EVA-625/MMC-1
&
EVA Vibration Analysis Tools Version 8 for Windows™

Operational Overview
The EVA-625 and EVA Elevator Vibration Analysis software is a combined hardware & software approach to recording and analyzing elevator & escalator vibration. The system is very powerful but is easy to use with just a little understanding of the EVA system vocabulary. There are two main areas that will be discussed, EVA-625 control and operations, and Analysis of EVA-625 data on your computer.

The main steps for making an elevator recording using the EVA are simple, but very important. These include:

1. Configure the EVA-625 system for recording elevator vibration and sound. The basic configuration is to set the EVA-625 record length (this is how long the EVA should record after you tell it to start recording, which depends on the length of the elevator ride) and the trigger mode (the trigger mode is how the EVA knows to start recording, pressing the start switch or self-trigger), and enter the ID#.

2. Place the EVA-625 on the floor of the elevator. Turn the system ON and check the battery voltage and the amount of available memory that you have remaining (this is in percentage of available memory). Remove the microphone from its strap. Return to Main Menu and Select **Measure Ride** and press **ENT**. Select **Elevator**, Select **Ride**, enter the elevator **ID number** (identification number) and press **ENT**. Press the start switch on the outside of the case (near handle). Press ENT one more time to get to Waiting for Trigger. and select the floor on the elevator. By standard (ISO18738) measurements are made from terminus to terminus. When the ride is finished, either wait for the EVA-625 to stop recording (depends on set record time) or press the start switch to stop the recording manually. (**Begin recording just prior to, or as the doors begin to close, record the entire trip, and finish recording after the doors have fully opened.**) Return to the Main Menu and turn off the unit or record another ride.

3a. Serial Communications: Connect the EVA-625 to your computer using the supplied EVA to PC serial cable. Start the EVA software and turn on the EVA-625. Enter any report information that you wish to have stored with each recording. Select **EVA Control,** then select **Retrieve EVA Data**. Enter the desired **Report Data**, and select the directory (**Data Path**) where you wish the data stored. Select the event or all events that you wish transferred.

b. USB Flash Memory: With the USB Flash Drive Upgrade, each event is stored onto a plug-in, USB Flash drive that is inserted into the USB port mounted on the keyboard of the EVA-625. Transfer is then accomplished by moving the drive to the computer being used for analysis and importing the data to the hard drive using the **EVA-625/MMC-1 Vibration Analysis Tools Software**.

4. After the data has been stored, your are now able to **Select** a **Record** (an EVA-625 recording) and view that recording on the display by selecting **Vibration Analysis Tools** under **Analysis**. When you wish to print a complete report, select **EVA Print** under **File operations**.

Suggestion: Obtain a copy of ISO18738: Measurement of Lift Ride Quality. This explains the methodology, analysis, and reporting requirements for the standardized measure of Lift Ride Quality.

PC Hardware Requirements

Requirements Include:

- Hard Disk with 10 Mb Free
- Pentium or Higher
- Microsoft Windows 95 or Higher
- VGA or higher resolution screen supported by Microsoft Windows
- CD Rom
- Serial Port (or USB with USB to Serial Converter)
- USB Port for USB Flash Memory Version

Installation

Insert CD containing EVA Vibration Analysis Tools software.
From the Start Menu: Select Run , Browse to the CD Drive, and select Setup.exe

This will install all support files in the appropriate places on your hard disk, and create the Program Files\PMT\EVA800 application directory, and Program Files\PMT\EVA875\DAT subdirectory, and install a sample data file (as used in the manual). Occasionally it will be necessary to exit from other running applications. **If the Microsoft Office toolbar is used, it is necessary to click on the toolbar and then stop running the application.**

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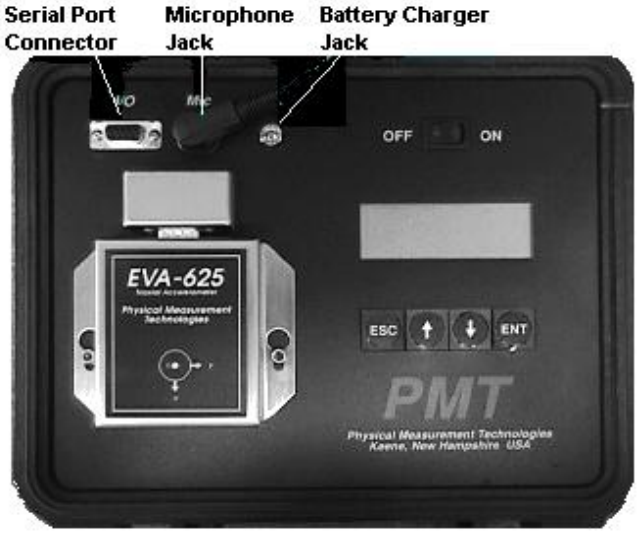
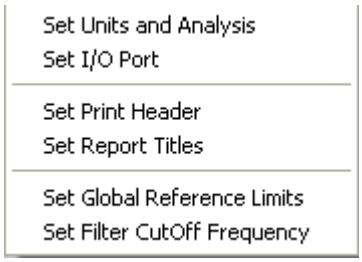
EVA-625 Controls & Components



Settings: EVA Software

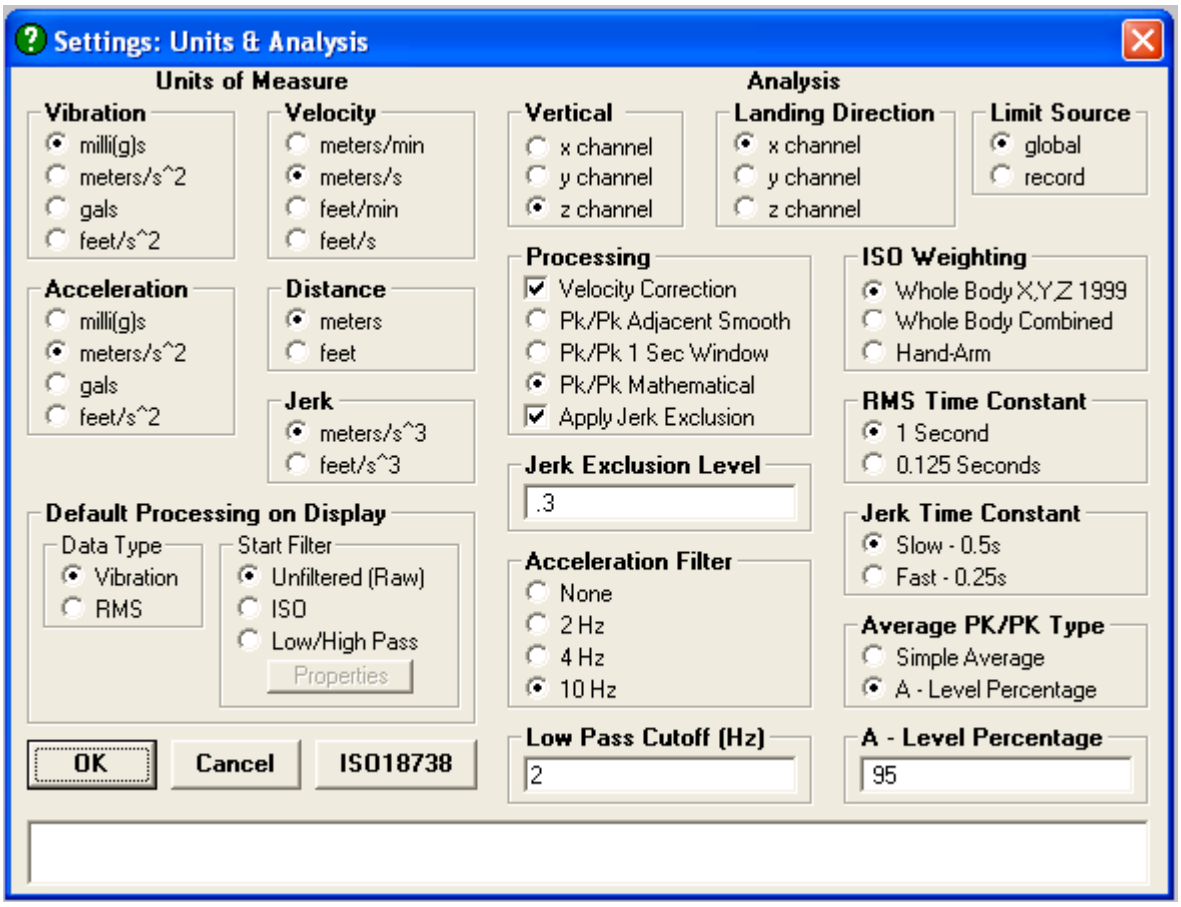
Custom Software Settings



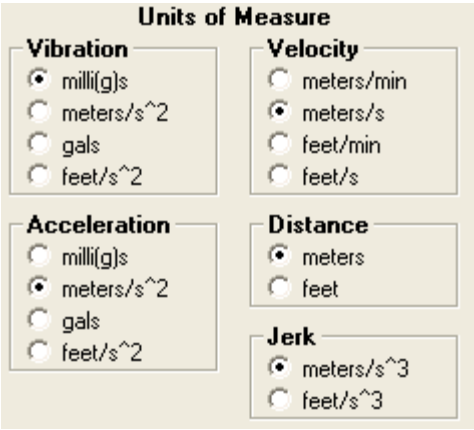
To properly use the EVA software and provide for customized reports, the software **must** be configured. All configuration selections can be changed at any time. The Settings Choices are:

Set Units & Analysis

Two general groups of controls are displayed, Units of Measure and Analysis.

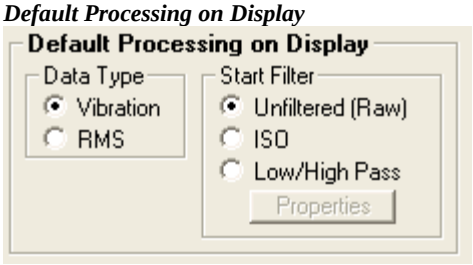


Units of Measure



The Units of Measure group allows selection of the appropriate units for the area in which you are working. Specifically, units can be selected for vibration, acceleration, velocity, distance, and jerk. The choices depend on what is customary to use in your country, and any specifications against which you may compare. Please keep in mind that SI units are the international standard but can be directly converted to other systems. SI units for acceleration are meters/s^2, meters/s for velocity, meters for distance, and meters/s^3 for jerk. Appendix A provides the conversions for the various units which are used. The choices are listed as follows:

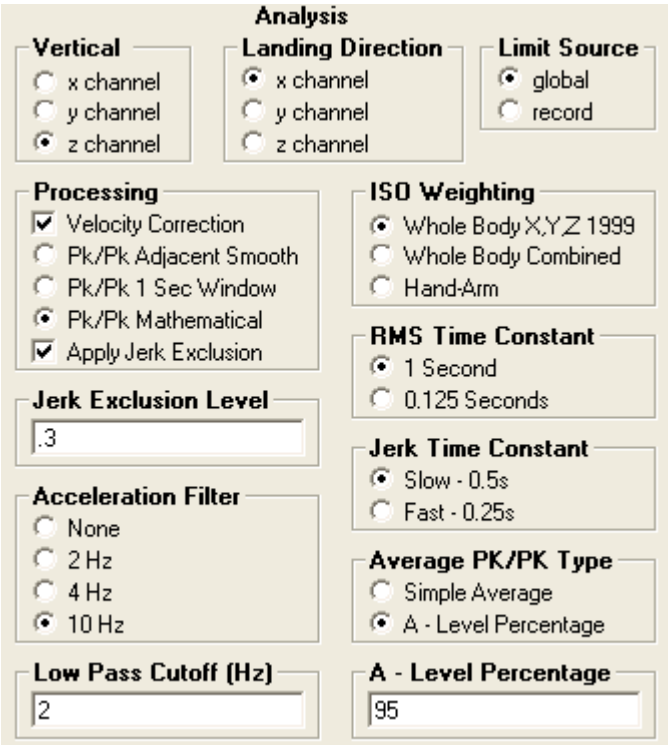
Default Processing on Display



This grouping is used to select how the data should be processed and displayed on startup (start of graphical display). It allows the operator to look only at the information of interest without viewing the raw vibration data.

Analysis

This grouping allows selection of the **Vertical** channel, **Landing Direction**, and **Processing** techniques that are applied to the acceleration data.



Vertical

This grouping is used to establish which channel was the vertical channel. The z channel is the vertical channel if the EVA-625 was operated in its normal orientation, feet to floor. The software analyzes the vertical channel for elevator speed, distance, and jerk using this selection.

Landing Channel

The Landing channel selection is used in escalator measurements for 2 dimensional acceleration and jerk measurements. With the EVA placed on the step (z channel vertical) and case handle pointing toward the lower landing, then the x channel would be the proper selection.

Limit Source

This selection offers the user the option of using the limits that have been set under global limits or limits that have been stored with the actual recording. It is most relevant when printing several different records at the same time that each of which may have different allowable vibration and performance limits.

Processing

This grouping provides toggle switches (on/off) and check boxes for control of the analysis. A √ in the switch box indicates that it is turned on. Tab to the selection and press the space bar to make a change. The switches are:

Velocity Correction - With this switched on, the software internally compensates for effects of hysterisis, etc.. It **may be** necessary to switch this off if more than one elevator start and stop sequence is stored in one recording. It **is** necessary to switch this off if only the starting section (or stopping section) of an elevator ride has been recorded (i.e. a full start, full speed, and stop sequence, was not recorded).

Pk/Pk Adjacent (Smooth) / Pk/Pk 1 Sec Window / Pk/Pk Mathematical - This option offers the user the chance to specify the method that is used to calculate peak to peak vibration levels are calculated. The adjacent peak to peak (smooth) method employs a low pass filter to find trends and calculate peak to peak vibration levels. An average peak to peak vibration is calculated for all measured peaks and adjacent peaks. The peak to peak, 1 second window is a method where maximums and minimums are found in a "moving" 1 second window. With this

method, the 1 second window is moved in .5 second increments and the greatest + and - vibration levels are found. An average is calculated for all of the 1 second windows to give an average peak to peak vibration level. Pk/Pk Mathematical simply finds the maximum adjacent peak to peak level. The standard setting (ISO18738) is Pk/PK Mathematical.

Apply Jerk Exclusion - Jerk exclusion is a method of evaluating peak to peak vibration both during acceleration & deceleration, and constant acceleration. With this box checked, the software differentiates the vertical axis motion into jerk zones and non jerk zones. Peak to peak vibration levels are reported for both the non-jerk zone (constant acceleration) and jerk zone (changing acceleration, associated with the starting and stopping of the elevator). The non-jerk zone is defined as the section of the vertical axis time history where jerk is less than 0.3 m/s3 and the jerk zone is where jerk is greater than 0.3m/s3. The jerk exclusion level is established in ISO18738, and is configured in the jerk exclusion level box.

Acceleration Filter - The selection here is to indicate to the software what low pass filter should be applied to the vertical channel time history (raw data) for the calculation of the acceleration profile of the elevator. The distance, velocity, and jerk time histories are all calculated from the acceleration profile. The standard is 10 Hz (ISO18738).

Low Pass Cutoff (Hz) - This entry box allows the user to enter the low pass cutoff frequency. The value is used when the Low Pass filter is selected under Elevator/Escalator Vibration Analysis Tools. The cutoff frequency is specified in Hertz (Hz) and marks the -3db cutoff point. The low pass filter is used if the Elevator or Escalator Vibration Analysis Tools sections for filtering any or all of the x, y, and z channels.

RMS Time Constant (S) - In analysis where RMS vibration level is to be analyzed a selection should be made for the RMS time constant. In general the slow time constant is used (mainly for general vibration and escalator applications).

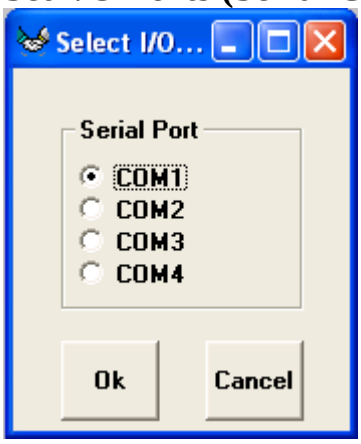
Jerk Time Constant (S) - This selection affects how jerk is calculated from the acceleration time history. The standard setting is **'Slow – 0.5s'** (ISO18738).

Average Pk/Pk Type – This selection offers the option of how the average peak to peak vibration is calculated. Simple average is a method where all of the peak to peak cycles are summed and then divided by the number of peak to peak cycles. A-Level Percentage is a statistical approach for finding the average. As an example, if the A-Level percentage is set to 95 then the software finds the level that 95% of the peak to peak cycles are less than or equal to, and 5% of the peak to peak cycles are greater than. A-Level percentage of 95 is established in ISO18738.

ISO Weighting - The appropriate ISO weighting to be selected is based on the data that is being analyzed. Whole Body X,Y,Z should be selected for elevator motion, while Whole Body Combined would be selected for measuring vibration on an escalator step. Hand-Arm would normally be selected when analyzing vibration data recorded on an escalator hand rail.
Elevators: Whole Body X,Y,Z, 1999
Escalators (Step): Whole Body Combined
Escalators (Hand Rail): Hand-Arm

Note: Selecting the ISO18738 Button will set all analysis options to the settings appropriate to ISO18738 Measurement of Lift Ride Quality

Set I/O Ports (Serial Communications Only)



The choice made here is dependent on your PC hardware and how it is configured. The **Serial Port** is used for communication with the EVA-625. The Serial Port choices are **COM1** to **COM16**. Almost all computers have at least COM1 available, and most have COM1 and COM2. Make sure that you select an available port. Check with your computer manual for the appropriate selection. Click on the appropriate selections and then click on the OK button.

Note: The EVA-625 will not communicate properly with the computer while Hot Sync, or any active PDA software that uses the serial port is active. Right mouse click on the Hot Sync icon and exit. This will reactivate when the computer restarts.

Set Print Header

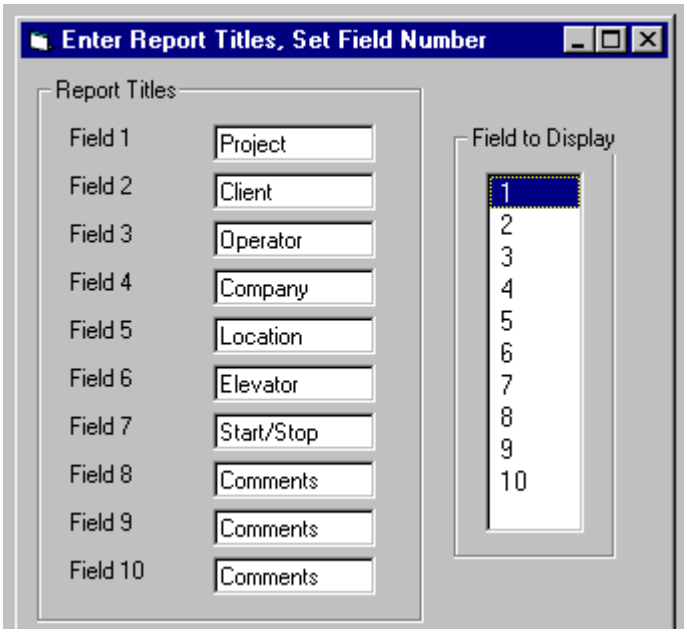
This selection allows you to enter **your** company information that will be printed (centered) at the top of the first page of the formal report. Up to 48 characters for two lines can be entered.

Example: Physical Measurement Technologies
Keene, New Hampshire, USA

This will be printed at the top of page 1 of the report.

Enter Report Titles, Set Field Number

The EVA software allows you to keep report information with each recording. The report data helps to identify the recording and any special information that is relevant. The report is comprised of 10 fields, including a title, and the report data. The report data will be printed on the first page (measurements page) of the formal report. Ten titles, of 10 characters each, can be entered.

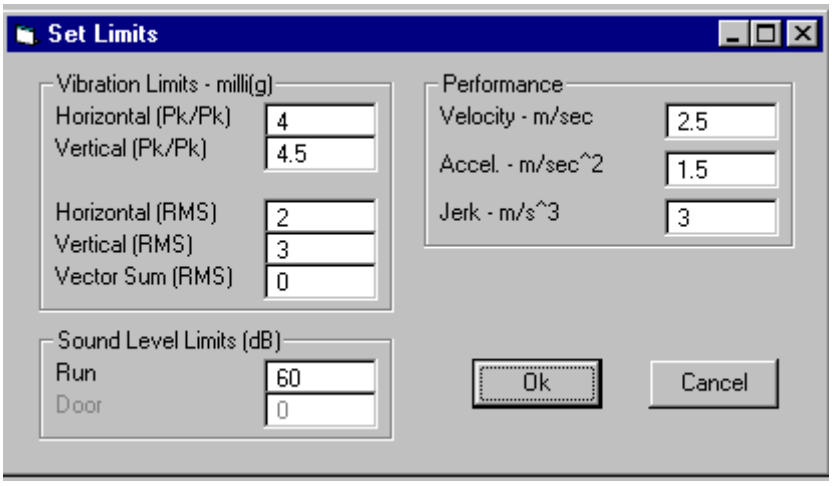


This information is used to fully identify the report. Its use is not required by the EVA software. The EVA-625 has a facility for selecting an Identification Number which is stored with the recorded data in the instrument. That ID Number will be transferred with the data to the PC and stored in field number 6 (the Elevator Field).

Field to Display
This allows the operator to select which field of the report data that will be displayed with each file (under Select Record) as a file identifier, and printed on each page of the formal report. If, for example, Project is Report Title number 1, and field number 1 is selected, the information that is entered in this field will be displayed when the list of files is displayed, and also printed on each page of the formal report.

Set Reference Limits

In the Vibration Analysis Tools, and on the printed graphical data analysis, reference lines can be displayed with the vibration and sound data.

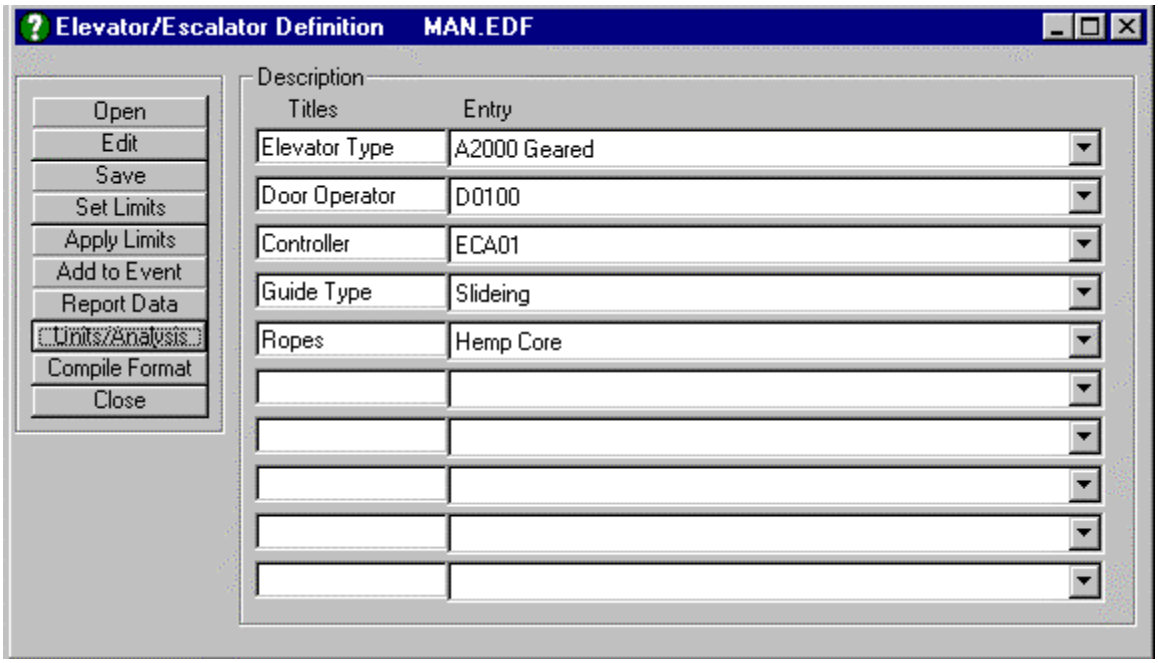


These limits are often based on contract specifications, or internal specifications. The limits that are entered are used for comparison with measured values. Numeric values are entered for horizontal vibration and vertical vibration separately, since allowable vibration levels may be specified individually. Similarly, allowable jerk, velocity, and vibration may be entered. (Please note that the vibration levels are entered as peak to peak values. If the contract or specification allows a maximum of 20 milli(g)s peak to peak vibration, enter 20. If 20 milli(g)s peak to peak is entered for the horizontal and vertical vibration limits, and 60 dB is entered for a sound level limitation, a dotted line will be plotted at +10.0 milli(g)s and -10.0 milli(g)s on the acceleration time histories, and a dotted line at 60 decibels will be plotted on the Sound Level time History. This provides a clear visual reference, particularly when showing and discussing the data with someone who is not familiar with vibration data. It also allows you to clearly identify areas where the vibration or sound exceeds a threshold which you have established. (Note that the RMS limitation will be used in future versions of the EVA Vibration Analysis Tools software.)

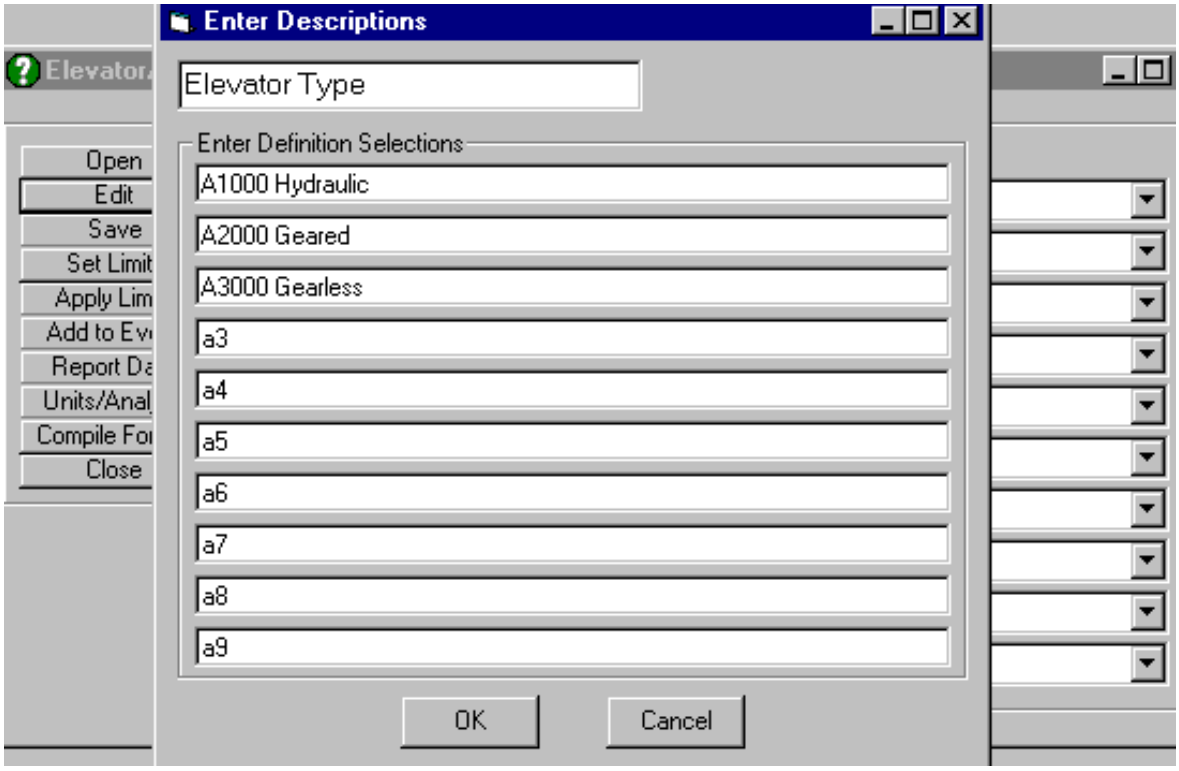
The Vibration Analysis Tools Software allows the selection of 2 sources of limits, Global and Record. If the Global source is specified, limits are applied from those set under Set Reference Limits, If the Record sources was selected then the reference limits that are stored with the individual records are used (See Elevator/Escalator Definition below).

Elevator/Escalator Definition

This is an extremely powerful addition to the Vibration Analysis Tools software. This utility allows the operator to create standard definition files for elevators and escalators that describes particular elevator or escalator types, include vibration and performance limits as explained above. An important feature is the ability to standardize how vibration is analyzed company wide. All aspects of the configuration of the EVA software can be set and stored. For example, the type of analyses of the vibration data that will be performed (peak to peak method, whether to apply jerk exclusion, jerk time constant, etc., as well as the allowable vibration and performance can be stored in a single file. In this way, the .EDF file can be distributed to all users within an organization so that all they have to do is to select the specific .EDF file and apply it so that their software is configured the same as all users within the same company. The utility also allows storage of a specified definition and associated limits with a particular file. After selecting Elevator/Escalator Definition the definition window will open:



A list of field names (Titles) and selections (Entry) and limits will be displayed. A definition and series of choices can be created by clicking on one of the titles and then clicking on the Edit button. The edit window will open (below) to allow a title and up to 10 selections to be entered. Ten titles with ten possible entries can be created for each definition file. After entering desired titles and entries, save the file (click on Save button) to Liftdef.edf. This will become your working template. It is then suggested to create a specific elevator definition by selecting the



appropriate choices for the model A2000 for instance, and entering the associated limits, and then saving the file as A2000 for example. It will then be a simple matter at any point in the future to select the A2000 definition, and then store the limits and selections with any desired EVA recorded event. By selecting Units and Analysis, Set Limits, or Report Data, all configuration aspects can be set.

Set Data Path

This is set under the File choice of the top menu bar (not under Configure). This tells the EVA software where to put the data that is transferred from the EVA system and where to find the data when you wish to analyze. A list of available directories is displayed. It is suggested that you use the DAT directory that was made under the installation data. However, any other directory can be selected as well as other disk drives, such as the floppy drive. To select another drive, Tab to the drive selection above the directory list and use the up or down arrows to select the appropriate drive. If you change the drive selection and you get an error, Disk Not Ready, just insert a diskette into the drive and it will allow the selection. When the selections are made, Tab to the OK button to accept.

EVA-625 Control and Configuration

To use the EVA-625 for recording data, the instrument must be configured appropriately for the operations in which it will be used. The time and date should be set to local time. When it arrives, the EVA-625 will be set to US Eastern time. Partial Configuration of the EVA-625 can be performed through the EVA-625 keyboard or the PC. Complete Configuration can only be performed through the PC. Retrieval of EVA-625 stored data can only be performed using the PC. The EVA-625 real time clock can be set through the PC or EVA-625 keyboard.

EVA-625 to PC Serial Communications

Communication between the EVA-625 and the PC is under software control, and is really very simple. Connect the EVA to PC serial cable, to the PC COM (serial) port which was selected under Configuration, and to the I/O connector on the EVA-625. This is the hardware link between your EVA-625 and PC. The PC end of the cable is a 9 pin female connector. This has become the standard, particularly for notebook PC serial connectors. If your PC has a 25 pin serial connector, a 25 pin to 9 pin adapter can be purchased at any personal computer or electronics store. The EVA-625 end of the cable is a 9 pin male connector. Normally, the connection should be made with the EVA-625 switched into the Off position and the PC turned off.

After the connection has been made, switch the PC on and start the EVA software. Switch the EVA-625 to the On position. Watch the EVA-625 display until the Main Menu is visible. **Any PC to EVA-625 Communications can only be made when the EVA-625 Main Menu is Visible**. In the EVA software, select **EVA Control**, click on **EVA Communications** The choices are:

Configure EVA
Retrieve EVA Data
Import Flash Drive Data (with 8.75.1000 and higher)

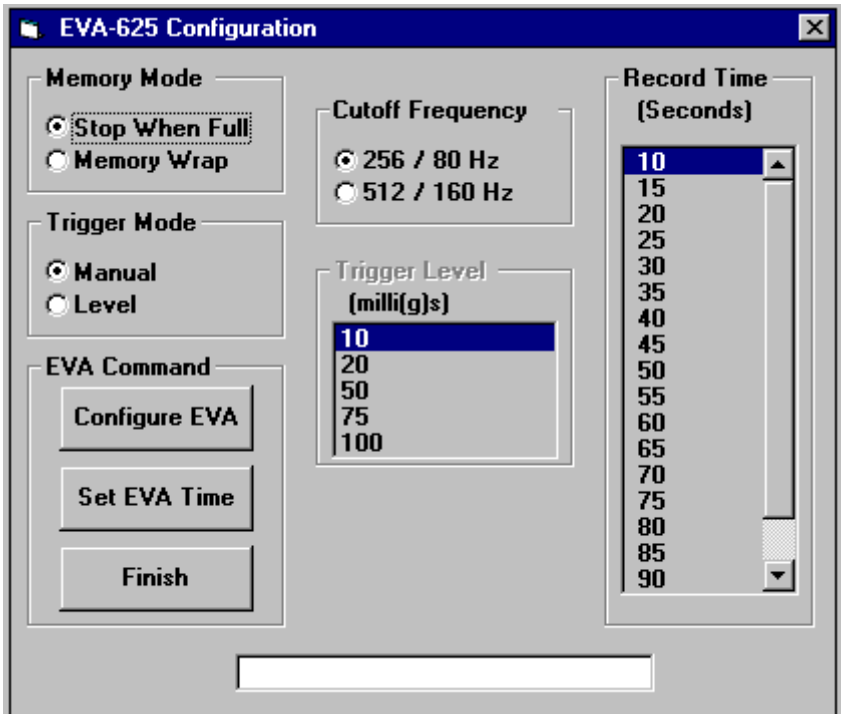
Configure EVA

Configuration of the EVA-625 consists of setting its operating parameters. Those can be set either through the EVA-625 keyboard or through the PC. Partial configuration is allowed through the EVA-625 keyboard, while a complete configuration can only be accomplished through the PC.

Very Important: Configuring the EVA-625 through the PC will clear the EVA-625 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring.

When the Configure EVA selection is made, a window will open which shows the operating parameters and their choices. The configuration elements or operating parameters, and how the configuration can be made, are listed as follows:

Parameter	EVA-625	PC
Memory Mode		X
Sample Rate	X	X
Trigger Mode	X	X
Trigger Level	X	X
Record Time	X	X
Time & Date	X	X



If using the keyboard, press the Tab key to move to the appropriate selections, and then send the configuration to the EVA-625 by selecting the displayed **Configure EVA** button. The configuration elements are described as follows:

Memory Mode (Serial Version)

The choices are:

Stop When Full
Memory Wrap

This controls how the EVA-625 handles the data it stores. The EVA-625 has up to 700 seconds of data storage capacity. This means that it will store up to a total of 700 seconds of vibration and sound data (Sample Rate = 256 SPS) in records or events of a length which has been configured by setting the Record Time. As an example, lets assume that the Record Time was configured to 30 seconds. The EVA-625 will hold approximately 22 recordings (events). If the EVA-625 was configured to Stop When Full, when the memory is full, the EVA-625 will not allow any further recordings until the data has been transferred and the unit was reconfigured to clear the memory. If the EVA-625 was configured to Memory Wrap, then when the memory has been filled, the oldest recording will be overwritten by the

newest recording. The Memory Mode can only be changed through the EVA software running on the PC.

Suggestion: Operate in Stop When Full Memory Mode. This will ensure that data will not be lost without the chance to offload the previously stored data.

Sample Rate

The Sample Rate/Cutoff Frequency Selections are:

256 SPS / 80 Hz
512 SPS/ 160 Hz

The sample rate and cutoff frequency is selected based on the range of vibration frequencies in which you are interested. When the sample rate is selected at 256, the EVA-625 chooses the appropriate internal hardware filter and records 256 samples per second per channel (there are 4 channels - x, y, z, microphone). In this mode, the vibration frequency response of the EVA-625 is 0 Hz to 80 Hz (hertz). The selection also affects the number of available recordings. The 256 Sample Rate selection provides about 700 seconds of available memory, while the 512 Sample Rate selection provides about 350 seconds of available memory. Twice as much data is stored, per second of recording, when the unit is configured for a sample rate of 512 samples per second per channel. Beginning with version 4.00 (EVA-625 firmware), the sample rate can be selected through the EVA keypad.

Note: The maximum Record Time allowed is 120 seconds for 256 SPS/Channel, and 60 seconds for 512 SPS/Channel.

Suggestion: Normally for recording elevator vibration, a Sample Rate selection of 256 is more than sufficient. A Sample Rate of 512 is only used when interested in specific mechanical elements or if very high frequencies are of interest. When recording with the accelerometer mounted within the EVA-625, select the sample rate of 256.

Trigger Mode

The Trigger Mode choices are:

Manual

The Trigger Mode is how the EVA-625 determines when to start recording. As an example, if the Trigger Mode is configured as Manual, the EVA-625 will only start recording when the ENT key on the keyboard or the start switch on the outside of the case is pressed. This allows control of exactly when the EVA-625 starts recording.

Level

The selection allows the EVA-625 to start recording based on a level, or threshold, of vibration. If the Level mode is selected, you must configure a trigger level as well. The choices of Trigger Levels are shown above. As an example, if Level mode is selected, and a Trigger Level of 20 milli(g)s is chosen, the EVA-625 will wait until at least a level of 20 milli(g)s of vibration is reached before it begins to record.

Suggestion: It is our experience that the Manual Mode offers the best control of when and what to record. In Level Mode, the system may start recording due to an unplanned movement by the operator. The Trigger Mode can be changed at any time through the EVA-625 keyboard.

Record Time

The Record Time selection allows you to configure the EVA-625 to record for a length of time after the unit triggers. The maximum allowable record time for a single recording is 120 seconds with the system configured to a Sample Rate of 256 SPS/Channel. The maximum allowable record time is 60 seconds, with the system configured to a Sample Rate of 512 SPS/Channel. **Do <u>Not</u> set a Record Time of Greater Than 60 Seconds When the EVA-625 is Configured for a Sample Rate of 512 SPS**. Future versions of the EVA software will handle PC memory to allow for the increased amount of data.

Note: The EVA-625 allows you to stop recording at any time by pressing the ESC key, or the start switch or external switch. This allows you to maximize use of EVA-625 available memory.

Suggestion: Most elevator trips take less than 50 seconds. Set the Record Time for the longest elevator trip that you expect to record. Use the EVA-625 start/stop switch to record only the data that is relevant. If you forget to stop the recording, it will only record up to the length of time that has been configured. The Record Time can be changed at any time, through the EVA-625 keyboard. For Elevators, the standard procedure is to begin recording just prior to the door closing, continue for the full ride, then stop recording after the doors have fully opened. This will ensure that the full trip, lobby noise, and door operator noise and vibration is captured.

Configure EVA

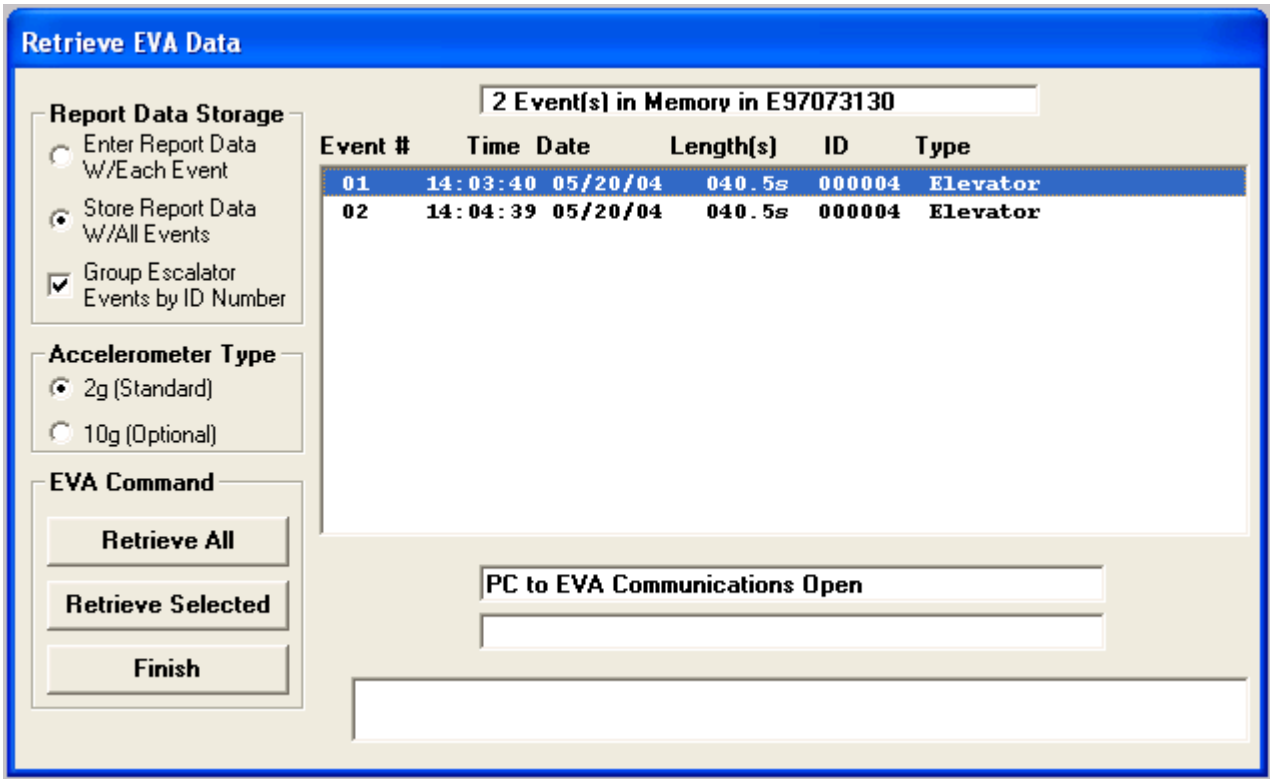
When the desired changes have been made to the configuration, it is time to send this information to the EVA-625. If using the keyboard, repeatedly press the Tab key until you have reached the **Configure EVA** button, and press **Enter**. The configuration will be transmitted via the serial port to the EVA-625. A short message should appear on the PC display (**EVA Communications Open**). At the same time, a message will appear on the EVA-625 display, **Communicating with PC**. When the data has been transmitted, the message will disappear from the PC display, and the EVA-625 will restart with the new configuration. A success message will be displayed if the transfer was completed without problems.

Remember: Configuring the EVA-625 through the PC will clear the EVA-625 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring. This is the suggested method to reset the EVA-625 memory.

Suggestion: Watch the EVA-625 display to verify that communications were completed. If there were any type of communications failure, it is possible that the **Communicating with PC** message will remain on the display. This means that the unit is still waiting for the end of the data. (It did not receive all of the data that it needs to configure). Should this happen, switch off and then restart the EVA-625, check all connections, and go back to Configure EVA.

Set EVA Time & Date
This selection sends the time & date which is currently set in your PC. The time & date is very important to the EVA-625 since all data files are time stamped, and the EVA software uses the time stamp to create file names for the data that is transferred from the EVA-625.

For EVA-625/MMC-1 Versions using Serial Communications Select:
Retrieve EVA Data



This selection is used to transfer data which has been stored in the EVA-625 to the PC. The EVA-625 and the PC must be connected by the EVA-625 to PC serial cable. When this selection is made, the EVA software communicates with the EVA-625 and determines how many events are stored. It then displays a list of the events stored, the trigger time and date for each recording, and the length in seconds of each recording. To transfer, it is necessary to select either **Retrieve All**, or **Retrieve Selected** under **EVA Command**. Retrieve All is selected to transfer all events stored in memory. Retrieve Selected allows the user to transfer a selected event. (Use the up and down arrows to highlight the desired event and double click with the mouse to mark the event). The example below indicates that there are 2 events in memory.

Two Report Storage options are available. They are:

Enter Report Data With Each Event
This selection forces the software to stop before the transfer of each recording to allow the user to enter Report Data.

Store Report Data With All Events
When this selection is made, the system allows the input of the Report Data before the first recording and then stores that data with all transferred recordings.

Group Escalator Events by ID Number
With this selection, escalator type recordings are automatically named based on the first recording with a specific ID number. For example, a measurement of an escalator would likely include vibration measurements of the step, left hand rail, right hand rail, sound level measurements, and tachometer measurements, while all measurements made of this escalator have the same ID number (identification number). With this selection turned on, the first recording made with a specific ID number is used to create the file name based on the trigger time and date of that recording. All subsequent recordings that have that same ID number will be transferred with the same base file name, but different file extensions will be used for each of the types of recordings. It is recommended that this switch be turned on. In this way, when an escalator record is being analyzed, the software will automatically load all of the related files.

Accelerometer Type
The standard type is 2g. An optional 10g accelerometer is offered as an accessory to the EVA-625. If the 10g accelerometer is utilized in place of the standard 2g accelerometer then this should be checked **before** downloading.

After the Report Data has been accepted, the current data path is displayed. The user can then direct the data to any available directory. File names for the data files will be created automatically from the trigger time & date, and the EVA-625 serial number. (The trigger time & date, is the time & date that the EVA-625 triggered to record that particular event.) When the transfer is completed, click on the Finish button to end Communications between the PC and the EVA-625.

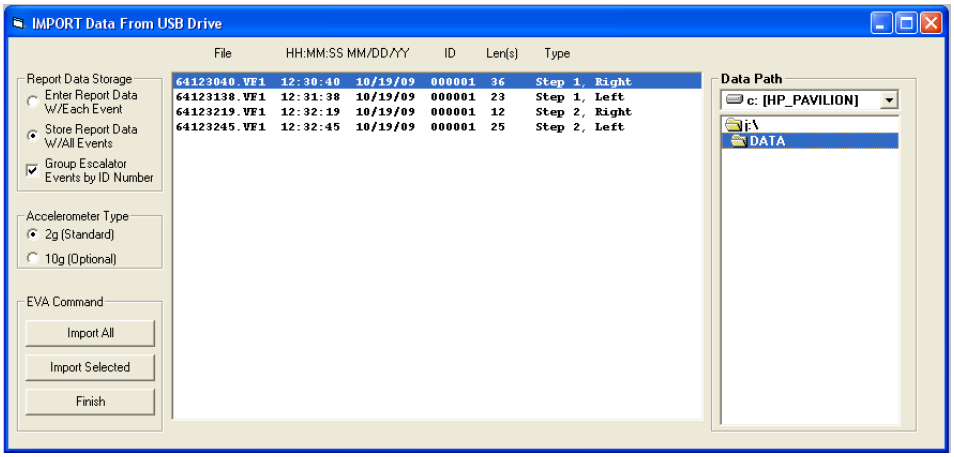
Note: When the data is retrieved, the EVA-625 memory is not erased. If there is a communication failure for any reason, the process can be repeated. If you have previously transferred this particular data from the EVA-625, that data will be overwritten.

Suggestion: Verify that the recordings have been transferred properly by viewing the data graphically before clearing the memory of the EVA-625. The memory should be cleared before next use of the system. It is best to clear the memory by reconfiguring the EVA-625 using the PC

For EVA-625/MMC-1 Versions using USB Flash Memory:
Now that the Elevator/Escalator events have been stored on the Flash Drive, they must be imported by the EVA Vibration Analysis Tools Software.

a. Insert the USB Flash Drive into the USB port on your PC or Laptop. Windows will automatically open a window asking what you wish to do with the files located on your removable storage device. Take note of the letter designation given to that port, such as **J:,** then close this window.

b. Open the EVA Vibration Analysis Tools Software Version 8.75.1000 or higher, then select **EVA/MMC Communications>Import USB Data**. This will open the Import Data from USB Drive Window shown below;



At this point, the EVA software is asking for where it should look for the Elevator/Escalator files, under Data Path, select the appropriate drive letter in the drop down box then select the appropriate folder location.

It then displays a list of the events stored, the trigger time and date for each recording, the length in seconds of each recording, and finally the type of recording that was made. To import, it is necessary to select either **Import All**, or **Import Selected** under **EVA Command**. Import All is selected to transfer all events stored on the flash drive. Import Selected allows the user to transfer a selected event. (Use the up and down arrows to highlight the desired event and **double click** with the mouse to mark the event). The example above indicates that there are 4 events on the drive.

Two Report Storage options are available. They are:

Enter Report Data With Each Event
This selection forces the software to stop before the transfer of each recording to allow the user to enter Report Data.

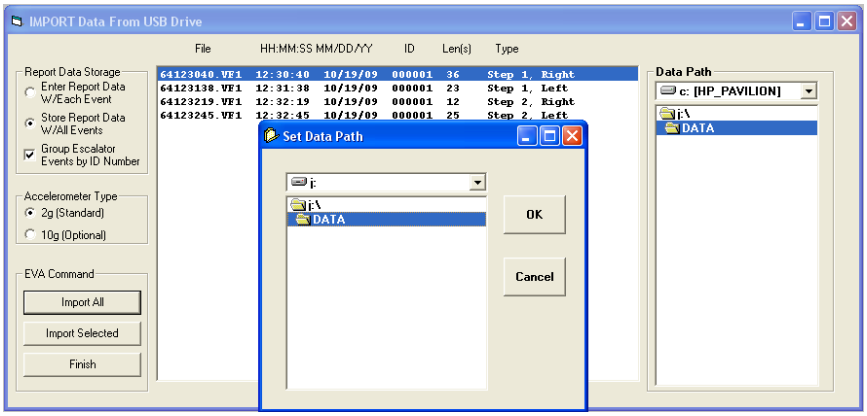
Store Report Data With All Events
When this selection is made, the system allows the input of the Report Data before the first recording and then stores that data with all transferred recordings.

Group Escalator Events by ID Number
With this selection, escalator type recordings are automatically named based on the first recording with a specific ID number. For example, a measurement of an escalator would likely include vibration measurements of the step, left hand rail, right hand rail, sound level measurements, and tachometer measurements, while all measurements made of this escalator have the same ID number (identification number). With this selection turned on, the first recording made with a specific ID number is used to create the file name based on the trigger time and date of that

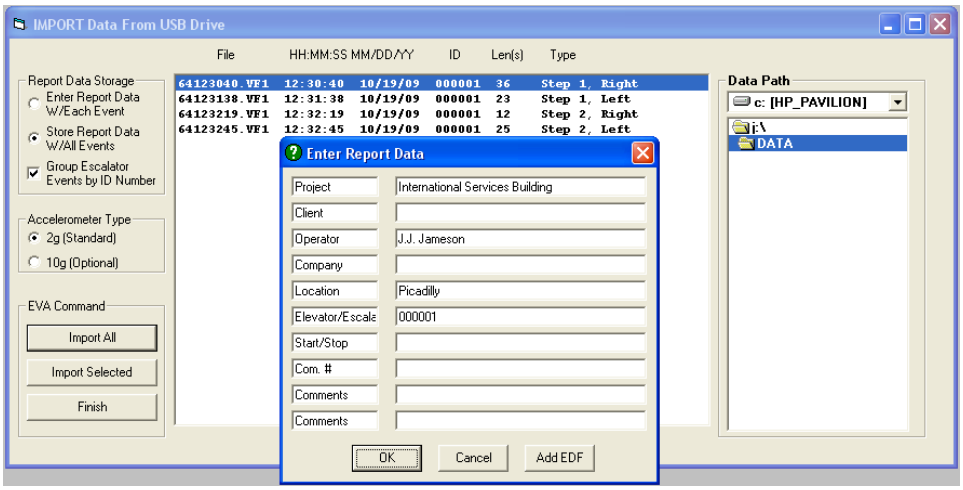
recording. All subsequent recordings that have that same ID number will be transferred with the same base file name, but different file extensions will be used for each of the types of recordings. It is recommended that this switch be turned on. In this way, when an escalator record is being analyzed, the software will automatically load all of the related files.

Accelerometer Type
Two SA accelerometers are currently available for the EVA-625 or MMC-1 (2g or 10g range). The appropriate accelerometer should be selected (checked) **before** downloading. The default setting is 2g.

Once the Import method and files to be imported have been chosen, the current data path is displayed. The user can then direct the data to any available directory. File names for the data files will be created automatically from the trigger time & date, and the EVA-625/MMC-1 serial number. (The trigger time & date, is the time & date that the EVA-625/MMC-1 triggered to record that particular event.) Click **OK** to continue.



Next, the **Enter Report Data** window appears, as shown below. Here is where the user can enter information related to the project to be stored with the recordings. It is important to note that when analyzing Step/Skirt Performance Index recordings, only data entered in the fields next to Project and Elevator/Escalator will be shown on the printed report. Click **OK** to continue.



As each file is transferred, an OK appears to the right. Once the files have been transferred, click Finish to close the window. The files that have been imported have been converted to the standard format EVA files and can be analyzed even with earlier versions of the EVA Elevator/Escalator Analysis software.

EVA-625 Operations

EVA-625 Components

The EVA-625 is a high accuracy acceleration and sound level recorder, that has been designed specifically to record elevator and escalator vibration & sound. The basic components of the system are the triaxial accelerometer unit, microphone, internal electronics (digital & analog), liquid crystal display, 4 key keypad, Start/Stop switch, and battery. The latest versions of the EVA-625 additionally have a jack to the right of the case handle for the included pendant switch for stand-off triggering. The system was designed to be reliable & rugged, but it is a high sensitivity measuring instrument and caution must be exercised. **Note: It is not necessary to take your PC into the field for EVA operations**.

Triaxial Accelerometer Package

The triaxial accelerometer is the acceleration (vibration) sensing part of the EVA-625 system. It is housed in a stainless steel case and is mounted on the left side of the keyboard plate. The electrical connection is made through a 9 pin connector. The package can be removed for measurement outside of the EVA-625 case, by connecting the supplied EVA-625 Serial to PC/Accelerometer Extension cable, to the EVA-625 and accelerometer package. **If that cable is lost, use a replacement with straight-through connections (pin 1 to pin 1, pin 2 to pin 2,.....pin 9 to pin 9). Using cables which are not straight-through can severely damage the EVA-625 and accelerometer electronics**. The accelerometer package is held in place by 2 socket head cap screws and should only be hand tightened when mounted to the EVA-625 top plate. Handle the accelerometer with care. **Damage can result if the package is dropped. The accelerometer package should only be opened by factory trained personnel.**

Axes of Sensitivity

The axes of sensitivity for the accelerometer package are called the X, Y, & Z axes. When mounted in the case, the X axis is from front to back, the Y axis is from side to side, and the Z axis is vertical. The directions are noted on the accelerometer package.

Note: The triaxial accelerometer package can be removed from the EVA-625 main unit for attachment to specific elevator mechanical elements for measurement and analysis. With the EVA-625 switched into the off position, loosen the 2 accelerometer retaining screws (do not remove screws) and carefully slide the package toward the handle of the main case. This will separate the accelerometer package from the 9 pin connector which is mounted on the keyboard plate. Vertically lift the accelerometer package from the EVA-625 system. The two mounting holes can be used for attachment to the desired mechanical element. Be careful not to bend the accelerometer package mounting ears, since this can disturb the orientation (tilt) of the accelerometer package when remounted in the EVA-625. **Do not remove or install the accelerometer package with the EVA-625 powered**. Use the supplied extension cable to make the electrical connections between the accelerometers and the EVA-625. The cable length is approximately 3 meters which will provide stand-off measurement capability. If a greater length is required, please contact your supplier or the factory.

Suggestion: When mounting the accelerometer package separately, make certain that the extension cable is attached to the mechanical element as well, since unwanted vibration can be recorded if the cable is free-swinging. Use tape or another means to make certain that the cable will not move relative to the accelerometer package, particularly close to the connection. When mounting the accelerometer package, make note of the orientation of the axes with respect to the mechanical element being measured. This will greatly enhance your understanding of the measurements when you later analyze the data. When using the mounting ears tighten only enough to ensure that there will be no relative motion between the accelerometer package and the element being measured.

Microphone

The microphone is mounted in the lid of the EVA with a Velcro strap. It is attached to the EVA-625 system by a cable (about 2 m), through the Mic connector on the top plate. The sound channel is designed to measure A-weighted, fast response, true RMS sound levels. This allows the EVA-625 to record sound levels that are equivalent to what and how the human ear responds to noise.

Tachometer

The optional ETCH011 tachometer can be added to the EVA-625 to greatly expand functionality. This addition allows the recording or operating in real time mode for the purposes of measuring escalator handrail to step speed, recording escalator braking, recording elevator door motion, or general use as a digital tachometer. The tachometer is connected to the 9 pin accelerometer connector on the keyboard.

Index Measurement Device

The optional IMD-1 index measurement device allows the EVA-625 to record escalator loaded gap/coefficient of friction data to fulfill the requirements of A17.1-2000. The IMD-1 data is fully compatible with EVA software version 6.00 or higher (EPROM or PC). See the IMD-1 operations manual.

Electronics

The internal electronics are low power CMOS circuitry and should not be handled by anyone other than factory, or factory approved, personnel. Be careful to avoid static discharges as damage could result. All signal conditioning and digital electronics are within the EVA-625.

Liquid Crystal Display (LCD)
The EVA-625 LCD is 4 lines by 20 characters, and with the keypad, provides the user interface while operating in the field. Never drop anything on to, or press on, the LCD, since it can be damaged.

KeyPad
The 4 key keypad allows the EVA-625 system to be configured while operating in the field. A PC is not necessary to operate the EVA-625 or change necessary operating parameters. The keypad is a silent type to avoid putting vibration into the assembly, which could be recorded with the vibration that you are trying to measure. Press as gently on the keypad as possible while recording, (such as escaping) to minimize vibration.

Start/Stop Switch
This switch is used for manual triggering, and to stop recording (outside of case, near handle). It has the function of the ENT and ESC keys while in the record mode. Using this switch to start & stop recording reduces the amount of vibration which can be induced into the recording.

Pendant Switch
The EVA-625 is supplied with a pendant switch. This allows the operator to manually trigger the EVA-625 from a stand-off position and also minimizes any movement created by using the keyboard or Start/Stop switch. The Pendant switch connector jack is located to the right side of the case handle and operates exactly as the Start/Stop switch.

Battery & Charger
The battery is a 12 volt lead-acid gel-cel. Normal continuous operating time for the EVA-625 is between 20 and 30 hours depending on temperature and age. The battery should never be allowed to discharge to below 10.5 volts, since battery life will be reduced. If it is allowed to discharge down below 9 volts, it may never recover even with charging, and will have to be replaced. The battery type is a NP2-12 manufactured by Yuasa. Always charge the battery after use to a full charge. The supplied battery charger is the universal voltage type. The connector power jack is on the top plate of the EVA-625. **Always charge the battery with the lid fully opened, and the EVA-625 switched to the Off position**.

Switch the EVA-625 to the off position, when not in use. Completely discharging will damage the internal battery.

Operating the EVA-625

Operating the EVA-625 is very easy, but it is important to develop and follow a methodology or procedure which can be repeated exactly. In this way, measurements and data can be compared from elevator to elevator and from time to time. The purposes of measuring elevator vibration and sound include determination of ride quality, diagnosis of mechanical system problems, and tracking of the condition of the elevator as the components of the elevator system age and wear. Therefore, it is very important that the "how vibration is measured" be standardized and repeated. The methodology is fully explained within ISO18738.

Placing the EVA-625 (Elevator)
When measuring for ride quality it is recommended that the EVA-625 be placed on the floor of the elevator in the center of the elevator. Placing the EVA-625 in the center of the elevator is in conformance with specifications for the measurement of elevator vibration and sound which are under development. The unit should be sitting on its 3 feet (tripod foot arrangement) with the handle towards the door. With your back to the elevator doors, and the lid open, the Y axis arrow on the accelerometer package will be pointing to the right. The X axis arrow is pointing toward the elevator doors, and the Z axis is pointing upward. Please note that the EVA-625 can be operated in any orientation, but this is a good method on which to standardize. For sound measurements, ideally, the microphone would be held at 1 meter above the floor in the center of the elevator. An alternative is to hold the microphone at ear level. The one meter suggested height is in conformance with ISO18738. Often, the microphone will simply be left in its mounting position in the lid. Please keep in mind that the sound field varies within the elevator and some sound may be transmitted through and modified by the EVA-625 case.

Operating
Switch the EVA-625 to the On position and watch the display. Verify that the battery voltage is within acceptable limits. Also verify that the EVA-625 time and date is correct. This is very important since file names and time stamps use the time and date. If it is incorrect, reset the time and date. The number of events recorded and the number of seconds of available memory will then be displayed. Verify that there is sufficient memory to make your recording. The EVA-625 configuration will then be displayed, including: Record Length in seconds (how long the EVA-625 will record after it triggers), the Trigger Mode (Manual or Level), the Memory Mode (Stop or Wrap), and Sample Rate. Make sure that the Record Length is long enough to record the entire elevator ride. If required, change the record length using the keypad. The Trigger Mode can be changed as well, but Manual Trigger is recommended. The Memory Mode and Sample Rate can only be changed using the EVA software and PC. The Main Menu will now appear. Selections from the Main Menu are made by using the up↑ and down ↓ arrows and pressing the ENT key.

Measure Ride
When you have verified that the EVA-625 is configured properly, you can now record the elevator ride, or measure ambient vibration and sound levels. At the Main Menu the selection arrow will be pointing at the Measure Ride selection. Press the ENT key. The display will then indicate the sub-menu:

MEASURE RIDE

ELEVATOR
ESCALATOR
REAL TIME MODE

ELEVATOR - Selection of ELEVATOR brings you to the MEASURE ELEVATOR sub-menu. The selections displayed are:

RIDE
SPEED
DOOR SPEED

Ride
When this selection is made the display will indicate:

Set ID#

Set ID#
This is used to enter an identifier number for the recording. The ID# is selected by using the up and down arrows and pressing ENT to accept the displayed number. The ID# will be stored with field number 6 of the Report Data. It is a good idea to use this feature to keep track of your recordings.

After pressing the ENT key,

RECORD RIDE
PRESS ENT OR START
TO BEGIN
PRESS ESC TO EXIT

will be displayed.

Do not change the orientation of the EVA-625 when this message is displayed. This is when the system self corrects for the present sensor orientation. Press the ENT key to tell the EVA-625 to wait for a trigger. If the orientation must be changed, return to the main menu. The message:

WAITING FOR TRIGGER

PRESS ESC TO EXIT

will be displayed. At this point you can press the Start or ENT switch (if in Manual Trigger Mode) on the EVA-625 to trigger the recording to begin, and immediately press the floor selection switch. Make certain that the EVA is recording before the elevator begins to move. **It is also important that no one should move or make sound while recording. People moving and talking, will create vibration and sound that is unrelated to elevator vibration and sound and will be recorded as well**. When the elevator comes to a stop you can allow the EVA-625 to stop recording by itself (when it has reached the Record Length) or you can very gently press the ESC key or Start/Stop switch to stop the recording. This is the recommended method because when the elevator doors open, people may step in, or be speaking while the EVA-625 is still recording. Manually stopping the recording allows you to ensure that only the elevator vibration is recorded. When the recording has finished, the maximum acceleration levels (in milli(g)s) for each of the 3 axes, and highest sound level (in decibels) that were recorded during the period, will be displayed. An example is:

X= 30m(g) Y= 26m(g)
Z=100m(g) Mic= 65dB
ENT/START TO RECORD
PRESS ESC TO EXIT

If you wish to record the elevator going in the other direction, press the ENT or Start switch key once to return "Waiting for Trigger" display again, and then trigger to record. If you are finished press the ESC key to return to the Main Menu. The data is stored in non-volatile memory and the EVA-625 can be switched to the Off position. **Always turn off the EVA-625 from the Main Menu. Data files can be corrupted by switching the EVA-625 off from any other than the Main Menu.**

Suggestion: Begin recording before the doors start closing, record the entire trip, and then finish recording after the doors have fully opened. This will ensure that the measurements are complete and will include ambient sound levels, door operator noise, and the full elevator trip.

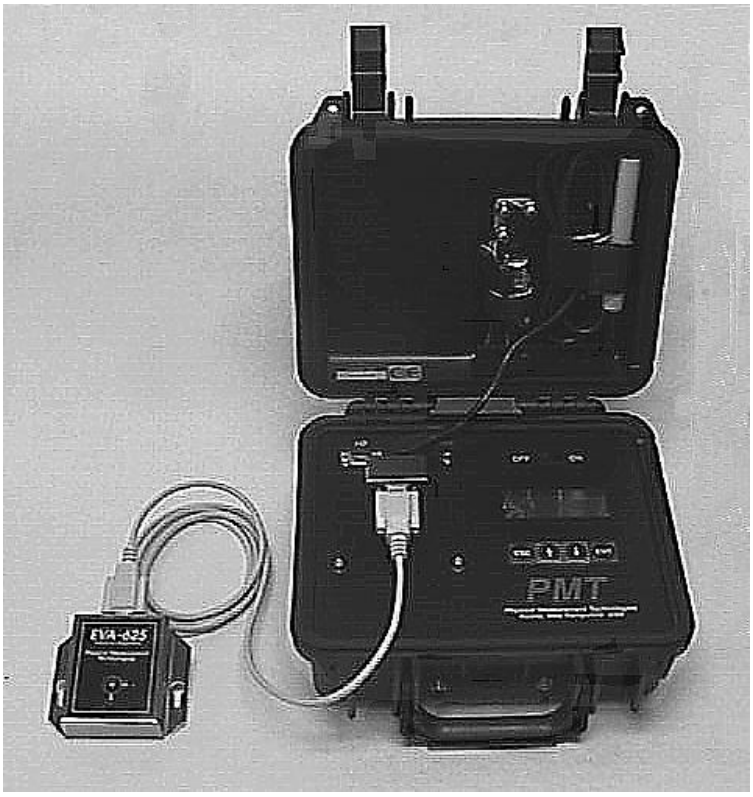
ESCALATOR - Selection of ESCALATOR brings you to the Set ID# window. **It is particularly important that the ID number be set for escalator recordings since file names are created based on the ID number and trigger time and date.** After entering the ID number the MEASURE ESCALATOR sub-menu will be displayed.

MEASURE ESCALATOR

STEP	**R. HANDRAIL**
SPEED	**L. HANDRAIL**
SOUND	**START/STOP**

Step - With this selection, vibration measurements of an escalator step is made. With the escalator running, the instrument is placed on the step and a recording is made of the full escalator run. It is suggested that the instrument be placed on the landing and brought to the point of WAITING FOR TRIGGER. Then the EVA is placed on the step as it comes out of the comb plate. Begin recording as quickly as possible by using the external trigger switch. When placing the EVA-625 on the step it is important to orient it properly and to make sure that the case does not hit the riser of the step above. It takes some practice. Finish recording just prior to touching the comb plate at the other end. Place the instrument as nearly as possible in the center of the step and make sure the step above does not hit the lid of the instrument. Always operate the EVA-625 **without the 3 tripod feet for escalator measurements**. (Vibration only measurements are made at this time. Sound level is not recorded)

R. HANDRAIL - This selection is used for measuring the **right handrail** of the escalator. Return to the main menu. Switch the EVA-625 to the OFF position. Remove the Accelerometer package and attach the supplied serial/accelerometer extension cable to the accelerometer connector on the EVA-625 and the triaxial accelerometer package on the accelerometer. Switch the instrument on, then return to the MEASURE ESCALATOR menu. Select R. Handrail. With the accelerometer level (you can place the sensor on the floor) go to WAITING FOR TRIGGER. The handrail measurement is intended to measure vibration in the x-axis only. Place the accelerometer package on the moving handrail with the cable end pointing in the direction of travel Hold the sensor firmly so that there is no slippage. Trigger the EVA-625 when you have reached the incline section of the handrail.



L. HANDRAIL - The same measurement is made as with the R. Handrail selection.

Note: The right handrail is defined as the right side handrail as seen looking from the lower landing up toward the upper landing regardless of direction of travel.

SPEED - This selection is intended for use with the optional ETCH01 tachometer package for the measurement of left and right handrail speeds, and step speed. The goal is to firmly establish the step to handrail speed differential. As before, return to the main menu and switch off the EVA-625. Disconnect the accelerometer and connect the tachometer cable to the accelerometer connector. Return to MEASURE ESCALATOR and select speed. Press enter until GO TO L. HANDRAIL is displayed. Hold the tachometer wheel on a flat section of the handrail. Do not measure on the wrap around section of the handrail since speed measurements will be slightly different from the top side of the handrail to the underside of the handrail. Press the trigger switch and allow the EVA-625 to record for 10 seconds. The record period is automatic. At the end of the record period GO TO R. HANDRAIL will be displayed. Repeat the procedure. After the recording has been completed, the message GO TO STEP will be displayed. Hold the tachometer so that the wheel is picking up the step immediately after the step leaves the comb plate. Press the trigger switch and hold it as steady as possible for 10 seconds.

SOUND - Sound level measurements for an escalator are a multi-step process. The EVA-625 operational software has been designed to simplify this as much as possible. The measurements include sound levels for one full escalator cycle at 4 points if accessible. Point 1 is the lower landing. Point 2 is the inclined section of the escalator. Point 3 is the upper landing, and Point 4 is 1 meter below the enclosure of the upper landing. Ambient is the sound level at the upper landing with the escalator switched off.

After selecting, the sound the sub-menu

MEASURE SOUND
RUN
AMBIENT

will be displayed.

RUN - The RUN selection is used to make a multi-point sound measurement of the running escalator. It allows either the storage of the actual sound level data, TIME HISTORY, or just saving the minimums, maximums, and averages of each point. It is recommended to save only the MIN/MAX/AVERAGE data. With either selection, the instrument will automatically record up to 120 seconds in order to allow measurement of the escalator's full cycle at the lower and upper landings. After selecting press the enter key until

**** GO TO POINT 1 ****
PRESS ENTER OR START
SWITCH TO BEGIN
PRESS ESC TO EXIT

is displayed. Go to the lower landing, hold the microphone about 1.5 meters above the lower landing, and 1 meter from the lower landing plate. (It is suggested to have marked a step so that the operator will know when one full cycle has been completed.) Press the start switch to begin the measurement. The message RECORDING will be displayed. After one cycle has been completed, press the start switch to stop. The measurement will be displayed. The measurement can be repeated if an unrelated sound had an effect on the measurement. Press the start switch to accept. The message ** GO TO POINT 2 ** will be displayed. Step on to the running escalator, again holding the microphone at 1.5 meters, and pointing toward the machine. Record until just before reaching the comb plate. (press the start switch to stop recording). Again the measurements can be accepted or repeated. Press the start switch to accept the measurements and the message
** GO TO POINT 3 ** will be displayed. The full cycle measurement is repeated for the opposite landing (like point 1). Again, accept or repeat the measurements. If it is desired (or accessible) to measure sound under the upper landing (under the machine), then make the POINT 4 measurement for one full cycle. Again accept or repeat the measurements. When completed, press the ESC key to return to the MEASURE ESCALATOR menu.

AMBIENT - The ambient measurement is a measure of the sound level in the room with the escalator in the off position. This is a 10 second recording made at the upper landing.

START/STOP - This selection is made for the measurement of the start and stop of an escalator. After connecting the tachometer, selecting **START/STOP** will display the MEASURE START/STOP menu. The choices are

VIBRATION
SPEED

VIBRATION - This selection is made when an 'accelerometer only' measurement of the motion during the stopping of the escalator is made.

SPEED - This is used to make a measurement of the stopping of the escalator with the tachometer. The stopping measurement is made by pressing the pendant switch button into the escalator stop safety switch. After selecting SPEED, the message

RECORD EVENT
PRESS ENT OR START
SWITCH TO BEGIN
PRESS ESC TO EXIT

will be displayed. Press the start switch once to display the WAITING FOR TRIGGER message. Hold the tachometer wheel at the point where the steps are coming out from the comb plate (can also be performed on handrail), while holding the tachometer handle as steadily as possible. Push the pendant switch into the stop switch on the escalator. At that point the EVA will begin recording the tachometer signal while the escalator comes to a stop. Hold the tachometer in position until the measurements screen is displayed. This is 3 seconds. Press ESC to finish, or the measurement can be repeated by pressing the start switch and going to the WAITING FOR TRIGGER message.

Real Time Mode
This selection under Measure Ride is used to measure vibration and sound levels, or velocity with the tachometer connected.. This is very useful for measuring ambient levels, or for measuring machine vibration levels. Use the Start switch to begin and to end. The maximum level of vibration for each of the 3 axes and maximum sound level for the preceding .25 seconds is displayed and updated every .25 seconds.

Other Main Menu Selections

Measure Index
The Measure Index selection allows the operator to make structured measurements of escalator loaded gap and coefficient of friction in conformance with A17.1-2000 code requirements. The measurements are made using the IMD-1 index measurement device. The IMD-1 attaches to an escalator step and applies a 112 Newton (25 lb.) force on the skirt, thereby pushing the step away from the skirt panel. The distance between the step and the skirt is the loaded gap. Additionally, the IMD-1 contains a sensor to measure the frictional force between a standard polycarbonate friction surface and the escalator skirt. The use of the IMD-1 with the EVA-625 is further described in the IMD-1 Operations Manual.

Configure: EVA-625/MMC-1 Using Serial Communications
The Configure selection displays the menu:

CONFIGURE

SET OPERATIONS
SET TIME & DATE
SYSTEM RESET

Set Operations
Selecting Set Operations allows you to change the EVA-625 configuration without the PC. The first message to be displayed will be

SET OPERATIONS

Use the up and down arrows to change the Record Time from 10 to 100 seconds in 5 second increments. Press ENT to accept. The message SET TRIGGER MODE will be displayed. The choices are:

MANUAL
LEVEL

If Manual is selected, the configuration is changed and stored. Control is returned to the Main Menu. If you select Level the message

SET TRIGGER LEVEL

is displayed. Use the up and down arrows to select from trigger levels between 10 and 100 milli(g)s. Pressing ENT will save the configuration and return you to the Main Menu.

Set Date & Time
The set date & time window will be displayed.

SET DATE & TIME
DATE TIME
MM-DD-YY HH:MM:SS
01- - - -

Use the up and down arrows to change the month to the appropriate month and press the ENT key. Repeat for Day (DD), Year (YY), Hour (HH), Minute (MM), Second (SS). Just pressing the ENT key will accept the present values.

System Reset
This selection allows the user to empty the EVA-625 memory without resetting through a PC. To clear the memory it is necessary to confirm by selecting **YES**. It is best to clear the memory of the EVA-625 by resetting the instrument using the PC (EVA Commmunications:Configure EVA/MMC). This will reset all internal variables and the user will need to reconfigure the instrument to the desired parameters.

Configure: EVA-625/MMC-1 Using USB Flash Memory
The Configure selection displays the menu:

CONFIGURE

SET OPERATIONS
SET TIME & DATE
SYSTEM UTILITIES

Set Operations
Selecting Set Operations allows you to change the EVA-625 configuration without the PC. The first message to be displayed will be

SET OPERATIONS

Use the up and down arrows to change the Record Time from 10 to 100 seconds in 5 second increments. Press ENT to accept. The message SET TRIGGER MODE will be displayed. The choices are:

MANUAL
LEVEL

If Manual is selected, the configuration is changed and stored. Control is returned to the Main Menu. If you select Level the message

SET TRIGGER LEVEL

is displayed. Use the up and down arrows to select from trigger levels between 10 and 100 milli(g)s. Pressing ENT will save the configuration and return you to the Main Menu.

Set Date & Time
The set date & time window will be displayed.

SET DATE & TIME
DATE TIME
MM-DD-YY HH:MM:SS
01- - - -

Use the up and down arrows to change the month to the appropriate month and press the ENT key. Repeat for Day (DD), Year (YY), Hour (HH), Minute (MM), Second (SS). Just pressing the ENT key will accept the present values.

System Utilities
Selecting System Utilities leads to a submenu of;

USB Drive Stats
System Reset

Selecting **USB Drive Stats** will search the installed Flash Drive to determine both the size of the drive and the remaining free space. This can take quite some time on drives larger than 2GB.

Selecting **System Reset** will reset all internal variables to the factory default as in previous versions. This will NOT clear the Flash Drive. The user will need to reconfigure the system parameters to the desired values.

Check Battery
This selection displays the present battery voltage. **A recharge warning will be displayed if below 11.5 volts. If the battery voltage drops below 10 volts, the EVA will not allow further operations until the battery has been recharged.**

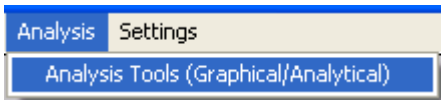
Quick Accuracy Test
It is relatively easy to verify the operations of the EVA-625 accelerometers. This should be done on an occasional basis to verify that the instrument is operating normally. To perform the quick test, place the instrument on a hard, level surface. Switch the instrument on and then operate the EVA-625 in Real Time Mode. The measured vibration level should be near 0 milli(g)s (assuming the table is not vibrating), Slowly tilt the EVA until the handle is pointing upward (as close to vertical as possible). As the instrument tilts, the average level on the x and z axes should increase through 999 milli(g)s and then start again at approximately 0 when the handle is perfectly vertical (the x axis is vertical, and the z axis is horizontal). Typically measurements will be between 950 and 1050 milli(g)s which would be displayed as between 950 and 50 milli(g)s. Return the instrument back to its normal position. Then rotate the instrument on to its side (resting on the side of the case and the lid). While rotating the instrument, measurements should increase on the y axis until it reaches a maximum when the y axis is vertical. Again, the measurements should be between 950 and 50 milli(g)s.

A more accurate test can be made by removing the accelerometer package and attaching the extension cable. The same general procedure can be followed. However for the best accuracy, the rotation of the accelerometer should be recorded.

Suggestion: To set the accelerometer axes at 90 degrees to their start position, it is useful to have a block with sides that are perpendicular to the table surface. In this way the accelerometer package can be rotated from the table surface, to the block surface. This will give an accurate 90 degree rotation. It is easiest to set the recording time to 60 seconds and then record all axis rotations into one recording. An axis rotation of 90 degrees should provide a measurement difference of 1000 milli(g)s. A confirmation of +/- 3% should be achievable using this procedure.

EVA Software Vibration Analysis Tools

Elevator Vibration Analysis Tools



The EVA software Vibration Analysis Tools is a powerful suite of tools designed to analyze elevator and escalator vibration and sound specifically recorded with the EVA-625 system. The tools allow you to display the acceleration (x,y, & z channels) (waveforms) and sound level (dB(A)) time histories. It also allows various levels of manipulation and control so that you can Expand and Zoom the time histories, scroll through the data, and time locate specific areas of interest. The actual elevator travel time can be measured with a high degree of precision. Analyses of the acceleration data include integration of the vertical acceleration data to develop elevator speed (elevator speed at any point of time) and location (where the elevator is located in distance with respect to its starting point at any point in time) time histories, RMS vibration levels, and high pass and low pass filtered vibration to compare to ISO human response criteria. The EVA software will also automatically locate the full speed section of the elevator ride and measure the peak to peak vibration during that section of the ride.

Before starting the Vibration Analysis Tools it is necessary to select an event or recording to analyze. Choose the File selection from the top Menu Bar.

Select Record
This selection allows you to choose an event to analyze. A list of files will be displayed along with the trigger time & date, and the Report Data field (15 characters) which had been selected. Highlight the event of interest and press Enter or click on the OK button. This record will become the current event. It will remain the current event until a new record is selected or you exit the software. After you have selected a record you can add or edit the Report Data.

Enter Report Data
Once a record has been selected, text information can be stored with each report. There are 10 fields with the Titles that were entered when the EVA software was configured. (The titles can be changed after selecting the recording for storage with the recording.)

Suggestion: Include report information that will help identify the record when you have long forgotten what and why you measured the elevator in the first place. It is good practice to enter common Report Data before transferring to the PC.

Elevator Vibration Analysis Tools

Once you have collected the elevator vibration data, analysis and interpretation becomes the most important part of the operations. This is where you will determine the level of ride quality for the elevator that was measured, and where problems will be identified and corrections planned.

Suggestion: It is a good idea to turn on the Velocity Correction switch at the same time for a normal elevator recording. Make sure that the correct vertical channel has been selected. In normal operations, the Z channel is the vertical channel.

After selecting a record, choose Analysis from the top Menu Bar. Press Enter or click on Vibration Analysis Tools.

The graphics screen (Figure 1) is divided into 4 graphics windows. The top window is used for displaying the Sound Level time history and for extended analyses including the Velocity, Distance, RMS, Jerk, and FFT analyses of the data. The bottom 3 windows are used for displaying the acceleration time histories for the x, y, and z channels, filtered and unfiltered. The acceleration/vibration time histories are the critical data for measuring Ride Quality and identifying problems. With practice they will make perfect sense and you will be able to identify problems with roller guides, rail joints, motor control, and cable vibration very quickly.

Suggestion: Set Vibration & Sound Limits (under **Settings**). This provides a clear visual reference. As an example, 10 milli(g)s peak to peak vibration is defined as the limit of acceptable vibration by many elevator specialists. The limits that are established in the Settings menu (Set Reference Limits) are 0 to peak. Enter 5 for the vibration limit (0 to peak is half of peak to peak) and enter 60 decibels for the sound limit. The limits will appear with the time histories as dashed lines for your visual reference.

At this point the graphics screen will be drawn. The current event data will be loaded and drawn on the display (See Figure 1). Once the data has been displayed all of the tools are available. Commands are listed on the command bar on the left edge.

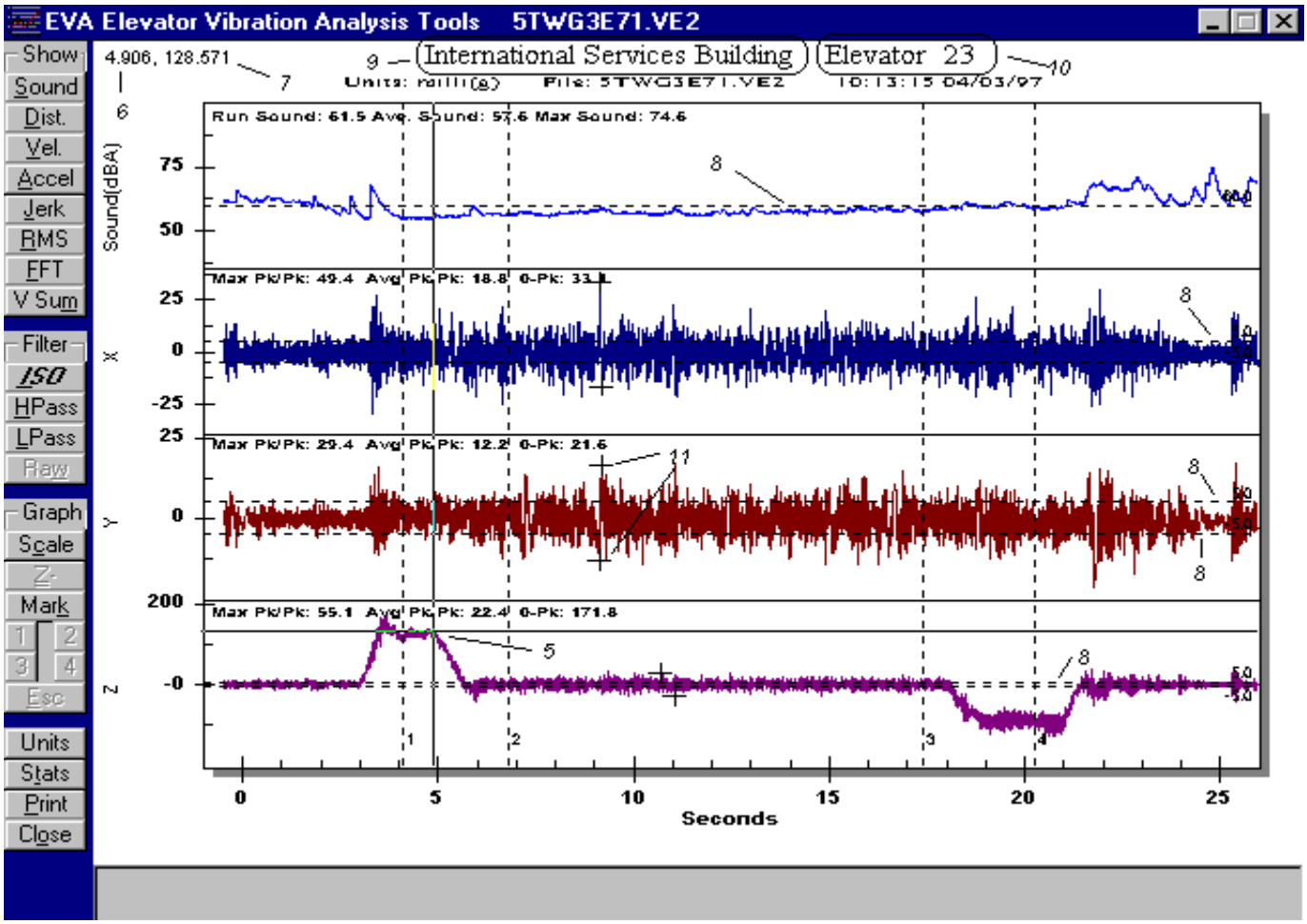


Figure 1

Figure 1 Legend (unfiltered data)

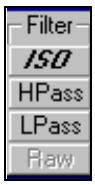
1. Boundary 1 - Point where elevator has travelled 0.5 m (500 mm) from its start position
2. Boundary 2 - Point where elevator has reached 90% of full speed plus 1 second
3. Boundary 3 - Point where elevator has slowed to 90% of its full speed minus 1 second
4. Boundary 4 - Point where elevator has travelled to within 0.5 m (500 mm) from its final position

Note:	**Vertical Channel (normally z channel) Peak to Peak Measurements are made over Full speed section of time history** **Horizontal Channel (normally x, y) Peak to Peak Measurement made over Full Run**

5. Cursor Bar - Movable with arrow, or by selecting a data point (mouse cursor becomes a hand) and clicking.
6. Time Position of Cursor Bar
7. Amplitude Value at cursor bar position, or mouse cursor position. Automatically adjusts depending on which window the cursor is referencing.
8. User Set Reference Limits (See Settings)
9. Displayed Field (See Settings: Enter Report Titles, Set Field Number)
10. Displayed ID Number

Command Bar Definitions

Sound - Display Sound Level Time History in Top Window
Dist. - Display Distance Time History in Top Window
Vel. - Display Velocity Time History in Top Window
Accel. - Display the Acceleration Time History
Jerk - Display Jerk Time History in Top Window
RMS - Display Root Mean Square Time Histories of All Channels (x,y,z)
FFT - Display Fast Fourier Transform of User Selected Data. Place Cursor Bar at position of interest, Click on FFT, Select Channel, Select length of section to analyze (Spectral Analysis)
V Sum - Display Vector Sum Time History in Top Window of User Selected Channels



ISO - Apply Selected ISO Weighting (filter) to the x, y, & z channels for measurement of Human Response (See Description Below)
HPass - High Pass filter Selected, or all channels.
Lpass - Low Pass Filter Selected, or all channels (Cutoff Frequency as Specified under Settings: Set Filter Cutoff Frequency)
Raw - Reload Unfiltered (Raw) Data

Z- Undo Zoom - You can zoom on a section of the time history by moving the mouse cursor to the point of interest and holding the left mouse button down while dragging and creating a zoom box. Select the Z- button to return to a normal display.
Mark - Allow the setting of the measurement points, Start of Motion, Start of Full Speed, End of Full Speed, End of Motion. Select the Mark Button, a message box will open directing you to move the cursor bar to the first point of motion and then press the 1 button. This is repeated until all 4 measurement points have been selected.
Esc - Allows the operator to escape from the Marking operation.

Scale - This grouping offers 2 choices for the scaling of the acceleration and the sound data on both the graphics display and formal printed report.

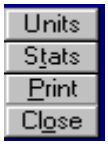
X,Y,Z Scaling
auto - selection of this option allows the software to scale the acceleration plots according to the largest amplitude measured in the acceleration data. The channels are therefore all scaled together. As an example, with this switched on all three channels are scaled together. If the maximum acceleration is on the z channel (e.g. 100 milli(g)s, and 25 milli(g)s on the x & y channels), the software will scale the time history on the display so that the z channel window will span from +100 to -100 milli(g)s. The x and y channels will be scaled so that their windows will also be scaled from +100 to -100 milli(g)s. This allows for a direct visual comparison.

individual - If this option is selected, each of the acceleration windows will scale individually (depending on the peak amplitude within each window).

manual - With this switch on, the scaling can be manually controlled by the operator. (See Set Manual Scaling) As an example, if the manual scale has been set to 50 milli(g)s, the full scale for each of the displayed (or printed) acceleration plots will be +/- 50 milli(g)s. Any greater acceleration levels will be “clipped” at the window boundaries. This is very useful for a visual comparison of one recording to another.

Mic Scaling
auto - selection of this option allows the software to scale the sound plot from 40 to 100 decibels.

manual - With this switch on, the scaling can be manually controlled by the operator.



Units - Set Units of Measure from Within Graphics Display (The data will be re-calculated & re-drawn)
Stats - Statistics (Measurements) Displays Measurements, Performance Measurements, and Analysis. The Page can be printed or closed. (**See Sample Report at back of Manual**)
Print - Print the Graphics to the System Printer
Close - Close Vibration Analysis Tools Data Display

Time Scale – This offers 2 options. Normal displays the full time history. Time Scale Referenced offers a display of the vibration record as referenced to the boundaries. With this selected, the beginning of the displayed time history will begin 3 seconds prior to the point at which the elevator has traveled 0.5 meters from the start position, to 3 seconds after the elevator has reached 0.5 meters from the stop position.

The list of Standard Commands Include:

Standard Commands

→	Right Arrow Moves Cursor Bar 1 Data Point to the Right
←	Left Arrow Moves Cursor Bar 1 Data Point to the Left
↑	Move Cursor Bar Reference Point (Cross Hair) to Window Above
↓	Move Cursor Bar Reference Point (Cross Hair) to Window Below

Right Mouse Button With the Mouse Cursor over the data, pressing on the right mouse button opens a window with various presentation and output option.

Description of Time Histories

Sound

This displays the Sound Level Time History in the top graphics window. This is the default when the Vibration Analysis Tools is started. The analysis is a time history of true RMS, A-weighted, fast response sound levels. This corresponds to how the human ear responds to various frequencies of sound and is what is typically measured using a standard sound level meter. The dotted line represents the limits set in the Configure section. Figure 1 shows a limit set to 65 db(A). The range of the sound window is 40 to 90 decibels.

Velocity (Elevator Speed)

This function performs a mathematical integration of the acceleration time history of the pre-selected vertical channel (See Settings: Units & Analysis). Since the EVA-625 can be used in any orientation to collect acceleration data, it is critical to properly set the vertical channel. The Z channel will correspond to the vertical channel if the EVA-625 was placed on the floor of the elevator with the feet of EVA-625 case on the floor. The elevator velocity time history is displayed in the top graphics window (See Figure 2, with the vertical channel time history immediately beneath). As the cursor bar is moved, the elevator speed is displayed to the right of the time history, in units that were chosen under Settings: Set Units & Analysis. Tested accuracy for this function is between 1 and 5 percent. The small level of inaccuracy results from integration of discrete data, and slight hysterisis in the accelerometers. The Vibration Analysis Tools software has a utility for correcting this under Settings: Set Units & Analysis: Velocity Correction. Normally, have the velocity correction switched to the on position. It may be necessary to switch the velocity correction to the off position when the recording contains multi-floor starts and stops, or the stopping sequence was not recorded in its entirety. The velocity time history is a very useful tool and stands well when compared with a standard tachometer.

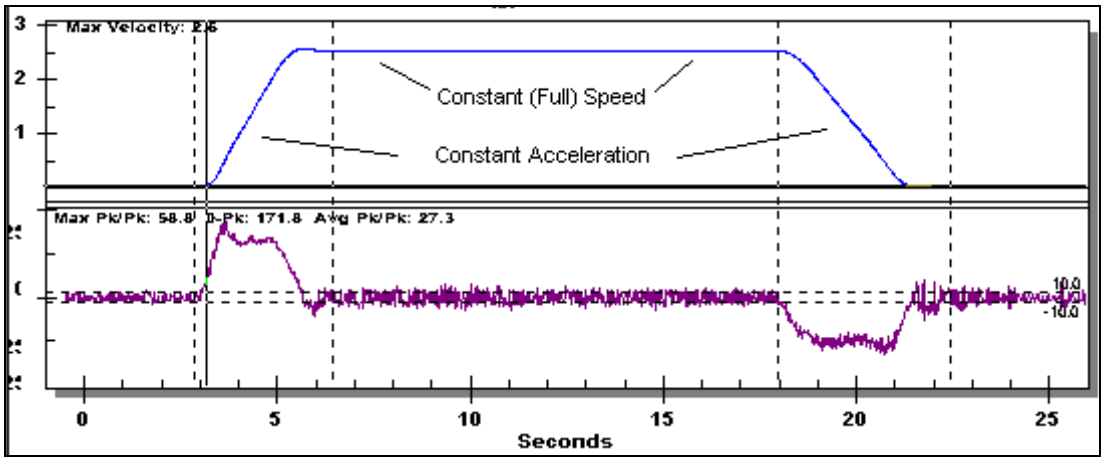


Figure 2
Velocity Time History The maximum velocity is about 2.6 meters/second.

Distance

This function performs 2 integrations of the acceleration time history, of the chosen vertical channel to develop an elevator location time history (where the elevator is with respect to its starting point). The vertical channel is based on what has been set in Settings: Set Units & Analysis:. The Z channel will correspond to the vertical channel if the EVA-625 was placed on the floor of the elevator with the feet of EVA-625 case on the floor. The elevator distance time history is displayed in the top graphics window (Figure 3, with the x channel time history). As the cursor bar is moved, the elevator location in units selected under Settings: Set Units & Analysis. The sign of the measurement indicates that the position is above (+) or below (-) the starting point. Tested accuracy for this function is between 2 to 5 percent. The small level of inaccuracy results from 2 integrations of discrete data, slight hysterisis in the accelerometers and the elevator floor not remaining level.

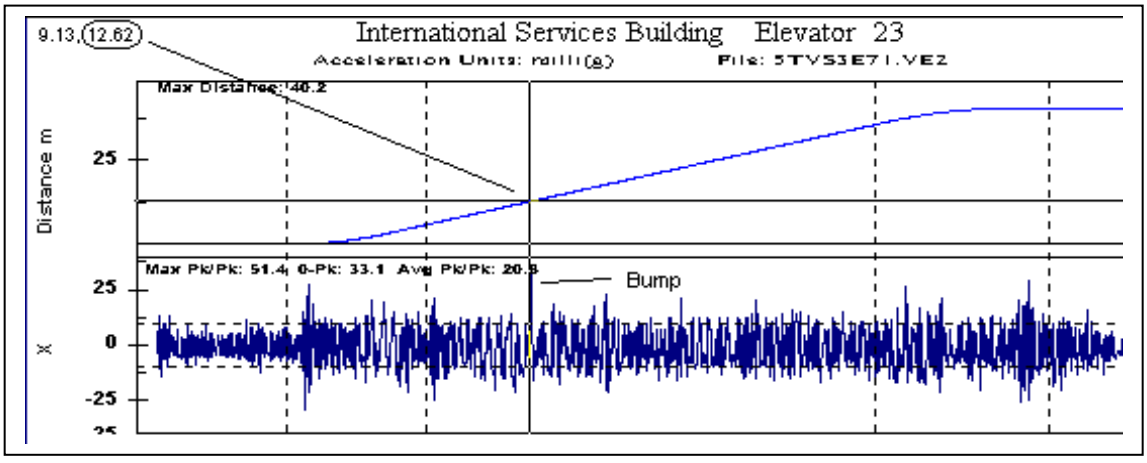


Figure 3
Location Time History Top, X Channel Time History Bottom

Suggestion: The distance time history is useful for locating problems in the hoistway. The "Bump" indicates a mis-aligned rail joint, located at 12.6 meters above where the elevator started moving. The distance from the starting point can be located with good precision. The misaligned rail joint in that area can be inspected visually and identified without having to inspect the entire hoistway.

Jerk
When this function is chosen, an analysis of the selected time history is performed to find the level of sustained jerk throughout the time history. Jerk is calculated from the pre-selected vertical channel (change in acceleration per unit time). Jerk is measured in meters/s^3 or feet/s^3 and is often used as a descriptor for shock. Figure 4 shows the jerk time history. The maximums in the jerk time history align with the maximum slopes in the acceleration (vertical channel) time history.

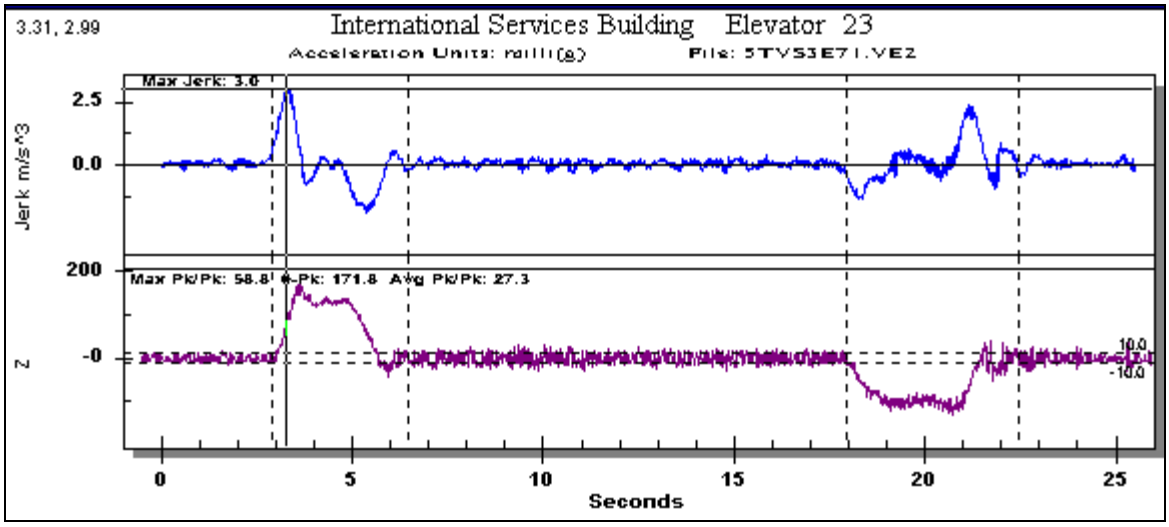


Figure 4

RMS
When this function is chosen, the Root Mean Square analysis of all three channels is performed and displayed.

***ISO* Filter**
The EVA Vibration Analysis Tools allows the acceleration data to be filtered so that measurements correspond with human response to vibration. Interest in Ride Quality or Ride Comfort is in large part the result of human response. Filtering is the mathematical process of removing components of the total vibration signature outside of a certain band of frequencies (the pass band). Specifically, the EVA software allows the acceleration data to be filtered using three different methods. The data can be high pass filtered (cutoff frequency 2 Hz) and/or a low pass filter (cutoff frequency is user specified), with the Sample Rate of 256 SPS. The high pass filter cutoff frequencies changes to about 4 with a data sample rate of 512 SPS. The third filter is the **ISO filter** and is one of the most powerful tools in the EVA Vibration Analysis Tools arsenal. The ISO Filter (or Weighting) is automatically applied to all 3 axes of motion(vertical weighting to the specified vertical channel, and horizontal weighting to the other 2 channels). The ISO filters corresponds to the Human Response characteristics specified in ISO 8041 for whole body horizontal, and whole body vertical, vibration (hence it is especially important to select the proper vertical channel). It should be noted that human response is variable since there are many psychological factors involved but it is a method which is backed by a significant number of empirical studies and allows a repeatable and scientifically explainable method for gauging human response to vibration.

When Elevator Vibration Analysis Tools had been selected for analyzing the vibration, the default selection is Whole Body X,Y,Z. When Escalator Vibration Analysis Tools had been selected, the default is Whole Body Combined.

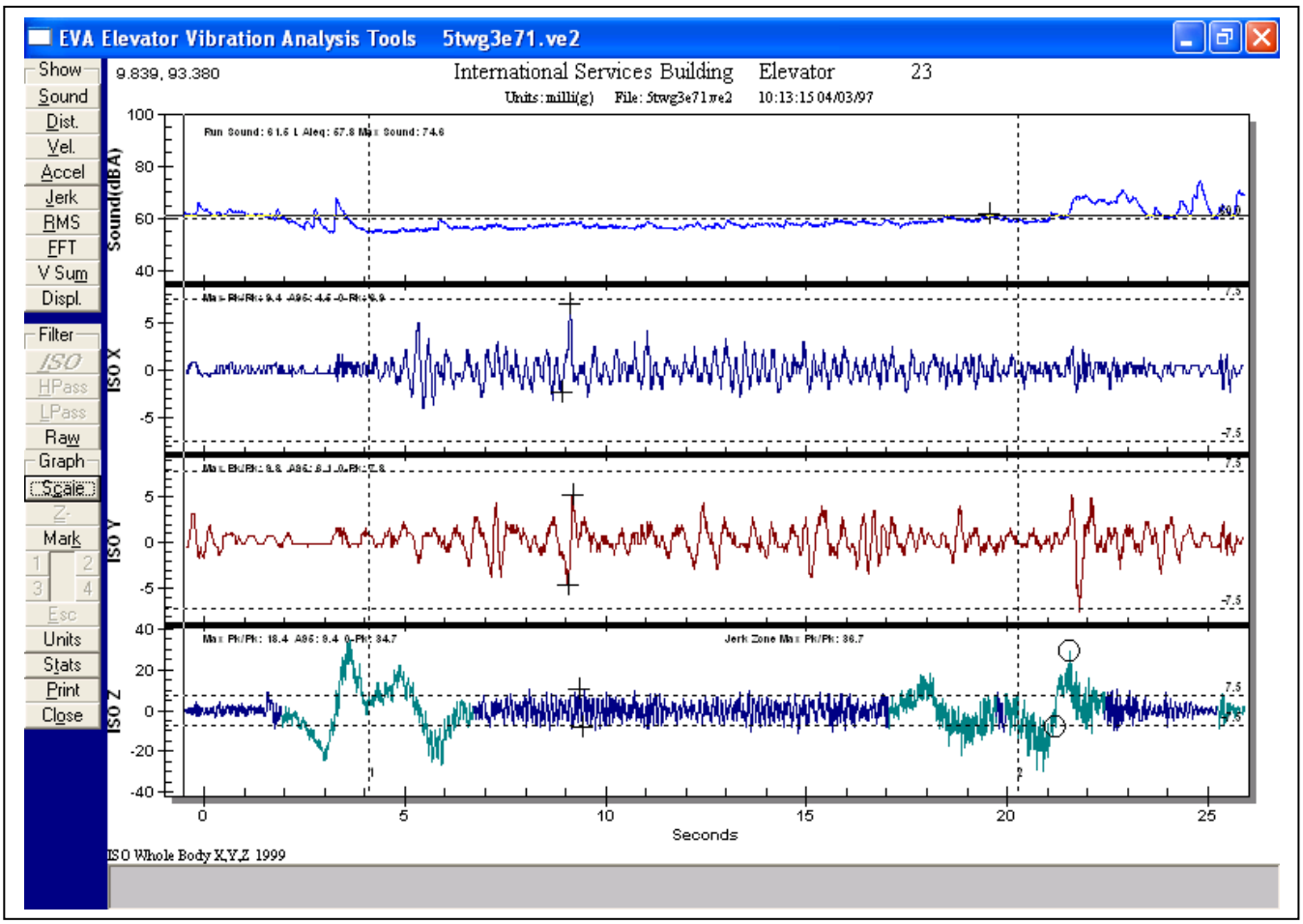


Figure 5

This is the same recording as Figure 1, but after the data has been filtered according to the ISO8041 & ISO18738 standards. Although this is meant to measure vibration in a way which corresponds to what a person would feel, it often also visually enhances the 'bumps' in the hoistway. This is particularly clear on the x channel time history at about 9.5 seconds. That particular bump is the same bump located at about 12.6 meters up.

Note the new boundary designations. Boundary 1 is at 0.5 meters from the start position and boundary 2 is at 0.5 meters from the end position. The vertical axis motion is differentiated by 2 colors, green and blue. Green designates the jerk zone (changing acceleration) and blue designates the non-jerk zone (constant acceleration).

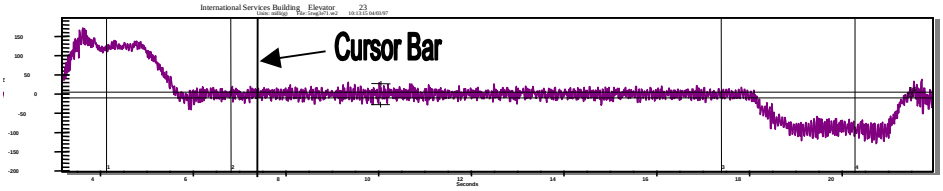
Suggestion: It is often valuable for trouble shooting to perform the ISO filtering and then display the distance time history in the top window. In this way the 'bumps' which can be most readily felt can be located and targeted for repair without inspecting the entire hoist way.

FFT (Fast Fourier Transform)
The FFT is an extremely powerful trouble shooting tool which provides amplitude and frequency information about the vibration of interest. An example would be to identify the vibration which is created by a flat spot on one of the guide rollers. The expected frequency can be calculated based on the diameter of the roller, and the speed of the elevator. For instance, the rotational frequency of a roller is calculated as follows:

Diameter (d) = 152 mm (6 in.)
Speed (v) = **3 meters/second** (9.84 ft/s)
Roller Circumference C = πd = 3.14159 x 152 mm = 577.5 mm = **.5775 meters** = 1.57 ft.
Rotational Frequency = v/C = **3**/**.5775** = 5.19 rotations per second (approx. 5.2 Hz)

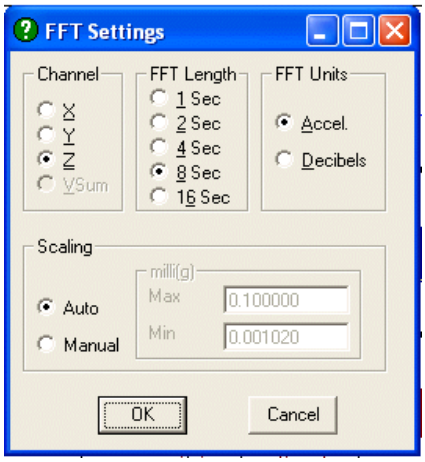
With this in mind, it would be appropriate to look for a 5.2 hertz peak in the FFT analysis. The same logic can be applied to vibration resulting from the sheave. It is important to keep in mind the roller guide vibration would show up in the horizontal axes, while vibration from the sheave would likely show up mainly in the vertical axis.

To utilize the FFT, **move the cursor bar to the beginning of the section of interest** and select the FFT button.



Typically it is best to place the cursor bar in the full speed section of the time history. In this way, rotating elements will be at a constant rotational frequency.

Select the Channel and FFT Duration (Click on OK)

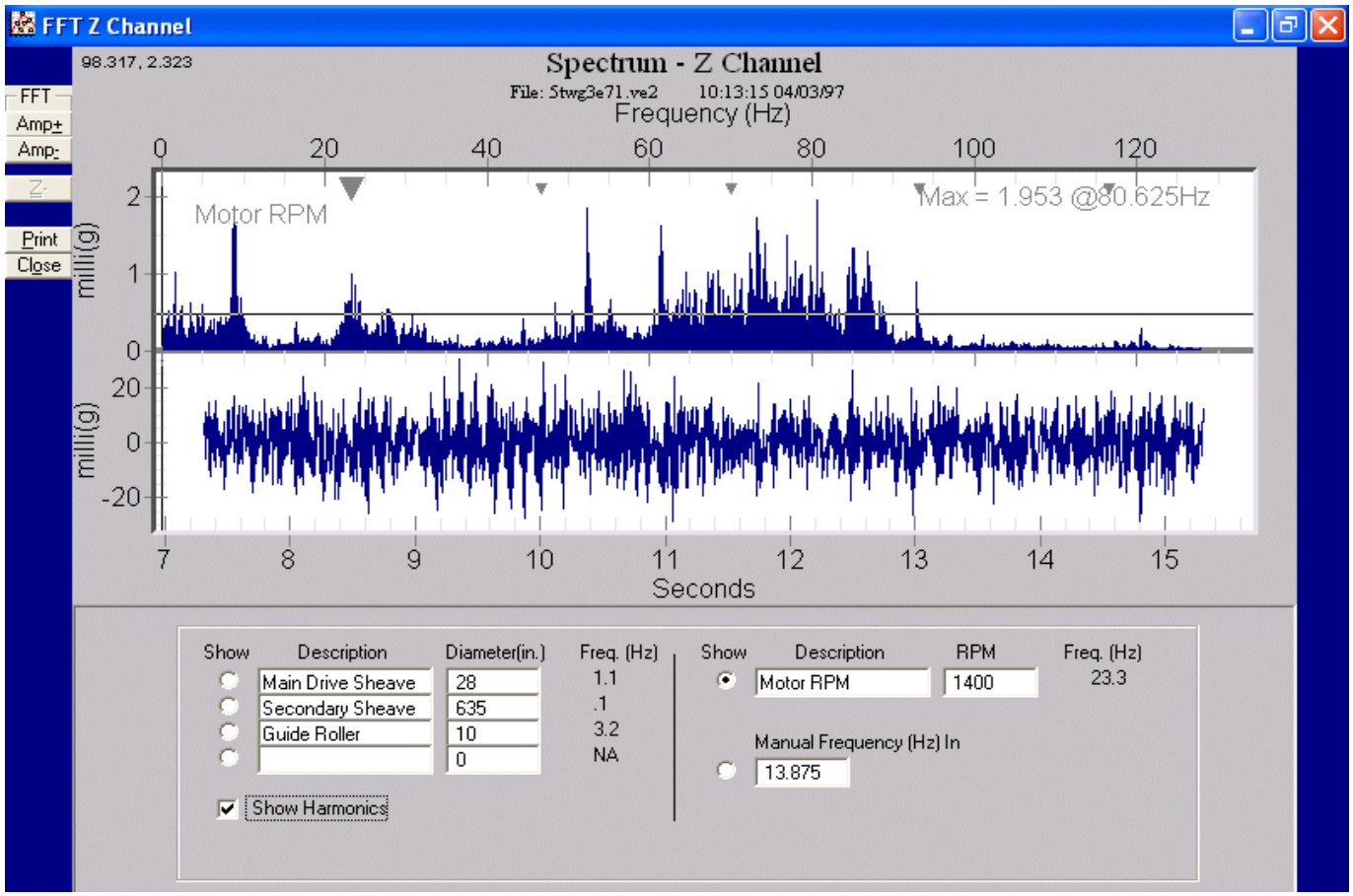


Note that selecting a longer FFT Length provides increased frequency resolution but analyzes a longer section of data. Selection of 1 Second provides a 1 Hz resolution, 2 seconds (0.5 Hz), 4 seconds (0.25 Hz), 8 seconds provides 0.125 Hz resolution, and 16 seconds provides 0.0675 Hz resolution.

FFT Display

The resulting FFT page presents an analysis (upper window)of that section of the z axis (lower window) channel time history. The analysis, or spectrum offers a presentation of vibration level versus frequency. The spectrum below shows significant vibration level at various frequencies. Each of those 'frequency peaks' are related to specific sections of the elevator system. The example below shows that the dominant frequency is at about 80 Hz. Additionally, the FFT page offers the ability to relate specific rotational frequencies based on various inputs.

An example of relating the rotational frequency of a component to the spectrum is shown below. The motor rotational frequency is known to be 1400 RPM. This is input to the RPM box and the spectrum is marked with that frequency by the large triangle. Additionally, the first 5 harmonics will be marked as well if the Show Harmonics check box is selected. Upon inspection, it is clear that the motor rotational frequency corresponds with the local vibration maximum at 23 Hertz. This indicates that the motor rotation (or attached elements) are causing a significant level of vibration. (See notes below)



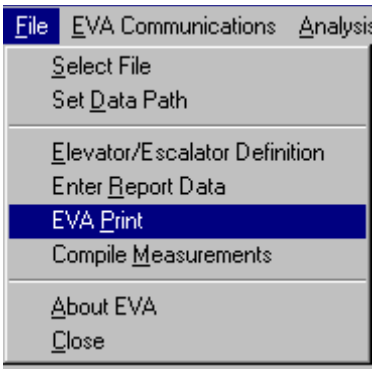
Suggestion: When looking for sources of vibration it is very important to place the cursor bar within the full speed section of the run. During full speed all rotating elements in an elevator system are at constant frequency. Additionally, the software uses the measured full speed to calculate the rotation frequencies for each of the rotation elements specified. The descriptions can be changed. Use the horizontal axes (X, Y) to correlate horizontal sources of vibration (guide rollers). Use the vertical axis (Z) when attempting to correlate vertical vibration sources (sheave, gear box, etc.).

Suggestion: When attempting to identify a problem that affects elevator (or escalator) ride quality, the data should be ISO filtered **before** applying the FFT analysis.

Printing and Output EVA Data

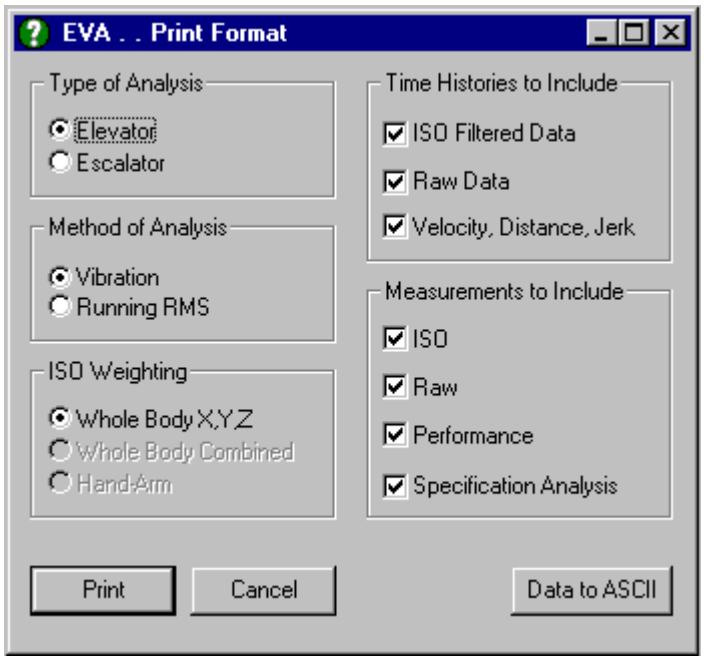
There are several methods for printing or outputting EVA data for presentation or analysis purposes. The most common approach is to print individual reports for each recording. However, the EVA Vibration Analysis Tools software also allows storage of the individual time history data into ASCII files for analysis of data using other analysis software, or compilation of measurements from many recordings to be compiled into a text data base for further analysis using programs such as MS Access or EXCEL. Any data base program can be used that can accept a tab delimited test file. The three methods are described below.

Printing



The EVA software provides two methods of printing. A quick screen print can be performed from the Vibration Analysis Tools graphics display by clicking on the Print button. The more formal method is to select **EVA Print** from the File menu on the top menu bar.

After selecting EVA Print, the directory list will open. Select the record to be printed by double clicking on the record of interest, or highlighting and pressing the S key. The EVA Print Format box will then be displayed:



Type of Analysis, ISO Weighting
The options are Elevator or Escalator. With Elevator selected, the allowable ISO weighting is ISO Whole Body X,Y,Z. When Escalator has been selected, the available ISO Weighting is either Whole Body Combined for measurements on an escalator step, or Hand-Arm for measurements made on an escalator hand rail.

Method of Analysis
Two methods of analysis. With vibration selected, measurements are made in terms of peak to peak vibration. With Running RMS selected measurements and presentation are in terms of RMS vibration levels.

Time Histories to Include
Allows the appropriate time histories to be included as part of the standard report (a sample standard report is included at the end of this manual). For the purposes of describing Ride Quality (also called Ride Comfort) it is important to include the ISO Filtered Data to support the measurements. The raw data mainly has value for trouble shooting purposes and would not generally be included with a report addressing Elevator Ride Quality. The Velocity, Distance, and Jerk time histories would generally be included for the purposes of addressing Elevator Performance. (When Escalator Analysis has been chosen, the Velocity, Distance, Jerk time history selection is disabled.)

Measurements to Include
ISO - Includes the actual measurements which had been found by the software analysis of the ISO time history.
Raw - Vibration Level Measurements from the Raw Data. This generally has little value from a ride quality standpoint and can often confuse the issue.

Performance - Includes the measurements of the performance characteristics of the elevator including maximum velocity, maximum jerk, maximum acceleration and deceleration, and distance traveled.

Specification Analysis - Includes an analysis made of horizontal and vertical vibration (ISO), jerk, velocity (elevator speed), acceleration, and sound levels with respect to the previously entered limitations (See Settings: Set Reference Limits)

Print/Data to ASCII - When the print button is selected, the data is sent to the selected printer. When the Data to ASCII button is selected, the selected time histories are stored into data files (1 for each time history). The ASCII data files will have the same file name (1st 8 characters) as the file selected. However the first two characters of the extension will be such that:
..FXn, FYn, FZn - ISO filtered for the x,y,z channels
..OXn, OYn, OZn - original data (raw) for the x,y,z channels
.MEn - microphone data, .VDn - velocity data, ..DDn - distance data, JDn - jerk data

Compile Measurements - This selection is used to store the measurements into a text file that can be imported into a database manager or spread sheet. The operation is very similar to the printing process except there is no graphical output. After selecting Compile Measurements, the Select File(s) event list will open. Double click on the events to be added to the text file. After clicking on OK, the Compile Format window will open (like Print Format) allow the selection of the method of analysis, allowing the choice of analysis method and the measurements to include. After clicking on the Compile button, the Save As . . . Compiled Data File Name window will be displayed. Either select an existing file (to add new measurements to that existing file), or type in a new file name. After selecting OK, each event will be analyzed, and the selected measurements will be added into the file.

Note: If a previously created file was selected, as message will be displayed asking confirmation to overwrite the existing file. The measurements will simply be appended to the file.

The format of the text file is:
Row 1 = Field Descriptions that are tab delimited
Rows 2 and Higher = tab delimited measurements

Appendix A - Units of Measure

Acceleration

Acceleration is typically measured in g's, meters per second squared (m/s2), feet per second squared (ft/s2), or gals.

$1g = 9.8\ m/s^2$
$1g = 32.2\ ft/s^2$
$1g = 980\ gal$
$1\ gal = 1\ cm/s^2$

The EVA system reports acceleration in milli(g)s. Conversions can be made such that:

$1\ milli(g) = .001g$
$1\ milli(g) = .0098\ m/s^2$
$1\ milli(g) = .032.2\ ft/s^2$
$1\ milli(g) = .980\ gal$

Velocity

The EVA system reports velocity in meters per second (SI units), meters per minute, feet per second, or feet per minute (Imperial units).

Distance

The EVA system reports distance or location in meters (SI units) or feet (Imperial units).

Sound Levels

The EVA reports sound levels in A-Weighted, Fast Response, True RMS measurements as decibels (dB(A))

A decibel is calculated from pressure using:

$$dB = 20\ Log_{10}(p/p_0)$$

Where: p = pressure

p_0 = reference pressure ($20x10^{-6}$ Pa, or $2.9x10^{-9}$ psi)

Appendix B - EVA-625 Specifications

EVA-625 Hardware:

Microprocessor: 8XC52 Family
Memory: Expandable to 1024Kb
Display: 4 Line by 20 Column Liquid Crystal
Keyboard: 1 X 4 Sealed Membrane
Communications: Serial RS232, 57600 Baud
Clock: Integrated Battery Backed Real Time Clock
Battery: 12 Volt, Rechargeable Lead Acid Gel Cel
Battery Life: 20 - 30 Hours Continuous Operation Between Charges
Battery Charger: Universal Voltage

EVA-625 Data Acquisition Characteristics

Sensors: 3 Accelerometers (x, y, z Triaxial Arrangement)
1 Condenser Microphone
A/D Converter: Self-Calibrating
Anti-Aliasing Filters: (Acceleration Channels)
Software Selectable: 80 Hz or 160 Hz Cutoff
Sampling Rate: Software Selectable: 256 SPS/Channel, 512 SPS/Channel
Frequency Response:
Acceleration Channels: Selectable 0 to 80 Hz, 0 to 160 Hz
Microphone Channel: A-Weighted Response Network, to 8 kHz, Type 2S, True RMS Sound Level Measurement, Fast Response
Range: Acceleration Channels, +1.5g to -1.5g
Microphone Channel, 40dB(A) to 90dB(A)
Resolution: Acceleration Channels, 360 micro(g), (.00036g)
Microphone Channel, 1 dB Over Full Range
Base Level Noise: 300 micro(g), (.0003g)
Data Storage: Up to 507 Seconds of 4 Channel Data

EVA Vibration Analysis Tools Software

PC Requirements: Pentium, VGA Required
Windows 95, Windows NT
8 Mb Free on Hard Drive
EVA-625 Configuration
Storage Mode Selection (Through EVA or PC)
Sample Rate/Frequency Response (Through PC)
Trigger Mode/Level (EVA or PC)
Record Time (EVA or PC)
Time/Date (EVA or PC)
PC Configuration
Serial Port Selection COM1 to COM4
Printer Port Selection Windows
Units of Measure: SI/CGS/Imperial
Operational Log Headings
Page Print Header
User Specified Vibration/Sound Limitations for Display/Printing

Packaging:

Case: Structural Resin, Water Proof
Dimensions: 27.3L x 24.7W x 12.7D (cm)
10.7L x 9.7W x 5.0D (in)
Weight: 3.85 (kg), 8.5 (LB)
Accelerometer Housing: Stainless Steel
(Removable as Unit for Reorientation, Attachment to Structural Member)
Microphone Housing: Anodized Aluminum

Specifications Subject to Change Due to Continuous Improvements

Appendix C - MMC & IMD Operations
MMC-1 Controls & Components

MMC-1 Control and Configuration

To use the MMC-1 for recording data, the instrument must be configured appropriately for the operations in which it will be used. The time and date should be set to local time. When it arrives, the MMC-1 will be set to US Eastern time. Partial Configuration of the MMC-1 can be performed through the MMC-1 keyboard or the PC. Complete Configuration can only be performed through the PC. Retrieval of MMC-1 stored data can only be performed using the PC. The MMC-1 real time clock can be set through the PC or MMC-1 keyboard.

MMC-1 to PC Serial Communications

Communication between the MMC-1 and the PC is under software control, and is really very simple. Connect the EVA to PC serial cable, to the PC COM (serial) port which was selected under Configuration, and to the I/O connector on the MMC-1. This is the hardware link between your MMC-1 and PC. The PC end of the cable is a 9 pin female connector. This has become the standard, particularly for notebook PC serial connectors. If your PC has a 25 pin serial connector, a 25 pin to 9 pin adapter can be purchased at any personal computer or electronics store. The MMC-1 end of the cable is a 9 pin male connector. Normally, the connection should be made with the MMC-1 switched into the Off position and the PC turned off.

After the connection has been made, switch the PC on and start the EVA software. Switch the MMC-1 to the On position. Watch the MMC-1 display until the Main Menu is visible. **Any PC to MMC-1 Communications can only be made when the MMC-1 Main Menu is Visible**. In the EVA software, select **EVA Control**, click on **EVA Communications**. This will take you to the EVA Communications program. Select **EVA Control**. The choices are:

Configure EVA/MMC
Retrieve Data
Import USB (EVA8.75.1000)

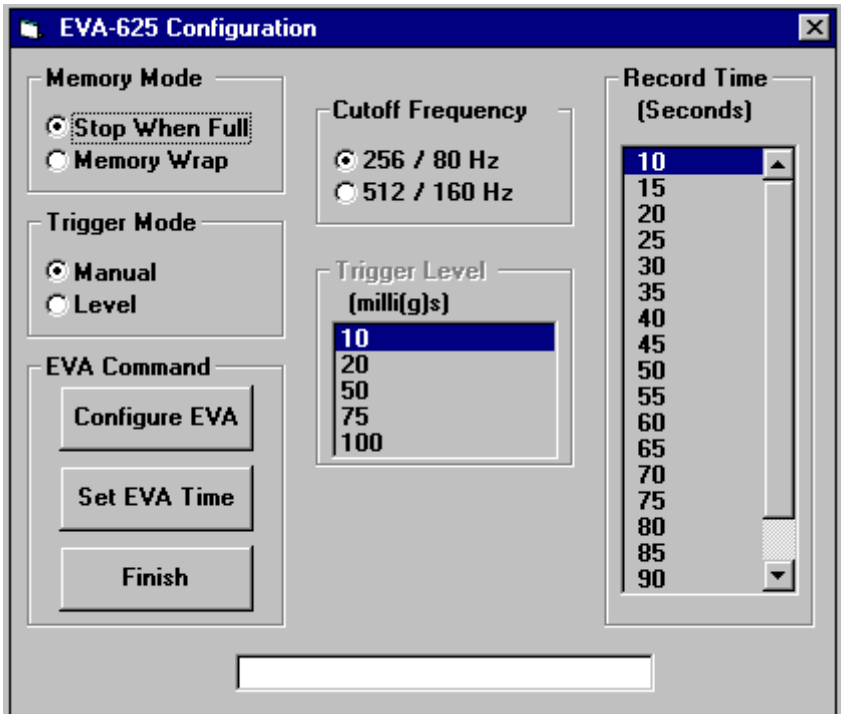
Configure EVA/MMC

Configuration of the MMC-1 consists of setting its operating parameters. Those can be set either through the MMC-1 keyboard or through the PC. Partial configuration is allowed through the MMC-1 keyboard, while a complete configuration can only be accomplished through the PC.

Very Important: Configuring the MMC-1 through the PC will clear the MMC-1 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring.

When the Configure EVA/MMC selection is made, a window will open which shows the operating parameters and their choices. The configuration elements or operating parameters, and how the configuration can be made, are listed as follows:

Parameter	MMC-1	PC
Memory Mode		X
Sample Rate	X	X
Trigger Mode	X	X
Trigger Level	X	X
Record Time	X	X
Time & Date	X	X



If using the keyboard, press the Tab key to move to the appropriate selections, and then send the configuration to the MMC-1 by selecting the displayed **Configure EVA** button. The configuration elements are described as follows:

Memory Mode

The choices are:

Stop When Full
Memory Wrap

This controls how the MMC-1 handles the data it stores. The MMC-1 has up to 700 seconds of data storage capacity. This means that it will store up to a total of 700 seconds of vibration and sound data (Sample Rate = 256 SPS) in records or events of a length which has been configured by setting the Record Time. As an example, lets assume that the Record Time was configured to 30 seconds. The MMC-1 will hold approximately 22 recordings (events). If the MMC-1 was configured to Stop When Full, when the memory is full, the MMC-1 will not allow any further recordings until the data has been transferred and the unit was reconfigured to clear the memory. If the MMC-1 was configured to Memory Wrap, then when the memory has been filled, the oldest recording will be overwritten by

the newest recording. The Memory Mode can only be changed through the EVA software running on the PC.

Suggestion: Operate in Stop When Full Memory Mode. This will ensure that data will not be lost without the chance to offload the previously stored data.

Sample Rate

The Sample Rate/Cutoff Frequency Selections are:

256 SPS / 80 Hz
512 SPS/ 160 Hz

The sample rate and cutoff frequency is selected based on the range of vibration frequencies in which you are interested. When the sample rate is selected at 256, the MMC-1 chooses the appropriate internal hardware filter and records 256 samples per second per channel. In this mode, the vibration frequency response of the MMC-1 is 0 Hz to 80 Hz (hertz). The selection also affects the number of available recordings. The 256 Sample Rate selection provides about 700 seconds of available memory, while the 512 Sample Rate selection provides about 250 seconds of available memory. Twice as much data is stored, per second of recording, when the unit is configured for a sample rate of 512 samples per second per channel.

Note: The maximum Record Time allowed is 120 seconds for 256 SPS/Channel, and 60 seconds for 512 SPS/Channel.

Suggestion: Normally for recording elevator/escalator vibration, a Sample Rate selection of 256 is more than sufficient. A Sample Rate of 512 is only used when interested in specific mechanical elements or if very high frequencies are of interest.

Trigger Mode

The Trigger Mode choices are:

Manual

The Trigger Mode is how the MMC-1 determines when to start recording. As an example, if the Trigger Mode is configured as Manual, the MMC-1 will only start recording when the ENT key on the keyboard or the start switch on the outside of the case is pressed. This allows control of exactly when the MMC-1 starts recording.

Level

The selection allows the MMC-1 to start recording based on a level, or threshold, of vibration. If the Level mode is selected, you must configure a trigger level as well. The choices of Trigger Levels are shown above. As an example, if Level mode is selected, and a Trigger Level of 20 milli(g)s is chosen, the MMC-1 will wait until at least a level of 20 milli(g)s of vibration is reached before it begins to record.

Suggestion: It is our experience that the Manual Mode offers the best control of when and what to record. In Level Mode, the system may start recording due to an unplanned movement by the operator. The Trigger Mode can be changed at any time through the MMC-1 keyboard.

Record Time

The Record Time selection allows you to configure the MMC-1 to record for a length of time after the unit triggers. The maximum allowable record time for a single recording is 120 seconds with the system configured to a Sample Rate of 256 SPS/Channel. The maximum allowable record time is 60 seconds, with the system configured to a Sample Rate of 512 SPS/Channel. **Do <u>Not</u> set a Record Time of Greater Than 60 Seconds When the MMC-1 is Configured for a Sample Rate of 512 SPS**. Future versions of the EVA software will handle PC memory to allow for the increased amount of data.

> **Note**: The MMC-1 allows you to stop recording at any time by pressing the ESC key, or the start switch or external switch. This allows the maximum use of MMC-1 available memory.

Configure EVA/MMC

When the desired changes have been made to the configuration, it is time to send this information to the MMC-1. If using the keyboard, repeatedly press the Tab key until you have reached the **Configure EVA** button, and press **Enter**. The configuration will be transmitted via the serial port to the MMC-1. A short message should appear on the PC display (**EVA Communications Open**). At the same time, a message will appear on the MMC-1 display, **Communicating with PC**. When the data has been transmitted, the message will disappear from the PC display, and the MMC-1 will restart with the new configuration. A success message will be displayed if the transfer was completed without problems.

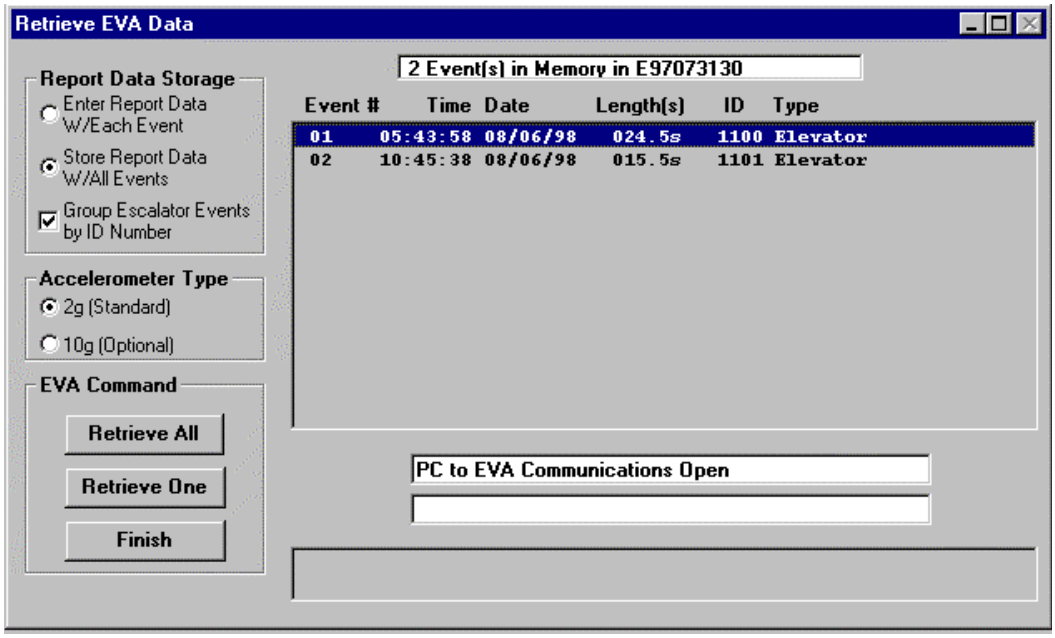
Remember: Configuring the MMC-1 through the PC will clear the MMC-1 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring.

Suggestion: Watch the MMC-1 display to verify that communications were completed. If there were any type of communications failure, it is possible that the **Communicating with PC** message will remain on the display. This means that the unit is still waiting for the end of the data. (It did not receive all of the data that it needs to configure). Should this happen, switch off and then restart the MMC-1, check all connections, and go back to Configure EVA.

Set Time & Date

This selection sends the time & date which is currently set in your PC. The time & date is very important to the MMC-1 since all data files are time stamped, and the EVA software uses the time stamp to create file names for the data that is transferred from the MMC-1.

Retrieve EVA/MMC Data



This selection is used to transfer data which has been stored in the MMC-1 to the PC. The MMC-1 and the PC must be connected by the MMC-1 to PC serial cable. When this selection is made, the EVA software communicates with the MMC-1 and determines how many events are stored. It then displays a list of the events stored, the trigger time and date for each recording, and the length in seconds of each recording. To transfer, it is necessary to select either **Retrieve All**, or **Retrieve One** under **EVA Command**. Retrieve All is selected to transfer all events stored in memory. Retrieve One allows the user to transfer the highlighted event. (Use the up and down arrows or click with the mouse to highlight the desired event). The example below indicates that there are 2 events in memory.

Two Report Storage options are available. They are:

Enter Report Data With Each Event
This selection forces the software to stop before the transfer of each recording to allow the user to enter Report Data.

Store Report Data With All Events
When this selection is made, the system allows the input of the Report Data before the first recording and then stores that data with all transferred recordings.

Group Escalator Events by ID Number
With this selection, escalator type recordings are automatically named based on the first recording with a specific ID number. For example, a measurement of an escalator would likely include vibration measurements of the step, left hand rail, right hand rail, sound level measurements, and tachometer measurements, while all measurements made of this escalator have the same ID number (identification number). With this selection turned on, the first recording made with a specific ID number is used to create the file name based on the trigger time and date of that recording. All subsequent recordings that have that same ID number will be transferred with the same base file name, but different file extensions will be used for each of the types of recordings. It is recommended that this switch be turned on. In this way, when an escalator record is being analyzed, the software will automatically load all of the related files.

Accelerometer Type
Two SA accelerometers are currently available for the MMC-1 (2g or 10g range). The appropriate accelerometer should be selected (checked) **before** downloading. The default setting is 2g.

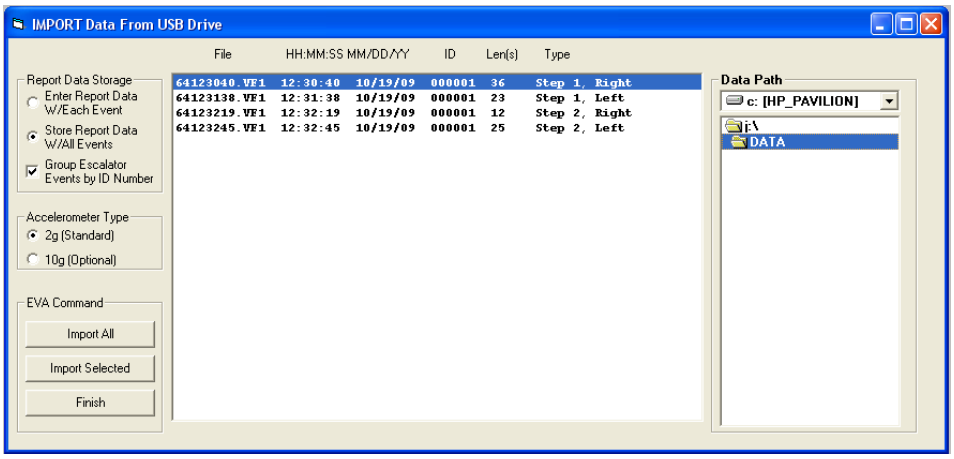
After the Report Data has been accepted, the current data path is displayed. The user can then direct the data to any available directory. File names for the data files will be created automatically from the trigger time & date, and the MMC-1 serial number. (The trigger time & date, is the time & date that the MMC-1 triggered to record that particular event.) When the transfer is completed, click on the Finish button to end Communications between the PC and the MMC-1.

Suggestion: Verify that the recordings have been transferred properly by viewing the data graphically before clearing the memory of the MMC-1.

Transfer of Files Stored on the USB Flash Drive to the PC/Laptop Hard Drive
Now that the Elevator/Escalator events have been stored on the Flash Drive, they must be imported by the EVA Vibration Analysis Tools Software.

a. Insert the USB Flash Drive into the USB port on your PC or Laptop. Windows will automatically open a window asking what you wish to do with the files located on your removable storage device. Take note of the letter designation given to that port, such as **J:,** then close this window.

b. Open the EVA Vibration Analysis Tools Software Version 8.75.1000 or higher, then select **EVA/MMC Communications>Import USB Data**. This will open the Import Data from USB Drive Window shown below;



At this point, the EVA software is asking for where it should look for the Elevator/Escalator files, under Data Path, select the appropriate drive letter in the drop down box then select the appropriate folder location.

It then displays a list of the events stored, the trigger time and date for each recording, the length in seconds of each recording, and finally the type of recording that was made. To import, it is necessary to select either **Import All**, or **Import Selected** under **EVA Command**. Import All is selected to transfer all events stored on the flash drive. Import Selected allows the user to transfer a selected event. (Use the up and down arrows to highlight the desired event and **double click** with the mouse to mark the event). The example above indicates that there are 4 events on the drive.

Two Report Storage options are available. They are:

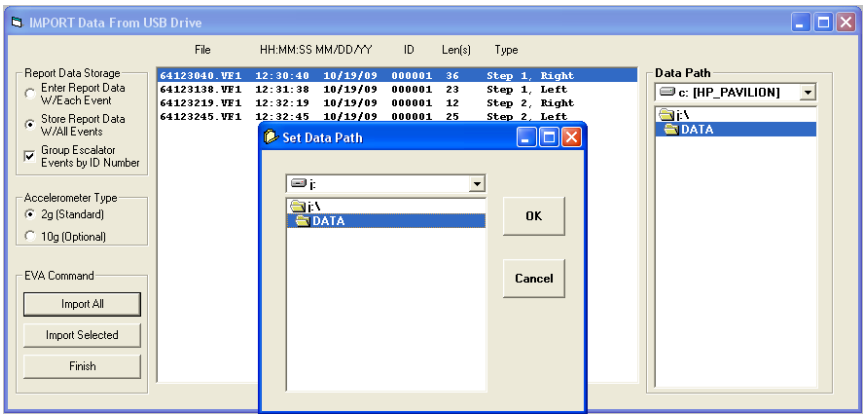
Enter Report Data With Each Event
This selection forces the software to stop before the transfer of each recording to allow the user to enter Report Data.

Store Report Data With All Events
When this selection is made, the system allows the input of the Report Data before the first recording and then stores that data with all transferred recordings.

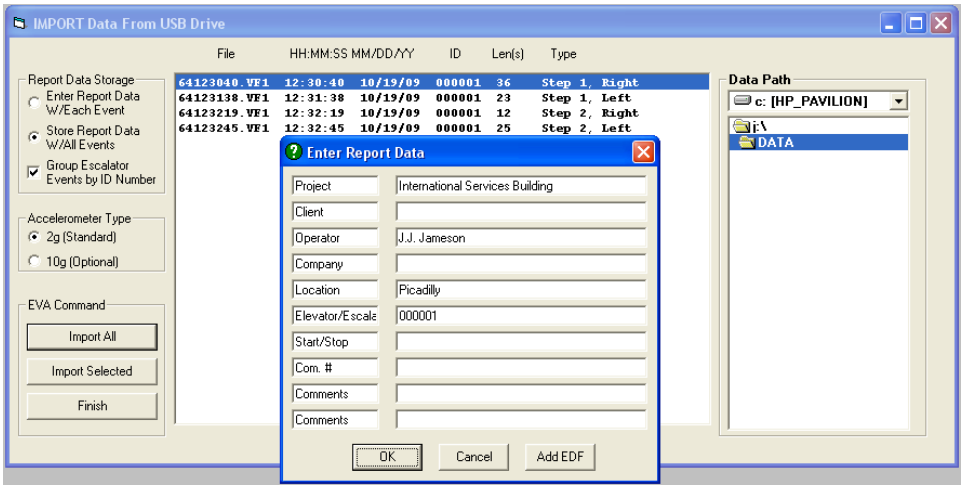
Group Escalator Events by ID Number
With this selection, escalator type recordings are automatically named based on the first recording with a specific ID number. For example, a measurement of an escalator would likely include vibration measurements of the step, left hand rail, right hand rail, sound level measurements, and tachometer measurements, while all measurements made of this escalator have the same ID number (identification number). With this selection turned on, the first recording made with a specific ID number is used to create the file name based on the trigger time and date of that recording. All subsequent recordings that have that same ID number will be transferred with the same base file name, but different file extensions will be used for each of the types of recordings. It is recommended that this switch be turned on. In this way, when an escalator record is being analyzed, the software will automatically load all of the related files.

Accelerometer Type
Two SA accelerometers are currently available for the MMC-1 (2g or 10g range). The appropriate accelerometer should be selected (checked) **before** downloading. The default setting is 2g.

Once the Import method and files to be imported have been chosen, the current data path is displayed. The user can then direct the data to any available directory. File names for the data files will be created automatically from the trigger time & date, and the EVA-625/MMC-1 serial number. (The trigger time & date, is the time & date that the EVA-625/MMC-1 triggered to record that particular event.) Click **OK** to continue.



Next, the **Enter Report Data** window appears, as shown below. Here is where the user can enter information related to the project to be stored with the recordings. It is important to note that when analyzing Step/Skirt Performance Index recordings, only data entered in the fields next to Project and Elevator/Escalator will be shown on the printed report. Click **OK** to continue.



As each file is transferred, an OK appears to the right. Once the files have been transferred, click Finish to close the window and begin analyzing the recordings.

MMC-1 Operations

MMC-1 Components

The MMC-1 is a high accuracy digital data recorder, that has been designed specifically to record sensor data for elevators and escalators. The basic components of the system are the internal electronics (digital & analog), liquid crystal display, 4 key keypad, Start/Stop switch, and battery. The latest versions of the MMC-1 additionally have a jack to the right of the case handle for optional pendant switch for stand-off triggering. The system was designed to be reliable & rugged, but it is a high sensitivity measuring instrument and caution must be exercised. **Note: It is not necessary to take your PC into the field for EVA/MMC operations**.

Sensor Types

The MMC-1 can accept a variety of PMT supplied sensors, including the IMD-1 Index Measurement platform, E2G03 Triaxial accelerometer, E10G01 uniaxial 10g accelerometer, and the ETCH01 tachometer. Additional sensors will be released in the future for the MMC-1. All sensors are connected to the Sensor Input connector mounted on the keyboard plate. The electrical connection is made through a 9 pin connector. Only PMT SA sensors should be connected to the Sensor Input connector, unless specifically approved by PMT. Additionally, the PMT supplied serial/extension cable may be used as an extension cable for the SA sensors. **If that cable is lost, use a replacement with straight-through connections (pin 1 to pin 1, pin 2 to pin 2,.....pin 9 to pin 9). Using cables which are not straight-through can severely damage the MMC-1 and/or sensor electronics**.

Accelerometer – Triaxial (optional)

The axes of sensitivity for the E2G03 accelerometer package are called the X, Y, & Z axes .and are noted on the accelerometer package.

Note: The two mounting holes can be used for attachment to the desired mechanical element. Be careful not to bend the accelerometer package mounting ears, since this can disturb the orientation (tilt) of the accelerometer package when remounted in the MMC-1. **Do not remove or install the accelerometer package with the MMC-1 powered**. Use the supplied extension cable to make the electrical

connections between the accelerometers and the MMC-1. The cable length is approximately 2 meters which will provide stand-off measurement capability. If a greater length is required, please contact your supplier or the factory.

Suggestion: When mounting the accelerometer package, make certain that the extension cable is attached to the mechanical element as well, since unwanted vibration can be recorded if the cable is free-swinging. Use tape or another means to make certain that the cable will not move relative to the accelerometer package, particularly close to the connection. When mounting the accelerometer package, make note of the orientation of the axes with respect to the mechanical element being measured. This will greatly enhance your understanding of the measurements when you later analyze the data. When using the mounting ears tighten only enough to ensure that there will be no relative motion between the accelerometer package and the element being measured.

Tachometer (optional)
The optional ETCH01 tachometer can be added to the MMC-1 to greatly expand functionality. This addition allows the recording or operating in real time mode for the purposes of measuring escalator handrail to step speed, recording escalator braking, recording elevator door motion, or general use as a digital tachometer. The tachometer is connected to the 9 pin **Sensor Input** connector on the keyboard.

Index Measurement Device (optional)
The optional IMD-1 index measurement device allows the MMC-1 to record escalator loaded gap/coefficient of friction data to fulfill the requirements of A17.1-2000. The IMD-1 data is fully compatible with EVA software version 6.00 or higher (EPROM or PC). See IMD-1 Operations Manual. The IMD-1 cable must be attached to the **Sensor Input** connector for all measurements.

Electronics
The internal electronics are low power CMOS circuitry and should not be handled by anyone other than factory, or factory approved, personnel. Be careful to avoid static discharges as damage could result. All signal conditioning and digital electronics are within the MMC-1.

Liquid Crystal Display (LCD)
The MMC-1 LCD is 4 lines by 20 characters, and with the keypad, provides the user interface while operating in the field. Never drop anything on to, or press on, the LCD, since it can be damaged.

KeyPad
The 4 key keypad allows the MMC-1 system to be configured while operating in the field. A PC is not necessary to operate the MMC-1 or change necessary operating parameters.

Start/Stop Switch
This switch is used for manual triggering, and to stop recording (outside of case, near handle). It has the function of the ENT and ESC keys while in the record mode.

Battery & Charger
The battery is a 12 volt lead-acid gel-cel. Normal continuous operating time for the MMC-1 is between 20 and 30 hours depending on temperature and age. The battery should never be allowed to discharge to below 10.5 volts, since battery life will be reduced. If it is allowed to discharge down below 9 volts, it may never recover even with charging, and will have to be replaced. The battery type is a NP2-12 manufactured by Yuasa. Always charge the battery after use to a full charge. The supplied battery charger is the universal voltage type. The connector power jack is on the top plate of the MMC-1. **Always charge the battery with the lid fully opened, and the MMC-1 switched to the Off position**.

Switch the MMC-1 to the off position, when not in use. Over discharging will damage the internal battery.

Operating the MMC-1

Operating the MMC-1 is very easy, but it is important to develop and follow a methodology or procedure which can be repeated exactly. In this way, measurements and data can be compared over time. It is very important that the "how measured" be standardized and repeatable.

Operating
Switch the MMC-1 to the On position and verify that the battery voltage is within acceptable limits and that the MMC-1 time and date is correct. This is very important since file names and time stamps use the system clock. If it is incorrect, reset the time and date. The number of events recorded and the number of seconds of available memory will then be displayed. Verify that there is sufficient memory to make your recording. The MMC-1 configuration will then be displayed, including: Record Length in seconds (how long the MMC-1 will record after it triggers), the Trigger Mode (Manual or Level), the Memory Mode (Stop or Wrap), and Sample Rate. Make sure that the Record Length is long enough to record the entire elevator ride. If required, change the record length using the keypad. The Trigger Mode can be changed as well, but Manual Trigger is recommended. The Memory Mode and Sample Rate can only be changed using the EVA software and PC. Selections from the Main Menu are made by using the up↑ and down ↓ arrows and pressing the ENT key.

Main Menu
The **Main Menu** offers four choices:

SA SENSORS
MEASURE INDEX
CONFIGURE
CHECK BATTERY

SA SENSORS
When you have verified that the MMC-1 is configured properly, you can now record the elevator ride, or measure ambient vibration and sound levels. At the Main Menu the selection arrow will be pointing at the Measure Ride selection. Press the ENT key. The display will then indicate the sub-menu:

SPECIAL APP. SENSORS
ACCELEROMETER
TACHOMETER
REAL TIME MODE

ACCELEROMETER
When this selection is made the display will indicate:

Set ID#

Set ID#
This is used to enter an identifier number for the recording. The ID# is selected by using the up and down arrows and pressing ENT to accept the displayed number. The ID# will be stored with field number 6 of the Report Data. It is a good idea to use this feature to keep track of your recordings.

After pressing the ENT key,

RECORD EVENT
PRESS ENT OR START
SWITCH TO BEGIN
PRESS ESC TO EXIT

will be displayed.

Do not change the orientation of the accelerometer when this message is displayed. This is when the system self corrects for the present sensor orientation. Press the ENT key to tell the MMC-1 to wait for a trigger. The message:

WAITING FOR TRIGGER
PRESS ESC TO EXIT

will be displayed. At this point, the Start or ENT switch can be pressed (if in Manual Trigger Mode) on the MMC-1 to trigger the recording to begin. The message RECORDING will be displayed. The system may be allowed up to the configured record time, or can be stopped at any point by pressing, the ENT, ESC, or start switched. When the recording has finished, the maximum acceleration levels (in milli(g)s) for each of the 3 axes, and highest sound level (in decibels) that were recorded during the period, will be displayed. An example is:

X= 30m(g) Y= 26m(g)
Z=100m(g)
ENT/START TO RECORD
PRESS ESC TO EXIT

When finished, press the ESC key to return to the Main Menu. The data is stored in non-volatile memory and the MMC-1 can be switched to the Off position. **Always switch off the MMC-1 from the Main Menu. Data files can be corrupted by switching the MMC-1 off from any other than the Main Menu.**

TACHOMETER - This selection is intended for use with the optional ETCH01 tachometer. As before, return to the main menu and switch off the MMC-1. Connect the tachometer cable to the Sensor Input connector. Continue to the WAITING FOR TRIGGER MESSAGE. Then hold the tachometer wheel against the moving element with just sufficient force to ensure that there is no slippage. Press the trigger switch and hold it as steady as possible.

Real Time Mode
This selection under SA SENSORS is used to measure vibration or velocity with the tachometer connected.. This is very useful for measuring ambient levels, or for measuring machine vibration levels. Use the Start switch to begin and to end. The maximum level of vibration for each of the 3 axes and maximum sound level for the preceding .25 seconds is displayed and updated every .25 seconds.

Other Main Menu Selections

Measure Index
Although the IMD-1 is a SA sensor, it is treated separately as the measurements are significantly more complex. The Measure Index selection allows the operator to make structured measurements of escalator loaded gap and coefficient of friction in conformance with A17.1-2000 code requirements. The measurements are made using the IMD-1 index measurement device. The IMD-1 attaches to an escalator step and applies a 12 Newton (25 lb.) force on the skirt, thereby pushing the step away from the skirt panel. The distance between the step and the

skirt is the loaded gap. Additionally, the IMD-1 contains a sensor to measure the frictional force between a standard polycarbonate friction surface and the escalator skirt. The use of the IMD-1 with the MMC-1 is further described in IMD-1 Operations Manual.

Configure: For MMC-1 Versions Using Serial Communications
The Configure selection displays the menu:

CONFIGURE

SET OPERATIONS
SET TIME & DATE
SYSTEM RESET

Set Operations
Selecting Set Operations allows you to change the MMC-1 configuration without the PC. The first menu to be displayed will be

SET SAMPLE RATE
► 256 SPS
512 SPS

The choice of sample rate is determined by the frequency of interest to be measured and mainly applies to measurements of acceleration. Normally, 256 samples per second would be utilized for vibration measurements covering the frequency range of interest for elevator/escalator ride quality measurement. Press ENT to accept.

The next menu selection is:

SET RECORD TIME
10 SECOND(S)

Use the up and down arrows to change the Record Time from 10 to 120 seconds in 5 second increments. Press ENT to accept.

The message menu selection displayed is:

SET TRIGGER MODE

►MANUAL
LEVEL

If Manual is selected, the configuration is changed and stored. Control is returned to the Main Menu. If you select Level the message

SET TRIGGER LEVEL

is displayed. Use the up and down arrows to select from trigger levels between 10 and 100 milli(g)s. Pressing ENT will save the configuration and return you to the Main Menu.

Note: It is suggested that Manual trigger mode should be selected. This allows the operator to completely control when the recording should start. Level Trigger mode is normally used when the operator can not be with the instrument to start the recording.

The final Menu displayed in the configuration sequence is:

SET DELAY TIME

0 SECOND(S)

The purpose of delay time is to allow the instrument to begin recording after a configured period of time (from 0 to 30 seconds). As an example, if the operator had selected a 5 second delay time, the instrument will begin recording 5 seconds after pressing the record start switch or ENT key. It is primarily intended to be used during measurements of the step/skirt performance index. By using the delay, the operator can set-up the MMC-1/IMD-1 on the escalator step and then press the start key to begin the delay interval. This will give the operator t sufficient time to allow the operator to get off the escalator and then start the escalator before the actual recording begins.

Set Date & Time

The set date & time window will be displayed.

SET DATE & TIME
DATE TIME
MM-DD-YY HH:MM:SS
01- - - -

Use the up and down arrows to change the month to the appropriate month and press the ENT key. Repeat for Day (DD), Year (YY), Hour (HH), Minute (MM), Second (SS). Just pressing the ENT key will accept the present values.

System Reset

This selection allows the user to empty the MMC-1 memory without resetting through a PC. To clear the memory it is necessary to confirm by selecting **YES**.

Configure: For MMC-1 Versions Using USB Flash Memory

The Configure selection displays the menu:

CONFIGURE

SET OPERATIONS
SET TIME & DATE
SYSTEM UTILITIES

Set Operations

Selecting Set Operations allows you to change the EVA-625 configuration without the PC. The first message to be displayed will be

SET OPERATIONS

Use the up and down arrows to change the Record Time from 10 to 100 seconds in 5 second increments. Press ENT to accept. The message SET TRIGGER MODE will be displayed. The choices are:

MANUAL
LEVEL

If Manual is selected, the configuration is changed and stored. Control is returned to the Main Menu. If you select Level the message

SET TRIGGER LEVEL

is displayed. Use the up and down arrows to select from trigger levels between 10 and 100 milli(g)s. Pressing ENT will save the configuration and return you to the Main Menu.

Set Date & Time

The set date & time window will be displayed.

SET DATE & TIME
DATE TIME
MM-DD-YY HH:MM:SS
01- - - -

Use the up and down arrows to change the month to the appropriate month and press the ENT key. Repeat for Day (DD), Year (YY), Hour (HH), Minute (MM), Second (SS). Just pressing the ENT key will accept the present values.

System Utilities
Selecting System Utilities leads to a submenu of;

USB Drive Stats
System Reset

Selecting **USB Drive Stats** will search the installed Flash Drive to determine both the size of the drive and the remaining free space. This can take quite some time on drives larger than 2GB.

Selecting **System Reset** will reset all internal variables to the factory default as in previous versions. This will NOT clear the Flash Drive. The user will need to reconfigure the system parameters to the desired values.

Check Battery
This selection displays the present battery voltage. **A recharge warning will be displayed if below 11.5 volts. If the battery voltage drops below 10 volts, the EVA will not allow further operations until the battery has been recharged.**

APPENDIX D - Measurement of the Step/Skirt Performance Index

Overview

The step/skirt performance index is calculated from the measurement of two quantities and is defined only for the inclined section of the escalator. The first quantity is the loaded gap($\mathbf{L_g}$). This is the distance between the edge of the step and skirt, while the step is 'pushed away' from the skirt using a force of approximately 110 N (25 lbs.). The second quantity measured is the coefficient of sliding friction ($\boldsymbol{\mu}$) between the skirt panel and a standard polycarbonate test sample (PMT supplied). The Index is defined as:

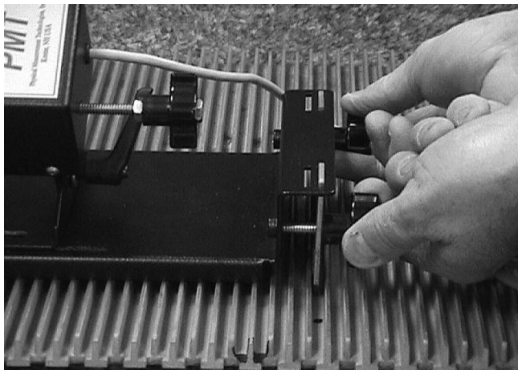
(a) Step/Skirt Performance Index = $e^y/(e^y + 1)$

Where: $y = -3.77 + 2.37(\boldsymbol{\mu}) + 0.37\ (\mathbf{L_g})$

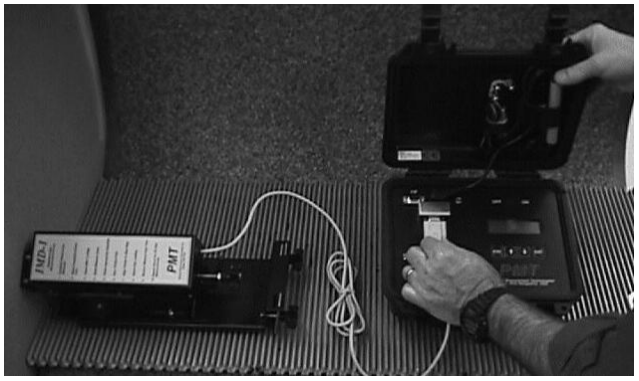
$e = 2.7183$

($\mathbf{L_g}$ in mm)

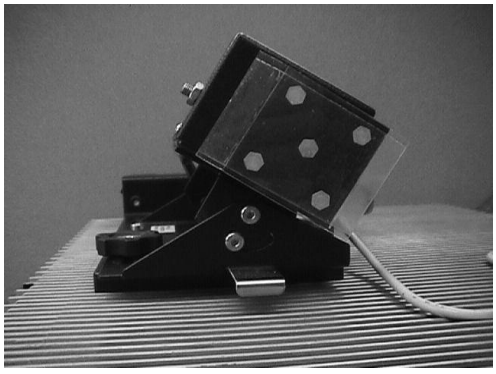
Specifically, the measurements are made on each side of two steps, separated by at least 8 steps. One step should be representative of the typical step. Additionally, the operator should attempt to identify the worst case step and make the measurements on this step as well. To conduct the index measurements:



Attach IMD-1 to the Escalator Step



Remove Accelerometer & Connect IMD-1 to MMC-1 to Accelerometer Input



When attaching the IMD-1 to the escalator be careful not to over tighten. Additionally attach the IMD-1 cable to the accelerometer analog input, not the I/O port that is used for serial communications. The MMC-1 can then be switched On. **Attach the IMD-1 With the Escalator Off (not running).**

Attach a new polycarbonate friction face to the IMD-1 by removing the paper backing to expose the adhesive. The adhesive is not aggressive and is meant only to hold the friction face in place long enough to adjust the face against the escalator skirt. The ramps should be aligned with the escalator incline.

Adjust Tilt Angle So Parallel to Incline Then Lock

Measure Index

The Measure Index leads to a sub-menu that allows the operator to either record index data (from the IMD-1), or display the index analysis in real time. Because the analysis of the step/skirt performance index data is so computationally demanding, the MMC-1 real time display should be considered as an estimate. The analysis performed on the PC provides the most accurate measure of the index and would normally be used for final analysis and documentation. The real time mode offers the ability for field personnel to quickly identify the locations on the escalator where either excessive loaded gap or friction are problematic.

Record Event
Real Time Mode

Record Event

The recording of the step/skirt performance index measurements is a multi-step process that involves making a series of 4 measurements. It is important to first identify the steps to be measured and it is suggested that they be marked. Initially, the IMD-1 should be attached to the escalator step. Although the measurements can be made in any order, for the purposes of discussion we'll start with Step 1 Left.

Step 1 Right
Step 1 Left
Step 2 Right
Step 2 Left

After attaching the IMD-1 to the EVA, select Step 1 Left (for example). The Set ID # message will be displayed. This allows the user to save up to six digits as an identifier to be stored with each identifier. **This is <u>very important</u>**. There will be one set of 4 IMD recordings for each escalator. The ID# associates all recordings with a specific ID number such that:

1. **Each Recording with the same ID Number Will Have the Same Base File Name**
2. **Earlier Recordings Still In the EVA Memory Will Be Overwritten With Later Recordings If They Have the Same ID#. This has an advantage such that if a mistake was made during a recording the latter recording will be saved.**

After setting the ID # the message

Go to Step 1 Left
Set Distance to 0
ENT/START TO BEGIN

Set Distance to 0

This is an important part of the procedure. This establishes the gap distance as zero (friction face is aligned with the step edge pointer) prior to any measurements. To do so push the friction face fully back to the stop position against the IMD-1 housing. Then press the ENT key on the MMC-1.

Setting Zero

After setting the zero position the message:

ADJUST SPRING
PRESS ENT OR START
SWITCH TO CONTINUE

will be displayed.

Adjust Spring (Load)
This adjustment is used to apply the 110N (25 lb.) Normal Force (friction face against the escalator skirt). To apply the full force, rotate the adjusting knob clockwise until bottomed. Do not tighten, simply rotate until the locknut touches the IMD housing.

Rotate Clockwise to Add Force

After pressing the ENT key the message WAITING FOR TRIGGER will be displayed. At this point the ENT key or EVA start switch can be pressed to begin the recording. Then the escalator should be started.

Important: The Step/Skirt Performance Index is defined only for the inclined section of the escalator. Attach the IMD-1 at the beginning of the incline, and run the escalator through to the end of the incline.
It is very important to not allow the IMD-1 to impact the comb plate or any deflector brushes that may be present.

After finishing any specific recording, it is very important to release the Normal Force before releasing the IMD-1 from the escalator step. This is done by rotating the Normal Force Adjust knob counter clockwise to its fully extended position. Simply rotate to the stop position, do not tighten.

Always turn off the MMC-1 from the Main Menu. Data files can be corrupted by switching the MMC-1 off from any other than the Main Menu.

The procedure should be followed for each side of the two selected steps.

Real Time Mode
Real Time mode allows the operator to quickly evaluate the step/skirt performance. The same set-up procedure is followed as with the recording. However, the data is not stored, but displays the loaded gap, coefficient of friction and estimated index on the MMC-1 LCD. The measurements are updated each 0.5 seconds, displaying the maximum for the preceding time interval. Additionally, the Index threshold at which the LED will switch-on can be selected between .15, .25, or .4.

Index

—Z—