

# Basic WinCAT Operation

Or

## What's the Setup Table All About.

### **Background**

The WinCAT system is a Digital Transient Recorder System. As you become familiar with the WinCAT, it's operation will become more intuitive.

A transient recorder, as the name implies, is a system designed to capture one time events. An event can be an accelerometer produced shock pulse from a product drop test, or at the other extreme, an explosive created shock (pyro) on a space bound system. A transient recorder usually has the following features to make the process of accurately capturing an event certain:

1. A block of digital memory (RAM) to serve as the recording media for the event,
2. A fast analog to digital converter circuit,
3. A trigger circuit that senses the incoming data and initiates the recording,
4. A Pre-trigger recording capability to control the location of the event in the file,
5. The ability to write to the RAM in a continuous mode (Merry-Go-Round).

In addition to these basic features, there are means of setting:

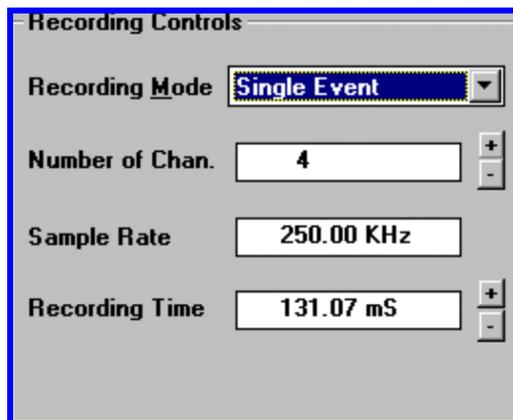
- a. The digitizing speed in order to capture the required detail
- b. The block length of recording RAM in order to bracket the event
- c. The full scale amplitude of the A/D recorder range
- d. Trigger threshold in order to initiate the recording on real signal
- e. Pre-trigger percentage, and trigger polarity, to discriminate the true event.

and for some applications, the ability to transfer the RAM data to a hard disk.

Once started, the transient recorder continuously digitizes input data and fills RAM space with samples. The memory block fills quickly and if no signal trigger occurs, the system will continue to write to the RAM in an overlapping fashion. For this reason, the RAM contains the history of the event for a period of time equal to the sampling rate divided by the length of the RAM block. During any cycle of writing to the RAM the digital trigger level is reached, the recording continues until the value of the Pre-Trigger "counter" has been exhausted. At this time, recording stops and the RAM contains the event and a short portion of history prior to the event known as the pre-trigger history.

### **1. SETUP FOR SHOCK TESTING**

See Figure 1, showing the portion of the setup screen that illustrates the following.



**Figure 1** Portion of Setup Screen Showing Mode Functions.

#### Setting the Recording Mode.

There are four (4) recording modes from which to select.

1. Single Event. This mode is the most common since it provides the most flexibility for post recording analysis. It selects a RAM block size of 256KS when selected. The time durations allowable in this mode are from 132msec to 1300sec.

2. Continuous Mode. In this mode, the trigger is set and data is acquired per the Setup Table. At the end of the recording, the data are displayed. The Trigger is immediately reset and the next signal that initiates the trigger is captured. This process continues until terminated by pressing the [Esc] Key.

3. Streaming Mode. This mode provides for saving recordings in rapid succession to the hard disk. It is used when it is desired to capture multiple triggered records in order to produce worst case "amplitude edited" spectra using the FFT software option. The user is prompted for the number or time duration of the files to be saved and the name to be attached to the file. The first trigger command initiates the mode. As each signal is captured, it is displayed and simultaneously saved to the disk drive under the selected name and a numerical sequence number. Any one of the files may be recalled and displayed, printout out, converted to ASCII, etc., exactly as would files recorded in the other modes.

The Optional FFT and SRS software modules contain menus that provide uploading and processing of PSD's, SRS's, etc., from the streamed files.

4. Short Memory. This mode reduces the size of the data block to 1/64th that of the 256KS block. This mode results in much shorter recording durations which are adequate for optimized tests where there is no uncertainty of physical phenomena occurring at times that would exceed the short memory recording duration. In addition, a sequence of short memory recording can be included in the normal 256KS file block size such that they are grouped together. They can then be recalled and analyzed one file at a time.

#### Setting the number of channels.

A major consideration when setting up the WinCAT transient recorder is to set the number of channels to be used for the intended test.

The WinCAT operates in a multiplexing mode to input data from 1, 2, 4, 8, or 16 channels. This refers to the design of the analog portion of the input electronics. The system has an 'aggregate' sampling speed of 1 million samples per second (MS/sec). A single A/D chip provides digitizing at this rate, but multiplexing divides down the sample rate by the number of channels used.

Multiplexing (MUX) refers to the very fast electronic switching between channels such that one sample per channel is taken per MUX address. The process starts from channel #1 and circles through the number of channels, arriving back at channel #1 again. If the trigger detector is TRUE, the RAM will receive a number of samples equal to the number of channels for this MUX cycle. The process will continue until the selected RAM block has been filled.

The WinCAT allows selection of 2, 4, 8, and 16 channels, providing the user the ability to set the minimum number of channels in order to preserve digitizing rate.

***Suggestion:***

Set the number of channels first using the setup menu. Consider the loss of digitizing speed due to the MUX function. In addition, also consider the recording time that controls the basic channel digitizing rate as described below.

**Recording Time**

The A/D circuit of the WinCAT always operates at the highest possible rate of 1 MS/s. When multiple channels are selected, the MUX function results in a lowered sampling rate for each channel, since the amount of RAM used for recording is constant. When the recording duration is selected, the RAM is written to at the MUX rate. The GHI PCI based A/D card is designed to support variable block lengths although only 128KB and 1MB blocks can presently be ordered. Short recording durations fill the data block quickly, conversely, long recording durations fill the data block slowly. The end result is that the user is provided with a selection of recording times which result in a wide range of sampling rates.

The sampling rates are shown on the WinCAT Setup screen. Figure 1 shows the Sample Rate Status Window that is software updated whenever the number of channels or recording time is reset.

*Importance of recording duration and sampling rate.*

The recording duration must be long enough to fully capture the event. It is wise to use a recording time that is longer in order to make certain that the event is completely captured. As illustration, a shock machine may produce a shock that is only 3 msec in length. This time is much shorter than the block length time when using any number of channels (132 msec in the Single Event Mode). In fact, the pulse will have to be expanded in order to look at it. However, if the shock were 100 msec in length, while the 132 msec block length would work, there is no allowance for recording much time prior to the shock. (This is called Pre-trigger recording, and it captures time history just prior to the event. This is important to have in order to identify the desired event in a noisy background and also to adjust any bias errors that would result in incorrect amplitude readings.

For most shocks, the 132 msec recording duration length works very well. In fact, it allows expansion of many times in order to investigate other phenomena that may be effecting the event. In addition, to be able to adjust the recorded signal for the real 0 value baseline.

When selecting the number of channels and the block length, the resulting sampling rate is displayed. The sampling rate must be kept high enough to be able to resolve the details in the event. For example, **there is a relationship known as the Rule of 10, which states that the sampling speed must be at least 10 times greater than the highest frequency of interest within the event in order to maintain the amplitude accuracy of the shock at no greater than 5% degradation.**

It is unwise to not take this rule into consideration when recording transient events. Unlike a low frequency stationary signal (one that does not change in frequency or magnitude over it's duration, and which can be digitized at a rate equal to about ½ the upper frequency bandwidth by reconstruction from many samples), you only get one shot at a transient.

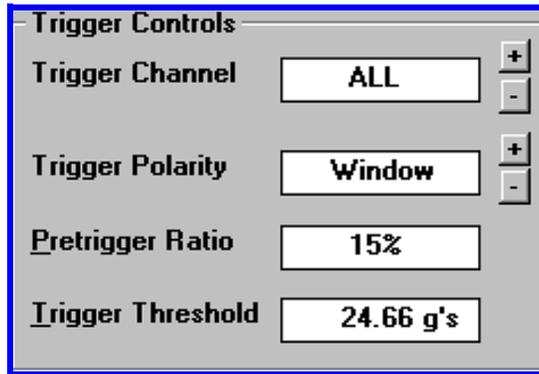
Like fine grain is to film, sampling rate is to transient recorders.

The finer the slices, the more the detail is preserved.

***Suggestion:***

A setting of 132 msec for the block length works for most shock tests.

Check the setup screen for what it tells you about sampling rate and compare this with your analysis requirements.



**Figure 2** Trigger function setup menu.

**Digital Trigger**

An important setting for successful operation is Trigger and it's polarity. The WinCAT trigger is digital. This means that it senses every data byte that is recorded and compares it against the values set up to initiate recording. The trigger settings possible are:

1. Trigger Channel, any of the number of channels, or all in parallel.
2. Trigger Amplitude,
3. Trigger Polarity,

The WinCAT allows the operator to use one or all channels on which a definable event is expected to occur to initiate the recording. In a similar fashion, a channel can be dedicated to a voltage mode trigger that will initiate recording.

This is useful when recording multiple channels from mixed sensor applications. For many applications, the item under test will have an initiation pulse, like firing a tank gun shell, or firing an airbag igniter. This pulse can be used as the system trigger on an unused channel to initiate recording. However, the digital trigger works well from the event time history for practically any test.

There are one or two items (See Figure below) to consider when setting the trigger (and also the Pre-trigger function as described later). First, the trigger should not be set at too low a value with respect to the signal baseline or every present noise will cause a false trigger. Likewise, the trigger should not be set at an amplitude greater than the expected event peak signal, or the event will be lost.

***Suggestion:***

Set the trigger level at about 50% of the expected event peak amplitude. This is usually high enough to prevent any noise from false triggering, and low enough to insure capturing the event.

***Event Polarity***

When entering trigger functions into the trigger portion of the Setup Menu, select the first going signal polarity of the event (see Figure above). This will depend on the output polarity of the sensor being used. Setting the polarity correctly provides some additional discrimination against noise such as RF spikes produced by package drop test machine with solenoid releases.

***Suggestion:***

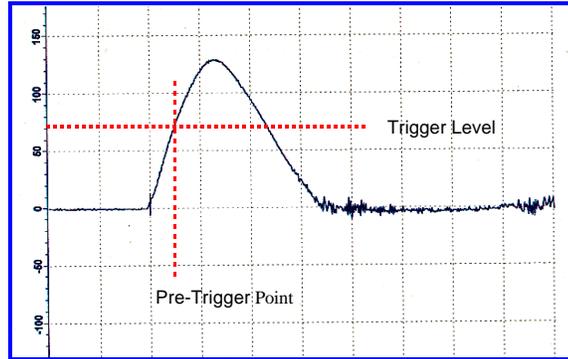
If the event signal polarity is well known, set the trigger polarity to correspond with the first going (Rise-time) deviation of the event signal. If this is unknown, use the ‘Window’ trigger setting that will initiate recording on either polarity from the sensor.

***Pre-Trigger Ratio***

The pre-trigger ratio is the percentage of RAM to be used for the event as a ratio of the amount used for the time history before the

amplitude trigger. For example, if a pre trigger value of 10% is set, then the first 10% of the displayed RAM block will consist of the time history prior to the event. If a recording block length of 132 msec is used, then the pre trigger duration will be 13.2msec prior to the trigger and 118.8msec after. The event will be in the 'after' portion of the file and the waveform cursor will pass through a point on the rise time equal to the selected trigger amplitude.

A graphical illustration of the Pretrigger and Trigger settings is seen in Figure 3 below.



**Figure 3.** Typical transient recorder plot. The pretrigger setting of 25% places the pulse at the 25% display grid line. Fast digitizing and gain functions have resolved the plot in high fidelity. This is a 3.2ms, 130g shock machine pulse. The pulse appears on the screen at the user selected points. There is no need to scan through long memories in order to find and analyze a single short duration event.

Settings:	
Trigger = 75 g's,	Pre-Trigger = 25%
Polarity = Positive or Window	Block Length = 132 ms

***Suggestion:***

Using a pre-trigger value of 15% to 20% of memory is usually sufficient. The above 130g shock was recorded using the above settings.

Full Scale Recording Range (Sensitivity)

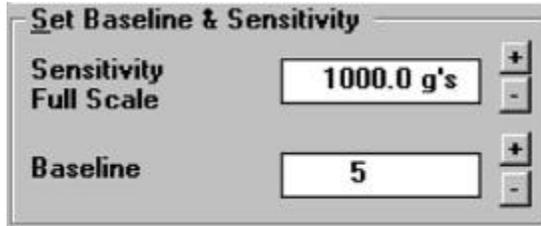


Figure 4 Sensitivity and Baseline Setting.

The full scale recording window amplitude is set by the Sensitivity selection. Prior to setting the value, it is necessary to define the sensor Engineering Units (EU's) on the Parameters Screen (see below).

Once the EU's for each channel are set, the full scale recording window sensitivity may be adjusted. Do this by clicking on the spinner arrows until a value that exceeds 2X the expected signal displayed. By setting the value to 2X, you are assured that the signal can be captured without clipping even in the event it has a different polarity than expected.

Engineering Units and other physical parameters.

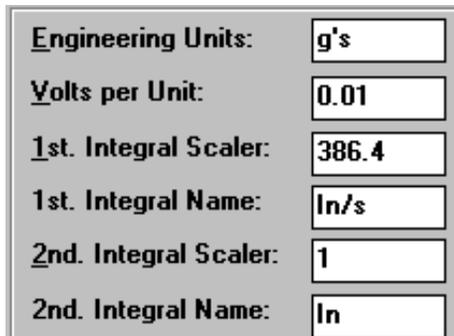


Figure 5 Setup Screen for Engineering Units. When setup all measurement made will be show in the correct units.

Figure 5 shows a typical Parameters Setup Menu. This setup is for a 10mV/g accelerometer with velocity change readout unit of inches/sec

and displacements units of inches. The entries are defined below, and must be made for each active channel.

*Engineering Units* Enter the physical property units that the sensor will be measuring. For an accelerometer, this name would be g's. By entering g's, the software will automatically enter all the remaining parameters. The illustration above shows the default setup for g's. It defaults to the most common accelerometer, 10mV/g, and first and second integral scalars and names for velocity change and displacement EU's. Entry is done using common Windows methods.

*Volts per Unit* This is the calibration value of the sensor, expressed in volts output per physical unit of excitation. In this case, the accelerometer is rated at 10mV/g, producing an output of 10mV for each g's of excitation. Different types of accelerometers will have different calibration factors.

If a charge type accelerometer is used, when the calibration factor of P/C per g has been entered into the charge amplifier (no furnished), set the output for 10mV/g and enter the data in exactly the same way as described here.

*1st Integral Scalar* The furnished software has the ability to perform integrals of the sensor signal as functions of time. The integral of acceleration versus time is velocity. For an impact shock, this velocity is equal to the velocity change of the system, assuming an elastic impact type rebound. For velocity change in English EU's, the scalar must convert the acceleration magnitude g's into acceleration EU's. This is done by multiplying the g's by the acceleration of gravity in English units, or 32.2 ft/sec<sup>2</sup>. This number must then be multiplied by 12 to convert the velocity from ft/sec to in/sec. The final number for English unit is 386.4in/sec<sup>2</sup>, but only the 386.4 is entered.

For velocity change in m/sec, use the metric scalar of 9.81 m/sec<sup>2</sup>.

*1st Integral Name* Enter here the name of the EU's that are produced by the first integral. This illustration of the default name shows In/s.

For velocity change in metric units, the name would be m/s.

2nd Integral Scalar The furnished software has the ability to perform the second integral of the sensor signal as a function of time. The second integral of acceleration versus time is displacement. For an impact shock, displacement is equal to the integral of velocity change of the system, assuming an elastic impact type rebound. For displacement in English EU's, the scalar must convert the acceleration integral area of velocity change in displacement, but since the acceleration magnitude multiplication has already been made above, the scalar is simply 1.

For displacement in metric units, it will be necessary to enter in the proper scalar for the EU's desired. Since the scalar for velocity change in metric units was entered as 9.81 m/s<sup>2</sup>, the displacement EU's would work out to be meters. This large magnitude is generally unworkable for shocks on commercial products, hence a scalar must be used to convert the displacement into the desired units. Displacements in metric units are most often measured in mm. Since there are 1000 mm/m, the proper scalar value for displacements in mm would be 1000.

2nd Integral Name Enter here the name of the EU's that are produced by the second integral. This illustration of the default name shows In.

For displacement in metric units, enter the name for the scalar you have entered above.

## **2. SETUP FOR VIBRATION**

Some vibration, such as that which is a response and results from shocks, is transient in nature. An example of this is the vibration that appears on a component of an automobile that is traveling across an uneven surface. This vibration is usually comprised of a series of transient vibrations of differing amplitudes and frequencies. It is a one time event and is not stationary. Stationary means that if the amplitude and frequency components of the signal are sampled at widely spaced times, they remain unchanged. This type of vibration is produced by controlled shakers for vibration testing.

To record vibration that is stationary, it is only required to save a small time duration sample that is long enough to cover the lowest frequency

components. For transients, it is sometimes best to record short time samples that contain the highest peaks of the transient portion of the signal and save this as sequential files to a hard disk. It is obvious that a tape recorder running in a continuous modes is an excellent means of saving long duration transient data. However, it becomes a problem when analysis is attempted. For most applications, PSD's are required.

A single PSD of a long continuous record is highly averaged and the peak transient information is lost. For this reason, it is better to process PSD's of the highest amplitude blocks of the data, and then estimate an ensemble average of the entire test. This is known as amplitude editing, and for long tape type recordings, requires the selection of transient events and the rejection of low amplitude data. For fatigue analysis, the low level response does not materially contribute to damage.

One very important subject is the use of Anti-alias filters to prevent damage to the data with subsequent incorrect analysis results. Because is desirable to use long data block lengths for vibration analysis, the WinCAT will have decreased sampling rate. A digitizing law exists that states that you must lowpass filter incoming data to the A/D converter at a sharp cutoff equal to just below the Nyquist frequency. The Nyquist frequency is  $\frac{1}{2}$  of the sampling rate. If you are doing vibration analysis, make sure you have an AA filter in the input, and also insure that it has a very sharp roll-off and imparts no phase distortion to the data. Considering the forgoing, there are two basic setups that you should be aware of:

1. For stationary vibration analysis, and
2. For transient vibration analysis.

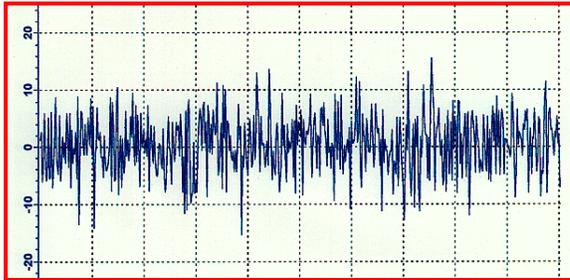
### **2.A. Setup for Stationary Vibration Analysis.**

Refer to the previous discussion about data recording block durations, digitizing rates, trigger and pre-trigger setting. The same fundamentals also apply here. A stationary waveform is shown in Figure 7.

#### Recording Duration

It is intuitive that the recording time block length should be long enough in time to capture the lowest frequencies of the signal. In general, a recording time of 6.5 sec will provide this for most stationary vibration.

However, you must also consider the sampling rate. You can only analyze data up to the Nyquist frequency and must use an AA filter when digitizing. The 6.5 sec block length time results in a single channel sampling rate of 20 KHz.



**Figure 6.** Example of a stationary random vibration signal. This is a 3 sigma or Gaussian limited example. Recording duration was 6.5 sec, trigger was 1g and pre-trigger as 0%.

The Upper Analysis Frequency Limit when using AA filters would be 8 KHz. This is adequate for mechanical system analysis. Conversely, if the same block time were used with 4 channels, the numbers would be 5KHz sampling and 2KHz analysis bandwidth. This may be marginal. From here up in channel count or longer in recording duration, the analysis bandwidth number probably degrades too much for practical use.

***Suggestion:***

Use nothing longer than 6.5 sec if using 4 channels. 6.5 sec with 1-4 channels is good, but dependant on the use of the AA filter. (Note, as an option, the WinCAT software can be supplied with software setup for our optional AA filter product. When the recording block duration is selected, the computer sets up the correct roll-off frequency.

As an alternative, some low frequency resolution can be sacrificed to maintain high digitizing speed. Do this by using a 3.2 sec recording time. This results in 4KHz analysis bandwidth for four channels.

### Trigger Setting

Since it is desirable to have the complete data block filled with the data, the trigger should be set such that when started, no delay is experienced. The WinCAT provides trigger level setting as low as 0 or 1g peak. For stationary data this is sufficient.

#### ***Suggestion:***

Set the trigger level to 0g for recording ongoing stationary random signals, after you have entered the sensor parameters and selected your vertical gain range.

### Pre-trigger

Again, since we want to fill the data block completely, and the fact that the signal will probably be present at the input when we set the WinCAT into operation, as short as possible pre-trigger should be used. In this case, we have used 0%.

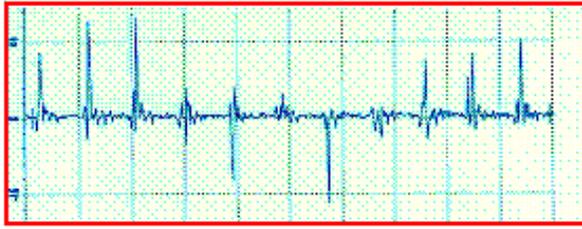
#### ***Suggestion:***

Use 0% Pre-trigger when recording ongoing stationary random vibration signals.

Since the data is stationary, it can be easily processed by Fourier analyzers in order to produce PSD's, transfer functions, Damage Potential Spectrums, FFT plots, etc. These functions are provided by the optional FFT software module.

## **2.B. Setup For Non-Stationary Vibration Analysis**

The system can be setup to record transient type vibrations, such as seismic events, table stimulus of repetitive shock driven stress screening machines and other types of vibration that does not meet the definition of Stationary random peak distribution.



**Figure 7.** Example of non-stationary vibration. This particular signal is from a 6DOF repetitive shock machine. Example of non-stationary vibration. This particular signal is from a 6DOF repetitive shock machine.

Setup is exactly as in the case of the Stationary Vibration explanation. The difference will be in the methods of analysis. While it is still possible to produce PSD or Fourier spectra of non-stationary vibration, the averaging functions of this type analysis destroys the most important feature of interest. This feature is information concerning the transitory peaks in the overall record. As example, in seismic records, the highest peaks are of most interest as they will relate to displacement damage. Other examples of commonly encountered non-stationary transient type vibration are:

1. Accelerations and forces produced by hard disk drives during periods of actuator activity.
2. Repetitive impact hammer driven stress screening chambers.
3. Vehicle vibration relating to engine compartments, suspensions, etc.

The best analysis tool for non-stationary vibration is the Shock Response Spectrum (SRS). This analysis tool is an option for your CAT product.

### 3. EDITING ICONS

The WinCAT software provides numerous functions to correct, enhance and prepare data for presentation. These ICONS are shown in Figure 8.



Figure 8. Editing ICONS on WinCAT screen.

Starting at the left in the figure above, the functions are described below.

a. **Zero Time at Cursor** This ICON is used to set the time reading on the data bar to zero at any particular point on a waveform.

b. **Zero Integral at Cursor** This function is used to adjust the recorded data if a DC offset bias is suspected. By clicking on this ICON, the numerical integral value is set to 0 at the location of the cursor.

c. **Zero Amplitude at Cursor** In order to adjust the amplitude of the readout for possible DC bias problems, locate the cursor at a position on the waveform known to be zero, such as within the pre-trigger portion, and click. All data reading will for this channel will be adjusted for this zero value.

d. **Zero Amplitude to Mean** In the case that a vibration signal has been recorded and lacks a clear zero value pre-trigger portion, this function can be used to zero the baseline to the numerical mean value as determined by averaging all of the data points in the file. By definition, for stationary vibration and in most cases, non-stationary, the mean value should be zero. The mean value of a single polarity shock pulse will not be the zero value of the baseline. It should not be used in this case.

e. **Zero Amplitude to A/D Midpoint** A method of baseline zero adjustment that works for both shock and vibration data is to set the baseline zero to the actual zero value of the A/D converter. This function provides this correction.

f. **Setup Auto Mode** This ICON initiates the Auto Mode of data setup, capture and analysis.

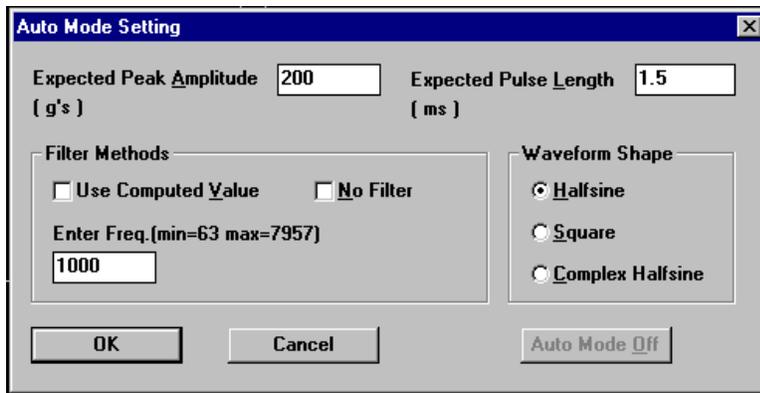


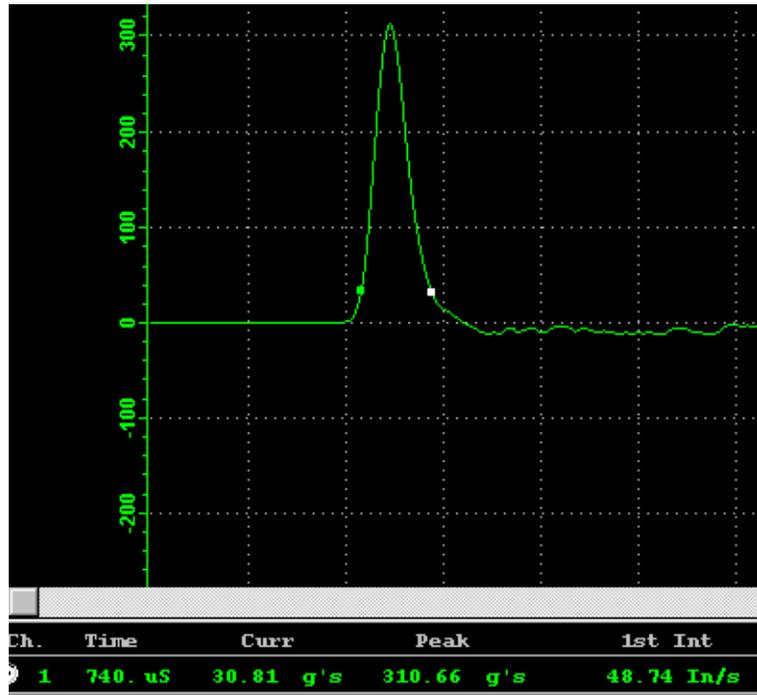
Figure 9. Auto Mode Setup dialog box.

When called, it displays a dialog box that provides setup of test parameters for automatic capture, display and analysis. This dialog box is seen in Figure 9.

To setup the Auto Mode, the user enters in the maximum g peak amplitude that is expected and the pulse duration. The values are entered in EU's. It is best to use values that are on the high end of the estimated shock and time ranges to prevent the system from setting up a condition that would lead to signal clipping.

Waveform Shape is entered next. Three choices are provided to click. 1) Halfsine (or haversine), which is the typical shock from a shock machine or an elastic cushion package drop test, 2) Square, which is produced by a programmable shock machine, and 3) Complex Halfsine. The settings are used to determine which type of filter calculation to be used if Use Computed Value under Filter Methods is chosen. Finally, if automatic is desired, the Filter Methods are entered.

The user may select Computed Value, which is based on waveshape, No Filter, or a specific filter frequency. When the choices have been entered, the next series of shocks will be processed automatically. WinCAT will select the correct recording mode, duration, amplitude, trigger and pretrigger settings, and degree of expansion to best show the captured waveform.



**Figure 11** Typical Auto Mode produced plot following automatic capture and analysis. Note that the time cursors are located at the 10% of peak amplitude points. The data bar reads out all information.

If filtering has been selected, the displayed signal will be displayed in the filtered condition. It is possible to re-filter or un-filter if necessary.

The Auto Mode may be canceled by clicking on the ICON.

g. Low Pass Filter Data This ICON calls a dialog box into which the user may enter the -3dB (knee) of a low pass digital filter. The filter may be applied to any waveform that has been recorded, or called back from disk file. If the signal has been previously filtered, it may be un-filtered. Simply follow the dialog box prompts.

h. Invert Waveform This feature inverts a recorded waveform in order to present it as a positive going function.

All measurement features of the WinCAT software operate on inverted as well as un-inverted waveforms.

#### 4. ANALYSIS ICONS

A group of ICONS allows selection of analysis functions to apply to recorded waveforms. These ICONS are described below from left to right

In addition, a yellow flag appears when the mouse pointer is positioned over any of the ICONS. These flags briefly describes it's function



a. Displacement Mode This mode provides a method of measuring the displacement of the accelerometer during an impact, such as a package drop test. If done correctly, the readout will show the velocity and displacement versus time integral plots. These are then used to determine rebound velocity (and coefficient of restitution) and cushion compression and dynamic set.

**CAUTION:** This mode provides the highest accuracy when a true DC accelerometer is used. ICP accelerometers are “AC” devices and they tend to differentiate the shock signal such that area under the curve is lost. This loss in velocity change causes errors in the 2<sup>nd</sup> integral of displacement.

When the mode is called, the user is prompted for the drop height. This is necessary in order to proper set the constants for the 1<sup>st</sup> and 2<sup>nd</sup> integrals. WinCAT uses the drop height to compute the initial drop velocity. If a shock machine is being used, then the value from drop height must be adjusted for the equivalent drop height of the shock machine pulse.

When the displacement plot appears, the user may use the active cursor to readout partial integral velocities and displacement.

b. Mil-Spec Tolerance Bar Module This ICON calls the optional MIL-STD software module. This module provide a database function for a series of tests. The tests must conform to the various test standards furnished. Using input from the user, the correct specification, waveshape, peak amplitude, duration and velocity integral and morphology are set. A set of the specified amplitude versus time tolerance bars are displayed. When a shock is recorded, an automatic mode (not the same as the before described Auto Mode) locates the signal within the tolerance bars. Using the mouse pointer, the user is able to move the waveform around within the bars to test for acceptable form, amplitude, duration and integral. Fast algorithms provide this capability. Pass/Fail criteria data is updated in the database file. Printouts of the time history and tolerance bars, as well as the database listing are provided.

c. SRS Module This optional module provides Shock Spectrum Analysis of a recorded signal, either shock or vibration. The module includes various analysis models that comply with all specifications. In addition, the module also provides velocity integral correction of baseline bias and ramps from sensors. Without these types of adjustments, the shape of the SRS will not be accurate.

d. Spectrum Analysis (FFT) Module Spectrum analysis is provided by the optional FFT Module. This module provides FFT, PSD, Transfer Function with Coherence, high pass, low pass and band pass filtering of FFT plots with Inverse FFT to reconstruct the waveform. This feature provides extremely high roll-off filtering and waveform reconstruction.

In addition, the FFT Module includes a Damage Potential Spectrum function for the comparative evaluation of fatiguing rates between two items under vibration loading.

e. Status Box The ICON positions a movable status box on the waveform screen that lists all pertinent setup parameters, modes, etc. It can be called or canceled by clicking.

f. What is this. This ICON is intended to aid in defining the functions of the Tool Bar buttons (ICONS). It is not implemented for systems that are furnished with the manual.

g. Fairing Cursor, Manual This function is used to manually 'fair' a recorded waveform, regardless of waveshape. When called, a horizontal cursor is placed on the screen at the position of the signal baseline. My moving the cursor up or down, it's amplitude is displayed on the data bar. This value will be printed out with a waveform report. This mode meets all requirements of various test specifications.

h. Fairing Cursor, Averaging Automatic This fairing mode may be used to obtain a computer estimated value for average amplitude of any particular waveform. To initiate the function, first place the reference cursor on the waveform to be analyzed at a place equal to it's start. For a square wave shock, this would be at the beginning of the rising portion. Call the function and correct the reference cursor if necessary.

Now move the measurement cursor to the end of the waveform. The average amplitude will be displayed on the data bar.

## 5. MISCELLANEOUS FUNCTIONS

In addition to the Editing and Analysis functions described above, there are additional features that will make reporting easier. These functions are described below.

a. Right Mouse Click Menu Click the right mouse key and a selection box appears. The selection box contains three choices: 1) Add/Edit Tab, 2) Set Horizontal Zoom Area, and 3) Move Vertically. By clicking on the first selection, the Tag Editing dialog box shown in the above figure is displayed.

a.1. Waveform Tag. This box allows for creating and editing tags to be placed on the waveform at the location of the cursor. The cursor must be in position when the function is called. The resulting tag may be moved anywhere on the screen and it will remain in place when the file is saved to disk, recalled or printed out.

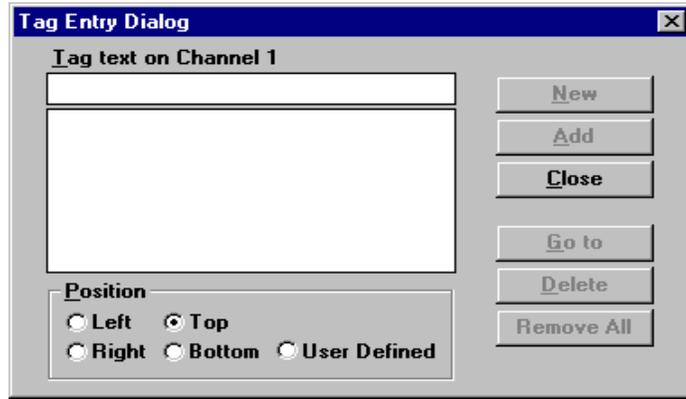


Figure 12.. Waveform Tag Editing dialog box.

a.2. Set Horizontal Zoom Area. This second selection provides a mode to select variable zoom for a waveform. The cursor must be at the location where the data to be zoomed begins (left most location).

When called, click the left button on the mouse and use the mouse pointer to paint the segment of unexpanded data to be expanded. The area painted can be long or short. The WinCAT will plot the data from the waveform memory represented by the zoom section. All measurement functions will be valid on this zoomed waveform. The zoomed waveform can be returned to the pre-zoomed state by clicking on the - magnifying glass ICON.

c. Move Vertically By selecting this function, you will be able to grab any waveform and move it quickly to any point on the screen. Right click the mouse or press [ESC] to terminate the mode.

## 6. CUSTOMER SUPPORT

Questions regarding the optional analysis software tools provided by GHI Systems, Inc., can be answered by our service center. Contact:

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