# M520 series oscilloscope
# Rollmode
# User's Guide
# Version 1.01
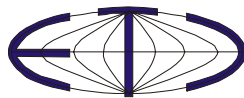
Thank you for choosing oscilloscope with rollmode from M520 series, a product of ETC s.r.o. We believe it will fulfill your expectations. In order to assure that we will be able to provide you with up-to-date information, please fill-out the registration form at the ETC website.

For any further information or consultations, please contact us via mail, phone or preferably e-mail on the following address:

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## Precautions

Please follow these recommendations to avoid any possible problems that might occur while using the oscilloscope:
- read the User's Guide
- always connect device using cable, which is the part of package. If it is not possible, always use USB 2.0 cable.
- never connect signal with absolute voltage higher than 200V to measuring inputs. This value is valid for frequencies lower than 100kHz. Over this frequency, the voltage lowers with raising frequency. For example frequency 200kHz of 100V, 400kHz of 50V is the limit.
- never connect voltage lower than –10V and higher than +13V to the external triggering input (frequency lower than 20kHz). Over 20kHz, voltage lower than -0.5V or higher than +4V is not recommended.
- never connect voltage to the oscilloscope ground, it may result in device or computer damage
- never disassemble device, since there are no user serviceable parts inside

# 1. Installation

## 1.1. Requirements

Minimum configuration:
- PC PENTIUM compatible computer with speed of at least 300MHz
- 64MB RAM
- CD-ROM
- VGA with resolution 800 x 600
- USB port
- mouse or other tracking device
- at least 20MB free space on the hard drive
- MS Windows 98 SE, ME, 2000 or XP

Recommended configuration:
- PC PENTIUM compatible computer with speed of at least 1.5GHz
- 128MB RAM
- CD-ROM
- VGA with resolution at least 1024x768
- USB port 2.0
- mouse or other tracking device
- at least 20MB free space on the hard drive
- MS Windows 98 SE, 2000 or XP

## 1.2. Hardware installation

Connect one side of the cable to the computer, other one to the device. Proceed with the software installation.

**WARNING: Always use cable, which is the part of the package. Usage of the improper cable can disable communication with the computer.**

## 1.3 Software installation

The software and the device drivers are located on the enclosed CD. Insert the CD into the CD-ROM drive. Then follow the instructions of the setup program that should launch automatically. If the CD autorun option is not enabled in your computer's settings, please run file *autorun.exe* from the CD.

# 2. Hardware

The information contained in this chapter will help you to understand the features of your oscilloscope.

## 2.1. Hardware description

The M520 series of dual channel digital storage USB oscilloscopes connect to the computer via USB. They are compatible with both USB 2.0 and USB 1.1. Measurement accuracy is achieved by the stability of the parts used together with the computing power of the computer. Calibration data are part of the HW, which makes it impossible to loose them (oppose to the calibration data located on the diskette). Therefore, it is possible to simply connect the hardware to any computer (via USB 1.1 or USB 2.0 interface). All you have to do is just install the software.

The M520 series oscilloscopes allow user to measure waveforms using two independent channels with resolution of 8 bits and sensitivity from 10mV/div to 5V/div (80mVfs to 40Vfs) in 9 steps. One division of the oscilloscope screen contains 32 dots. Input impedance matches the oscilloscope standards, therefore any regular oscilloscope probe (with minimum compensation range of 32pF) can be connected to the device. The software supports 1:1, 1:10, 1:100 and 1:1000 probes. AC or DC coupling and type of probe can be independently selected for each vertical channel. Any input can be grounded without disconnecting the probes from the measured system. Vertical track position can be controlled with accuracy of 1 pixel of the oscilloscope screen. Measurement can be triggered from the Channel A and Channel B and/or blocked from Channel A, Channel B and/or External ARM input. Trigger and ARM threshold can be set independently for each channel in the range of whole oscilloscope screen with resolution of one pixel. Threshold of the External ARM input is fixed to about 1.5V (TTL and CMOS compatible).

Each measuring channel of the M520 series oscilloscopes has its own AD converter. No channel multiplexing is used for dual channel operation. Data are stored in the internal dual port buffer of the device. The computer continuously reads data as fast as possible (depending mainly on the operational system and other tasks opened). If the computer interrupts reading for time longer then the time necessary to acquire higher amount of data then the capacity of the internal buffer the buffer overflow occurs. This situation is indicated by vertical red line. Probability of buffer overflow is raising with higher sampling speed and higher amount of running applications. During data acquisition it is recommended to close all applications, which are not necessary for your current work.

# 3. Basic information

## 3.1. Front panel layout

Channel A, channel B, external ARM input and LED are accessible on the front panel.



*Fig. 3.1.1. – Front panel*

If the LED color is:
- green, the device is configured and there is no communication with a computer in this moment
- orange, the device communicates with a computer
- red, device is powered, but not configured

## 3.2. Basic terms

This Chapter explains the basic terms used throughout the text.

**Click** – Position the mouse cursor over the chosen object. Then press and release the left mouse button.

**Double-Click** – Two successive clicks.

**Drag** – Position the mouse cursor over the object you want to move. Then press the left mouse button and hold it down. The chosen object moves with the mouse cursor. After releasing the mouse button the object moves to the new location.

**Enter the value into the edit box** – Click the edit box. Use the keyboard to enter the desired value and confirm by pressing "Enter".

**Insert the value into the edit box** – Click the edit box. Use the keyboard to enter the desired value.

**Set the value using the scroll bar** – It is possible to change a value by simply dragging the scroll bar slider. Clicking the arrows of the scroll bar increases or decreases the value by minimal steps. Clicking in between the slider and the arrows changes the value by larger steps.

**Select the value from the combo box** – Open the list of all possible values of the edit box by clicking it. Then set the desired value by clicking it.

## 3.3 Structure

The "Roll mode" control software consists of two independent applications.

- The data acquisition application controls device, measures and stores the measured data.

- The data viewer displays the previously measured data and allows simple voltage and time relation measurements.

These applications are independent. The only relations between them are the measured data.

# 4. The data acquisition main window

The main window opens after the application starts. Most of the oscilloscope functions are accessible via the controls located on this screen.



*Fig. 4.1. – Main window*

All controls connected to one of the channels have channel color.

**TIP: The channel color can be changed in main menu.**

## 4.1. Oscilloscope screen

The oscilloscope screen is located in the middle of the main window.

*Fig. 4.1.1. – Oscilloscope screen*

The oscilloscope screen is divided into 8 vertical divisions. The number of horizontal divisions depends on the size of the application window and the screen resolution.

There are three kinds of marks displayed on the screen.

- If the buffer overflow occurs, and some data are lost, data loss is marked by red vertical line. This line marks the loose of data continuity.

- The device settings change is marked by read vertical line.

- If the data acquisition is blocked by ARM conditions, the data discontinuity is marked by olive green vertical line.

The waveforms are displayed in the colors selected for each channel. The default colors are: green for channel A and yellow for channel B.

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**TIP: The channel colors can be changed in main menu.**

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## 4.2. Grid controls

The cursors and grid controls are located in the left part of the main window.



*Fig. 4.2.1. – Grid controls*

"Grid" –  switches the grid on/off
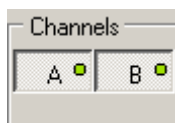
 The scrollbar  –  adjusts grid brightness

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**TIP: The grid color can be changed in main menu.**

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## 4.3. Channel visibility controls

The channel visibility controls are located in the left of the main window.



*Fig. 4.3.1. – Channel visibility controls*

"A" – activates/deactivates channel A waveform
"B" – activates/deactivates channel B waveform

## 4.4. Display mode controls

The display mode controls are located in the left of the main window.



*Fig. 4.4.1. – Display mode controls*

"BF" – activates/deactivates „Beam finder" mode. When activated, the waveform exceeding vertical range is displayed as line on appropriate side of the screen.

"Line" – activates/deactivates mode, where the sample is connected with adjacent one with line.

"Rew" (Rewrite) and "Roll" control the waveform drawing mode. When "Rew" is selected, the waveform is always drawn from the left to right side of the screen and the old waveform is continuously cleared off. When "Roll" is selected, the waveform is drawn always on the right edge of the screen and rolls to left.

**TIP: The "Roll" mode requires more processor time. If you display waveform sampled with high sampling rate, choose the "Rew" mode.**
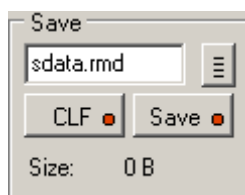
"Display" – switches on/off the oscilloscope screen

**TIP: Switching off the oscilloscope screen lowers the possibility of data loss.**

## 4.5. Data save controls

The data save controls are located in the bottom of the main window.

*Fig. 4.5.1. – Data save controls*

The name of target file has to be inserted into the upper edit box.

The  button opens standard operating system dialog, where you can select target file.

Click „Save" to enter the "data saving" mode. The data are continuously saved to disk during acquisition. The length of the file is indicated on the right of the "Size" label.

"CLF" – (Clear file) erases the file

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**WARNING: The "Data save" controls are inactive, when the data acquisition is in progress.**

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If the selected file already exists on the disk, measured data will be appended to it.

## 4.6. Waveform display mode control

The controls are located in the bottom of the main window.



*Fig. 4.6.1. – Waveform display mode controls*

If more than 1 sample is displayed to one dot of the waveform, it is necessary to set the mode of creating the dot. There are two buttons to choose the basic mode.

If "SNG" is selected, only the first sample of time period represented by the dot is displayed.

If "Calc" is selected, the dot is calculated out of all samples. The method of calculation depends on the following controls:

If the  is activated, the displayed dot is calculated as average of the measured samples.

If the  is activated, the displayed dot is calculated as a maximum of measured samples.

If the  is activated, the displayed dot is calculated as a minimum of measured samples.

If both the  and  are activated, the line between maximum and minimum value of samples is displayed.

"Clear Scr" clears the oscilloscope screen.

## 4.7. Timebase controls

The timebase controls are located in the bottom of the main window.
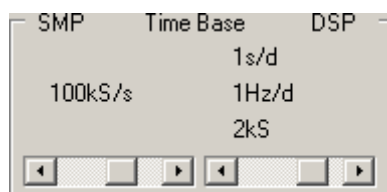


*Fig. 4.7.1. – Timebase controls*

The scrollbar on the left side controls the sampling frequency. The actual sampling frequency is shown above. Usable values are 50S/s to 5MS/s settable in 1-2-5 sequence.

**WARNING: The fastest sampling frequency is usable only if the oscilloscope is connected to computer via USB 2.0 interface. It is strongly recommended to close any other application and choose the "Rew" display mode or switch the oscilloscope display off (see chapter 4.4.). If the oscilloscope is connected to computer via USB 1.1 interface the maximum usable sampling frequency is 250kS/s.**

The scrollbar on the right side controls the display timebase. The following information are displayed above this scrollbar:
- time of one grid division
- 1/time of one grid division
- number of samples aggregated to one screen point

**TIP: For more information about display mode please see chapter 4.6.**

If the change of one scrollbar results in lack of samples to create the dot, the position of the second scrollbar will be adjusted to get one sample for each displayed dot.
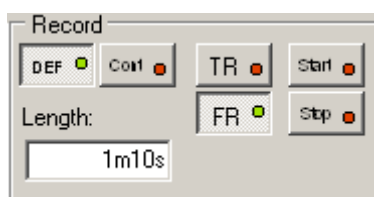
**WARNING: If the scrollbar position is adjusted due to above mentioned reasons automatically, it won't be readjusted back, when the reasons are gone.**

## 4.8. Data acquisition mode control

The data acquisition mode control elements are located in the bottom of the main window.

*Fig. 4.8.1 – Data acquisition mode controls*

These controls allow to set mode of data acquisition start and its length.

The controls located in the left side sets the length of data acquisition. When the "Cont" button is pressed, the continuous mode of data acquisition is selected. In this case, only way to stop the data acquisition is pressing the "Stop" button located on the right side of this group.

Pressing the "DEF" button activates the "Length" edit box. Now it is possible to enter the length of the data acquisition in hours, minutes and seconds. "h" means hours, "m" minutes and "s" seconds. For example 2h35m25s means two hours, 35 minutes and 25 seconds.

Controls on the right side of the group define the conditions for the start of data acquisition and start or stop it.

The "FR" button sets the free run mode. In this mode the data acquisition starts after pressing the "Start" button immediately.

The "TR" button sets the triggered mode. To start the data acquisition it is necessary to press the "Start button" and then to reach the trigger conditions selectable by "trigger controls" (see. chapter 4.9.).

Pressing the "Start" button starts the data acquisition according to the conditions mentioned above.

Pressing the "Stop" button stops the data acquisition immediately.


## 4.9. Trigger controls

These elements are located in the bottom side of the main window. They have effect only if the triggered data acquisition mode is set (see chapter 4.8.)
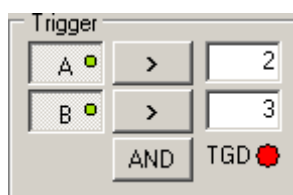


*Fig. 4.9.1. – Trigger controls*

The first row of the control elements represent Channel A, the second one channel B trigger condition settings. The left button ("A" and/or "B") activates the trigger condition for Channel A, or Channel B. The buttons located in the middle column set the relations to value written in edit boxes located at the right side of the group. The value written to these boxes represents voltage in volts or milivolts (m).

The button located in the bottom row of the group becomes active if both trigger conditions for Channel A and Channel B are activated. It defines the influence of each of the channels on the trigger event. It can be set to one of the following states:

- "AND" the data acquisition starts if both conditions are met

- "OR" the data acquisition starts if any condition is met.
         The "TGD" indicator changes its color under the following conditions:
- it is red if the trigger condition did not occurred yet
- it is green if the trigger condition has already occurred.

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**WARNING: ARM-ing circuitry (see chapter 4.10.) have higher priority than the triggering circuits. If the triggering circuits are set to the conditions under which the data acquisition is blocked (by ARM-ing circuitry), the acquisition will never start.**

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## 4.10. ARM-ing the data acquisition

         Located in the bottom right side of the main window, these control elements allow to set conditions under which the data acquisition is interrupted. The reason of interruption can be the voltage measured by each channel and/or logic level on the "E" input of the instrument.
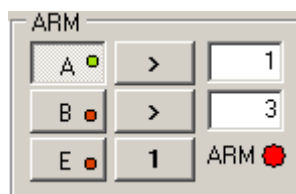


*Fig. 4.10.1. – ARM control elements*

         The first and second row of the control elements represents the Channel A and Channel B ARM condition settings. The left button ("A" and/or "B") activates the ARM conditions for Channel A or Channel B. The buttons located in the middle set the relations to value written in edit boxes located at the right side of the group. The value written to these boxes represents voltage in volts, or milivolts (m). If the condition set is FALSE the data acquisition is interrupted. It starts again when all active conditions are met.
         There are two buttons in the bottom row. When the "E" button is active the data acquisition is controlled also by the "E" input of the device. This input is LVCMOS 3.3V compatible with threshold of about 1.5V. The button located on the right side defines the ARM condition for the "E" input. If it is set to "0" the data acquisition will be interrupted if the "E" input is connected to log. 1. If it is set to 1, log.0 interrupts the data acquisition.
         If there are several ARM inputs set to active state, every active condition must be met to allow data acquisition.

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**TIP: Internal 10 kOhm pull-up resistor is connected between "E" input and 3.3V power supply of the oscilloscope. This sets log.1 to unconnected input. This condition can be used for simple data acquisition control. If only the E arming condition is active and set to 1, grounding the "E" input interrupts the data acquisition. If the condition is set to 0, grounding the "E" input starts the data acquisition.**

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         The "ARM" indicator changes its color under following conditions:

- it is red, if the data acquisition is not started (and triggered) yet
- it is yellow, if the data acquisition has started already, but it is interrupted by ARM-ing system
- it is green if the data acquisition is in progress.

## 4.11. Vertical range controls

The vertical range controls are located in the right of the main window.



*Fig. 4.11.1. – Range controls*

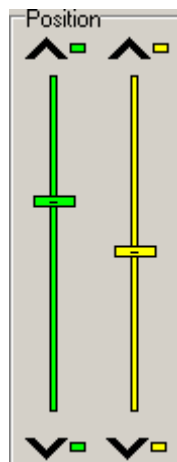Channel A controls are located in left, channel B controls are located in the right side.

 - changes the range to less sensitive
 - changes the range to more sensitive

## 4.12. Vertical shift controls

The vertical shift controls are located in the right side of the main window.



*Fig. 4.12.1. – Vertical shift controls*

Channel A controls are located in left, channel B controls are located in the right.
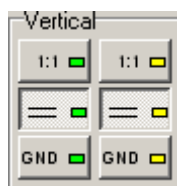 - the waveform is shifted upwards by smallest possible value
 - the waveform is shifted downwards by smallest possible value.
Click between slider and button to shift waveform by approx. 1 point.
The vertical shift can be set by dragging the slider as well.

## 4.13. Signal source controls

The signal source controls are located in the right of the main window.



*Fig. 4.13.1. – Signal source controls*

Channel A controls are located in the left, channel B controls are located in the right.

"1:1", "1:10", "1:100" or "1:1000" – probe attenuation ratio

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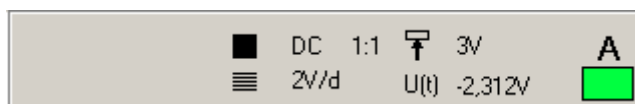**WARNING: Selection of improper probe attenuation may result in wrong information about voltages.**

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Click  to select coupling. Click  to ground input.

## 4.14. Channel information

The channel information are displayed in the top of the main window.
Channel A information are located in the left, channel B information in the right.



*Fig. 4.14.1. – Channel information*

Following information are displayed:

■ - information about coupling and probe attenuation ratio
≡ - range

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**WARNING: If the improper probe attenuation is set, the information will be inaccurate.**

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„U(t)" – the last measured value
⊤ - trigger threshold voltage

## 4.15. Main menu

The main menu is located in the top of the main window. Following menu items are available:

*File* / *Viewer* – Opens the data viewer.

*File | Exit* – Closes application.

*Settings | Restore defaults* – Reloads oscilloscope settings loaded on the application start.

*Settings | Load settings* – Loads oscilloscope settings saved by selecting "Settings | Save settings" menu item.

*Settings | Save settings* – Saves oscilloscope settings to hard disk (to other file than default settings).

*Settings | Demo setup* – Opens window, where you can select signal parameters in demonstration mode.

*Settings | Color setup* – Opens window for color selection.

*Settings | Tool tip help* – Activates/deactivates the tool tip help.

*Settings | High priority* - Sets high priority execution of oscilloscope application.

*Help | Index* – Displays the Help index.

*Help | ETC web* – Starts the internet browser installed in the computer to display the ETC's web site. This feature works only if the computer is already connected to internet.

*Help | Support* – Sends the e-mail message to the ETC's customer support. This feature works only if the computer has connection to internet.

*Help | About* – Displays information about product.

## 4.15.1. Demo setup window

The demo setup window is opened after click on the main menu item.
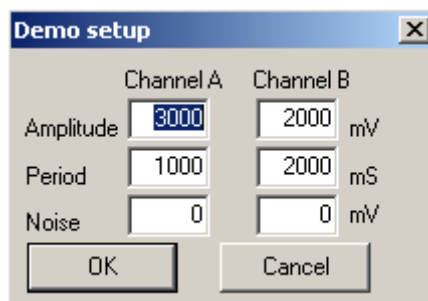


**Fig. 4.15.1.1. – Demo setup window**

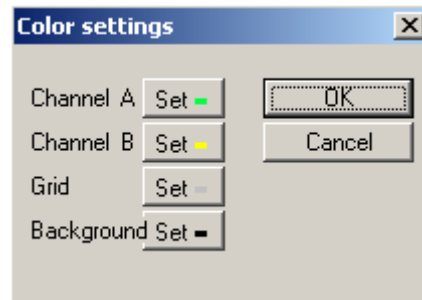Channel A controls are located in left, channel B controls are located in the right.

"Amplitude" – amplitude of demo signal in mV

"Period" – period of demo signal in ms

"Noise" – noise level in mV

## 4.15.2. Color settings window

The color settings window is opened after click on the main menu item.

***Fig. 4.15.2.1. – Color settings window***

Click "Set" button located by label to open standard operating system color dialog to change color of:

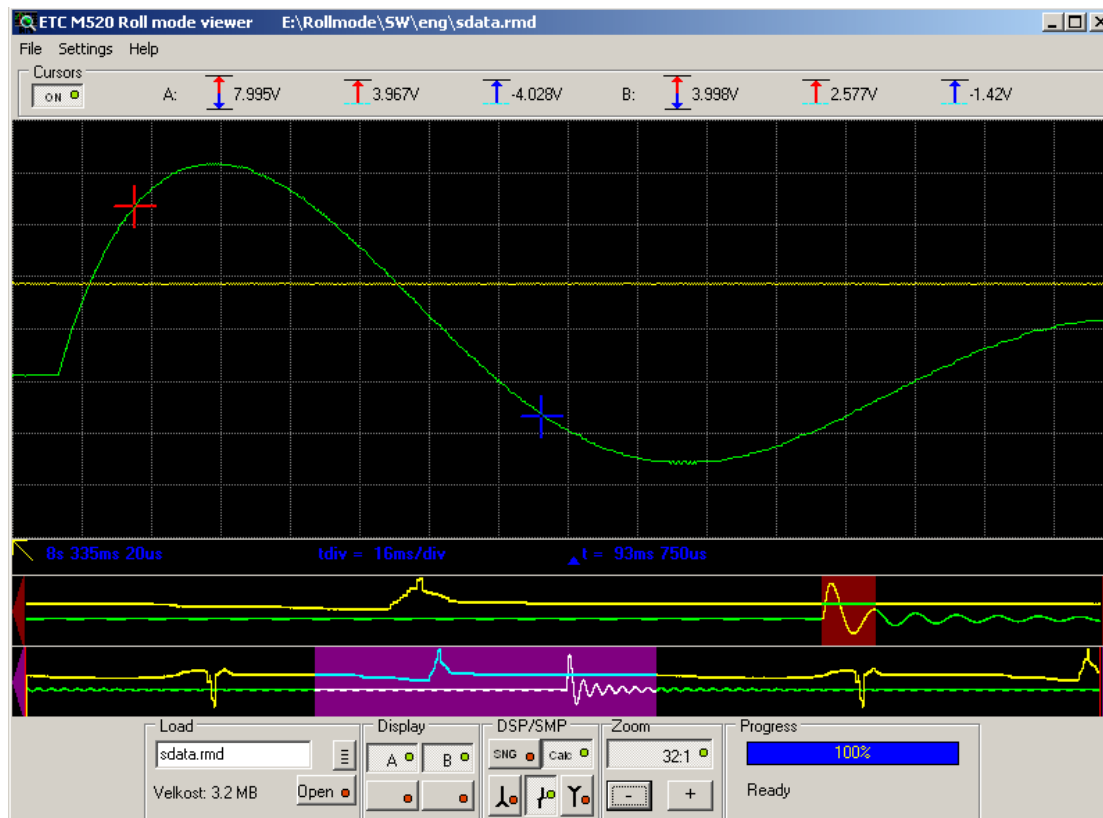"Channel A" – channel A waveform and controls
"Channel B" – channel B waveform and controls
"Grid" – grid
"Background" – background

# 5. Data viewer main window

Figure 5.1. shows the main window of the data viewer.



***Fig. 5.1. – The data viewer main window***

The main window consists of the waveform screens, control elements, set of measured data and the main menu. The first operation you have to perform is opening the data file you want to view. If no file is opened, most of the control elements are inactive.

## 5.1. Opening the data file

The viewer is designed to use data created by the "Roll mode" of M520 series oscilloscopes. Every file is created with extension "rmd". Structure of the data file is designed for handling huge amount of data. To speed up operations with the data file some data integrity checks are not performed. Please note that opening the file containing data incompatible with the viewer data structure can lead to unpredicted behaviour of the viewer.

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**WARNING: Opening the incompatible file can lead to unpredictable behaviour of data viewer.**

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The control elements for opening the data file are located on the lower left side of the screen.
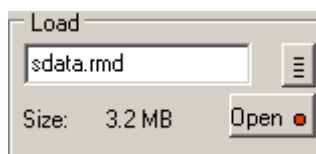
*Fig. 5.1.1. – Data file control elements*

The file name has to be inserted into the upper edit box.

The  button opens standard operating system dialog, where you can select the target file.

Click „Open" to load data.

The length of the file is indicated on the right of the "Size" label.

The "progress" bar located on the right bottom side of the screen indicates the state of the load operation.
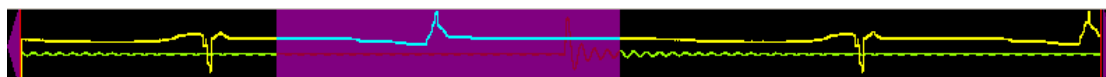
## 5.2.  Waveform screens

The waveform screens are shown on the fig. 5.2.1. They are used to display the whole data stored in the data file, part of data stored in internal buffer of the computer and part of data used for detailed measurements.
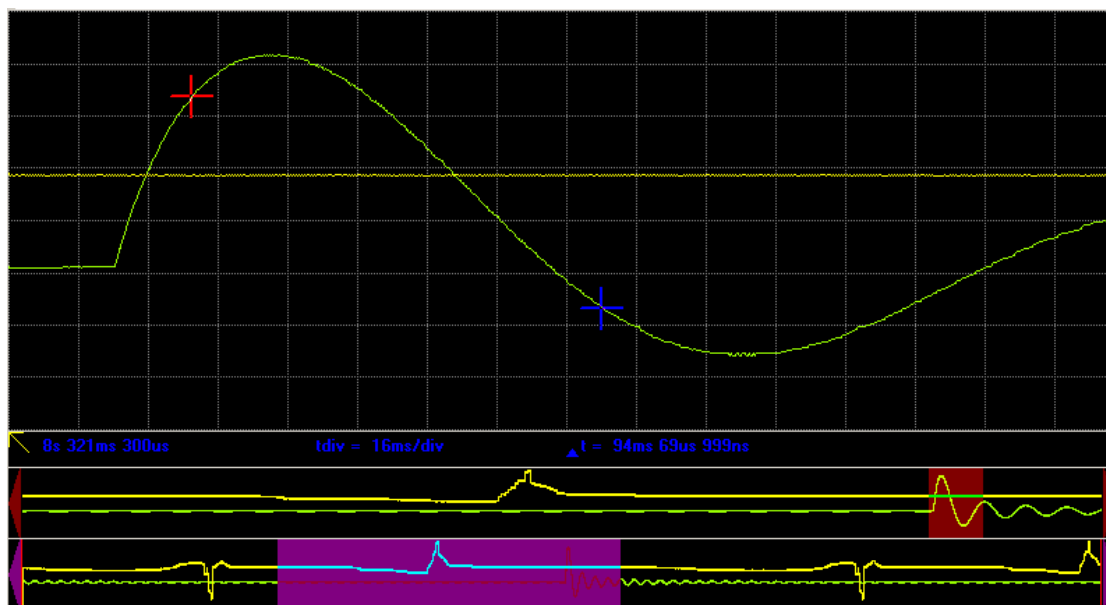


*Fig. 5.2.1. – Waveform screens*

The "file screen" is located on the bottom side of the screens. It shows whole data stored in the data file (Fig.5.2.2). The violet color bar marks the data area cached in the internal waveform buffer of the computer. By moving this bar it is possible to change the content of the internal buffer. To move this bar click on screen on left or right side of it, click on arrows or simply drag it to desired position.
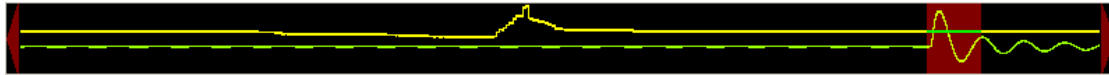


*Fig. 5.2.2. – File screen*

**WARNING: Moving data to internal buffer is the time consuming operation. The reaction to bar movements can take several seconds.**

The waveform stored in the internal buffer is displayed on the screen positioned right above the file screen. Fig. 5.2.3. shows this "Buffer screen".



*Fig. 5.2.3. – Buffer screen*

The brown color bar marks the area displayed on the screen called "Main screen". This screen shows detailed waveforms and allows cursor measurements. The brown color bar can be moved over the buffer screen. Moving this bar changes the content of the main screen.

The main screen occupies the largest part of the screen area (fig. 5.2.4.).
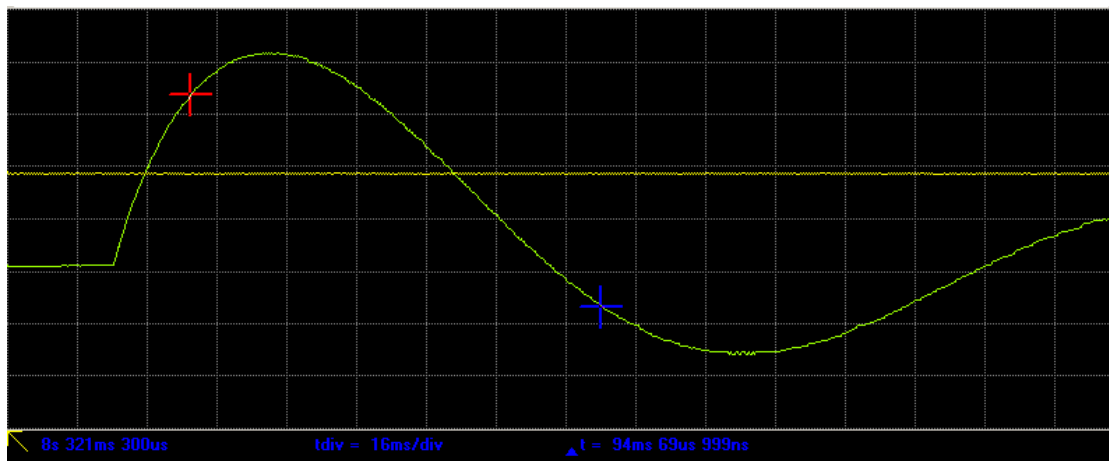


*Fig. 5.2.4. – Main screen*

Its vertical resolution is 256 points. It is able to display all details of the waveform. There are auxiliary information displayed on the bottom of this screen. From right to left: The real time of the left edge of the screen, horizontal grid size (time) and time between the screen cursors (red and blue cross).

**VARNING: Any place of the data can be marked by the time synchronization mark. The real time of the marked place can be set to any value. The real time of the left most edge of the screen is related to this mark. Sometimes it can be a negative value.**

In addition to the waveforms, three types of cursors can be displayed on the main screen.

## 5.3. Cursors

There are three types of cursors to perform measurements on the waveforms.
- time synchronization mark
- waveform cursors

- screen cursors

The first and the second one are usable for time relation measurements. The screen cursors are usable for both time and voltage measurements.

The time synchronization mark can be set to any place of the whole waveform. The time of this place can be set to any value. Any "real time" information will be calculated using this time. If the time synchronization mark is not used or it is deleted, the "real time" information are synchronized with the beginning of the measurement with time 0.

It is possible to place 10 "waveform cursors" (including the time synchronization mark) to whole waveform. The positions of these cursors are shown on all screens. They have different colors and names (C0 – C9). They are usable to get "real time" information of their positions, information of time periods between these cursors and the time period between the position of any of these cursors and the red screen cursor. It is also simple to change the position of the main screen for displaying the waveforms around any of these cursors (see chapter 5.3.1.).

It is possible to activate two "screen cursors" on the main screen. They are displayed as the red and blue crosses. The information about the time period between these cursors is displayed under the screen (i.e. ). The results of voltage measurements using these cursors are displayed above the main screen.

## 5.3.1. Using cursors

Click right mouse button on the main screen to pop-up menu.
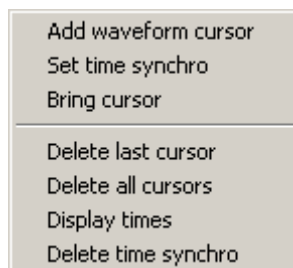


*Fig. 5.3.1.1. – Cursor manipulation menu*

*Add waveform cursor* – Adds waveform cursor. It is possible to drag it to any place of the main screen. The image of this cursor is also added to the file and buffer screens. The cursor is visible on main and buffer screen depending on their content.

*Set time synchro* – Creates time synchronization mark, if it is not already created. The mark has real time value 0 and it is possible to drag it to any place of the main screen.

*Bring cursor* – Moves selected waveform cursor to the main screen. After activation of this function the cursor selection menu will be displayed.
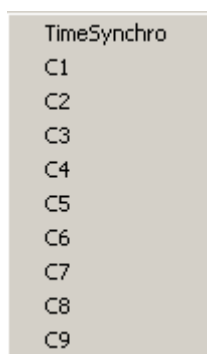
*Fig. 5.3.1.2. – Cursor selection menu*

*Delete last cursor* – Deletes the last added cursor

*Delete all cursors* – Deletes all waveform cursors

*Display times* – Displays time periods between cursors



*Fig. 5.3.1.3. – Time periods table*

       Because the string of the displayed time could be too long to display, if you locate the mouse over the time string, the full information will be displayed. The time periods are displayed including information of the relation of the cursors. It is the difference between position of the cursor from the upper row and the cursor from left column. If the time period value is negative, the cursor from left column points to later time than the cursor from upper row.

       Click "Export to clipboard" to save the time periods information to the clipboard. The data consists of the pair of cursor's names followed by data period information (from position of the second cursor is subtracted the position of the first one). The example of the clipboard export follows:

TimeSynchro-C1 =  63ms 29us 999ns
TimeSynchro-C2 =  126ms 779us 999ns
TimeSynchro-C3 =  3s 433ms 909us 999ns
TimeSynchro-C4 =  3s 592ms 529us 999ns
TimeSynchro-C5 =  5s 548ms 519us 999ns

TimeSynchro-C6 =  10s 2ms 339us 999ns
TimeSynchro-C7 =  10s 64ms 739us 999ns
TimeSynchro-C8 =  10s 128ms 419us 999ns
TimeSynchro-C9 =  13s 562ms 360us
C1-TimeSynchro = - 63ms 49us 999ns
C1-C2 =  63ms 740us
C1-C3 =  3s 370ms 869us 999ns
C1-C4 =  3s 529ms 490us
C1-C5 =  5s 485ms 479us 999ns
C1-C6 =  9s 939ms 299us 999ns
C1-C7 =  10s 1ms 699us 999ns
C1-C8 =  10s 65ms 379us 999ns
C1-C9 =  13s 499ms 320us
C2-TimeSynchro = - 126ms 800us
C2-C1 = - 63ms 760us
C2-C3 =  3s 307ms 119us 999ns
C2-C4 =  3s 465ms 739us 999ns
C2-C5 =  5s 421ms 729us 999ns
C2-C6 =  9s 875ms 549us 999ns
C2-C7 =  9s 937ms 949us 999ns
C2-C8 =  10s 1ms 629us 999ns
C2-C9 =  13s 435ms 569us 999ns
C3-TimeSynchro = - 3s 433ms 929us 999ns
C3-C1 = - 3s 370ms 889us 999ns
C3-C2 = - 3s 307ms 139us 999ns
C3-C4 =  158ms 610us
C3-C5 =  2s 114ms 600us
C3-C6 =  6s 568ms 420us
C3-C7 =  6s 630ms 820us
C3-C8 =  6s 694ms 500us
C3-C9 =  10s 128ms 440us
C4-TimeSynchro = - 3s 592ms 550us
C4-C1 = - 3s 529ms 510us
C4-C2 = - 3s 465ms 760us
C4-C3 = - 158ms 630us
C4-C5 =  1s 955ms 979us 999ns
C4-C6 =  6s 409ms 799us 999ns
C4-C7 =  6s 472ms 199us 999ns
C4-C8 =  6s 535ms 880us
C4-C9 =  9s 969ms 819us 999ns
C5-TimeSynchro = - 5s 548ms 539us 999ns
C5-C1 = - 5s 485ms 500us
C5-C2 = - 5s 421ms 750us
C5-C3 = - 2s 114ms 620us
C5-C4 = - 1s 956ms
C5-C6 =  4s 453ms 809us 999ns
C5-C7 =  4s 516ms 210us
C5-C8 =  4s 579ms 889us 999ns
C5-C9 =  8s 13ms 830us
C6-TimeSynchro = - 10s 2ms 359us 999ns

C6-C1 = - 9s 939ms 319us 999ns
C6-C2 = - 9s 875ms 569us 999ns
C6-C3 = - 6s 568ms 439us 999ns
C6-C4 = - 6s 409ms 819us 999ns
C6-C5 = - 4s 453ms 829us 999ns
C6-C7 =  62ms 389us 999ns
C6-C8 =  126ms 69us 999ns
C6-C9 =  3s 560ms 9us 999ns
C7-TimeSynchro = - 10s 64ms 760us
C7-C1 = - 10s 1ms 720us
C7-C2 = - 9s 937ms 969us 999ns
C7-C3 = - 6s 630ms 840us
C7-C4 = - 6s 472ms 220us
C7-C5 = - 4s 516ms 230us
C7-C6 = - 62ms 409us 999ns
C7-C8 =  63ms 670us
C7-C9 =  3s 497ms 609us 999ns
C8-TimeSynchro = - 10s 128ms 439us 999ns
C8-C1 = - 10s 65ms 399us 999ns
C8-C2 = - 10s 1ms 649us 999ns
C8-C3 = - 6s 694ms 519us 999ns
C8-C4 = - 6s 535ms 899us 999ns
C8-C5 = - 4s 579ms 909us 999ns
C8-C6 = - 126ms 90us
C8-C7 = - 63ms 690us
C8-C9 =  3s 433ms 929us 999ns
C9-TimeSynchro = - 13s 562ms 379us 999ns
C9-C1 = - 13s 499ms 340us
C9-C2 = - 13s 435ms 590us
C9-C3 = - 10s 128ms 460us
C9-C4 = - 9s 969ms 840us
C9-C5 = - 8s 13ms 849us 999ns
C9-C6 = - 3s 560ms 29us 999ns
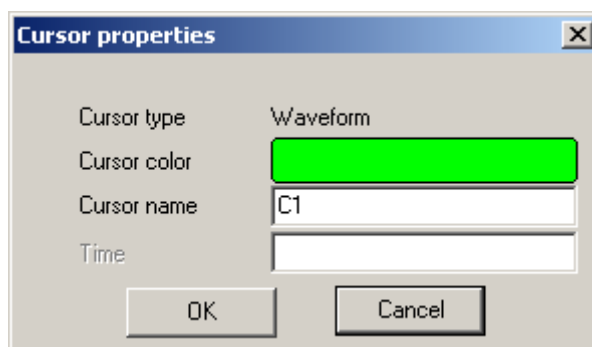C9-C7 = - 3s 497ms 630us
C9-C8 = - 3s 433ms 949us 999ns

*Delete time synchro* – Deletes time synchronization mark

The cursor properties can be modified. After clicking on the cursor (positioned on the main screen) the following menu appears.
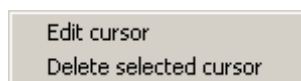


*Fig. 5.3.1.4. – Cursor modification menu*

*Edit cursor* – Displays the property modification screen

***Fig. 5.3.1.5. Property modification window***

*Cursor color* – Changes the cursor's color

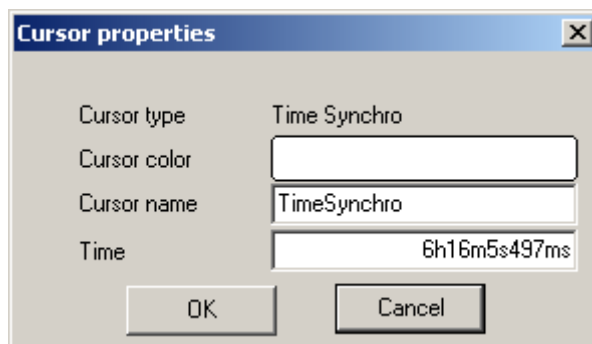*Cursor name* – The name of the selected cursor

---

**VARNING: No warning or error message is displayed when the entered name is the same as the name of any other cursor.**

---

The entered attributes become active after clicking on the "OK" button. Clicking "Cancel" closes the window with no property changes.

Clicking on the time synchronization mark opens different window.



***Fig. 5.3.1.6. – Time synchro mark modification window***

*Cursor color* – Change the cursor's color

*Cursor name* – The name of the selected cursor

*Time* – Sets the real time of the time synchronization mark position. All real time information will be related to this time. The following format is usable to enter the time: xxhyymzz.zzzs. Where xxh – time in hours, yym – time in minutes, zz.zzzs – time in seconds. While entering the time information the color of the string is blue. It changes to black after pressing the "ENTER" key. Then it is possible to click to "OK", or "Cancel" as it is described above.

Fig. 5.3.1.7. shows the viewer screens with screen cursors activated. The screen cursors can be activated/deactivated using the "Cursors" button above the screens. There are nine waveform cursors and the time synchronization mark positioned over the waveform. If the screen cursor or the time synchronization mark is

not visible on the main screen, its position is marked by left or right pointing triangle. The color of the triangle is the same as the color of the cursor.
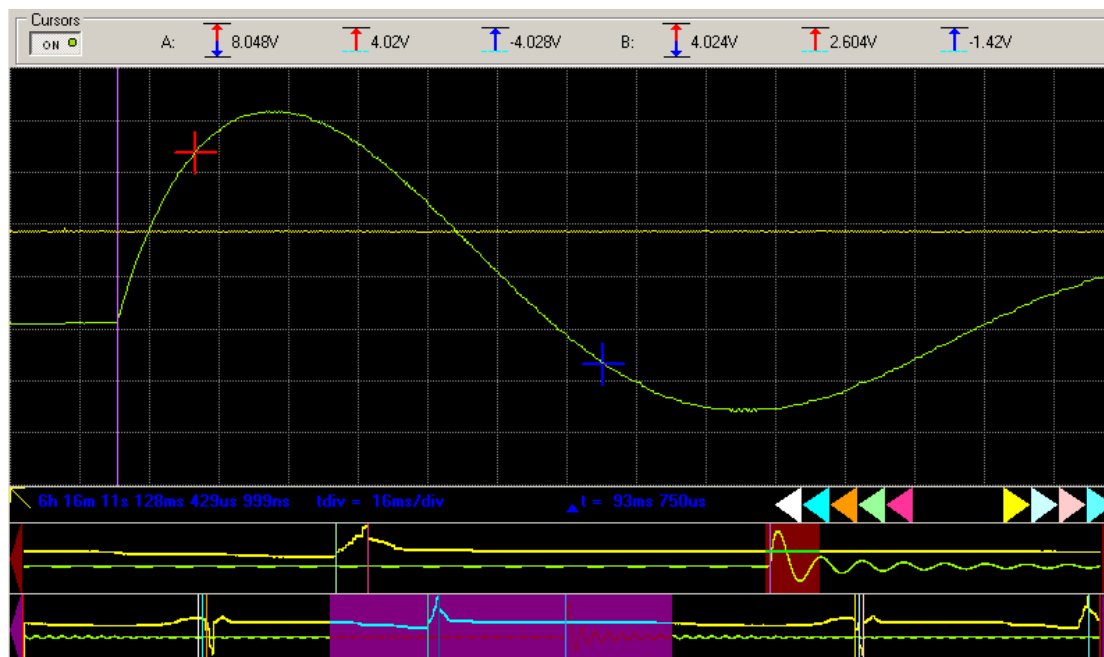


***Fig. 5.3.1.7. – Viewer screens with waveform cursors and time synchro mark***

The relative position (order) of these triangles is the same as the placement of the cursors.

Positioning the mouse cursor to the triangle, the real time of the cursor position and the time period between the red screen cursor and the selected waveform cursor (or synchronization time mark) is displayed. If the waveform cursor is visible on the main screen, positioning the mouse cursor to it has the same effect as the positioning to the triangle. If the screen cursors are not active, the time period between the waveform cursor and the red screen cursor is not displayed.

The triangles are also usable to change the main screen position in the waveform. Clicking to triangle changes the position of the main screen to display waveform around the selected cursor (or time synchronization mark).

The screen cursors are also usable to measure voltages. The voltage of the vertical position of red cursor, blue cursor and voltage between red and blue cursors (for channels A and B) are displayed above the screen.

## 5.3.2. Measuring non-continuous data

Two types of discontinuity can occur:
- Internal buffer overflow during data acquisition.
- Discontinuity caused by ARM-ing data acquisition.

The result of a time period measurement with time discontinuity caused by internal buffer overflow is displayed in red color, or as a string followed by "!" character. This indicates, that the displayed time is not correct.

If the time break is caused by ARM-ing the data acquisition, the time can be reconstructed and there is no difference between displaying the result of

measurements with no time discontinuities and with time discontinuities caused by ARM-ing.

## 5.4. Channel visibility controls

The channel visibility controls are located in the left of the main window.



*Fig. 5.4.1. – Channel visibility controls*

"A" – activates/deactivates channel A waveform
"B" – activates/deactivates channel B waveform
The buttons on the bottom row are reserved for future use and have no effect.

## 5.5. Waveform display mode control

The controls are located in the bottom of the main window.



*Fig. 5.5.1. – Waveform display mode controls*

If more than 1 sample is displayed to one dot of the waveform, it is necessary to set the mode of creating the dot. There are two buttons to choose the basic mode.

If "SNG" is selected, only the first sample of time period represented by the dot is displayed.

If "Calc" is selected, the dot is calculated out of all samples. The method of calculation depends on the following controls:

If the  is activated, the displayed dot is calculated as average of the measured samples.

If the  is activated, the displayed dot is calculated as a maximum of measured samples.

If the  is activated, the displayed dot is calculated as a minimum of measured samples.

If both the  and  are activated, the line between maximum and minimum value of samples is displayed.

## 5.6. Zoom control

The waveform displayed on the main screen can be zoomed. The zoom controls are located below the screens.



*Fig. 5.6.1. Zoom controls*

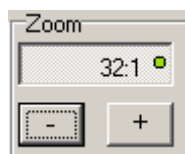The upper button switches zoom on/off. If it is switched off each sample is displayed as the dot on the screen. If it is activated, each displayed dot represents several samples. Number of samples (zoom ratio) is displayed on the button. The display mode is described in chapter 5.5. of this manual. The zoom ratio is controlled via buttons "-" and "+".

## 5.7. Progress indicator

Some operations with the long data files can take lot of time. The progress indicator located in the lower left side of the main window informs you about the state of the operation.
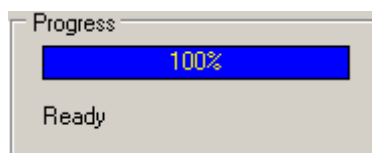


*Fig. 5.7.1. Progress indicator*

The type of operation is indicated below the progress indicator.

## 5.8. Main menu

The main menu is located in the top of the main window. Following menu items are available:

*File | Print* – Opens the print manager .
*File | Exit* – Closes application.
*Settings | Color setup* – Opens window for color selection.
*Settings | Show grid* – Activates/deactivates the grid on the main screen.
*Help | Index* – Displays the Help index.
*Help | ETC web* – Starts the internet browser installed in the computer to display the ETC's web site. This feature works only if the computer is already connected to internet.
*Help | Support* – Sends the e-mail message to the ETC's customer support. This feature works only if the computer has connection to internet.

*Help | About* – Displays information about product.

## 5.8.1. Print Support

To open the print manager window, click the "Print" item of the <u>main menu</u>.
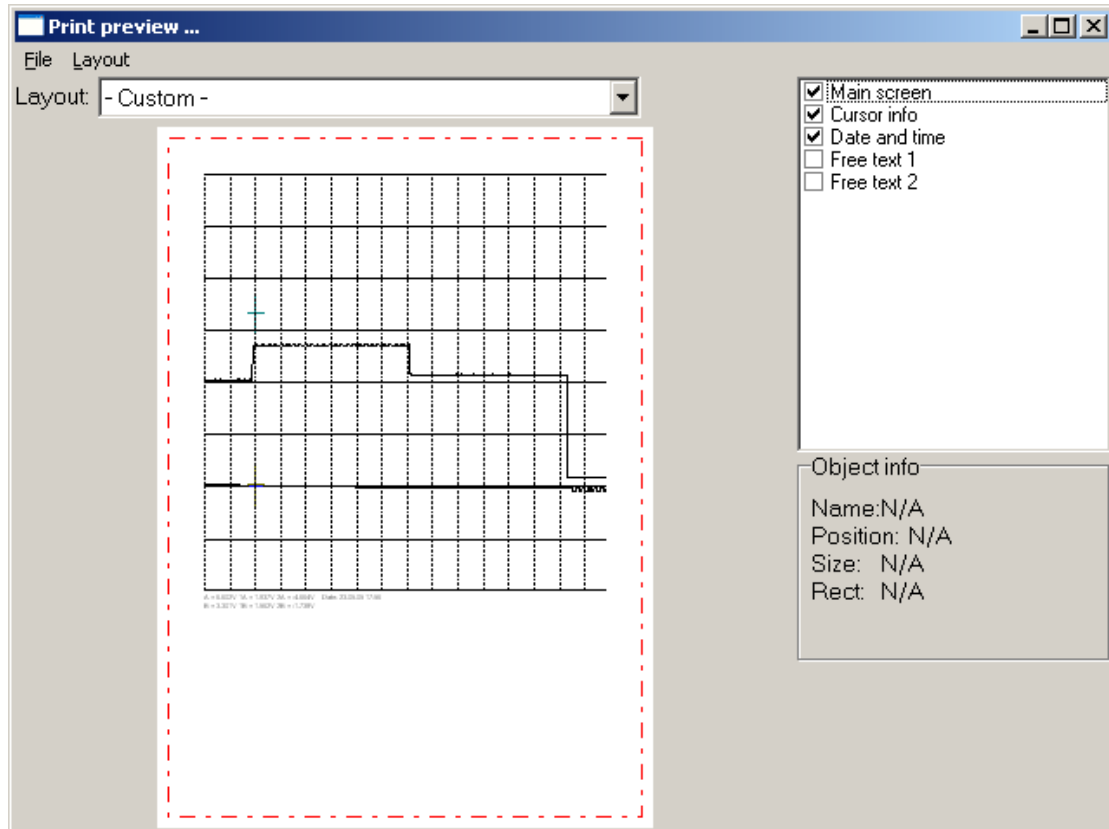


*Fig. 5.8.1.1. - Print Manager Window*

On the left side of the window the page is previewed as it will be printed. Several important parts of the page are highlighted. The lines marking these parts will not be printed. The red line outlines the printable area of the page. Selected object is marked by black dashed outline.

To select an object, click it. You can move it into a desired position by dragging it. To change the size of a chosen object, drag its outline.

In the lower right corner of the window the following information on the properties of the selected object is shown:

"Name"     – Name of the object
"Position" – Coordinates of the upper-left corner of the object on the page in millimeters
"Size" – Size of the object in millimeters
"Rect" – Position of the upper-left corner and the lower-right corner on the page in millimeters
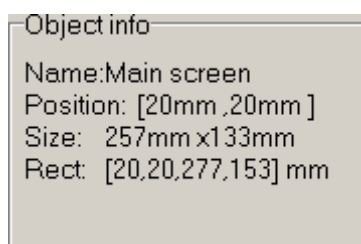
*Fig. 5.8.1.2. - Object Info*

In the upper-right corner of the window names of all the objects that can be placed into the page are listed. To display/hide an object, click the box next to the object name. To select an object, click the name of the object (if the object is displayed).
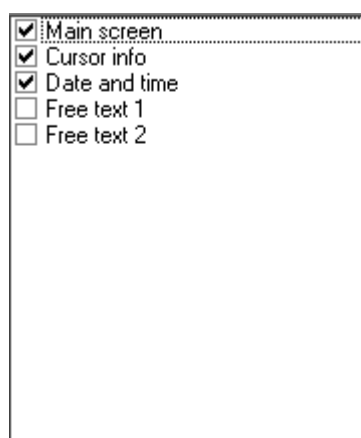


*Fig. 5.8.1.3. - List of available objects*

**TIP: Two objects with content that can be specified by the user are available (objects "Free text 1" and "Free text 2"). Double-clicking any of these objects opens a dialog window to insert the text to be displayed.**

It is possible to select automatic layout and predefined schemes of object display in the "Layout" combo-box. Choosing the "Custom" item does not affect the current layout.

**WARNING: In the "Layout" combo-box only the layouts available for the current paper size are shown.**

It is possible to save a modified layout under the current name choosing the "*Layout | Save layout*" item of the main menu of this window. To save it under a different name, choose "*Layout | Save layout as*". A dialog box will appear to insert the name for the new layout.

Following are the other items Layout menu consists of:
„*Layout | Manage layouts*" – Opens the Layout manager window.
„*File | Printer setup*" – Opens the printer settings window
„*File | Print*" – Prints the page

„*File | Close*" – Terminates the print manager

### 5.8.1.1. Setting the name of a new layout

To open the Specify layout name dialog window, select the "*Layout | Save layout as*" item. Now you can enter the name of the new scheme.
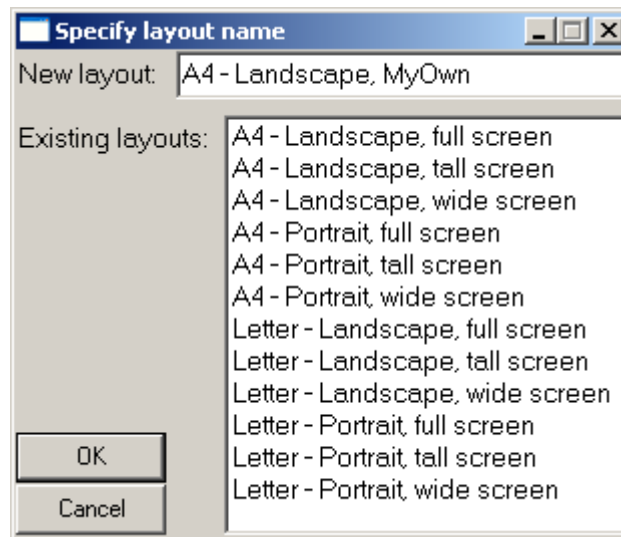


*Fig. 5.8.1.1.1. - Specify Layout Name Window*

It is necessary to insert a name of the new layout into the "New layout" box. This name has to differ from the names of the existing layouts. If the name would be identical with the name of another layout, this layout would be replaced by the new layout. At the same time the existing layout would be highlighted in the layout list. If you click a name of a layout in the list, this name will appear in the "New layout" box.

To save the layout, click the OK button.

### 5.8.1.2. Layout Manager

To open the Layout Manager window, select the "*Layout | Manage layouts*" item in the main menu of the print manager window.
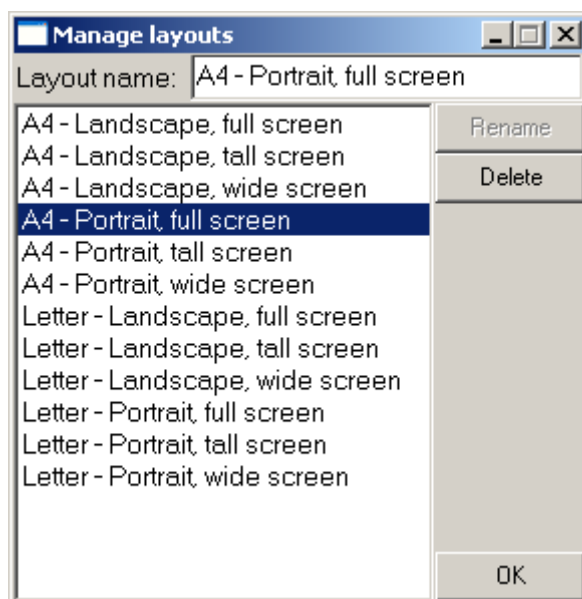
*Fig. 5.8.1.2.1. - Layout Manager Window*

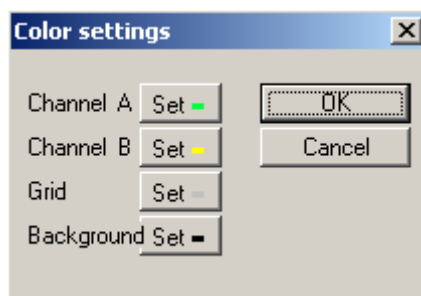To select a layout, double-click its name in the list.
To erase the selected layout, click the "Delete" button.
To rename a layout, select it, insert the new name into the "Layout name" box and then click the "Rename" button.

### 5.8.2. Color settings window

The color settings window is opened after click on the main menu item.


*Fig. 4.15.2.1. – Color settings window*

Click "Set" button located by label to open standard operating system color dialog to change color of:
"Channel A" – channel A waveform and controls
"Channel B" – channel B waveform and controls
"Grid" – grid
"Background" – background

## 6. Data file format

The format of acquired data is described in this chapter. The name of the file can be any Windows compatible string with extension „rmd".

## 6.1. File contents

The main part of the file contains data measured by the oscilloscope. Also the following data defining the oscilloscope's setup are present:
- Vertical shift of channel A
- Vertical shift of channel B
- Attenuation of the probe connected to input of channel A
- Attenuation of the probe connected to input of channel B
- AC/DC switch setting on channel A
- AC/DC switch setting on channel B
- Position of zero, channel A
- Position of zero, channel B
- Sampling frequency
- Sensitivity of channel A
- Sensitivity of channel B

In addition to these information, there are two special indicators to indicate the ARM and OVERRUN conditions of data acquisition.

## 6.2. Data format

The samples are represented as the 8 bit values with valid data range from 1 to 255.

---

**TIP: The value 0 for acquired data is invalid. It is used to indicate the field of special information.**

---

The samples are stored chronologically in order of sampling. Channel B is first.

The special indicators are stored in the place of occurrence. There are two special indicators, both are 16 bit wide:

ARM: 0x0002 (this indicator is stored in 16 bit word as 02 00, because the Big Endian method is used.).

OVERRUN: 0x0001 (this indicator is stored in 16 bit word as 01 00, because the Big Endian method is used.).

## 6.3. The oscilloscope settings

All oscilloscope settings are stored as the array of 16 bit words. The structure of the array is as follows:

0x0000 – Beginning of the oscilloscope settings field.
LNG    - Length of the structure including field indicator in 16-bit wide words.
CODE   - Setting code
DATA   - Data for described setting

## 6.3.1. Setting codes

**0x0001** – measurement start/stop
> \+ 16-bit word (1 – start of measurement , 0 – stop of measurement)

**0x0002** – Vertical shift of channel A
> \+ 16-bit value of vertical position
> \+ 16-bit signed position of 0V

**0x0003** – Vertical shift of channel B
> \+ 16-bit value of vertical position
> \+ 16-bit signed position of 0V

---

**REMARK: Position of zero represents the position of 0V on the screen. In case the waveform is shifted out of the scope screen, it can be <1 or >255.**

---

**0x0004** – Attenuation of probe connected to input of channel A
> \+ 16-bit attenuation value (1 – 1:1, 2 – 1:10, 3 – 1:100, 4 – 1:1000)

**0x0005** - Attenuation of probe connected to input of channel B
> \+ 16-bit attenuation value (1 – 1:1, 2 – 1:10, 3 – 1:100, 4 – 1:1000)

**0x0006** – AC/DC switch setting for channel A
> \+ 16-bit word (1 – AC, 0 – DC)

**0x0007** - AC/DC switch setting for channel B
> \+ 16-bit word (1 – AC, 0 – DC)

**0x0008** – Position of zero in for channel A
> \+ 16-bit signed position of 0V

**0x0009** - Position of zero in for channel B
> \+ 16-bit signed position of 0V

**0x000A** – Sampling frequency
> \+ 32-bit sampling frequency (in Hz)

**0x000B** – Sensitivity of channel A
> \+ 32-bit sensitivity (in mV/div)

**0x000C** – Sensitivity of channel B
> \+ 32-bit sensitivity (in mV/div)