moving parts.

Start/Stop Time

Time Query method for LDC system. See Start Time/Duration method.

Start Time/Duration

Time Query method for LDC system See Start/Stop Time method.

Surge

A transient wave of voltage, current, or power in an electrical circuit.

Sync

Abbreviation for Synchronize or Synchronization

Synchrophasor

A phasor calculated from data samples using a standard time signal as a reference for the measurement. Synchronized phasors from remote sites have a defined common phase relationship. See IEEE C37.118-2005 Standard for Synchrophasors for Power Systems, IEEE Power Engineering Society.

T

TCP/IP

The Internet Protocol Suite, commonly known as TCP/IP, is a four-layered set of communications protocols used for the Internet and other similar networks. Two of the most important protocols in the suite are the Transmission Control Protocol (TCP) and the Internet Protocol (IP), hence the common name.

Text/Data Only

An ASCII (q.v.) text format that can be sent to the Windows Clipboard; these files have a *.txt* or *.dat* extension; they can be viewed or printed by using a word processor.

THD

Acronym for Total Harmonic Distortion

TR#

Abbreviation for Trigger Number

U

UDP/IP

The Internet Protocol Suite, commonly known as TCP/IP (q.v.), is a four-layered set of communications protocols used for the Internet and other similar networks. Two of the protocols in the suite are the User Datagram Protocol (UDP) and the Internet Protocol (IP), hence the common name.

With UDP, computer applications can send messages (datagrams). Datagrams may arrive out of order, appear duplicated, or go missing without notice. Time sensitive applications often use UDP because dropping of packets is preferable to waiting for delayed packets.

URL

Acronym for Uniform Resource Locator. In computing, a URL is a Uniform Resource Identifier (URI) that specifies where an identified resource is available and the mechanism for retrieving it. URL is often incorrectly used as a synonym for URI. The best-known example of a URL is the address of a web page on the World Wide Web, e.g. <http://www.example.com>.

USB

Acronym for Universal Serial Bus. It is a specification for a bus used to establish communication between devices and a host controller, usually a personal computer (PC). USB is a bit-serial bus in general use to connect peripherals such as mice, keyboards, digital cameras, printers, scanners, media players, flash drives, and external hard drives.

USI

Acronym for Utility Systems, Inc.

UTC

Acronym for Universal Time Code

V

Vac

Acronym for Volts AC.

Val

Also Val. Abbreviation for Value

VAR

Volt-Amperes Reactive, the unit of reactive power

Vector

In mathematics and physics a vector (also known as a Euclidian vector) is a geometric entity endowed with both length and direction. In physics, Euclidian vectors are used to represent physical quantities which have both magnitude and direction, such as force, in contrast to scalar quantities,

such as pressure, which have no direction. In the energy distribution industry, a vector represents a magnitude (voltage, current, impedance) and a direction (phase angle with respect to a reference).

W-X-Y-Z

WAN

Acronym for Wide Area Network

Watt

The unit of power. Named after British engineer James Watt (1736-1819).

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