Machine Analyst for On-Line Systems

The Asset Efficiency Optimization Software

Supports Software Version 2.2

User Manual Part No. 31916300-EN

Revision A

User Manual

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I

Introduction to Machine Analyst for On-Line Systems

Organization of Your Machine Analyst for On-Line Systems User Manual

This Machine Analyst for On-Line Systems User Manual describes Machine Analyst software operating with the On-line plug-in installed. In these pages you will find information on the operation of the:

- **Multilog Condition Monitoring Unit (CMU)**
- **Multilog Local Monitoring Unit (LMU)**
- **Monitor Interface Module (MIM) hardware,**

and their Machine Analyst for On-Line Systems features. Since all On-Line features work in conjunction with standard Machine Analyst operations, you should be familiar with Machine Analyst and its User Manual before using Machine Analyst for On-Line Systems software.

This user manual describes hardware functionality, as well as on-line operations using Machine Analyst for On-Line Systems software. Each on-line device is detailed in its own hardware overview chapter (chapters 2, 3, and 4), and applicable appendices. This manual's other chapters contain information that applies to all three systems, with any differences noted.

The user manual is organized as follows:

Introduction - This introductory chapter describes the **CMU, LMU** and **MIM** systems, including the architecture and operation of all three systems. Read the remainder of this chapter for an overview.

Chapter 1, Software Installation – Helps you install your on-line device driver software on your PC.

Chapter 2, CMU Overview– Provides an overview of the Condition Monitoring Unit's (CMU) hardware.

Chapter 3, LMU Overview– Provides an overview of the Local Monitoring Unit's (LMU) hardware.

Chapter 4, MIM Overview – Provides an overview of the Monitor Interface Module's (MIM) hardware.

Chapter 5, Communication – Overviews the CMU, LMU, and MIM communication options.

Chapter 6, How The CMU, LMU and MIM Systems Collect Data – Describes CMU, LMU, and MIM data collection and uploading procedures.

Chapter 7, Configuring and Downloading CMU, LMU and MIM POINTs - Describes in detail how to configure and download POINTs to your on-line device.

Chapter 8, Displaying CMU, LMU and MIM Data - Describes On-Line procedures for displaying CMU, LMU, or MIM POINT data.

Appendix A, Event Log Redirection - Describes Event Log redirection codes and terminology.

Appendix B, Front Panel Switch Module and Simultaneous Power Options - Describes optional LMU configurations.

Appendix C, Protection System Wiring Diagrams - Details wiring diagrams for MIM connection to various protection systems.

Appendix D, Tachometer Signal Conditioning - Describes MIM applications that may require adjustment of tachometer channel parameters for the MIM to trigger effectively on a variety of input signals.

Appendix E – Machine Analyst and Monitor Connection Service – Describes the .exe file that allows users to set up multiple computers with Machine Analyst for Online Systems, and have them communicate with each other.

Definition of On-Line Systems

Throughout this Machine Analyst for On-Line Systems User Manual, SKF's Multilog Condition Monitoring System, Multilog Local Monitoring System, and Monitor Interface Module System are referred to as SKF's On-Line Systems.

References specific to the Multilog Condition Monitoring System use the term CMU (Condition Monitoring Unit). References specific to the Multilog Local Monitoring System use the term LMU (Local Monitoring Unit). References specific to the Monitor Interface Module System use the term MIM (Monitor Interface Module).

References that apply to the CMU, LMU, and MIM systems use the general term “on-line device.”

Each of these systems is discussed in detail in its own section within this chapter.

What is the Multilog CMU (Condition Monitoring Unit) System?

Multilog CMU is a continuous machinery monitoring system that allows for quick and automatic data acquisition even in remote, hazardous, or difficult to reach locations. With Multilog CMU, users spend less time collecting data and more time on the analysis and diagnosis of machine problems.

Using permanently installed sensors, the Multilog CMU processes overall vibration, acceleration, velocity, enveloping, and other measurements continuously. It works with Machine Analyst for On-Line Systems software to automatically capture alarms and record data on a scheduled basis, making problem detection and analysis on key production assets timely, reliable, and efficient.

With sensor input and programmable alarm setpoints, the **CMU System:**

- Senses machinery changes and automatically warns maintenance personnel of machinery problems.
- Provides FFT spectrum, time waveform, and polar vector displays for analysis of machinery condition.
- Provides an Event Log that logs and displays machinery alarm events as they occur.
- Provides an on-line interface to Machine Analyst databases.

Monitored machinery parameters include:

- Vibration (acceleration, enveloped acceleration, velocity, displacement)
- Temperature
- Speed

- Process variables (for example, pressure, flow)
- Digital logic signals from PLCs and other machinery control systems

The **CMU System** consists of:

- Sensors and Wiring
- Condition Monitoring Units (CMUs)
- A Host Computer (with Ethernet or SKF LAN Card CMMA30058B connection) and appropriate Windows O.S. drivers
- Machine Analyst for On-Line Systems Software
- Machine Monitor
- Microlog Data Collector / Analyzer (optional)

The **CMU System** uses **C**ondition **M**onitoring **U**nits (CMUs) to automatically collect and monitor machinery data from permanently attached sensors and/or from other installed continuous monitoring systems. Collected data is automatically uploaded through an Ethernet connection or RS-485 LAN connection to a host computer running Machine Analyst for On-Line Systems software for permanent storage, graphic display, and analysis.

> ➢ "Machine Analyst for On-Line Systems" is the term used to describe Machine Analyst after the On-Line Plug-in software installation has been performed. Machine Analyst and Machine Monitor alone do not offer "on-line" features. Machine Analyst for On-Line Systems is Machine Analyst with "on-line" features.

The Condition Monitoring Unit (CMU)

The Multilog CMU System consists of one or more independent, multi-channel, condition monitoring units (CMUs) connected to a host computer through a high-performance, digital, local area network (LAN). The CMU

is the heart of the CMU System. It is contained in a NEMA-4X enclosure and is designed to be installed in adverse environments found on the plant floor.

The CMU is permanently installed close to sensors that are permanently mounted on the monitored machinery. Up to 32 static or dynamic sensor inputs, 8 tachometer signal inputs, and 16 digital logic inputs can be connected to each CMU. Each CMU is capable of performing up to 256 measurements on these sensor inputs. This design keeps wiring costs to a minimum, since the wire length from the numerous sensors to the CMU is kept to a minimum, and only a single Ethernet or RS-485 LAN connection need be made to the host computer.

The CMU is a modular system. Modules plug into slots in one of three racks on the motherboard. The following modules are supported:

- The Multi-parameter Input Module
- The Tachometer Input Module
- The Digital IO Module
- The Direct Access Module.

In addition to the modules installed in slots, the CMU includes the On-Line module, which is the heart of the CMU. The On-Line module contains a rugged Windows CE™ computer and high performance analog and digital signal processing electronics.

➢ Refer to **Chapter2; CMU Overview** for more detailed information on the CMU's modules.

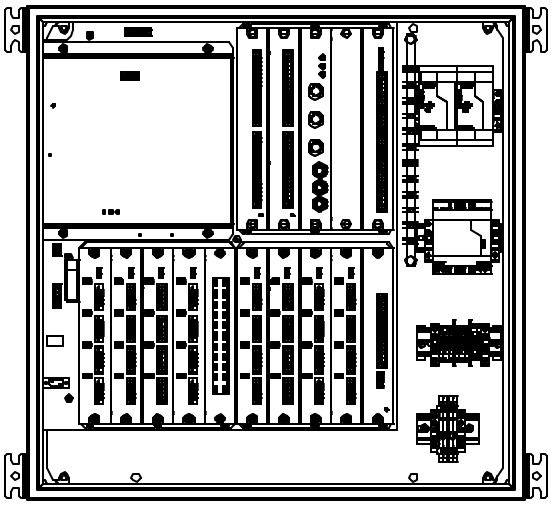


Figure I - 1.
The CMU - Inside View.

The CMU Motherboard

A CMU motherboard contains 3 racks and each rack provides 4 slots for modules. The two bottom racks provide slots for Multi-Parameter Input Modules. The rack in the upper right–hand corner contains the slots for the Digital IO modules, the Direct Access Module, and the Tachometer Input Module.

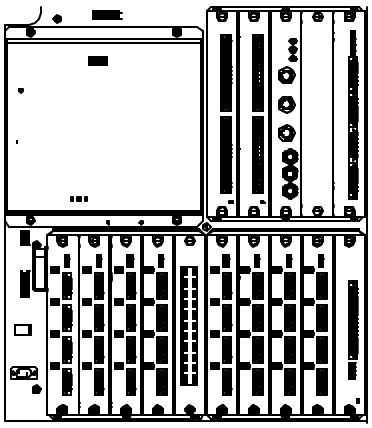


Figure I - 2.
The CMU Motherboard Racks, Slots, and Modules.

Input wiring is connected to the CMU at removable connectors on the front panel of each module. There are five types of terminal strip inputs:

- Multi-Parameter Input Module connections (CHANNEL1, CHANNEL2, etc.)
- Tachometer Input Module connections (TACH1, TACH1 GND),
- Logic inputs (GND, BIN)
- RS-485 LAN communication lines (LAN IN +, LAN IN –, LAN OUT +, LAN OUT –)
- RJ-45 Ethernet connector
- Power inputs (AC IN L, AC IN N, FG)

Only a qualified electrician should install the AC power line to the CMUs.

The CMU Electronics Module

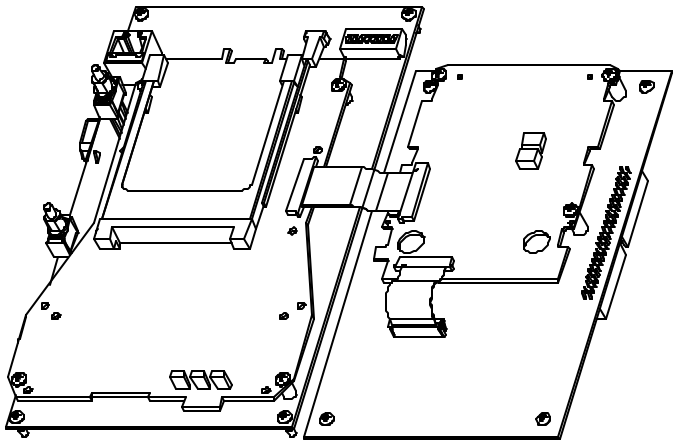


Figure I - 3.
The CMU Electronics Module.

The CMU **electronics module** (Figure I - 3) is mounted on the upper left-hand corner of the Motherboard and consists of four circuit boards:

- The CMU Analog board
- The CMU Digital board
- The CMU Digital Support, and
- The CMU Multiplexer board
  - Each board's components and functions are described in **Chapter 2, CMU Overview**.

The CMU's electronics module performs two tasks.

1. Its primary task is to collect data.
2. Its secondary task is to communicate with the host computer and Machine Analyst for On-Line Systems software using the system's RS-485 local area network, or an Ethernet connection.

CMU Functional Description

Downloading POINT setups to the CMU – The CMU stores its POINTs in Flash memory so POINT setups are never lost. When the CMU is first powered up or reset, it checks Flash memory for stored POINTs and begins data collection immediately when it finds them. If no POINTs are found, it waits for the host computer to send (download) a list of measurement POINT configurations. Each downloaded POINT arrives with its "POINT setup" that specifies all measurement and alarm parameters required for data collection. POINTs and data that are stored in the CMU are deleted when a new download initiates.

POINT Order Optimization – Once the download is complete, the CMU reorders the POINTs in order to reduce the amount of time spent settling after selecting a new sensor channel. First, the POINTs are grouped by channel. Then, the POINTs within each channel are grouped with integration POINTs last, since integration POINTs require more settling that other POINT types. Finally, channel groups are ordered to alternate between bank 1 and bank 2. This allows the next channel in the opposite bank to power the sensor and start settling, while the current channel collects data.

Collecting and Reporting Data - At the completion of the download process and the POINT order optimization process, the CMU begins to collect data *one POINT at a time* (Module LEDs indicate the active channel). After data has been collected for the first POINT, the CMU

checks with the host computer to see if it has requested a measurement's value or alarm status to be uploaded to the Machine Analyst for On-Line Systems software. If the host computer has made a request, the CMU sends the appropriate reply. If no request was made, the CMU collects data from the next POINT in the downloaded list.

This process of data collection and communication with the host computer is repeated for each POINT in the list. When the CMU has collected data on the last POINT in the list, it starts over with the first POINT. The time it takes for the CMU to complete the list and start over is called the "turn around" time and is regulated by the number of POINTs in the list and each POINT's measurement configuration.

What is the LMU (Multilog Local Monitoring System)?

The **LMU System** is a multi-parameter, programmable machinery monitoring system that provides continuous scanning, on-line machinery monitoring.

With sensor input and programmable alarm setpoints, the **LMU System:**

- Senses machinery changes and automatically warns maintenance personnel of machinery problems.
- Provides FFT spectrum, time waveform, and polar vector displays for analysis of machinery condition.
- Provides an Event Log that logs and displays machinery alarm events as they occur.
- Provides an on-line interface to Machine Analyst databases.

Monitored machinery parameters include:

- Vibration (acceleration, enveloped acceleration, velocity, displacement)
- *SEE* (*S*pectral *E*mitted *E*nergy)
- Temperature
- Speed
- Process variables (for example, pressure, flow)

The **LMU System** consists of:

- Sensors and Wiring
- Local Monitoring Units (LMUs)
- A Host Computer (with LAN card or SKF LAN Plus (CMMA8350 LMU / MIM to USB Transceiver) interface installed) and appropriate Windows O.S. drivers
- Machine Analyst for On-Line Systems Software
- Machine Monitor
- Microlog Data Collector / Analyzer (optional)

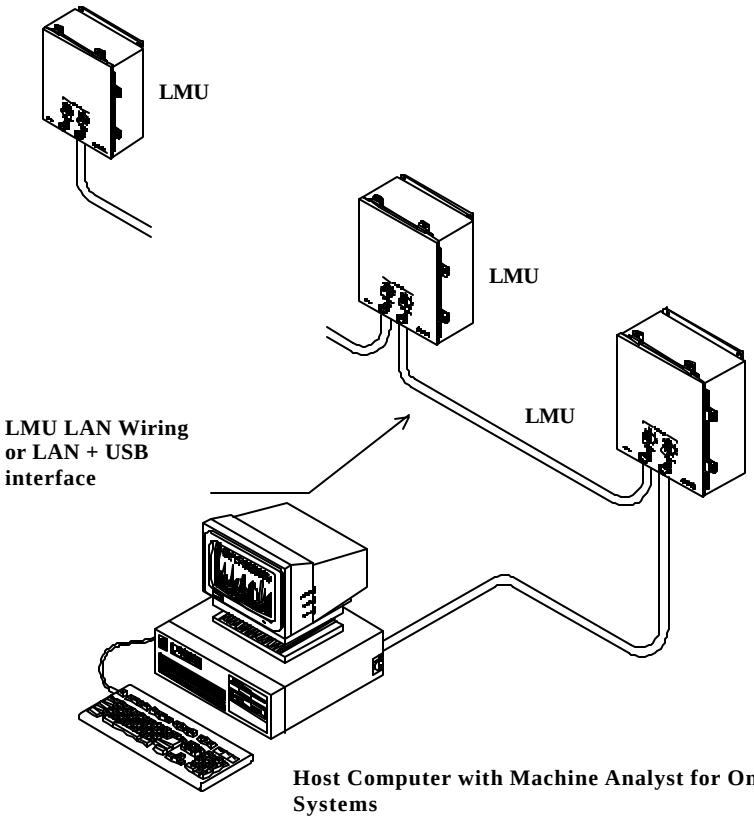


Figure I - 4.
The LMU System.

The **LMU System** uses **L**ocal **M**onitoring **U**nits (LMUs) to automatically collect and monitor machinery data from permanently attached sensors and/or from other installed continuous monitoring systems. Collected data is automatically uploaded through a **L**ocal **A**rea **N**etwork (LAN) to a host computer running Machine Analyst for On-Line Systems software for permanent storage, graphic display, and analysis.

- "Machine Analyst for On-Line Systems" is the term used to describe Machine Analyst after the LMU / MIM Plug-in software installation has been performed. Machine Analyst and Machine Monitor alone do not offer "on-line" features. Machine Analyst for On-Line Systems is Machine Analyst with "on-line" features.

The Local Monitoring Unit (LMU)

The LMU System (Figure I - 4) consists of one or more independent, multi-channel, local monitoring units (LMUs) connected to a host computer through a high-performance, digital, local area network (LAN). The LMU is the heart of the LMU System. It is contained in a NEMA-4X enclosure and is designed to be installed in adverse environments found on the plant floor.

The LMU firmware must be version 3.29 or greater.

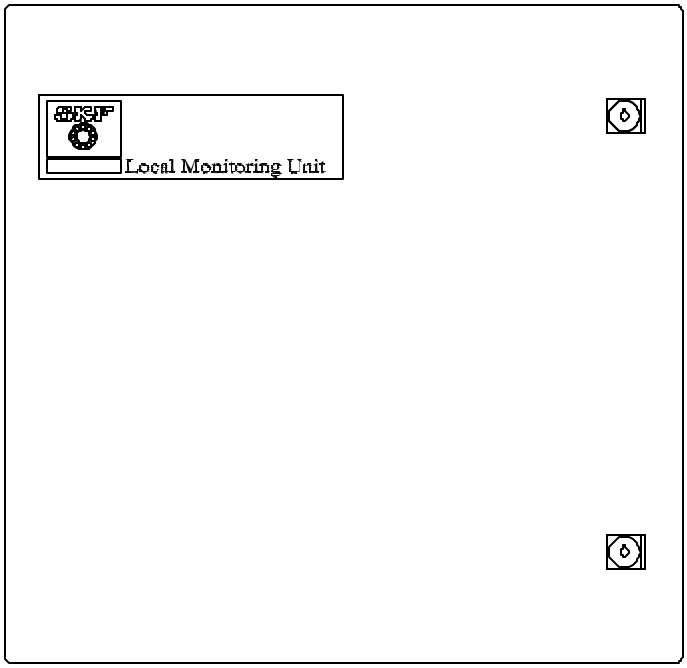


Figure I - 5.
The LMU's NEMA-4X Enclosure.

The LMU is permanently installed close to sensors that are permanently mounted on the monitored machinery. Up to 32 sensor inputs can be connected to each LMU. Each LMU is capable of performing up to 256 measurements on these sensor inputs. This design keeps wiring costs to a minimum, since the wire length from the numerous sensors to the LMU is kept to a minimum, and only a single LAN cable or LAN + USB interface need be routed the long distance to the host computer.

The LMU houses two main components:

- The LMU Motherboard, and the
- LMU Electronics Module

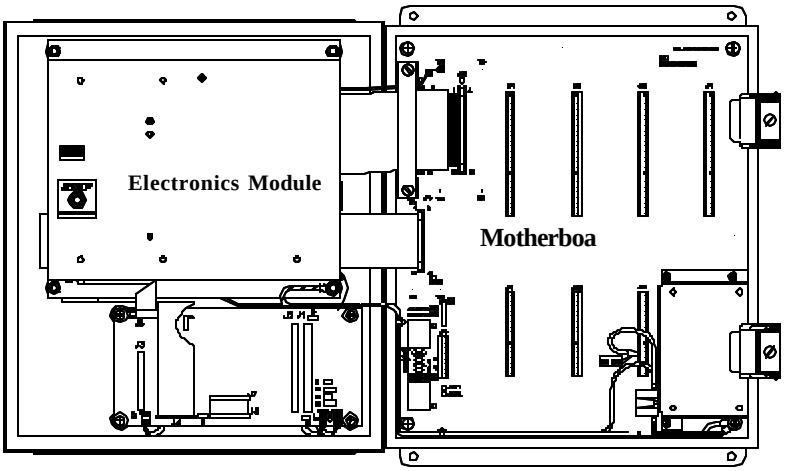


Figure I - 6.
The LMU - Inside View.

The LMU Motherboard

An LMU motherboard containing several terminal strip connectors is mounted inside the NEMA-4X enclosure (Figure I - 6 & Figure I - 7).

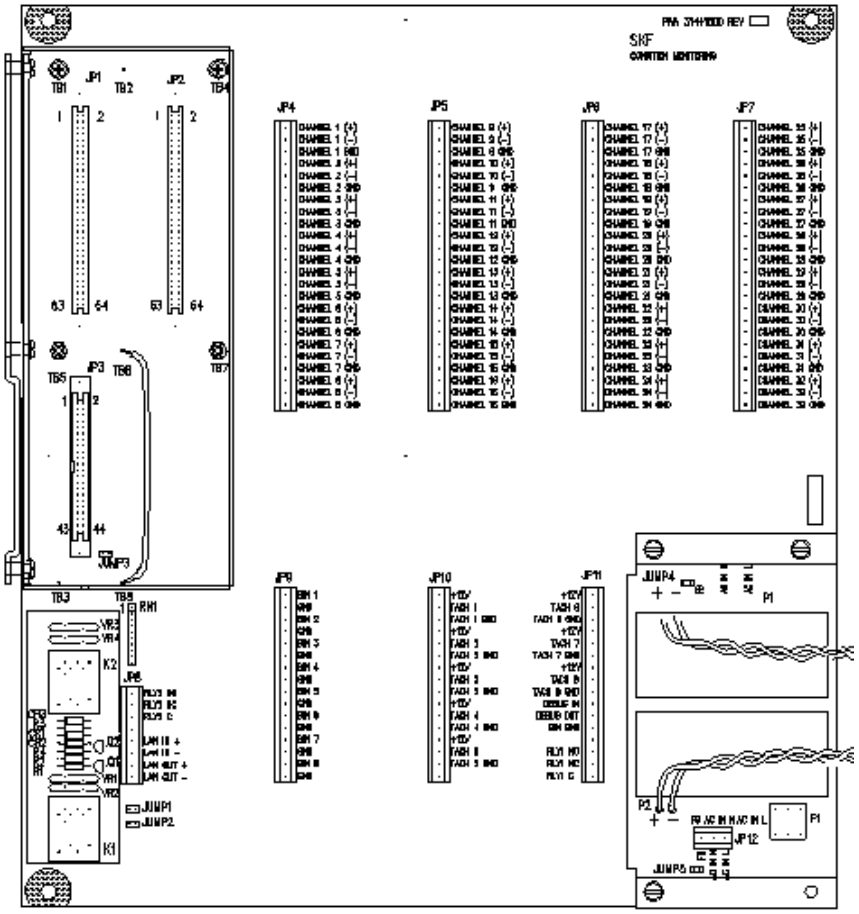


Figure I - 7.
The LMU Motherboard Terminal Strip Connectors.

Input wiring is connected to the LMU at the motherboard terminal strip connectors. There are five types of terminal strip inputs:

- Sensor inputs (CHANNEL1, CHANNEL2, etc.)
- Tachometer inputs (TACH1, TACH1 GND),
- Logic inputs (GND, BIN)
- LAN communication lines (LAN IN +, LAN IN –, LAN OUT +, LAN OUT –)
- Power inputs (AC IN L, AC IN N, FG)

Only a qualified electrician should install the AC power line to the LMUs.

The LMU Electronics Module

The LMU electronics module (Figure I - 7) is mounted on the inside of the enclosure door and consists of four circuit boards:

- The LMU Analog board
- The LMU Digital board
- The LMU Enveloping / *SEE* / Power board, and
- The LMU Multiplexer board
  - Each board's components and functions are described in **Chapter 3, LMU Overview**.

The LMU's electronics module performs two tasks.

3. Its primary task is to collect data.
4. Its secondary task is to communicate with the host computer and Machine Analyst for On-Line Systems software using the system's local area network or a LAN + USB interface.

LMU Functional Description

Downloading POINT setups to the LMU - When the LMU is first powered up or reset, it waits for the host computer to send it (download) a list of measurement POINT configurations. While it is waiting for downloaded measurement configurations, the LMU's status lamp (located on the electronics module's front cover) blinks slowly (once every 2 seconds). Each downloaded POINT arrives with its "POINT setup" that specifies all measurement and alarm parameters required for data collection.

Collecting and Reporting Data - At the completion of the download process, the LMU begins to collect data *one POINT at a time* (the LMU's status lamp blinks rapidly). After data has been collected for the first POINT, the LMU checks with the host computer to see if it has requested a measurement's value or alarm status to be uploaded to the Machine Analyst for On-Line Systems software. If the host computer has made a request, the LMU sends the appropriate reply. If no request was made, the LMU collects data from the next POINT in the downloaded list.

This process of data collection and communication with the host computer is repeated for each POINT in the list. When the LMU has collected data on the last POINT in the list, it starts over with the first POINT. The time it takes for the LMU to complete the list and start over is called the "turn around" time and is regulated by the number of POINTs in the list and each POINT's measurement configuration.

What is the MIM (Monitor Interface Module) System?

Requiring input from an M800A or other protection system, the MIM System is a SKF multi-parameter, programmable, on-line machinery monitoring system.

The **MIM System:**

- Senses machinery changes and automatically warns maintenance personnel of machinery problems.
- Provides FFT spectrum, time waveform, and polar vector displays for analysis of machinery condition.
- Provides an Event Log that logs and displays machinery alarm events as they occur.
- Provides an on-line interface to Machine Analyst databases.

The **MIM System** consist of:

- Monitor Interface Module (MIM) v. 4.01+
- A Host Computer (with LAN card or SKF LAN Plus (CMMA8350 LMU / MIM to USB Transceiver) interface installed) and appropriate Windows OS drivers
- Machine Analyst for On-Line Systems Software
- Machine Monitor
- Phoenix contact combicon plugs
- M800A or other Protection System

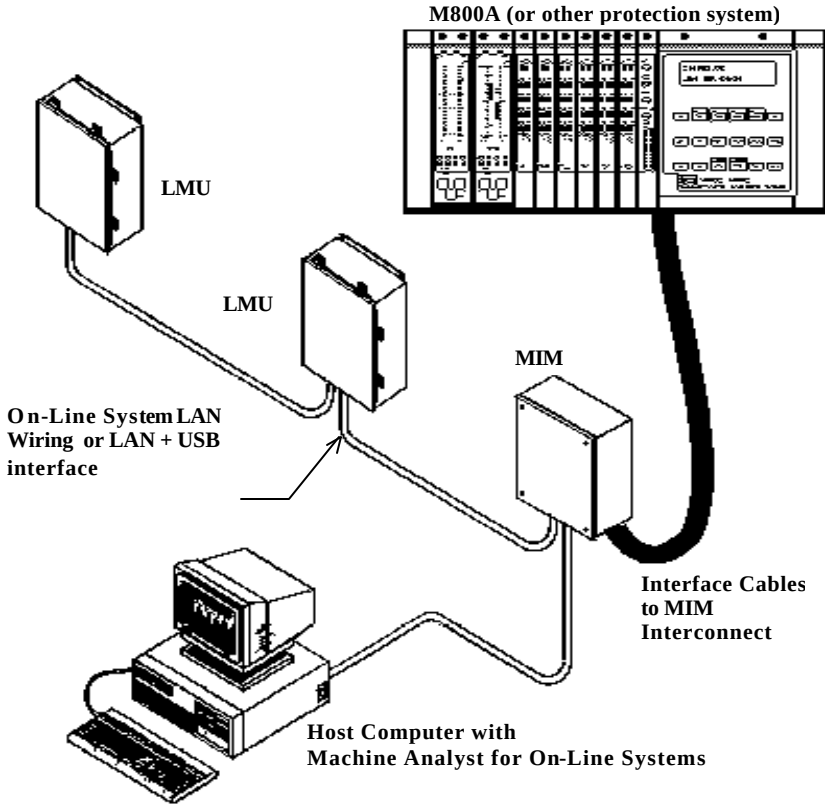


Figure I - 8.
The MIM System with LMUs On the Same LAN Cable.

The **MIM System** is designed to interface to any machine protection system with buffered signal outputs. Some supported machine protection systems are:

SKF Reliability Systems	M800A
Bentley Nevada	7200, 3300, and 9000
Dymac	M700
IRD	5915 and 5800 series

If the MIM requires interface to a protection system that does not provide readily-accessible buffered outputs, the MIM is connected to live signal terminals. Adequate care must be taken to ensure that an accidental system shut down does not occur during this procedure. The protection system should first be taken out of "shut down" mode before any MIM interconnect attempt takes place. The same shut down-disable procedure should be employed that is used when a probe is replaced with the protection system running.

The MIM System interfaces with machine protection systems through their buffered signal outputs. No high level communication occurs between the MIM System and the machine protection system. The MIM System does not affect the normal operation of the machine protection system in any way.

The MIM is a permanently installed 32 channel data collection system designed to monitor steady state machinery operating conditions. The main purpose of the MIM is to provide inexpensive on-line access to any channels monitored by a machine protection system.

The MIM automatically collects data from its attached protection system, processes it, and detects alarm conditions. Data is then uploaded to a host PC running Machine Analyst for On-Line Systems software over a high speed RS-485 LAN cable.

The Monitor Interface Module (MIM)

The MIM System (Figure I - 9) consists of one or more independent, multi-channel, Monitor Interface Modules (MIMs) connected to a host computer through a high-performance, digital, local area network (LAN).

The MIM enclosure is not sealed against moisture or dust and should **not** be mounted in a harsh environment.

Figure I - 9.
The MIM Enclosure.

The MIM is permanently installed close to the protection system (M800A, M700,...). Up to 32 configurable inputs are available on the MIM. Any of the 32 inputs may be selected for single channel data collection. Each MIM is capable of performing up to 128 measurements on these inputs.

The MIM houses two main components:

- The Interconnect board
- MIM Electronics Platter

The MIM interface cables connect directly to the MIM interconnect board using the Phoenix contact combicon plugs. The other ends of the MIM interface cables are wired to the protection system's buffered outputs (M800A, M700, etc.).

The following connections are made to terminal blocks on the front of the MIM enclosure.

- LAN communication lines (LAN IN, LAN OUT)
- Power inputs

Only a qualified electrician should install the AC power line to the MIMs.

The MIM Electronics Platter

The MIM electronics platter is mounted inside the enclosure and consists of four circuit boards:

- The MIM Analog board
- The MIM Digital board
- The MIM 2nd Channel Analog board
- The MIM Multiplexer board

The MIM's electronics platter performs two tasks.

1. Its primary task is to collect data.
2. Its secondary task is to communicate with the host computer and Machine Analyst for Online Systems software using the system's local area network.

MIM Functional Description

Downloading POINT setups to the MIM - When the MIM is first powered up or reset, it waits for the host computer to send it (download) a list of measurement POINT configurations. Each downloaded POINT arrives with its "POINT setup" that specifies all measurement and alarm parameters required for data collection.

Collecting and Reporting Data - At the completion of the download process, the MIM begins to collect data *one POINT at a time*. After data has been collected for the first POINT, the MIM checks with the host computer to see if it has requested a measurement's value or alarm status to be uploaded to the Machine Analyst for On-Line Systems software. If the host computer has made a request, the MIM sends the appropriate reply. If no request was made, the MIM collects data from the next POINT in the downloaded list.

This process of data collection and communication with the host computer is repeated for each POINT in the list. When the MIM has collected data on the last POINT in the list, it starts over with the first POINT. The time it takes for the MIM to complete the list and start over (turn around time) is regulated by the number of POINTs in the list and each POINT's measurement configuration.

The Host Computer

The host computer and Machine Analyst for On-Line Systems software perform all database management, trending, and display functions (live and stored) for the On-Line System. Using Machine Analyst for On-Line Systems and the host computer, the user can display live or stored CMU, LMU, or MIM data in a variety of formats and can re-program CMU, LMU, or MIM measurements and alarm parameters. Host computer specifications and setup are described in **Chapter 2, Software Installation**.

Machine Analyst for On-Line Systems Software Overview

"Machine Analyst for On-Line Systems" is the term used to describe Machine Analyst with the On-line plug-in.

Machine Analyst for On-Line Systems software and Machine Monitor are used to collect data from on-line monitoring devices and to display analysis plots and reports of the collected on-line data. It is also used for database entry (adding measurement POINTs), for downloading measurement POINT setups to portable monitoring devices (Microlog or MARLIN), for database manipulation of off-line and on-line measurement POINTs, and to generate plots and reports on data uploaded from off-line and on-line data collection devices.

To run Machine Analyst for On-Line Systems:

- Double-click the SKF Machine Analyst icon.

After double-clicking the SKF Machine Analyst icon, log in to the application. Machine Analyst menus provide features used with the **On-Line Systems** for gathering and viewing machinery and alarm data, and for setting up CMU, LMU or MIM measurement configurations.

Machine Analyst menu options allow you to perform the following **On-Line System** features:

- Automatic uploading of measurement and alarm data from CMUs, LMUs, or MIMs to Machine Analyst databases.
- Live spectrum, time domain, or polar display for a selected CMU, LMU, or MIM POINT.
- Automatic alarm display for CMU, LMU, or MIM POINTs.
- Automatic event logging for alarms as they occur.
- Remote hierarchy or ROUTE downloading of measurement configurations from Machine

Analyst for On-Line Systems to CMUs, LMUs, or MIMs.

Menus containing On-Line System specific options include the **Transfer** menu and the **Customize** menu.

Figure I - 10.
Machine Analyst for On-Line Systems' **Transfer** Menu.

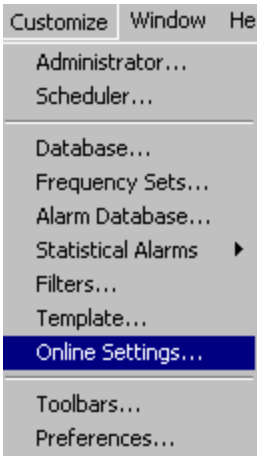


Figure I - 11.
Machine Analyst for On-Line Systems' **Customize** Menu.

Each menu's options are described in detail later in this manual.

License Key

SKF Machine Analyst for On-Line Systems requires a license key for installation. The license key corresponds to the number of on-line devices working with the Machine Analyst software.

To view the current license key:

- Select the **Help** menu's **About Application** option. The **License Key** tab displays the current license key and the number of devices included in the current system configuration.

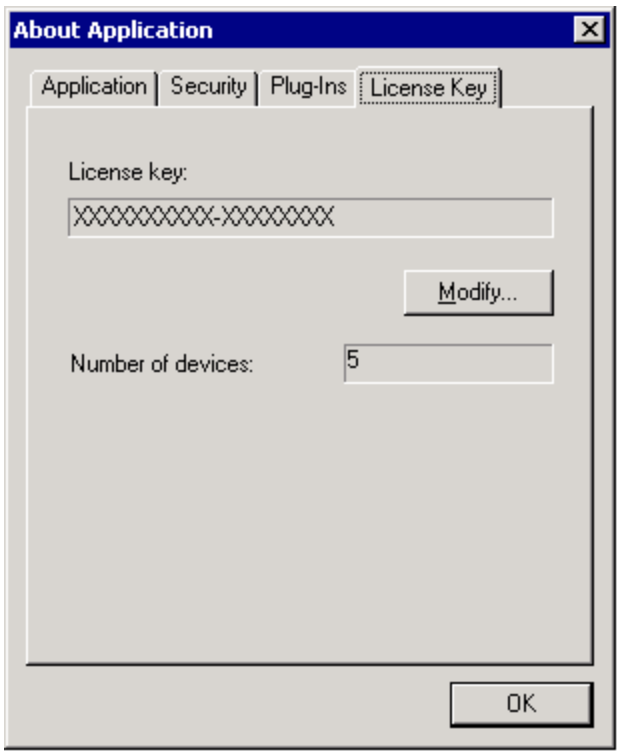


Figure I - 12.
Machine Analyst for On-Line Systems' **License key** Tab.

You may need to modify your license key if you add or remove devices from your system. Contact SKF's Technical Support Center for more information.

To modify the license key:

- Click the **License Key** tab's **Modify** button. The **Modify** dialog displays.

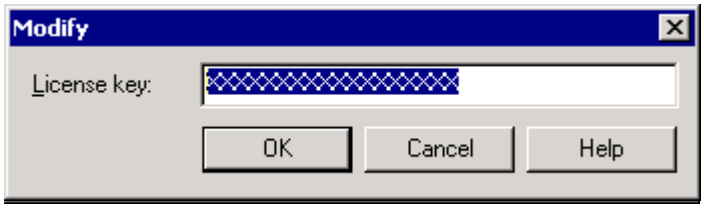


Figure I - 13.
The **Modify** Dialog.

- Enter the new license key (provided by SKF's Technical Support Center) in the **License Key** field and click **OK**.

Monitor Status Display

The initial display screen automatically shows alarm and communication information along the bottom of the display window.

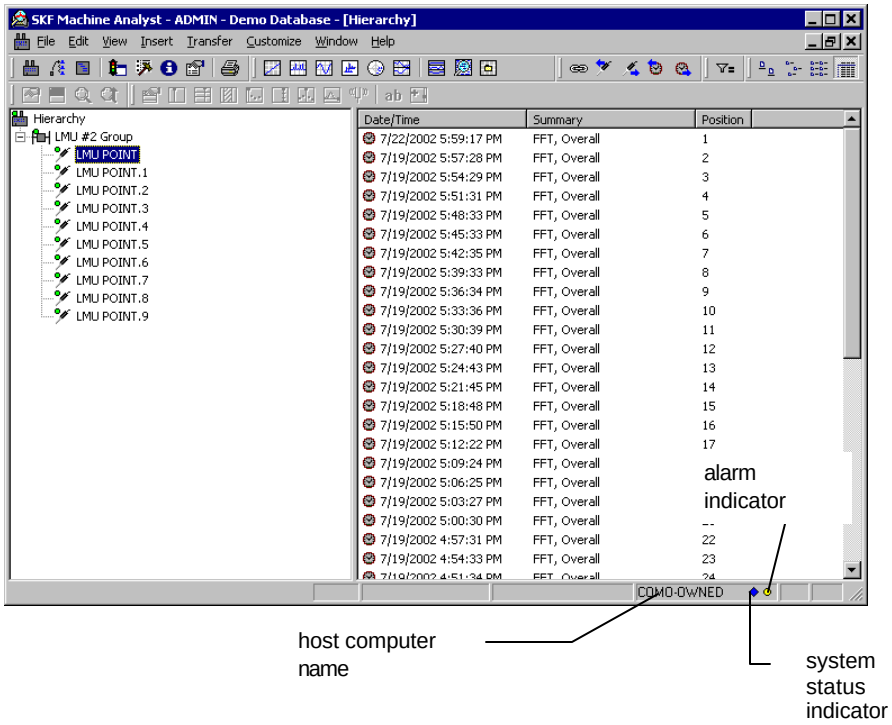


Figure I - 14.
Display Showing Alarm Indicator, System Status Indicator and Host Computer Name.

- **Alarm Indicator** - The small circle displays current alarm status. Green indicates a clear alarm condition, meaning no measurement POINTs are in alarm since it was last viewed. Yellow indicates an alert alarm condition, and red indicates a danger alarm condition. The alarm indicator calls your attention to changes in alarm conditions as the data is received from the hardware. The Monitor application allows all connected computers running Machine Analyst for On-Line Systems software to display the alarm indicators. The

indicator color remains the same until the alarm condition moves to another alarm level.

- **System Status Indicator -** The diamond icon indicates the current system status. Blue indicates a system problem or change. Possible system status conditions include:

  No device defined
  Communications Failed
  Download Request Failed
  Channel Error (BOV)
  Channel Restored
  Hardware Mismatch
  Invalid Firmware
  User Enabled Data Collection
  User Disabled Data Collection
  Box Download Failure
  Box Not Responding
  Box Responding
  Box Power Up
  Box Changed to Local Mode
  Box Changed to Collection Mode
  Box is Full
  Bad POINT Setup
  Incompatible Devices
  Unknown POINT Error
  Collection Data Stream Problem
  POINT Not Downloaded
  POINT Setup Issue

- **Host Computer Name –** This area displays the name of the host computer with the LAN card, USB connection, or TCP / IP connection to the hardware.

Machine Analyst displays Alarm Indicators and System Status Indicators for each available Monitor connection. The indicators continue to display until they are acknowledged.

Automatic Event Logging

The **Event Log** automatically stores and displays a list of alarm and system events.

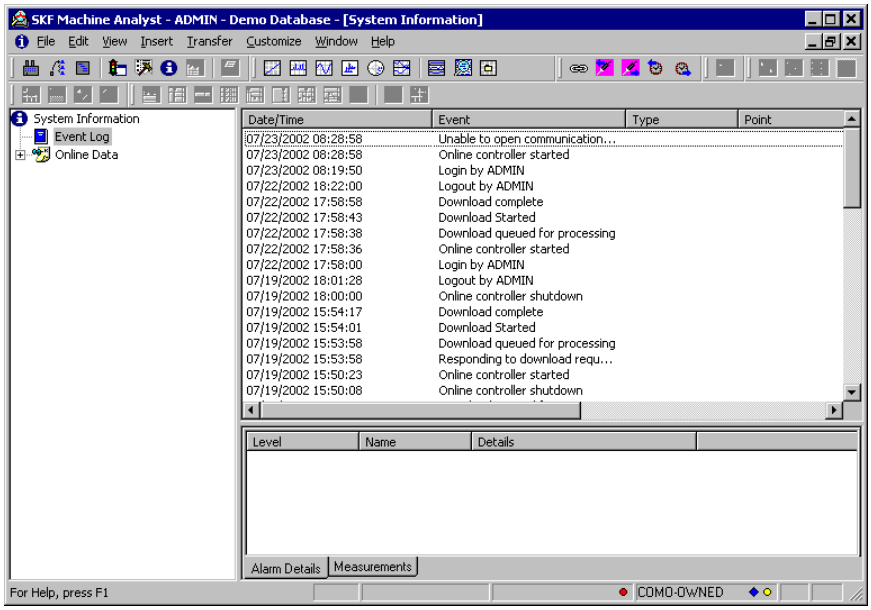


Figure I - 15.
An Event Log Example.

Analyzing the Event Log provides a detailed history of both machinery and condition monitoring system events.

1

SKF Machine Analyst for On-Line Systems Installation

Overview

This manual describes how to install the Machine Analyst for On-Line Systems software.

IMPORTANT:
Before installing Machine Analyst – On-Line software, you must already have Machine Analyst version 2.2 or newer installed on your computer.

- If you are installing Machine Analyst-On-Line software immediately after installing Machine Analyst version 2.2, you may need to restart after the On-Line software installation.
- Reference your Machine Analyst Installation Manual for specific hardware recommendations and for more information on logging in and changing your password.

Technical Support

If installation assistance is needed, contact SKF Reliability Systems Technical Support:

North and South America
4141 Ruffin Road
San Diego, CA 92123 USA
Telephone: (800) 523-7514

FAX (858) 496-3534
Email: tsc-usa@skf.com

Asia, Pacific
No. 1 Changi South Lane
Level 2M
Singapore 486070
Telephone 65-68767591
FAX 65-68767708

Or contact Technical Support through our web site;
www.skfreliability.com

Launching the Installation Program

The Machine Analyst for On-Line Systems installation program is available on CD only.

To launch the install program:

- With your computer running in Microsoft Windows 2000 or Windows NT 4.0 Service Pack 5, insert the CD into your CD drive. The install program automatically launches.
  - If the install program does not run automatically, locate the root directory using Windows Explorer. Double click the **Autorun.exe** file to manually launch the install program.
- Select the appropriate language from the displayed menu.
- Select **SKF Machine Analyst - Online**.

Installation Process

When the install program is properly launched, the **Welcome** screen displays.

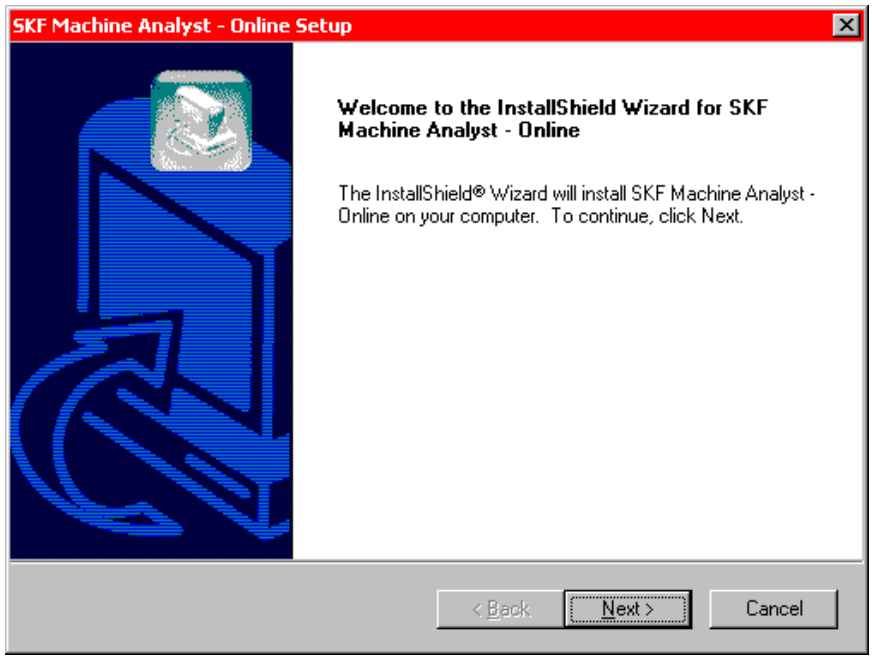


Figure 1 - 1.
The **Welcome** Screen.

- Read the **Welcome** screen information, then click the **Next** command button to proceed with the installation.

The installation program displays the **License Agreement** screen.

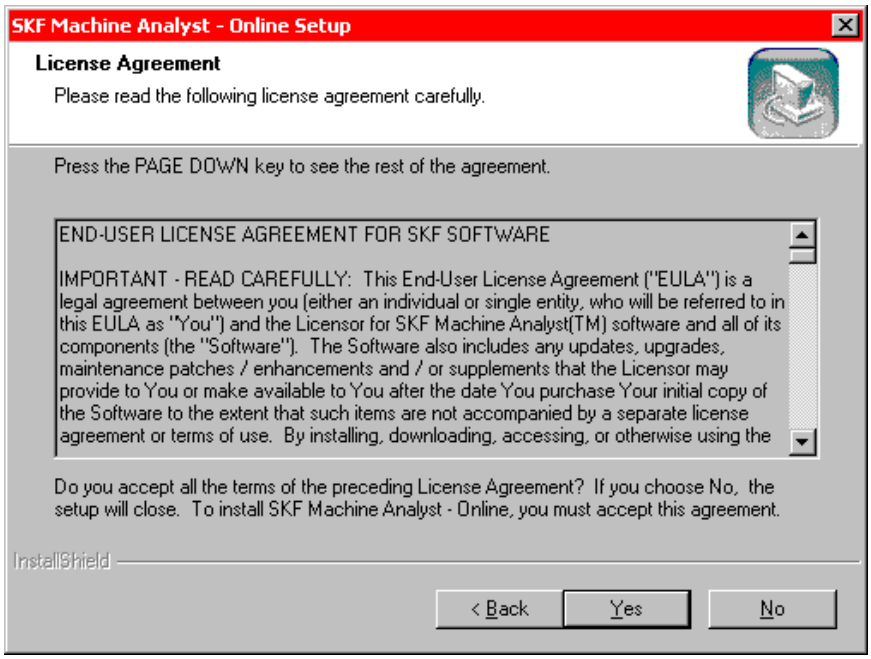


Figure 1 - 2.
The **License Agreement** Screen.

- Read the license agreement carefully and click **Yes** to accept the license terms.

The **Enter the Serial Number** dialog appears and prompts you to enter the serial number. The serial number is located on the outside of the box and on the Installation. It is a product Identification number that the customer must provide when calling Technical Support.

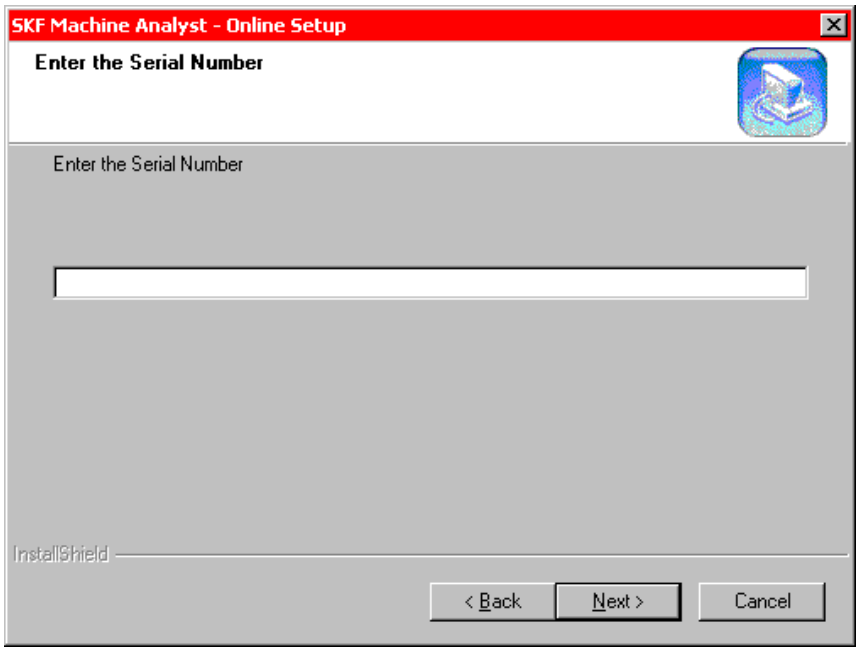


Figure 1 - 3.
The **Enter the Serial Number** Screen.

The **Enter the License Key** dialog appears and prompts you to enter the license key.

SKF Machine Analyst for On-Line Systems requires a license key for installation. The license key corresponds to the number of on-line devices working with the Machine Analyst software.

To view the current license key:

Select the **Help** menu's **About Application** option. The **License Key** tab displays the current license key and the number of devices included in the current system configuration.

You may need to modify your license key if you add or remove devices from your system. Contact SKF's Technical Support Center for more information.

To modify the license key:

- Click the **License Key** tab's **Modify** button. The **Modify** dialog displays.

Enter the new license key (provided by SKF's Technical Support Center) in the **License Key** field and click **OK.**

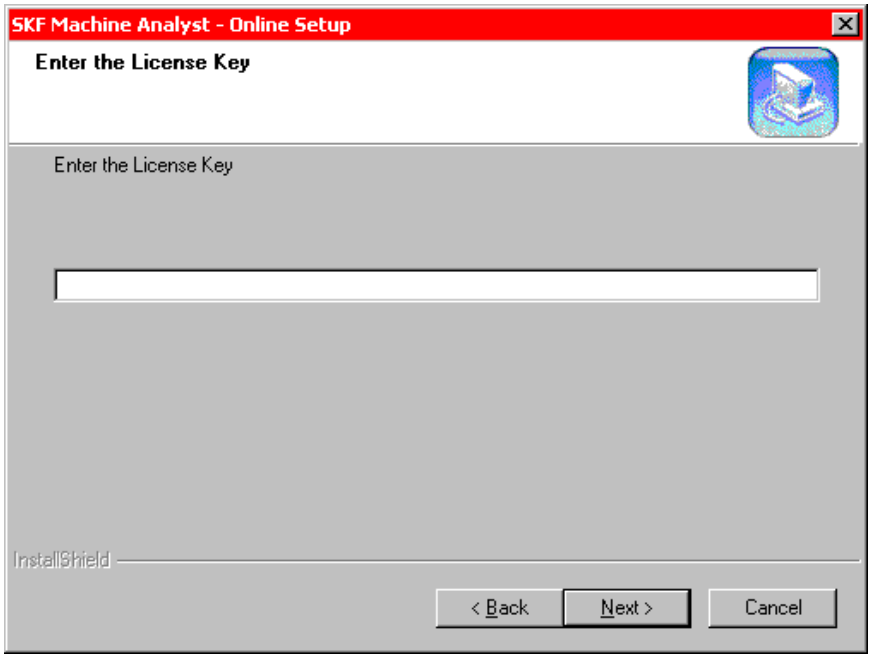


Figure 1 - 4.
The **Enter the License Key** Screen.

The **Enter Text** dialog appears and prompts you to enter the product key. The product key is the 11-digit number found on a sticker on the CD case.

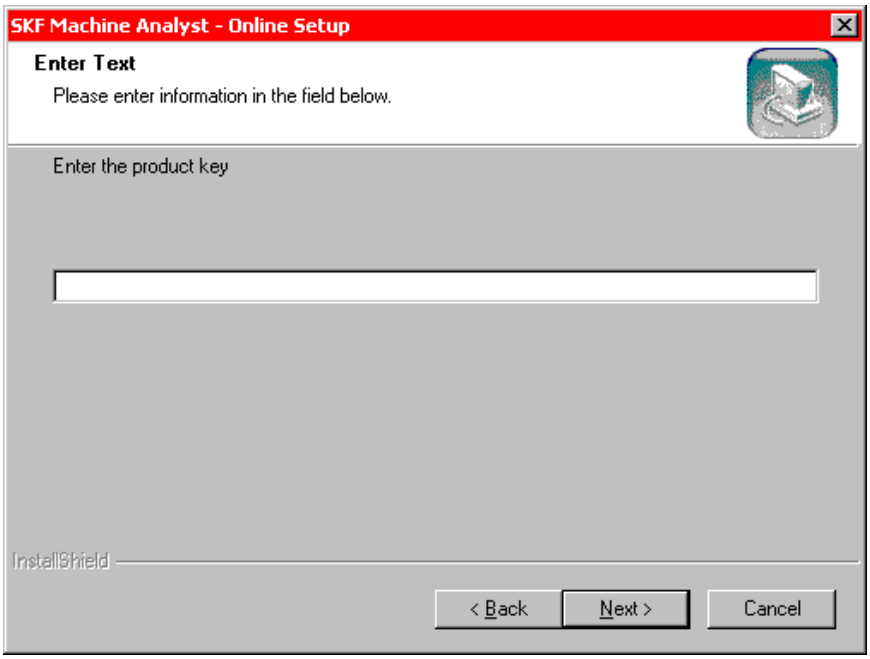


Figure 1 - 5.
The **Enter Text** Screen.

- Enter the Machine Analyst – On-Line plug-in product key number and click the **Next** command button.
  The **Start Copying Files** screen displays.
  - The Machine Analyst for On-Line Systems product key is different than your Machine Analyst version 2.2 product key.

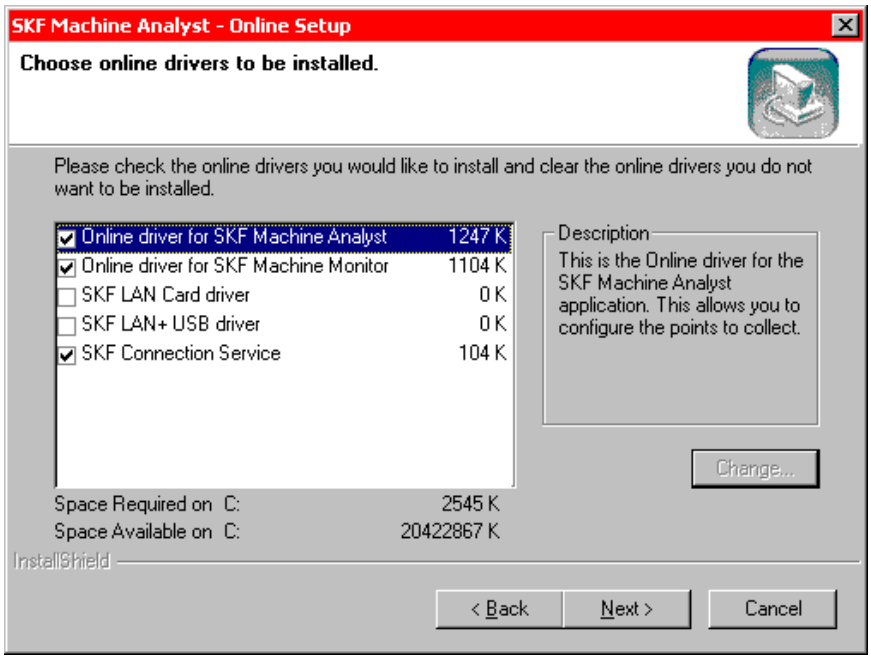


Figure 1 - 6.
The **Online Setup** Screen.

The **Online Setup** screen prompts you to select the online drivers you wish to install.

- Click an item's check box to include it in the installation. Click a second time to clear an item's check box and omit the item from the installation.
- Click **Next** to continue. The **Setup Type** screen displays.

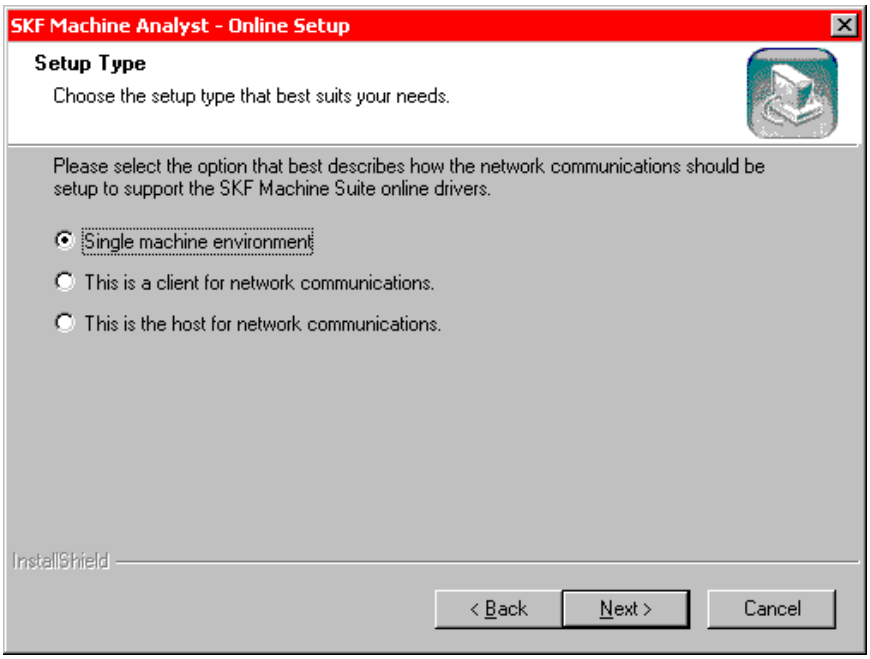


Figure 1 - 7.
The **Setup Type** Screen.

The **Setup Type** screen prompts you to select your network connection requirements.

Single machine environment – Select this option if the Machine Analyst for On-Line Systems software will only be installed on a single computer.

Client Network Communications – Select this option if this installation is being performed on a client computer which will communicate with the host computer via network connections.

Host Network Communications – Select this option if this installation is being performed on the host computer which will communicate with client computers via network connections.

- Select the appropriate installation type. If the **Client Network Communications** option is selected, the **Edit Data** dialog displays, prompting you to enter the host computer name.

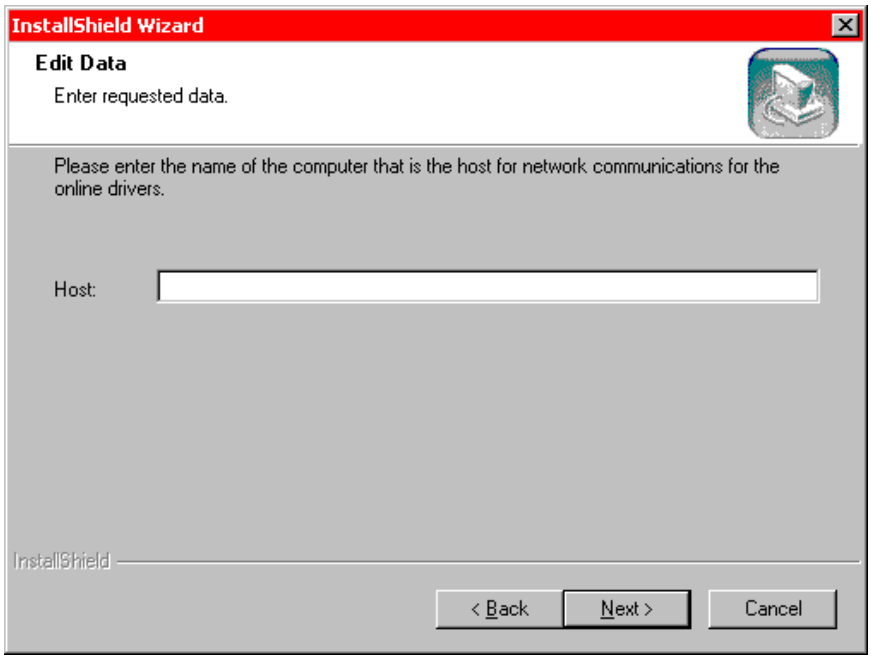


Figure 1 - 8.
The **Edit Data** Screen.

Enter the host computer name (**Client Network Communications** installation only) and click **Next** to continue. The **Start Copying Files** screen displays.

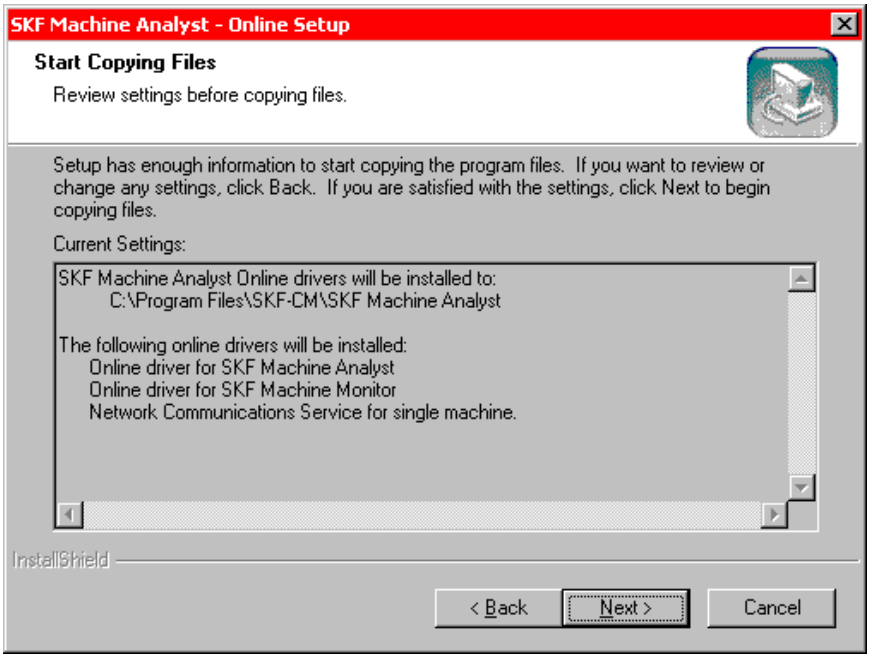


Figure 1 - 9.
The **Start Copying Files** Screen.

The **Start Copying Files** screen displays a summary of the settings to be used to install the Machine Analyst for On-Line Systems software.

- Review these settings carefully. If the settings are acceptable, click the **Next** command button to begin installing the Machine Analyst for On-Line Systems software. If the settings require editing, click the **Back** button to return to the previous screen(s).

The installation program proceeds to create the specified installation directory on the specified drive, and additional subdirectories branching from the specified directory. Program files are then copied into their appropriate directories, which were configured during the Machine

Analyst version 2.2 installation. Progress displays on the **Setup Status** screen.

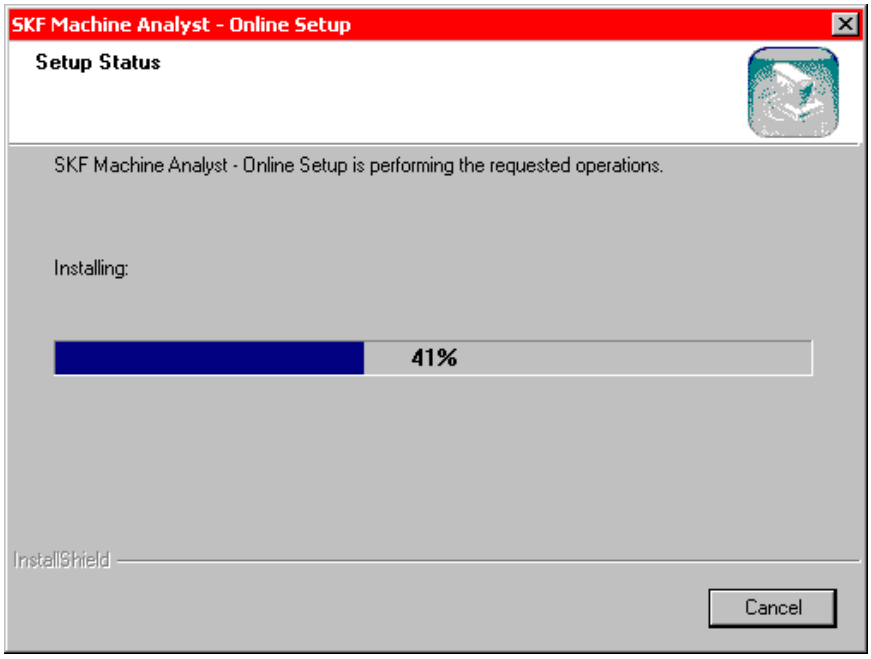


Figure 1 - 10.
The **Setup Status** Screen.

Before installation is complete, an **Information** message appears instructing you to upgrade your database after completing the install.

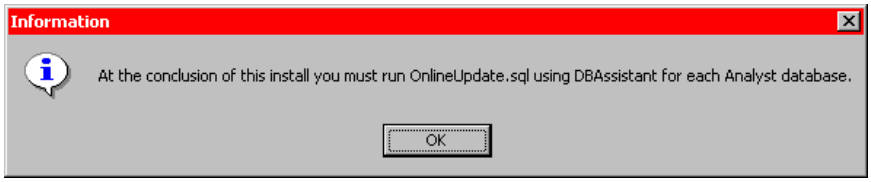


Figure 1 - 11.
The **Information** message.

When installation is complete, the **InstallShield Wizard Complete** screen displays.

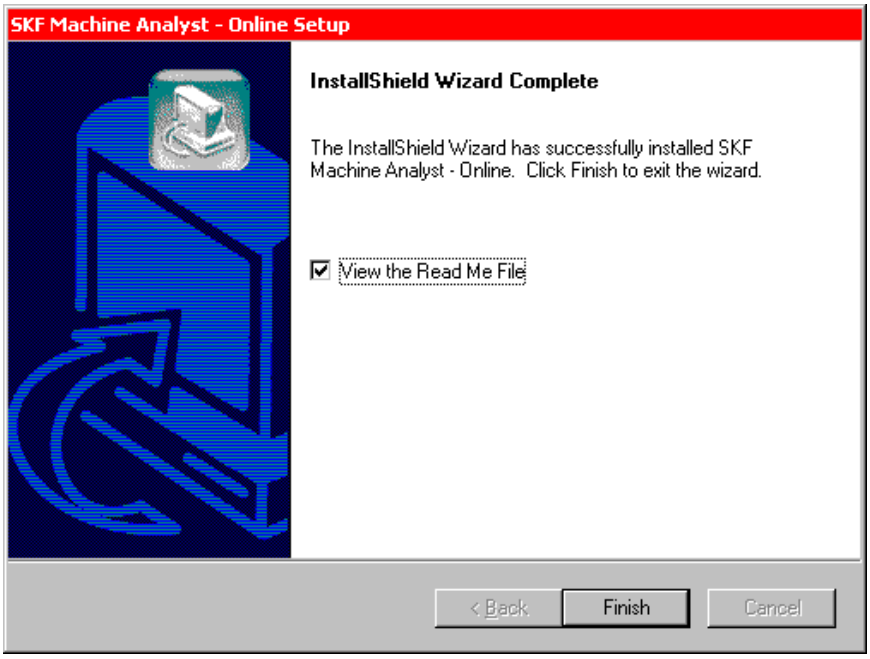


Figure 1 - 12.
The **InstallShield Wizard Complete** Screen.

- Click the **View the Read Me File** checkbox and click the **Finish** command button.

After reading the **Read Me** file, close the file.

After completing the install of Machine Analyst for On-Line Systems, run DbAssistant to upgrade your database.

To run DbAssistant:

- Go to **Start** > **Programs** > **SKF Machine Suite** > **DbAssistant**.
- For the **Account** name, you must log-in as "Sys" to run dbupdate.sql.

- Contact your System Administrator if you do not know the password. If Oracle was installed through the Machine Analyst install, the password is "change_on_install".
- Ensure that the **Name** matches the name given to your database. If running in stand-alone mode, the name of your database will be "cmlocal".
- Select **dbupdate** in the **Script files** field, and click **Execute.**
- Repeat this process for any additional databases.

Upon completion, close DbAssistant. Your Machine Analyst for On-Line Systems installation is now complete.

2

CMU Overview

- This chapter provides a hardware overview for the CMU system. Please refer to the appropriate Installation Manual for hardware installation information.

The Condition Monitoring Unit (CMU)

The Multilog CMU System consists of one or more independent, multi-channel, condition monitoring units (CMUs) connected to a host computer through a high-performance, digital, local area network (LAN). The CMU is the heart of the CMU System. It is contained in a NEMA-4X enclosure and is designed to be installed in adverse environments found on the plant floor.

The CMU is permanently installed close to sensors that are permanently mounted on the monitored machinery. Up to 32 static or dynamic sensor inputs, 8 tachometer signal inputs, and 16 digital logic inputs can be connected to each CMU. Each CMU is capable of performing up to 256 measurements on these sensor inputs. This design keeps wiring costs to a minimum, since the wire length from the numerous sensors to the CMU is kept to a minimum, and only a single Ethernet or RS-485 LAN connection need be made to the host computer.

The CMU is a modular system. Modules plug into slots in one of three racks on the motherboard. The following modules are supported:

- The Multi-parameter Input Module
- The Tachometer Input Module
- The Digital IO Module

- The Direct Access Module.

In addition to the modules installed in slots, the CMU includes the On-Line module, which is the heart of the CMU. The On-Line module contains a rugged Windows CE™ computer and high performance analog and digital signal processing electronics.

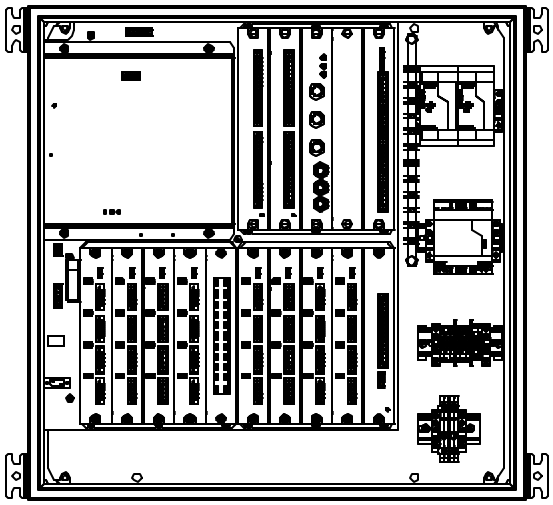


Figure 2 - 1.
The CMU - Inside View.

The CMU Motherboard

A CMU motherboard contains 3 racks and each rack provides 4 slots for modules. The two bottom racks provide slots for Multi-Parameter Input Modules. The rack in the upper right–hand corner contains the slots for the Digital IO modules, the Direct Access Module, and the Tachometer Input Module.

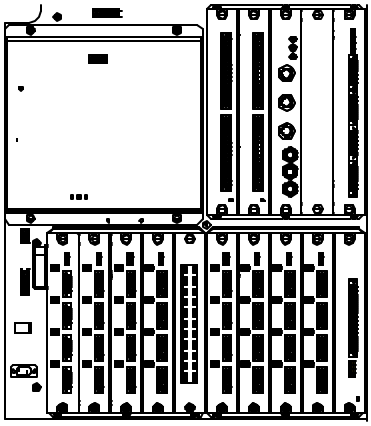


Figure 2 - 2.
The CMU Motherboard Racks, Slots, and Modules.

Input wiring is connected to the CMU at removable connectors on the front panel of each module. There are five types of terminal strip inputs:

- Multi-Parameter Input Module connections (CHANNEL1, CHANNEL2, etc.)
- Tachometer Input Module connections (TACH1, TACH1 GND),
- Logic inputs (GND, BIN)
- RS-485 LAN communication lines (LAN IN +, LAN IN –, LAN OUT +, LAN OUT –)
- RJ-45 Ethernet connector
- Power inputs (AC IN L, AC IN N, FG)

Only a qualified electrician should install the AC power line to the CMUs.

The CMU Electronics Module

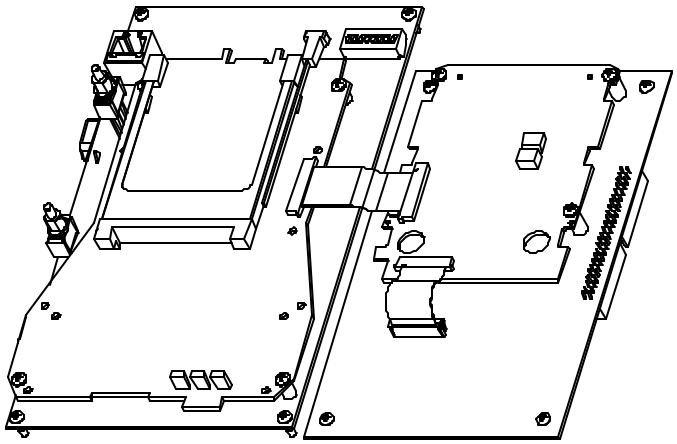


Figure 2 - 3.
The CMU Electronics Module.

The CMU **electronics module** (Figure 2-3) is mounted on the upper left-hand corner of the Motherboard and consists of four circuit boards:

- The CMU Analog board
- The CMU Digital board
- The CMU Digital Support, and
- The CMU Multiplexer board

The CMU's electronics module performs two tasks.

5. Its primary task is to collect data.
6. Its secondary task is to communicate with the host computer and Machine Analyst for On-Line Systems software using the system's RS-485 local area network, or an Ethernet connection.

The CMU Modules

The CMU is a modular system that can be purchased with a variety of modules installed. Additional modules can also be purchased and added after the system is installed. Each module is detailed below.

The CMU Multi-Parameter Input Module

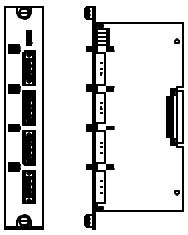
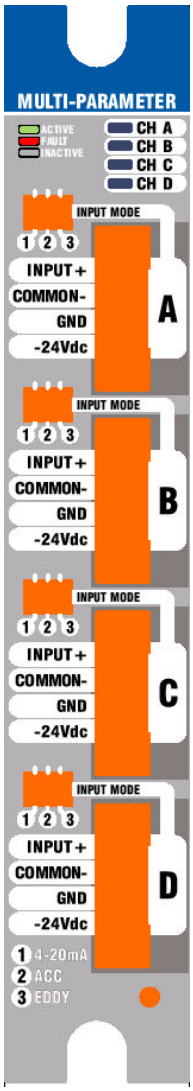


Figure 2 - 4.
The Multi-Parameter Input Module.

Each Multi-Parameter Input Module (MP Module) accepts 4 dynamic or process inputs. This module can provide 4 mA constant current power for various sensors (such as accelerometers), as well as –24 V dc power for an eddy current probe driver. This module supports multi-parameter measurements, such as velocity, acceleration enveloping, temperature, etc. The Multilog CMU supports up to 8 modules for a total of 32 channels.



Connections

Each MP module has four input channels labeled A, B, C, and D. Each input channel has four available connections. The connection "INPUT +" is connected to the vibration probe or other compatible signal source. The connection "INPUT +" may also provide constant current power to an ICP sensor.
The connection "COMMON-" is connected to the return line of the signal source. The connection "GND" is connected to the sensor cable shield. "–24 V dc" is an output and is available for powering a displacement probe driver.

Configuration

The input mode jumper has three positions. Place the jumper in position 1 for displacement probe inputs, or in position 3 for 4-20 mA current loop signal sources. Place the jumper in position 2 for all other signal sources.

Function

For each input channel A, B, C, and D, there is a corresponding LED located at the top of the module. A green LED indicates that input is currently selected for data collection. A red LED indicates that an input channel error, such as a BOV error, has occurred. The LED remains on until the problem has been resolved.

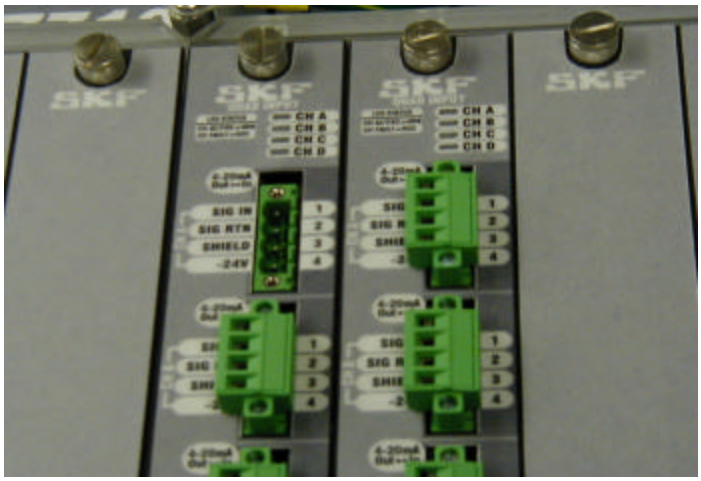


Figure 2 - 5.
The Multi-Parameter Input Module's Input Connectors.

The CMU Digital I/O Module

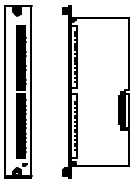
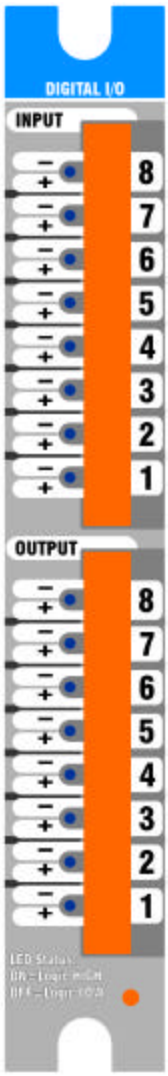


Figure 2 - 6.
The Digital I/O Module.

Each Digital I/O Module provides 8 isolated TTL logic inputs and 8 open collector logic outputs. The inputs can be used to gate or initiate measurements in the Multilog CMU. The logic outputs can be used to communicate alarm conditions to PLCs or alarm enunciators. The Multilog CMU supports up to 2 Digital I/O Modules for a total of 16 digital Inputs / Outputs.



Connections

The eight input channels are numbered 1-8 and have two connections. The connection "+" is connected to a logic signal source, such as a Programmable Logic Controller. The connection "-" is connected to the logic signal source return line. The logic inputs are optically isolated and must be driven high or low by the signal source.

The eight output channels are numbered 1-8 and have two connections. The connection "+" is an open collector output that may be connected to control loads such as relays or actuators. The power and pullup resistor for the output must be provided externally.

Function

Each of the eight input channels and eight output channels has an LED. If the LED is ON, the input or output is a high logic voltage. If the LED is OFF, the input or output is a low logic voltage.

The CMU Tachometer Input Module

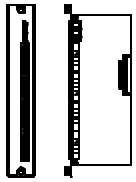
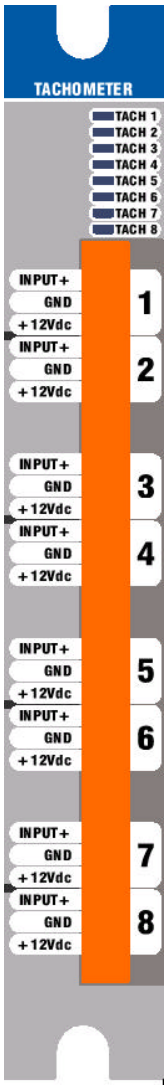


Figure 2 - 7.
The Tachometer Input Module.

The Tachometer Input Module provides 8 tachometer inputs for a wide variety of sensors, including optical, proximity switch, key-phasor, and magnetic. The Multilog CMU supports one 8channel Tachometer Input Module.



Connections

The eight tachometer inputs are numbered 1-8. Each input has three connections. The connection "INPUT +" is connected to the tachometer signal source. The connection "GND" is connected to the tachometer signal and power return. The connection "+12 V dc" connection supplies 12 volt dc power for the tachometer, if needed.

Function

Each tachometer input has a corresponding Activity-Indicator LED at the top of the module. The LED blinks at the rate of the tachometer input. As the speed of the machine increases, the LED's "blinks" merge and become a continuous solid light. The LED blinks as long as there is a signal connected to that channel, regardless of which one is selected for the output.

The CMU Direct Access Module

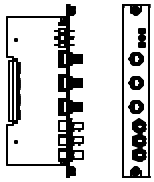
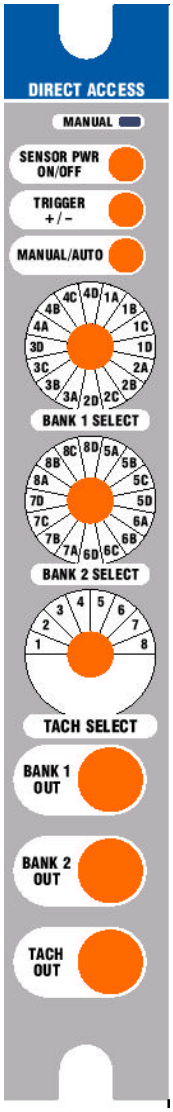


Figure 2 - 8.
The Direct Access Module.

The Direct Access Module provides direct outputs from sensors connected to the Multilog CMU. Any multi-parameter input signal and any tachometer signal can be selected using a rotary switch. Exact replicas of the input signals are available via BNC connectors for convenient data collection using a Microlog data collector.



Connections

Three BNC connectors are provided for easy connection to a data collection or analysis device. The outputs are buffered and short circuit protected, but should not be connected to any active signal source.

Function

Set the **MANUAL** / **AUTO** toggle switch to the **MANUAL** position to enable control of the CMU. Use the **BANK 1** selector switch to route one of the BANK 1 MP Module inputs to the **BANK 1 OUT BNC**. Use the **BANK 2** selector switch to route one of the BANK 2 MP Module inputs to the **BANK 2 OUT BNC**. If the selected sensors require +24 V dc constant current (ICP) power, set the SENSOR PWR to the **ON** position. If a trigger is required, use the **TACH** selector switch to route one of the tachometer to the **TACH OUT BNC**. If needed, set the **TRIGGER +/-** polarity toggle switch to the negative position to invert the signal at the **TACH OUT BNC.**

The CMU On-Line Module

Figure 2 - 9.
The On-Line Module.

The On-Line Module contains a Windows CE embedded computer that collects the data, compares the data to alarm criteria, and notifies the host computer that the alarm or scheduled data is available. If the Analog and Digital boards in the On-Line Module are not installed, the system can be used with the Direct Access Module as a manually operated switchbox.

Configuration

The DIP switches in the center top of the On-Line module are used to set the CMU address. The CMU address is used for both SKF LAN and Ethernet communications. The address is set as a binary number between 1 and 63. The table is provided so the binary switch positions for any address may be looked up. Once the address is set, the power must be cycled or the RESET button pressed before the new address becomes effective.

- The CMU's switch polarity is different than the LMU's or MIM's. The CMU's binary 1 position is with the switch up and toward the ON position.

Function

The On-Line module provides three status LEDs. The green LED indicates communications activity. The red LED indicates an error has occurred. The yellow LED blinks to indicate the On-Line module is functioning normally. If the yellow LED stops blinking for more than 5 seconds, the system is not functioning properly and should be reset or powered down. All three LEDs are used to signal normal start-up and shutdown activity.

The On-Line module provides a RESET button that resets the CPU on the digital board. Press the RESET button when the system LED activity has stopped.

The On-Line module also provides a recessed “alternate” switch. This switch is provided for service purposes and should not be pressed during normal operation.

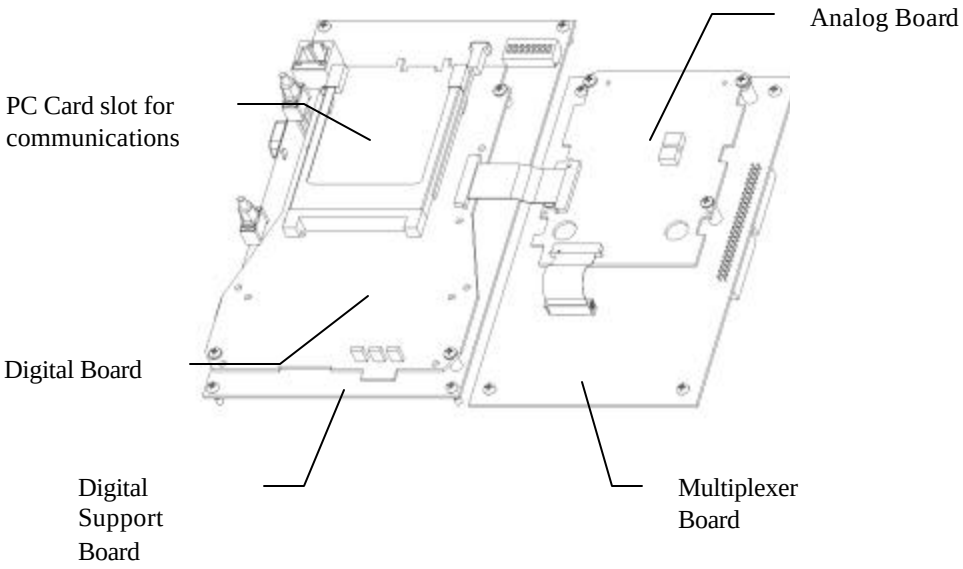


Figure 2 - 10.
The Multilog CMU – Inside View.

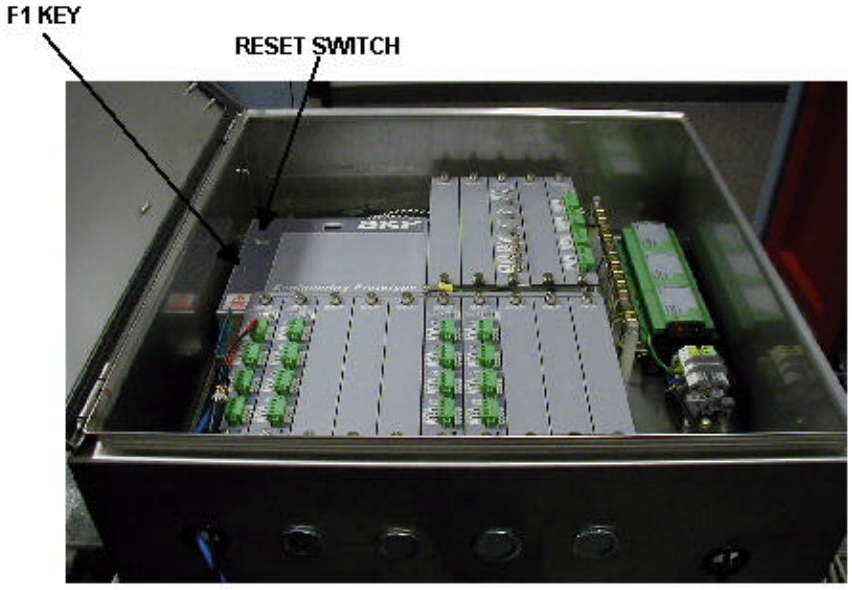


Figure 2 - 11.
The Reset Switch and F1 Key Locations.

Available CMU Configurations

Ten separate CMU Configurations are available based on the combination of installed components. For example, CMU units may be configured with different numbers of channels, communication options, enclosure options, and number of digital outputs. New configurations can be provided on request.

The CMMA7710 model number is followed by additional identifying numbers and letters that indicate the exact configuration. For example, the Multilog CMU model number **CMMA7710-32-E0-S-ON** indicates a 32 channel, Ethernet system with a Stainless steel enclosure, and no digital outputs.

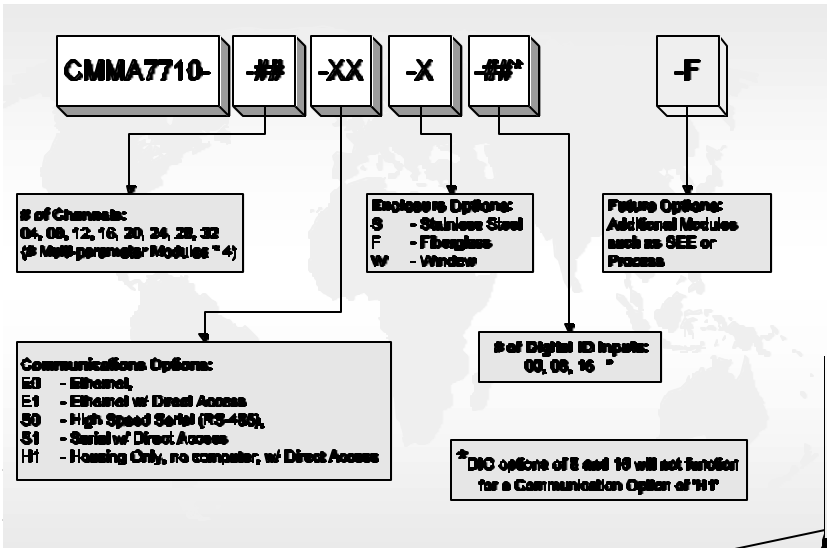


Figure 2 - 12.
Multilog CMU Model Number Diagram.

Specifications for CMU Hardware

Programming

Configured from Machine Analyst for On-Line Systems Software via the SKF LAN or via Ethernet .

Performance

32-bit, high performance, RISC CPU”

Windows CE Operating System version 2.12, which is multi-tasking and multi-threaded with real time capability

FFT spectrum resolution to 12800 lines in user selectable increments.

FFT processing time for 400 line FFT: 0.7 seconds/average. TBD.

Storage

OS Flash Memory: 16 Mbyte

Data Flash Memory: 4 Mbyte

RAM: 16 Mbyte

POINT and Data Storage

Power Supply

85 to 264 VAC; 45 to 65 Hz, 0.8A Max.

Backup Battery Information
6V DC @ 0.5Ah
Manufacturer: Power Sonic
Model No.: PS-605WL (SKF PN#: 10913800)

Size

23.62 inches wide (600 mm) x 23.62 inches high x 8.27 inches (210 mm) deep in stainless steel NEMA 4X weatherproof enclosure.

Approximately 68.2 lbs. (31kg)

Environmental

Operating temperature: -20 degrees C to 55 degrees C (0 degrees F to 130 degrees F).

Humidity: to 100% condensing (in NEMA 4X enclosure).

SKF LAN Communications

Via Ethernet

- Support 10Base-T
- Maximum distance between CMU and hub is 100 meters.
- Data transfer rate: 10 Mbps

Via SKF LAN Plus

- LMU Local Area Network (LAN) based on RS-485 specification.
- Up to 32 Condition Monitoring Units per network.

  Data transfer rate: 230 Kbaud.

  Maximum total LAN cable length per network:
- 3200 ft. using standard (i.e. capacitance < 40 pf/ft.), twisted pair, shielded instrument cable.

  Several factors influence actual system communications limits; please refer to SKF Publication CM9127 "**Maximum permissible LMU LAN Cable Length and Example Belden Cable Specifications**" for recommendations.

Multi-Parameter Module Specifications

Parameter	Specification
Channel Count	4 inputs per module and up to 8 modules for 32 channels per CMU
Total dynamic range	140 dB (time domain)
Measurement S/N ratio	90 dB (time domain)
Cross talk	80 dB @ 10kHz with 2-pole slope (68 dB at 20kHz)
Voltage range	20mVpp to 40Vpp (centered around zero)
Current range	4-20mA.
Input frequency range	Dynamic 0.1 to 40kHz Static: DC to 1Hz (BOV/gap)
MUX Input isolation	Channel to channel isolation (any terminal) better then 140 dB over full frequency range.
Input protection	440 volt
Constant current provision	On/Off, 4mA @ 24V shall be provided to the acceleration sensor when On. A single -24 V dc shall be provided for displacement probes.
Sensor validation measurement	Bias Output Voltage measurement with sensor OK/Bad LEDs
Eddy Probe (Displacement Probe) Power	-24 V. Each output is fused @ 100 mA. Total available current depends on DIN rail supply.

- To find available current, take a standby – 24 V current loading. Subtract from the maximum current spec. The rest is available to divide between the MP module.

Digital I/O Module Specifications

Parameter	Specification
Channel Count	8 / 16
Voltage Range	TTL compatible 0 to 5 Volt.. Voltages below 0.8 V are regarded as a "zero". Voltages higher than 2.5 V are regarded as "one"
Sample Rate	Determined by POINT Sequence
Visual Indicators	LED is ON for High Logic LED if off for Low Logic

Tachometer Module Specifications

Parameter	Specification
Channel Count	8 (Multiplexed)
Power Provision for external tacho device	A single +12 Vdc @ 500 mA for all 8 tachos
Visual Indicators	LED for each Tacho. LED blinks at low frequencies, remains illuminated continuously at high frequencies.
Frequency Range	10 – 60,000 RPM ±1% (as actually seen on the tacho input)
Voltage Range	2Vpp to 30Vpp
Duty Cycle	Minimum of 5%
Trigger Slope	User selectable positive or negative
Trigger Level	Automatic
Phase accuracy Tacho to Signal	Better then 2 Degrees

Direct Access Module Specifications

Parameter	Specification
Output Voltage	± 20 V or 40 V p-p into 10k???
Frequency Range	Dc – 50 kHz
Maximum Load, Output	Each output is short circuit protected
Channel Selection	Rotary switches
Trigger Polarity	+ / - selectable
Max. Offset	± 3 mV
Accuracy	+ / - 5%

- The front panel's Manual / Auto switch activates the module and overrides any programmed settings. 4 mA power can be applied to the probe using the "sensor power" switch.

CMU Communication Options

Two communication options are available.

- Refer to **Chapter 5, Communications** for more detailed information on available CMU communication options.

SKF LAN via Ethernet (TCP / IP)

Communication between the host computer and the CMU network is established at the host computer via a 10BaseT Ethernet. A hub is needed to establish communication between the Multilog CMU network and the host computer.

SKF LAN via CMMA3850 SKF LAN PLUS (On-Line Device to USB Transceiver)

Communication between the host computer and the on-line device network is established using SKF's CMMA3850 LAN Plus (On-Line Device to USB Transceiver). This transceiver uses standard, off-the-shelf USB cables, and can be used with either desktop PCs, or with laptops equipped with a USB interface, running Windows 2000.

User Notes

3

LMU Overview

- This chapter provides a hardware overview for the LMU system. Please refer to the appropriate Installation Manual for hardware installation information.

Specifications for LMU Hardware

Input

Up to 32 dynamic or static inputs: 50 VAC Peak to Peak, ±25 VDC

Speed Inputs: Eight speed inputs:

.2 Hz to 10 kHz frequency range (programmable events/revolution), accepts ± pulse signals.

All inputs, including power supply, connected to easily accessible compression type terminal strips.

Programming

Configured from Machine Analyst for On-Line Systems Software via the LMU Local Area Network (LAN).

Performance

16 bit, 286-equivalent micro-processor.

Multi-tasking to permit simultaneous display and data acquisition.

FFT spectrum resolution to 6400 lines in user selectable increments.

FFT processing time for 400 line FFT: 0.7 seconds/average.

Storage

2.25 Mbyte memory.

Overall, FFT, phase vector, and time waveform measurements are stored per POINT: the latest measurement, the latest alarm, and the latest scheduled due data to be uploaded to Machine Analyst for On-Line Systems.

Output

Accelerometer power supply: 4.4mA at 24 VDC.

To host computer via Local Area Network (LAN).

OPTO 22 digital output feature located in host PC, for remote alarm annunciation (optional).

Provisions for 2 optional relays.

Power Supply

85 to 265 VAC; 47 to 440 Hz.

Size

23.62 inches wide (600 mm) x 23.62 inches high x 8.27 inches (210 mm) deep in stainless steel NEMA 4X weatherproof enclosure.

Approximately 68.2 lbs. (31kg)

Environmental

Operating temperature: -20 degrees C to 55 degrees C (0 degrees F to 130 degrees F).

Humidity: to 100% condensing (in NEMA 4X enclosure).

Communications

LMU Local Area Network (LAN) based on RS-485 specification.

Up to 64 Local Monitoring Units per network.

Data transfer rate: 230 Kbaud.

Maximum total LAN cable length per network:

6000 ft. (1800 meters) using high-quality (i.e. capacitance < 15 pf/ft.), twisted pair, shielded data cable.

3500 ft. (1100 meters) using standard (i.e. capacitance < 40 pf/ft.), twisted pair, shielded instrument cable.

Several factors influence actual system communications limits; please refer to SKF Publication CM9127 "**Maximum permissible LMU LAN Cable Length and Example Belden Cable Specifications**" for recommendations.

Installing the Local Monitoring Unit (LMU)

Permanently install each LMU close to each group of machines to be monitored. Up to thirty-two sensor inputs can be connected to each LMU. A 105 volt to 265 volt AC power line must be connected to each LMU.

Each LMU contains a motherboard and an electronics module.

The LMU Motherboard

The LMU's motherboard contains a 24 volt DC power supply, a 12 volt DC power supply, and terminal strip

connectors for sensor inputs, tachometer inputs, LAN connections, provisions for two optional relays, binary logic inputs, and AC power inputs.

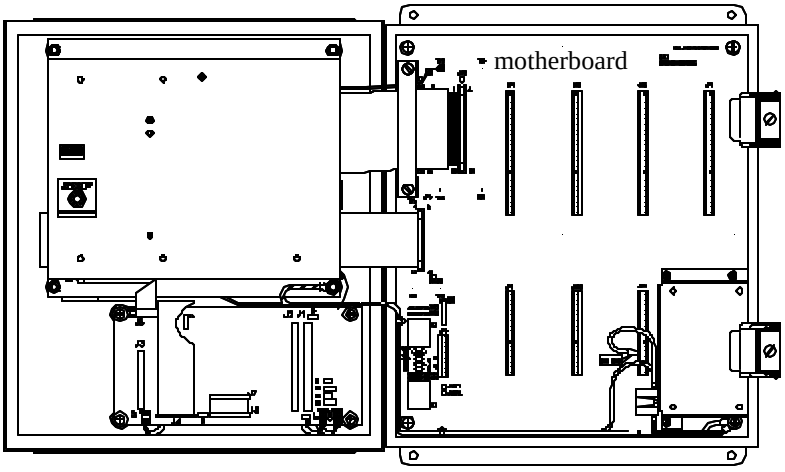


Figure 3 - 1.
The Location of the LMU Motherboard.

There are five jumpers located on the motherboard that configure various grounding and LAN options. The jumpers are configured in the factory and do not require modification for most installations.

JUMPER 1, JUMPER 2

These jumpers should always be installed.

JUMPER 3

This jumper connects the electronic signal processing circuitry's ground reference to the motherboard's ground plane. It should not be installed under most conditions. In some cases, installing this jumper (and

therefore grounding the electronic signal processing circuitry) improves the system's noise performance. If unacceptable noise performance is encountered at a specific installation, installing this jumper may improve the noise performance. This jumper is not installed in the factory.

JUMPER 4

This jumper connects the FG safety ground at JP12 to the motherboard's ground plane. It should be installed under most conditions, depending on the installation. This jumper is installed in the factory.

JUMPER 5

This jumper connects the FG safety ground to the enclosure. It should be installed if the enclosure is not grounded by some other means. Otherwise, it should not be installed (to prevent ground loops). This jumper is installed in the factory.

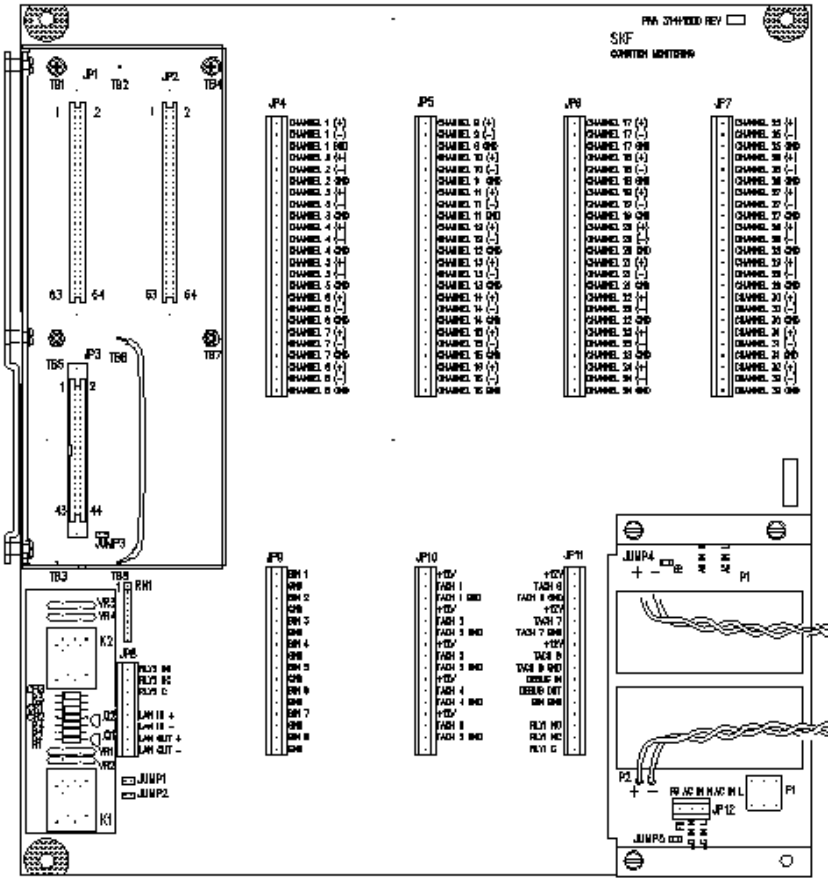


Figure 3 - 2.
The LMU Motherboard.

Tachometer Inputs

On the motherboard terminal strip connectors are eight sets of tachometer connections (+12v, TACH n, and TACH n GND, where n is 1 - 8). These provide +12 volt DC output, TACH input, and ground for eight tachometer connections.

LAN Connections

On the terminal strips are two sets of terminals; one labeled LAN IN + and –, and one labeled LAN OUT + and –. Use these terminals to wire the host computer to the first LMU, and to wire LMU's to each other.

The LMU AC Power Input

A separate terminal strip connector exists for AC power input. The power supply accepts AC inputs from 105 V to 265 VAC and 47 Hz to 63 Hz.

The LMU AC Line Fuse

The AC line is fused with a 1/2 amp, 250 V, AGC (formerly 3AG), non-time-delay fuse. Five spare fuses are shipped with your LMU.

The LMU Electronics Module

The LMU electronics module is mounted on the enclosure door (Figure 3-3).

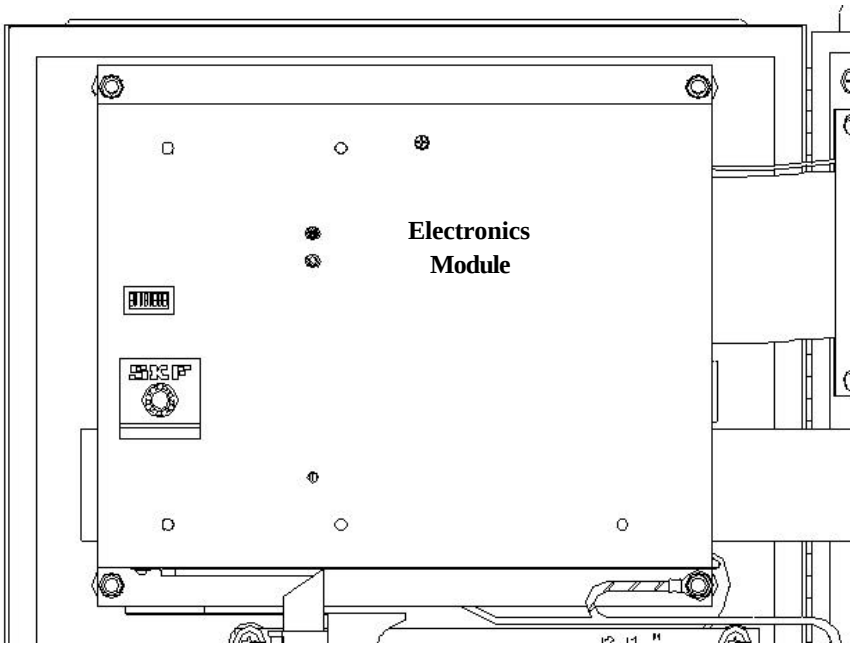


Figure 3 - 3.
The LMU Electronics Module.

The LMU electronics module holds four circuit boards:

- The LMU Analog board
- The LMU Digital board
- The LMU Enveloping/*SEE*/Power board, and
- The LMU Multiplexer board

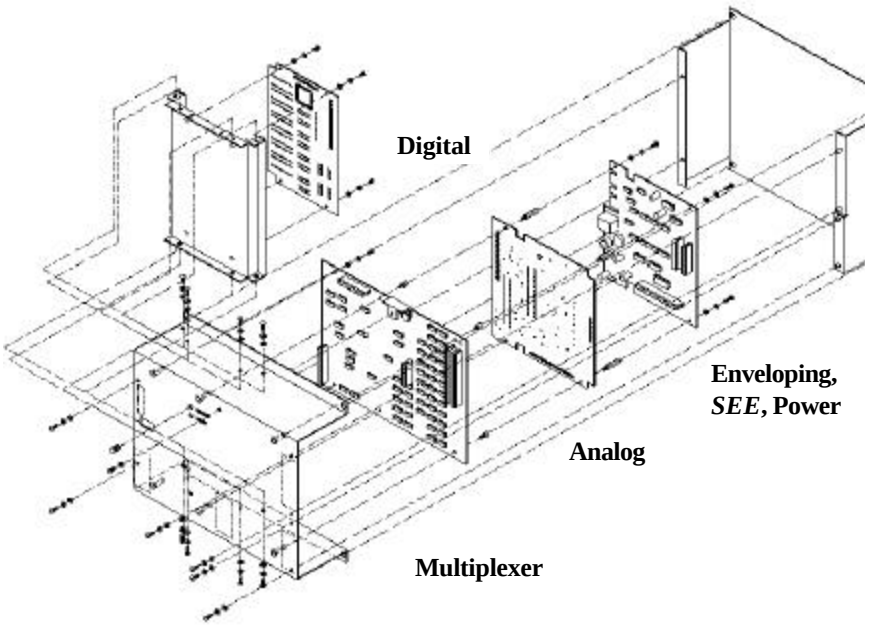


Figure 3 - 4.
An Exploded View of the Electronics Module.

The LMU Analog Board

The analog board contains conditioning circuitry and an analog-to-digital converter. All adjustments to the analog board are critical and must be performed at a qualified repair center. No field serviceable parts exist on the analog board.

The LMU Digital Board

The digital board contains the microprocessor, non-volatile memory, and firmware chips that control all data gathering,

storage, and calculation algorithms. There are no serviceable parts on the digital board.

Future firmware updates may be incorporated in the field. The firmware chips are labeled U16 and U17. They are located on the digital board in the lower right corner.

To replace these chips (if the need arises):

- Disconnect power from the LMU.
- Use a small screwdriver to carefully pry out the two chips.
- Replace them with the new chips (making sure to orient the notch on the chip to match the outline on the digital board).
- Re-connect power.

The LMU Enveloping/*SEE*/Power Board

The enveloping/*SEE*/power board contains advanced signal conditioning circuitry and power supply circuitry. All adjustments to the enveloping/*SEE*/power board are critical and must be performed at a qualified repair center. No field serviceable parts exist on the enveloping/*SEE*/power board.

The LMU Multiplexer (MUX) Board

The multiplexer board (Figure 3-5) contains voltage regulator circuitry, signal multiplexing circuitry, LAN circuitry, and the LAN address switch panel. Voltage regulators are factory adjusted and are not field adjustable.

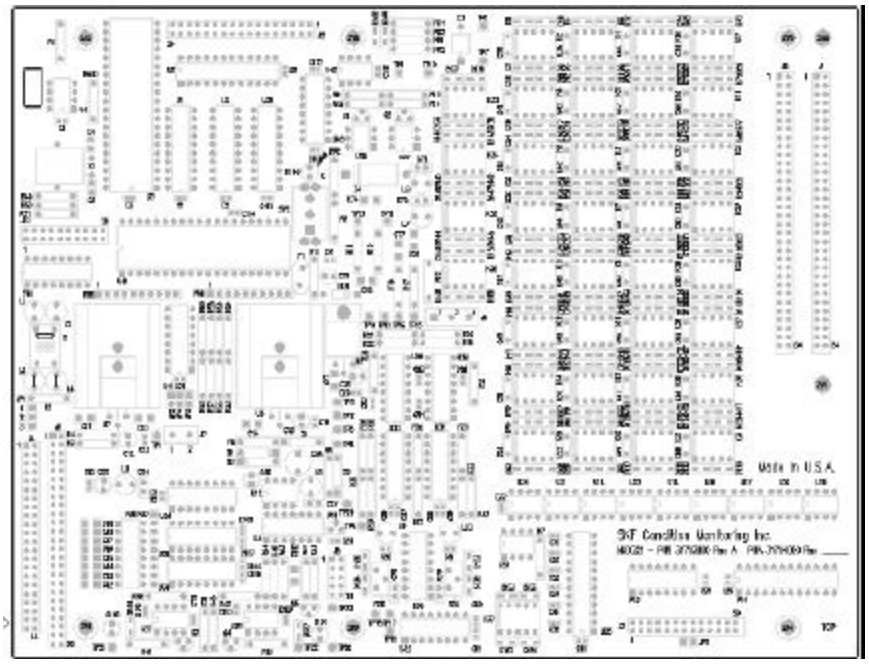


Figure 3 - 5.
The LMU Multiplexer Board.

You must set each LMU's LAN address (using the DIP switches) during system installation. Instructions for setting address DIP switches are detailed later in this chapter.

The Reset Button and Status Lamp

On the electronics module's front cover are the LMU's reset button and status lamp.

Status Lamp - When lit, the status lamp indicates the LMU is receiving AC line power. The status lamp also flashes at different intervals to indicate the LMU's status.

Slow flash (once every two seconds) - Indicates the LMU is ready and waiting for Machine Analyst for On-Line Systems to download measurement POINT setups.

Rapid flash - (5 times per second) Indicates the LMU is actively scanning downloaded POINTs and collecting data.

Reset Button - Push the reset button to reset the LMU. All measurement POINT configurations and collected data are lost and must be re-downloaded.

LMU Communication Options

Two communication options are available:

SKF LAN via CMMA3850 SKF LAN PLUS (On-Line Device to USB Transceiver)

Communication between the host computer and the on-line device network is established using SKF's CMMA3850 LAN Plus (On-Line Device to USB Transceiver). This transceiver uses standard, off-the-shelf USB cables, and can be used with either desktop PCs, or with laptops equipped with a USB interface, running Windows 2000.

SKF LAN Card CMMA30058B

Communication is established using a proprietary SKF LAN Card CMMA30058B network based on RS485 architecture using FM0 modulation. This network is designed to be installed using data grade, shielded, twisted pair cable. The host computer communicates with its on-line devices via these local area network cables.

4

MIM Overview

- This chapter provides a hardware overview for the MIM system. Please refer to the appropriate Installation Manual for hardware installation information

Specifications for MIM Hardware

Input

Up to 32 (16 matched pairs) dynamic or static inputs: ±25 VAC Peak to Peak, ±50 VDC

Speed Inputs: Two speed inputs:

.2 Hz to 10 kHz frequency range (programmable events/revolution), accepts a variety of input signals.

Programming

Configured from Machine Analyst for On-Line Systems Software via the MIM Local Area Network (LAN).

Performance

16 bit, 286-equivalent micro-processor.

Multi-tasking to permit simultaneous display and data acquisition.

FFT spectrum resolution to 3200 lines in user selectable increments.

FFT processing time for 400 line FFT: 0.7 seconds/average.

Storage

1 Mbyte memory.

Output

To host computer via Local Area Network (LAN).

Power Supply.

105 to 265 VAC; 47 to 440 Hz.

Approximate Dimensions

12 inches wide x 15 inches high x 4.75 inches deep.

Environmental

Operating temperature: -20° C to 55° C (0° F to 130° F).

Communications

SKF Local Area Network (SKF LAN) based on RS-485 specification.

Data transfer rate: 230K baud.

Maximum total LAN cable length per network:

- 6000 ft. (1800 meters) using high-quality (i.e. capacitance < 15 pf/ft.), twisted pair, shielded data cable.
- 3500 ft. (1100 meters) using standard (i.e. capacitance < 40 pf/ft.), twisted pair, shielded instrument cable.

Several factors influence actual system communications limits; please refer to SKF Publication CM9127 "**Maximum permissible LMU LAN Cable Length and Example Belden Cable Specifications**" for recommendations.

Installing the Monitor Interface Module (MIM)

The MIM is designed to be attached to the protection system's buffered output using individual Combicon plugs.

Permanently install each MIM close to the protection system (M800A, M700, etc). Up to 32 configurable inputs are available on the MIM. Two tachometer inputs are also available on the MIM.

Mounting the MIM

The MIM enclosure is designed to be mounted in a control room environment, close (typically within 3 meters) to the protection system it is to monitor. The MIM enclosure is not sealed against moisture or dust and should *not* be mounted unprotected in a harsh environment.

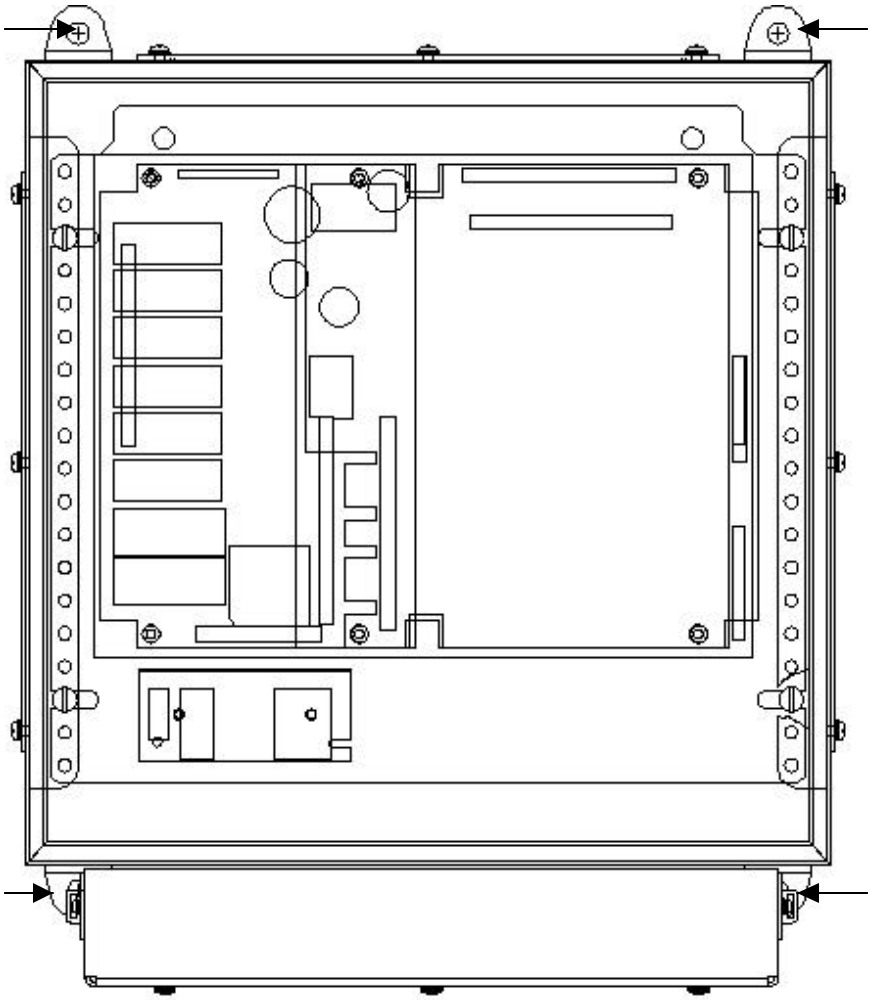


Figure 4 - 1.
The MIM Bracket Hole Locations.

The MIM is fitted with hardware that allows it to be bolted to a flat surface. Four ten millimeter holes must be drilled in the mounting surface at locations indicated in Figure 4 -

1. The brackets may be adjusted during installation for special mounting requirements.

- Shims may be required to ensure a flat surface.

The MIM Interface Cables

The MIM Interface cables connect to the protection system's buffered outputs using the Combicon plugs.

Connecting the MIM Interface Cable to the Protection System

The MIM interface cables are wired to the protection system monitor's buffered outputs.

- When wiring a single MIM to more than one machine protection system, each machine protection system should be wired to a common ground. Each protection system ground is tied together through the MIM. If each machine protection system is at a different ground potential, ground loop currents will flow, causing noisy or erroneous readings.

Power and LAN Connections

The MIM power and LAN connections are made on the MIM front panel.

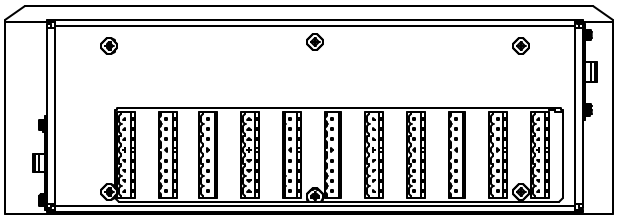


Figure 4 - 2.
MIM Front Panel.

The MIM allows a wide range of AC input power. The acceptable input voltage is 105 to 265 VAC and the frequency range is 47 to 440 Hz. This supports most requirements without the need for jumpers or component changes.

WARNING - *Always replace the factory-provided cover plate over the AC power strip after its removal for AC power wire installation.*

The MIM Electronics Module

The MIM electronics module is mounted inside the enclosure.

The MIM electronics module holds four circuit boards:

Analog board
Digital board
2nd Channel Analog board, and
Multiplexer board

The MIM LAN address may be changed on the Multiplexer board. The MIM firmware is located on the digital board.

The MIM Analog Boards

The two analog boards have no field serviceable parts.

The MIM Digital Board

The digital board contains the microprocessor, non-volatile memory, and firmware chips that control all data gathering, storage, and calculation algorithms. There are no serviceable parts on the digital board.

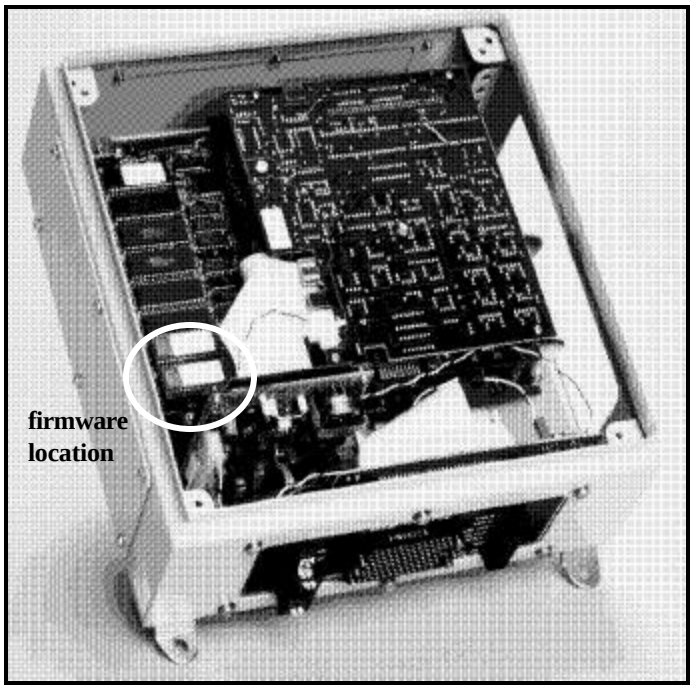


Figure 4 - 3.
The Location of the MIM Digital Board.

Future firmware updates may be incorporated in the field. Firmware chips are labeled U16 and U17. They are located on the digital board in the lower left corner.

To replace these chips (if the need arises):

- Disconnect power from the MIM.
- Use the supplied tongs to carefully pry out the two chips.
- Replace them with the new chips (making sure to orient the notch on the chip to match the outline on the digital board).
- Re-connect power.

The MIM Multiplexer (MUX) Board

The multiplexer board contains voltage regulator circuitry, signal multiplexing circuitry, LAN circuitry, and the LAN address switch panel.

- Voltage regulators are factory adjusted and are not field adjustable.

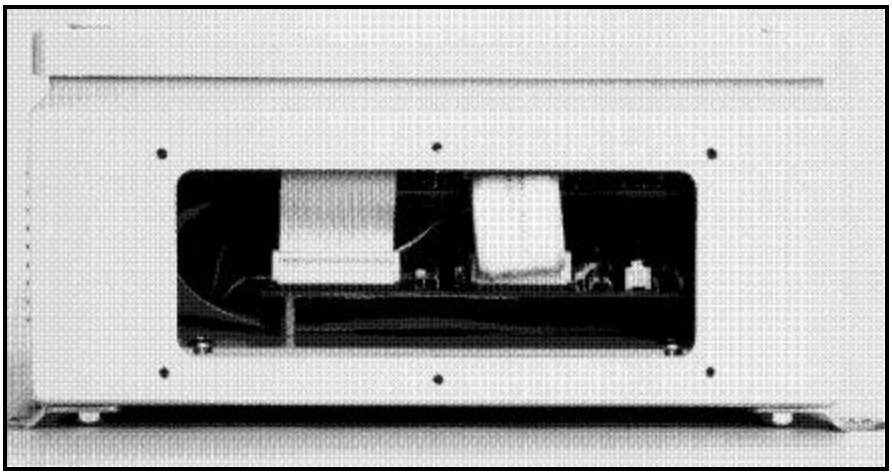


Figure 4 - 4.
The MIM Multiplexer Board

You must set each MIM's LAN address (using the DIP switches) during system installation. Instructions for setting address DIP switches are detailed in **Chapter 5, Communication Overview**.

The Reset Terminal

The reset terminal is located on the front of the MIM enclosure.

To reset the MIM:

- Place a wire on the reset terminal and ground to another terminal.
  - All measurement POINT configurations and collected data are lost and must be re-downloaded.

MIM Communication Options

Two communication options are available:

SKF LAN via CMMA3850 SKF LAN PLUS (On-Line Device to USB Transceiver)

Communication between the host computer and the on-line device network is established using SKF's CMMA3850 LAN Plus (On-Line Device to USB Transceiver). This transceiver uses standard, off-the-shelf USB cables, and can be used with either desktop PCs, or with laptops equipped with a USB interface, running Windows 2000.

SKF LAN Card CMMA30058B

Communication is established using a proprietary SKF LAN Card CMMA30058B network based on RS485 architecture using FM0 modulation. This network is designed to be installed using data grade, shielded, twisted pair cable. The host computer communicates with its on-line devices via these local area network cables.

5
Communications

Overview

This chapter overview the available communication protocols for the CMU, LMU, and MIM systems. Reference the appropriate section for your hardware configuration. For detailed communication protocol installation information, refer to your on-line device's installation manual.

The CMU Ethernet (TCP / IP) Connection

- The Ethernet connection type is only available for use with CMUs.

An Ethernet (TCP / IP) connection allows you to create a network consisting of several PCs and CMUs. The PCs and CMUs are connected via an intranet. A single PC running the Machine Analyst Monitor application can communicate with the CMUs and with several additional PCs running Machine Analyst for On-Line Systems software by utilizing an Ethernet connection. The CMU unit behaves like any other peripheral on the intranet; for instance, a laser printer.

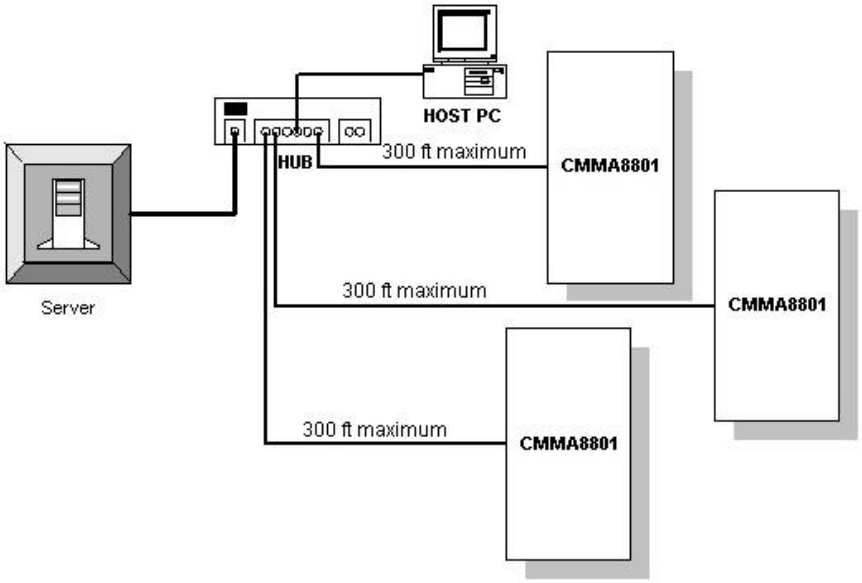


Figure 5 - 1.
An Example Multilog CMU Ethernet Configuration.

CMMA8350 SKF LAN Plus (On-Line Device To USB Transceiver)

- The SKF LAN Plus connection type may be used with a CMU, LMU, or MIM system.

Your CMMA8350 SKF LAN Plus User Manual provides an overview of the new transceiver and guides you in the installation and use of this device with the SKF LAN and your PC operating Machine Analyst.

The LAN Plus is a plug-n-play transceiver. It uses standard, off-the-shelf USB cables, and can be used with either desktop PCs, or with laptops equipped with a USB interface, running Windows 2000.

The SKF LAN Plus is an external device that can sit on a desk, or may be secured to the side of your PC or laptop using Velcro™. Power is provided via the USB interface – no AC power transformers or batteries are required. Figure 5 - 2.
Recommended Configuration With A Desktop PC. illustrates a typical set up.

On-Line System With SKF LAN Plus Configuration

A typical on-line system utilizing the SKF LAN Plus consists of the following components:

1. A host computer (desktop PC or laptop) running Machine Analyst for Windows software and equipped with a USB interface.
2. A USB type A-B cable connecting the PC to the transceiver.
3. Up to two RS-485 LMU LAN cables connecting the on-line device network to the transceiver.

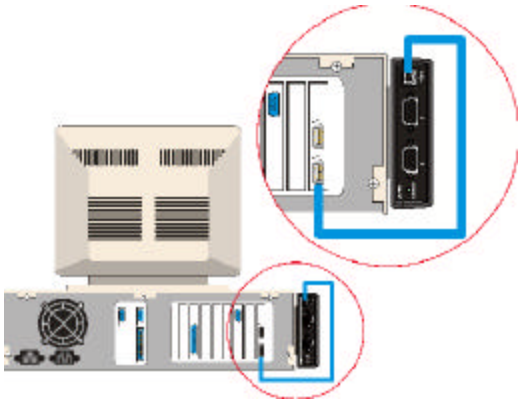


Figure 5 - 2.
Recommended Configuration With A Desktop PC.

Figure 5 - 3.
Recommended Configuration With A Laptop PC.

What is USB?

USB is an acronym for Universal Serial Bus. It was designed to be an industry standard to provide an extension to the PC architecture with focus on Computer Telephony Integration, consumer, and productivity applications. Main contributors to the USB Specification include Compaq, Intel, Microsoft, and NEC.

USB is a low-cost solution that can offer up to 12 Mbits / second data transfer rates, and future USB systems will provide up to 480 Mbits / second rates. For the CMMA320 systems however, the overall communication rate is still limited to the current 225 kbits / second to maintain compatibility with existing systems.

USB is simple and easy to use. There is a single model for cabling and connectors, and the end user does not need to worry about providing power or other electrical details. The CMMA8350 is a self-identifying peripheral that can be dynamically attached and removed.

In a similar fashion to other networks, multiple devices can co-exist on a USB LAN. Up to 127 USB devices can share a USB LAN. Thus, if you have a USB digital camera and a USB printer, they both can operate on the same USB LAN simply by having a USB hub – much like an Ethernet 10BaseT hub is used.

Termination Jumpers

You may need to make adjustments to the CMMA8350 motherboard's termination jumpers if you previously used a LAN card, or if you need to configure your system according to LAN termination rules.

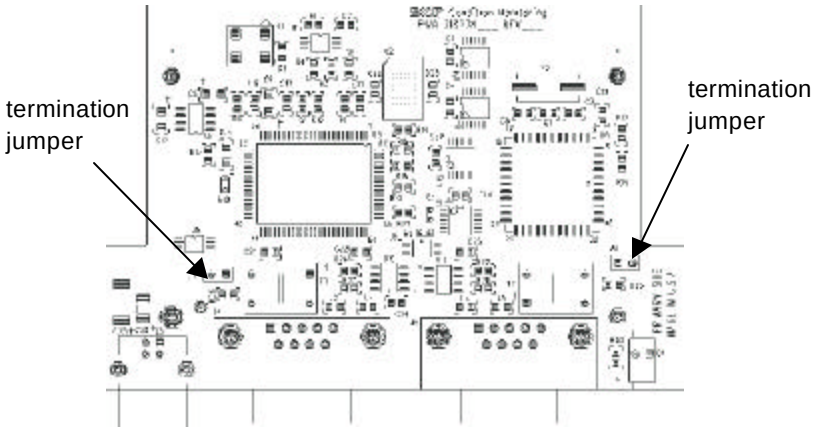


Figure 5 - 4.
The CMMA8350 Motherboard.

If you need to configure your system to conform to LAN termination rules, refer to articles JB60D0 and JB7N4L on SKF's website, www.skfreliability.com for detailed instructions.

- If you previously used an SKF CMMA30058B LAN card, configure the CMMA8350 motherboard termination jumpers to match your previous LAN Card settings.

Termination Jumper Settings

Each termination jumper corresponds to its nearest port.

If the shunt is covering 2 pins on a termination jumper, the jumper's nearest port is terminated.

If the shunt is covering only 1 pin on a termination jumper, the jumper's nearest port is not terminated.

Replacing Your USB Cable

If you ever need to replace your CMMA8350 USB cable, you may purchase one at your local electronics or audio / video store. The cable type is a USB A-B Cable and any length less than 2 meters will work.

- USB cables and extensions greater than 2 meters are available in the consumer marketplace, however SKF has not tested the CMMA8350 with these longer lengths and does not guarantee system performance if a USB cable longer than 2 meters is used.

- Close the Machine Analyst application before disconnecting the USB cable from the CMMA8350 or the host computer.

CMMA8350 Specifications

Power supply current: 150 mA maximum

Communications I / O:

- 1 USB Type-B Receptacle
- 2 DB9 Serial Connectors: RS-485, 225kbuad, FM0

PCB Classification: IPC-600 Level II

Mechanical:

- Enclosure size: 4.5" x 3.1" x 1.2"
- Weight: approximately 0.3 lbs. (0.14 kg)
- Material: ABS 94HB Plastic

Environmental:

- Temperature: 32º F to +122º F (0º C to +50º C)

Certifications:

CE

Processors and Memory:

- 24 MHz USB Controller
- 16 MHz Serial Communications Controller
- 16-Byte EEPROM (used for Windows Plug-and-Play)

References

1. "Universal Serial Bus Specification," Revision 1.1, September 23, 1998, available at http: / / www.usb.org
2. PRISM[4] for Windows On-Line Systems User Manual, Part Number 31828200-SL.

The SKF Local Area Network (LAN)

➢ The SKF LAN network (accessed through a LAN card) is available only for LMU and MIM systems. The CMU does not support this type of LAN connection.

The On-Line System uses an SKF local area network based on RS485 architecture. This SKF LAN network is similar to a computer network (multiple on-line devices are daisy-chained to each other and back to a host computer). This proprietary network is designed to be installed using the type of twisted pair cable often run in a plant environment as spare cable, permitting significant savings where spare cable is present. The host computer communicates with up to 63 networked on-line devices via this local area network cable.

A local area network card must be installed in your host computer.

Installing the SKF Local Area Network (LAN)

The **On-Line System** uses a proprietary network based on RS485 architecture using FM0 modulation. This network is designed to be installed using data grade, shielded, twisted pair cable. The host computer communicates with its on-line devices via these local area network cables.

Installing the LAN Card

Install the LAN card (Figure 5-5) in any expansion slot in the host computer. The LAN card provides two cable connectors. Connect the LAN cable to either LAN connector (D-9 female connector). Either LAN channel may be used for field wiring connections. Both may also be used simultaneously as long as their field wiring is kept electrically separated.

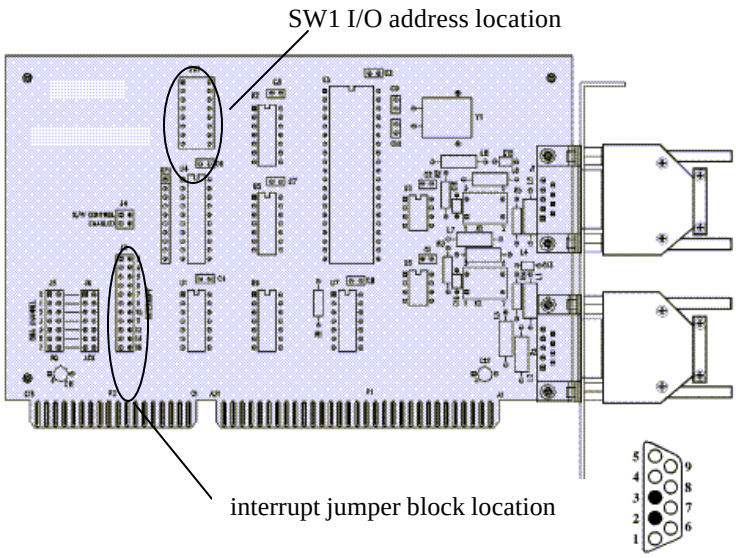


Figure 5 - 5..
The LMU or MIM LAN Card.

- The SKF LAN card uses your host computer's DMA channel 1 selectable base I/O address (default is IRQ 3). No other devices may use these resources while the SKF LAN card is in use in order to avoid conflicts. DMA channel 1 is not normally used by any device in a standard configuration computer. IRQ address 3 is normally assigned to I/O device COM 2.

SKF LAN Card (CMMA30058B) I/O Address Settings

The LAN card (CMMA30058B) provides the hardware interface between Machine Analyst for On-Line Systems and the LMU or MIM unit(s). As supplied, the LAN card is configured to match Machine Analyst for On-Line System's default settings. If you do not anticipate or experience problems with the default settings, there is no

need to change either the LAN card or Machine Analyst settings.

The default settings are:

I/O Address:	218H
IRQ:	3

The most probable cause of a potential conflict is a serial communication card, serial mouse, or internal modem using COM2 on IRQ3. This can be corrected by changing the IRQ to an IRQ not currently used by any other installed card in the PC.

If you do anticipate or experience conflicts with other installed cards, there are five user configurable switches or jumpers on the CMMA30058B that can be used to eliminate the problem. They are:

I/O Address - The I/O address can be set using switch SW1. Refer to Figure 5-14 to locate SW1 on the LAN card. Refer to the chart in Figure 5-15 to determine the correct setting for the desired address. The switch positions can be set using any small pointed object, such as a pen. The same address must also be set in the Machine Analyst/On-Line software.

IRQ - The IRQ can be set using the INTERRUPT jumper block. Refer to Figure 5-14 to locate the interrupt jumper block on the LAN card. The desired IRQ is selected by removing the INTERRUPT jumper block and placing it over the pair of terminals adjacent to the desired IRQ. The same IRQ must also be set in the Machine Analyst for On-Line Systems software through the SKF LAN card control panel icon.

- Do not select any I/O address or IRQ not supported by Machine Analyst. This may interfere with proper PC operation and result in data loss.

DMA Channel

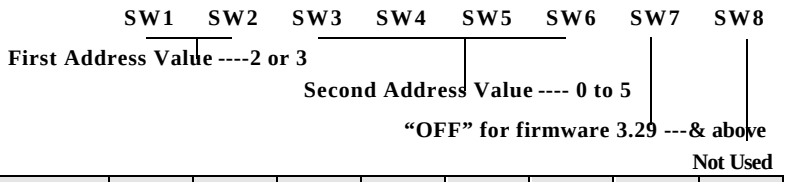
RQ (Request) - This must be set to 1 for all current software versions.

ACK (Acknowledge) - This must be set to 1 for all current software versions.

- Do not select any other DMA channel RQ or ACK. This may interfere with proper PC operation and result in data loss.

S/W Control - This must be set to ENABLED for all current software versions.

- Do not select any other Control setting. This may interfere with proper PC operation and result in data loss.



Address		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
218	On		■	■	■	■			X
	Off	■					■	■	X
220	On		■	■	■		■		X
	Off	■				■		■	X
240	On		■	■		■	■		X
	Off	■			■			■	X
258	On		■	■		■			X
	Off	■			■		■	■	X
300	On			■	■	■	■		X
	Off	■	■					■	X
310	On			■	■	■			X
	Off	■	■				■	■	X
318	On			■	■	■			X
	Off	■	■				■	■	X
330	On			■	■				X
	Off	■	■			■	■	■	X
340	On			■		■	■		X
	Off	■	■		■			■	X
350	On			■		■			X
	Off	■	■		■		■	■	X
358	On			■		■			X
	Off	■	■		■		■	■	X

SKF LAN Card Address Settings (■ - Shows switch position, X - Not Used).

Installing the LMU LAN Cable

Maximum total LAN cable length per network:

6000 ft. (1800 meters) using high-quality (i.e. capacitance < 15 pf/ft.), twisted pair, shielded data cable.

3500 ft. (1100 meters) using standard (i.e. capacitance < 40 pf/ft.), twisted pair, shielded instrument cable.

Several factors influence actual system communications limits; please refer to SKF Publication CM9127 "**Maximum permissible LMU LAN Cable Length and Example Belden Cable Specifications**" for recommendations.

Run a single LAN cable from the host computer to the first LMU. Connect the cable to the LMU motherboard's LAN IN terminals. Connect output wiring (to next LMU in chain) to the LAN OUT terminals.

Terminating the LMU LAN Chain

Jumper JP1 on the multiplexer board (Figure 5-5) from pin 1 to pin 2 (top two pins) for all LMUs in the chain except the last. Terminate the last LMU in the chain by jumpering JP1 from 2 to 3 (bottom two pins).

Installing the MIM LAN Cable

Maximum total LAN cable length per network:

6000 ft. (1800 meters) using high-quality (i.e. capacitance < 15 pf/ft.), twisted pair, shielded data cable.

3500 ft. (1100 meters) using standard (i.e., capacitance < 40 pf/ft.), twisted pair, shielded instrument cable.

Several factors influence actual system communications limits; please refer to SKF Publication CM9127 "**Maximum permissible LMU LAN Cable Length and Example Belden Cable Specifications**" for recommendations.

Run a single LAN cable from the host computer to the first MIM. Connect the cable to the MIM interconnect board's LAN IN terminal. Connect output wiring (to next MIM in chain) to the LAN OUT terminals.

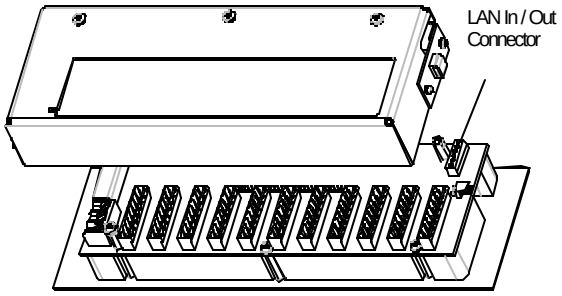


Figure 5 - 6.
The MIM Board's LAN IN and OUT Connector.

Terminating the MIM LAN Chain

Jumper JP1 on the interconnect board (Figure 5-5) from pin 1 to pin 2 for all MIMs in the chain except the last. Terminate the last MIM in the chain by jumpering JP1 from 2 to 3.

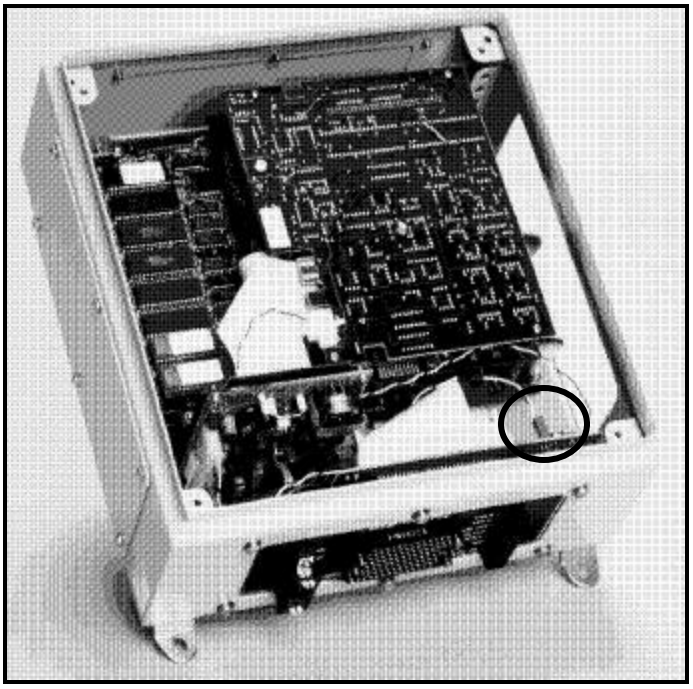


Figure 5 - 7.
Jumper Location on the MIM's Interconnect Board.

Assigning the LMU and MIM Address

Each LMU or MIM in the LAN chain must be assigned a unique LMU or MIM address from 1 through 64. The host computer and Machine Analyst/On-Line software communicate with each LMU or MIM using its LMU or MIM address. The host computer is automatically assigned an address of zero (0).

Each LMU's multiplexer board or MIM's interconnect board contains an 8 switch **D**ual **I**nline switch **P**ackage (known as DIP switches). Use these switches to assign each LMU or MIM its LMU or MIM address. Figure 5-8

and Figure 5-9 diagram switch panel address configurations. Switch 8 should always be in the On position.

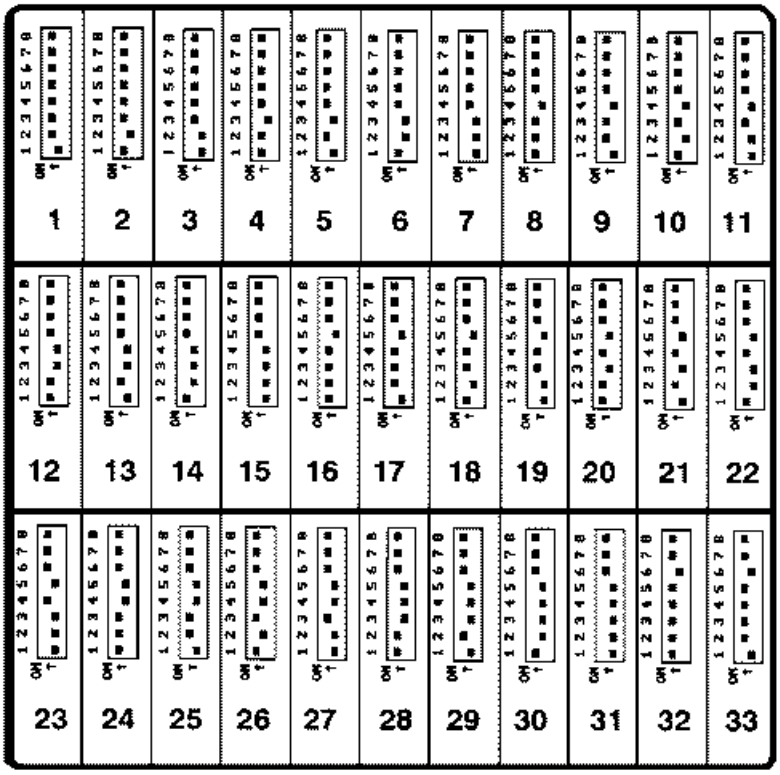


Figure 5 - 8.
DIP Switch Settings 1 - 33.

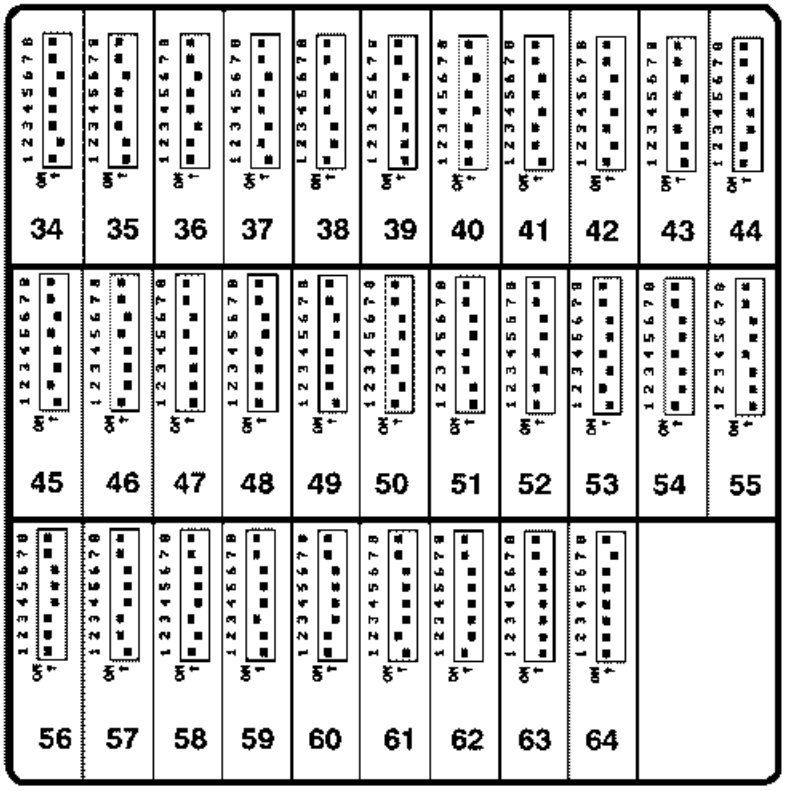


Figure 5 - 9.
DIP Switch Settings 34 - 64.

User Notes

6

How the On-Line Systems Collect Data

- CMU, LMU, and MIM systems collect data in the same manner. The following description applies to all three systems. References that apply to the CMU, LMU, and MIM systems use the general term "on-line device."
- Information specific to the CMU only is preceded by a note stating:

  CMU Users – The following information applies to the CMU only.

Overview

Each CMU, LMU, or MIM provides three databases for collected data, the:

Current Data database - Stores the most recently collected measurement data for each downloaded POINT.

New Alarm Data database - Stores new alarm data waiting to be uploaded to the host computer and Machine Analyst for On-Line Systems software.

Scheduled Data database - Stores scheduled POINT data waiting to be uploaded to the host computer and Machine Analyst database.

- These databases exist in the on-line device's volatile (temporary) memory. If

the on-line device loses power or is reset, all database data is lost!

The host computer and Machine Analyst for On-Line Systems software periodically poll the "new alarm data" and "scheduled data" databases for data. Upon polling, any stored "new alarm data / scheduled data" is uploaded via the LAN to the host computer and Machine Analyst for On-Line Systems software for permanent storage and viewing.

Current Data Database

Each on-line device collects POINT data from its sensors in a round-robin sequence. Each POINT's measurement data is stored in the on-line device's "current data" database as it is collected. The time it takes for the on-line device to complete the round-robin sequence and start over is regulated only by the number of POINTs in the collection list and each POINT's measurement configuration. After collecting data on the last POINT in the list, the on-line device starts over with the first POINT. As each POINT's measurement is repeated, its new value overwrites its existing value in the "current data" database.

New Alarm Data Database

As each POINT's data is stored in the current data database, the on-line device compares its value to its programmed alarm parameters. If the POINT's value exceeds its alarm level(s), an alarm occurs and the alarm data is immediately copied to the DAD's "new alarm data" database (the "new alarm data" database flag is raised).

Upon polling the on-line device, Machine Analyst for On-Line Systems software recognizes the raised "new alarm data" flag and uploads the stored alarm data.

- **CMU Users – The following information applies to the CMU only.**

When the connection to the host computer is lost for some reason, the **CMU** can store a history of up to 5 alarm measurements per POINT in the alarm data

database. The initial alarm will always be saved. Once 5 alarms are stored and when another alarm is logged, the next to the oldest alarm will be overwritten. When the host computer finally does connect to the **CMU** all of the alarm data in the alarm data database will be uploaded.

Scheduled Data Database

A programmed data collection **Schedule** for each POINT directs that its data be copied from the DAD's "current data" database to its "scheduled data" database on a fixed time schedule (the "scheduled data" database flag is raised). Since the **Schedule** setting may differ for each POINT, the on-line device may copy data for one POINT to its "scheduled data" database once in 8 hours while data for another POINT may be copied to the "scheduled data" database once every 2 hours.

- If a POINT's current data (stored in the DAD's "current data" database) is in alarm when the POINT's scheduled time expires, the alarm data is uploaded to the DAD's "scheduled data" database. Thus, the "scheduled data" database may contain alarm data, as well as non-alarm data.

Upon polling the on-line device, Machine Analyst for Online Systems recognizes the raised "scheduled data" flag and uploads the stored scheduled data from the on-line device.

- **CMU Users – The following information applies to the CMU only.**

When the connection to the host computer is lost for some reason, the **CMU** can store a history of up to 5 scheduled measurements per POINT in the scheduled data database. Once 5 sets of scheduled POINT data are stored and when another set of scheduled data is saved, the oldest set of scheduled data will be overwritten. When the host computer finally does

connect to the **CMU** all of the scheduled data in the scheduled data database will be uploaded.

Understanding the Polling Process

Using Machine Analyst for On-Line Systems software, your host computer controls all communication with the on-line device(s). Your host computer requests data from each on-line device in a pre-programmed process known as polling.

The host computer polls one on-line device at a time, asking for stored "new alarm data" and "scheduled data". If the on-line device has any "scheduled data" or new "new alarm data" the host computer uploads the data from the on-line device and stores it in the Machine Analyst for On-Line Systems database.

On-line devices are polled sequentially using their CMU, LMU, or MIM addresses. After the host computer has received all information requested from an on-line device, the on-line device with the next higher address is polled. This process continues until all the on-line devices on the network have been polled, then the process begins again with the first on-line device.

Processing Delay

The minimum time between the polling of each on-line device is called the **Processing Delay**. The processing delay time is set with the **Transfer** menu's **Online / Settings** tab and may be a value between 0 and 120 seconds.
You can set a processing delay for:

Device Sync
Unscheduled Data
Scheduled Data
Live Data

If it takes five minutes to check for unscheduled data and the processing delay is set for two minutes, then the processing of unscheduled data runs for its five minutes, then rests for two minutes, runs for five minutes, rests for two minutes and so on.

CMU, LMU, and MIM Data Collection Summary

There are several steps to collecting data for each on-line device.

- **CMU Users – The following information applies to the CMU only.**

Channel Selection and Settling – Selects the proper measurement channel and waits the programmed sensor settling time. The CMU is optimized to also select the next channel in the opposite bank so that it settles while the current channel collects data. The CMU lights the green LED on the current channel as well as the next channel.

- Channel Selection and Settling does not apply to the LMU or MIM.

BOV (Bias Output Voltage) Gating – If BOV gating is enabled, the CMU or LMU (this feature is not supported by the MIM) verifies that the sensor is OK. If the sensor is not OK, the CMU lights the red LED for that channel. The sensor error is then logged in the Machine Analyst Event Log and is shown in the Device Status tab and Online Data view.

- Refer to the **Sensor Bias-Output-Voltage Gating** section later in this manual for more information

Data Acquisition - Selects the proper measurement POINT in the on-line device and converts its input data to digital form.

Signal Processing - Performs pre-programmed measurements on the digital data, providing other

representations useful in signal analysis FFT spectrum, time domain, phase vector, and overall).

Alarm Processing - Compares the processed data against the POINT's programmed alarm parameters. If a *new* alarm condition exists (one that did not exist when data was last taken), additional data is taken to verify the alarm. If the alarm is verified by the additional data, the alarm data is copied to the on-line device "new alarm data" database. When the on-line device is next polled, this alarm data is uploaded to the host computer and is tagged as Machine Analyst for On-Line Systems' **unscheduled** data in the database.

If the POINT was in an alarm condition the last time data was taken, no attempt is made to verify the new alarm, and no new alarm data is saved.

Data Logging - Checks the current time against the POINT's scheduled "scheduled data" update time. If it is time to update, data is copied from the "current data" database to the "scheduled data" database in the on-line device. When the on-line device is next polled, this "scheduled data" is uploaded to the host computer and is tagged as **scheduled** data in the Machine Analyst database.

Understanding the Alarm Process

The alarm process informs you when a sensor signal *changes* from a non-alarm condition to an alarm condition.

When you create a POINT, you specify alarm parameters for that POINT. Alarm parameters may define alarm levels for an overall value comparison, a spectral alarm envelope for spectral comparison, or spectral alarm bands for spectral comparison of discreet frequencies. When the POINT is downloaded to an on-line device, the POINT's alarm parameters are downloaded along with the POINT's measurement setup.

The four steps in the alarm process are:

Detect an alarm,
Verify the alarm,
Store the alarm data in the on-line device "new alarm data" database, and
Upon the next polling, upload the alarm data tagged as unscheduled data to Machine Analyst's database.

Alarm Detection

When the on-line device collects data on a POINT, it compares that data against the POINT's alarm parameters to detect any alarm condition.

Alarm Verification

If the POINT is in a new alarm condition, the on-line device immediately takes data for that POINT two additional times. Each time it compares the value against the alarm parameters.

- If an alarm existed when the POINT was last collected, these two additional data collections are not performed and no alarm data is copied to the "new alarm data" database.

Alarm Data Storage

If the POINT remains in a new alarm condition (after the two additional collections), the on-line device copies the data from the "current data" database to the "new alarm data" database.

Uploading Alarm Data

There are four steps to uploading alarm data.

Set the on-line device "new alarm data" status flag to indicate that alarm data has been stored for a POINT.

If the alarm status flag is found to be set when the host computer next polls the on-line device, upload the data

from the on-line device “new alarm data” database to Machine Analyst’s database, tagged as unscheduled data.

Write the alarm information to Machine Analyst for On-Line Systems’ **Event Log**.

Example of the Alarm Process

A POINT named POINT 1 is created. For this example, we make the following assumptions:

The alarm type is set to LEVEL, with the lower level ALARM1 set to .10 IPS, and the upper level ALARM2 set to .20 IPS.

The on-line device takes 10 minutes to collect data on all its POINTs. This implies that data will be collected for POINT 1 every ten minutes.

The host computer's processing delay is 1 minute. That is, the host computer asks one on-line device per minute for status.

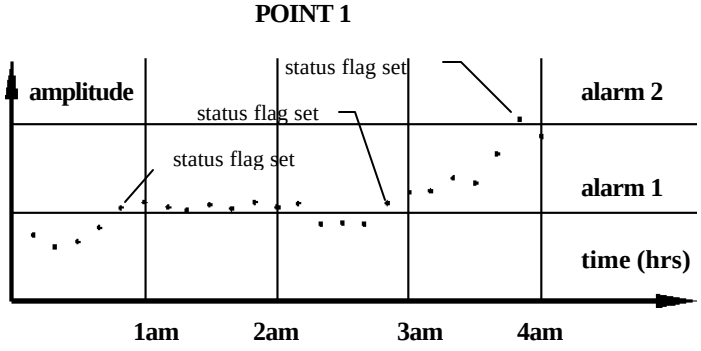


Figure 6 - 1.
An Alarm Process Example.

During the first hour, data is collected every ten minutes for POINT 1 and is below the ALARM1 level. Since the

alarm status flag has not been set, no data is uploaded to the host computer.

At 12:50 a.m. the collected data exceeds the ALARM1 level. The alarm is detected and verified, the on-line device "new alarm data" status flag is set (indicating an alarm has been detected and verified), and data is stored in the "new alarm data" database. When the host computer next polls this on-line device, it finds the status flag set and requests that the alarm data be uploaded. The data is uploaded and the information written to Machine Analysts for On-Line Systems' Event Log.

At 1:00 data is again collected for POINT 1. An alarm is detected, but since an alarm was previously processed, the data is not verified nor copied to the "new alarm data" database.

At 2:20 data is collected and no alarm is detected.

At 2:50 an ALARM1 level alarm is again detected. Since no alarm was detected the last time data was collected, the alarm data is verified, the status flag set, and the data copied to the "new alarm data" database. When the host computer next polls this on-line device, it finds the status flag set and requests that the alarm data be uploaded. The data is uploaded and the information written to Machine Analysts for On-Line Systems' Event Log.

At 3:50 the data exceeds the ALARM2 level. Since no ALARM2 level alarm was detected the last time data was collected, the alarm is verified, the status flag set, and the data copied to the "new alarm data" database. When the host computer next polls this on-line device, it finds the status flag set and requests that the alarm data be uploaded. The data is uploaded and the information written to Machine Analysts for On-Line Systems' Event Log.

Signal Autoranging

During signal autoranging, the amplitude of the signal is determined and a gain is selected that maximizes the signal amplitude without overloading.

- Autoranging works best with constant signal levels. Do not use autoranging with irregular, impact-type signals.

Signal autoranging:

Produces the largest possible display which is completely contained within the display window.

Gives best signal-to-noise ratio to reduce the influence of the noise signal.

Gives the best dynamic resolution, which results in more accurate amplitude values.

Selecting Autoranging

Set autoranging to **ON** or **OFF** using the **POINT Properties** dialog's **Autorange** drop down list.

Data Collection Gating

Gating is a method of controlling data collection for one POINT, called a **dependent** POINT, based on the current state of a second POINT, called the **control** POINT.

If the control POINT's conditions are met, the dependent POINT's measurement is performed. If the control POINT's conditions are not met, the dependent POINT's measurement is not performed.

- All data collection gating is performed within an on-line device. Therefore a control POINT and its dependent POINT must be in the same on-line device.

There are five types of gating:

Parametric Gating

Gating

Sensor Bias-Output-Voltage Gating

Tachometer Gating

Extended Logic Gating

Parametric Gating

Parametric gating is based on a measured value. Parametric gating was developed to monitor vibration under consistent running conditions. If a machine being monitored changes speed or load, its vibration level could change dramatically. This change in vibration has little correlation to machinery health. Data collected with the machine running at a consistent speed and load, however, is useful for determining the machine condition.

Parametric gating allows you to configure the data collection process so that data is collected on vibration POINTs only when the machine is in a predetermined speed and load range.

- Parametric gating works best with processes that change less frequently than once in 10 minutes. Do not use it where levels are actively varying.

Example - A winder in a steel mill operates at varying speeds. Starting from a standstill, the winder accelerates to 900 RPM, then decelerates as the rolled up product grows in diameter, and finally decelerates to a standstill. The user wants to collect vibration data at both 900 and 500 RPM. Vibration data at other speeds is not desired.

To accomplish this, the user creates two RPM POINTs. These RPM POINTs act as control POINTs. They monitor the machine speed via one of the tachometer inputs. One RPM POINT, 900 LINE SPEED, is set to alarm if the speed is in a window between 850 and 950 RPM. The

other, 500 LINE SPEED, is set to alarm between 450 and 550 RPM. The alarm window parameters define the control POINTs' criteria. Only if the control POINTs' values are within these alarm windows are the conditions met (and the dependent POINTs' measurements performed).

The user then creates the vibration POINTs (dependent POINTs). These POINTs are linked to the control POINT by selecting the appropriate RPM POINT in the parametric gating setup. This guarantees that vibration data can be trended over consistent speed conditions.

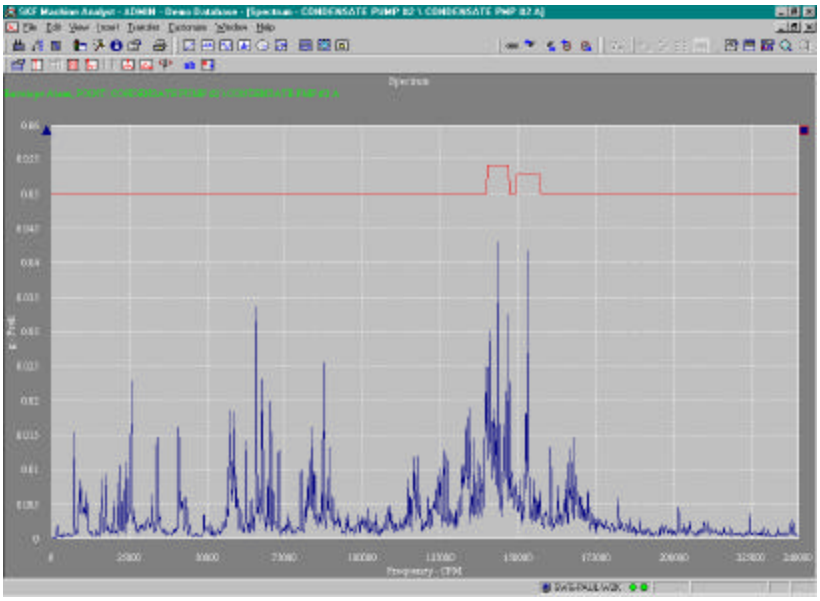


Figure 6 - 2.
Spectrum Envelope for a Control POINT.

Figure 6 - 2.
Spectrum Envelope for a Control POINT. shows another way to perform parametric speed gating. This method uses

a spectrum envelope for a control POINT. This spectrum envelope creates an alarm as long as the running speed does not change significantly and the peak value does not become too low. While the control (RPM) POINT remains in its alarm window, conditions are considered “true” and the dependent POINT is measured and collected. If the machine is not running or not running at the correct frequency, the control POINT does not produce a spectrum alarm and the dependent POINT's measurement is not performed.

Logic Gating

Logic gating is a type of parametric gating, therefore it can be used in the same applications. In logic gating, the control POINT is alogic POINT. A logic POINT allows signals from external control circuitry, such as programmable logic controller outputs, to make the gating decisions.

When a logic POINT takes data, it checks the state of a TTL logic input (0 to 5 volts). A value of one (HIGH) or zero (LOW) is saved. If the logic POINT is used to control another POINT, the logic POINT's input value (HIGH or LOW) determines if data is collected on the dependent POINT. You can specify which state, high or low, will be the triggering or **Active State** (Figure 6-3).

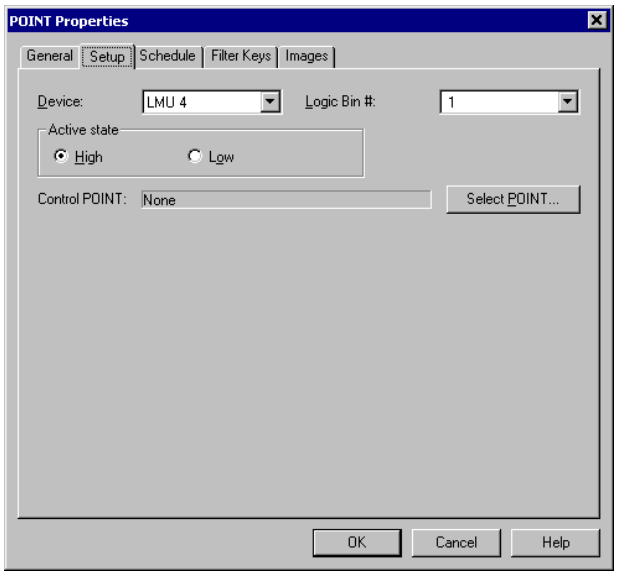


Figure 6 - 3.
POINT Setup Fields for Logic Control POINT Setup.

Example - A grinder in an automotive manufacturing plant operates in three modes, grinding, idle, and stop. In the grinding mode there is so much vibration from the grinding wheel that vibration data, indicative of the condition of the spindle and its bearings, is drowned out. During idle mode, the useful machinery condition vibration signals can easily be detected.

The process is controlled via a programmable logic controller (PLC) in the manufacturing cell. The PLC has programmable logic outputs. One of these outputs can be used as a logic input to the on-line device (the control POINT). The control computer's logic output can be programmed to be high during idle mode and low in grinding mode.

The user creates a logic control POINT that monitors the appropriate logic input. Since the signal from the

controller is high during idle mode, the logic POINT's **Active State** should be set to **high**. The user then creates vibration monitoring POINTs (dependent POINTs) and links them to the logic (control) POINT. This allows the collection of consistent vibration data during the idle mode of operation.

Sensor Bias-Output-Voltage Gating

- **Sensor Bias-Output-Voltage Gating** applies to CMUs and LMUs only, MIMs do not support this feature.

This gating method verifies proper sensor operation and may be used for any POINT using a sensor with a dynamic signal riding on a DC bias voltage. Examples are an accelerometer with internal electronics or an eddy current displacement probe. The sensor's bias output voltage value is indicative of its operating condition.

Sensor Bias Output Voltage (BOV) is a DC voltage on which the AC signal rides. A CMU or LMU can monitor the bias output voltage as well as the AC signal. If the bias output voltage is outside the sensor manufacturer's specified operating range, the signal coming from the sensor should probably be disregarded.

Example - Two accelerometers are installed at key points on a motor drive. The accelerometers are cabled to the first two CMU / LMU sensor inputs. The user has created one dynamic POINT for each of these channels and has enabled sensor BOV gating for both POINTs. The lower BOV for each is set to +2 VDC and the upper BOV to +22 VDC; BOVs outside this window are indicative of failures in the sensor or in its cabling. Figure 6-4 shows the BOV Gating Setup of the **Sensor Setup** Tab for one of these dynamic POINTs.)

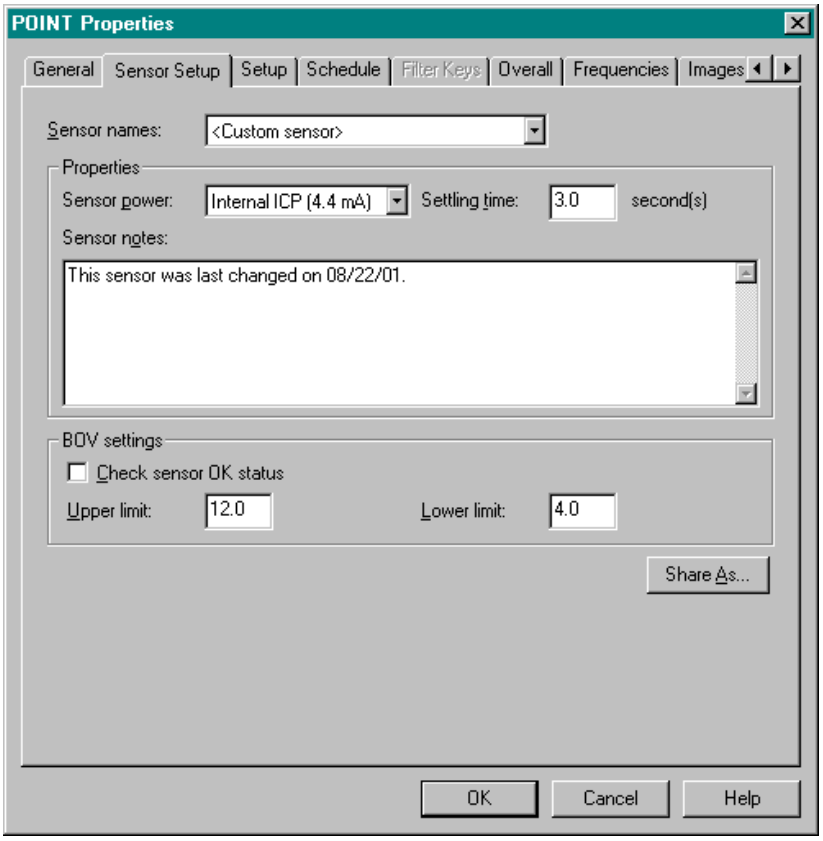


Figure 6 - 4.
Sensor Setup Tab.

Three months later during routine maintenance of the turbine, one of the sensor cables is accidentally cut. The sensor BOV rises up to +24V DC (the open circuit voltage). The CMU / LMU will not collect data for the POINT that uses the channel with the cut cable, but will continue to collect data on the other dynamic POINT.

Tachometer Gating

Tachometer gating is used to disable data collection for a POINT *when its machine stops.*

Example - In the sensor BOV motor drive example, an optimal tachometer is permanently mounted on the motor. The output of the tachometer is cabled to the TACH 1 input on the CMU / LMU motherboard. The tachometer outputs a pulse for each revolution of the motor.

The user has enabled TACH 1 for all POINTs downloaded to the CMU, LMU, or MIM. The CMU, LMU, or MIM waits for a pulse from the tachometer prior to collecting data on each of the points. If no pulse is registered after ten seconds (6 RPM), the motor is assumed to have stopped.

This provides consistently trendable vibration data by turning off data logging when the machine is stopped.

Extended Logic Gating

Normally, CMUs and LMUs collected data is based upon the previously described “round robin” principle. However, with Extended Logic Gating, it is possible to make the CMU / LMU wait for a signal from an external device (typically a PLC triggering the CMU’s 16 logic input / LMU’s 8 logic input), and when the signal is received, immediately start data collection for a POINT. This gating method is useful when monitoring machine tool applications as the measurement should only be performed when the spindle is off.

The overall extended logic gating process follows:

Set up the measurement.

Check the BOV (if enabled in the POINT setup).

Check the Tacho input (if enabled in the POINT setup).

Wait until the Byte value for the CMU's 16 logic inputs / LMU's 8 logic inputs matches the POINT's mask, or wait until the bit has the correct value.

Start data collection.

Check that the logic inputs (Byte) or the bit value did not change state (except TLP POINTs).

Store data.

The wait time is configurable. If the POINT "times out", the POINT is skipped and the next POINT's collection process initiates.

Defining Extended Logic POINTs in Machine Analyst for Online Systems

Machine Analyst for Online Systems uses the **POINT Setup** dialog's **Description** field to specify Extended Logic POINTs. The **Description** field's first eight characters are used.

The **Description** field format to define an Extended Logic POINT is:

XELP value time-out

XTLP value time-out

Where:

X : identifier character with the following values

@ - check sixteen / eight logic inputs as a Byte mask
& - check only 1 bit

ELP : Extended Logic POINT (Byte mask / bit number checked after measurement)

TLP : Triggered Logic POINT (no check of Byte mask / bit number after the measurement)

value : number used as a matching mask of the PLC. Range is 0-255 for Byte mask, 1-16 or 1-8 for bit match. An underscore before the bit number indicates that the measurement starts when the bit becomes zero.

time-out: optional time-out value in seconds (1-99). Default = 30.

- Always use spaces between fields for the Byte mask and the time-out value.

Examples:

@ELP 7 55 The measurement starts when all 8 logic inputs together equal the value "7" (00000111). The maximum wait time is 55 seconds. The PLC signal is checked after the measurement.

&TLP _5 The measurement starts when the bit number 5 becomes zero (xxxx0xxx) (where x indicates 0 or 1). The maximum wait time is the default 30 seconds. There is no PLC signal check after the measurement.

&ELP 3 40 The measurement starts when the bit number 3 becomes 1 (xx1xxxxx). The maximum wait time is 40 seconds. The PLC signal is checked after the measurement.

Setting Up a Control POINT

To choose a control POINT for the POINT being configured:

Click the **Control POINT** button to bring up the **Control POINT Selection** dialog.

- The control POINT and its dependent POINT must be in the same on-line device.

In the list, click to select the POINT's control POINT (or select **None**, for no control POINT).

For more information in setting up a control POINT, see **Chapter 7, Configuring and Downloading CMU, LMU, and MIM POINTs**.

Gating - POINT Configuration Rules

There are three rules for setting up control and dependent POINTs.

Rule 1. A control POINT can have as many dependent POINTs as the on-line device will hold.

Rule 2. A dependent POINT can have only one control POINT.

In Figure 6-5, data is collected for control POINT A prior to collecting data on each dependent POINT. Data will be collected for a dependent POINT only if control POINT A's alarm criteria are met.

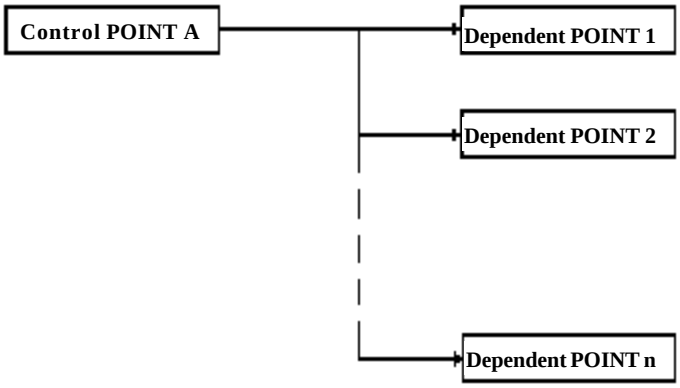


Figure 6 - 5.
Gating Rules 1 and 2.

Rule 3. A control POINT can also be a dependent POINT, that is, it can also be controlled.

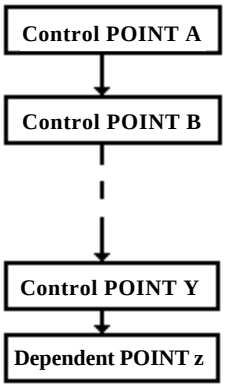


Figure 6 - 6.
Gating Rule 3.

In Figure 6-6, data is collected for control POINT A prior to collecting data on its dependents (control POINTs B through Z). If control POINT A's alarm criteria are met, data will be collected on control POINT B. If control POINT B's alarm criteria are met, data will be taken on its dependent POINT and so on down to dependent POINT Z. This implies that all of the conditions of control POINTs A through Y must be met to collect data on dependent POINT Z.

Figure 6-7 is an example of a combination of the three rules for setting up control and dependent POINTs.

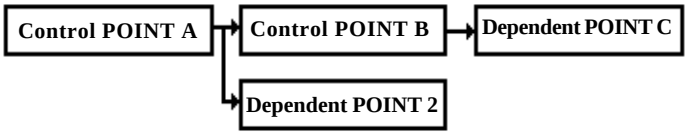


Figure 6 - 7.
A Combination of Gating Rules 1, 2, and 3.

If control POINT A's alarm criteria are met, data will be collected on control POINT B and dependent POINT 2. If control POINT B's alarm criteria are met, data will be collected on dependent POINT C. The possible combinations are endless.

7

Configuring and Downloading CMU, LMU, and MIM POINTs

Overview

- References that apply to the CMU, LMU, and MIM systems use the general term "on-line device."

After installing your On-Line System's hardware and software, you are ready to configure and download measurement POINTs to your networked on-line devices.

As a new Machine Analyst for On-Line Systems user, you fall into one of two categories:

You are a new Machine Analyst for On-Line Systems user and have performed installation of Machine Analyst and its On-Line plug-in software installation for the first time.

You are an experienced Machine Analyst user and have recently upgraded Machine Analyst software by installing the On-Line plug-in software.

Regardless of your situation, we strongly suggest you create a new Machine Analyst hierarchy and use it to familiarize yourself with Machine Analyst for On-Line Systems' features.

This chapter's sections follow the typical procedure for new CMU /LMU / MIM users:

Setting Up New CMU / LMU / MIM POINTs.

Setting On-Line Communication and Data Collection Preferences.

Downloading CMU / LMU / MIM POINTs.

Online Settings

Machine Analyst for On-Line Systems' **Online Settings** dialog allows you to add or remove devices and sensors.

Devices

- Select the **Customize** menu's **Online Settings** tab.
- Select the **Devices** Tab.

All available devices display in the **Available hardware devices** drop down list. When a device from this list is selected, its entered **Properties** and **Settings** display in the dialog's other fields.

To add a new device:

- Click the tab's **Add** button. By default, the name "New Device.#" displays.

Fields include:

Device Name - Assign the new device a unique name by typing it in the **Device name** field.

Host – This field identifies the computer that controls the device. Select the appropriate host from the drop down list. If the appropriate host is not available in the drop down list, click the **Hosts** button to display the **Hosts** dialog. Use this dialog to add, edit, or remove host computers.

Dad Type – Select the appropriate DAD type (CMU, LMU, or MIM).

Communication Type – Select the appropriate communication type.

CMU – Ethernet (TCP / IP) or SKF LAN Plus (USB)

LMU or MIM - SKF LAN Card (ISA) or SKF LAN Plus (USB).

DAD # - Select the appropriate DAD number (1 – 63). DAD #s are unique for Host / Communication type combination.

Data Collection Method – Select the appropriate data collection method:

Live & Scheduled – Data is collected for POINTs selected for live display in between data collection for the other downloaded POINTs. An advantage of this data collection method is that any alarms encountered for other downloaded POINTs are detected. A disadvantage of this data collection method is slower updates to live displays.

Live Only – When selected, the CMU, LMU, or MIM collects data only for the POINTs selected for live data display.

Compression Method – Select compressed or uncompressed. When data is compressed, all LMU or MIM data is stored in compressed format. Data stored in compressed format uses about half the LMU or MIM memory of normally stored data, however, some amplitude resolution is lost (typically 1%, worst case 4%).

- **Compression Method** is not available for CMU devices.

Once you have made changes, the **Save** and **Undo** buttons appear. Click **Save** to save your new device settings. Click **Undo** to clear the entered settings.

To remove a device:

- Select the device you wish to remove from the **Available Hardware Devices** drop down list.
  - Only devices without assigned POINTs can be removed.
- Click the **Remove** button.

- When prompted, confirm you wish to remove the selected device by clicking **Yes**.

Sensor Settings

- Select the **Customize** menu's **Online Settings** tab.
- Select the **Sensor Settings** Tab.

All available sensors display in the **Sensor Names** drop down list. When a sensor from this list is selected, its entered **Properties** and **Settings** display in the dialog's other fields.

To add a new sensor:

- Click the tab's **Add** button. By default, the name "New Sensor Settings.#" displays.

Fields include:

Name - Assign the new sensor a unique name by typing it in the **Name** field.

Sensor Power – Select the appropriate sensor power setting. Options include **Charge Converter, External Power**, and **Internal ICP (4.4 mA)**.

Settling Time – Type in the appropriate settling time in seconds.

Sensor Notes – Type in any additional information you would like to store with the selected sensor settings.

The **BOV Settings** area provides options relating to BOV gating.

Check Sensor OK Status – Click to enable this option. When enabled, Machine Analyst for On-Line Systems software will check the sensor status, and will display sensor status in **Device status** and **Online Data View** dialogs.

Upper Limit – Type in the BOV upper limit value.

Lower Limit – Type in the BOV lower limit value.

To remove a sensor:

- Select the sensor you wish to remove from the **Sensor Names** drop down list.
  - Only sensors without assigned POINTs can be removed.
- Click the **Remove** button.
- When prompted, confirm you wish to remove the selected device by clicking **Yes**.

On-Line Access Level Definitions

Administrators may add customized access levels, based on the defaults of the existing access levels, and assign to individual or multiple users.

Use the **Levels** tab to customize access for particular users to meet your application's requirements. You can expand user access by *allowing* certain access rights to levels *not* given default access, or you can restrict user access by *preventing* access from levels *with* default access.

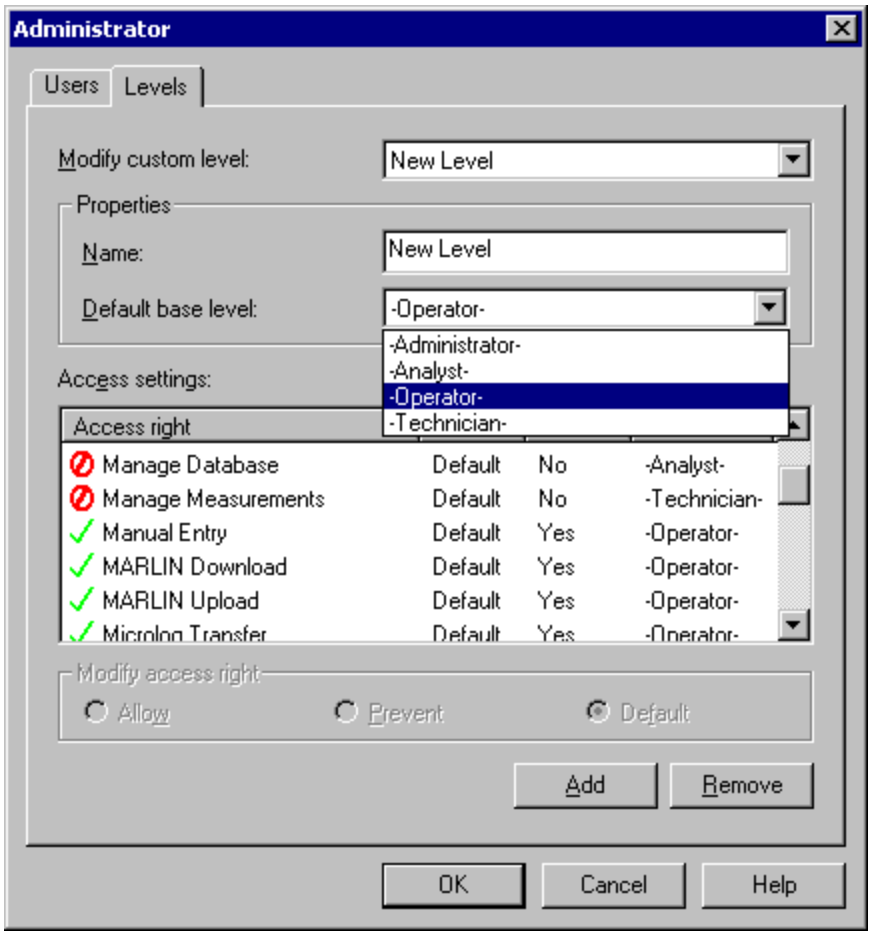


Figure 7 - 1.
The **Administrator** Dialog's **Levels** Tab.

The following access level definitions apply to Machine Analyst for On-Line Systems.

- Refer to your Machine Analyst User Manual for more information on access

levels, and a complete listing of all other access level definitions.

Online Transfer Access Level - Allows access to the **Transfer** menu's **Online** option.

Override Live Data Collection Access Level - Prevents other users from downloading a POINT while the current user is viewing that POINT's live data.

On-Line Preferences

The Machine Analyst **Customize** menu's **Preferences** options allow you to customize Machine Analyst's settings.

- Refer to your Machine Analyst User Manual for more information on setting up your Machine Analyst preferences.

On-Line General Preferences

Use the **Customize** menu's **Preferences** option to display the **Preferences / General** tab.

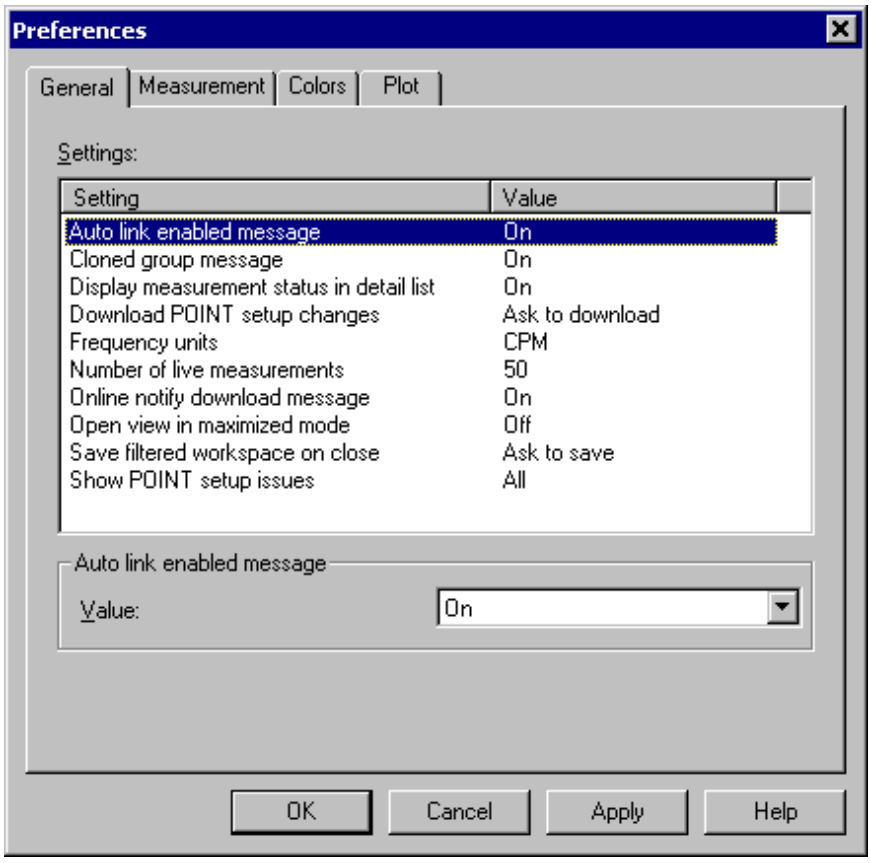


Figure 7 - 2.
The **Preferences** Dialog's **General** Tab.

The following **General** preference settings apply to Machine Analyst for On-Line Systems.

Download POINT Setup changes - Indicate how you would like to update your on-line device when a POINT's setup is modified. Options include:

Ask to Download – When a POINT's setup is modified, a dialog displays, and asks you if you wish

to update the device with the POINT setup changes. Select **Yes** to download the POINT information and update the device. Select **No** to cancel the download.

Never Download – When a POINT's setup is modified, the information is not downloaded and the device is not updated.

Always Download – When a POINT's setup is modified, the information is automatically downloaded and the device is updated.

Online notify download message - Indicate whether or not you would like to be notified to re-download to your on-line devices after making changes to your hierarchy data using Modify By Attribute, the Multiple POINT Properties dialog, or when a change is made to a shared alarm, or sensor settings. When set to **On**, a dialog displays prompting you to re-download. You may also disable this feature by de-selecting the dialog's **Show this message box again** checkbox.

- The default setting is **On**.

On-Line Plot Display Preferences

Number of live measurements - Type in the number of live measurements you want to save in memory when collecting live data. After reaching the entered limit, the first measurement will is erased.

- The default setting is **50**.

On-Line Color Preferences

The **Preferences** dialog's **Colors** tab allows you to change colors of items appearing in graphic display plots and in the colors of alarm indicators (on hierarchy lists and in graphic displays).

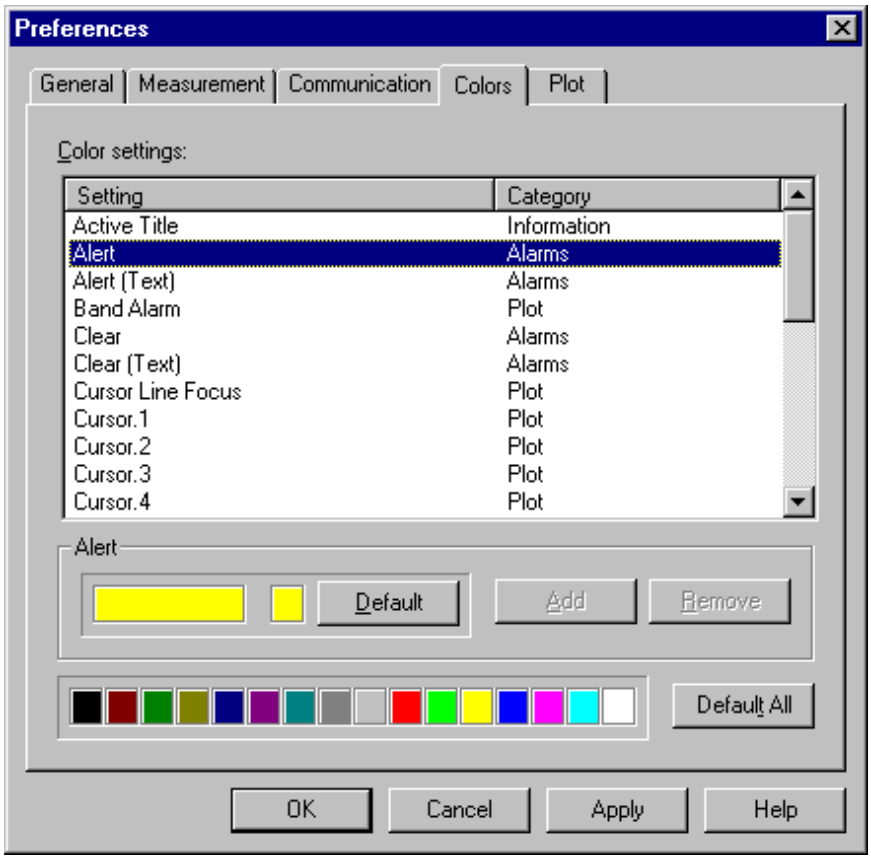


Figure 7 - 3.
The **Preferences** Dialog's **Colors** Tab.

The following **General** preference settings apply to Machine Analyst for On-Line Systems.

Channel-Bad - Determines the color of the bad channel status indicator on the **Online** dialog's **Status** tab, indicating the sensor's status. If the sensor voltage is outside the range specified in the sensor setup, it is considered a bad channel.

Channel-Bad (Text) - Determines the color of the text indicating the bad channel number in the **Online** dialog's **Status** tab's **Channel Status** area.

Channel-Good - Determines the color of the good channel status indicator on the **Online** dialog's **Status** tab, indicating the sensor's status. If the sensor voltage is within the range specified in the sensor setup, it is considered a good channel.

Channel-Good (Text) - Determines the color of the text indicating the good channel number in the **Online** dialog's **Status** tab's **Channel Status** area.

Download Progress - Determines the color of the download progress bar that displays in the online connection status area during a download.

System Indicator-Clear - Determines the color of the system indicator icon when in the system is in clear mode.

System Indicator-Problem - Determines the color of the system indicator icon when a system problem is detected.

System Indicator-Problem (Text) – Determines the color of the system indicator text when a system problem is detected.

On-Line Filter Attributes

Filters allow you to setup and apply filter criteria that determine which POINTs display in a new filtered **Workspace** window. Filtered workspaces group together POINTs and Groups (based on your filter input) in one window for easy comparison and analysis.

The following filter attributes apply to Machine Analyst for On-Line Systems.

- Refer to your Machine Analyst User Manual for more information on working

with filters, and a complete listing of all other individual filter attributes.

Active State

This attribute is located under **POINT / Online.**

Filters for all POINTs matching the indicated **Active State** setting (**High** or **Low**) (as configured in **POINT Properties / Setup** for Logic POINTs).

Edit – Select the **Active State** setting, **High** or **Low**.

Autorange

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Autorange** setting (**On** or **Off)** (as configured in **POINT Properties / Setup)**.

Edit – Select the **Autorange** setting; **On** or **Off**.

Channel Number

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated minimum and maximum **Channel Number** entries.

Edit – Enter the **Minimum** and **Maximum** channel number values.

Control POINT

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Control POINT** selection.

Edit – Select the appropriate **Control POINT** from the displayed hierarchy.

Device

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Device** type (as configured in **POINT Properties / Setup)**.

Edit – Select one or more device type from settings list. Use the **All** button to select all device types units in the settings list. Use the **Clear** button to clear all selections from the device types in the settings list.

Downloaded POINTs

This attribute is located under **POINT / Online**.

Filters for all POINTs that have been downloaded to the selected device.

Edit – Select one or more devices from settings list. Use the **All** button to select all devices in the settings list. Use the **Clear** button to clear all selections from the devices in the settings list.

Logic Bin Number

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Logic Bin Number 1-16** (as configured in **POINT Properties / Setup** for Logic POINTs).

Edit – Select one or more logic bin numbers from settings list (Logic Input Numbers 1-8 for LMU POINTs and 1-16 for CMU POINTs). Use the **All** button to select all logic bin numbers in the settings list. Use the **Clear** button to clear all selections from the logic bin numbers in the settings list.

Sensor Settings

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Sensor Settings** (as configured in **Customize / Online Settings / Sensor Setup**).

Edit – Select one or more sensor setting definitions from settings list. Use the **All** button to select all sensor setting definitions in the settings list. Use the **Clear** button to clear all selections from the sensor setting definitions in the settings list.

Tacho Number

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Tacho number** (as configured in **POINT Properties / Setup)**.

Edit – Select one or more tacho number from settings list. Use the **All** button to select all tacho numbers in the settings list. Use the **Clear** button to clear all selections from the tacho numbers in the settings list.

Tacho Enable

This attribute is located under **POINT / Online**.

Filters for all POINTs matching the indicated **Tacho enable** setting (**Enable** or **Disable)** as configured in **POINT Properties / Setup)**.

Edit – Select the **Enable Tacho** setting; **Enable** or **Disable.**

On-Line Modify By Attribute Settings

Machine Analyst's **Modify by Attribute** feature allows you to make similar changes for one or more machines or POINTs by allowing you to change specific attributes (for example, alarm values, collection schedules, etc.) all at once.

- Refer to your Machine Analyst User Manual for more information on modify by attribute procedures, and a complete listing of all other individual attributes available for modification.

On-Line Settings Available for Modification

The following attributes are available beneath the **Online Settings** folder.

Active State

Modify the selected POINT's active state setting.

Value - Indicates the current active state specified for the current POINT.

Edit - Make your edit selection from the drop down menu. Options include**:**

High

Low

The active state specifies whether the logic condition is true when the signal is *high* or *low*.

Autorange

Modify the selected POINT's auto range setting.

Value - Indicates the current auto range setting specified for the current POINT.

Edit - Make your edit selection from the drop down menu. Options include**:**

On – Autoranging enabled

Off – Autoranging disabled.

Channel Number

Modify the selected POINT's channel number.

Value - Indicates the current channel number specified for the current POINT.

Edit - Make your edit selection from the drop down menu. Options include**:**

Channel 1 - 32

Control POINT

Modify the selected POINT's control POINT assignment.

Value - Indicates the current control POINT specified for the current POINT (if applicable).

Edit – Click to select a new control POINT or clear the current control POINT assignment.

Device

Modify the selected POINT's device setting.

Value - Indicates the current device associated with the current POINT.

Edit - Make your edit selection from the drop down menu. Options include all previously assigned devices.

Tacho Enable

Modify the selected POINT's tachometer setting.

Value - Indicates the current tacho setting specified for the current POINT.

Edit - Make your edit selection from the drop down menu. Options include:

Enable – Tachometer enabled

Disable – Tachometer disabled

Logic Input Number

Modify the selected POINT's logic input number (BIN number).

Value - Indicates the current logic input number (BIN number) specified for the current POINT.

Edit - Make your edit selection from the drop down menu. Options include:

Logic Input Number 1 – 8 for LMU POINTs

Logic Input Number 1 – 16 for CMU POINTs

Sensor Settings

Modify the selected POINT's sensor settings.

Value - Indicates the current sensor setting specified for the current POINT (if applicable).

Edit – Click to select a new sensor setting or edit the current sensor setting.

Tacho Number

Modify the selected POINT's tacho number assignment.

Value - Indicates the current tacho number assigned to the current POINT.

Edit - Make your edit selection from the drop down menu. Options include:

Tacho 1 – 8 (CMU and LMU)

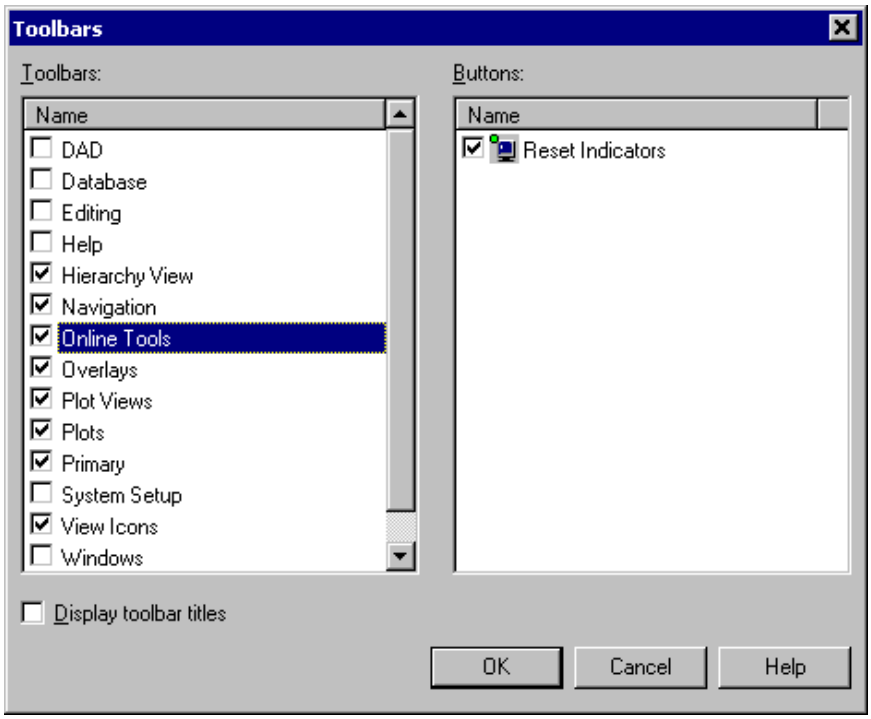
Tacho 1-2 (MIM)

On-Line Toolbar Group

The **Customize** menu's **Toolbars** option allows you to enable or disable any or all available toolbar buttons. Toolbar buttons are available for each menu item and available function. By default, only toolbar buttons for commonly utilized features are active. Buttons are arranged by related functionality in separate sections of the toolbar area.

The following custom toolbar applies to Machine Analyst for On-Line Systems.

- Refer to your Machine Analyst User Manual for more information on working with custom toolbars, and a complete listing of all other toolbar groups.



The **Online Tools** toolbar contains buttons for on-line specific operations.

- The default setting is **on.**

On-Line Transfer Settings

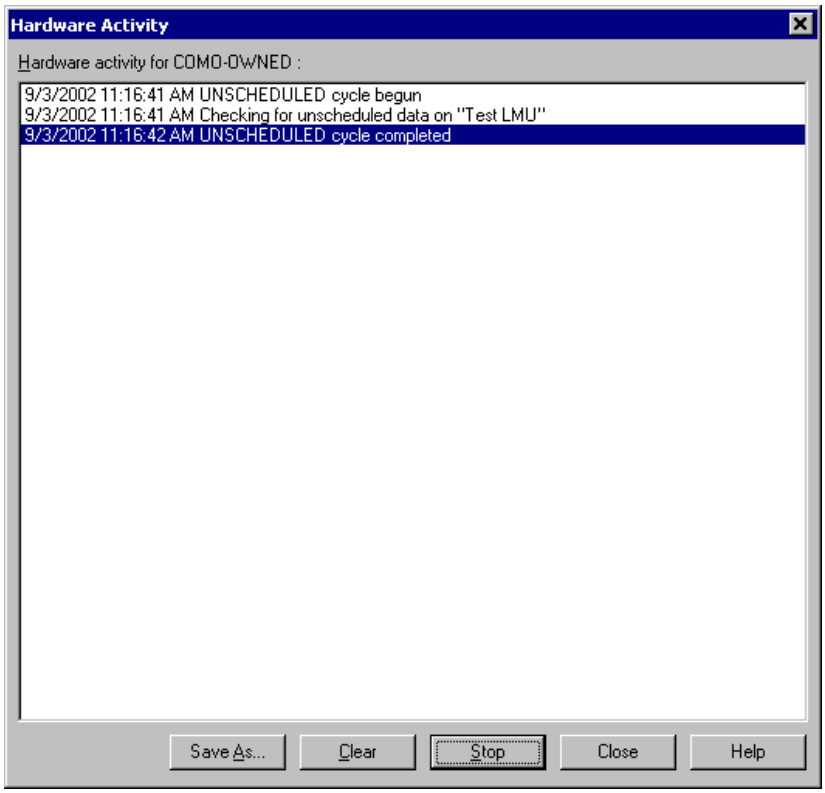
The **Transfer** menu's **Online** dialog allows you to configure your processing delay settings.

- Select the **Transfer / Online / Settings** tab.
- Select the appropriate server from the **Configure Server** drop down list.

- Use the slide bars to adjust the processing delay time (0 – 120 seconds) for the following operations:

  Device sync
  Unscheduled data
  Scheduled data

- Click the **Activity** button to view an activity log of the interaction between the Machine Analyst Online System and the on-line device network.



The **Hardware Activity** dialog displays activity between the current hardware device and Machine Analyst for Online Systems.

Save As – Click to save **Hardware Activity** window contents to a specified location.

Clear – Click to clear the **Hardware Activity** window contents.

Stop – Click to stop the **Hardware Activity** window from displaying the interaction between the Machine Analyst Online System and the CMU / LMU / MIM network.

Close – Click to close the **Hardware Activity** window.

Setting Up New CMU POINTs

New POINTs must be created in Machine Analyst.

This section describes Machine Analyst for On-Line Systems' **POINT Properties** dialog's options for configuring CMU POINTs.

- LMU and MIM POINT configuration is described later in this chapter.
- Reference your Machine Analyst User Manual for information on setting up groups and non-on-line device POINTs.

To add CMU POINTs to your database:

- In the hierarchy list, click to highlight the group from which you wish the POINT to branch.
- Select the **Insert** menu's **New POINT** option or with the group selected, right click to access the context menu. Select the men's **Insert Item** option. The **DAD / POINT Type Selection** dialog displays.
  - The keyboard's **Insert** key may also be used to insert a new POINT.
  - If anything except a group (set or machine) is highlighted in the hierarchy list, the **Insert** menu's **New POINT**

option is dimmed. POINTs must branch from groups.

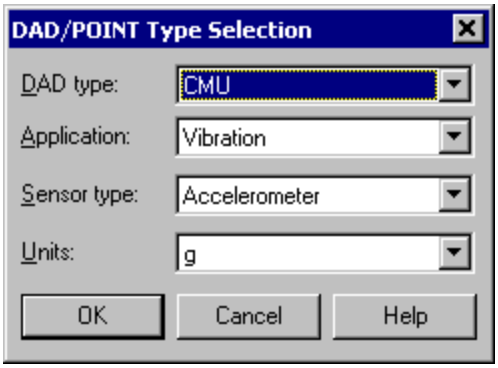


Figure 7 - 4.
The **DAD / POINT Type Selection** Dialog.

- Using the drop down lists, select **CMU** as the **Dad Type.**
- Select the appropriate **Application, Sensor Type,** and **Units.**
- Click **OK.** The **POINT Properties** dialog displays.

Point Properties

General Tab

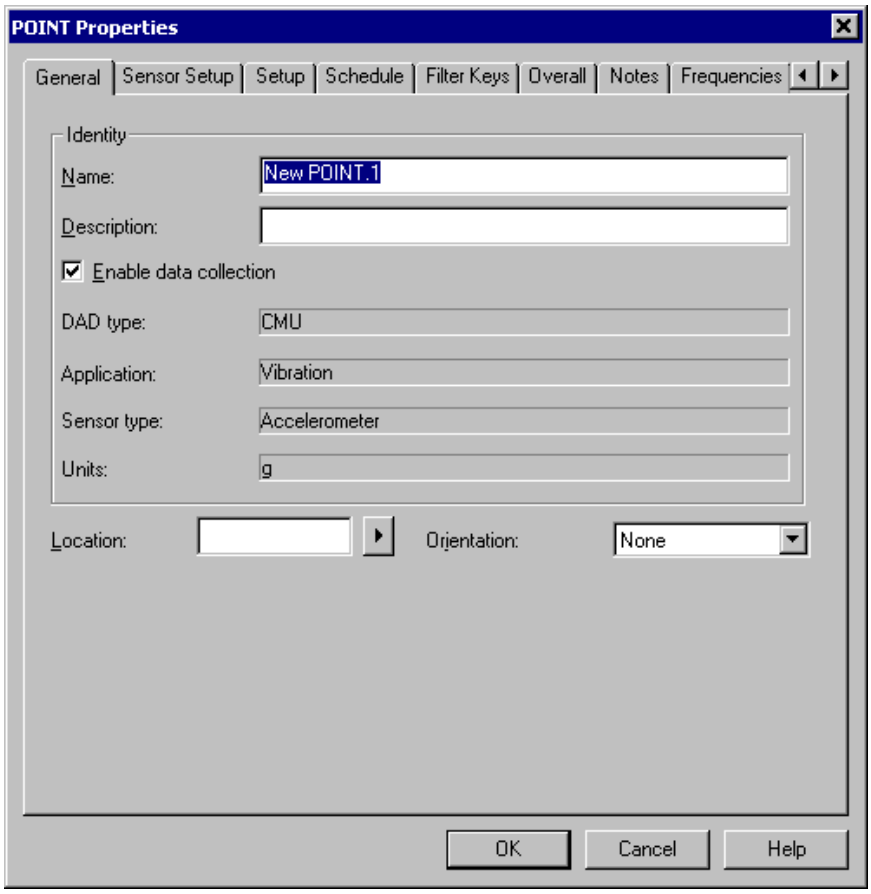


Figure 7 - 5.
The **POINT Properties / General** Tab.

The **POINT Properties** dialog's **General** tab allows you to enter the POINT name and description and displays the DAD / POINT Type information you previously entered.

POINT Properties / General fields include:

Name – Enter a unique name to identify the POINT. The name must be unique within a set of POINTs.

Description – Enter a description to further identify the POINT. Also used for Parameter Gating, which is further described in **Chapter 7, How the CMU, LMU, and MIM Systems Collect Data.**

Enable data collection – When POINTs are downloaded to the collection instrument, the **Enable data collection** setting determines whether the POINT is downloaded or ignored. Click the checkbox to enable.

- When a POINT is disabled from downloading, its existing alarm conditions do NOT affect the system.

DAD type – Displays the DAD type previously assigned when the POINT was created.

Application – Displays the application type assigned when the POINT was created.

Sensor type – Displays the sensor type assigned when the POINT was created.

Units – Displays the appropriate measurement unit assigned when the POINT was created.

- The **DAD Type**, **Application**, **Sensor**, and **Units** fields of the **General** tab cannot be edited once they have been assigned.

Location – Enter the data collection POINT on the machine. Options include:

Normal – Alphabetic identifiers A-J.

Displacement – Numeric identifiers 1-10.

Other – Six specific identifiers:

Drive End
Non-Drive End
Outboard
Inboard
Coupled End
Non-Coupled End

Orientation – Select from drop down list options (**Axial, Horizontal, Vertical, X, Y, Radial**).

Sensor Setup Tab

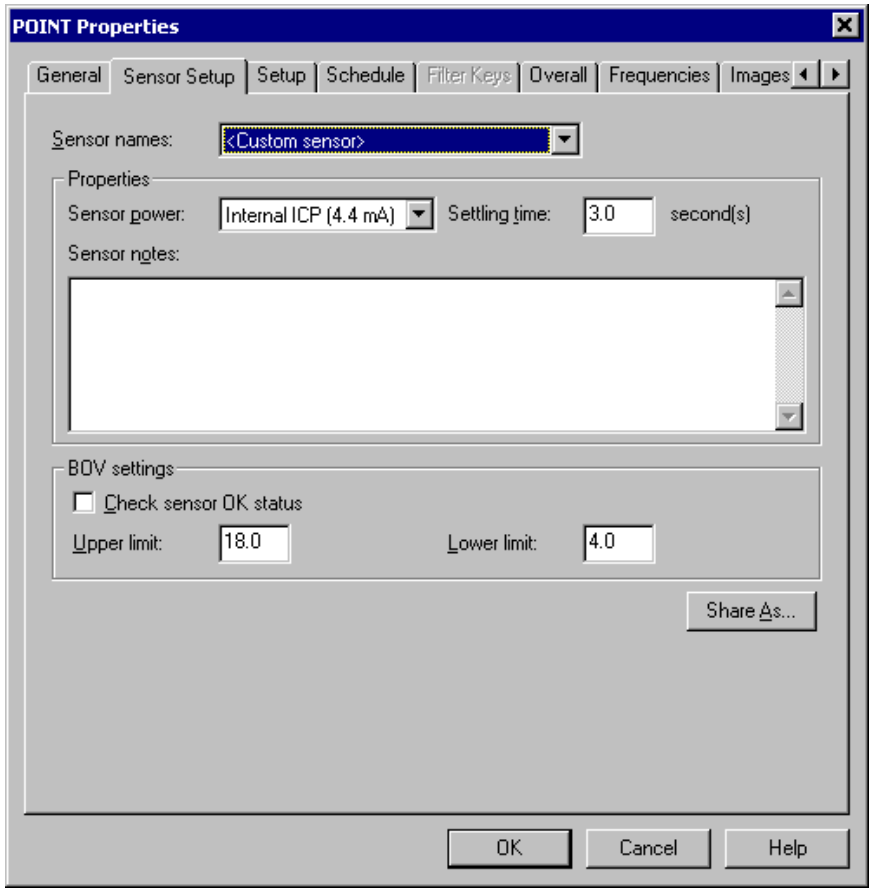


Figure 7 - 6.
The **POINT Properties / Sensor Setup** Tab.

- MIM POINTs, RPM POINTs, and Logic POINTs do not support sensor setup, so the **Sensor Setup** tab does not appear in the **POINT Properties** dialog if the selected POINT is configured as a MIM, RPM, or Logic POINT.

The **Sensor Setup** tab allows you to re-apply previously defined "shared" sensors, eliminating the need to define sensor settings individually, saving time and database space.

Use the **Sensor Setup** tab to set a POINT's sensor settings. Settings can be configured in a variety of ways using the tab's fields.

The current sensor name appears in the **Sensor names** field. The current sensor's properties display below in the dialog's **Properties** and **BOV Settings** areas.

The **Sensor names** drop down list displays all previously created seniors and a <**Custom Sensor**> option. Use this drop down list to specify whether you wish to set up a unique **<Custom Sensor>** for the current POINT only, or specify a previously defined sensor (selected by name). If you specify a shared sensor, its settings automatically display in subsequent fields. If you specify a custom sensor, proceed to configure the tab's alarm settings as described below.

The **Properties** area provides options relating to Sensor Power, Settling Time, and Sensor Notes.

Sensor Power – Select the appropriate sensor power setting. Options include **Charge Converter, External Power**, and **Internal ICP (4.4 mA)**.

Settling Time – Type in the appropriate settling time in seconds.

Sensor Notes – Type in any additional information you would like to store with the selected sensor settings.

The **BOV Settings** area provides options relating to BOV gating.

Check Sensor OK Status – Click to enable this option. When enabled, Machine Analyst for On-Line Systems software will check the sensor status, and

will display the sensor status in **Device status** and **Online Data View** dialogs.

Upper Limit – Type in the BOV upper limit value.

Lower Limit – Type in the BOV lower limit value.

To assign a shared sensor to the current POINT:

- Select the shared sensor from the drop down list and click the **OK** button. Shared sensors may be applied to an unlimited number of POINTs.

Shared Sensors

Sensors initially created as custom sensors may be converted into shared sensors. To share a newly created custom sensor, select the new custom sensor and click the tab's **Share As** button.

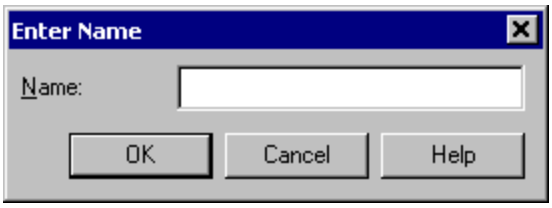


Figure 7 - 7.
The **Share As** Dialog.

The **Share As** dialog specifies the sensor as a shared sensor. When the **Share As** dialog displays, you will be prompted to give the shared sensor a unique name for easy identification.

- Enter a name for the shared sensor and click the **OK** button.

The new shared sensor now appears as an available selection in the drop down list. Shared sensors are easily assigned to other POINTs to simplify POINT setup and maintenance.

Setup Tab – CMU POINTs

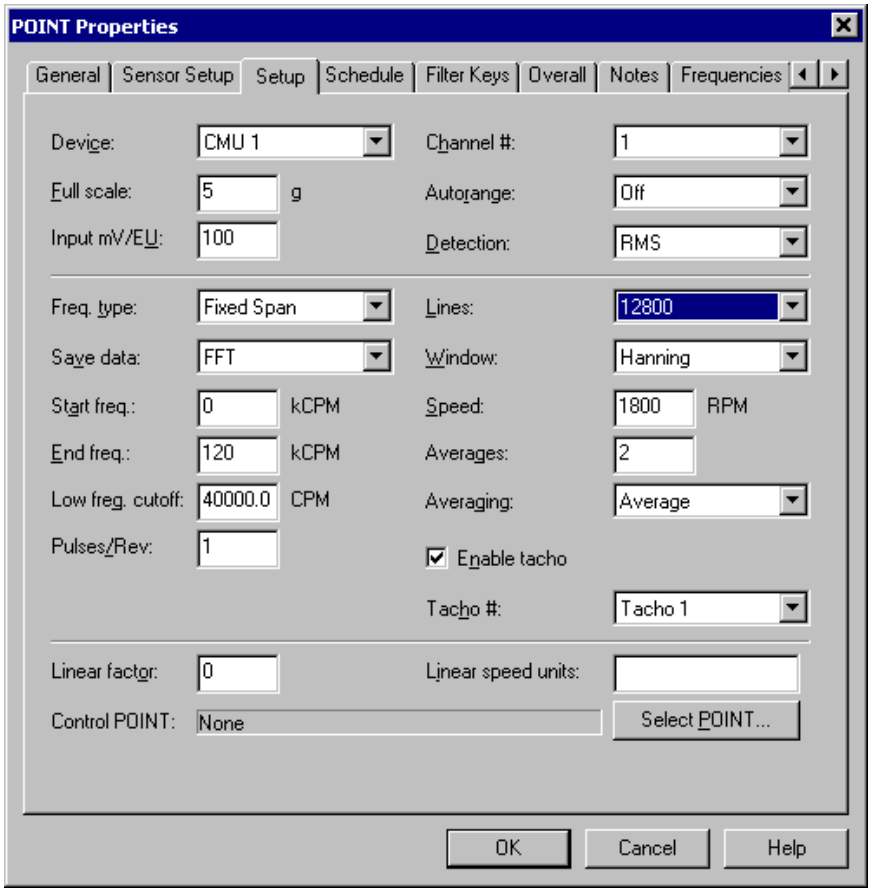


Figure 7 - 8.
The **POINT Properties / Setup** Tab.

Enter on-line device POINT setup information in this tab.

- The **POINT Properties / Setup** tab displays differently, depending on the POINT type. The following **Setup** fields apply to CMU POINTs.

If **Setup** units allow editing, the values display in an edit field.

- The POINT Setup Validation Dialog launches when you enter incompatible or erroneous information on the **Setup** tab.

Setup fields include:

Device – Select the appropriate on-line device name from the drop down list. The list contains all available device names.

- Devices may be added or removed in the **Customize** menu's **Online Settings** dialog.

Full Scale - Enter a number to define the anticipated maximum amplitude to be measured for this POINT.

Input mV / EU - If applicable, enter a value for the sensitivity of the pickup to be used in making the measurement.

- 100 mV / EU is used for most acceleration sensors, 200 mV / EU for most non-contact displacement sensors, and 1,000 mV / EU if the input is volts and the scale is to be read directly.

Channel # - Enter the terminal strip channel input (sensor input) number (1-32) at which the POINT's sensor is connected.

Autorange - (On or Off). Determines whether the POINT's full scale value is autoranging, or determined with the POINT's Full scale field setting.

Detection - Click on the list box to view the choices (**Peak, Peak to Peak**, and **RMS**). Select the method of dynamic signal detection from the drop down list.

Freq. Type - Click the drop down list box to view the choices (**Fixed Span** or **Order Track**).

Fixed Span – Specifies frequency as the unit of measurement for the horizontal axis of the FFT spectrum.

Order Track – Specifies orders of running speed as the unit of measure for the horizontal axis of the FFT spectrum, requires a phase reference input to collect the measurement.

Save Data – Determines whether the DAD collects **FFT** data, **Time** Record data, or both. An additional **FFT and Phase** option is available for Order Tracking POINTs.

Start / End Freq. –

Order Track / Orders – If **Freq. Type** is **Order Track**, enter the lower and upper, full scale order range of the FFT between 0 and 100.0 orders. For optimum results, use values from approximately 2 to 10 orders.

Fixed Span / Frequency – If **Freq. Type** is **Fixed Span**, enter the lower and upper, full scale frequency range of the FFT between 0.06 kCPM and 2400 kCPM, or the equivalent in Hz. Unless you are making a very unusual measurement, the upper full scale frequency should always be greater than running speed.

Low Freq. Cutoff – Enter a low frequency cutoff filter value for dynamic measurements. Although values are allowed from 0.0 CPM to 2,400 kCPM, the range for normal measurements is from approximately 200 CPM to 600 CPM, or the equivalent in Hz.

Pulses / Rev - Used to determine machine running speed. If a tachometer is connected, enter the number of tach. pulses that occur for each shaft revolution.

Lines – The spectrum's FFT resolution. Click the drop down list box to view available choices.

- The higher the resolution, the slower the data collection.

100	200	400	800
1600	3200	6400	12,800

Window – Select the type of window used in the FFT processing. Click the drop down list box to view the choices (**Uniform, Hanning,** or **Flat Top**). A window function must be applied to any periodic time record prior to performing an FFT. The **Hanning** and **Flat Top** window functions attenuate to zero both the leading and trailing edges of the sample in order to prevent leakage error caused by discontinuities in the time record.

Uniform – A dynamic signal analyzer window function with uniform weighting across time. Useful for measuring transients or mechanical response measurements.

Hanning – A dynamic signal analyzer window function that provides better frequency resolution than Flat Top, but with reduced amplitude accuracy. Useful for machine vibration measurements, general purpose measurement, and measurements containing random noise.

Flat Top – A dynamic signal analyzer window function which provides the best amplitude accuracy for measuring discrete frequency components. Useful for calibration of machine vibration measurements using displacement probes in fluid-film bearings.

Speed – Enter the nominal shaft speed in CPM or Hz.

Averages – Enter the number of FFT averages to be collected (from 1 to 99). Four to six averages are adequate and are normally used for machine monitoring. The higher the number of averages, the slower the data collection.

Averaging – (**Average**, **Off**, **Peak Hold**, or **Synchronous Time**) If averaging has been selected for the POINT, determines the type of averaging performed, (either normal averaging, no averaging, peak hold averaging, or synchronous time averaging). Synchronous Time requires a tachometer assignment.

Enable Tacho – Click to enable tachometer.

Tacho # - (Tacho input number 1-8 for CMU and LMU, and 1-2 for MIM) Select the terminal strip tacho input number where a tachometer input is connected for this POINT.

Linear Factor – Type in the numeric linear factor.

Linear Speed Units – Type in the linear speed unit.

Control POINT Setup

To select a control POINT for the POINT being configured:

- Click the **Setup** tab's **Select POINT** button. The **Control Point** dialog displays.

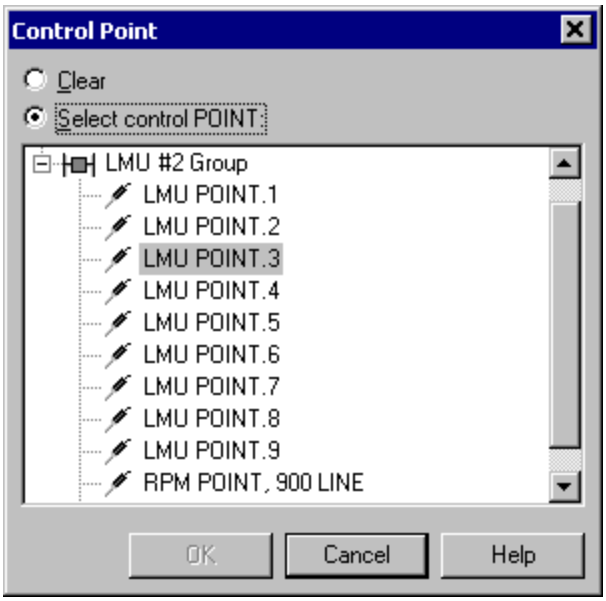


Figure 7 - 9.
The **Control Point** Dialog.

- The control POINT and its dependent POINT must be in the same LMU or MIM.

- Click the **Select control POINT** button.
- In the list, click to select the new POINT's control POINT.
- Click **OK**.

To clear the control POINT for the POINT being configured.

- Click the **Clear** button.
- Click **OK**.

Setup Tab – CMU Logic POINTs

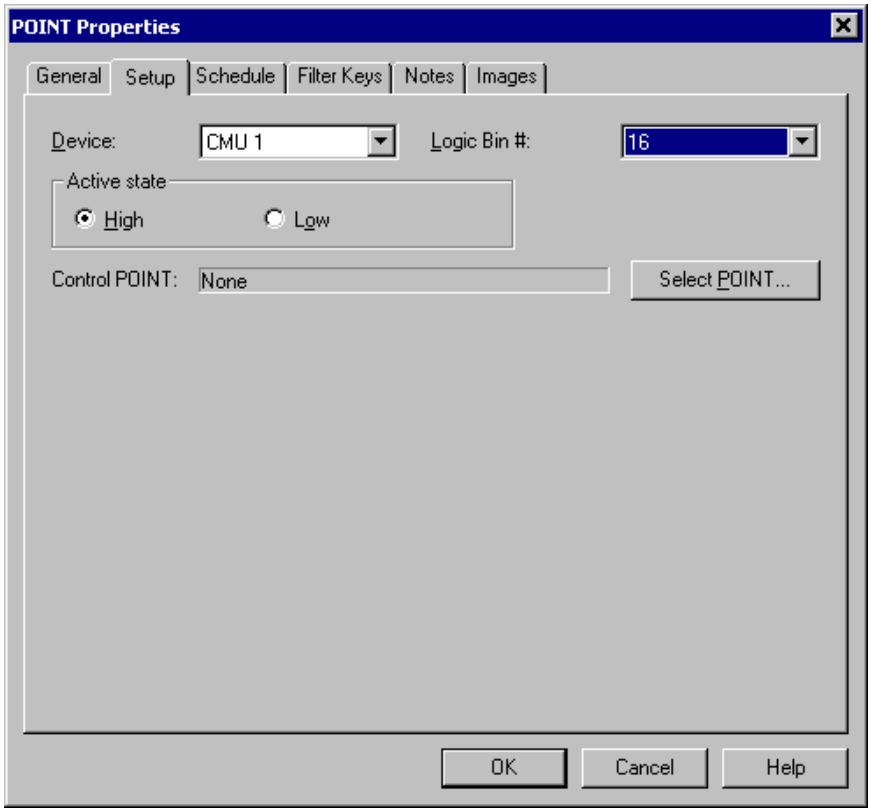


Figure 7 - 10.
The **POINT Properties / Setup** Tab.

Enter Logic POINT Setup information in this tab.

- The **POINT Properties / Setup** tab displays differently depending on the POINT type. The following **Setup** fields apply to CMU Logic POINTs.

A logic POINT monitors the logic state (high or low) of one of 16 BIN (Buffered Input) lines on the CMU's

motherboard. These BIN lines accept TTL signals from Programmable Logic Controllers (PLCs). Logic POINTs are often used as gating control POINTs.

Setup fields include:

Device – Select the device from the drop down list.

Logic Bin # - Select the appropriate motherboard BIN (1-16) for this logic POINT from the drop down list.

Active State – Click to select **High** or **Low**. The active state specifies whether the logic condition is true when the signal is *high* or *low***.**

In addition to data being saved to the "Scheduled" database on the regular time schedule, additional "Scheduled" data is saved for a logic POINT each time its state changes (from high to low, or low to high).

Control POINT – Displays the name of the current control POINT, if applicable.

- Click the **Select POINT** button to select a control POINT.

Setting Up LMU POINTs

Setup Tab – LMU POINTs

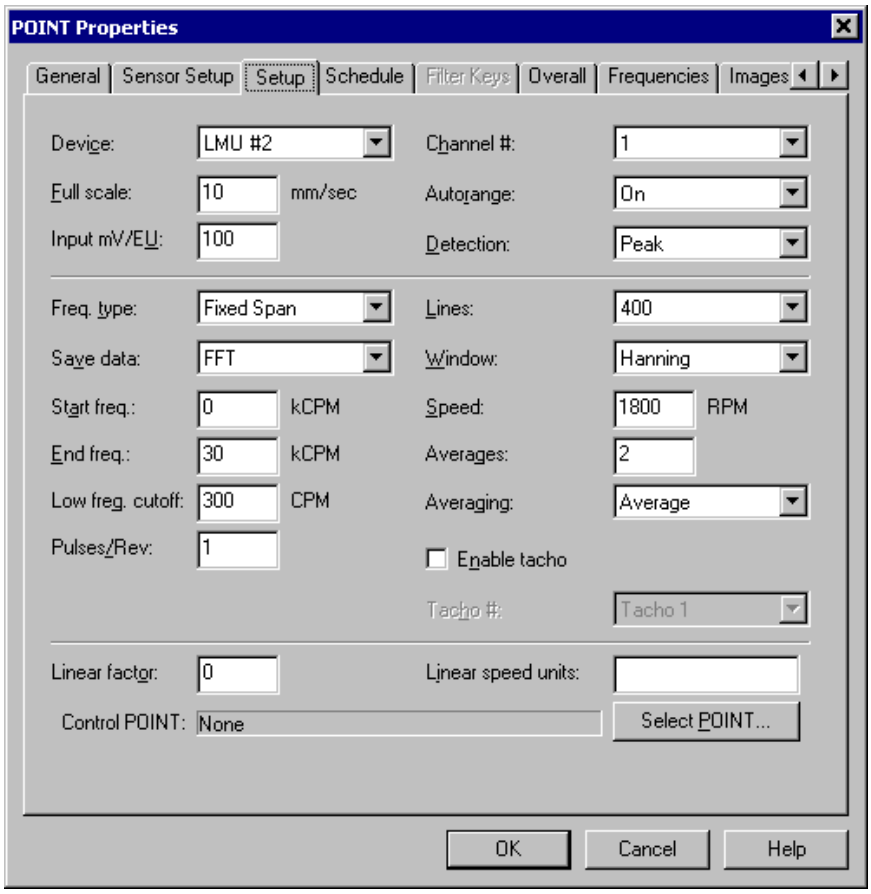


Figure 7 - 11.
The **POINT Properties / Setup** Tab.

LMU POINTs are configured using the same setup parameters as described previously for CMU POINTs with the following exceptions.

Lines – The spectrum's FFT resolution. Click the drop down list box to view available choices.

The higher the resolution, the slower the data collection.

100 200 400 800

1600 3200 6400

- For the lines field, the highest value for the LMU is 6400 instead of 12,800 for the CMU.

Fixed Span / Frequency – If **Freq. Type** is **Fixed Span**, enter the lower and upper, full scale frequency range of the FFT between 0.06 kCPM and 1200 kCPM, or the equivalent in Hz. Unless you are making a very unusual measurement, the upper full scale frequency should always be greater than running speed.

- For the **Fixed Span / Frequency** field, the highest value for the LMU is 1,200 kCPM instead of 2,400 kCPM for the CMU.

Low Freq. Cutoff – Enter a low frequency cutoff filter value for dynamic measurements. Although values are allowed from 0.0 CPM to 1200 kCPM, the range for normal measurements is from approximately 200 CPM to 600 CPM, or the equivalent in Hz.

- For the **Low Freq. Cutoff** field, the highest value for the LMU is 1,200 kCPM instead of 2,400 kCPM for the CMU.

Setup Tab – LMU Logic POINTs

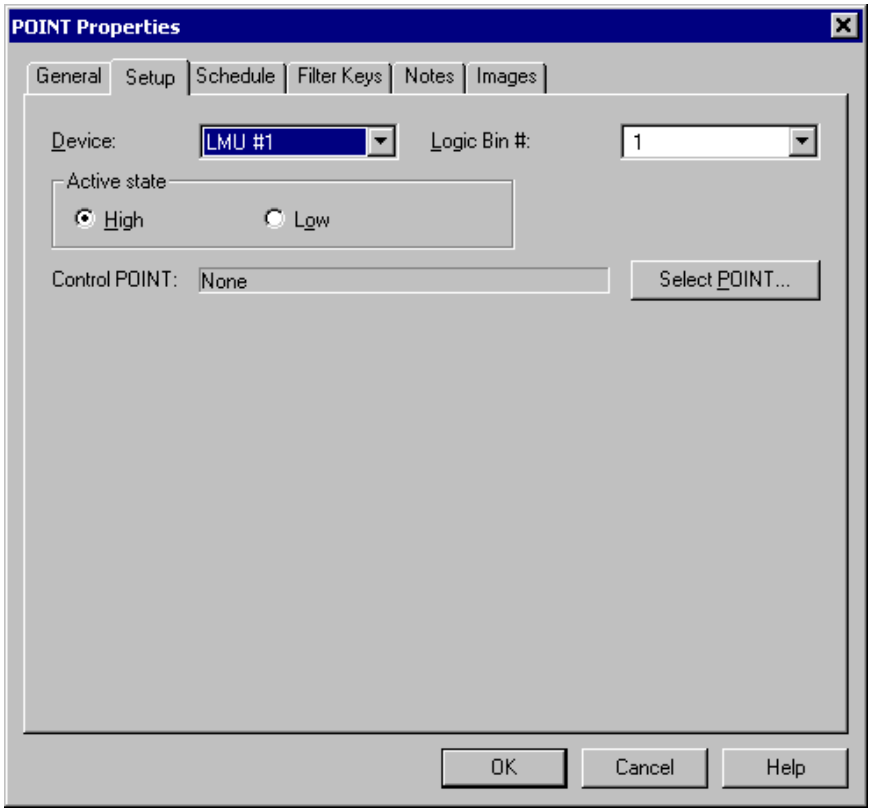


Figure 7 - 12.
The **POINT Properties / Setup** Tab.

LMU Logic POINTs are configured using the same setup parameters as described previously for CMU Logic POINTs with the following exceptions.

Logic Bin # - Select the appropriate motherboard BIN (1-8) for this logic POINT from the drop down list.

- LMUs have only 8 BIN (Buffered Input) lines instead of 16 like the CMU.

Setting Up New MIM POINTs

Setup Tab – MIM POINTs

MIM POINTs are configured using the same setup parameters as described previously for LMU POINTs with the following exceptions.

Tacho # - (Tacho 1 or Tacho 2) Select the terminal strip tacho input number where a tachometer input is connected for this POINT.

- The MIM 's Tacho selection is limited to Tacho 1 and Tacho 2.

Lines – The spectrum's FFT resolution. Click the drop down list box to view available choices.

The higher the resolution, the slower the data collection.

100 200 400 800

1600 3200

For the lines field the highest value for the MIM is 3200 instead of 6400 for the LMU or Microlog, or 12,800 for the CMU.

Downloading POINTs

After configuring your on-line device POINTs, and configuring your system's preferences, use "Download" options in the **Transfer menu's Online** dialog to download the new POINTs to your on-line device network.

- A maximum of 128 MIM POINTs or 256 CMU / LMU POINTs can be downloaded.

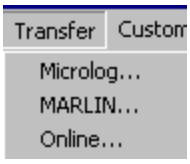


Figure 7 - 13.
The **Transfer** Menu.

Download

- The **Online** tab's **Download** tab allows you to download an individual hierarchy item, or entire ROUTEs or workspaces.

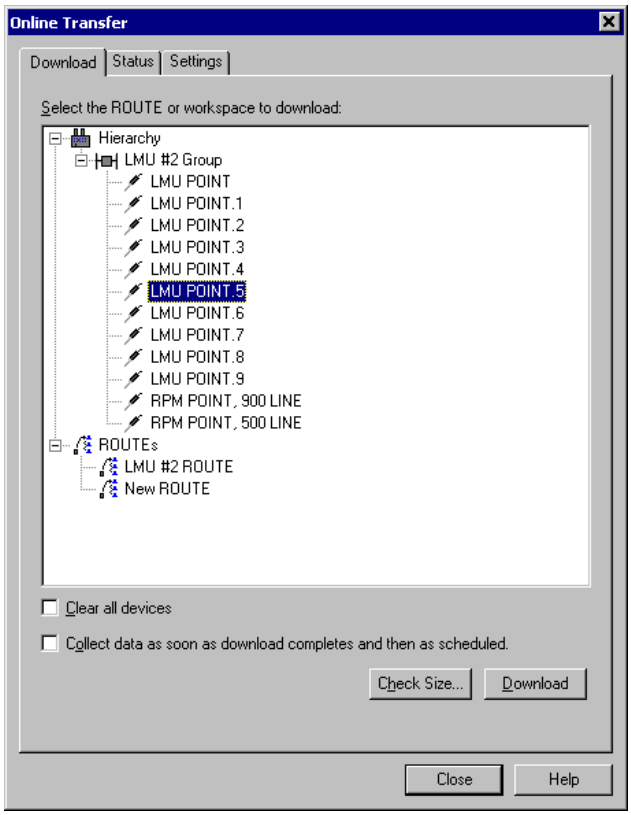


Figure 7 - 14.
The **Download** Tab.

- Click to select a single hierarchy item or a ROUTE or workspace for download from the appropriate Hierarchy, ROUTE, or Workspace list.

Clear All Devices – Click to enable. When enabled, all devices will be cleared when the download is initiated.

Collect Data As Soon as Download Completes and Then as Scheduled – Click to enable.

z CMU Users – The following information applies to the CMU only. CMU Users – The following information applies to the CMU only. CMU Users – The following information applies to the CMU only. CMU Users – The following information applies to the CMU only.Check Size – Click to check the download size of the selected item(s). The **Check Download Size** dialog displays. Download size details include the selected device's available memory, total memory used, and status. The POINT details area displays the memory used by each POINT in the selected ROUTE or Workspace.

- **CMU Users – The following information applies to the CMU only.**

The POINT details area displays the POINT memory and Measurement memory for CMU POINTs.

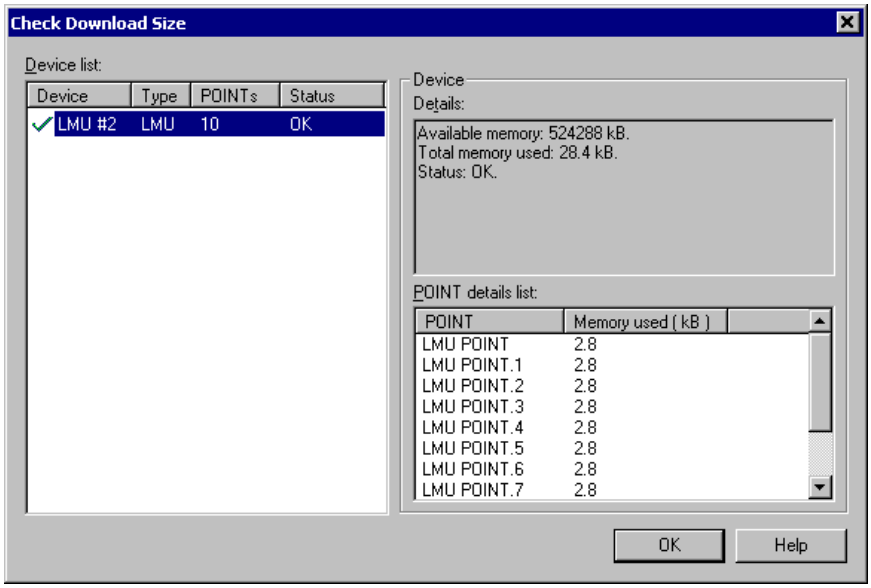


Figure 7 - 15.
The **Check Download Size** Dialog (LMU and MIM POINTs).

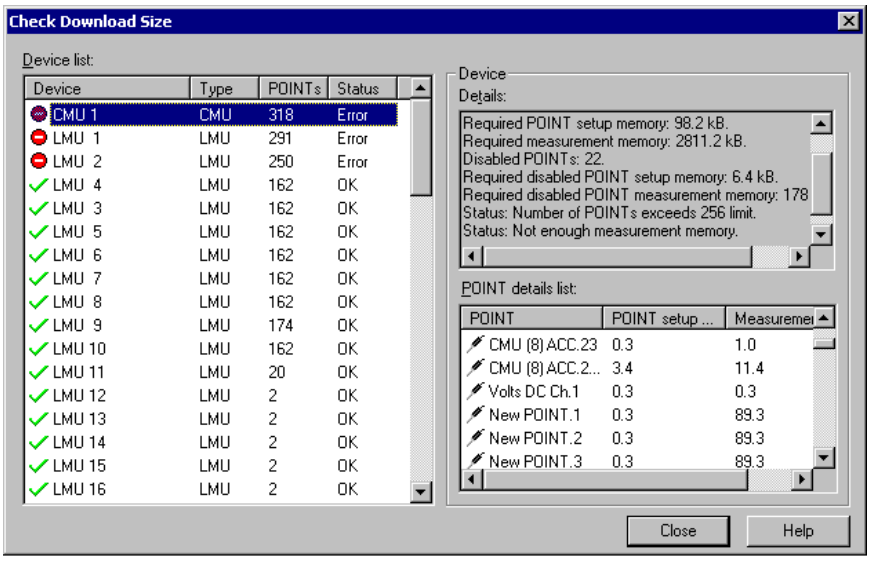
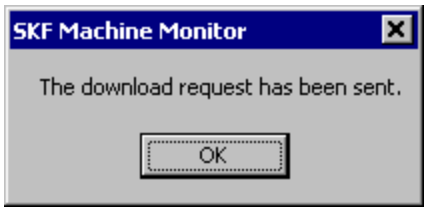
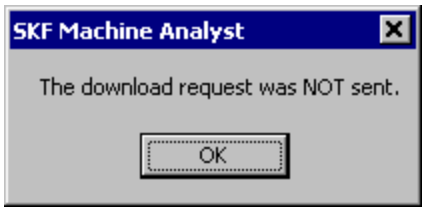


Figure 7 - 16.
The **Check Download Size** Dialog (CMU POINTs).

Download – Click to download the selected item(s) to the selected device. A dialog appears indicating whether or not the download request was successfully sent.

- Activity status can be viewed through the **Status** tab's progress bar.





Status

The **Online** tab's **Status** tab allows you to view a selected device's status information.

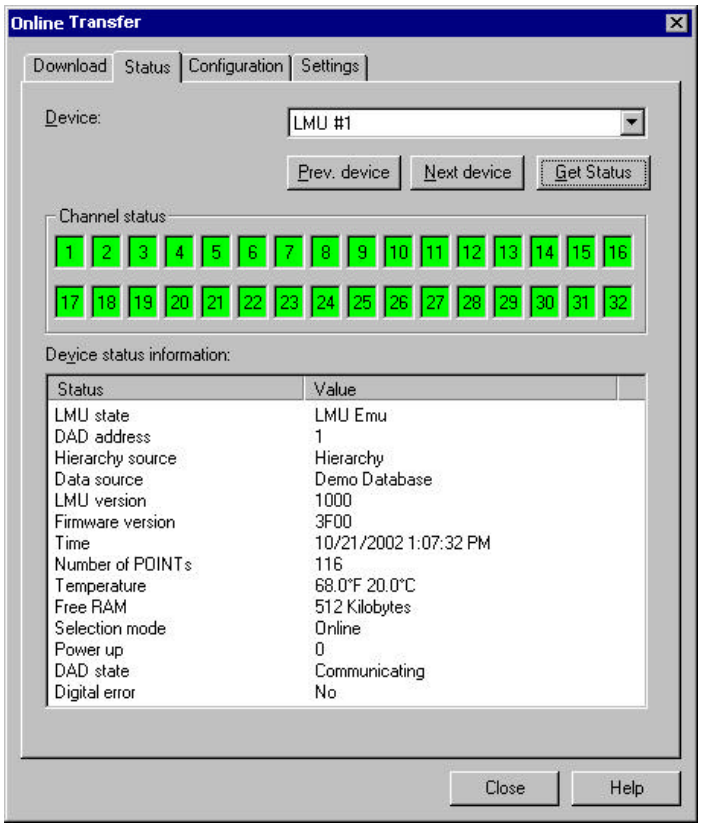


Figure 7 - 17.
The **Status** Tab.

To determine the DAD status:

- Select the appropriate DAD from the **Device** drop down list.
- Click the **Get Status** button. The selected DAD's status appears in the **Channel status** and **Device status information** areas.
- Click the **Prev. device** or **Next device** buttons to navigate the **Device** drop down list and to get status.

The **Channel status** area displays 32 numbered boxes, each representing a channel on the CMU or LMU. A blue indicator through the channel number represents a sensor problem for the indicated channel. Green indicates there are no problems.

- Channel status cannot be displayed for the MIM.
- Channel status is applicable only for channels set up for BOV Gating.

The **Device status information** area displays the following information:

CMU / LMU state - Indicates the channel number and tachometer being used.

DAD address - The physical DAD number as per the switches on the box itself.

ROUTE / Workspace - Name of the ROUTE or Workspace that was downloaded to the DAD.

- Items deleted from the ROUTE or Workspace are not deleted from the DAD.

Data Source - Name of the current database.

CMU / LMU / MIM Version – The hardware version number. If the selected device is a CMU, this option appears as "**CMU Version**." If the selected device is a MIM, this option appears as "**MIM Version**."

Firmware Version – The on-line device's firmware version number. Useful for servicing and product update information.

Time - The on-line device's clock's date and time settings.

Number of POINTs - Displays the number of POINTs downloaded to the on-line device.

Temperature - The on-line device's temperature, recorded in both degrees Fahrenheit and centigrade.

Free RAM - The amount of free RAM in the on-line device.

Selection Mode - Either On-Line or Local. "Local" displays when the DAD is being accessed with a data collection device from its front panel BNC connectors. While in the Local mode, no on-line data collection occurs.

Power Up - Displays a numeric code indicating power up status.

DAD State – Displays the on-line device's activity status.

Digital Error - Displays the on-line device's RAM status. "No" indicates no RAM problems. "Yes" indicates RAM problems.

Configuration

The **Online** tab's **Configuration** tab allows you to adjust status, data collection, and compression settings.

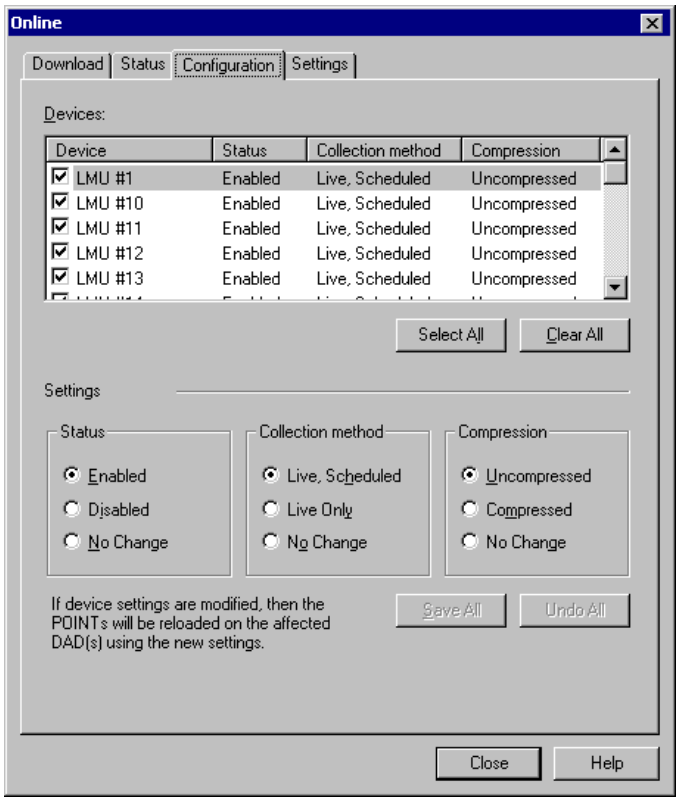


Figure 7 - 18.
The **Configuration** Tab.

To adjust DAD settings:

- Select the appropriate DAD from the **Device** control list.
  - To select multiple devices, click and drag the cursor over the appropriate devices, or click **Select All** to select all devices listed, or Ctrl+Click individual devices.
  - **Clear All** clears the selection(s).

Status – Select **Enabled** or **Disabled**. This will enable / disable data collection for the selected device(s). To toggle between **Enabled** and **Disabled**, use the check box next to the device in the **Device** control list. Clicking **No Change** will undo any changes to the **Status** settings.

Collection method – Select **Live, Scheduled** or **Live Only**. Clicking **No Change** will undo any changes to the **Collection method** settings.

Live, Scheduled - Data is collected for POINTs selected for live display in between data collection for the other downloaded POINTs.

Live Only - When selected, the CMU / LMU collects data only for POINTs selected for live data display.

Compression - Select **Compressed** or **Uncompressed**. When data is compressed, all LMU or MIM data is stored in compressed format. Data stored in compressed format uses about half the LMU or MIM memory of normally stored data, however, some amplitude resolution is lost (typically 1%, worst case 4%). Clicking **No Change** will undo any changes to the **Compression** settings.

- **Compression** is not available for CMU devices.
- A star displays next to any affected devices in the **Device** control list.

Undo All reverts back to the last **Save All**.

To save changes:

- Click the **Save All** button to apply your new settings to the selected device(s).
  - Adjusted settings will not take effect if you do not click the **Save All** button.
  - Once you have clicked **Save All**, the **Undo All** button will be disabled.

User Notes

8

Displaying CMU, LMU, and MIM Data

Overview

> ➢ References that apply to the CMU, LMU, and MIM systems use the general term "on-line device."

Machine Analyst for On-Line Systems allows you to display your collected measurements in various plot formats for machinery analysis purposes.

Graphic On-Line Systems plot formats include:

- Trend Plot
- Spectrum Plot
- Trend / Spectrum Plot
- Time Plot
- Trend / Time Plot
- Trend / Spectrum / Time Plot
- Waterfall Plot
- Polar Vector Plot
- Mag / Phase Trend Plot
- Band Trend Plot
- Extracted Trend Plot
- Extracted Band Plot

Live Data Displays

Machine Analyst's Live Data Displays allow you to view a POINT's live data in various graphical formats. When **Live Data** mode is enabled, the active display updates as new data is collected by its on-line device.

- Live data display is only available when a single POINT is selected.

When live data mode is enabled, displayed measurements automatically update on a continuous basis. Previous spectra and time waveform plots are overwritten by updated spectra / time waveforms.

To display live data:

- Select a POINT from the hierarchy list.
- Display the desired plot type using the **View** menu's **Plot** options, or the plot type toolbar buttons. The selected plot displays in its plot window.

- Click the **Live Data** toolbar button to initiate live data mode, or select the **View** menu's **Plot / Live Data** option.

The plot window initially displays * **WAITING LIVE *** in the upper corners and displays **"Waiting for live data for the plot"** in the center.

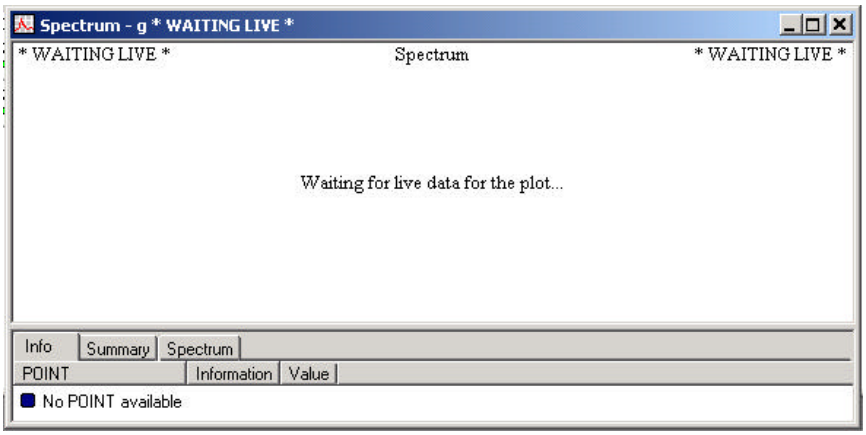


Figure 8 - 1.
A Spectrum Plot Window – Waiting For Live Data.

Once live data is available, the plot window displays * **LIVE** * in its upper corners and the live data appears in the selected graphical format.

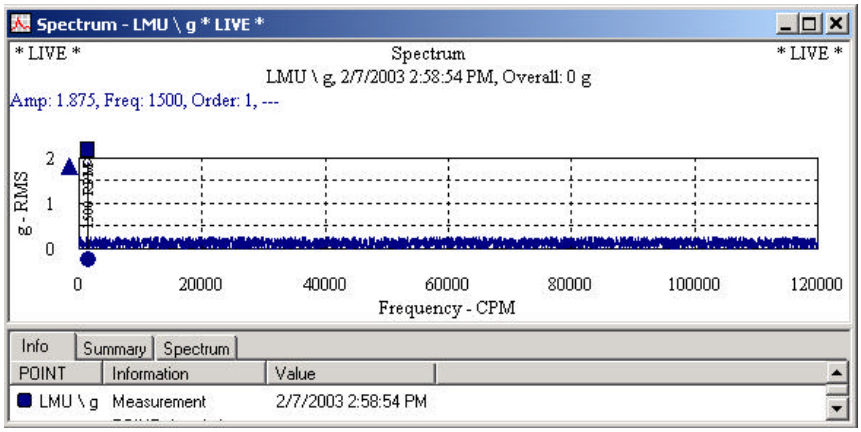


Figure 8 - 2.
A Spectrum Plot Window Displaying Live Data.

Spectrum and Time Waveform Plots

As the POINT's DAD collects new data, the new data overwrites the existing data on the spectrum and time plots.

Trend Plot

The trend plot in live data mode “grows” from the bottom of the overall trend plot with each new DAD data collection. When the overall Trend plot fills the overall trend plot, a First In First Out process begins, in which the oldest data moves off the display to make room for the most recent data.

Spectrum Waterfall Plot

Instead of overwriting previous FFT spectra with each update, live data waterfall plots' previous spectra scroll up the spectrum display window with each update, creating a waterfall spectra display.

Polar Vector Plots

An on-line polar vector display can also go “live”. However, unlike non-live polar vector displays, with live displays, only the POINT's current value is displayed and updated every few seconds, no historical data appears.

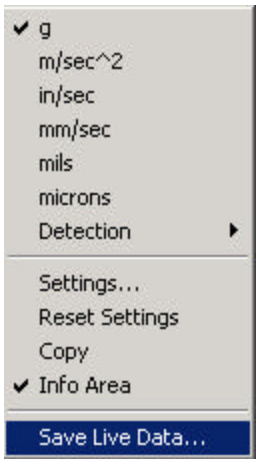
Alarm criteria remains assigned to the displayed POINT. The line segment (vector) that includes the hollow circle as its endpoint shows the selected harmonic's current magnitude and phase. This vector’s magnitude and direction (phase) update every few seconds.

Saving Live Data

Live data may be saved either to the POINT or to a live data set in your hierarchy.

To save live data:

- Right-click in the live data plot window to display the plot’s context menu.



- Select **Save Live Data**. The **Save Live Data** dialog displays.

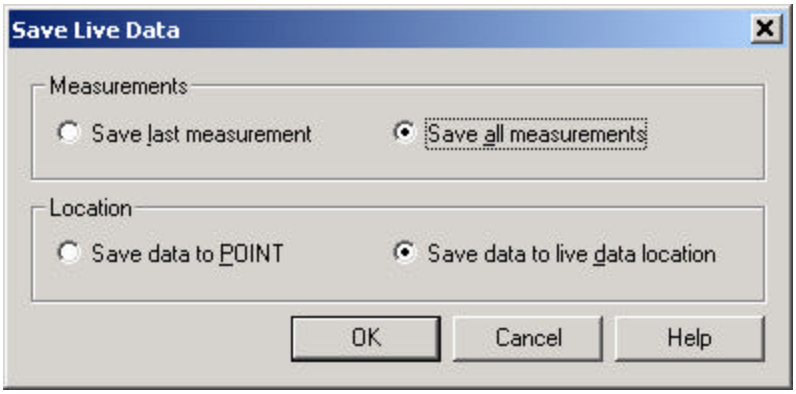


Figure 8 - 3.
The **Save Live Data** Dialog.

The **Save Live Data** dialog allows you to specify which measurements to save and where you'd like to save their live data.

Measurements

- Click to select **Save last measurement** or **Save all measurements.**

Location

Save data to POINT – Select this option to save the live data to the POINT. Live data is saved to the POINT itself and may be viewed when the POINT is selected in the hierarchy.

Save data to live data location – Select this option to save the live data to a LIVE DATA SET in the hierarchy. The first time this option is selected, a new SET named **LIVE DATA** is created in the hierarchy. When this option is selected, the live data, along with the machine name, date / time stamp, and a copy of the POINT are stored in the **LIVE DATA** SET. The live data is ***not*** saved directly to the original source POINT.

System Information

Machine Analyst's **System Information** display provides detailed **Event Log** and **Online Data** information.

Select the **View** menu's **System Information** option or click the **System Information** toolbar button. The **System Information** display appears.

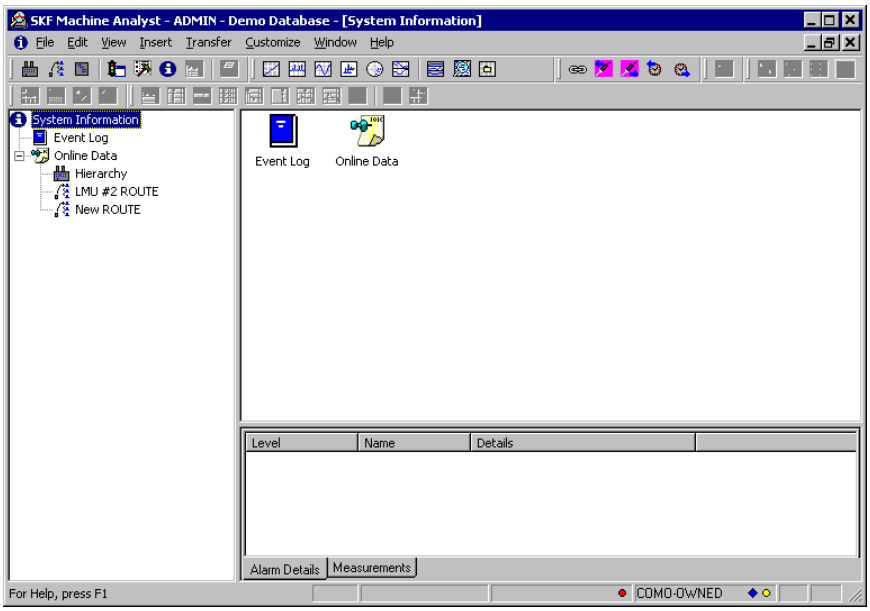


Figure 8 - 4.
The **System Information** Display.

When an **Event Log** or **Online Data** item is selected, additional details display in the lower area.

The **System Information**'s **Alarm Details** and **Measurement** buttons provide additional information about the selected **Event Log** or **Online Data** item, if the selected item has POINT information.

Alarm Details – Describe the alarmed POINT. The detail information may be sorted by **Level**, **Name**, or **Details** by clicking the appropriate header.

Measurements - Display the measurement history for the selected POINT. The measurement history may be sorted by **Date / Time** or **Summary**.

Event Log

The **Event Log** stores and displays a list of alarms and events that have occurred on the system. The most recently collected event data displays at the top of the Event Log list.

To view the Event Log:

- In the display's left panel, click the **Event Log** item. The **Event Log** information displays in the right panel.

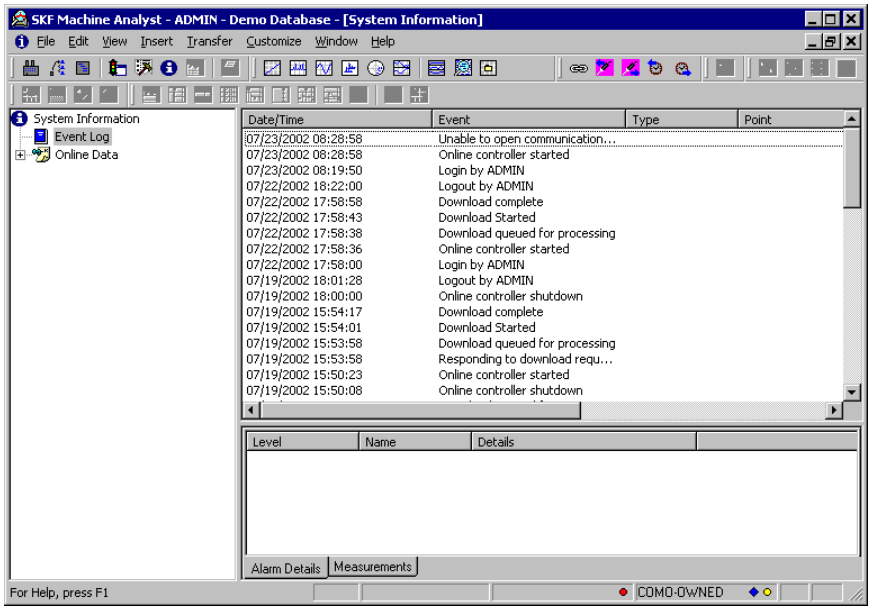


Figure 8 - 5.
An Example **Event Log** Display.

Each event is identified with its:

Date / Time
Event Type
POINT ID
Host

DAD Type
Device
User

To specify which columns appear in the Event Log:

With an event log item selected, right click to display the context menu. Select the **Columns** option. The **Select Columns** dialog displays.

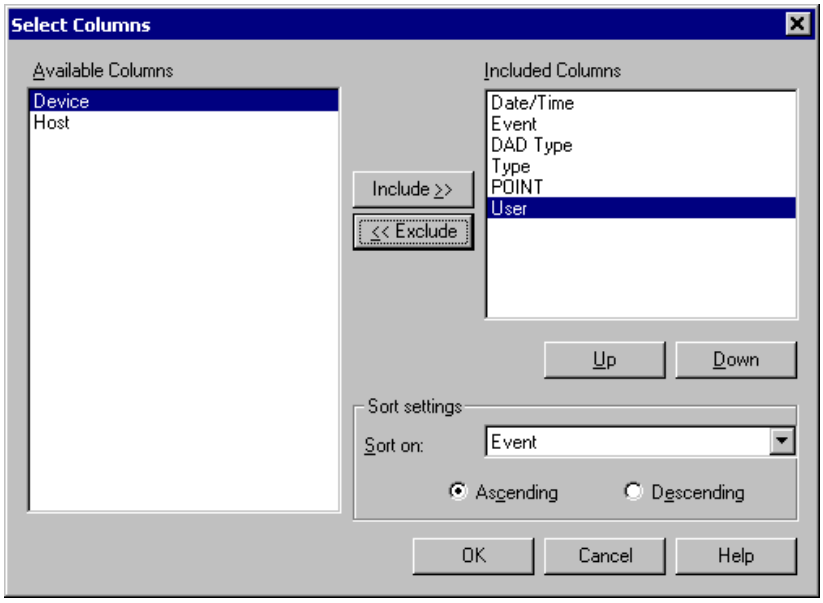


Figure 8 - 6.
The **Select Columns** Dialog.

Use the **Select Columns** dialog to specify which columns appear in the event log, to specify column order, and select column sort criteria.

All available columns appear in the **Available columns** area. All included columns appear in the **Included columns** area.

To add / remove columns:

- Click the column type to select it.
- Use the **Include** and **Exclude** buttons to add or remove the column from the **Included columns** area.

To specify column order:

- Click the column type in the **Included columns** area to select it.
- Use the **Up** and **Down** buttons to place the column into the desired position.

To specify sort criteria:

- Select a column type from the **Sort on** drop down list box.
- Click the desired sort method button, **Ascending** or **Descending**.
- Click **OK** to save changes.
- Click **Cancel** to undo settings.

The Event Log displays specific messages which classify each event type according to the different events which occur in the system. Possible event types are as follows:

Access
Data Collection
Communication
Online Alarm
Configuration
Monitor

When you change the database while Off-Line, you must download upon re-entering the On-Line mode.

Online Data

The **Online Data** view summarizes all POINTS which have been downloaded to an on-line device network. As

POINTS are downloaded to an on-line device, they appear in **Online Data** view.

To view the Online Data:

- In the display's left panel, click the **Online Data** item. The **Online Data** information displays in the right panel.

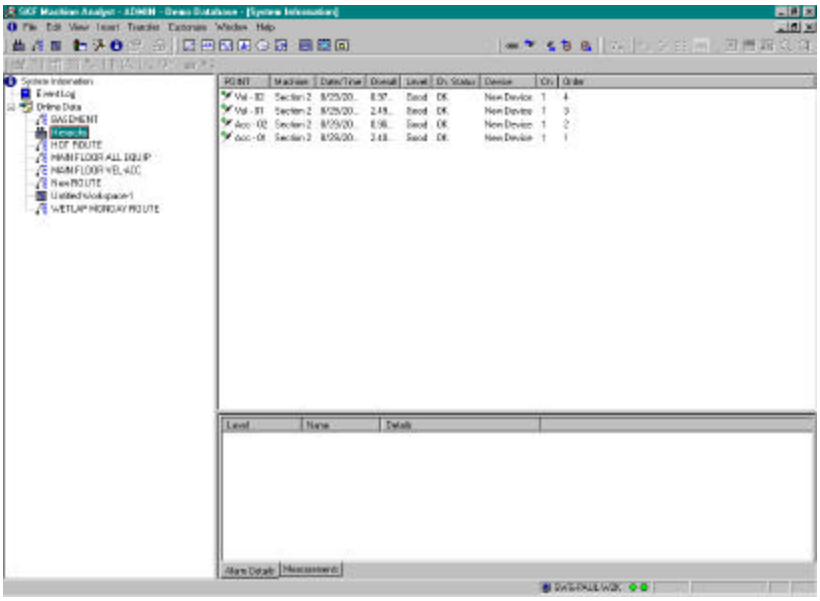


Figure 8 - 7.
An Example **Online Data** Display**.**

Each POINT is identified with its:

Machine
Date and **Time** POINT was measured
Overall
Level
Ch. Status
Device
Ch.
Order

An icon appears next to each POINT name in the Online Data view. The icons provide additional POINT information:

	A sensor icon indicates a POINT ***without*** data.
	A sensor next to a green* circle indicates a POINT ***with*** data.
	A sensor with a yellow* circle indicates a POINT with data in Alert alarm condition.
	A sensor with a red* circle indicates a POINT with data in the Danger alarm condition.
	A sensor with a blue** background indicates a POINT with BOV condition.

* The green, yellow, and red colors are the default colors. Machine Analyst's Online Data view uses the system color preferences.

** The blue background for the bad BOV condition is the default color. Machine Analyst's Online Data view uses the system color preferences.

Appendix A
Event Log Redirection

Overview

- References that apply to the CMU, LMU, and MIM systems use the general term "on-line device."

Event Log redirection allows you to automatically capture or print alarm or system event information by directing the information to either a serial communications port or to a parallel printer port. Communication parameters (port, baud rate, etc.) are user selected.

When an alarm(s) is uploaded from an on-line device, or when a system event occurs (e.g., bad sensor, on-line device LAN communication failure, etc.), Machine Analyst for On-Line Systems formats each event as it occurs and immediately redirects the formatted output through the selected port to the connected device or printer. Printed events are formatted differently than the COM port redirected events.

Example

Following is an example of an Event Log redirected to a printer. Each line was printed as the alarm or system event occurred.

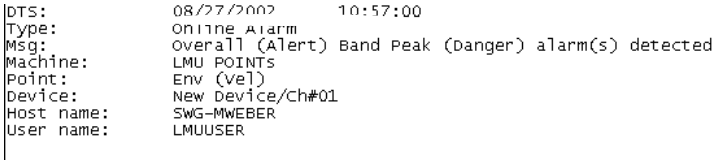


Figure A - 1.
Example Event Log Redirection to a Printer.

The following are the categories in each redirected event. The same data is included, regardless of whether it is redirected to a printer or a COM port.

Date / Time Setup (DTS) - 19 characters -
MM / DD / YYYY HH:MM:SS

Event type – 20 characters maximum

Alarm Message (MSG) - 240 characters maximum

Machine name – 20 characters maximum

POINT name – 20 characters maximum

Device name – 250 characters maximum (contains / ch#nn at end if there is channel for the event)

Host name – 15 characters maximum

User name – 30 characters maximum

Printed events have labels for each item of data. The labels are defined in the language file. The channel abbreviation that may be included with the device name also comes from the language file. Printed lines are wrapped if they exceed 80 characters.

The format for events redirected to COM (serial) ports is as follows:

	Character Location	Character Width
DTS	1-19	19
Machine Name	21-40	20
POINT Name	42-61	20
Event Message	63-302	240
Event Type	304-323	20
Device	325-574	250
Host Name	576-590	15
User Name	592-621	30
\r	622	
\n	623	

User Notes

Appendix B

LMU Front Panel Switch Module and Simultaneous Power Options

- This appendix applies to LMUs only.

Overview

The standard CMMA320 Multilog Local Monitoring Unit (LMU) consists of an enclosure, power supply, electronics module, and motherboard. Three optional configurations are available.

Two of these optional configurations provide LMU front panel switches and BNC connectors. These switches and BNC connectors allow local data collection with the Microlog Portable Data Collector or other data collectors / signal analyzers. These optional front panel versions are the:

CMMA320-HO (Housing Only), and

CMMA320-SW (SWitches)

The third optional configuration is the addition of a simultaneous power module option that provides 4.4 mA power simultaneously to up to sixteen sensors attached to the LMU's motherboard, the

CMMA320-PS (Simultaneous Power)

This simultaneous power option may be used with any LMU version.

320-HO (Housing Only) LMU Version

The **320-HO** LMU version is a simpler version of the standard LMU with **local** data collection features only. The 320-HO LMU does not contain the on-line electronics module and therefore does not provide continuous scanning, on-line data collection and storage.

Instead, the 320-HO LMU version houses a front panel **switch module** with switches and BNC connectors that provide easy local access to 32 vibration sensors and 8 tachometers. Manual data collection is very efficient as multiple sensors become accessible from one central location using a Microlog Data Collector, analyzer, or tape recorder.

The 320-HO LMU is the least expensive LMU version and may be upgraded to a full featured on-line system. This permits the user to evolve from a periodic to a continuous monitoring system as needs develop or as money becomes available.

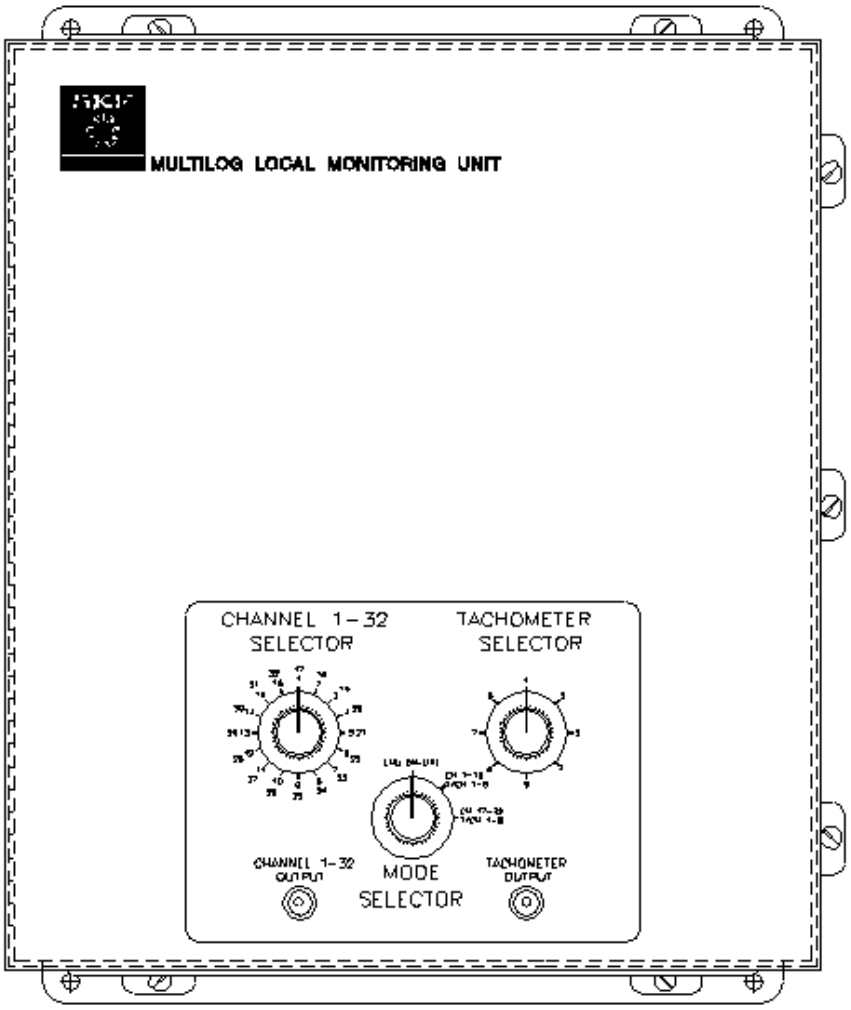


Figure B - 1.
Exterior View - 320-HO / SW LMU Versions.

Switch Module Operation

The 320-HO LMU's front panel switch module operates using three switches and two BNC connectors. The switches are labeled:

MODE SELECTOR
CHANNEL 1-32 SELECTOR
TACHOMETER SELECTOR

MODE SELECTOR

The MODE SELECTOR switch sets the LMU in either the **LMU On-line** mode or the *local* data collection mode.

- **LMU ON-LINE** - Sets the LMU for continuous scanning, on-line machinery monitoring.
  - The **LMU On-Line** switch setting is invalid on the 320-**HO** LMU version. The 320-HO LMU version has no electronics module and does not provide continuous scanning, on-line data collection and storage.

The **local** data collection mode has two switch positions;

CH 1-16 / TACH 1-8 - for local monitoring of one of the LMU's dynamic channels (channels 1 through 16) and of one of the LMU's 8 available tachometer inputs.

CH 17-32 / TACH 1-8 - for local monitoring of one of the LMU's dynamic channels (channels 17 through 32) and of one of the LMU's 8 available tachometer inputs.

CHANNEL 1-32 SELECTOR

The CHANNEL SELECTOR switch is used in conjunction with the MODE SELECTOR switch to select which LMU channel is monitored by the connected Microlog Data Collector.

- If the MODE SELECTOR switch is set for channels 1 - 16, use the CHANNEL SELECTOR switch's

inner ring of channel numbers (1-16) to select which channel is monitored.

- If the MODE SELECTOR switch is set for channels 17 - 32, use the CHANNEL SELECTOR switch's outer ring of channel numbers (17-32) to select the channel.
    - For local data collection, the Microlog uses a special BNC connector cable (SKF part no. CMSS50079).
    - Local collection of *SEE* signals requires a different BNC connector cable. Contact your SKF representative for ordering information.

TACHOMETER SELECTOR

When the MODE SELECTOR switch is set for CH 1-16, **TACH 1-8** or CH 17-32, **TACH 1-8** the TACHOMETER SELECTOR switch selects which of the eight possible LMU tach inputs is monitored by the connected Microlog Data Collector.

- For local tach signal collection, the Microlog uses the above mentioned CMSS50079 cable along with a CMSS6135D Adapter and CMSS50189 cable.

A fuse is installed on the switch module to protect the user from potential high voltage conditions. If the switch module fails due to a blown fuse, do not attempt to repair the unit. A hazardous voltage situation may exist. Contact your local SKF service representative for assistance.

BNC Connector Operation

The switch module provides two BNC connectors for collecting channel and tachometer data. The BNC connectors are labeled:

- **CHANNEL 1-32 OUTPUT**, and
- **TACHOMETER OUTPUT**

Each BNC connector corresponds to the switch directly above it.

The **TACHOMETER OUTPUT** BNC outputs the LMU tachometer signal selected with the **TACHOMETER SELECTOR** switch.

The **CHANNEL 1-32 OUTPUT** BNC outputs the LMU channel signal selected with the **CHANNEL 1-32 SELECTOR** and **MODE SELECTOR** switches.

In local data collection mode, the selected channel and tach data are output simultaneously.

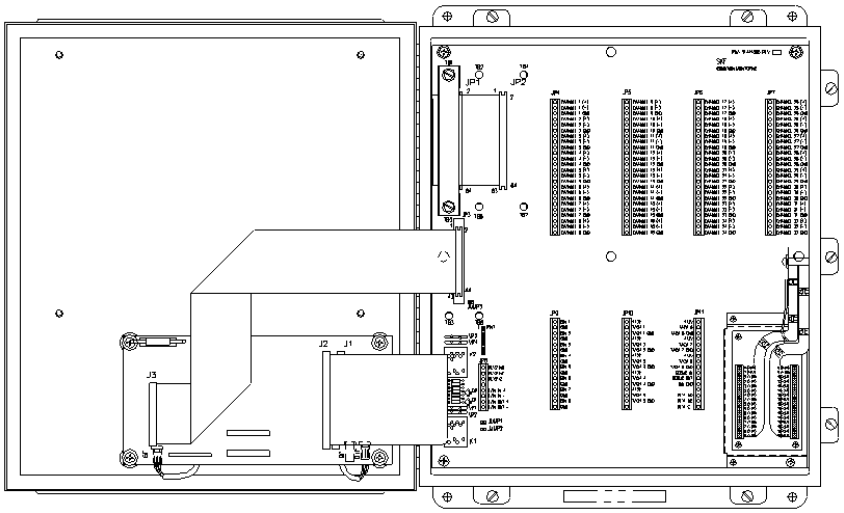


Figure B - 2.
320-HO LMU (Inside View).
Note the Presence of the Switch Module
and the Absence of the Electronics Module.

4.4 mA Power Option

The front panel switch module has an added feature in that it can provide 4.4 mA power to the *selected channel's* sensor. This 4.4 mA power feature is enabled by jumping jumpers M1 and M6 on the 320-HO LMU's switch module's circuit board.

4.4 mA power enabled - M1 and M6 jumped
4.4 mA power disabled - M1 and M6 not jumped

- When 4.4 mA power is enabled, it is not necessary to supply power to the sensor from the portable data collector. Conversely, when 4.4 mA power is disabled, it is necessary to supply power to

the sensor from the portable data collector or some other external power supply.

320-HO Switch Panel Wiring

- Switch module to LMU wiring configurations are different for the 320-HO and 320-SW LMU versions.

Channel Wiring

For the **320-HO** LMU version, dynamic channel signals are cabled from the motherboard to the switch module using 2 unjacketed 64-pin cables supplied with the unit.

One cable connects the switch module's J1 connector to the motherboard's JP1 connector.

The other cable connects the switch module's J2 connector to the motherboard's JP2 connector.

320-HO - Tach and Single Channel 4.4 mA Power Wiring

Tach signals and 4.4 mA power are cabled from the motherboard to the switch module using an additional cable that connects the switch module's J3 connector to the motherboard's JP3 connector.

320-SW (SWitches) LMU Version

The **320-SW** LMU version is the most versatile LMU version. It is the standard 320 On-Line LMU with the addition of the front panel **switch module**.

This configuration allows both continuous scanning, on-line data collection and storage, and local Microlog data collection.

Switch Module Operation

The front panel switch module operates using three switches and two BNC connectors. The switches are labeled:

MODE SELECTOR
CHANNEL 1-32 SELECTOR
TACHOMETER SELECTOR

MODE SELECTOR

Sets the 320-SW LMU in either the **LMU On-line** mode or the local data collection mode.

- **LMU On-Line** - Sets the LMU for continuous scanning, on-line machinery monitoring.

  The **local** data collection mode has two switch positions;

  CH 1-16 / TACH 1-8 - for local monitoring of one of the LMU's dynamic channels (channels 1 through 16) and of one of the LMU's 8 available tachometer inputs.

  CH 17-32 / TACH 1-8 - for local monitoring of one of the LMU's dynamic channels (channels 17 through 32) and of one of the LMU's 8 available tachometer inputs.

  - When the 320-SW LMU is performing in the On-Line mode and is switched to one of the two local (off-line) switch settings, the host computer and Machine Analyst On-Line software display an **LMU # In Local Mode** message in the event log (the # sign is replaced with the LMU address number).
  - When the 320-SW LMU's MODE SELECTOR switch is switched back to the LMU ON-LINE position, an **LMU # In On-Line Mode** message appears in the event log.

CHANNEL 1-32 SELECTOR

Used in conjunction with the MODE SELECTOR switch, the CHANNEL SELECTOR switch selects which LMU channel is monitored by the connected Microlog Data Collector.

- If the MODE SELECTOR switch is set for channels 1 - 16, use the CHANNEL SELECTOR switch's inner ring of channel numbers (1-16) to select which channel is monitored.
- If the MODE SELECTOR switch is set for channels 17 - 32, use the CHANNEL SELECTOR switch's outer ring of channel numbers (17-32) to select the channel.
    - For local data collection, the Microlog uses a special BNC connector cable (SKF part no. CMSS50079).
    - Local collection of *SEE* signals requires a different BNC connector cable. Contact your SKF representative for ordering information.

TACHOMETER SELECTOR

When the MODE SELECTOR switch is set for CH 1-16, **TACH 1-8** or CH 17-32, **TACH 1-8** the TACHOMETER SELECTOR switch selects which of the eight possible LMU tach inputs is monitored by the connected Microlog Data Collector.

- For local tach signal collection, the Microlog uses the above mentioned CMSS50079 cable along with a CMSS6135D Adapter and CMSS50189 cable.

A fuse is installed on the switch module to protect the user from potential high voltage conditions. If the switch module fails due to a blown fuse, do not attempt to repair the unit. A hazardous voltage situation may exist. Contact your local SKF service representative for assistance.

BNC Connector Operation

The switch module provides two BNC connectors for collecting channel and tachometer data. The BNC connectors are labeled:

- **CHANNEL 1-32 OUTPUT**, and
- **TACHOMETER OUTPUT**

Each BNC connector corresponds to the switch directly above it.

The **TACHOMETER OUTPUT** BNC outputs the LMU tachometer signal selected with the **TACHOMETER SELECTOR** switch.

The **CHANNEL 1-32 OUTPUT** BNC outputs the LMU channel signal selected with the **CHANNEL 1-32 SELECTOR** and **MODE SELECTOR** switches.

In local data collection mode, the selected channel and tach data are output simultaneously.

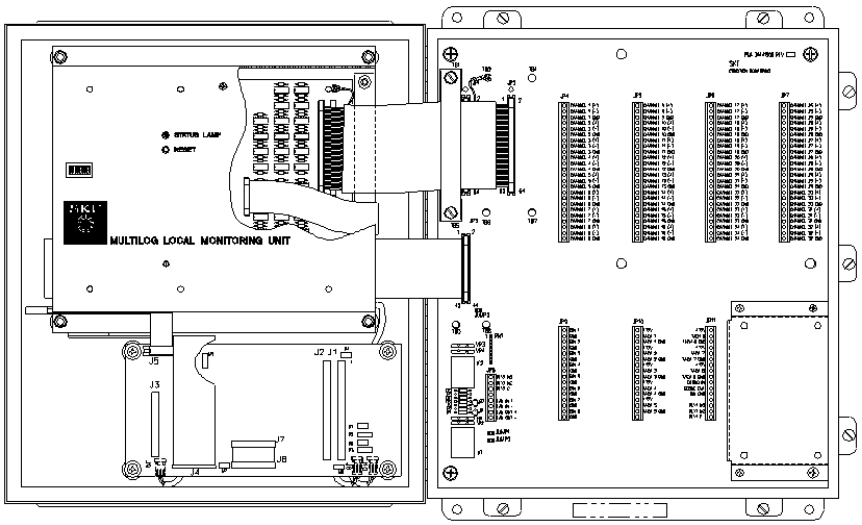


Figure B - 3.
320-SW LMU (Inside View).
Note the Presence of both the Switch Module
and the Electronics Module.

4.4 mA Power Option

The front panel switch module has an added feature in that it can provide 4.4 mA power to the *selected channel's* sensor. This 4.4 mA power feature is enabled by jumping jumper M7 on the 320-SW LMU's switch module's circuit board.

4.4 mA power enabled - M7 jumped
4.4 mA power disabled - M7 not jumped

- When 4.4 mA power is enabled, it is not necessary to supply power to the sensor from the portable data collector. Conversely, when 4.4 mA power is disabled, it is necessary to supply power to

the sensor from the portable data collector or some other external power supply.

320-SW Switch Panel Wiring

- Switch module to LMU wiring configurations are different for the 320-HO and 320-SW LMU versions.

320-SW - 32 Channel, Tach, and 4.4 mA Power Wiring

For the **320-SW** LMU version, channel signals, tach signals, and 4.4 mA power are cabled to LMU's electronics module. Channel and tachometer signal selections are decoded in the electronics module. The appropriate channel is then selected and routed to the switch module for local data collection.

320-PS (Simultaneous Power) Option

The 320-PS simultaneous power option provides 2.2 mA power simultaneously to up to sixteen sensors connected to the LMU's motherboard. The 320-PS module may be used with any of the three LMU configurations.

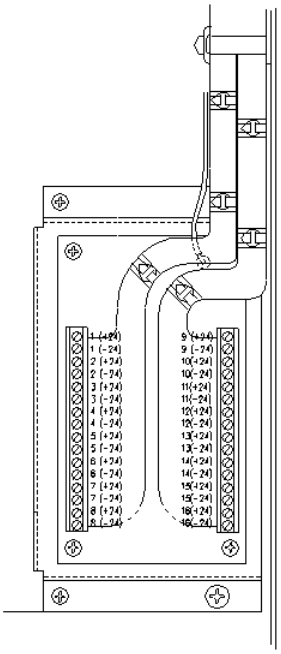


Figure B - 4.
The 320-PS Module Installed on the LMU's Power Supply.

The 320-PS module is required when using CMSS793T and CMSS797T accelerometer / temperature sensors with your LMU. These sensors monitor both temperature and acceleration and require that power be supplied simultaneously to the accelerometer and temperature parts of the sensor to enable temperature measurements.

320-PS Installation

The 320-PS module may be used with any of the three LMU configurations (320, 320-HO, 320-SW).

The 320-PS module attaches to the LMU's power supply cover. The module consists of:

- 320-PS printed circuit board
- connecting washers and screws

The 320-PS module is attached to the LMU's power supply cover and connected to up to sixteen user selected channels on the LMU's terminal strip connectors using instrument grade, shielded, twisted pair wire.

Installation instructions are included with the 320-PS module.

Summary

The optional LMU front panel versions, the:

- 320-HO, and
- 320-SW

allow you to locally collect data from your LMU with a Microlog Portable Data Collector or other data collector / signal analyzer.

The **320-HO** LMU version is the simplest LMU version. It allows local data collection only.

The **320-SW** LMU version is the most versatile LMU version. It provides continuous scanning, on-line monitoring and local data collection features.

Also available is a Simultaneous Power module option.

- 320-PS

This module may be used with any of the three LMU configurations to simultaneously provide 2.2 mA power to up to sixteen sensors connected to the LMU's motherboard.

	ALLOWABLE UPGRADES	
Original Configuration	CMMA320-PS	CMMA320-SW
CMMA320	Yes	No
CMMA320-HO	Yes	Yes
CMMA320-SW	Yes	N/A

Appendix C

Protection System Wiring Diagrams

- This Appendix details wiring diagrams for MIM connection to various protection systems. This appendix applies to MIMs only.

Described Protection Systems are:

SKF's

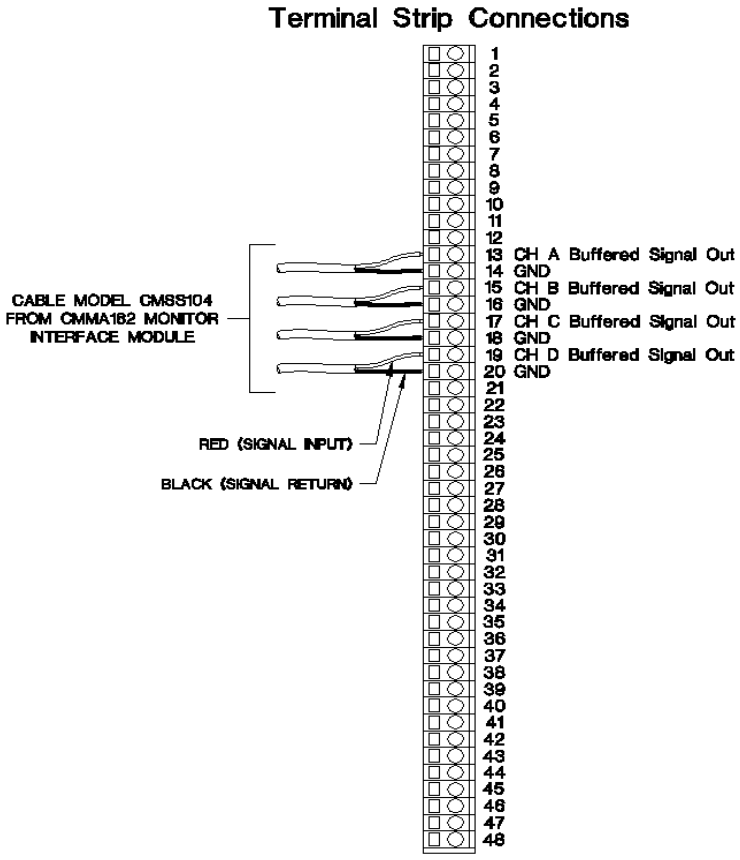
CMMA824 Displacement Monitoring Module
CMMA826 Vibration Monitoring Module
CMMA833 Thrust / Position Monitoring Module
CMMA864-DSP Monitoring Module
CMMA871 Temperature Monitoring Module
CMMA881 Speed Monitoring Module

Bentley Nevada 3300's

Dual Vibration Monitor
Dual Thrust Position Monitor
Dual Accelerometer Input Monitor
Dual Differential Expansion Monitor
Ramp Differential Expansion Monitor
Complementary Input Differential Expansion Monitor
Case Expansion Monitor
Six-Channel Temperature Monitor
Eccentricity Monitor
Tachometer
Dual Velocity Input Monitor
Vector Monitor
Dual Probe Monitor
Dual Valve Position Indicator

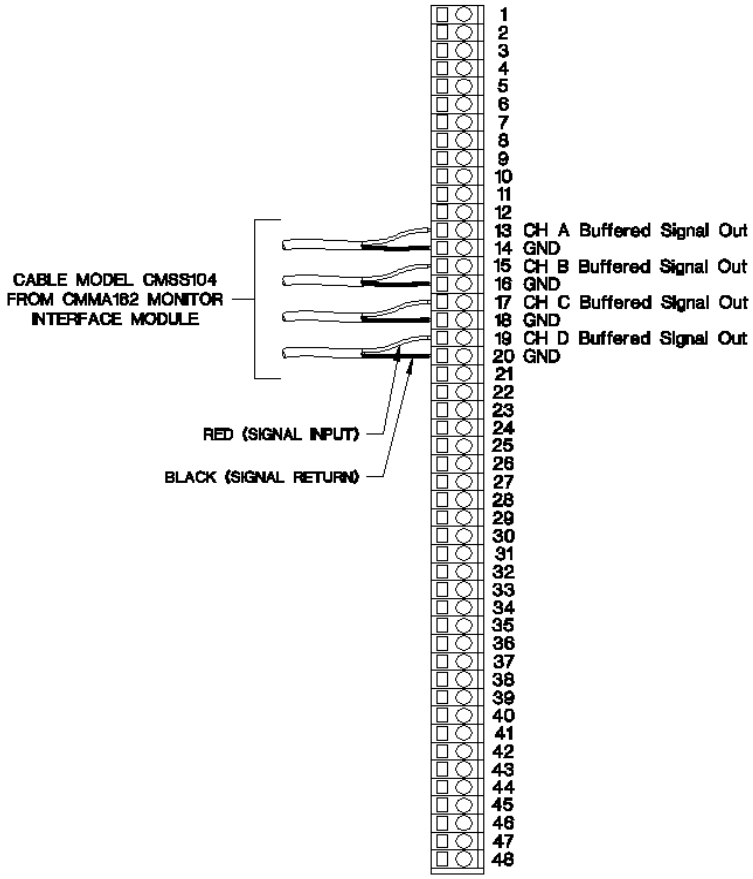
SKF M800A

CMMA824 Displacement Monitoring Module

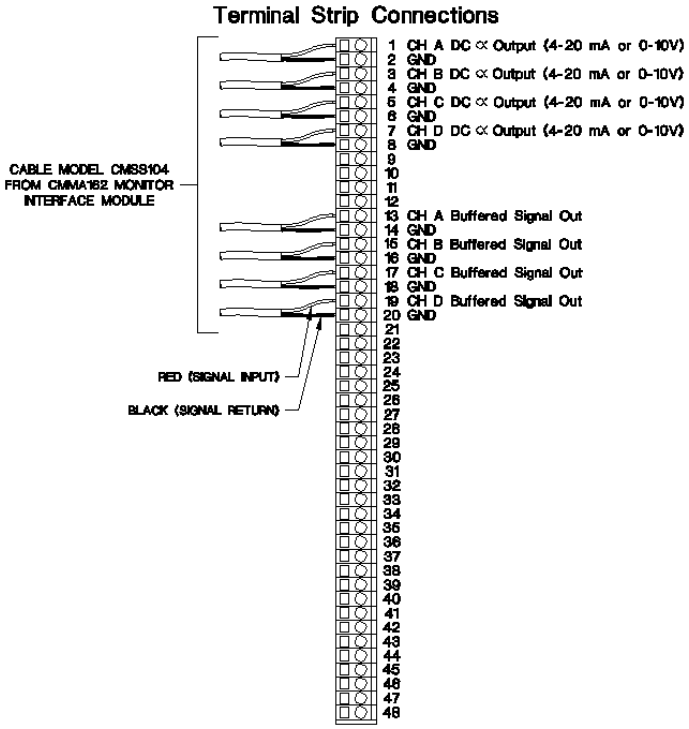


CMMA826 Vibration Monitoring Module

Terminal Strip Connections

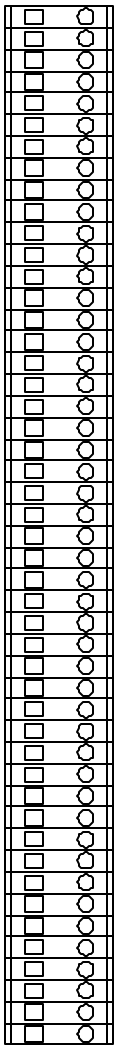


CMMA833 Thrust / Position Monitoring Module



CMMA864-DSP Monitoring Module

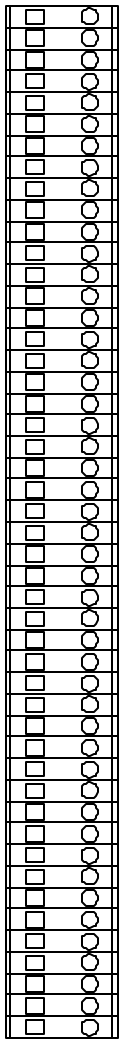
A.L. I / O



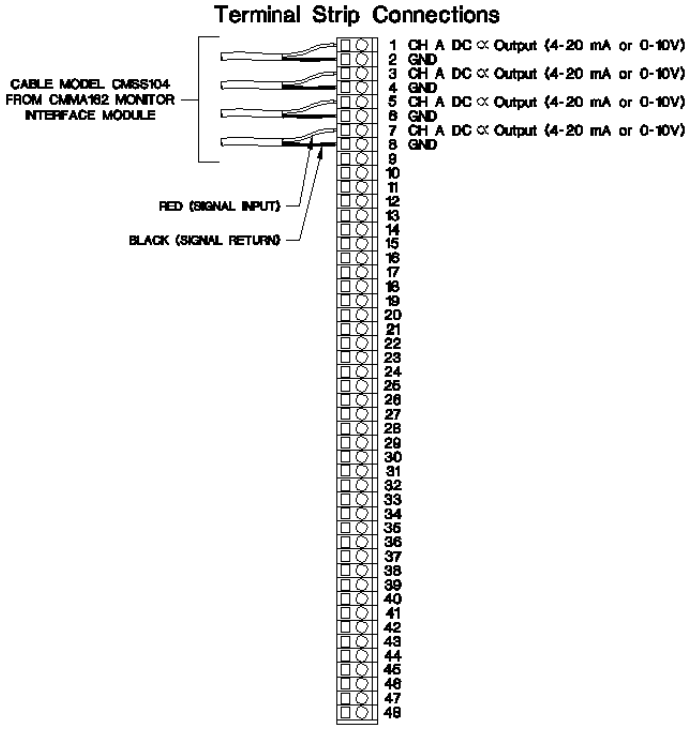
1	CH A DC Output (4 - 20mA or 0 - 10V)
2	Ch A DC Output GND
3	Ch A Buffered signal out #1
4	Ch A Buffered signal GND
5	CH A Buffered signal out #2
6	Ch A Transducer 1 PWR
7	Ch A Positive signal #1 input
8	Ch A Negative signal #1 (GND)
9	Ch A Positive signal #2 input
10	Ch A Negative signal #2 (GND)
11	Ch A GND
12	Ch A Transducer 2 PWR
13	CH B DC Output (4 - 20mA or 0 - 10V)
14	Ch B DC Output GND
15	Ch B Buffered signal out #1
16	Ch B Buffered signal GND
17	CH B Buffered signal out #2
18	Ch B Transducer 1 PWR
19	Ch B Positive signal #1 input
20	Ch B Negative signal #1 (GND)
21	Ch B Positive signal #2 input
22	Ch B Negative signal #2 (GND)
23	Ch B GND
24	Ch B Transducer 2 PWR
25	CH C DC Output (4 - 20mA or 0 - 10V)
26	Ch C DC Output GND
27	Ch C Buffered signal out #1
28	Ch C Buffered signal GND
29	CH C Buffered signal out #2
30	Ch C Transducer 1 PWR
31	Ch C Positive signal #1 input
32	Ch C Negative signal #1 (GND)
33	Ch C Positive signal #2 input
34	Ch C Negative signal #2 (GND)
35	Ch C GND
36	Ch C Transducer 2 PWR
37	CH D DC Output (4 - 20mA or 0 - 10V)
38	Ch D DC Output GND
39	Ch D Buffered signal out #1
40	Ch D Buffered signal GND
41	CH D Buffered signal out #2
42	Ch D Transducer 1 PWR
43	Ch D Positive signal #1 input
44	Ch D Negative signal #1 (GND)
45	Ch D Positive signal #2 input
46	Ch D Negative signal #2 (GND)
47	Ch D GND
48	Ch D Transducer 2 PWR

CMMA864-DSP Monitoring Module

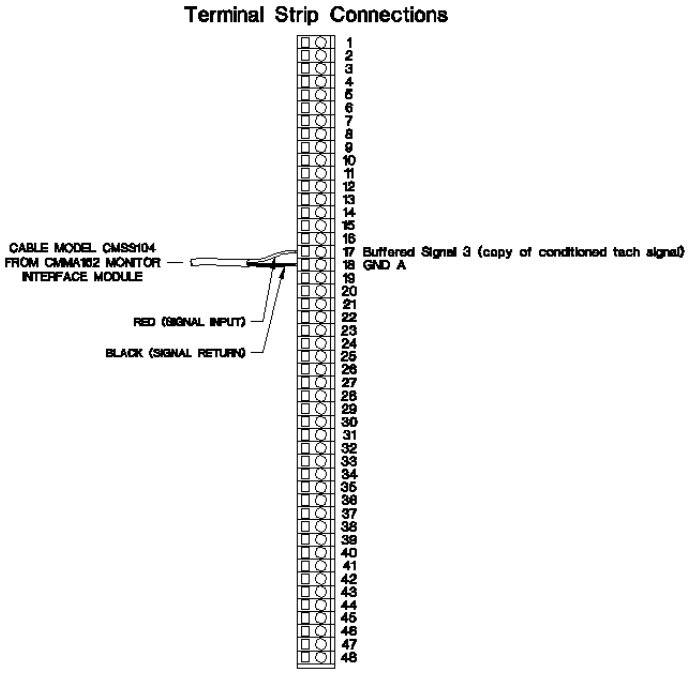
B.C. I / O



CMMA871 Temperature Monitoring Module

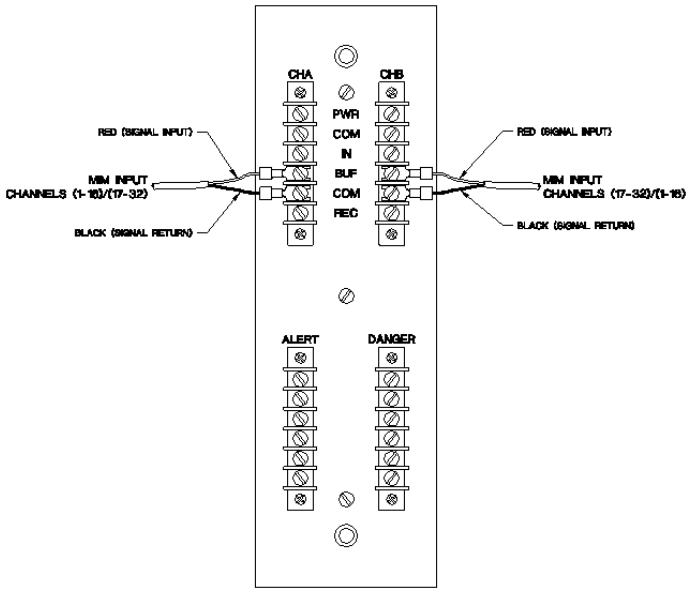


CMMA881 Speed Monitoring Module

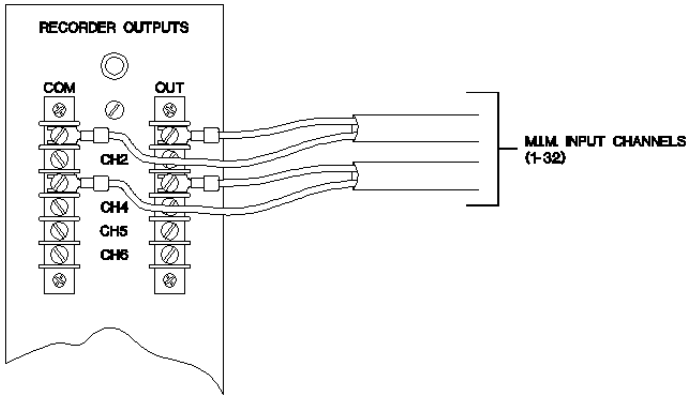


Bentley Nevada 3300

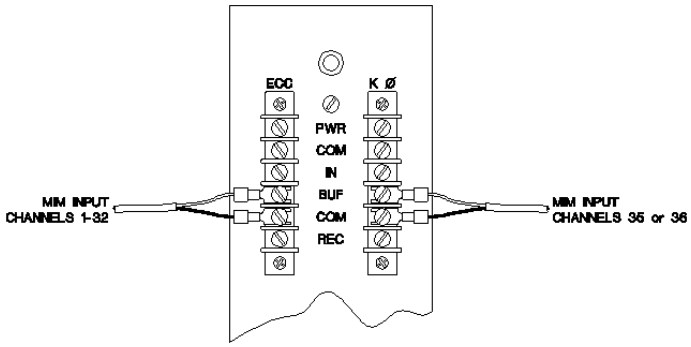
Dual Vibration Monitor
Dual Thrust Position Monitor
Dual Accelerometer Input Monitor
Dual Differential Expansion Monitor
Ramp Differential Expansion Monitor
Complementary Input Differential Expansion Monitor
Case Expansion Monitor



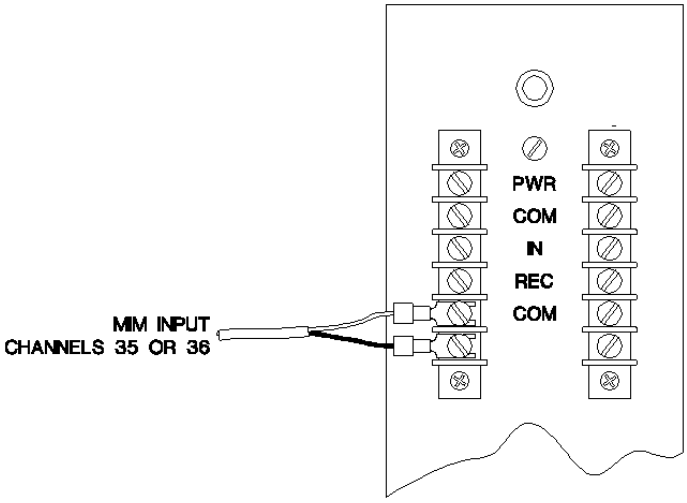
Six-Channel Temperature Monitor



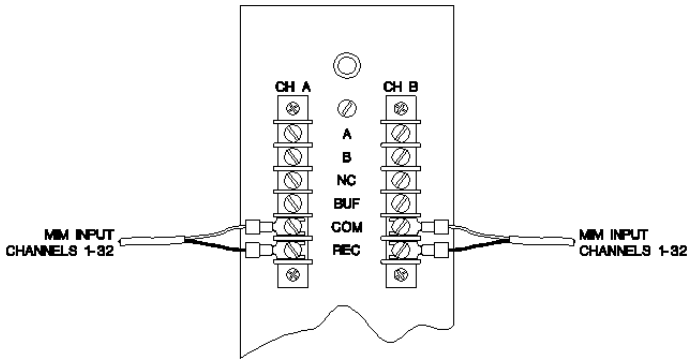
Eccentricity Monitor



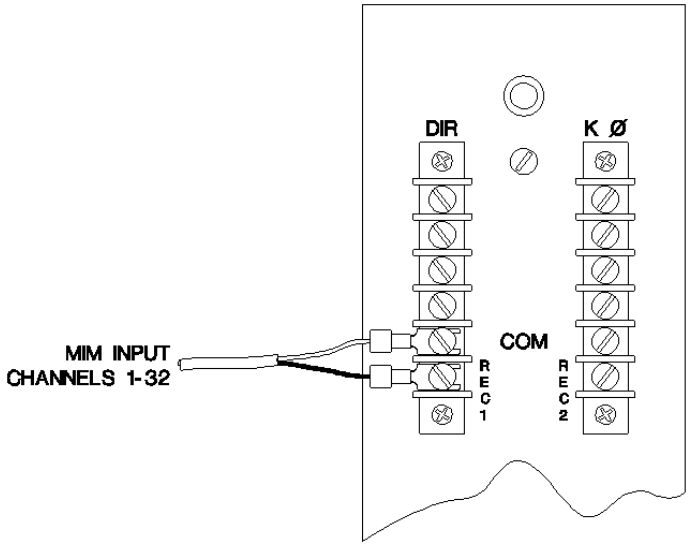
Tachometer



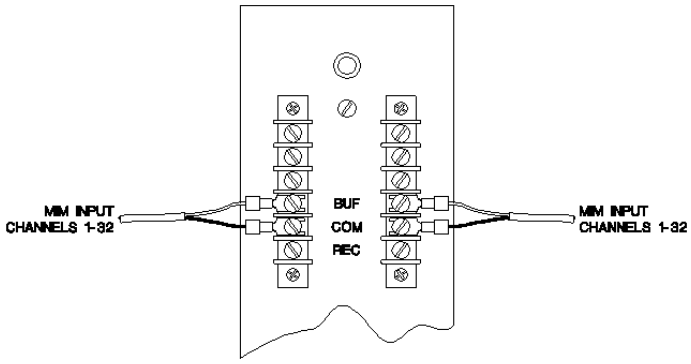
Dual Velocity Input Monitor



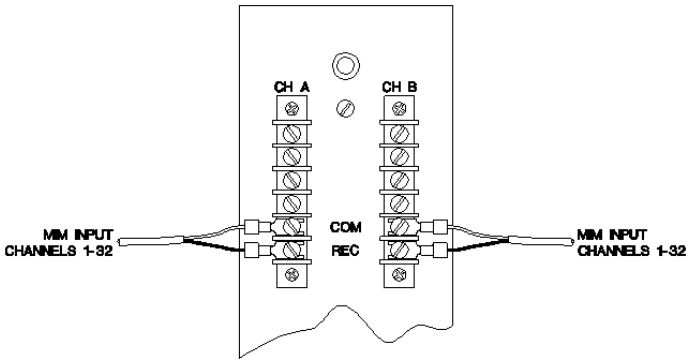
Vector Monitor



Dual Probe Monitor



Dual Valve Position Indicator



Appendix D
Tachometer Signal Conditioning

➢ This appendix applies to MIMs only.

Overview

The Monitor Interface Module (CMMA162) provides signal conditioning for tachometer input signals. This tachometer signal conditioning allows the MIM to trigger effectively on a variety of input signals. Each tachometer channel has signal conditioning with several adjustable parameters. **These parameters are preset at the factory and do not require further adjustment for most applications.**

Only the following applications require parameter adjustment:

- Slow speed applications. Machines running at speeds below 5Hz (one pulse per revolution). Slow speed applications may require a manual trigger adjustment.
- Applications with electrical noise or a non-trigger vibration signal greater than 2.0 Volts peak to peak on the tachometer input. This type of application may require a hysteresis adjustment (see page two).
- Applications with a tachometer signal smaller than 3.0 Volts peak to peak. This type of application may require a hysteresis adjustment.

Tachometer Signal Conditioning Adjustments

The following tools are required to make adjustments to the tachometer signal conditioning circuit:

- Medium size Phillips head screwdriver.
- Small flat head screwdriver or standard potentiometer tweaker.
- Digital Multimeter capable of measuring resistances up to 200k ohm and voltages from -5 Vdc to +5 Vdc.
    - **Important** - Remove power from the CMMA162 and disconnect the tachometer inputs before opening the unit!

To access the tachometer signal conditioning PC board:

- Remove the CMMA162 side panel directly opposite the side panel with the LAN address label affixed. Remove the six Phillips head screws that hold the panel in place, then remove the panel.

The tachometer signal conditioning PC board is the MIM's bottom-most PC board. Test points TP1-TP7 are located along the edge of the tachometer signal conditioning PC board.

Hysteresis Adjustment

Each tachometer channel has adjustable hysteresis from 400mV to 4.0 Volts. Hysteresis is the difference in input voltage required to trigger for a increasingly positive signal, as opposed to a increasingly negative signal. Increasing the hysteresis increases the MIM's ability to reject noise on the tachometer input. The tachometer signal must always be greater than the hysteresis in order to correctly trigger on the tachometer signal. The hysteresis level is factory preset to 2.4 Volts. The amount of hysteresis may be increased if additional noise rejection is required. The amount of

hysteresis may be decreased if the tachometer signal level is lower than 3 Volts peak to peak and fails to cause the MIM to trigger.

An ohm meter is required to properly set the resistance that controls the hysteresis level. To adjust the hysteresis for tachometer channel one, connect the two ohm meter leads to tests points on the tachometer signal conditioning PC board. The resistance value is preset to 60k ohms. This resistance value corresponds to 2.4 Volts of hysteresis. The relationship between the resistance value measured at the test points and the amount of hysteresis voltage is governed by the following equation:

$$V_{hysteresis} = \frac{R_{hysteresis}}{25}$$

The formula results in the following standard settings.

$V_{hysteresis}$ (volts)	$R_{hysteresis}$ (K ohms)
4.0	100
3.0	75
2.0	50
1.0	25
0.4	10

For **Tachometer Channel 1**, $R_{hysteresis}$ is measured between test points TP3 and TP4. Connect a jumper wire from TP3 to TP1. This jumper isolates the potentiometer R24 from the rest of the circuit, allowing an accurate resistance reading to be taken. $R_{hysteresis}$ is adjusted by the single turn potentiometer R24 for tachometer channel 1. Turning R24 clockwise decreases the resistance down to 10K ohms. Turning R24 counter-clockwise increases the resistance up to 110K ohms.

For **Tachometer Channel 2**, $R_{hysteresis}$ is measured between TP6 and TP7. Connect a jumper wire from TP6 to TP1. This jumper isolates the potentiometer R22 from the rest of the circuit, allowing an accurate resistance reading to be taken. $R_{hysteresis}$ is adjusted by the single turn potentiometer R22 for tachometer channel 1. Turning R22 clockwise decreases the resistance down to 10K ohms. Turning R22 counter-clockwise increases the resistance up to 110K ohms.

Manual Trigger Level Adjustment

The Trigger level is the voltage at which the trigger circuit triggers. An auto threshold circuit and a manual threshold circuit are available on the tachometer signal conditioning PCB. The auto threshold circuit is jumper selected at the factory. The auto threshold circuit works correctly for most applications. For slow speed applications (slower than 5Hz), the manual threshold circuit should be used. The manual threshold circuit is jumper selectable (the jumper is located on the Tachometer Signal Conditioning PC board).

To select the manual threshold circuit for tachometer channel 1:

- Move jumper JP1 to position 2-3.

To select the manual threshold circuit for tachometer channel 2:

- Move jumper JP2 to position 2-3.

To adjust the manual threshold level for tachometer channel 1:

- Connect a digital voltmeter to TP1 (ground) and TP2 (threshold level).
- Using the potentiometer R23, adjust the threshold to be more positive (counter-clockwise) or more negative (clockwise).

The voltage swing is from +5 Volts to -5 Volts. This voltage swing corresponds to an input voltage swing of +12.5 Volts to -12.5 Volts. The following equation defines the relationship between the adjustable reference voltage and the input voltage trigger threshold.

$$V_{\text{Manual Threshold Adjustment}} = V_{\text{Input Trigger Threshold}} / 2.5$$

For example:

If the desired input trigger threshold is -5.0 volts, adjust the manual threshold adjustment to -2.0 Volts dc.

User Notes

Appendix E
SKF Connection Service

Overview

The SKF Connection Service passes messages between SKF Machine Analyst and SKF Machine Monitor. It is an .exe file that typically runs during installation. This feature allows users to set up multiple computers with Machine Analyst for Online Systems and have them communicate with each other.

Command Line Parameters

You can use command line parameters to further customize Machine Analyst for On-Line Systems. Command line parameters are entries you type in when configuring the connection service. Enter the following characters after the path (in the Run dialog or in the shortcut Properties' Target field) to enable the desired feature.

- For more information on creating shortcuts, refer to your Microsoft Windows User's Guide.

The complete list of command line parameters for the connection service is as follows:

/Help	Displays this list of command line parameters
/Service	Register the service as local
/Service /Remote <*server_name*>	Register the service as remote to <*server_name*>
/Unregserver	Unregister the service
/NoOutput	Do not show information type messages (silent output)
/Debug	Enable operating system Event Log ouput.

Configuration

Single User Configuration

When Machine Analyst and Monitor are being run on the same computer, a single user configuration is necessary. In the SKF Machine Analyst directory, run **connectionService.exe / service** from the command line.

Multi User Configuration

When Machine Analyst and Monitor are being run on different computers a multi user configuration is necessary.

In a local network configuration, dedicate a machine as the server to host the Connection Service. This should be a "critical" system that will always be running while Machine Analyst is running. The system running the Oracle database is a good candidate.

To set up the server:

1. From the command line, go to the SKF Machine Analyst directory (default C:\Program Files\SKF-CM\SKF Machine Analyst).

2. From the command line, run **connectionservice.exe / service**.

3. For WinNT users:

From the Windows Start menu, open **Settings** / **Control Panel** / **Services**, then start the service called "**SKF Connection Service**".

or

For Win2000 users:

From the Windows Start menu, open **Settings** / **Control Panel** / **Administrative Tools** / **Services**, then start the service called **SKF Connection Service**.

To set up the client:

From the command line, run **connectionservice.exe / service / remote** *<server machine name>*.

Example: ConnectionService.exe /service /remote SERVER_01

Peer-to-Peer Network Configuration

When the LMU system must run on a network without an established domain (peer-to-peer relationship) additional considerations must be made to allow client communication through the connection service. In this situation where the machines are running "stand-alone", each system has completely different security principals (analogous to each system being its own domain).

To allow DCOM communication in this case, the Windows operating system relies on its fallback mode which is the "matching account names and passwords" mode. This requires that you create matching username and password

pairs on the client (systems running Machine Analyst or Monitor) and server computer (the one running the connection service). Any computer that is a client to the connection service host computer must have established a local user account that corresponds to the username / password of the logged-in user of the connection service host computer. In addition, the connection service host computer must have local user accounts that mirror all connecting users and each connecting client computer must have a local user account that mirrors the logged-in user of the host computer running the service.

The steps required to perform the above peer-to-peer network setup requirements are as follows:

To set up the server:

On the host computer, create user account(s) that reflect all connecting computer(s).

- Creating user accounts requires administrative rights on the host computer.

For WinNT users:

1. From the Start menu, select **Programs** / **Administrative Tools** / **User Manager**
2. From the dialog's menu, select **User** / **New User**.
3. Enter the username (case-sensitive) of the client account that will be connecting to the connection service from a client computer. Enter this user's password exactly as it is (case-sensitive) on the client system and then confirm the password.
4. For the description, enter "SKF Connection Service connecting client account"
5. Select the **Password Never Expires** checkbox and deselect all others.
6. Click the **Groups** button to open the **Group Memberships** dialog. Select **User** from the **Member**

Of list and click **Remove**. Select **Guest** from the **Not Member Of** list and click **Add**. Click **OK** to close the dialog. Click **OK** to close the **New User** dialog.

7. For each client that connects to the service running on the host computer, repeat steps two through six.

For Win2000 users:

1. From the Start menu, select **Settings** / **Control Panel** / **Administrative Tools** / **Computer Management**.
2. Under **Local Users and Groups** tree item, right click **Users** and select **New User**.
3. Enter the username (case-sensitive) of the client account that will be connecting to the connection service from a client computer. Enter this user's password exactly as it is (case-sensitive) on the client system and then confirm the password.
4. For the description, enter "SKF Connection Service connecting client account".
5. Deselect the **User must change password at next logon** checkbox. Select the **Password Never Expires** checkbox and deselect all others. Press the **Create** button, then press the **Close** button.
6. Right click the newly created user in the right hand pane, select **Properties** and go to the **Members Of** tab. Highlight the **Users** and press **Remove**. Click **Add** to open the **Select Groups** dialog. Select **Guests**, click **Add**, then click **OK** to close the dialog. Click **OK** to close the **Properties** dialog.
7. For each client that will connect to the service running on the host computer, repeat steps two through six.

Client Setup:

For each client computer (running Machine Analyst or Monitor) that is to connect to the connection service running on the host computer, create single user accounts that reflect the account logged in to the host computer.

- Creating user accounts requires administrative rights on the client computers.

For WinNT users:

- From the Start menu, select **Programs** / **Administrative Tools** / **User Manager**
- From the dialog's menu, select **User** / **New User**.
- Enter the username (case-sensitive) of the account that will be logged into the host computer. Enter this user's password exactly as it is (case-sensitive) on the host system and then confirm the password.
- For the description, enter "SKF Connection Service host computer account"
- Select the **Password Never Expires** checkbox and deselect all others.
- Click the **Groups** button to open the **Group Memberships** dialog. Select **User** from the **Member Of** list and click **Remove**. Select **Guest** from the **Not Member Of** list and click **Add**. Click **OK** to close the dialog. Click **OK** to close the **New User** dialog.

For Win2000 users:

- From the Start menu, select **Settings** / **Control Panel** / **Administrative Tools** / **Computer Management**.
- Under **Local Users and Groups** tree item, right click **Users** and select **New User**.
- Enter the username (case-sensitive) of the account that will be logged into the host computer. Enter this user's password exactly as it is (case-sensitive) on the host system and then confirm the password.
- For the description, enter "SKF Connection Service host computer account"

- Deselect the **User must change password at next logon** checkbox. Select the **Password Never Expires** checkbox and deselect all others. Press the **Create** button, then press the **Close** button.
- Right click the newly created user in the right hand pane, select **Properties** and go to the **Members Of** tab. Highlight the **Users** and press **Remove**. Click **Add** to open the **Select Groups** dialog. Select **Guests**, click **Add**, then click **OK** to close the dialog. Click **OK** to close the **Properties** dialog.

Troubleshooting

Problem	Cause	Solution
The attempt to initiate a Connection Service interface failed with "Class not registered" error.	**ConnectionService.exe** was not registered as a service either in client or server, or both.	Register **ConnectionService.exe** as a service in both client and server.
The attempt to initiate a Connection Service interface failed with "The RPC server is unavailable" error.	The server or the network was down, or the client registered its Connection Service to a non-existent remote server name.	Ensure the server and the network are working, and the **ConnectionService.exe** in the client is registered to the correct server name.

The attempt to initiate a Connection Service interface failed with “Access denied” error.	The connection service on the server was not started, and the client did not have sufficient permission to launch the service. Establish whether or not the clients to the connection service are all connected within a common domain or that the network relationship is peer-to-peer.	Start the connection service on the server and consider the information contained in “Running The Connection Service on Peer-to-Peer Networks.”
The attempt to invoke a Connection Service interface failed with “The RPC server is unavailable” error.	The server or the network was down.	Ensure the server and the network are working.

Problem	Cause	Solution
Connection Service interfaces were initiated and invoked without error, but Machine Analyst did not show any connection to a Monitor running in a different machine.	Either the server or any of the clients did not register the **ConnectionService.exe** as a service. If the **ConnectionService.exe** was not registered in the server properly, the server would produce multiple Connection Service processes; each for different user accounts. If the client did not register it properly, the client would have its own Connection Service process, instead of using the one in the server.	Re-register the **ConnectionService.exe** as a service.

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