RT-View

Real Time - View 1.5

Overview

RT-View is a simple to use real time analysis tool optimized for use with TEAC VR-24 Portable Video Recorder.

It allows various trigger modes and analysis of the time data with up to eight cursors and advanced zoom methods. Any calculation, display setting or number of views can be altered in real time.

RT-View uses a simple human interface (optimized for touch panels) without nested dialogs. In nearly all cases RT-View uses one button for one function.

Auto layout let you display up to 2 diagrams with selectable functionality.
This embraces

- Time diagram
- Frequency spectrum
- Power spectrum and power spectral density
- Frequency Response Function
- Cross Spectrum and cross spectral density
- Auto Correlation
- Cross Correlation
- Spectogram
- Sound (1/N Octave Analysis, L_P, L_{EQ})
- Digital Multimeter for numeric display

Content

VR-24 Operation

The RT-View software is highly integrated in the TEAC VR24 software environment. This means that:

1. RT-View will automatically start at System Startup
2. RT-View will automatically initialize to work properly with the measurement setup defined in the VR-24 Recorder software
3. RT-View can simply be updated by VR24 Recorder software
4. RT-View is not accessible by the User except via VR24 Recorder software GUI

Note: If the Camera use setting is set to "1CH (HD 30fps)", RT-View display of analog data is not possible when record ready or recording.

Access RT-View GUI via VR24 Recorder GUI

To access the RT-View GUI via VR24 Recorder GUI, press the button in the lower right corner during recording standby, recording, playback standby or playback.
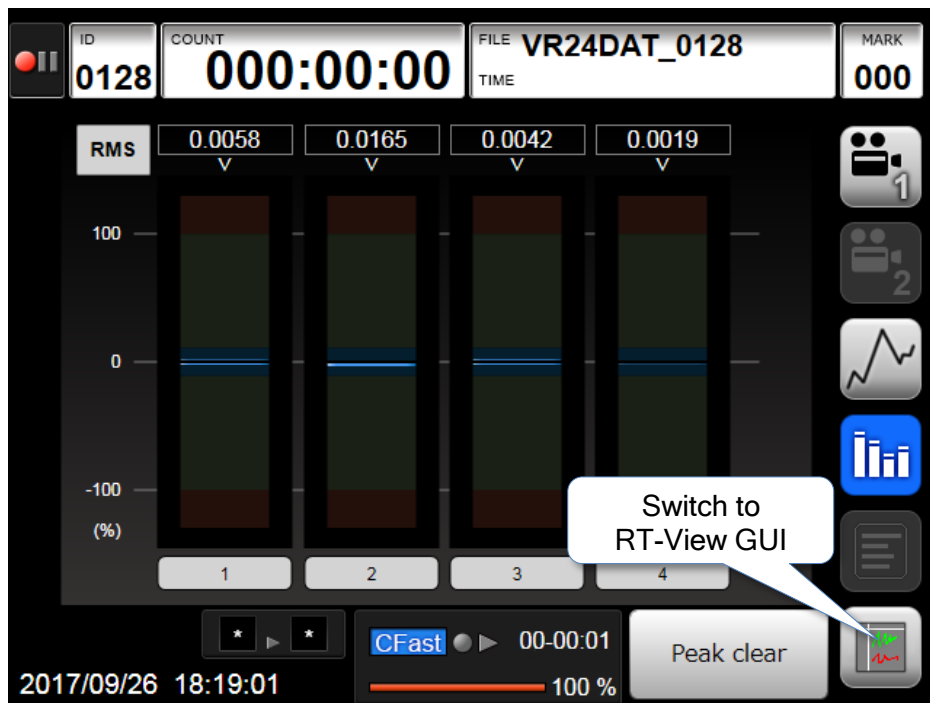
Access VR24 Recorder GUI via RT-View GUI

To access the VR24 Recorder GUI via RT-View GUI, press the button in the upper right corner at any time.
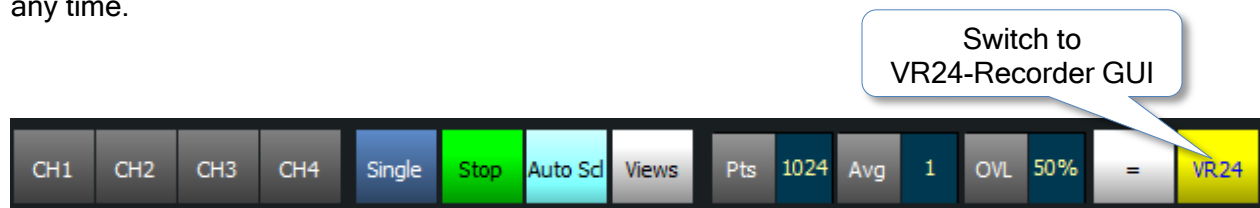
Global settings with the control bar

For global settings you will find the global control bar up in the RT-View window. He allows
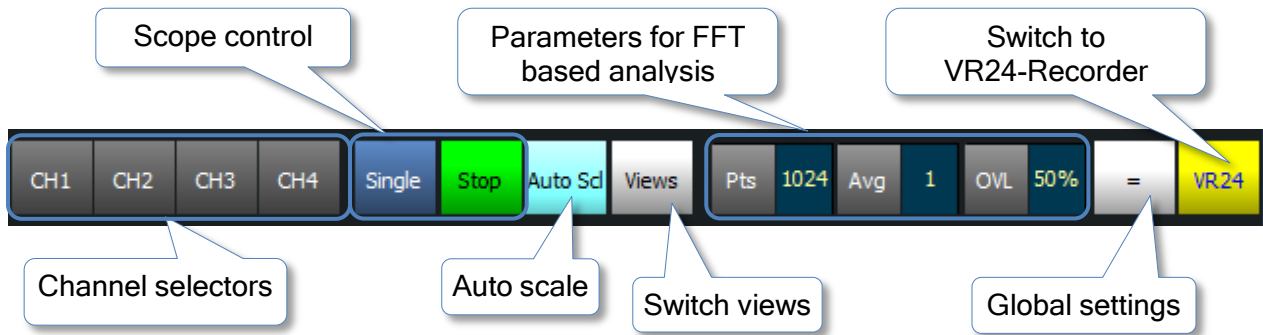
Select channels

To select the channels to be viewed, you have to activate them by clicking on the corresponding button.

Auto scale

For fast operation auto scale is done automatically whenever you call a view the first time.
You can call auto scale manually for the active display by pressing the Auto scl button in the global control panel.

When the active display is in "TIME", "FFT" or "PS[D]" view and all displayed channels have the same physical unit (e.g. all channels in Volts) you can choose between auto scaling each channel separately or scaling all channels to the same axis.

To auto scale all channels separately choose "All Channels" to auto scale all channels to same scale choose "Same y-Axis"

Note: Auto scale always works on the active display only (See "General operation for all diagrams" for further information about active/inactive display).

Views

With the Views button in the global control panel you switch between the one view layout and the two views layout.
Every view can show any type of diagram. The Time diagram in the first view is responsible for collecting data with or without triggering. All other diagrams calculations are done with this data points. This guaranties synchronization of the views.
Time diagram in first view is always running, also if you show for example a PSD in the first view.

Run/Stop and Single

The `Run/Stop` button in the global control panel enables or disables sampling data into the time diagram. Remember that the time diagram also delivers the data for the most other views and triggers the calculation of FFT, PSD etc. if the buffer of time diagram is filled.

The `Single` button allows sampling until the buffer defined by the timing in the time diagram is full. Then sampling stops and the other diagrams get a data ready signal and begin with their calculation. This function can also be used with triggering.

Running or stopping doesn't affect sampling and recording to disk. This is independent from the function of any diagram.

Global settings

The global settings menu contains the following entries:

Sign	Function
Load settings	Restores saved RT-View configurations
Save settings	Saves the actual RT-View configuration (four slots available)
p0 log Y-Axis	Set reference value p0 for logarithmic calculations

After the selection an on-screen keyboard appears witch you can use for the demanded entries.

Note: The on-screen keyboard contains:

- Numbers: 0 - 9
- Capital letters: A - Z
- Special characters: " . " and " _ "
- Command character: Backspace ("BS")
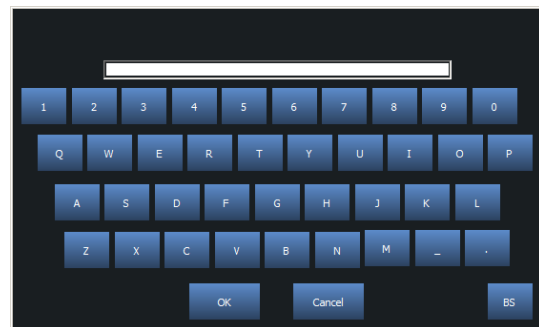
Set parameters for FFT base calculations

Use the ⎣Pts⎦ button to set the number of data points for all FFT based calculations. This includes FFT, PSD, FRF, CRS, COH, ACR, CCR and SPC diagram.

For some operations it is desired to use averaging to increase accuracy.
Tap ⎣Avg⎦ button and choose from the appearing context menu to alter the configuration. The context menu ends with "Auto" which calculates the number of possible averaging steps depending on available data points, and overlap of FFT windows.

Overlapping is a common method to increase time resolution of short time events. Use ⎣Ovl⎦ button to select between 0%, 25%, 50% and 75% of the FFT data points. 0% means no overlapping is used.

By adjusting the number of points the averaging or overlap the frequency domain buffer rescales automatically. The size of the actual frequency domain buffer is always shown above the x-axis of a diagram as grey "box".

If the length of the frequency domain buffer exceeds the length of the time domain buffer (grey box overruns the end of x-axis) the automatic time frequency domain buffer survey intervenes. For more details about the intervening see "Automatic time-frequency domain buffer survey".

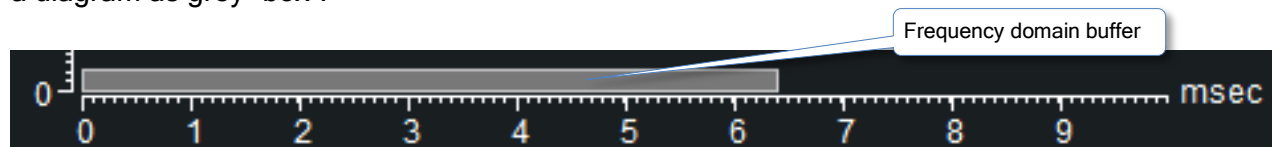## Automatic time-frequency domain buffer survey

To ensure valid calculations in all displays RT-View has implemented an automatic buffer length survey which guarantees that the time domain buffer always is equal or larger than the frequency domain buffer. To achieve this there are two different mechanisms:

First mechanism:
When you are changing the number of points the averaging or overlap and the frequency domain buffer length exceeds the time domain buffer length the time domain buffer is automatically resized (increased).

The "XDv" value will turn red after intervening to indicate automatic resizing of the time domain

Second mechanism:
When you are changing the time scale (time domain buffer size) and the frequency domain buffer exceeds the time domain buffer the frequency domain buffer is automatically resized (decreased). This mechanism will always decrease the number of points to adjust the buffer sizes.

The "Pts","Avg" and "OVL" values will turn red after intervening to indicate automatic resizing of the frequency domain buffer.

Selecting the diagram type

The diagram type will be selected down in the current view. Selection is possible at any time.

| TIME | FFT | PS[D] | FRF | CRS | COH | ACR | CCR | SPC | SND | DMM |
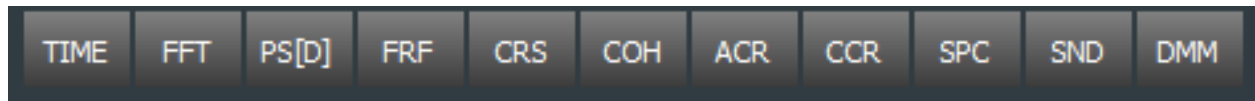
Button	Function
Time	Time diagram
FFT	Frequency diagram
PSD	Power Spectrum or Power Spectrum Density, Same as Auto Spectrum
FRF	Frequency Response Function
CRS	Cross Spectrum or Cross Spectrum Density
COH	Coherence function
ACR	Auto correlation
CCR	Cross Correlation
SPC	Spectogram
SND	Octave analysis, SPL(L), Equivalent continuous SPL (L_{EQ})
DMM	Digital multimeter display numeric values

General operation for all diagrams

There are some operations that are the same in all diagrams. Left of the diagrams you see the diagram controls. Here you can set the Y-Axis division and offset and X-Axis division and offset of the selected diagram. These settings are available for each input channel even in the same view.

Display activation

To switch between the diagram controls of the two views, tap on the diagram you want see the diagram controls for (activate display).
The active display is the display you can see the controls for. It is always signed with a little arrow beside the diagram selection, pointing toward the diagram controls.

Channel dependent diagram controls

To switch between channel dependent diagram controls tap and hold the corresponding channel selector. To show which channel is chosen the borderlines of the channel dependent diagram controls will turn into the channel corresponding color.

Further information about the channel dependent controls in different diagram types can be found in the diagram specific topics.

Zoom function

If you want to zoom, tap in the diagram and drag. A moving rectangle appears, that shows the range of X or Y axis that will be shown if you tap in the rectangle. The rectangle can be resized with the handles.

After changing the Y or X axis a button for X and Y axis expansion appears. Pressing this button restores the axis to their original values.

Use of touchscreen optimized context menu

To reduce the risk of choosing unwanted options in large context menus, we have implemented a special type of selection method. The optimized context menu appears whenever you short tap on a menu where more than eight options are available. It works like followed:

To choose one of the options in the appearing context menu, scroll in it until the desired option is surrounded by the red rectangle.

To confirm the selected option, short tap on the corresponding menu button again.

When a context menu consists of eight or less entries a "classic" context menu appears where the selection is done by simple tap on the corresponding button.

Cursor

You can set up to eight cursors. To create a new cursor, tap in the diagram. A cursor with info windows appears at this position.

Its info window shows the position on the X-Axis and the cursor ID number in the first line and the corresponding values of the active channels in the lines below.
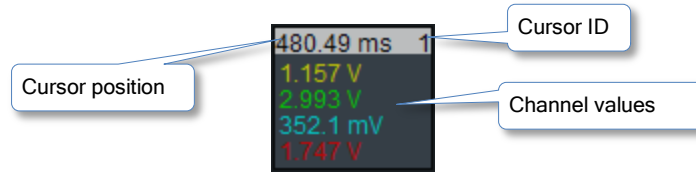
The positioning of the info window can be changed by tab on it and move it up and down. Left - right move of the info window will move the cursor in the x-domain.

If at minimum two cursors are defined an additional window appears. It shows the difference values of cursor one and two.
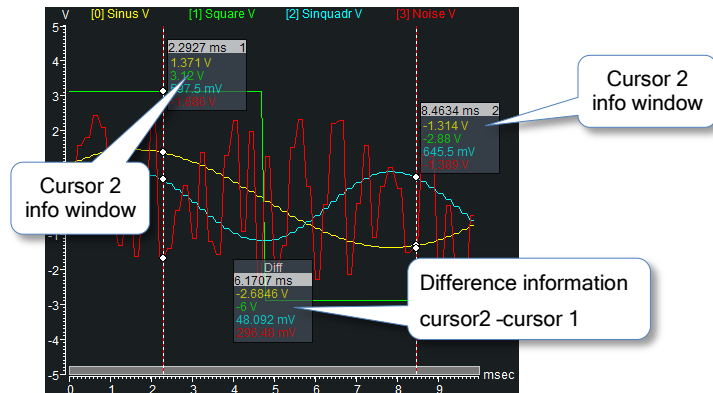
The cursor difference window shows in the first line the time or frequency span between the first two cursors. The following lines show the difference of the signal values displayed in cursor window one and two. For time diagram you can switch the difference window to another mode where it shows the rms value between the first two cursors. To change the difference calculation method tap on the cursor difference window and choose on the appearing context menu between these entries:

Button	Function
Diff	Show difference values from cursor 2 and cursor 1. This includes difference on the x axis and difference of the two signals between the two cursors.
RMS	Shows rms value between cursor 1 and 2. Only enabled in time diagram.

Cursor functions

To choose a cursor function short tap on the cursor info window; a context menu with these options appears:

Sign	Function
Cancel	Leaves the selection without changes
Delete	Delete cursor
Max	Move cursor to absolute maximum of the selected channel (see Cursor Min/Max)
Min	Move cursor to absolute minimum of the selected channel (see Cursor Min/Max)
Q	Show Q factor of the selected channel (see Show Q factor at cursor position; only for frequency based analysis, else invisible)

Deleting cursor

Cursors get deleted by short tapping the corresponding info window and choosing "Delete". Deleting cursors which were set by "AutoMax" while "AutoMax" is active will have no effect.

Set cursor to min or max

Cursors can be set manually to minimum or maximum, of a specific channel by short tapping the corresponding info window, choosing "Min" or "Max" and then choosing the channel in the appearing context menu

To set cursors automatically to the maximum of each active channel, you will find a button "Curs" on the left side of the diagram to set cursor mode to "AutoMax".
Cursor one will be set to the maximum of channel one. Cursor two will be set to the maximum of channel two (if channel is active) and so on.
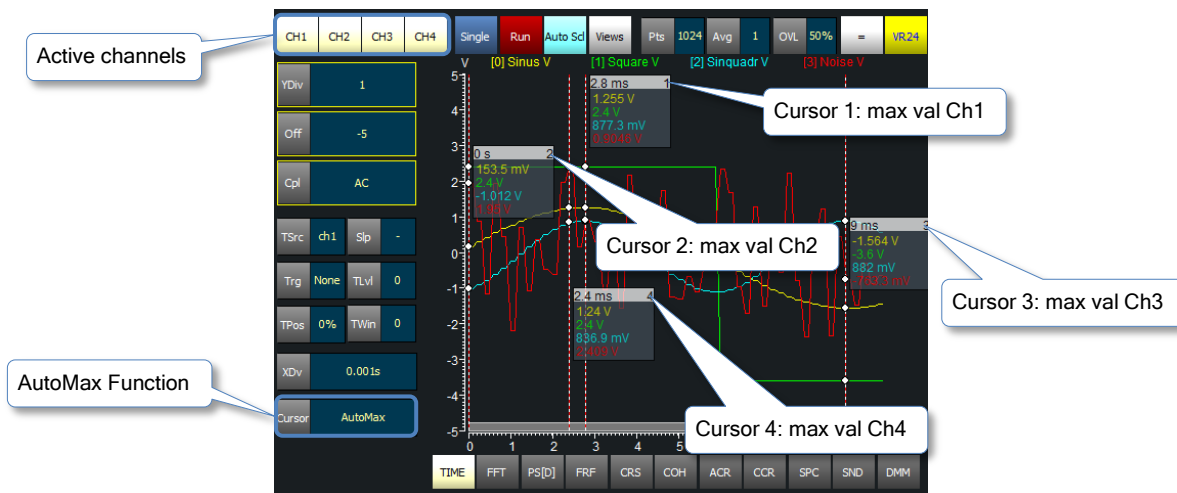
This function is only available in TIME, FFT, PSD and ACR diagram. In other diagrams there is no sense to do so.

Show Q factor at cursor position

The Q Factor can be calculated with aid of the cursors by positioning a cursor on the peak you want to calculate the Quality for and then tap on its info window and choose "Q".

The Quality factor will be shown in the cursor info window.

This is only possible in FFT, PSD or FRF display.

Selecting a window function for FFT based calculations

One problem with spectrum analysis is that the duration of the signals is finite. Using the FFT method to finite-duration sequences can produce inadequate results because of "spectral leakage," due primarily to the periodic extension assumption underlying DFT.

The effect occurs when the finite duration of the signal does not result in a sequence that contains a whole number of periods. This is especially true when FFT is used for signal detection or estimation - that is, for detecting weak signals in the presence of strong signals or resolving a cluster of equal strength frequencies.

In FFT analysis, "windows" are frequency weighting functions applied to the time domain data to reduce the spectral leakage associated with finite-duration time signals. Windows are smoothing functions that peak in the middle frequencies and decrease to zero at the edges, thus reducing the effects of the discontinuities as a result of finite duration.

The different window function deal with that. They balance between frequency selectivity and amplitude accuracy.

Windows	Function
Rect	No window. Best frequency selectivity
Bartlett	Triangle window
Hann	Good universal window
Hamming	Good for noise measurement
Blackman	Good for audio
Flat top	Gives accurate magnitude, but bad frequency selectivity
Low Side Lob	Sharp main lob, side lobs are low

To select the applied window function tap on the "Wind" button and choose the best fitting window function for your application. This works for all FFT based diagrams.

Time diagram (TIME)

The time diagram is the first diagram that is shown after start. Time diagram is a key diagram because it controls the other diagrams. The time diagram in the first view (and only in the first view) is responsible for collecting data. If collecting is finished it signals the other diagrams to make their calculation with its data. This guaranties the synchrony of the calculated data. So for example the Coherence diagram shows its result matching to the Frequency response diagram. Only exception is the Octave diagram, which needs a continuous stream of data for its filter banks. This means that you'll not see any data before the time diagrams buffers are filled. The lengths of the buffers are defined by the XDv button, which scales the X-Axis.
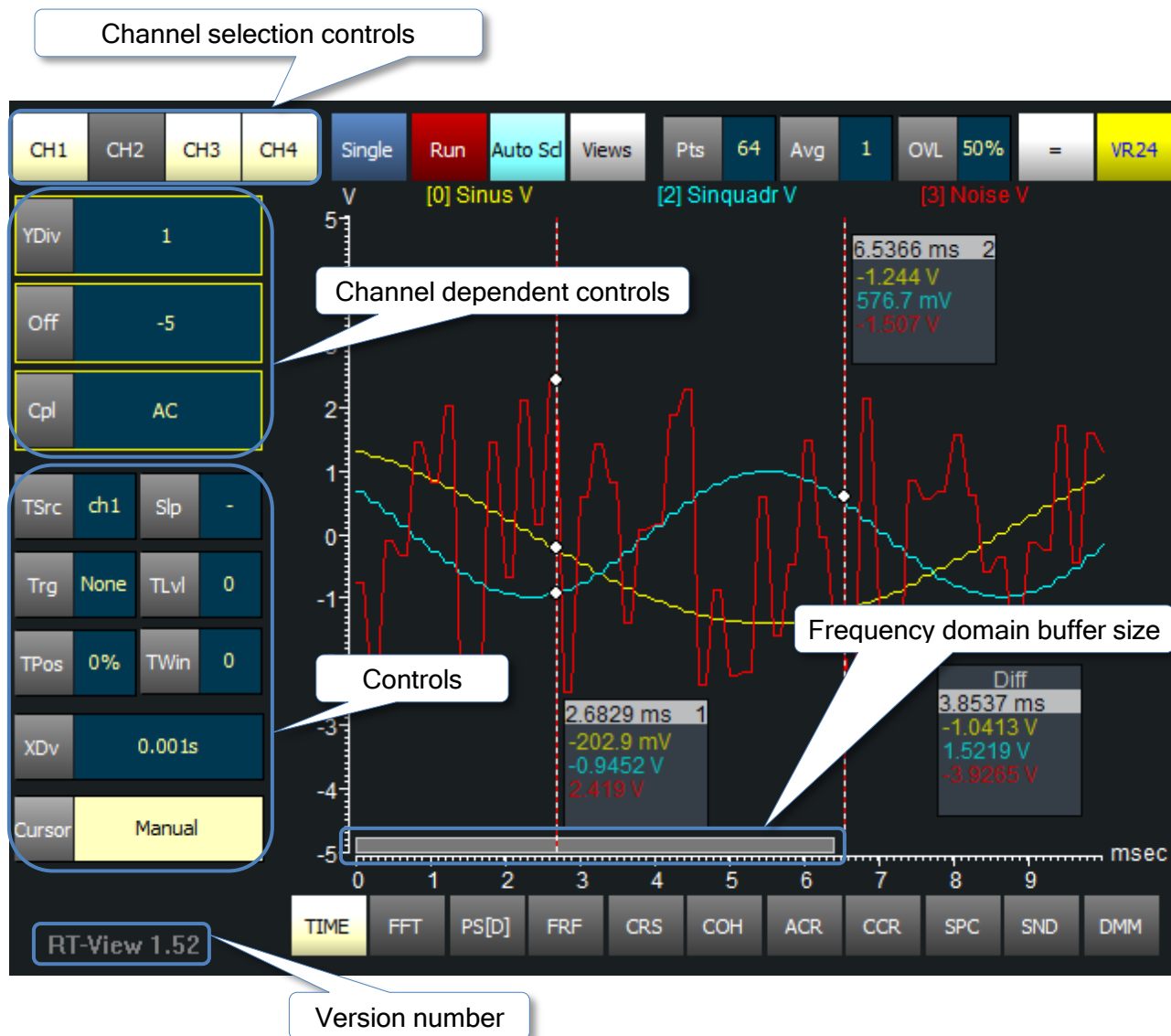
Channel selection

Channel selection is done into the global control panel. You can either switch channels on or off by short tapping or you can change the presentation properties for each channel by tap and hold. You can alter the configuration at any time.

Setting Y Axis of diagram

The Y-Axis is divided by 10 divisions.

The YDiv button alters the scale of a Y division in 1-2-5 steps.

The Off button allows to shift the signal in the diagram up and down.

The Cpl button toggles the signal coupling between AC and DC. This is a calculated coupling and doesn't affect the coupling in the hardware setup.

Trigger

Trigger is definable in the time diagram in the first view only. Any activated channel from the setup can be used as trigger channel. Trigger source can be any activated channel. He is selected with the Tsrc button.

Three Trigger modes are available. The will be selected with the TSlp button.
Following states are selectable.

| Mode	Function
none	No triggering. Display runs free and shows data a soon as the buffer is filled. Depending of the Run/Stop or single button in the global control bar the display stops or runs again.
auto	Trigger level is calculated from the incoming signal. This gives only good results if the signal is periodic.
level	You must define trigger level manually with the buttons TLvl and TWin.

Definition of trigger event

Select between three possible events

Sign	Function
+	Trigger event is if the signal crosses the low level in positive direction and without falling below the low level crosses the high level in positive direction. This mode can be used in Auto and Level trigger mode.
-	Trigger event is if the signal crosses the high level in negative direction and without raising above the high level crosses the low level in negative direction. This mode can be used in Auto and Level trigger mode.
<>	Trigger event is if the signal crosses the high level in positive direction or the low level in negative direction. This mode can only be used level trigger mode.

For manually definition of the trigger level tap on the TLvl button and scroll to the desired trigger level. Tap on the TLvl button again to select the trigger level. The trigger level will be shown

graphically in the diagram. To alter the hysteresis or window width, tap the TWin button and scroll to the desired value. Tap the TWin button again to select the desired value. This is also showed graphically.

Abbildung 1Trigger slope +

Abbildung 2Trigger slope -

Abbildung 3Trigger slope <>
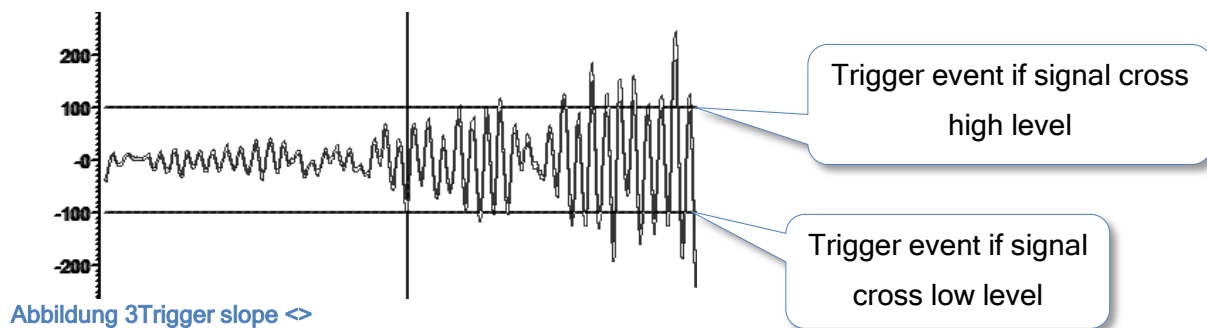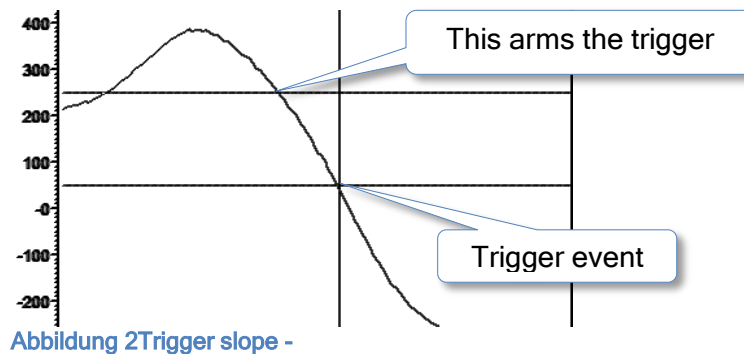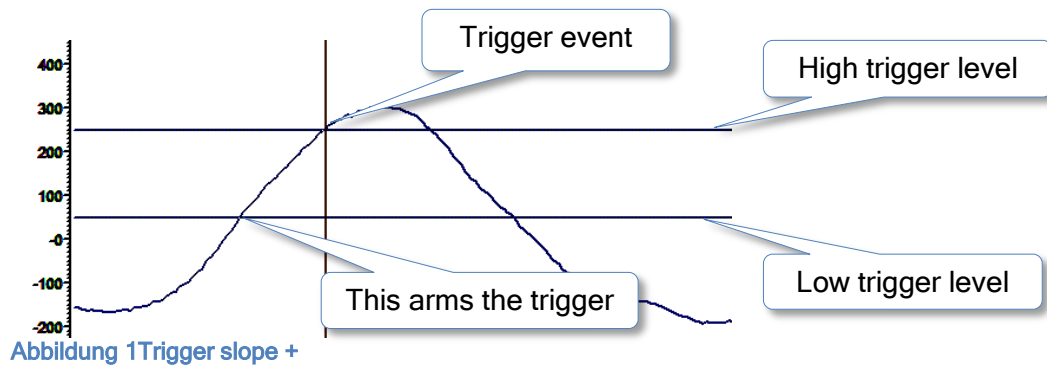
Post- and Pre trigger

Pre and post trigger are defined by the button TPos. You can vary the value between 0 and 90% of the X Axis span in 10% steps by tapping the TPos button. Scroll to the desired value and tap again to select it.

Automatic cursor

With `Curs` you can choose between "Manual" cursor setting and automatic cursor setting "AutoMax"

When "AutoMax" is enabled cursors will be set to the maximum of each channel. Cursor one will be set to the maximum of channel one cursor two to the maximum of channel two and so on.

When "AutoMax" is enabled cursors cannot be set manually.

Setting X Axis

The X axis is divided by 10 divisions. The `XDv` button alters the time per division. This setting determines together with the sample rate the depth of the sampling buffers. These buffers are used for all following calculations. Changing before the next sampling shot adjusts the buffers. Changing this after sampling has been done, it alters only the view of the signals. The buffer depth is preserved until the next sampling shot.

Due to the fact that all calculations are done on the data collected here you have to ensure that the time domain buffer of the first view is larger than the frequency domain buffer defined by "Pts,"Avg" and "OVL".

To keep all calculations running even if you don't mind about buffer sizes the automatic time-frequency domain buffer survey will intervene when the frequency domain buffer exceeds the size of the time domain buffer. For further information about the intervening methods see "Automatic time-frequency domain buffer survey".

Zoom X and/or Y axis with moving rectangle

See general operation for all diagrams.

Setting and moving cursors

See general operation for all Diagram Cursor

Release Version Number

The actual release number of the software can be found in the bottom left corner of the screen when time diagram is selected as active view.

FFT diagram (FFT)

The FFT diagram shows the Magnitude of the frequency domain of the acquired data. The FFT algorithm uses some information from the global control panel. These are Pts AVG and Ovl. This information is used to setup the frequency domain buffer.
Read "Set parameters for FFT base calculations".

Note: The time domain buffer has always to be larger or the same size than the frequency domain buffer. When the frequency domain buffer size exceeds time domain buffer size the automatic time-frequency domain buffer survey will intervene. For further information see "Automatic time-frequency domain buffer survey".
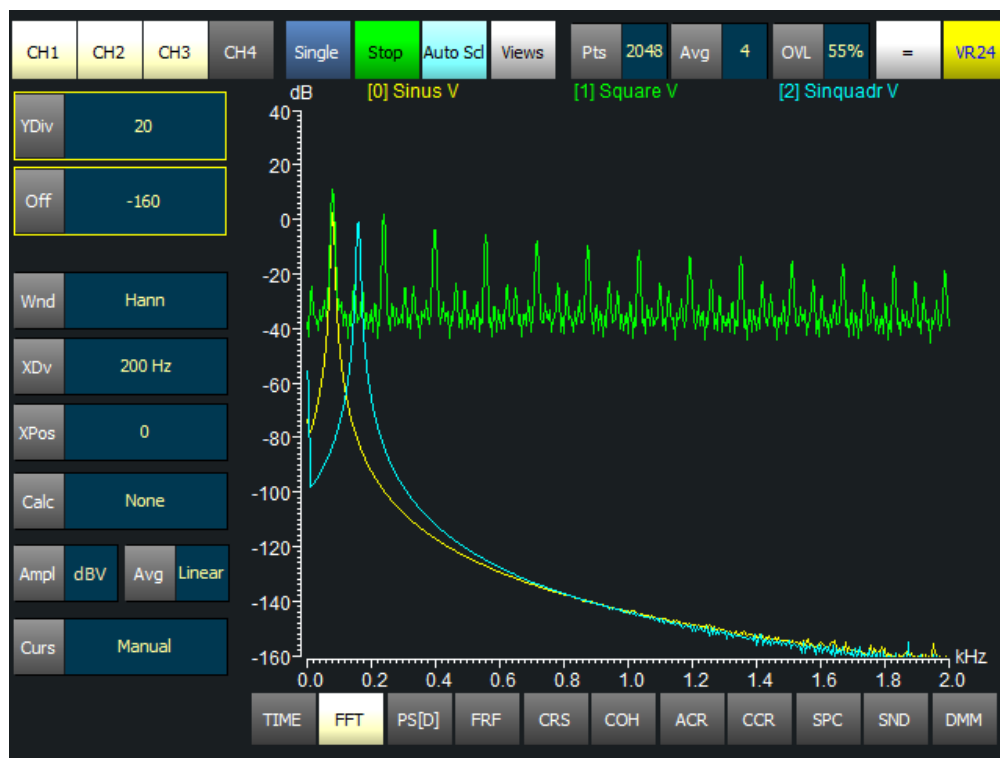
Set Y axis

Ampl changes the computation mode of Y-axis.

Mode	Function
RMS	Add all single results and part by not of averages. This is good for more static signals.
Peak	Shows peak .
dBV	Logarithmic scale. Reference is one (Calculation: Log10("Peak"-value))

For example you have a 2V sine wave with 1kHz. The "Peak" mode will show you 2 V at 1 kHz, while the "RMS" mode will show 0.707 V and "Log" mode will show you 0dB.

Set X axis

Use XDv to change the x-axis scale and XPos to change the x-axis offset

Calculation methods

With Calc you can choose between three calculation modes:

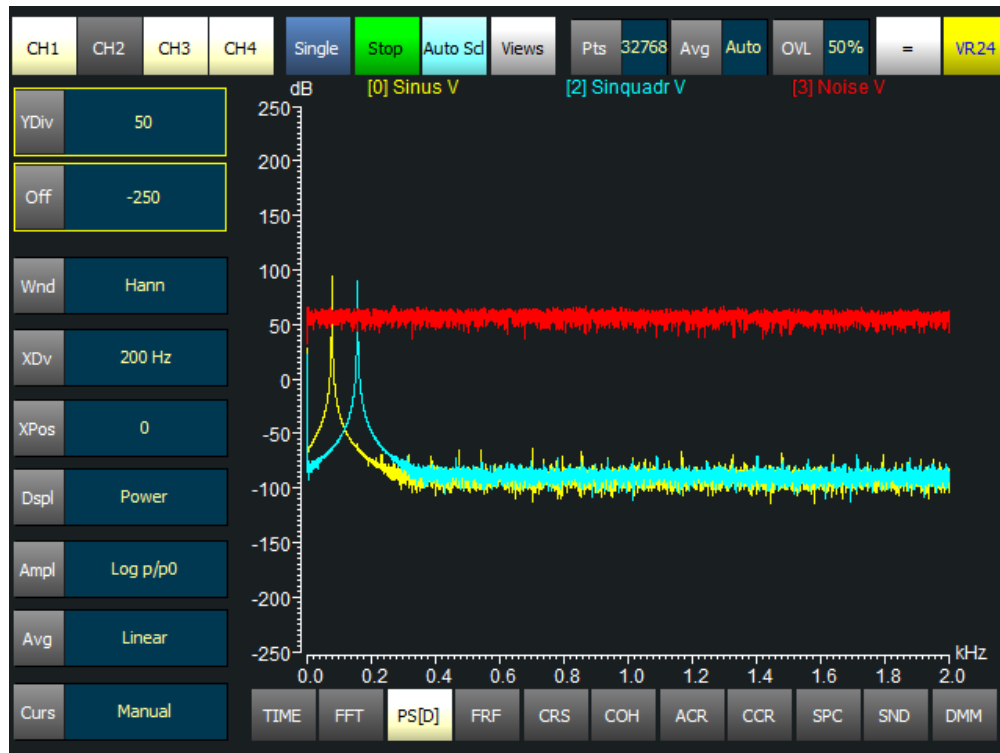| Mode	Function
None	Display shows FFT raw data
Int	Display shows the result of a single integration of the FFT raw data
IniInt	Display shows the result of a double integration of the FFT raw data

Select mode of averaging

Avg button let you alter the method of averaging. Three methods are available.

Mode	Function
Linear	Add all single results and part by not of averages. This is good for more static signals.
Peak hold	Peak Hold is not really averaging. Instead, the new spectral magnitudes are compared to the previous data, and if the new data is larger, the new data is stored. This is done on a frequency bin-by-bin basis. The resulting display shows the peak magnitudes which occurred in the previous group of spectra. This is good for varying or transient signals.
Cascade	No averaging. Displays the single results in a 3D cascade diagram

Power spectrum or Autopower diagram (PS[D])

Power or Power density spectrum

Switch between Power or Density

Dspl let you choose between normal power or density

Y Axis

Ampl changes the scaling of Y-axis.

| Mode	Function
RMS	Add all single results and part by not of averages. This is good for more static signals.
log(p/p0)	Logarithmic scale. p0 is 20uP.
Log(p/pmax)	Logarithmic scale. The maximum is 0dB
dBV	Logarithmic scale reference is 1V.

Select mode of averaging

Avg button let you alter the method of averaging. Two methods are available.

Mode	Function
Linear	Add all single results and part by not of averages. This is good for more static signals.
Peak hold	Peak Hold is not really averaging. Instead, the new spectral magnitudes are compared to the previous data, and if the new data is larger, the new data is stored. This is done on a frequency bin-by-bin basis. The resulting display shows the peak magnitudes which occurred in the previous group of spectra. This is good for varying or transient signals.

Frequency Response Function diagram (FRF)

The frequency response function, short FRF, in general calculates the frequency response of any system by dividing the output signal by the input signal.
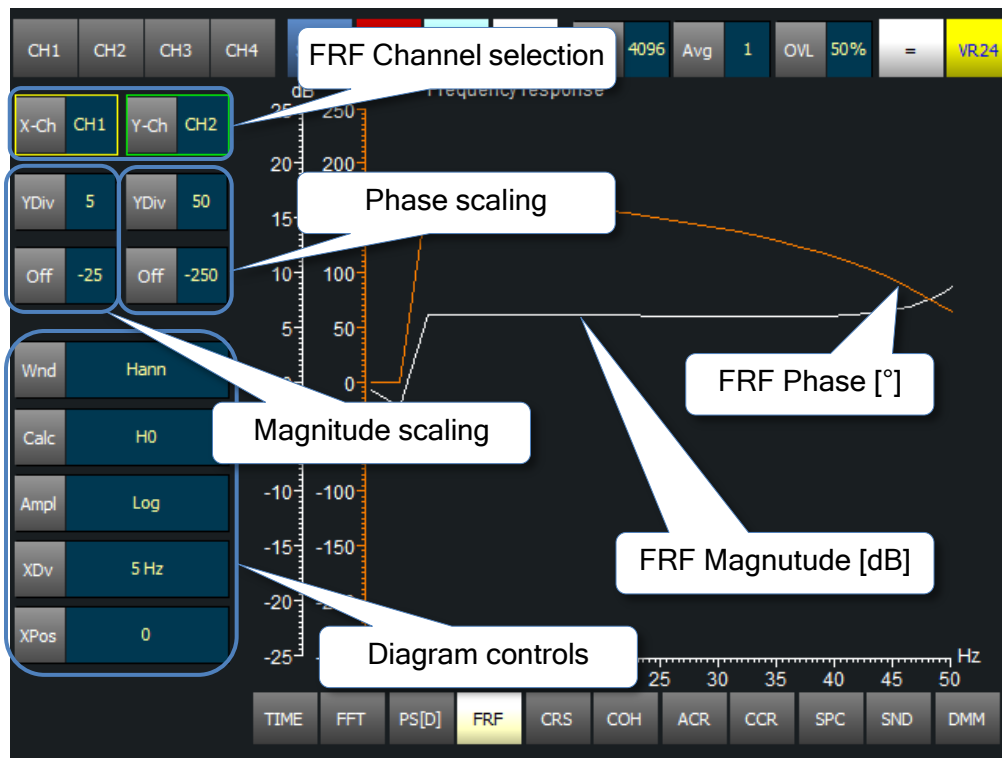
FRF Channel selection

To choose the channels for computation use the "X-Ch" and "Y-Ch" button at the FRF channel selection. Note that channel two represents the input channel and channel one represents the output channel. The global channel selector is unused.

Magnitude and phase scaling

To change the magnitude or phase scaling use the corresponding buttons.

Calculation

To achieve best accuracy at in all situations there are implemented three standard computation methods to calculate the FRF. You can switch between them by tapping the Calc button and choosing the desired calculation method. Available Calculation methods are:

| Mode	Function
H0	Standard, no improvement
H1	Reduces influence of output noise
H2	Reduces influence of input noise

Note: In all calculation methods channel *two* is *input* and channel *one* is *output*

Other diagram controls (see "FFT diagram")

Other FRF diagram controls were already described in the chapter "FFT diagram". For further information read "FFT diagram".

Coherence diagram (COH)

The coherence diagram is a statistic that can be used to examine the relation between two signals. It is commonly used to estimate the power transfer between input and output of a linear system. If the signals are ergodic, and the system function linear, it can be used to estimate the causality between the input and output.
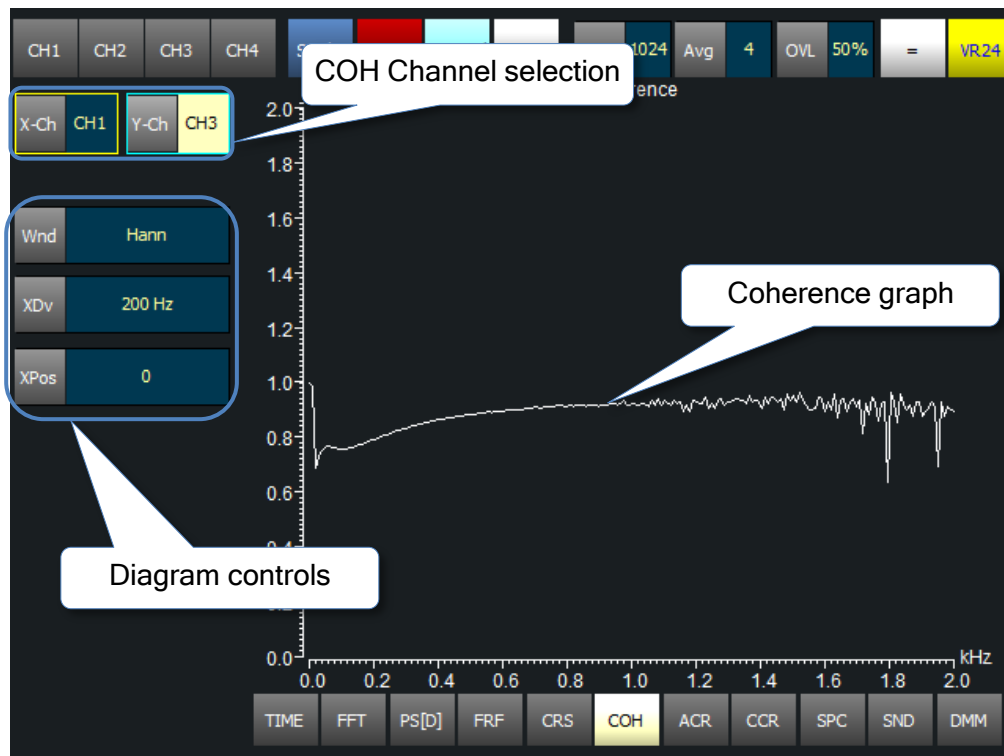
COH channel selection

To choose the channels for computation use the "X-Ch" and "Y-Ch" button at the COH channel selection. The global channel selector is unused.
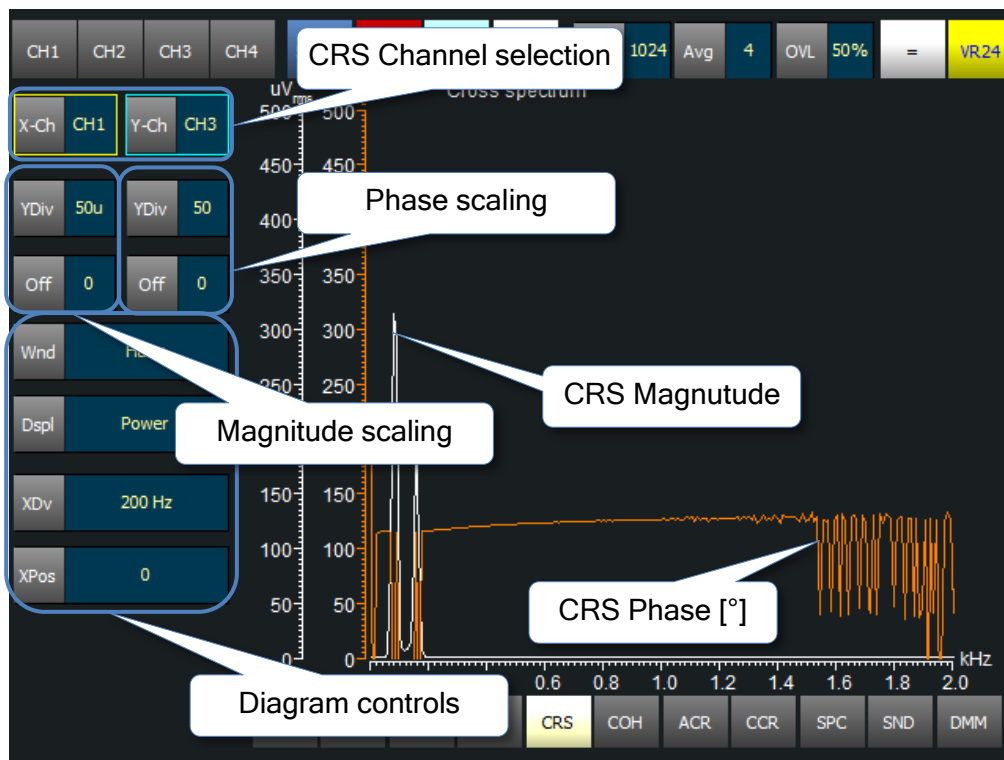
Diagram controls (see "FFT diagram")

The coherence diagram controls were already described in the chapter "FFT diagram". For further information read "FFT diagram".

Cross spectrum or Crosspower diagram (CRS)

The cross spectrum display delivers a presentation of the furrier transform of the two sided cross correlation.

This function is rarely used in signal analysis. In most cases it is used as base for further calculations.

CRS channel selection

To choose the channels for computation use the "X-Ch" and "Y-Ch" button at the CRS channel selection. The global channel selector is unused.

Magnitude and phase scaling

To change the magnitude or phase scaling use the corresponding buttons.

Diagram controls (see "FFT diagram")

All CRS diagram controls have already been discussed in the chapter "FFT diagram". For further information read "FFT diagram".

Crosscorrelation diagram (CCR)

The crosscorrelation diagram can be used to measure the similarity of two signals or to measure the lag between two signals.
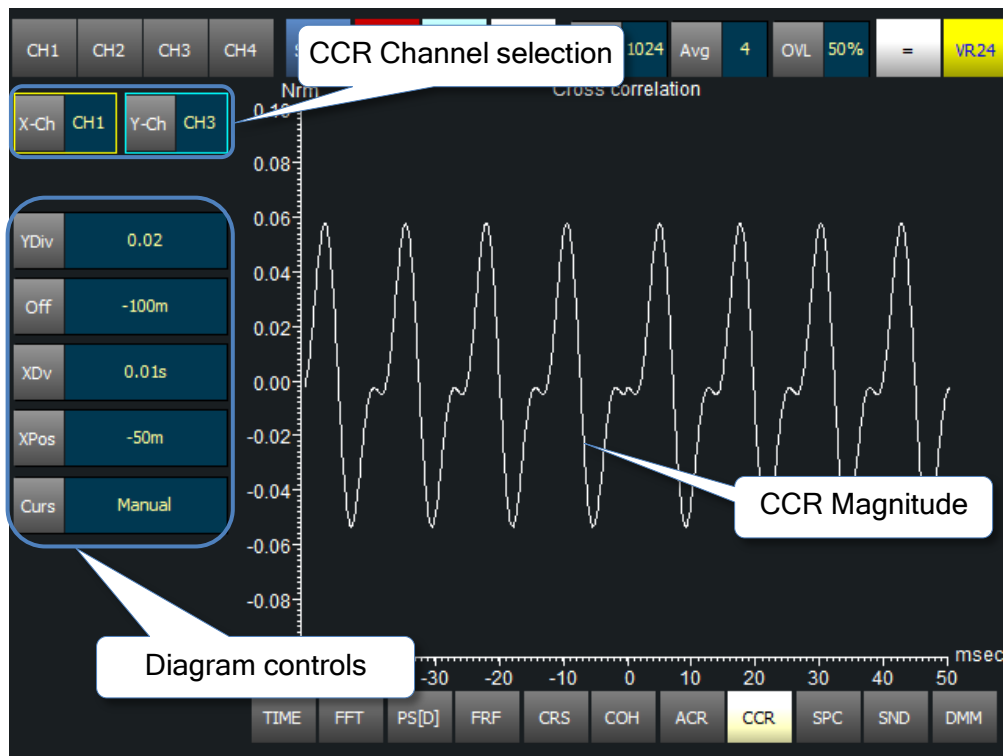
CCR channel selection

To choose the channels for computation use the "X-Ch" and "Y-Ch" button at the CCR channel selection. The global channel selector is unused.
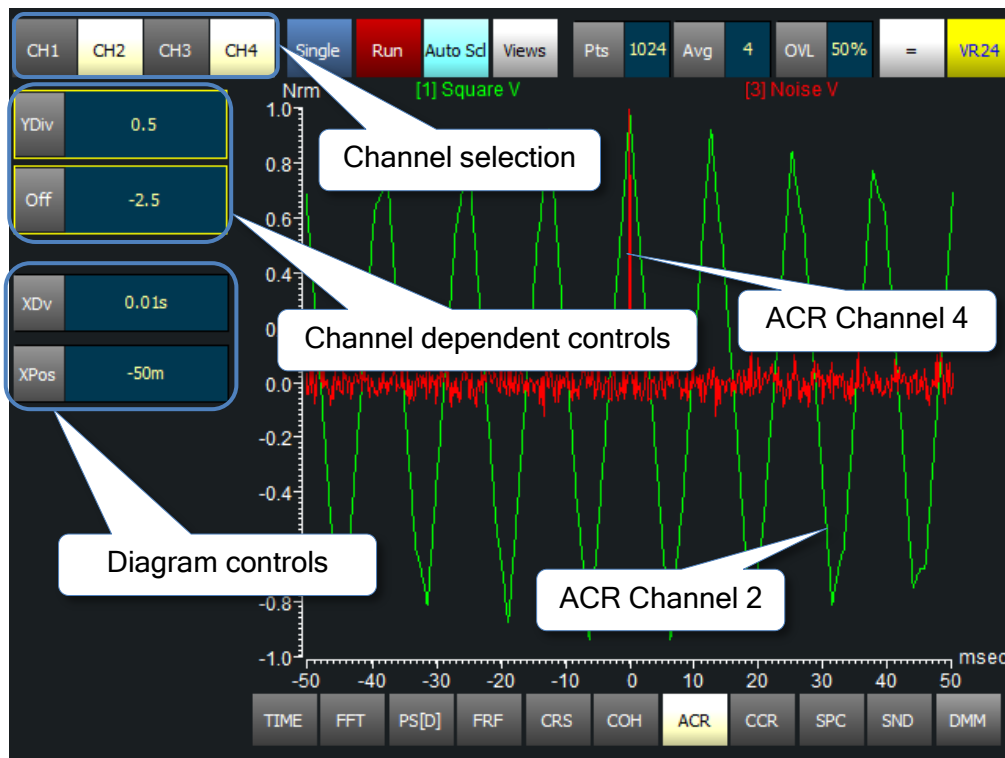
Diagram controls (see "Time diagram")

All CCR diagram controls have already been discussed in the chapter "Time diagram". For further information read "Time diagram".

Autocorrelation diagram (ACR)

The autocorrelation diagram can be used to detect non-randomness in signals or to identify an appropriate time series model if signals are not random.

The autocorrelation has implemented the same computing algorithm like the crosscorrelation. The difference between CCR and ACR is that in ACR you cannot choose the channels to correlate. Autocorrelation always correlates a channel with itself.

ACR channel selection

As difference to the CCR in ACR display you can view the ACR of all active channels in one diagram. To choose which channel should be presented use the global channel selector.
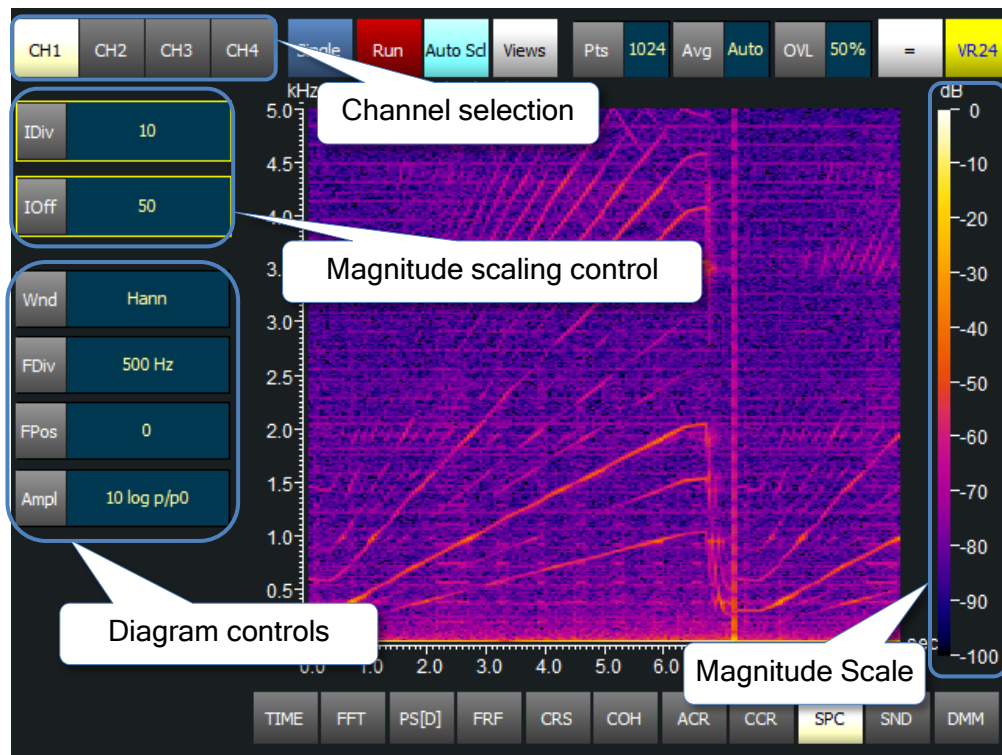
Diagram controls (see "Time diagram")

All ACR diagram controls have already been discussed in the chapter "Time diagram". For further information read "Time diagram".

Spectrogram diagram (SPC)

The spectrogram diagram allows the presentation of multiple FFTs in dependence of the time when the FFT was made. To realize this it shows the time domain on the X-Axis the Frequency domain on the Y-Axis and the Magnitude is represented by its color while dark blue is the lowest Magnitude and bright white the biggest.

So each point in the time domain gets assigned the time fitting FFT.

Magnitude scaling

To scale the Magnitude (Color assignment) use the Magnitude scaling control. Note: all Channels use the same color assignment.

Frequency domain scaling (Set Y-axis)

Use FDiv to change the frequency axis scale and FPos to change the frequency axis offset.

Other Diagram controls (see "FFT diagram")

All other SPC diagram controls have already been discussed in the chapter "FFT diagram". For further information read "FFT diagram".

Sound diagram (SND)

The Sound diagram provides an Octave analysis with A, C or linear (Z) weighting and different sound level calculation methods, such as sound pressure level and equivalent continuous sound pressure level with A, C or linear (Z) weighting

Octave analysis is widely used in acoustics. It divides the frequency range in bands with constant relative bandwidth. This corresponds best with human perception of sound. Various averaging and weighting techniques are used to correlate the calculated octave spectrum with the subjective evaluation of sound by the human ear.
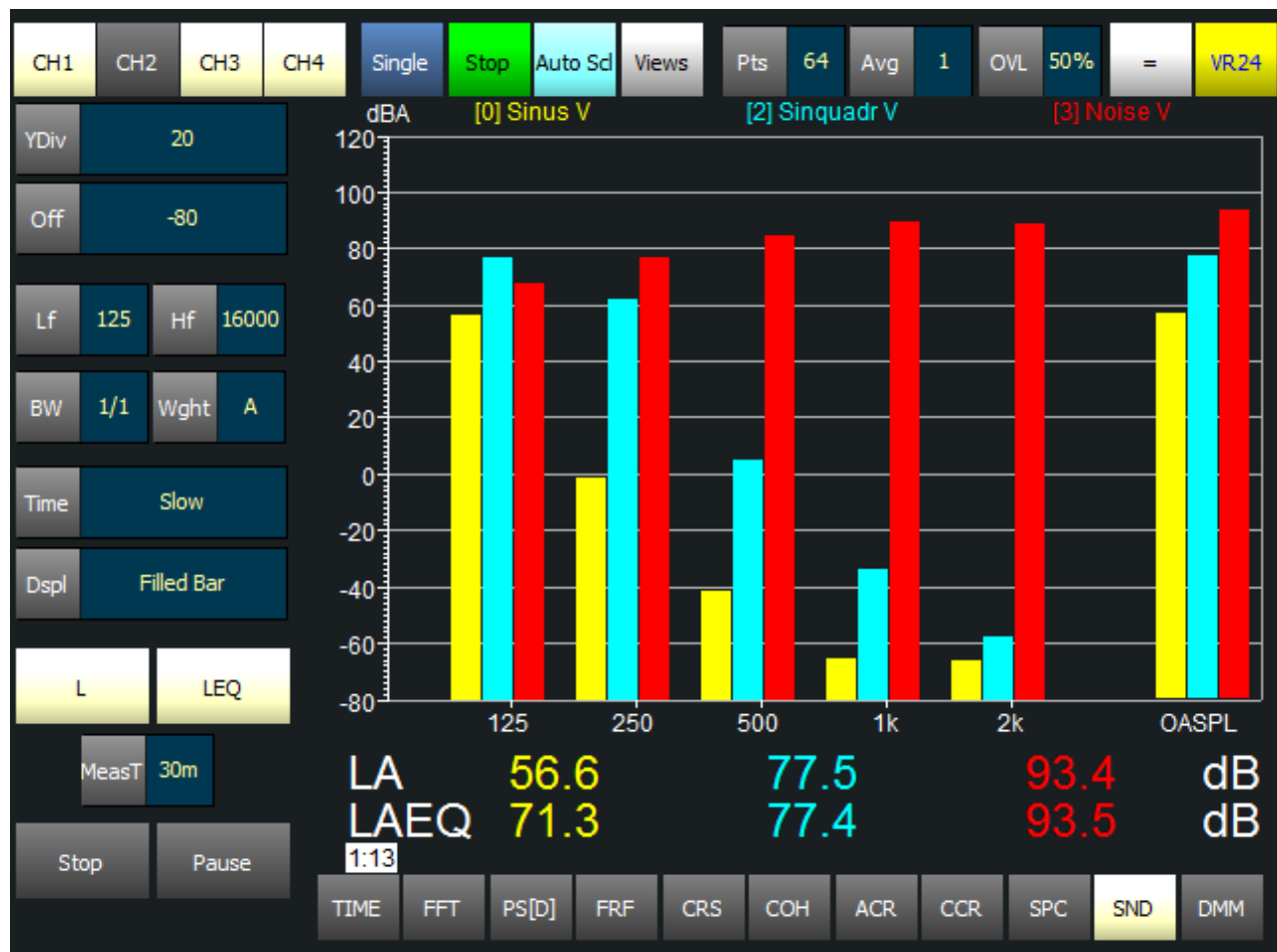
RT-View computes the spectrum with digital 6th order Butterworth filters, as recommended by ANSI standards.
This gives better time resolution than analysis based on FFT.

Supported standards are:
Filter bank   IEC 1260:1995 and the ANSI S1.11:2004
A-Weighting IEC 61672:2003

Y-Scaling

`YDiv` and `Off` allows definition of Y Scaling.

Manually define frequency range for octave analysis

`LowFrq` Let you choose the lowest frequency band.

`HighFrq` Let you choose the highest frequency band.

Bandwith

`BW` let you select the "Bandwidth" for the analysis. You can select between 1/1 and 1/3 Octave.

Weighting

The human sense of hearing is a function of the frequency and does not perceive sound equally.

Weighting curves are used to adjust the value of every octave band to the human ear.

'A' weighting is widely accepted as best approximation to human perception.

The button `Weight` selects the weighting filter. You can choose between Linear (unweight / Z) , A or C Filter.

Time weighting

Exponential averaging with selectable integration time is used to improve accuracy.

`TIME` let you choose between Slow (1sec), Fast (125msec) or 35 msec integration time.

This allows adaption of a wide variety of signals.

Display

`Dspl` switches the presentation style of the diagram between line and filled bar.

L – Sound pressure level

`L` toggles on or off the presentation of the frequency and time weighted sound pressure level.

LEQ - Equivalent continuous sound pressure level

`LEQ` Toggles on or off the presentation of the frequency weighted equivalent continuous sound pressure level

`MeasT` defines the duration of the equivalent continuous sound pressure level calculation

To start the calculation of LEQ tap `Start`

To stop the calculation of LEQ tap `Stop`

To pause the calculation of LEQ tap `Pause` .

To continue a paused LEQ calculation tap `Pause` again.

Digital multimeter (DMM)

The DMM shows the minimum, maximum, RMS, mean or instantaneous channel values with integration times of 0.3, 1 and 3 seconds.

You can change the calculation method by tapping the Calc button and choosing one of these options:

Calulation	Function
ONE	Last value in tine interval T
Mean	Mean Value with integration time T
RMS	Root Mean Square value with integration time T
MIN	Min value in time T
MAX	Max value in time T

To change the integration time tap the T button and choose between the options: "0.3", "1"and "3".