

Thank you for your purchase of this WaveForm display analysis program. This program swiftly displays data in waveform on the screen from data file which consists of a pair of header-file in TEXT format and 16 bits of binary-file (DADiSP-compliant format). Binary-file is made of data acquired in interlacement through our firm's PC Card recorder. On top of that, it is after-monitor program which can aim to efficiently extract data partially. For the purpose of data analysis function, it is equipped with such functions as fundamental numerical statistics computation, FFT analysis, X-Y display graph, transfer function operation etc. So it is quickly judged if a test has been valid or invalid after the test completion.

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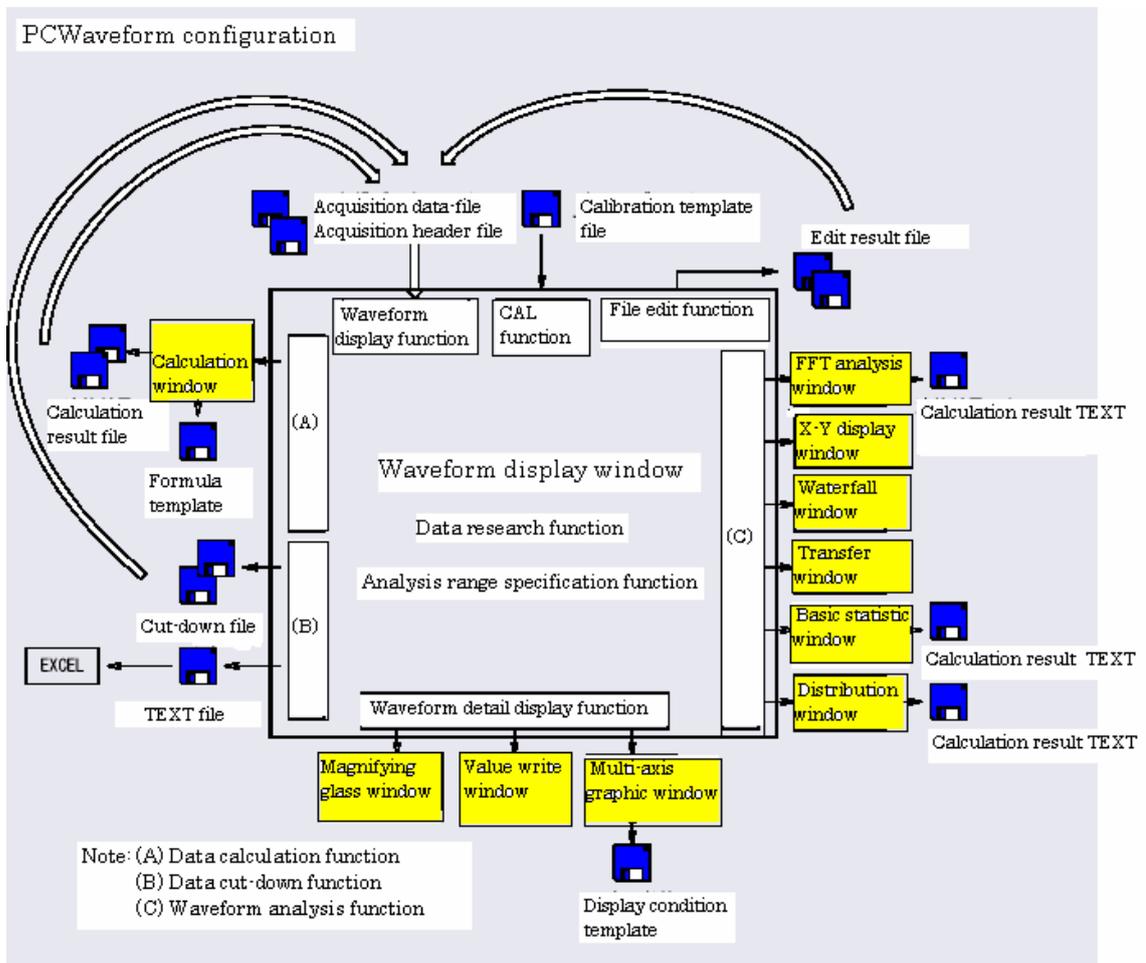
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Chapter 1 Waveform display window



1-1 Initiation of waveform display window

It is the window which is automatically displayed on the screen when the program is executed. Details of data file that are opened immediately before will be shown just after initiation.

1-2 Reading-out of acquisition data file (Displaying acquired data in waveform)

To display the acquired data in waveform on the screen, just read out header-file of the acquired data. Then the waveform will be automatically displayed.

1-2-1 How to read out by specifying the filename.



Click "File" on the menu bar and choose "Open". Or click "Open-file" icon on the tool bar. Then a dialog will appear. In the file type box there will be either *.hdr* or *a* as an extension. Choose the appropriate file you want to open and open the file.

1-2-2 How to read out the newest file in the current directory.



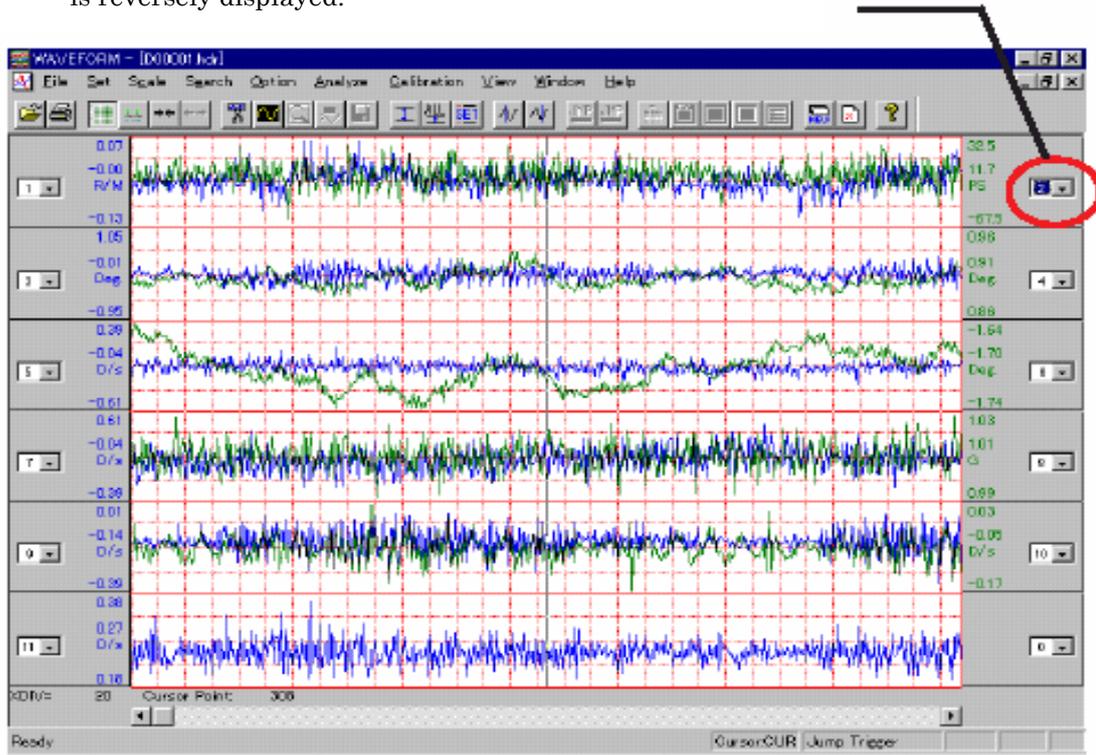
Click "File" on the menu bar and choose "Open Newest File". Or click the icon on the tool bar. When acquiring data using SCSI interface-built-in data recorder like DR-160 or DR-200, etc., this function is very convenient, because it is very easy to confirm acquired data just after data-recording while connecting SCSI interface to data-recorder in advance.

If it is impossible to read the chosen file, the following causes may be considered. The contents that are described in the header-file are different. Or the proper data file does not exist. See the appropriate file format as will be seen later

When data file is properly read, up to 16 channels can be shown in max 8 waveform display strips (400 data-points for every channel) in reference to the number of acquisition channels described in the header-file. Waveform display strips on the screen are up to 8 strips. However, 2 channels can be shown in overlapping form in each strip, so up to 16 channels can be shown on the screen at the same time. The example below shows 11 acquisition channels displayed on the screen. When 2 channels are displayed in overlapping form, the waveform whose color is the same as

that of the scale values on either side of annotation margin is the waveform of the appropriate channel. The scales displayed on annotation margin of both sides show those of different channels, respectively.

- * The current channel is the channel whose channel list box is reversely displayed.



1-3 Basic operation of waveform graph

1-3-1 Setting of Y-axis scale (Setting of vertical-axis scale)

1-3-1-1 Auto-scaling function

Select "Auto scale" in the pull-down list box of " Scale" on the menu bar. Or click the icon on the tool bar. There are 2 cases where you can choose for auto-scaling : one is targeting either current channel only or all of the displayed channels. The waveform of the current channel or those of all channels will be scaled automatically as soon as you have completed the above operation.



Click this icon. Then all of the displayed channels will be auto-scaled for redrawing.



Click this icon. Then the current channel only will be auto-scaled for redrawing.

1-3-1-2 Manual scaling function

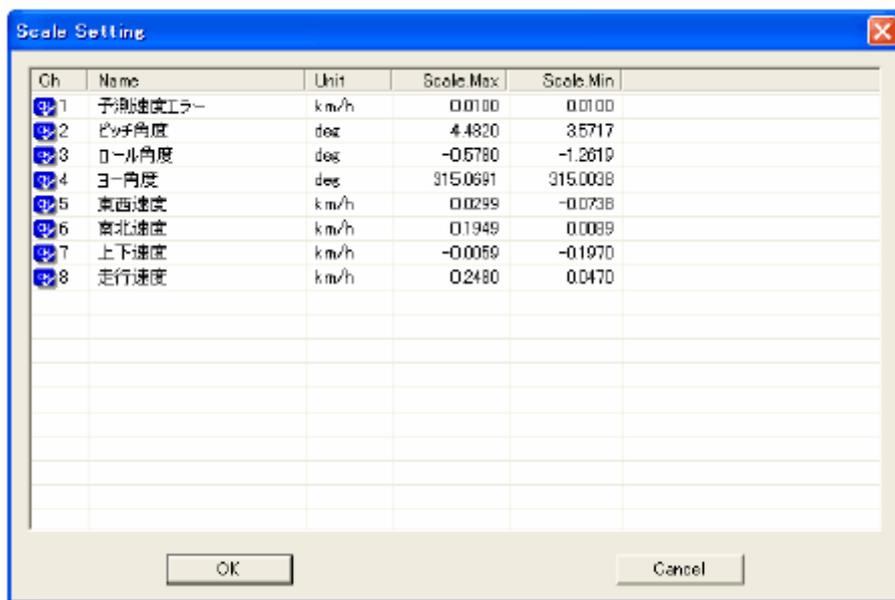
1-3-1-2-1 How to input scale values explicitly

Choose "Change" in the pull-down list box of "Scale" on the menu bar. Or click the icon on the tool bar. Then a setting dialog will appear.



Click this icon. Then a setting dialog on Y-axis scale of current channel will appear.

In the dialog, signal name, unit and max & mini scale value of every acquisition channel in a display-targeted file will be displayed. Further, with regard to the currently displayed channels "Click-mark" will be indicated at the top of each line to announce the channel on display.



In this dialog, settable items are max scale value and mini scale value. There are 2 ways of setting them.

① Direct input of numerical value

Click appropriate line and click the item to change once more, then it becomes settable.



② Copying of max & mini scale values on each line.

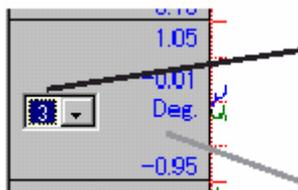
Firstly reverse the line to be copied, then right-click it. “Copy” “Paste” will be displayed in pull-down menu. Click “Copy” and then reverse the line you want to paste. Click “Paste” using right-click. Furthermore, if you want to copy plural lines, it is possible to paste them by selecting.

Ch	Name	Unit	Scale.Max	Scale.Min
1	予測速度エラー	km/h	0.0100	0.0100
2	ピッチ角度	deg	4.48	7
3	ロール角度	deg	-0.57	9

1-3-1-2-2 How to set scaling while seeing waveform

You can increase or decrease the scale value of Y-axis of the current channel by hitting the up-arrow key or down-arrow key. Hit the up-arrow key to increase it, while the down-arrow key to decrease it. You can move the offset by hitting the down-arrow or up-arrow key while pressing and holding down the shift key. Hit Shift + up-arrow key to move the whole of waveform of the current channel upward while Shift + down-arrow key downward.

When using mouse, move your mouse-cursor to the displayed scale area and left-click to enlarge the waveform while right-click to reduce it. When the appropriate channel is not current, left-click the annotation margin of the waveform window.



To render this channel current, left-click this margin area.

Left-click this margin for enlargement. Right-click it for reduction.

Max or min limit of scale value

The graph to be depicted on the waveform window where speed is paramount is drawn by 2byte integer format. For this reason, max or mini scale value given to the graph cannot exceed ± 32767 on an inner data conversion basis. Each of these is related to the slope value described in the header-file of the appropriate channel, and is the limit value of graph scale which is allowable for scale max value / SLOPE value ≤ 32767 , scale mini value / SLOPE value ≥ -32768 .

1-3-1-3 Setting of the indication format of Y-axis scale value



You can set the indication formats of Y-axis scale values & values-at-cursor for all channels on the screen regardless of the current channel or not. Choose " Y-Format & Precision " in the pull-down list box of " Set " on the menu bar. Then a setting dialog will appear.

In the dialog, 3 formats of Exponential, Fractional and Significant will be shown.

Exponential format : value is shown in exponential format.

Fractional format : value is shown with the specified number of digits to the right of the decimal (fixed decimal point form).

Significant format : value is shown in the format where the number of the whole digits is specified to express..

In Precision box, enter the display precision.

In the case of displaying 15.3, for example, specify 3 digits in the Precision box.

Exponential format will show 1.53e + 001.

Fractional format will show 15.300.

Significant format will show 15.3.

The Y-axis display format set here will be referred to all waveforms of display channels in common.

The setting number of digits is required to enter in "Precision" box on the dialog.

1-3-1-4 Saving of Y-axis scale values.



It is possible to save the current scale of each display waveform into the header-file. The scale value saved here can be the initial value of respective display channel by referring to the header-file when the appropriate file is read out.

To save the present display scale values, select "Save Scale" from the pull-down menu of "Scale" on the menu bar. At this selecting point, the channel information lines of header-file which has been read out in inner memory will be modified. For information, no special response can be obtained at this operating time, but a response dialog that asks for effectiveness of the change will

appear. If you click NO, scale values won't be saved. Still you can operate saving of Y-axis scale value over and over again. At every saving time, current display scale values can be updated and saved.

* Initial display values of Y-axis can also be set with calibration template as will be mentioned. Therefore, if performing calibration with calibration plate, the saved scale values are replaced with scale values written in calibration plate.

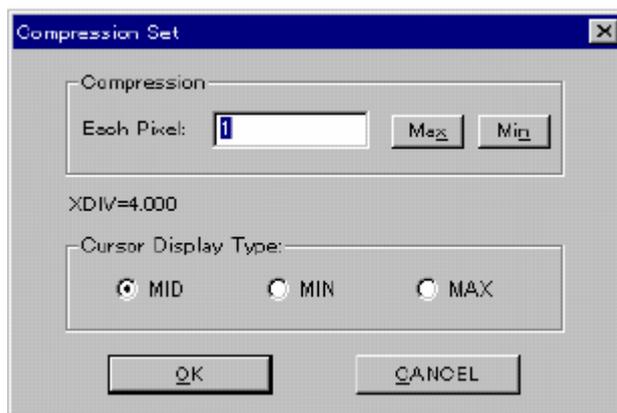
1-3-2 Display setting of X-axis width



X-axis width of the waveform displayed just after having read the file represents one data-point with one pixel on the screen. The displayed data width depends on the sampling frequency of acquired data. This program has the function which can display the horizontal axis (time axis) of acquired data in compressed form.

1-3-2-1 How to set the display width explicitly.

Choose " Compression " in the pull-down list box of " Set " on the menu bar. Or Click the icon on the tool bar. Then a dialog will appear.



Enter cardinal number in Each Pixel box to show how many data-points you want to display using one pixel. Initial value is 1. Click Max button and then click OK button when you want to display all acquired data in one screen. In other words, it means you specify the max compression. Click Min button and then click OK button when you want to display one

data-point with one pixel. In other words, it means you specify the max magnification. The number of XDIV on the box shows the width of seconds per x-axis screen grid division. If you change the above-stated number in Each Pixel, this number will also update automatically. If a waveform is compressed, plural data-points are compressed into each pixel. Value of plural data-points in each pixel of the waveforms at waveform cursor is indicated on the basis of MID, MIN & Max. The value in each pixel is determined in the following way : MID indicates arithmetic mean data value, MIN, the minimum value and MAX, the max value. Each type is shown at right bottom on the

screen like Cursor xxx. Note: In the case of max magnification, it will be shown like Cursor CUR regardless of MID,MIN & MAX.

1-3-2-2 How to set x-axis width with mouse while seeing waveform.

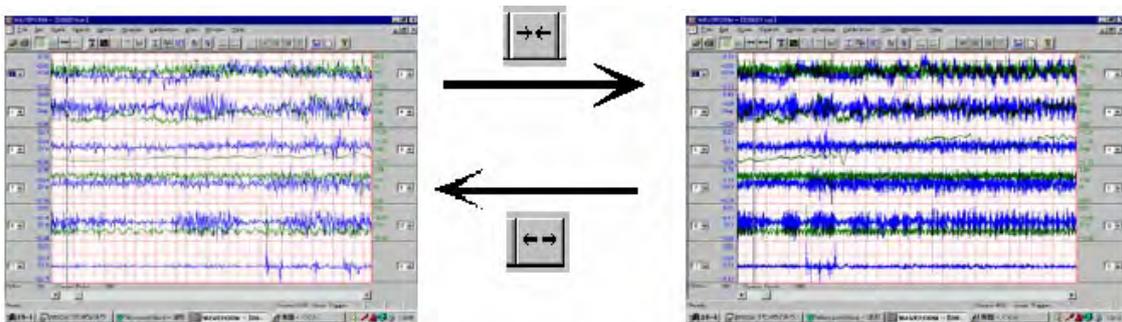
Click magnification icon or compression icon on the tool bar. When compression icon clicked, the number of data-points per pixel which is currently set will increments (+ 1) by every clicking of the mouse button. The waveform will be redrawn in compressed form each time. When magnification icon clicked, the number of data-points per pixel which is currently set will decrease (- 1) by every clicking of the mouse button. The waveform will be redrawn in magnified form each time. You can compress the waveform to the extent where all acquired data can be displayed on one screen. To the contrary you can magnify the waveform to the extent where one data-point per pixel will reach. If neither of them can be realized, the icon will inform you of it by lightout. Note : Though you compress the waveform, the shape will not be thrown off-balance because the waveform is displayed with two points of the max and min data values in one pixel.



Click this button to show magnified display width (compressed waveform).



Click this button to show compressed display width (magnified waveform).



1-3-2-3 How to display the whole of acquired data on the screen.

To display the whole range of acquired data on the screen, a special ready-to-use icon is at the ready other than clicking compression button over and over again. Only one operation of clicking max compression button on the tool bar enables the entire range of acquired data to be shown on the screen.



Click this button. Then the waveform, compressed to a maximum in time-axis direction will be displayed to the extent of fitting on the screen.

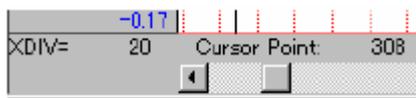
1-3-2-4 Setting of scale value indication format to X-axis.



You can select either data-point or time for the indication format. Choose from among the pull-down menu of " Option " on the menu bar. (Scale values of x-axis are shown on bottom annotation line)

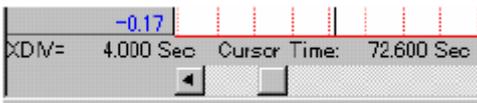
Choose " Point Display", if you want to indicate x-axis by data-point. Choose " Time Display " , if you want to indicate x-axis by time. Choose " Range On Screen Display " if you want to indicate the wave range from leftmost end to rightmost of the display graph in time regardless of the waveform cursor position.

When choosing " Point Display ",



When choosing " Time Display ",

Note : When choosing time format other than " Real" or " Relative " .

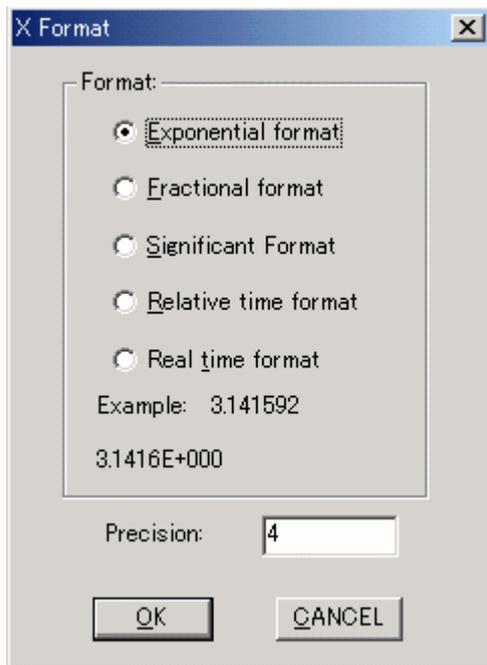


When choosing " Range On Screen Display ",

The time at leftmost end and rightmost end of the current graph is shown.



1-3-2-4-1 Setting of indication format



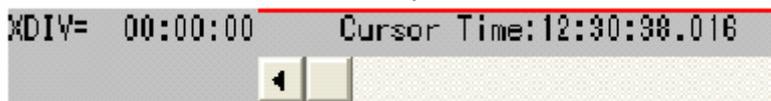
Choose " X Format & Precision" from the pull-down list box of " Set " on the menu bar. Then a setting dialog box will appear. In the case of choosing "Time Display", you can select either " Relative time format " or " Real time format ". Relative shows the elapsed period of time from acquisition start time to the waveform cursor position time. Real shows actual time of day at waveform cursor based on acquisition-start time of day. Maximum unit is 1ms for both Relative and Real. The format for them is expressed as HH:MM:SS:XXX. In case of high-speed sampling(1ms or lower), the same value keeps on being indicated till ms changes with moving of waveform cursor.

If there is a status like pause in the acquired data, correct time of day may not be shown.

The case of "Relative" when "Time Display" is chosen.



The case of "Real" when "Time Display" is chosen.



1-3-3 Setting of current channel

When the screen displays plural channels at the same time, one channel among them is set a current channel (active channel). The current channel is the channel targeted for scale change and/or analysis, for example. (The action you perform will occur in this channel.)

Changing with keyboard : Push Tab key. Then the current channel moves to the waveform window below. If two waveforms overlap, the current channel will move from left to right side within the same waveform window. If pushing Tab key again, it will

move to the left side of the channel below. Push Shift + Tab key. Then the current channel moves to the waveform window above in the opposite steps described above. Current channel indicator in channel list box is displayed reversely.

Changing with mouse : Move your cursor to left or right annotation margin of any waveform strip area and click . Then the waveform you click will become the current channel.

To magnify Y-axis scale, move your cursor to the annotation margin of the current channel and click the left mouse button. To compress Y-axis scale, move your cursor to the annotation margin of the current channel and click the right mouse button.

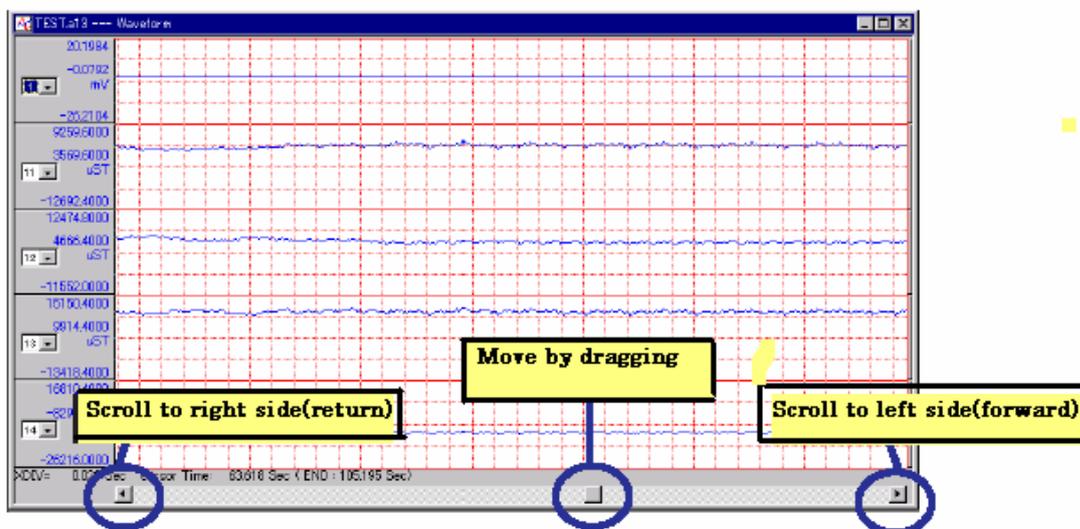
1-3-4 Scrolling of waveform to the left or right.

Except when the waveform shown in the graph displays all data, a side-to-side scrolling of the waveform is possible using either the keyboard or mouse.

Scrolling with keyboard : Push Shift + right arrow key () to scroll the display waveform to the left side (i.e. in a forward direction). Push Shift + left arrow key () to scroll it to the right side (i.e. in a rear direction).

Pushing arrow key only moves the waveform cursor.

Scrolling with mouse : You can scroll the display waveform by dragging the arrow button in the horizontal scroll bar. Drag the left arrow button to scroll the waveform to the left side. Drag the right button to scroll it to the right side.

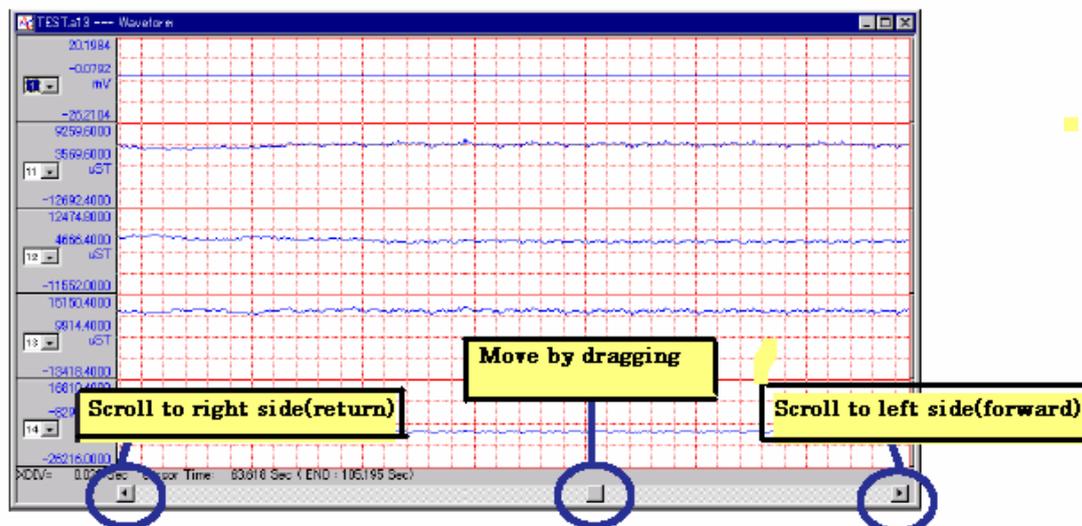


1-3-5 Setting of view channels

To set view channels, choose " View Channels " from the pull-down list box of " Set " on the menu bar.



When chosen, a setting dialog box will appear. Acquisition data file channel information will be shown on the left side of the dialog box, while the currently displayed channel information on the right. Up to 8 channels of waveforms can be shown on the screen simultaneously. On top of that, if Overlap box (the function of enabling 2 chan's to be displayed on the same waveform strip area at the same time) is checked, up to 16 channels of waveforms can be shown on the screen simultaneously.



1-3-5-1 Addition of display channels

Click the channels you want to display from among the acquisition channel list on the left side and bring them into reverse video. Then click display-register button ">>" at center portion of the dialog box to add them to the display channel list on the right side. Should 16 channels have already been displayed, adding of new channels is impossible. It is necessary to add them after deleting unwanted files.

1-3-5-2 Deletion of display channels

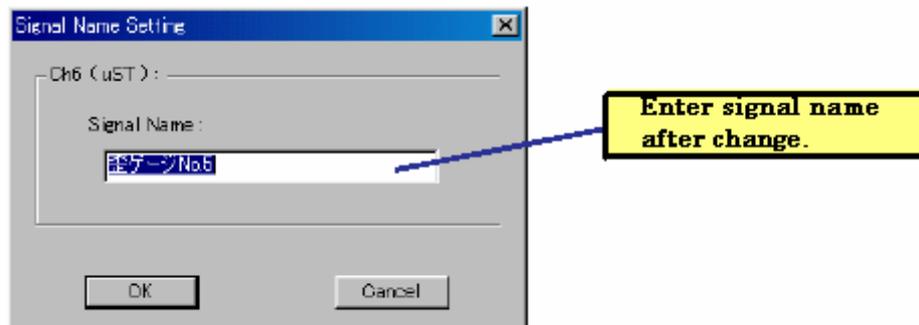
Choose (Click) a channel from among current display channel list and click " DEL" button on the dialog box to delete it. It is possible to delete plural channels at the same time.

Dialog can not be brought to an end, if all of display channel list have been deleted.

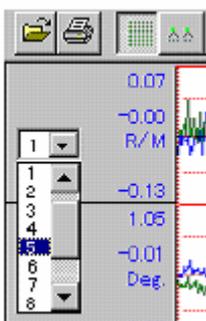
It is possible to display plural of the same channels.

1-3-5-3 Changing of signal name

Double-click a channel you want to change from acquisition channel list on the waveform view setting dialog. Then a signal name setting dialog box will appear. Move your cursor to signal name box and click it. Then input becomes possible. Click OK button to change it to new signal name.



1-3-5-4 Changing of view channel on the waveform graph



You can choose the view channel by clicking a channel from drop-down channel list box on each of all waveform-display window strip. It is permissible to display the same channel on each of all waveform-display strip windows. If choosing 0 chan, nothing will be shown. The number of channels which can be displayed is up to 99.

The initial value to be displayed will be automatically chosen from the lowest channel-number described in header-file. The channel-number which is not shown in this list box does not exist in header-file.

1-3-5-5 Switching of multiple display (view) channel list.

It is possible to switch rapidly multiple acquisition channels to display (view) channels shown in graph in waveform display windows. Set display channel list in display channel setting dialog box 1-3-5 .

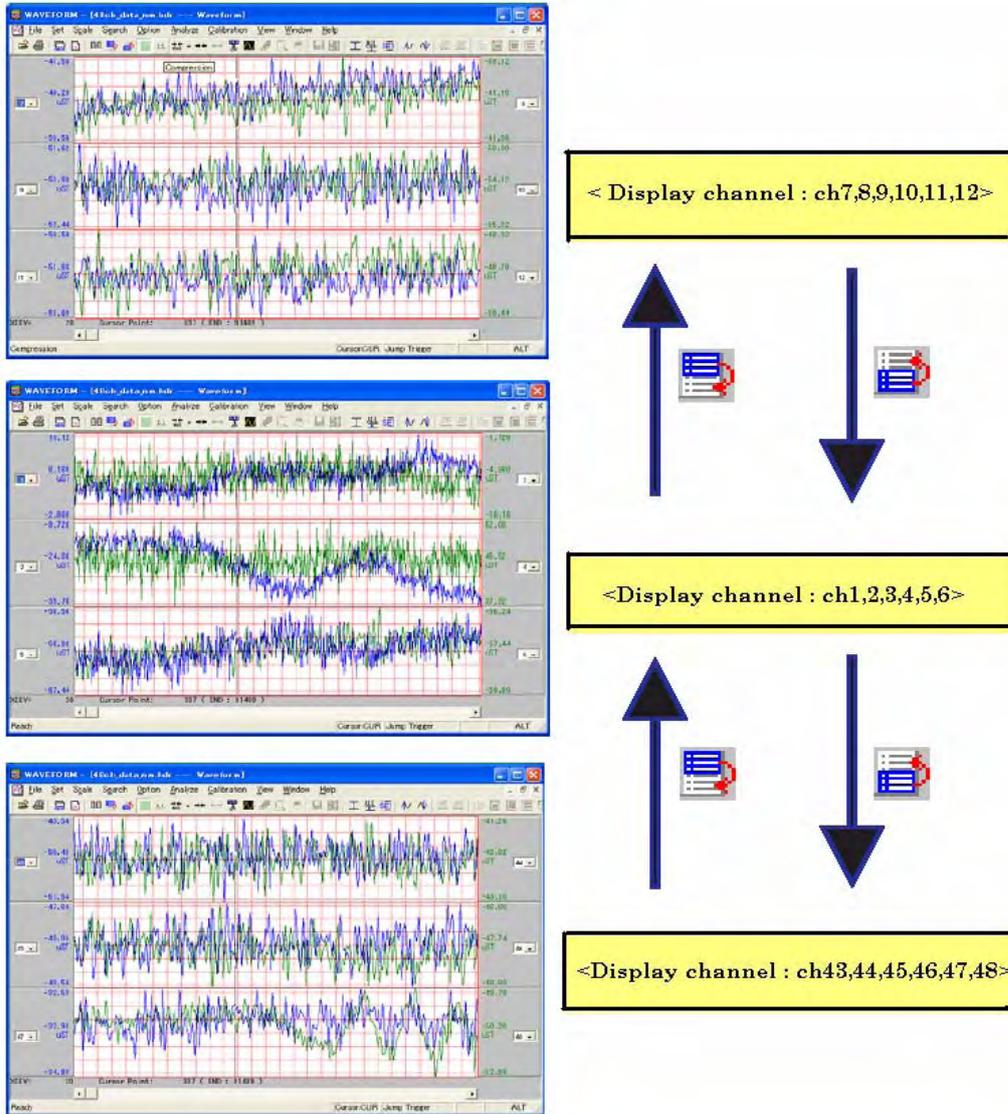
1-3-5-5-1 “Next Set” button (ascending display selection button)

Click “Next Set” of the pull-down menu of “Set” on menu bar. Or click the icon on tool bar. When clicking the button, some in acquisition channel list will be selected as display channels by the same number of display channel list and will be given number from next of the largest channel number in ascending order.

1-3-5-5-2 “Before Set” button (descending display selection button)

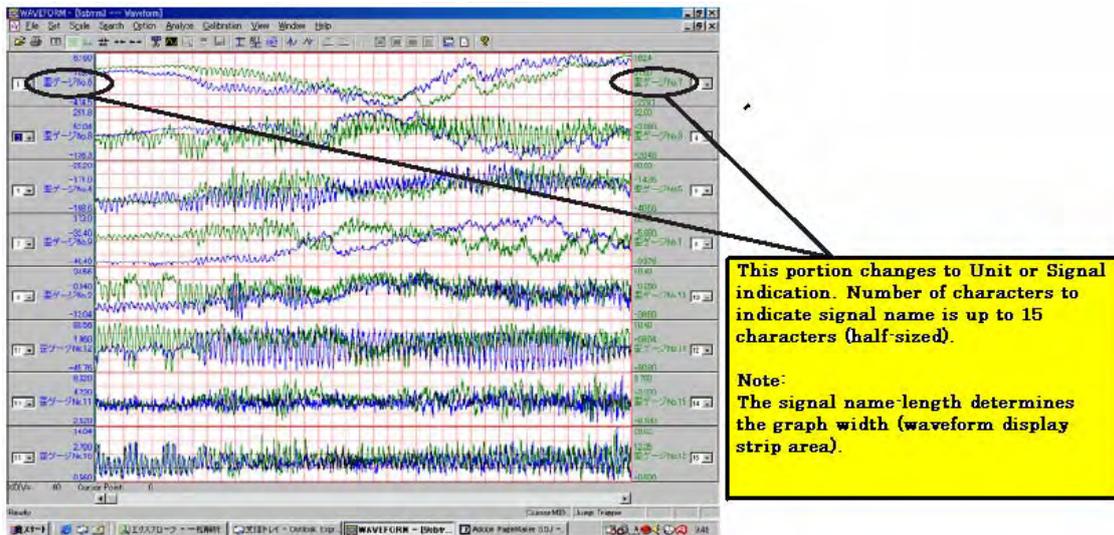
Click “Before Set” of the pull-down menu of menu bar. Or click the icon on tool bar. When clicking the button, some in acquisition channel list will be selected as display channels by the same number of display channel list and will be given number from next of the smallest channel number in descending order.

- * A sample when selecting ch1 to ch6 in display (view) channel list in the case of number of acquisition data channels : 48 .



1-3-6 Changing of signal name / unit

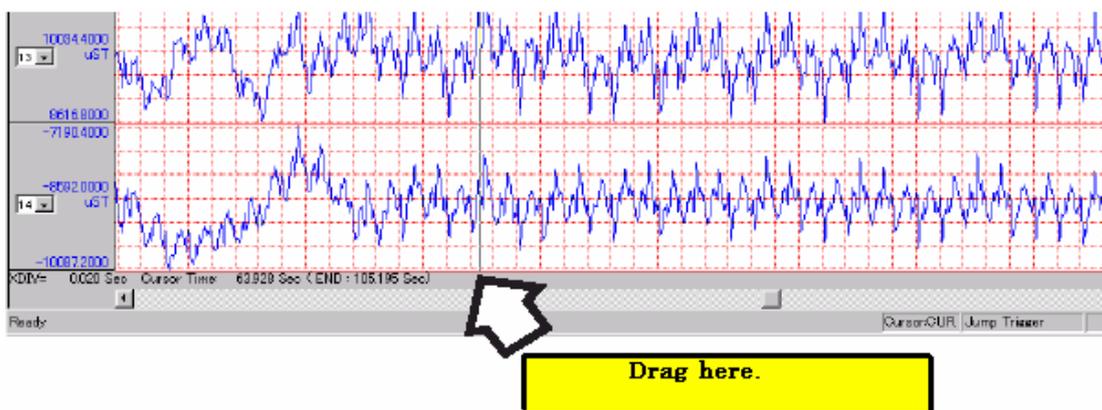
The unit or signal name of each channel can be changed. Choose " Unit Display " to change the unit, or " Name Display " to change the signal name from the pull-down list box of " Option " on menu bar.



1-3-7 The function of waveform cursor

Waveform cursor has the function of helping read out the waveform data during display or set the start-point for region of interest (for analysis target).

Moving with keyboard : You can move the waveform cursor by pushing the left or right arrow key on the keyboard. Waveform cursor moves on the screen at every pixel. Use keyboard for a small movement of the cursor. Use mouse for a big movement of it.



Moving with mouse : Move your cursor onto the bottom annotation line of the screen and drag. Move it to left or right while pressing and hold down the mouse button. Waveform cursor will move with your cursor at the same time. Every data value of all waveform strip ends will be updated in conjunction with the waveform cursor's movement.

Waveform cursor moves at every pixel (minimum unit) on the screen . Therefore, the value at waveform cursor is shown on the basis of MID, MAX,MIN determined by data compression rate of X-axis display width. Needless to say, the value shows data value as it is, irrespective of the setting unless data compression is set.

1-3-8 Jump function of waveform cursor

1-3-8-1 Jump to the max value position of waveform on the screen.

This function allows the waveform cursor to move to max value position of current channel in displayed waveform graphs.



Choose " Peak On Screen " in the pull-down list box of " Search" on the menu bar, or click the icon on the tool bar. Then the waveform cursor will move to max value position of the current channel waveform.

The value at the cursor on compressed waveform depends on MID, MIN or MAX specified at the time of the compression. (See 1-3-2-1 How to set the display width explicitly). It is, therefore, required to set MAX at the time of compression setting in order to display max value correctly.

1-3-8-2 Jump to the min value position of waveform on the screen.

This function allows the waveform cursor to move to min value position of current channel in displayed waveform graphs.

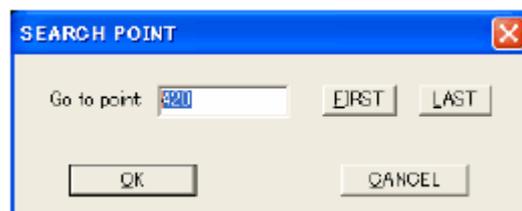


Choose " Valley On Screen " in the pull-down list box of " Search " on the menu bar., or click the icon on the tool bar. Then the waveform cursor will move to min value position of the current channel waveform. It is necessary to set MIN at the time of compression setting for the correct display.

1-3-8-3 Jump to specified data-point position



This function allows the waveform cursor to automatically jump to a given data location set for targeting all data. Choose " Go to Point " in the pull-down list box of " Search " on the menu bar. Then a dialog box will appear.



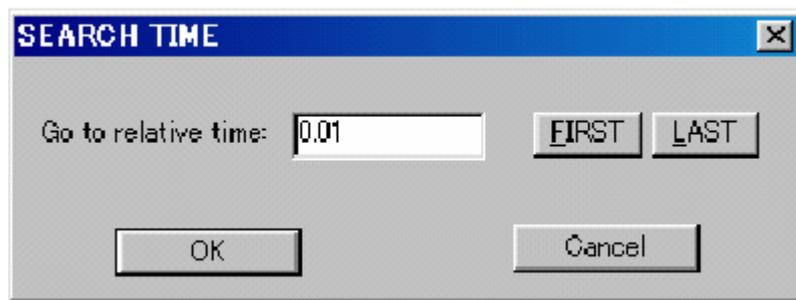
The initial value shows the current location of the waveform cursor.

Enter the number of data-points you want it to move to in the text box of the dialog anew.

FIRST button will set acquisition-start data position, while LAST acquisition-end data position. Point means data count value which increments (+1) at every acquisition sampling with the data location at the acquisition-start as 0. If you input 1230, it means 1230th data position from initial acquisition data position. The number of data points you can input is acceptable for whole range of acquisition data. It is impossible to set the range beyond it.

1-3-8-4 Jump to elapsed time position of post-acquisition

Choose " Go to Time " from the pull-down list box of " Search " on the menu bar.



Then a dialog box will appear. Elapsed time from acquisition time to waveform cursor position is reversely shown in seconds. Input the elapsed time in seconds anew if you want to move the waveform cursor to the position. FIRST button will set acquisition start time, while LAST button will set acquisition-end time in seconds.

Elapsed time is the result of multiplying the data location by sampling period when the data location at acquisition start time is set 0. Therefore, if PAUSE is included in acquired data, correct elapsed time can not be gained.

1-3-8-5 Jump to mark position

Choose " Jump Mark Mode " from the pull-down list box of " Search " on the menu bar.

The choice will allow Mark Jump to be selected as a cursor jump mode.



To perform this function, prior creation of mark list in the header-file is needed at the time of data-acquisition by a data recorder. Unless created, the function does not work.

In a state where mark jump is chosen in cursor jump mode, click the icon (right arrow), and the waveform cursor moves to the location in forward direction. With each clicking of this icon, the cursor jumps to next marked location. In the same way, click the icon (left arrow) to move it to the location in rearward direction. With each clicking of this icon, the waveform cursor jumps to the previously marked location.

1-3-8-6 Jump to pause position

This function allows the waveform cursor to automatically jump to pause location in waveform data file. First choose " Jump Pause Mode " from the pull-down list box of " Search " on the menu bar. The choice will allow Pause Jump to be selected as a cursor jump mode.

To perform this function, prior creation of pause list in the header-file is needed at the time of data-acquisition by a data recorder. Unless created, the function does not work.

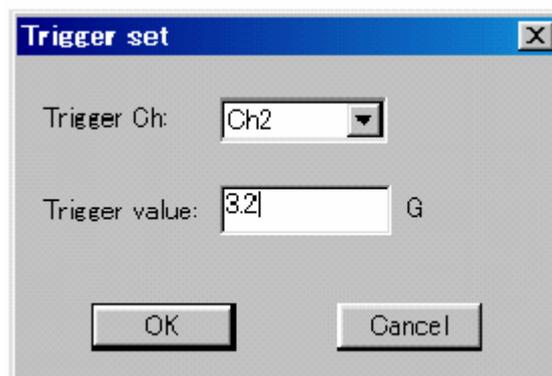
In the jump mode status where pause jump is chosen, click the icon (right arrow), and the waveform cursor moves to the pause location in forward direction. With each clicking of this icon, the cursor jumps to next paused location. In the same way, click the icon (left arrow) to move it to the paused location in rearward direction. With each clicking of this icon, the waveform cursor jumps to the previously paused location.

1-3-8-7 Jump to the set level position

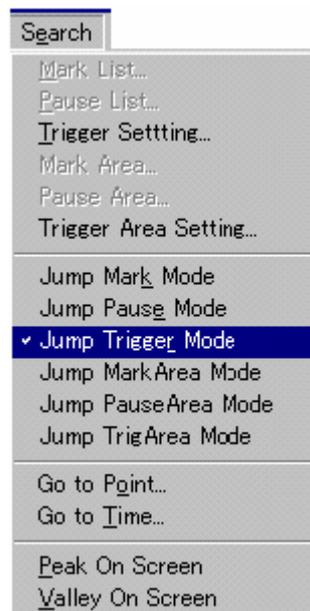
This function allows the waveform cursor to automatically jump to the channel and its waveform location exceeding the trigger-level you have set on acquired data. To perform this function, setting of trigger channel No. and its trigger value are required first of all. Choose " Trigger Setting " from the pull-down list box of " Search " on the menu bar. Then a dialog box will appear.



In trigger channel box, choose the channel No. you want to



set level-trigger on and then in trigger value box, input the level you want to set by absolute value expressed in unit.



After having set trigger channel & level, set cursor jump mode to trigger jump mode. Choose " Jump Trigger Mode " from the pull-down list box of " Search" on the menu bar. The choice allows Mark Jump to be selected as a cursor jump mode.



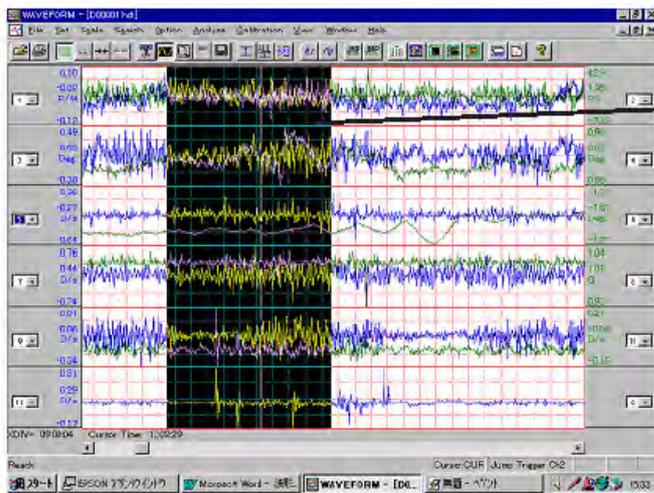
Click the icon(right arrow) on the tool bar. Then the waveform cursor jumps to the data location just exceeding the set level trigger value (in absolute value) lying after cursor's current position. With each clicking of this icon, the waveform cursor jumps to the value position exceeding your set value. Click the icon (left arrow). Then the waveform cursor jumps to the data location just exceeding the set level value (in absolute value) lying before cursor's present position. If there is no data value exceeding the set level trigger value, waveform will not move.

In the case where the waveform cursor exceeds the set level continuously, it moves to adjacent data-position. Hence, when it jumps to the location exceeding the set level over again, click the jump button after having moved the cursor explicitly.

1-3-9 How to specify the analysis range.



The range specification of the display waveform is needed for its provisional magnification, analysis and text conversion. To specify the range, choose " Cut Down Enable " from the pull-down list box of " Set " on menu bar. Or click the icon on tool bar. Then a reverse video area will be displayed. This area is the specified range.



Reverse video area is displayed on the graph.
Analysis is performed for this Area.

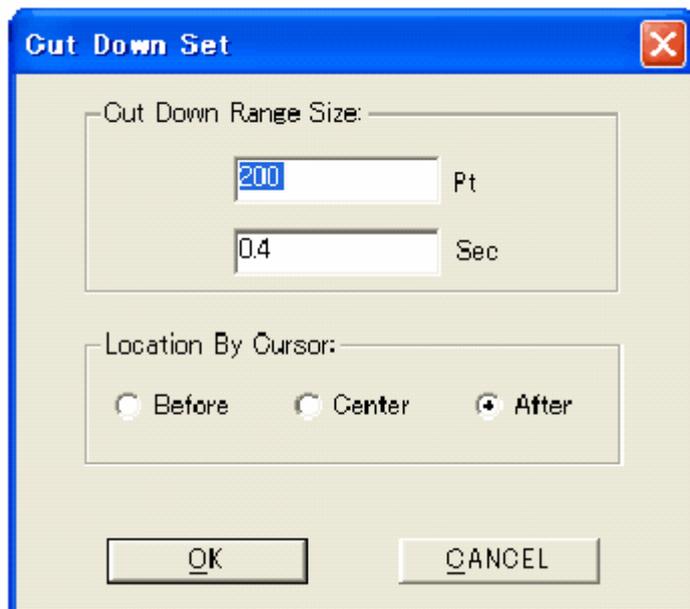


To render all of acquired data to be analysis area, click



button.

1-3-9-1 Explicit setting of start location and width for analysis range.



Choose " Cut Down Set " from the pull-down list box of " Set " on the menu bar. Or click the icon on tool bar. Then a dialog box will appear.

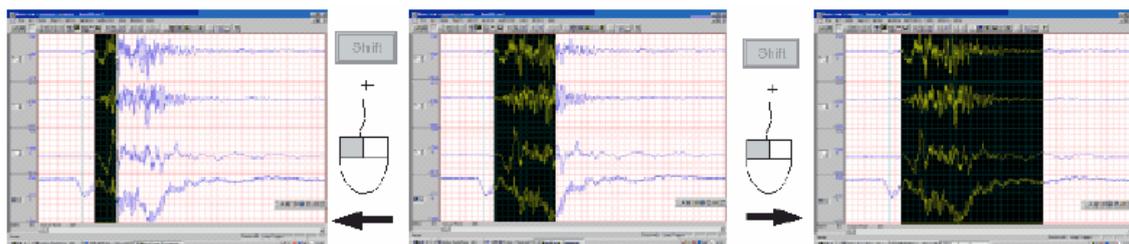
Input the number of data-points or seconds for specified range in Cut Down Range Size box. And then select one option from three choices in Location By Cursor box. Before : the reverse video area is displayed before

the waveform cursor. Center : it is displayed with the waveform cursor in the center area. After : it is displayed after the waveform cursor.

To specify the range roughly, use mouse and to specify it accurately, use keyboard.

1-3-9-2 Setting of analysis-range width with mouse.

To magnify or reduce the specified range width, move your mouse-cursor into reverse video area and while pressing and holding down a shift key on the keyboard drag it to left or right.

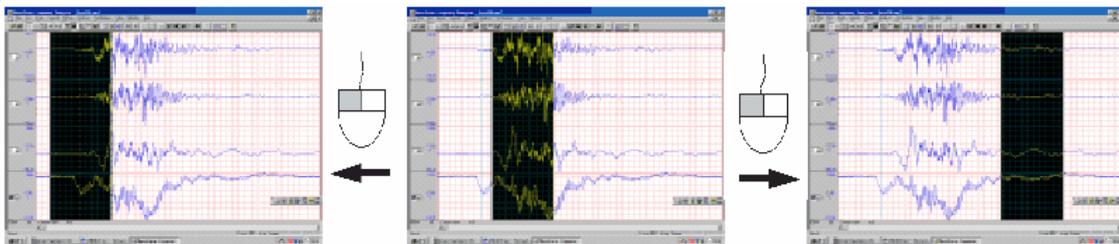


Dragging to left reduces analysis range width.

Dragging to right magnifies analysis range width.

1-3-9-3 Moving of analysis-range width with mouse

To move the specified range width, move your mouse-cursor into reverse video area and drag it to left or right.



To move the reverse video range to left, drag it to left.

To move the reverse video range to right, drag it to right.

1-3-10 Jump function of analysis range

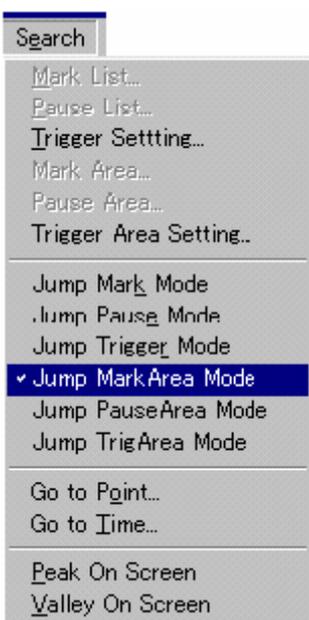
1-3-10-1 Jump to Mark-to-Mark section

It means the reverse video area jumps to the section sandwiched between Mark and Mark as an analysis range. This function is effective only when MARK Line exists in header-file. Reverse video area moves to the area between mark and mark. First choose " Jump Mark Area Mode " from the pull-down menu of " search " on menu bar. In the status of this mode, click the

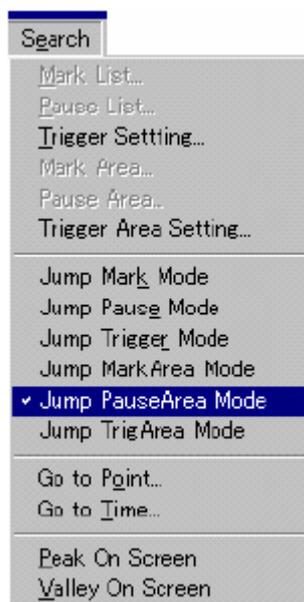
icon  (right arrow) on tool bar to move current reverse video area to the mark-to-mark area existing to the right direction. The width of reverse video area will be automatically determined by the number of data-points between

mark and mark. Alternatively, click the icon  (left arrow) on tool bar to move current reverse video area to the mark-to-mark area existing to the left direction. Mark-to-mark area at the extreme left end is the area between acquisition start point and initial mark , while that at the extreme right end is

the area between last mark and acquisition end mark.



1-3-10-2 Jump to Pause-to-Pause section



It means the reverse video area jumps to the section sandwiched between Pause and Pause as an analysis range. This function is effective only when PAUSE Line exists in header-file. Reverse video area moves to the area between pause and pause. First choose " Jump Pause Area Mode " from the pull-down menu of " Search " on menu bar. In the

status of this mode, click the icon  (right arrow) on tool bar to move current reverse video area to the pause-to-pause area existing to the right direction. The width of reverse video area will be automatically determined by the number of data-points between pause and pause. Alternatively, click the

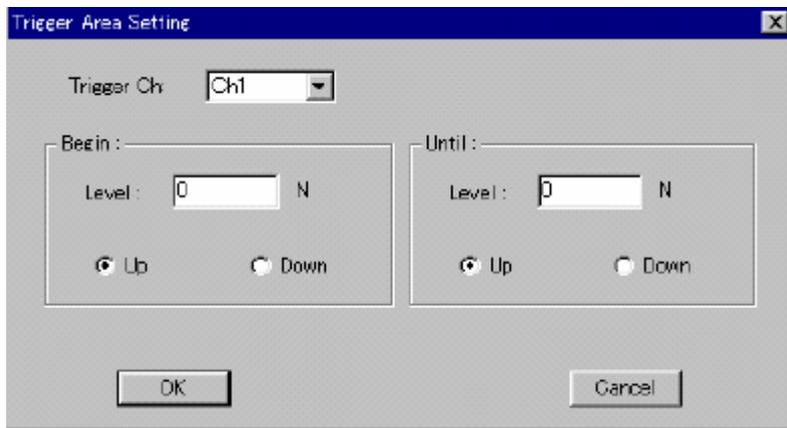
icon  (left arrow) on tool bar to move current reverse video

area to the pause-to-pause area existing to the left direction. Pause-to-pause area at the extreme left end is the area between acquisition start point and initial pause, while that at extreme right end is the area between last pause and acquisition end point.

1-3-10-3 Jump to the set trigger establishment range



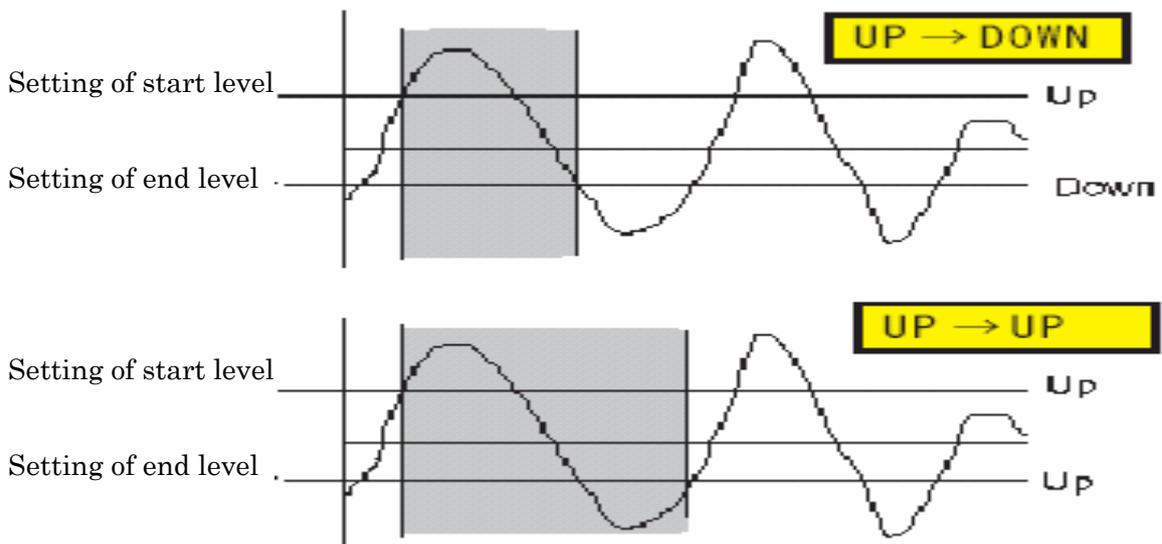
Set trigger values and trigger directions on the acquired data. This is the function which allows the reverse video area to move to the range sandwiched between the locations where the set trigger values and directions satisfy the set conditions. To jump to this set-trigger establishment range, trigger conditions and a referred channel have to be set first of all. Choose " Trigger Area Setting " from the pull-down menu of " Search " on menu bar.

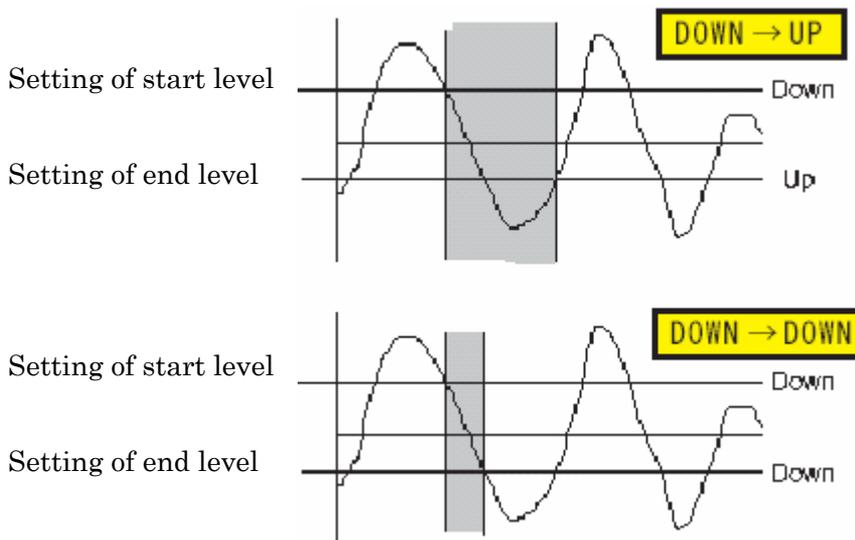


Then a setting dialog box will appear. Select a trigger setting channel from options. A channel to be selected does not need to be that of currently displayed ones. To set trigger-level, 2 items of trigger-levels for start & end have to

be set. When setting trigger direction, set each of the passing directions just at the time of crossing the set trigger level.

A given graph section can be searched by combination of trigger level and trigger direction as shown below.





To activate this function, setting of area jump mode has to be set after setting of trigger conditions. Choose " Jump Trigger Area Mode " from the pull-down menu of " Search " on menu

bar. In this status, click the icon  (right arrow) on tool bar and current reverse video area will move to a trigger-established section existing to the right side of the screen. Alternatively, click the icon  (left arrow) on tool bar and current reverse video area will move to a trigger-established section existing to the left side of the screen. Needless to say, unless the trigger conditions set in advance are to be satisfied, it won't move.

Should trigger area jump mode be executed without setting trigger conditions, the immediately preceding set conditions or initial values of program conditions would be adopted. The initial value for trigger area is as follows: channel is the first channel among acquisition channels, level trigger is 0 and trigger directions are UP/DOWN.

1-3-11 Redrawing (enlargement of axis-width) function of analysis range



You can redraw the current width of display graph within the specified range. Choose "Cut Down Range Zoom In" from the pull-down menu of "Set" on menu bar.



Or click the icon on tool bar. Then the specified range can be redrawn. This function can not, however, be used in the case where the graph is depicted with one data per one pixel, in other words depicted in uncompressed status.

This function is very useful in changing a specified portion of the compressed display graph to the enlarged width graph for analysis speedily. For example, it is effective in changing a portion of all-data display waveform or Mark-to-Mark display waveform to a magnified display waveform for analysis.

It is impossible to return to just preceding compressed waveform from this enlarged redrawn one. See the chapter described about a magnifying glass window for provisional scaleup.

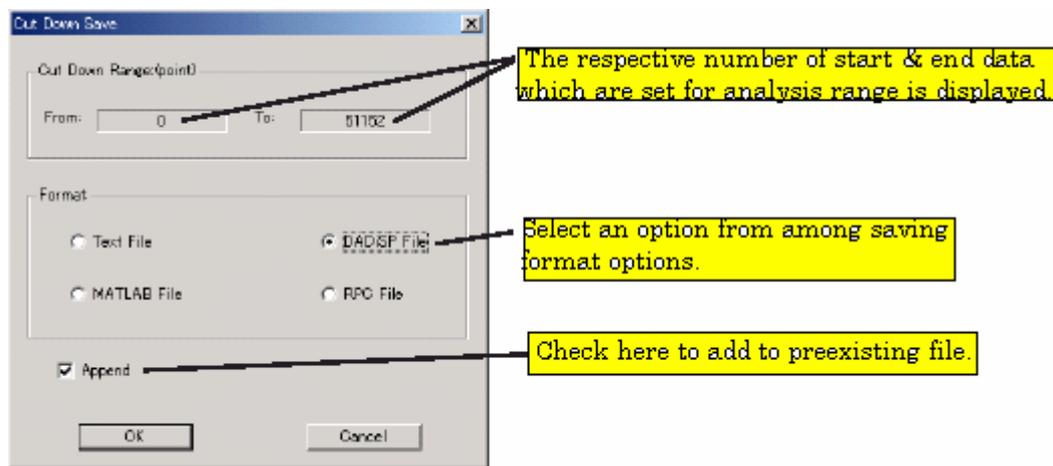
1-3-12 Cutting down and saving function of waveform

This function allows the specified (reverse video) area of a display waveform to be recorded into another file. It aims at creating another file for the useful range or the region of interest extracted from acquired data, or creating a different file in a specific format to analyze by other analysis program.

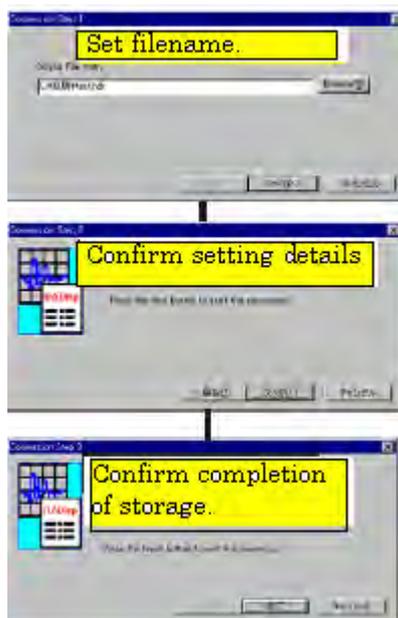
Choose " Cut Down Save " from the pull-down list box of " Set " on tool bar.



Or click the icon  on tool bar. Then a dialog box will appear. Select one option from among the following 4 options in format box : Text File, DADiSP File (this program's format), MATLAB File and RPC File.



1-3-12-1 How to save by DADiSP format.



Select DADiSP file. On clicking OK button, a write-setting wizard will appear. Input a filename you want to create. Press Browse (B) button to see reference dialog. No extension needs to be added to the filename. It will be generated with "hdr" for header-file and with "dat" for data-file.

If preexisting file of the same filename should exist, an overwrite confirmation dialog box will appear. Recorded data file can be read by this program or DADiSP program.

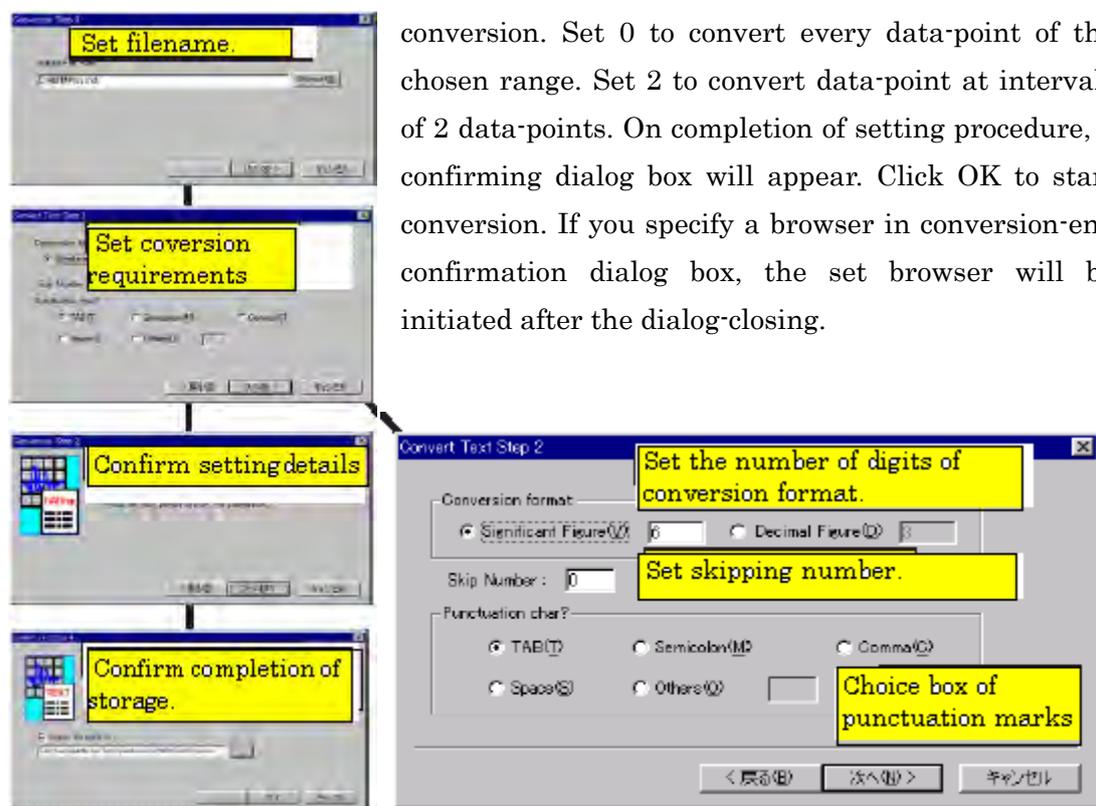
When you want to join two files in time-axis direction, for example, a file recorded in the morning to another file recorded in the afternoon of the day, checking APPEND box in advance is required. In this case, the filename to be set has to be the same one recorded in the morning while currently displayed waveform file has to be the waveform recorded in the afternoon.

Further, as other requirements, the following three requirements have to be satisfied : acquisition channel series, unit of each channel and channel number & slope value of each channel are all identical to each other.

1-3-12-2 How to save by TEXT format.

Select Text File for a format. There are two procedures of saving by TEXT format : one is creation of new text file, or another is appending it to already-existing file. After checking APEND box, click OK button for appending. Then a write-setting wizard will appear. Firstly, input existing filename to which you want to append in Output File box, If you want to avoid entering effort, choose it from among dialog.

Secondly, set text conversion format, punctuation and so forth. There are two options for conversion format : choice of either all figure specification or decimal figure specification. Skid Number is jumping number on time-axis at the time of TEXT conversion. Set 0 to convert every data-point of the chosen range. Set 2 to convert data-point at intervals of 2 data-points. On completion of setting procedure, a confirming dialog box will appear. Click OK to start conversion. If you specify a browser in conversion-end confirmation dialog box, the set browser will be initiated after the dialog-closing.





Enter program name in full path.

When you want to initiate a browser (e.g. EXCEL) automatically at completion of TEXT conversion storage, check the check box in the confirmation dialog box and enter a program name to be initiated.

Conversion result by TEXT format (sample in Excel)

No.	DATE TIME	ms	Ch1 (G)	Ch2 (G)	Ch3 (G)	Ch4 (G)	Ch5 (G)	Ch6 (G)	Ch7 (G)	Ch8 (G)
8908	15:43:40	891	-0.505	-0.947	-0.72	-0.56	-0.219	-0.182	-0.716	-0.689
8909	15:43:40	891	-0.57	-0.92	-0.703	-0.444	-0.204	-0.047	-0.741	-0.63
8910	15:43:40	891	-0.465	-0.968	-0.819	-0.348	-0.204	-0.352	-0.705	-0.74
8911	15:43:40	891	-0.32	-0.802	-0.831	-0.498	-0.189	-0.091	-0.519	-0.722
8912	15:43:40	891	-0.541	-0.956	-0.801	-0.481	-0.168	-0.041	-0.711	-0.722
8913	15:43:40	891	-0.573	-0.826	-0.849	-0.328	-0.216	-0.232	-0.752	-0.819
8914	15:43:40	891	-0.369	-0.799	-0.843	-0.478	-0.153	-0.182	-0.647	-0.677
8915	15:43:40	892	-0.36	-0.717	-0.849	-0.464	-0.243	-0.041	-0.7	-0.775

The initial number in the first column begins from 1 by data number which indicates acquisition start data no. In above chart, extracted (cut-down) data numbers are shown. The DATE TIME in 2nd column shows real elapsed period of time from acquisition-start time described in header-file of acquisition file. However, it does not always show correct data time if there are operations like Pause in acquisition data-file. In above sample chart, time description is set in Excel.

1-3-13 Setting of graph title

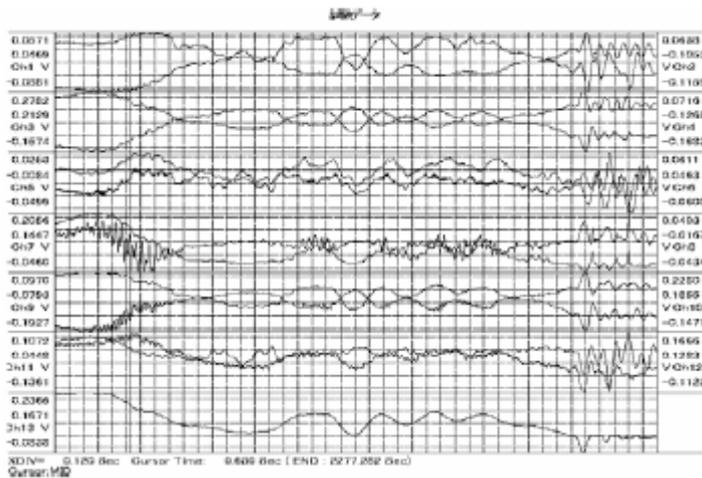
Acquisition data filename is used as initial value of waveform graph's title. To change it, choose " Title" from the pull-down list box of "Option " on menu bar. Then a setting dialog box will appear.



Graph title is referred to at printing time.

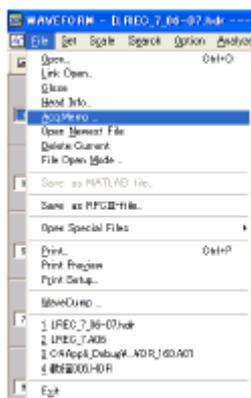
1-3-14 Printing of waveform graph

Choose "Print" from the pull-down list box of "File" on menu bar. On choosing it, a connected printer to your PC will produce printed output. To set the printer on paper size or orientation, choose "Print Setup" from the pull-down list box of "File" on menu bar. Then a setting dialog box will appear. See the operation manual of the printer for setting-operation as the setting dialog is printer-specific. Further, to preview a page, choose "Print Preview" from the pull-down list box. Then Preview window will be displayed.

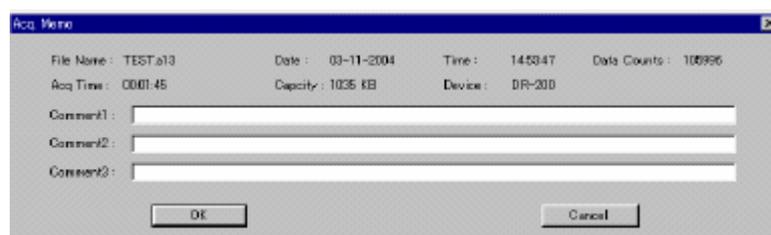


1-3-15 Checking and writing function of measurement-memo

This function allows COMMENT line in header-file to be checked and written newly.



Choose "Acq. Memo" from the pull-down list box of "File" on menu bar.



Then a setting dialog box will appear. In the dialog box, current data filename, acquisition-start date & time, acquired data count, acquisition period of time, data capacity and recorder (device) name are described in upper row space. In lower row space, 3 comment lines described in header-file are shown. Unless annotated at acquisition time, they become empty. When you want to comment or change current comment, type it in this box from keyboard. Click OK to change the details in comment lines of header-file.

It is recommended to write memo just after acquisition.

1-3-16 Display of header-file

Acquired data file is constructed of header-file and data-file as a pair. Header-file is TEXT-formatted file, and varieties of data-acquisition requirements as well as acquisition start-date & time are recorded. Data-file is 2-byte integer-formatted, binary file in which A/D conversion values are recorded on "as is" basis. Waveform of this program is displayed by referring to both files. It is possible to display header-file details on the screen to check acquisition requirements. Choose "Head Info..." from the pull-down list box of "File" on menu bar. The details of header-file will be shown on the screen as they are.

Details of header-file

See a paragraph of acquisition data format for header-file details described in header.

1-3-16-1 Printing of header-file

Choose "Print" from the pull-down list box of "File" on menu bar. Or click the printer icon on tool bar. The printer will produce printed output.

1-3-17 Calibration function

It is the function of converting physical unit for acquired data. This program provides us with the following ways to convert engineering unit : one is referring to template file created by an optionally available program PL-U4112 "PcWaveCal", two is entering calibration factors directly and three is using computing function on operation window as described later.

1-3-17-1 The way of referring to template

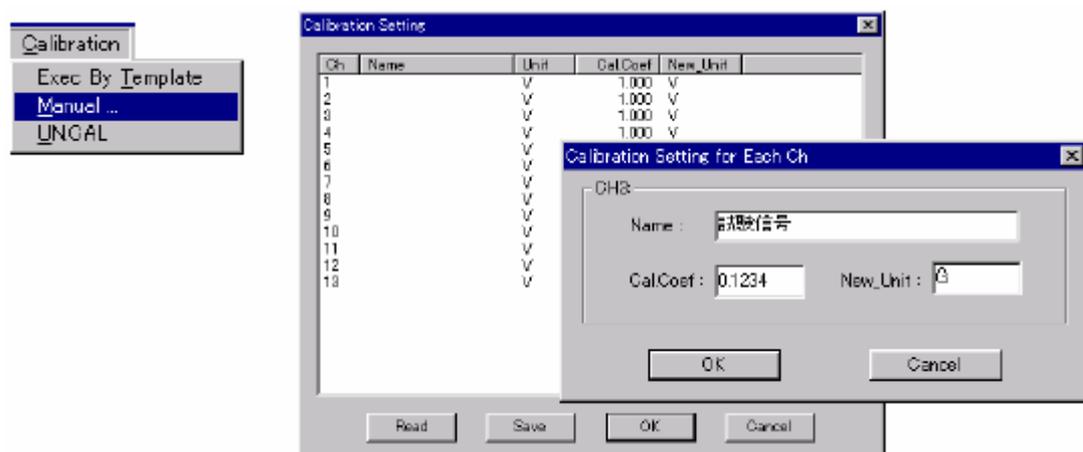
When template file has already been created by optionally available program "PL-U4112 " calibration program in advance, without converting physical unit by executing calibration program every acquisition, it is possible to convert physical unit by specifying template file from this program Choose "EXEC by Template" from the pull-down list box of "Calibration" on menu bar. Then a setting dialog box will appear. Specify the appropriate template file to execute calibration.



*When the channel number of calibration-target data-file exists in calibration template file, and pre-calibration unit between template file and acquisition data-file meets each other, calibration is executed.

1-3-17-2 The way of typing in calibration factors

Choose "Manual" from the pull-down list box of "Calibration" on menu bar. Then a setting dialog box will appear. Currently set details are shown in the dialog box.



1-3-17-2-1 Setting of calibration requirements

Select a channel line you want to set from a list of choices and double-click it.. Then another setting dialog box will appear. In this new box, signal name, calibration coefficient and engineering unit can be set. You can not ,however, set offset value. Further, be sure to check that the sign of the value to set in this Cal Coef box has to be positive. In short, the result of acquired data value multiplied by this Cal Coef value set in his box becomes calibration result. ($y = ax$)

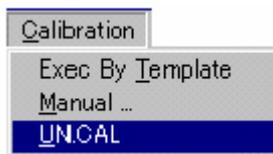
1-3-17-2-2 Saving of set calibration requirements

On clicking "Save" button in calibration setting dialog box, a saving dialog box will appear. Save it by typing a filename. The file saved here will be stored in the same format as calibration template file.

1-3-17-2-3 Read-out of calibration requirements

On clicking "Read" button in calibration setting dialog box, a read-out dialog box will appear. Read out a calibration template file created in advance by specifying filename. This function is equivalent to that of reading out template and executing calibration.

1-3-17-2-4 Canceling of calibration



It is possible to show the values of waveform in the same details as described in original header-file after executing calibration once and later abandoning it. Choose "UN.CAL" from the pull-down list box of "Calibration" on menu bar.

On choosing, the values of waveform will return to those immediately before calibration.

It is impossible to get the values of waveform back to original ones, once having displayed already-calibrated file (already-saved file) on the screen.

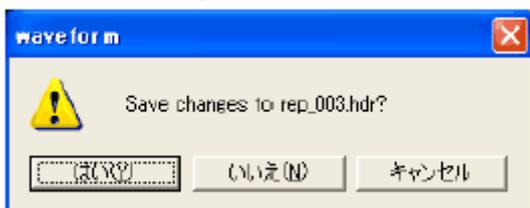
1-3-18 Closing of data file during display



Choose "Close" from the pull-down list box of "File" on menu bar. On choosing it, data-file during display will be closed. However, when calibration has been carried out in the program, a dialog box asking whether the header-file has to be rewritten or not will appear. If rewriting is chosen, the waveform to be shown next time will be displayed in calibrated status.

1-3-19 Saving of the file whose header-file has been changed.

After the change of header-file, choose "Close" from the pull-down menu of "File" on



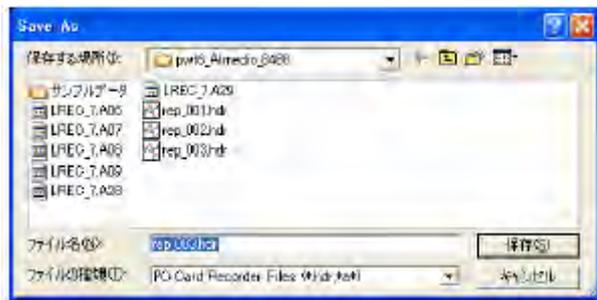
menu bar. Or click "x (Close)" button at the upper right on waveform window. Then a confirmation dialog box will appear.

Filename is changeable for the file in which calibration and other change have been carried out.

“YES”... “Save As” dialog box will appear. Click “Yes” button, and the changed file is saved.

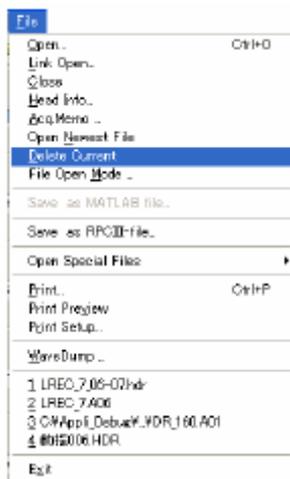
“NO”... Clicking “No” button closes the file. * Once closed, retrieval can not be allowed.

“Cancel”... Previous screen comes back.



In Save As dialog box, the directory where read-in file exists will be shown as initial value.

1-3-20 Deleting of data file during display



It is possible to delete the acquired data currently shown on the screen. We mean by deletion function that a pair of data-file and header-file recorded on the disk can be deleted on the spot for example. This function is very effective and convenient in the following case. For example, when we are examining the recorded data immediately after acquisition and find a failure in acquisition, we can delete the defective current file on the spot using this program. Choose "Delete Current" from the pull-down list box of "File" on menu bar. Or click the icon on tool bar.



Then a confirmation dialog box will appear. Click OK button to delete current file.

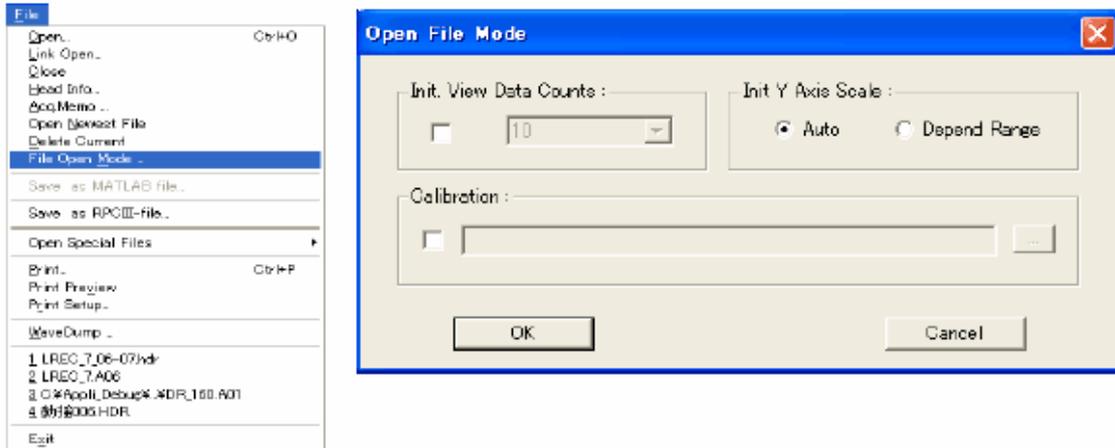
1-3-21 Setting of presence & absence of grid in graph window

It is possible to turn ON/OFF of grid (scale mark) shown within graph frame. Click

the grid icon  on tool bar to turn it ON/OFF.

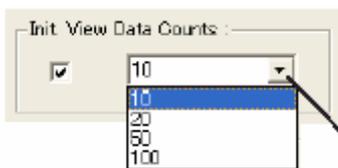
1-3-22 Setting of waveform display form just after read-in of file

Click “File Open Mode” from the pull-down menu of “File” on menu bar.. On choosing it, a setting dialog box will appear.



1-3-22-1 Setting of display percentage of acquired data on the screen at file-open time.

Set the data account to display on the screen(amount by % for the whole just after opening of file). Check the check box, and a drop-down list box opens to show



available choices. Four choices are available: 10%, 20%, 50% and 100%. If unchecking, it changes to initial set value.

Select available data count choices (10,20,50 or 100) from the pull-down menu.

1-3-22-2 Setting of Y-axis display scale attribute.



Set Y-axis scale attribute to be displayed just after opening of file. When selecting “Auto” option button, you can display Y-axis scale on AutoScale scheme.

When selecting “Depend Range” option button, you can display Y-axis scale based on the measurement range which is described in header-file specified form. Unless described, Y-axis scaling is performed on AutoScale scheme.

* When calibration function described in calibration box at lower part of the dialog box is on, display scale described in calibration template is given priority.

1-3-22-3 Setting of auto-calibration function

Just after opening of file, confirm whether calibration is to be performed or not. On checking check box of calibration, input box becomes effective. You can display calibration file by hitting the button at right. For information, should a channel which does not match with template details, calibration of the appropriate channel is not performed to display a warning dialog.



It is convenient when the same template is used.

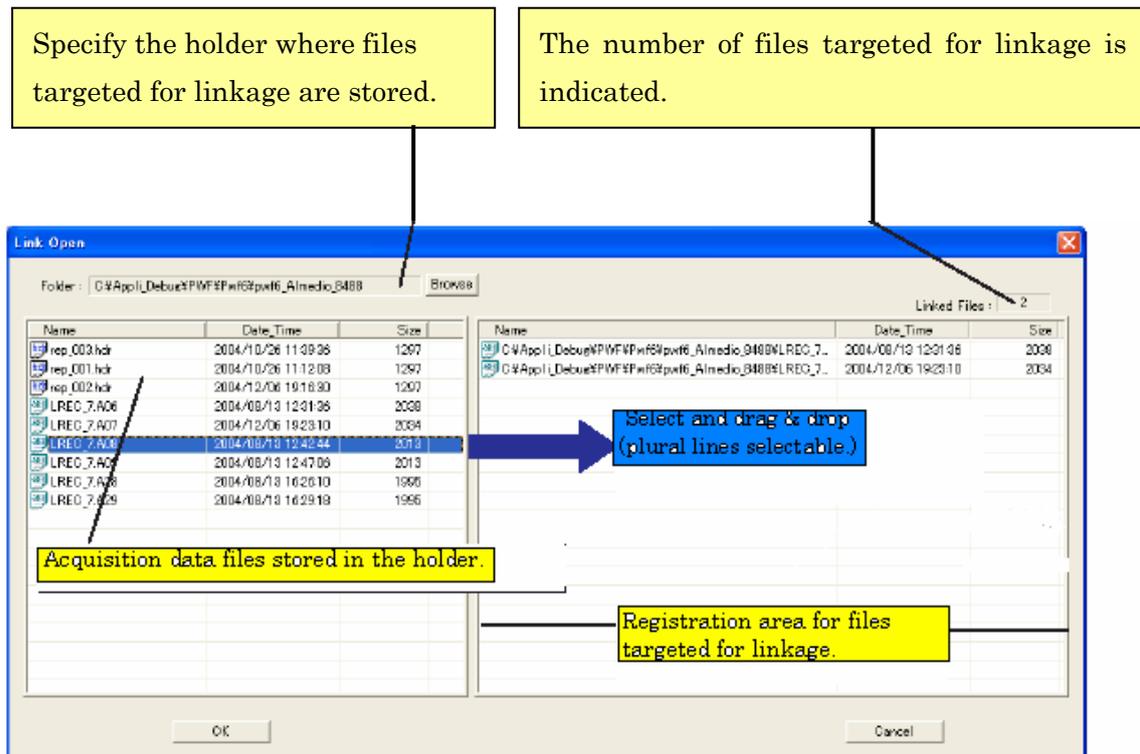
Warning error message * When incompatible with template file.

1-3-23 Coupling & loading function of acquisition data file



This function allows the files which recorded data under the same acquisition conditions to be coupled and read out. Choose "Link open" from the pull-down list box of "File" on menu bar. On choosing it, a dialog box will appear.

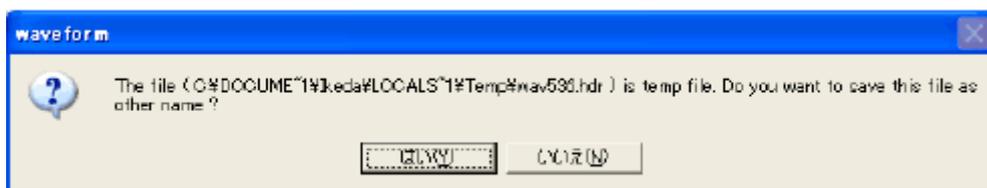
It is convenient to use this function, for example, for the case where you work with the acquisition file created at fixed interval times as a coupled file, for the case where you work with the acquisition files created at morning test and afternoon test as a coupled file, or for the case where you work with files created by extracting effective section of individual acquisition file by one operation. Further, it is possible to handle acquisition files in different holders in batch.



On clicking “OK” button, link processing is performed. For information, files are sorted in ascending order according to filenames prior to the processing and then linked. Still, when link processing is performed, the relation between acquisition-start time and acquisition data is checked. If they are apart in time, Pause line, or if less than 1 sec, Mark line is automatically generated in created header-file.

1-3-23-1 How to save a file.

On completion of linkage, Temp file of wav ***.hdr (and wav***.dat) name is created in waveform window. When finishing waveform window work, the following message will appear. To save the file, click “Yes”, and a dialog box will appear. After changing the proper name, save it. If clicking “No”, data is deleted. Be careful the retrieval is not allowed.

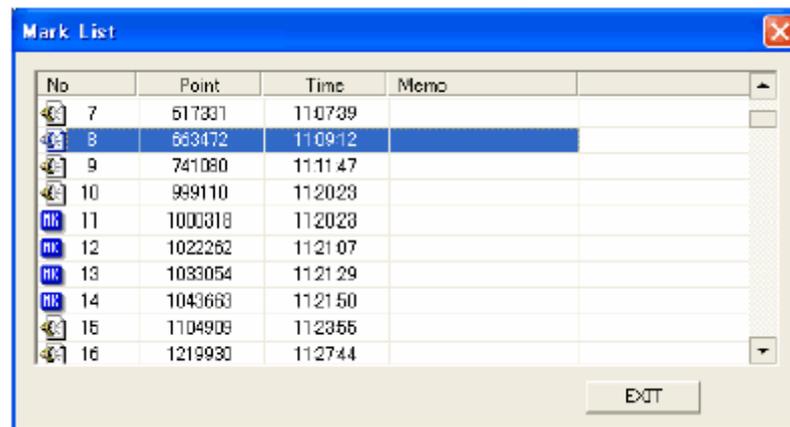


1-4 Expansion function of waveform graph



This function allows MARK information given during acquisition to be indicated in list form and move cursor line to a selected MARK location. It also allows a selected MARK voice-memo to be played back.

Choose “Mark List” from the pull-down list box of “Search” on menu bar. When choosing it, mark list dialog box will appear. If Mark List is inactive, it means neither voice-memo nor Mark has been recorded.



In dialog box, mark number, marked data-point and its time of the day are shown. There are 2 kinds of marks : mark given by operation button and mark given by voice-memo. In the dialog, both of them are shown at the same time. The variety is represented by the icon at the leading edge of each line.

MARK given by operation button is indicated with  while MARK given by voice-memo is indicated with .

1-4-1 Moving of cursor line by using MARK list.

Double-click MARK location on the list to move cursor line to a given MARK location. On double-clicking it, cursor line moves to the selected MARK location. MARK list dialog box won't close.

* If a MARK location outside of currently displayed range of waveform display window is selected, the waveform display window is automatically renewed so that selected MARK location comes to center position of the screen.

1-4-1-1 Playback of voice mark by using MARK list.

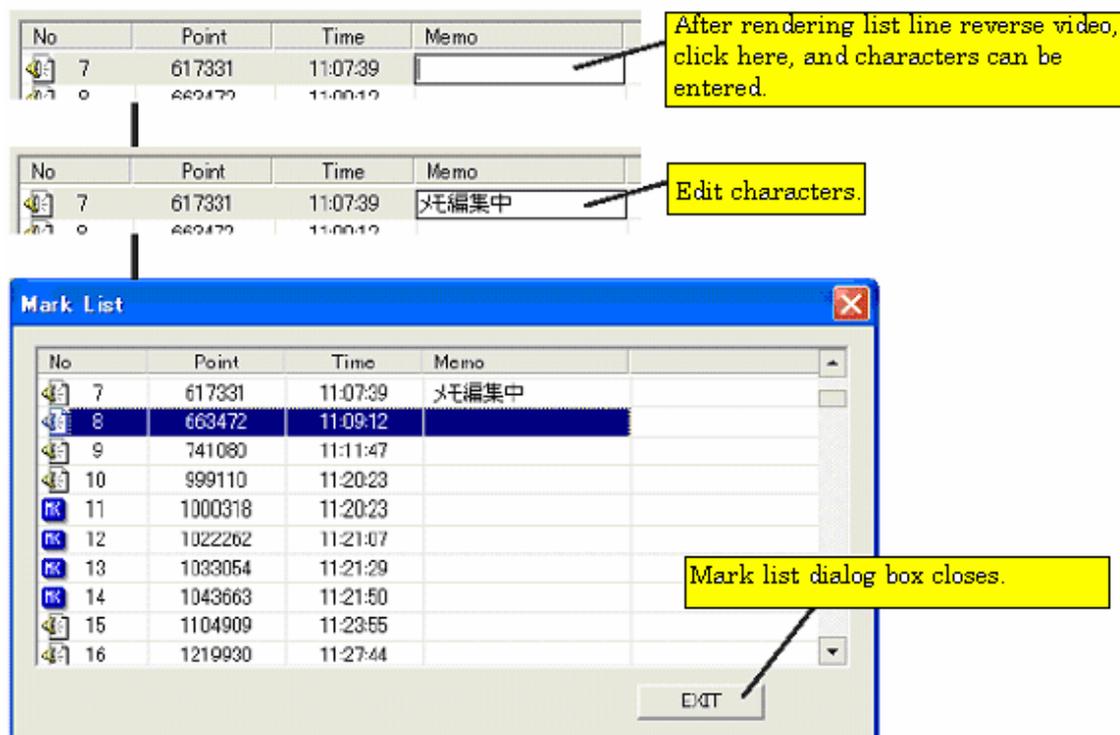
When you want to play back voice-memo, move the current line (reverse video line) to voice-memo mark line and click  button. Then sound playback dialog box will appear and play back a voice-memo which has been recorded during acquisition. Playback is automatically repeated till OK button is clicked.



1-4-1-2 Editing of memo box in MARK list

Move cursor to Mark memo box in the Mark list where you want to enter and click Memo box on the cell. Memo box can be edited. Enter characters there directly. When you have finished edit, push "Enter" on keyboard or when you have entered characters, move reverse video line on the Mark list. Then edit is completed.

When operation on Mark list have finished, click "Enter" button on Mark list dialog box, and the dialog box closes. Then waveform display window will come back on the screen.



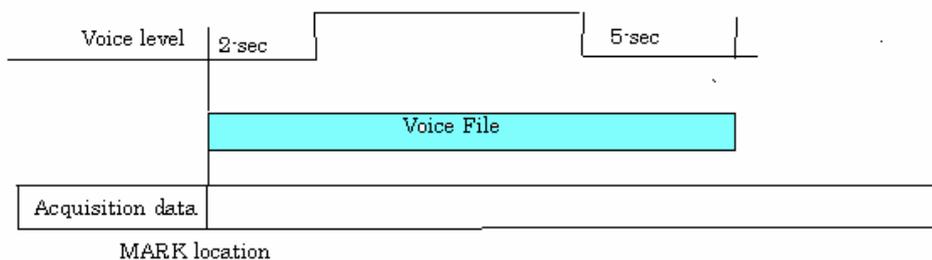
No	Point	Time	Memo
7	617331	11:07:39	
8	663472	11:09:12	
9	741080	11:11:47	
10	999110	11:20:23	
11	1000318	11:20:23	
12	1022262	11:21:07	
13	1033054	11:21:29	
14	1043663	11:21:50	
15	1104909	11:23:55	
16	1219930	11:27:44	

1-4-1-3 Creation of voice-memo file using HR-12.

Connect optional RC-12V (remote control unit with voice-memo function) to HR-12 and connect a microphone to RC-12V. Then voice-memo can be recorded. But it can be recorded only during acquisition. In the case of HR-12, voice-memo is handled in the same way as MARK and recorded into header-file.

Voice-signals captured from a microphone are converted to 64 kbps of digital serial signals through CODEC-IC in RC-12V, and then compressed by 1/8 by mounted DSP. Voice-signals input into RC-12V are at all times monitored. When detected to surpass a limited value, compressed voice serial data will be transmitted to HR-12 from the preceding 2 seconds of detection time. On reception, HR-12 begins to create voice-memo file whose name is provided automatically, aside from acquisition file.

It will create MARK line having a new filename in header-file. File format to be created will be voice-file format with ".wav" as extension. Closing of this voice file will be automatically executed 5 seconds later after the level of voice signals falls below a fixed level.



1-4-1-4 A sample of created header-file

The following is a sample of created header-file when voice-memos were recorded by HR-12 PC Card Recorder.

```

DATASET ACQ005_HDR
VERSION 1
SERIES CH_1, CH_2, CH_3, CH_4, CH_5, CH_6, CH_7, CH_8, CH_9, CH_10, CH_11, CH_12
DATE 10-14-2000
TIME 19:55:44
RATE 1000
VERT_UNITS uST, uST, uST, uST, uST, uST, uST, uST, V, V, V, V
HORZ_UNITS Sec
NUM_SERIES 12
STORAGE_MODE INTERLACED
FILE_TYPE INTEGER
SLOPE 2. 000000e-01, 2. 000000e-01, 2. 000000e-01, 8. 000000e-02, 2. 000000e-01, 4. 000000e-01
. 4. 000000e-01, 4. 000000e-01, 1. 000000e-04, 1. 000000e-04, 1. 000000e-04, 1. 000000e-04
X_OFFSET 0
Y_OFFSET 65448, 4, 65528, 34, 149, 65522, 106, 67, 0, 0, 0, 0
NUM_SAMPS 41990
DEVICE HR12
FILENAME ACQ005.DAT
DATA
MARK 1820, 19:55:45, HR12YACQ¥017B76AE.WAV
MARK 5020, 19:55:49
MARK 11201, 19:55:53
MARK 21120, 19:56:05
MARK 38460, 19:56:21, HR12YACQ¥017B76D2.WAV
MARK 40910, 19:56:23
CLOCK INTERNAL
END 41990

```

The above sample shows MARKs performed at 4 different times by operation button while it shows MARKs performed at 2 different times by voice-memo. Each of voice filename was created in the format of 017B76AE.WAV or 017B76D2.WAV.

* To ensure uniqueness, voice filename is made by expressing the total number of seconds of HR-12 built-in real-time clock in hexadecimal notation.

1-4-1-5 How to copy voice-memo file.

In acquisition data file, voice-memo files are created together with a pair of TEXT-formatted header-file and binary-formatted data-file. When copying PC Card onto PC hard disk, etc, a batch copying is required. In other words, the holder storing header-file in it has to store data-file as its pair and voice-memo file simultaneously. Header-file and data-file have the same filename, but their extension is different to each other. In the case of acquisition by HR-12, extension of header-file is “.hdr” while that of data-file is “.dat”. The extension of voice-memo file is “.Wav” and its filename

is created on time basis, so there is no relationship with other filenames. To extract specific group from the results in PC Card in which multiple acquisitions are recorded, handle in the following way.

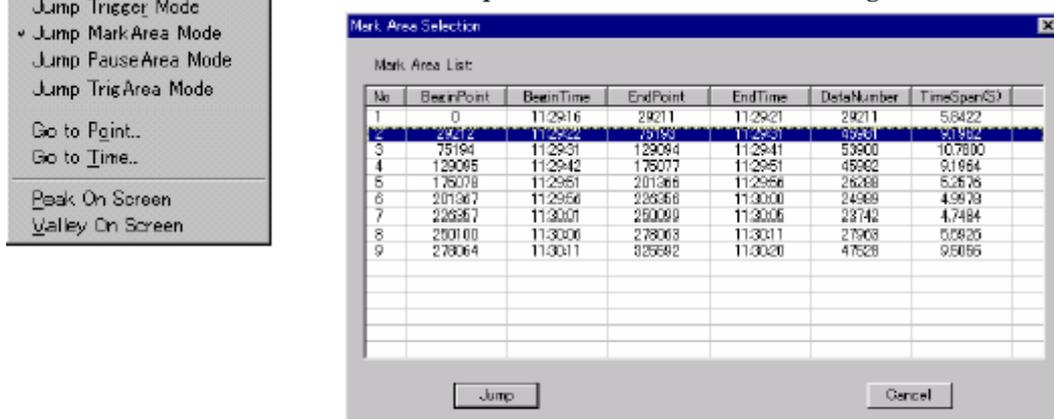
名前	サイズ	ファイルの種類	更新日時
Acq001.hdr	2KB	HDR ファイル	00/10/16 1854
Acq001.dat	197KB	DAT ファイル	00/10/16 1854
017cb96d.wav	19KB	WAVE サウンド	00/10/16 1854
Acq002.hdr	2KB	HDR ファイル	00/10/16 1855
Acq002.dat	302KB	DAT ファイル	00/10/16 1855
017cbaf1.wav	43KB	WAVE サウンド	00/10/16 1855
Acq003.hdr	2KB	HDR ファイル	00/10/16 1857
Acq003.dat	300KB	DAT ファイル	00/10/16 1857
017cb97d.wav	23KB	WAVE サウンド	00/10/16 1857
017cb98e.wav	12KB	WAVE サウンド	00/10/16 1857

First, initiate Explorer in Windows and display acquisition data file list on the screen. Set display format in detail and sort renewal date in descending numeric order. Files would be stored in such an order as header-file

data-file voice-memo file voice-memo file... and then next header-file ... When copying, copy a group of them in a batch, as the files are listed from header-file to just preceding file of next header-file in one group. If missing voice-memo file, retrieve it by referring to MARK line in the header-file and move it into the same holder.

1-4-2 Moving of analysis range using "Mark Area List"

Choose "Mark Area" from the pull-down list box of "Search" on menu bar. But this function (shown as inactive) could not be performed if MARK information should not exist in acquisition header-file or reverse video area (analysis range) should not be displayed on waveform graph. When chosen, "Mark Area List" will be displayed. Click the destined MARK-to-MARK line. The reverse video area moves to the specified MARK-to-MARK range.



In this status, if "Jump Mark Area Mode" is chosen as analysis range jump mode, analysis range will move from current MARK-to-MARK range as initial value to next range existing to the right or left direction by clicking the icon  or  on tool bar.

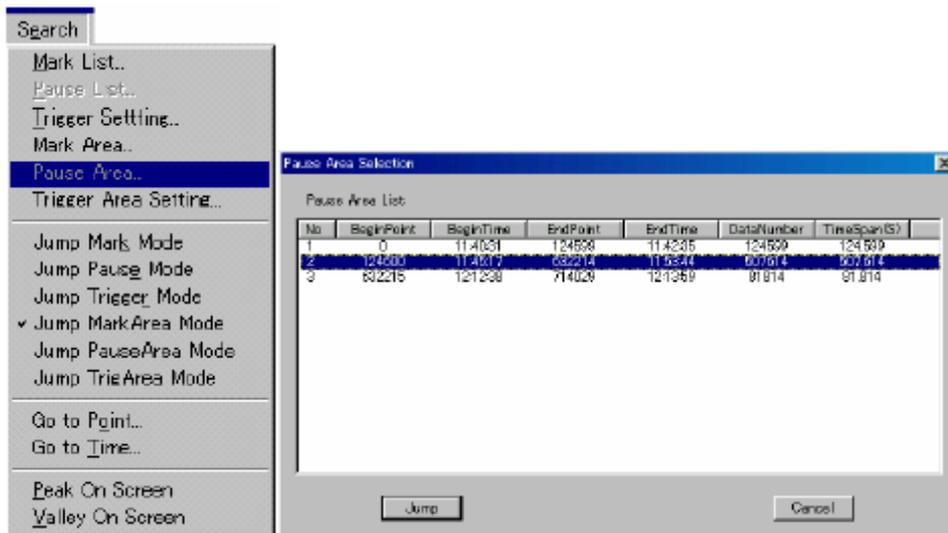
The width of reverse video area will be automatically determined by the number of data-points between mark and mark.

1-4-3 Moving of analysis range using "Pause Area List".

Choose "Pause Area" from the pull-down list box of "Search" on menu bar.

When chosen, "Mark List" will be displayed. Click the destined Pause-to-Pause line.

The reverse video area moves to the specified Pause-to-Pause range.

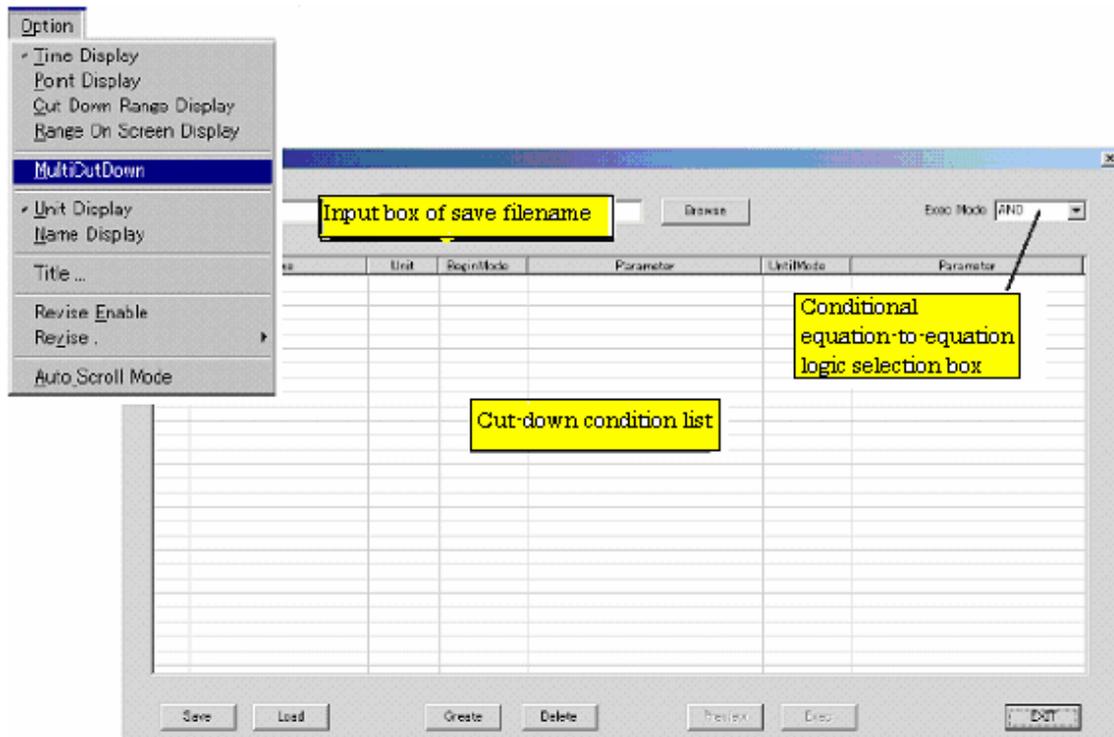


In this status, if "Jump Pause Area Mode" is chosen as analysis range jump mode, analysis range will move from current Pause-to-Pause range as initial value to next

range existing to the right or left direction by clicking the icon  or  on tool bar.

The width of reverse video area will be automatically determined by the number of data-points between pause and pause.

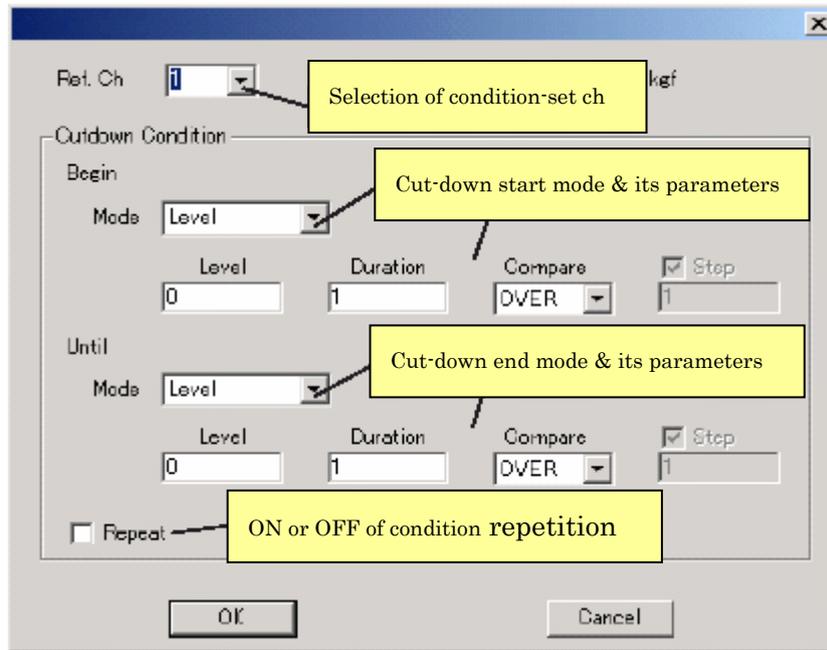
1-4-4 The function allowing simultaneous cut-down of plural sections of waveform.



This function allows creation of a file by cutting down the waveform sections which satisfy the set cut-down condition from display waveforms, and analyzing plural effective sections spreading across various sections of waveforms in batch.

Choose "MultiCutDown" from the pull-down list box of "Option" on menu bar. When chosen, a cut-down condition setting/execution dialog box will appear.

1-4-4-1 Setting of cut-down conditions

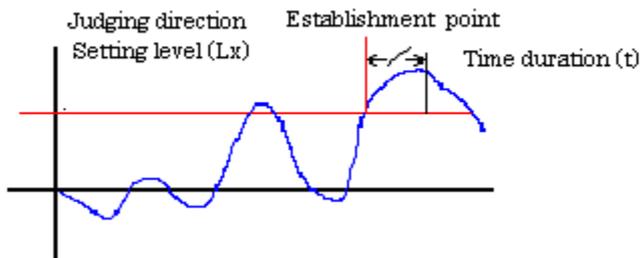


Click "Create" button on the dialog. Then a condition setting dialog box will appear. Set the following items of cut-down conditions : Ref. channel, cut-down start mode (and its parameters), cut-down end mode (and its parameters) and YES/ NO of referred condition repetition. Ref. channel is the target channel of cut-down conditions. The range of this channel which satisfies cut-down conditions applies to those of all other channels

Cut-down mode supports the following 8 varieties of setting : Level, Level Cross, Level Area, MARK, PAUSE, Pulse-Count, Data-Count and Level variation ratio. Start and End modes need not to be identical . Various combination of modes are available.

Setting conditions become effective when data of reference channel exceeds the set level in judging direction (over or under) and still holds during set period of time. The establishment point is , however, decided to the point of going back by duration-time.

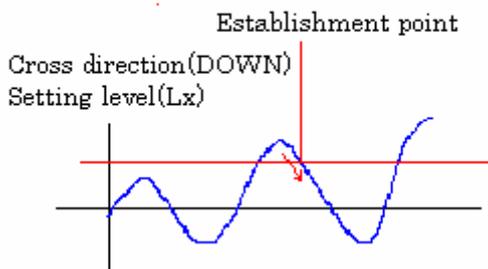
1-4-4-1-1 Level setting



Select "Level" in a list of mode box. The parameters consist of Level, time duration, judging direction and variation value. Variation value becomes effective when Repeat is checked ON. This variation

value is added to the current setting level when this setting is performed next time. When Repeat is OFF, reference ceases once set conditions are satisfied. In short, cut-down operation based on current conditions is performed only in onetime operation.

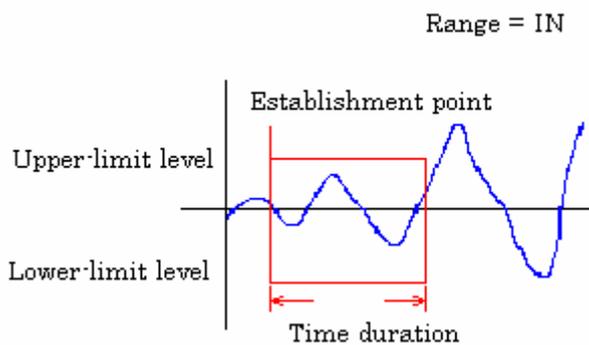
1-4-4-1-2 Level Cross setting



Select "Level Cross" in a list of mode box. The parameters consist of Level, cross direction (UP or DOWN) and variation value. When data of Ref. channel goes beyond the set level in cross direction (UP or DOWN), the mode is established. Variation value becomes effective when Repeat is checked ON. And this variation value is

added to the current setting level when the same conditions are referred to next time.

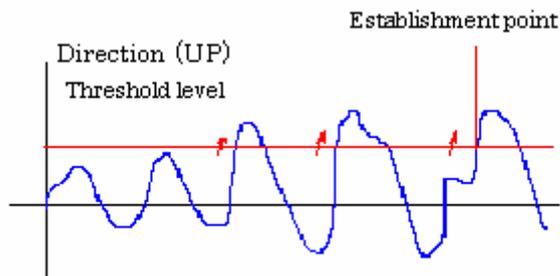
1-4-4-1-3 Area setting



Select "Area" in a list of mode box. The parameters consist of Low-limit level, Upper-limit level, Time duration and Area (IN or OUT). In the case of Area "IN", the mode is established when data of Ref. channel comes in the box drawn by the settings of lower-limit level, upper-limit level and time duration. In the case of

"OUT" ,the mode is established when data of Ref. channel goes outside the box.

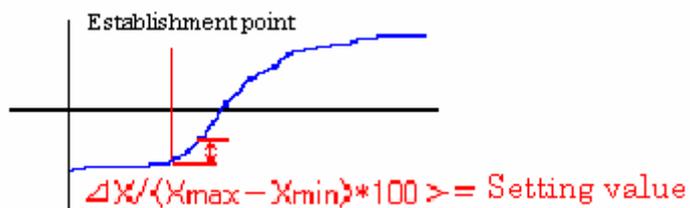
1-4-4-1-4 Pulse-Count setting



Select "Pulse-Count" in a list of mode box. The parameters consist of Count, Threshold, Direction (UP or DOWN) and variation value. When data of Ref. channel goes beyond the set threshold level initially and again exceeds it, we count the process as an onetime. The location where the

number of pulses reaches the set number is decided as an establishment point. Suppose direction is UP. If data of Ref. channel goes beyond the set threshold level in positive direction and again exceeds it in positive direction, we count the process as an onetime. In the case of DOWN, if channel's data goes beyond the set threshold level in negative direction and again exceeds it in negative direction, we count the process as an onetime. The diagram of 3-times by pulse-number is shown as illustrated as a sample.

1-4-4-1-5 Level-Ratio setting



Select "Level-Ratio" in a list of mode box. The parameters consist of Threshold Ratio (%) and Compare (NORMA or ACCUMULATE). Seek percentage of an expression

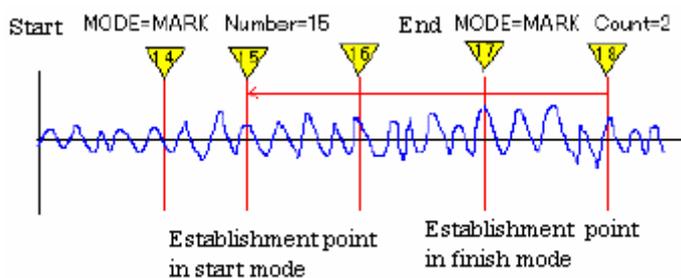
which sets one-rank differential value of Ref. channel as numerator and (Max - Min) value in analysis range as denominator. When the result is equal to or beyond the set value, the mode is established. In the case of accumulation setting, the establishment point of mode is judged by adding one-rank differential value by one-ranks in unestablishment section. Accumulation is cleared at establishment time.

1-4-4-1-6 Data-Count setting

Select "Data-Count" in a list of mode box. The parameters consist of Data-Count and variation value. The mode is established when the set number of data-points just after the initiation of evaluation reaches the set count. Variation value becomes effective when Repeat is checked ON. At next judgment, judgment is carried out by adding variation value to the set data count.

For example, suppose data count is set 1.000 and variation value 100 as cut-down end condition. First establishment point is 1.001 points from cut-down start point, second establishment point is 1,1001 point from cut-down start point and third establishment point is 1,201 point from cut-down start point.

1-4-4-1-7 MARK setting



Select "MARK" in a list of mode box. The parameters consist of MARK NO. and additional number when used for start-condition and MARK times when used for finish-condition. When used for start-condition,

data location of the set MARK no. is establishment point. But no condition can be established if MARK does not exist within the set analysis range. When Repeat is checked ON, the data location of specified MARK number + additional number becomes establishment point a second time. When used for finish condition, the data location which has passed the set number of MARKs is determined as an establishment point.

As far as establishment point is concerned, MARK NO. is absolute number when being used for start condition, while the number of MARKs is an establishment point when being used for finish condition.

1-4-4-1-8 PAUSE setting

Select "PAUSE" in a list of mode box. The parameters consist of PAUSE NO. and additional number when used for start-condition and PAUSE times when used for finish-condition. When used for start-condition, data location of the set PAUSE no. is establishment point. But no condition can be established if PAUSE does not exist within the set analysis range. When Repeat is checked ON, the data location of specified PAUSE number + additional number becomes establishment point a second

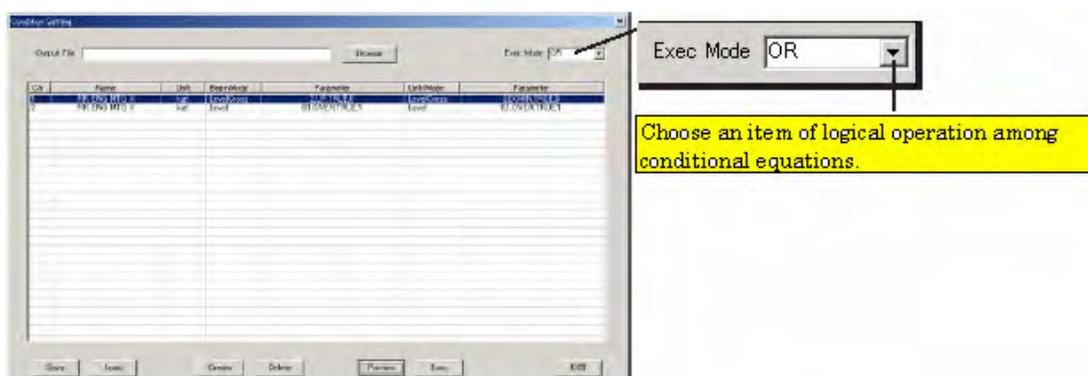
time. When used for finish condition, the data location which has passed the set number of PAUSEs is determined as an establishment point.

As far as establishment point is concerned, PAUSE NO. is absolute number when being used for start condition, while the number of PAUSEs is an establishment point when being used for finish condition.

1-4-4-2 Logical operation for multiple conditions

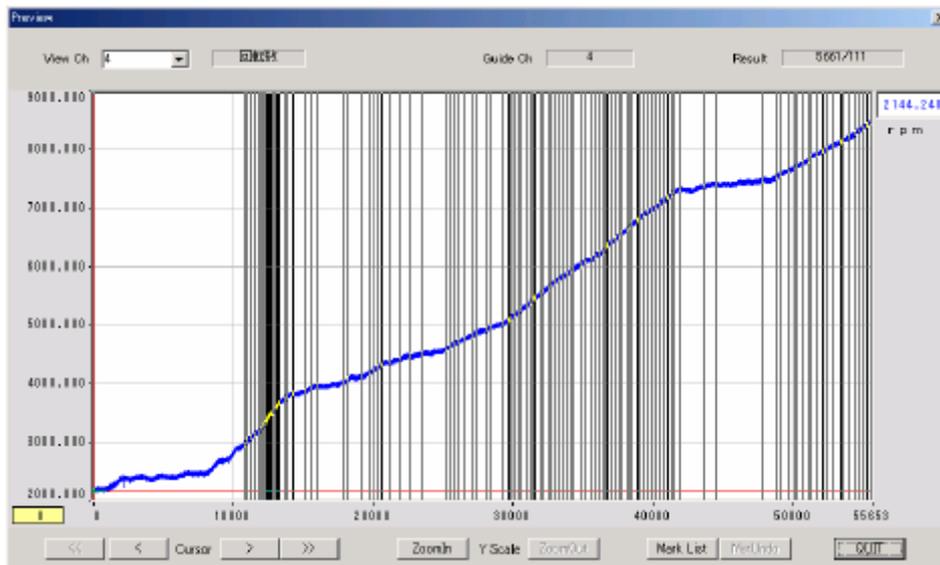
Various cut-down conditions can be applied to plural lines by repeatedly setting of cut-down condition. Using logical operation, You can set relation among each defined cut-down condition. Choose one item from 3 kinds of “AND”, “OR” and “SEQ” in Exec Mode box at upper-right corner on cut-down condition setting/execution dialog box. “AND” means cut-down of the range which satisfies all of each set cut-down condition. “OR” means cut-down of the range which satisfies the set condition though it is only one range. “SEQ” is special. Each line condition defined across plural lines is interpreted on a line basis.

For example, let’s analyze a guide channel by speed-transmission placement. Define cut-down condition of a 1-speed transmission on the first line, and define cut-down condition of 2-speed on the second line and then finally define cut-down condition of Top-speed on the third line. When choosing SEQ, a file of the guide channel which consists of cut-down ranges of 1 to Top speed transmission extracted from each of acquisition data files will be created. It is possible, however, to specify only one item of logical operation regarding each of condition-defined lines.



1-4-4-3 Checking of condition-established range

It is possible to check the established ranges which have been executed by the set cut-down conditions. Click a conditional line of the list in cut-down condition setting/execution dialog. Then the line will be shown in reverse video and "Preview" button will become effective simultaneously. When clicking "Preview" button, a preview dialog will appear. In the dialog, by taking the conditions indicated with reverse video line and the result of logical operation into account, established ranges of waveform are displayed in reverse video. At the same time, the number of established ranges & data-points are displayed at the upper right of the dialog. In the case where plural lines have already been defined, if you want to display them without taking the result of logical operation into consideration, you have to set SEQ of logical operation prior to clicking "Previous" button.



1-4-4-3-1 Selection of confirmation channel

Initial channel NO. of the dialog list is identical to that of the appropriate guide channel. When you want to display other channel NO., select it from a list of choices at the upper left of the dialog. But the location of reverse video ranges remains in the same status, though selecting other channel.

1-4-4-3-2 Cursor operation

Click a given location within waveform display frame in Previous dialog, and cross-cursor moves there to indicate the value at cursor location. Clicking of 「<」 「>」 button, the cursor line moves by one point. Clicking of [] [] button makes the cursor to move to each of establishment points.

1-4-4-3-3 Changing of y-axis scale value on display window

Click 「ZoomIn」 button to magnify y-axis scale value, while 「ZoomOut」 button to scale it down.

1-4-4-4 Saving of cut-down conditions

It is possible to save the set cut-down conditions. Click "Save" button on the condition setting/ execution dialog, and a file-save dialog will appear. Enter a filename and click OK. The set cut-down conditions are saved. Details to be saved are conditions of the set lines and logical operation modes. The extension of the file is .cut and file form is in inner format.

1-4-4-5 Loading of cut-down conditions

It is possible to read the pre-saved cut-down conditions. Click "Load" button on the condition setting/execution dialog, and a load dialog will appear. Select a filename and click OK to load them. Note that if condition setting line has already existed, a confirmation dialog will appear. When clicking OK in the dialog, current display details are abandoned and newly loaded file details are replaced for the previous ones.

※ If a condition set line does not exist, an error will result and loading can not be executed. Check to see, however, that if the channel exists, but unit and signal name differ each other, the unit or signal name of the currently displayed file is referred to show. Set conditions and logical operation of inter-conditional lines are referred to just the way they are.

1-4-4-6 Edits of cut-down conditions

To change cut-down conditions of a line of the list registered in condition setting/execution dialog, double-click the line you want to change. Then a setting dialog whose currently set details of cut-down conditions are displayed as initial values will appear. It is impossible, however, to change the guide channel. If you want to change the guide channel, delete it from the list once using deletion function as described later and set it again using "Create" function.

1-4-4-7 Deletion of cut-down conditions

To delete cut-down conditions of a line of the list registered in condition setting/execution dialog, click the line you want to delete and render it reverse video and then click "Delete" button. The appropriate line will disappear from the list.

1-4-4-8 Cut-down execution (Creation of file)

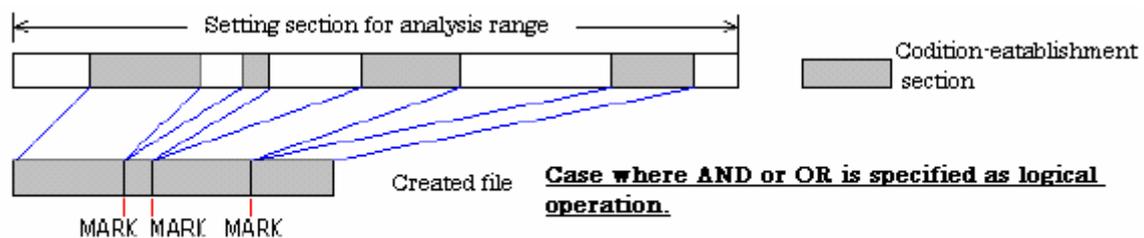
In Output File box on condition setting/execution dialog box, enter a filename to which cut-down result is saved. There are 2 kinds of setting ways : typing a filename in the box directly, or produce a file-save dialog on the screen by clicking "Browse" button on the right side of "Output File" box and set a filename in the dialog. After setting a filename, click "Execute" button, and cut-down ranges are saved into the file in accordance with the set conditions. Channel configuration won't alter, because the file to be saved stores condition-establishing ranges from every acquisition channel. In the header-file to be created, MARK and PAUSE lines which have already been written into the header-file are abandoned. For the other, the same details are loaded.

1-4-4-8-1 Creation of MARK/PAUSE line

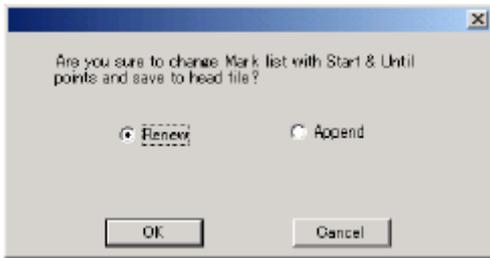
MARK lines which show the start point of cut-down are created and loaded in condition-saved header-file. Further, in the case where SEQ is specified as logical operation, PAUSE line is created as delimiters in set conditional line.

Already-existing MARKs and PAUSEs in acquisition file won't be reflected in a creating file.

The data string of creating file composed of cut-down areas becomes discontinuous. When performing processing every time of cut-down and save, each seam can be discriminated with ease by using function like "Jump MarkArea mode" or "Jump PauseArea mode".



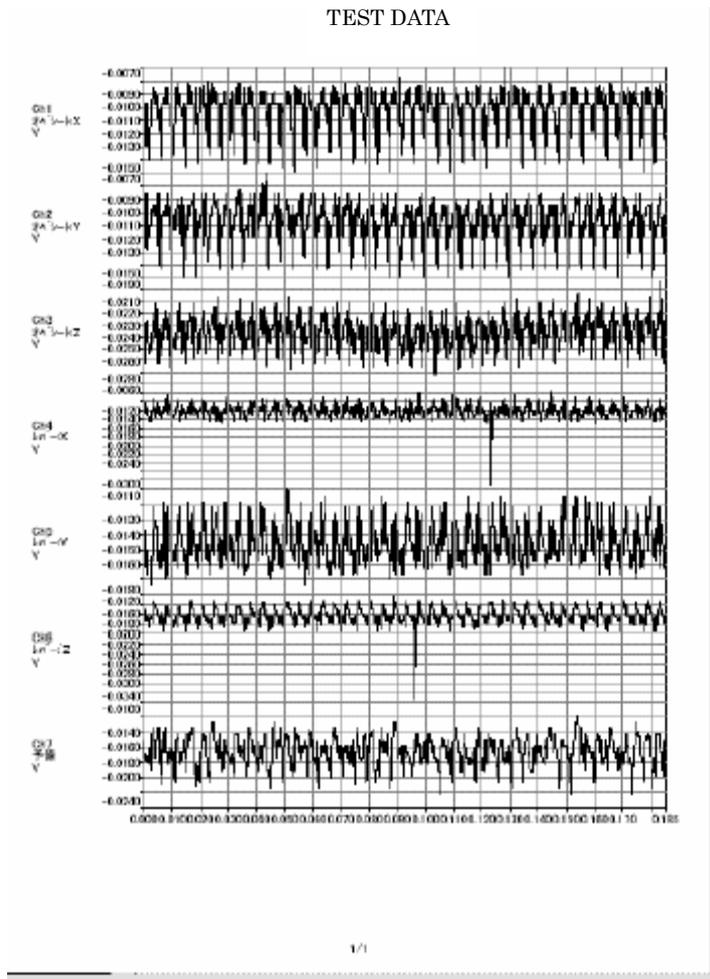
1-4-4-9 Update of analysis-targeted header-file



It is possible to write MARK lines of condition-established point in the header-file of analysis-targeted file (cut-down-targeted file). This function becomes effective only when condition-established section exists and logical operation is not set SEQ. Click "Mark List"

button on Previous dialog, and a confirmation dialog will appear.

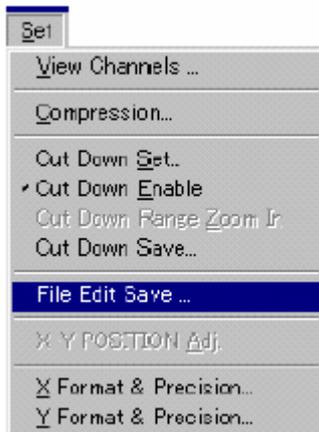
Select an option button to determine how to write MARK line. When selecting "Renew", preexisting MARK lines in analysis range setting section are deleted and newly established points are created as MARK lines. When selecting "Append", preexisting MARK lines are not deleted and newly established condition points are added as MARK lines. Further, memo will be attached to MARK line to be created in order to see the difference between start-point and finish-point. Start-point memo is described as BEGIN (x), while finish-point as UNTIL (x). x is established section NO. and the number is assigned from the left side of Preview dialog on an established section basis like 1.2.3....



The sample at left shows pdf-formatted printout. Paper orientation is set in portrait orientation.

1-4-6 File edit function

This function allows a given section of plural acquisition data files displayed on the



screen to be edited and combined into each channel of one file, or different sections of the same data file to be edited into one file by transferring them to each channel of the file. This function is very effective at performing simultaneous analysis by rendering different acquisition results of pre- or post-improvement in one file. Choose "File Edit Save" from pull-down list box of "Set" on menu bar or click the icon on tool bar, and a file-edit dialog box will appear.

This function does not work unless analysis range is displayed on the graph.

To edit plural files to combine them, they have to be created by the same sampling frequency.

Should other file which is displayed be unable to be selected, it is supposed that analysis range is not specified or sampling frequency is not the same.

1-4-6-1-4 Write of comment line

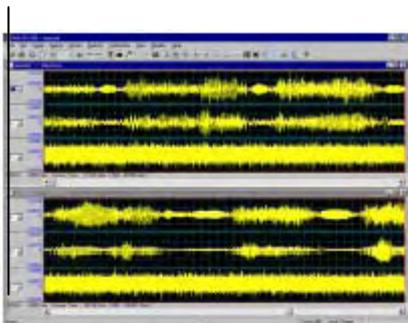
The details of comment line described in header-file of data file which are initially specified in copy-source-filename box is referred to the comment line of the creating file Type information directly in comment input box.

1-4-6-2 Handling of MARK/PAUSE information

MARK information in copy-source-header-file is reflected in the creating file. But MARK NO. and data location are updated. PAUSE information is ignored and not reflected.

1-4-6-3 Edit operation (a sample)

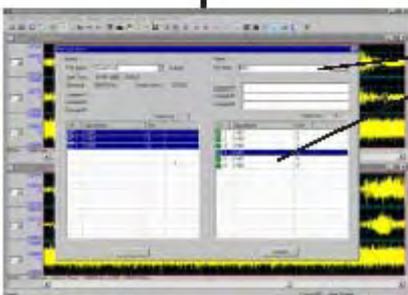
Combine two files to a single file and produce a new file.



Read each file to be combined. And display each of them in waveform on the screen, respectively. Choose "HorzTile" from the pull-down list box of "Window" on menu bar, and 2 files are displayed simultaneously on the screen. Set the analysis range of each file you want to combine.



Choose "File Edit save" from the list box of "Set" on menu bar, and a file-edit dialog box will appear. Drag channel information list and copy them to registration list.



After changing filename, drag channel information list and add them to registration list. Set a new filename and click "OK". Already-edited file will result.

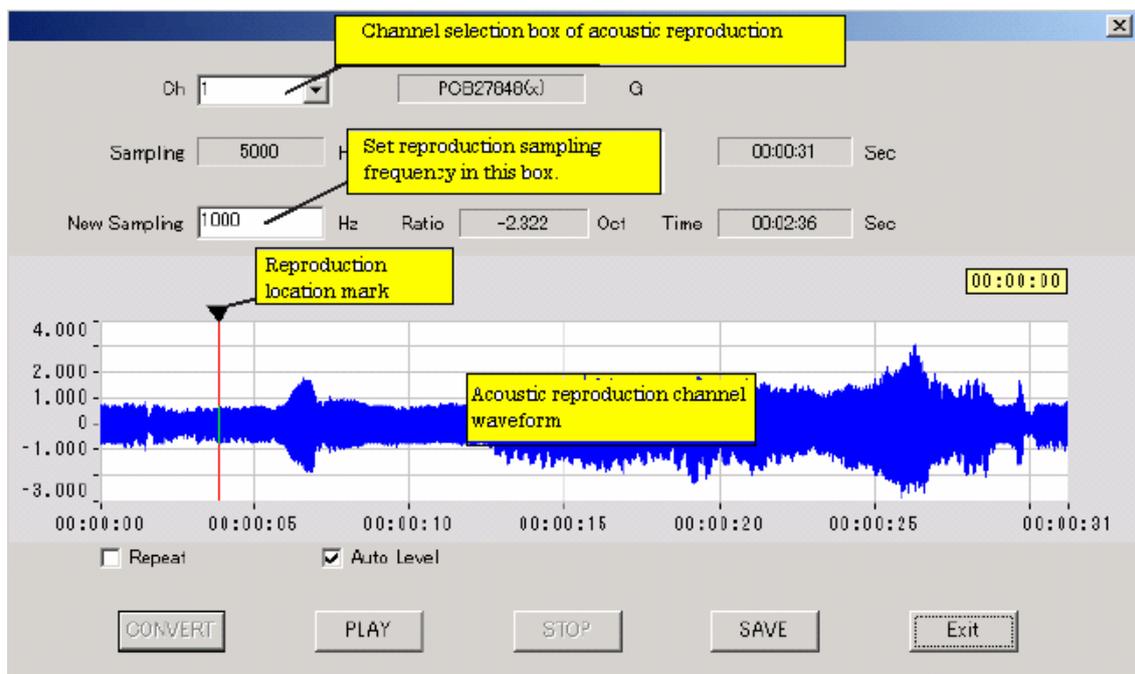
1-4-7 Playback function of acquired data



Using this function, you can reproduce an analysis range of acquired data by sound. This function allows the properties of such acoustical signals as vibration acceleration, displacement, force, strain and revolution pulses except noise ,etc. to be grasped by hearing them with sound. The convertible signals to acoustical ones have to fluctuate in \pm . Choose "Sound" from the pull-down list box of "Analysis" on menu bar, and a sound reproduction dialog box will appear.

This function can not work unless analysis range is specified.

1-4-7-1 Operation of sound reproduction dialog box



1-4-7-1-1 Selection of sound reproduction channel

Displayed initial values on the dialog box are those of current channel. When selecting other channel for acoustic reproduction, select it from choices in channel box. Signal name and unit of selected channel are indicated on the right side of channel box.

When selecting a channel, data waveform of a channel targeted for reproduction is displayed.

1-4-7-1-2 Setting of reproduction sampling frequency

Acquisition sampling frequency is indicated as initial value. It might go out of audible frequency in some case. Setting of it newly is required. Setting higher sampling frequency than acquisition sampling frequency can lead to higher sound pitch and at the same time to shorter reproduction period of time. Higher sampling frequency is suitable for listening to low vibration acceleration. On the contrary, setting lower sampling frequency than acquisition sampling frequency can lead to lower sound pitch and at the same time to longer reproduction period of time. Lower sampling frequency is proper for listening to signals of high frequency. Number of octaves to be shifted and reproduction time are indicated on the right side of New Sampling input box.

ex. When setting 4 kHz in new sampling box at the time of acquisition sampling frequency 1 kHz, analysis range 40 secs, the sound pitch shift becomes 2 octaves and reproduction time becomes 10 secs, respectively.

1-4-7-1-3 Conversion into acoustic data (CONVERT button)

Convert data of the channel targeted for reproduction into wav-formatted file for the purpose of acoustic reproduction. Click "CONVERT" button in the dialog box, and conversion will start. Progress bar informs us of conversion implementation stages.

Acquired data is converted into wav-formatted file in the same 16 bit binary data.

1-4-7-1-4 Setting of auto-sound level (Auto Level)

When converting into acoustic data, it is possible to determine whether auto-setting of sound level is to be selected or not. Check "Auto Level" box, and auto-level setting turns ON. Uncheck the box, and auto-level setting turns OFF. It means by Auto-Level that after making max absolute value of conversion-target data match with the set value of 30000, the matched data is converted to acoustic data.

In short, this function renders max value to max sound level, regardless of large and small of waveform data. When auto-level is checked OFF, acquired data is converted to acoustic as it is.

1-4-7-1-5 Start of reproduction (PLAY button)

Click "Play" button, and the mark "▼" which indicates reproduction location begins to move along the top of waveform graph frame concurrently with acoustic reproduction.

Setting of sampling frequency, change of reproduction channel, conversion into wav file ,etc. can not be performed during acoustic reproduction.

1-4-7-1-6 Stop of reproduction (STOP button)

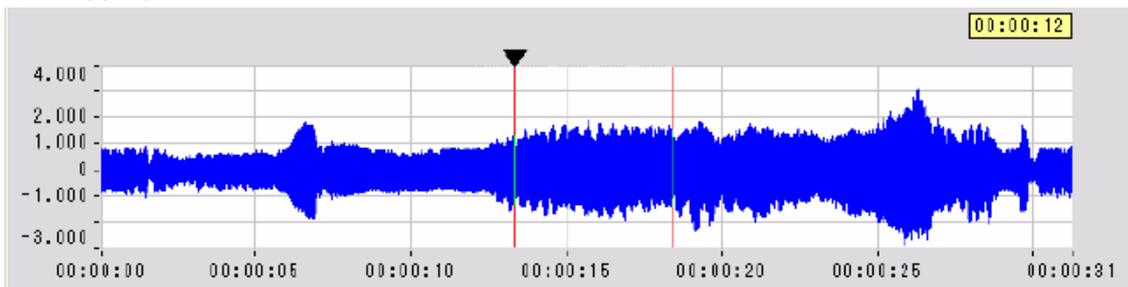
To stop performance during reproduction or during "Repeat"- set reproduction period of time, click "STOP" button in the dialog box, and reproduction will stop.

1-4-7-1-7 Repeating of reproduction

Click "REPEAT" box in the dialog box, and after reaching the end, reproduction repeatedly starts from the first.

1-4-7-1-8 Setting of reproduction range

Determine reproduction range by moving cursor-lines on right and left sides in waveform graph frame. Click a given place within waveform graph frame, and the cursor-line near to either side comes to clicking location. Cursor-line can also be moved by dragging.

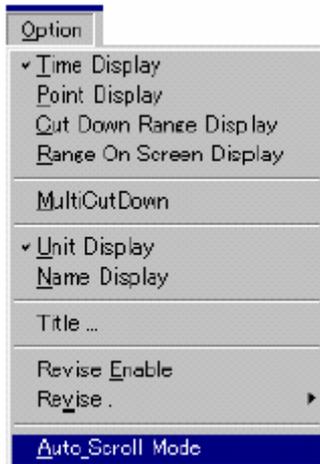


1-4-7-1-9 Saving of wav file

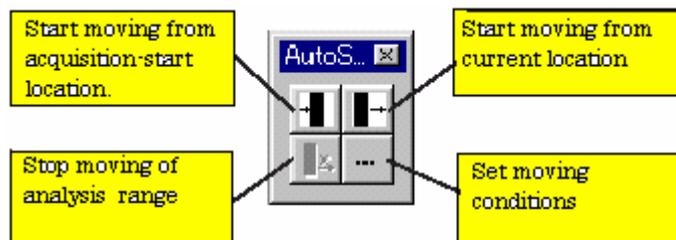
It is possible to save converted wav file under the status where reproduction has already stopped and conversion into wav file has also finished. Click "SAVE" button in the dialog box, and a file-save dialog will appear. Set filename and save it.

Saved wav file can be reproduced using other reproduction program.

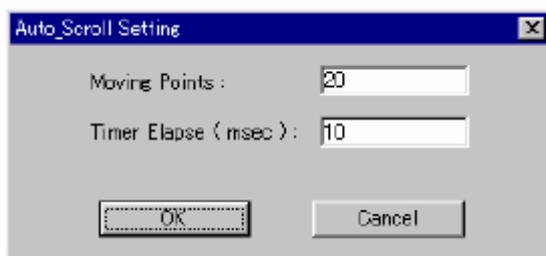
1-4-8 Auto-scroll function of analysis range



This function allows the set analysis range to move automatically. It is used at the time of ganged operation with other windows. Note that it does not work unless analysis range has been set. Click "Auto-Scroll Mode" from the pull-down list box of "Option" on menu bar, and an auto-scroll box will appear on the screen.



1-4-8-1 Setting of auto-scroll conditions



Click "Auto-scroll condition setting" button, and a setting dialog will appear.

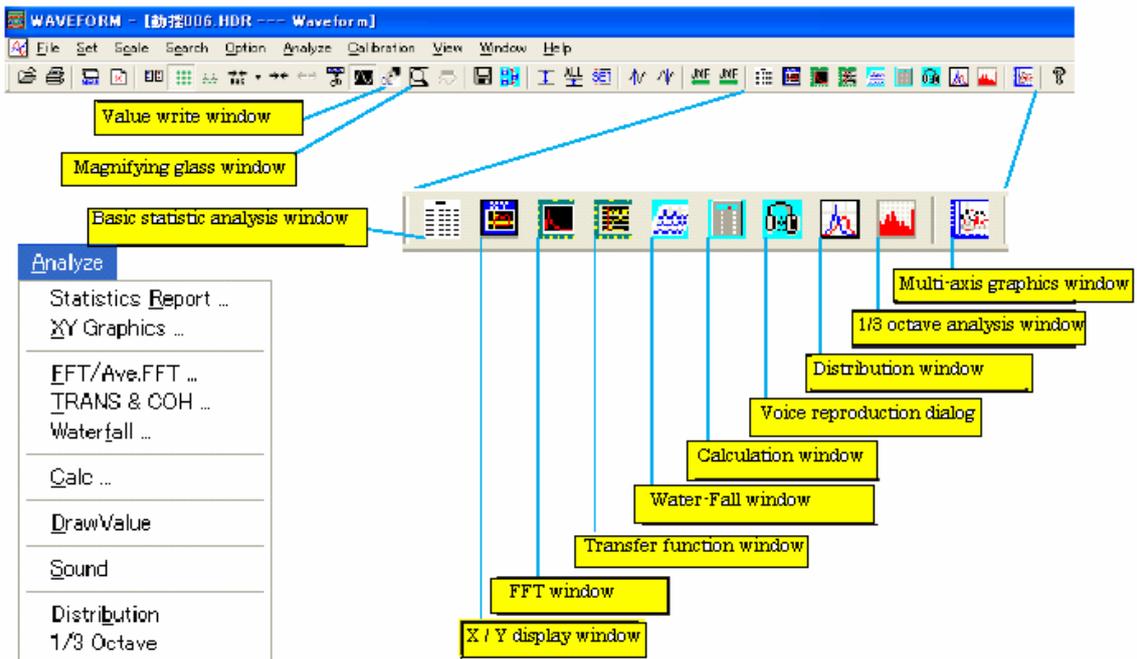
Specify Moving Points box with number of data. Settable number of data is up to 1000points. Specify scroll-time interval.

Mini is 10ms, Max is 1000ms. and in step of 10ms.

If other ganged operating window becomes heavy, make scroll interval longer. If too heavy, remedy of computer's resource allocation is adopted. In some case, there might be a fear that entering from keyboard could not be performed.

1-5 Initiation of other windows

When setting analysis range, other windows for waveform analysis can be initiated. To initiate them, select an analysis item from the pull-down list box of "Analyze" on menu bar, or click an icon on the tool bar.

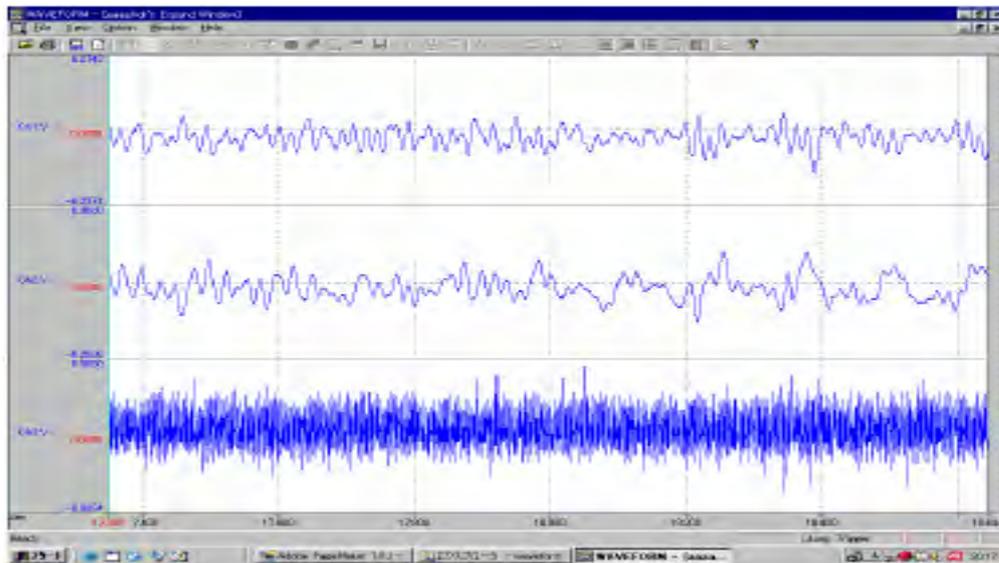


Chapter 2

A magnifying glass window

2-1 Initiation of magnifying glass window

 When analysis range on waveform display window is specified and the number of display data in the range comes within the integral domain, the icon on tool bar becomes active. Click the icon, or select "X Zoom In" from the pull-down list box of "Scale" on menu bar, and a magnifying glass window will appear.



You can provisionally scale up and display the set analysis range of waveform on the screen. This function differs from that of screen magnification with respect to the following: 1) A randomly-set area can be displayed on another window in a scaleup form. 2) These 2 kinds of respective analysis range of waveform can be displayed on the screen simultaneously, and ganged operation of them can be performed as well.

This provisional scaleup function can allow the uncompressed max magnified waveform (displayed with a data-point per one pixel) to be displayed to even further scaleup waveform. Click the icon on tool bar, and an exclusive window is shown to display data of the specified range. Close the provisionally scale-up display window, and previous waveform display screen will return

2-2 How to operate.

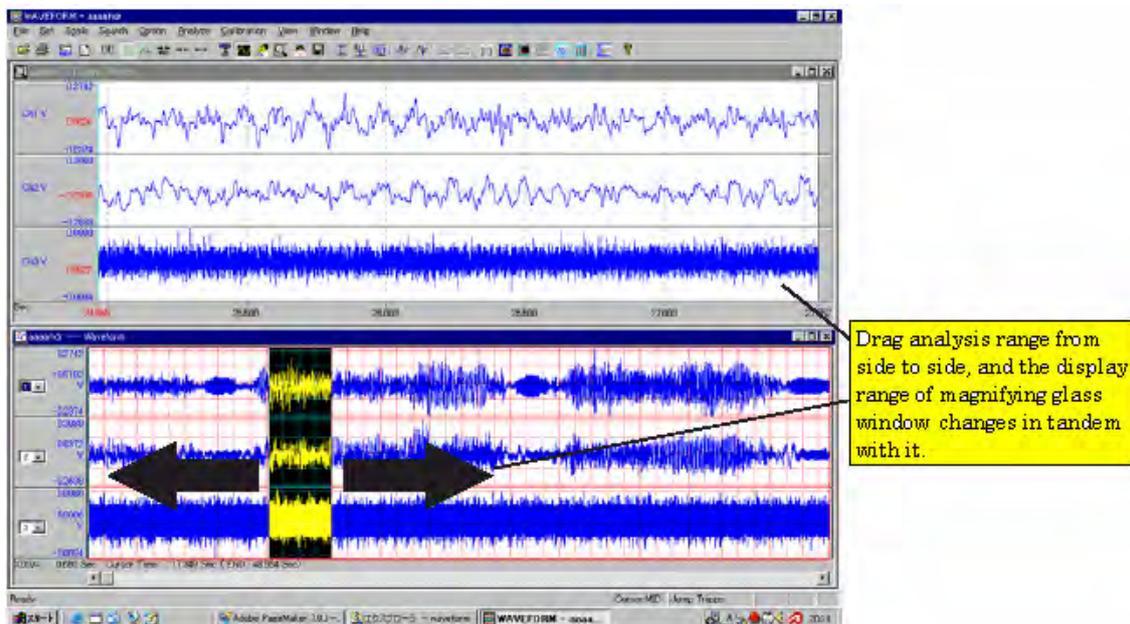
2-2-1 Cursor function

Click a given location of the display waveform, and a cursor line moves to the clicked location. Drag the cursor line, and it moves by responding quickly to the drag action. You can also move it using arrow-keys on the keyboard. Note that the value at cursor line indicates correct value there, because the value at the cursor is displayed on non-compression basis.

2-2-2 Ganged operation with waveform display window

Display both of a waveform display window and a magnifying glass window on the screen. When moving the analysis range of waveform display window, the display graph on the magnifying glass window is updated and the range details of waveform display window are at all times shown in a scale-up form.

To display both of windows simultaneously, select "Horz Tyle" from the pull-down list box of "Window" on menu bar.



2-2-2-1 Auto-scroll function of the display range

When setting auto-scroll of the analysis range in waveform display window, the waveform display in magnifying glass window scrolls automatically. See 1-4-8

「Auto-scroll function of analysis range」 (Chapter 1) for further details.

2-2-3 Display of signal name



Signal name can be displayed at left outside of graph frame. Choose "Name Display" from the pull-down list box of "Option" on menu bar, and signal name and unit are displayed. To return the display to channel no. and unit, choose "ChNo Display" from the list box.

2-2-4 Setting of graph title



When printing magnifying glass window, you can set graph title. Choose "Title" from the pull-down list box "Option" on menu bar. This setting becomes effective only at print

time, so the title is not displayed on the screen. Once set, the title is stored in memory and won't change till it is changed.

2-2-5 Printout of magnifying glass window

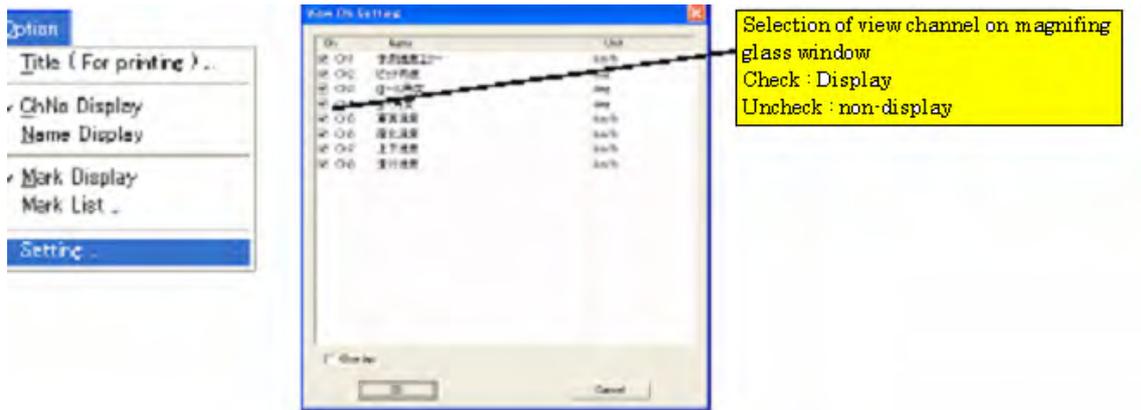
Choose "Print" from the pull-down list box of "File" on menu bar, and the connected printer begins printing out. To set paper size, paper orientation, etc., choose "Print Setup" from the pull-down list box of "File", and a printer-setting dialog box will appear. As the dialog is the connected printer-specific, refer to the printer operation manual for operation. Further, when you want to confirm print-form in advance, choose "Print Preview" from the pull-down menu, and Preview window is displayed.

2-2-6 Selection of view channels

You can select display channel on magnifying glass window.

2-2-7 Procedural steps of selecting channel

Select “Setting” from the pull-down list box of “Option” on menu bar on magnifying glass window, and “View Ch Setting” dialog box will appear. Click check box at left side of Ch no., and the checked Ch no. will be displayed. Uncheck it, and the display is canceled.

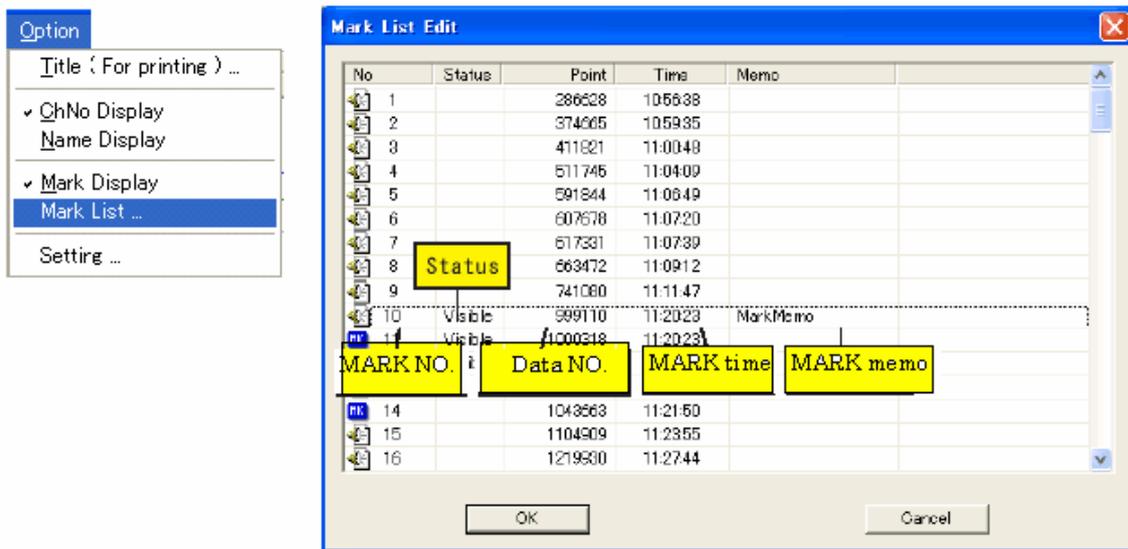


2-3 Handling of MARK information

On magnifying glass window, you can not only display MARK information given during data acquisition but also correct MARK location and delete / add MARK.

2-3-1 Display of MARK information

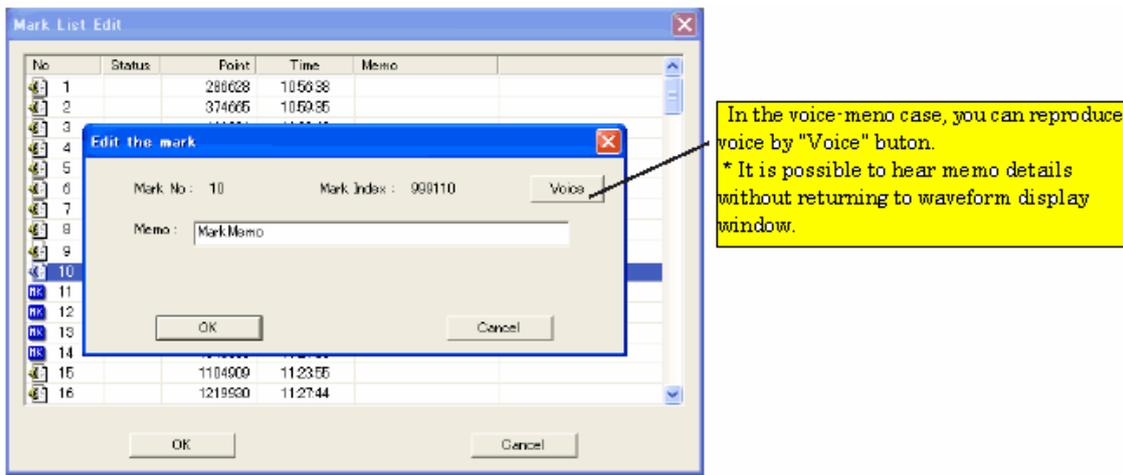
Choose "Mark List" from the pull-down list box of "Option" on menu bar, and a MARK list dialog box will appear.



MARK NO. is automatically allotted in ascending order of data no. It is automatically updated every deletion or addition of MARK information mentioned later on. "Visible" in Status column of the list means that MARK is at present during display on magnifying glass window. "New" means that a MARK has been newly added.

2-3-2 Edit of MARK memo

Double-click a MARK line in MARK list which you want to edit, and a MARK edit dialog box will appear. Type memo information in memo box. Click OK button, and memo information will change. You can also edit MARK memo using expansion function of waveform graph (1 to 4 ~). Further, you can edit MARK memo by double-clicking MARK no. position at outside of graph frame as will be seen later.



2-3-3 Reproduction function of voice-memo

Double-click MARK no. position to display memo-edit dialog box. "Voice" becomes effective only when MARK no. is voice-memo. Then voice can be reproduced.

* Should it not be voice MARK, button becomes ineffective and can not be selected.

2-3-4 Deletion of MARK

Right-click a MARK line in MARK information list which you want to delete, and a deletion-confirmation dialog box will appear. Click OK in the dialog box, and it will disappear from the list. MARK NO.'s are updated with the space between lines filled after deletion.

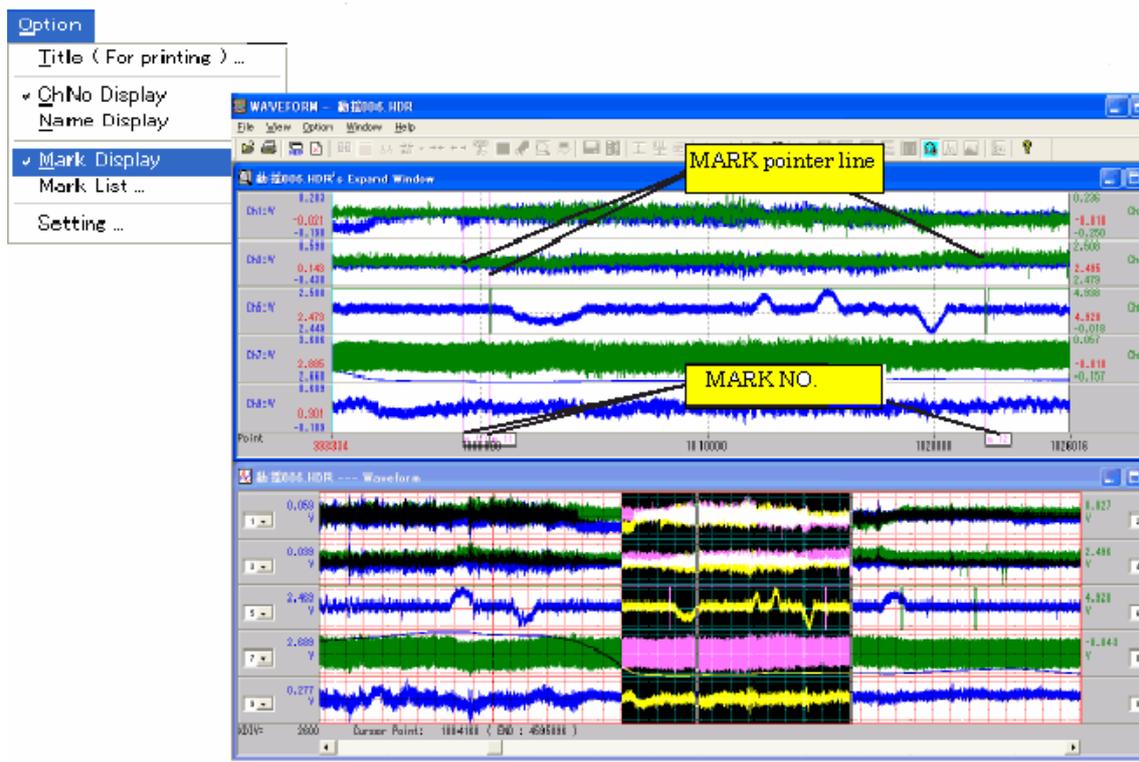
2-4 Indication and edit of MARK location

It is possible not only to indicate a given MARK location on waveform with MARK pointer line in magnifying glass window, but add newly and delete it.

2-4-1 Display of MARK pointer line

Choose "Mark Display" from the pull-down list box of "Option" on menu bar, and MARK pointer line will appear in waveform graph frame. But it won't be displayed unless MARK exists within current display range.

Choose "Mark Display" again, if you want to stop displaying MARK pointer line.



2-4-2 Edit of MARK memo

Double-click a MARK no. location you want to edit, and MARK-edit dialog box will appear. Type memo information in memo box and click "OK" button. Then the memo will be updated.

2-4-3 Reproduction function of voice MARK

Double-click a MARK no. location you want to edit, and MARK-edit dialog box will appear. When the clicked MARK no. is a voice memo, "Voice" button becomes effective to be able to reproduce voice. * When not a voice MARK, the button is inactive and can not be selected.

2-4-4 Deletion of MARK

Right-click MARK NO. location in the outside of display graph frame, and a deletion-confirmation dialog box will appear. Click "OK" button, and the MARK is deleted. Other MARK NO.'s are automatically updated with the pointed off number filled.

2-4-5 Addition of MARK

Right-click a given place within the graph frame, and a MARK-registration dialog box



will appear. Click "OK" button, and a MARK is added at current pointer line. MARK NO. is assigned in ascending order of data NO. and updated automatically.

Moving of MARK location can not be done directly. To move MARK , add it once and delete the previous one, or add it newly after deleting the previous one.

2-4-6 Jumping of cursor line to MARK location

In the status where MARK pointer line is displayed within graph frame,  jump icon is active. When clicking an icon, cursor line moves to MARK pointer line near by in icon-specified direction and read out data-point at MARK position.

MARK information is saved in a memory temporarily. When closing the file, a confirmation dialog box asking if loading of it is required or not will appear. Click "OK" button, and it is written into header-file.

Chapter 3**Basic statistic window**

Max number of channels	All of acquisition channel
Calculation statistic	Mean value, Max value, Min value, Variation value, Effective value, Max amplitude value, Sum total
MARK / PAUSE – ready	Division between MARK to MARK, division between PAUSE to PAUSE, non-division, changing
Print	Available
File storage	Text format, Extension txt, Append record available, Channel series in row order, Channel series in column order, selectable

3-1 Initiation of basic statistic window

Set analysis range, and basic statistic analysis becomes workable. It calculates basic statistics about specified analysis range of all channels and displays the results of them. Choose "Statistics Report" from the pull-down list box of "Analyze" on menu bar, or click icon on tool bar.

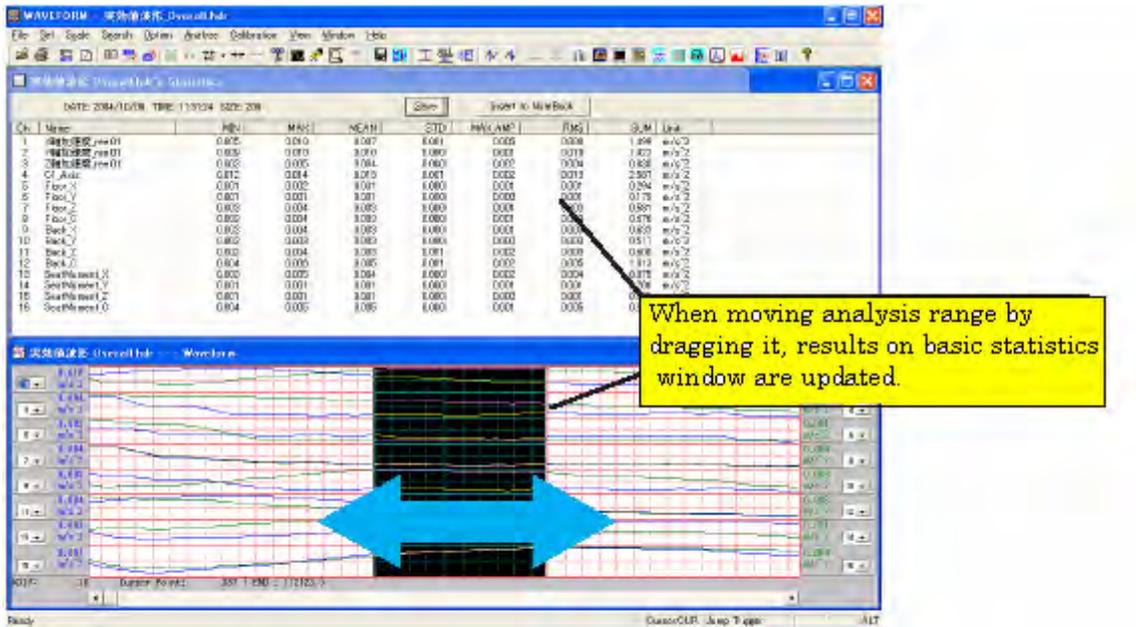
Ch	Name	MIN	MAX	MEAN	STD	MAX AMP	RMS	SUM	Unit
1	加速度 (x) rms	0.005	0.010	0.007	0.001	0.005	0.008	1.499	m/s ²
2	加速度 (y) rms	0.009	0.010	0.010	0.000	0.001	0.010	1.903	m/s ²
3	加速度 (z) rms	0.003	0.005	0.004	0.000	0.002	0.004	0.800	m/s ²
4	CT_Axis	0.012	0.014	0.013	0.001	0.002	0.013	2.587	m/s ²
5	Floor_X	0.001	0.002	0.001	0.000	0.001	0.001	0.294	m/s ²
6	Floor_Y	0.001	0.001	0.001	0.000	0.000	0.001	0.179	m/s ²
7	Floor_Z	0.003	0.004	0.003	0.000	0.001	0.003	0.681	m/s ²
8	Floor_C	0.003	0.004	0.003	0.000	0.001	0.003	0.676	m/s ²
9	Back_X	0.003	0.004	0.003	0.000	0.001	0.003	0.633	m/s ²
10	Back_Y	0.002	0.003	0.003	0.000	0.000	0.003	0.511	m/s ²
11	Back_Z	0.002	0.004	0.003	0.001	0.002	0.003	0.600	m/s ²
12	Back_C	0.004	0.006	0.005	0.001	0.002	0.005	1.013	m/s ²
13	SeatMoment_X	0.003	0.005	0.004	0.000	0.002	0.004	0.815	m/s ²
14	SeatMoment_Y	0.001	0.001	0.001	0.000	0.001	0.001	0.200	m/s ²
15	SeatMoment_Z	0.001	0.001	0.001	0.000	0.000	0.001	0.161	m/s ²
16	SeatMoment_C	0.004	0.006	0.005	0.000	0.001	0.005	0.913	m/s ²

Basic statistics are 7 kinds of max value, min value, mean value, standard deviation, max amplitude, effective value and sum total. And channel number, signal name and unit are indicated.

3-2 Gang operation of analysis range

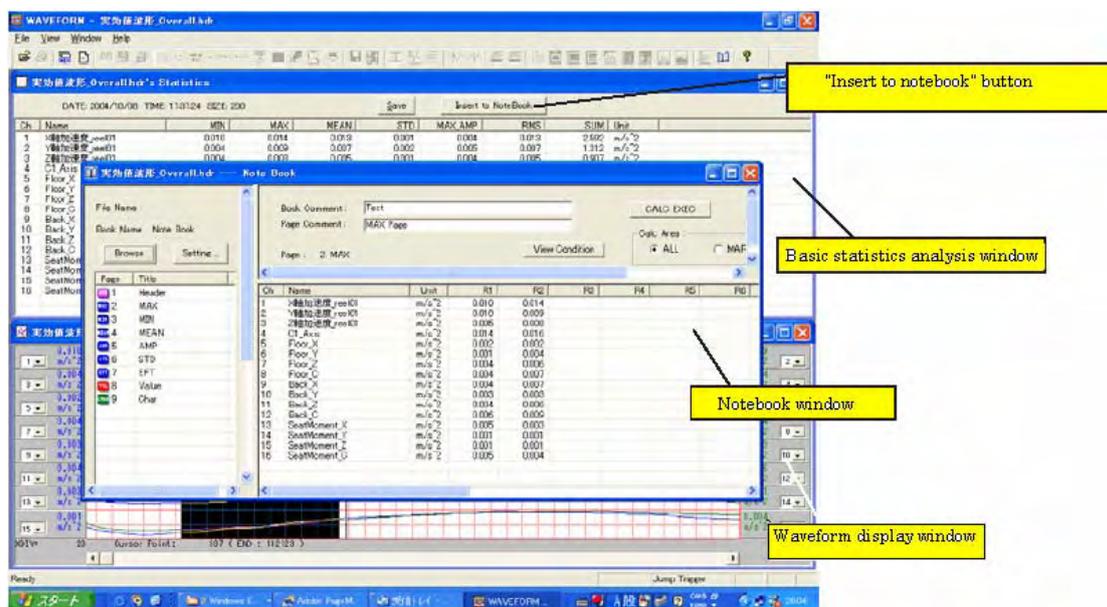
3-2-1 Ganged operation with waveform display window

In tandem with the movement of analysis range, calculation results shown on basic statistics window are recalculated and indicated newly on the screen.



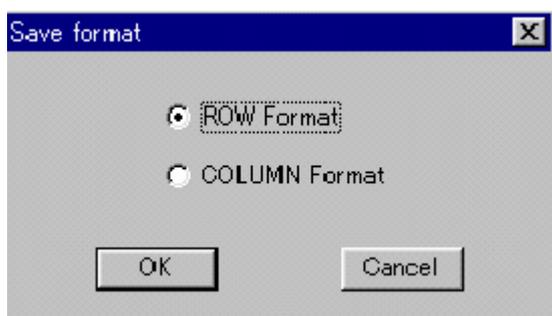
3-2-2 Gang operation with notebook window

Specify analysis range on waveform display window, and initiate notebook window. (See chapter 14 Notebook window.) When 3 windows have been displayed, “Insert to notebook” button on basic statistics analysis window becomes effective. Click the button, and calculation results currently indicated on basic statistics window will be reflected (added) on the final column of notebook window.



3-3 Saving of calculation result

The result of calculation can be recorded. Click "Save" button on the screen, and a save-format setting dialog box will appear.



The type of COLUMN or ROW depends on whether channels are placed in a vertical order or in a horizontal order. The format displayed above is a sample in which channels are placed in a vertical order. Choose a format type and click "OK" button, and a file-save dialog box will appear.

When clicking “OK” button on the file-save dialog, the results are recorded in csv file-format under specified filename. If specifying already-existing filename in filename box, additional recording (append record) is performed.

3-3-2 Printing of calculation result

Calculation result can be printed out either by choosing "Print" from the pull-down list box of "File" on menu bar or by clicking printer icon on tool bar. Print format is the same as that when choosing column

Chapter 4

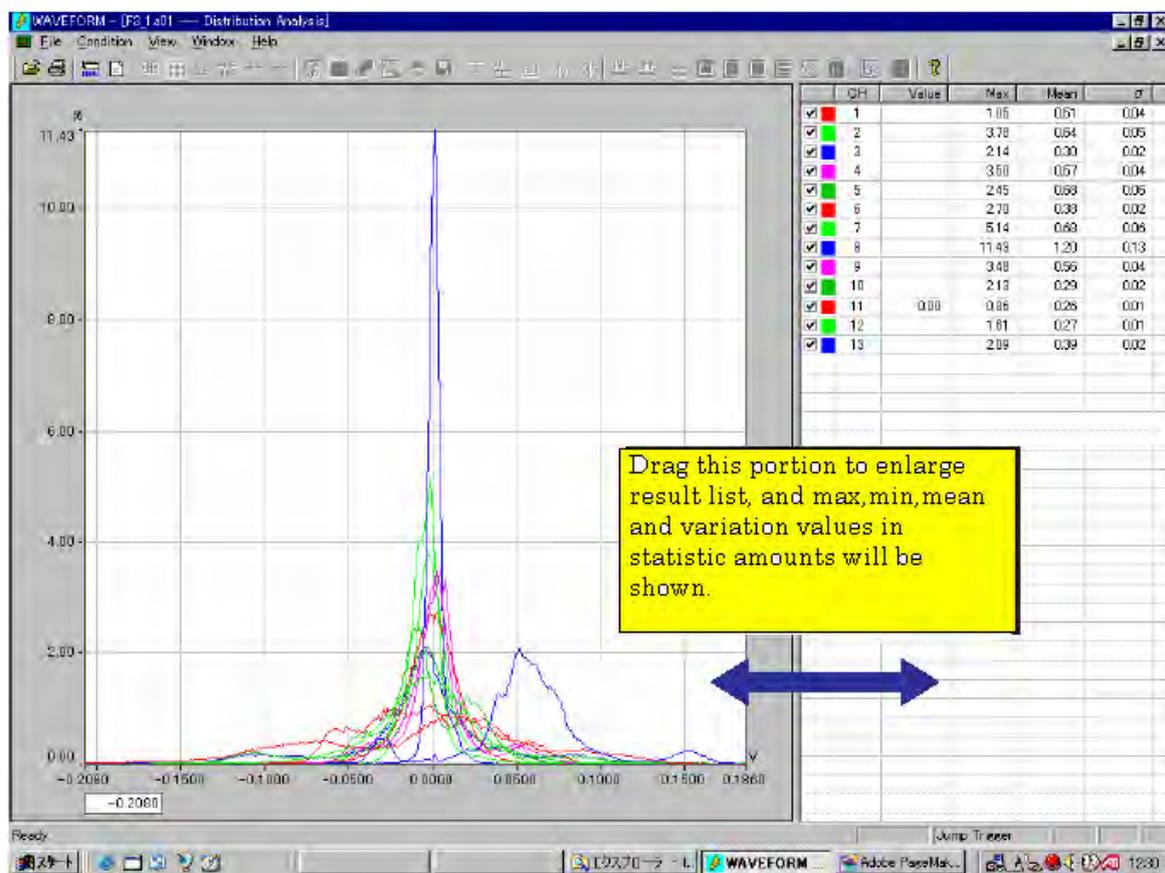
Distribution window

Setting of graph title	available
Number of cells	Up to ± 2000 initial value ± 100
Slice level setting	any level 1/100 of max absolute value of analysis-target channels at display of initial values
Unit of Y-axis	percentage indication (number of all data = 100%), count value, changeable
Scale of Y-axis	auto, specification of max/min/grid spacing, changeable
Scale of X-axis	auto, specification of max/min/grid spacing, changeable
Number of max simultaneous display results	16 ready for analysis of separate ranges of same or different channels
Statistical unit	Max frequency of occurrences, mean value and standard deviation
Cursor function	available
Specification of graph color	available
Print	available
Saving of results	available. TEXT-format, extension csv

4-1 Initiation of distribution window



When using frequency distribution analysis method, it is possible to analyze data of the same signal unit within specified analysis range and display the results in graph on the screen. Choose "Distribution" of the pull-down menu of "Analyze" on menu bar or click the icon on tool bar. After data is analyzed according to the just preceding set conditions, a new window opens and the results are shown in graph.



Y-axis in the graph shows the frequency of occurrence, while X-axis shows engineering unit. To be precise, Y-axis is shown either by expressing the number of all data within specified analysis range as 100%, or by expressing count number (number of occurrences). It depends on just preceding setting conditions. Initial value of program is expressed in percentage unit.

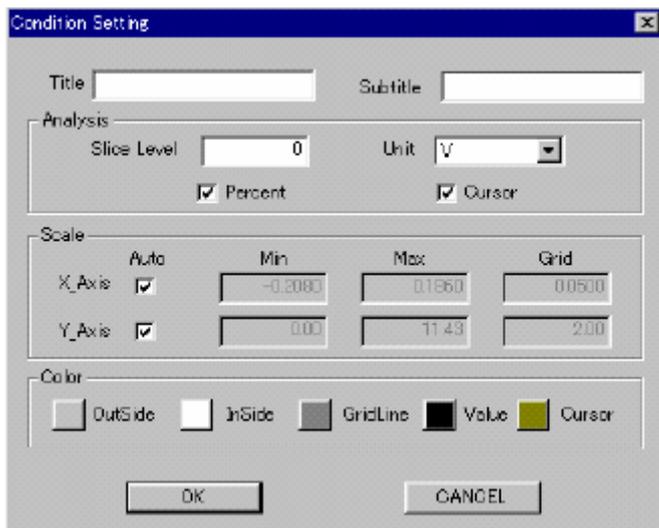
A list chart is also shown on the screen and gives information about line color, display channel, signal name, frequency value at present location of cursor line and max value, mean value, standard deviation () within specified analysis range, and statistical values (max, min, mean, variation).

4-2 Setting of analysis conditions



Choose "Condition" from the pull-down menu of "Condition" on menu bar of distribution window, and a condition-setting dialog box will appear.

4-2-1 Setting of graph title and subtitle



You can provide a title and subtitle to distribution graph. Initial value is blank, so title & subtitle are not described in the boxes. Type information in each box.

4-2-2 setting of slice level

To perform the analysis, you need to set slice level (cell-size). The fact that initial value shows 0 means the setting is done automatically. The initial value of slice level is set at 1/100 of max absolute value in analysis-target channels. In short, max absolute value is divided and counted into ± 100 pieces of cells. When a channel whose slice level has already been set and additionally has the same unit as preset one is in existence, the next previous value is used. Further, this distribution window can provide resolution of up to 2000 pieces on a number-of-cell basis. If the result after dividing by a set slice level exceeds prepared max number of cells, exceeding level is counted in the cell at the high end (at the low end).

4-2-3 Choosing of analysis-target channel's unit

This frequency distribution analysis is carried out on the channels having the same unit among the plural channels which are specified as an analysis range. Therefore, choice of unit for analysis is needed to select analysis-target channel. Should the next previous set unit does not exist at analysis, the current channel's unit on waveform window (analysis guide window) is automatically set.

※ The channels subject to this analysis need to have the same unit. And they have also to be displayed on waveform display window. The channels which are not displayed can not become analysis-target, though they have the same unit.

4-2-4 Choosing of Y-axis (occurrence-axis)unit

Y-axis unit is expressed either by a percentage based on the number of data included within analysis range as 100% or by counter value. Either is selectable. Initial value is expressed as a percentage. To express it by count value, uncheck "Percent" box.

4-2-5 ON/OFF selection of cursor function

Initial value of cursor function is ON. To turn it OFF, uncheck "Cursor" box in the dialog box.

4-2-6 Setting of Y-axis (occurrence-axis) scale

You can select either auto-scaling or manual scaling. Initial value is auto-scaling. When "Auto" box is checked, auto-scaling is set. When you want to set manual scaling , uncheck it. On unchecking it, setting boxes of min value, max value and grid spacing of graph become active.

4-2-7 Setting of X-axis (engineering unit axis) scale

You can select either auto-scaling or manual scaling. Initial value is auto-scaling. When "Auto" box is checked, auto-scaling is set. When you want to set manual scaling , uncheck it. On unchecking it, setting boxes of min value, max value and grid spacing of graph become active.

4-2-8 Choosing of color of graph elements



You can set the color of 5 graph elements : outside & inside of graph, grid line, scale value and cursor line. To change the color of one or more graph elements, click a color button on the dialog box, and a basic color palette dialog box will appear.

Choose a color from the color palette, or if you want to choose other color than that on palette, click color-creation button. Then an expanded color dialog box will appear. You can create additional colors and add them to the basic colors palette.

※ You can set data-line color of each channel by performing color-set-operation in the list on distribution window. See “Setting of graph display colors” (7-2-6) for details.

4-3 Analysis operation

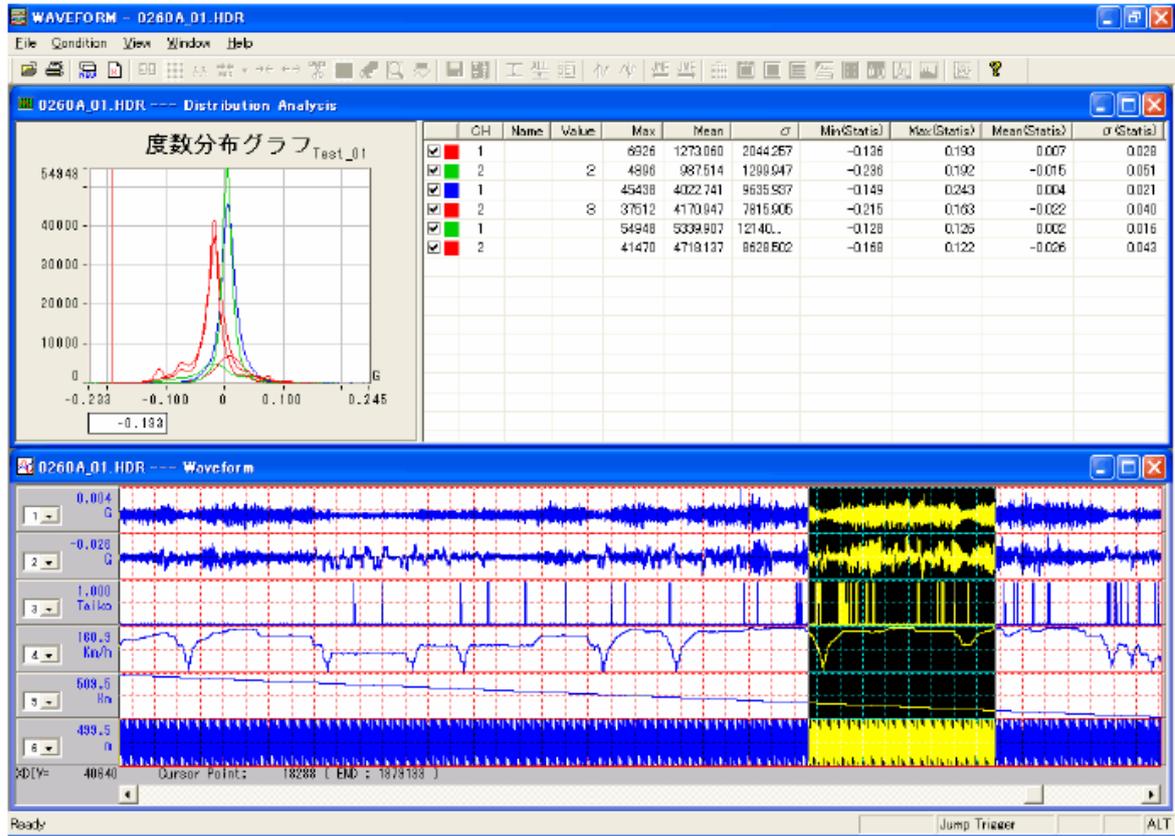
4-3-1 Gang operation with other windows (waveform display window)

Specify analysis range and initiate a distribution window. Then click “Horz Tile” of the pull-down menu of “Window” on menu bar. (If you prefer side-to-side to up-and-down in operation, click “Vert Tile”). Move analysis range of waveform display window by dragging it and click the icon on tool bar, and the results of distribution window are updated newly. As this operation is very effective for operation of other windows, it is advisable to keep it in mind.

4-3-2 Increasing of number of simultaneous display channels

While keeping gang operation in action,..... waveform display window without closing distribution window, and the menu on menu bar will change. In such a state, click “Distribution” button or the icon on tool bar, and you can add analysis-cable (displayable) channels.

* In this status, for the accumulation of distribution analysis results, don't close distribution window. The set details will be reset and return to initial values.

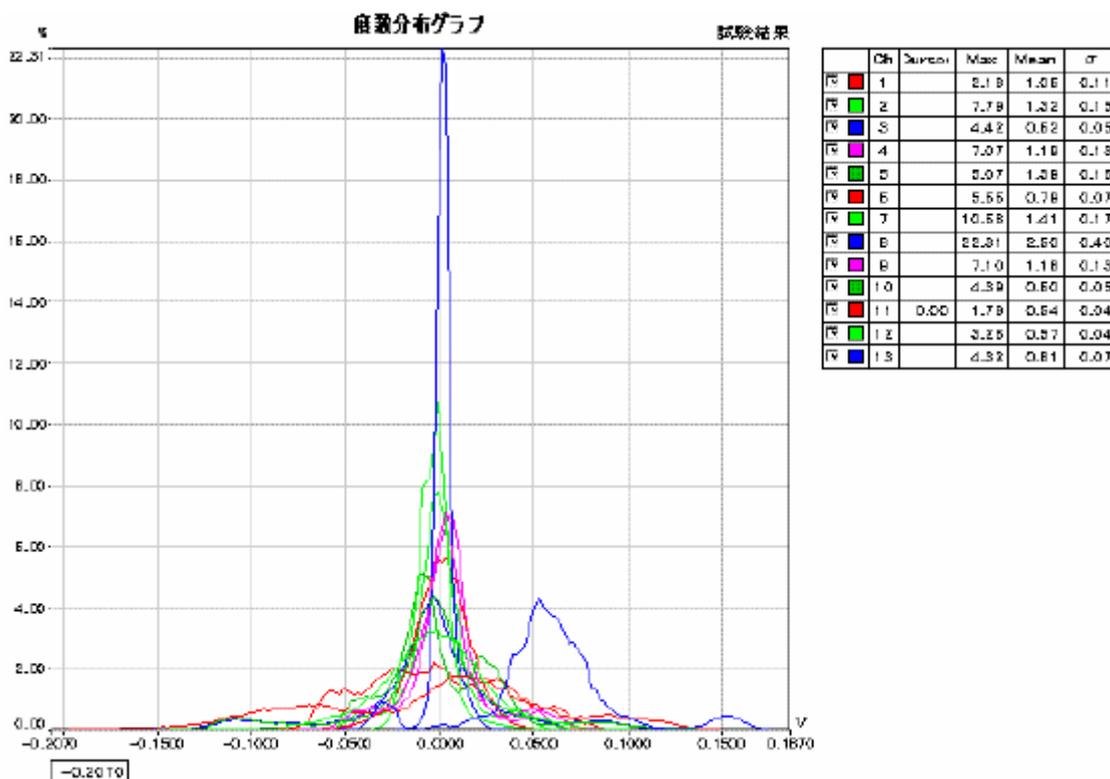


4-4 Printing out of graph



You can print out the details shown in distribution window. Choose "Print" from the pull-down list box of "File" on menu bar. On choosing it, the set printer produces color printing. For information, to set the connected printer, choose "Print Setup" from the pull-down list box, and a printer setting dialog

box will appear. And if you want to see printout result in advance, choose "Print Preview" from the pull-down list box.



4-5 Saving of result

You can save the result of frequency distribution analysis. Choose "Save as" from the pull-down list box of "File", and a file-save dialog box will appear. Type the filename and save it.

4-5-1 Storage format

The analysis results can be saved in csv-formatted TEXT file. "Distribution Analysis" in 1st line is fixed and shows the results of the distribution analysis. In 2nd line, analysis-target filename and the date & time of the file creation are described. In 3rd line, the title and subtitle are described. In 4th to 7th lines, analysis-target channel no, name, the number of data and unit are described in sequence. In 8th to 11th lines, the set slice level, max-count (max value), mean-count (mean value) and σ (standard deviation) are described in sequence. In each line of from 13th on, the results are described. When seeing the result vertically, median values of cell are described in the 1st column. In each column of from 2nd on, count values are described. Further, count value, max value, mean value and standard deviation depend on the set Y-axis attributes. With percentage-indication ON, they are represented by %, while with percentage-indication OFF, they are represented by count value. The following is a sample of result file obtained using Excel program.

Distribution Analysis		
R000157 04-01-04 20.41.56 87.200k - 400m.hdr	01-01-1997	0:00:00
度数分布グラフ	試験結果	
ch	1	2
Name	左右動揺加速度	上下動揺加速度
Number of data	1475	1475
Unit	G	G
Slice	0.004	0.004
Max_Count	11.12	18.92
Mean_Count	2	1.43
σ	0.27	0.16
物理量	計数量	計数量
-0.142	0	1
-0.138	0	1
-0.134	0	0

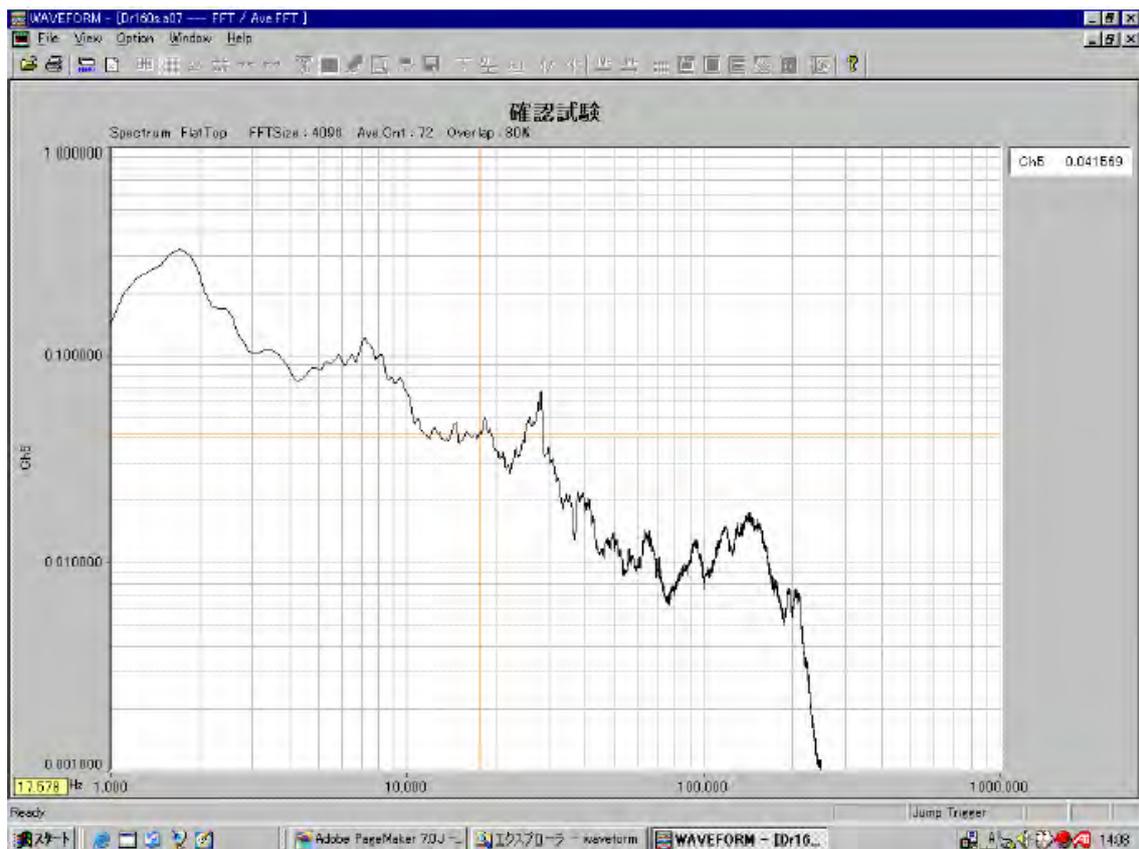
Chapter 5

FFT analysis window

Graph title setting	available
Number of data-points for FFT	512, 1024, 2048, 4096, 8192 and 16384 selectable
Number of window functions	Hanning, Hamming, Blackman, Kaiser-Bessel, FlatTop, Exponential and Rectangular
Analysis type	Spectra, Power spectra, Power spectra density, rms value and Amplitude Selectable
Number of average FFT times	Automatic calculation based on analysis range and overlapping ratio
Overlapping ratio	0 to 99% any setting
Number of display spectra	Setting Up to the number of FFT data points/2
Average FFT time display	average spectra, max spectra or both of them, Selectable
Cursor function	available indication of cursor value
X-axis attribute	LINEAR LOG Selectable
Y-axis attribute	LINEAR LOG Selectable
Y-axis scale	AUTO AUTO-HOLD MANUAL, Selectable
X-axis scale	AUTO MANUAL, Selectable
Simultaneous display of spectra	simultaneous display of plural results is allowed. unlimited
Gang operation with other windows	Gang operation with analysis range of waveform display window
Setting of graph colors	available, graph outside, graph inside, grid lines, scale value color, cursor line and spectrum line of result
Printing function	available
Storage of results	available TEXT format

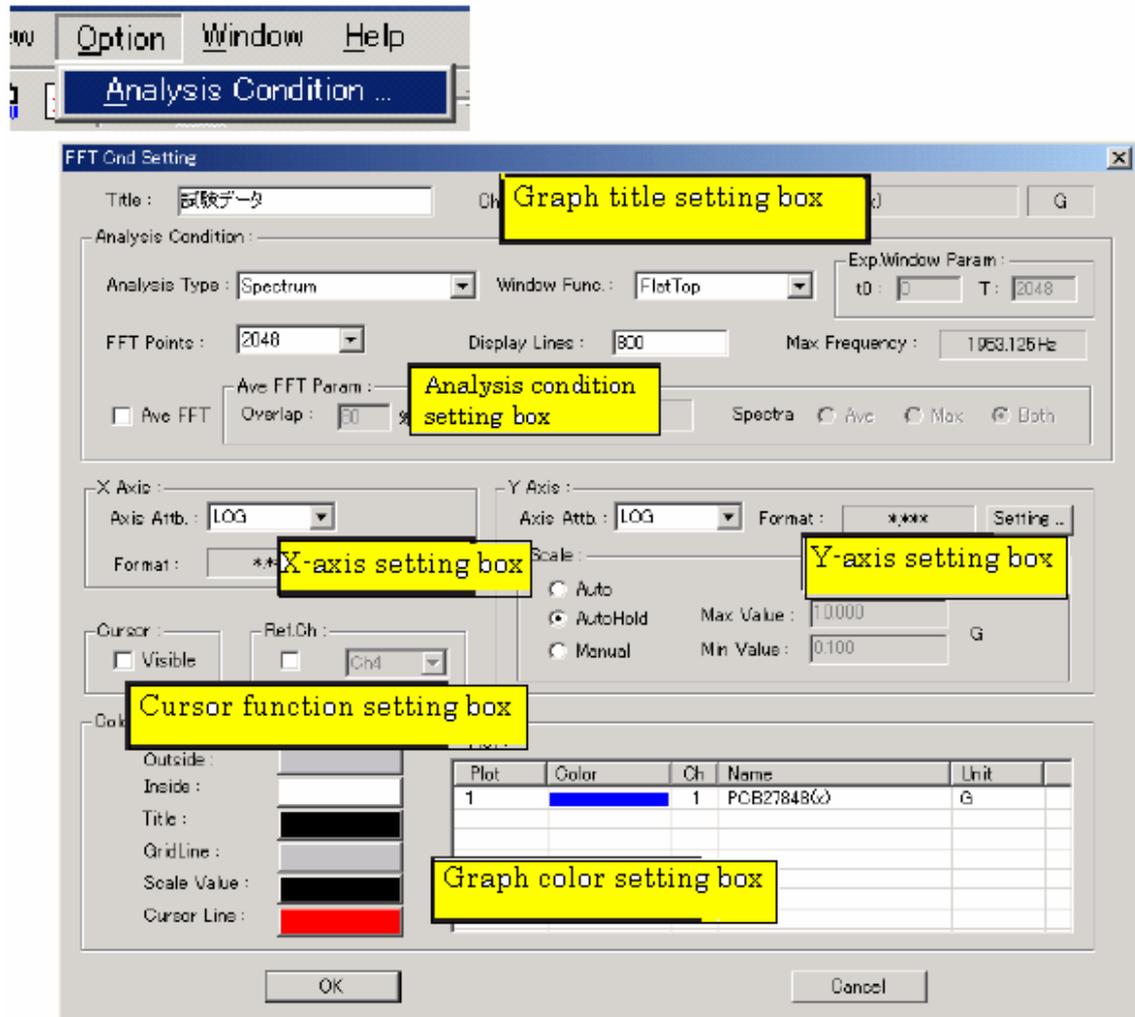
5-1 Initiation of FFT analysis window

This function allows FFT calculation result for the specified analysis range of current channel to be displayed on the screen. Choose "FFT/Ave. FFT" from the pull-down list box of "Analysis" on menu bar. Or click the icon on tool bar. When choosing it, FFT analysis is performed on preset analysis conditions and the result is added to the same graph on the window that has already been shown. If any window is not displayed, a new window will be opened and display the graph.



5-2 Setting of analysis display conditions

Choose "Analysis Condition" from the pull-down menu of "Option" on menu bar, and a condition-setting dialog box will appear.



5-2-1 Graph title setting

By typing graph title in Title box, you can indicate graph title in FFT analysis result graph. Initial value is the same contents as the next previous set ones. Further, analysis-target current channel no., signal name and unit are indicated on right side of the title box and they provide us with information of analysis channel.



5-2-2 Setting of analysis conditions

FFT analysis conditions consist of the following : analysis result to be gained (Analysis Type), processing window function(Window Func.), FFT size(FFT Points), number of display spectra (Display Lines) and do or not-do of average processing & overlap ratio (OverLap), or if performing average processing, display or non-display of max value of each spectrum (SpectraMax).

5-2-2-1 Choosing of analysis result (Analysis Type)

Choose the analysis result to be displayed. Selectable results are listed below.

Analysis type	Amplitude	Calculation expression	Effective value	Calculation expression
Spectrum	Spectrum	A	Spectrum(rms)	$A/\sqrt{2}$
Power spectrum	Power spectrum	$P = A^2$	Power spectrum(rms)	$Prms = (A^2)/2$
Power spectrum Density	Power spectrum Density	$PSD = P/f$	Power spectrum Density (rms)	$PSDrms = Prms/f$

When choosing analysis result (Analysis Type) in an overlaid display state, overlay is released and latest result alone is displayed in the graph.(See 5-3 for overlay display operation of plural channels)

5-2-2-2 Choosing of window function

You can apply window function to the time axis data on which FFT processing is to be performed. Selectable window functions are described below.

window function name
Hanning
Hamming
Blackman
Kaiser-Bessel
FlatTop
Exponential
Off

Window function equations of Hanning and Hamming

$$w(t) = \alpha - (1 - \alpha) \cos\left(2\pi \frac{t}{T}\right)$$

T represents FFT frame length. $\alpha = 0.5$ for Hanning function, while $\alpha = 0.54$ for Hamming function

Window function equation of Blackman

$$w(t) = .42659 - .49656 \cos\left(2\pi \frac{t}{T}\right) + .76848 \cos\left(4\pi \frac{t}{T}\right)$$

Window function equation of Kaiser-Bessel

$$w(t) = 1 - 1.24 \cos\left(2\pi \frac{t}{T}\right) + .244 \cos\left(4\pi \frac{t}{T}\right) - .00305 \cos\left(6\pi \frac{t}{T}\right)$$

Window function equation of FlatTop

$$w(t) = 1 - 1.93 \cos\left(2\pi \frac{t}{T}\right) + 1.29 \cos\left(4\pi \frac{t}{T}\right) - .388 \cos\left(6\pi \frac{t}{T}\right) + .0322 \cos\left(8\pi \frac{t}{T}\right)$$

Window function expression of Exponential

$$w(t) = e^{-(t-t_0)/\tau}$$

When choosing Exponential window function, you can set t_0 and τ values. t_0 represents window-start-points in FFT frame, and τ represents window-width.

The relation of $0 < t_0 < T$, $t_0 + \tau < T$ has to hold. You can determine setting values using index number (data number) in frame. Note that these are not changed automatically if the number of FFT points is changed.

5-2-2-3 Setting of FFT analysis frame length (FFT Points)

Choose frame length (number of data-points) for FFT analysis. Select from among 512, 1024, 2048, 4096, 8192 and 16284. Further, if you don't perform average processing, the area from start-points of the preset specific analysis range to the end of frame length you set this time becomes analytic target.

When changing FFT analysis frame length in an overlaid display state, overlay is released and latest result alone is displayed in the graph.

5-2-2-4 Setting of number of display spectra (Display Lines)

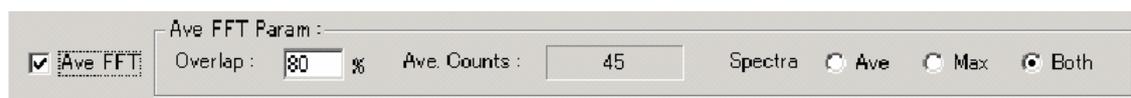
Set the number of spectrum lines to be shown in graph. The number of settable max display spectra is up to FFT frame length/2. If changing FFT frame length, the number of display spectra returns to the initial value.

FFT frame length	Initial value of the number of display spectra	Max number of display spectra
512	200	255
1024	400	511
2048	800	1023
4096	1600	2047
8192	3200	4095
16384	6400	8191

The spectrum of 0 Hz (direct current) is not displayed.

For information, on setting the number of display lines, max display frequency is calculated to be indicated on right side of the setting box.

5-2-2-5 Setting of average processing (Ave FFT)



Click the check box "Ave FFT". Then FFT processing is repeated and average spectra are sought.

When changing ON /OFF of average processing in an overlaid display state, overlay is released and latest result alone is displayed in the graph.

5-2-2-6 Setting of overlap ratio (Over Lap)

If average spectra calculation is specified, average FFT parameters become active and you can set overlap ratio of iterated FFT procession. Settable value is in the 0-to-99% range. When overlap ratio is set, the number of iterated FFT processing times is indicated on right side of setting box.

FFT processing is performed on preset analysis range repeatedly by the set overlap ratio, but if the last processing cannot meet FFT frame length, the unfinished range can not be analyzed.

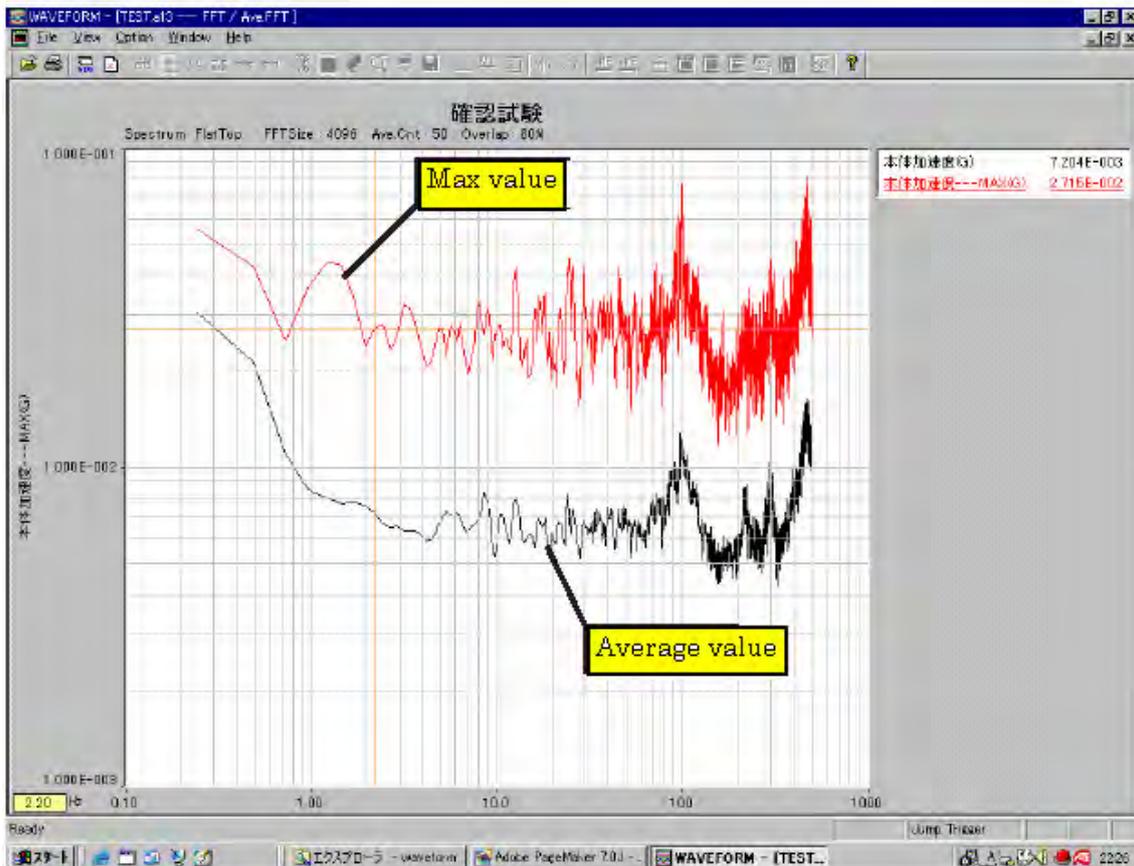
The number of average processing times is automatically determined by preset analysis range size and the set overlap ratio. Therefore, if you want to set the number of average additional times explicitly, you can set it by seeking the width of analysis range from number of addition times you want.

5-2-2-7 Display setting of average FFT analysis results

Select an option button from among average spectra, max spectra and both to display analysis result.

On selecting both, 2 kinds of average spectra and max spectra are displayed in the graph.

< Display sample of average values / max values >



5-2-3 Setting of graph-axis and scale

The screenshot shows the 'Setting of graph-axis and scale' dialog box. The X Axis is set to LOG with a Format of ****. The Y Axis is also set to LOG with a Format of ****. The Scale is set to AutoHold with a Max Value of 10.000 and a Min Value of 0.100. The Ref.Ch is set to Ch4. The dialog box includes the following controls:

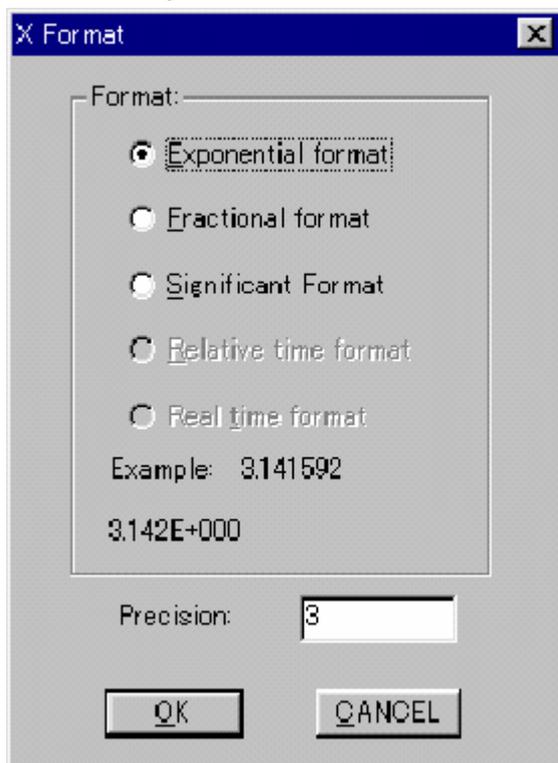
- X Axis: Axis Attb.: LOG, Format: ****, Setting ...
- Y Axis: Axis Attb.: LOG, Format: ****, Setting ...
- Scale:
 - Auto
 - AutoHold
 - Manual
- Max Value: 10.000
- Min Value: 0.100
- Ref.Ch: Ch4
- Cursor: Visible

5-2-3-1 Setting of X-axis (frequency axis) attributes (Axis Attb)

Select LINEAR or LOG. When selecting LINEAR, the left-hand edge of X-axis indicates 0 Hz, and the right-hand edge indicates the frequency obtained from the number of the set display spectrum lines. On the other hand, when selecting Log, graph fluctuates by the decade. The left-hand edge of X-axis indicates decade-start-frequency including primary frequency (f), and the right-hand edge indicates decade-finish-frequency including the frequency calculated from the number of display spectrum lines.

5-2-3-2 Setting of indication format of X-axis scale value (Format).

Presently used indication format is shown. To change indication format, click "Setting" button on right side of "Format" box, and a format-setting dialog box will appear.



You can select 3 kinds of indication formats : Exponential format, Fractional format and Significant format. After selecting a format, enter the number of digits.

For example, If you set 3 digits in Exponential format, scale value is expressed as 3.142E + 000. If you set 3 digits in Fractional format, scale value is expressed as 3.142. If you set 3 digits in Significant format, scale value is expressed as 3.14.

5-2-3-3 Setting of Y-axis (data axis) attributes (Axis Attb).

Select LINEAR or LOG. You can set either section scale or logarithmic scale, or varying combinations of both by mixing X and Y axis attributes.

5-2-3-4 Setting of Y-axis scale value indication format (Format)

Presently used indication format is shown. To change indication format, click "Setting" button on right side of "Format" box, and a format-setting dialog box will appear.

You can select 3 kinds of indication formats : Exponential format, Fractional format or Significant format. After selecting a format, enter the number of digits.

5-2-3-5 Setting of Y-axis scale

You can select an option from among 3 options of Auto, AutoHold and Manual for scale. In Auto mode, graph scale is set every time with each analysis result of the current channel to be written on the graph. Graph scale is automatically updated with each latest result even when analysis results of plural channels are shown. In AutoHold mode, the next previous scale stays active unless a value exceeds the max value of the preset scale. Only when the value of the preset scale is exceeded, the scale will be updated. In Manual mode, you can set scaling by setting the max value and min value of scale explicitly. In this mode, both of max value input box and min value input box become active to be able to set max & min values of graph scale.

In the case of Y-axis attribute 「LOG 」 except manual setting, decade- start value including the min value of display result is indicated as the min value of graph scale. For example, if the min value of the result is 0.23, 0.1 is adopted. Similarly, decade-finish value including the max value of display result is indicated as the max value of the graph. For example, if the max value is 12.3, 100 is adopted.

5-2-3-6 Setting of cursor function (Visible)

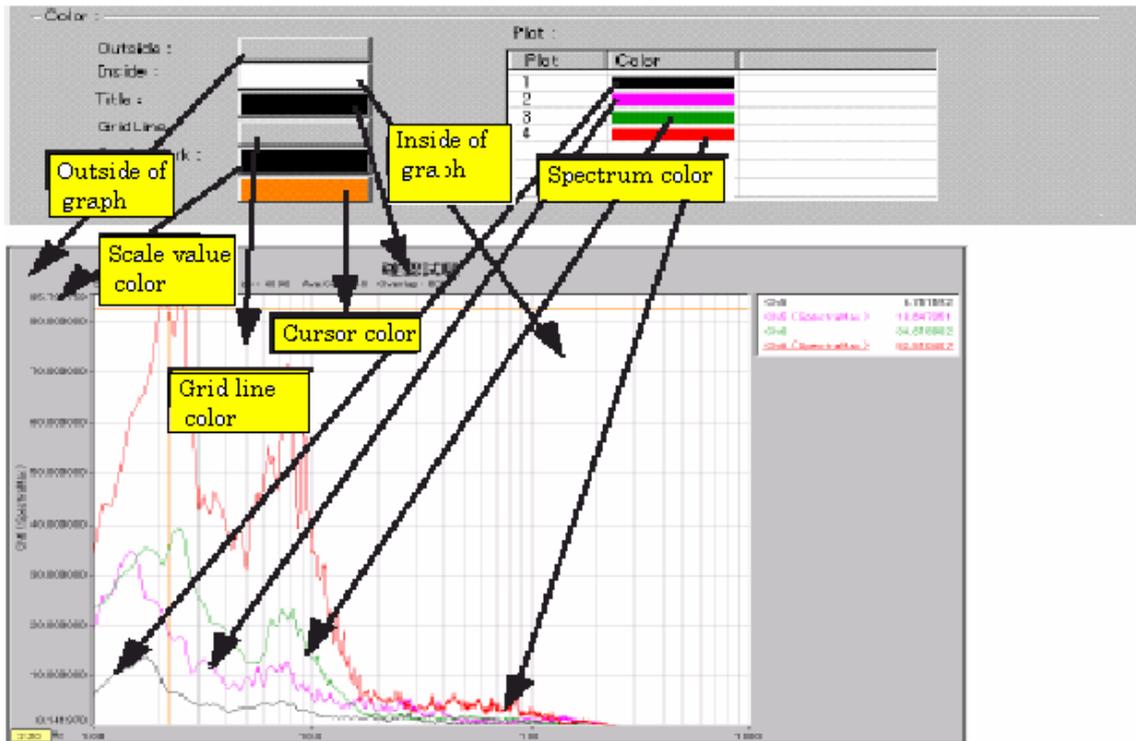
Click the check box "Visible", and cursor function works to display cross-cursor line. You can move to any position by mouse-drag. If you want to move it minutely, move it with arrow-keys of keyboard. Frequency at cursor position is indicated at the lower-left corner of outside of graph frame, and Y-axis value is indicated at the upper-right corner of outside of graph frame.

5-2-3-7 Displaying average value of reference channel(Ref. Ch)

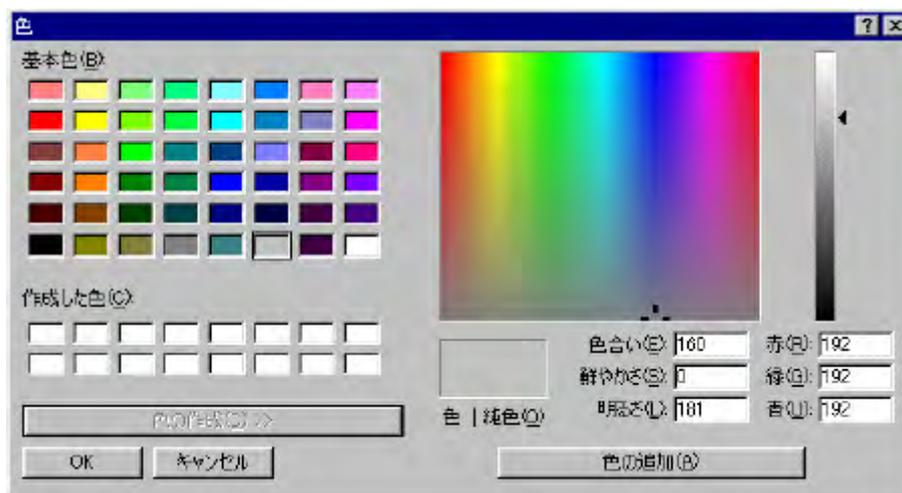


When clicking the check box "Ref. Ch", an average value of the area corresponding to FFT processing of chosen reference channel is displayed at right-end of the line below graph-title. For example, in the case where analysis channel is vibration, choose R/M channel as reference channel, and R/M of the same time-axis range is displayed on FFT analysis result. It defines spectrum analysis of vibration in a certain R/M range.

5-2-4 Setting of graph colors



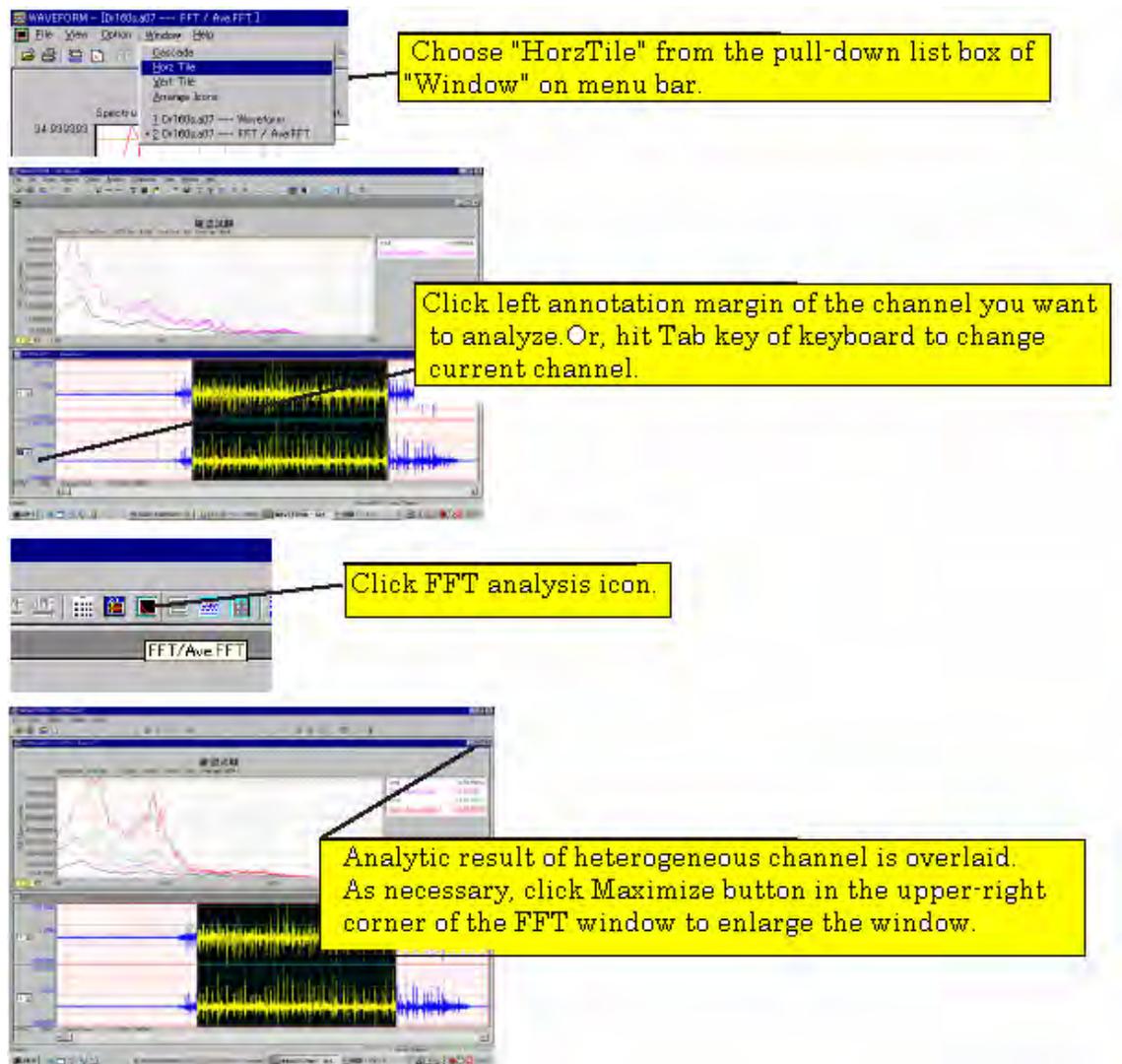
To change colors, click each of color buttons. On clicking a button, a colors palette dialog box will appear. You can select any of basic colors from the palette. If you want to change the spectrum line color displayed in graph, double-click the line you want to change in plot list chart. A colors palette will appear.



After choosing a color, click OK button, and the screen returns to condition-setting dialog box.

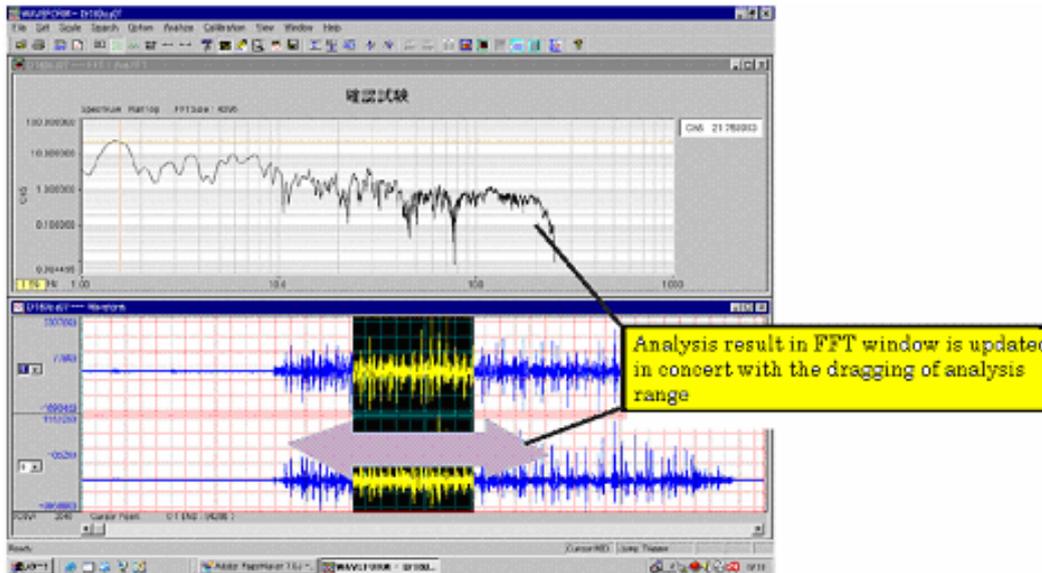
5-3 Overlay display operation of plural channels

It is possible to display the result of the same analysis range of heterogeneous channel. Display waveform display window just when FFT window is open. Change analysis channel to other heterogeneous channel and then click FFT analysis icon again. The analysis range of the heterogeneous channel will be overlaid on the just preceding display spectrum graph.



5-4 Gang operation with other window

Analysis result in FFT window is updated in synchronization with change of the analysis range in waveform display window. Display waveform display window and FFT window simultaneously on the screen. Then drag the set specific analysis range of waveform display window from side to side, and FFT analysis result will be updated in concert with the movement.

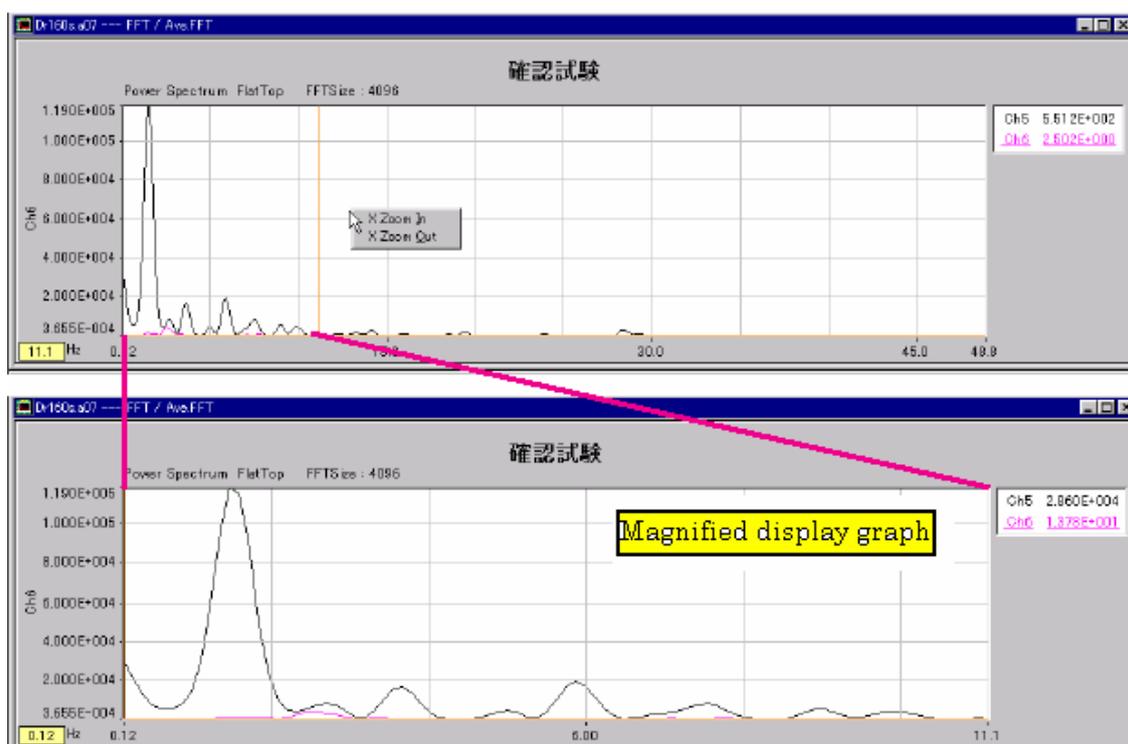


However, when plural channels are displayed in FFT window at the same time, the movement of analysis range causes the results of other channels than that of current channel to be lost. To release linkage, change analysis range (width), and the analysis result displayed in FFT window won't be updated though moving the analysis range. If you want to perform FFT analysis again, you have to click FFT analysis icon on tool bar of waveform display window. On clicking it, analysis result will be overlaid on just preceding display analysis graph.

If you want to overlay different analysis ranges, firstly change the width of analysis range once and move it. Secondly set it to the same width as that of previous analysis range. Then click FFT analysis icon. This practice can make the FFT analysis result in the same channel's different area or in other channel's different area to be overlaid in the graph.

5-5 Zooming operation of X-axis of the graph

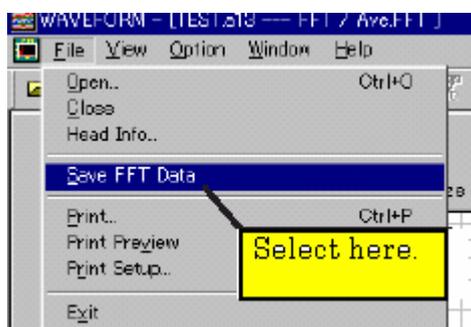
Right-click a given place within graph frame, and a pull-down menu "X Zoom In / X Zoom Out" will appear. Choice of "X Zoom In" enlarges the result to cursor-line's current position. But if LOG is selected as X-axis attribute, the result is enlarged by decade unit including cursor line position. "X Zoom In" operation enables enlargement in succession. (an additional enlargement to enlarged result). See 5-2-3-6 for setting of cursor function (Visible).



Likewise, if you choose "X Zoom Out", frequency indication returns to that of the frequency calculated from the number of originally determined spectra.

The number of X-axis spectra of the graph that has been enlarged by "X Zoom In" operation does not update the preset number of spectra in condition-setting dialog box, but it holds internally and is effective at overlay later on. Please note that change of the set number of spectra in the condition-setting dialog box does not carry out "Zoom Out".

5-6 Storage of analysis result



You can save FFT analysis result in csv-formatted file. Choose "Save FFT Data" from the pull-down list box of "File" on menu bar, and a file-save dialog box will appear. Enter filename in filename box and save it.

5-6-1 Result save format

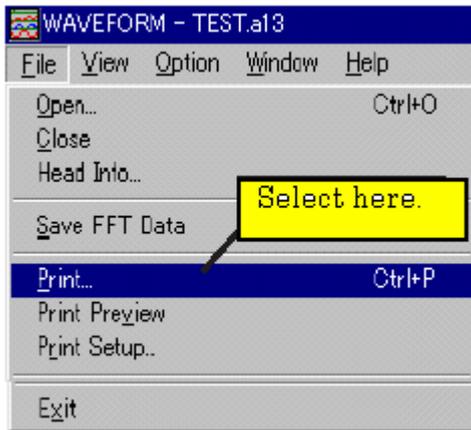
The result is saved in TEXT file of extension ".csv".

In 1st line, keyword, graph-title, analysis date and analysis time are described. In 2nd line, analysis-target filename is described. In 3rd line, signal name and each unit of each analysis column, in 4th line, channel number of each analysis column, in 5th line, analysis display format of each analysis column, in 6th line, used window function of each analysis column and in each line of from 7th line on, the analysis results are described. When seeing the result vertically, spectrum number is described in the 1st column, and frequency is described in the 2nd column. In each column of from 3rd column on, analysis results are described.

Storage sample (Description sample of Excel)

FFT RESULT	確認試験	2004年3月13日	21:55:42
File Name	TEST.a13		
	Name (Unit)	ローラ横押し圧 1 (N ² /Hz)	ローラ横押し圧 2 (N ² /Hz)
	ChNo	Ch11	Ch12
	Analysis Mode	Power Spectrum Density	Power Spectrum Density
No	Frequency (Hz)	FlatTop	FlatTop
1	0.24	21790.000	168400.000
2	0.49	9861.000	76870.000
3	0.73	1038.000	8859.000
4	0.98	72.490	956.300
5	1.22	36.180	472.200
6	1.46	26.670	326.300
7	1.71	20.760	254.600
8	1.95	15.700	186.100
9	2.2	13.100	133.800

5-7 Printing of analysis result



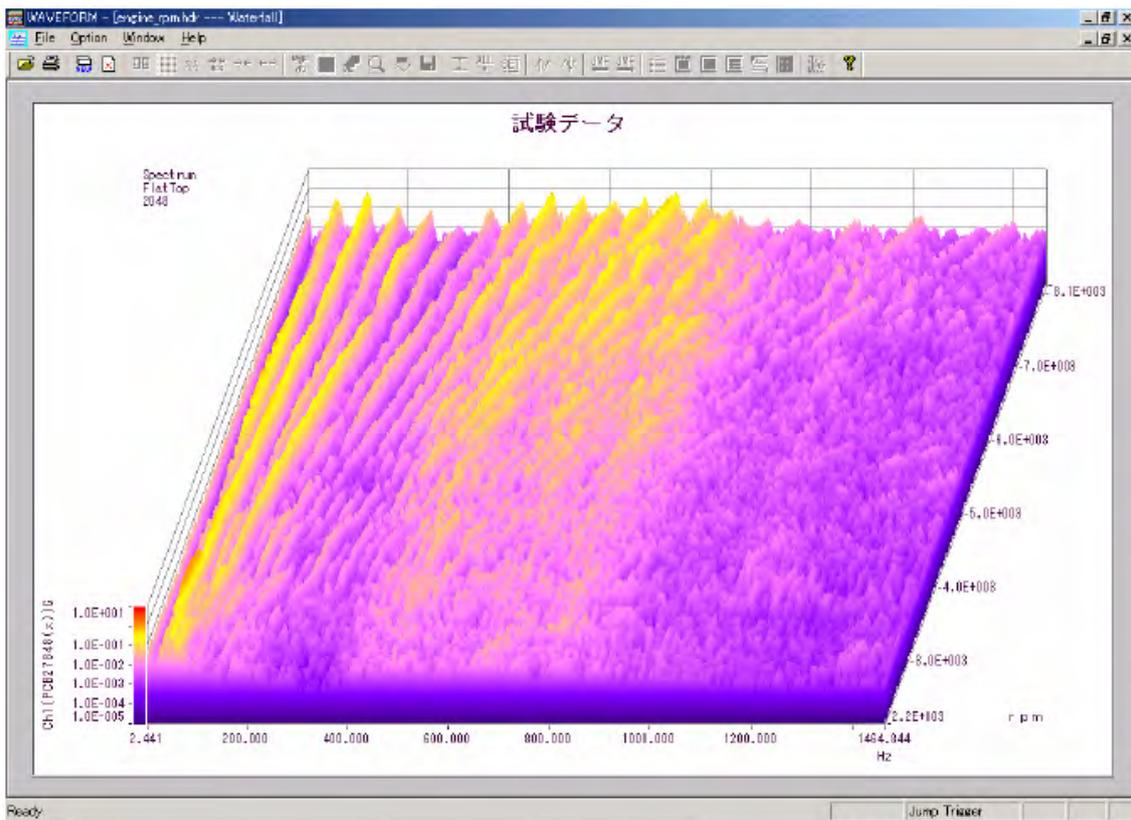
You can print out the analysis result using the connected printer. Choose "Print" from the pull-down list box of "File" on menu bar. On choosing it, the set printer produces printout. For your information, to set the connected printer, choose "Print Setup" from the pull-down list box, and a printer setting dialog box will appear. And if you want to see printout result in advance, choose "Print Preview" from the pull-down list box. Preview window will open.

Chapter 6**WATER FALL analysis window**

Setting of graph title	available
Number of data-points	512, 1024, 2048, 4096, 8192, 16384 selectable
Number of window functions	Hanning, Hamming, Blackman, FlatTop, Kaiser-Bessel, Exponential and Rectangular
Analysis type	Spectra, Power spectra, Power spectra density, rms value and Amplitude Selectable
Number of average FFT times	setting 1-to
Overlapping ratio	0 to 99% any setting
Number of display spectra	Setting Up to the number of FFT data-points / 2
Graph angles	0, 5,10,20 degree selectable
Cursor function	available : X-axis cursor Y-axis cursor OFF selectable
X-axis attribute	LINEAR LOG Selectable
Y-axis attribute	LINEAR LOG Selectable
Z-axis attribute	LINEAR continuous time time interval Ref. channel / Step-specification MARK
Y-axis scale	AUTO MANUAL Selectable
X-axis scale	AUTO MANUAL Selectable
Graph display form	color map curve Selectable
Setting of graph colors	available : graph outside, graph inside, grid lines, scale value color, cursor line and spectrum line of result
Printing function	available
Storage of result	available TEXT format

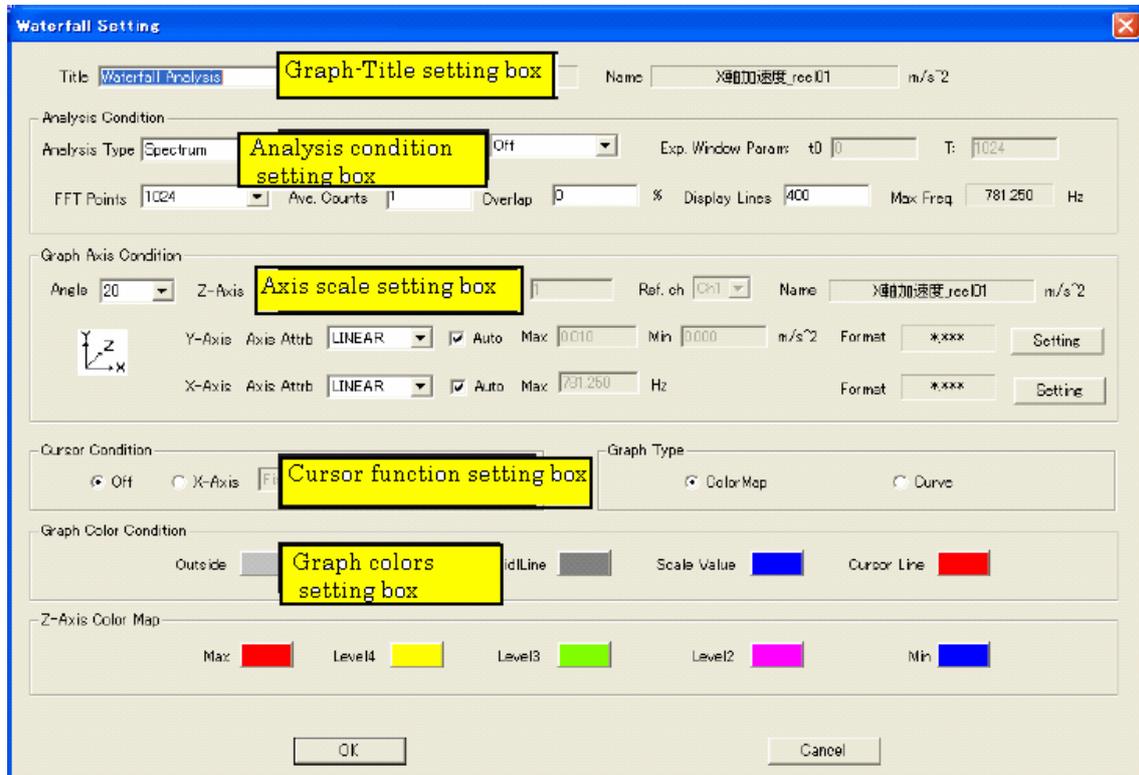
6-1 Initiation of WATER FALL analysis window

You can display FFT calculation results of specified analysis range of current channel in Water Fall form. Choose "Waterfall" from the pull-down list box of "Analyze" on menu bar. Or click the icon on tool bar. On choosing it, analysis is performed on just preceding set Waterfall analysis conditions and Waterfall analysis window opens to show the results in graphic form. If the preset condition is inconsistent, analysis-condition change message will be displayed instead of graph.

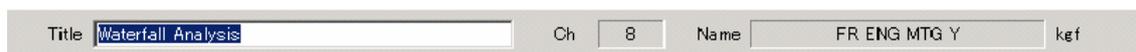


6-2 Setting of analysis display conditions

Choose "Analysis Condition" from the pull-down menu of "Option" on menu bar of Water Fall analysis window, and a condition-setting dialog box will appear.



6-2-1 Setting of graph title



You can display graph-title in Waterfall analysis result graph. The initial value is what you have set just before. For information, current analysis channel no., signal name and unit are indicated on the right side of title-input box to assure analysis channel.

6-2-2 Setting of analysis conditions



6-2-2-1 Choosing of analysis result (Analysis Type)

Choose an analysis type. Selectable results are described below.

Analysis type	Amplitude	Calculation expression	Effective value	Calculation expression
Spectrum	Spectrum	A	Spectrum (rms)	$A / \sqrt{2}$
Power spectrum	Power spectrum	$P = A^2$	Power Spectrum (rms)	$Prms = (A^2) / 2$
Power spectrum density	Power spectrum density	$PSD = p / F$	Power Spectrum Density (rms)	$PSDrms = Prms / F$

6-2-2-2 Choosing of window function (Window Func.)

Selectable window functions are described below.

Window function name	
Hanning	
Hamming	
Blackman	
Kaiser-Bessel	
FlatTop	
Exponential	
Rectangular	

When choosing Exponential window function, you can set t_0 and Δ values. t_0 represents window-start-points in FFT frame, and Δ represents window-width.

The relation of $0 \leq t_0 < T$, $t_0 + \Delta \leq T$ has to hold. You can determine setting values using index number (data number) in frame. Note that these are not changed automatically though the number of FFT points are changed.

6-2-2-3 Choosing of FFT analysis frame length (FFT Points)

Choose frame length (number of data-points) for FFT analysis. Select from among 512, 1024, 2048, 4096, 8192 and 16284.

6-2-2-4 Setting of number of display spectra (Display Lines)

Set the number of spectrum lines to be shown in graph. The number of settable max display spectra is up to FFT frame length/2. If changing FFT frame length, the number of display spectra returns to the initial value.

The spectrum of 0 Hz (direct current) is not displayed.

For information, on setting display lines, max display frequency is calculated to be indicated on right side of the setting box.

6-2-2-5 Setting of average processing (Ave. Counts)

To obtain average spectra over a certain number of spectrum lines, plural times of FFT processing need to be performed. To achieve it, specify the times of FFT average processing to be performed over specific number of spectrum lines about which you want to get FFT average. Initial value is one-time.

6-2-2-6 Setting of overlap ratio (Over lap)

Except when Z-axis' mode (described later on) is set "CONT", if average processing times are one or further, overlap ratio becomes effective and you can set overlap ratio of repeating FFT processing. Settable values are in the range of 0 to 99%. In CONT mode, it becomes effective even when number of average processing times is 1.

6-2-3 Setting of graph axis and scale

Graph Axis Condition

Angle 20 Z-Axis Mode **CONT** Step 1 Ref. ch Ch1 Name Z軸加速度_reeD1 m/s²

Y-Axis Axis Attrib **LINEAR** Auto Max 0.010 Min 0.000 m/s² Format *** Setting

X-Axis Axis Attrib **LINEAR** Auto Max 781.250 Hz Format *** Setting

6-2-3-1 Selecting of graph drawing angles (Angle)

Select an angle of graphic Z-axis direction. Selectable angles are 0, 5, 10, 15 and 20. Initial value is 20 degrees.

6-2-3-2 Choosing of Z-axis attributes (Mode)

You can choose Z-axis mode from among 4 kinds of Cont, Time, Mark and Ref.ch. "Cont" is chosen when you see the change of spectra varying with elapse of time. Data is continuously sliced on the set FFT frame basis in data sequence (time axis) and FFT-processed. And these processed items of data are put into time-axis order. Therefore, Z-axis attribute is time.

Basically, "Time" has the same meaning of "Cont", but Step box becomes effective as a parameter and you can set explicitly the time interval of performing FFT processing. For example, if you set 10 in Step box, FFT-processing is performed every 10 seconds on time-axis and the processed items of data are put into time-axis order. For information, in the status where average times have already been set, if FFT-processing target data length exceeds the set increment-in-step value (time interval), time interval takes priority over target data length. Average processing times will be carried out up to allowable times.

In "Mark" mode, FFT-processing is carried out on a Mark basis in analysis range and processed items of data are put into time-axis order. Step and Ref. ch becomes effective as parameters. Step indicates the number of jumps over Mark numbers.

Initial value is 1. In short, FFT-processing is carried out on Mark-to-Mark basis. Though Z-axis is the same attribute as Time, scale is Mark number scale. Scale indication value is expressed by data value of the channel which has been set in Ref.ch box. "Ref.ch" renders a given channel data of acquired data the Z-axis. It is selected when you see the change of spectra varying with the change of Z-axis data. Its parameters are Step and Ref.ch. Step means increment-in-step value of the channel which has been set as Z-axis. FFT-processing is performed on every value points set as increment-in-step value in addition to Z-axis channel specified as an analysis range. Further, data of channel which has been set as Z-axis need to be sorted in descending or ascending order. You can judge descending or ascending order, by comparing which is large or small between start data and end data within the analysis range of Z-axis channel..

6-2-3-3 Choosing of X-axis attribute (Axis Attb)

Select either LINEAR or LOG. When selecting LINEAR, the left-hand edge of X-axis indicates 0 Hz, and the right-hand edge indicates the frequency obtained from the number of the set display spectrum lines. On the other hand, when selecting Log, graph fluctuates by the decade. The left-hand edge of X-axis indicates decade-start-frequency including primary frequency (f), and the right-hand edge indicates decade-finish-frequency including the frequency calculated from the number of display spectrum lines.

6-2-3-4 Setting of X-axis scale

Initial value is AutoScale setting. It depends on the number of spectrum display lines which have been set by analysis-conditions. When you want to set it manually, uncheck Auto check box. On unchecking it, scale max value input box becomes effective. If LOG is selected as X-axis attribute and a value is given as X, the value obtained as $X' = (X)$ is used. And the round-up value will be indicated at the top end of the graph (at right end for frequency). The unit is expressed in decade. Further, when the value to be entered includes the fractional portion of the number, the fractional portion will be dropped.

6-2-3-5 Setting of indication format of X-axis scale value (Format).

Presently used indication format is shown. To change indication format, click "Setting" button on right side of "Format" box, and a format-setting dialog box will appear.

You can select 3 kinds of indication formats : Exponential format, Fractional format and Significant format. After selecting a format, enter the number of digits.

For example, If you set 3 digits in Exponential format, scale value is expressed as 3.142E + 000. If you set 3 digits in Fractional format, scale value is expressed as 3.142. If you set 3 digits in Significant format, scale value is expressed as 3.14.

6-2-3-6 Choosing of Y-axis (data value axis) attribute (Axis Attb)

Choose either LINEAR or LOG.

6-2-3-7 Setting of Y-axis scale

Initial value is AutoScale. In AutoScale mode, min value and max value of all display spectra are referred to. When LINEAR is selected as axis attribute, max value alone is referred to and min value of the graph becomes 0. When LOG is selected, decade-start value including min value becomes the min value of the graph. For example, if min value is 0.23, 0.1 is adopted as the min value of the graph. Likewise, decade-finish value including the max value to be sought becomes the max value of the graph. For example, if the max value is 123.45, 1000 is adopted as the max value of the graph. For manual setting, uncheck Auto check box. On unchecking it, max and min value input boxes become effective.

See "Setting of scale" 6-2-3-4 for details.

6-2-3-8 Setting of Y-axis scale value indication format (Format)

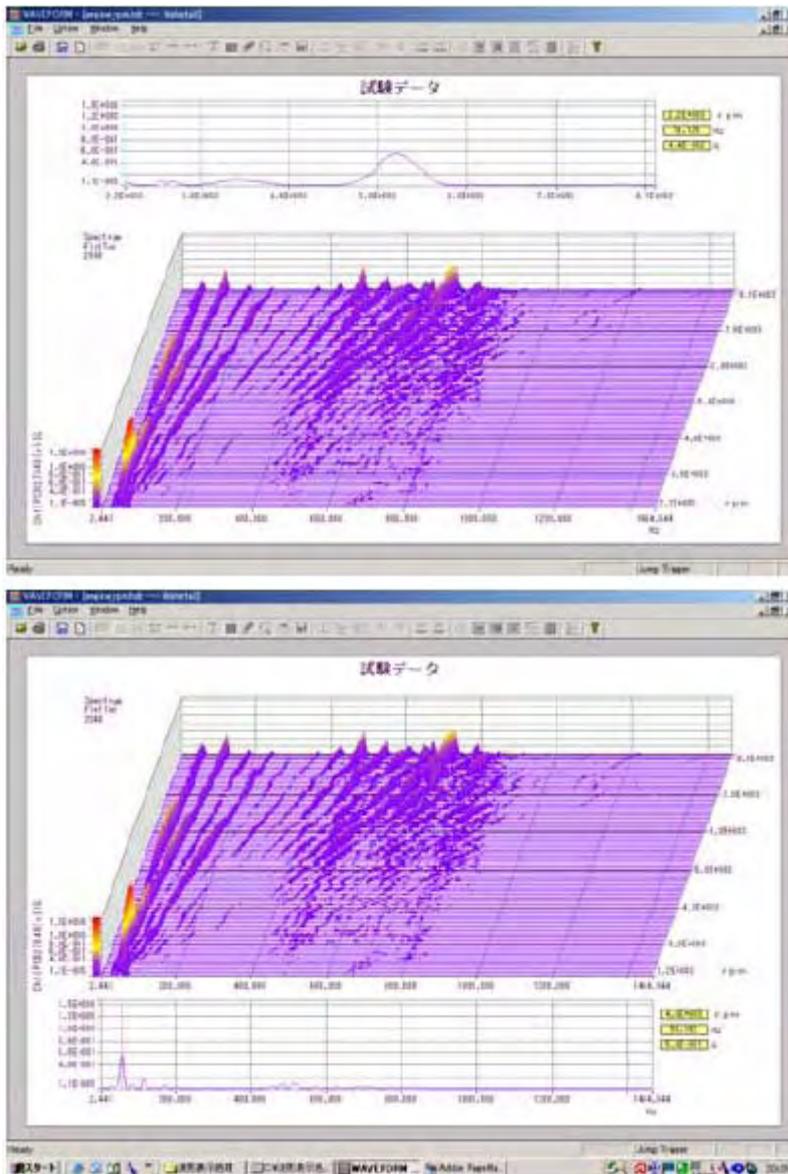
Presently used indication format is shown as is the case with X-axis. To change indication format, click "Setting" button on right side of "Format" box, and a format-setting dialog box will appear. You can select 3 kinds of indication formats : Exponential format, Fractional format or Significant format. After selecting a format, enter the number of digits.

6-2-4 Selecting of cursor function and selecting of graph form



6-2-4-1 Selecting of cursor function

You can select cursor function from 3 kinds of OFF, X-Axis or Z-Axis. "X-Axis" is the type of the function where cursor line moves on X-axis. "Z-Axis" is the type of the function where cursor line moves on Z-axis. Further, if you select "X-Axis", you can select Fixed or Separate.

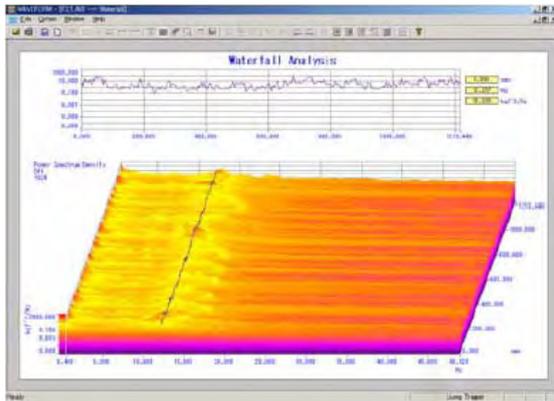


When X-Axis option button is selected, cursor line moves on X-axis and values on present cursor line are drawn in a new graph above Waterfall graph.

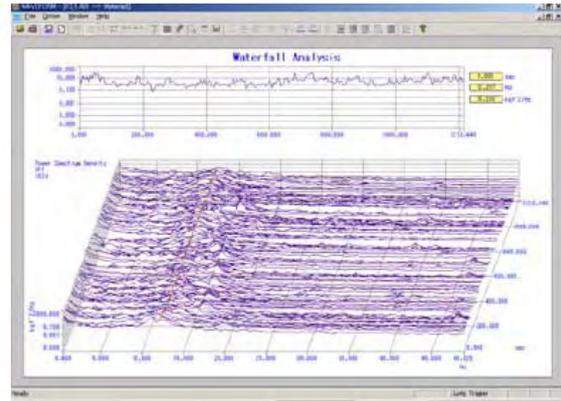
When Z-Axis option button is selected, cursor line moves on Z-axis and spectra on cursor line are drawn in a new graph form below Waterfall graph.

6-2-4-2 Selecting of graph form

To display each spectrum, which do you select, with lines or by light and shade of colors? If you want to display them by light and shade of colors, select Color Map option button. If you want to display them with lines, select Curve option button.



Graph display when selecting Color Map.



Graph display when selecting Curve.

6-2-5 Setting of graph colors



You can set graph color to each of outside of graph, inside of graph, grid line, scale value and cursor line, respectively. To change colors, click each of color buttons. On clicking a button, colors palette dialog box will appear. You can not only select any of basic colors from the palette, but you can create your own colors.

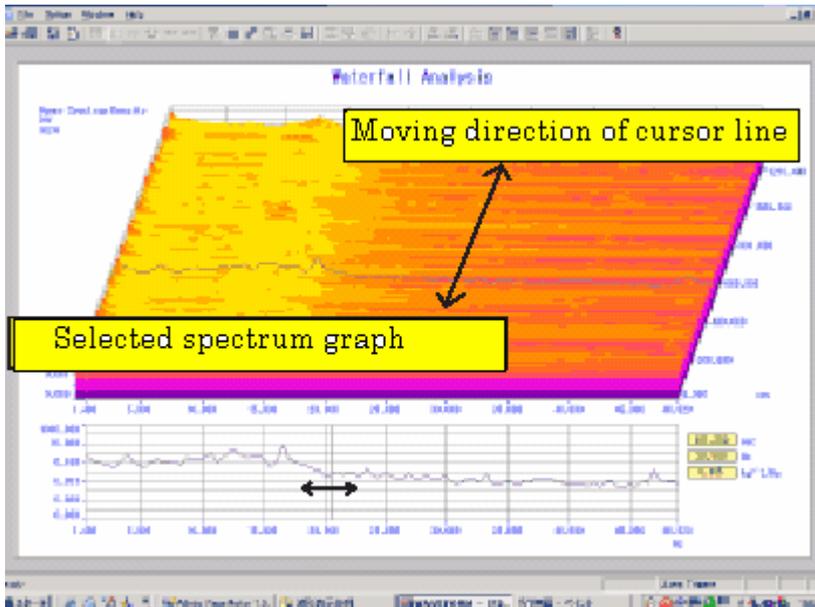
6-2-6 Setting of Color Map



When selecting Color Map for graph form, you can color max to min-values of graph's Y-axis by 5 color schemes. The set color-to-color boundary is continuously changed in colors. When selecting Curve for graph form, the color set by Min button alone is referred to.

6-3 Operation of cursor line

6-3-1 Operation of Z-axis cursor line

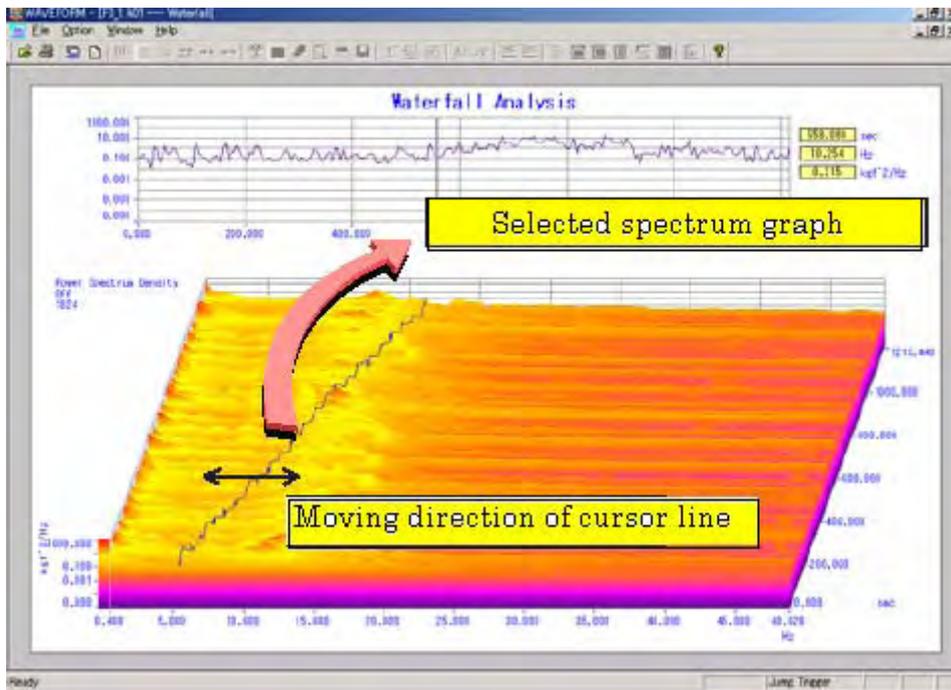


When selecting Z-axis option button, cursor line is displayed on Z-axis in Waterfall graph and the spectra selected by cursor line are displayed in a new graph.

The movement of cursor line can be done either by dragging within Waterfall graph frame or by hitting the up or down arrow key on keyboard. Likewise, the movement of cursor line on spectrum graph which is shown below the Waterfall graph can be done either by dragging within the graph frame or by hitting the right or left arrow key on keyboard.

6-3-2 Operation of X-axis cursor line

When selecting X-Axis option button, cursor line is displayed on X-axis in Waterfall graph. The spectra in Z-axis direction selected by cursor line are displayed in a new graph form.



How to determine cursor line's movement.

When selecting "Fixed" option.

- You can drag the cursor line within the WATER FALL graph frame.

When selecting "Separate" option.

< By mouse >

The cursor line on operator side can be dragged by left-mouse, while the cursor line on rear side can be dragged by right-mouse.

< By keyboard >

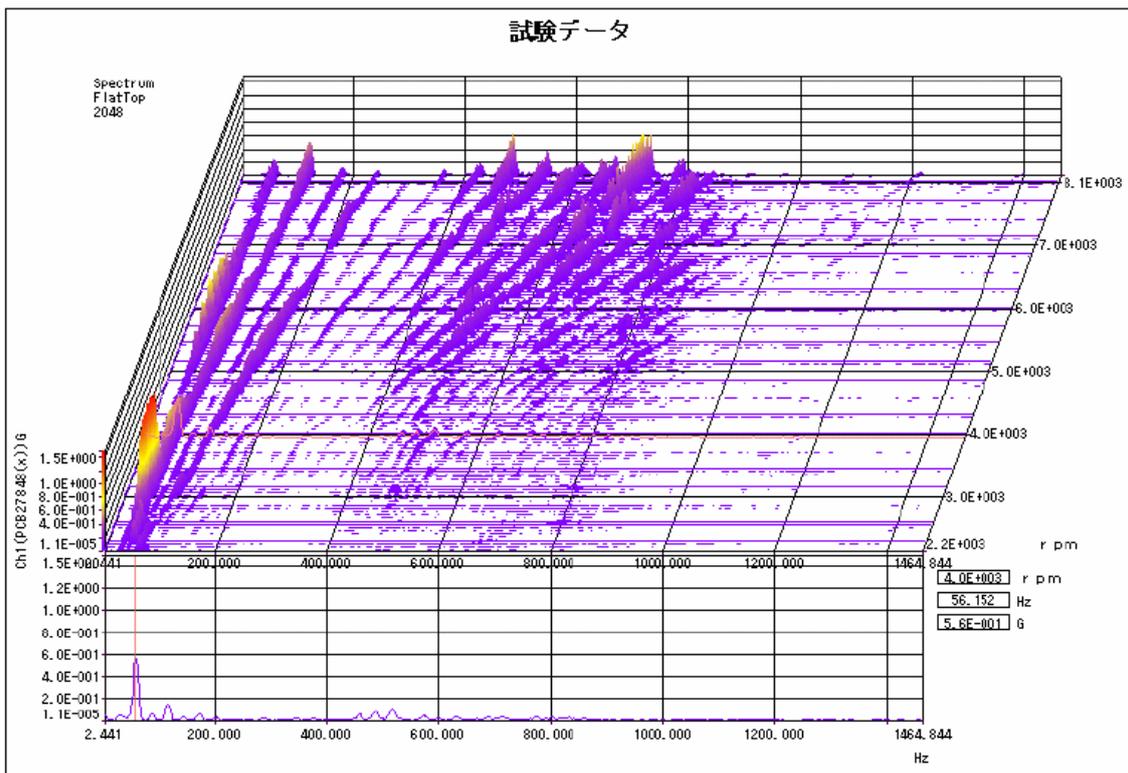
You can move operator side of the cursor line by hitting right or left arrow key on keyboard and can move the rear side of the cursor line by hitting right or left arrow key + Shift key on keyboard.

In Separate, cursor can be drawn in a slanting direction in WATER FALL graph through the use of this function. Further, you can drag the slanted cursor line using the Ctrl + right or left arrow key combination.

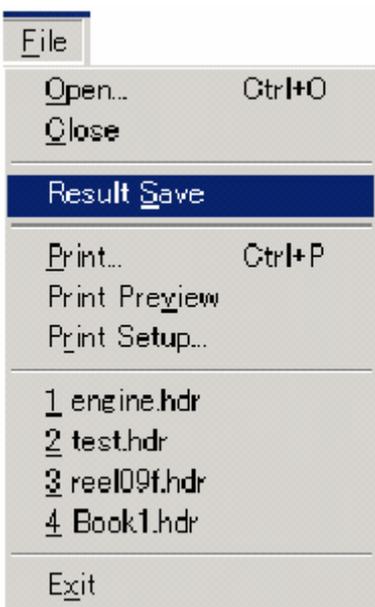
The cursor line in spectrum graph displayed above can be moved within graph frame by dragging. Likewise, it can be moved by hitting the up or down arrow key on keyboard.

6-4 Printing of graph

Choose "Print" from the pull-down list box of "File" on menu bar. On choosing it, the connected printer produces printout. To set the connected printer, choose "Print Setup" from the pull-down list box, and a printer setting dialog box will appear.



6-5 Storage of analysis result



You can save Waterfall analysis results in csv-formatted file.

Choose "Result Save" from the pull-down list box of "File" on menu bar, and a file-save dialog box will appear. Enter filename box in the file-save dialog box and save it.

6-5-1 Result save format

The results are saved in TEXT format with extension “csv”. Numeric values & digits to be saved are subject to Y-axis scale format setting on the analysis condition setting dialog box.

1 st line	1 st column	“WaterFall Analysis”	Fixed keyword
1 st line	2 nd column	the set TITLE	
1 st line	3 rd column	analysis date	
1 st line	4 th column	analysis time	
2 nd line	1 st column	analysis filename	
2 nd line	2 nd column	analysis CH number	
2 nd line	3 rd column	analysis CH signal name	
2 nd line	4 th column	analysis CH unit	previous unit available (non-subjective to analysis type).
3 rd line	1 st column	analysis type	Power Spectrum Density
3 rd line	2 nd column	FFT points	FFT = xxxxx
3 rd line	3 rd column	Window name	ex. FLAT TOP
3 rd line	4 th column	overlap ratio	ex. 80%
4 th line	1 st column	any one among Z-axis attribute	CONT, TIME, MARK, REF.CH
4 th line	2 nd column	Step value + Z-axis unit	But unit only for MARK, CONT
4 th line	3 rd column	Z-axis signal name	But TIME Fixed at TIME or CONT

Note: REF.CH NO. when signal name is blank.

< 5th line represents headline of analysis results >

5 th line	1 st column	“N0”	fixed
5 th line	2 nd column	“Frequency(Hz)”	fixed
5 th line	3 rd column	Z-axis value of leading spectrum	
5 th line	4 th column	Z-axis value of next spectrum	
5 th line	5 th column	column numbers dependent on the number of spectrum lines are created thereafter.	

< Analysis result lines from 6th line on >

6th line 1st column order 1 to number of display spectrum line – 1

6th line 2nd column frequency value

6th line 3rd column Y-axis value at the appropriate frequency

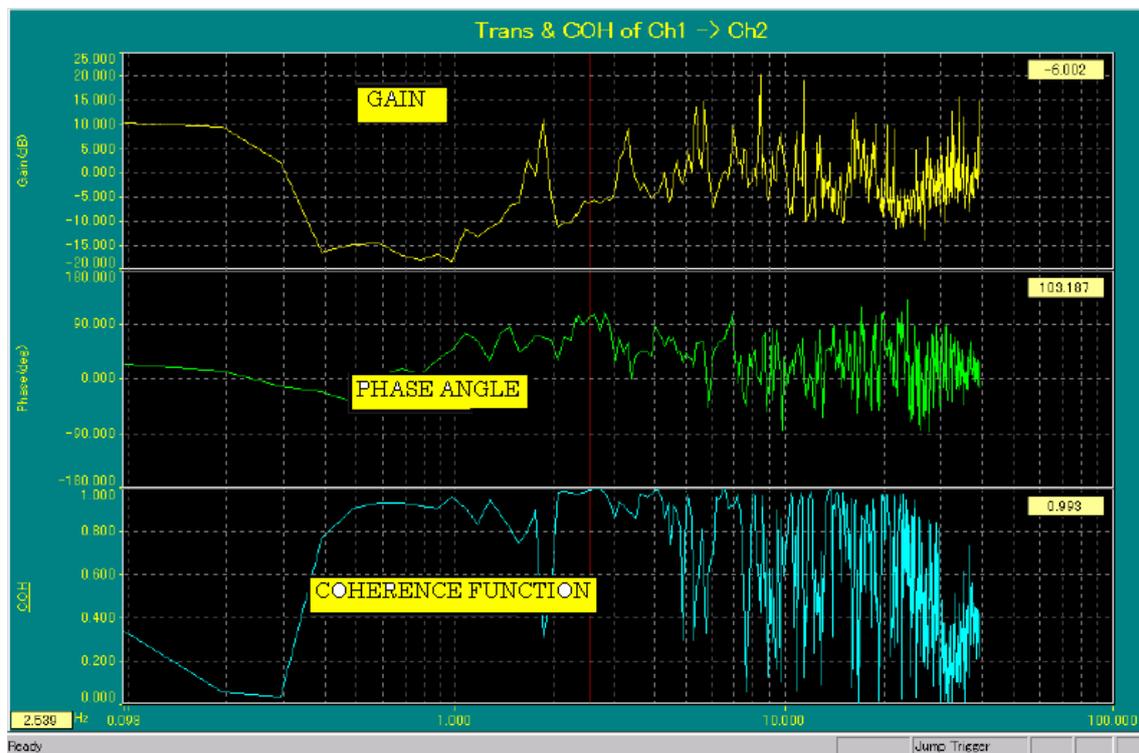
6th line 4th column the same

Chapter 7	Transfer function window
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Graph title setting	available
FFT data-points	512, 1024, 2048, 4096, 8192, 16384 selectable
Window function	Hanning, Hamming, Blackman, FlatTop, Kaiser-Bessel, Exponential and Rectangular
Number of average FFT times	Auto-calculation from overlapping ratio and analysis range width
Overlapping ration	0 to 99% any setting
Number of display spectra	Setting Up to the number of FFT data-points / 2
Graph display form	BODE form : Gain/Phase angle/Coherence graph NYQUIST form : Real part imaginary part X-Y/ coherence graph
Cursor function	available
X-axis attribute	LINEAR LOG but LINEAR alone for NYQUIST graph
Y-axis attribute	GAIN : dB-LINEAR fixed other : LINEAR fixed
Y-axis scale	AUTO, MANUAL only for GAIN graph and NYQUIST graph Coherence 0 to 1 fixed, Phase angle $\pm 180^\circ$ fixed
Setting of graph colors	available : graph outside, graph inside, grid lines, scale color, cursor line and spectrum line of result
Printing function	available

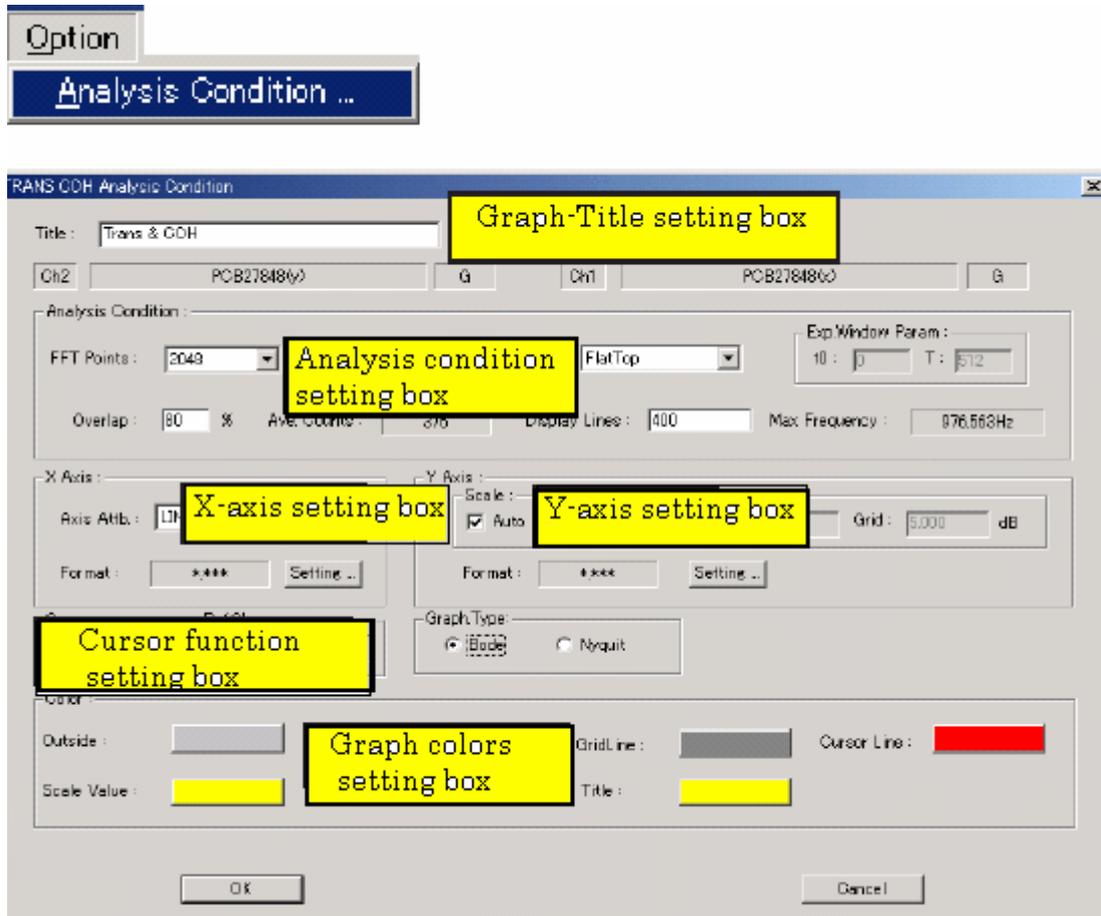
7-1 Initiation of transfer function window

This window allows transfer function to be calculated between a pair of the following two channels : an analysis range-specified current channel and another channel which is overlapped in the same waveform strip and the calculated result to be displayed in graph form. But this function becomes effective only when the current channel is set on the left side of the waveform display strip. Choose "TRANS & COH" from the pull-down list box of "Analyze" on menu bar. Or click the icon on tool bar. On choosing it, transfer characteristic analysis is performed on just preceding set conditions and transfer characteristic window opens. If the preset conditions are inconsistent, a condition-error message will be displayed. Set display conditions.



7-2 Setting of analysis display conditions

Choose "Analysis Condition" from the pull-down menu of "Option" on menu bar of transfer function window, and a condition-setting dialog box will appear.



7-2-1 Setting of graph title



You can display graph-title in transfer function window. What you have set just before is used as the initial value.

Analysis target channel, signal name and unit are displayed below title-input box. Display channel on left side is input channel while display channel on right side is output channel.

7-2-2 Setting of analysis conditions

7-2-2-1 Choosing of FFT analysis data-points (FFT points)

Select the number of FFT points which you want to use for transfer characteristic analysis. Selectable FFT points are described below.

FFT points	512	1024	2048	4096	8192	16384
------------	-----	------	------	------	------	-------

7-2-2-2 Choosing of window function (Window Func.)

Window function processing can be applied on time-axis data to be FFT-processed. Selectable window functions are described below.

Window function	Hanning	Hamming	Blackman	Kaiser-Bessel	FlatTop	Exponential
-----------------	---------	---------	----------	---------------	---------	-------------

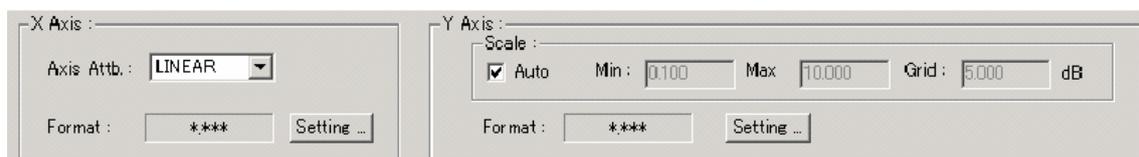
7-2-2-3 Setting of overlap ratio (Over Lap)

Set overlap ratio of data on time-axis of FFT processing frame. Selectable values are in the range of 0 to 99%. When setting overlap ratio, the number of FFT times to be repeated within the presently set analysis range is displayed on right side of the setting box.

7-2-2-4 Setting of display spectra (Display Lines)

Set the number of spectrum lines to be shown in graph. The number of settable max display spectra is up to the set FFT data-points / 2. For information, when setting display lines, max display frequency is indicated on right side of the setting box.

7-2-3 Setting of graph-axis attribute



7-2-3-1 Selecting of X-axis attribute (Axis Attb)

Select X-axis (frequency axis) attribute on graph from either LOG or LINEAR.

When choosing Nyquist (to be described later on), it is coherence function alone that follows this setting.

7-2-3-2 Setting of X-axis scale value indication format (Setting)

Presently used indication format is shown. To change indication format, click setting button. On clicking it, a format-setting dialog box will appear. You can select 3 kinds of indication formats : Exponential format, Fractional format and Significant format. After selecting a format, enter the number of digits.

For example, if you set 3 digits in Exponential format, scale value is expressed as 3.142E + 000. If you set 3 digits in Fractional format, scale value is expressed as 3.142. If you set 3 digits in Significant format, scale value is expressed as 3.14.

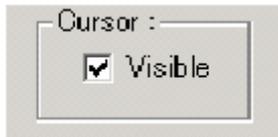
7-2-3-3 Setting of Y-axis scale (Scale)

Y-axis scales in phase angle graph are indicated as ± 180 in fixed scale and Y-axis scales in coherence function graph are indicated as 0 to 1 in fixed scale. Therefore, the scales you set here are applied only to GAIN graph or Nyquist graph. You can select scale setting from 2 kinds of Auto or Manual. When checking Auto check box, scale values are automatically determined from max value and min value of display target data. For information, in the case of Nyquist line graph, scale values are automatically determined from absolute max values of the real part or imaginary part. When unchecking Auto check box, max value, min value and grid-spacing setting boxes become effective to be settable. As the values to be set are based on gain graph, enter dB values in Nyquist line graph, too. When Nyquist line graph is selected as graph type, scale values are inversely calculated from dB set as max value to Linear axis and used as Y-axis scale values.

7-2-3-4 Setting of Y-axis scale indication format (setting).

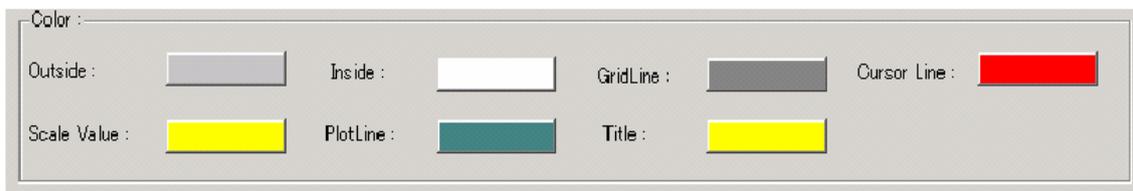
Presently used indication format is shown. To change indication format, click "Setting" button on right side of "Format" box, and a format-setting dialog box will appear. You can select 3 kinds of indication formats : Exponential format, Fractional format and Significant format. After selecting a format, enter the number of digits.

7-2-4 ON/OFF of cursor function (Visible)



When checking Visible check box, cursor function turns on and cursor line is displayed on the graph. To move display cursor line, drag it or click a given position on the graph. On clicking, the cursor line will move to a clicking position. Value at cursor position is indicated at the top right corner of graph frame. Further, the cursor line can be moved by hitting right or left arrow key on keyboard.

7-2-5 Setting of graph display colors



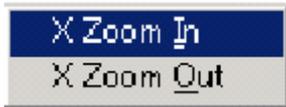
You can set graph color to each of outside of graph, inside of graph, grid line, cursor line, scale value, plot line and graph title, respectively. To change colors, click one of color buttons. On clicking a button, colors palette dialog box will appear.



After selecting the color to be changed, click "OK" button. Then the screen returns to the condition-setting dialog box.

7-3 X-axis Zoom function

When graph display form is Bode line graph (Gain, Phase angle) and X-axis attribute is LINEAR, click a given position within graph frame with right-mouse, and a Zoom menu will be displayed. If selecting "Zoom In", a graph from left edge of the graph to the present cursor position will be redrawn. To get the redrawn graph back to the original size, select "Zoom Out". Then the screen will return to display initial value.



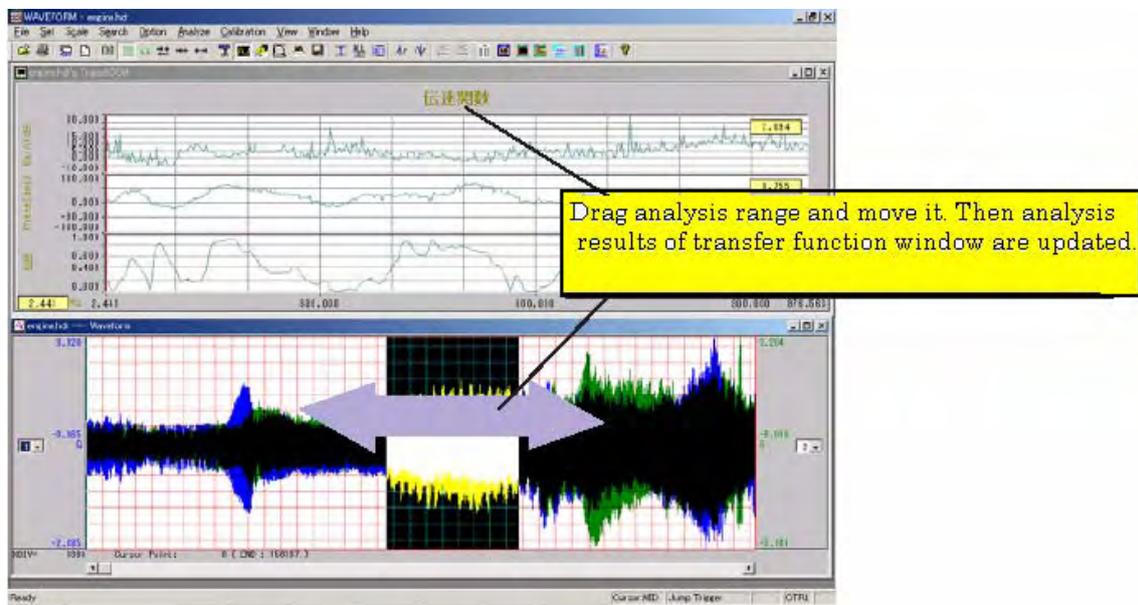
Though Zoom is selected, the number of display spectrum lines on condition-setting dialog box is not corrected.

7-4 Printing of transfer function graph

Choose "Print" from the pull-down list box of "File" on menu bar, or click printer icon on tool bar. You can print out transfer characteristic calculation results.

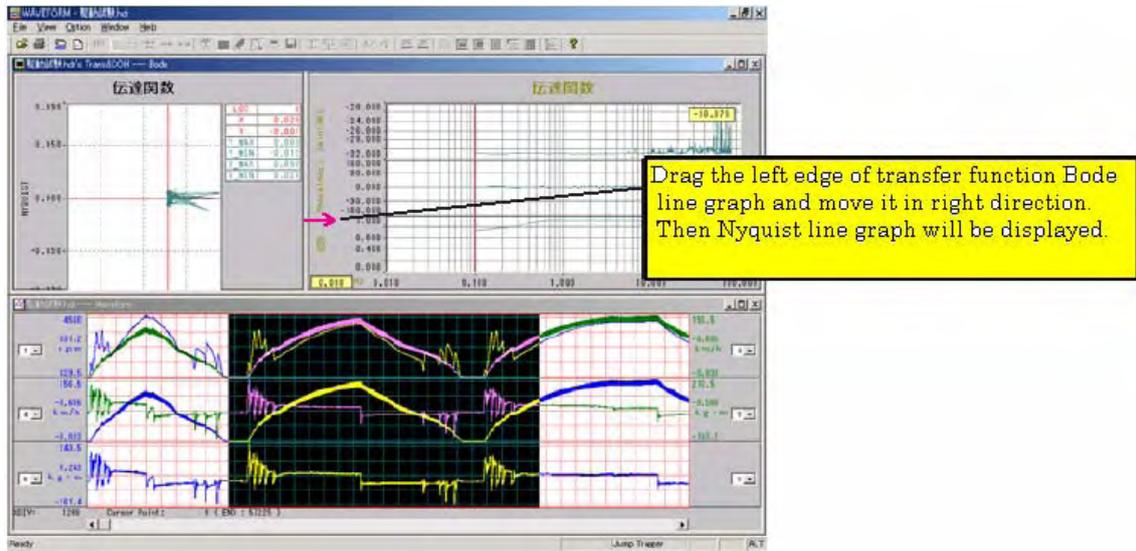
7-5 Gang operation with waveform display window

Transfer function analysis window can be operated in synchronization with waveform display window. When moving analysis range of waveform display window, the display details of transfer function analysis window are recalculated to be shown.



7-6 Displaying of Nyquist line graph

Drag the left edge of transfer function window in right direction, and Nyquist line graph will be displayed. When moving the cursor on Bode line graph, cross-cursor line moves to the same frequency position on Nyquist line graph.

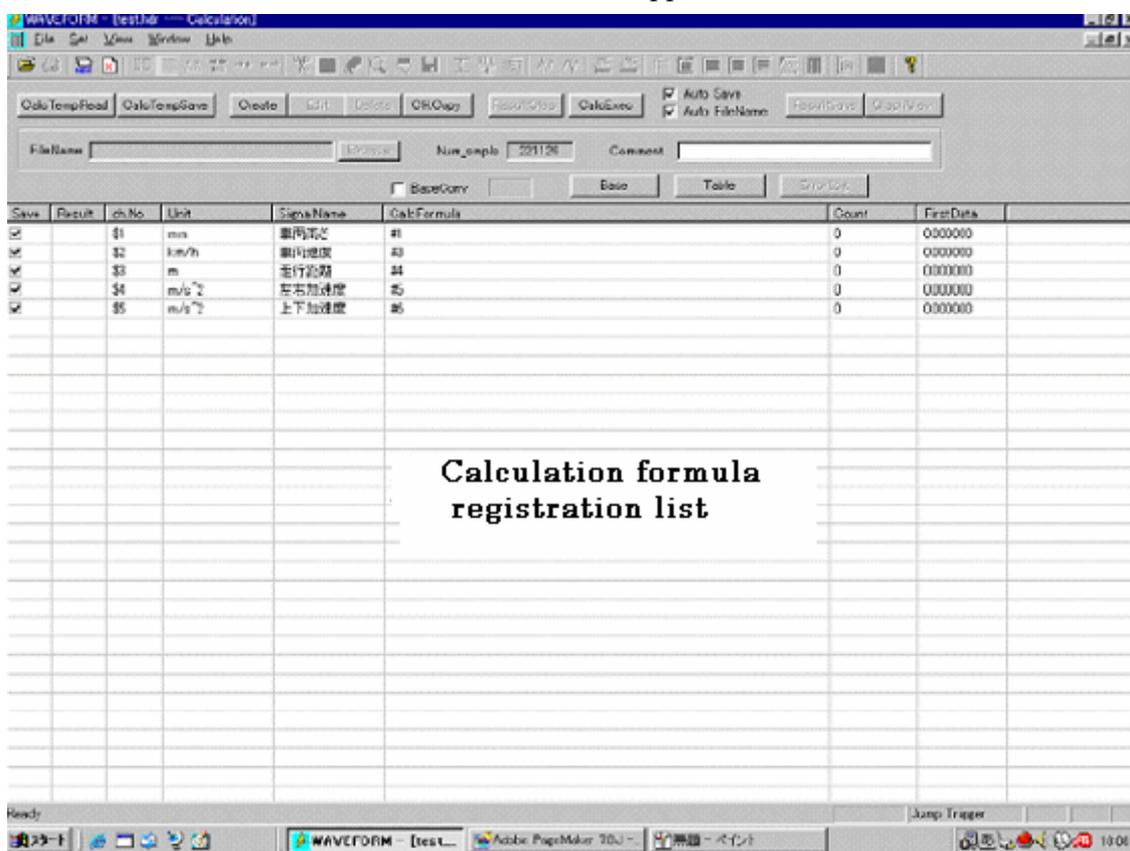


Chapter 8**Calculation window**

Calculation notation	formula	Infix notation ex. $((12 + 34) * 2) ^ 2$
Calculation types		Four fundamental calculation (+ - * /) Power calculation (^) Function calculation, Table conversion
Calculation order control		Parentheses ()
Calculation order		Function, Power, Multiplication / Division, Addition / Subtraction
Constant		F form (123,456) E form (1.2345E-6)
Channel reference		Acquisition channel "#" + channel number ex. #3 Calculation result channel "\$" + channel number ex. \$4
Table reference		TBL (table name) or "%" + table number
Function reference		Function name (argument or formula)

8-1 Initiation of calculation window

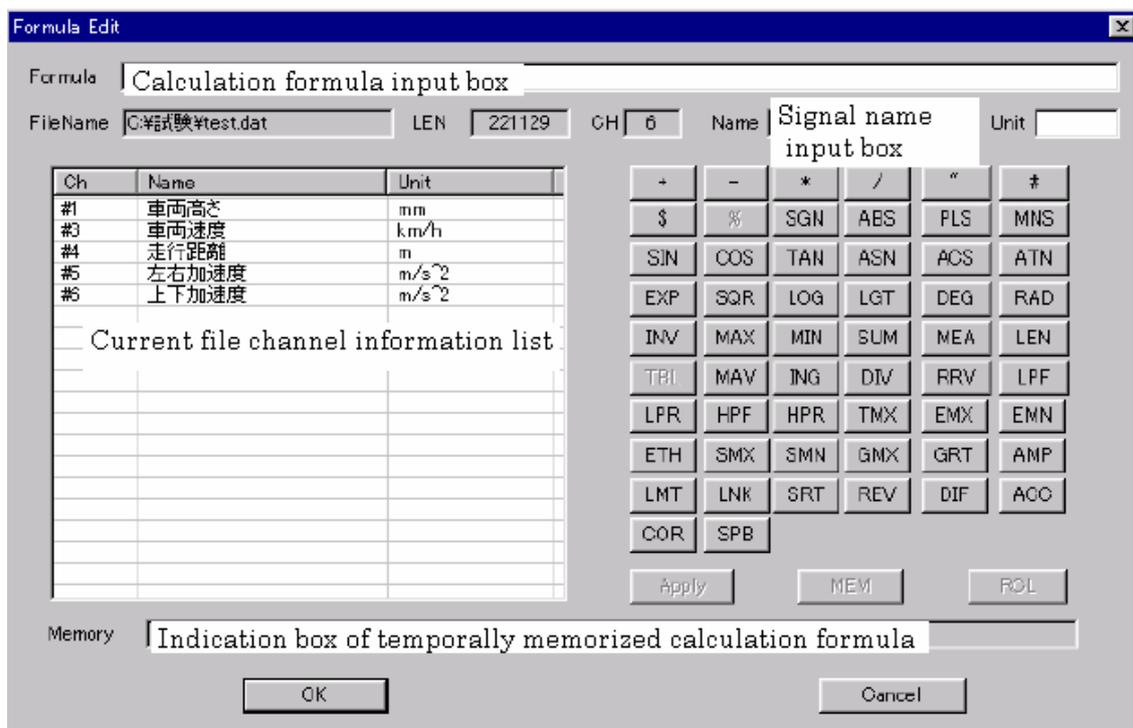
Specify analysis range of display waveform, and calculation function becomes effective. Calculation function enables channel-to-channel calculation or functional calculation to be performed and from acquired data file can create up to 99 channels of new data files which reflect the calculation results. The data file format that has been created here satisfies the file format to be required for PC waveform and can be read in the same way as other acquisition files. To display calculation window, choose "Calc" from pull-down list box of "Analyze" on menu bar of waveform display window, or click the icon on tool bar. Then a calculation window will appear.



8-2 How to register calculation formula.



Click "Create" button in the calculation window, and a calculation formula registration dialog will appear.

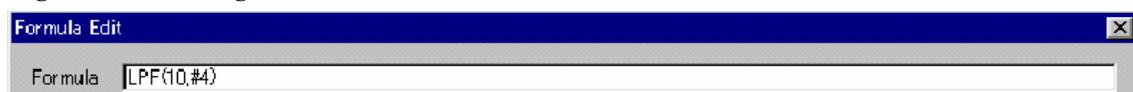


On left side of the dialog, range specified current filename and the number of data-points are shown, and below these, information about acquisition channel, signal name and unit is displayed in list form. At the top of the dialog a calculation formula input box is displayed, while on right side of the dialog the calculation formula input buttons are displayed.

8-2-1 How to operate calculation formula registration dialog

8-2-1-1 Entering of calculation formula

Input a calculation formula to be registered into "Formula" box of calculation formula registration dialog.



Refer to notation of calculation formula (paragraph 8-3) for formula notation.

8-2-1-2 Support button for calculation formula input

Concerning entering a function in common use, the clicking of a function button on the dialog is equivalent to entering the calculation formula into the input box.

ex. when processing offset by mean value deletion of ch1, you input as #1-MEA(#1), but you can enter the same formula by inputting it as # 1 - MEA # 1).

8-2-1-3 Temporary memory of calculation formula

It is possible to memorize the input calculation formula temporarily. When storing it in temporary memory area, click "MEM" button on the dialog. On clicking the button, the calculation formula which has been entered is copied into temporary memory area. Memorized result is held even after the dialog is closed. Further, if you want to recall calculation formula in temporary memory to calculation formula input box, click "RCL" button on the dialog. On clicking the button, calculation formula will be copied to calculation formula input box from temporary memory area. Using this function, you can copy calculation formula to another channel.



8-2-1-4 Copying of current file channel

When copying current file channel as it is, click the current file channel information list shown on left side of the dialog and display reverse-video line. Reverse-video line can be moved with up or down arrow key. Click "Apply" button on the dialog, and the details of the channel that is presently indicated in reverse-video line move to calculation formula input box. Already-described calculation formula will be overwritten.



When copying to plural channels from current file, use this channel copy function.

8-2-1-5 Inputting of signal name

Signal name of new channel is not automatically created. You have to enter it in signal name input box from keyboard. Move cursor to signal name input box and click it. Then it becomes ready for entering.

8-2-1-6 Inputting of unit

Unit of new channel is not automatically created. You have to enter it in unit input box from keyboard. Move cursor to unit input box and click it. Then it becomes ready for entering.

When registering a channel that has the same signal name and unit as previous channel's ones, move the appropriate channel into calculation formula using "Apply" button, and afterward rewrite the formula.

8-2-1-7 Execution of calculation formula registration

Click "OK" button in calculation formula registration dialog, and the input calculation formula will be checked for syntax error. If the check reveals no error, the dialog is closed and the screen returns to calculation window. The calculation formula that has been input in calculation template list is reflected.

8-3 Notational conventions of calculation formula

Calculation formula consists of reference channel no., function, constant, parenthesis and operator. And it adopts notation (Infix notation) of ordinary calculation formula.

ex. It is described as $10 * (20 + 30) / 5$. To enter calculation formula, move cursor to the input box and click it. Then you can enter calculation formula from keyboard. All of calculation formula is written in alphanumeric characters.

8-3-1 Notation of reference channel number

A current file channel (the channel indicated in calculation formula registration dialog) can be identified by confirming # at the front of its channel number. On the other hand, a new channel that has already been registered (the channel indicated in calculation formula registration list of the calculation window) can be indicated by providing \$ at the front of channel number. When referring to a range-specified channel, describe it as #1[start-data number, the number of data-points]. If range specification is omitted, all data within analysis target range is entered. The number of occurrences of channel no. in calculation formula does not matter. Further, when plural number of the same channel number occurs in calculation formula, they take on the same value as they are entered in internal virtual calculation register. For example, it means that calculation result of $\#1^2 - \#1$ is equal to #1.

Sample of range-specified registered number :

#1[0,200] data no. 0 to 200 of ch1 are registered.

Start-data number is the value that sets the data number at left edge of calculation-target range as 0. Start-data number + number of data-points - 1 have to be equal to or less than the number of data-points in analysis target range.

8-3-2 Notation of constant

You can describe constant in calculation formula. Constant can be fixed point, integer number or exponent notation. For example, you describe them as $123.456 + 123 - 123.34E - 6$.

ex. of description: $\#2 * 12.34$ every value of ch2 is multiplied by 12.34.

8-3-3 Notation of operator

Addition is indicated by the sign of "+", subtraction by the sign of "-", multiplication by the sign of "*", division by the sign of "/" and power by the sign of "[^]". Operator precedence is power multiplication or division addition or subtraction. Usually operator is described between operands (reference channel, constant or function). However, it must be noticed that adding minus sign at the front of operand to indicate negative number can not be allowed with the exception of constant. For example, the description of $- \#1$ is in error. When describing negative constant in calculation formula, use parentheses as description of operators in succession can not be allowed.

ex. of description: $\#1 * (-123)$ every value of ch1 is multiplied by - 12.3.

8-3-4 Notation of parenthesis

You can use parentheses to specify calculation precedence or define the formula. The number of left parentheses and right parentheses in the formula has to be equal.

ex. of description $((12+13)-(10+20)/10) * 10$ the result comes to 220.

There is no limitation about the number of parenthesis occurrences in the formula, but the number of nested parentheses is up to 4-deep around. Above example indicates 2-deep around.

8-3-5 Notation of function

Function consists of 3 characters of capital letters & alphanumeric as a keyword and parentheses. For example, sin function is described as SIN(x). Common form of function notation is as follows:

Function is commonly described in such form as function name (parameter) or function (parameter 1, parameter 2)

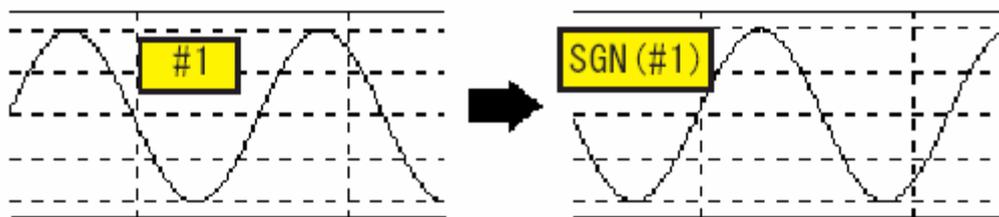
Argument can be formula, channel reference or constant. Their attributes can also be either vector or scalar. However, among the functions having plural number of parameters (argument), there are some functions whose attributes are restricted to be scalar amount depending on their parameters.

See the paragraph “built-in functions” (8-4) for notation and features of available built-in functions.

8-4 Built-in functions

8-4-1 Negation function

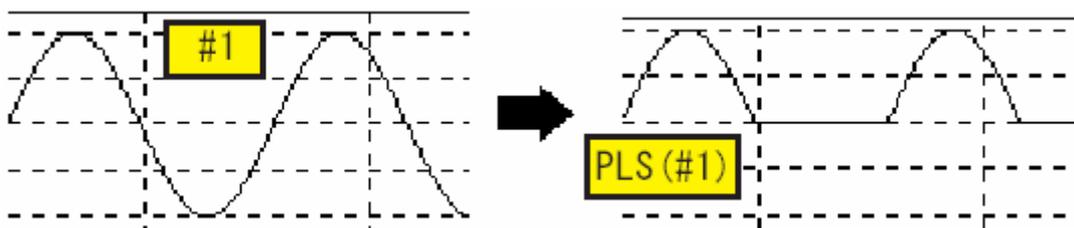
SGN (x) Reverse the sign of argument x. x can be constant, function or channel reference.



Result is equal to #1 * (-1).

8-4-2 Positive regionalization function

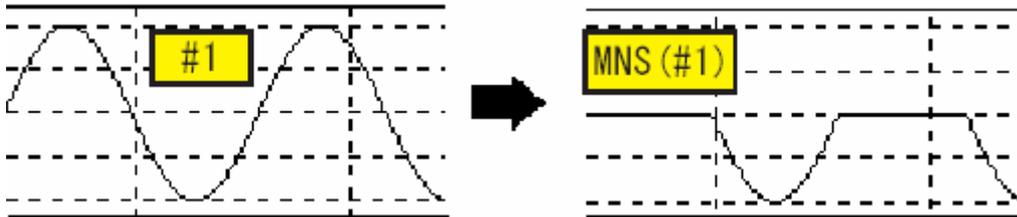
PLS (x) Replace every data in negative region of argument x with 0. x can be constant, function or channel reference.



Result becomes the same as #1 - NMS (#1).

8-4-3 Negative regionalization function

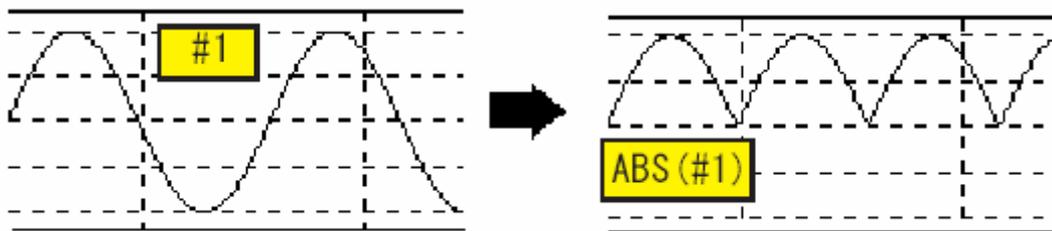
MNS (x) Replace every data in positive region of argument x with 0. x can be constant, function or channel reference.



Result becomes the same as #1 - PLS (#1).

8-4-4 Absolute value function

ABS (x) Seek absolute value of argument (x). x can be constant, function or channel reference.



Result becomes the same as PLS (#1) + SGN (MNS (#1)).

8-4-5 Radian function

RAD (x) Convert to radian unit by multiplying argument x by $\pi / 180$. x can be constant, function or channel reference.

Argument of trigonometric function to be described later on is in radian unit.

ex. of description: SIN (RAD (30)) \rightarrow seek sine value of 30° .

8-4-6 Degree function

DEG (x) Convert to degree unit by multiplying argument x by $180 / \pi$. x can be constant, function or channel reference.

Result of inverse trigonometric function to be described later on is in radian unit.

ex. of description: DEG(ATN(#1 / #2)) \rightarrow seek differential angle between ch1 and ch2 in degree unit.

8-4-7 Square root function

SQR (x) Seek square root of argument x. x can be constant, function or channel reference. However, equation $x \geq 0$ has to be satisfied. Negative number results in error at the execution.

ex. of description: SQR (ABS (#1)) → seek square root of ch1's absolute value.

8-4-8 Integration function

ING (k,x) Argument k is scalar and means initial value of integration. x is column vector and means data row to be integrated.

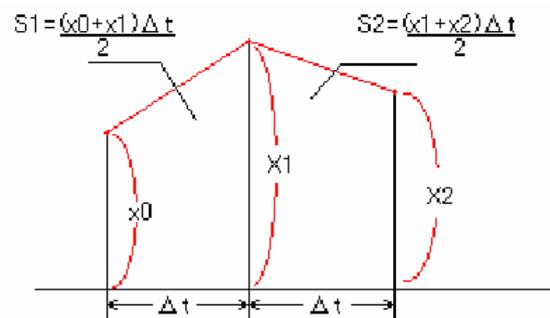
ex. of description: ING (0,#1) → seek integration result that sets ch1 as integration initiation value 0.

Integration calculation adopts trapezoidal formula.

$$S_0 = k$$

$$S_1 = S_0 + \left(\frac{(x_0 + x_1)\Delta t}{2} \right)$$

$$S_n = \sum_{i=0}^{n-1} S_i + \left(\frac{(x_{n-1} + x_n)\Delta t}{2} \right)$$



Set integration initial value of argument k, when first data of integration result is not 0.

For example, when seeking speed from acceleration, you can obtain actual speed by giving the initial value at the time of seeking speed variation in deceleration zone at brake test. In short you can get actual speed by giving speed at brake starting-time as the initial value. In this case, if you execute integration by providing initial value with 0, speed becomes minus in braking zone.

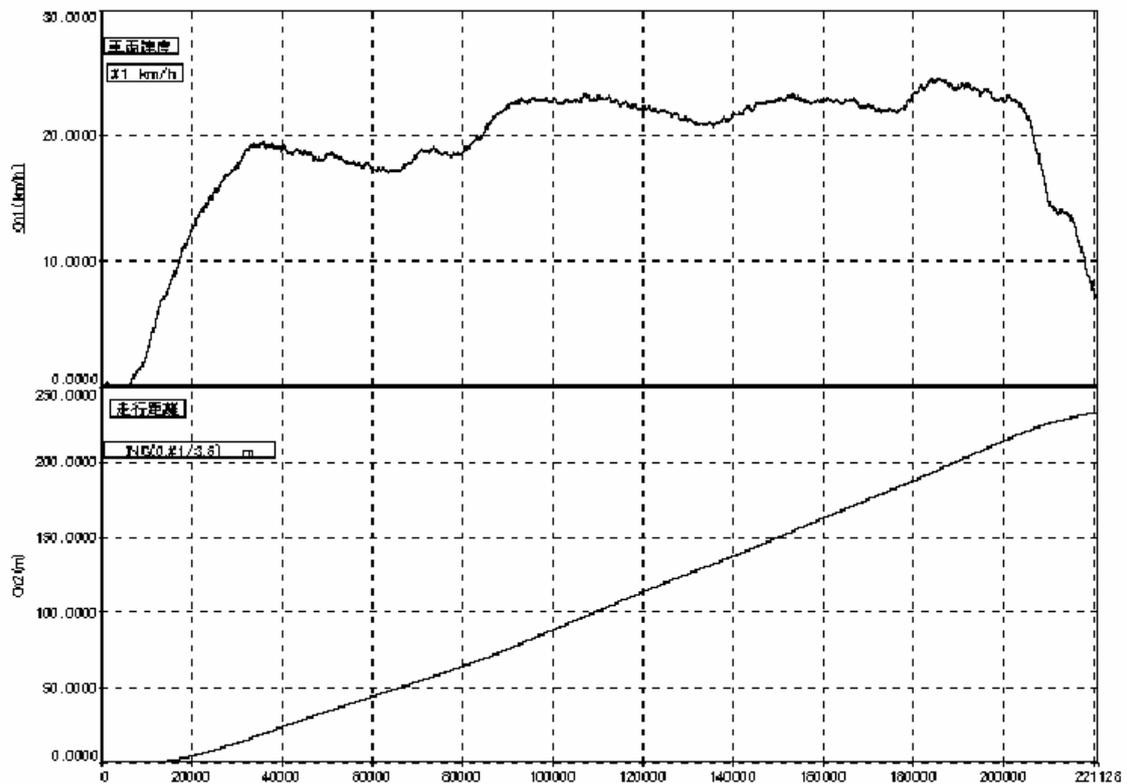
If integration-targeted column vector contains direct current like offset ,etc. at measurement time, the result becomes higher in right direction (when direct current is positive) as column vector is integrated together with direct current contained. To prevent it, elimination of direct current in advance is required.

ex. of description: $ING(0, \#1 - \#1[0,1]) \rightarrow$ set the data at integration starting-point of ch1 as 0.

$ING(0, \#1 - MEA(\#1)) \rightarrow$ eliminate mean value of ch1.

$ING(0, HPF(0.01, \#1)) \rightarrow$ execute high-pass process at 0.01Hz for ch1. (cut-off frequency is an example)

An example of calculation is given. The following graphs show an example of calculating travel distance (m) from speed(km/h). Definition formula is $ING(0, \#1/3.6)$. Travel distance from car-stop-status point is sought.



8-4-9 Differential function

DIV (x) Seek differentiation of argument x. x has to be column vector.

ex. of description: DIV (#1) → seek differentiation result of ch1.

Differential calculation is to seek the value of dividing difference value of first order by Δt .

$$A_0 = (X_1 - X_0) / \Delta t$$

$$A_t = (X_{t+1} - X_t) / \Delta t$$

8-4-10 Moving average function

MAV (k, x) Argument k is the number of average data-points. x is column vector and means the data-row to be moving-averaged.

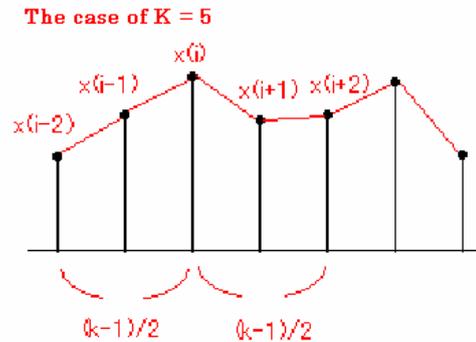
ex. of description: MAV(5, #1) → seek the result of moving average of ch1 by 5 data-points.

The number of average data-points k has to be positive integer number that does not include the fractional portion as its attribute is the number of data-points. The number of average data-points needs to be odd number as both of the wings are averaged by equal number. If even number is input, it will be used after being changed to odd number with +1 added.

Further, to equalize the number of the data-points of moving average result with that of pre-average, the following calculation method is adopted: extend both wings of the number of average data-points in sequence from average-start till 1/2 of average data-points that has been set by k. After reaching 1/2 in number, average the number of data-points of k. Likewise, decrease the number of average data-points in sequence from the terminal(k-1)/2 of data string.

Calculation formula in which the number of average data-points is set 5 is shown.

$$\begin{aligned}
 a_0 &= x_0 \\
 a_1 &= \frac{x_0 + x_1 + x_2}{3} \\
 a_i &= \text{Log}_e x_i \\
 a_2 &= \frac{x_0 + x_1 + x_2 + x_3 + x_4}{5} \\
 a_i &= \frac{x_{i-2} + x_{i-1} + x_i + x_{i+1} + x_{i+2}}{5} \\
 a_{n-1} &= \frac{x_{n-2} + x_{n-1} + x_n}{3} \\
 a_n &= x_n
 \end{aligned}$$



8-4-11 Common logarithm function

LGT (x) Seek log. value that sets argument x as base 10. x can be constant, formula, function and channel reference. In case of $x \leq 0$, however, the result of calculation does not indicate error but returns 0 at the execution.

$$a_i = \text{Log}_{10} x_i$$

ex. of description: $20 * \text{LGT}(\text{RRV}(1, \#1) / 20e-6)$ convert moving effective value of #1 to dB value.

8-4-12 Natural logarithm function

LOG (x) Seek log. value that sets argument x as base 10. x can be constant, formula, function or channel reference. In case of $x \leq 0$, however, the result of calculation does not indicate error but returns 0 at the execution.

8-4-13 Inverse function

INV (x) Seek inverse number of argument x. x can be constant, formula, function or channel reference, but in case of $x = 0$, an error will result at the execution.

ex. of description: $\text{INV}(\#1) \rightarrow$ seek inverse number of ch1.

The same result can be gotten for $\text{INV}(\#1)$ and $1/\#1$.

8-4-14 Maximum value function

MAX (x) Argument x is column vector. Seek maximum value of elements. The result becomes scalar.

8-4-15 Minimum value function

MIN (x) Argument x is column vector. Seek minimum value of elements. The result becomes scalar.

8-4-16 Sum total function

SUM (x) Seek sum total of Argument x. The result becomes scalar.

$$S = \sum_{i=0}^n x_i$$

8-4-17 Mean value function

MEA (x) Seek mean value of argument x. The result becomes scalar.

$$mean = \frac{1}{n+1} \sum_{i=0}^n x_i$$

The same result can be gotten for MEA (#1) or SUM (#1) / LEN ().

8-4-18 Number-of-datapoints function

LEN () No argument. Seek the number of datapoints in analysis range.

The calculation of any functions described below results in 1 with regard to the number of data-points:

Functions: maximum value function, minimum value function, sum total function, mean value function and number-of-datapoints function.

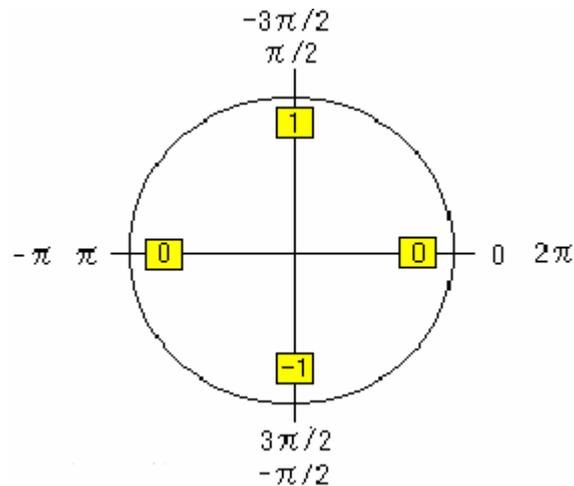
For this reason, should the calculation of these functions be performed with other functions, the first piece can only be saved for the number of other channel's datapoints, because the channel of least datapoints is referred to.

Usually this sort of functions is used in the calculation process, or saving of the calculation result is not set.

8-4-19 Sine function

SIN (x) Seek sine value, regarding argument x as radian unit. x can be constant, function, formula or channel reference.

Calculation result is within ± 1 range, but argument is not restricted. (Result value in right chart is indicated by sine value.)



8-4-20 Cosine function

COS (x) Seek cosine value, regarding argument x as radian unit. x can be constant, formula, function or channel reference. Calculation result is within ± 1 range, but argument is not restricted just as with sine function.

8-4-21 Tangent function

TAN (x) Seek tangent value, regarding argument x as radian unit. x can be constant, formula, function or channel reference, but it has to be within $-\pi/2$ to $\pi/2$ range.. $-\pi/2$ and $\pi/2$ returns allowable maximum value 22273405434.

Note: when saving the result, correct minimum value of the appropriate channel can not be sought, because the result will be converted to integer whose maximum value is set 30,000 and double-accuracy coefficient.

8-4-22 Arcsine function

ASN (x) Seek angle in radian unit, regarding argument x as sine value. x can be constant, formula, function or channel reference, but it has to be within -1 to 1 range. If argument is outside of the range. An error will result at the execution. The result can be sought as $-\pi/2$ to $\pi/2$.

ex. of description: DEG (ASN (#1)) \rightarrow seek -90° to 90° of angle, regarding each of datapoint of ch1 as sine value.

8-4-23 Arccosine function

ACS (x) Seek angle in radian unit, regarding argument x as cosine value. x can be constant, formula, function or channel reference, but it has to be within -1 to 1 range. If argument is outside of the range, an error will result at the execution. The result can be sought as $-\pi/2$ to $\pi/2$.

8-4-24 Arctangent function

ATN (x) Seek angle in radian unit, regarding argument x as tangent value. x can be constant, formula, function and channel reference.

The result can be sought within $-\pi/2$ to $\pi/2$ range.

8-4-25 Exponential function

EXP (x) Seek exponential value of argument x. x can be constant, formula, function and channel reference.

$$e^x$$

$$\ast x = e^{\text{Log}_e x}$$

8-4-26 Moving effective value function

RRV (k,x) Taking argument k as integral period (sec in unit), seek moving effective value of argument x. In this case, the following has to be satisfied: Argument k is scalar, x is column vector and has the number of datapoints to satisfy the set integral period k. The result also shows the number of datapoints decreases corresponding to the number of integral periods. The calculation is executed by the following formula.

$$Ev(t_0) = \left[\frac{1}{\tau} \int_{t_0-\tau}^{\tau} x^2(t) dt \right]^{\frac{1}{2}}$$

ex. of description: RRV (0,125,#1) → seek moving effective value of ch1 by integral period 125 ms.

8-4-27 Table reference function

TBL (table name) Table reference function is not calculation function. It is the function which refers to predefined table name in the formula. Therefore, argument needs to be character string. Further, when handling it in calculation formula, promise exists about the occurrence order.

For example, when modifying #1 by TABLE (invert), #1*TBL (invert) → modify ch1 by table name "invert". TBL (invert) * #1 → incorrect description,

In the same manner, when calculating the table-modified result in addition, you have to enclose table-modified calculation in parentheses as shown by (#1 * TBL (invert)) + #2.

Table reference is often used when executing non-linear correction. See paragraph 8-8 for table reference.

8-4-28 Maximum principal strain function (Rosette gage analysis function)

EMX (x,y,z) Argument x, y and z represent strain and can be constant, formula, function or channel reference, but the number of their datapoints has to be equal.

The calculation formula is as follows. (Ea,Eb,Ec in the formula corresponds with argument x, y, z.)

$$\varepsilon_{\max} = \frac{1}{2} \left\{ \varepsilon_a + \varepsilon_c + \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]} \right\}$$

ex. of description: EMX (#1, #2, #3) → seek maximum principal strain from Rosette gage comprised of ch1, ch2 and ch3.

8-4-29 Minimum principal strain function (Rosette gage analysis function)

EMN (x,y,z) Argument x, y and z represent strain and can be constant, formula, function or channel reference, but the number of their datapoints has to be equal.

The calculation formula is as follows. (Ea,Eb,Ec in the formula corresponds with argument x, y, z.)

$$\varepsilon_{\min} = \frac{1}{2} \left\{ \varepsilon_a + \varepsilon_c - \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]} \right\}$$

ex. of description: EMN(#1, #2, #3) → seek minimum principal strain from Rosette gage comprised of ch1, ch2 and ch3.

8-4-30 Principal strain direction function (Rosette gage analysis function)

ETH (x,y,z) Argument x, y and z represent strain and can be constant, formula, function or channel reference, but the number of their datapoints has to be equal.

The calculation formula is as follows. (Ea,Eb,Ec in the formula corresponds with argument x, y, z.)

$$\theta = \frac{1}{2} \tan^{-1} \left\{ \frac{2\varepsilon_b - \varepsilon_a - \varepsilon_c}{\varepsilon_a - \varepsilon_c} \right\}$$

ex. of description: ETH (#1, #2, #3) → seek principal strain direction from Rosette gage comprised of ch1, ch2 and ch3.

The calculation result is in radian unit.

8-4-31 Maximum shearing strain function (Rosette gage analysis function)

GMX (x, y, z) Argument x, y or z is strain amount and can be constant, function or channel reference, but the number of their datapoints of x, y or z has to be equal.

Calculation formula is as follows. (Ea, Eb, Ec in the formula corresponds with argument x, y, z).

$$\varepsilon_{\max} = \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]}$$

8-4-32 Maximum principal stress function (Rosette gage analysis function)

SMX (E,v,X,Y,Z) Argument E is modulus of vertical elasticity in scalar quantity v represents Poisson's ratio in scalar quantity. X, Y or Z is strain amount and can be constant, formula, function or channel reference, but the number of their datapoints has to be equal.

Calculation formula is as follows. (Ea, Eb, Ec in the formula corresponds with argument x, y, z).

$$\sigma_{\max} = \frac{E}{2(1-\nu^2)} \left\{ (1+\nu) \times (\varepsilon_a + \varepsilon_c) + (1-\nu) \times \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]} \right\}$$

8-4-33 Minimum principal stress function (Rosette gage analysis function)

SMN (E,v,X,Y,Z) Argument E is modulus of vertical elasticity in scalar quantity. v represents Poisson's ratio in scalar quantity. X, Y or Z is strain amount and can be constant, formula, function or channel reference, but the number of their datapoints has to be equal.

Calculation formula is as follows. (Ea, Eb, Ec in the formula corresponds with argument x, y, z).

$$\sigma_{\min} = \frac{E}{2(1-\nu^2)} \left\{ (1+\nu) \times (\varepsilon_a + \varepsilon_c) - (1-\nu) \times \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]} \right\}$$

8-4-34 Maximum shearing stress function (Rosette gage analysis function)

TMX (E,v,X,Y,Z) Argument E is modulus of vertical elasticity in scalar quantity. v represents Poisson's ratio in scalar quantity. X, Y or Z is strain amount and can be constant, function or channel reference, but the number of their datapoints has to be equal.

Calculation formula is as follows. (Ea, Eb, Ec in the formula corresponds with argument x, y, z).

$$\tau_{\max} = \frac{E}{2(1+\nu)} \sqrt{2 \left[(\varepsilon_a - \varepsilon_b)^2 + (\varepsilon_b - \varepsilon_c)^2 \right]}$$

8-4-35 Gage factor correction function

GRT (k,x) Argument k represents gage factor in scalar of used gage. Argument x is measurement strain amount and can be constant, formula, function or channel reference. E in the formula corresponds with argument x.

$$\varepsilon_c = \frac{2.0}{k} \times E$$

8-4-36 Filter function

There are Low-pass filter function LPF (k, x) or LPR (k, x), and high-pass filter function HPF (k, x) or HPR (k, x). Argument k of any type of them is cut-off frequency and x is column vector.

Filter function adopts IIR type of 4th Butterworth filter and its cut-off characteristic is fixed at -24dB/oct. Argument is cut-off frequency (unit = Hz) and can be set freely, but have to be set at less than 1/4 of the set sampling frequency. Cut-off frequency also means the frequency of -3dB of damp in amplitude characteristic. For information, 2 types of LPF and LPR are available for low-pass filter function, while 2 types of HPF and HPR are available for high-pass filter function. Any type of them, however, is 4th Butterworth filter of -24 dB / oct cut-off characteristic and does not differ with respect to filter characteristic. The difference between them is in processing direction. When performing filter processing, LPF and HPF execute it in forward direction, in short, in time-elapse direction, while LPR and HPR execute it in backward direction, in short, in time-go-back direction from the end-point of analysis range. You can make up non-phase-lag 48 dB / oct filter if combining LPF function with LPR function. Flat part passing gain is set -0.01 dB.

Sample of filter characteristic is shown below. Cut-off frequency of low-pass filter is set 5 Hz, while that of high-pass filter is set 10Hz.



Characteristic diagram of low-pass filter

Relation between the set cut-off frequency (f_c) and maximum amplitude flat frequency. maximum amplitude flat frequency comes to $f_c \times 0.46807$.

ex. of description: LPF (10, #1) → apply 10Hz of low-pass to CH 1.



Characteristic diagram of high-pass filter.

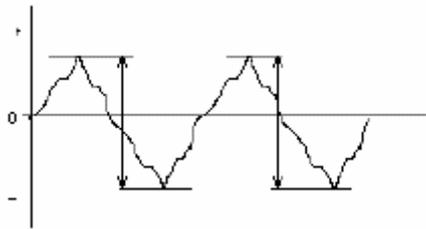
Relation between the set cut-off frequency (f_c) and minimum amplitude flat frequency. minimum amplitude flat frequency comes to $f_c \times 2.13199$.

ex. of description: HPF (10, #1) → apply 10Hz of high-pass to CH 1.

8-4-37 Amplitude value conversion function (special function)

AMP (k, x) Argument k is scalar quantity and x is column vector amount.

The feature of this function is that after having extracted the amplitudes from max value and mini value within the range extending from the position where signal passes 0 in positive slope to another point where it again passes 0 in positive slope, convert all datapoints to amplitude values. Array of amplitude values that have been obtained is sorted by parameter k value. In case of $k = 0$, it remains just as it is, in short, in extraction order. In case of $k = 1$, extracted amplitude values are sorted in ascending order, while $k = -1$, in descending order.



ex. of description:

AMP (0, #1) → convert the data of ch1 to amplitude value.

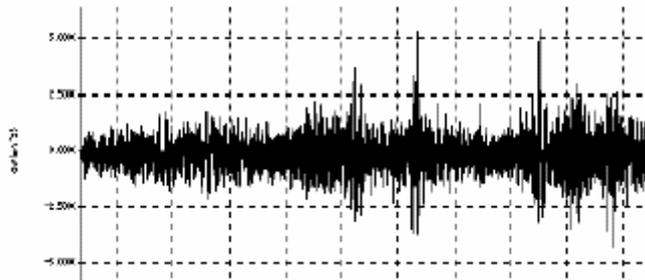
AMP (1, #1) → after having converted the data of ch1 to amplitude values, sort them in ascending order.

AMP (-1, #1) → after having converted the data of ch1 to amplitude values, sort them in descending order.

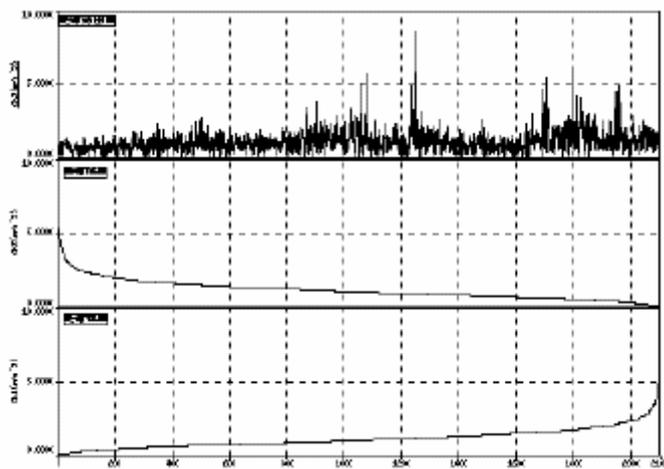
When signal does not pass 0, amplitude can not be obtained. Further, number of datapoints of the result depends on number of extracted amplitude values.

X-axis assumes a time-axis for convenience's sake, but has no meaning. It has the attribute of number of extracted amplitudes. Sampling frequency of analysis-target file x time becomes the number.

Analysis sample is shown. The graph below displays analysis-target data.



Analysis result graphs of extracted amplitudes are displayed in extracting, descending or ascending order, respectively from the top.

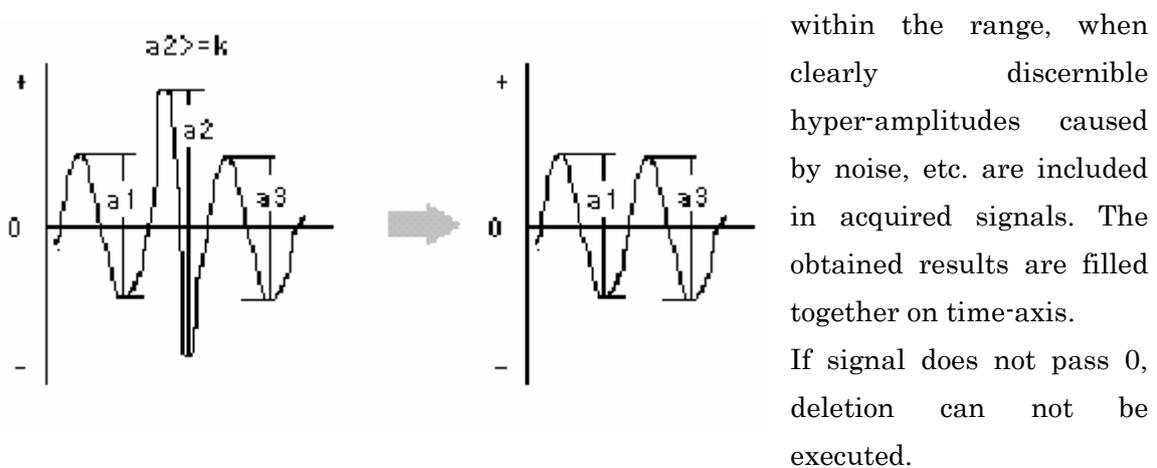


8-4-38 Hyper-amplitude deletion function (special function)

LMT (k, x) Argument k is scalar quantity and represents hyper-amplitude value.

x is column vector and process-target data row. The feature of this function is that after having converted amplitudes from max value and mini value within the range extending from the position where signal passes 0 in positive slope to another position where it again passes 0 in positive slope, compare the amplitudes with the values of the set parameter k.

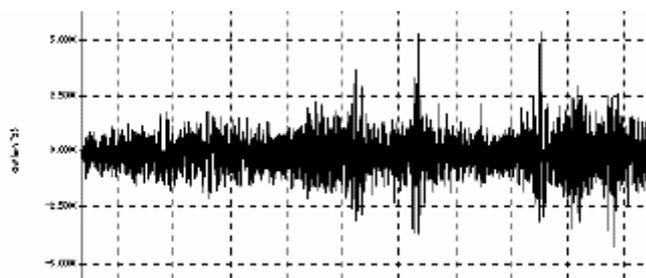
The sign of parameter k has to be definitely positive. It is used to delete the data



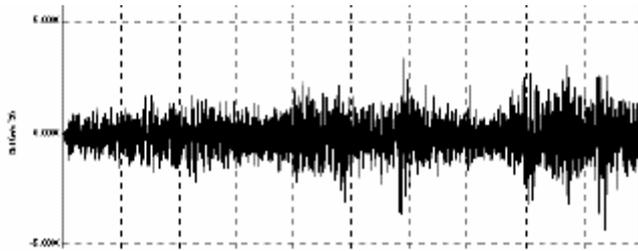
ex. of description: LMT (5, #1) → after having converted data of ch1 to amplitude values, delete greater data than the amplitude which has been set by k.

Analysis sample is shown below.

Analysis-target data



The result after deleting greater hyper-amplitude values than 5 from the data above.



8-4-39 Link function (special function)

LNK (x, y) Both of argument x, y are column vector amount. This function enables y-designated data row to connected to the rear of x-designated data row. This function is often used in manipulating different acquisition signal channels or the different sections even of the same channel as one array. Checking of inconsistency of signal attribute or unit system is not executed in particular.

ex. of description: `LNK (#1 [200,1000],# 2 [150, 200])` → create the array (a new channel) that links 150th to 200 datapoints of ch2 to the rear of 200th to 1000 dataponits of ch1.

8-4-40 Sorting function (special function)

SRT (k, x) Argument k is the parameter that specifies ascending or descending order. $k \geq 0$ specifies descending order, while $k < 0$ specifies ascending order. x means data row to be sorted and can be channel reference, formula or function. Datapoints of the result does not change in number.

8-4-41 Time-axis reversing function (special function)

REV (x) Argument x means data row and can be formula, function or channel reference. This function has a feature of reversing the array of data string.

8-4-42 Difference function

DIF (x) Argument x means data row and can be formula, function or channel reference. This function converts specified data row to difference value of first order. The number of datapoints of the result becomes -1. The calculation formula is shown.

$$A_i = x_i - x_{i-1}$$

8-4-43 Accumulation function

ACC (x) Argument x means data row and can be formula, function or channel

reference. This function seeks accumulation value of specified data row. The calculation formula is shown.

$$A_0 = x_0$$

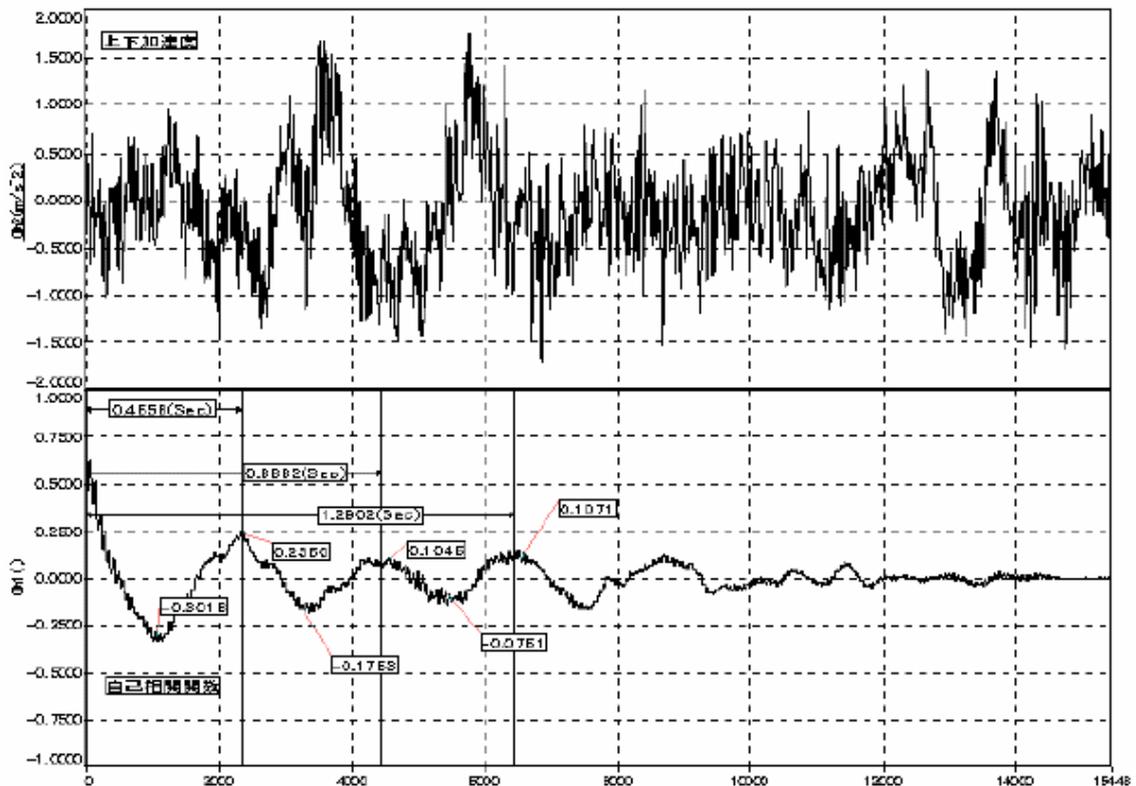
$$A_i = \sum_{n=0}^i x_n$$

8-4-44 Correlation function

COR (x, y) Both of x and y are data rows and datapoints of them have to be equal in number. Their specifications can be formula, function or channel reference. When argument x and y are the same, it becomes autocorrelation. When they are different, it becomes cross correlation.

ex. of description: COR (#6, #6) seek autocorrelation function of ch6.

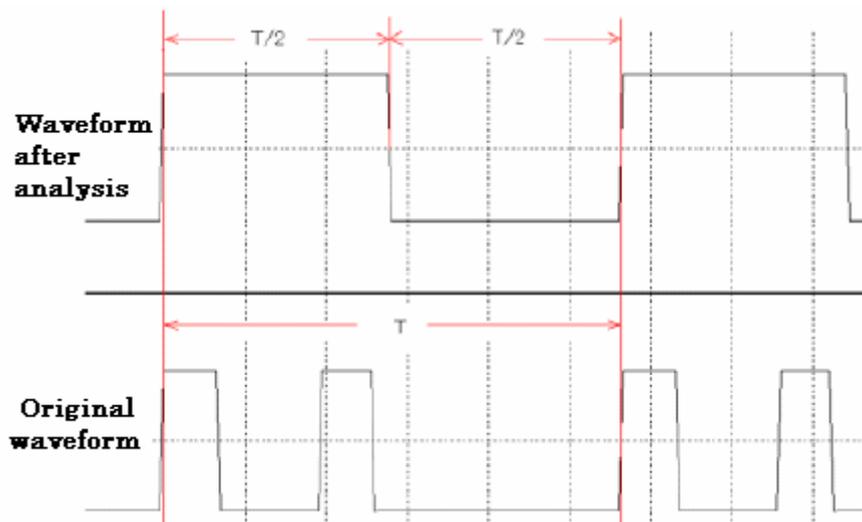
Sample of analysis is shown. Upper graph frame shows acceleration waveform, and lower graph frame shows its autocorrelation function.



8-4-45 Tachopulse conversion function

TPC (k, x) Argument k means number of jumps of pulse and x means analysis channel.

Description form TPC (1,#1) extract at interval of one pulse from pulse train of ch1 and match their duty ratio to 50%.



Taking ignition pulses on 4 cycle-6 cylinder engine's primary side as an example, 3 times of pulses exist in one rotation. To convert it to one pulse per one rotation, set $k = 2$ and set x on engine rotation pulse channel. Duty ratio of finished pulses will be matched to 50 %, and a new pulse train which has 10,000 value on pulse-high side and has 0 value on pulse-low side will be replaced. Further, the threshold level of pulse train takes average value of analysis channel.

8-4-46 Elapsed time function

SPB (k) Argument k is initial elapsed time. This function is used when creating elapsed time channel from time sampling data.

Description form SPB (0) create elapsed time data by regarding analysis-start-position as elapsed time 0. The unit is sec.

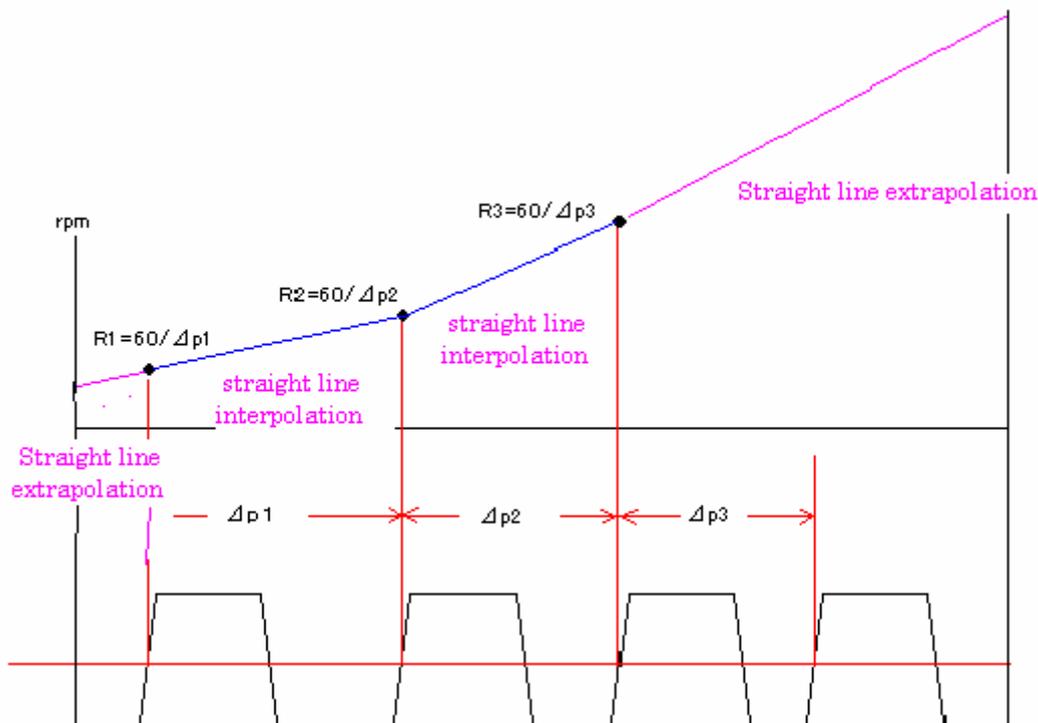
This function is used to prevent time data loss when converting from time sampling to distance sampling.

8-4-47 F - V function

FVC (k, x) k is number of pulses per one rotation and has to be integer of $k \geq 1$. x is column vector and specified to any one of channel no., formula or function. This function has the feature of converting from pulse train to number of rotations.

Description form FVC (3, #1) seek rpm from # 1 pulse train channel that indicates 3 pulses per one rotation.

For example, when the number of pulses on 4 cycle - 4 cylinder engine's primary side is one pulse at 120 degree, 3 pulses exist in one rotation. In this case, set $k = 3$. By cycle between pulses being calculated, pulse train is converted to number of rotations. A given threshold level of pulse train adopts average value of its pulse train. Regarding the range from the point of passing a threshold level in positive slope to the point of passing a threshold level in positive slope again as a cycle, convert pulse train to number of rotations using linear interpolation. Further, if either number of rotations between initial pulses or last pulse do not exist, assuming them to exist on prolonged line of nearest straight line, seek number of rotations using straight line extrapolation calculation.



8-4-48 Audio correction A curve filter function (ANSI SI . 42 - 2001)

WAC (x) Pass X-indicated channel through audio correction A curve filter.

ex. of description: WAC (#3) pass ch3 through audio correction A curve filter.

Sample of usage

How to calculate noise level (SPL). Take ch1 as sound pressure signal channel unit Pa.

$$\text{SPL [dB]} = 20 * \text{LGT}(\text{RRV}(1, \text{WAC}(\#1)) / 20\text{E}-6)$$

LGT (x) is Log function of base 10, and RRV (k, x) means moving effective value function that sets k as integral period.

8-4-49 Hand / arm vibration correction filter function (ISO5349)

HTV (x) Pass X-indicated channel through hand/arm vibration correction filter.

ex. of description: HTV (#1) pass ch1 through hand/arm vibration filter.

Sample of usage

How to calculate hand/arm vibration composite value. Take each of ch1, ch2 or ch3, respectively as vibration signal channel unit m/s^2 of x, y, z axis.

$$\text{HTV}(\text{m/s}^2) = \text{SQR}(\text{RRV}(1, \text{HTV}(\#1))^2 + \text{RRV}(1, \text{HTV}(\#2))^2 + \text{RRV}(\text{HTV}(\#3))^2)$$

8-4-50 Whole-body vibration correction filter function (ISO2631-1)

WBK (x) Pass (Z-axis in seated, standing, face-up position) through whole-body vibration correction filter k.

WBD (x) pass (X, Y-axis in seated, standing, face-up position) through whole-body vibration correction filter D.

WBC (x) Pass (X-axis in seated position) through whole-body vibration correction filter C.

WBE (x) Pass (X, Y, Z-axis rotation vibration in seated position) through whole-body vibration correction filter E.

ex. of description: WBK (#3) Regarding ch3 as Z-axis vibration channel, pass it through correction filter.

Sample of usage

How to calculate whole-body composite value. Take each of ch1, ch2 or ch3, respectively as vibration signal channel unit m/s^2 of x, y, z axis.

$$\text{WBV}(\text{m/s}^2) = \text{SQR}((1.4 * (\text{RRV}(1, \text{WBD}(\#1))))^2 + (1.4 * (\text{RRV}(1, \text{WBD}(\#2))))^2 + (\text{RRV}(1, \text{WBK}(\#3))))^2)$$

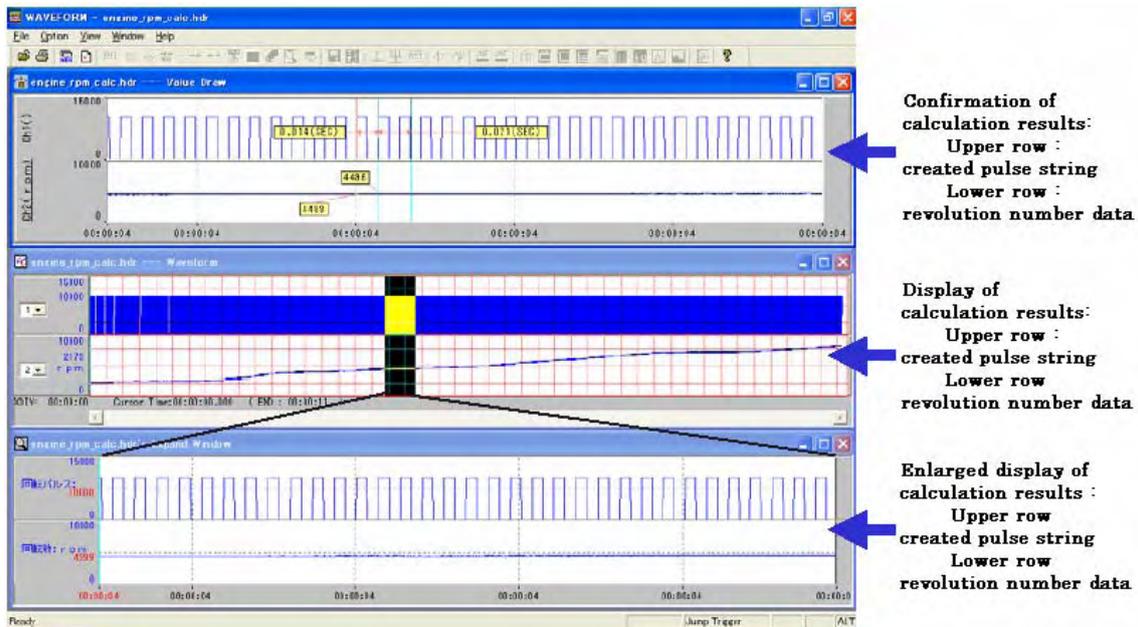
8-4-51 Rotation pulse creation function (Reverse F-V function)

RTP(k, X) Recognizing X-given channel data as rotation number (rpm) data, create rotation pulses from the data. You can specify number of creating pulses per one revolution by k.

* Minimum creating pulse period has to be greater than two times of sampling period of data.

Sample of usage

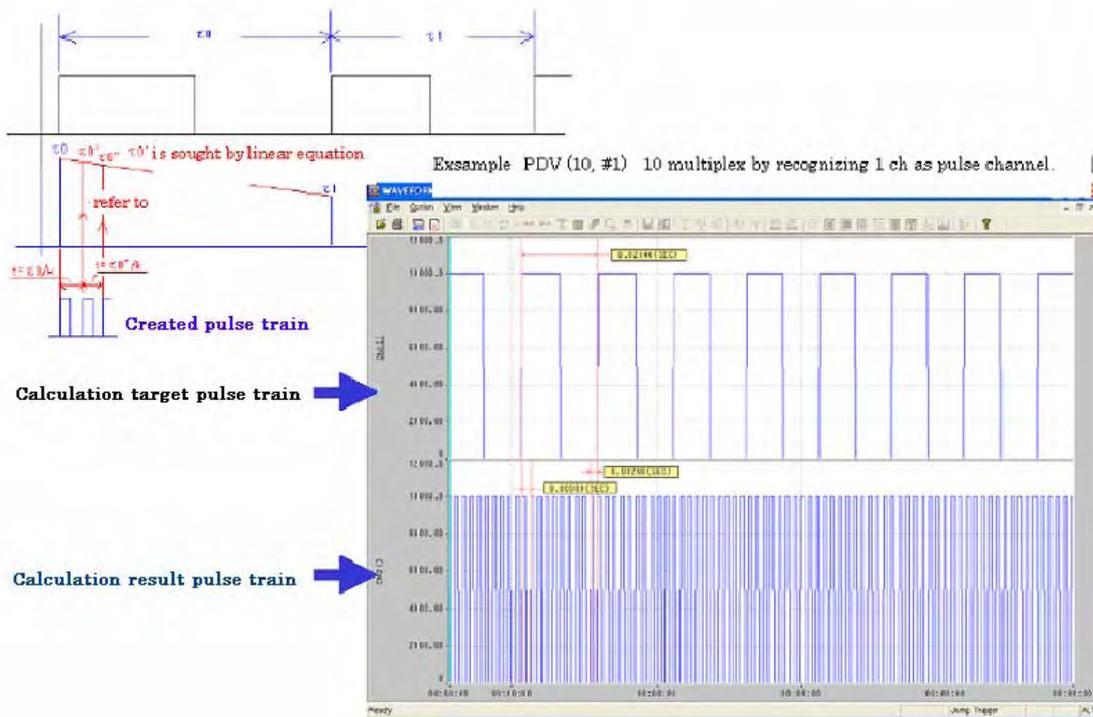
RTP(1,#1) Ch1 is revolution number(rpm) data. Calculate the data as one pulse / one revolution.



8-4-52 Pulse multiplex function

PDV (k, X) Create a new pulse train that divides pulse-to-pulse of X-given channel pulse train by k-set multiplex number. Still, interpolated change of pulse period is processed by linear interpolation of original pulse train period.

* Minimum pulse period to be created has to be greater than two times of sampling period of data.



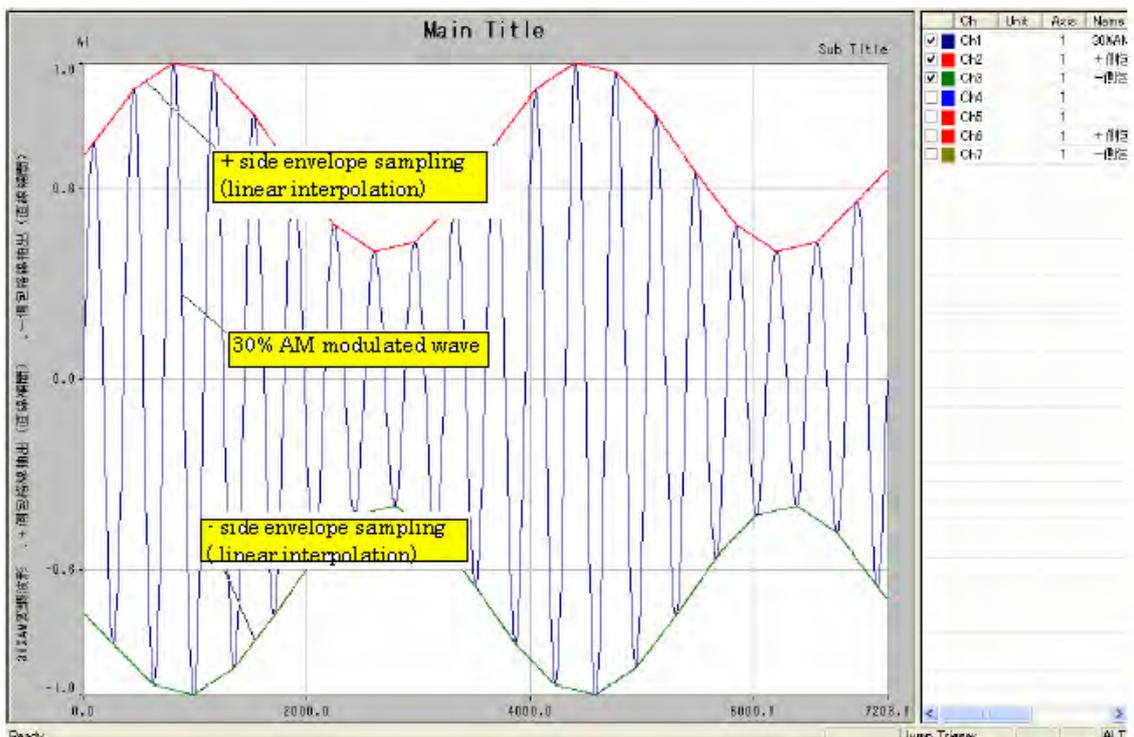
8-4-53 Envelope function

ENV (k, X) Seek an envelope graph of X-given channel data waveform using k-expressed sampling procedure.

K := 1 absolute value, linear interpolation k := 2 + side, linear interpolation

K := 3 - side, linear interpolation k := -1 absolute value, spline interpolation

K := -2 + side, spline interpolation k := -3 - side, spline interpolation



< List of built-in functions >

Function name	Notation	Function	Note
Negation function	SGN (x)	Reverse the polarity of x	Equivalent to $-1*x$
Absolute value function	ABS (x)	Seek absolute value of x.	All of the region becomes positive domain.
Positive regionalization function	PLS (x)	Replace all negative number of x with 0.	
Negative regionalization function	MNS (x)	Replace all positive number of x with 0.	#1 = PLS (#1) + MNS (#!) results.
Radian function	RAD (x)	Multiply x by $\pi/180$,	
Square root function	SQR (x)	Seek square root of x.	
Degree function	DEG (x)	Multiply x by $180/\pi$.	
Integration function	ING (k, x)	Integrate x using trapezoidal formula by setting k as initial value.	K is scalar quantity, x is column vector
Differential function	DIV (x)	Divide difference of first order of x by t.	Last and immediately one before last become the same.
Moving average function	MAV (k, x)	Seek moving average of x. k is width.	If k is even number, +1 is added to be used.
Common logarithmic function	LGT (x)	Seek log of base 10 of x.	In case of $x \leq 0$, 0 is returned.
Natural logarithm function	LOG (x)	Seek log of base e of x.	In case of $x \leq 0$, 0 is returned.
Inverse function	INV (x)	Seek inverse number (1/x).	
Maximum value function	MAX (x)	Seek maximum value of x.	Number of elements of calculation result becomes 1.
Minimum value function	MIN (x)	Seek minimum value of x,	Number of elements of calculation result becomes 1.
Sum total function	SUM (x)	Seek total value of x.	Number of elements of calculation result becomes 1.
Mean value function	MEA (x)	Seek mean value of x.	Number of elements of calculation result becomes 1.
Sine function	SIN (x)	Seek sine value regarding x as radian unit.	
Cosine function	COS (x)	Seek cosine value regarding x as radian unit.	

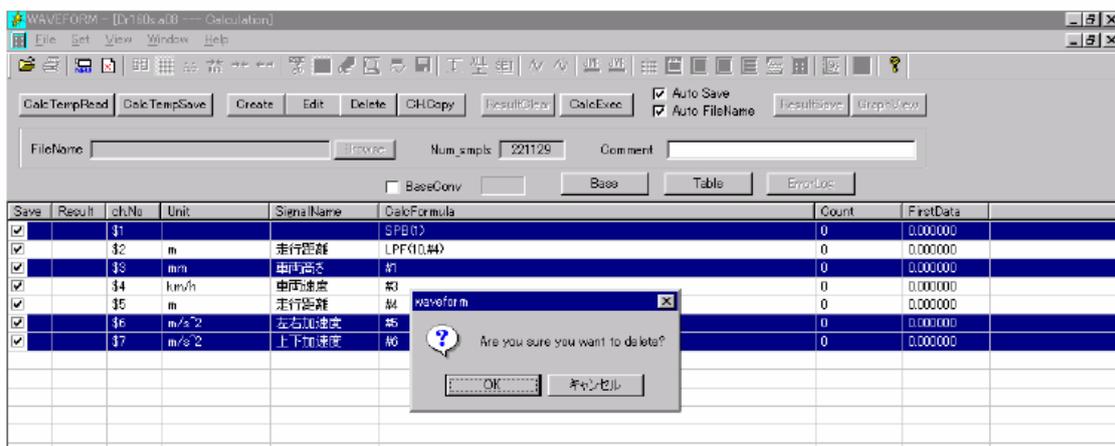
Function name	Notation	Function	Note
Tangent function	TAN (x)	Seek tangent value regarding x as radian unit.	
Arcsine function	ASN (x)	Seek angle rad regarding x as sine value.	The range of x has to be -1 to +1.
Arccosine function	ACS (x)	Seek angle rad regarding x as cosine value.	The range of x has to be -1 to +1.
Arctangent function	ATN (x)	Seek angle rad regarding x as tangent value.	
Exponential function	EXP (x)	Seek exponential value.	X = EXP(LOG(x)) results.
Table reference function	TBL (x)	Refer to table indicated by name.	Ex. of description: #1*TBL (invert)
Moving effective value function	RRV (k, x)	Seek moving effective value by Taking k(sec) as integral period,	Data row becomes by period.
Low-pass filter	LPF (k, x)	Low-pass filter that sets K(Hz) as cut-off frequency	Cut-off characteristic -24dB/oct : forward direction process. Details are described late on.
Low-pass filter	LPR (k, x)	Low-pass filter that sets K(Hz) as cut-off frequency	Cut-off characteristic -24dB/oct : backward direction process. Details are described late on.
High-pass filter	HPF (k, x)	High-pass filter that sets K(Hz) as cut-off frequency	Cut-off characteristic -24dB/oct : forward direction process. Details are described late on.
High-pass filter	HPFR (k, x)	High-pass filter that sets K(Hz) as cut-off frequency	Cut-off characteristic -24dB/oct : backward direction process. Details are described late on.
Maximum shearing stress function	TMX (E, v, X, Y, Z)	E is modulus of vertical elasticity, v represents Poisson's ration and X,Y or Z is strain amount.	Refer to Rosset gage analysis function.
Maximum principal strain function	EMX (X, Y, Z)	X,Y or Z is strain amount.	Refer to Rosset gage analysis function.
Minimum principal strain function	EMN (X, Y, Z)	X,Y or Z is strain amount.	Refer to Rosset gage analysis function.

Function name	Notation	Function	Note
Principal strain direction function	ETH (X, Y, Z)	X, Y or Z is strain amount.	Refer to Rosset gage analysis function.
Maximum principal stress function	SMX (E, ν , X, Y, Z)	E is modulus of vertical elasticity, ν represents Poisson' ratio and X, Y or Z is strain amount.	Refer to Rosset gage analysis function.
Minimum principal stress function	SMN (e, ν , X, Y, Z)	E is modulus of vertical elasticity, ν represents Poisson' ratio and X, Y or Z is strain amount.	Refer to Rosset gage analysis function.
Maximum shearing strain function	GMX (X, Y, Z)	X, Y or Z is strain amount.	Refer to Rosset gage analysis function.
Gage factor correction function	GRT (k, x)	K is gage factor. X is strain amount.	Refer to Rosset gage analysis function.
Amplitude value conversion function	AMP (k, x)	Extract amplitudes of x and sort them.	K=0 extraction order, K=1 ascending order, K=2 descending order
Hyper-amplitude deletion function	LMT (k, x)	Delete the domain exceeding the amplitude specified by k.	Deleted result is filled together on time axis.
Data link function	LMK (X, Y)	Link Y to the rear of X.	
Sorting function	SRT (k, X)	Sort X in descending or ascending order.	k \geq 0 descending order, k<0 ascending order
Time-axis reversing function	REV (x)	Set a series of x in reverse order.	
Difference function	DIF (x)	Seek difference of one order of x.	
Accumulation function	ACC (x)	Seek accumulation of x.	
Number-of-datapoints function	LEN ()	Seek the number of data in analysis range.	
Correlation function	COR (X, Y)	Seek cross correlation function of X, Y.	In case of X = Y, it becomes autocorrelation function.
Tachopulse function	TPC (k, x)	Pull out pulse train of x.	k : = number of jumps
F-V conversion function	FVC (k, x)	Change pulse train of x to number of rotations (rpm).	K : = number of pulses per one rotation.
Audio correction filter	WAC (x)	Pass x through audio correction A curve filter.	
Hand / arm correction filter	HTV (x)	Pass x through hand-arm vibration correction filter	ISO5349

Function name	Notation	Function	note
Whole-body correction D filter	WBD (x)	Pass whole-body vibration correction D filter	ISO2631-1 seated position, standing position, face-up position X Y axis
Whole-body correction K filter	WBK (x)	Pass whole-body vibration correction K filter.	ISO2631-1 seated position, standing position, face-up position Z axis
Whole-body correction C filter	WBC (x)	Pass whole-body vibration correction C filter.	ISO2631-1 x-axis direction of the backrest
Whole-body correction E filter	WBE (x)	Pass whole-body vibration correction E filter.	ISO2631-1 Rotation vibration in seated position
Envelope extract function	ENV (k, V)	Extract envelope of x ch waveform by k-expressed sampling procedure	
Pulse creation function	RTP (k, X)	X= rotation number (rpm) data, k= number of pulses per one revolution	Reverse F-V function
Pulse multiplex function	PDV (k, X)	Generate a new pulse train in which status the pulse train of X has been increased by k-times.	

8-5 Deletion of registered calculation formula from calculation formula registration list

Move cursor onto the line you want to delete on calculation formula registration list in the window and click it. Then it turns to reverse video. You can move reverse-video line with up or down arrow key. To delete reverse-video line, click "DEL" button. When deleting plural lines at the same time, drag the appropriate lines while pressing down SHIT key, or click the lines while pressing down Ctrl key. After checking that the plural lines of calculation formula registration list have become in reverse-video, click **Delete** button in calculation window, and a confirmation dialog box will appear. Click "OK" to delete them.



8-6 Edit of registered formula in calculation formula registration list

Double-click the line you want to edit or click **Edit** button, and calculation formula registration dialog will appear.

8-7 Registration by copy of plural channels

When registering plural channels of current file by one operation, in addition to one channel-by-one channel registration using "Apply" button on calculation formula registration dialog, there is another way of registering plural channels at the same time.

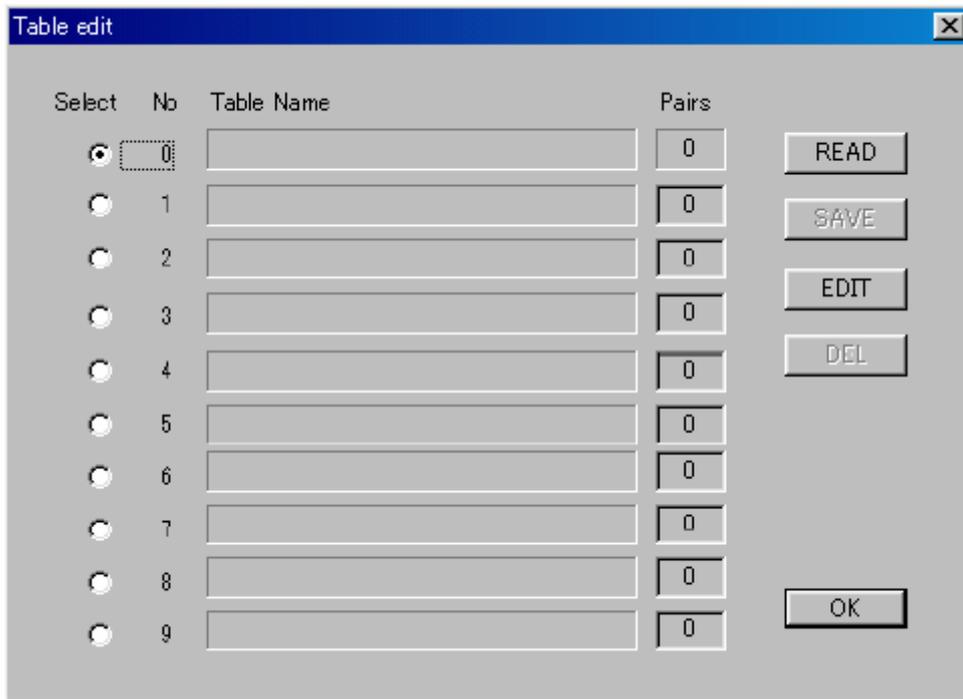
Click **CHCopy** button in the window. Click it, and a copy dialog box will appear. Select a channel to be registered from the list. If you want to select plural lines at the same



time, drag while pressing down SHIFT key, or click the list while pressing down Ctrl key. After having selected them, click "OK" button, and they will be registered in calculation formula registration list in the window.

8-8 Definition of table

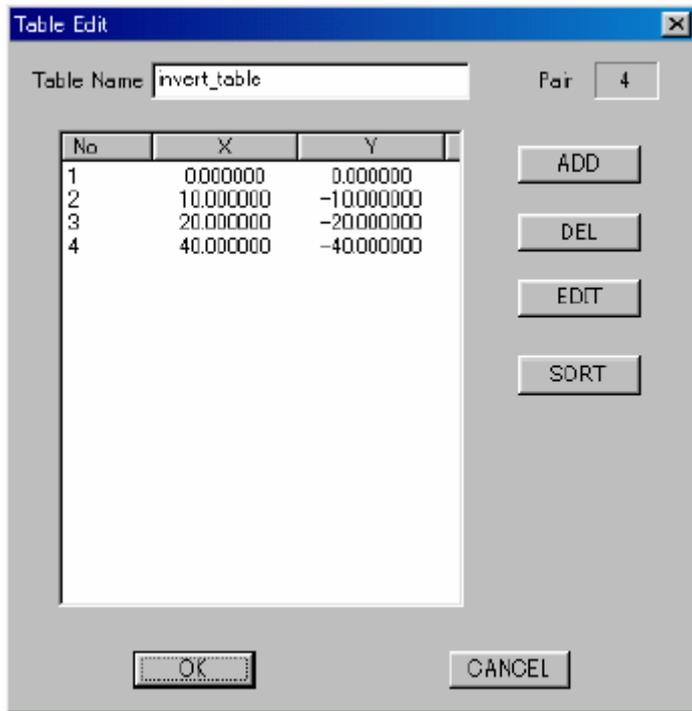
Table is often used when linearizing non-linear data. When converting acquired data by table, registration of a table to be used is required in advance of calculation formula definition. Click  button in the window, and a table-registration dialog will appear.



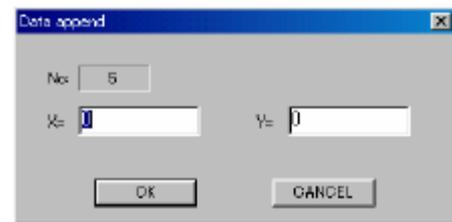
The number of simultaneously usable (registerable) tables is up to 10. Presently registered table names are indicated in the dialog. "READ", "SAVE", "EDIT" and "DEL" buttons are ready for operation.

8-8-1 A new creation / edit of table

When building a table newly, or editing table definition file temporarily that has already been registered, click "EDIT" button, and a table-edit dialog will appear.



When editing an already-existing table, table name, pair number, X value and Y value are indicated in list box. When building it newly, whole area is blanked. Operational buttons consist of "ADD" (add or new), "DEL" (delete), "EDIT" (change) and "SORT" (sorting) buttons.



8-8-1-1 Entering of table name

To build a table newly, enter a table name in the dialog. The table name to be entered here can be referred to in calculation formula. Further, the table name is used as initial value of filename at table storage time.

8-8-1-2 Newly adding of table line

Click "ADD" button, and +1 is assigned to the max value of presently used pair number and then a input-dialog of X value & Y value will appear.

※ Each of X value and Y value is referred to as X = input and Y = output. Further, when building a new table, a value greater than 20 has to be entered for X value and Y value.

8-8-1-3 Change of table line

Click the line (pair) in list box you want to edit, and reverse video line will be indicated. In that status, click "EDIT" button, and a X value / Y value-input dialog which sets indicated value as initial value will appear. Input the value you want to change and click "OK" button to edit it.

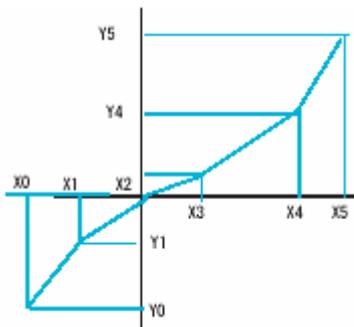
8-8-1-4 Deletion of table line

Click the line in list box you want to delete, and reverse video line will be indicated. In that status, click "DEL" button, and the line you have selected will be deleted from the table. Note that you can delete one line only at a time.

8-8-1-5 Sorting of table lines

Click "SORT" button, and the lines will be sorted in ascending order of X value. Sorting operation is definitely needed at the time of new creation of a table or additional edit of line.

※ Table reference performs interpolation. In case where target-data exceeds the range of the defined x, extrapolation processing is made using last straight line. In case where qualified data x_k exists between x_3 and x_4 , the qualified result y_k is interpolated by the straight line equation of $y_k = \{ (Y_4 - Y_3) / (x_4 - x_3) \cdot (x_k - x_3) \} + Y_3$. In case where x_k is greater than x_5 , extrapolate it by extending the straight line which is formed with X_4, Y_4 and X_5, Y_5 . In the same way, in case where x_k is less than x_0 , extrapolate it by extending the straight line which is formed with X_0, Y_0 and X_1, Y_1 .



8-8-2 Saving of table

Click "SAVE" button in table registration dialog, and a file-saving dialog will appear. Enter a filename to save it.

8-8-2-1 Format of table file

Table definition file is TEXT-formatted with extension .tbl. The format is as follows.

PWF_ TABLE	1 st line	Keyword is fixed.
PAIR = 3	2 nd line	Number of table definition pairs
0, 0	3 rd line or later	Table definition pair. 1 st column is x and 2 nd column is y.
10, 20	4 th line	
20, 40	5 th line	
※ Number of table pairs is up to 30.		

8-8-3 Read-in of table definition file

When reading out created table, select registered table number on table registration dialog in advance. Then click "READ" button, and you can read it out to register.

- ※ Table registration area is available for 0 to 9 (up to 10). After selecting an area to register, click "READ" button. When reading it into already-registered-area, details will be updated to the read-in ones.

8-8-4 Deletion of defined table

After selecting the table area you want to delete, click "DEL" button, and a confirmation dialog will appear. Click "OK" button to delete it.

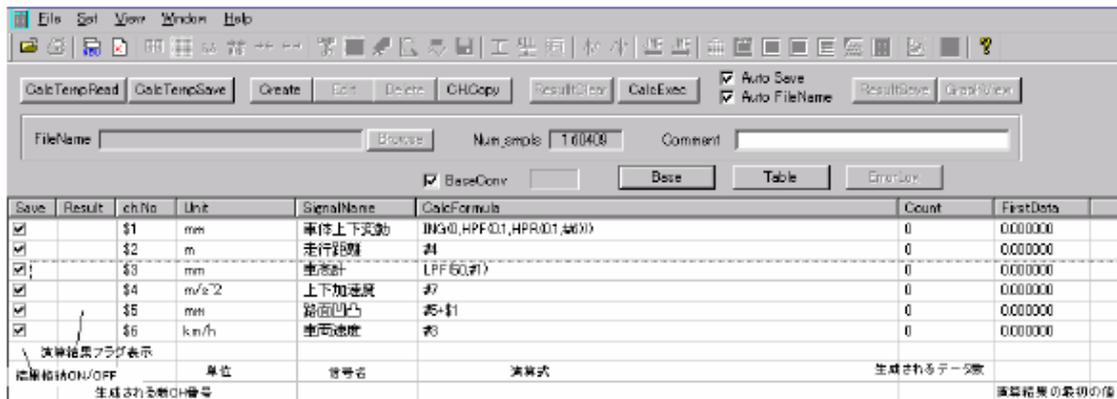
- ※ If you delete the table to which you have already referred in calculation formula, an error will result at calculation execution. At deletion execution time, check to be sure that it is not referred to calculation formula.
- ※ The way of referring to table in calculation formula

In regard of table reference, 2 kinds of reference ways are available : a way of describing table number and another way of describing table name using TBL function. For example, In the case of reference by table number (registration area no.), describe area number just after leading character %. For example, when referring to an area NO.3 of table, describe it as % 3. And in the case of reference by table name, describe table name directly using TBL function. For example, if table name is INVERT, describe it as TBL (INVERT). If table name of the same name is registered in the plural, the table of youngest table no. is referred to.

8-9 Execution of calculation and saving of the result

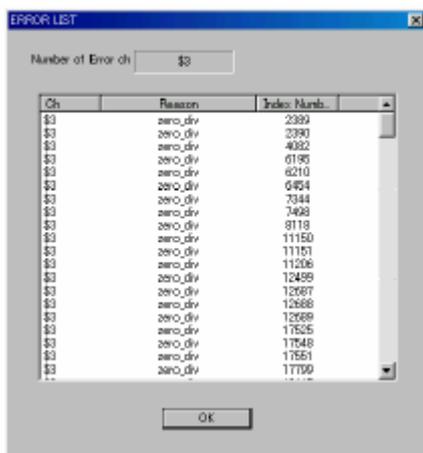
8-9-1 Execution of calculation

When calculation formula is registered, "Calc.Exec" button becomes effective. Click the button, and calculation is performed in sequence from ch1on in calculation formula registration list. The results are indicated by the flag of "Y" or "Err". If Err is indicated, it means that an error has arisen at execution time.



Number of data and first data are indicated in each created channel list as a result of calculation execution. In the case where calculation result becomes scalar quantity, this first data reading means the result.

8-9-2 Indication of error at calculation execution

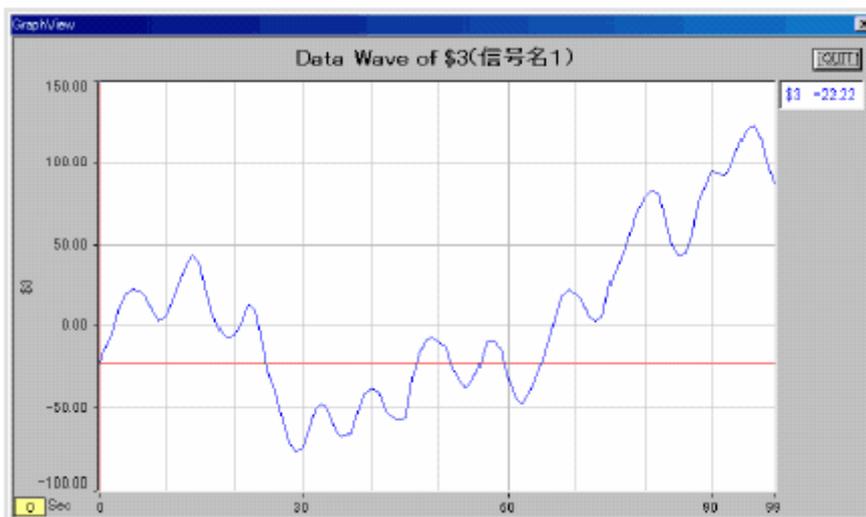


Data at the time of error occurrence during execution is replaced by 0. A new channel, though an error has arisen at execution time, will be created but can not be a target for storage. To check error details at execution, click error-channel in the list box to render the channel reverse, and "ErrorLog" button will be effective. Then click the button, and an errorLog dialog will appear. Error cause and error data no. at execution are indicated in the list box. Occurrence no. is index number that

sets calculation start-point as 0. Should number of error sum total exceeds 200, they won't be described in the list.

8-9-3 Confirmation of calculation result

If number of data indicates 1 as a calculation result, the value displayed in First Data item is obtained value. And when obtained result becomes vector (data row), calculation result can be confirmed in waveform. If you want to confirm waveform, move cursor onto a result line in the calculation formula registration list and click it. Click the line, and it will be shown in reverse-video. Further, movement of reverse-video line can be operated with up or down arrow key. Waveform confirmation is performed on a channel basis. Click "GraphView" button on the window, and a waveform-display dialog will appear.



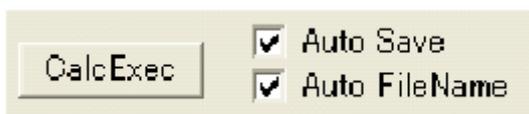
Drag within waveform display frame, and a cross-cursor will appear. It makes us read out data at cursor's present position.

8-9-4 Saving of calculation result

If Y is indicated in Result box as a result of calculation, the result can be saved. 2 kinds of saving ways are available: Auto-save and manual save.

8-9-4-1 Auto-save of calculation result

Check AutoSave box in the window, and Save box in the calculation formula registration list will be checked after the end of calculation. Then "Y" given channel as



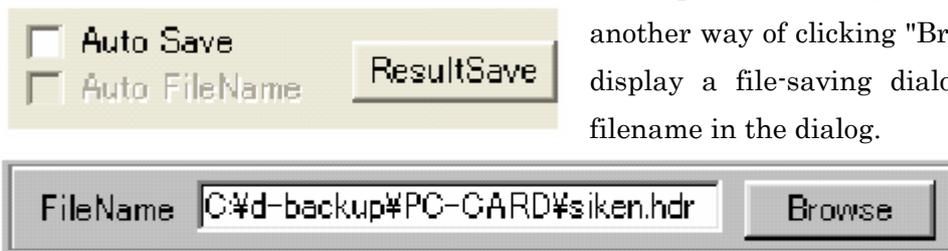
a result of calculation are automatically saved. If Auto FileName box is checked, a saving filename will be automatically saved

in the same folder as current file with suffix "_ Calc" added. If the file of the same

name is currently in use, it is created with "_Calc" suffix in addition, but in non-use, it will be overwritten. In either case, special warning message is not shown. When Auto Filename is unchecked, a file-saving dialog will be displayed after the execution of calculation, If you specify the filename presently in use on the dialog, an error message that writing can not be carried out at writing execution time is displayed. To save calculation result , in that case where auto-saving function fails, uncheck Auto Save check box once to save calculation result using manual save function.

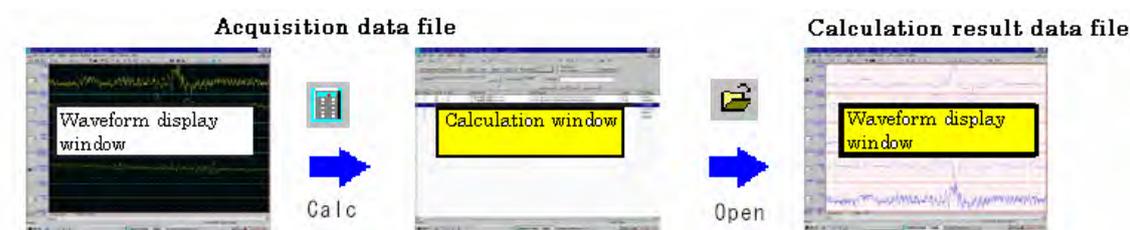
8-9-4-2 Manual save of calculation result

If Auto Save check box is unchecked, the result of calculation execution is not saved automatically. As "Result Save" button becomes effective, click the button to save it. However, the save-target filename has to be set in filename input box in advance. 2 ways of setting a file name are available: a way of entering a filename in full pass form into input box directly from keyboard and another way of clicking "Browse" button to display a file-saving dialog. Then set a filename in the dialog.



8-9-5 Saving format of calculation result

Calculation result is saved in the same format as acquisition data file. So you can read it out with PC WaveForm just as in the case of acquisition data file. If you want to covert it to TEXT, read out calculation result file as a first step, extract a necessary range and save it in TEXT format.



※ Calculation is executed by double precision, but data file is converted to 2-byte integer type. The result is saved in the type which sets the max value of each channel as 30,000 at conversion time.

8-9-5-1 Date setting of calculation result file

Calendar-clock of PC in use is referred to the date which is written in header-file of calculation result file and becomes date/time at storage time. If you want to match it with the date/ time in acquisition data file, uncheck "Create File Date" of pull-down menu of "Set" in the window.



8-9-5-2 Handling of MARK information

If MARK information in analysis-target file is included in analysis range, it is also entered in calculation result file. However, data number is updated to the number which sets leading data as 0. The time depends on creation date to be entered in the header-file. If you set it to the same date as original file, it does not alter. If setting creation date to the date/time of storage time, the data will be updated by sampling frequency and data number by setting leading data as storage time.

※ Format of MARK information MARK data number, time{, voice filename
{, after-memo}}

8-9-5-3 Handling of PAUSE information

In the case where PAUSE information in analysis-target file is included in analysis range, if making file creation date/time identical to that of original file, the same date/time is also described in calculation result file. But data number is updated to the number which sets leading of analysis range as 0. If setting the creation data/time in calculation result file as date/time of storage time, PUSE information won't be reflected though the information is included in analysis range.

※ Format of PAUSE information PAUSE data number, Pause release time

8-10 Initialization of calculation result

Click "Result Clear" button in the window, and calculation results can be initialized. In the case where calculation results have not been obtained, the function becomes invalid and selection can not be done.

8-11 Resampling and mutual conversion of frequency / spatial frequency

It is possible to change sampling frequency, or change from fixed time sampling to equidistant sampling or conversely from equidistant sampling to fixed time sampling. Any one of them is carried out by one operation just after calculation results of all channels have been obtained.

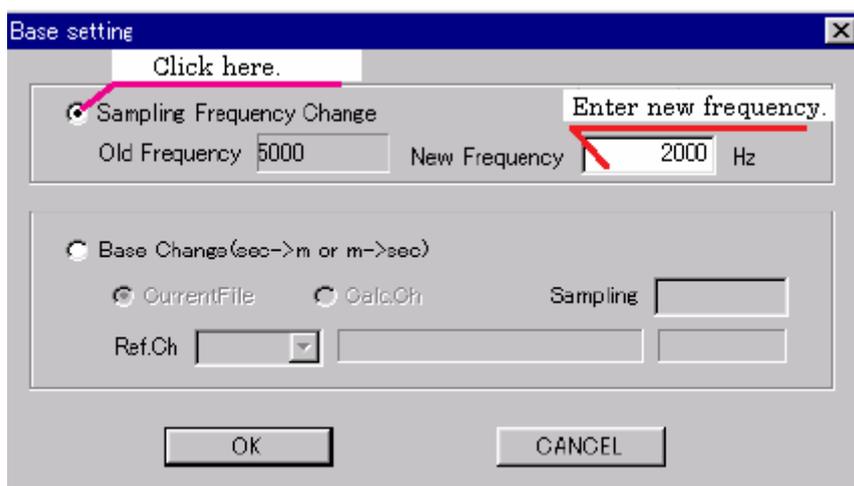
To set, click "baseCon" check box in the window, and "Base" button becomes effective.



Then click "Base" button, and a setting dialog will appear.

8-11-1 Setting of resampling

Select "Sampling Frequency Change" in the setting dialog. Select it, and sampling frequency input box becomes effective. Enter a sampling frequency in the box.



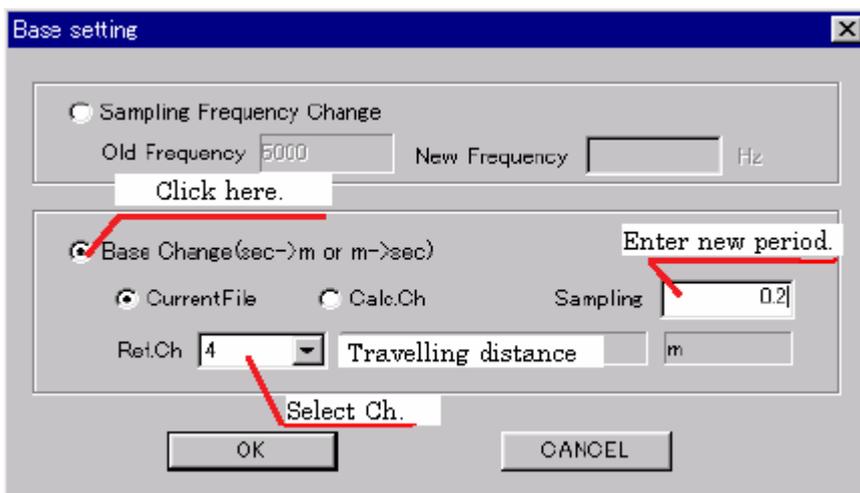
- ※ Resampling is executed to LCM (least common multiple) of new & old frequency by zero- interpolation procedure temporarily. Then after being processed at 1/2 of the change frequency with non-phase lag and low-pass filter, downsampling is executed by the change frequency and finally amplitude restoration is carried out. Do this processing aiming at new & old LCM within about 10 times limitations of pre-change frequency.

8-11-2 Setting of mutual conversion of frequency/ spatial frequency

Select "Base Change" in setting dialog, and input box becomes effective.

8-11-2-1 Selection of elapsed time channel or travel distance channel

Traveling distance channel is required to convert from fixed time sampling to equidistant sampling. Conversely, to convert equidistant frequency to fixed time sampling, elapsed time channel has to exist. Regarding a channel, both of acquisition file (current file) and calculation result file are OK. To begin with, select current file or calculation result file and then select a channel.



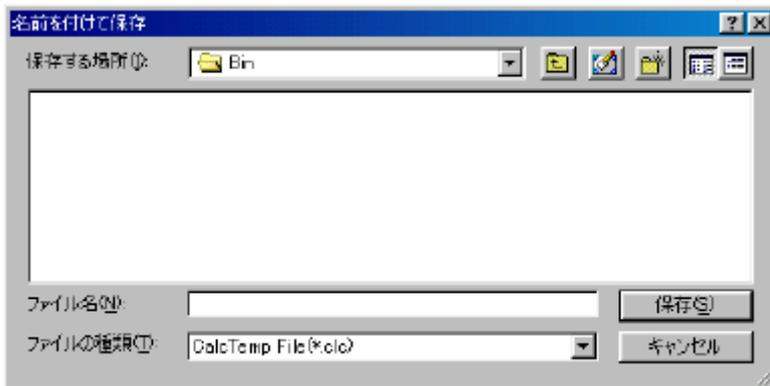
8-11-2-2 Entering of period

Enter sampling period. Enter it in second (sec) unit for conversion to fixed time sampling, while in meter (m) unit for conversion to equidistant sampling.

※ Set both of frequency sampling and spatial sampling by period (wavelength).

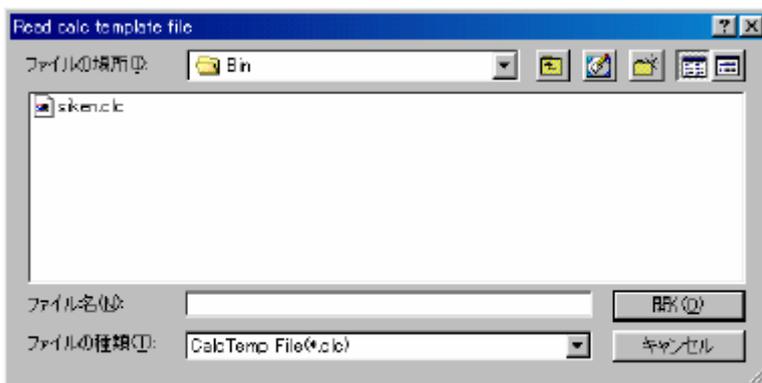
8-12 Saving of calculation template

Registered calculation formula can be saved. To save it, click "CalcTempSave" button, and a file-saving dialog will appear. After entering a filename, click "Store" button to store it in filename folder. Storage form is inner format with extension ".c1c".

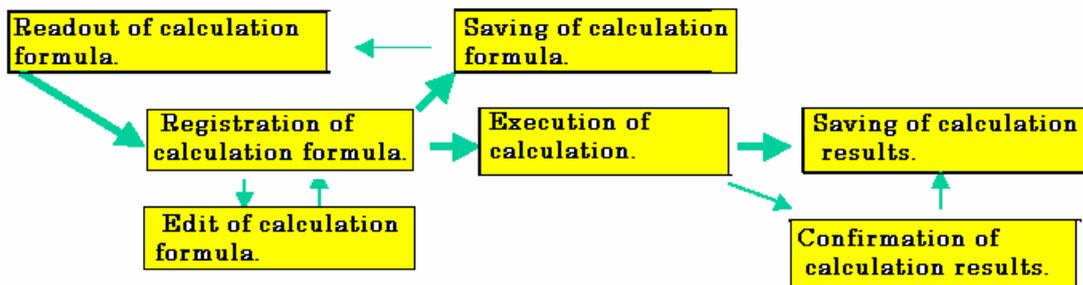


8-13 Reading of calculation template

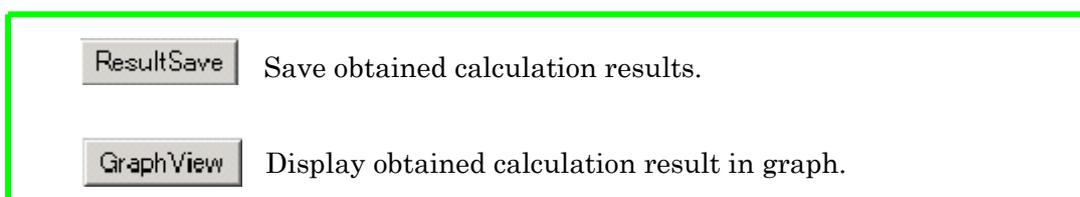
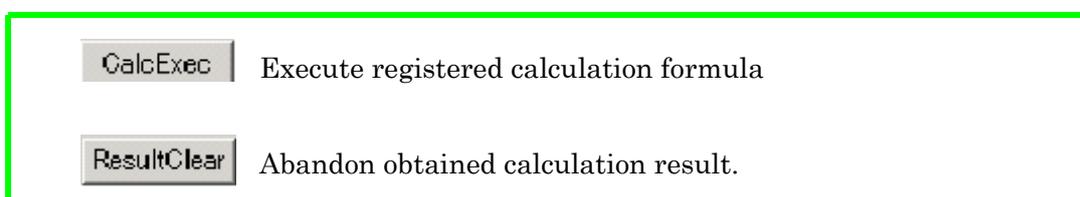
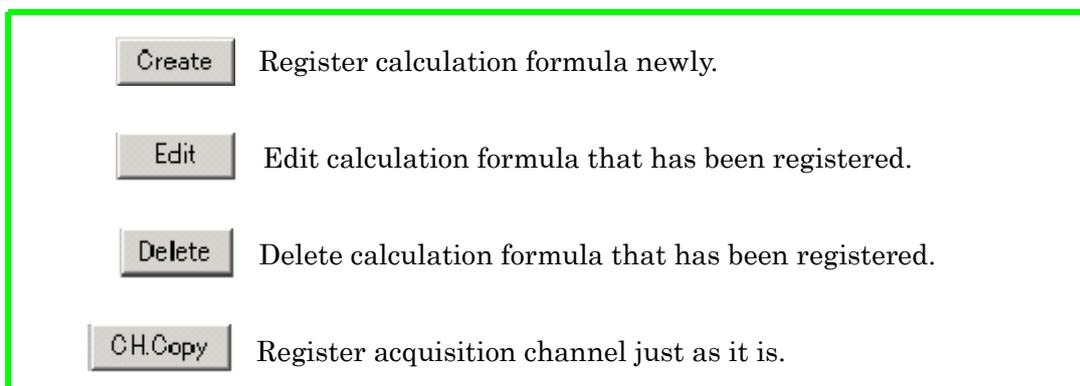
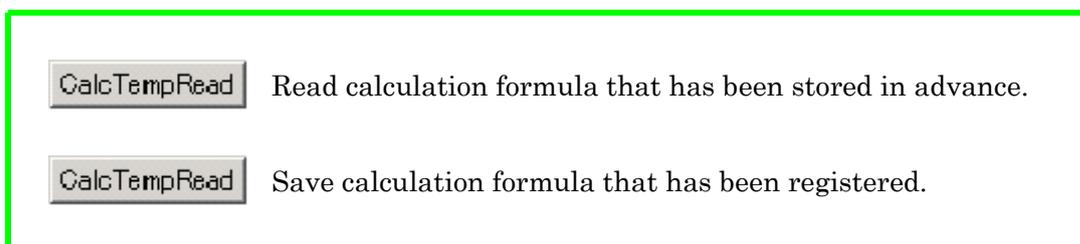
Precreated calculation template can be read for use. To read it, click "CalcTempRead" button in the window. Click it, and a file-read dialog will appear. Enter a filename into input box and click "Open" button. Then calculation template file is read out and calculation formula registration list is updated.



< Operation flowchart >



< Summary of operational buttons >



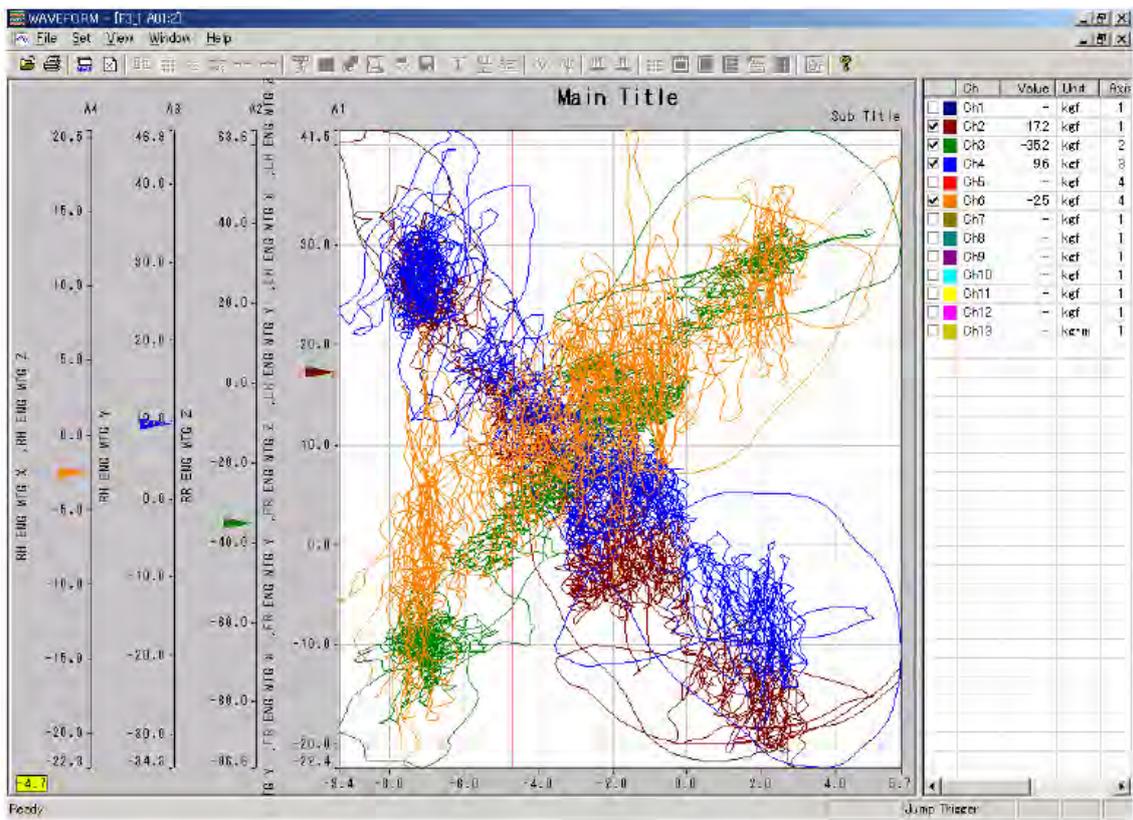
Chapter 9

X - Y display window

Setting of graph title	available
Number of simultaneous display channels	unlimited
Number of simultaneous display Y-axes	4 axes ON/ OFF on a axis basis
Assignment function of Y-axis to channel	available
Assignment function of X-axis to channel	available on a channel basis
ON/OFF of Y-axis channel display	available on a channel basis
X-axis scale	auto or manual
Y-axis scale	axis-independent auto or manual
Scale factor setting of X-axis	available
Scale factor setting of Y-axis	available channel-independent
Numerical value indication form of X-axis	number of digits, selection of indication form
Numerical value indication form of Y-axis	number of digits, selection of indication form
Statistic	correlation coefficient, standard deviation value, mean value
Cursor function	available
Graph display form	LINE or DOT
Graph display colors	outside of graph, inside of graph, grid line, scale reading color, cursor line and data line
Printing function	available
Analysis display parameter storage	available parameter storage parameter read-out

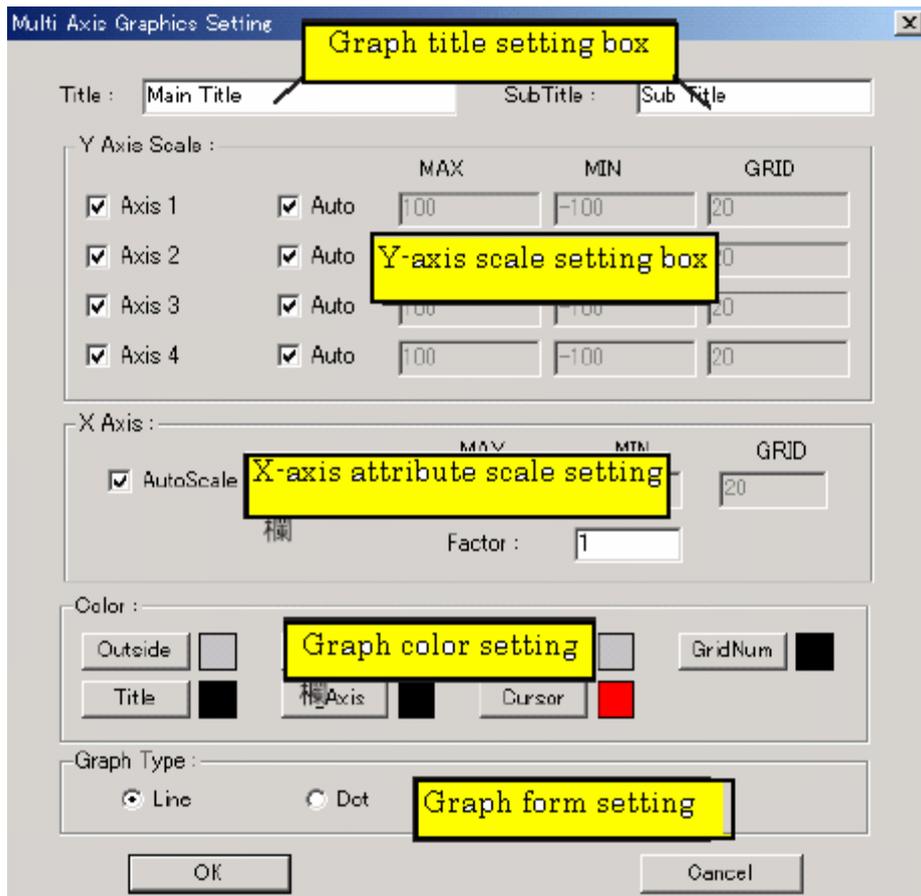
9-1 Initiation of X - Y display window

Date of all channels whose analysis ranges have been defined can be displayed in X - Y display form. Choose "XY Graphics" of pull-down menu of "Analyze" on menu bar, or click the icon on tool bar. On choosing it, X-Y display window is opened on just preceding set display conditions to display graphics.



9-2 Setting of display conditions

Choose "Analysis condition" from pull-down menu of "Set" on menu bar, and a condition-setting dialog will appear.



9-2-1 Setting of graph title



X - Y graph title and subtitle can be set.

9-2-2 Setting of Y-axis scale

Y Axis Scale :		MAX	MIN	GRID
<input checked="" type="checkbox"/> Axis 1	<input checked="" type="checkbox"/> Auto	100	-100	20
<input checked="" type="checkbox"/> Axis 2	<input checked="" type="checkbox"/> Auto	100	-100	20
<input checked="" type="checkbox"/> Axis 3	<input checked="" type="checkbox"/> Auto	100	-100	20
<input checked="" type="checkbox"/> Axis 4	<input checked="" type="checkbox"/> Auto	100	-100	20

It is possible to draw up to 4 lines of Y-axis. To indicate axis-line, you need to check axis-check box. There are 2 ways of setting scale: auto-scale and explicitly setting of max value & mini value of graph and grid spacing.

Selection of the channel no. which is assigned to each line of Y-axis to be displayed is performed in channel information list on right side of X-Y graph frame.

9-2-3 Setting of X-axis scale

X Axis :	MAX	MIN	GRID
<input checked="" type="checkbox"/> AutoScale	100	-100	20

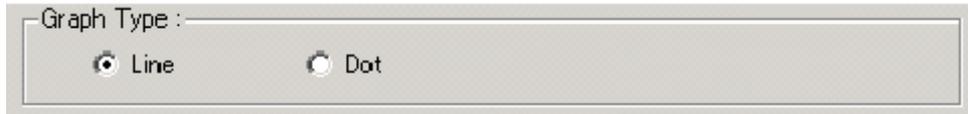
There are 2 ways of setting scale: auto-scale and explicitly setting of max value & mini value of graph and grid spacing.

9-2-4 Setting of graph colors

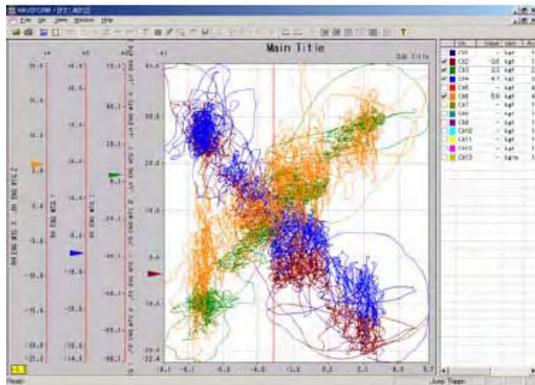
Color :	
Outside <input type="checkbox"/>	Inside <input type="checkbox"/>
Grid <input type="checkbox"/>	GridNum <input type="checkbox"/>
Title <input type="checkbox"/>	Y_Axis <input type="checkbox"/>
Cursor <input type="checkbox"/>	

You can use a different color for each of the following: outside of graph, inside of graph, graph grid line, graph scale reading, graph title, added Y-axis and cursor line. To change colors, click the appropriate button in the dialog, and a color palette will appear. Select the proper color on the palette.

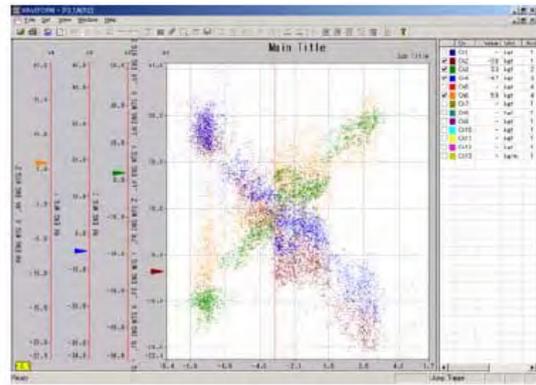
9-2-5 Selection of graphic form



Select Line for X-Y graph. Select Dot for scatter diagram.

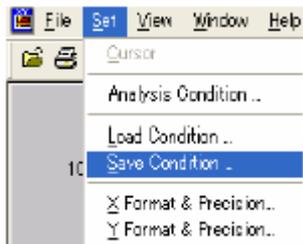


X-Y graph form



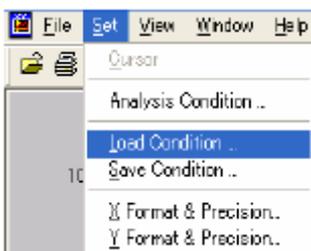
Scatter diagram

9-3 Saving of graph-display conditions



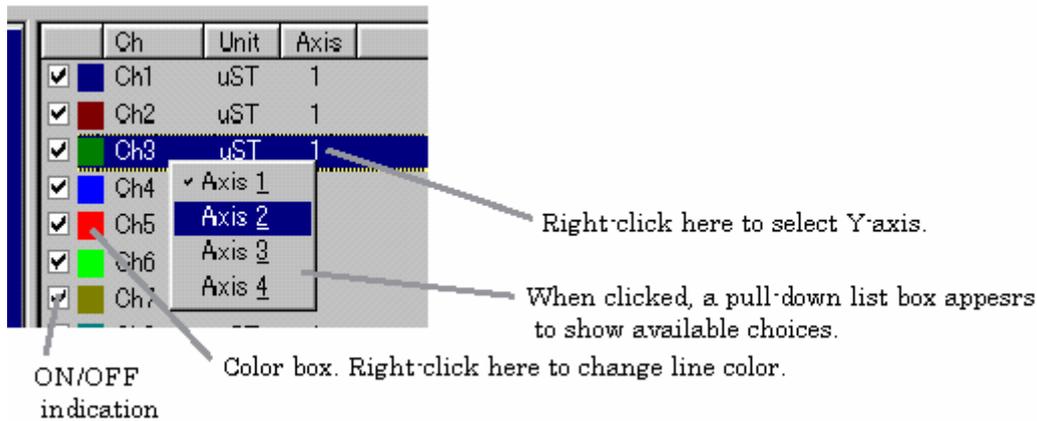
You can save the details of setting dialog in a file. Choose "Save Condition" of pull-down menu of "Set" on menu bar. Choose it, and a file-save dialog will appear. Set storage target folder and filename to store it. The storage is carried out in internal format having extension ".mas" .

9-4 Readout of graph-display conditions



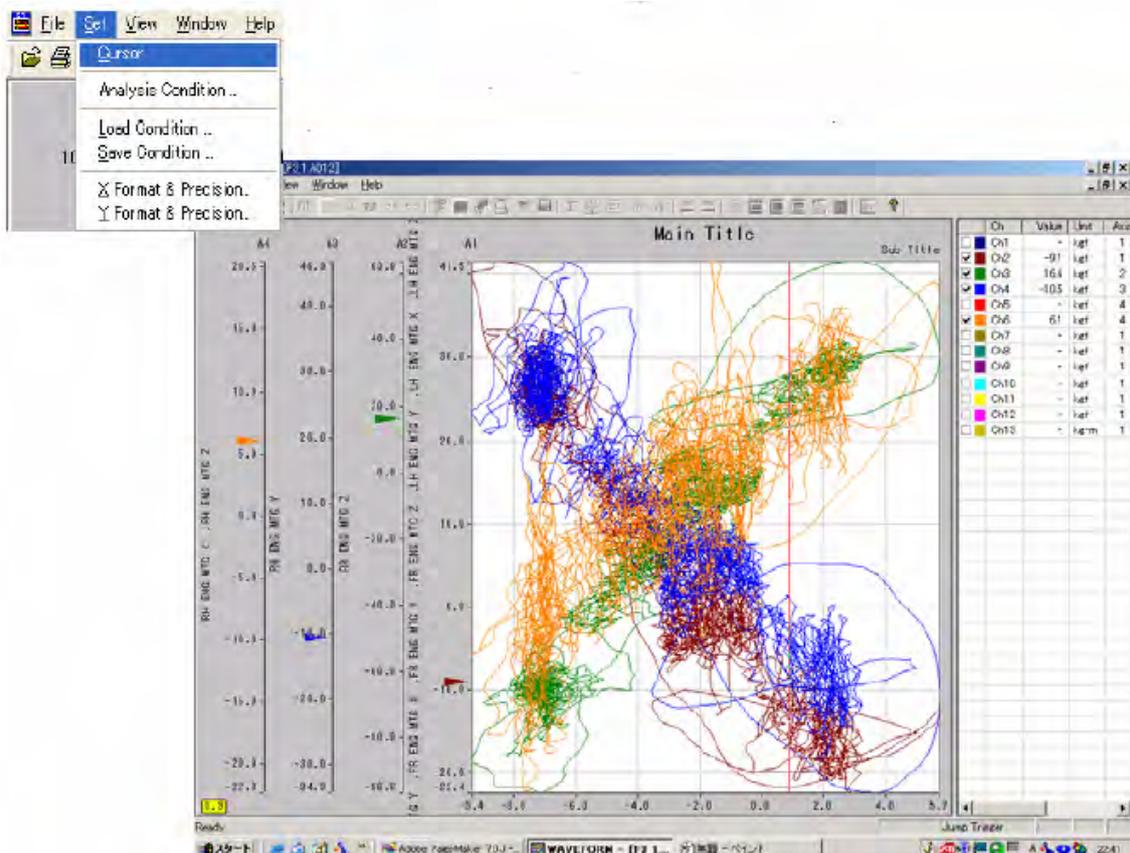
Choose "Load Condition" of the pull-down menu of "Set" on menu bar. Choose it, and a file-readout dialog will appear. Select a file to read and read out pre-stored graph conditions. Presently displayed graph will be redrawn on the basis of readout result.

9-5 Setting of display channel and axis-selection



To display a channel graph, check the check-box at left edge of the list on right side of X-Y graph. If unchecking the check-box, the dialog is cleared. Up to 99 channels of data can be displayed at the same time. You can select a display channel's Y-axis no. from preset Y-axes by right-clicking a proper channel no. in reference axis no. column.

9-6 Cursor function



Choose "Cursor" of the pull-down menu of "Set" on menu bar. Choose it, and make it known that cursor function with check mark turns on. Note, however, that cursor function can not be chosen if X-axis attribute is not time. When cursor function is switched on, cursor line within graph frame is displayed. Initial value is left edge. Movement of cursor can be operated with left or right arrow key on keyboard.

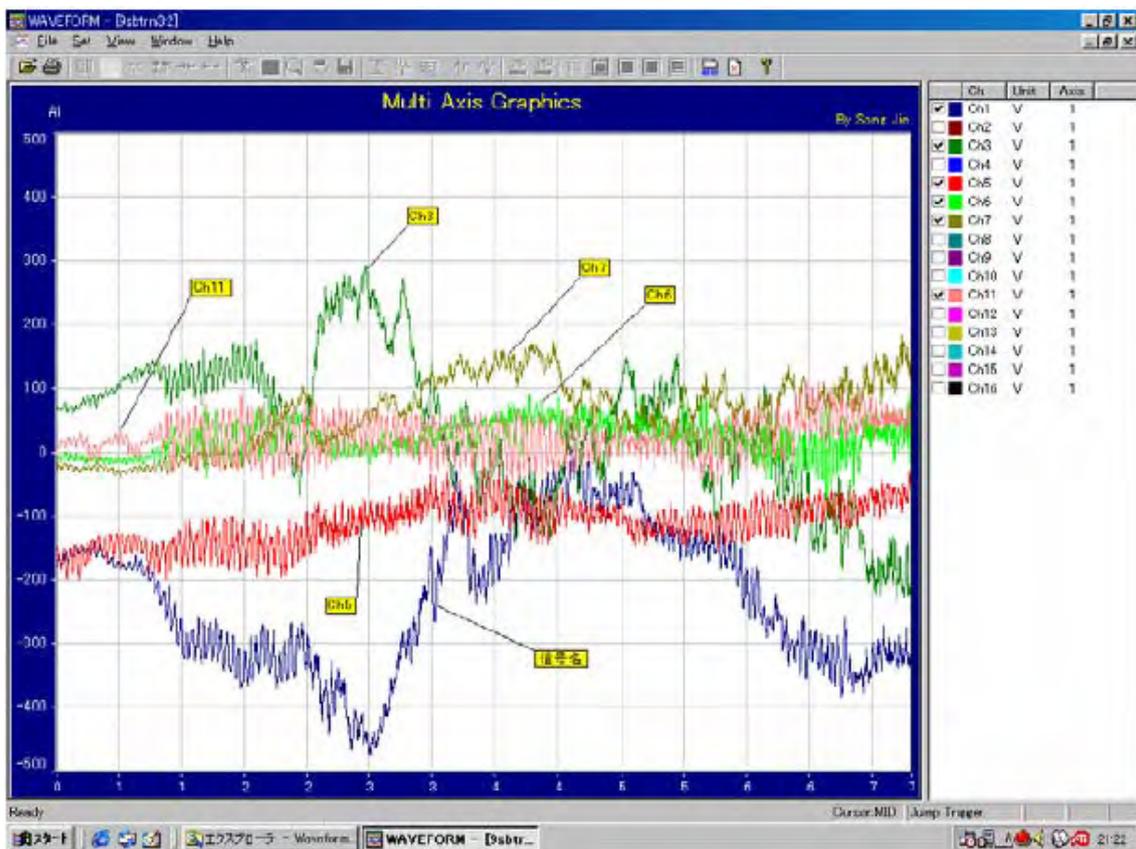
Chapter 10

Multi-axis graphics window

Setting of graph title	available.
Number of simultaneous display channels	unlimited
Number of simultaneous display Y-axes	4 axes ON/OFF indication on a axis basis
Y-axis scale	AUTO or MANUAL axis-independent
Assignment function of Y-axis to channel	available.
ON/OFF of Y-axis channel display	available on a channel basis
Cursor function	available. switching with signal name indication
Signal name indication within graph frame	available. switching with cursor function
Setting of graph display colors	available. outside of graph, inside of graph, grid line, scale reading color, cursor line and data line
Printing function	available.
Storage of analysis display parameters	available. parameter storage, parameter readout

10-1 Initiation of multi-axis graphics window

This window allows plural channels of data to be displayed in a single graph frame at one time. (After defining analysis range in waveform window), choose "Multi-Axis" from the pull-down menu of "View" on menu bar, or click the icon on tool bar. When chosen, all of data (up to 99 channels) are overlaid into a single waveform display (graph) frame to show them in graphics. The initial values of display scale are indicated by a Y-axis scale line of upper-limit 100, lower-limit -100 and grid spacing 10.



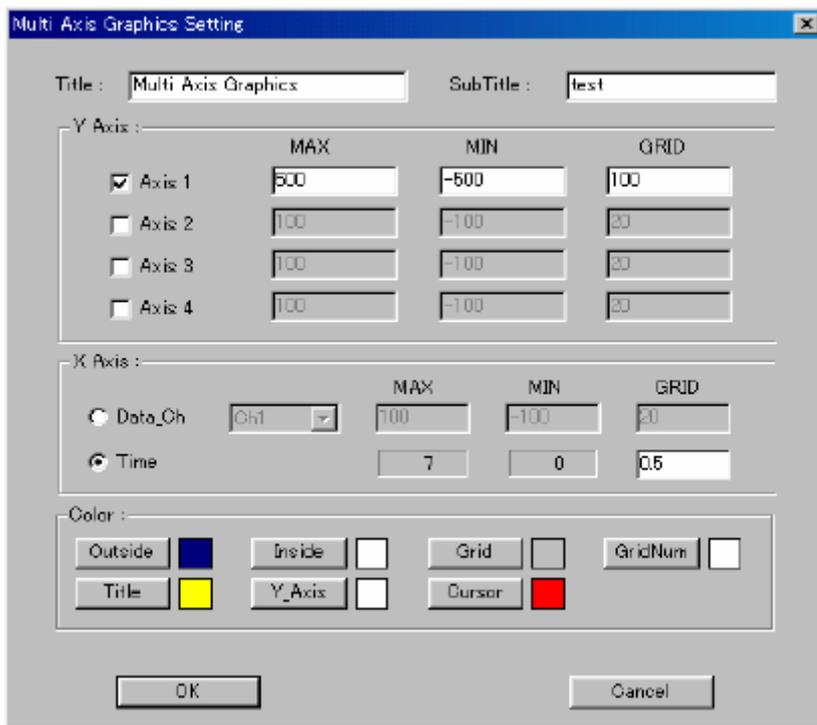
10-2 Setting of display conditions



Choose "Setting" from the pull-down menu of "Set" on menu bar in multi-axis window, and a multi-axis graph setting dialog will appear. You can set graph title, up to 4 lines of Y-axis scale, X-axis attribute and graph colors.

10-2-1 Setting of graph title

You can set 2 kinds of graph title : main title and subtitle.



10-2-2 Setting of Y-axis scale

Up to 4 lines of Y-axis can be indicated. When selecting the axis to be indicated, check the check-box of the axis to give check-mark to it. It is definitely important that axis is used from 1 in a sequence. Scale can be set on a axis basis by determining the values of upper-limit, lower-limit and grid spacing.

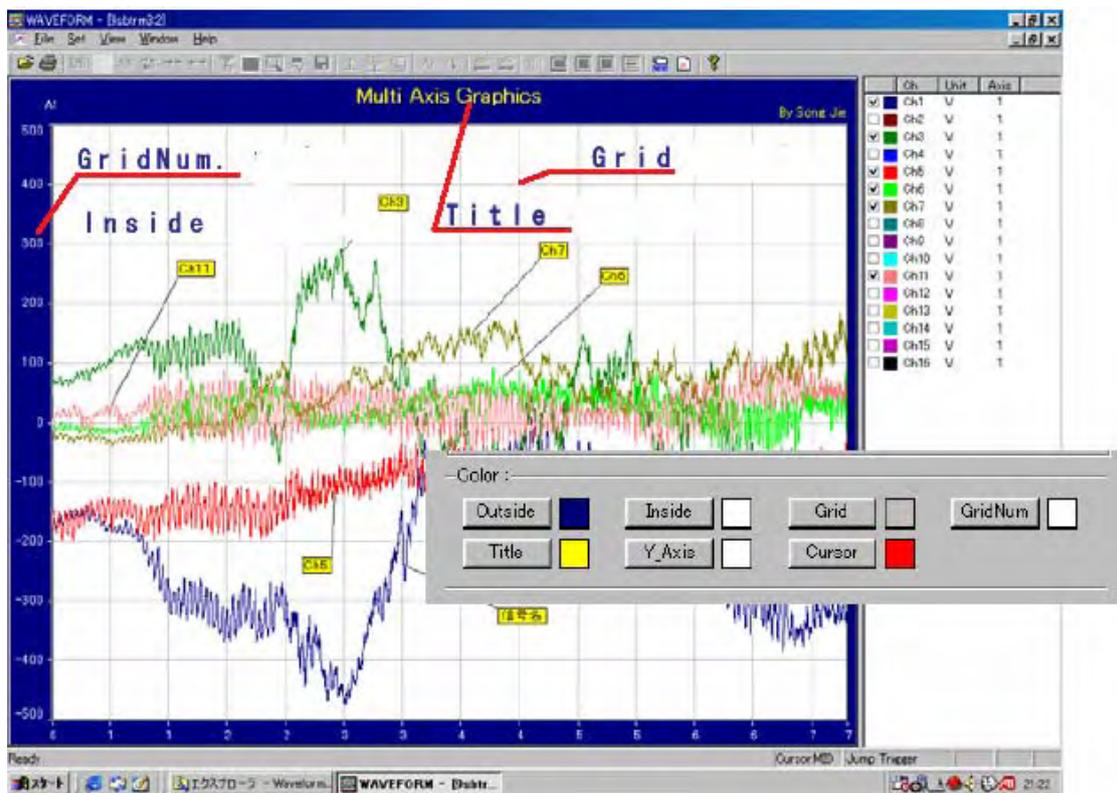
※ Matching between axes and channels to be displayed is not set here.

10-2-3 Setting of scale and attribute of X-axis

You can select time-axis or data-axis for X-axis attribute. Time-axis attribute has been selected as initial value. Scale differs according to the attribute: you can set grid spacing only for time-axis attribute, while you can set upper-limit (left-edge of graph), lower-limit (right-edge of graph) and grid spacing for data attribute.

10-2-4 Setting of graph colors

You can set a different color for each portion of the graph. To set it, click color-box at the side of each item name in the dialog. Click a color-box, and a color palette dialog will appear. Select the proper color from the palette. Names of several parts of graph are described below.

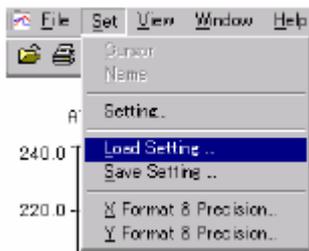


10-3 Storage of graph display conditions



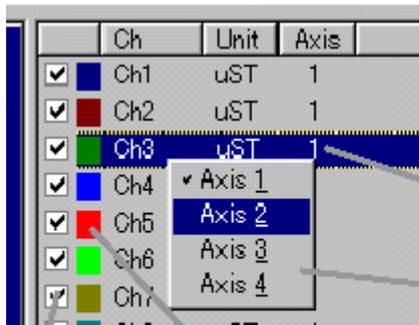
You can save the details of setting dialog in a file. Choose "Save Setting" from the pull-down menu of "Set" on menu bar. Choose it, and a file-saving dialog will appear. Set storage-target folder and filename to store. The storage is carried out in internal format having extension ".mas".

10-4 Readout of graph display conditions



Choose "Load Setting" of the pull-down menu of "Set" on menu bar. Choose it, and a file-readout dialog will appear. Select the file to read and read out pre-stored graph conditions. Presently displayed graph will be redrawn on the basis of readout result.

10-5 Setting of display channel and axis-selection



Right-click here to select Y-axis.

Click here to select display axis.

ON/OFF
indication

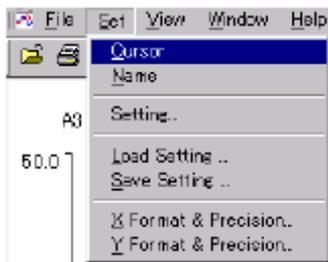
Color box. Right-click here to change color.

A channel-graph is displayed by clicking a check-box at left-edge of the list on right side of multi-axis graph. if unchecking it, the display is deleted. Up to 99 channels of data can be displayed at a time. To select a display' channel's Y-axis, right-click the appropriate channel of reference axis number column from the preset Y-axes.

10-5-1 Setting of display line colors

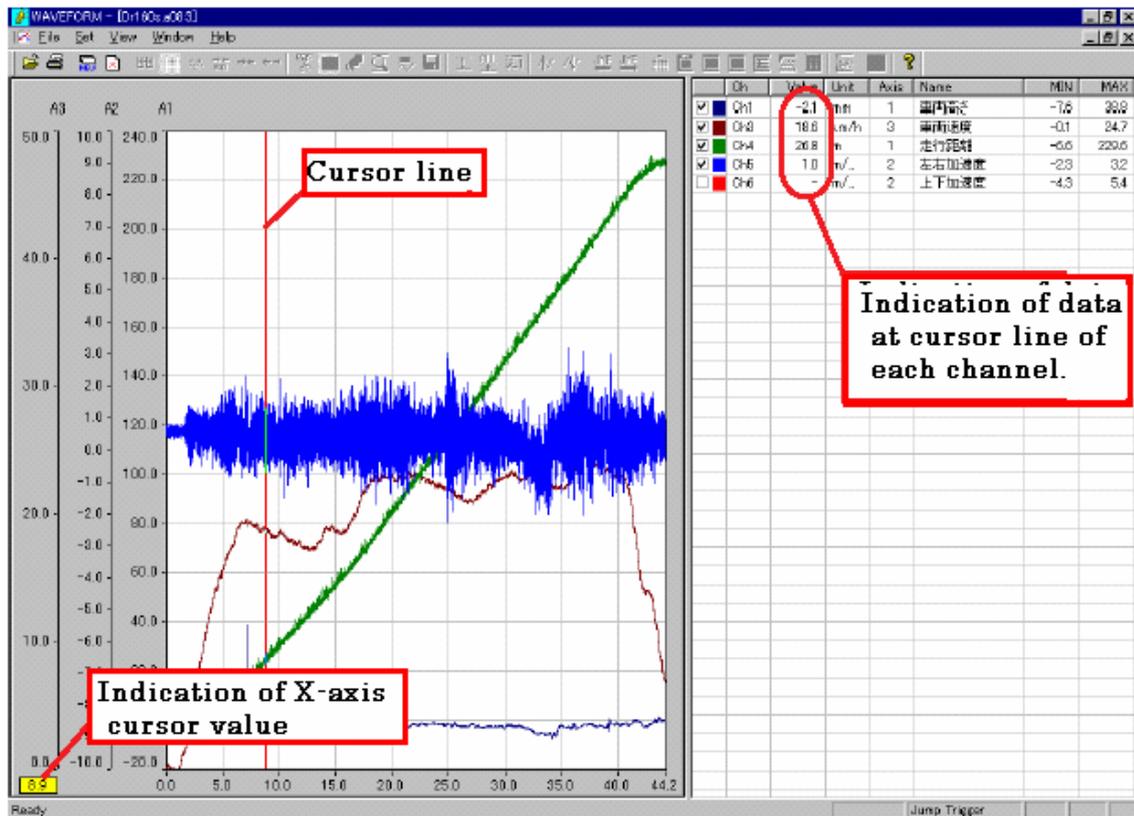
Right-click the color-box of a channel whose line color you want to change in the list on right side of multi-axis graph. Click "Change Color" from the pull-down menu, and a color palette dialog will appear. Select a proper color to display.

10-6 Cursor function of multi-axis graph



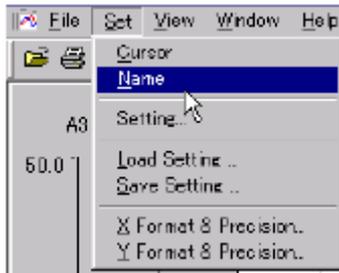
Choose "Cursor" from the pull-down menu of "Set" on menu bar. Choose it, and make it known that cursor function with check-mark turns on. Note, however, that cursor function can not be chosen if X-axis attribute is not time. When cursor function is switched on, cursor line in the graph is displayed. Initial value is left-edge. Left or right movement

of cursor can be operated by dragging it within graph. Data at cursor position is indicated in the list on right side.

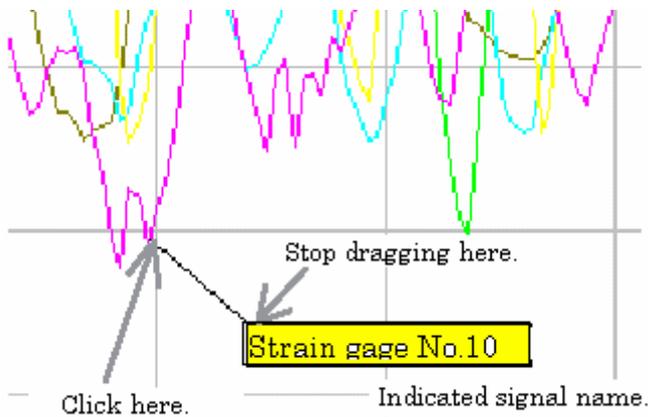


※ Cursor value of display-off-set channel is not indicated.

10-7 Signal name indication function



Signal name indication function enables signal name to be written directly in waveform graph frame. Choose "Name" from the pull-down menu of "Set" on menu bar. It is impossible to make this function effective simultaneously with the cursor function described above. If cursor function is on, select "Cursor" once and after having unchecked it, select "Name" again. When selecting it,



check-mark is given to "Name" to make it known that signal name indication function turns on. To indicate signal name, click the data to be indicated in the graph and then drag to a given position where signal name is to be indicated. If signal name is blank (not set yet), channel number will be indicated.

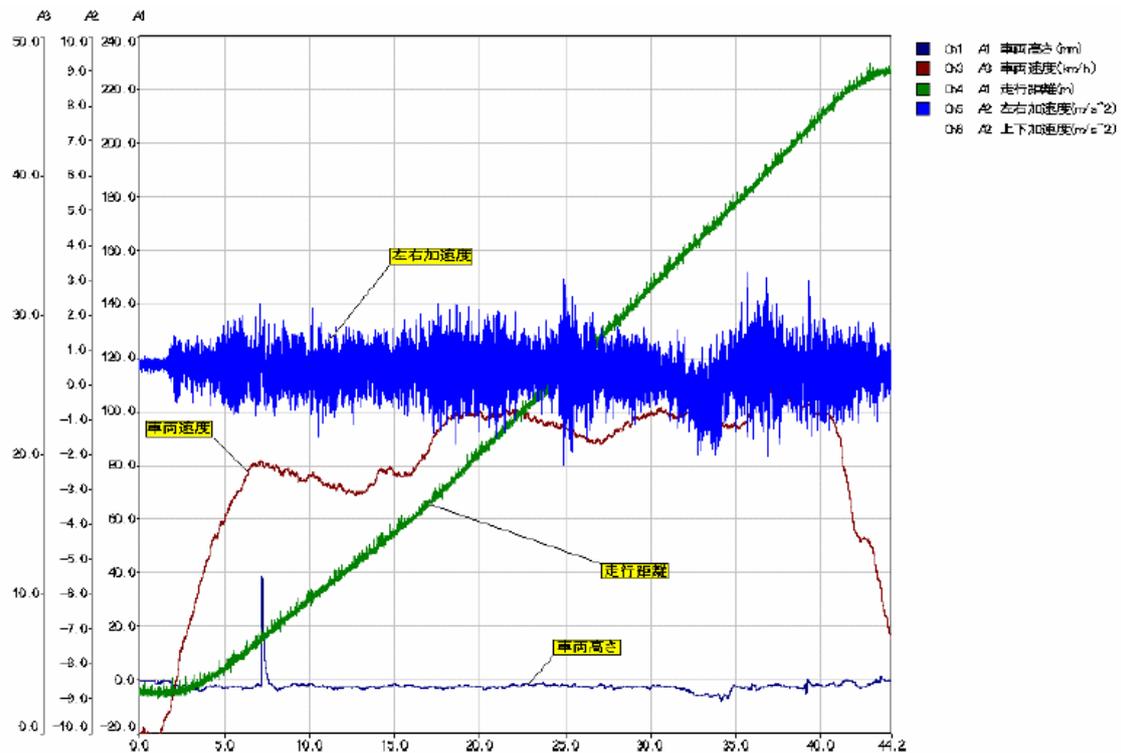
10-7-1 Deletion of indicated signal name

When indication function of signal name that has already been indicated is on, right-click the indicated signal name to delete it.

10-8 Printing of multi-axis graph

Choose "Print" of the pull-down menu of "File" on menu bar, or click the icon 

on tool bar. The connected printer prints out in color. Further, "Print Preview" function is also available. In the case where number of indication channels in multi-axis graph is within 32 channels, graph part and signal attribute part are printed out in a single sheet, while in the case where the number is beyond 32 channels, graph parts are printed out in the same sheet, but signal attribute parts beyond 32 channels are printed out in sequence.

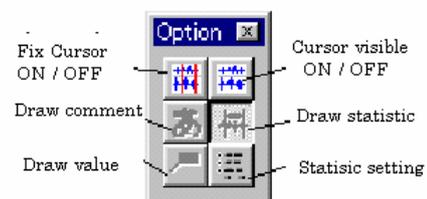
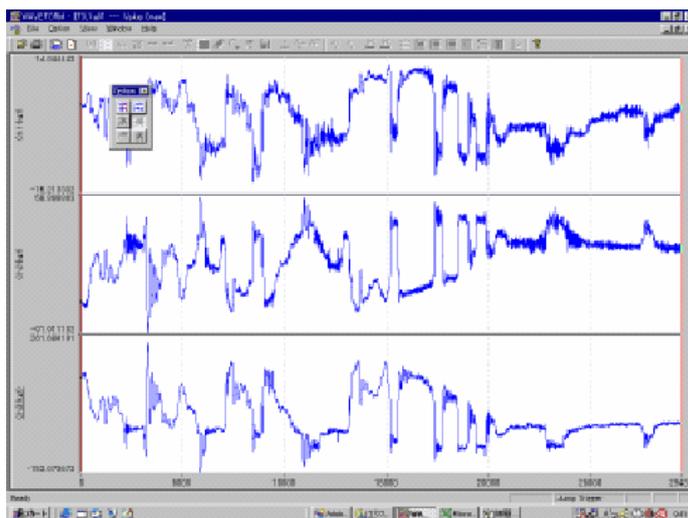


Chapter 11	Value write window
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Number of max display channels	8 channels
Writing mode	comment, value and statistic data
Setting of statistic data	area-max value, area-mini value, area-mean value, area-time, area-mean slope value and area- amplitude value. data value at left cursor position data value at right cursor position data difference value at right & left cursor positions
Cursor function	2 cursor-lines right or left movement-independent manipulation cursor visible ON/OFF fix of cursor ON/OFF
Y-axis scale	AUTO or MANUAL
Setting of numerical value indication format of Y-axis	available
Setting of numerical value indication format of X-axis	available
Printing function	available

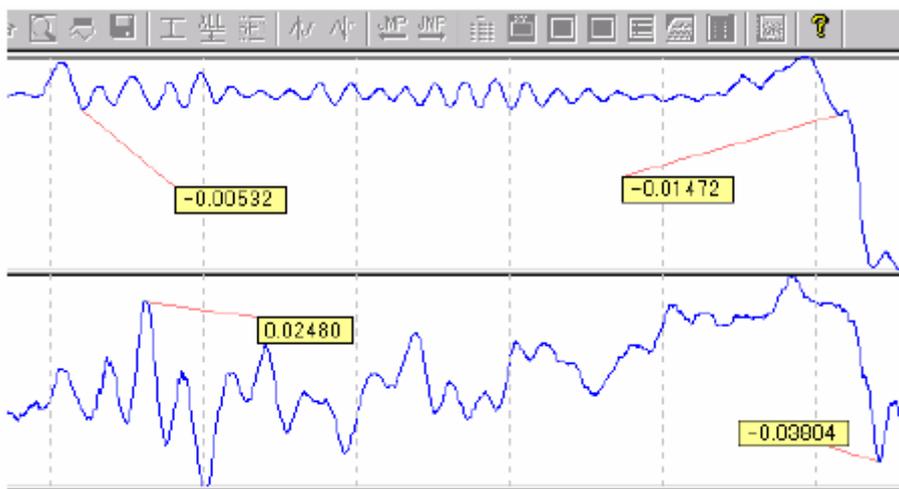
11-1 Initiation of value write window

In this window, you can write comment, value or statistic value within the analysis-defined range of the waveform graph frame. Choose "Draw Value" of the pull-down menu of "Analyze" on menu bar. When chosen, the window which displays up to 8 ch of data domain defined as analysis range will open to show graphs in different graph display strip on a channel basis and additionally display a tool box in the window. The display channels are those which have been shown in waveform display window (analysis guide window). However, if greater than 8 ch are displayed, up to 8 ch are displayed in display order. (This window does not allow overlapped graphs of plural channels to be drawn in a single display strip.)



11-2 Writing of value

First, select "Fix Cursor" or "Cursor Visible OFF" from tool box. In short, the status conditions where cursor is in move-inhibit (visible, though) or cursor is in visible-inhibit are needed. Second, select "Draw Value" from tool box. Move cross-cursor to the waveform position where you want to write value and click there. On clicking, cross-cursor changes to extension line. Drag there to the position where you want to write value. The value will be written at the spot where you stop dragging.



11-2-1 Deletion of written value

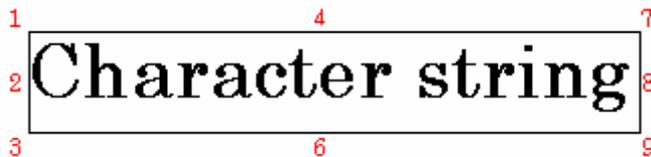
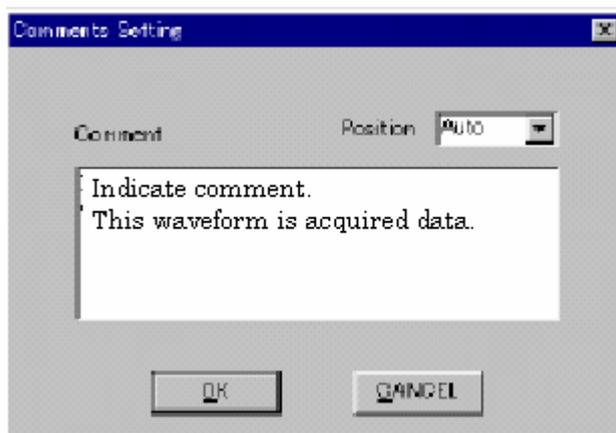
To delete a written value, move mouse cursor onto a written value box and right-click it. A confirming dialog will appear. Click "OK" to delete it.

11-2-2 Moving of written value box

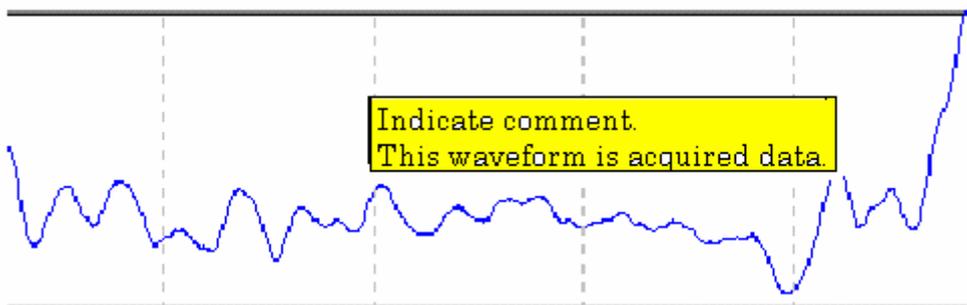
To move a written value box, drag the box to the spot where you want to move and click there. But it is impossible to move it to outside of graph frame of the proper channel.

11-3 Writing of comment

When "Fix Cursor" is on or "Cursor Visible" is off, choose "Draw Comment" from tool box, and comment becomes writable. Move cursor to the position where you want to write comment and click the spot. A comment-creation dialog will appear. Signal name may be indicated as initial value in comment box. To write a given comment, move cursor onto comment box and write comment directly from keyboard. After entering comment, click "OK" button to write it into the pre-clicked spot.



Further, Position on the dialog determines the relation between registration position and write-into-position of comment. Select from Auto, 1, 2, 3, 4, 5, 6, 7, 8, 9.



11-3-1 Deletion of written comment

To delete written comment in graph frame, move cursor onto the comment box and right-click it. On clicking, a confirmation dialog will appear. Click "OK" button to delete

it.

11-3-2 Movement of comment box

To move comment box, drag it. But it is impossible to drag it outside of graph frame.

11-4 Writing of statistic value

You can write max value, mini value, mean value, amplitude value, time-width, etc. within the area enclosed by 2 given cursor-lines. When writing statistic values, calculation area has to be defined by moving cursor-lines. After defining a calculation area once, fix cursor-lines, select "Draw Statistic" from tool box and click a given spot in the area enclosed by cursor-lines. Then statistic value will be written.

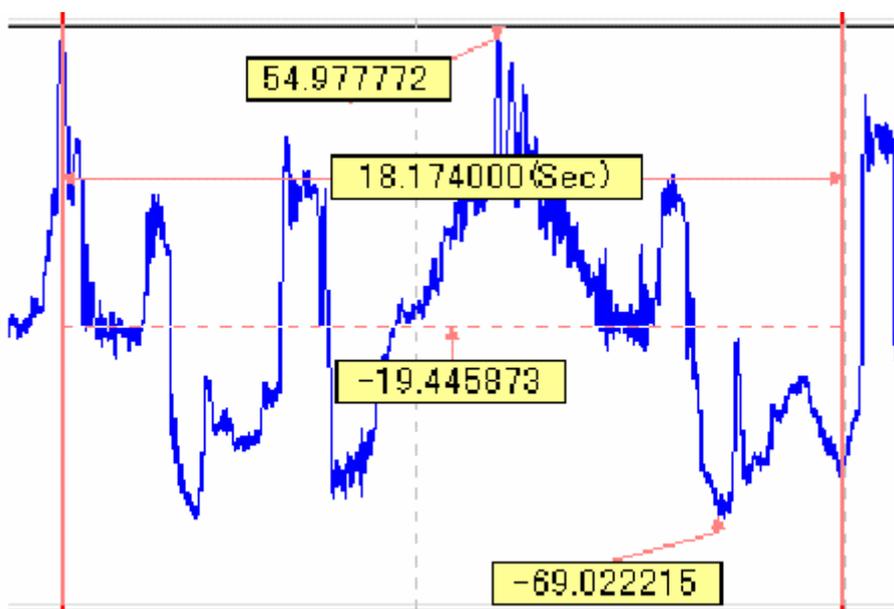
11-4-1 Movement of cursor-line

Select "Fix Cursor" OFF and "Cursor Visible ON" from tool box, and 2 cursor-lines are ready. In this status, click a given spot in graph frame, and a cursor-line near by will move to the clicked location. Likewise, the movement of cursor-line can also be operated by dragging. Minute side-to-side movement of left cursor-line can be operated by right or left arrow key of keyboard, while that of right cursor-line can be operated by Shift + right or left key of keyboard.

11-4-2 Fixing of cursor-line

Select "Fix Cursor" from tool box to fix cursor-line.

11-4-3 Writing of statistic value



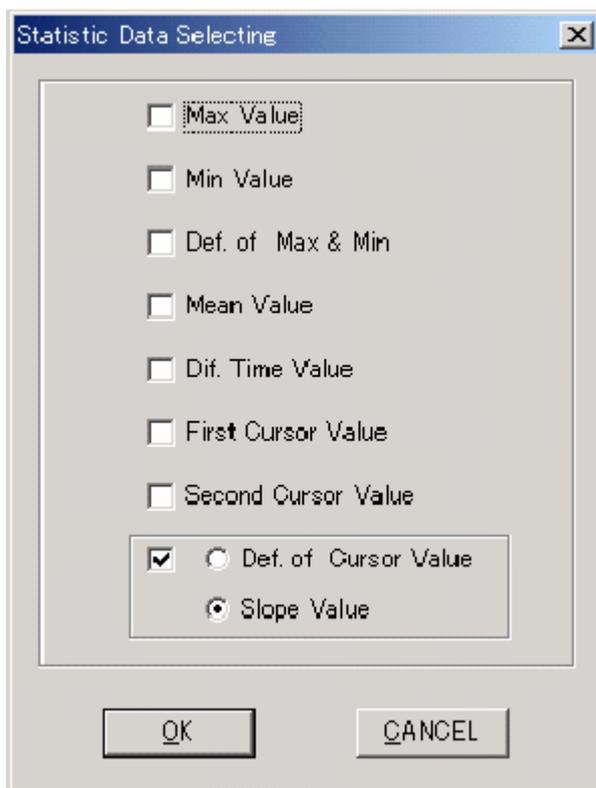
Note:

The chart above shows 4 kinds of values: max value, mini value, mean value and time as an example.

First, in fixed cursor status, select " Draw Statistic" from tool box. Second, click a given spot in the area enclosed by 2 cursor-lines of the channel graph where you want to write, and preset-write items will be written in graph frame. In a sample above, time-width, max value, mini value and mean value are shown.

11-4-4 Statistic setting

Select "Statistic setting " from tool box, and a statistic write-item setting dialog will appear. Check the items which you want to write within graph. Checking of all items does not matter, but note that overlaid writing might result from lack of drawing space.



Max Value : Indicate max value between right & left cursor-lines.

Mini Value : Indicate mini value between right & left cursor-lines.

Def. of Max & Min : Indicate difference of max value and mini value between right & left cursor-lines.

Mean value : Indicate mean value between right & left cursor-lines.

Dif. Time Value : Indicate time-width between right & left cursor-lines.

First Cursor Value : Indicate data value at left cursor position.

Second Cursor Value : Indicate data value at right cursor position.

Def. of Cursor value : Indicate difference between data values at right and left cursor positions.

Slope value : Indicate mean slope values between right & left cursor-lines.

- ※ Simultaneous indication of Def. of Cursor Value and Slope Value can not be done. Either of them is selectively indicated.
- ※ Mean slope is the result of dividing the sum total of difference of first order by time between right & left cursor-lines.

11-4-5 Deletion of written statistic data

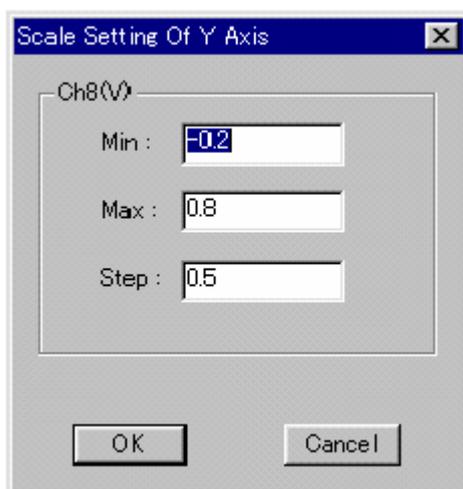
To delete written statistic data box in graph, move cursor onto the box and right-click it. A confirmation dialog will appear. Click "OK" button to delete it.

11-4-6 Moving of statistic value box

When moving each of statistic boxes once written in graph, drag it. But moving outside of the proper channel graph frame can not be done.

11-5 Setting of graph scale

At initial indication time, each of waveform graph scale is indicated by Auto Scale operation according to the data area defined as an analysis range on a channel-by-channel basis. You can change Y-axis scale of display waveform. You can scale it with up or down arrow key from keyboard. In addition to it, you can change it explicitly. Select "Y Manual Scale" from the pull-down menu of "Option" on menu bar, and a scale-setting dialog will appear.



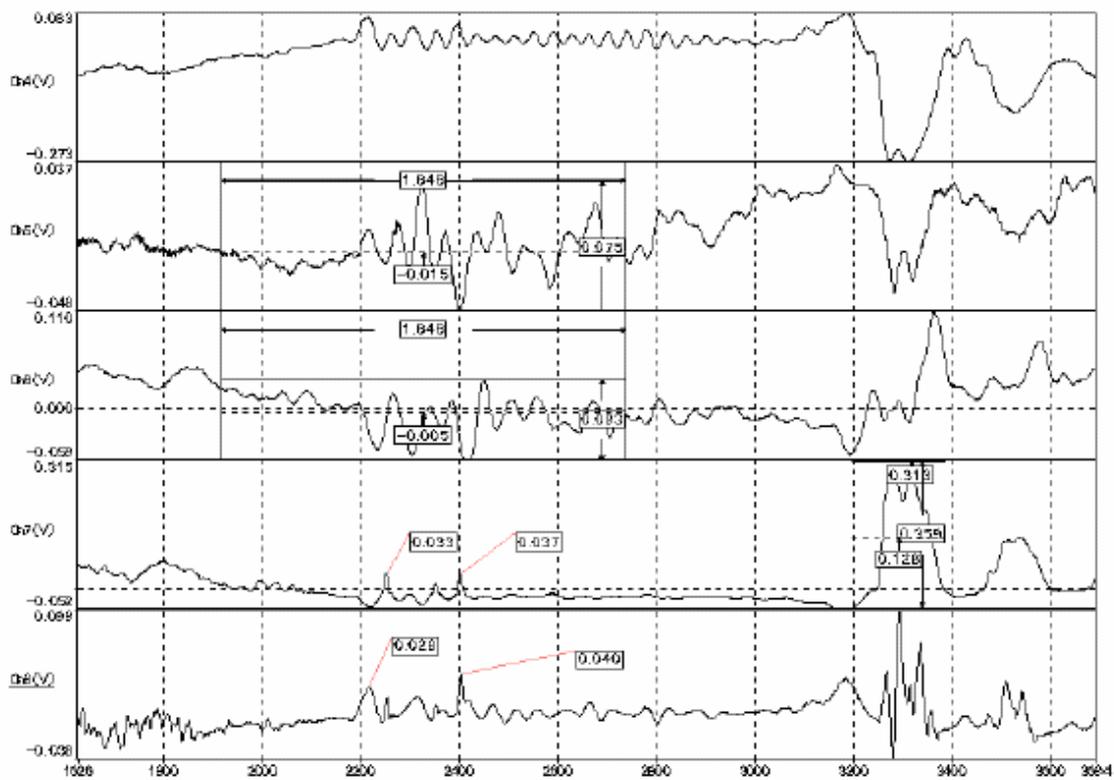
Min box determines mini value of Y-axis of the graph, Max box determines max value of Y-axis of the graph and Step box determines grid spacing of Y-axis. On finishing setting, waveform graph of the proper channel will be redrawn. Note that scale setting is performed on current channel at present. Change of current channel can be done by pressing Tab key on keyboard.

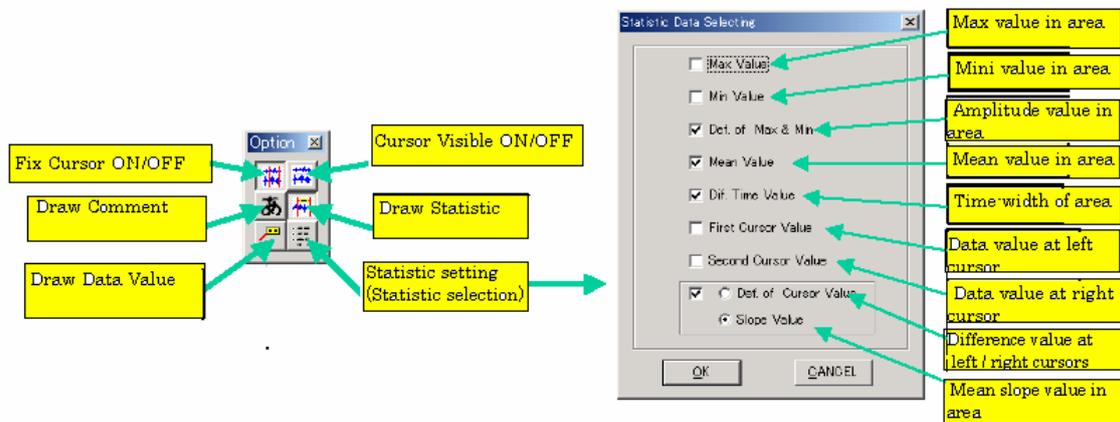
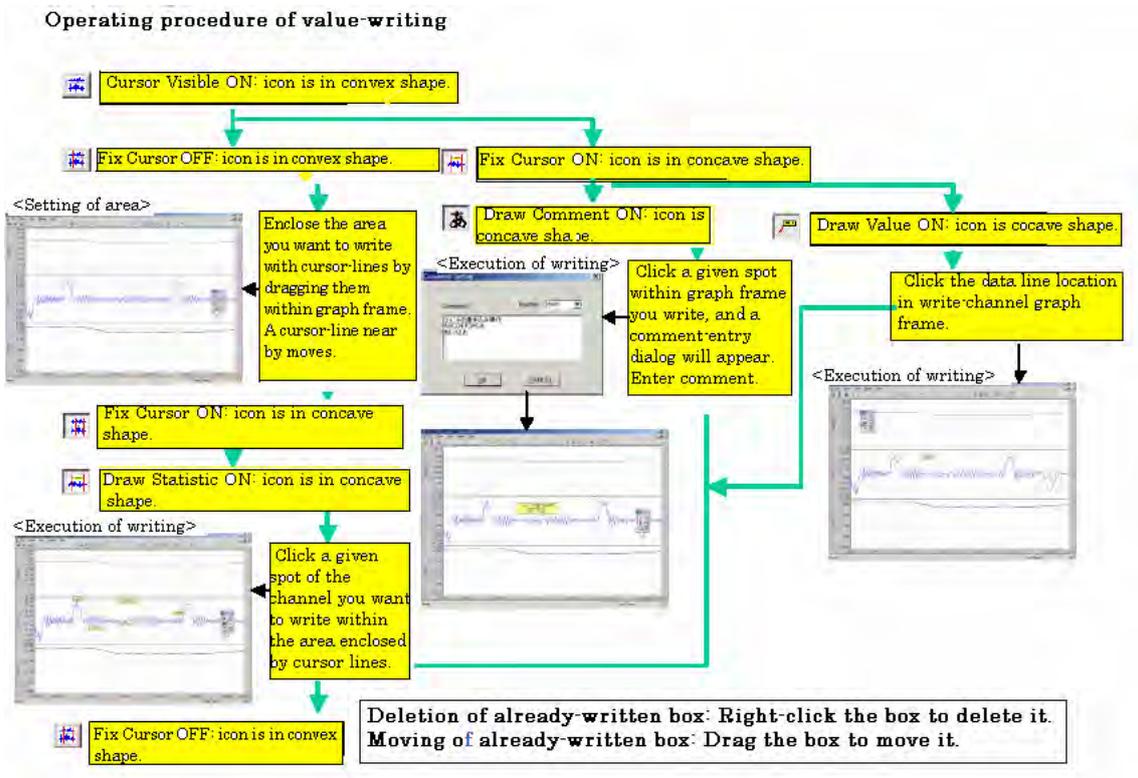
11-6 Setting of numerical value indication format

This window can not allow various formats of numerical values which will be written in graph to be set. Perform it using menu in waveform window. See "Setting of the indication format of Y-axis scale value (1-3-1-3) for further details.

11-7 Printout

It is possible to print out graph together with various written values and waveforms. Choose "Print" from the pull-down menu of "File" on menu bar, and a connected printer will print them out.



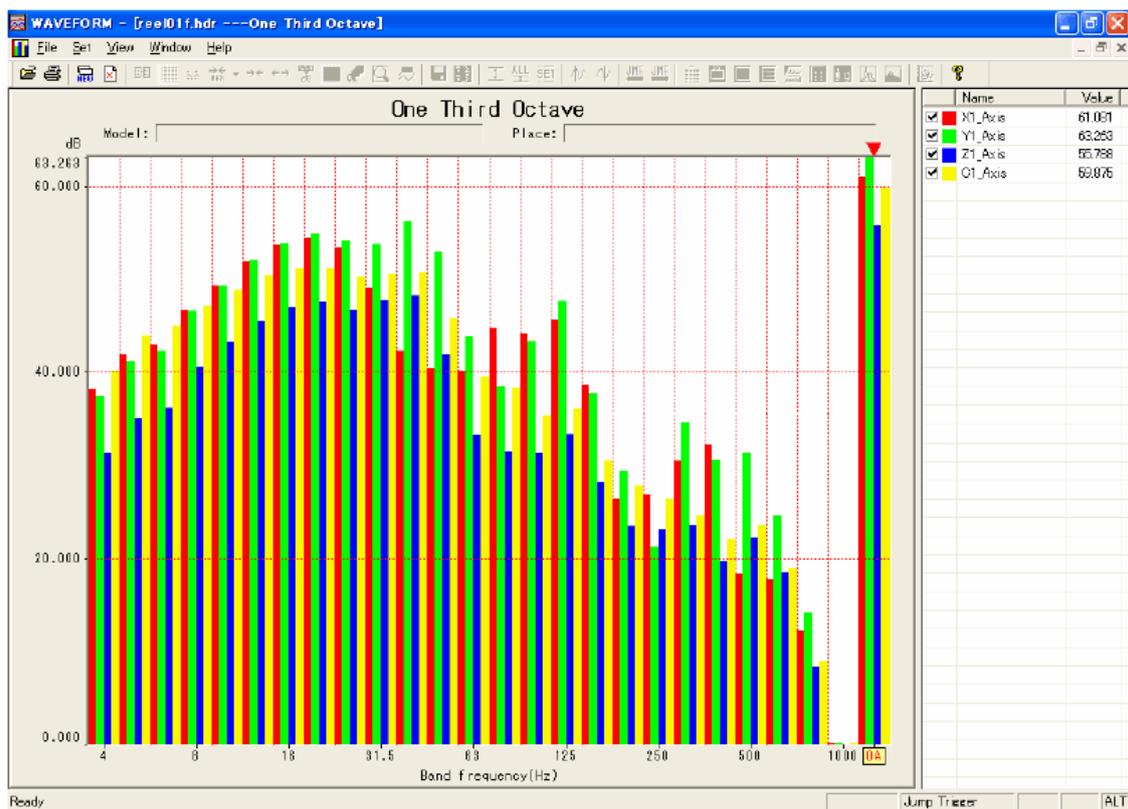


Chapter 12

1 / 3 Octave analysis window

12-1 Initiation of 1 / 3 Octave analysis window

1 / 3 Oct analysis is performed on data of the same signal unit within the analysis-specified range. Choose “1/3 Octave” of the pull-down menu of “Analyze” on menu bar, or click the icon of tool bar. When chosen, the screen will change to 1 / 3 Oct analysis window. Display frequency band is automatically set from the set FFT data-points and sampling frequency at acquisition time.



12-2 Selection of analysis channel

The analysis channels are automatically selected to up to 4 same signal unit channels from current channel on down in waveform display window. Signal name in the window is referred to that of analysis channel. To indicate a display axis, click a check box of the list on right side of graph frame, and a display axis will be shown. On unchecking it, it will disappear.

12-3 Cursor operation

When hitting right or left arrow key on keyboard, mark at top of graph frame moves to indicate current value of frequency band at mark position in the list on right side of graph frame.

12-4 Setting of graph title and indication scale

Select “Condition” from the pull-down menu of “Set” on menu bar, and a setting dialog will appear.

Condition Dialog

Title: One Third Octave

Model: Place:

FFT

Point: 512 Window: FlatTop Overlap: 80

Y Scale

Auto Unit: dB 0dB = 2.0e-005

Max: 63.263 63.263

Min: 0.000 0.000

Grid: 20.000

Min Band Frequency: 4 Hz

OK CANCEL

12-4-1 Setting of graph title

Enter title in title box from keyboard, and the details input here will be indicated as graph-title at top-center outside of graph frame.

12-4-2 Title memo setting

In addition to main title, you can enter a memo into Model box and Place box(a part, measurement site, etc.). This setting is not, however, a required item.

12-4-3 FFT parameter setting

12-4-3-1 Selection of FFT data-points

Select FFT data-points to perform 1/3 Oct analysis. Select an item from among 512,1024,2048 and 4096 in the list box.

12-4-3-2 Selection of window function

Select a window function for FFT processing. Select an option from among an optional list of OFF, Hamming, Hanning, Blackman, KaiserBessel, FlatTop or Exponential.

12-4-3-3 Overlap ration setting

Set overlap ration. Initial value is 80.

12-4-4 Y-axis scale setting

You can select either AutoScale or manual setting. To select auto scale, check autoscale check box. To select manual setting, uncheck the check box. When unchecking it, you can set max scale, mini scale and grid-spacing. If you want to display the data by converting it into dB, specify 0dB value.

12-4-5 Mini band frequency setting

It is automatically set by sampling frequency and the selected FFT data-points.

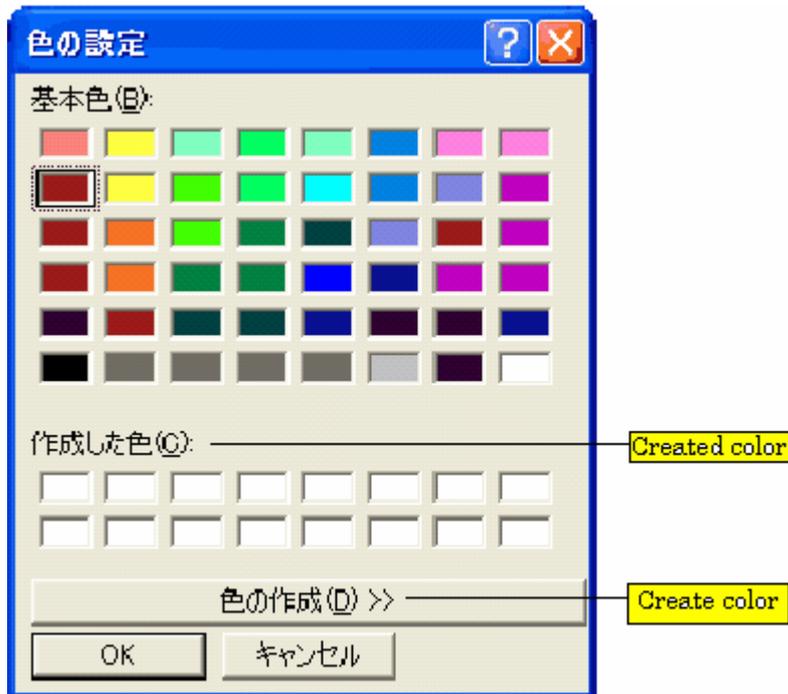
12-4-6 Graph display form setting



The initial value is displayed by a bar chart. You can select Bar (bar chart) or Line for graph display type. Select Bar or Line from the pull-down of “Graph Type” of “View” on menu bar.

12-4-7 Display color setting

Right-click color box on right side of display ON/OFF check box in the list on right side of graph frame. Then a color pallet dialog will appear.



Click display color box, and hit OK. Then display color of selecting axis will change to the set color. Further, if you want to use the non-existing color on the dialog, click “Create Color” button, and the dialog will expand to create a given color.

12-4-8 Saving of 1 / 3 Oct analysis results

Choose “Save as” from the pull-down menu of “File” on menu bar. When chosen, a file-save dialog will appear. Specify a file to save it.

12-4-9 Save format

Analysis results are saved in TEXT format with extension csv. Identification item, analysis filename, etc are described from 1st to 4th lines. Analysis results are described from 6th line on down. The center frequency (nominal frequency) of frequency band is described on 1st column and after 2nd column, values of each axis are described.

A sample of stored analysis results that have been read by EXCEL is shown below.

< See format below for details.>

12-4-10 Printing of analysis result graph

Choose “Print” from the pull-down menu of “File” on menu bar, and the connected printer will print out the result graph. < See next page for details.>

<< Stored format >>

1/3 Octave Analysis				
FILE:	reel01f.hdr	34071	73922	39852
TITLE:	One Third Octave			
CONDITION:	512	FlatTop	80%	
Center Freq	X1_Axis (dB)	Y1_Axis (dB)	Z1_Axis (dB)	C1_Axis (dB)
4	38.112257	37.415139	31.36609	40.158506
5	41.882373	41.185255	35.136206	43.928622
6.3	42.885806	42.188688	36.139639	44.932055
8	46.724338	46.613447	40.469244	47.061928
10	49.272351	49.336115	43.165593	48.869962
12.5	51.838494	52.009601	45.418863	50.376188
16	53.622588	53.86172	46.88886	51.179901
20	54.517058	54.926004	47.531877	51.192308
25	53.463901	54.111929	46.697453	50.290471
31.5	49.038296	53.736336	47.79566	50.628027
40	42.248451	56.271235	48.276917	50.774819
50	40.292798	52.977971	41.842757	45.715603
63	40.136027	43.754084	33.26042	39.580714
80	44.732737	38.465713	31.565973	38.280112
100	44.128305	43.267389	31.370701	35.412341
125	45.6799	47.692644	33.372838	35.99622
160	38.603283	37.670902	28.161548	30.604276
200	26.468607	29.418445	23.528287	27.908453
250	26.924915	21.217261	23.205814	26.441111
315	30.575132	34.740443	23.671018	24.651875
400	32.391479	30.706481	19.696442	22.074575
500	18.332095	31.35305	22.26439	23.660139
630	17.678943	24.651376	18.444956	18.912352
800	12.192418	14.254792	8.291569	8.853811
1000	0.000081	0.000103	0.000052	0.000055
OA	61.080997	63.262952	55.788386	59.874591



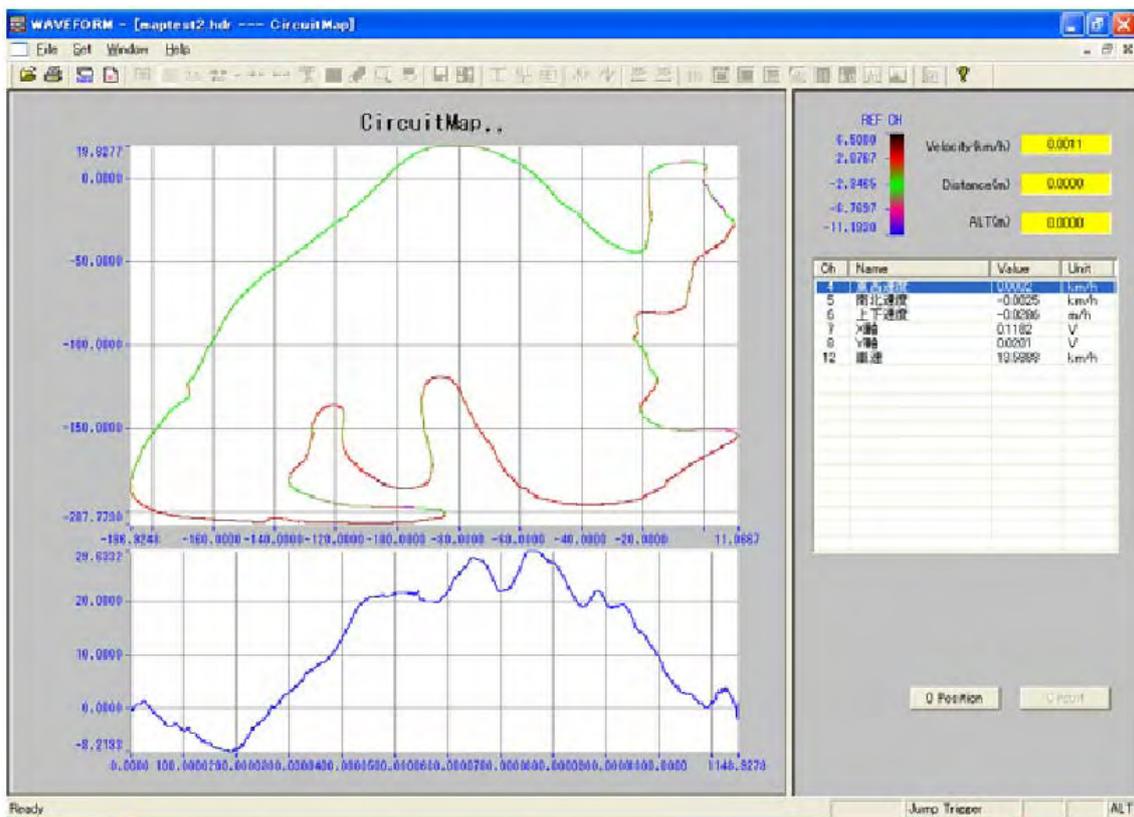
Chapter 13	Travel behavior window
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Graph form	Plane chart (Y-axis: North-South, X-axis: East-West) Altitude chart (Y-axis: Ups and Downs, X-axis: travel distance) Plane chart + Altitude chart
Cursor function	Gang operation with waveform display window by cursor Travel behavior window Independent, switch-capable
Travel behavior chart	Create using acquired data (north-south velocity, east-west velocity, up-and-down velocity)
Course map	Matching by using acquired data (vehicle velocity)
Map conversion function	Available using travel behavior chart
Color map function for plane chart	Specified channel data, vehicle velocity, relative altitude

13-1 Initiation of travel behavior window

Travel behavior can be shown in the window when such data as north-south velocity(km/h), east-west velocity (km/h) and up-and-down velocity (km/h) is included in acquired data. Further, if acquired data contains travel velocity (km/h), it is possible to read and display course map data in travel behavior window that has been created in the proper window in advance.

The travel behavior window can open to display a travel behavior graph on condition that has been set just before, when choosing “Circuit Map” from the pull-down menu of “Option” on menu bar after specifying analysis range.



13-2 Display condition setting



When choosing “ Condition” from pull-down menu of “ Set ” on menu bar, a condition-setting dialog will appear.

13-2-1 Map data attribute setting

To draw travel behavior data (map data), select either currently acquired data or pre-saved course map file to use them.

13-2-1-1 Drawing travel behavior by using acquired data.

Select “Data”. Then channel selection box becomes effective.

Set north-south velocity channel in N-S Velocity box. And select east-west velocity channel and up-and-down velocity channel in E-W Velocity box and in U-D Velocity box, respectively. In all cases, travel behavior map is drawn by assuming unit to be km/h.

Travel behavior chart can not be drawn by using acquired data if such data as north-south velocity, east-west velocity and up-and-down velocity does not exist in acquired data.

13-2-1-2 Drawing travel behavior by using pre-saved course map file.

Select “File”. Then “File” box becomes effective. Click “Browse” button to display a file-read dialog. Then set pre-saved course map file. And at the same time specify velocity data channel. The unit of velocity data channel is treated by assuming the unit to be km/h.

Should velocity data channel not exist, course map can not be referred to.

In addition, when referring to course map, you can set Start Offset value. Set correction value in unit(m) in the box, if there is a difference using course map and analysis-defined range with respect to each start-point.

13-2-2 Graph type selection

Select graph type for travel behavior or course map.



For plane, a plane chart will be drawn in graph type defining north-south distance as Y-axis and east-west distance as X-axis. For altitude, an altitude chart will be drawn in graph type defining relative altitude as Y-axis and absolute distance as X-axis.

Plane + Altitude will display both of plane chart and altitude chart simultaneously.

13-2-3 Specifying cursor attribute

Check Cursor Attribute check-box to render it Linked attribute, the cursor moves to the same position on travel behavior or course map by linking with cursor operation in waveform display window. On unchecking it, linked operation stops and cursor operation is performed in the proper window.

Set the number of jump-points at cursor's high-speed movement operation under the non-link status (Link-unchecked) of the window with other window.

13-2-4 Color map specification

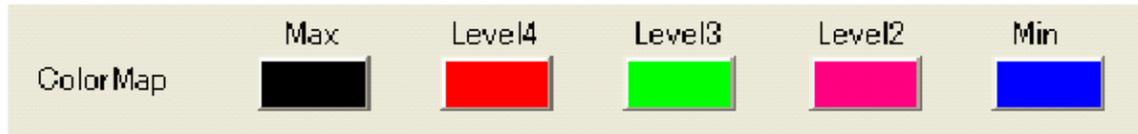
You can specify screen color elements (parts of a window) of travel behavior or course map. Make a choice among 4 kinds below for color attribute.

- | | |
|---|--|
| <input type="radio"/> Mark | Mark: Based on MARK-by-MARK information in acquired data, color level changes and the course is colored. |
| <input checked="" type="radio"/> Ref.Ch | Ref.Ch: Based on data value of acquisition channel, course is colored. |
| <input type="radio"/> Velocity | Velocity: Based on travel velocity, course is colored. |
| <input type="radio"/> Altitude | Altitude: Based on relative altitude, course is colored. |

In addition, when selecting travel velocity or relative altitude, color level scaling can be done.

13-2-5 Color level setting

Color levels to be applied to a course are divided into 5 color setting from max value to mini and automatically gradated except when Mark is selected as color attribute.

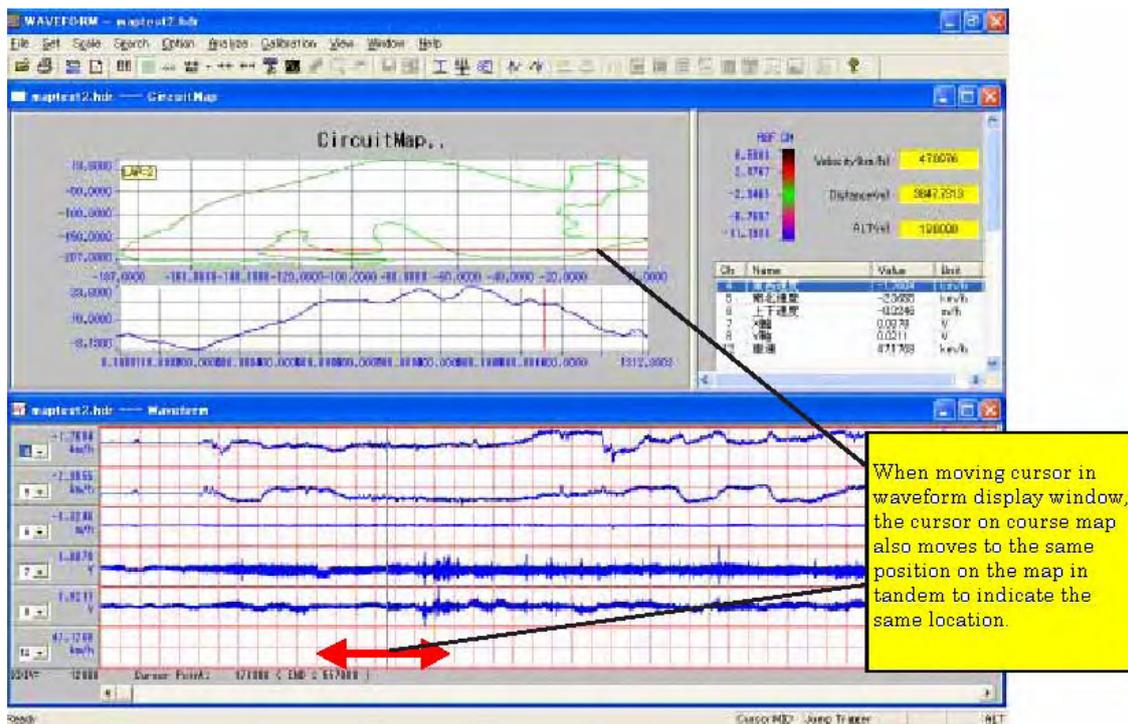


To change color level, click color button, and a colors palette dialog will appear. Choose a given color.

13-3 How to operate cursor.

13-3-1 Gang operation (Linked-check) setting with other window.

The cursor moves in tandem with the cursor operation in waveform display window.



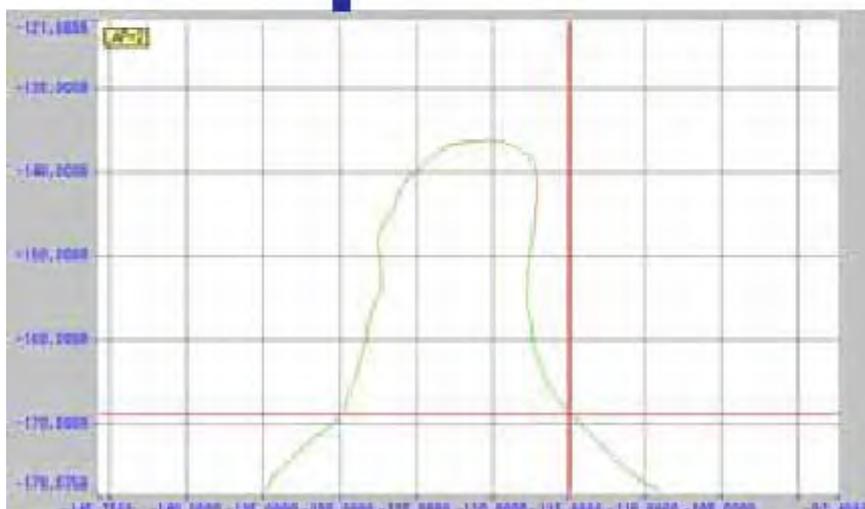
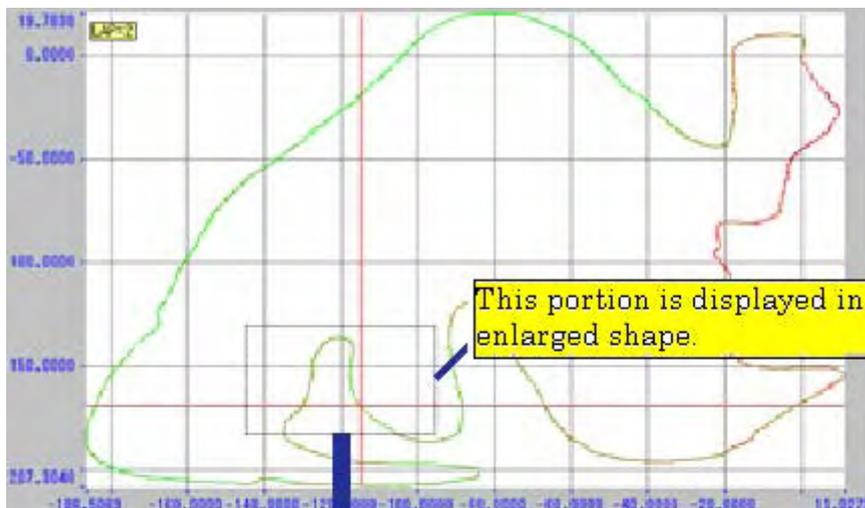
Should the cursor move across analysis-specified range in waveform display window, it stops moving at exceeding bounds. On entering into analysis range, it starts linked movement. Further, regardless of whether the cursor is in non-display status or specified analysis range has been changed, the set analysis range at initiation of travel behavior window is effective as it holds internally.

13-3-2 Setting of non-linked movement with other window (Linked-uncheck)

When cursor is in non-linked status, it is possible to operate cursor in travel behavior window. Use right or left key on keyboard to move cursor. If you want to move it at high-speed, hit right or left key + Shift key on keyboard.

13-4 Enlarging of travel behavior or course map

On dragging a portion of travel behavior or course map you want to magnify, a frame which depicts magnifying portion appears in the window by keeping the same aspect ration as that of presently displayed graph. When stopping dragging, enlarged travel behavior or course map is shown on the screen.



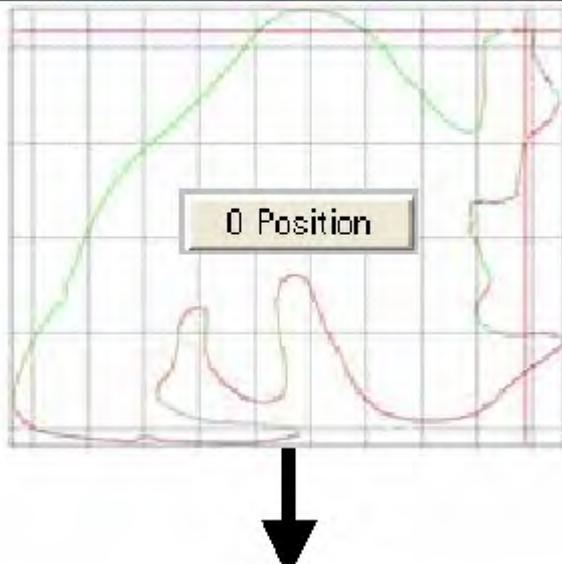
Magnifying operation can be performed repeatedly. To put it back to previous shape, right-click within graph frame, and travel behavior or course map returns to the first status.

13-5 Conversion from travel behavior to course map

You can convert travel behavior to course map. Having converted, it is possible to refer to pre-created course map, if vehicle's velocity data exists. When travel behavior is displayed, "0 Position" on lower right side of the window becomes effective.

13-5-1 Course map start-point setting

Set course map start-point to be extracted from travel behavior.



Move a cursor's position on travel behavior graph to a given course map-start position. If you want to render a drawing's start-point course for map start-point, hit "Home" key on keyboard.

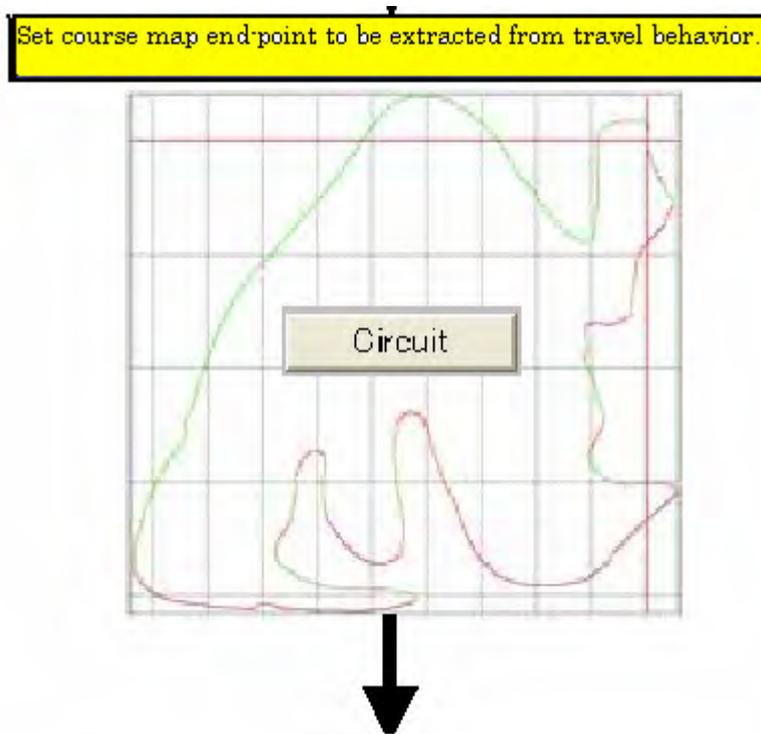
After the cursor has moved to the start-point, click "0 Position" button to define the location as start-point. And when "0 Position" button is hit, "Circuit" button becomes effective.

button becomes effective.

Non-link operation setting(Linked-uncheck) is required to move cursor in the window.

13-5-2 Course map end-point setting

Move a cursor's position on travel behavior graph to a given course map-end position. If you want to move cursor to end-point of travel behavior graph, hit "End" key on keyboard. At the time of clicking "Circuit" button, travel behavior during display is converted to course map and redrawn.

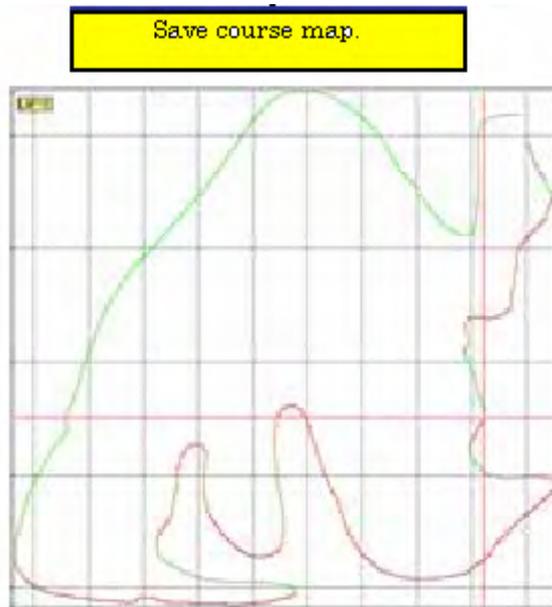


13-5-3 Restoration from course map to travel behavior

Restoration to travel behavior can be done by double-clicking course map just after conversion to course map. When reading and displaying course map-converted result file, however, restoration to travel behavior is not allowed.

When restoring course map to travel behavior, "0 Position" button becomes effective again.

13-5-4 Course map storage



To store course map-converted results, choose “ MapSave” from the pull-down menu of “ Set ” on menu bar. When chosen, a file-saving dialog will appear. Enter a filename to save it.

13-5-4-1 Course map file format

Course map is saved in TEXT-formatted file with extension csv.

1st line displays identification line and “CIRCUIT ” is indicated on 1st column.

At 2nd line- 1st column, the set title “Circuit Map” is described. 3rd line is data header line.

Data is described from 4th line on: North-South relative distances are described on 1st column,, East-West relative distances are described on 2nd column and Altitude relative values are described on 3rd column, respectively. In all cases, values are expressed in unit (m).

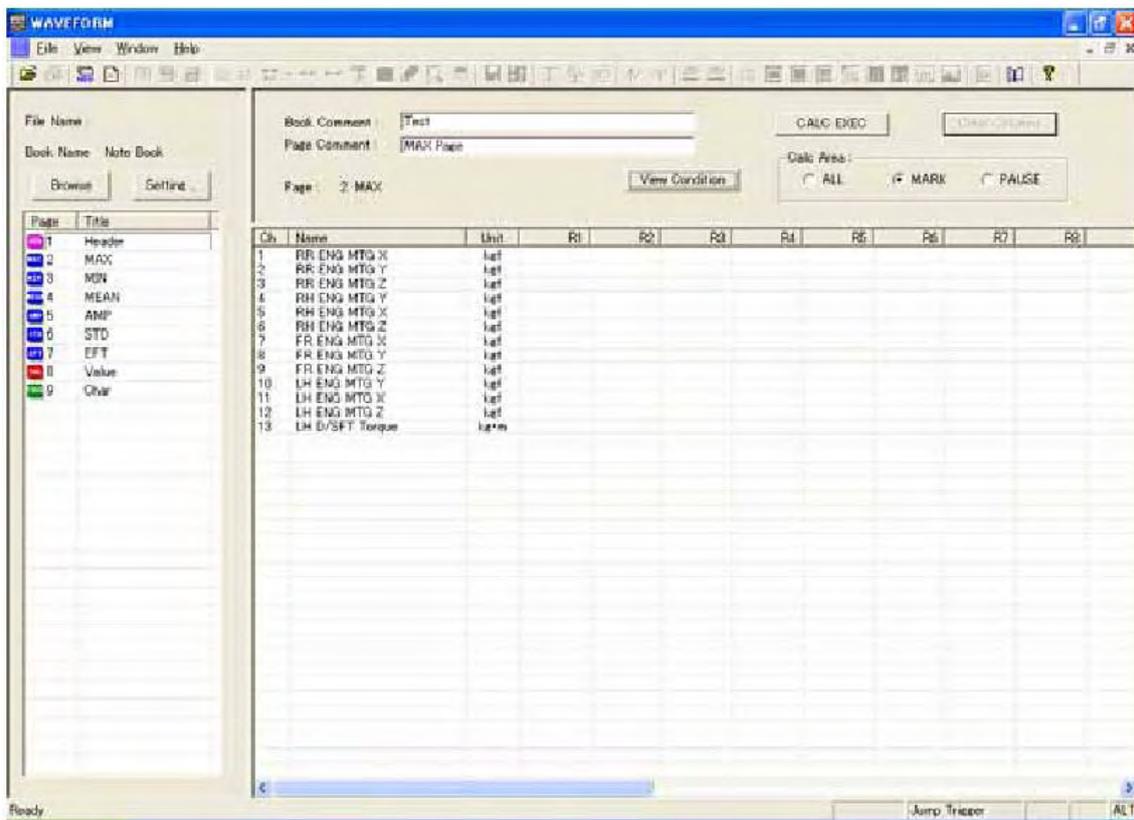
CIRCUIT	TIME		
CircuitMap			
N-S(m)	E-W(m)	ALT(m)	
0	0	0.00049991	
0	0	0.00199964	
0	0	-0.0004666	
-0.006908	0	-0.0048991	
-0.006908	0	-0.0019663	
0	0	0.00143307	
0	0	0.00386596	
-0.0103553	0	0.00139975	

Chapter 14**NoteBook window**

Calculation items	Max value, Mini value, Mean value, Max amplitude value, Variable value and Effective value
Page attribute	System (leading page, calculation result pages) User (numeric value setting page, memo setting page)
Max number of pages	Initial value (system 7 + user 2=9 page) Max number of pages 20 pages
Max number of channels in a page	1000 ch
Max number of calculation results in a page	1000 times
Settable evaluation condition variety	7 variety

14-1 Initiation of NoteBook window

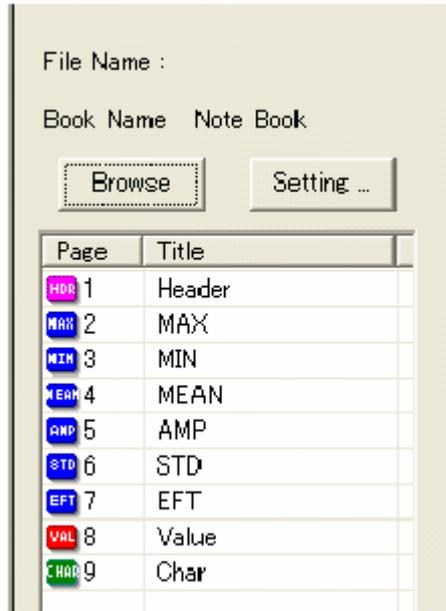
NoteBook window is used to record & manage the statistical values of acquisition file. Besides the function of calculating statistical values on a MARK section basis from the same acquisition file at a time, you can record statistical values across acquisition files to the same NoteBook file. To initiate NoteBook window, choose “NoteBook” from the pull-down menu of “Analyze” on menu bar. You can initiate it without specifying analysis range, but if so set, another calculation result can not be added newly. When initiating NoteBook window after specifying analysis range, the window can calculate statistical values within the specified analysis range to record them into the NoteBook file. When initiated, a NoteBook window will appear.



14-2 NoteBook configuration

NoteBook is made up of 9 pages (initial) and the attribute has been decided on page-by-page basis. The first page describes the analysis result-sought range, filename and so on. From next pages on, calculation result pages computed on operational item-by-item basis, the specification value page, etc. are configured as definable pages. Present page configuration is displayed on left side of the window and current page is displayed on right side.

14-2-1 The display of already-existing notebook file and calculation appendage.



When displaying pre-created notebook or adding calculation results, you need to specify and read out the notebook file. You can display a file under an initial value-set status to perform calculation and record calculation results without specifying the file, you can not, however, write additional data to the pre-created notebook unless specifying the file. To confirm whether the presently displayed page indicates the pre-created file details or those in memory alone, check the filename field at upper-left corner of the window. If the field is blank, a notebook in memory alone is displayed.

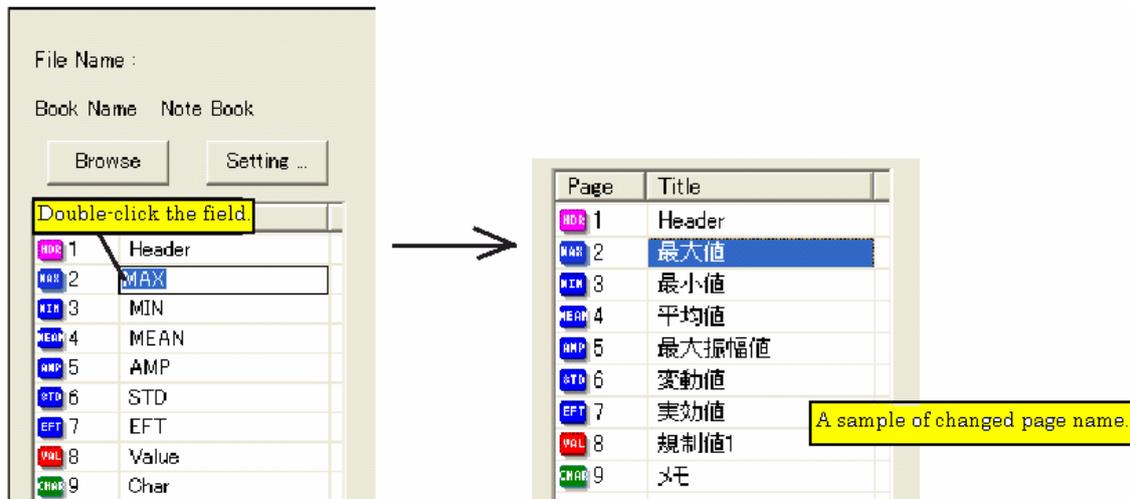
To read out a file to register, click “Browse” button. Then a file-reading and registration dialog will appear. Specify a read-out file in the dialog.

When exiting NoteBook window, it is automatically closed And once a filename is specified, the details of the file is automatically read out at next opening of NoteBook window.

Under non-specified file status, if you read an already-existing notebook, presently displaying data is updated by that of readout notebook file.

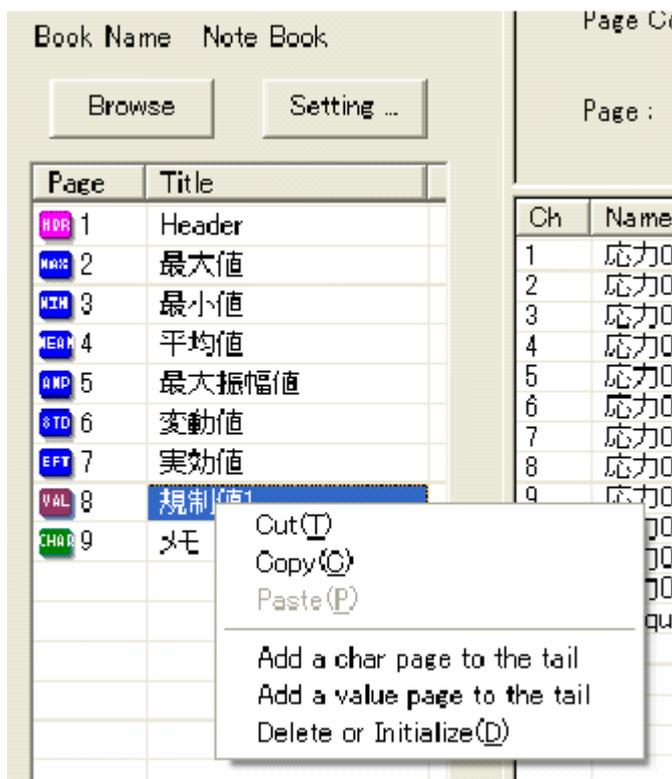
14-2-2 Page name setting

You can name pages on a page basis. At initial stage, a leading page is named as Header and subsequent pages that describe calculation results are named in mnemonics expressing each operational details such as MAX for max value-described page, MIN for mini value, MEAN for mean value, AMP for max amplitude value, STD for variation value and EFT for effective value. In addition, pages that express a set value and the setting memo are named as Value and Char, respectively. Page name can be changed. Double-click a page name field (Title) to enter a given page name.



14-2-3 Addition / deletion and initiation of page

You can delete or add the initially set Value and Char pages. However, leading and subsequent pages that describe calculation results can not be deleted or added. Right-click page name field, and a page-edit menu will appear.



When adding a page, make a choice among the following options according to additional page attribute.

“Add a char page to the tail” adds a memo page to last page.

“Add a value page to the tail” adds a value page to last page.

When deleting or initializing a page, choose “Delete or initialize”.

While set Value and Char memo pages can be deleted, leading and calculation result display pages can not. They will be initialized instead.

14-2-4 Changing of current display page

Double-click a page number field you want to display, and the appropriate page window will be displayed.

Page	Title
1	Header
2	最大値
3	最小値
4	最大振幅値
5	変動値
6	実効値
8	規制値1
9	メモ

Ch	Name	Unit					
1	応力001	MPa	0.000	0.000	0.00		
2	応力002	MPa	0.000	0.000	0.00		
3	応力003	MPa	0.000	0.000	0.00		
4	応力004	MPa	0.000	0.000	0.00		
5	応力005	MPa	0.000	0.000	0.00		
6	応力006	MPa	0.000	0.000	0.00		
7	応力007	MPa	0.000	0.000	0.00		
8	応力008	MPa	0.000	0.000	0.00		
9	応力009	MPa	0.000	0.000	0.00		
10	応力010	MPa	0.000	0.000	0.00		
11	応力011	MPa	0.000	0.000	0.00		

14-2-5 Page configuration

Pages are organized in such way as channels are indicated in line direction while calculation results in column-wise direction. In short, one-time calculation occupies a column.

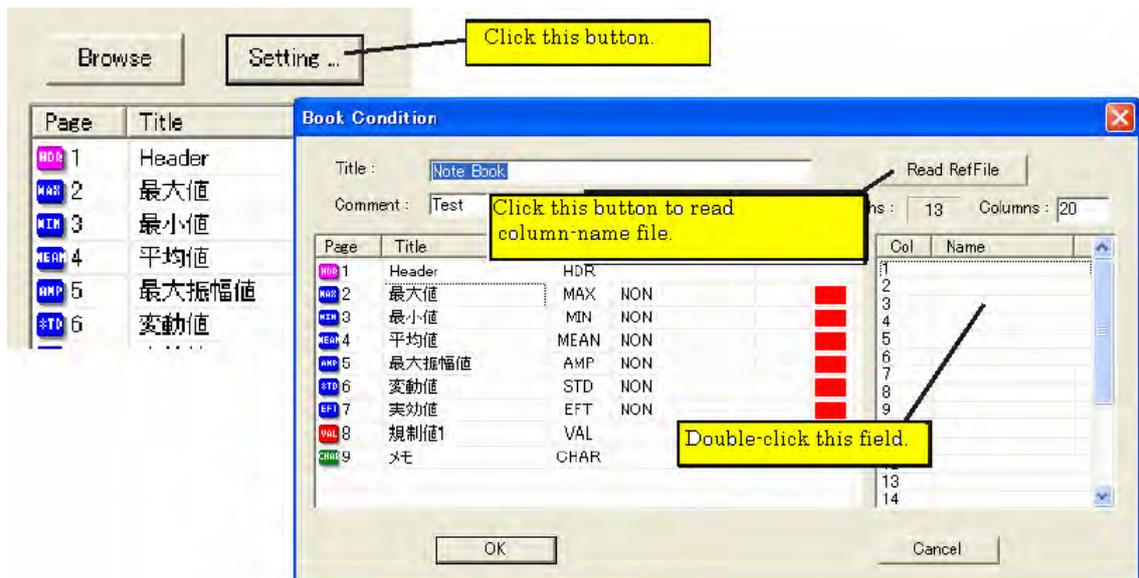
Ch	Name	Unit					
1	応力001	MPa	0.000	0.000	0.000	0.000	0.000
2	応力002	MPa	0.000	0.000	0.000	0.000	0.000
3	応力003	MPa	0.000	0.000	0.000	0.000	0.000
4	応力004	MPa	0.000	0.000	0.000	0.000	0.000
5	応力005	MPa	0.000	0.000	0.000	0.000	0.000
6	応力006	MPa	0.000	0.000	0.000	0.000	0.000
7	応力007	MPa	0.000	0.000	0.000	0.000	0.000
8	応力008	MPa	0.000	0.000	0.000	0.000	0.000
9	応力009	MPa	0.000	0.000	0.000	0.000	0.000
10	応力010	MPa	0.000	0.000	0.000	0.000	0.000
11	応力011	MPa	0.000	0.000	0.000	0.000	0.000
12	応力012	MPa	0.000	0.000	0.000	0.000	0.000
13	Torque	kg·m	0.000	0.000	0.000	0.000	0.000

(Note) Channel direction

Calculation-times direction

14-2-6 Setting of column names

Click “Setting” button at the top of page list, and a condition-setting dialog (Book Condition) will appear.



There are two kinds of ways that are prepared to set column-names. One is entering them into column-name list on the dialog and the other is reading them from pre-created column-name file. In the latter case of reading them from file, click “Read ReFile”, and a file-loading dialog will appear. Specify a file to read it.

14-2-6-1 Column-name file format

Column-name file is in TEXT format with extension .csv. 1st column represents column number, and 2nd represents column-names.

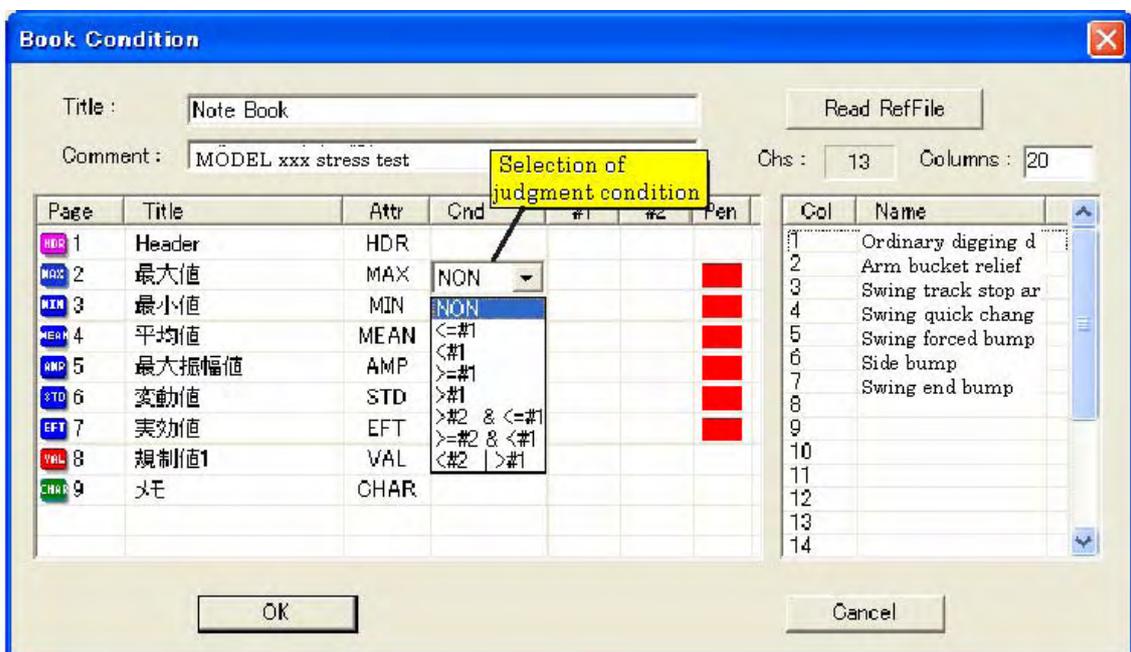
Described sample is shown below.

1. Ordinary digging dozer lowering
2. Arm bucket relief
3. Swing track stop arm elongation
4. Swing quick change
5. Swing forced bump
6. Side bump
7. Swing end bump

14-2-7 Judgment notation setting

It is possible to change display color of calculation result numerical value that meets setting condition by comparing calculation results to the set numerical values described on numerical value setting page. By using judgment values or specification values set in numerical value page, the results calculated from acquired data can be made in a form that gives instant judgment.

Set judgment notation on condition setting dialog.

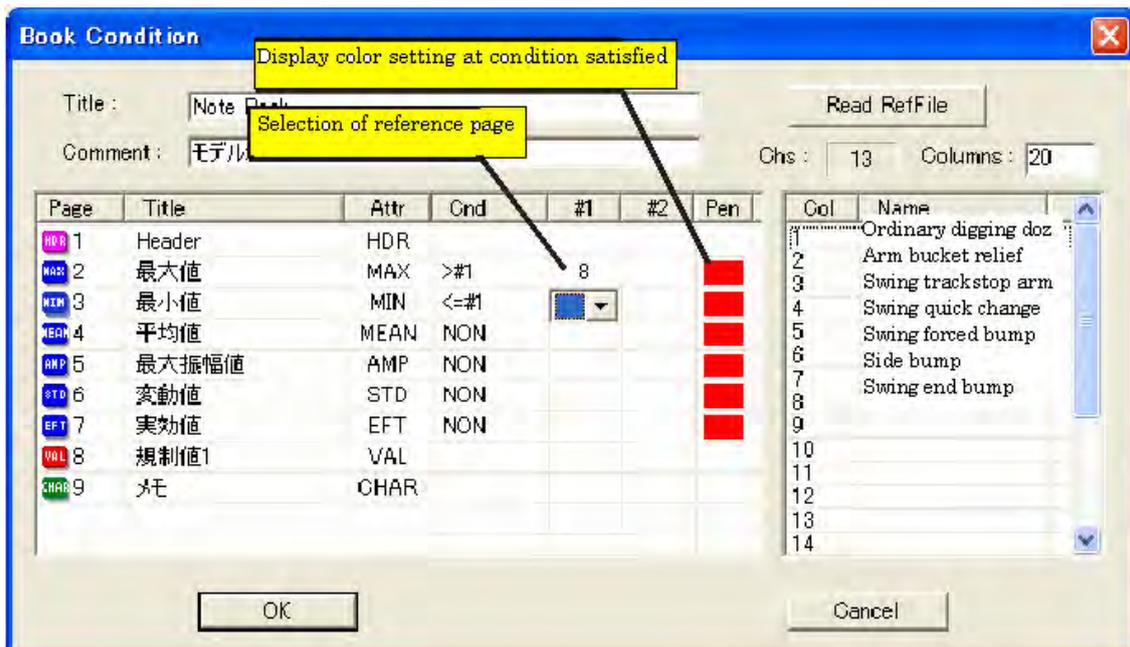


Double-click "Cnd" field of page list on the dialog to select an option from among settable condition list options.

Settable conditions are described below.

Conditional expression	Details	No of refer. pages
NON	Condition-free	0
$\leq \#1$	Hold for less than or equal to ref. value	1
$< \#1$	Hold for less than ref. value	1
$\geq \#1$	Hold for greater than or equal to ref. value	1
$> \#1$	Hold for greater than re. Value	1
$\geq \#2 \ \& \ < \#1$	Hold for greater than or equal to re. Value 2 and less than ref. value 1	2
$> \#2 \ \& \ \leq \#1$	Hold for greater than ref. value 2 and less than or equal to ref. value 1	2
$< \#2 \ \ > \#1$	Hold for less than ref. value 2 or greater than ref. value 1	2

To set reference value page, double-click #1 field or #2 field after deciding Cnd and select a settable value page. Double-click Pen field to set display color at the time when conditional expression is satisfied. On double-clicking Pen field, a color-pallet dialog will appear. Set a given display color.



14-2-8 Edit of numerical value setting page (User-specified setting page)

Double-click the value setting page on left side of notebook window to display the numerical value setting page (initial value: Value) you want to edit.

Double-click a cell to input, and the cell becomes input-available. Enter numerical value to it directly. Further, right-click the cell to display edit-menu. You can copy the cell to paste it to other cells. This practice can save you from having to enter each cell.

Ch	Name	Unit	Ordinary dig	Arm bucket	Swing track	Swing quick	Swing forced	Side bump	Swing end bu
1	Stress001	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
2	Stress002	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Stress003	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
4	Stress004	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Stress005	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
6	Stress006	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
7	Stress007	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Stress008	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
9	Stress009	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
10	Stress010	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
11	Stress011	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
12	Stress012	MPa	100.000	0.000	0.000	0.000	0.000	0.000	0.000
13	Torque	kg·m	100.000	0.000	0.000	0.000	0.000	0.000	0.000

14-3 Calculation execution

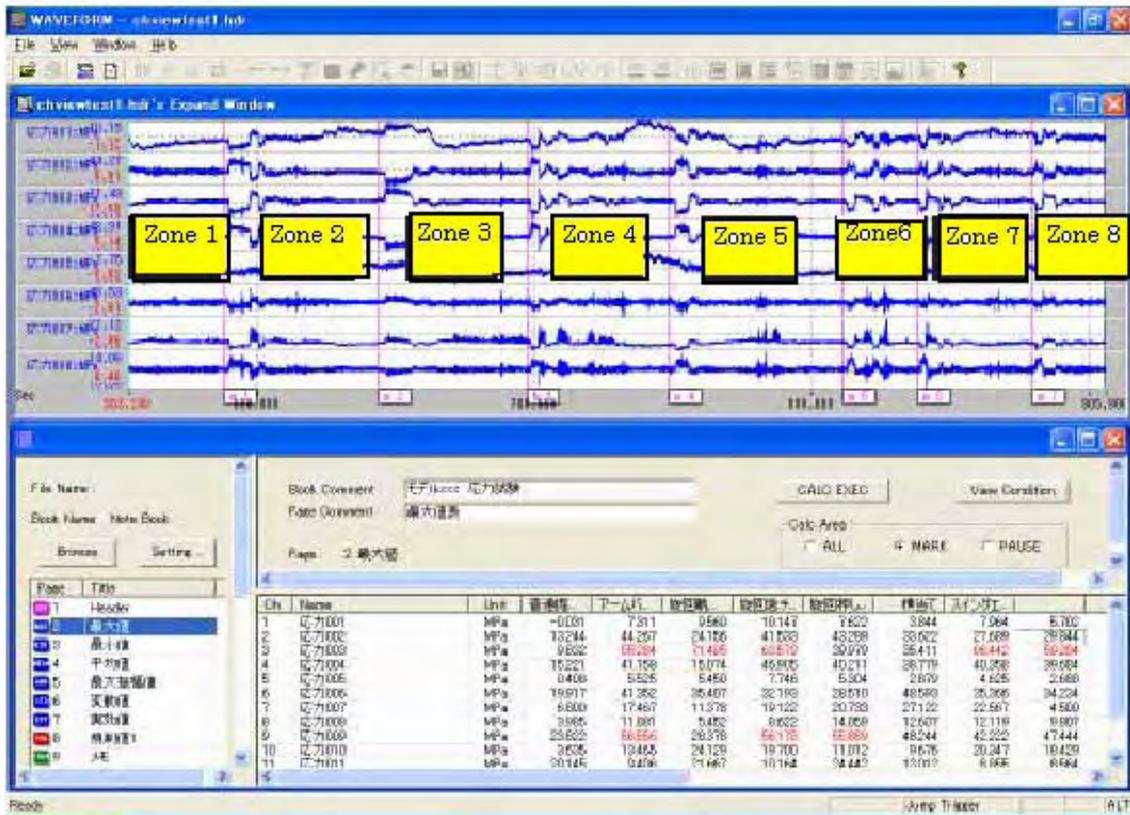
Initiate NoteBook window after having specified analysis range, and “CAL EXEC” button becomes effective. When clicking the button, the window calculates the specified analysis range and load the results to calculation result pages. Calculation range conforms to the direction of selected Calc Area.

For example, if “ALL” is selected, calculation is performed by regarding the whole of the specified analysis range as calculation area. If “MARK” or “PAUSE” is selected, calculation is performed on MARK-to-MARK ranges, or PAUSE-to-PAUSE ranges included in analysis range.

Note that the result uses the column corresponding to the section separated by “MARK” or “PAUSE”. The cell which has become effective in the judgment condition-set status will be indicated by the set PEN color.

The screenshot shows the WAVEFORM software interface. The 'Calc Area' section is set to 'ALL'. The 'CALC EXEC' button is highlighted with a yellow box and labeled 'Calculation execution button'. The 'Calc Area' section is also highlighted with a yellow box and labeled 'Selection of calculation area'. The main window displays a table of calculation results with the following columns: Ch, Name, Unit, 書込範囲 (Ordinary dig), アームバケ (Arm bucket), 旋回軌跡 (Swing track), 旋回急止 (Swing quick), 旋回強制 (Swing forced), 側面バンプ (Side bump), and スイングエンド (Swing end bu). The table contains 6 rows of data.

Ch	Name	Unit	書込範囲	アームバケ	旋回軌跡	旋回急止	旋回強制	側面バンプ	スイングエンド
1	X軸加速度	G	-0.0031	7.211	9.999	10.147	7.622	3.844	0.106
2	Y軸加速度	G	13.244	44.267	24.155	41.539	43.399	22.622	0.123
3	Z軸加速度	G	0.9932	65.284	71.896	63.679	39.929	35.411	0.174
4	ピッチレート	deg/s	15.223	41.158	15.074	46.905	40.211	38.779	0.638
5	ロールレート	deg/s	0.409	5.525	5.453	7.746	5.304	3.079	1.040
6	ヨーレート	deg/s	19.917	41.262	35.407	22.199	29.010	48.599	106.495

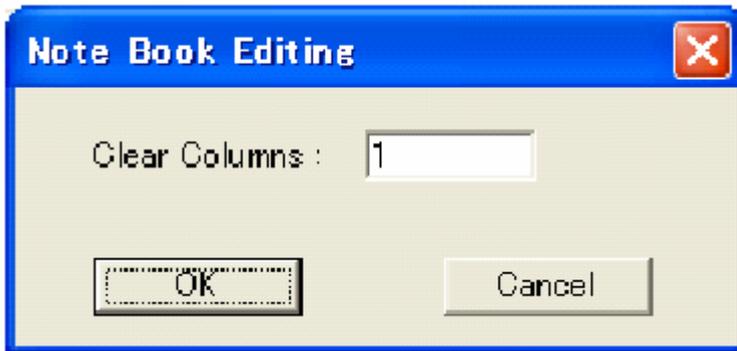


Though selecting “MARK” or “PAUSE” for calculation area, the values of whole analysis range are sought unless “MARK” or “PAUSE” exists. In short, the result becomes the same as when “ALL” is selected.

In the case where “MARK” or “PAUSE” is contained in calculation area, calculation result is sought by regarding the section between the start-location specified as analysis range and first “MARK” or “PAUSE” existing within analysis range as 1st Zone, while it is also sought by regarding the section between the final-location specified as analysis range and last “MARK” or “PAUSE” existing within analysis range as last zone. Therefore, if you want to seek calculation results on MARK-by-MARK basis, you need to set “MARK” to “MARK” locations precisely within analysis range when specifying the range.

14-3-1 Cancellation of calculation execution

To cancel once-produced calculation result, click “Clean Columns” button. Then an execution-calculation dialog will appear. Enter number of cancellation columns counted in reverse order from last column. For example, as initial value is set 1, it means that the last column among calculation result columns is to be cancelled.



It is impossible to initiate in-between columns.

14-3-2 Sharing of NoteBook file among different acquisition files

You can use the same NoteBook file for a different acquisition file. But you can not use the same NoteBook file whose windows are opened at the same time. Notebook file is updated every time the window is closed. Therefore, if you want to write the results of different acquisition file into the notebook at the same time, closing of notebook window is required every time acquisition result is written.

For example, in the case where 2 kinds of A & B acquisition files are displayed at the same time (to write B-file result additionally on the notebook file that has recorded A-file result.), use the following procedure :

- ① Specify analysis range on waveform display window of A-file.
- ② Initiate NoteBook window.
- ③ Register a NoteBook file to be recorded on.
- ④ Execute calculation.
- ⑤ Close NoteBook window. → The notebook file closes after the result has been recorded in it.
- ⑥ Specify analysis range on waveform display window of B-file.
- ② Initiate NoteBook window.
- ③ Read out the notebook file to record. → The notebook window opens.
- ④ Execute calculation.
- ⑤ Close notebook window. → It closes after the results added on the notebook file have been recorded.

To share a notebook file between different files, difference in their sampling frequencies does not matter, but their channel series and unit need to be the same. If different, channel series of the file that becomes analysis-targeted acquisition file newly is given priority.

If signal name and unit of the same channel no. differ, they are updated to the signal name and unit described in the file that becomes finally targeted for analysis.

Should a non-existing channel in just prior results be included, the channel is automatically added.

Should a channel that has been existing in just prior result be not included, the result of the channel is deleted.

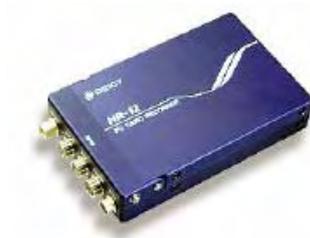
Chapter 15

Acquisition data format

15-1 Applicable devices

This program can be applied to data files acquired through such PC card recorders as HR - 12, HR - 12R, DR- 160S, DR - 200, DR - 600, WR – 80, and data files created by PcWaveForm program.

HR-12 12ch PC card recorder



DR-200 16ch PC card recorder



15-2 Acquisition data file configuration

Acquisition data file is made up with header-file of TEXT format and binary data-file of binary format in pairs. Data-file and header-file have a filename in common, but are distinguished with extensions.

15-2-1 Extension of header-file

2 kinds of extensions ".hdr" or ".axx" exist and they are used according to acquisition devices. "axx" is composed of leading character of "a" and 2 digits of subordinate numerics.

15-2-2 Extension of binary data-file

2 kinds of extensions "dat" or "dxx" exist and they are used according to acquisition devices. "dxx" is composed of leading character of "d" and 2 digits of subordinate numerics. When extension of header-file is "hdr", that of binary data-file becomes "dat". In the same way, when extension is "axx", that of binary data-file becomes "dxx". Mixed use can not be allowed.

15-2-3 Filename

In principle, the same filename is used for header-file and binary data-file in common, but a different filename, if used, does not produce any problem. For information, all of the files that have been acquired by PC card recorders use the same filename. When a file is created by extensions of "hdr" and "dat" in pairs, the filename is modified and 2 digits of numerics are added to its end. On the other hand, when a file is created by extensions of "axx" and "dxx" in pairs, numerical numbers is given to extensions as described before, but the file is not modified. These numerical numbers increment (+1) as an identifier of repeated acquisition under the same filename by PC card recorder. Note that filename is upper/lower case sensitive.

PC card recorders whose files are created in pairs of "axx" and "dxx":

DR - 160 / 160S / 200.

PC card recorders whose files are created in pairs of "hdr" and "dat":

HR - 12, WR - 80 and DR - 600.

15-3 Header-file format

Acquisition conditions, etc. are described in header-file. Basic grammar follows keyword { parameter { , parameter { , parameter } } } format. Keyword is described with half-size capital letters. Keyword-to-parameter is separated with a half-size space and parameter-to-parameter is separated with a half-size comma " , " . Number of parameters is determined by keyword meaning and is unlimited in number.

Header-file sample

```
DATASET TEST_A12
VERSION 1
SERIES CH_1, CH_3, CH_4, CH_5
DATE 03-12-1998
TIME 20:56:27
RATE 200
VERT_UNITS mV, uST, uST, V
HORZ_UNITS Sec
NUM_SERIES 4
STORAGE_MODE INTERLACED
FILE_TYPE INTEGER
```

```

SLOPE  8. 000000e-04, 4. 000000e-02, 4. 000000e-02, 0. 000000e+00
X_OFFSET  0. 000000e+00
Y_OFFSET  -1. 280000e-02, 6. 000000e-01, -2. 400000e-01, 0. 000000e+00
NUM_SAMPS  2462
DATA
DEVICE  DR-160
FILENAME  TETS.D12
MARK  600, 20:56:30
END  2462

```

15-3-1 DATASET line (mandatory, leading line)

Grammar DATASET header-filename_hdr

Denote header-filename. But filename-to-extension is described with "_" (half-size underline)

ex. of description: DATASET test_a01 it denotes that header-file is test.a01.

15-3-2 VERSION line (mandatory, 2nd line)

Grammar VERSION number

Denote version of header-file. But number "1" (half-size number) is fixedly described.

ex. of description: VERSION 1 fixed.

15-3-3 SERIES line (mandatory)

Grammar SERIES channel number {, channel number {, channel number {, channel number {, channel number parameter } } } }

Denote relation between channel no. of acquisition data and acquired data. Channel numbers are required by the same number of acquisition channels. Describe channels with number or character string incl. number. Channel no. has to be half-size and unique. Sequence of channel numbers must conform to that of acquisition data channels

ex. of description: SERIES ch1, ch2, ch4, ch5, ch8 it means sequence of acquisition channels.

When extracting described channel no., the number to encounter initially in character string describing channel no. is recognized as channel no. For example, when describing Abc23_ch1, 23 is recognized as channel no.

15-3-4 DATE line (mandatory)

Grammar DATE MM - DD - YYYY

This is the line where date of acquisition start time is described and mandatory. 2 digits of MM represent month, 2 digits of DD represent day, and YYYY represent Christian era.

ex. of description: DATE 02-03-2004 it means acquisition starting date is on Feb.03 in 2004.

15-3-5 TIME line (mandatory)

Grammar TIME hh:mm:ss

Indicate time at acquisition data no. 0 position. The time of day is half-size and is expressed with 2 digits of 24-hour format. Minute is described with 2 digits sandwiched between two colons and second is described with 2 digits separated between minute and second by a colon. In each case where time is represented with a single digit, it is added with 0 to be made 2 digits. The time to be recorded refers to present time of calendar clock mounted in PC card recorder at acquisition start time. Strictly speaking, accuracy may have an error of ± 1 sec, though the mounted clock is precise.

ex. of description: TIME 16:08:09 it denotes acquisition start time is 16 hour:8 minute:9 second.

15-3-6 RATE line (either RATE line or INTERVAL line is mandatory)

Grammar RATE frequency

This line denotes acquisition sampling frequency and either RATE or INTERVAL (12-3-7) has to be described. Describe frequency with half-size number, decimal point and half-size dot.

ex. of description: RATE 1000 it means that sampling frequency is 1000.

It becomes frequency or spatial frequency. Their unit is " Hz" or " 1/m", respectively.

15-3-7 INTERVAL line (either RATE line or INTERVAL line is mandatory)

Grammar INTERVAL period

Denote acquisition sampling cycle. Either RATE line described above or INTERVAL line has to be described. Describe period with half-size number, decimal point and half-size dot.

ex. of description: INTERVAL 0.334 it means that sampling cycle is 0.334.

Period becomes cycle or wavelength and the unit is " sec" or " m", respectively.

15-3-8 VERT_UNITS line (mandatory)

Grammar VERT_UNITS unit {, unit {, unit {, unit {, unit }}}

Denote acquisition channel's unit of acquired data. Units are required by the same number conforming to that of acquisition channels and their sequence is described in conformity to that of the channels in SERIES. Describe unit with half-size alphanumeric.

ex. of description: VERT_UNITS mV, V, uST, Pa, KN ← it denotes units of 5 acquisition channels.

15-3-9 HRIZ_UNITS line (mandatory)

Grammar HRIZ_UNITS unit

Denote unit in ascending order direction of data number (sampling direction). Unit is either "sec" or "m". Describe unit with half-size Roman letters.

ex. of description: HRIZ_UNITS sec → it means that X-axis is in second.

15-3-10 NUM_SERIES line (mandatory)

Grammar NUM_SERIES number of acquisition channels

Indicate number of acquisition channels. Describe number of acquisition channels with half-size numbers.

ex. of description: NUM_SERIES 5 ← it means that acquisition is for 5 channels.

15-3-11 STORAGE_MODE line (mandatory)

Grammar STORAGE_MODE recording mode

Denote recording mode of binary data-file. Recording mode is fixed as INTERLACED.

ex. of description: STORAGE_MODE INTERLACED ← fixed.

15-3-12 FILE_TYPE (mandatory)

Grammar FILE_TYPE file format

Denote recording format of binary data-file. Recording mode is fixed as INTERLACED.

ex. of description: FILE_TYPE INTEGER ← fixed.

15-3-13 SLOPE line (mandatory)

Grammar SLOPE coefficient {, coefficient {, coefficient {, coefficient {, coefficient} } } }

Denote coefficient for the purpose of converting binary data-file to the described unit. Coefficient is described by either E format or fixed point format in half-size characters. They are written by the same number of acquisition channels in conformity to their sequence.

ex. of description: SLOPE 0.2234, 123E-3, 123, 45E+3, 0, 01, 125 ← it means conversion coefficient of each channel.

15-3-14 Y_OFFSET line (mandatory)

Grammar Y_OFFSET value {, value {, value {, value {, value } } } }

Denote offset value of each channel. Offset value is described by either E format or fixed point format in half-size characters. They are written by the same number of acquisition channels in conformity to their sequence. The units of offset values are those which have been described on each channel in VERT_UNITS line.

ex. of description: Y_OFFSET 0, 0, 0, 0, 0 ← it means offset values of each channel.

※ Values recorded in binary data-file are A/D converted values themselves. In waveform display program, to calculate engineering unit (unit at acquisition time), multiply the above value by slope value described in header-file and add Y-axis offset value described in header-file. Reconstruction from binary data-file recorded 2 byte

integer data to acquisition data is performed by linear equation $Y = aX + b$. a is the value described in SLOPE line. b is the value described in OFFSET line. For example, when unit is V, binary value is 25000, slope value is $4E - 5$ and OFFSET value is 0, it becomes $4E - 5 \times 25000 + 0 = 1$ [V].

15-3-15 X_OFFSET line (mandatory)

Grammar X_OFFSET offset value

Denote offset value in ascending order direction of data number (sampling direction). It is 0 for normal start/stop of acquisition, but in the case of pre-trigger mode of acquisition, it becomes the offset (sec or m) by same number of pre-trigger datapoints.

ex. of description: X_OFFSETS 2 ← it denotes the acquisition-start-time going back for 2 seconds before acquisition-start-time.

15-3-16 NUM_SAMPS line (mandatory)

Grammar NUM_SAMPS number of acquisition data

It denotes number of acquisition data per channel. Describe it with half-size number.

ex. of description: NUM_SAMPS 100000 ← it means that number of acquisition data is 100,000 points per channel.

15-3-17 DATA line (mandatory, finish line of mandatory items)

Grammar DATA

Denote the end of mandatory lines. Describe Keyword only.

15-3-18 EVICES line

Grammar DEVICE acquisition device

Indicate what kind of device was used for acquisition. Normally, describe the model of recorder in half-size characters. When created by PC waveform program, it is described as "PWF".

ex. of description: DEVICE DR - 200

15-3-19 FILE_NAME line

Grammar FILE_NAME binary data-filename

Indicate binary data-file which is pair of header-file. If binary data-file does not exist in the same holder as the appropriate header-file, or if header-filename differs from that of binary data-file, this line becomes mandatory.

ex. of description: FILE_NAME test. d02

12-3-20 MARK line

Grammar MARK data number, time {, voice-memo filename {, memo}}

Indicate MARK given during acquisition or processing. MARK creates 1 line per one time. Therefore, if marked at plural times, plural lines are created. When creating plural MARK lines, they have to be described from younger data number (ascending order) written in MARK lines. Describe time by that of the appropriate data number with hh : mm : ss (ex. 16 : 03 : 24) in half-size characters. In the case of PC card recorder, accuracy may be an error of ± 1 sec as recorder built-in lock is referred to. Voice-memo filenames are acquired by HR-12 / DR-600 series. When a MARK is created by voice-memo function, the MARK line is described and indicates voice-memo filename. For information, memo is character string to be added when informing the explanation of MARK position and so on after acquisition.

ex. of description: MARK 12345, 12:03:45 the case of no voice file and
no memo.
MARK 12500, 12:05:45, test0101.wav the case of no memo.
MARK 12500, 12:05:45, test0101.wav, start over bumps
complete MARK line
MARK 12500,12:05:45, , start over bumps the case where
voice-memo does not exist and memo was described.

You can not use half-size comma " , " for the character string of MEMO.

In the case of MARK line created by TEAC-made data-recorders of GX-1, LX-10, as differed from standard form, plural numbers of MARK location data numbers are described just after MARK by being separated with comma. In short, all MARK locations are indicated by one MARK line. In this waveform program, as MARK line is internally converted in recognition of the acquisition by GX-1 or LX-10 by referring to DEVICE line, header-file recorded by GX-1 / LX-10 can also comply with MARK research function and MARK -area-jump function.

15-3-21 PAUSE line

Grammar PAUSE data number, time {, MEMO }

Denote that acquisition starts again after acquisition temporal stop. PAUSE line is created by one line in one PAUSE operation. Its data number and time of day indicate the leading data no. and time of day when acquisition is restarted. Data numbers are consecutive numbers that have set the first acquisition data no. as 0. Time of day refers to the built-in clock.

ex. of description: PAUSE 123456, 13:54:50

Data no. written in PAUSE line is given with consecutive number that has set the first acquisition data no. as 0. Its time-of-day is the time of acquisition restart. Time-of-day at PAUSE is the time that adds time-of-day of acquisition-start to the result of subtracting X_OFFSET line written offset (sec) from the consequence (elapsed seconds) of dividing the next previous data no. by sampling frequency. Therefore, period-of-time of PAUSE is a difference between the time at PAUSE and the time written in PAUSE line. For information, when sampling was performed by spatial frequency, PAUSE period-of-time can not be obtained.

15-3-22 COMMENT line

Grammar COMMENT n comment character string

Indicate acquisition memo. n is the number that adds to keyword COMMENT and adds number from 1 on in sequence. Up to 3 COMMENT lines exist.

ex. of description: COMMENT 1 preliminary test on 凹凸 road
COMMENT 2 pavement road in HAMURA-city areas (some
repaired spots)
COMMENT 3 fine weather, dry road

15-3-23 CHn line (channel information line)

Grammar CHn amp. model, RANGE = value, FILTER = frequency {, max initial value of graph display, mini initial value of graph display }

Indicate setting conditions at acquisition time of recorder built-in signal conditioner. This line is created depending on acquisition device in use. New keyword is created by adding channel no. to keyword CH. Parameters to be described are as follows: amp. model, setting range "RANGE=" (keyword), setting range character string, low-pass filter cut-off frequency, "FILTER="(keyword), frequency. This line means giving information of acquisition conditions at acquisition time, but it is channel information which is not used for data reconstruction.

ex. of description CH 1 AR-C1DC1, RANGE= 5V, FILTER= 200Hz
 CH 3 AR-C1DC1, RANGE= 5V, FILTER= 100Hz
 CH 5 AR-C1ST2, RANGE=1000uST, FILTER= 200Hz

When setting initial value of graph display in calibration program, CHn line is referred to for adding setting value.

15-3-24 CLOCK line

Grammar CLOCK condition character string

Indicate that acquisition was performed either by internal clock or by external clock. Basic condition character string is either INTERNAL or EXTERNAL, but there may be cases where specific character string will be described depending on acquisition device. Sampling frequency which is described in RATE line of a device acquired from external sampling (slave side of simultaneous acquisition) is 1 and its CLOCK line is described as EXTERNAL.

ex. of description: CLOCK INTERNAL

15-3-25 END line (mandatory, final line)

Grammar END number of acquired data

Indicate final line of header-file. Number of acquisition data is written in half-size by the same value as that of NUM_SAMPS line.

ex. of description: END 12345667

15-4 Format of binary data-file

Binary data-file which is created in pairs with header-file is recorded by integer type of 1data/2byte. Recording mode is interlace. For example, if acquisition is done to 1ch to 4ch, they are recorded like 1ch2ch3ch4ch1ch2ch3ch4ch in order of acquisition channel, in order of sampling. And 1 data is expressed with integral number of -32768 to +32768 and is recorded in order of low byte, high byte. In the case of binary data-file, any end mark or information like header-file is not included.

