M1221 Mixed-signal Oscilloscope

User's Guide

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Contents

The ETC company would like to thank you for purchasing the ETC Measuring Lab device. We believe that it will meet your expectations. To keep you informed, please fill out the registration card, you have obtained with the shipment. In case you need any assistance, do not hesitate to contact our nearest distributor:

Package Contents

The Oscilloscope set you have obtained contains:

1 pc – EM221 PC add-on card
1 pc – cable with a plug on one end and an alligator clip on the other one
1 pc - cable with a plug on one end and a standard clip on the other one
2 pcs – module connection wires
1 pc - 3.5 inch disk containing SCOPE software
1 pc - User's guide

The logic analyzer adapter set contains:

1 pc	- EM121 PC add on card
1 pc	- EA121 input adapter
2 pc	- EA327/9 set of connecting clips
1 or 2 pcs	- 3.5 inch disk containing LogiScope software
1 pc	- User's guide

Warranty conditions

The Limited Warranty set forth below is given by ETC Ltd. with respect to the M1221 Digital Oscilloscope and Logic Analyzer package excluding the LogiScope software. This limited warranty is only effective upon presentation of the warranty card. This product is warranted against defective materials or workmanship for half a year (when the registration card is filled out and sent to ETC warrant period extends to one year), and is limited to repair, adjustment and/or replacement of the defective product.

Within the warranty period ETC will repair or replace the product free of charge, while the shipping fee is paid by the customer. After the warranty period, ETC will charge for parts, labor and shipping fee when returning the merchandise to the customer. ETC shall not be responsible for any abuse, misuse, accident, negligence, or modification by anyone other than the manufacturer.

Software license agreement

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1. GRANT OF LICENSE. ETC Ltd. as Licensor, grants you, the License, a nonexclusive right to use and display this copy of the SCOPE and LogiScope software (hereinafter the „SOFTWARE"), this EM221 and EM121 add-on cards and accompanying written materials, on a single COMPUTER at a single location and only together so long as you comply with the terms of this License.

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Recommendation for the use of EM221 and EM121 devices

- Read the README.TXT file before working with the device.
- Before adjusting or installing the add-on cards turn your computer off.
- Secure the front panel with the screw before turning your computer on.
- Do not attempt to set trimmers located on the add-on card.
- When setting base address always install just one jumper.
- Do not connect the voltage exceeding –4 V to +9 V range to the analyzer inputs.
- Do not connect any other device than EA121 to the EM121 connector.

Who is this book addressed to

This book is addressed to the users of the digital storage oscilloscope M221 and the logic analyzer M121. In order to fully understand the book and the software, the user should have a basic knowledge how of operating a device of this type, and some basic knowledge of working with Microsoft Windows. In case you have problems with the environment, please consult MS Windows User's Guide.

1. General information

The information contained in this chapter will help you to understand the features of the M1221 ETC Measuring Lab devices.

1.1. Oscilloscope characteristics

The M221 dual channel digital storage oscilloscope uses the EM221 add-on card for data collection, and a PC computer for data processing. The accuracy of measurement is provided by a combination of the stability of parts used in EM221 and of computer calculations. Information concerning device characteristics are part of the hardware; therefore, there is no need for any additional calibration data.

This oscilloscope allows the user to measure waveforms using two different channels with a resolution of 8 bits. The vertical deflection system range is from 50 mV/div to 2 V/div in a six steps sequence. The input impedance of this device conforms to the usual standards; it is therefore possible to use either a 1:1 or a 1:10 probe. You can set the coupling (AC or DC) for each channel individually. One step in the track vertical shift is smaller than 1% of the oscilloscope screen range. You can select the trigger source to be channel A, channel B, External trigger input or their combination. It is possible to set the trigger level individually for each channel. External trigger input is TTL compatible. EM221 chipset allows data collection frequency to be a maximum of 20 MS/s (megasamples per second), it means that it is not possible to sample nonperiodic waveforms faster than 50 ns per sample. However, the random sampling method allows the possibility of sampling periodic waveforms at the rate of 0.5 ns per sample (2 GS/s). The time base range is from 20 ns/div to 2 s/div (when measuring periodic waveform).

The M221 digital storage oscilloscope is equipped with two A-D converters, that allows independent measuring on both channels, without any distortions, that can happen when using oscilloscopes with multiplexed measuring channels. The record length of each channel is 8000 samples when the sweep runs after the trigger. Furthermore, this device allows to run the sweep before the trigger. In this mode it displays 7872 samples before the trigger and 128 samples after the trigger.

1.1.1 Digital Shielding (DSH)

To solve the problem of the interference of the computer circuits and of the display unit to the measured object, ETC Ltd. has designed Digital Shielding circuits that are cheaper and as equally effective as the classic electromagnetic shielding of input circuits. DSH circuits remove all interference not synchronized with the measured signal, and it does not affect the frequency characteristics of the measured signal. The only negative effect of DSH is a longer time period of stabilization. It is, however, very simple to turn the DSH off using the on-screen controls. You affect the PC and monitor interference level in a positive way by keeping the rules that will be described later. The level of efficiency of DSH corresponds to the DSH level factor that can be set to 2, 4, 8, 16, 32 and 64. The higher the level you choose, the longer it takes to stabilize.

1.2. Logic analyzer characteristics

Connecting the EM121 Logic analyzer adapter to the EM221 DSO, allows the acquiring of data of 16 digital channels. Besides this, it also creates two external clock inputs additional trigger inputs that can control not only the data acquisition of the logic analyzer, but also sampling of the oscilloscope.

The logic analyzer adapter is not equipped with clocking and time base circuits. It uses the time base of the EM221 DSO card. All oscilloscope modes can also be used with logic analyzer. The accompanying software allow you to use the device in following modes:

-Oscilloscope
-Logic analyzer
-MSO 1 (Mixed Signal Oscilloscope)
-MSO2
-MSO – user

The logic analyzer mode allows to analyze digital signals, where each of these signals can be displayed as standalone signal, can belong to a group of signals or can be reconstructed to the analog waveform.

The MSO 1 and MSO 2 modes allow display of both digital and analogue data and control of the main elements of both devices. The difference between these two modes is in way of displaying data and controlling the device.

The MSO – user mode allows to display analog waveforms as well as

digital data on the same screen. Using this mode, user can move the groups control elements anywhere on the desktop.

It is possible to trigger data acquisition from any of the oscilloscope and analyzer input signals. This means that it is possible to trigger both analyzer and oscilloscope from any of the oscilloscope channels as well as from any combination of values of analyzer signals.

If you have the EM121 Logic Analyzer adapter connected to the EM221 DSO card, it is still fully useable as an Digital Storage Oscilloscope, therefore it is no problem to continue using the single purpose SCOPE software with any hardware adjustments.

1.3. Dynamic address space allocation (DSA)

A serious problem with measuring devices designed as PC ISA add-on cards is the lack of I/O address space. To solve this problem ETC Ltd. has designed the DSA system, which allows you to connect 248 devices using just 8 I/O addresses. We will describe the DSA system very briefly. In case you would like to use the EM221 card in bigger systems, please contact the manufacturer.

Each device using the DSA system allocates eight consecutive I/O addresses. The lowest one is called the Base Address and a jumper on the add-on card indicates its value. To differentiate the active device, there is also the Module User Code (MUC) that is also indicated by a jumpers on the add-on card. The MUC value can be from 0 to 7; therefore only eight devices of the same type can be installed into the same system. Make sure that the EM121 base address is set to the same value as base address on EM221 before installing. The MUC code can be set to any value, even the same as on the EM221.

WARNING: When installing two devices of the same type, make sure they do not have the same MUC.

2. Installation

This chapter contains all the necessary information concerning the installation of hardware and software.

2.1. Minimum computer requirements

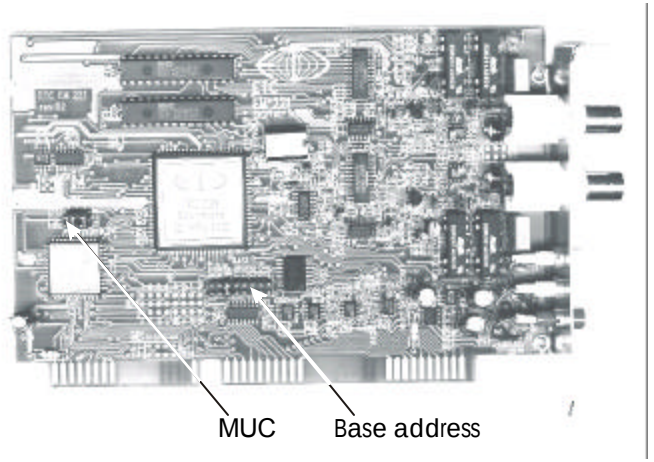
- 386 compatible computer
- 4 MB RAM
- 3.5 inch FDD
- VGA display adapter
- mouse or other pointing device
- 2 MB hard disk free space
- MS Windows 3.1, MS Windows 95 or MS Windows NT, depends on purchased software version.

2.2. Setting up the EM221 add-on card

Before installing the module to the computer it is important to set the Base Address and MUC.

To set the Base Address, simply install one jumper to the BASE part. When looking on the card (front panel is on right side), jumpers represent the following addresses (from left to right): 100h, 108h, 110h, 118h, 120h, 128h, 130h and 138h. In case you want to add this device to the EML System (ETC Measuring Lab), it is important to set the same base address as on the already installed devices. Default base address is 110h and there is usually no reason for changing it.

WARNING: Never install two Base Address jumpers. It can cause a device to malfunction.



To set the MUC you can install any combination of up to three jumpers on the EM221 add-on card in the MUC part. The jumpers represent the following values (from left to right): 4, 2, 1. To set the specific MUC, please, see the following table:

MUC	4	2	1
0	CLOSED	CLOSED	CLOSED
1	CLOSED	CLOSED	OPEN
2	CLOSED	OPEN	CLOSED
3	CLOSED	OPEN	OPEN
4	OPEN	CLOSED	CLOSED
5	OPEN	CLOSED	OPEN
6	OPEN	OPEN	CLOSED
7	OPEN	OPEN	OPEN

WARNING: It is crucial that no two devices of the same type have the same MUC. Such situation usually leads to system malfunction.

IDEA: We recommend you make a note of the MUC. It will ease the installation of the software.

2.3. EM221 device installation

To install this device, simply insert it into any open ISA Bus slot. Please, consult this action with your computer dealer. Always turn your computer off before installation. Before you turn your computer back on, put the screw back in its place.
To minimize interference obey the following rules:

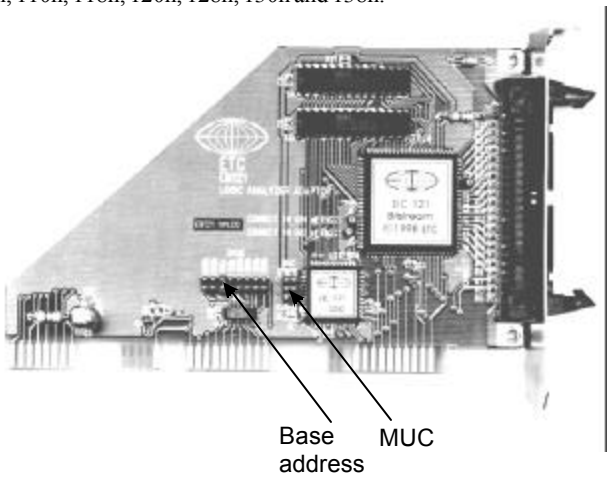
-Install the device as far from the power source as possible.
-Leave the by slot open.

These rules are not categorical. Not following these rules, can just lead to an increase in interference.

2.4. Setting up the EM121 add-on card

Before installing the module to the computer it is important to set the Base Address and MUC.

Set the same Base Address , as on the EM221 card, with which the analyzer will cooperate. When looking at the card (front panel is on right side), jumpers represent the following addresses (from left to right): 100h, 108h, 110h, 118h, 120h, 128h, 130h and 138h.



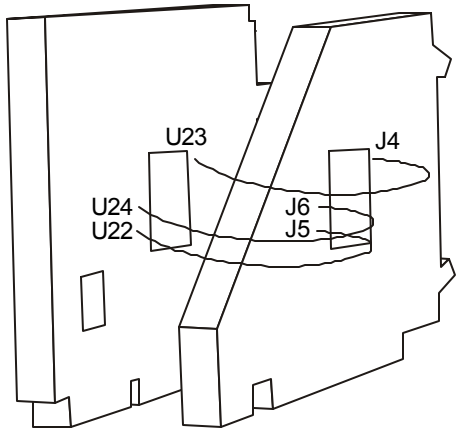
WARNING: Never install two Base Address jumpers. It can cause a device malfunction.

To set the MUC, you can install any combination of up to three jumpers on the EM221 add-on card in the MUC part. The jumpers represent following values (from left to right): 4, 2, 1. To set the specific MUC, please see the table in chapter 2.2. Setting up the EM221 card.

IDEA: We recommend, that you make a note of the MUC. It will ease the installation of the software

2.5. EM121 device installation

After installation of the EM221 DSO card, as described in chapter 2.3., it is necessary to insert connection cables to the installed EM221 device. Hold the EM121 device above the EM221 device and insert the loose ends of the connection wires into the shells on the EM121 card. Insert the EM121 device into the ISA Bus slot and secure it with the screw.



2.6. Software installation

There are software versions for MS Windows 3.1, MS Windows 95 and MS Windows NT available. The standard M1221 shipment includes only one of these versions. It is possible to purchase more software versions for an extra fee.

The LogiScope software has to be installed on the hard disk, and it needs approximately 2 MB of free space.

IDEA: We recommend that you make a backup copy before the first installation.

WARNING: When installing more than one EM221 or EM121 device, it is not necessary to install the software more than once. It is possible to control several devices using just a single software package.

Software is provided on one or two 3.5" disks. It contains the SETUP.EXE program that installs the whole software for you. A version of the host operating system is indicated on the disk label.

2.6.1. Microsoft Windows 3.X version

1. Insert the install disk into A or B drive.
2. Run Windows 3.1
3. Start PROGRAM MANAGER
4. Select FILE from the main menu
5. Select RUN
6. Input „a:\setup.exe" or „b:\setup.exe"
7. After running the installation software, follow the instruction on the screen.
8. After the installation is finished, remove the disk from the drive and store in a safe place.

2.6.2. Microsoft Windows 95 and Windows NT version

1. Insert the install disk into A or B drive.
2. Run Windows 95 or Windows NT
3. Open the Control Panel group

4. Select Add/Remove programs
5. Enter the name and location of the installation software „a:\setup.exe" or „b:\setup.exe" and press ENTER
6. After running the installation software, follow the instructions on the screen.
7. After the installation is finished, remove the disk from the drive and store in a safe place.

2.6.3. Running the LogiScope M1221 program

After a successful installation, SETUP creates a group called ETC Measuring Lab. In this group you will find an icon which runs the LogiScope M1221 program. You can run the program by double clicking, or pressing ENTER when it is selected.

When running the program for the first time, the program tries to find and work with a device on the default base address (110h) and the default MUC (0). In case you have moved the jumpers on the card, an error message will appear and Demo mode will start. How to fix this problem see chapter 3.7.1.1.

2.7. Exiting the program

It is possible to exit the program by several different ways:

- Select the item File/Exit from the main menu and press ENTER
- Press ALT+F and then ALT+E
- Use the host environment controls for exiting the running program

When exiting the program, program will ask whether you really want to exit. If your answer is positive, it will end. In case your reply is negative, it will keep running.

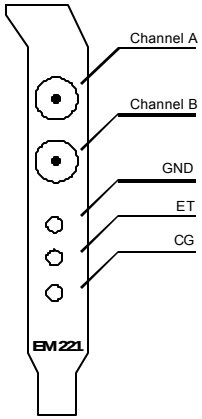
3. Using the device

The following chapter describes the usage of the M1221 measuring device that comprises of two interconnected devices: the EM221 DSO, and EM121 Logic Analyzer adapter. After the installation you can control both devices using the LogiScope software.

3.1. EM221 Front panel

All connectors are located on the EM221 card's front panel. Two BNC connectors are used to connect A or B channel. Beneath the two BNC connectors, there are three sockets. They have the following purpose:

GND - common potential (ground)
ET - external trigger input
CG - Auxiliary generator output



3.2. EM121 Front panel

The EA121 adapter can be connected to the connector located on the EM121 front panel.

WARNING: Do not connect any other device than the EA121 adapter to the connector located on the EM121 Front panel.

Two sets of clips can be connected into two 10-pin connectors located on the input adapter. Clips connected into left connector connect signals numbered 0 to 7, and external clock input C1. Clips connected in the right connector represent signals numbered from 8 to 15 and external clock input C2. Inputs can be easily distinguished by the color of wire. To find out which color represents which signal see following table:

signal's name	wire's colour	connector
0	brown	left
1	red	left
2	orange	left
3	yellow	left
4	green	left
5	blue	left
6	violet	left
7	grey	left
C1	white	left
GND	black	left
8	brown	right
9	red	right
A	orange	right
B	yellow	right
C	green	right
D	blue	right
E	violet	right
F	grey	right
C2	white	right
GND	black	right

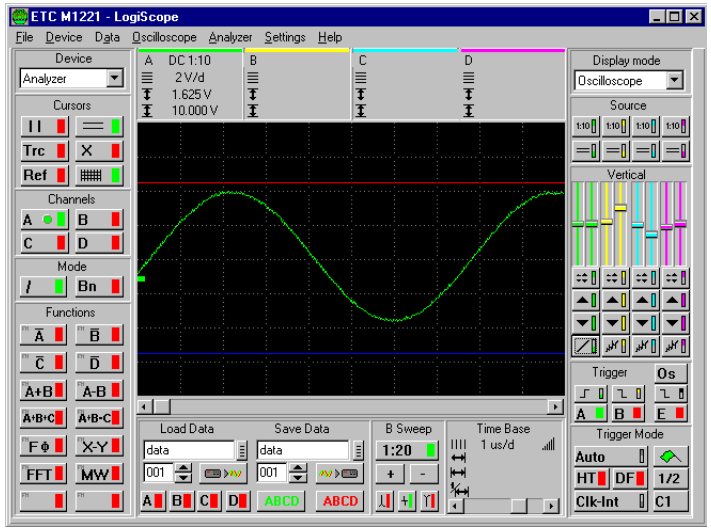
WARNING: Do not connect voltage exceeding range –4 V to +9V to the device input.

3.3. Main screen

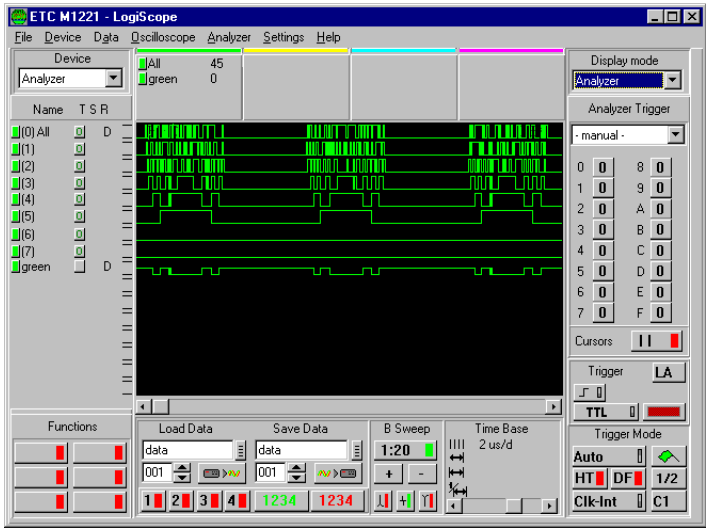
After running the LogiScope program, the device screen and control panel is displayed on your monitor. All common functions are easy to access on the control panel. Others can be reached through the main menu. User can choose from following modes:

1.Oscilloscope
2.Analyzer
3.MSO 1 and 2
4.User defined

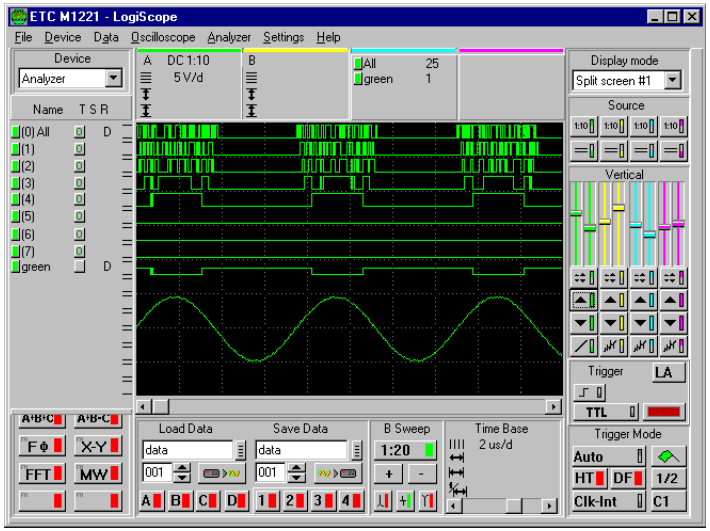
Oscilloscope mode



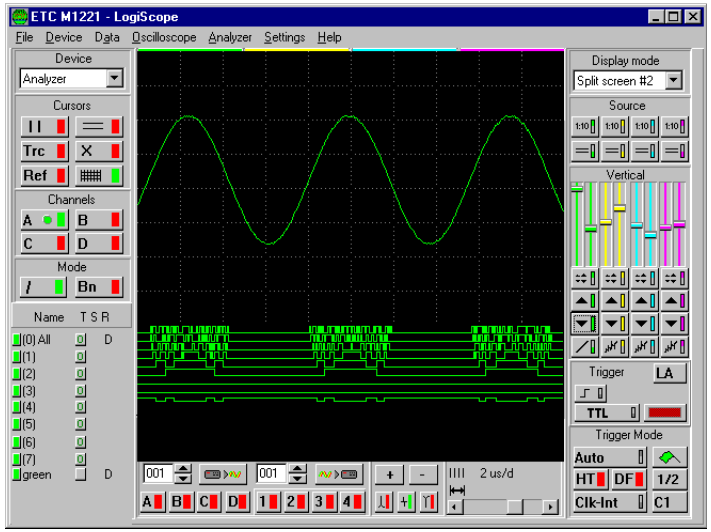
Analyzer mode



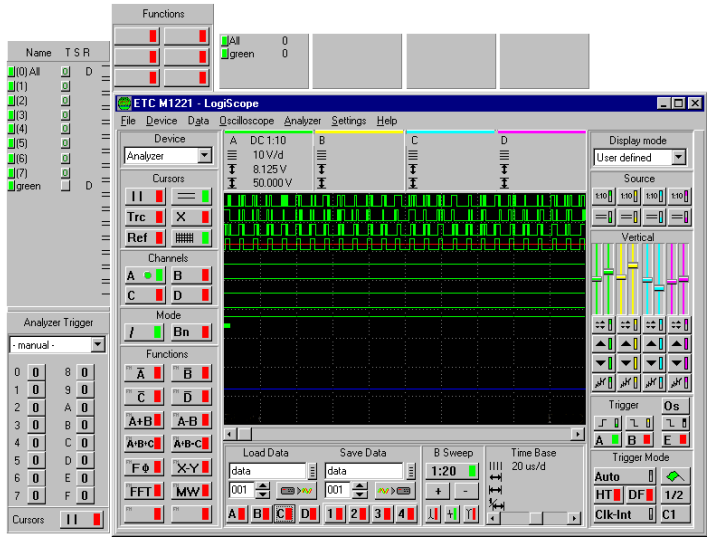
Mixed mode 1



Mixed mode 2



User-defined mode



3.4. General control elements

3.4.1. Operating modes

The control element in the upper right hand corner controls the operating mode and the design of the virtual device window on your monitor.

1.Oscilloscope mode
2.Analyzer mode
3.Mixed mode – MSO 1 and MSO 2
4.User defined MSO mode

Oscilloscope mode
This mode serves only for the controlling the M221 DSO. It is possible to display only analog waveforms acquired by EM221 card.

Analyzer mode
This mode is for controlling the M121 Logic analyzer. The screen can only display the digital waveforms measured by the M121 device.

Mixed modes MSO 1 and 2
These modes will let you take advantage of measuring and displaying mixed signals on one screen. There are all the control elements necessary for controlling both devices at the same time. The difference between these two mixed modes is in the size of the screen and in location of some control elements.

User defined MSO mode
This mode is very similar to the mixed ones. It is also used for controlling both devices. However, in this mode the user can place the group of control elements on any place on the desktop where it fits best.

All control elements directly related to specific channel are color-coded (i.e. they are marked with the channel color). For example, the color of channel B is yellow, therefore all control elements directly related to channel B are yellow.

IDEA: In case you are not satisfied with channel colors, it is possible to change them. See Main menu *Settings | Color*.

Control elements, which turn functions on and off are green when they are ON and red when they are OFF. Every single element can be controlled by either keyboard or mouse. Software was designed to be easy-to-use, keeping all MS Windows control standards. In the following text, the mouse control will be described as a main, and the keyboard one as an additional. You should understand the following terms in order to understand the rest of the text in this manual.

Click - point the mouse cursor over the component press and then release the left mouse button.

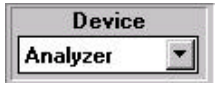
Double click - point the mouse cursor over the component and click twice quickly.

Drag - point the mouse cursor over the component you want to move and press the left mouse button (do not release). Move the mouse cursor together with the component. After releasing the mouse button, component will move to its final position.

Recommendation: To work with the LogiScope software, we recommend you to use a mouse or other pointing device. Operating the software through the keyboard seems very clumsy compared to using a mouse.

3.4.2. Setting up active device

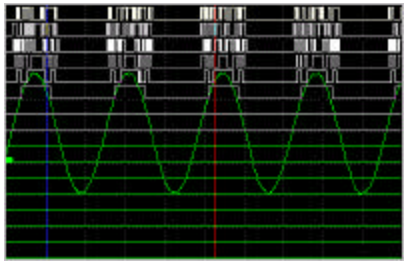
The LogiScope software allow you to control several devices connected to your computer. Using the control element in the upper left hand corner you can specify the device you want to work with. Such a device will be referred to as **active device.** After clicking on this control element the list of all devices that are configured to work with the LogiScope software will appear. To add and remove devices from the list see chapter 3.7.1.1. Setting up parameters of individual devices.



3.4.3. Measuring device screen

By the term "Measuring device screen" we understand the rectangle part in the middle of the monitor screen; The screen displays analog

waveforms acquired by oscilloscope and digital signals acquired by logic analyzer, as well as grid, horizontal and vertical cursors, a reference cursor and a trigger mark.



The Measuring device screen has two different sizes depending on device operating mode. In a Split screen 2 mode the screen will get larger so you can see non-overlapping digital and analog waveforms.

3.4.4. Controlling the data display length

Beneath the measuring device screen there is a group of elements controlling the data display length. There are 8000 samples measured and stored into memory for each oscilloscope channel and each of the analyzers channels. The device screen, however, can display a maximum of 400 samples, it is therefore very important to indicate which samples are to be displayed on the oscilloscope screen. Default setting is 400 samples from 8000. This is indicated in the upper part of the B Sweep window by 1:20 label, because just 1/20 of stored samples is displayed. By clicking the "+" or "-" buttons it is possible to change the display ratio form 1:2 to 1:20 (See tab. 3.4.4)

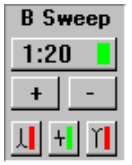


Table 3.4.4.

ratio	displayed data length	one pixel on screen represents x measured samples
1:20	400	1
1:10	800	2
1:4	2000	5
1:2	4000	10
1:1	8000	20

Oscilloscope

When the ratio button is off, data is displayed in a 1:1 ratio, otherwise the display ratio is equal to the ratio indicated on the button. The LogiScope software allows the user to choose one of the three modes of transformation x samples into one pixel. To choose the transformation mode simply click on one of the three transformation buttons.

Maximum: from x measured samples the computer displays the maximal one

Average: the computer computes the average value and displays it on screen

Minimum: from x measured samples the computer displays the minimal one

The standard setting of these control elements is Average. The Average mode has a special feature of smoothing out the waveform; therefore it does not display any glitches. If you are looking for any imperfections switch the transformation mode to Minimum or Maximum.

Analyzer

When display mode is set to 1:10, 1:4, 1:2 or 1:1 there are always several samples displayed as one pixel on the screen (see table 3.4.4.). When transforming several samples into one pixel, software always takes the first sample and displays it. Therefore buttons Maximum, Average and Minimum have no effect.

IDEA: When using 1:20,1:10, 1:4 or 1:2 display mode, it is possible to set the beginning of the data display to another value than the beginning of the data buffer.

IDEA: When using 1:20 display mode, one pixel on screen represents one sample without any further transformations. This mode; therefore, should be used as basic.

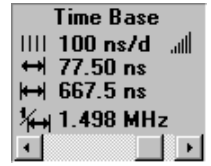
3.4.5. Scanning through samples

A scroll bar is located right under the measuring device screen. Using this scroll bar the user is able to scan through the samples. The very left position corresponds to data displayed from the

very beginning of the whole array of 8000 samples. The very right position corresponds to the end of the 8000 sample array. When using 1:1 ratio any scroll bar movement causes two grid colored cursors to appear. The area between these two cursors will be zoomed to the whole device screen when switched to the B sweep.

3.4.6. Controlling the time base and time base data

To control the time base there is a scroll bar located in the lower part of the time base window. Above this scroll bar there are values representing time base settings. To set the time base, simply grab the scroll bar and move it either left or right. Moving it left causes the time base to lengthen (i.e. allows measuring slower events). Moving the scroll bar right causes the time base to shorten (i.e. allows measuring faster events). By clicking on the arrows on the sides of the scroll bar we can change the time base in steps. The current time base is displayed above the scroll bar in seconds per division.



- this mark is displayed only when the device works in sampling mode.

WARNING: You can turn the sampling mode on only when data acquisition is triggered from the oscilloscope channels.

Besides the values corresponding directly to the time base setting, the software also displays the following data measured with the use of vertical cursors (only if they are on):

- time from beginning of displayed data to red vertical cursor

- value represents time between vertical cursors

- value representing frequency in hertz between vertical cursors

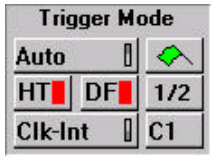
A list of time base ranges is in Appendix F

WARNING: The time base, and other values in this window, change with the changing display ratio. It is because time is in time units per division, and when the ratio changes, the amount of samples per division changes too.

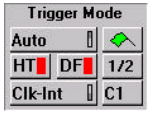
IDEA: If you want to know the sampling frequency, simply move the vertical cursors together, so that there is no space between them. The frequency between these two cursors is the sampling frequency.

3.4.7. Triggering mode controls

Next to the right of the measuring device screen there are two control elements. Using these two elements it is possible to control the triggering mode and start this mode (right, flag marked button). By clicking on the upper left button it is possible to set following modes:

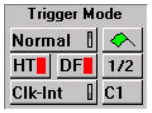


-**AUTO** Measurement is repeatedly triggered. If the trigger does not occur until half the time required to fill the whole buffer, the sweep free-runs without the trigger signal; otherwise it is triggered by trigger. This

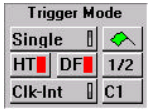


mode is recommended when you are trying to display an unknown waveform. When you click on the start button (flag marked button), the software will try to get the signal on the screen using the vertical shifting and voltage range switching. While the program is performing this action, flag button turns to red color.

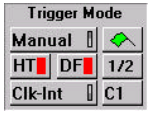
-**NORMAL** Measurement is repeatedly triggered. It produces a sweep only when the trigger signal meets the level and slope criteria. The start (flag marked button) does not have any function in this mode.



-**SINGLE.** Single measurement. Starts by clicking on the start button (flag marked button). The sweep runs after trigger signal has occurred. While waiting for trigger signal flag button color changes to red .It is possible to repeat the measurement by clicking on start button (flag marked button).



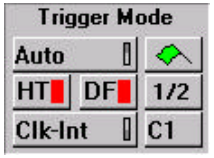
-**MANUAL.** Single measurement. It starts by clicking on the start button (flag marked button). The sweep runs immediately, it does not wait for the trigger signal. It is possible to repeat the measurement by clicking on the start button (flag marked button).



3.4.8. Digital filter

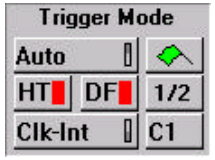
The button labeled DF (digital filter) controls the digital filter activity (ON/OFF). The digital filter stands in the way of all synchro signals. It is a low pass filter, which automatically changes its frequency and therefore it adjusts itself to the measured waveform.

WARNING: When the device works in the sampling mode, the digital filter is turned off automatically, and it is not possible to turn it back on while in sampling mode.



3.4.9. Sweep before trigger mode

In the lower right corner of screen there is a button labeled HT. This element controls the turning of the „Sweep before trigger mode" to either on or off. If this mode is on, the oscilloscope collects 7872 samples before and 128 after the trigger.



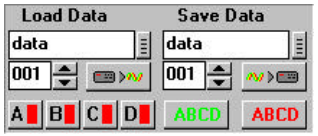
WARNING: In case the trigger signal comes too soon, the number of samples could be smaller.

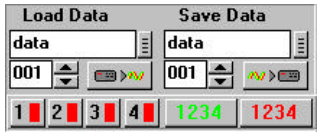
WARNING: In Sweep before trigger mode, the device is not able to work in sampling mode; therefore the sampling speed is limited to be less or equal to 20 MS / s.

3.4.10. Storing the data

Oscilloscope mode 3.4.10.1. Analyzer mode 3.4.10.2

Underneath the measuring device screen, there is a group of control elements that control data storage. Waveforms are stored into file exactly the same as they are showed on the device screen. All currently displayed





analog waveforms and all digital channels that belong to at least one of the active groups are stored into a file. To see how to add digital signals into active groups see chapter 3.7.3.2. To set the active set of signals use buttons marked as 1,2,3 and 4.

To enter the filename there are two input lines, one for the name (DATA by default) and the other one for the extension (001 by default), which combined together make a filename (DATA.001 by default). It is possible to change the name simply by clicking on it, and entering a new one. The extension is required to be a number from 000 to 999.

-clicking this button pulls out a standard file-handling dialog window, and there you can pick a file where data will be stored .

- this button starts the process of data storage. After a successful operation, the value of extension will increase by one.

WARNING: Only displayed data are stored into a file. Therefore it is impossible to move over stored and then loaded data.

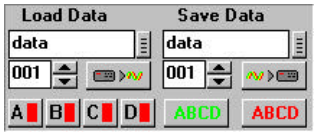
WARNING: The file also contains time base and vertical range values, in order to display reasonable data after loading the file back into your computer.

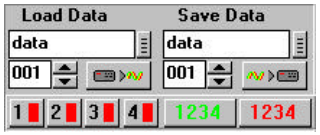
IDEA: Stored data are in Windows Profile format; therefore it is possible to add your own comments by simply adding a new line at the very beginning of the file and writing ";" character followed by your comments. The number of comment lines is not limited. After this you can, for example, send this file to your colleague by E-mail.

3.4.11. Loading the data

Oscilloscope mode Analyzer mode

Beneath the measuring device screen, there is a group of control elements that control data loading. All control elements have very similar





meaning as in a data-storing window. Entering the filename works in the same way as described in chapter 3.4.11. Storing the data.

Analog waveforms:

It is important to indicate which channels are to be displayed on the oscilloscope screen. Buttons A, B, C and D represent individual channels. The loaded channel will be displayed only if the corresponding button is on.

Digital signals:
Four control elements marked as 1,2,3 and 4 represent four different signal groups. Loaded group will be displayed only if the corresponding button is on.

It is possible to load only the files, which were created with the use of the function described in previous chapter. When data is read from the file, the time base and vertical parameters are set in the same way as when the file was created. The color of the loaded data is easy to adjust from the menu. They are grey by default. Loaded waveforms will stay on the screen until the time base or vertical parameters are changed.

IDEA: In case that loaded data has the same color. To identify which track belongs to which channel, simply turn the channel off and then back on.

IDEA: Loaded data can be displayed in all operating modes. Changing the operating mode does not cause the loaded data to disappear from the screen.

3.4.12. Triggering

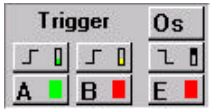
The LogiScope software allow you to trigger the data acquisition from two different sources:

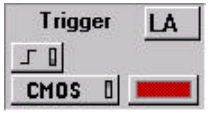
1. from digital oscilloscope inputs
2. from digital inputs of logic analyzer

To switch between these two sources use the button located on the right of the device screen. The button can be marked as Os (Oscilloscope) or as LA (Logic Analyzer). As you change the trigger source, the control elements around the button change (see the following picture).

Oscilloscope mode Analyzer mode

You can find a closer description of these control elements in chapter 3.5 or 3.6.

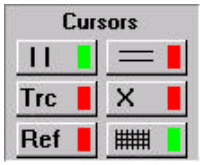




3.5.Oscilloscope control elements

This chapter describes elements that control the oscilloscope. All of the following control elements can be used in Oscilloscope mode as well as in user defined mode. Some of them can also be used in the rest of the modes, too.

3.5.1.Cursors and grid



Next to the left of the measuring device screen, there is a group of elements, which controls the cursor and the grid display. To move the cursor around the oscilloscope screen, just simply grab it, and move it to the desired location. While moving the cursor, you will notice, the measured data of the time base and each channel changing. You can also notice that cursors have different colors; the red one has a special function (See Next Chapter)


- turns vertical cursors ON and OFF. Using the vertical cursors, it is possible to measure time or frequency characteristics of the waveform. The measured data is displayed beneath the oscilloscope screen, where the time base is set.


- turns horizontal cursors ON and OFF. Using the horizontal cursors, it is possible to measure the voltage of the waveform. The measured values are displayed among the data of each channel above the oscilloscope screen.


- turns Track cursors mode ON and OFF. With this mode on, it is possible to move both vertical or horizontal cursors at the same time by moving the red cursor. The distance between the cursors is maintained at all times.


- turns XCursors mode ON and OFF. With XCursors mode on, it is possible to move two cursors together at the same time. To do so, just grab the cursors at the place where they cross and move them. When you do not grab them at the place of intersection, they can be moved independently.

-turns reference cursor ON and OFF. It belongs to the group of horizontal cursors and is used for measuring in combination with the red cursor. Using the reference cursor we can, for example, measure voltage with respect to the ground:

1. Make the short connection of the probe to the ground.
2. Set the reference cursor to position corresponding with the zero voltage.
3. Connect the probe with the measured point. Using the red cursor, it is now possible to measure the voltage with respect to the ground.

IDEA: In case both types of cursors are turned off, and you want to turn them on in the XCursor mode, simply click on the XCursor. The LogiScope software understands that horizontal and vertical cursors are also required to be turned on; therefore, they will be turned on automatically.

WARNING: When using 1:10 probe, do not forget to turn the channel's probe attenuation switch to 1:10. If you fail to do so, the measured data will be approximately 10 times smaller and not precise.

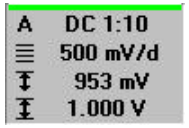
- turns grid ON and OFF. You can use the grid to find out the approximate characteristics of a waveform.

Grid dimensions:

Time Base: 1 division per 40 pixels; i.e. 10 divisions, 400 pixels whole screen
Vertical: 1 division per 32 pixels; i.e. 8 divisions, 256 pixels whole screen

3.5.2. Channels A, B vertical data

Above the measuring device screen, there are four boxes (one for each channel) containing these data:

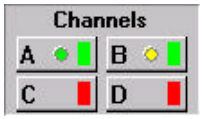


- Channel name (the box is also marked by a colored strip in the upper part)
- Probe attenuation (i.e. 1:1 or 1:10)
- Coupling status (i.e. AC or DC)
- Voltage per division
- Voltage between red and reference cursors
- Voltage between horizontal cursors

WARNING: Channel data is displayed only when the channel is active. Measured data is displayed only when the horizontal cursors are on.

3.5.3. Turning channels on and off

Next to the left of the measuring device screen there are four buttons that control A, B, C and D channel. By clicking these buttons, you are able to turn each measuring channel on or off.



WARNING: It is not possible to activate channels C and D. It is possible to use them to display the results of the functions.

IDEA: In case you are measuring only one channel, turn off the rest; it will speed up the performance.

3.5.4. Display mode

Next to the left of the measuring device screen there are two buttons for controlling the waveform display mode.

- turns the "Interpolation mode" ON and OFF. With the interpolation mode on, the software connects the measured data into a continuous line, otherwise the waveform is displayed as an independent series of dots.

IDEA: The convenience of this mode being on or off depends on the waveform characteristics; therefore, we recommend setting the mode off first and then turning it on. This is to assure the exclusion of errors of comprehension concerning the waveform shape.

WARNING: We do not recommend you to use the interpolation mode in sampling mode; therefore, when the oscilloscope is switched to sampling mode, interpolation is turned off automatically.

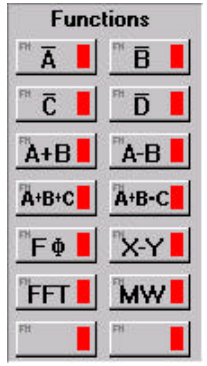
- turns "Beam Finder mode" ON and OFF. When the BF mode is on, all measured data exceeding the range of the oscilloscope screen is displayed on either the top or bottom of the oscilloscope screen. When this mode is off, data exceeding the range of the oscilloscope screen is not displayed.

IDEA: Before taking the actual measurement it is advisable to turn the Beam finder mode on, because the line either on top or bottom of the oscilloscope screen gives us a clue whether the actual track is located above or below the oscilloscope screen.

WARNING: The Beam finder mode may lead to some distortions on the bottom or top edge of the oscilloscope screen. When you are not quite sure about the shape of the waveform, turn the Beam finder mode off.

3.5.5. Functions

In the left-hand corner of the screen there are 14 buttons. Using these buttons it is possible to execute functions that work with the measured data. More detailed description of the standard functions is in the appendix.



To execute a function, follow these steps:

-Grab the desired function
-Move it to the channel that you have chosen to show the function results. (Moving to the channel means to release it on the desired channel's button)

In case you want to execute function from the keyboard follow these steps:

-Set the rectangle on the desired function and press space.
-In the dialog window you indicate the desired channel.

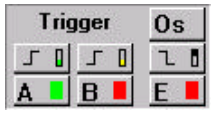
Turning the function off is possible by either clicking on channel button or clicking on the function button.

While a function is being performed on a certain channel all, control elements of the function will be colored by the channel's color.

WARNING: It is not possible to use the same function on two channels at the same time.

3.5.6. Trigger controls

Next to the right of the measuring device screen there is a group of six control elements. Using these elements, the user is able to set up the trigger conditions. It is possible to set the trigger source on channel A, B or external input using the lower row of buttons (A, B or E button). The upper button row indicates whether the oscilloscope triggers on the leading or the trailing edge. Clicking them switches the function to an opposite state.



 - triggers on leading edge

 - triggers on trailing edge

WARNING: When the trigger source is either channel A or channel B, it is also important to adjust the trigger level. (see 3.5.12)

3.5.7. Controlling the Digital Shielding

Next on the right of the measuring device screen there are control elements corresponding to individual channels A or B. Using them, the user is able to turn the Digital shielding on or off.

 - switch turned on

 - switch turned off

When the Digital shielding is on, the oscilloscope tries to separate the repetitive waveform from the noise (See chapter 1.1.1.). To turn Digital shielding on is advisable only for a well-synchronized waveform.

IDEA: It is possible to change the Digital shielding level. See chapter 3.7.1.5. Setting other parameters.

3.5.8. Setting the range

Next to the right of the measuring device screen there are eight control elements. Their function is to control the setting of the oscilloscope voltage range. There are two buttons for each channel. By clicking them, you can either increase or decrease the voltage range.

 - increase the voltage range

 - decrease the voltage range

The value of the voltage range is displayed for each channel individually in the channel parameter box above the oscilloscope screen. For the M1221 it is possible to set the following ranges:

Tab. 3.2.16.1. Ranges for 1:1 probe

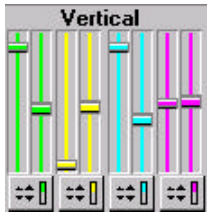
voltage per division	voltage per whole screenu
50 mV/div	400 mV/scr
100 mV/div	800 mV/scr
200 mV/div	1.6 V/scr
500 mV/div	4 V/scr
1 V/div	8 V/scr
2 V/div	16 V/scr

Tab. 3.2.16.2. Ranges for 1:10 probe

voltege per division	voltage per whole screen
500 mV/div	4 V/scr
1 V/div	8 V/scr
2 V/div	16 V/scr
5 V/div	40 V/scr
10 V/div	80 V/scr
20 V/div	160 V/scr

IDEA: Before you change the range we recommend you to set the triggering mode to Auto. Thus, the waveform does not disappear from the screen.

3.5.9. Controlling the vertical shift



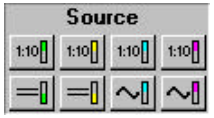
To control the vertical shift there are eight scroll bars (two for each channel) located next to the right of the oscilloscope screen. The purpose of the right scroll bar is to make an approximate shift. However, the left one helps to make a fine shift. To control these scrollbars simply grab one and move it to the desired location. If you wish to move the scroll bar only one step up or down simply click on the upper or lower edge.Under the scroll bars there is a button, which controls the vertical shift mode.

 - when attempting to make a vertical shift using the approximate scroll bar, the fine scroll bar will be centered

 - changing the location of the approximate scroll bar does not influence the fine scroll bar

IDEA: To find and get the measured waveform on the oscilloscope screen quickly, set triggering mode to Auto and click on Start (flag marked button) (see 3.2.13)..

3.5.10. Setting the coupling

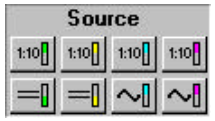


Next to the right side of the oscilloscope screen there is a group of two control elements (only buttons for channels A and B are operable). Using them, the user is able to switch the coupling either on AC or DC

 - DC coupling

 - AC coupling

3.5.11. Setting the probe attenuation



Using the two buttons located next to the right of the oscilloscope screen elements (only buttons for channels A and B are operable), the user is able to set the each channel's probe attenuation (1:1 or 1:10). When you switch the probe, always switch the corresponding button by clicking on it.

WARNING: When the probe attenuation switch does not correspond to the actual probe setting, the measured values are not accurate..

3.5.12. Trigger level mark

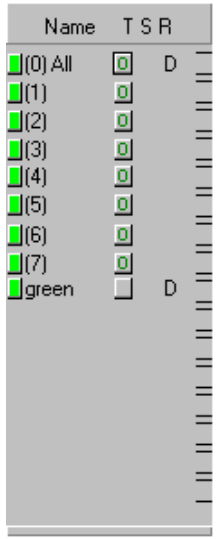
After setting the trigger source on channel A or B, the trigger level mark in the same color as the channel appears on the left-hand edge of the oscilloscope screen. The mark location represents the level. To set a different level, simply grab the level mark and move it to the desired location.

In the lower right corner of screen there is a button labeled "1/2". After clicking on this button the trigger level mark moves to the location representing the waveform average.

3.6. Analyzer control elements

The logic analyzer allows you to measure and display 16 digital signals. These signals can be divided into various groups. A color, name and display mode as well as other display parameters can be assigned to each group. Logic analyzer control elements allow working with groups and controlling the measurement.

3.6.1. Signal groups

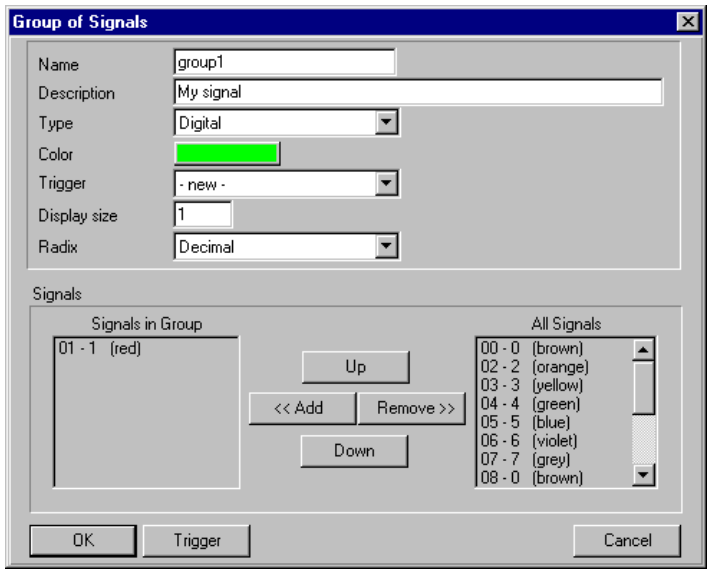


Left of the measuring device screen there is a set of elements for controlling groups. All groups currently displayed on screen are on this panel. Each group allocates exactly as many lines in panel as on the device screen. The following data is about each group available in this panel.

-Group color
-name
-trigger
-set of groups
-way of displaying numeric data

Properties of each group can be changed as follows:

-by clicking the control element where the color of the group is displayed
-clicking the empty space in panel
-using the *Analyzer|Signal group|Edit* menu (see chapter 3.7.3.2.)



Name – signal group name
Description – detailed description of the signal group
Type – signal group type. You can choose one of the following types

> **Digital** – you can display one or more signals. Signals are displayed separately.
> **Bus** – allows displaying of signals as data bus, i.e. in places where any of the signal changes, a vertical line is drawn. You can find out signal values using the vertical cursor.
> **Analog** – displays digital data as reconstructed analog waveform. The most significant signals are on top and least significant on the bottom of the group.

Color – group color
Trigger – assigns a trigger to a group
Display size – size in which will signals appear on screen. Default value of size is 1. When using default value, exactly 16 signals will fit onto the device screen. This setting affects only Analog and Bus group type. Group type Digital has automatically assigned size.

Radix – numeric base in which state of the digital signals will be displayed. You can choose from decimal, hexadecimal and octal bases.

Used signals – contains a list of signals that belong to a particular group. Signals are sorted from the most significant at the top and least significant at the bottom.

Using buttons Add and Remove you can add and remove signals to and from the group.

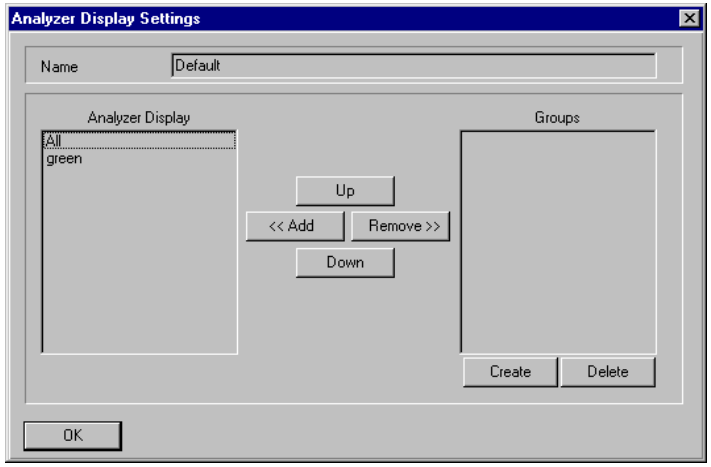
> **Add** – select the signal you want to add to the group and press this button
> **Remove** – select the signal you want to remove from the group and press this button

You can change the signal order in groups using the following buttons:

> **Up** – select the signal you want to move upwards and press this button.
> **Down** – select the signal you want to move downwards and press this button.

3.6.2. Displaying signal groups

The LogiScope software allows you to group signals into groups and place them on screen. Organizing signal groups can be done in following window.



This window appears after clicking into the signal groups panel (see chapter 3.7.3.4.). It can also be called from menu *Analyzer|Display|Edit*.
It contains the following elements:

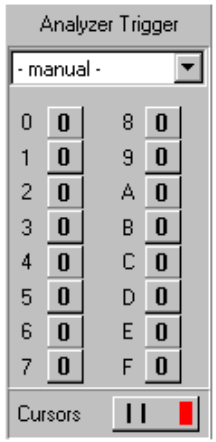
Name – display name
Analyzer display – group list that will appear on the device screen. Groups are listed in the same order as will appear on screen.
Groups – list of groups that are created, but are not displayed on the device screen.
Create – creates a new group (see chapter 3.7.3.4)
Delete – erases selected group

<< Add – select a group you want to add to a list of displayed groups and press this button.
Remove >> - select a group you want to remove from the list of displayed groups and press this button

You can change order of groups using following buttons:

Up – select a group you want to move upwards and press this button
Down – highlight a group you want to move downwards and press this button

3.6.3. Triggering on digital event



Left of the device screen there is a group of control elements, using which you can set the trigger event for triggering from logic analyzer. The digital trigger event consists of the list of input signals states. Trigger for each input signal can be set to any of the following values:

0 – logical 0
1 – logical 1
X – don't care

Here is a description of values that can be set for each channel:

-0 means that trigger event occurs when the level of the particular signal drops to 0
-1 means that trigger event occurs when the level of the particular signal rises to 1
-X means that this signal cannot affect the trigger event

Each signal is represented by one button. The button state can be changed by clicking it with a mouse.

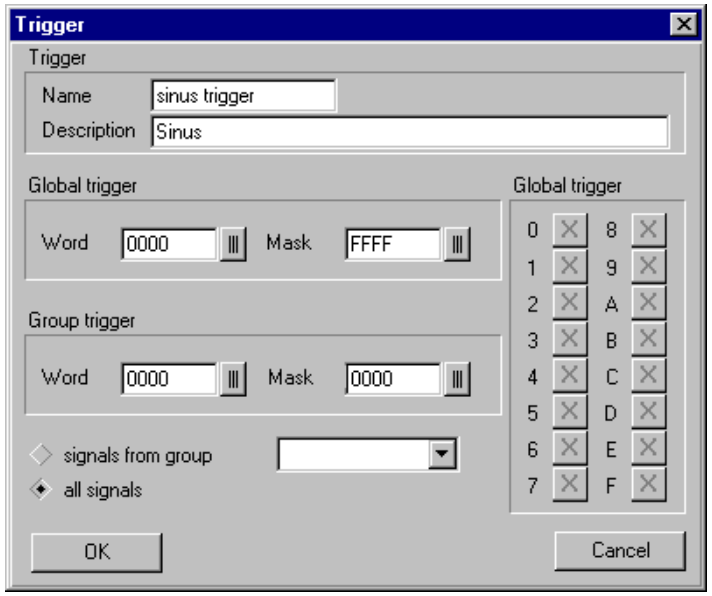
Threshold voltage value depends on TTL/CMOS button state (see chapter 3.6.3.2.). It is possible to synchronize on beginning or on end of trigger event (see chapter 3.6.3.2.).

Besides setting the trigger event directly you can also preset some trigger events you will use more often. To select one of the predefined trigger events, use the control element located above the buttons for setting trigger event.

Using this control element, you can choose one of the following:

-**none** – no predefined trigger. All signals are in X state.
-**manual** – trigger can be set by above described way
-**"other"** – user-defined trigger event

3.6.3.1. User defined trigger events



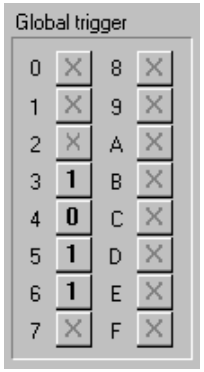
The LogiScope software allows you to set your own trigger events, save them and use them afterwards. The window for creating these events can be called from menu (see chapter 3.7.3.1) or from the window for editing group properties (see chapter 3.7.3.2).

You can set the following data in this window:

name – trigger event name
description – short description of the trigger event
global trigger - word – 16-bit hexadecimal value that represents value 0 or 1 for each of the signals
global trigger - mask – 16-but hexadecimal value that represents mask in which bits with value 0 will be used for synchronization and bits with value 1 will be marked as X (don't care) and not used for synchronization.
group trigger - word – n – bit hexadecimal value. It is similar to global trigger and is used only for specific group.

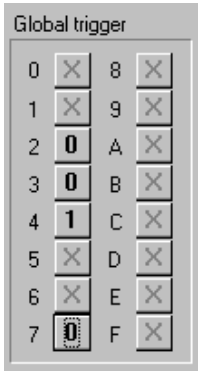
group trigger - mask - n – bit hexadecimal value. It is similar to global mask and is applied only to specific group.
signals group – allows specifying of the signal group, that is related to particular trigger event
all signals – trigger event will be defined over all signals
16 buttons – trigger event buttons. All have one of the three mentioned states (1,0,X).

Examples of usage:
1. You want to create a trigger event that will occur when signals 3, 5 and 6 will be in logical 1 and signal 4 in logical 0. You can't care for other signals.



Input following value into the window and confirm with ENTER.
global mask – FF87
(1111 1111 1**0000** 111)
global trigger – 0068
(0000 0000 0**110 1**000)

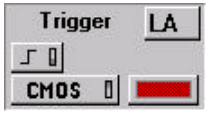
The 16 trigger buttons will display the state showed on figure 3.6.3.1.1.



2. You want to create a trigger event on a bus defined as a group of signals called "BusX" that consists of signals 2,3,4 and 7. The trigger event has to occur on signal 4 (0100). Set the group signals and choose BusX.
Enter following values and confirm with ENTER.
group mask – 0 (0000)
group trigger – 4 (0100)

3.6.3.2. Other synchronization settings

On the right side of the device screen there is a group of control elements that allow you to set some of the logic analyzer trigger parameters. The buttons have the following meaning:

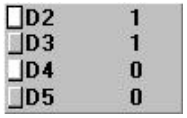


TTL CMOS sets the voltage levels to logical 1 and logical 0 corresponding to TTL or CMOS standard.

sets the trigger on beginning or on end of trigger event.

3.6.4 Using cursors

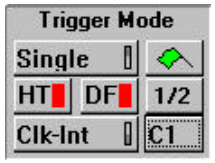
Using the control element to the right from the device screen you can turn the vertical cursors on and off. After turning it on, two cursors will appear on the screen with which you can measure time or frequency (see chapter 3.5.1.) using the red cursor you can also find out the state of the digital signal, or group of signals in a specific place.



Measured data are displayed above the device screen. Displayed value can be in decimal, hexadecimal or octal base depending on the setting for a specific group of signals.

3.6.5. Clock source

There is a group of control elements in the lower right-hand corner of the measuring device window. Using these control elements you can set the data acquisition clock.
Using the button on the left you can choose from internal or external source of the data acquisition clock. Time base is considered to be an internal source.



Using the button on the right you can choose the source of the external clock as follows:

C1 -signal C1 is considered to be data acquisition clock

C2 -inverted signal C2 is considered to be data acquisition clock

C12 -C1 AND inverted C2 to be the external clock

3.7 Main menu

The menu bar allows the user to access all menu commands. To pick an individual menu item using the mouse, simply click on it. When using the keyboard you can access individual items using a combination of ALT and the underlined letter. It is possible to use arrow keys within the menu. If the item is followed by three dots (...), it causes the dialog window to open. If the item is followed by a right arrow (>), it opens another submenu.

WARNING: When using the menu, the measurement stops. It comes back on after exiting the menu.

3.7.1.1. Setting parameters of individual devices

To set parameters such as base address and user code (MUC)simply pick *Device | Setup* from the main menu. It opens a dialogue window in which the user is able to change the device parameters.

To add a new device, pick*Device | Adddevice* from the main menu. It opens the same dialog window. The user is expected to state the device name, type, version, base address, user's code and number of channels. After confirmation, it will be possible to pick the device in the upper left corner of the screen.

Name - device's user given name (can be anything). This name will represent the relevant measuring device in the list of measuring devices.
Type – Oscilloscope & Analyzer
Version - EM221 & EM121
Connected via: - ISA BUS
-EPP version 1.9 (when using M701 adaptor)
-EPP version 1.7 (when using M701 adaptor)
Base address - address corresponding to the jumpers installed on EM221 and EM121 cards
User's code - code (MUC) corresponding to jumpers installed on EM221and EM121cards

In the window that appears after clicking on the button "Settings" you can specify whether you want to control just oscilloscope or oscilloscope and logic analyzer.

Picking the item *Device | Remove* from main menu opens the dialog window, in which the user can select the device to be removed.

3.7.1.2. Automatic detection of measuring devices

The LogiScope software includes the built-in possibility of detecting all ETC Measuring Lab line devices. After clicking on the *Device | Autodetect* item in the main menu, a dialog window opens. It is important to indicate all the addresses where you want the software to attempt the detection of devices. After clicking on the*Detect* button, the list of detected devices will be displayed.

WARNING: In case you attempt detection of a device on address which is already used by some other device not manufactured by ETC, the computer can "freeze". When this happen try to reinstall measuring devices on a different address.

WARNING: The fact, that a device is not found even on the address where it is installed can be caused by having some other device from some other manufacturer occupying the same address.

3.7.1.3. Printing the measurement report

To print out the measurement report simply click on the*File | Print* item in the main menu. It opens a standard dialog window, in which you can choose a printer. After selecting the desired printer, the software prints out the report.

In case you want to set up the printer before printing, just click on *File | Printer* setup item in the main menu.

IDEA: The LogiScope software allows you to preview the document before printing.

3.7.1.4. Exporting data

In case you need to transfer the measured data to other software for further processing, use the function*Export*. This function was designed to allow user to export data to any Windows oriented software. This is why it uses a clipboard. As an example we will describe exporting data to MS

Excel. Using the controls for storing and restoring, choose which data to export. Click on the Export item in the main menu, and the program will store the selected data to the clipboard. Now you have to run the destination application, which in this case is MS Excel, and select Paste from the main menu, which makes data to form a table of up to 4 columns (1 column per channel and each). Following the same steps, it is possible to copy data into any program that works under the MS Windows and allows working with clipboard.

3.7.1.5. Help

When you are struck by a problem while working with the LogiScope software, you can find help either in the User's guide or in the LogiScope software by selecting the Help item in the main menu. The help option in the LogiScope software is written with respect to the standards of MS Windows' environment. You can find more thorough information concerning Help and its use in the MS Windows User's guide.

3.7.1.6. Setting up some of the features

The LogiScope software allows you to store and restore the configuration of all control elements. Configuration is stored into a file, which is indicated by the user. Such a file has the default extension INI. There is also the LOGISCOP.INI file, in which the software stores the configuration of control elements when exiting the program. This data is used to set up the device when the program is restarted. For storing and loading the configuration data use the *Settings | Save* item or *Settings | Load* item from the main menu. Besides these two items, there is a *Setting | Load defaults* item. Using this item all control elements will be set to their default state.

In case you are not comfortable with the preset colors of channels, cursors and some other elements, it is possible to change them by clicking on the *Settings | Colors* item from the main menu. In the dialogue window, which appears after choosing this item, the program displays control elements and their colors. To change the color, click on Set color button, and pick the color in the dialog window, that follows it.

WARNING: After changing the color of channels A or B all elements related to certain channels in any way will change their color too.

The last item in the Settings submenu is Commix. If there is a " ✓" in front of the word Commix, it means, that this option is on. With Commix help on, when you point the mouse cursor over any element, after a short period of time a brief help text is displayed.

IDEA: For the user, who has already mastered LogiScope, it would be better to turn the Commix help off, so as not to be disturbed from the measurement.

3.7.2. Oscilloscope menu items

3.7.2.1. Device testing

Item *Device|Test*, which can be pulled out from the main menu, is used to test the measuring device. After selecting this item, the dialogue window containing all instructions will appear.
This test serves as a simple oscilloscope check. It utilizes a compensation generator that is accessible from the lowest connector on a device front panel. To perform the test, follow the subsequent steps:

Connect the 1:10 probe to channel A. In case you do not have the 1:10 probe available, you can connect the auxiliary generator output to the channel A input through the attenuator with approximately a 1:10 ratio.

- Connect the probe tip to the Compensation Generator.
- Activate testing mode by selecting *Device|Test* from the main menu.
- After this a waveform similar to either 3.7.2.1.1.a, b or c figure should appear on the screen. If it does not, there is an error in the oscilloscope circuits or probe.

It is possible to use this test to adjust the probe precisely for the particular oscilloscope. Note that probe is not adjusted by the manufacturer; therefore, we recommend you to adjust it before the first use. To adjust the probe, keep twisting the adjustable capacitor on the probe, until the waveform looks exactly like the 3.7.2.1.1.b. figure.

3.7.2.2. Setting the digital shielding

After clicking on the *Settings | Shielding* item in the main menu, a dialog window, allowing user to set the digital shielding level, appears on

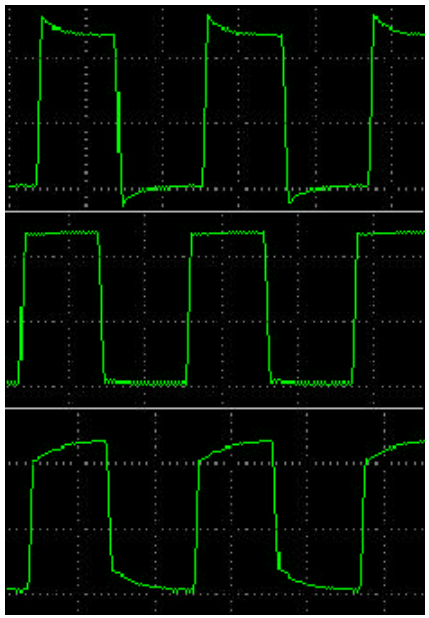


fig. 3.7.2.1.1.a

fig. 3.7.2.1.1.b

fig. 3.7.2.1.1.c

the screen. It is possible to set shielding level to values: 2, 4, 8, 16, 32 or 64. The default value is 4.

IDEA: We recommend you to use Digital shielding for well synchronized signals only.

3.7.3. Logic analyzer menu items

The main menu of the LogiScope software contains the item *Analyzer*. All items in *analyzer* submenu allow you to control some of the logic analyzer functions.

3.7.3.1. Preset trigger events

Following operations can be performed with preset trigger events:

Create - *Analyzer|Trigger|Create*
Edit -*Analyzer|Trigger|Edit*
Delete -*Analyzer|Trigger|Delete*

You can select the active trigger event using the menu *Analyzer|Trigger|Select*.

3.7.3.2. Signal groups

Following operations can be performed with signal groups:
Create - *Analyzer|Signal group|Create*
Edit -*Analyzer|Signal group|Edit*
Delete -*Analyzer|Signal group|Delete*

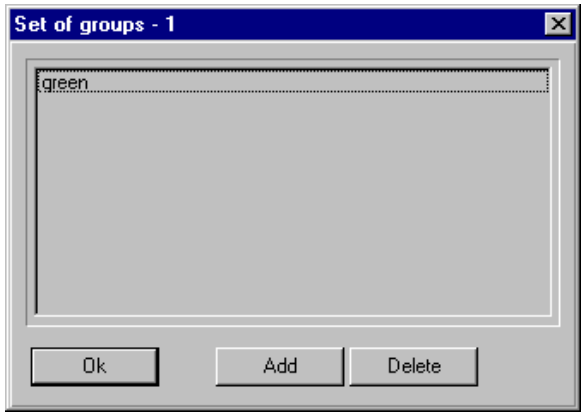
To set up the signal groups use the *Analyzer|Signal group|Organize* menu.

3.7.3.3. Signal group sets

Signal groups can be organized into four sets. When saving data, only sets displayed on screen are saved (see chapter 3.4.10). Use *Analyzer|Signal groups|Set X* menu to work with any of these sets.

After clicking one of the four menu items, the dialog window appears. This window contains the list of signal groups that belong to specific set.

Using the two buttons on the bottom of this window you can add, or remove signal groups to and from the set.



Add – displays a list of all signal groups. Select one group and click OK.
Remove - select groups you want to delete from the set and click on button **Delete**

3.7.3.4. Save display settings of logic analyzer

Following operations can be performed with display settings of logic analyzer:

Create -*Analyzer|Display|Create*
Edit -*Analyzer|Display|Edit*
Delete -*Analyzer|Display|Delete*

Use *Analyzer|Display|Select* menu item to select the logic analyzer display settings.

4.Oscilloscope hardware

The block scheme of the EM221 ISA bus add-on card is on the fig. 4.1. The EM221 card consists of analog and digital part.

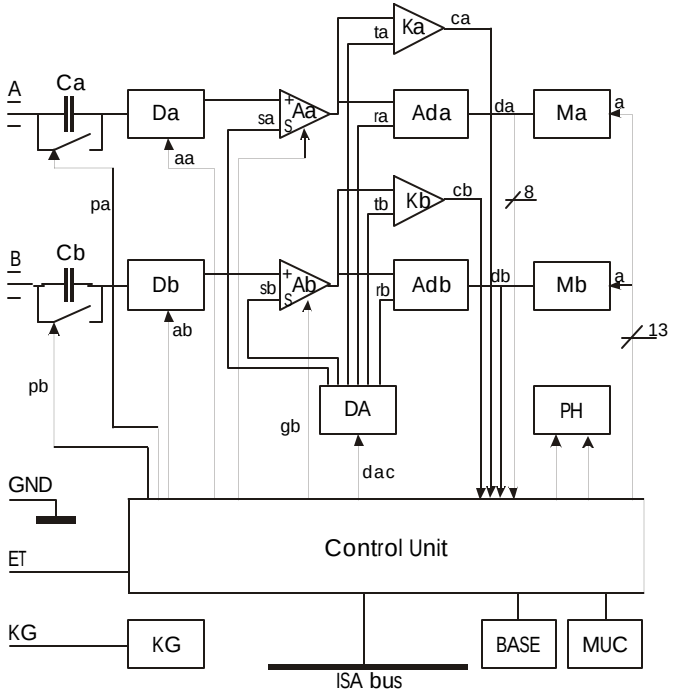


Fig. 4.1. EM221 Block scheme

Through the standard connector (BNC) and capacitor (Ca or Cb), that can be shorted by digital signal (pb), the measured signal is connected to the digitally controlled attenuator (Da or Db). Digital signals aa, (ab) control the input attenuator ratio (1:1 or 1:10). The attenuator output is connected to the input of the amplifier with an adjustable offset and gain. It is possible to adjust the amplifier's vertical offset (track vertical location) using the analog signals sa (sb). The amplifiers' outputs are connected to the fast A-D converters Ada (Adb) inputs which provide digitization of the measured waveform. It is also connected to the comparator's inputs that

generate the trigger signals . The comparator's threshold voltages can be controlled by ta (tb) signals. The waveform's digitized pattern is stored into Ma (Mb) memory.

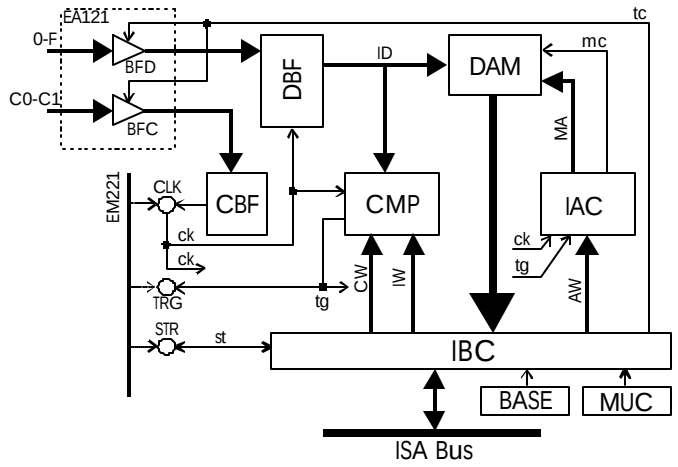
The device's control unit, which communicates with the computer's bus, is equipped with sufficient logic and registers to generate the control signals pa (pb), aa (ab), which we have already described. It also generates a ga (gb) signal, which change the input amplifier's gain ratio to 1:2. From the digital information, the DA converters connected to the control unit make the control analog signals. To adjust the comparators' threshold voltage, ta (tb) signal is used. By using the sa (sb) signals, you can control the track's vertical shift .

The External trigger (ET) signal and sampling pulse phase measurement circuits are connected directly to the control unit.

The auxiliary generator (KG) is a free running generator with no possibility of any control.

5. Logic analyzer hardware

The logic analyzer hardware is a 16-bit ISA compatible add-on card. Figure 5.1 shows the block scheme of the device. Input data are delivered into the device through the EA121 input adapter that comprises of two buffers: measured data buffer (BFD) and external clock buffer (BFC). Buffer threshold can be set using the tc signal. Output data of the EA121 input adapter are connected to the input buffer (DBF). Output of this register is connected to the data memory input, where all samples are stored, and to the comparator (CMP) input, which determines whether samples are identical to ones set by CW and IW. The tg signal indicates whether samples are equal. This signal also serves for starting the data acquisition. The source of this signal can be, apart from the CMP comparator, a cooperating EM221 DSO device, that is connected to the logic analyzer. Data acquisition is clocked by ck, that can be generated either by CBF clock, or by EM221 DSO module. The st, signal, which is generated by bus controller IBC, or by EM221 DSO device, is used initializing the logic analyzer device. The IAC controller uses ma address and me signals for controlling data acquisition and data storage into DAM memory. To a programmer, this block is accessible on address derived from BASE and MUC settings. It also generates controlling signal for buffers of EA121 input adapter as well as control words CW,IW.



6. Performance characteristics

The following characteristics are valid for temperatures between 5°C and 35°C and relative humidity of less than 70 percent.

6.1. Vertical deflection system - DSO

Deflection Factor Range	50 mV/division to 2 V/division in 1-2-5 sequence
Accuracy	± 2.5 % of whole screen range
Resolution	8 bits (0.4%)
Frequency response in ±3dB range	DC coupling - 0 Hz - 100 MHz AC coupling - 1.2 Hz - 100 MHz
Step response rise time	3.5 ns
Channel isolation	min -40 dB for 0 Hz to 50 MHz min -23 dB above 50 MHz
Input resistance	1 MOhm - 5% + 15%
Input resistance inaccuracy adjustment	Digital for absolute measurement accuracy ± 3% + probe inaccuracy
Input capacity	22 pF ±3 pF
Maximum input voltage	100 V (DC + peak AC)

6.2. Logic analyzer data inputs

Number of inputs	16
Input resistance	> 1MOhm
Input capacity	< 30pF
Threshhold voltage	selectable TTL - cca 1.2 V CMOS - cca 2.5 V
Max. input voltage	9 V
Min. input voltage	- 4 V

6.3. External clock inputs

Number of inputs	2
Input resistance	> 1 MOhm
Input capacity	< 30 pF
Threshold voltage	selectable TTL - cca 1.2 V CMOS - cca 2.5 V
Max. inpurt voltage	9 V
Min. input voltage	- 4 V
Min. impulse period length	50 ns
Min. length of H impulse	25 ns
Min. length of L impulse	25 ns

6.4. Horizontal deflection system

Sweep time base range	2 s/div to 20 ns/div in a 1-2-4 sequence of 25 steps
Sweep accuracy	±0.25% of whole displayed range for 2 s/div to 200 ns/div ±2 % of whole displayed range for 200 ns/div to 20 ns/div
Sampling frequency range	real time 400 Hz tp 20 MHz repetitive 400 Hz to 2 GHz
Sampling jitter	2 ns ± 1 sample
Record length	max. 8000 samples per channel

6.5. Triggering

Threshold setting	Channel A and B on the whole display range, Ext. fixed about 1.2 V
Maximum external input voltage	40 V (DC + peak AC)
Minimum trigger pulse length	10 ns
Minimum trigger pulse period	Channel A, Channel B - 33 ns External input - 20 ns
Trigger sources	Channel A, channel B, or any combination out of any group of logic analyzer signal, external input of the oscilloscope.

6.6. Auxiliary generator

Output resistance	1 kOhm
Output waveform	Rectangle with 1:1 ratio
Output waveform period	approx. 850 ms
Output voltage	approx. 22 Vpp

Appendix A : Hardware requirements

Minimum:
- PC386 compatible computer
- 4 MB RAM
- 3.5" FDD
- hard disk
- mouse or other pointing device

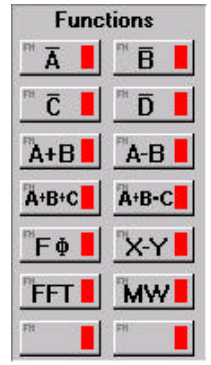
Recommended:
- PC486/100 MHz or more
- 8 MB RAM or more
- rest the same as minimum

Appendix B: Host environments

Host Environment	Compatible versions
Microsoft Windows 3.1	Microsoft Windows 3.11 Microsoft Windows For Workgroups Microsoft Windows 95
Microsoft Windows 95	Microsoft Windows 95
Microsoft Windows NT	Microsoft Windows NT 4.0

Appendix C: m221fnc.dll library standard functions

1. Channel A inversion
2. Channel B inversion
3. Channel C inversion*
4. Channel D inversion*
5. Sum of channels A and B
6. Channel A and B difference
7. Sum of channels A, B and C*
8. Sum of channels A and B minus channel C*
9. Average
10. X-Y display (channel A = X, channel B = Y)
11. Fast Fourier Transformation (FFT)



Appendix D: Fast Fourier transformation

This function allows the user to display the measured signal frequency spectrum.
To display the frequency spectrum follow the following instructions:

1. Highlight one period of the measured signal using the vertical cursors.
2. Execute the function on any of the available channels.
3. On the right side of the screen the window appears. It contains the channel A frequncy specrum. The first column displays numbers of harmonics. Second one dispalys the frequency, and the third one shows amplitude of specific frequency.

In case you are unable to highlight period using the cursors, you can change the range by simply entering the numbers. Using the four control elements labeled as A, B, C and D you are able to select the channel for which the FFT will be calculated.

Frequency spectrum of selected channel is displayed on the oscilloscope screen. Graph is displayed in the area between the cursors, where:
x axis - frequnecy (right - highest, left - lowest)
y axis - frequency spectrum amplitudes

Appendix E: Multi Wave

When using this new function, waveforms are not removed from the screen every time they are redrawn. To activate this function just grab it and place it on the desired channel. It is possible to utilize this function in two ways:

1.Place function on a well synchronized channel. The trace "thickens" after a while, and you see what interval covers the measured data.

2. Place function on a non-synchronized channel. After a while a stripe that envelopes the signal appears.

WARNING: When you activate the Multi Wave function, the interpolation will always be deactivated.

Appendix F: Time base ranges

	mode	t/div 400 samples	t/div 8000 samples	measure-ment period	sampling period	sampling frequency
1	R	20 ns/d	400 ns/d	400 µs	500 ps	2 GHz
2	R	40 ns/d	800 ns/d	400 µs	1 ns	1 GHz
3	R	100 ns/d	2 µs/d	400 µs	2.5 ns	400 MHz
4	R	200 ns/d	4 µs/d	400 µs	5 ns	200 MHz
5	R	400 ns/d	8 µs/d	400 µs	10 ns	100 MHz
6	R	1 µs/d	20 µs/d	400 µs	25 ns	40 Mhz
7	N	2 µs/d	40 µs/d	400 µs	50 ns	20 MHz
8	N	4 µs/d	80 µs/d	800 µs	100 ns	10 MHz
9	N	10 µs/d	200 µs/d	2 ms	250 ns	4 MHz
10	N	20 µs/d	400 µs/d	4 ms	500 ns	2 MHz
11	N	40 µs/d	800 µs/d	8 ms	1 µs	1 MHz
12	N	100 µs/d	2 ms/d	20 ms	2.5 µs	400 kHz
13	N	200 µs/d	4 ms/d	40 ms	5 µs	200 kHz
14	N	400 µs/d	8 ms/d	80 ms	10 µs	100 kHz
15	N	1 ms/d	20 ms/d	200 ms	25 µs	40 kHz
16	N	2 ms/d	40 ms/d	400 ms	50 µs	20 kHz
17	N	4 ms/d	80 ms/d	800 ms	100 µs	10 kHz
18	N	10 ms/d	200 ms/d	2 s	250 µs	4 kHz
19	N	20 ms/d	400 ms/d	4 s	500 µs	2 kHz
20	N	40ms/d	800 ms/d	8 s	1 ms	1 kHz
21	N	100 ms/d	2 s/d	20 s	2.5 ms	400 Hz

Mode: N - Real time sampling
R - Repetitive sampling (only for periodic waveforms)

Index

T

V