DATAMAN oscilloscope
User's Guide
Version 3.02

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Contents

Package contents (DATAMAN 520 and 570 series) 9
Package contents (DATAMAN 774 oscilloscope) 9
Warranty conditions 9
Software License Agreement 9
Precautions (DATAMAN 520 and 570 series) 10
Precautions (DATAMAN 770 series) 10
1. Installation 12
1.1. Requirements 12
1.2. Hardware installation 12
1.3 Software installation 12
2. Hardware 13
2.1. Hardware description of the DATAMAN 570 family 13
2.1.1. Digital Shielding (DSH) 14
2.1.2. Trigger circuits 14
2.1.3. Data acquisition 16
2.2. Hardware description of the DATAMAN 520 family 17
2.2.1. Digital Shielding (DSH) 18
2.2.2. Trigger circuits 18
2.2.3. Data acquisition 21
2.3. Hardware description of the DATAMAN 770 family 22
2.3.1. Digital Shielding (DSH) 23
2.3.2. Trigger circuits 23
2.3.3. Data acquisition 25
3. Basic information 27
3.1. Front and rear panel layout 27
3.1.1. Front panel layout 27
3.1.2. DATAMAN 770 series rear panel layout 27
3.2. Basic terms 28
4. Main window 29
4.1. Main window in classic view 30
4.1.1. Oscilloscope screen 30
4.1.2. Quickview 32
4.1.3. Cursors and grid controls 32
4.1.4. Channel display controls 33
4.1.5. Save/load controls 34
4.1.6. Zoom controls 35
4.1.7. Timebase controls 36
4.1.8. Trigger mode controls 37
4.1.9. Trigger controls 38
4.1.10. Vertical range controls 40
4.1.11. Vertical shifts controls 41
4.1.12. Signal source controls 41
4.1.13. Channel information 42
4.1.14. Special functions controls 43
4.1.15. Fading controls 43
4.2. Main window in simple view 44
4.2.1. Oscilloscope screen 45

4.2.2. Quickview 46
4.2.3. Channel display controls 47
4.2.4. Special functions controls 47
4.2.5. Zoom controls 48
4.2.6. Timebase controls 48
4.2.7. Channel controls 49
4.2.8. Trigger controls 49
4.2.9. Channel information 50
4.3. Main menu 51
4.3.1. Options 51
4.3.2. Manage exports as ASCII window 55
4.3.3. Manage exports as image window 57
4.3.4. Hotkeys window 58
5. Other functions 61
5.1. Print Support 61
5.1.1. Setting the name of a new layout 63
5.1.2. Layout Manager 63
5.2. Vertical shift calibration 64
5.3. Mask testing 66
5.3.1. Creating the test mask 66
5.3.3. Using the test mask 68
6. Special functions 69
6.1. 80% function (80%) 69
6.2. Channel difference function (A-B) 69
6.3. Channel add function (A+B) 69
6.4. Channel A inversion (-A) 69
6.5. Channel B inversion (-B) 69
6.6. Channel A voltage inversion (-VA) 69
6.7. Channel B voltage inversion (-VB) 70
6.8. X-Y function (X/Y) 70
6.9. Fourier transformation function (FT) 71
6.9.1. Main menu 73
6.9.2. Complex filter window 75
6.10. Inverse Fourier transformation function (IFT) 77
6.11. Waveform parameters function (Wp) 77
6.11.1. – Main menu 79
6.12. Phase shift calculation (Pf) 80
7. Performance characteristics 81
7.1. DATAMAN 570 series performance characteristics 81
7.1.1. Vertical deflection system 81
7.1.2. Triggering 81
7.1.3. Data acquisition system 82
7.1.4. Probe compensation generator 82
7.1.5. Power 82
7.1.6. Mechanical characteristics 82
7.1.7. DATAMAN 574 timebase ranges 82
7.2. DATAMAN 520 series performance characteristics 83
7.2.1. Vertical deflection system 83
7.2.2. Triggering 84
7.2.3. Data acquisition system 84

7.2.4. Probe compensation generator 85
7.2.5. Power 85
7.2.6. Mechanical characteristics 85
7.2.7. DATAMAN 522 timebase ranges 85
7.2.8. DATAMAN 524 timebase ranges 86
7.2.9. DATAMAN 526 timebase ranges 86
7.3. DATAMAN 770 series performance characteristics 87
7.3.1. Vertical deflection system 87
7.3.2. Triggering 87
7.3.3. Data acquisition system 88
7.3.4. Probe compensation generator 88
7.3.5. Power 88
7.3.6. Insulation specification 88
7.3.7. Mechanical characteristics 89
7.3.8. DATAMAN 774 timebase ranges 89
8. Other information 90
8.1. .esb format 90
8.1.1. Block structure 90
8.1.2. Available information 92
8.2. Command lines parameters 94
8.2.1. Selecting the settings loaded on application start 94
8.2.2. Selecting the type of device used 94

Figures and tables

Fig. 2.1.2.1. – Block schematics of trigger circuits 14
Fig. 2.1.2.2. – Examples of trigger events (all inputs are enabled) 15
Fig. 2.1.3.1. – Simplified block schematics of the data acquisition 17
Fig. 2.2.2.1. – Block schematics of trigger circuits 19
Fig. 2.2.2.2. – Examples of trigger events (all inputs are enabled) 20
Fig. 2.2.3.1. – Simplified block schematics of the data acquisition 21
Fig. 2.3.2.1. – Block schematics of trigger circuits 23
Fig. 2.3.2.2. – Examples of trigger events (all inputs are enabled) 24
Fig. 2.3.3.1. – Simplified block schematics of the data acquisition 25
Fig. 3.1.1.1. – Front panel of the DATAMAN 570 series oscilloscope 27
Fig. 3.1.1.2. – Front panel of the DATAMAN 520 series oscilloscope 27
Fig. 3.1.1.3. – Front panel of the DATAMAN 770 series oscilloscope 27
Fig. 3.1.2.1. – M770 series rear panel layout 28
Fig. 4.1. – View mode selection 29
Fig. 4.1.1. – Main window in classic view 30
Fig. 4.1.1.1. – Oscilloscope screen 31
Fig. 4.1.2.1. – Quickview 32
Fig. 4.1.3.1. – The cursors and grid controls 33
Fig. 4.1.4.1. – Channel display controls 33
Fig. 4.1.5.1. – Save/load controls 34
Fig. 4.1.5.2. – Load controls 34
Fig. 4.1.5.3. – Save controls 35
Fig. 4.1.6.1. – Zoom controls 35
Fig. 4.1.7.1. – Timebase controls 36
Fig. 4.1.8.1. – Trigger mode controls 37
Fig. 4.1.8.2. – Trigger mode controls with separate hold controls 38
Fig. 4.1.9.1. – Trigger controls 38
Fig. 4.1.9.2. – Trigger source controls 38
Fig. 4.1.9.3. – After trigger amount controls 39
Fig. 4.1.9.4. – Hold-off controls 40
Fig. 4.1.10.1. – Range controls 40
Fig. 4.1.11.1. – Vertical shift controls 41
Fig. 4.1.12.1. – Signal source controls 41
Fig. 4.1.12.2. – External attenuation controls 42
Fig. 4.1.12.3. – Selecting external attenuation 42
Fig. 4.1.13.1. – Channel information 42
Fig. 4.1.14.1. – Special functions controls 43
Fig. 4.1.15.1. – Fading controls 44
Fig. 4.2.1. - Main window in simple view 45
Fig. 4.2.1.1. – Oscilloscope screen 45
Fig. 4.2.2.1. – Quickview 47
Fig. 4.2.3.1. – Channel display controls 47
Fig. 4.2.4.1. – Special functions controls 47
Fig. 4.2.5.1. – Zoom controls 48
Fig. 4.2.6.1. – Timebase controls 48
Fig. 4.2.7.1. – Channel controls 49
Fig. 4.2.8.1. – Trigger controls 49

Fig. 4.1.13.1. – Channel information 50
Fig. 4.3.1.1. – Options window 52
Fig. 4.3.2.1. – Manage exports as ASCII window 55
Fig. 4.3.3.1. – Manage exports as image window 57
Fig. 4.3.4.1. – The hotkeys window 58
Fig. 5.1.1. - Print Manager Window 61
Fig. 5.1.2. - Object Info 62
Fig. 5.1.3. - List of available objects 62
Fig. 5.1.1.1. - Specify Layout Name Window 63
Fig. 5.1.2.1. - Layout Manager Window 64
Fig. 5.2.1. – Vertical shift calibration – warm up 65
Fig. 5.2.2. – Vertical shift calibration – inputs grounding 65
Fig. 5.2.3. – Vertical shift calibration – calibration method 66
Fig. 5.3.1. – Creating the test mask 67
Fig. 5.3.2.1. – Mask testing 68
Fig. 6.8.1. – X-Y function window 70
Fig. 6.9.1. – Fourier transformation window 71
Fig. 6.9.2. – Status panel 72
Fig. 6.9.3. – Information about harmonic selected by cursor 73
Fig. 6.9.4. – Screen controls 73
Fig. 6.9.2.1. – Complex filter window 76
Fig. 6.9.2.2. – Selected frequency controls 76
Fig. 6.9.2.3. – Frequencies controls 76
Fig. 6.9.2.4. – New frequency window 77
Fig. 6.11.1. – Waveform parameters window 78
Fig. 6.12.1. – Phase shift window 80
Table 7.1.1.1. – Vertical deflection system 81
Table 7.1.2.1. – Triggering 81
Table 7.1.3.1. – Data acquisition system 82
Table 7.1.4.1. – Compensation generator 82
Table 7.1.5.1. - Power 82
Table 7.1.6.1. – Mechanical characteristics 82
Table 7.1.7.1. – DATAMAN 574 timebase ranges 83
Table 7.2.1.1. – Vertical deflection system 84
Table 7.2.2.1. – Triggering 84
Table 7.2.3.1. – Data acquisition system 84
Table 7.2.4.1. – Compensation generator 85
Table 7.2.5.1. - Power 85
Table 7.2.6.1. – Mechanical characteristics 85
Table 7.2.7.1. – DATAMAN 522 timebase ranges 86
Table 7.2.8.1. – DATAMAN 524 timebase ranges 86
Table 7.2.9.1. – DATAMAN 526 timebase ranges 87
Table 7.3.1.1. – Vertical deflection system 87
Table 7.3.2.1. – Triggering 88
Table 7.3.3.1. – Data acquisition system 88
Table 7.3.4.1. – Compensation generator 88
Table 7.3.5.1. – Power 88
Table 7.3.6.1. – Insulation specification 89
Table 7.3.7.1. – Mechanical characteristics 89
Table 7.3.8.1. – DATAMAN 774 timebase ranges 89

Table 8.2.2.1. – Allowed device types of –d parameter 94

Package contents (DATAMAN 520 and 570 series)

- DATAMAN oscilloscope – 1pc
- USB cable – 1pc
- installation leaflet – 1pc
- CD with software and user's guide in pdf – 1pc

Package contents (DATAMAN 774 oscilloscope)

- USB oscilloscope – 1pc
- USB cable – 1pc
- Safety grounding cable – 1pc
- installation leaflet – 1pc
- CD with software and user's guide in pdf – 1pc

Warranty conditions

Dataman Programmers Ltd guarantees reliable operation of the oscilloscope in compliance with this documentation during a period of 24 months (2 years) from the date of purchase.

Should a malfunction occur during the warranty period, excluding errors for which Dataman can not be held responsible; Dataman guarantees the repair of the product or its replacement with a new or repaired one free of charge.

Dataman shall not be responsible for malfunctions of the device caused by an accident, incorrect usage, unauthorized interventions or similar.

When requesting the warranty service, the customer should send the device in its original packaging to Dataman with a description of the defect or malfunction. The customer agrees that when returning a product it would be insured against damage or loss during transport.

Software License Agreement

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Precautions (DATAMAN 520 and 570 series)

Please follow these recommendations to avoid any possible problems that might occur while using the oscilloscope of DATAMAN 520 or 570 series:
- read the User's Guide
- always connect the device using the cable, which is the part of package. If it is not possible, always use a USB 2.0 specification cable.
- never connect a signal with absolute voltage higher than 200V to the 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. However we do not recommend connecting a voltage higher than 50V, because touching it can be dangerous.
- never connect a 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 a voltage to the oscilloscope ground, it may result in device or computer damage
- never disassemble the device, since there are no user serviceable parts inside
- touching parts under test with voltage higher than 50V can be dangerous for your health

Precautions (DATAMAN 770 series)

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 USB cable, which is the part of the package.
- never connect voltage higher than 200Vp between the measuring ground and the input. This value is valid for frequencies lower than 100 kHz. Over this frequency, the

voltage lowers with rising frequency. For example voltage of 100Vp with frequency 200 kHz is the limit. You can always connect voltage with peak value up to 4 times the input range set (32 time the sensitivity in v/div) independent on frequency.
- never connect voltage lower than –10V and higher than +13V to the external triggering input (frequency lower than 20 kHz). Over 20 kHz, voltage lower than –0.5V or higher than +4V is not recommended.
- the measuring ground is common for all of the measuring connectors. The voltage connected to one of these grounds appears also on the rest two of them. Do not connect different voltages to the grounds of the measuring connectors. It can destroy the measuring instrument and/or the measured device.
- when the voltage above 50V is connected to one of the measuring connector's ground, touching the rest of two of them can be dangerous for your helth.
- when you connect the voltage higher then 50V to the measuring ground, please be sure, that the instrument is dry. If you brought the instrument from the colder environment please wait until it warms up to the temperature of the new environment.
- when the voltage higher than 50V is connected to the measuring ground, for safety reasons we recommend connect the chassis ground of the instrument (connector on the back side of the instrument) to the ground of the environment (i.e. main's ground, water pipe, etc...). The grounding cable is in the standard package.
- do not connect voltage higher than 500 Vp to the measuring ground. Also the V * Hz factor should be lower than 50000. For example if the voltage is 500V its frequency should be lower than 100 Hz.
- never disassemble the device, since there are no user serviceable parts inside.
- touching parts under test with voltage higher than 50V can be dangerous for your health

1. Installation

1.1. Requirements

Minimum configuration:
- PC PENTIUM compatible computer
- 64MB RAM
- CD-ROM
- VGA with resolution 800 x 600
- USB port 1.1
- mouse or other tracking device
- at least 20MB free space on the hard drive
- MS Windows 98 SE, ME, 2000, XP, Vista or 7

Recommended configuration:
- PC PENTIUM compatible computer with speed of at least 800MHz
- 256MB 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, XP, Vista or 7

1.2. Hardware installation

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

WARNING: Always use the cable which is the part of the package. Usage of an improper cable can cause problems with 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 is not enabled in your computer's settings, please run the 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 of the DATAMAN 570 family

The DATAMAN 570 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 host computer. Calibration data is part of the HW, which makes it impossible to loose the values (opposed to the calibration data located on the diskette/CD). Therefore, it is possible to simply connect the hardware to any computer (via a USB 1.1 or USB 2.0 interface). All you have to do is just install the software.

The DATAMAN 570 series oscilloscopes allow the 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 the type of probe can be independently selected for each vertical channel. Any of the inputs can be grounded without disconnecting the probes from the measured system. Vertical track position can be controlled with an accuracy of 1 pixel of the oscilloscope screen. Measurement can be triggered from Channel A, Channel B and/or External trigger input. Trigger threshold can be set independently for each channel in the range of the whole oscilloscope screen with resolution of one pixel. Threshold of the External trigger input is fixed to about 1.5V (TTL and CMOS compatible). The DATAMAN 570 series oscilloscopes have the dual level triggering system, which is further described in chapter 2.1.2. Oscilloscope hardware offers data acquisition with a maximum rate of 50, 100 or 200MS/s depending on the model. Therefore it is not possible to sample non-repetitive waveforms faster than every 20, 10 or 5ns (depending on the model). However, thanks to the random sampling method, it is possible to sample repetitive waveforms with period of 200, 100 or 50ps (depending on the model), which corresponds with equivalent sampling rate of 5, 10 or 20GS/s. For displaying waveforms acquired using the random sampling method we use a system called WCD (Waveform Conformity Detection), which speeds up display of changes to the measured waveform.

The oscilloscope hardware can acquire data in one universal mode.

Acquiring data before and after the trigger with selectable trigger position displays the waveform before and/or after the trigger. The position of the trigger is selectable by the user. In this mode the hardware of the oscilloscope starts data acquisition immediately after the start of measurement. The trigger event terminates the data acquisition after collection the data amount set by the user. The trigger position can be set to any place between these margins. The "Hold Off" timer allows the user to

prevent the occurrence of a trigger event after the start of data acquisition. This feature allows you to acquire the proper amount of data before the trigger.

Each measuring channel of the DATAMAN 570 series oscilloscopes has its own AD converter. No channel multiplexing is used for dual channel operation.

2.1.1. Digital Shielding (DSH)

Digital Shielding removes interference asynchronous with the measured signal, and it does not affect the frequency characteristics of the measured waveform. The only negative effect of DSH is a longer time period of waveform stabilization. It is, however, very simple to turn the DSH off using the on-screen controls. The DSH efficiency level corresponds to the DSH level factor that can be set to any value from 2 to 64. The higher the level you choose, the longer it takes to stabilize.

2.1.2. Trigger circuits

The block schematics of the dual level trigger circuits are shown in figure 2.1.2.1.

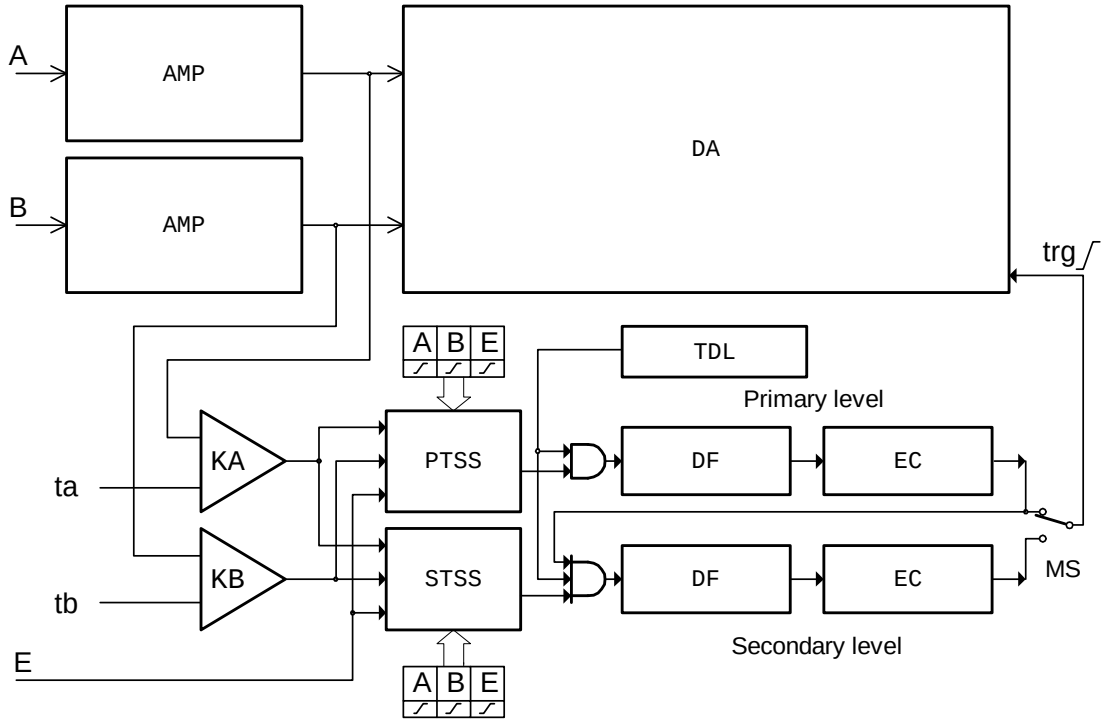


Fig. 2.1.2.1. – Block schematics of trigger circuits

Data for trigger circuits come either from Channel A, Channel B or from external trigger input (E). The comparators KA an KB produce binary signals for Primary Trigger Source Selector (PTSS) and Secondary Trigger Source Selector (STSS) while the threshold of each comparator (ta, tb) can be set to any value in the vertical range. If the actual output voltage of the channel is higher, then the actual threshold the output of comparator is set to 1 (TRUE). If it is lower than the threshold, the output will be 0 (FALSE). The Trigger Source Selectors for each triggering level are independent. It is possible to select the source of the triggering signal for each level independently. In addition to source selection, the PTSS and STSS can invert any of

the input signal The trigger event is generated with respect to a change of the selector (PTSS, STSS) output signal from 0 (FALSE) to 1 (TRUE). A constant level of the signal cannot start the measurement. In the case that only one of the signals is selected the trigger event is generated corresponding to the polarity, which is symbolically presented by the direction of change of the signal. (0 to 1 means no inversion). When there are several inputs selected, the selector makes a logical addition (OR) of all of the selected inputs. Before adding the signals together, ones are adjusted with respect to the polarity settings. A trigger event is generated only when the change of result of the logical addition occurred from 0 to 1 (FALSE to TRUE). Logical values of the signals in the input of logical adder (OR) from which the trigger event is generated are created on the basis of following rules: value 0 (FALSE) is the value that the selector input signal should have before a valid trigger event. 1 (TRUE) is the value that this signal will have after the valid trigger event. For example, if triggering from Channel A is set to the trailing edge, then the output voltage of the channel is higher than the threshold voltage, consequently the value on the adder input will be 0 (FALSE). Inverse situation will be taken as 1 (TRUE). Note that when using logical addition, all values must be 0 (FALSE) in order for the result to be 0 (FALSE). It is relatively easy to find out which are the valid trigger events. Figure 2.1.2.2 shows several valid and invalid trigger events (all inputs are enabled).

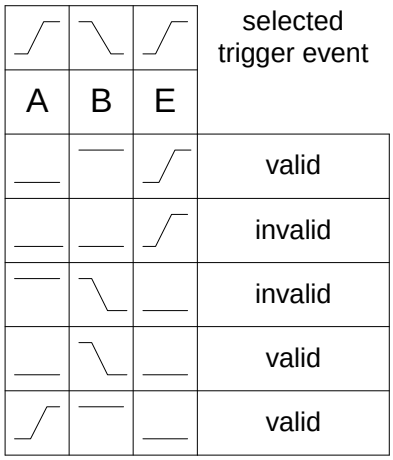


Fig. 2.1.2.2. – Examples of trigger events (all inputs are enabled)

The digital pulse filters (DF) are implemented in both primary and secondary trigger levels. If activated, they filter out pulses shorter then the value 4*N*Ts, where Ts is the actual real time sampling period and N is the value set by the user (1 <= N <= 32767). If we want to use this option it is necessary to set the valid trigger event to the end of the pulse. For example, if the pulse we want to filter off is positive (0 to 1 to 0) the trigger event should be set to the trailing edge (1 to 0). If the pulse is inverse (1 to 0 to 1), the trigger event should be set to the leading edge (1 to 0). The outputs of the digital pulse filters are connected to event counters (EC). It counts the unfiltered pulses. If the MS switch is set to the primary level, the output of the primary event counter will change from 0 (FALSE) to 1 (TRUE) to indicate the valid trigger event after reaching the terminal count, which is user selectable in the range of 1 to 32767. If the MS switch is set to the secondary level, the output of the primary event counter activates the secondary trigger level. The input selector, digital filter and event counter can be set for secondary level independently to define the valid trigger event.

The trigger circuits of the DATAMAN 570 series DSOs are equipped with Hold Off timer (TDL). It blocks the triggering event for a time period T=4*H*Ts from the start of data acquisition, where Ts is the actual real time sampling period and H is the user selectable value from 0 to 32767. It is important to set the proper value H to ensure that the hardware of the oscilloscope acquires the proper amount of data before the triggering event. For example, if we want to display the waveform for the time period of Tz before the trigger it is necessary to set T >= Tz to ensure that all of the data will be displayed. The DATAMAN 570 series oscilloscopes have four triggering modes available:

AUTO – Data acquisition is triggered by a valid trigger event. However, when after a certain time the trigger event does not occur, measurement starts.

NORMAL – Data acquisition is triggered by a valid trigger event.

SINGLE – Data acquisition starts after activation from the control panel and it is synchronized by the valid trigger event. Just one measuring cycle is executed.

MANUAL – One measuring cycle is executed immediately after activation from the control panel.

2.1.3. Data acquisition

The simplified block schematics of data acquisition is shown in Figure 2.1.3.1.

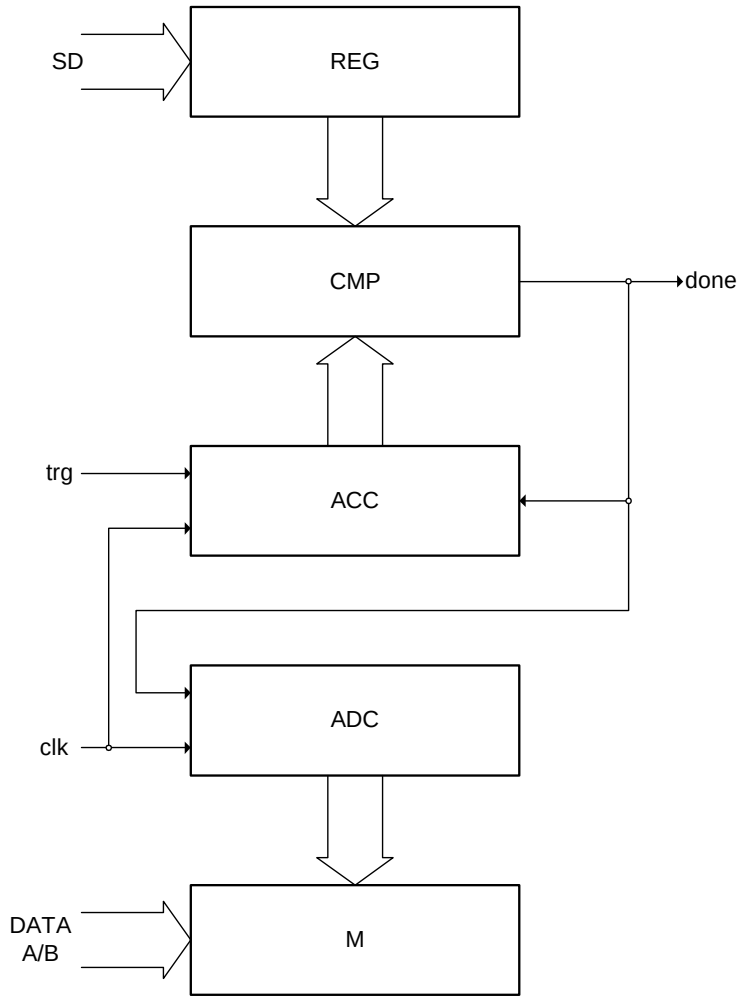


Fig. 2.1.3.1. – Simplified block schematics of the data acquisition

The data from the AD converters are stored in the oscillocope's onboard memory M. This memory is addressed by the address counter ADC, which starts to count immediately after the start of measurement, regardless of trigger event. The occurrence of a valid trigger event starts the after trigger data counter (ACC). The Comparator CMP compares the state of ACC with the output of the register (REG), which contains the data amount acquired after trigger. When the output of ACC reaches the value written to REG, the comparator produces the signal (done), which stops both the ADC and ACC counters. The amount of data written after the trigger to memory depends on the value of REG. The value written to REG controls the relation of the trigger event and the displayed data. By changing the value of REG it is possible to display data before, before and after or only after the trigger.

2.2. Hardware description of the DATAMAN 520 family

The DATAMAN 520 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 host computer. Calibration data is part of the HW, which makes it impossible to loose (opposed to the calibration data located on the diskette/CD). 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 DATAMAN 520 series oscilloscopes allow the user to measure waveforms using two independent channels with a 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 a 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 the type of probe can be independently selected for each vertical channel. Any of the inputs can be grounded without disconnecting the probes from the measured system. Vertical track position can be controlled with an accuracy of 1 pixel of the oscilloscope screen. Measurement can be triggered from Channel A, Channel B and/or the External trigger input. Trigger threshold can be set independently for each channel in the range of the whole oscilloscope screen with a resolution of one pixel. Threshold of the External trigger input is fixed to about 1.5V (TTL and CMOS compatible). The DATAMAN 520 series oscilloscopes have the dual level triggering system, which is further described in chapter 2.1.2. The oscilloscope hardware offers data acquisition with a maximum rate of 50, 100 or 200MS/s depending on the model. Therefore it is not possible to sample non-repetitive waveforms faster than every 20, 10 or 5ns (depending on the model). However, thanks to the random sampling method, it is possible to sample repetitive waveforms with a period of 200, 100 or 50ps (depending on the model), which corresponds with equivalent sampling rates of 5, 10 or 20GS/s. For displaying waveforms acquired using the random sampling method, we use a system called WCD (Waveform Conformity Detection), which speeds up display of the changes to the measured waveform.

The oscilloscope hardware can acquire data in one universal mode.

Acquiring data before and after trigger with selectable trigger position displays the waveform before and/or after the trigger. The position of the trigger is selectable by the user. In this mode the hardware of the oscilloscope starts data acquisition immediately after the start of measurement. The trigger event terminates the data acquisition after collecting the data amount set by the user. The ammount of data acquired after the trigger can be set from two to over 63000 samples. This is much more than the capacity of the onboard data buffer. This feature allows you to display the waveform corresponding with the capacity of the onboard storage (4KS or 8KS for each channel depending on the model) before the trigger or waveforms after the trigger delayed from the occurrence of the trigger up to 63000 samples in length of the capacity of the onboard storage. The trigger position can be set to any place between these margins. The "Hold Off" timer allows the user to prevent the occurrence of a trigger event after the start of data acquisition. This feature allows you to acquire the proper amount of data before the trigger.

Each measuring channel of the DATAMAN 520 series oscilloscopes has its own AD converter. No channel multiplexing is used for dual channel operation.

2.2.1. Digital Shielding (DSH)

Digital Shielding removes interference asynchronous with the measured signal, it does not affect the frequency characteristics of the measured waveform. The only negative effect of DSH is longer time period for waveform stabilization. It is, however, very simple to turn the DSH off using the on-screen controls. The DSH efficiency level corresponds to the DSH level factor that can be set to any value from 2 to 64. The higher the level you choose, the longer it takes to stabilize.

2.2.2. Trigger circuits

The block schematics of the dual level trigger circuits are shown in the figure 2.2.2.1.

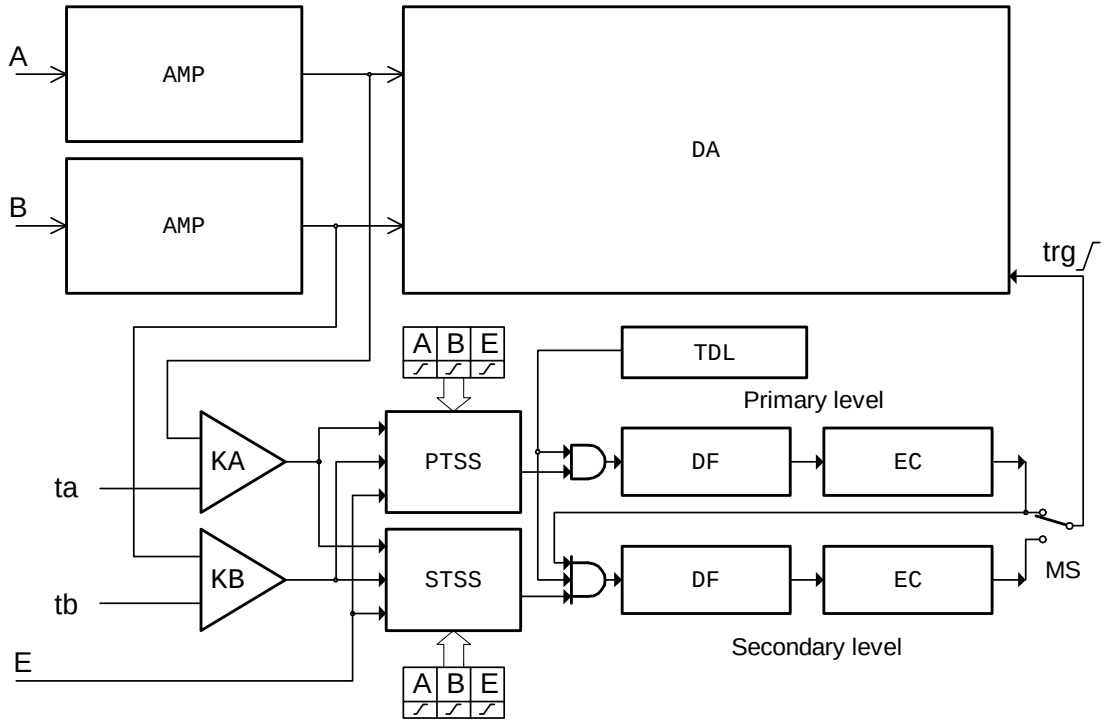


Fig. 2.2.2.1. – Block schematics of trigger circuits

Data for trigger circuits come either from Channel A, Channel B or from the external trigger input (E). The comparators KA an KB produce binary signals for Primary Trigger Source Selector (PTSS) and Secondary Trigger Source Selector (STSS) while the threshold of each comparator (ta, tb) can be set to any value in the vertical range. If the actual output voltage of the channel is higher then the actual threshold the output of the comparator is set to 1 (TRUE). If it is lower than the threshold, the output will be 0 (FALSE). The Trigger Source Selectors for each triggering level are independent. It is possible to select the source of triggering signal for each level independently. In addition to source selection, the PTSS and STSS can invert any of the input signal The trigger event is generated with respect to the change of the selector (PTSS, STSS) output signal from 0 (FALSE) to 1 (TRUE). A constant level of the signal cannot start the measurement. In the case that only one of the signals is selected, the trigger event is generated corresponding to the polarity, which is symbolically presented by the direction of change of the signal. (0 to 1 means no inversion). When there are several inputs selected, the selector makes a logical addition (OR) of all of the selected inputs. Before adding the signals together, ones are adjusted with respect to the polarity settings. A trigger event is generated only when the change of the result of the logical addition occurred from 0 to 1 (FALSE to TRUE). Logical values of the signals in the input of logical adder (OR) from which the trigger event is generated are created on the basis of following rules: value 0 (FALSE) is the value that selector input signal should have before the valid trigger event. 1 (TRUE) is the value that this signal will have after the valid trigger event. For example, if triggering from Channel A is set to the trailing edge, then the output voltage of the channel is higher than the threshold voltage, the consequent value on the adder input will be 0 (FALSE). An inverse situation will be taken as 1 (TRUE). Note that when using logical addition, all values must be 0 (FALSE) in order for the result to be 0 (FALSE). It is relatively easy to find out which are the valid trigger

events. Figure 2.1.2.2 shows several valid and invalid trigger events (all inputs are enabled).

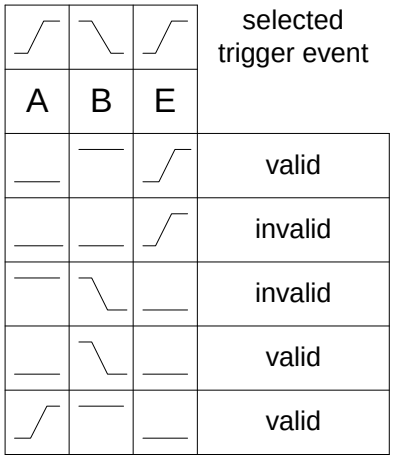


Fig. 2.2.2.2. – Examples of trigger events (all inputs are enabled)

The digital pulse filters (DF) are implemented in both primary and secondary trigger levels. If activated, they filter out pulses shorter then the value 4*N*Ts, where Ts is the actual real time sampling period and N is the value set by the user (1 <= N <= 32767). If we want to use this option it is necessary to set the valid trigger event to the end of the pulse. For example, if the pulse we want to filter off is positive (0 to 1 to 0) the trigger event should be set to the trailing edge (1 to 0). If the pulse is inverse (1 to 0 to 1), the trigger event should be set to the leading edge (1 to 0). The outputs of the digital pulse filters are connected to event counters (EC). It counts the unfiltered pulses. If the MS switch is set to the primary level, the output of the primary event counter will change from 0 (FALSE) to 1 (TRUE) to indicate the valid trigger event after reaching the terminal count, which is user selectable in the range of 1 to 32767. If the MS switch is set to the secondary level, the output of the primary event counter activates the secondary trigger level. The input selector, digital filter and event counter can be set for secondary level independently to define the valid trigger event.

The trigger circuits of the DATAMAN 520 series DSOs are equipped with an Hold Off timer (TDL). It blocks the triggering event for a time period T=4*H*Ts from the start of data acquisition, where Ts is the actual real time sampling period and H is the user selectable value from 0 to 32767. It is important to set the proper value H to ensure that the hardware of the oscilloscope acquires the proper amount of data before the trigger event. For example, if we want to display the waveform for a time period of Tz before the trigger it is necessary to set T >= Tz to ensure that all of the data will be displayed. The DATAMAN 520 series oscilloscopes have four triggering modes implemented:

AUTO – Data acquisition is triggered by a valid trigger event. However, when after certain time the trigger event does not occur, measurement starts.

NORMAL – Data acquisition is triggered by a valid trigger event.

SINGLE – Data acquisition starts after activation from the control panel and it is synchronized by the valid trigger event. Just one measuring cycle is executed.

MANUAL – One measuring cycle is executed immediately after activation from the control panel.

2.2.3. Data acquisition

The simplified block schematics of data acquisition are shown in Figure 2.2.3.1.

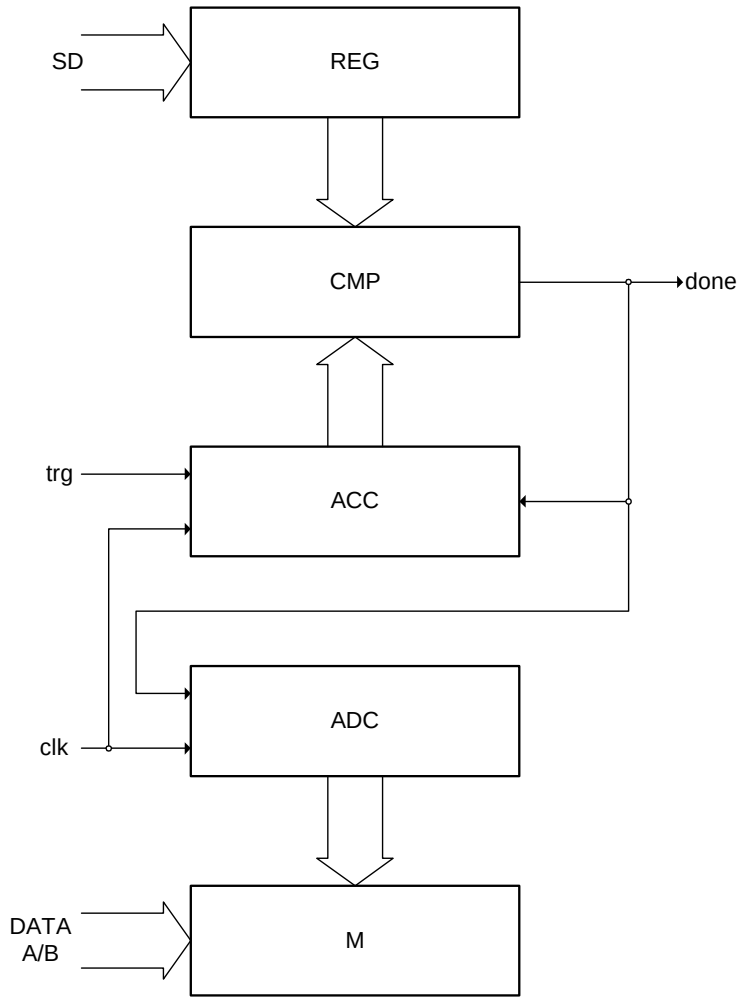


Fig. 2.2.3.1. – Simplified block schematics of the data acquisition

The data from the AD converters is stored in the onboard memory M. This memory is addressed by the address counter ADC, which starts to count immediately after the start of measurement, regardless of trigger event. The occurrence of a valid trigger event starts the after trigger data counter (ACC). The comparator CMP compares the state of ACC with the output of register (REG), which contains the data amount acquired after trigger. When the output of ACC reaches the value written to REG, the comparator produces the signal (done), which stops both the ADC and ACC counters. The amount of data written after the trigger to memory depends on the value of REG. The value written to REG controls the relation of the trigger event and the displayed data. By changing the value of REG it is possible to display data before, before and after or only after the trigger. Because the length of the ACC counter is much longer than the capacity of the onboard memory (more than 63000), it is possible to display data delayed from the trigger event past the capacity of the onboard storage. However the length of the displayed waveform is determined by the capacity of the onboard

memory. This structure of data acquisition creates the illusion of the onboard memory having a capacity determined by the length of ACC counter.

2.3. Hardware description of the DATAMAN 770 family

The DATAMAN 770 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 simple connect the hardware to any computer (via USB 1.1 or USB 2.0 interface). All you have to do is just installing the software.

The common potential of measuring inputs (measuring ground) is isolated from the common potential (ground or chassis) of the host computer.

The DATAMAN 770 series oscilloscopes allows 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 of the inputs 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, Channel B and/or External trigger input. Trigger threshold can be set independently for each channel in the range of whole oscilloscope screen with resolution of one pixel. Threshold of the External trigger input is fixed to about 1.5V (TTL and CMOS compatible). The DATAMAN 770 series oscilloscopes have the dual level triggering system, which is closely described in chapter 2.1.2. Oscilloscope hardware offers data acquisition with maximum rate of 50, 100 or 200MS/s depending on the model. Therefore it is not possible to sample non-repetitive waveforms faster than every 20, 10 or 5ns (depending on the model). However, thanks to random sampling method, it is possible to sample repetitive waveforms with period of 200, 100 or 50ps (depending on the model), which corresponds with equivalent sampling rate of 5, 10 or 20GS/s. For displaying waveforms acquired using the random sampling method, we use system called WCD (Waveform Conformity Detection), which speeds up display of changes of measured waveform.

The oscilloscope hardware can acquire data in one universal mode.

Acquiring data before and after trigger with selectable trigger position displays waveform before and/or after trigger. The position of the trigger is selectable by the user. In this mode the hardware of the oscilloscope starts data acquisition immediately after the start of measurement. The trigger event terminates the data acquisition after collection the data amount set by the user. The trigger position can be set to any place between these margins. The "Hold Off" timer allows the user to prevent the occurrence of a trigger event after the start of data acquisition. This feature allows to acquire proper amount of data before the trigger.

Each measuring channel of the DATAMAN 770 series oscilloscopes has its own AD converter. No channel multiplexing is used for dual channel operation.

2.3.1. Digital Shielding (DSH)

Digital Shielding removes interference asynchronous with the measured signal, and it does not affect frequency characteristics of the measured waveform. The only negative effect of DSH is longer time period of waveform stabilization. It is, however, very simple to turn the DSH off using the on-screen controls. The DSH efficiency level corresponds to DSH level factor that can be set to any value from 2 to 64. The higher the level you choose, the longer it takes to stabilize.

2.3.2. Trigger circuits

The block schematics of the dual level trigger circuits are shown on the figure 2.1.2.1.

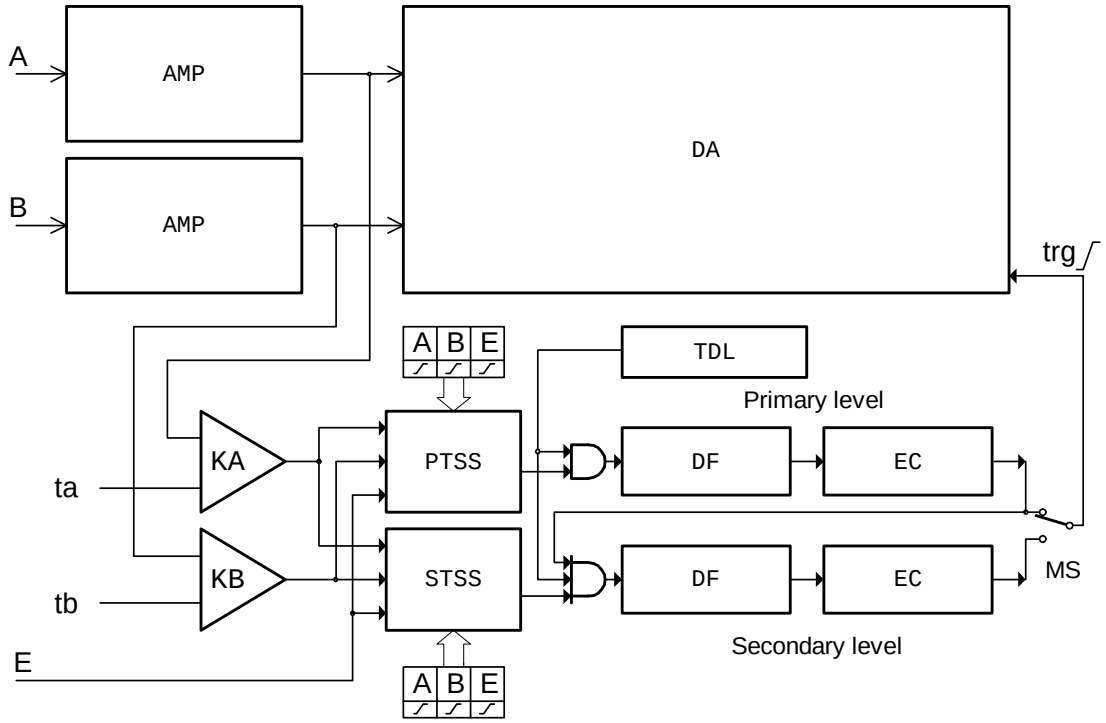


Fig. 2.3.2.1. – Block schematics of trigger circuits

Data for trigger circuits come either from Channel A, Channel B or from external trigger input (E). The comparators KA an KB produce binary signals for Primary Trigger Source Selector (PTSS) and Secondary Trigger Source Selector (STSS) while the threshold of each comparator (ta, tb) can be set to any value in the vertical range. If the actual output voltage of the channel is higher then the actual threshold the output of comparator is set to 1 (TRUE). If it is lower than the threshold, the output will be 0 (FALSE). The Trigger Source Selectors for each triggering level are independent. It is possible to select the source of triggering signal for each level independently. In addition to source selection, the PTSS and STSS can invert any of the input signal The trigger event is generated with respect to change of the selector (PTSS, STSS) output signal from 0 (FALSE) to 1 (TRUE). Constant level of the

signal cannot start the measurement. In case that only one of the signals is selected, trigger event is generated corresponding to the polarity, which is symbolically presented by direction of change of the signal. (0 to 1 means no inversion). When there are several inputs selected, the selector makes a logical addition (OR) of all of the selected inputs. Before adding the signals together, ones are adjusted with respect to the polarity settings. Trigger event is generated only when the change of result of the logical addition occurred from 0 to 1 (FALSE to TRUE). Logical values of the signals in the input of logical adder (OR) from which the trigger event is generated are created on the basis of following rules: value 0 (FALSE) is the value that selector input signal should have before valid trigger event. 1 (TRUE) is the value that this signal will have after the valid trigger event. For example, if triggering from Channel A is set to the trailing edge, then the output voltage of the channel is higher than the threshold voltage, consequent value on the adder input will be 0 (FALSE). Inverse situation will be taken as 1 (TRUE). Note that when using logical addition, all values must be 0 (FALSE) in order for result to be 0 (FALSE). It is relatively easy to find out which are the valid trigger events. Figure 2.1.2.2 shows several valid and invalid trigger events (all inputs are enabled).

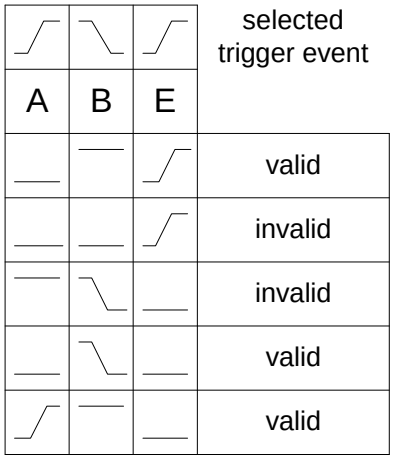


Fig. 2.3.2.2. – Examples of trigger events (all inputs are enabled)

The digital pulse filters (DF) are implemented in both primary and secondary trigger levels. If activated, they filter out pulses shorter then the value 4*N*Ts, where Ts is the actual real time sampling period and N is the value set by the user (1 <= N <= 32767). If we want to use this option it is necessary to set the valid trigger event to the end of the pulse. For example, if the pulse we want to filter off is positive (0 to 1 to 0) the trigger event should be set to trailing edge (1 to 0). If the pulse is inverse (1 to 0 to 1), the trigger event should be set to leading edge (1 to 0). The outputs of digital pulse filters are connected to event counters (EC). It counts the unfiltered pulses. If the MS switch is set to primary level, the output of primary event counter will change from 0 (FALSE) to 1 (TRUE) to indicate the valid trigger event after reaching the terminal count, which is user selectable in the range of 1 to 32767. If the MS switch is set to secondary level, the output of primary event counter activates the secondary trigger level. The input selector, digital filter and event counter can be set for secondary level independently to define the valid trigger event.

The trigger circuits of the series DATAMAN 770 DSOs are equipped with Hold Off timer (TDL). It blocks the triggering event for time period T=4*H*Ts from the start of data acquisition, where Ts is the actual real time sampling period and H is the user

selectable value from 0 to 32767. It is important to set the proper value H to ensure that the hardware of the oscilloscope acquires proper amount of data before trigger event. For example, if we want to display waveform for time period of Tz before the trigger it is necessary to set T >= Tz to ensure that all of the data will be displayed.The DATAMAN 770 series oscilloscopes have four triggering modes implemented:

AUTO – Data acquisition is triggered by a valid trigger event. However, when after certain time the trigger event does not occur, measurement starts.

NORMAL – Data acquisition is triggered by a valid trigger event.

SINGLE – Data acquisition starts after activation from the control panel and it is synchronized by the valid trigger event. Just one measuring cycle is executed.

MANUAL – One measuring cycle is executed immediately after activation from the control panel.

2.3.3. Data acquisition

The simplified block schematics of data acquisition are shown on figure 2.3.3.1.

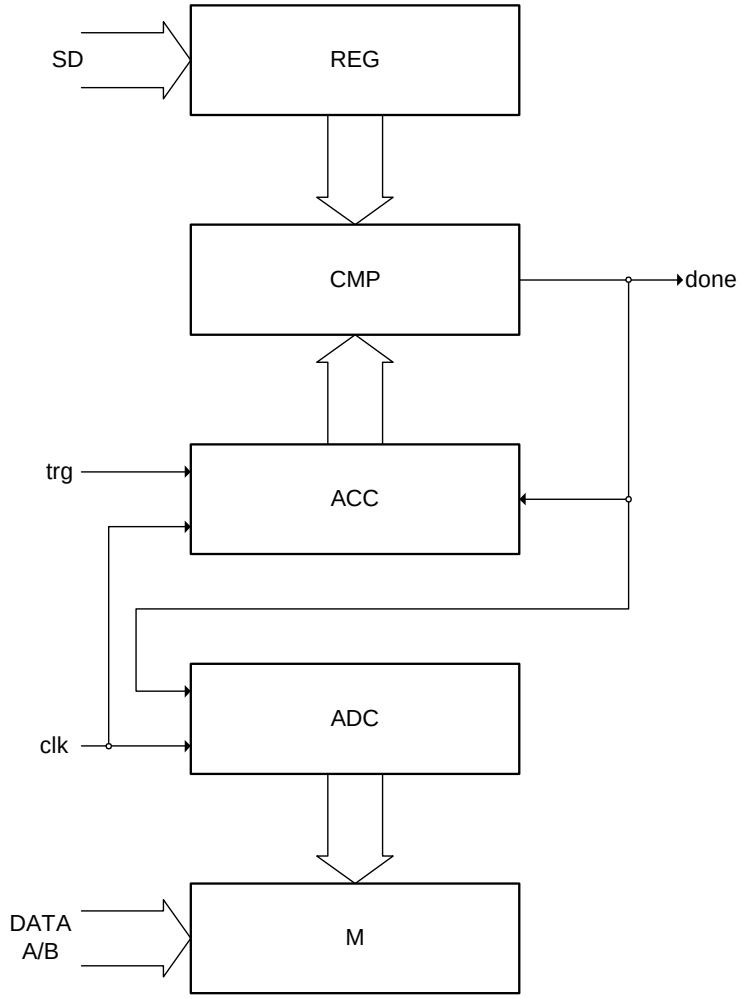


Fig. 2.3.3.1. – Simplified block schematics of the data acquisition

The data from AD converters are stored in the onboard memory M. This memory is addressed by address counter ADC, which starts to count immediately after start of measurement, regardless of trigger event. The occurrence of valid trigger event starts the after trigger data counter (ACC). Comparator CMP compares the state of ACC with the output of register (REG), which contains data amount acquired after trigger. When the output of ACC reaches the value written to REG, the comparator produces the signal (done), which stops both the ADC and ACC counters. The amount of data written after trigger to memory depends on the value of REG. The value written to REG controls the relation of the trigger event and the displayed data. Changing the value of REG it is possible to display data before, before and after or only after trigger.

3. Basic information

3.1. Front and rear panel layout

3.1.1. Front panel layout

Channel A, channel B, external synchronization input / compensation generator output and an LED are accessible on the front panel.



Fig. 3.1.1.1. – Front panel of the DATAMAN 570 series oscilloscope



Fig. 3.1.1.2. – Front panel of the DATAMAN 520 series oscilloscope



Fig. 3.1.1.3. – Front panel of the DATAMAN 770 series oscilloscope

If the LED color is:

- green, the device is configured and there is no communication with a computer at this time
- orange, the device is communicating with a computer
- red, device is powered, but not configured

3.1.2. DATAMAN 770 series rear panel layout

Two connectors are available on the rear panel.

- USB connector for communication with computer (used for supplying device with power as well)
- banana jack (4mm) for optional ground connection. This connector is connected to the ground (chassis) of the host computer and should be connected to the

environment ground when the higher voltage than 50 V is connected to the instrument's measuring ground (shielding of the BNC connectors on the front panel).



Fig. 3.1.2.1. – M770 series rear panel layout

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 of the left mouse button.

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.

4. Main window

The window, which allows you to select the view mode, is displayed during the first application start.

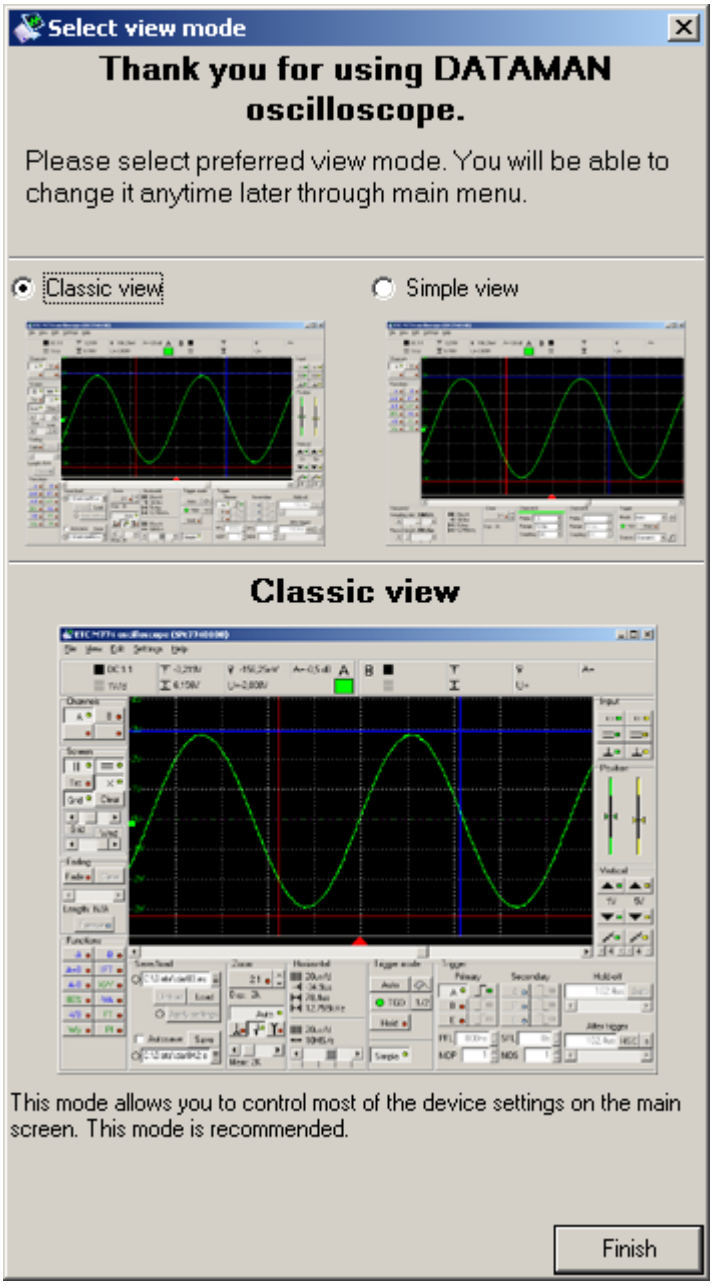


Fig. 4.1. – View mode selection

Two view modes are available: classic view and simple view.
The classic view allows you to control most of the oscilloscope parameters in the main window. This view enables access to all oscilloscope settings.
The simple view allows you to control the most important parameters in the main window. This view sets advanced parameters (such as secondary level of the trigger system) automatically.

4.1. Main window in classic view

The main window opens after the application starts if the classic view is selected. The controls in this window allow you to use most of the oscilloscope functions.

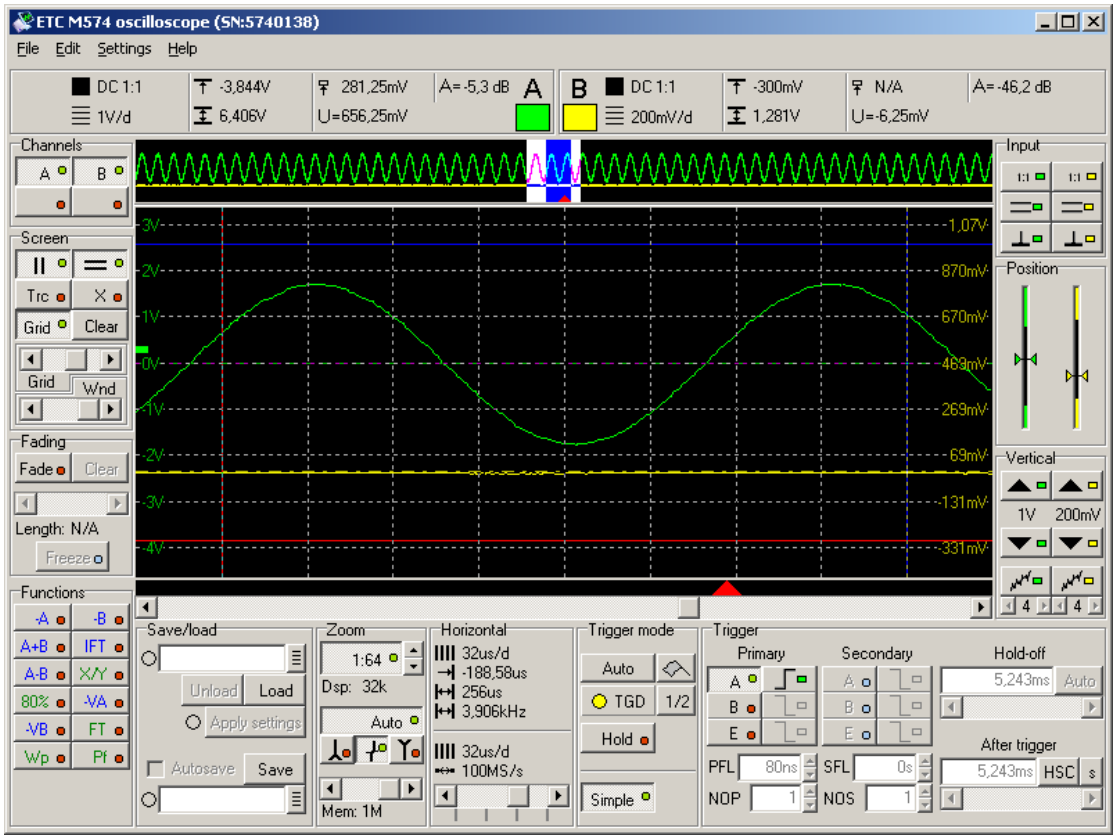


Fig. 4.1.1. – Main window in classic view

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

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

4.1.1. Oscilloscope screen

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

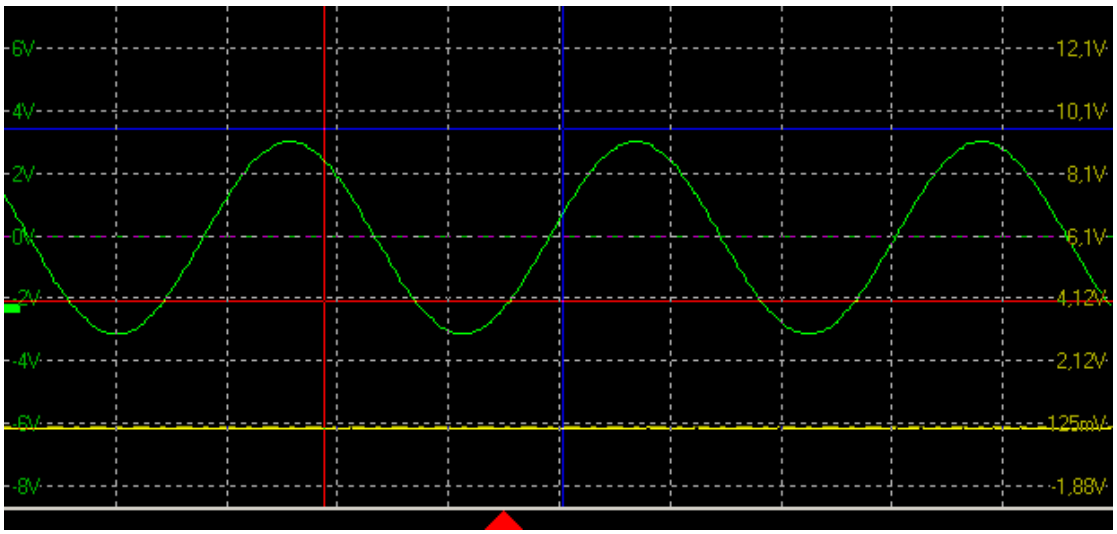


Fig. 4.1.1.1. – Oscilloscope screen

The oscilloscope screen is divided into 10 horizontal and 8 vertical divisions.

TIP: You can activate the „Dynamic grid position (ground line)" mode in the options. This mode adjusts the grid position to keep the ground of channel A (or channel B, if channel A is turned off) on one of the horizontal grid lines.

Where the „Display legend" is turned on in the options, the voltage of each horizontal grid line is displayed (channel A on the left, channel B on the right).

The trigger event is marked with the red triangle located in the bottom of the screen. If the trigger event occured before the displayed waveform, an arrow pointing left is drawn. If the trigger event occured after the displayed waveform an arrow pointing right is drawn.

WARNING: The trigger mark position can slightly differ (especially when using a fast timebase) from the real position of the trigger event.

TIP: Drag the trigger mark (red arrow) to set the after trigger point. This feature can be turned off in the main menu.

Where the „Display ground level" is turned on in the options, the horizontal dotted line of the appropriate channel color is displayed. If the „Allow vertical shift change by dragging ground position" is turned on in the options, drag this line to set the vertical shift of the appropriate channel.

Two vertical and two horizontal cursors can be activated. Vertical cursors are red (cursor 1) and blue (cursor 2) by default. Horizontal cursors have red (cursor 1) and blue (cursor 2) color by default as well.

TIP: The cursors color can be changed in the main menu.

You can move cursor by dragging it. The waveform is drawn using the channel color. The default channel colors are as follows: Channel A green, channel B yellow, virtual channel (the one used for display of function result) C is light blue and channel D is orange.

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

The threshold voltage mark is located in the left. You can change the threshold voltage by dragging it.

TIP: If the used memory size is larger than 64k, the quickview is displayed above the oscilloscope screen. Use the quickview to select the 64k part of the memory, that can be displayed in the oscilloscope screen.

Click „Fade" button to activate fading display. Please see chapter 4.16. for more information.

4.1.2. Quickview

If the used memory size is larger than 64k, the quickview is displayed above the oscilloscope screen.

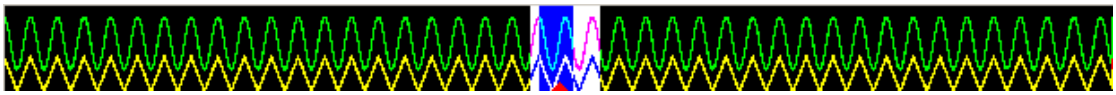


Fig. 4.1.2.1. – Quickview

The white rectangle indicates the part which **can** be displayed in the oscilloscope screen(scrollable). Drag this rectangle to change its position.

The blue rectangle indicates the part, which **is** displayed in the oscilloscope screen. Drag this rectangle to change its position.

The triangle in the bottom of the quickview indicates the trigger position.

TIP: You can turn the quickview on/off in the main menu. If the quickview is turned off, you can display more than 64k samples in the oscilloscope screen.

WARNING: The quickview is available only for the oscilloscope with more than 64k memory size.

4.1.3. Cursors and grid controls

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



Fig. 4.1.3.1. – The cursors and grid controls

 - activates/deactivates vertical cursors.

 - activates/deactivates horizontal cursors.

„Grid" - activates/deactivates grid.

„Trc" - activates/deactivates the Trace mode, where the cursors behave as follows:
- the cursor 2 behaviour is not affected
- while dragging cursor 1, the cursor 2 moves to maintain the distance between cursors

„X" – activates/deactivates the mode, where the dragging of the cursors intersection moves both cursors

„Clear" – clears all acquired waveforms on the screen

The top scrollbar (Grid) adjusts grid brightness. The bottom scrollbar (Wnd) adjusts window transparency.

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

WARNING: The window transparency consumes system resources when turned on. Drag the scrollbar to the right to turn the window transparency off.

WARNING: The window transparency is supported by Windows 2000, XP, Vista and 7. In the case where the software runs under different operating systems the scrollbar is disabled.

4.1.4. Channel display controls

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



Fig. 4.1.4.1. – Channel display controls

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

The special function can be activated by clicking on the appropriate button (located in special functions box) followed by clicking on one of the buttons located in the bottom of the channel controls. Function results are displayed with the color of the selected virtual channel (left button is channel C, right one is channel D).

4.1.5. Save/load controls

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

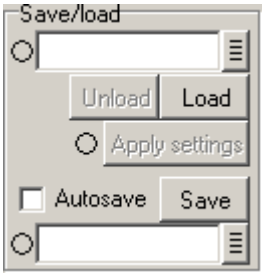


Fig. 4.1.5.1. – Save/load controls

The load controls are located in the panel top.

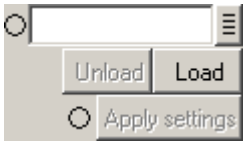


Fig. 4.1.5.2. – Load controls

The name of source file has to be inserted into the upper edit box. Click  to browse for the file.

Click the "Load" button to load and display data. The indicator by the edit box turns green on successful load.

TIP: If the filename ends with the number, this number can be automatically incremented on a successful load (this feature can be turned on/off through the main menu).

Click the "Unload" button to stop displaying the loaded data.
Click the "Apply settings" to set the settings loaded from the data file.

TIP: The settings can be applied automatically (this feature can be turned on/off through the main menu).

The indicator by the „Apply settings" button changes color depending on the actual settings:

Green – the actual settings and settings from the data file are same

Yellow – the actual settings differ from the settings from the data file in some parameters, but the range and timebase settings are the same

Red – the actual settings differ from the settings from the data file in range or timebase settings

The save controls are located in the panel bottom.

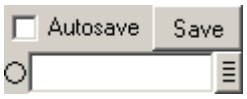


Fig. 4.1.5.3. – Save controls

The name of the target file has to be inserted into the upper edit box. Click  to browse for the file.
Click the "Save" button to save data. The indicator by the edit box turns green on a successful save.

TIP: If the filename ends with a number, this number can be automatically incremented on the successful save (this feature can be turned on/off through main the menu).

If the autosave is enabled in the options (see chapter 4.14.1.), it is possible to activate this mode by checking the „Autosave" checkbox.

The acquired data is automatically saved in this mode after every acquisition and the filename is automatically incremented after save (if possible).

4.1.6. Zoom controls

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



Fig. 4.1.6.1. – Zoom controls

Click top button to activate/deactivate zoom.

TIP: While scrolling the scrollbar (the one under the main screen) with zoom deactivated, two violet lines are drawn on the screen. These lines determine the part of the waveform displayed with zoom activated.

 ,  – change zoom factor

If there are more than 500 samples displayed on the screen, one displayed sample has to be calculated out of more than one measured sample. The samples are then displayed as follows in this case:

If the  button is activated, the displayed sample is calculated as an average of the measured samples.

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

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

If both the  button and  button are activated, the line connecting the measured sample with a maximum and minimum value is displayed.

The software can automatically select suitable display mode by analyzing input waveform. Click 

button to activate/deactivate this.

TIP: The software selects correct display mode with high probability. We recommend to use „Auto" mode for most measurements.

Use the scrollbar in the bottom of the panel to change the used memory size.

4.1.7. Timebase controls

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

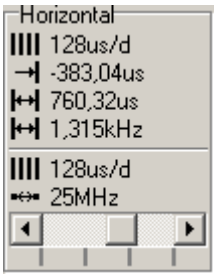


Fig. 4.1.7.1. – Timebase controls

You can change the timebase using the scrollbar located in the bottom of the screen.

The following information is available above the divider:

- time of one screen division (used to acquire currently displayed data)
- time between trigger event and vertical cursor 1
- time between vertical cursors
- frequency between vertical cursors

The following information is available below the divider:

- time of one screen division (current settings)

- sampling rate (current settings)

WARNING: If the information about the time between trigger event and vertical cursor 1 has to be accurate (error smaller than 10ns), it is necessary to make the following correction: measure the time between the trigger event mark and real trigger event and use this value to correct the information.

If the sampling mode is activated, the is displayed with two rectangles reflecting the amount of samples acquired (left rectangle represents channel A, right one represents channel B):

red – less than 50% of samples are acquired
yellow – more than 50% but less than 100% of samples are acquired
green –100% of samples are acquired

4.1.8. Trigger mode controls

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



Fig. 4.1.8.1. – Trigger mode controls

Click the button on the top left corner to switch between the following trigger modes:

„Normal" – It produces a sweep only when the trigger signal meets the threshold level and slope criteria. If the "Enable flag in normal trigger mode (starts acquisition)" is enabled in the options, clicking on the button starts data acqusition with no regard to the trigger.

„Auto" – Measurement if repeatedly triggered. If the trigger event does not occur before the timeout, the sweep free-runs without the trigger signal; otherwise it is triggered by trigger.

„Single" – Single measurement. Starts by clicking on the button. Sweep is produced only when the trigger signal meets the threshold level and slope criteria.

„Manual" – Single measurement. Starts by clicking on the button. Sweep is produced regardless of the trigger signal.

The „TGD" indicator reflects the measurement state by changing its color:

red – the measurement has started, but the trigger event has not occured yet

yellow – the measurement has started, trigger conditions met, but the data acqusition hasn't finished yet

green – the measurement has ended, the data is displayed on the oscilloscope screen

"1/2" – sets the trigger threshold to the middle between the maximum and minimum value of the waveform.

"Hold" – pauses the measurement

"Simple" – switches trigger controls to/from simple mode. The secondary triggering level is deactivated, the trigger counter on the primary level is set to one and a digital filter on the primary level is activated and set to the minimum value in simple mode.

In case the "Separate hold of channel A and B" option is enabled, the controls, which allow separate "hold" are displayed.

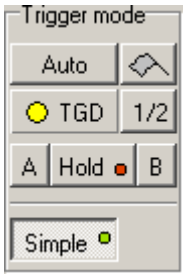


Fig. 4.1.8.2. – Trigger mode controls with separate hold controls

Click the "A" button to pause measurement on channel A, click "B" button to pause measurement on channel B.

4.1.9. Trigger controls

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

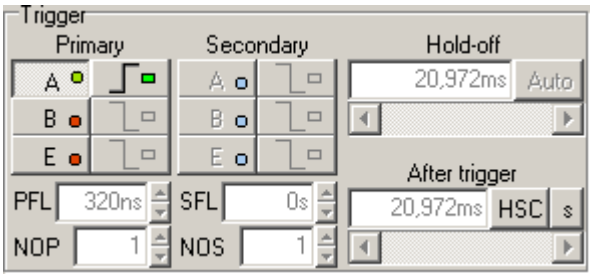


Fig. 4.1.9.1. – Trigger controls

The trigger source controls are located on the left.



Fig. 4.1.9.2. – Trigger source controls

Left buttons control primary level, the right ones control secondary level.

"A" – activates/deactivates channel A as triggering source

"B" – activates/deactivates channel B as the triggering source

"E" – activates/deactivates triggering from the external triggering input (E)

 - switches between sensitivity on leading/trailing edge

You can enter the required trigger event occurences count into NOP (primary level) or NOS (secondary level) edit box. The count can be any value from 1 to 65535.

You can enter the minimum length of the trigger event considered as valid into PFL (primary level) or SFL (secondary level) edit box.

TIP: You can use units in the PFL/SFL edit box (for example 45u is 45 microseconds). Valid units are: n – nano, u – micro, m – milli).

The after trigger amount controls are located in the bottom right corner.

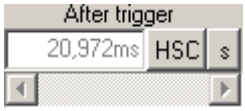


Fig. 4.1.9.3. – After trigger amount controls

The button in the right switches between the following after trigger modes:

"HSC" – Half of the memory is acquired after, the other half before the trigger.

"FSC" – Whole memory is acquired after trigger. This in fact is the classic after trigger mode.

"MIN" – The amount of data acquired after the trigger is set to the minimal possible value (pure before trigger mode).

"SET" – The time acquired after the trigger event can be set by entering a value into the edit box or using the scrollbar.

TIP: You can use units in the edit box (for example 45u is 45 microseconds). Valid units are: n – nano, u – micro, m – milli).

TIP: Drag the trigger mark (red arrow) to set the after trigger amount. This feature can be turned off in the main menu.

Click the „s" or „%" button to change the information, which will be displayed in the after trigger edit box:

In case the „s" is selected:

- the after trigger amount is displayed in seconds

- when the oscilloscope settings change the software changes the amount of samples acquired after the trigger to keep the selected time (for example increasing sampling rate twice increases the amount of samples after trigger twice)

In case the „%" is selected:

- the after trigger amount is displayed in percents of memory size
- when the oscilloscope settings change the software changes the amount of samples acquired after the trigger to keep the selected part of the memory after the trigger (for example increasing memory size twice increases amount of samples after trigger twice)

The hold-off controls are located in the top right corner.

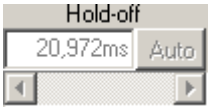


Fig. 4.1.9.4. – Hold-off controls

The button on the right switches between the following hold-off modes:

"AUTO" – The hold-off time is set to guarantee acquisition of the whole memory.

"SET" – The hold-off time can be set by entering a value into the edit box or using the scrollbar.

TIP: You can use units in the edit box (for example 45u is 45 microseconds). Valid units are: n – nano, u – micro, m – milli).

4.1.10. Vertical range controls

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

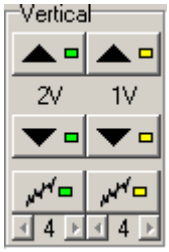


Fig. 4.1.10.1. – Range controls

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

 - changes the range to less sensitive
Range with no respect to probe attenuation is displayed below this button.

 - changes the range to more sensitive

 - activates/deactivates digital shielding

Click ◂ or ▸ to decrease or increase digital shielding level.

4.1.11. Vertical shifts controls

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

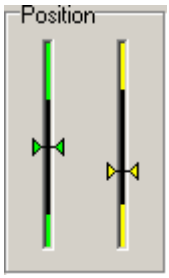


Fig. 4.1.11.1. – Vertical shift controls

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

The main screen position is highlighted by the rectangle of main screen color (black by default) – if this is switched on in the options.

Click between above or below the slider to shift the waveform by the smallest possible value.

The vertical shift can be set by dragging the slider as well.

TIP: Keeping the mouse button pressed above or below the slider results in shift by 20 smallest possible values per second.

It is possible to change the vertical shift by dragging the waveform on the main screen.

TIP: Changing the vertical shift by dragging the waveform can be turned on/off in main menu.

4.1.12. Signal source controls

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

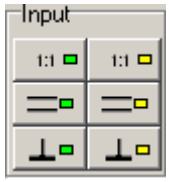


Fig. 4.1.12.1. – Signal source controls

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

WARNING: Selection of improper probe attenuation ratio may result in incorrect information about voltages.

Click  or  to select coupling. Click  to ground input.

If the external attenuation is enabled in the options the external attenuation controls are available in the top of the panel.



Fig. 4.1.12.2. – External attenuation controls

External attenuation controls allow you to measure the voltage on the divider where the software automatically calculates voltage on the divider input.

WARNING: In case you are using 1:10 probe, don't use external attenuation controls to perform transformation. Please always use above mentioned controls to set the probe attenuation.

Click the button to open the window where you can select the divider attenuation.



Fig. 4.1.12.3. – Selecting external attenuation

Click „1:1" button to set 1:1 ratio automatically.
Enter the value into the edit box to select the ratio. It is possible to enter the value as the real number (such as „0.5") or as the ratio (for example „1:2").

4.1.13. Channel information

The channel information is displayed in the top of the main window.

Channel A information is located in the left, channel B information is located in the right.

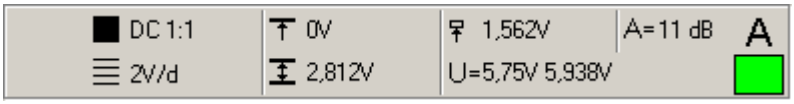


Fig. 4.1.13.1. – Channel information

The following information is displayed:

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

- voltage between horizontal cursor 1 and 0V (this information is not displayed when coupling is set to AC)

- voltage between horizontal cursor 1 and 2

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

„U(t)" – minimum and maximum (in case more than one sample is displayed on one point of the screen) voltage between 0V and the intersection of vertical cursor 1 and waveform

- trigger threshold voltage

"A" – ratio of the peak-peak voltage of the waveform on the screen and the voltage between horizontal cursors in decibels

4.1.14. Special functions controls

The special functions controls are located in the lower left corner of the main window.



Fig. 4.1.14.1. – Special functions controls

Two function types exist:

1. Transformation functions which display result on the main screen using the virtual channel. These have a blue color.

2. Other functions which dont display results on the main screen. These have a green color.

Click one of the transformation function buttons to half-activate it. After clicking on the desired virtual channel the function is fully activated and the results are displayed with the color of the selected virtual channel.

Click one of the other function buttons to activate it.

You can find the special functions description in chapter 6.

4.1.15. Fading controls

It is possible to display data on the screen with persistance (fading mode). When in this mode the old waveform isn't removed from the screen when a new one is being

drawn. Old waveforms will fade for the selected time. Waveforms older than the selected time are removed from the screen.

The fading controls are located in the left part of the main window.



Fig. 4.1.15.1. – Fading controls

Click „Fade" button to activate fading mode.
Click „Clear" button to clear old waveforms.

The persistance length can be selected using the scrollbar located in the middle of the controls (persistance length can be set to 0.5s, 1s, 2s, 5s, 10s, 20s, 50s, 100s and 3600s).

Click „Freeze" button to suspend fading of the old waveforms and updating of the new one. When the fading is frozen, it is not possible to change any parameters which affect the waveform on the screen (such as seeking in the device memory, resizing window ...).

WARNING: The fading mode is much more processor and graphic card intensive than standard display mode. Therefore the update rate of the waveform may be slower.

4.2. Main window in simple view

The main window opens after the application starts if the simple view is selected. The controls in this window allow you to use the most important oscilloscope functions. Please use classic view for more advanced oscilloscope settings.



Fig. 4.2.1. - Main window in simple view

All controls connected to a channel are the same colour as that channel.

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

4.2.1. Oscilloscope screen

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

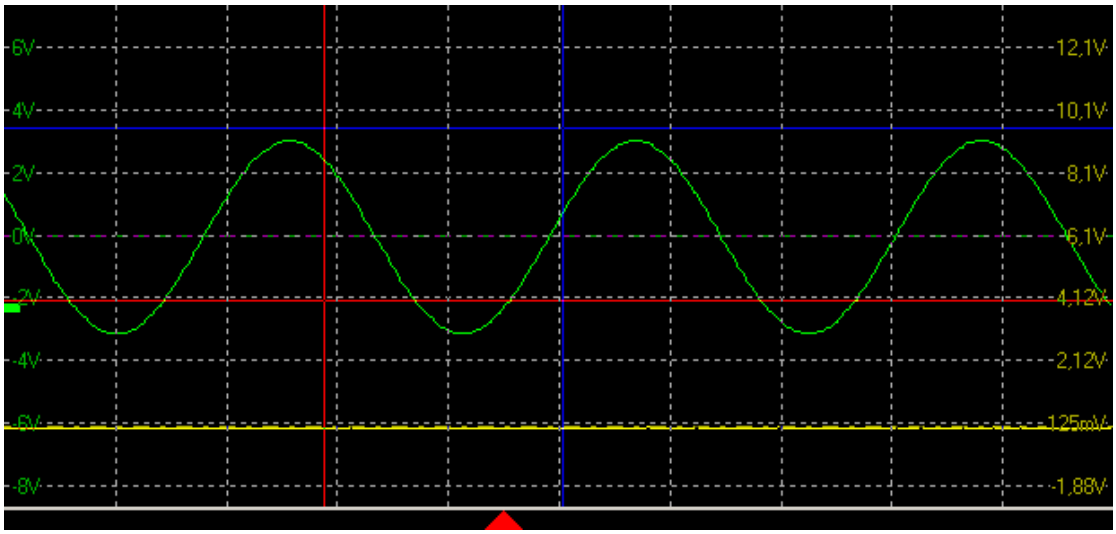


Fig. 4.2.1.1. – Oscilloscope screen

The oscilloscope screen is divided into 10 horizontal and 8 vertical divisions.

Drag the horizontal grid lines to set the vertical shift on channel A (or channel B, if channel A is turned off).
The grid position is adjusted to keep the ground of channel A (or channel B, if channel A is turned off) on one of the horizontal grid lines.
The voltage of each horizontal grid line is displayed (channel A on the left, channel B on the right).
The trigger event is marked with the red triangle located in the bottom of the screen. If the trigger event occured before the displayed waveform, the arrow pointing left is drawn. If the trigger event occured after the displayed waveform the arrow pointing right is drawn.

WARNING: The trigger mark position can differ slightly (especially when using a fast timebase) from the real position of the trigger event.

The horizontal dotted line of the appropriate channel color indicates the ground position of the appropriate channel. Drag this line to set the vertical shift of the appropriate channel. If the ground position is off of the screen, the arrow with the ground symbol is displayed on the top or bottom of the main window. Drag this arrow to get the ground position back onto the screen.

Two vertical and two horizontal cursors can be activated. Vertical cursors have red (cursor 1) and blue (cursor 2) color by default. Horizontal cursors have red (cursor 1) and blue (cursor 2) color by default as well.

TIP: The cursors color can be changed in the main menu.

You can move a cursor by dragging it.
The waveform is drawn using the channel color. The default channel colors are as follows: Channel A green, channel B yellow, virtual channel (the one used for display of function result) C is light blue and channel D is orange.

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

The threshold voltage mark is located on the left. You can change the threshold voltage by dragging it.

TIP: If the memory size used is larger than 64k, the quickview is displayed above the oscilloscope screen. Use the quickview to select the 64k long part of the memory that can be displayed in the oscilloscope screen.

4.2.2. Quickview

If the memory size used is larger than 64k, the quickview is displayed above the oscilloscope screen.

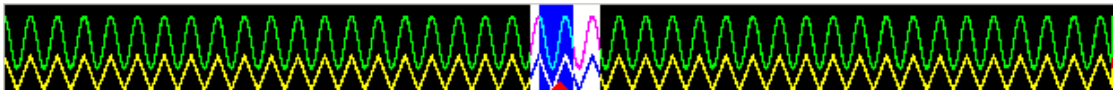


Fig. 4.2.2.1. – Quickview

The white rectangle indicates the part which can be displayed in the oscilloscope screen. Drag this rectangle to change its position.
The blue rectangle indicates the part which is displayed in the oscilloscope screen. Drag this rectangle to change its position.
The triangle in the bottom of the quickview indicates the trigger position.

TIP: You can turn the quickview on/off in the main menu. If the quickview is turned off, you can display more than 64k samples in the oscilloscope screen.

WARNING: The quickview is available only on oscilloscopes with more than 64k memory size.

4.2.3. Channel display controls

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



Fig. 4.2.3.1. – Channel display controls

„A" – activates/deactivates channel A waveform
„B" – activates/deactivates channel B waveform
The special function can be activated by clicking on the appropriate button (located in special functions box) followed by clicking on one of the buttons located in the bottom of the channel controls. Function results are displayed with the color of the selected virtual channel (left button is channel C, right one is channel D).

4.2.4. Special functions controls

The special functions controls are located in the lower left corner of the main window.



Fig. 4.2.4.1. – Special functions controls

Two function types exist:
1. Transformation functions, which display result on the main screen using the virtual channel. These have a blue color.
2. Other functions, which don't display result on the main screen. These have a green color.

Click on one of the transformation function buttons to half-activate it. After clicking on the desired virtual channel the function is fully activated and the results are displayed with the color of the selected virtual channel.
Click one of the other function button to activate it.

You can find the special functions description in chapter 6.

4.2.5. Zoom controls

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



Fig. 4.2.5.1. – Zoom controls

Click the top button to activate/deactivate zoom.

TIP: While scrolling the scrollbar (the one under the main screen) with zoom deactivated, two violet lines are drawn on the screen. These lines determine the part of waveform displayed with activated zoom.

, – change zoom factor

If there are more than 500 samples displayed on the screen one displayed sample has to be calculated out of more than one measured sample. The way this processing occurs is selected automatically by the software.

4.2.6. Timebase controls

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

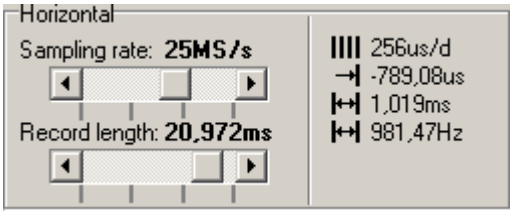


Fig. 4.2.6.1. – Timebase controls

Drag the top scrollbar to change sampling rate.
Drag the bottom scrollbar to change record length (used memory size of the device).

You can change the timebase using the scrollbar located at the bottom.
The following information is available to the right of the divider:

- time of one screen division (used to acquire currently displayed data)
- time between trigger event and vertical cursor 1

- time between vertical cursors
- frequency between vertical cursors

WARNING: If the information about the time between trigger event and vertical cursor 1 has to be accurate (error smaller than 10ns), it is necessary to make the following correction: measure the time between the trigger event mark and the real trigger event and use this value to correct the information.

If the sampling mode is activated, the icon is displayed with two rectangles reflecting the amount of samples acquired (left rectangle represents channel A, right one represents channel B):
red – less than 50% samples are acquired
yellow – more than 50% but less than 100% samples are acquired
green –100% samples are acquired

4.2.7. Channel controls

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

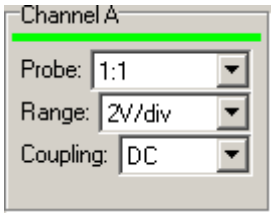


Fig. 4.2.7.1. – Channel controls

Click „Probe" combobox to select the probe attenuation on the appropriate channel.
Click „Range" combobox to select the range on the appropriate channel.
Click „Coupling" combobox to select the coupling on the appropriate channel.

4.2.8. Trigger controls

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



Fig. 4.2.8.1. – Trigger controls

Click „Mode" combobox to select the trigger mode. The following four trigger modes are available:

„Normal" – Produces a sweep only when the trigger signal meets the threshold level and slope criteria. If the "Enable flag in normal trigger mode (starts acquisition)" is enabled in the options, clicking on the button starts data acqusition with no regard to the trigger.

„Auto" – Measurement if repeatedly triggered. If the trigger event does not occur before the timeout, the sweep free-runs without the trigger signal; otherwise it is triggered by trigger.
„Single" – Single measurement. Start by clicking on the button. Sweep is produced only when the trigger signal meets the threshold level and slope criteria.
„Manual" – Single measurement. Start by clicking on the button. Sweep is produced regardless the trigger signal.

The „TGD" indicator reflects the measurement state by changing its color:
red – the measurement has started, but the trigger event has not occured yet
yellow – the measurement has started, trigger conditions met, but the data acqusition hasn't finished yet
green – the measurement has ended, the data is displayed on the oscilloscope screen

Click „Hold" button to pause measurement.
Click „Source" combobox to select trigger source.
Click or to select trigger sensitivity on the leading or trailing edge.

4.2.9. Channel information

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



Fig. 4.1.13.1. – Channel information

The following information is displayed:

- information about coupling and probe attenuation ratio
- range
- voltage between horizontal cursor 1 and 0V (this information is not displayed when coupling is set to AC)
- voltage between horizontal cursor 1 and 2

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

„U(t)" – minimum and maximum (in case more than one sample is displayed on one point of the screen) voltage between 0V and the intersection of vertical cursor 1 and waveform
- trigger threshold voltage
"A" – ratio of the peak-peak voltage of the waveform on the screen and the voltage between horizontal cursors in decibels

4.3. Main menu

The main menu is located at the top of the main window. The following menu items are available:

File | *Print* – Opens print manager.

File | *Exit* – Closes application.

View | *Simple mode* – Activates simple mode of the main window.

View | *Classic mode* – Activates classic mode of the main window.

Edit | *Export as ASCII* | *Manage exports* – Opens the window, where the export definitions can be configured. Click item in the *File* | *Export as ASCII* to export data using specified definition.

Edit | *Export as image* | *Manage exports* – Opens the window, where the export definitions can be configured. Click item in the *File* | *Export as image* to export data using specified definition.

Settings | *Save settings* – Saves current settings into the selected file

Settings | *Load settings* – Loads settings from the selected file

Settings | *Reset to factory defaults* – Restores factory default

Settings | *Process licence file* – Loads and processes the specified licence file

Settings | *External trigger output* | *Compensation generator* – Activates/deactivates compensation generator.

Settings | *WCD sensitivity* | *Very high* – Sets very high WCD sensitivity.

Settings | *WCD sensitivity* | *High* – Sets high WCD sensitivity

Settings | *WCD sensitivity* | *Medium* – Sets medium WCD sensitivity

Settings | *WCD sensitivity* | *Low* – Sets low WCD sensitivity

Settings | *WCD sensitivity* | *Off* – Turns the WCD off

Settings | *Digital shielding level* – Opens window, where you can select the digital shielding level.

Settings | *Options* – Opens the window where the software options can be changed

Tools | *Mask test* | *Create mask* – Opens the window where you can select the mask parameters

Tools | *Mask test* | *Load mask* – Loads the mask from selected file

Tools | *Vertical shift calibration* | *Calibrate vertical shift* – Opens the wizard which will guide you through the calibration process

Tools | *Vertical shift calibration* | *Calibration data* | *Use calibration data* – In case the additional calibration data is loaded, this item is checked. Click it to turn using this data off. Turning them off is not permanent – once the application is restarted the data will be loaded.

Tools | *Vertical shift calibration* | *Calibration data* | *Delete calibration data* – Click this item to delete calibration data saved on the disk. The calibration data in the device remains intact.

Help | *Help* – Displays the Help index

Help | *View readme* – Opens the readme.txt file, which contains information about implemented changes in the application

Help | *About* – Displays information about the product.

4.3.1. Options

Click the item in the main menu to open the options window.

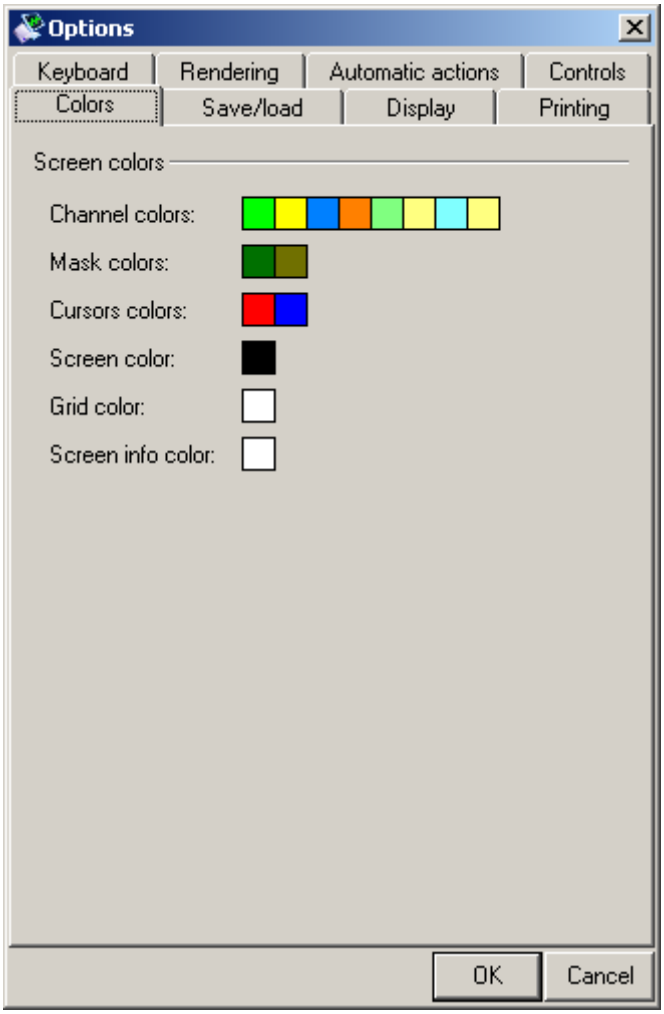


Fig. 4.3.1.1. – Options window

The following options are available:

Colors | *Screen colors* | *Channel colors* – click color of the channel to change it

Colors | *Screen colors* | *Mask colors* – click color of the mask to change it (the first mask corresponds with channel A, second one with channel B)

Colors | *Screen colors* | *Cursors colors* – click color of the cursor to change it

Colors | *Screen colors* | *Screen color* – click color to change the screen background

Colors | *Screen colors* | *Grid color* – click color to change the grid color

Colors | *Screen colors* | *Screen info color* – click color to change the color of the text on the main screen

Save/load | *Save behaviour* | *Automatically increment filename* – if the filename of the target file ends with a number, that number will be automatically incremented on a successful save

Save/load | *Save behaviour* | *Enable autosave option* – Enables/disables checkbox on the main screen, which turns autosave on/off. Check checkbox on the main window to activate the mode in which the data is saved to disk automatically after they are acquired.

Save/load | *Load behaviour* | *Automatically increment filename* – if the filename of the source file ends with a number that number will be automatically incremented on a successful load

Save/load | *Load behaviour* | *Automatically apply settings* – settings from the data file will be automatically applied on successful load

Save/load | *X and Y offset* | *Allow X offset change by dragging waveform* – the X offset of the loaded waveform can be changed by dragging the waveform on the oscilloscope screen

Save/load | *X and Y offset* | *Allow Y offset change by dragging waveform* – the Y offset of the loaded waveform can be changed by dragging the waveform on the oscilloscope screen

Display | *General* | *Tool tip help* – activates tool tip help

Display | *General* | *Separate hold of channel A and B* – the standard „hold" controls on the main screen will be replaced by the ones which allow separate holding of channel A and B

Display | *Main screen* | *Allow display start change by dragging waveform* – the displayed part of the waveform on the oscilloscope screen can be changed by dragging the waveform on the oscilloscope screen

Display | *Main screen* | *Allow vertical shift change by dragging waveform* – the vertical shift can be changed by dragging waveform on the oscilloscope screen

Display | *Main screen* | *Allow AT change by dragging mark* – the after trigger amount can be changed by dragging the trigger mark (red triangle)

Display | *Main screen* | *Autoset trigger mode when dragging mark* – when this option is on the trigger mark drag automatically sets the trigger mode to „set"

Display | *Main screen* | *Show information on main screen* – the information about timebase, range and vertical cursors' distance will be displayed on the main screen

Display | *Main screen* | *Clear screen in single/manual mode on acq. start* – the screen is automatically cleared (all acquired waveforms are removed), when the acquisition is started by clicking on the „flag" button (single or manual trigger mode).

Display | *Grid* | *Display ground level* – turns display of the ground on the screen on/off

Display | *Grid* | *Allow vertical shift change by dragging ground position* – the vertical shift can be changed by dragging the ground line

Display | *Grid* | *Allow vertical shift change by dragging grid* – if turned on, it is possible to drag the grid (horizontal lines) to set the vertical shift. This option is available only with the Dynamic vertical grid option on.

Display | *Grid* | *Allow display start change by dragging grid* – if turned on, it is possible to drag the grid (vertical lines) to set the display start.

Display | *Grid* | *Dynamic vertical grid position (ground on the line)* – if turned on, the grid position is automatically adjusted to keep ground of the channel A (or channel B if channel A is turned off) on the horizontal line

Display | *Grid* | *Dynamic horizontal grid position (trigger event on line)* – if turned on, the horizontal grid position will be adjusted to match the trigger event (one of the vertical lines will match the trigger event).

Display | *Grid* | *Display legend* – turns the grid legend on/off

Display | *Grid* | *Precise legend values* – if turned off, the legend values will be rounded to achieve best readability, otherwise they are rounded to three decimals

Display | *Quickview* | *Display quickview* – if more than 64k samples are acquired, quickview is displayed above the oscilloscope screen

Keyboard | *General* | *Keyboard control* – enables/disables mode, which allows you to control some functions using the keyboard. Please see chapter 4.14.4. for the list of supported functions.

Keyboard | *General* | *Distinguish between left and right shift/ctrl* – if this options is enabled the left and right ctrl (or shift) are considered as different keys. If the keyboard control is disabled this setting has no influence on the application.

Keyboard | *Hotkeys* | *Configure hotkeys* – opens the window where you can configure hotkeys (see chapter 4.14.4.).

Printing | *Printing* | *Print in black and white* – enables/disables black and white printing

Printing | *Printing* | *Use application color scheme* – activates/deactivates printing in the application color scheme (the screen and channels will be printed in the application colors)

Rendering | *Waveform rendering* | *Enhanced xor draw* – activates/deactivates enhanced xor waveform drawing. The standard draw method produces dots instead of peaks, because the lines, which create waveform, xors themselves out. Enhanced drawing solves this problem, but requires more processor time.

Automatic actions | *Triggering* | *Set auto trigger mode, when the input is grounded* – if turned on, the software automatically sets "auto" trigger mode, when at least one input is grounded

Automatic actions | *Triggering* | *Move trigger level together with vertical shift* – if turned on, the software automatically sets trigger level to maintain its level in volts, when the vertical shift changes

Automatic actions | *Triggering* | *Move trigger level together with range* – if turned on, the software automatically sets trigger level to maintain its level in volts, when the range changes

Automatic actions | *Autosave* | *Deactivate autosave on startup* – if turned on, the autosave is always turned off on the application startup. This option defaults to on because of the safety issues (to prevent running out of hard drive space).

Controls | *Vertical* | *Display screen position in vertical position sliders* – if turned on, the main screen position is displayed in the vertical shift sliders

Controls | *Vertical* | *Calculate range with regard to probe attenuation* – if turned on, the probe attenuation information is included in the range information in vertical panel

Controls | *Vertical* | *Enable external attenuation controls* – if turned on, the controls which allow you to select the external attenuation ratio (other than probe), are displayed in the main screen

4.3.2. Manage exports as ASCII window

Click the item in the main menu to open „Manage exports" window.

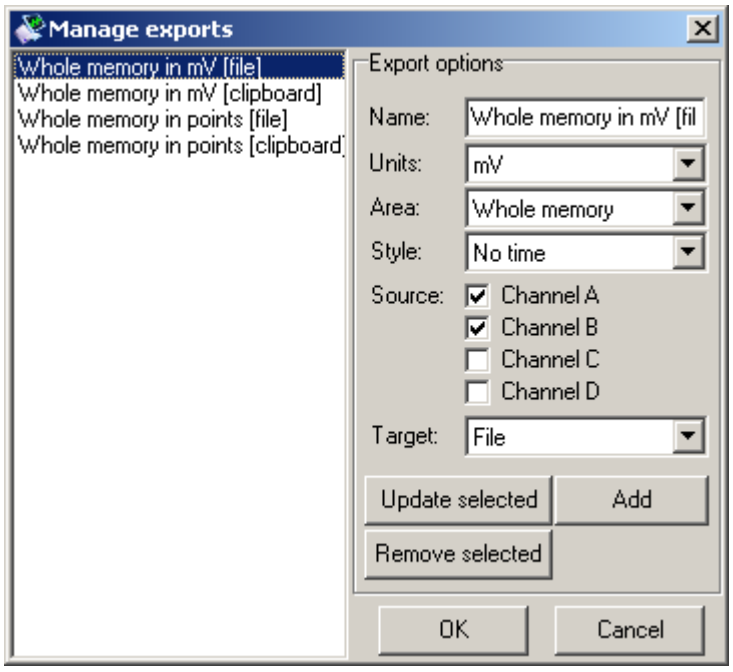


Fig. 4.3.2.1. – Manage exports as ASCII window

The list of all saved definitions is in the left of the window. Click the definition from the list to select it and fill the options on the right with it.

TIP: The export items in the main menu are created in the order the definitions are in the list. Drag a definition in the list to change its position.

Each definition has the following options:

Name – identifies definition in the main menu. Click menu item to export data using the definition.

Units – indicates which units the data will be converted to. The following options are available:

mV – samples will be exported in mV
V – samples will be exported in V
Points – samples will be exported as number from 0 to 255

Area – indicates the area that will be exported. Following options are available:

Whole memory – whole memory will be exported
Screen – data on the oscilloscope screen will be exported
Vertical cursors – data between vertical cursors will be exported

Style – indicates the style which will be used to export data:

No time – exports each sample on a separate line and the tabulator is used as the delimiter between channels. In case the data for the channel doesn't exist the dash („-„) is exported instead.

Time in us – exports each sample on a separate line. The time in us from the trigger event is exported to the first column, selected channels are exported to the following columns. In case the data for the channel doesn't exist, the dash („-„) is exported instead.

Source – indicates the source of the data for the export. The following options are available:

Channel A – channel A will be exported
Channel B – channel B will be exported
Channel C – channel C will be exported (first virtual channel)
Channel D – channel D will be exported (second virtual channel)

Target – indicates the target of the export. The following options are available:

Clipboard – data will be exported to the clipboard
File – data will be exported to the file. The standard dialog window opens before the export which will allow you to select the target file.

Click „Update selected" button to update the selected definition.

Click „Remove selected" button to remove the selected definition.

Click „Add" button to add the definition to the list.

Click „OK" to update items in the main menu which allows you to export data according to the new definitions.

4.3.3. Manage exports as image window

Click the item in the main menu to open „Manage exports" window.

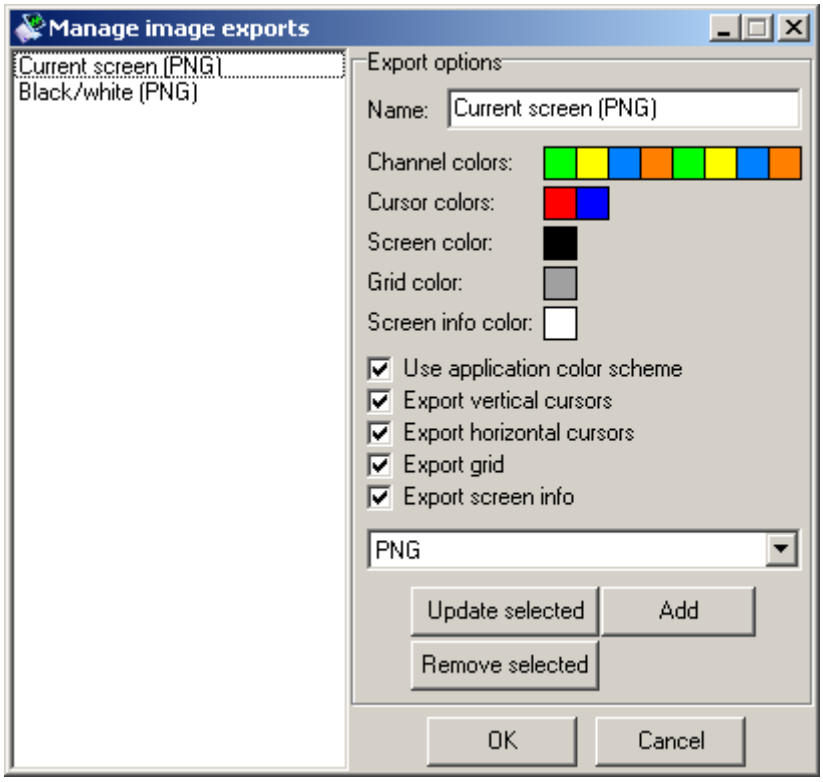


Fig. 4.3.3.1. – Manage exports as image window

The list of all saved definitions is in the left of the window. Click the definition in the list to select it and fill the options in the on the right with it.

TIP: The export items in the main menu are created in the order of the definitions in the list. Drag the definition in the list to change its position.

Each definition has the following options:

Name - identifies definition in the main menu. Click menu item to export data using the definition.

Channel colors – indicates the channel colors
Cursor colors – indicates the cursor colors
Screen color – indicates the screen background color
Grid color – indicates the grid color
Screen info color – indicates the color of the screen information (text)

WARNING: In case the „Use application color scheme" is turned on, all color settings have no effect.

Use application color scheme – all export color settings will be overriden by application colors during export

Export vertical cursors – the vertical cursors will be exported (if they are on)

Export horizontal cursors – the horizontal cursors will be exported (if they are on)

Export grid – the grid will be exported (if it is on)

Export screen info – the screen information will be exported (if they are on)

The image format can be selected in the combobox:
PNG – the format with lossless compression
JPG – the format with lossy compression
BMP – the format with no compression

TIP: In case you need to change the format often, select the format you are using most often. It is possible to change the format during the export.

4.3.4. Hotkeys window

The hotkeys window opens after clicking on the „Configure hotkeys" button in the „Options" window. You can define hotkeys in this window.

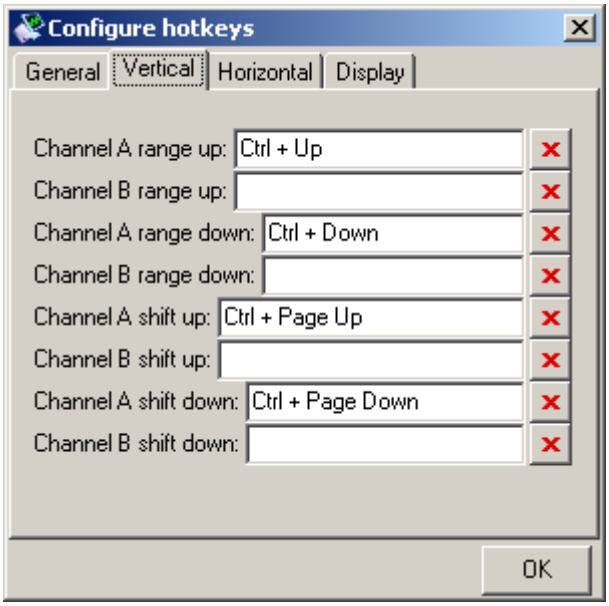


Fig. 4.3.4.1. – The hotkeys window

The following functions can be controlled using the keyboard (the default value is specified in the brackets):

General | Hold (ctrl + space) – pauses the acquisition

Vertical | *Channel A range up (ctrl + up arrow)* – sets less sensitive range on channel A

Vertical | *Channel B range up (no default)* – sets less sensitive range on channel B

Vertical | *Channel A range down (ctrl + down arrow)* – sets more sensitive range on channel A

Vertical | *Channel B range down (no default)* – sets more sensitive range on channel B

Vertical | *Channel A shift up (ctrl + page up)* – shifts channel A upwards

Vertical | *Channel B shift up (no default)* – shifts channel B upwards

Vertical | *Channel A shift down (ctrl + page down)* – shifts channel A downwards

Vertical | *Channel B shift down (no default)* – shifts channel B downwards

TIP: If you hold the hotkey for any shift function, the channel shifts until you release the hotkey.

Horizontal | *Timebase up (ctrl + right arrow)* – sets faster timebase

Horizontal | *Timebase down (ctrl + left arrow)* – sets slower timebase

Display | *Zoom in (ctrl + + of numeric keyboard)* – zooms into the waveform

Display | *Zoom out (ctrl + - of numeric keyboard)* – zooms out of waveform

Display | *Move screen right (2 divs)* – moves waveform on the screen by 2 divisions to the left

Display | *Move screen left (2 divs)* – moves waveform on the screen by 2 divisions to the right

Display | *Move screen right (8 divs)* – moves waveform on the screen by 8 divisions to the left

Display | *Move screen left (8 divs)* – moves waveform on the screen by 8 divisions to the right

Display | *Clear screen* – clears whole screen (works in all display modes)

Display | *Clear fading* – clears old waveforms (fading) in the fading mode (works only in fading mode)

TIP: If you hold the hotkey for any move function, the waveform moves until you release the hotkey.

Click the edit box and push the hotkey to redefine the hotkey for any function. Click  if you want to remove the hotkey for a specified function.

5. Other functions

5.1. Print Support

To open the print manager window, click the "Print" item on the main menu. The black and white printing can be turned on/off in the options window (please see chapter 4.14.1.).

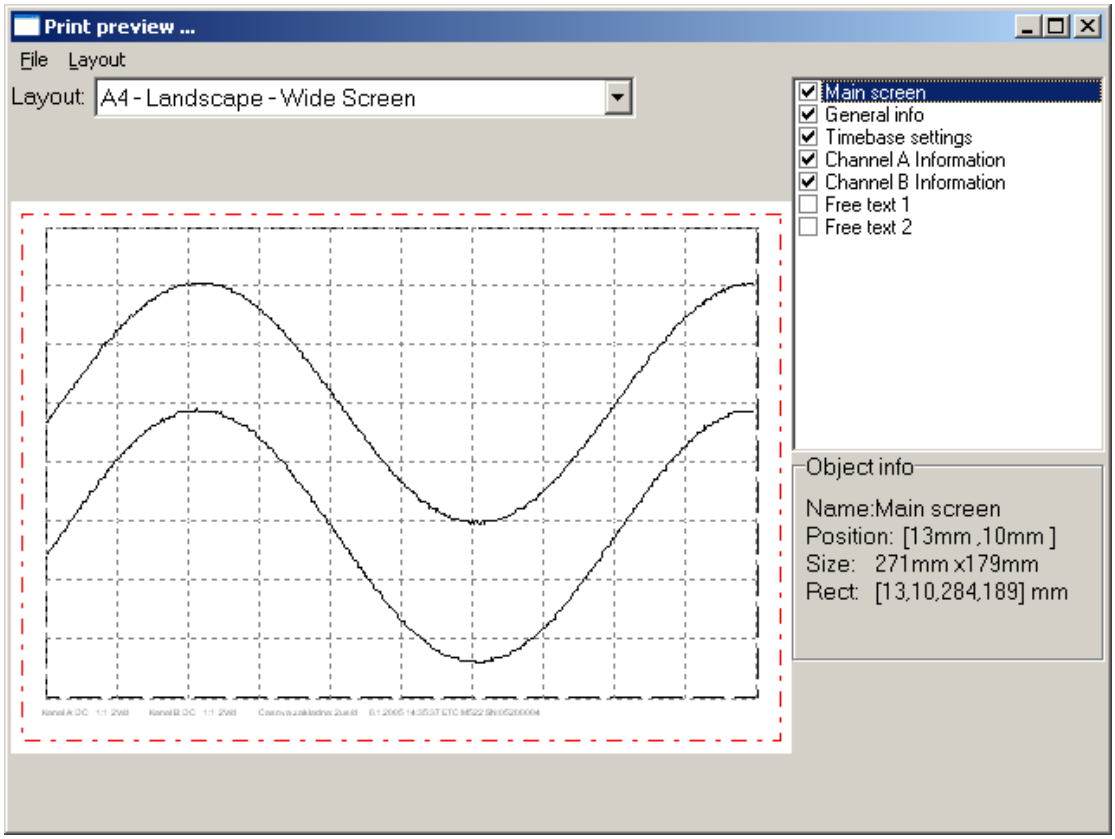


Fig. 5.1.1. - Print Manager Window

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. The selected object is marked by a black dashed outline.

To select an object click on 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

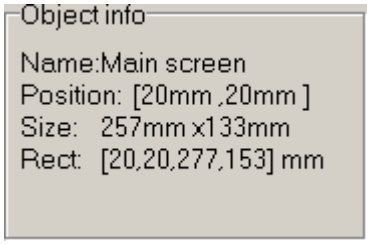


Fig. 5.1.2. - Object Info

In the upper-right corner of the window the 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. 5.1.3. - 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 the 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

5.1.1. Setting the name of a new layout

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

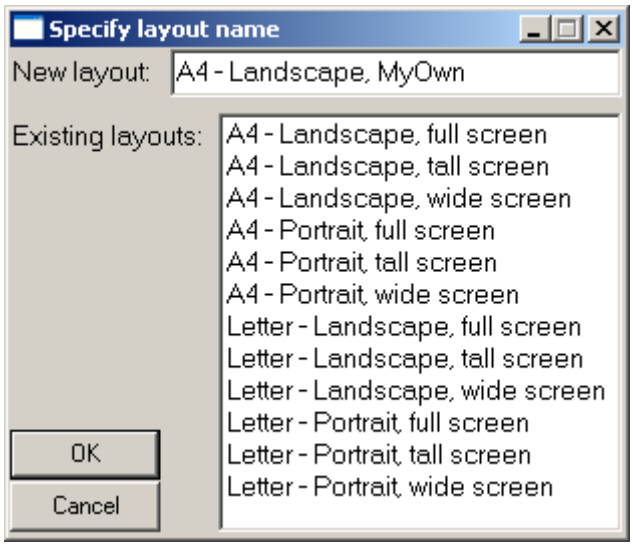


Fig. 5.1.1.1. - Specify Layout Name Window

It is necessary to insert a name for 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 to 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 the name of a layout in the list, this name will appear in the "New layout" box.

To save the layout, click the OK button.

5.1.2. Layout Manager

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

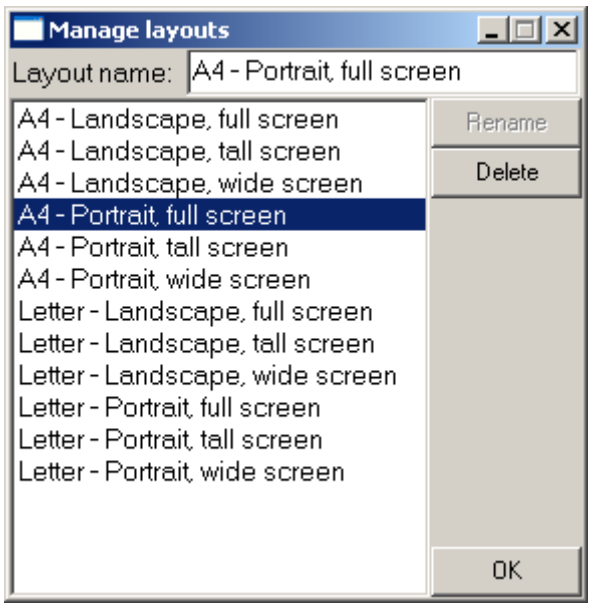


Fig. 5.1.2.1. - Layout Manager Window

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.

5.2. Vertical shift calibration

The vertical shift of the Dataman USB oscilloscopes is calibrated with 2.5% precision. This precision is guaranteed over the whole temperature range and in other working conditions which may change. The Scope software allows you to greatly increase the precision by autocalibration of the device in the environment where it is used. Click the main menu item (Tools -> Vertical shift calibration -> Calibrate vertical shift) to open the wizard which will guide you through the calibration process.

Step 1 – In order to achieve optimal precision it is necessary to warm up the oscilloscope for at least 10 minutes.

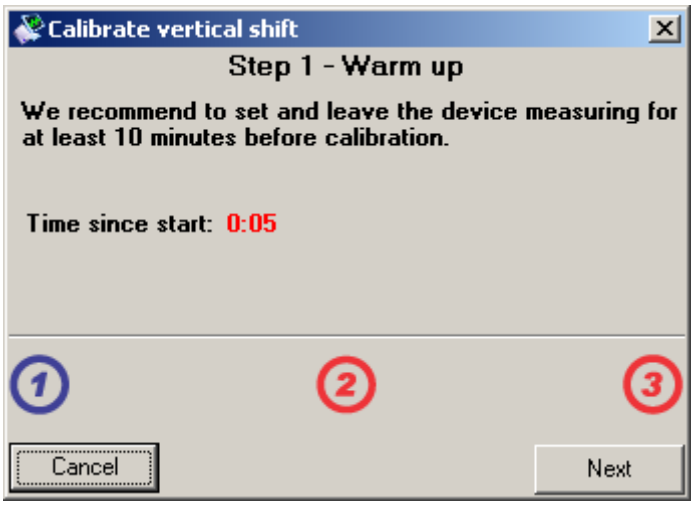


Fig. 5.2.1. – Vertical shift calibration – warm up

The application indicates the time that has elapsed since the oscilloscope start. Once the ten minutes are reached, the time is displayed in green.

Step 2 – Both oscilloscope inputs should be grounded. In the case where you only require lower precision, leave the inputs disconnected.

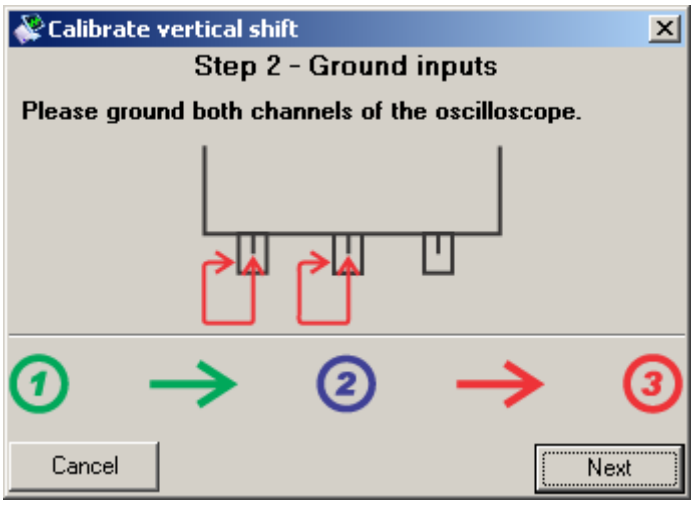


Fig. 5.2.2. – Vertical shift calibration – inputs grounding

Step 3 – The application offers two calibration modes:

Precise calibration – it takes approximately nine minutes and offers the best precision

Fast calibration – it takes approximately three minutes and offers lower precision. We recommend to perform precise calibration if possible.

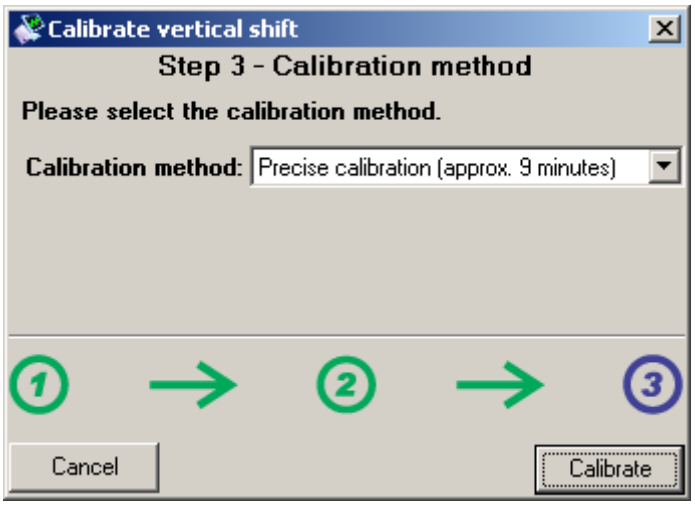


Fig. 5.2.3. – Vertical shift calibration – calibration method

Once the calibration completes, the application saves the calibration data to the hard drive to its directory and automatically loads it during all further startups.

The calibration data in the device is not affected by this additional calibration. Click „Tools -> Vertical shift calibration -> Calibration data -> Delete calibration data" in the main menu to delete the calibration data from the disk.

5.3. Mask testing

The mask testing allows you to detect the change of the signal shape. The signal tolerance in both the vertical and horizontal direction is specified during the mask creation.

5.3.1. Creating the test mask

Click the main menu item (Tools | Mask test | Create mask) to open the window where you can create the mask

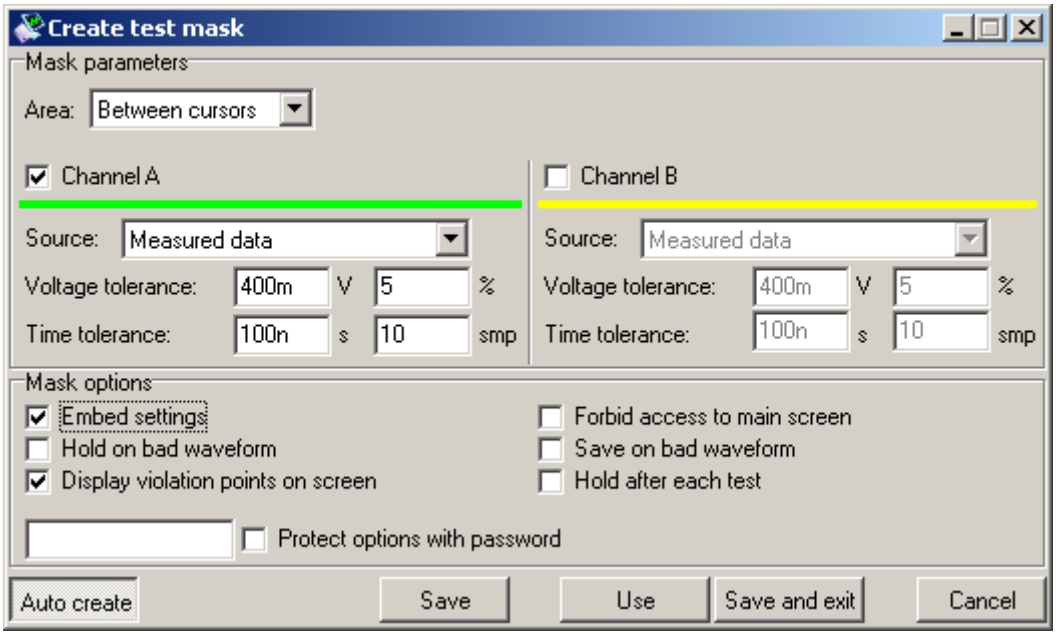


Fig. 5.3.1. – Creating the test mask

Following settings are available:

„Area" combo box allows you to select the part of the waveform which the mask should be created from:

Between cursors – the mask will be created from the waveform between the vertical cursors

Screen – the mask will be created from the waveform on the screen

Whole memory – the mask will be created from the whole waveform

Check „Channel A" or „Channel B" to enable the mask for the respective channel. Once the channel is enabled you can select the source and tolerance of the created mask.

The combo box „Source" allows you to select the source waveform for the respective channel. Select „Measured data" to create the mask from the currently acquired data. In the case where you have loaded the data from the file, the „Loaded data" item is available. Select it to create the mask from respective channel of the loaded data.

You can select the voltage tolerance (vertical) in two „Voltage tolerance" boxes in volts (first edit box) or in the percents from the current range (second edit box).

You can select the time tolerance (horizontal) in two „Time tolerance" boxes in seconds (first edit box) or in the samples (second edit box).

TIP: You can use units in the time and voltage tolerance (for example „m" – mili, „u" – micro, „n" – nano, „p" – pico).

You can select the mask options in the „Mask options" panel. Following options are available:

„Embed settings" – the current oscilloscope settings will be saved with the mask. Once the mask is loaded, the oscilloscope settings will be restored.

„Forbid access to main screen" – this options allows you to forbid the access to the main screen during testing. Use this setting to forbid the oscilloscope settings being changed during testing.

„Hold on bad waveform" – in the case where the mask violation is detected the measurement will be held to let you analyze the waveform shape which has violated the mask

„Save on bad waveform" – in the case where the mask violation is detected the waveform is saved to the hard drive. In the case you use the automatic numbering you can save any number of the waveforms for further analysis.

„Display violation points on screen" – in the case where the mask violation is detected the violation points are marked by red circles on the screen

„Hold after each test" – the software holds the measurement after each test. Further data will be acquired after clicking on the appropriate button of the use mask screen.

„Protect options with password" – above mentioned options can be changed while using the mask. In the case where the mask is protected by the password, it is

necessary to enter the password in order to change them. Enter the password to the edit box on the left.

If the „Auto create" button is pressed the mask is automatically created on each parameter change or acquisition of the new data. In the case where the button is not pressed, click „Create" button to create the mask.

Click „Save" button to open the dialog window where you can select the target file.

Click „Use" button to use mask without saving. Please note, that it is not possible to save it later.

Click „Save and exit" to open the dialog window where you can select the target file. This window is closed on successful save.

5.3.3. Using the test mask

By using the new mask or by clicking on the item in the main menu („Mask test -> Load mask"), the mask test window opens.

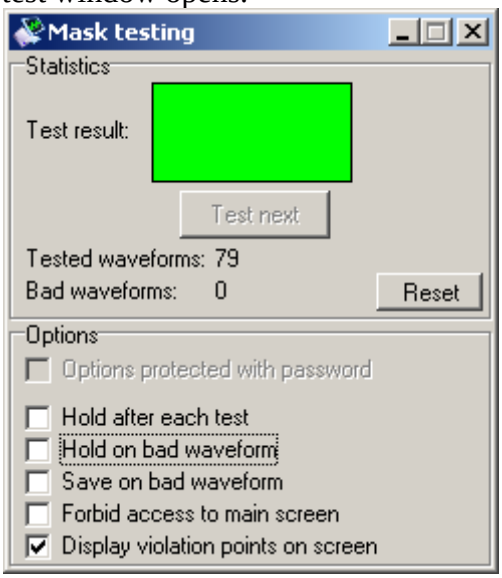


Fig. 5.3.2.1. – Mask testing

In the case where the last acquired waveform hasn't violated the mask, the „Test result" is green. In the case where it has violated the mask, „Test result" is red.

In the case where the „Hold after each test" is on, click „Test next" button to acquire data and analyse it.

The tested waveforms count and bad waveforms count are displayed below test results. Click „Reset" button to clear these statistics.

The options which are described in the previous chapter are available in the bottom of the window. In case they are protected by the password, click „Options protected with password" box and enter the password. Once you do this, you will gain access to these options.

6. Special functions

6.1. 80% function (80%)

The horizontal cursors' positions are affected as follows:

Lower horizontal cursor is moved upwards by 10% of the distance between cursors and the upper one is moved downwards by the same 10%.

6.2. Channel difference function (A-B)

The function result depends on the reference cursor state:

1. Reference cursor active: this function calculates the difference between channel A and channel B, where the reference cursor level is considered to be zero. The result of the zero value is displayed on the reference cursor position.

2. Reference cursor inactive: this function calculates the difference between channel A and channel B, where the 0V level is considered to be zero. The result of the zero value is displayed in the middle of the screen (between the fourth and fifth divisions).

6.3. Channel add function (A+B)

The function result depends on the reference cursor state:

1. Reference cursor active: this function adds channel A and channel B, where the reference cursor level is considered to be zero. The result of the zero value is displayed on the reference cursor position.

2. Reference cursor inactive: this function adds channel A and channel B, where the 0V level is considered to be zero. The result of the zero value is displayed in the middle of the screen (between the fourth and fifth divisions).

6.4. Channel A inversion (-A)

Function calculates the inversion of channel A (with no respect to 0V).

6.5. Channel B inversion (-B)

Function calculates the inversion of channel B (with no respect to 0V).

6.6. Channel A voltage inversion (-VA)

Function calculates the channel A inversion, where the reference cursor position is considered as a zero value (reference cursor on) or the 0V is considered as a zero value (reference cursor off).

6.7. Channel B voltage inversion (-VB)

Function calculates the channel B inversion, where the reference cursor position is considered as a zero value (reference cursor on) or the 0V is considered as a zero value (reference cursor off).

6.8. X-Y function (X/Y)

The X-Y function window is opened after activation of the X-Y function.

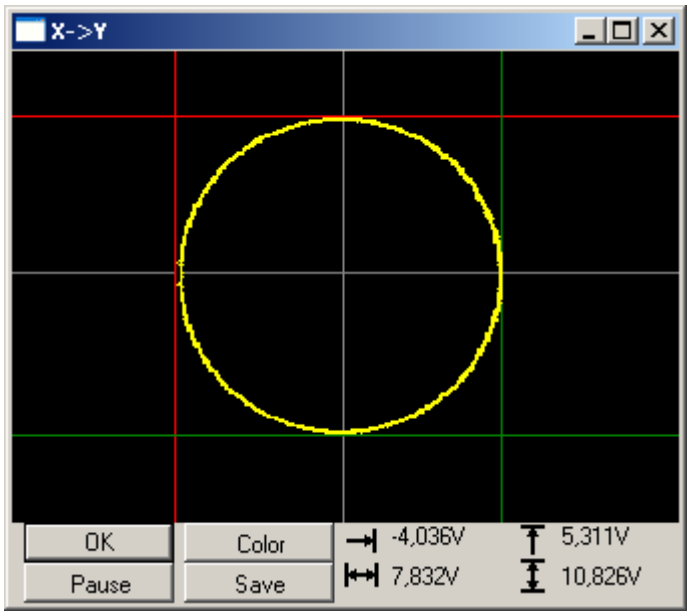


Fig. 6.8.1. – X-Y function window

TIP: The X-Y function window always stays on top. Therefore it is possible to change the oscilloscope settings and see their influence immediately.

The 0V values for X-axis and Y-axis are displayed in gray.

TIP: The 0V positions can be changed by vertical shift for both axis.

Two horizontal and two vertical cursors are available. Drag them to change their position.

TIP: The X-Y function displays the data visible on the main screen. The zoom function affects the amount of displayed data.

The cursors' position information is displayed in the lower right corner of the window:

- voltage between red vertical cursor and 0V
- voltage between vertical cursors
- voltage between red horizontal cursor and 0V
- voltage between horizontal cursors

"Color" – opens standard operating system dialog where you can select the shape color

"Save" – saves the shape in .jpg format.

"Pause" – pauses shape updating

6.9. Fourier transformation function (FT)

The Fourier transformation transforms acquired samples using the Fourier transformation. The FFT (fast Fourier transformation) and DFT (discrete Fourier transformation) are implemented. In case the automatic period selection is activated, one period of the waveform is transformed; otherwise the part distinguished by the cursors in the oscilloscope software is transformed.

The Fourier transformation window is opened after activation of the FT function.

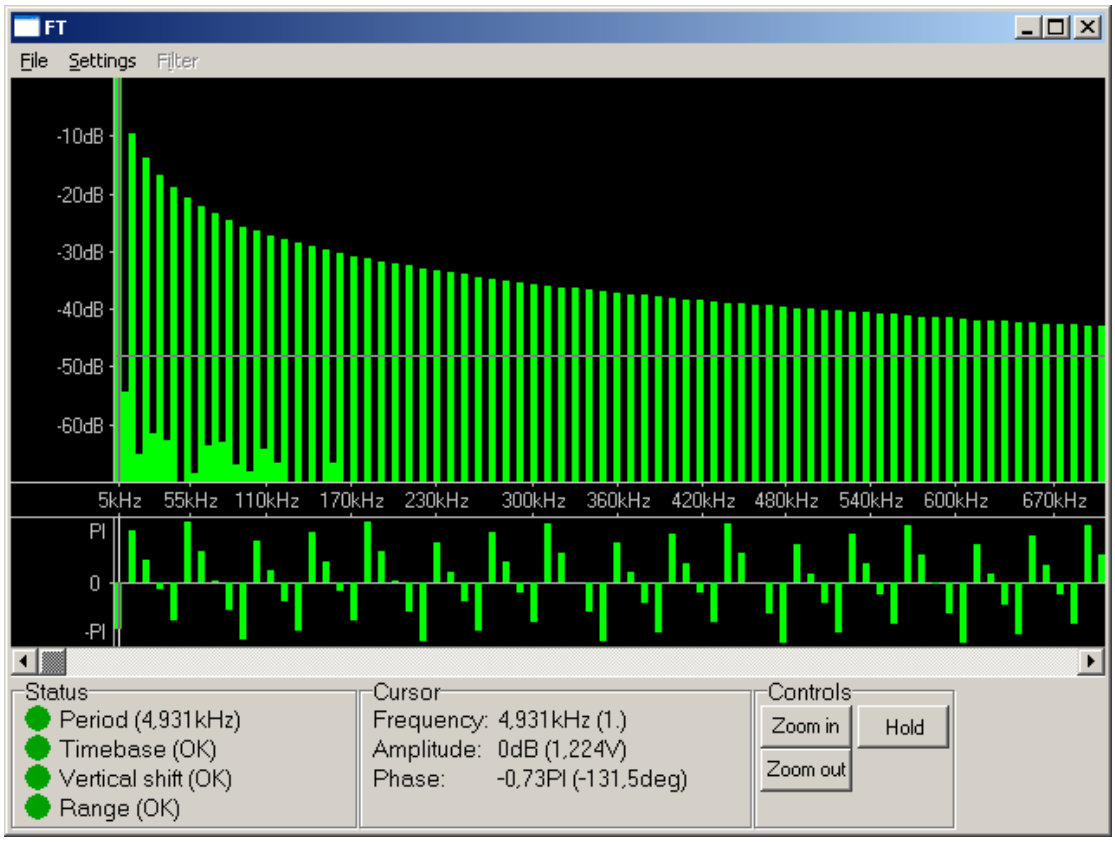


Fig. 6.9.1. – Fourier transformation window

The main screen is located in the top of the window. The frequency bar divides it into two parts. You can change the parts' size by dragging this bar. The harmonics' amplitude is displayed in the top part (amplitude part), the phase in bottom part.

The threshold amplitude is represented by a grey horizontal line in the amplitude part. You can change the threshold by dragging this line. Phase is displayed only for the harmonics with amplitude above this threshold.

If the decibels amplitude mode is activated, you can change the amplitude range by dragging ticks in the left of the amplitude part.

The captured harmonic can be selected by the vertical grey cursor.

You can scroll data using the scroll bar located below the main screen.

The status panel with information about the analyzed signal is located in the left bottom corner of the main window.

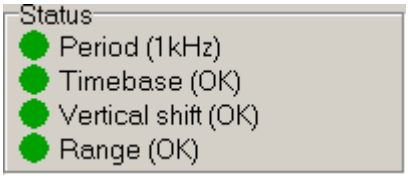


Fig. 6.9.2. – Status panel

If the indicator „Period" is:

red – the application was not able to find the period automatically
green – period found successfully
grey – the manual selection of the period is activated
The current selected period is displayed in parentheses.

If the indicator „Timebase" is:

red, yellow – the timebase is too slow for the analyzed signal, a faster timebase will produce better results
green – suitable timebase is set
grey – the automatic period selection is deactivated

If the indicator „Vertical shift" is:

red – the vertical shift is not suitable. If the „Up" is in parentheses, the waveform is shifted up, „Down" – waveform is shifted down.
green – suitable vertical shift is set.

If the indicator „Range" is:

red – the range is not suitable. If the „Sensitive" is in parentheses, the sensitive range is set, „Insensitive" – the insensitive range is set.
green – suitable range is set.

The information about the harmonic selected by the cursor are displayed in the bottom of the main window.

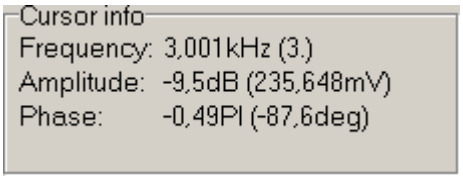


Fig. 6.9.3. – Information about harmonic selected by cursor

„Frequency" – Frequency of harmonic (its index)
„Amplitude" – Amplitude of harmonic in decibels (in voltage)
„Phase" – Phase of harmonic in radians (in degrees)

TIP: The effective or peak voltage of the harmonic can be displayed. You can select it in the main menu.

The main screen controls are located in the bottom right corner of the main window.

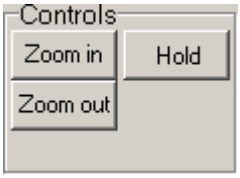


Fig. 6.9.4. – Screen controls

Click the „Hold" button to pause/unpause the data refresh. Click the „Zoom in" to display less data on the screen, click „Zoom out" to display more.

TIP: You can zoom in/out using the mouse wheel: if the mouse cursor is over the amplitude part of the screen, rotation of the wheel away from you zooms in, towards you zooms out. The position of the harmonic below the mouse cursor remains intact after zoom (if possible).

6.9.1. Main menu

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

File | *Print* – Opens the print manager
Settings | *Data source* | *Channel A* – Sets channel A as data source
Settings | *Data source* | *Channel B* – Sets channel B as data source
Settings | *Period selection* | *Automatic* – Activates automatic period selection

WARNING: Automatic period selection can fail to find the period of some signals. If you are not sure whether the detected period is correct, select the period using the cursors and activate one of the manual modes.

Settings | *Period selection* | *Manual with fine shift* – The period selected by the cursors is automatically adjusted to match the period. The period is adjusted maximally by +-2 points of the scope screen.

TIP: Manual mode with fine shift is suitable if you need to select a signal period longer than 500 samples. It is not possible to select a period with precision of one sample in manual mode if there is more than 500 samples on the oscilloscope screen.

Settings | *Period selection* | *Manual* – The period is selected by vertical cursors

WARNING: It is not possible to select a period with a precision of one sample in manual mode if there are more than 500 samples on the oscilloscope screen because one screen point corresponds with more than one acquired sample. The manual mode with fine shift is suitable for most measurements.

TIP: The more samples that a period is composed of, the more precise the results that will be achieved.

Settings | *Algorithm* | *FFT* – Data will be transformed by fast Fourier transformation.

Settings | *Algorithm* | *DFT* – Data will be transformed by discrete Fourier transformation.

TIP: The FFT is suitable for most measurements. DFT is suitable for extremely high precision measurements only: FFT with very high quality is essentially the same as DFT.

Settings | *FFT quality* | *Normal* – Sets normal FFT quality. This quality distorts harmonics near the half of the sampling frequency.

Settings | *FFT quality* | *High* - Sets high FFT quality. This quality distorts harmonics a little near the half of the sampling frequency.

Settings | *FFT quality* | *Very high* – Sets very high FFT quality. The result is essentially the same as if it were transformed using DFT.

WARNING: FFT with normal quality lowers amplitude of harmonics near half of the sampling frequency. We do recommend using DFT for precise measurements of these frequencies (or FFT with very high quality, if fast transformation is desired).

Settings | *Amplitude mode* | *Decibels* – Displays the harmonics' amplitudes in logarithmic mode, where 0dB is the amplitude of the harmonic with the highest energy.

Settings | *Amplitude mode* | *Voltage* – Displays the harmonics' amplitudes in linear mode in voltage.

Settings | *Voltage mode* | *Amplitude* – Voltage will represent amplitude of harmonic.

Settings | *Voltage mode* | *Effective* – Voltage will represent effective voltage of harmonic.
Settings | *Stay on top* – Activates/deactivates always on top mode for main window.

The following items control the inverse Fourier transformation (IFT). It is necessary to activate IFT to use them.

Filter | *Mode* | *Surpress noise* – The harmonics with a level higher than the threshold will be used for inverse Fourier transformation.

Filter | *Mode* | *Simple* – Inverse Fourier transformation is calculated from selected harmonics. Hold ctrl and click on the harmonic to select/deselect it. Hold shift and double click on the screen to select/deselect all harmonics.

Filter | *Mode* | *Complex* – The harmonics are modified by a filter specified before IFT calculation. Therefore, the result represents the input waveform passing through the specified filter. You can specify the filter by clicking on the item in the main menu.

Filter | *Algorithm* | *FFT* – Data will be transformed by the inverse fast Fourier transformation.

Filter | *Algorithm* | *DFT* – Data will be transformed by the inverse discrete Fourier transformation.

WARNING: The inverse FFT algorithm has a negative effect on the waveform quality. To achieve best results, use DFT on both transformations (inverse Fourier transformation and Fourier transformation).

Filter | *FFT Quality* | *Normal* – Sets normal quality of the inverse FFT.

Filter | *FFT Quality* | *High* – Sets high quality of the inverse FFT.

Filter | *FFT Quality* | *Very high* – Sets very high quality of the inverse FFT.

WARNING: Inverse FFT quality settings affect only inverse Fourier transformation. Change the parameters of the Fourier transformation to eliminate errors caused by the Fourier transformation.

Filter | *Configure complex filter* – Opens the configure complex filter window.

6.9.2. Complex filter window

The complex filter window is opened after clicking on the main menu item.

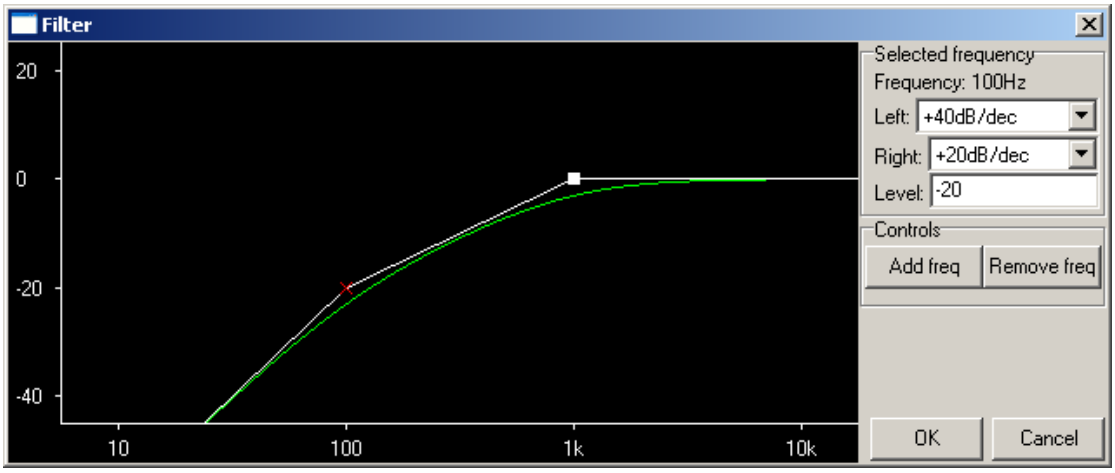


Fig. 6.9.2.1. – Complex filter window

The filter graph is displayed in the left part of the window. Cut frequencies are marked by a cross or square. The software composes a real filter from RC filters with specified cut frequencies. The real filter is displayed in green.

Cut frequency marked by a cross has its level fixed. Other frequencies' levels (marked by square) are calculated from a fixed frequency level.

Click the cross or square to select the cut frequency. The selected cut frequency is displayed in red.

The selected frequency controls are located on the right of the window.

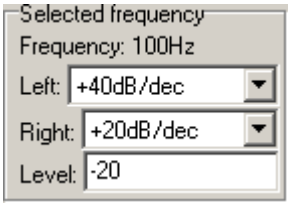


Fig. 6.9.2.2. – Selected frequency controls

Click the „left" combobox to change the filter steepness below the selected frequency, click the „right" combobox to change the filter steepness above the selected frequency.

It is possible to set attenuation at a specified frequency in the „level" edit box. The frequency's level becomes fixed after this operation.

Frequencies controls are located in the bottom left corner of the window.



Fig. 6.9.2.3. – Frequencies controls

Click the „Remove freq" button to delete the selected frequency.

Click the „Add freq“ button to open a window where you can select the new cut frequency.



Fig. 6.9.2.4. – New frequency window

It is necessary to enter the desired frequency into the „Frequency“ edit box.

TIP: It is possible to enter a value into the „Frequency“ edit box with a power of ten (for example 1k = 1000). It is possible to use k – kilo and M – mega.

6.10. Inverse Fourier transformation function (IFT)

This function calculates the inverse Fourier transformation from the data calculated by the Fourier transformation module (FT).

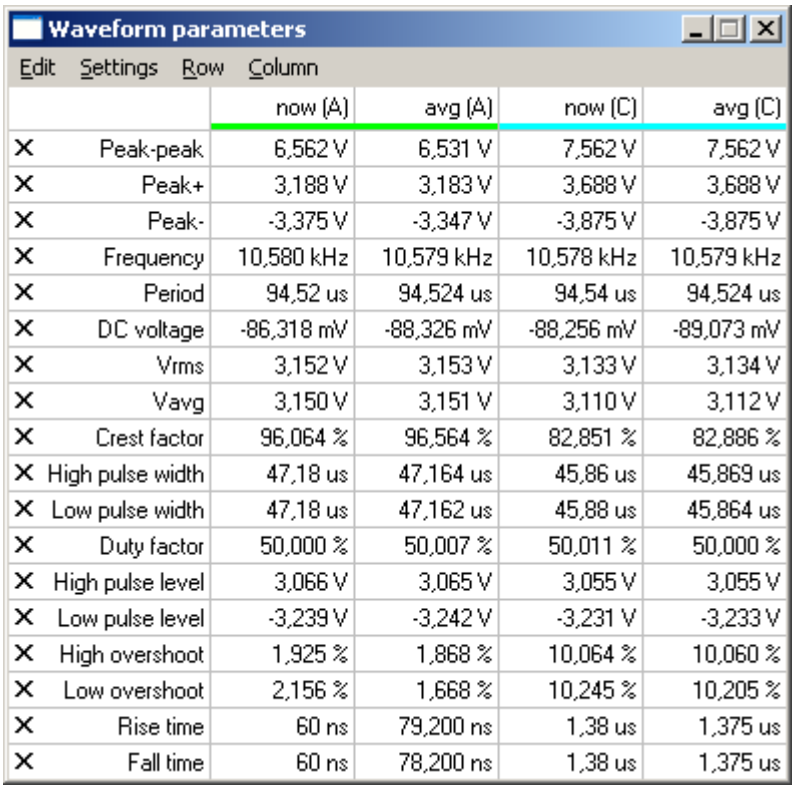
WARNING: You can only use this function together with the FT function. If the FT function is not activated it is not possible to activate the IFT function.

All IFT settings are accessible through the FT module's main menu.

6.11. Waveform parameters function (Wp)

The waveform parameters function calculates the parameters of the channel A, B, C or D waveform.

The following window opens after module activation.



	now (A)	avg (A)	now (C)	avg (C)
Peak-peak	6,562 V	6,531 V	7,562 V	7,562 V
Peak+	3,188 V	3,183 V	3,688 V	3,688 V
Peak-	-3,375 V	-3,347 V	-3,875 V	-3,875 V
Frequency	10,580 kHz	10,579 kHz	10,578 kHz	10,579 kHz
Period	94,52 us	94,524 us	94,54 us	94,524 us
DC voltage	-86,318 mV	-88,326 mV	-88,256 mV	-89,073 mV
Vrms	3,152 V	3,153 V	3,133 V	3,134 V
Vavg	3,150 V	3,151 V	3,110 V	3,112 V
Crest factor	96,064 %	96,564 %	82,851 %	82,886 %
High pulse width	47,18 us	47,164 us	45,86 us	45,869 us
Low pulse width	47,18 us	47,162 us	45,88 us	45,864 us
Duty factor	50,000 %	50,007 %	50,011 %	50,000 %
High pulse level	3,066 V	3,065 V	3,055 V	3,055 V
Low pulse level	-3,239 V	-3,242 V	-3,231 V	-3,233 V
High overshoot	1,925 %	1,868 %	10,064 %	10,060 %
Low overshoot	2,156 %	1,668 %	10,245 %	10,205 %
Rise time	60 ns	79,200 ns	1,38 us	1,375 us
Fall time	60 ns	78,200 ns	1,38 us	1,375 us

Fig. 6.11.1. – Waveform parameters window

The following parameters are displayed in the table:
„Peak-peak" – peak-peak voltage
„Peak+" – voltage of the maximum
„Peak-„ – voltage of the minimum
„Frequency" – frequency
„RPM" – frequency/60 (revolutions per minute)
„Period" – period
„DC voltage" – DC voltage
„Vrms" – effective voltage
„Vavg" – average voltage
„Crest factor" – crest factor

If the module fails to detect the periodicity of the waveform, „N/A" is displayed in place of „Frequency", „Period", „DC voltage", „Vrms", „Vavg", „Crest factor".

„High pulse width" – high pulse width
„Low pulse width" – low pulse width
„Duty factor" – duty factor
„High pulse level" – level of the high pulse
„Low pulse level" – level of the low pulse
„High overshoot" – overshoot of the leading edge
„Low overshoot" – overshoot of the trailing edge
„Rise time" – length of the leading edge
„Fall time" – length of the trailing edge

If the module fails to detect the periodicity or rectangular shape of the waveform, „N/A" is displayed in place of „High pulse width", „Low pulse width", „Duty factor",

„High pulse level", „Low pulse level", „High overshoot", „Low overshoot", „Rise time", „Fall time".

Time between 10% and 90% of the voltage between the low and high pulse is considered to be the length of the edge.

Click the cross on the left side of the parameter name to hide it.

It is possible to display the following statistics for each parameter:

„now" – current value of the parameter
„min" – minimal value of the parameter
„max" – maximal value of the parameter
„avg" – average value of the parameter
„dev" – parameter deviation

WARNING: The statistics are calculated from the whole history of the waveform. Click the item in the main menu to reset them.

6.11.1. – Main menu

The main menu is located at the top of the window. The following items are available:

Edit | *Copy* – Copies table to clipboard in text format.

Edit | *Reset params* – Resets statistics of all parameters.

Settings | *Channel C range source* – Channel C parameters will be calculated using the range of selected channel.

Settings | *Channel D range source* – Channel D parameters will be calculated using the range of selected channel

Settings | *Stay on top* – Activates/deactivates mode always on top mode of the window.

Row | *Show* – Shows/hides selected parameter

Row | *Show only* – Shows selected parameters and hides others.

Row | *Show all* – Shows all parameters

Row | *Configure rows* – Opens the window, where it is possible to show/hide the parameters.

Column | *Channel* – Activates/deactivates selected channel parameters

Column | *Show* – Shows/hides selected statistic

Column | *Show only* – Shows selected statistic and hides others.

Column | *Show all* – Shows all statistics.

Column | *Configure columns* – Opens the window, where it is possible to activate/deactivate the channels and show/hide the statistics.

6.12. Phase shift calculation (Pf)

Phase shift calculation (Pf) calculates the phase shift between channel A and B. The window is displayed after the module is activated.

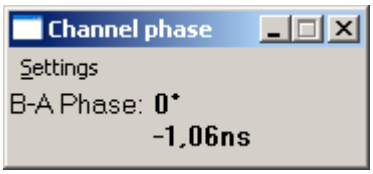


Fig. 6.12.1. – Phase shift window

The information about phase in degrees and time is displayed in the window. In case the channel A and B waveforms have different period, N/A is displayed.

WARNING: Software uses first harmonic to detect the phase shift of the channels. In case the waveform of channel A or B is corrupt, the wrong phase can be calculated.

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

Settings | *Stay on top* - Activates/deactivates mode always on top mode of the window.

7. Performance characteristics

7.1. DATAMAN 570 series performance characteristics

7.1.1. Vertical deflection system

No of divisions	8
No of pixels per division	32
Deflection factor range	10mV/div to 5V/div in 1-2-5 sequence
Accuracy	+- 2% of current value + 1 pixel
Resolution	8 bits (0,39%)
Frequency response (-3dB)	DC: 0 - 150 MHz, AC: 1.2Hz – 150 MHz
Step response rise time	max. 2.4 ns
Channel isolation	min. –60 dB
Resistance	1 MOhm +5 %, -2 %
Input resistance inaccuracy adjustment	Digital for absolute accuracy +- 2% of current voltage + 1 pixel
Capacitance	29 pF +- 1pF
Zero setting accuracy	+- 2% of the screen
Maximum input voltage	+- 200V at 100 kHz or less

Table 7.1.1.1. – Vertical deflection system

7.1.2. Triggering

System type	Dual level
Trigger source for primary level	selectable Channel A, Channel B or external trigger input
Trigger source for secondary level	selectable Channel A, Channel B or external trigger input
Threshold setting	Channel A and Channel B on the whole display range. External fixed on about 1.5V
Slope selection	Leading or trailing edge independently on each source
Minimum trigger pulse period	5 ns
Minimum trigger pulse length	2.5 ns
Maximum voltage on external trigger input	–10V to +13V at 20 kHz or less
Adjustments	Digital filter with ability of setting the valid pulse length up to 131072*Ts for each level and counter of valid triggering events selectable from 1 to 32768 for each level. HOLD-OFF selectable up to 1048576*Ts with selectable AUTO mode, to sample proper amount of data before trigger. (Ts – actual real time sampling period)

Table 7.1.2.1. – Triggering

7.1.3. Data acquisition system

No of divisions	10
No of pixels per division	50
Mode of operation	Sampling before and after trigger with continual selection of the trigger position
Record length	selectable from 1024 to 1048576 (1M) samples for each channel
Time base range in 1:1 mode	5 ns/d to 100 ms/d in 1-2-5 sequence
Time base range using different ZOOM modes	625 ps/d to 204.8 s/d
Time base accuracy	0.01 % to 100ns/d, 0.5 % for 50ns/d to 5 ns/d
Real time sampling frequency	500 Hz to 100 MHz
Equivalent sampling frequency	500 Hz to 10 GHz
Display range with respect to trigger event	1048576 samples before and 1048576 samples after trig. event in length of 1048576 samples

Table 7.1.3.1. – Data acquisition system

7.1.4. Probe compensation generator

Output connector	BNC, together with External trigger input
Output impedance	1 kOhm to parallel with 10nF and approx. 50 Ohm serial
Output waveform	Pulse with 1:1 duty cycle
Frequency	1465 Hz
Output voltage (no load)	3.3V +- 5%

Table 7.1.4.1. – Compensation generator

7.1.5. Power

Power source	USB interface via USB cable
Max current	USB1.1 – 350mA; USB2.0 – 450mA

Table 7.1.5.1. - Power

7.1.6. Mechanical characteristics

Dimensions without feet and connectors	165 x 111 x 35 mm
Dimensions with feet and connectors	182 x 111 x 39 mm
Weight	520 g

Table 7.1.6.1. – Mechanical characteristics

7.1.7. DATAMAN 574 timebase ranges

No	REAL TIME	t/div 1:16	t/div 1:1	t/div 10:1	Max. ACQ. TIME	SAMP. PERIOD	SAMP. FREQ.

1	no	10.24us	5ns	500ps	102.4us	100ps	10GHz
2	no	20.48us	10ns	1ns	204.8us	200ps	5GHz
3	no	40.96us	20ns	2ns	409.6us	400ps	2.5GHz
4	no	102.4us	50ns	5ns	1.024ms	1n	1GHz
5	no	204.8us	100ns	10ns	2.048ms	2n	500MHz
6	no	409.6us	200ns	20ns	4.096ms	4ns	250MHz
7	yes	1.024ms	500ns	50ns	10.24ms	10ns	100MHz
8	yes	2.048ms	1us	100ns	20.48ms	20ns	50MHz
9	yes	4.096ms	2us	200ns	40.96ms	40ns	25MHz
10	yes	10.24ms	5us	500ns	102.4ms	100ns	10MHz
11	yes	20.48ms	10us	1us	204.8ms	200ns	5MHz
12	yes	40.96ms	20us	2us	409.6MS	400ns	2.5MHz
13	yes	102.4ms	50us	5us	1.024s	1us	1MHz
14	yes	204.8ms	100us	10us	2.048s	2us	500kHz
15	yes	409.6ms	200us	20us	4.096s	4us	250kHz
16	yes	1.024s	500us	50us	10.24s	10us	100kHz
17	yes	2.048s	1ms	100us	20.48s	20us	50kHz
18	yes	4.096s	2ms	200us	40.96s	40us	25kHz
19	yes	10.24s	5ms	500us	102.4s	100us	10kHz
20	yes	20.48.s	10ms	1ms	204.8s	200us	5kHz
21	yes	40.96s	20ms	2ms	409.6s	400us	2.5kHz
22	yes	102.4s	50ms	5ms	1024s	1ms	1kHz
23	yes	204.8s	100ms	10ms	2048s	2ms	500Hz

Table 7.1.7.1. – DATAMAN 574 timebase ranges

7.2. DATAMAN 520 series performance characteristics

7.2.1. Vertical deflection system

No of divisions	8	
No of pixels per division	32	
Deflection factor range	10mV/div to 5V/div in 1-2-5 sequence	
Accuracy	+- 2% of current value + 1 pixel	
Resolution	8 bits (0,39%)	
Frequency response (-3dB)	522	DC: 0 - 60 MHz, AC: 1.2Hz - 60MHz
	524	DC: 0 - 120 MHz, AC: 1.2Hz – 120MHz
	526	DC: 0 – 150 MHz, AC: 1.2Hz – 150MHz
Step response rise time	522	max. 5.8 ns
	524	max. 2.9 ns
	526	max. 2.4 ns
Channel isolation	min. –75 dB	
Resistance	1 MOhm +5 %, -2 %	
Input resistance inaccuracy adjustment	Digital for absolute accuracy +- 2% of current voltage + 1 pixel	
Capacitance	30 pF +- 1pF	
Zero setting accuracy	+- 2% of the screen	
Maximum input voltage	+- 200V at 100 kHz or less	

Table 7.2.1.1. – Vertical deflection system

7.2.2. Triggering

System type	Dual level
Trigger source for primary level	selectable Channel A, Channel B or external trigger input
Trigger source for secondary level	selectable Channel A, Channel B or external trigger input
Threshold setting	Channel A and Channel B on the whole display range. External fixed on about 1.5V
Slope selection	Leading or trailing edge independently on each source
Minimum trigger pulse period	5 ns
Minimum trigger pulse length	2.5 ns
Maximum voltage on external trigger input	–10V to +13V at 20 kHz or less
Adjustments	Digital filter with ability of setting the valid pulse length up to 131072*Ts for each level and counter of valid triggering events selectable from 1 to 32768 for each level. HOLD-OFF selectable up to 131072*Ts with selectable AUTO mode, to sample proper amount of data before trigger. (Ts – actual real time sampling period)

Table 7.2.2.1. – Triggering

7.2.3. Data acquisition system

No of divisions	10	
No of pixels per division	50	
Mode of operation	Sampling before and after trigger with continual selection of the trigger position	
Record length	8192 samples for each channel	
Time base range in 1:1 mode	522 524 526	10 ns/d to 100 ms/d in 1-2-5 sequence 5 ns/d to 100 ms/d in 1-2-5 sequence 2 ns/d to 100 ms/d in 1-2-5 sequence
Time base range using different ZOOM modes	522 524 526	1 ns/d to 800 ms/d 500 ps/d to 800 ms/d 200 ps/d až 1.6 s/d
Time base accuracy	0.01 % to 100ns/d, 0.5 % for 50ns/d to 5 ns/d	
Real time sampling frequency	522 524 526	500 Hz to 50 MHz 500 Hz to 100 MHz 500 Hz to 200 MHz
Equivalent sampling frequency	522 524 526	500 Hz to 5 GHz 500 Hz to 10 GHz 500 Hz to 20 GHz
Display range with respect to trigger event	8190 samples before and 63000 samples after trig. event in length of 8192 samples	

Table 7.2.3.1. – Data acquisition system

7.2.4. Probe compensation generator

Output connector	BNC, together with External trigger input
Output impedance	1 kOhm to parallel with 10nF and approx. 50 Ohm serial
Output waveform	Pulse with 1:1 duty cycle
Frequency	1465 Hz
Output voltage (no load)	3.3V +- 5%

Table 7.2.4.1. – Compensation generator

7.2.5. Power

Power source	USB interface via USB cable
Max current	USB1.1 – 350mA; USB2.0 – 450mA

Table 7.2.5.1. - Power

7.2.6. Mechanical characteristics

Dimensions without feet and connectors	165 x 111 x 35 mm
Dimensions with feet and connectors	182 x 111 x 39 mm
Weight	520 g

Table 7.2.6.1. – Mechanical characteristics

7.2.7. DATAMAN 522 timebase ranges

No	REAL TIME	t/div 1:16	t/div 1:1	t/div 10:1	ACQ. TIME	SAMP. PERIOD	SAMP. FREQ.
2	no	160ns	10ns	1ns	1.638us	200ps	5GHz
3	no	320ns	20ns	2ns	3.276us	400ps	2.5GHz
4	no	800ns	50ns	5ns	8.192us	1n	1GHz
5	no	1.6us	100ns	10ns	16.38us	2n	500MHz
6	no	3.2us	200ns	20ns	32.76us	4ns	250MHz
7	no	8us	500ns	50ns	81.92us	10ns	100MHz
8	yes	16us	1us	100ns	163.8us	20ns	50MHz
9	yes	32us	2us	200ns	327.6us	40ns	25MHz
10	yes	80us	5us	500ns	819.2us	100ns	10MHz
11	yes	160us	10us	1us	1.638ms	200ns	5MHz
12	yes	320us	20us	2us	3.276ms	400ns	2.5MHz
13	yes	800us	50us	5us	8.192ms	1us	1MHz
14	yes	1.6ms	100us	10us	16.38ms	2us	500kHz
15	yes	3.2ms	200us	20us	32.76ms	4us	250kHz
16	yes	8ms	500us	50us	81.92ms	10us	100kHz
17	yes	16ms	1ms	100us	163.8ms	20us	50kHz
18	yes	32ms	2ms	200us	327.6ms	40us	25kHz
19	yes	80ms	5ms	500us	819.2ms	100us	10kHz
20	yes	160ms	10ms	1ms	1.638s	200us	5kHz
21	yes	320ms	20ms	2ms	3.276s	400us	2.5kHz
22	yes	800ms	50ms	5ms	8.192s	1ms	1kHz

23	yes	1.6s	100ms	10ms	16.384s	2ms	500Hz

Table 7.2.7.1. – DATAMAN 522 timebase ranges

7.2.8. DATAMAN 524 timebase ranges

No	REAL TIME	t/div 1:16	t/div 1:1	t/div 10:1	ACQ. TIME	SAMP. PERIOD	SAMP. FREQ.
1	no	80ns	5ns	500ps	819.2us	100ps	10GHz
2	no	160ns	10ns	1ns	1.638us	200ps	5GHz
3	no	320ns	20ns	2ns	3.276us	400ps	2.5GHz
4	no	800ns	50ns	5ns	8.192us	1n	1GHz
5	no	1.6us	100ns	10ns	16.38us	2n	500MHz
6	no	3.2us	200ns	20ns	32.76us	4ns	250MHz
7	yes	8us	500ns	50ns	81.92us	10ns	100MHz
8	yes	16us	1us	100ns	163.8us	20ns	50MHz
9	yes	32us	2us	200ns	327.6us	40ns	25MHz
10	yes	80us	5us	500ns	819.2us	100ns	10MHz
11	yes	160us	10us	1us	1.638ms	200ns	5MHz
12	yes	320us	20us	2us	3.276ms	400ns	2.5MHz
13	yes	800us	50us	5us	8.192ms	1us	1MHz
14	yes	1.6ms	100us	10us	16.38ms	2us	500kHz
15	yes	3.2ms	200us	20us	32.76ms	4us	250kHz
16	yes	8ms	500us	50us	81.92ms	10us	100kHz
17	yes	16ms	1ms	100us	163.8ms	20us	50kHz
18	yes	32ms	2ms	200us	327.6ms	40us	25kHz
19	yes	80ms	5ms	500us	819.2ms	100us	10kHz
20	yes	160ms	10ms	1ms	1.638s	200us	5kHz
21	yes	320ms	20ms	2ms	3.276s	400us	2.5kHz
22	yes	800ms	50ms	5ms	8.192s	1ms	1kHz
23	yes	1.6s	100ms	10ms	16.384s	2ms	500Hz

Table 7.2.8.1. – DATAMAN 524 timebase ranges

7.2.9. DATAMAN 526 timebase ranges

No	REAL TIME	t/div 1:20	t/div 1:1	t/div 10:1	ACQ. TIME	SAMP. PERIOD	SAMP. FREQ.
1	no	40ns	2ns	200ps	409.6ns	50ps	20GHz
2	no	100ns	5ns	500ps	1.024us	125ps	8GHz
3	no	200ns	10ns	1ns	2.048us	250ps	4GHz
4	no	400ns	20ns	2ns	4.096us	500ps	2GHz
5	no	1us	50ns	5ns	10.24us	1.25ns	800MHz
6	no	2us	100ns	10ns	20.48us	2.5ns	400MHz
7	yes	4us	200ns	20ns	40.96us	5ns	200MHz
8	yes	10us	500ns	50ns	102.4us	12.5ns	80MHz
9	yes	20us	1us	100ns	204.8us	25ns	40MHz
10	yes	40us	2us	200ns	409.6us	50ns	20MHz
11	yes	100us	5us	500ns	1.024ms	125ns	8MHz
12	yes	200us	10us	1us	2.048ms	250ns	4MHz
13	yes	400us	20us	2us	4.096ms	500ns	2MHz

14	yes	1ms	50us	5us	10.24ms	1.25us	800kHz
15	yes	2ms	100us	10us	20.48ms	2.5us	400kHz
16	yes	4ms	200us	20us	40.96ms	5us	200kHz
17	yes	10ms	500us	50us	102.4ms	12.5us	80kHz
18	yes	20ms	1ms	100us	204.8ms	25us	40kHz
19	yes	40ms	2ms	200us	409.6ms	50us	20kHz
20	yes	100ms	5ms	500us	1.024s	125us	8kHz
21	yes	200ms	10ms	1ms	2.048s	250us	4kHz
22	yes	400ms	20ms	2ms	4.096s	500us	2kHz
23	yes	1s	50ms	5ms	10.24s	1.25ms	800Hz
24	yes	2s	100ms	10ms	20.48s	2.5ms	400Hz

Table 7.2.9.1. – DATAMAN 526 timebase ranges

7.3. DATAMAN 770 series performance characteristics

7.3.1. Vertical deflection system

No of divisions	8
No of pixels per division	32
Deflection factor range	10mV/div to 5V/div in 1-2-5 sequence
Accuracy	+- 2% of current value + 1 pixel
Resolution	8 bits (0,39%)
Frequency response (-3dB)	DC: 0 - 150 MHz, AC: 1.2Hz – 150 MHz
Step response rise time	max. 2.4 ns
Channel isolation	min. –60 dB
Resistance	1 MOhm +5 %, -2 %
Input resistance inaccuracy adjustment	Digital for absolute accuracy +- 2% of current voltage + 1 pixel
Capacitance	28 pF +- 1pF
Zero setting accuracy	+- 2% of the screen
Maximum input voltage	+- 200V at 100 kHz or less

Table 7.3.1.1. – Vertical deflection system

7.3.2. Triggering

System type	Dual level
Trigger source for primary level	selectable Channel A, Channel B or external trigger input
Trigger source for secondary level	selectable Channel A, Channel B or external trigger input
Threshold setting	Channel A and Channel B on the whole display range. External fixed on about 1.5V
Slope selection	Leading or trailing edge independently on each source
Minimum trigger pulse period	5 ns
Minimum trigger pulse length	2.5 ns
Maximum voltage on external trigger input	–10V to +13V at 20 kHz or less

Adjustments	Digital filter with ability of setting the valid pulse length up to 131072*Ts for each level and counter of valid triggering events selectable from 1 to 32768 for each level. HOLD-OFF selectable up to 1048576*Ts with selectable AUTO mode, to sample proper amount of data before trigger. (Ts – actual real time sampling period)

Table 7.3.2.1. – Triggering

7.3.3. Data acquisition system

No of divisions	10
No of pixels per division	50
Mode of operation	Sampling before and after trigger with continual selection of the trigger position
Record length	selectable from 1024 to 1048576 (1M) samples for each channel
Time base range in 1:1 mode	5 ns/d to 100 ms/d in 1-2-5 sequence
Time base range using different ZOOM modes	625 ps/d to 204.8 s/d
Time base accuracy	0.01 % to 100ns/d, 0.5 % for 50ns/d to 5 ns/d
Real time sampling frequency	500 Hz to 100 MHz
Equivalent sampling frequency	500 Hz to 10 GHz
Display range with respect to trigger event	1048576 samples before and 1048576 samples after trig. event in length of 1048576 samples

Table 7.3.3.1. – Data acquisition system

7.3.4. Probe compensation generator

Output connector	BNC, together with External trigger input
Output impedance	1 kOhm to parallel with 10nF and approx. 50 Ohm serial
Output waveform	Pulse with 1:1 duty cycle
Frequency	1465 Hz
Output voltage (no load)	3.3V +- 5%

Table 7.3.4.1. – Compensation generator

7.3.5. Power

Power source	USB interface via USB cable (power ground isolated from ground of measuring inputs)
Max current	470mA

Table 7.3.5.1. – Power

7.3.6. Insulation specification

Maximum working voltage	500Vp while the voltage [V] * frequency [Hz] factor must not exceed 50000 [V Hz]
Resistance	> 2 GOhm

Capacitance	cca 150pF

Table 7.3.6.1. – Insulation specification

7.3.7. Mechanical characteristics

Dimensions without feet and connectors	165 x 111 x 35 mm
Dimensions with feet and connectors	182 x 111 x 39 mm
Weight	550 g

Table 7.3.7.1. – Mechanical characteristics

7.3.8. DATAMAN 774 timebase ranges

No	REAL TIME	t/div 1:16	t/div 1:1	t/div 10:1	Max. ACQ. TIME	SAMP. PERIOD	SAMP. FREQ.
1	no	10.24us	5ns	500ps	102.4us	100ps	10GHz
2	no	20.48us	10ns	1ns	204.8us	200ps	5GHz
3	no	40.96us	20ns	2ns	409.6us	400ps	2.5GHz
4	no	102.4us	50ns	5ns	1.024ms	1n	1GHz
5	no	204.8us	100ns	10ns	2.048ms	2n	500MHz
6	no	409.6us	200ns	20ns	4.096ms	4ns	250MHz
7	yes	1.024ms	500ns	50ns	10.24ms	10ns	100MHz
8	yes	2.048ms	1us	100ns	20.48ms	20ns	50MHz
9	yes	4.096ms	2us	200ns	40.96ms	40ns	25MHz
10	yes	10.24ms	5us	500ns	102.4ms	100ns	10MHz
11	yes	20.48ms	10us	1us	204.8ms	200ns	5MHz
12	yes	40.96ms	20us	2us	409.6MS	400ns	2.5MHz
13	yes	102.4ms	50us	5us	1.024s	1us	1MHz
14	yes	204.8ms	100us	10us	2.048s	2us	500kHz
15	yes	409.6ms	200us	20us	4.096s	4us	250kHz
16	yes	1.024s	500us	50us	10.24s	10us	100kHz
17	yes	2.048s	1ms	100us	20.48s	20us	50kHz
18	yes	4.096s	2ms	200us	40.96s	40us	25kHz
19	yes	10.24s	5ms	500us	102.4s	100us	10kHz
20	yes	20.48.s	10ms	1ms	204.8s	200us	5kHz
21	yes	40.96s	20ms	2ms	409.6s	400us	2.5kHz
22	yes	102.4s	50ms	5ms	1024s	1ms	1kHz
23	yes	204.8s	100ms	10ms	2048s	2ms	500Hz

Table 7.3.8.1. – DATAMAN 774 timebase ranges

8. Other information

8.1. .esb format

The data in the .esb format is saved in binary form without compression. The file consists of the information block. The format of the block depends on its type. The following eight types are defined:

integer (integer)
floating-point (double)
integer array (intarray)
boolean array (boolarray)
floating-point array (doublearray)
fixed-length integer array (fintarray)
boolean (boolean)
acquired data (acqdata)

8.1.1. Block structure

Each block starts with 8 bytes which determine the block length in bytes (32 bit value written in the first 4 bytes) and information about the block contents (32 bit value written in the last 4 bytes). In case the block contains the information which the application doesn't need the application can skip this block (by using the known block length).

Block structure is follows:

Integer

4 bytes	4 bytes	4 bytes
block length (12)	information code	value

Double

4 bytes	4 bytes	8 bytes
block length (16)	information code	floating-point value (double)

IntArray

4 bytes	4 bytes	4 bytes	4 bytes	4*n bytes
block length	information code	array length (n)	array length 2 (n)	array contents

Array length and array length 2 must be the same. In case they are not, the file is corrupted.

BoolArray

4 bytes	4 bytes	4 bytes	4 bytes	n bytes
block length	information code	array length (n)	array length 2 (n)	array contents

Array length and array length 2 must be the same. In case they are not, the file is corrupted.

DoubleArray

4 bytes	4 bytes	4 bytes	4 bytes	8*n bytes
block length	information code	array length (n)	array length 2 (n)	array contents

Array length and array length 2 must be the same. In case they are not, the file is corrupted.

FIntArray

4 bytes	4 bytes	4 bytes	4 bytes
block length (16)	information code	first array item	second array item

Boolean

4 bytes	4 bytes	4 bytes
block length (12)	information code	boolean value (0 = false, 1 = true)

AcqData

4 bytes	4 bytes	4 bytes	4 bytes	-	...	-
block length	information code	channel count (n)	channel count 2 (n)	1-st channel data		n-th channel data

Channel count and channel count 2 must be the same. In case they are not, the file is corrupted.

The structure of the channel data is follows:

4 bytes	4 bytes	n bytes
array length (n)	array length 2 (n)	array contents

Array length and array length 2 must be the same. In case they are not, the file is corrupted.

8.1.2. Available information

The following information is available in the file:

MemorySize (Integer) – code 0
Size of the memory used for data acquisition (in samples).

Timebase (Double) – code 1
Sampling rate used for data acquisition (in samples per second).

Range (DoubleArray) – code 2
Selected ranges (in mV per division). Array length corresponds with the channel count.

Shift (IntArray) – code 3
Vertical shift (0 is the maximal shift downwards, 4095 is the maximal shift upwards). Array length corresponds with the channel count. To determine the position of the 0V, use „GroundPos" information.

Filter (BoolArray) – code 4
Indicates whether the digital filter is on. Array length corresponds with the channel count.

FilterFactor (IntArray) – code 5
The digital filter level. Array length corresponds with the channel count.

TriggerSrcOnPrimary (BoolArray) – code 6
Indicates whether the source is on/off (index 0 – channel A, 1 – channel B, 2 – external trigger input)

TriggerSrcLeadingPrimary (BoolArray) – code 7
Indicates whether the triggering from the source is sensitive on the leading edge (index 0 – channel A, 1 – channel B, 2 – external trigger input).

TriggerLevel (IntArray) – code 8
The trigger threshold level (in quantization levels – from 0 to 255). Array length corresponds with the channel count.

TriggerCount (FIntArray) – code 9
The trigger count required to start acquisition on the trigger levels.

TriggerLength (FIntArray) – code 10
Minimal length of the valid trigger event (in samples).

TriggerMode (Integer) – code 11
The trigger mode (0 – Auto, 1 – Normal, 2 – Single, 3 – Manual).

AfterTriggerSamples (Integer) – code 12
Amount of samples acquired after trigger event.

HoldOffSamples (Integer) – code 13
Hold-off length in samples.

ProbeMode (IntArray) – code 14
The probe attenuation (0 – 1:1, 1 – 1:10, 2 – 1:100, 3 – 1:1000). Array length corresponds with the channel count.

Ground (BoolArray) – code 15
Indicates whether the grounding is on. Array length corresponds with the channel count.

DC (BoolArray) – code 16
Indicates whether the DC coupling is on. Array length corresponds with the channel count.

GroundPos (DoubleArray) – code 17
Position of the 0V on the screen (in quantization levels – from 0 to 255). Array length corresponds with the channel count.

AcquiredData (AcqData) – code 18
The data measured on the channels (together with virtual channels).

Version (Integer) – code 19
File version (currently set to zero).

FirstValidSamples (IntArray) – code 20
Index of the first valid sample in the channel data.

LastValidSamples (IntArray) – code 21
Index of the last valid sample in the channel data.

TriggerSrcOnSecondary (BoolArray) – code 22
Indicates triggering on the secondary level from source (index 0 – channel A, 1 – channel B, 2 – external trigger input).

TriggerSrcLeadingSecondary (BoolArray) – code 23
Indicates whether the triggering from the source is sensitive on the leading edge (index 0 – channel A, 1 – channel B, 2 – external trigger input).

ATMode (Integer) – code 24
After trigger count mode (0 – HSC, 1 – FSC, 2 – Set, 3 – Min).

HFMode (Integer) – code 25
Hold-off mode (0 – Auto, 1 – Set).

SimpleTrigger (Bool) – code 26
Indicates „Simple" mode of the trigger system.

WCDSensitivity (Integer) – code 27

Indicates WCD sensitivity. Value 255 indicates WCD switched off, 0 indicates the biggest sensitivity.

8.2. Command lines parameters

There are several command line parameters available for the Scope application. You just have to add the parameter to the icon target in the icon properties (change target for example from "C:\Program Files\dataman\Scope\scope.exe" to "C:\Program Files\dataman\Scope\scope.exe" -s "c:\program files\dataman\Scope\Settings\default.st").

8.2.1. Selecting the settings loaded on application start

Parameter –s allows you to select the settings file that will be used during application start. This file is not overwritten on application exit, so the application always starts with the same settings.

Syntax: scope.exe –s "<settings file name>"
Example: "C:\Program Files\dataman\Scope\scope.exe" -s "c:\program files\dataman\Scope\Settings\default.st"

The example uses the settings from the c:\program files\dataman\Scope\Settings\default.st file. The settings file can be created by selecting *Settings* | *Save settings* from main menu.

8.2.2. Selecting the type of device used

Parameter –d allows you to select the device type. Devices of all other types will be ignored during initialization.

Syntax: scope.exe –d <device type>
Example: "C:\Program Files\dataman\Scope\scope.exe" –d 570

The example searches for and initializes only the DATAMAN 574 oscilloscope.
Allowed device types are as follows:

Parameter	Device type
520	DATAMAN 522, 524, 526
570	DATAMAN 574
770	DATAMAN 774

Table 8.2.2.1. – Allowed device types of –d parameter