Active Technologies S.r.l.

www.activetechnologies.it

AT-LA500

USB Logic Analyzer

USER MANUAL

Contents

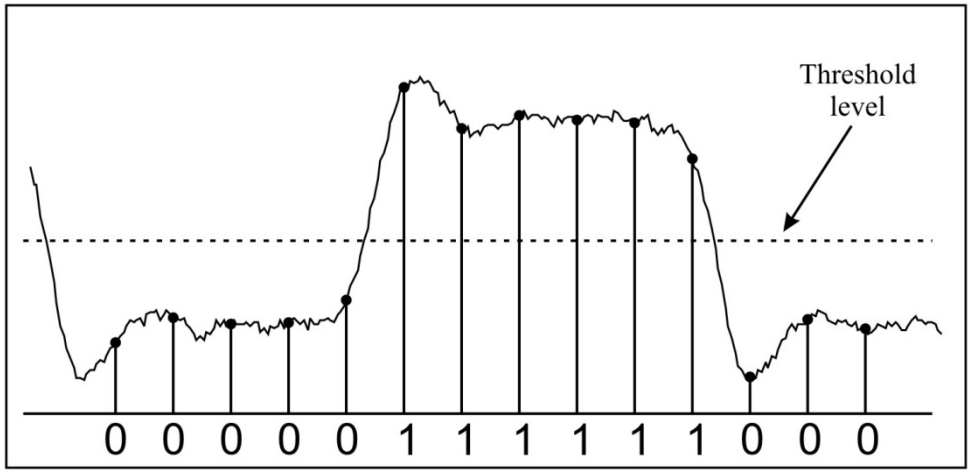
Introduction

Overview

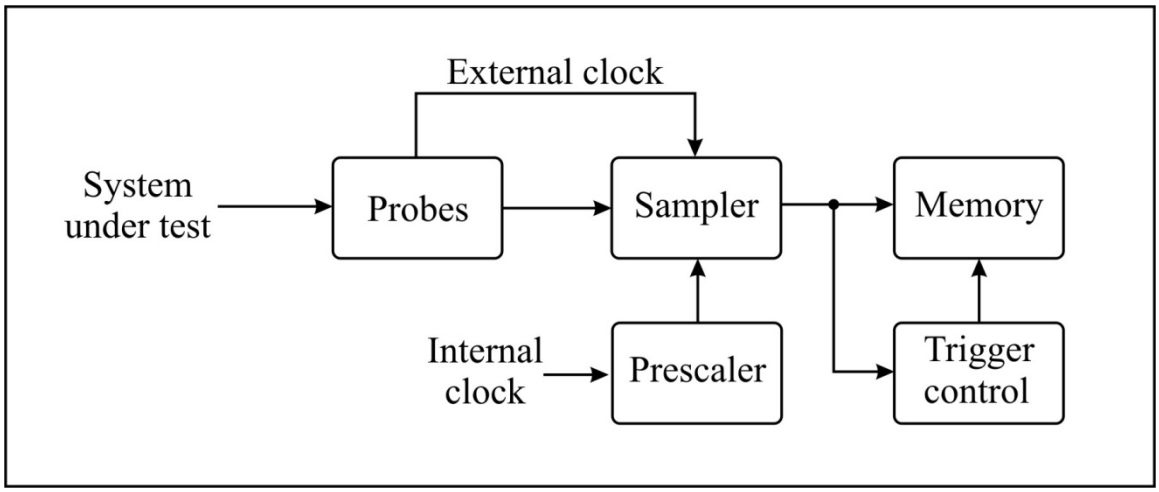
AT-LA is an instrument able to acquire digital data through 36 channels, divided in 4 banks of 9 channels each and to visualize their time behavior thanks to the dedicated software.
AT-LA is available in different configurations, depending on the maximum available memory (varying from 2M to 4M samples).
AT-LA is connected to the system under test by means of probes with different electrical characteristics, depending on the signals to be acquired. Each probe supports 18 channels, divided in two banks of 9 channels each. Each probe is hot pluggable and is automatically recognized. Four independent and programmable thresholds are available (one for each bank of 9 channels) and used by active probes to discriminate between low and high levels.
Data acquisition starts when a triggering event is detected by the instrument. The trigger can be configured by the user by selecting the suitable conditions on signal edges or on the input signal levels. Furthermore, it is possible to generate internally a trigger event so that data acquisition is independent of applied signals and it is performed automatically (free acquisition) or enabled by the user (manual acquisition).
AT-LA can also trigger on events occurring on many serial protocols (i.e. I^2C, SPI, RS232) and then analyze the packets of data transferred.
Once data acquisition is terminated, data are transferred to the PC through a USB 2.0 or a USB 1.1 connection and then visualized as waveforms or values.
AT-LA can sample input signals by using an internal clock signal (Time Analysis), whose frequency can be reduced on the basis of the signal to be acquired, or it can synchronize signal sampling to a signal clock provided by the system under test (State Analysis).

Operating principles

Digital signals acquisition means: *i)* to sample input signals, *ii)* to convert this values in logic values (0 and 1), *iii)* to organize these values in a set of waveforms.
To establish the logic value of a sampled signal, it is necessary to compare the input value to a reference voltage, called threshold, that can assume a fixed value or can be varied depending on the used probe. If the input value is greater then the threshold, it will be converted to a high logic state (1), otherwise it will be converted to a low logic state (0).



To detect the trigger event starting data acquisition the signal status must be monitored continuously. The operating principle of a Logic Analyzer can then be schematically represented as:



***Note**: This manual refers to a single AT Logic Analyzer. However, since up to 8 AT-LA can be connected together to increase the number of examined channels up to 288.*

Getting started

Hardware requirements

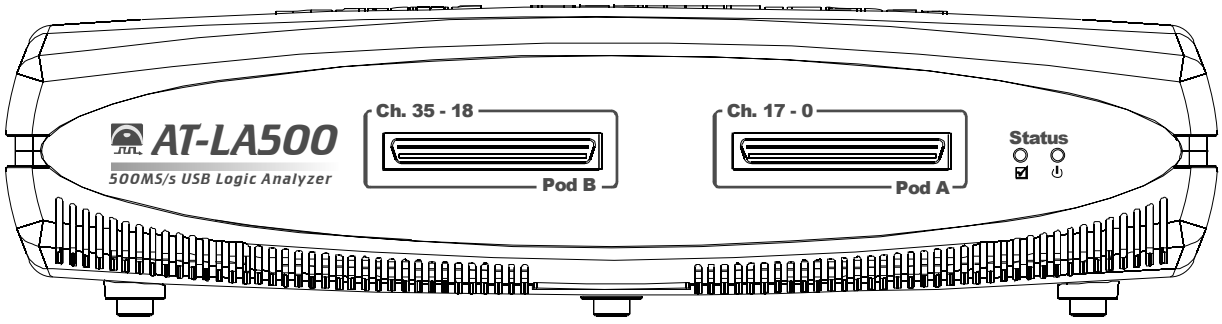
Minimum system requirements

- Microsoft™ Windows® 2000 or XP operating system;
- Pentium® III processor;
- 128 MBytes RAM;
- 100 MBytes available on hard disk for software installation;
- 800x600 video resolution;
- USB 1.1 connection.

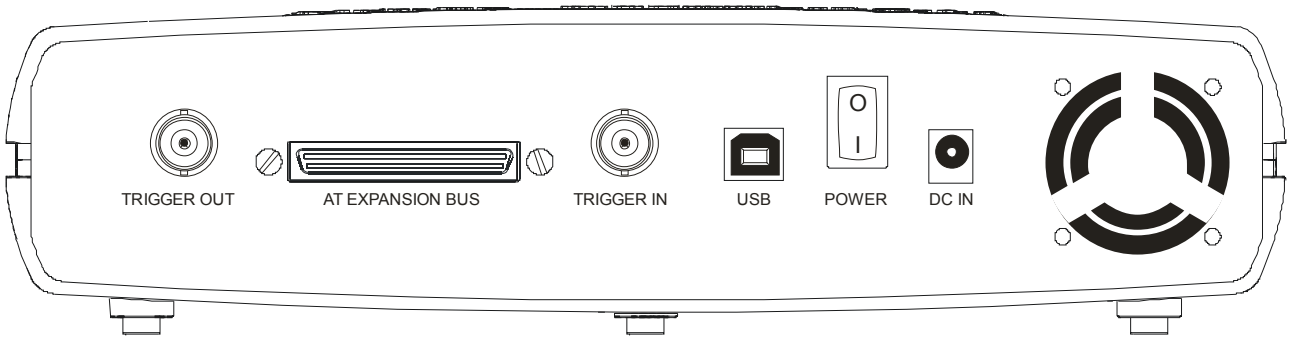
Suggested requirements

- Microsoft™ Windows® XP operating system;
- Pentium® IV processor;
- 512 MBytes RAM;
- 1024x768 video resolution;
- USB 2.0 connection.

Instrument description



AT-LA500 – Front view



AT-LA500 – Rear view

- **Pods A and B**: probe connectors;
- **Power led**: it indicates whether the instrument is ON;
- **Status led**: it indicates the instrument status as further specified;
- **Power connector**: connector for the external power supply
- **Power-on switch**;
- **USB connector**;
- **AT expansion bus connector**: connector for the AT-expansion bus, a dedicated cable used to connect several instruments and also to connect an external device, like an oscilloscope, (with optionally AT-scope card);

Status Led
The status led may be: **ON, OFF**, or **blinking** and it indicates different operating conditions.

The status led is **ON** when:
- The instrument is ON, it is connected to the PC and its drivers have been correctly installed.

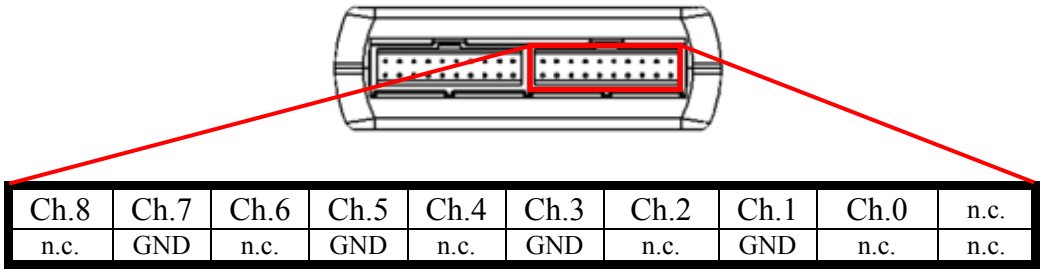
The status led is **OFF** when:
- The instrument is switched on but is not connected to the PC;
- The instrument is switched on and it is connected to the PC but its drivers have not been installed;
- The instrument has been disconnected following the procedure described in the *Remove an AT Logic Analyzer* paragraph.

The status led is **blinking** when:
- The instrument is reconfiguring;

Probes description

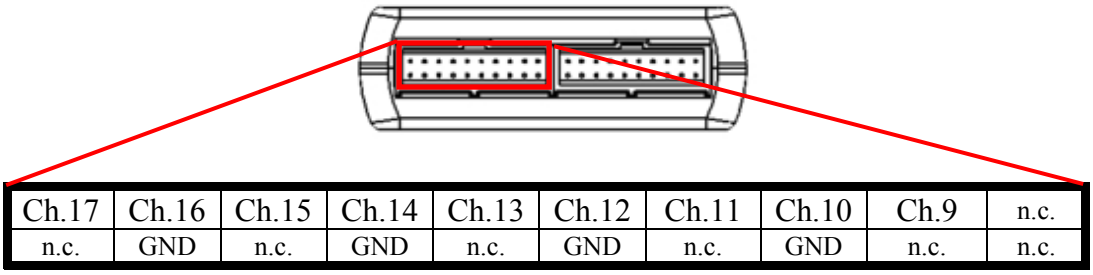
Probes have to be connected to the testing board by means of opportune connectors. Regarding the probes connected to the **Pod A** the correspondence between the pins and the number of channels is reported in the following tables:

Bank 0 (Ch. 8..0):



Ch.8	Ch.7	Ch.6	Ch.5	Ch.4	Ch.3	Ch.2	Ch.1	Ch.0	n.c.
n.c.	GND	n.c.	GND	n.c.	GND	n.c.	GND	n.c.	n.c.

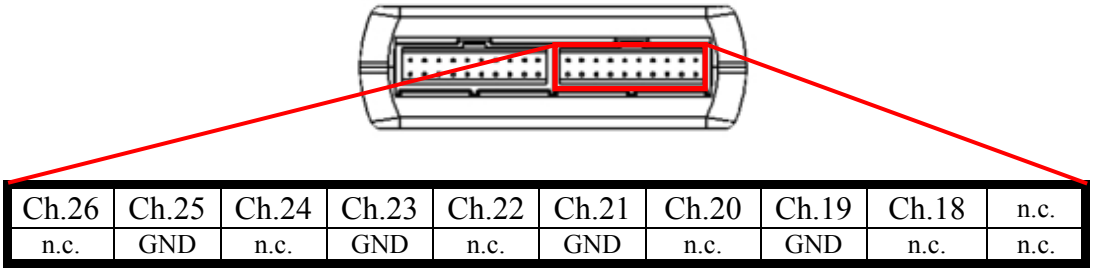
Bank 1 (Ch 17..9):



Ch.17	Ch.16	Ch.15	Ch.14	Ch.13	Ch.12	Ch.11	Ch.10	Ch.9	n.c.
n.c.	GND	n.c.	GND	n.c.	GND	n.c.	GND	n.c.	n.c.

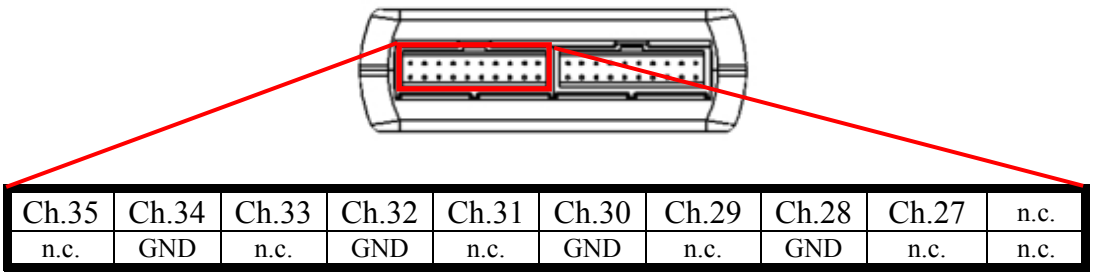
Regarding the probes connected to the **Pod B** the correspondence between the pins and the number of channels is reported in the following tables:

Bank 2 (Ch. 26..18):



Ch.26	Ch.25	Ch.24	Ch.23	Ch.22	Ch.21	Ch.20	Ch.19	Ch.18	n.c.
n.c.	GND	n.c.	GND	n.c.	GND	n.c.	GND	n.c.	n.c.

Bank 3 (Ch. 35..27):



Ch.35	Ch.34	Ch.33	Ch.32	Ch.31	Ch.30	Ch.29	Ch.28	Ch.27	n.c.
n.c.	GND	n.c.	GND	n.c.	GND	n.c.	GND	n.c.	n.c.

The correspondence between the channels and the pod cables colours is the following:

Colours	Channels			
	Pod A		Pod B	
	Bank 0	Bank 1	Bank 2	Bank 3
Black	0	9	18	27
Brown	1	10	19	28
Red	2	11	20	29
Orange	3	12	21	30
Yellow	4	13	22	31
Green	5	14	23	32
Blue	6	15	24	33
Purple	7	16	25	34
Gray	8	17	26	35

All white cables are ground connected.

Instrument disconnection

Before disconnecting or switching OFF an AT-LA500, it must be disabled by clicking with the left mouse button on the  icon on the application bar and by selecting “Safely remove USB Logic Analyzer”.

Note: *If an instrument that has not been disabled is switched off or disconnected, its software may not work properly.*

Probe connection

Data acquisition requires at least one probe connected to the instrument. Probes can be plugged-in or removed even when the instrument is on and the software is under execution. Any time a probe is connected or removed, the software notifies the event and consequently enables or disables the setup parameters.

Note: *Never remove a probe during data acquisition: acquired data may not be coherent.*

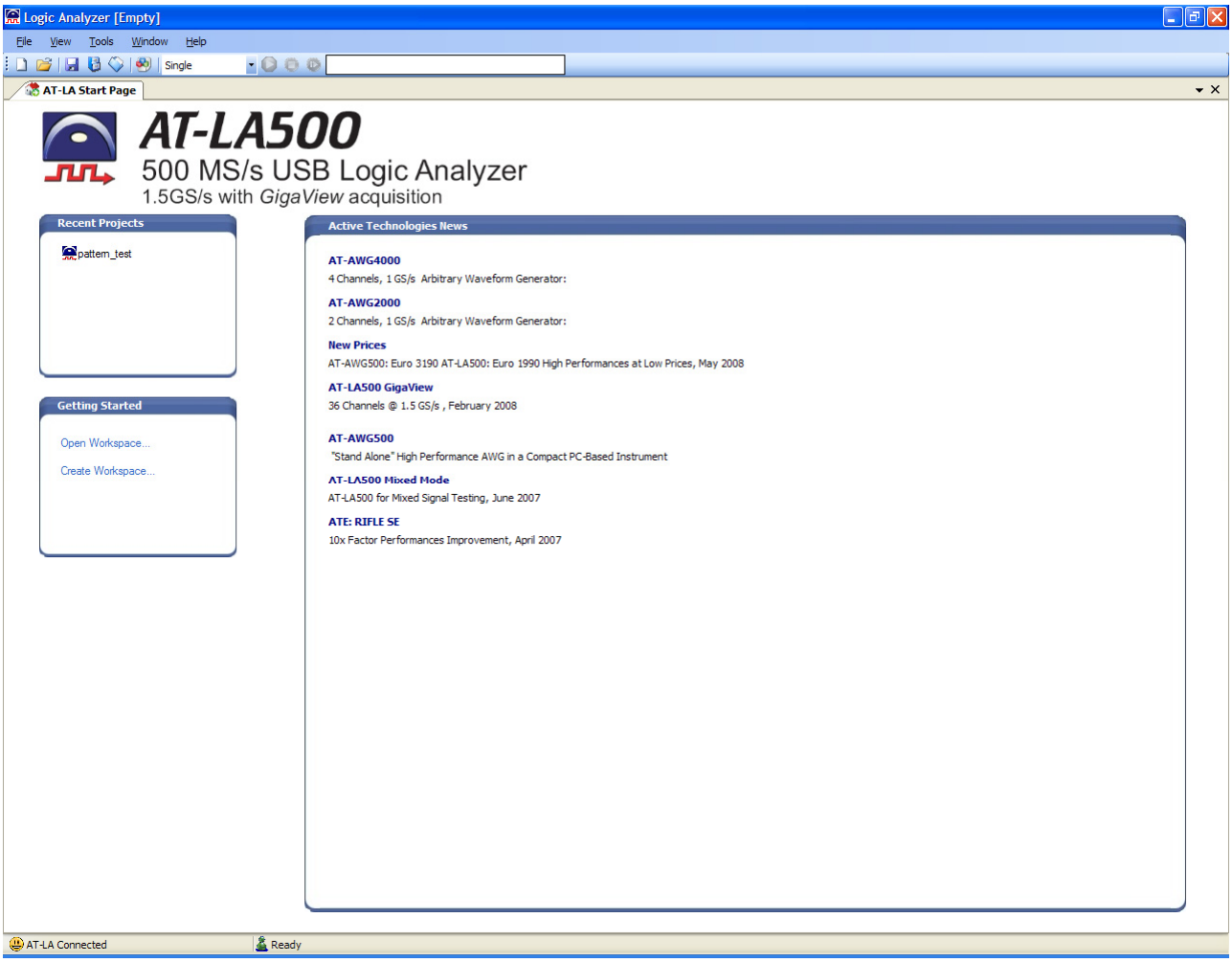
Probes must be connected to the system under test by means of the provided connectors, following the corresponding enumeration for signals and grounds. Signals present on a probe connected to Pod A correspond to channels 0..17, while those present on a probe connected to Pod B correspond to channels 18..35

Note: *All ground connectors are electrically connected. A wrong connection may cause short circuits and damage the system under test.*

Software loading

Note: *Before loading the AT-LA500 control software it is necessary that the instrument is switched ON and connected to the PC and that the drivers have been correctly installed. If the Logic Analyzer is switched OFF or if it is non connected to the PC, the software DEMO version will be loaded.*

Once the software has been loaded, the *AT-LA Start Page* window appears. At this point a new project can be created, or an existing project can be opened. If available, the list of the recent projects appears on the left of the main window. If an Internet connection is available, the Active Technologies website news are shown in the Start Page.



Guide to the first acquisition

The procedure required to perform a data acquisition is here described step-by-step.

Probe connection

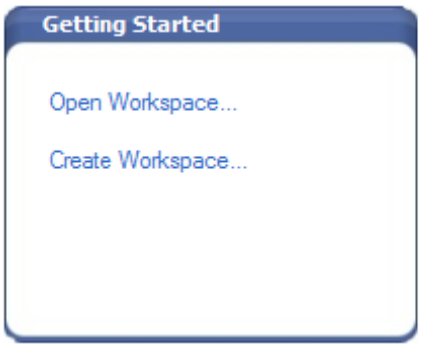
- Connect a probe to Pod A;
- Connect channel 0 of the probe to a signal source of the system under test (for instance a signal clock) whose amplitude does not exceed the probe limit;
- Connect the probe round to the signal ground;

Software loading

- Check whether the instrument is connected to the PC and that is switched ON. Drivers must have been correctly installed;
- Launch AT-LA software;

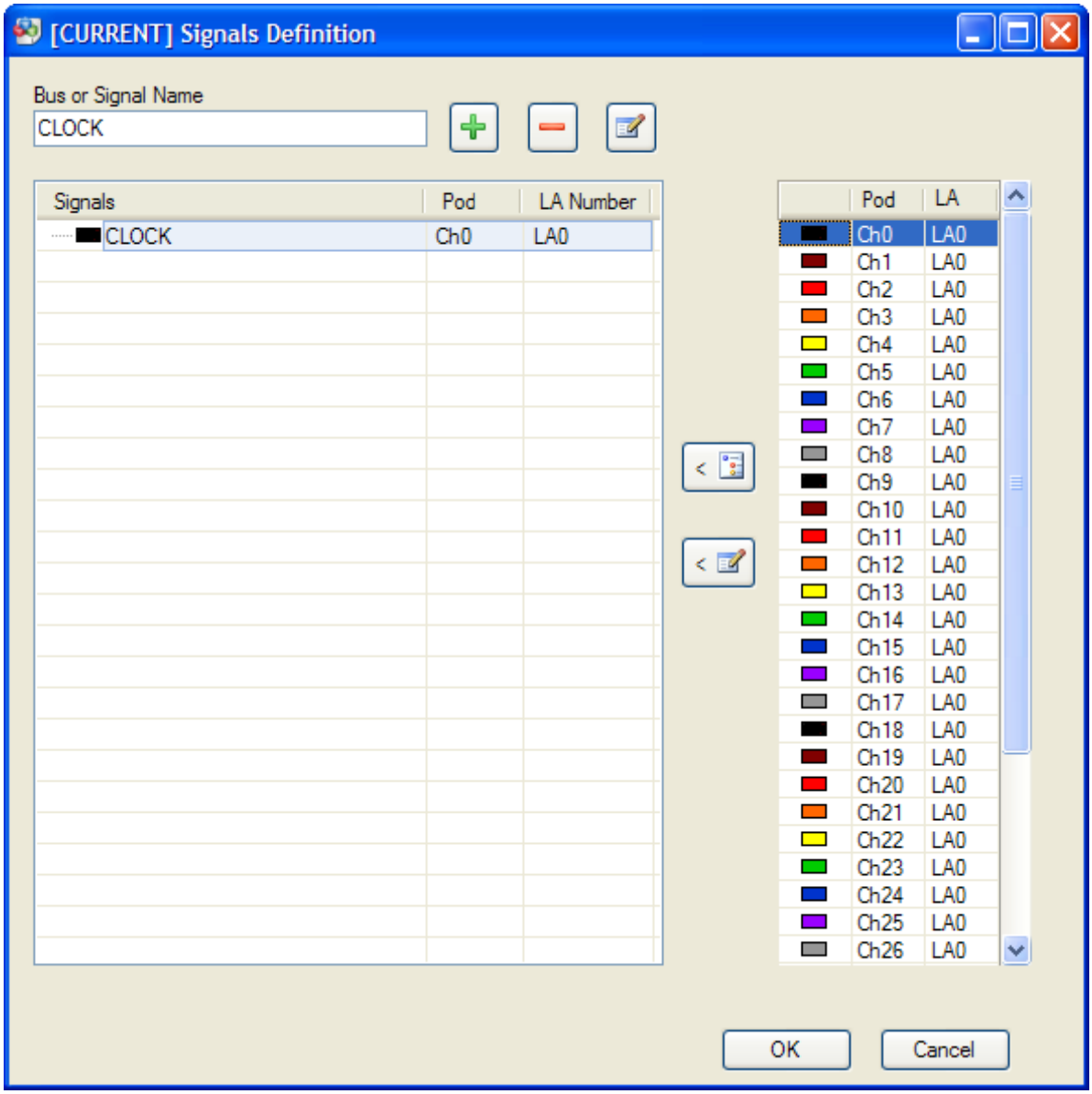
Create a Workspace

- Click on Create Workspace on the *Getting Started* box on the left of the main window.



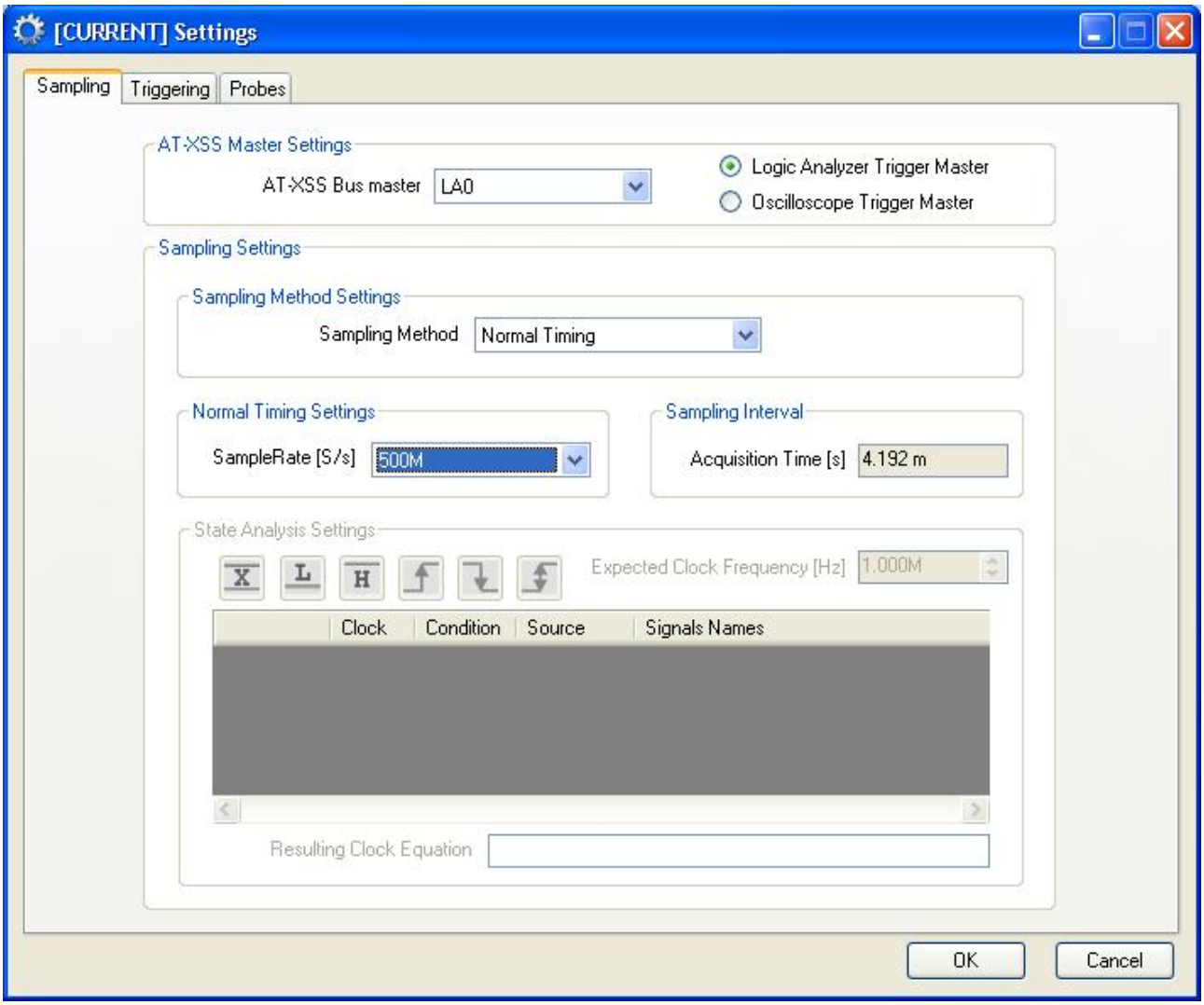
- In the New Workspace window, you can insert the desired name for the project, and the folder path where the acquired and settings data will be stored. Insert required data then press OK;

- On the left of the main window will appear the project tree column;
- Double click on the Signal Definition icon : the Signal Definition window will appear;
- Enter a name of a signal in the *Bus or Signal Name* box, i.e. CLOCK, then click on the button to add it to the list of the signals;

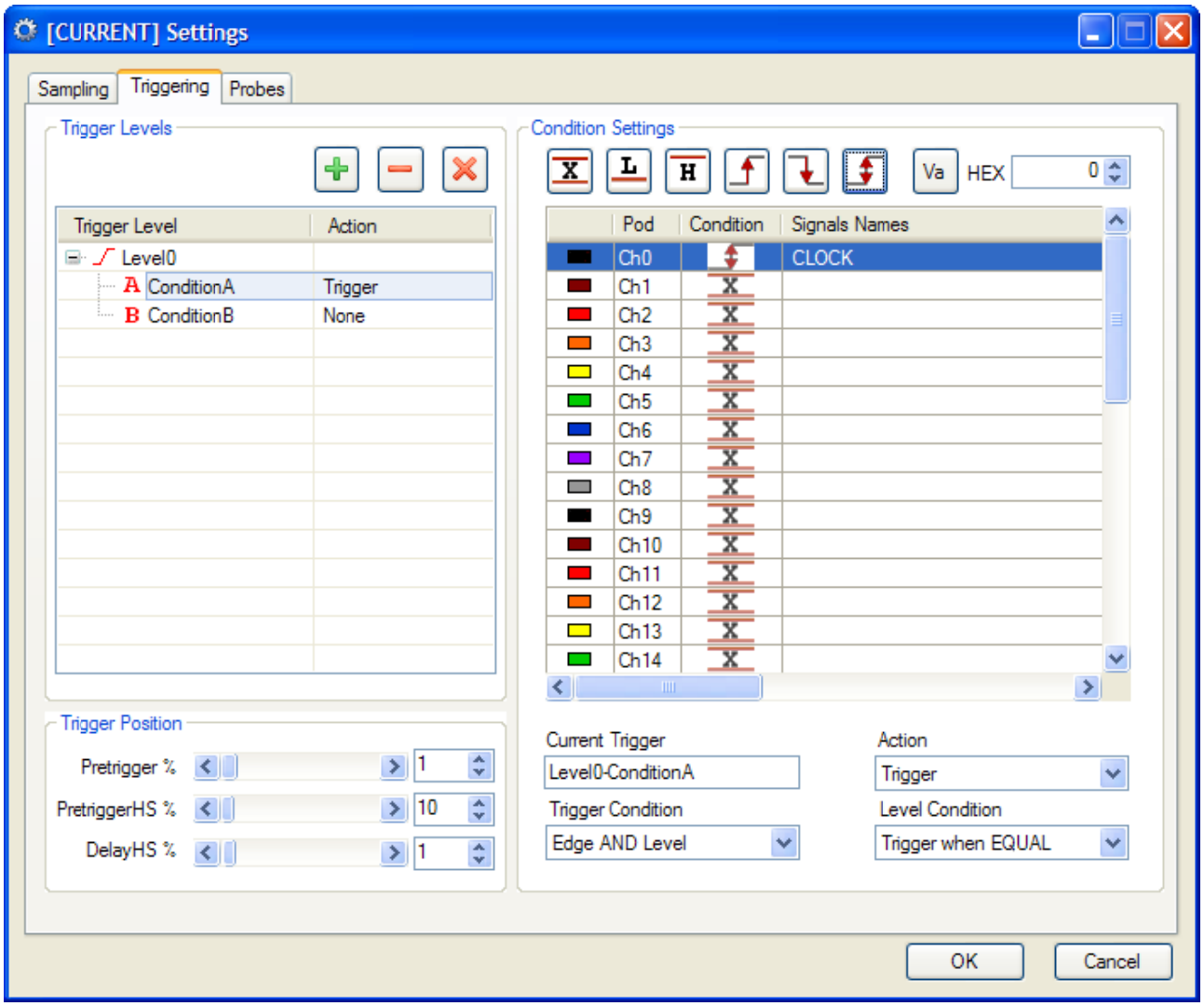


- Double click the Ch0 row on the channel list available on the right. This will set the correspondence of the channel 0 of the AT-LA500 with the signal "CLOCK" defined at the previous point. Click OK to close the Signals Definition window.

- Double click on the Setting icon : the Settings window will appear;



- In the Sampling tab, choose the better Sample Rate (i.e. 5x the frequency of the signal to acquire);



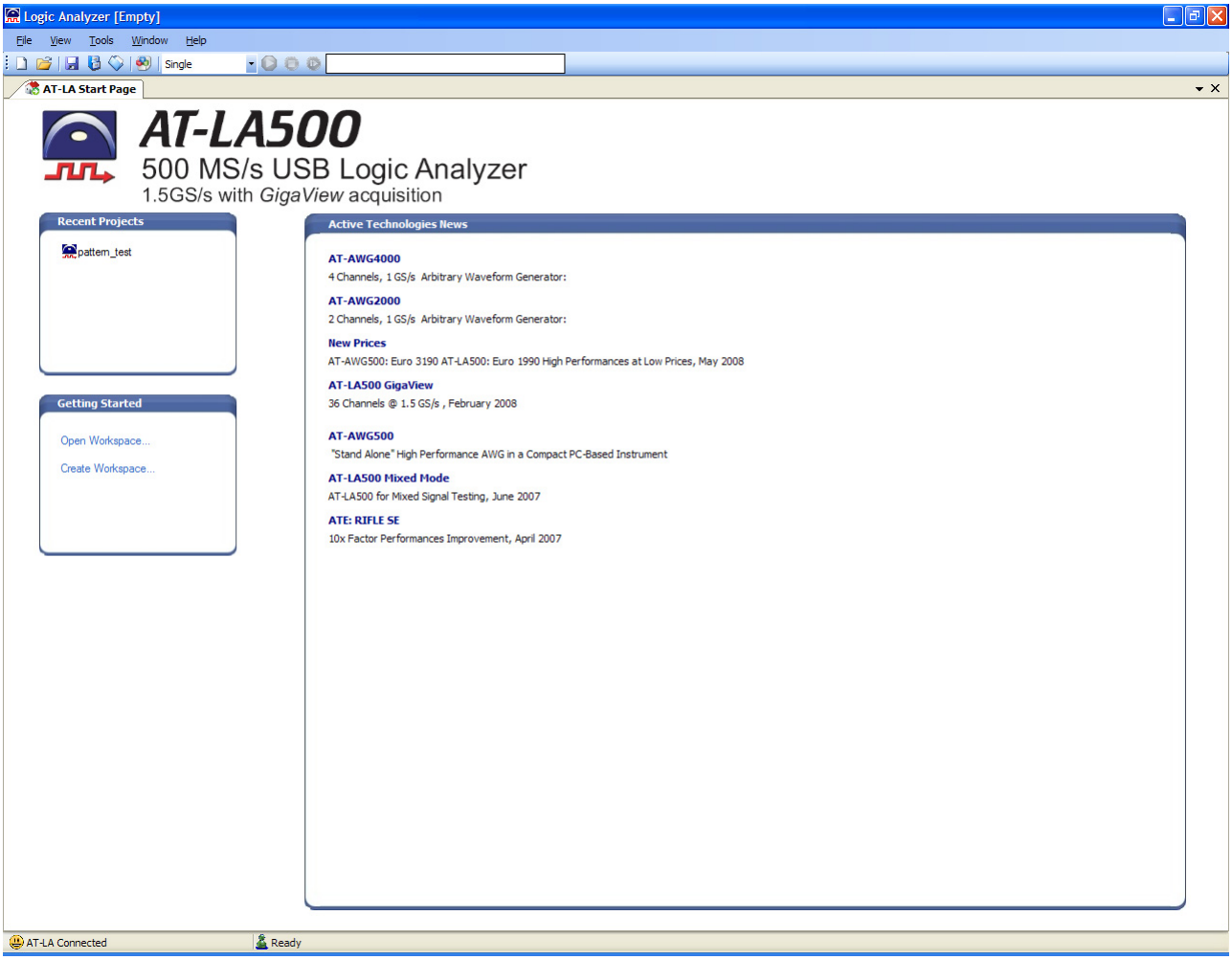
- In the Triggering tab, click on *ConditionA* branch of the Level0 tree; click on the Ch0 row (it now contains also the signal name: CLOCK); click on the "both edges" icon . Now the condition A of the trigger level 0 is verified on every event occurring on the channel 0 of the AT-LA500;

- In the Probes tab you can set the threshold of the logic levels detected by the AT-LA500. This options is available only for active probes. Press OK to close the window;

- Press the Start button on the toolbar to start the acquisition. At the first edge on the channel 0, the instrument will trigger, then a Signal Selection window will appear. Click on the Add All button , then click OK. Now you can examine acquired data on the Waveform View. Click on the *Go to* button on the toolbar to center the Waveform window on the trigger event.

AT-LA500 Software

AT-LA Software allows controlling all settings related to the instrument and to the open acquisition windows. Closing the AT-LA Navigator means to exit from the instrument control program.



Menu bar

The following menu are available on the menu bar:

File

- **New Workspace**: it allows creating a new workspace, by specifying its name and its work directory;
- **Open Workspace…**: it allows opening an already existing project;
- **Open Settings…**: it allows loading settings already saved;
- **Open Signal Definition…** : it allows loading signal definitions already saved;
- **Save Settings As…**: it allows saving current settings with another name;
- **Save Context**: it allows saving current project;
- **Save Acqisition As...**: it allows saving current acquisition data with another name
- **Save Signal Definition As…**: it allows saving current signal definition with another name;
- **Import Acquisition…**: it allows loading acquisitions data previously saved;
- **Close Current Window**: Closes the window currently selected;
- **Close All Window**: Closes all the windows in the project;
- **Exit**: it allows closing the program.

View

- **AT-LA Solution Explorer**: it shows the project explorer tree;
- **AT-LA Start Page:** it shows the Start Page, with the recent projects list.

Tools

- **Pod Status…:** it opens the Pod Status Reader window, that shows the current logic status of all the inputs;
- **Options**: it allows changing the default projects folder;
- **Analog Delay...**: it opens the Analog Delay window, that allows aligning correctly digital and analog data in the Mixed Signal Display Mode (see Analog-Digital Delay Alignement window chapter for details)

Window

- Lists the name of the project windows and allow showing the one which is selected.

Help

- **About…**: it shows the information related to the current software release.

Status bar

The status bar on the bottom side of the main window shows the status of the AT-LA500. It also notify the insertion or removal of a probe.

Tool bar

Following controls and indicators are available on the main tool bar:

 It allows creating a new project;

 It allows opening an existing project;

 It allows saving the current project;

 It allows saving the current acquisition: all parameters will be stored and the saved acquisition will be added to the Solution Explorer tree;

 It shows the Solution Explorer;

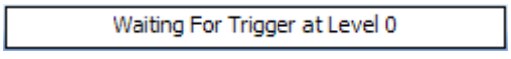
 It allows visualizing the status of inputs in real time;

It allows choosing between *Single* or *Continuous* acquisitions;

 It starts the data acquisition;

 It stops the data acquisition;

 It forces the trigger event;

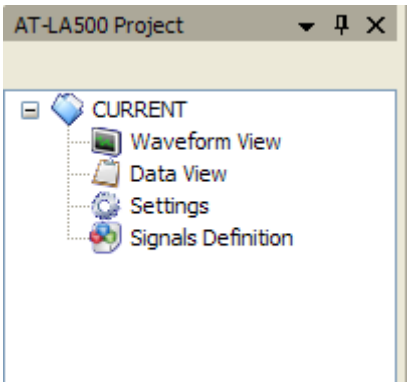


It shows the current status of the acquisition.

Note: *When Single acquisition is selected, the AT-LA500 will perform only one acquisition when the*  *button is pressed; when Continuous acquisition is selected, the AT-LA500 will automatically restart after every acquisition until the*  *button is pressed.*

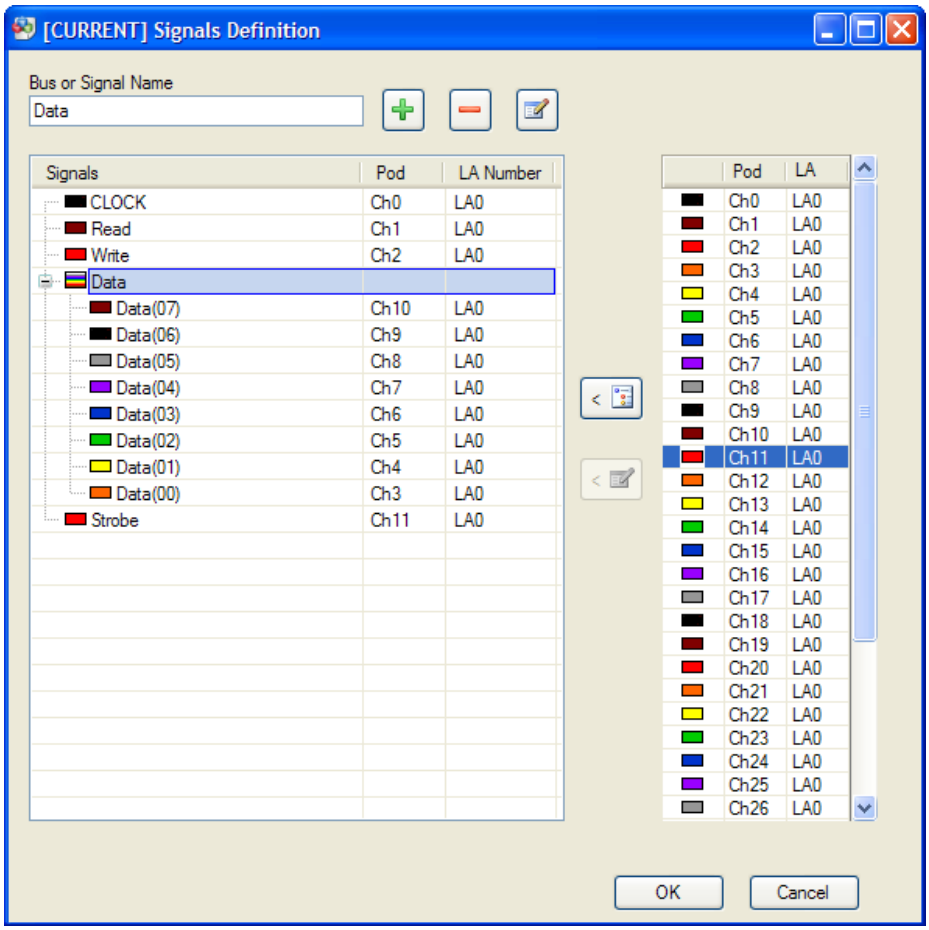
Solution Explorer

This area contains a list of shortcuts to open the Waveform View, the State Listing, the Settings window and the Signal Definition window. It also contains user saved acquisitions. By double clicking with the left mouse button on the *Waveform View* icon, on the *State Listing* icon, on the *Settings* icon or on the *Signal Definition* icon, the corresponding window will be opened or created.



Signal Definition

This panel allows defining a list of signals or bus and choosing their correspondence to the channels of the AT-LA500. Only the signals defined in this panel can be viewed in the Waveform View or State Listing windows. The right table shows all the AT-LA500 channels and the colors of the correspondent wires.



***Note**: When a signal protocol trigger is selected, their standard signals are automatically added to the projects (i.e. for the I^2C the SCL and SDA signals).*

Adding a signal

To add a signal to the list, write the desired name in the *Bus or Signal Name* box and click on +, then double click on the desired channel row of the right table to set the correspondence between signal name and channel. You can also select the desired channel row and click on <. Both these methods can be used also to change any previously defined correspondence.

Adding a bus

To add a bus to the list, write the desired name in the *Bus or Signal Name* box and click on +, then select the rows of the channels that will form the bus in the right table. Click on < to add all selected signals to the bus.

***Note**: To chose more than one channel keep pressed the Ctrl key and click on the desired channels. To chose a group of consecutive channels, click on the first one, keep pressed the Shift key, then click on the last one. All the channels between the first and the last will be selected.*

Removing a signal or a bus

To remove a signal or a bus, select it then click on −.

Editing a signal or bus name

To change the name of a signal, select it, change its name in the *Bus or Signal Name* box and click on .

Settings

The **Settings** panel allows configuring AT-LA500 for a correct acquisition. It is divided in several tabs: *Sampling*, *Triggering*, and *Probes*. The Sampling tab and Triggering tab change depending on the selected Sampling Method.

Sampling

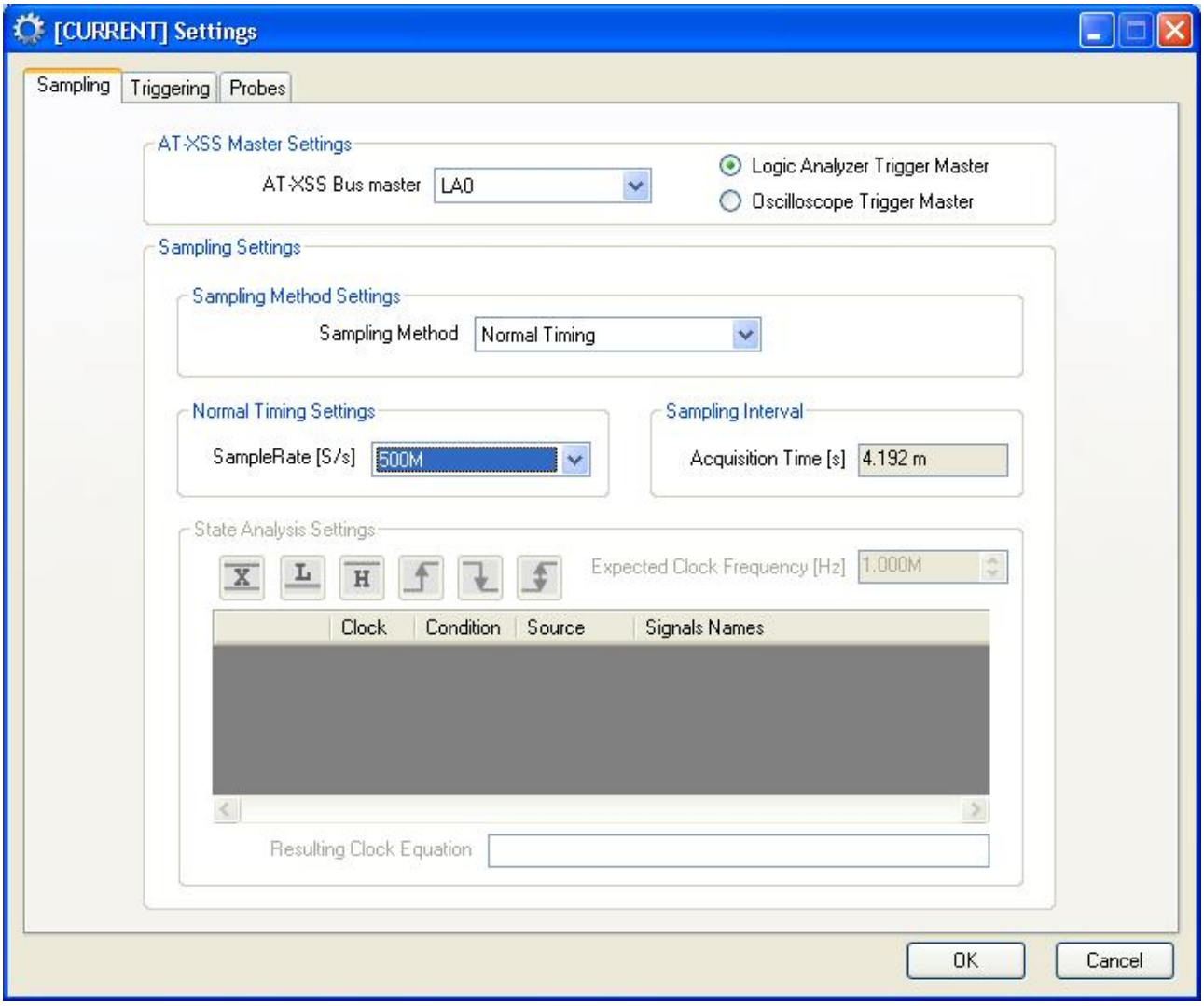
Within the S*ampling* tab it is possible to set the clock source, the sampling method, the sampling frequency and the AT-XSS Bus master if available. Furthermore, the acquisition time is shown.
Five sampling modes are available within the *Sampling Method* menu ring:

- Normal Timing
- State Analysis
- I^2C
- SPI/µWire
- UART/RS232

If more than one instrument are connected together by means of the AT-XSS Expansion Bus, the user can select the instrument where to set the trigger by using the menu ring *AT-XSS Bus Master*.
Using the radio buttons *Logic Analyzer Trigger Master* and *Oscilloscope Trigger Master* it's possible to select the trigger signal source, if an oscilloscope is present and connected; all the AT-LA500 instruments connected together, can be triggered by the oscilloscope.
Note: *The trigger event will be always generated evaluating only one of the connected instruments. For a better acquisition is suggested to set the trigger settings on a middle positioned Logic Analyzer.*

Normal Timing Analysis

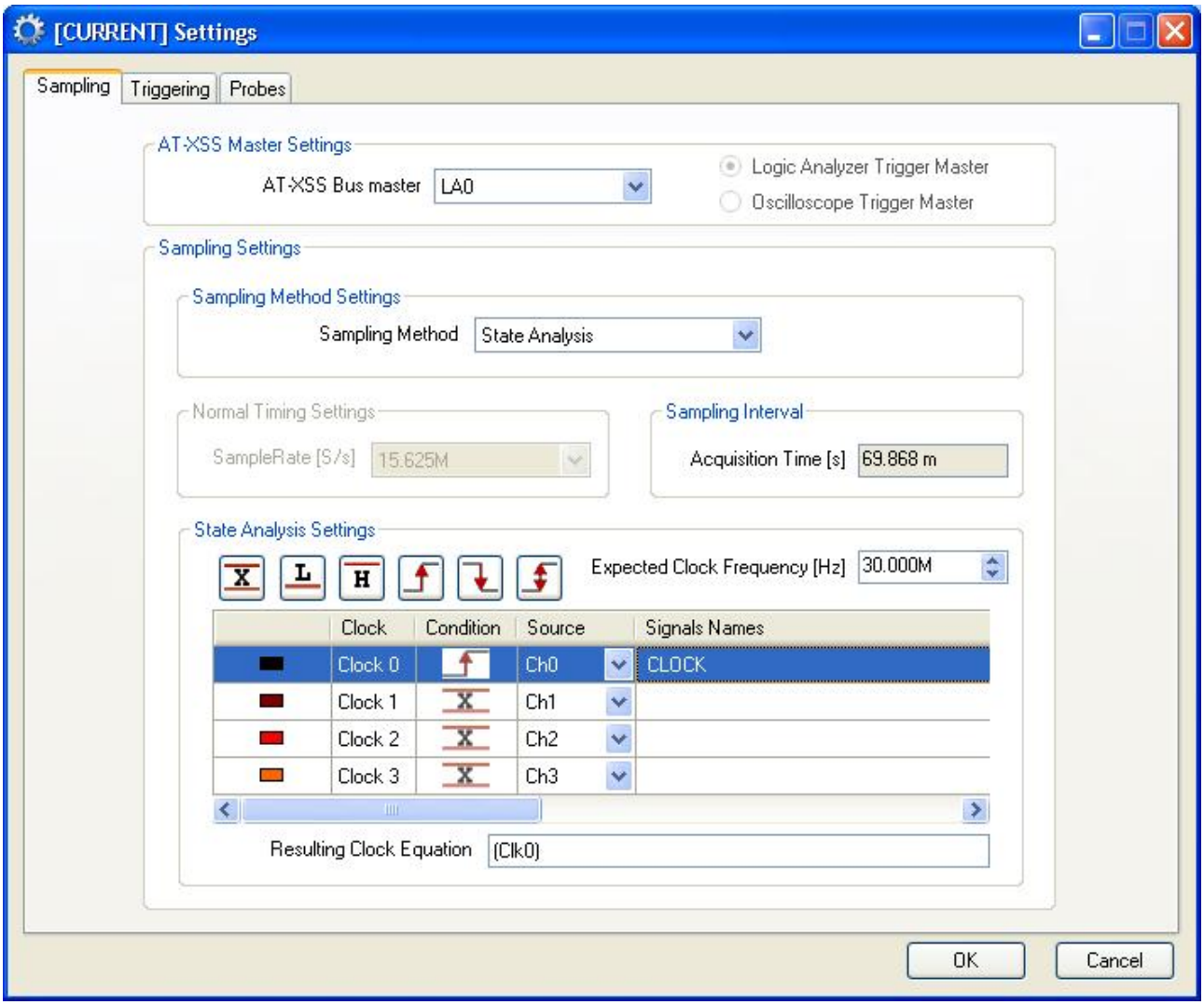
When this sampling mode is selected, data acquisition is performed by AT-LA500 by using an internal clock. The sampling frequency can be selected by means of the *Sample Rate [S/s]* menu ring. In addition, when configured in Normal Timing Analysis, the AT-LA500 also acquires data at 1.5GS/s. This is useful to detect glitches or skew between signals. These data are identified with the "HS" (High Speed) prefix. The High Speed sample rate is fixed, and the correspondent memory depth is 1kSample for each channel. However, it is possible to set a pretrigger and a delay specific for the HS acquisition data.



Note: For a correct acquisition, the sampling frequency should be at least 4 or 5 times higher than the maximum frequency of the signals to be acquired.

State Analysis

When this sampling mode is selected, data acquisition is triggered by a specific event. If a clock signal is present in the system under test, this sampling mode allows synchronizing the data acquired by AT-LA500.



In the *Expected Clock Frequency [Hz]* control the clock frequency applied to the instrument can be entered. This feature allows dimensioning correctly the time bars in the visualization windows.
Signals determining the clocks are divided in 4 groups of 4 signals, one for each bank. The division is the following:

Clock	Channel
0	0, 9, 18, 27
1	1, 10, 19, 28
2	2, 11, 20, 29
3	3, 12, 21, 30

For each clock it is possible to select one channel among four available. This feature allows using all the programmable thresholds with the maximum flexibility.

For each clock it is possible to select the event triggering data acquisition. The possible choices are:


Don’t care (the signal will be ignored);


High logic value;


Low logic value;


Rising edge;


Falling edge;


Any edge.

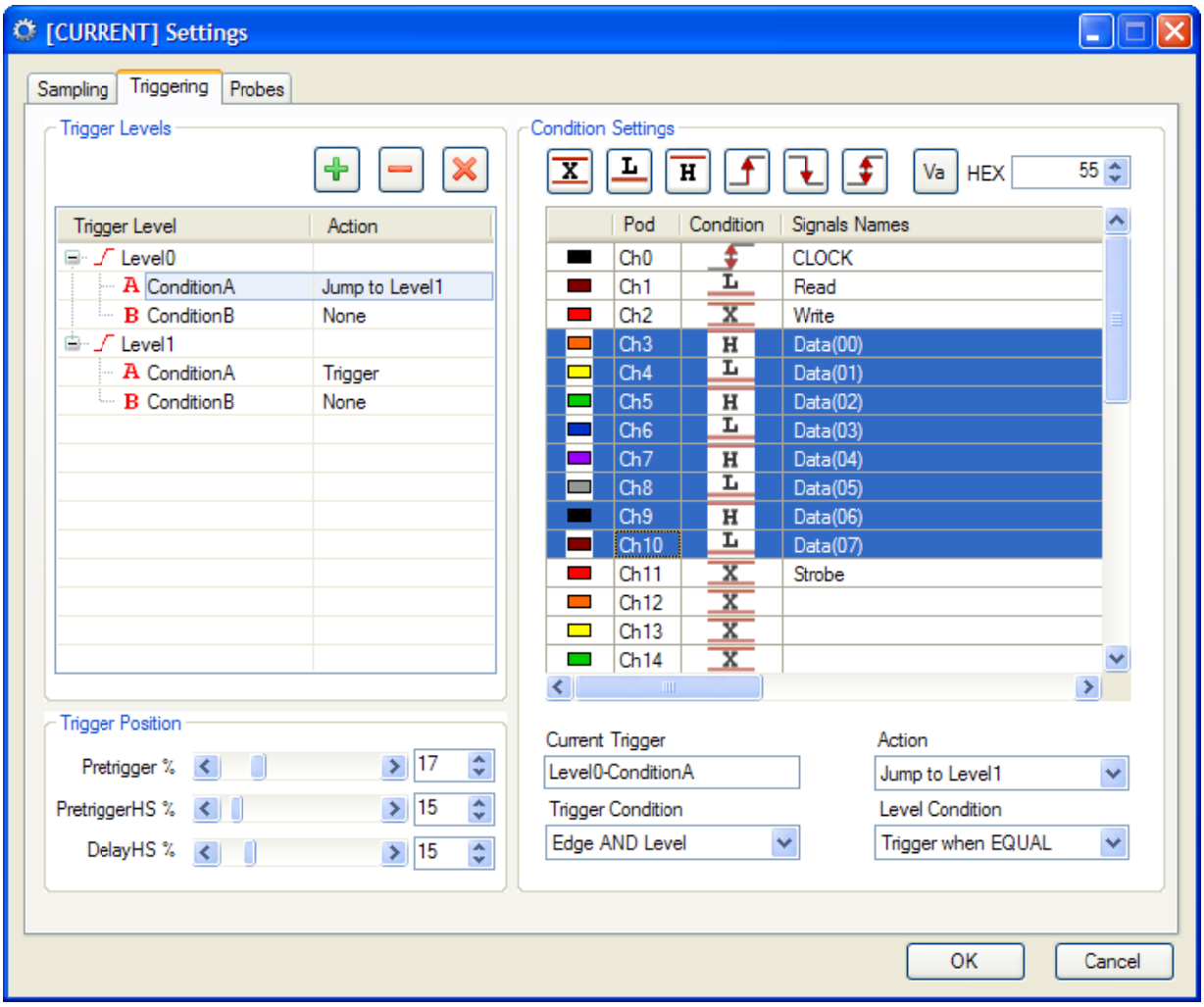
Each sample will be acquired when at least one condition is verified on the signal edges and at least one condition on the signal levels. The *Resulting Clock Equation* indicator summarizes the logic condition that has been set.

***Note**: At least one condition on an edge of at least one clock must be set.*

***Note**: Before commuting to an external clock, the instrument requires an initialization phase. Samples acquired during this phase are meaningless.*

Normal and State Analysis Trigger

All trigger levels and conditions necessaries for data acquisition can be set in this tab. The controls and the name of this tab changes depending on the Sampling Method selected.



Trigger Levels

AT-LA500 permits to edit up to 31 trigger levels, which are represented with the symbol in the tree positioned on the left side of this tab.
To add a trigger level click on : a new trigger level will be added at the end of the list.
To remove a trigger level click on : this command will remove the last level from the list.
To clear all the trigger settings and to get the default trigger conditions click on .
Each trigger level has 2 trigger condition "A" and "B". Selecting one of the conditions **A** or **B** on the tree, the correspondent settings pattern will be automatically updated on controls/indicators at the right side of this tab. For each condition the user, by using the menu ring *Action,* can also set up the action to do when the condition appears. The possible actions are:

- None — The condition happening will be ignored (Never Trigger);
- Trigger — The condition happening leads to a Trigger event;
- Jump to Level *n* — The condition happening leads to a jump at trigger Level *n*, where *n* is the number of one of the present trigger levels.

***Note**: Whenever the acquisition starts the Logic Analyzer waits for the conditions at Level0.*

Edges and Levels

In order to set the condition "A" or "B" the user must properly set the state of the Logic Analyzer channels. Each channel state can assume the following attribute:

.

Don't care (the signal will be ignored);

High logic level;

Low logic level;


Rising edge;


Falling edge;


Any edge;

Va Sets the value entered in the near control box to a bus.

To set it on a channel, first select the condition A or B of the desired level, then click on the row correspondent to the channel to set in the table on the right side of the window (note that the column *Signal Names* contains the user defined names for the signals to acquire). To set a condition, click on the desired button on the top. If more than one signal are selected, the same level or edge setting will be applied to all selected signals. Also, it is possible to set a level setting to all selected signals by writing its value in hexadecimal format then clicking the *Va* button.

Note: *Some channels can't also be available if they are used as Clock sources on State Analysis mode.*

Conditions on edges

For each signal it is possible to indicate whether the trigger condition must be detected on a rising edge, on a falling edge or for any of the two edges. When the trigger conditions have been set on edges of several signals, the trigger event will be determined by the occurrence of **at least one** condition. If no trigger conditions on edges have been set for any signals, trigger events on edges will never occur.

Conditions on logic levels

For each signal it is possible to indicate whether the trigger condition must be detected on a high or a low logic level. When the trigger conditions have been set on logic levels of several signals, the trigger event will be determined by the occurrence of all conditions simultaneously.
If no trigger conditions on logic levels have been set for any signal, the trigger conditions on logic levels are always considered as verified.
The trigger condition set on logic levels is useful when the trigger event must be detected for a specific pattern.
By using the *Level Condition*: menu ring it is possible to select among several conditions for trigger events on logic levels.

- Trigger when EQUAL: The trigger event occurs when the state of the evaluated signals is equal to the specified pattern;

- Trigger when NOT EQUAL: The trigger event occurs when the state of the evaluated signals is different from the specified pattern;

- Trigger when CHANGED: The signals selected for a trigger event on logic levels are examined when data acquisition starts. These sampled values will constitute the reference pattern. The trigger event occurs when the state of the selected signals is different from the reference pattern.

  The conditions chosen by the user on logic levels are ignored. AT-LA500 will simply use the information related to which channels are to be examined for trigger detection.

Relationship between trigger conditions

A relationship between trigger conditions on edges and trigger conditions on logic levels can be set by the user, by using the *Trigger condition* menu ring. Several options are available:

- Edge OR Level: A trigger condition occurs when one between an edge condition or a logic level condition is detected;
- Edge AND Level: A trigger condition occurs when an edge condition and a logic level condition are satisfied simultaneously;
- Edge BEFORE Level: A trigger condition occurs when an edge condition has been detected at least once before that on logic levels;
- Edge AFTER Level: A trigger condition occurs when an edge condition has been detected at least once after that on logic levels;
- ALWAYS: A trigger condition occurs automatically when data acquisition starts. Any setting on edges or on logic levels will be ignored;
- NEVER: Trigger is inhibited. Any setting on edges or on logic levels will be ignored. A trigger event, however, can be activated manually during data acquisition.

***Note**: The trigger event is detected in an asynchronous way, independently of the sampling frequency. If this frequency is too low or an external clock is used, the trigger event, even if correctly detected, may not be visualized in the Waveform or Data Windows.*

Pretrigger, PretriggerHS and DelayHS

The *Pretrigger* control allows specifying the position in which the trigger event will be located with respect to the AT-LA500 memory. If the most meaningful data must be sampled after the trigger detection, low pretrigger percentage must be selected. On the contrary, if signal evolutions before trigger event must be analyzed, a high pretrigger percentage is more suitable.
The High Speed data have a dedicated PretriggerHS control to set the trigger position respect to the 1kSample HS memory.
It is also possible to insert a programmable delay to shift the High Speed data acquisition to help to focus the event to examine if this is far from the trigger instant.

***Note**: The PretriggerHS can only assume values in the range 10% - 90%.*

I²C Trigger

In this mode, the AT-LA500 can trigger when a selected event occurs on a I²C (Inter Integrated Circuit) bus. Furthermore, the acquired data are decoded and shown in the Waveform View and State Listing windows.

To set up the AT-LA500 for an I²C acquisition, the following steps are required:

- Connect a Passive Probe or a High-Z Probe to the pod A. In this case you also have to correctly set the threshold voltage in the *Probes* tab of the *Settings* window;
- Connect at least one grounded pin (white wires) to the ground of the board to test;
- Connect the **Channel 0** (black wire) to the **SDA** line of the I²C bus to test;
- Connect the **Channel 1** (brown wire) to the **SCL** line of the I²C bus to test.

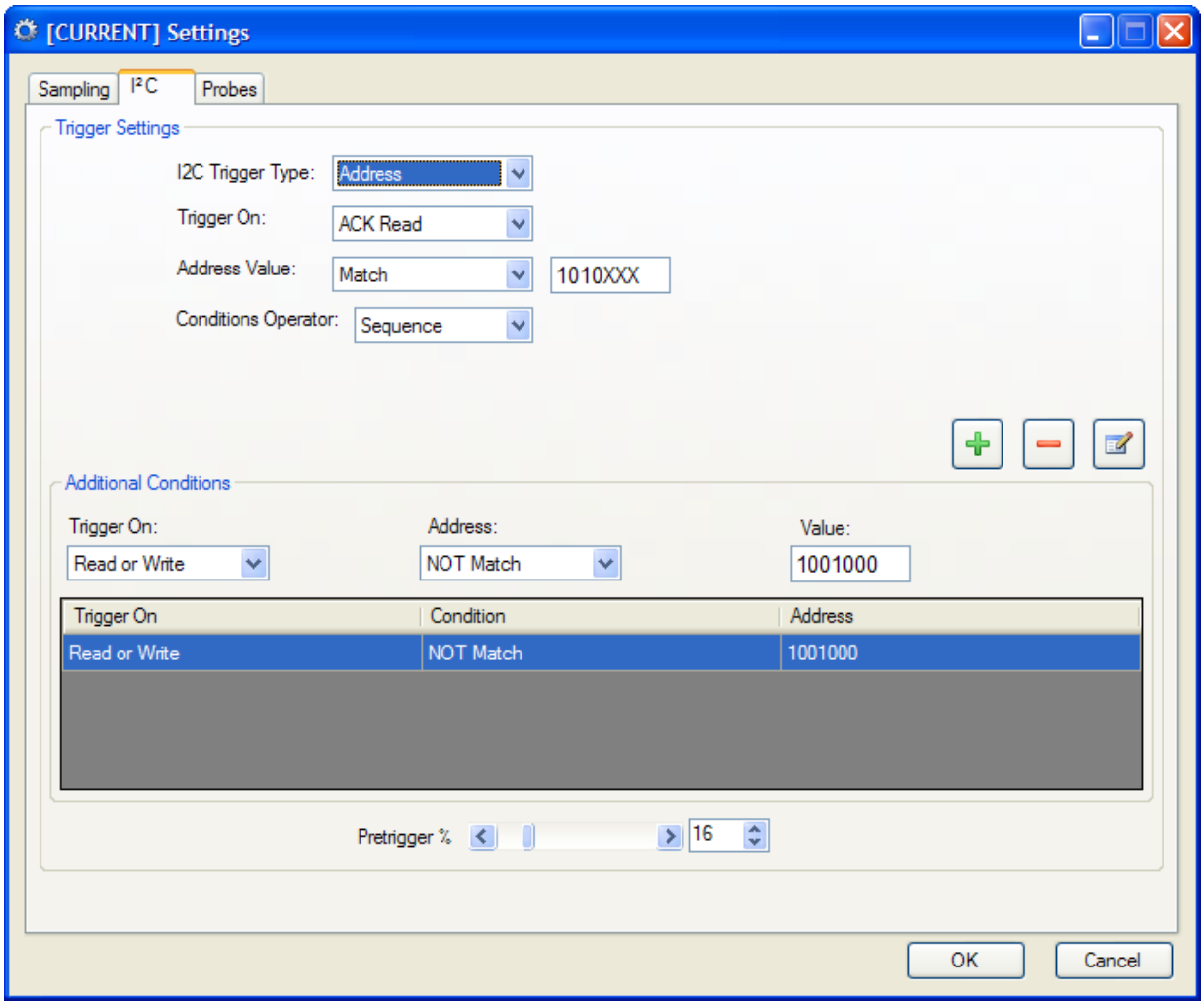
***Note**: It is not possible to use a Low-C Probe to analyze an I²C bus: this could prevent the system under test to work properly.*

The I²C trigger has 2 different options: Address and Address&Data. These options are selectable by using the *I2C Trigger Type* control.

Address

In this mode, the AT-LA500 can trigger when the I²C bus addresses one or more peripheral.
In the *Trigger On* control, it is possible to choose which operation has to be triggered. The available options are:

- **Read or Write**: trigger on every operation on the bus;
- **Read**: trigger when the bus is performing a read operation, ignoring the ACK bit;
- **Write**: trigger when the bus is performing a write operation, ignoring the ACK bit;
- **ACK R/W**: trigger on every acknowledged operation on the bus;
- **ACK Read**: trigger on an acknowledged read operation on the bus;
- **ACK Write**: trigger on an acknowledged write operation on the bus;
- **NACK R/W**: trigger on every not acknowledged operation on the bus;
- **NACK Read**: trigger on a not acknowledged read operation on the bus;
- **NACK Write**: trigger on a not acknowledged write operation on the bus;



In the *Address Value* control it is possible to insert the 7-bit binary value of the address to trigger, leaving X on the don't care bits. Furthermore, it is possible to choose if the inserted value should match or not match the one to trigger on.

It is possible to add other address conditions (up to 15) in the *Additional Conditions* frame on the bottom side of the window. The controls have the same meaning of the ones just described.
To add a condition, fill the controls on the *Additional Conditions* frame, then click on .
To remove a condition, select the correspondent row in the table, then click on .
To edit a condition, double click on the correspondent row in the table, modify the required parameters, then click on to apply them.

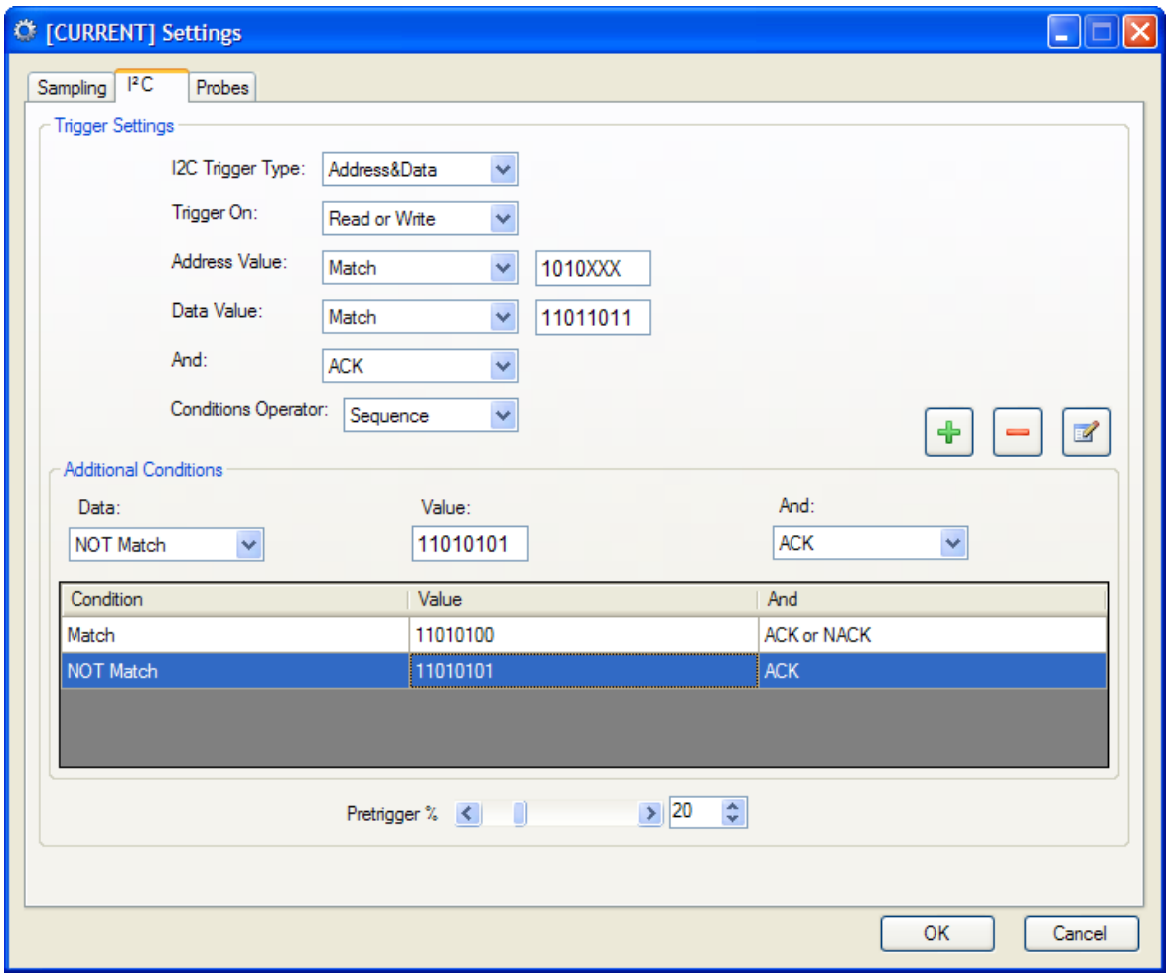
When more than one address condition are set, the *Conditions Operator* control is enabled, by which is possible to choose between:

- **Sequence**: the AT-LA500 triggers when all the entered address conditions are verified in the specified order;
- **OR**: the AT-LA500 triggers when at least one of the entered address conditions is verified.

Address&Data

When this option is selected, the AT-LA500 triggers when a on the bus is detected the selected address followed by one or more data bytes.
The controls related to the address have the same meaning of the *Address* trigger type case just described.
To set the data, it is necessary to fill the *Data Value* controls by writing the 8-bit binary value of the data byte to trigger on, and choose if this value should match or not match the one detected on the bus. Furthermore, with the *And* control, it is possible to choose between:

- **ACK or NACK**: the acknowledge bit is ignored;
- **ACK**: trigger on an acknowledged data;
- **NACK**: trigger on a not acknowledged data.



It is possible to add other data conditions (up to 15) in the *Additional Conditions* frame on the bottom side of the window. The controls have the same meaning of the ones just described.
To add a condition, fill the controls on the *Additional Conditions* frame, then click on .
To remove a condition, select the correspondent row in the table, then click on .
To edit a condition, double click on the correspondent row in the table, modify the required parameters, then click on to apply them.

When more than one data condition are set, the *Conditions Operator* control is enabled, by which is possible to choose between:

- **Sequence**: the AT-LA500 triggers when the address condition and all the entered data conditions are verified in the specified order;
- **OR**: the AT-LA500 triggers when the address condition and at least one of the entered data conditions are verified.

Pretrigger

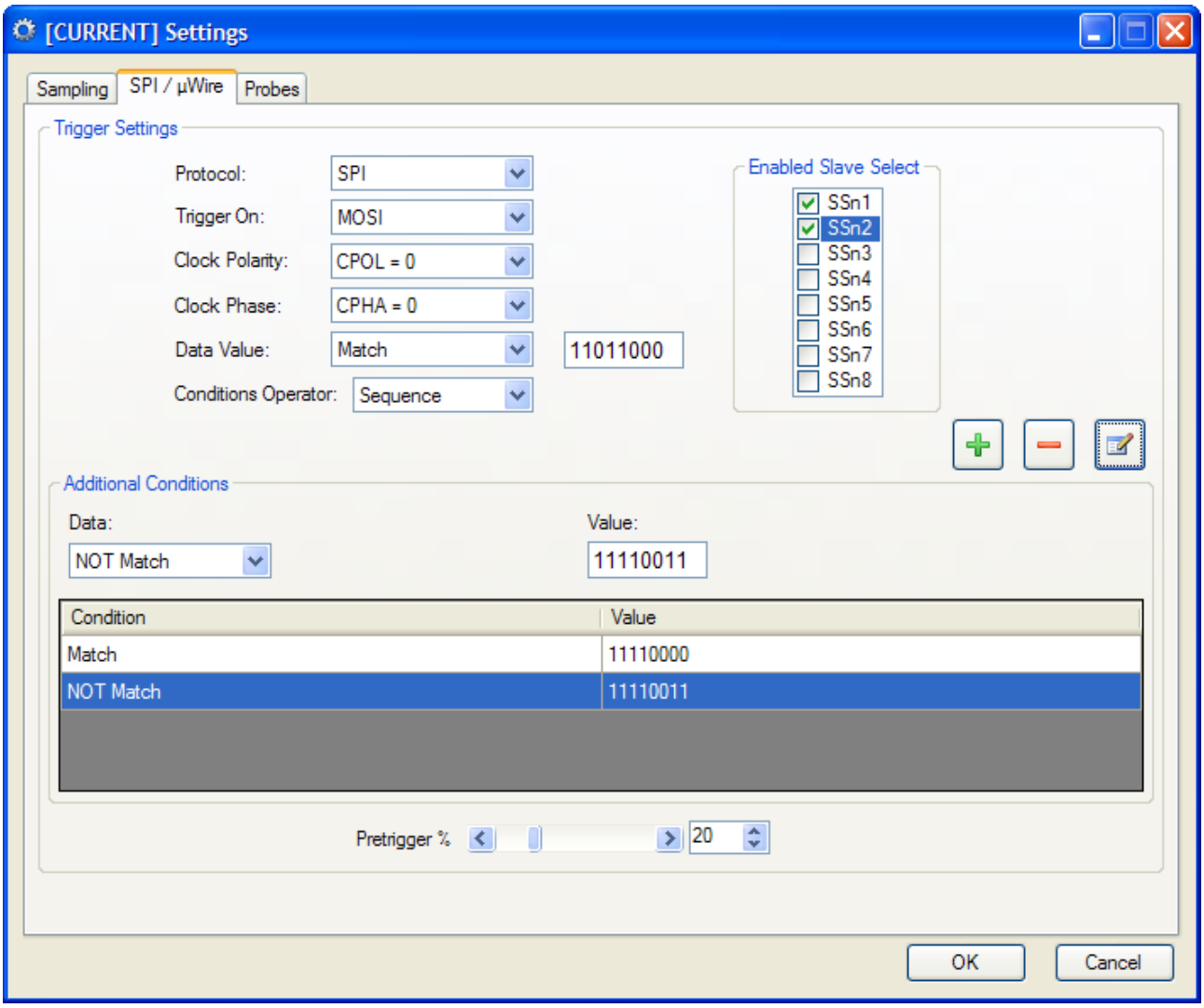
The *Pretrigger* control on the bottom side allows specifying the position in which the trigger event will be located with respect to the AT-LA500 memory. If the most meaningful data must be sampled after the trigger detection, low pretrigger percentage must be selected. On the contrary, if signal evolutions before trigger event must be analyzed, a high pretrigger percentage is more suitable.

SPI/µWire Trigger

In this mode, the AT-LA500 can trigger when a selected event occurs on a SPI (Serial Peripheral Interface) or µWire bus. The AT-LA500 can trigger on SPI operations addressing up to 8 different peripherals by monitoring the related SSn (Slave Select) signals. Furthermore, the acquired data are decoded and shown in the Waveform View and State Listing windows.
The *Protocol* control allows to select between SPI and µWire protocol. When the µWire protocol is selected, some controls are disabled. The following description refers to the more general SPI protocol trigger settings options.

To set up the AT-LA500 for a SPI acquisition, the following steps are required:

- Connect a probe to the pod A of the AT-LA500;
- Connect at least one grounded pin (white wires) to the ground of the board to test;
- Connect the **Channel 0** (black wire) to the **SCLK** line of the SPI bus to test.
- Connect the **Channel 1** (brown wire) to the **MOSI** line of the SPI bus to test;
- Connect the **Channel 2** (red wire) to the **MISO** line of the SPI bus to test.
- Optionally, connect **Channels 3 to 10** to the **SSn** lines of the SPI peripherals of the board under test;



SPI Trigger Options

The AT-LA500 can trigger on SPI events occurring on the MOSI or on the MISO lines. The *Trigger On* control allows to select between these two options.
SPI peripherals have 2 configuration bits to allow 4 working modes, depending on the clock polarity (CPOL) and phase (CPHA). The four mode are:

- **Mode 0**: CPOL = 0; CPHA = 0;
- **Mode 1**: CPOL = 0; CPHA = 1;
- **Mode 2**: CPOL = 1; CPHA = 0;
- **Mode 3**: CPOL = 1; CPHA = 1;

The *Clock Polarity* and *Clock Phase* controls allows to select between these modes.
Since every SPI peripheral has its own SSn enable signal, it is possible to connect these lines to the channels 3 to 10 of the AT-LA500 and to select which ones should be evaluated during the trigger detection. The *Enabled Slave Select* frame lists all the SSn available signals. Check the ones that have to be enabled. For example, if the SSn1 and SSn2 box are checked, the AT-LA500 will trigger when the selected condition is verified on the SPI peripheral whose SSn signal is connected to channel 3 or on the one whose SSn signal is connected to channel 4. If none of the SSn boxes is select, all these lines will be ignored.

To set the data to trigger on, it is necessary to fill the *Data Value* controls by writing the 8-bit binary value of the data byte, leaving X on the don't care bits, and choose if this value should match or not match the one detected on the bus.
It is possible to add other data conditions (up to 15) in the *Additional Conditions* frame on the bottom side of the window. The controls have the same meaning of the ones just described.
To add a condition, fill the controls on the *Additional Conditions* frame, then click on  .
To remove a condition, select the correspondent row in the table, then click on .
To edit a condition, double click on the correspondent row in the table, modify the required parameters, then click on  to apply them.

When more than one data condition are set, the *Conditions Operator* control is enabled, by which is possible to choose between:

- **Sequence**: the AT-LA500 triggers when the address condition and all the entered data conditions are verified in the specified order;
- **OR**: the AT-LA500 triggers when the address condition and at least one of the entered data conditions are verified.

Pretrigger

The *Pretrigger* control on the bottom side allows specifying the position in which the trigger event will be located with respect to the AT-LA500 memory. If the most meaningful data must be sampled after the trigger detection, low pretrigger percentage must be selected. On the contrary, if signal evolutions before trigger event must be analyzed, a high pretrigger percentage is more suitable.

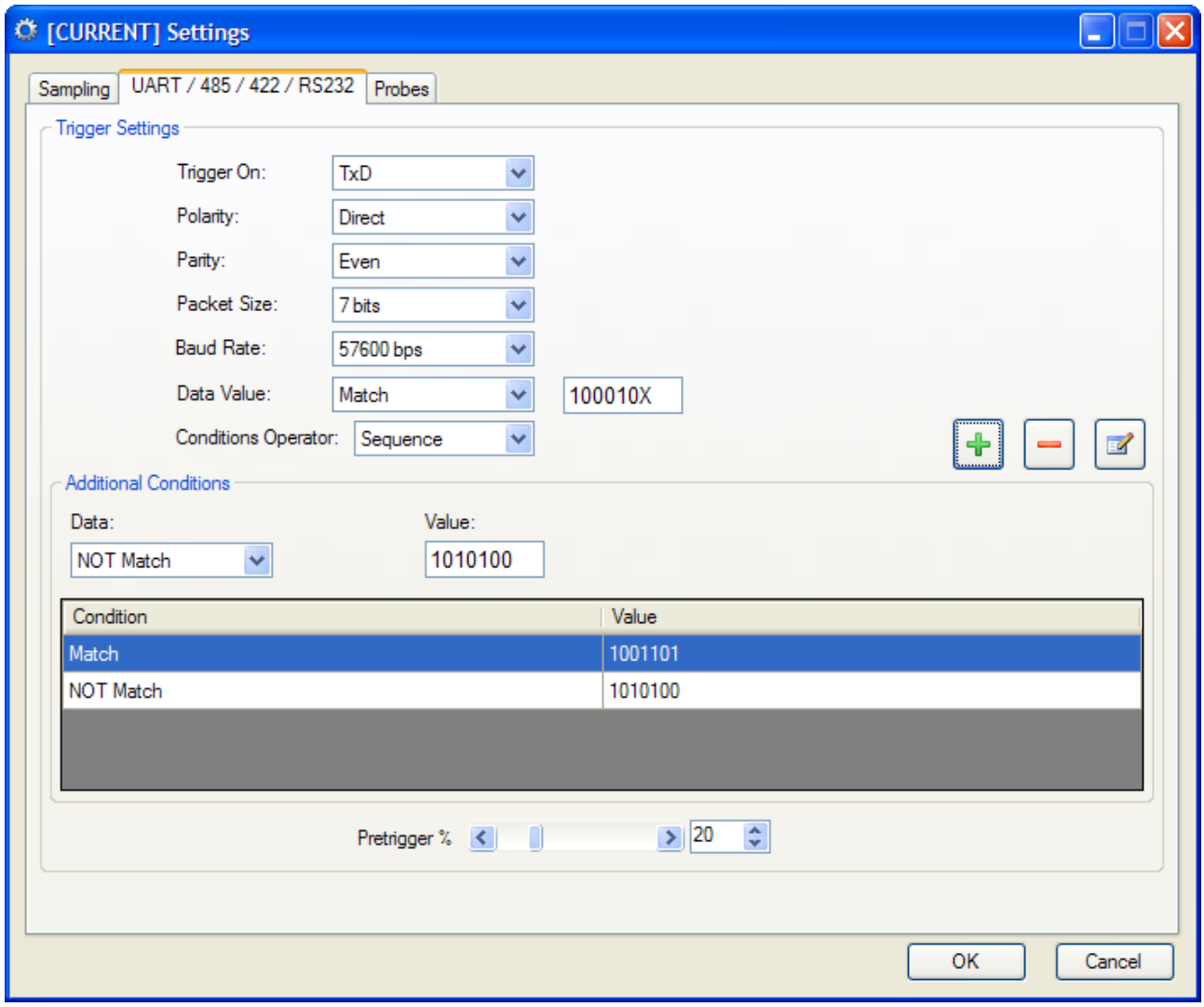
UART/RS232 Trigger

In this mode, the AT-LA500 can trigger when a selected event occurs on a UART (Universal Asynchronous Receiver and Transmitter) bus. Furthermore, the acquired data are decoded and shown in the Waveform View and State Listing windows.

To set up the AT-LA500 for an UART acquisition, the following steps are required:

- Connect a High-Z Probe to the pod A. In this case you also have to correctly set the threshold voltage in the *Probes* tab of the *Settings* window;
- Connect at least one grounded pin (white wires) to the ground of the board to test;
- Connect the **Channel 0** (black wire) to the **RxD** line of the UART bus to test;
- Connect the **Channel 1** (brown wire) to the **TxD** line of the UART bus to test.

***Note**: It is not possible to use a Low-C Probe or a Passive Probe to analyze a RS232 bus: this could prevent the system under test to work properly and damage the probes.*



UART Trigger Options

The AT-LA500 can trigger on UART events occurring on the RxD or on the TxD lines. The *Trigger On* control allows to select between these two options.
The *Polarity* control allows to select the polarity of the UART signal to analyze.
The *Parity* control allows to choose the parity bit type to trigger on. The options are:

- **None**: use this option if the parity bit is not present in the protocol;
- **Don't care**: the parity bit will be ignored during the trigger detection;
- **Even**: trigger on data followed by even parity bit;
- **Odd**: trigger on data followed by odd parity bit;
- **Mark**: trigger on data followed by a mark bit;
- **Space**: trigger on data followed by a space bit.

The *Packet Size* control selects the number of data bits for every transfer on the bus. The range is from 5 bits to 9 bits.
The *Baud Rate* control represents the data rate of the UART bus. The available values are 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 128000 and 153600 bps.

To set the data to trigger on, it is necessary to fill the *Data Value* controls by writing the 5 to 9 bit binary value of the data byte, leaving X on the don't care bits, and choose if this value should match or not match the one detected on the bus.
It is possible to add other data conditions (up to 15) in the *Additional Conditions* frame on the bottom side of the window. The controls have the same meaning of the ones just described.
To add a condition, fill the controls on the *Additional Conditions* frame, then click on  .
To remove a condition, select the correspondent row in the table, then click on  .
To edit a condition, double click on the correspondent row in the table, modify the required parameters, then click on  to apply them.

When more than one data condition are set, the *Conditions Operator* control is enabled, by which is possible to choose between:

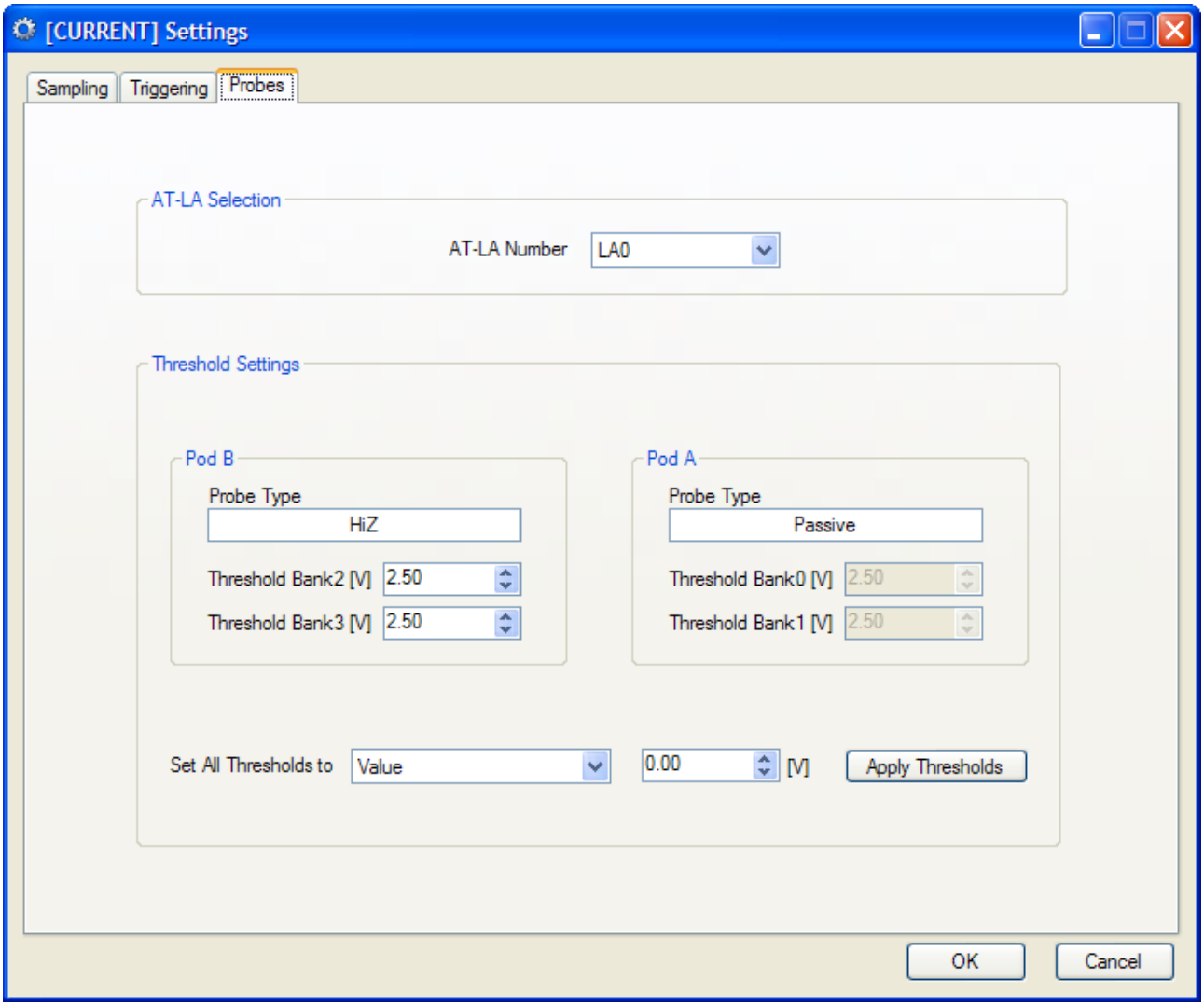
- **Sequence**: the AT-LA500 triggers when the address condition and all the entered data conditions are verified in the specified order;
- **OR**: the AT-LA500 triggers when the address condition and at least one of the entered data conditions are verified.

Pretrigger

The *Pretrigger* control on the bottom side allows specifying the position in which the trigger event will be located with respect to the AT-LA500 memory. If the most meaningful data must be sampled after the trigger detection, low pretrigger percentage must be selected. On the contrary, if signal evolutions before trigger event must be analyzed, a high pretrigger percentage is more suitable.

Probes

This tab allows setting the threshold levels for each bank (only for probes supporting this option).



If more than one AT-LA500 are connected used, the *AT-LA Number* menu ring allows to select the instrument to set.

The threshold for each bank can be set manually by writing its value in V in the corresponding control. Depending on the probe type, the threshold voltage must be confined in a range automatically set by AT-LA500 when the probe is plugged-in.

Furthermore it is possible to set all thresholds to the same value by entering the selected value in the *Set All Thresholds to* control and by clicking on *Apply Thresholds*.

In addition, for sake of simplicity, some threshold voltages are already available for the mostly used logic families in the *Set All Thresholds to* menu ring:

- TTL (1.5V)
- CMOS (2.5V)
- ECL (-1.3V)

- PECL (3.7V)
- LVPECL (2V)
- LVCMOS 1,5 (750mV)
- LVCMOS 1,8 (900mV)
- LVCMOS 2,5 (1.25V)
- LVCMOS 3,3 (1.65V)
- LVDS (100mV)

The appropriate value can be selected by means of the *Threshold Presets* menu ring and then the *Set all* key must be pressed.

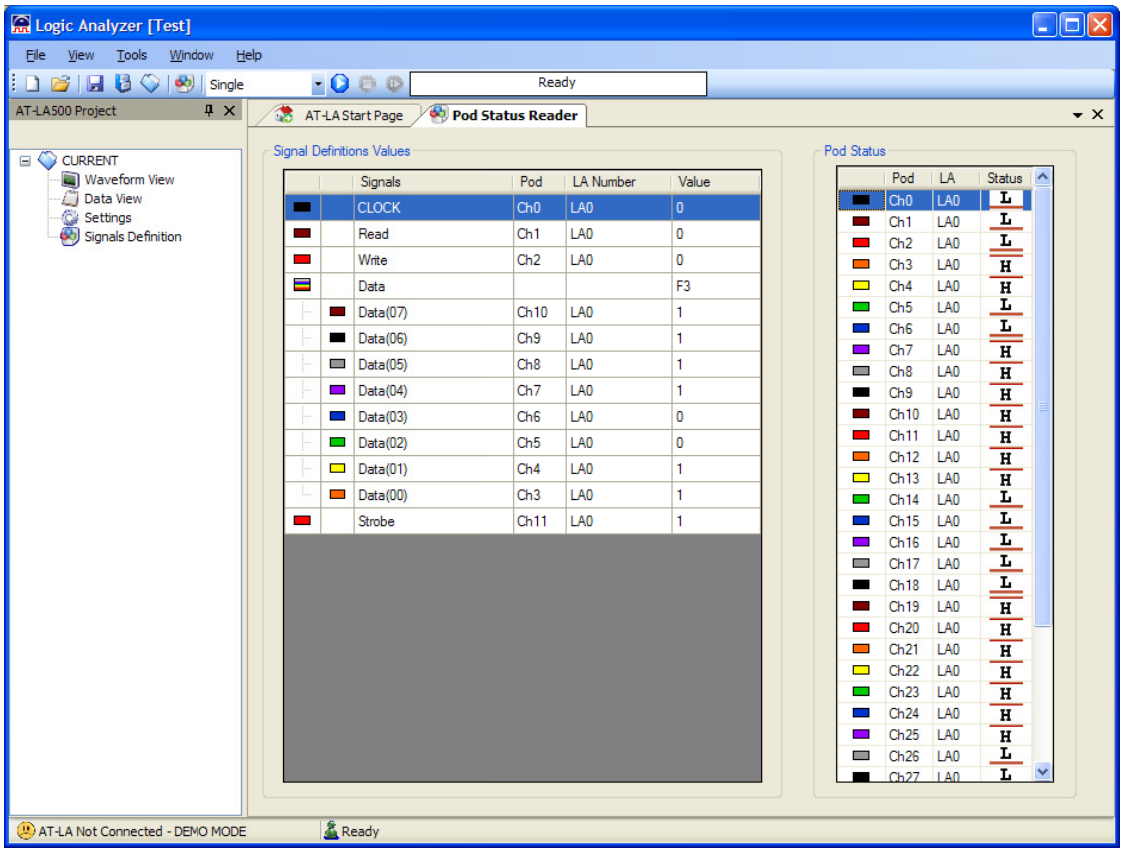
***Note**: If an active probe is not connected to a Pod, it is not possible to set a specific threshold voltage for the corresponding banks.*

Data Acquisition

Channel Status

Once one or more probes have been connected to the system under test, the logic level of each input can be examined in real time. This feature is activated by clicking on the key in the tool bar or from the **Tools** menu**, Pod Status…** command.

The opened panel is formed by two tables: *Signal Definitions Values* and *Pod Status*



Signal Definition Values

If signals have been associated to the channels, they will be represented in the **Signal Definition** table. This option is useful, for instance, to detect the values of bus signals, since every signal and bus are represented with its own value.

Pod Status

In the **Pod Status** frame the status of each channel is represented in real time by means of three symbols:

It indicates that a voltage below the threshold value is present on the corresponding channel;

It indicates that a commutation is present on the corresponding channel (rising or falling edge);

It indicates that a voltage above the threshold value is present on the corresponding channel.

Start a data acquisition

Once AT-LA500 has been set correctly, data acquisition can be started by clicking on the  button of the tool bar.

The status box on the tool bar shows the acquisition status. The possible options are:

- Ready — The project has been loaded and the AT-LA500 is ready to acquire;
- Waiting for trigger at Level *n* — AT-LA500 is waiting for the trigger event at Level *n*;
- Waiting for External Trigger — AT-LA500 is waiting for an external trigger event (AT-scope card is needed);
- Waiting for Serial Protocol Trigger — AT-LA500 is waiting for a trigger event on the selected serial protocol;
- Trigger Detected - Filling Memories — AT-LA500 detected a trigger event and it is sampling data;
- Reading Acquisition Data — Data acquisition is terminated and data are transferring to the PC;
- Acquisition Data Ready — Data acquisition is terminated and data have been transferred to the PC.

***Note**: If the sampling frequency is extremely high, these messages may appear only for few instants or they may even not appear.*

If the trigger event does not occur, it can be forced manually by clicking on the  button during data acquisition.
If the sampling frequency is very low or if an external clock is used whose trigger condition is no longer verified, data acquisition may stop or it can proceed very slowly and the message *Filling Memories* may remains visualized for a long time.

Stopping the acquisition

Data acquisition may be stopped at any time by clicking on the  button.

If the  button is pressed before a trigger event occurred, data acquisition is automatically terminated.

If the  button is pressed after a trigger event occurred (for instance to abort a too slow memory filling), data already acquired will be transferred to the PC for their visualization and/or storage.

Tips for a good acquisition

Some tips allow improving data acquisition:

- Electrical contacts must be checked when connecting probes;
- Connect as many grounds as possible to the system under test. All grounds are connected together, therefore it is important to check all ground connections to avoid short circuits;
- Once probes have been connected, check the input status on the *Channels Status* window to verify that the visualized behavior corresponds to the expected one;

- When active probes are used, set the threshold level to a value suitable to the signal nature;
- If data acquisition is performed in the *State Analysis* mode, it is convenient to use active probes for signal clocks. In this case a correct setting of threshold values allows using the clock signal with the correct duty-cycle. Signal clocks, furthermore, must be (if possible...) not affected by noise or disturbs that may activate erroneous acquisitions. Depending on clock signal frequencies, it could be necessary to invert the trigger setting on edge conditions to get a better acquisition;
- If data acquisition is performed in the *Timing Analysis* mode or in the serial protocol analysis, select the most suitable sampling frequency. If the sampling frequency is too low, acquired data may be not coherent, while a too high frequency can evidence spikes or propagation delays, furthermore reducing the useful acquisition time window.

Data Visualization

Two different window types are available to visualize the acquired data: Waveform View and State Listing. It is also possible to visualize digital signals and analog data (acquired by an external device) together. This feature is called Mixed Signal Display Mode.

Mixed Signal Display Mode

The *Mixed Signal Display Mode* allows the user to visualize digital and analog data in the same window. To acquire Analog data the AT-LA500 software can be installed on a PC based oscilloscope connected to the AT-LA500 by means of the TriggerIN and TriggerOUT rear connectors (use 1m length BNC cable) and the USB 2.0 connection.

The AT-LA500 TriggerIN input must be connected to the oscilloscope TriggerOUT, and the AT-LA500 TriggerOUT output to the oscilloscope TriggerIN.

The Mixed Signal Display Mode is available for Normal Timing and Serial Protocol Analysis acquisition modes. In Normal Timing mode, the AT-LA500 can send/ receive the Trigger pulse to/from the oscilloscope. For Protocol Analysis AT-LA500 can only send the trigger pulse to the oscilloscope through the TriggerOUT output.

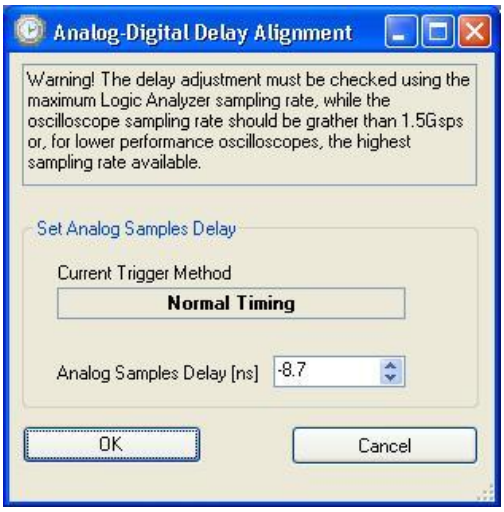
If the AT-LA500 is set to receive the Trigger pulse from the oscilloscope, the Trigger condition must be set manually, if AT-LA500 is the Trigger master, the oscilloscope settings will be set by the AT-LA500 software automatically.

Note: *The analog data visualized on the Waveform View are the same shown by the oscilloscope. Thus, only the channels of the oscilloscope that are turned on will be visualized in the Waveform View.*

The names associated with the analog data are Analog Ch0, Analog Ch1, Analog Ch2, Analog Ch3. The analog data properties can be changed as for any digital data.

Analog-Digital Delay Alignement window

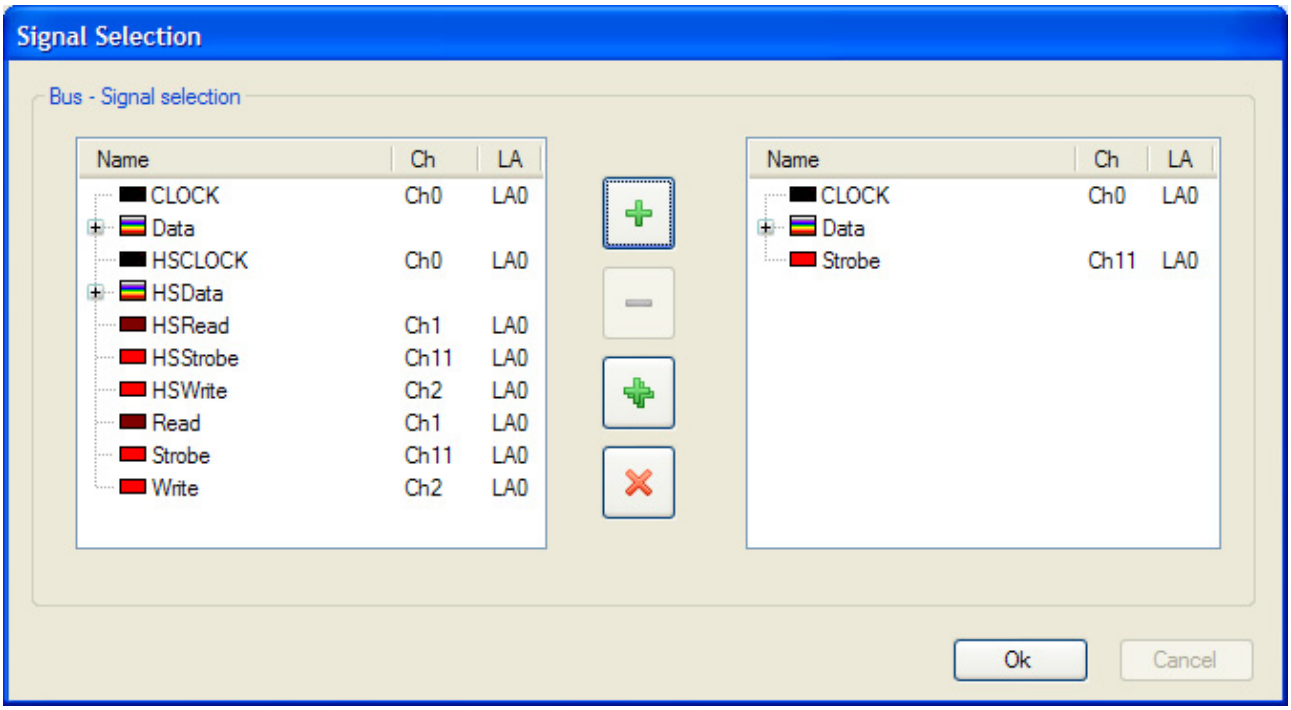
To open the Analog-Digital Delay Alignement window, click on the Analog Delay item of the Tools menu on the menu bar.
The *Analog Samples Delay(ns)* box allows to change (if it's necessary), the delay between digital and analog signals, to obtain the correct alignement. For example, if in the Waveform Window, analog and digital signals are affected by a delay of 3ns, *Analog Samples Delay(ns)* value must be changed by 3ns.



Waveform View

Create a Waveform View window

To open the Waveform view, double click on the icon in the Solution Explorer.
When a new acquisition is complete, and the Waveform View window is not yet open, a *Signal Selection* window will appear to select which signals or groups of signals among those that have been acquired are to be visualized, then the Waveform View window will be shown.



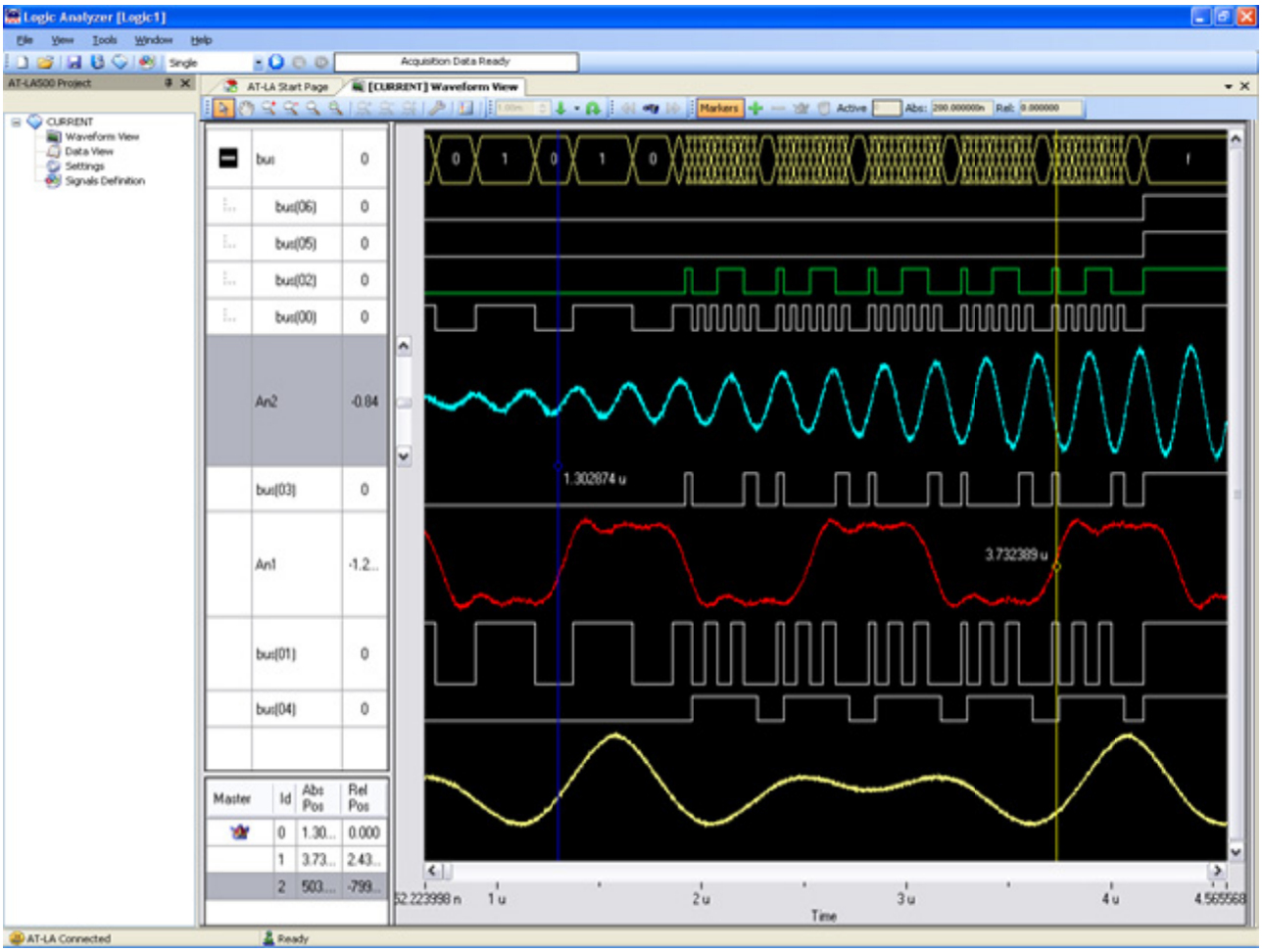
***Note**: The High Speed signals acquired will appear with the user defined name and the "HS" prefix. Analog data will not be shown in this list: they will be automatically added to the Waveform View.*

To add a signal or a bus to the list of the ones that will be shown in the Waveform View window, select it on the left side table and click on .
To add all signals at a time, just click on .
To remove a signal from the visualization list, select it on the right side table and click on .
To remove all signal at a time, just click on .

***Note**: Signals can be added in (removed from) the Waveform View window at any time by clicking on the icon in the Waveform View window toolbar.*

***Note**: When the trigger is set on a serial protocol mode, the signal protocol names are automatically shown. They can't be removed from the Waveform View window.*

The Waveform Window allows analyzing acquired data in a graph containing digital and analog waveforms. Single signals are visualized as digital signals, while grouped signals are represented as buses.



***Note**: Waveform View window can be opened only after the first data acquisition.*

In the Waveform View, a bus is indicated by a ⊞ icon on the left. Double click on it to open a bus. The icon of an opened bus becomes ⊟. Double click on it to close a bus.
It is possible to drag and drop the waveforms and change their order, to help the user to focus the time relationship between edges. To do this, click on a signal name and drag it in the new position.

In the same way, it is also possible to insert a signal into an opened bus or to extract a waveform from it.
To resize the signals amplitude, just drag the line between signals name.
On the right of every signal or bus name, a number indicates the value that this signal or bus assumes at the time position of the master cursor (the cursors properties are described in the *Cursors* chapter).
By clicking with the right mouse button on the signal name column, a shortcut menu will appear with these options:

- Add samples scale — Select this option to add a signal, indicated by a icon, with a series of interval that represents the number of samples.
- Remove samples scale — Select this option to remove the selected sample scale.
- Analog mode display — This option (available only for the buses) will represent a bus as an analog waveform. This is useful for example if an ADC or a DAC has to be tested.
- Add-Remove signals — This option allows to add or remove signals to the Waveform View.
- Waveform View Settings — Select this option to open the The Waveform View Settings window (see *Graph Property* chapter for details)
- MSB on top — This option (available only for the buses) will represent a bus with the most significative signal displayed as first;
- LSB on top — This option (available only for the buses) will represent a bus with the less significative signal displayed as first;

Zoom

To move along the waveforms and to zoom, the Waveform View window provides many instruments, placed on the upper side toolbar:


Selection tool


Hand tool. Use the hand tool to pan the acquisition. Click and drag to move it.


Zoom In auto. Click to zoom in.


Zoom Out auto. Click to zoom out.


Zoom Manual. Select this tool to manually select the area to zoom. Click in the start point of the Waveform View and drag the cursor to the end point keeping the left mouse button pressed.


Zoom All. Click to fit the visualization to view all the acquisition time.

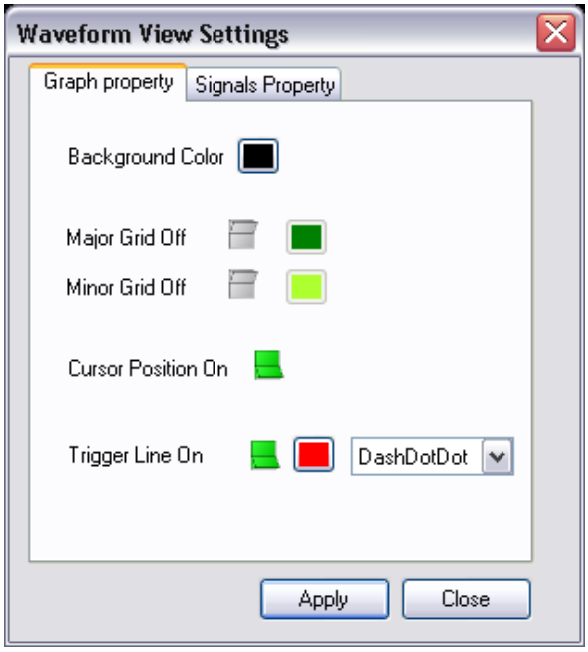

Analog Zoom in. Click to zoom in the selected analog waveform (if present)


Analog Zoom out. Click to zoom out the selected analog waveform (if present)

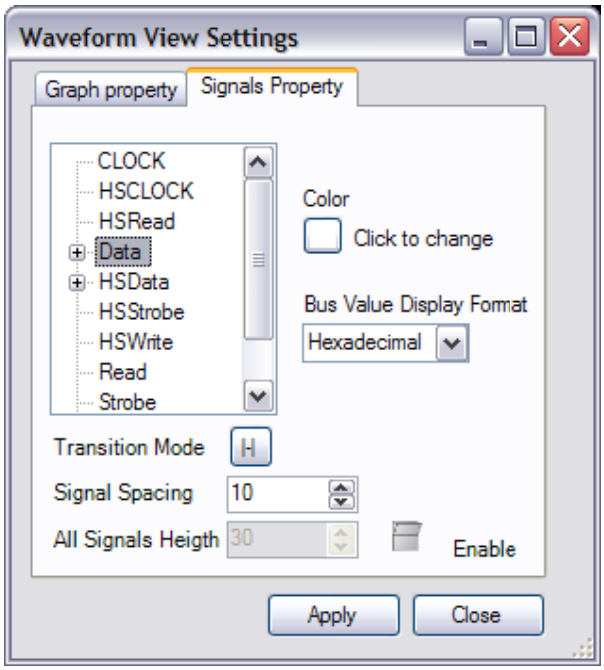

Analog Autoscale. Click to fit the selected analog waveform amplitude in the

Graph Property

To change the graph properties, click on the icon. The Waveform View Settings window will be shown.



In the *Graph property* tab it is possible to change the graph background color by clicking on the *Background Color* box.
By clicking the *Major Grid* and the *Minor Grid* switches it is possible to show or hide the vertical grids and to choose their colors.
By clicking the *Cursor Position* switch it is possible to show or hide the cursor position indication near the cursors.
By clicking the *Trigger Line* switch it is possible to show or hide a line that always identify the trigger position: it is possible also to select the line color and the linr style.

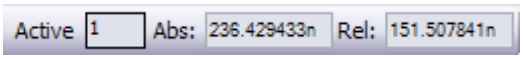


In the *Signals Property* tab it is possible to change the color of a single signal, the representation of the value of a bus, the transition visualization mode, the space between signals and the height of all signals.

Note: *The minimum All Signals Height value is 4.*

Cursors

Cursors (also called markers) are useful to identify and enlighten data that, therefore, may be recognized or found easier. In addition cursors can be used to measure and to analyze acquired data. By clicking on *Markers* label in the Waveform View toolbar, it is possible to show or hide the marker window. In the Waveform View toolbar are also available indicators that show the active cursor (that is, the Id of the cursor currently selected), and the Absolute and Relative Positions, whose means are described below.

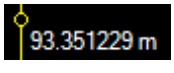


In the marker window are listed all cursors present in the Waveform View window. The master cursor is identified by the icon. All relative positions will be calculated respected to the position of the master cursor. Furthermore, the master cursor is moved automatically during a data search operation to show results. To change the master cursor, select the new cursor in the marker window and click on the icon in the Waveform View toolbar.

Note*: In the Waveform View window, the master cursor is drawn in blue; all others cursors are drawn in yellow.*

Master	Id	Abs Pos	Rel Pos
	0	200.000000n	0.000000
	1	268.291840m	268.291640m
	2	268.291840m	268.291640m
	3	93.367724m	93.367524m

The columns of the marker window show the progressive cursor identifier, the absolute time position (the time distance between the cursor position and the start of the acquisition) and the relative time position (the time distance between the cursor and the master cursor). Any time one of the cursors is moved, all the values are automatically updated and shown.

- To add a cursor: Click on the key of the Waveform View window. A new cursor will be added to the visualization area.
- To remove a cursor: Select the cursor to be removed in the marker window and click on the key.
- To move a cursor: Drag on the selected cursor. By dragging the cursor dot it is possible to move the cursor position indication: 

.
- To remove all cursors: Click on the key of the Waveform View window.

It is also possible to add or remove cursors and set the master by clicking with the right mouse button in the marker windows and by selecting the desired option in the shortcut menu that will appear.

***Note**: It is possible to remove all the cursors but one. The user, however, can create as many cursors as needed.*

Go To a Selected Target

The *Go to* menu ring allows selecting the position where the master cursor is going to be moved within the visualization area. The possible options in the *Go to* menu ring are:

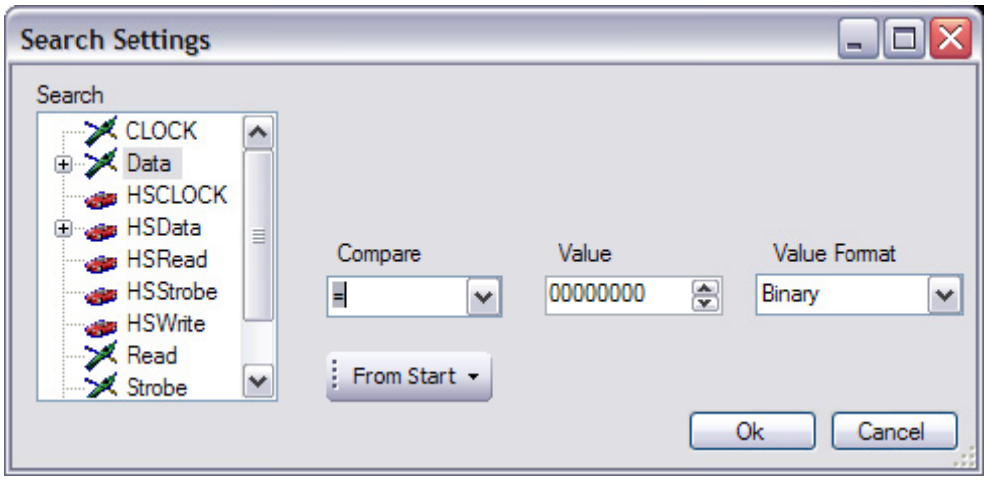
- Go to trigger: the master cursor is moved to the trigger event and the visualization area is centered on it;
- Go to time: the master cursor is moved to the time position specified in the box near the control;
- Go to normal samples start: the master cursor is moved at the acquisition begin and the visualization area starts with the acquisition begin;
- Go to normal samples end: the master cursor is moved at the acquisition end and the visualization area starts with the acquisition begin;
- Go to Gigaview start: the master cursor is moved at the begin of the High Speed acquisition and the visualization area is centered on it;
- Go to Gigaview end: the master cursor is moved at the end of the High Speed acquisition and the visualization area is centered on it;
- Go to Analog samples start: the master cursor is moved at the begin of the analog acquisition and the visualization area is centered on it. This option is available only with oscilloscope integration;
- Go to Analog samples end: the master cursor is moved at the end of the analog acquisition and the visualization area is centered on it. This option is available only with oscilloscope integration;
- Cursor *n*: The visualization area is centered on the cursor *n*.

The *Go to* button must be pressed to activate this operation (it shows the icon selected in the *Go to* menu ring)
To move the selected cursor to the middle of the current visualization, click on the icon.

Search

In the Waveform View it is possible to search a value related to a bus or, for a single signal, a rising edge or a falling edge.

To activate the search option, click on the *Search Settings* key and the Search Settings window will be opened, and search criteria can be entered.



In the *Search* list, all defined signals and bus (also the High Speed signals) are shown. It is possible to select the signal or bus where to search a specified value.
In the *Value* box, the value or the edge to search can be entered.

The menu ring allows selecting the start location for searching. Possible options are:

- From Start: Search starts from the acquisition begin;
- From End: Search starts from the acquisition end;
- From Trigger: Search starts from the trigger position;
- From Gigaview Start: Search starts from the High Speed acquisition begin;
- From Gigaview End: Search starts from the High Speed acquisition end;
- Cursor *n*; Search starts from the cursor *n* location;

Depending on the signal type selected in the *Search* list, the *Compare* and the *Value* menu ring contains different options.

If a single signal is selected, the *Value* box can assume these values:

- 0 Search for a logic 0;
- 1 Search for a logic 1;
- HiZ Search for a High Impedance (only for Pattern Generator Mode);
- Rise Search for a rising edge;
- Fall Search for a falling edge;
- Change Search for any edge;

The *Compare* menu ring allows to select between the search option:

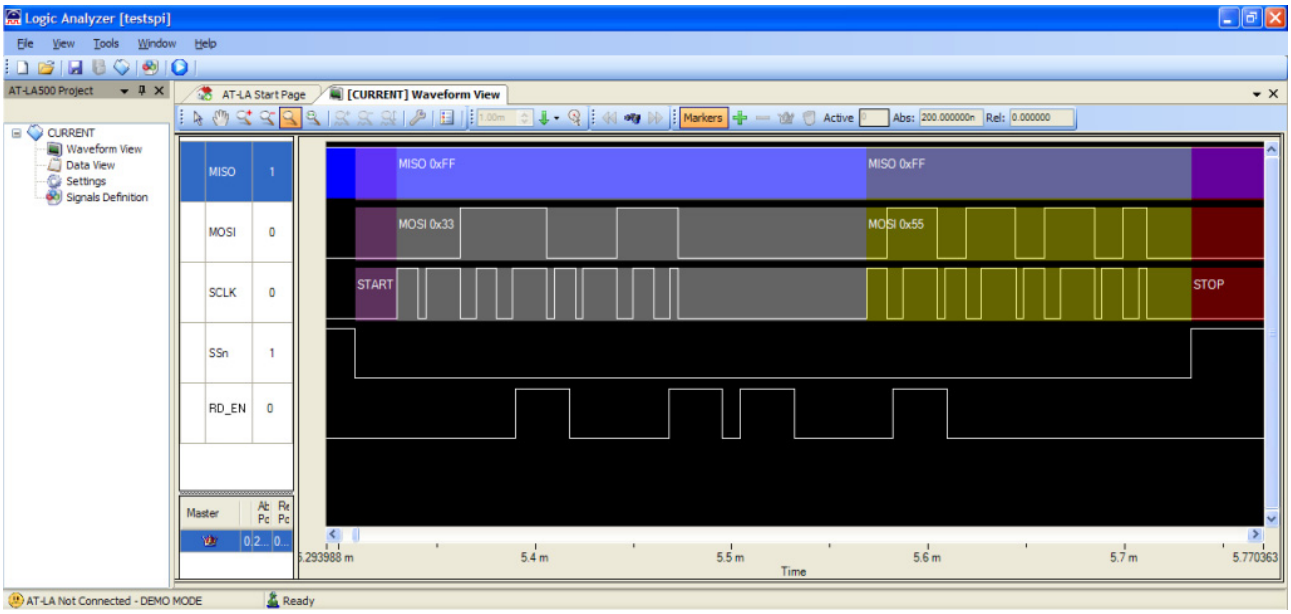
- = Find if equal;
- != Find if not equal;
- > Find greater values (enabled only if a bus is selected);
- < Find minor values (enabled only if a bus is selected);
- HiZ High Impedance (only for Pattern Generator Mode);

To make active the selected criteria, click the *OK* button and the *Search Settings* window will be closed.

In the visualization window, click on the *Search Forward* key or on the *Search Backward* key. The master cursor will move to the next found value.

Serial Protocol Interpreter

When a Serial Protocol trigger is selected, the serial bus acquired data are visualized and their interpretation is indicated in the Waveform View window: coloured rectangles will show where the bus operations begin and end; a string will specify which operation is represented.



The following table indicates the information that are shown for every protocol:

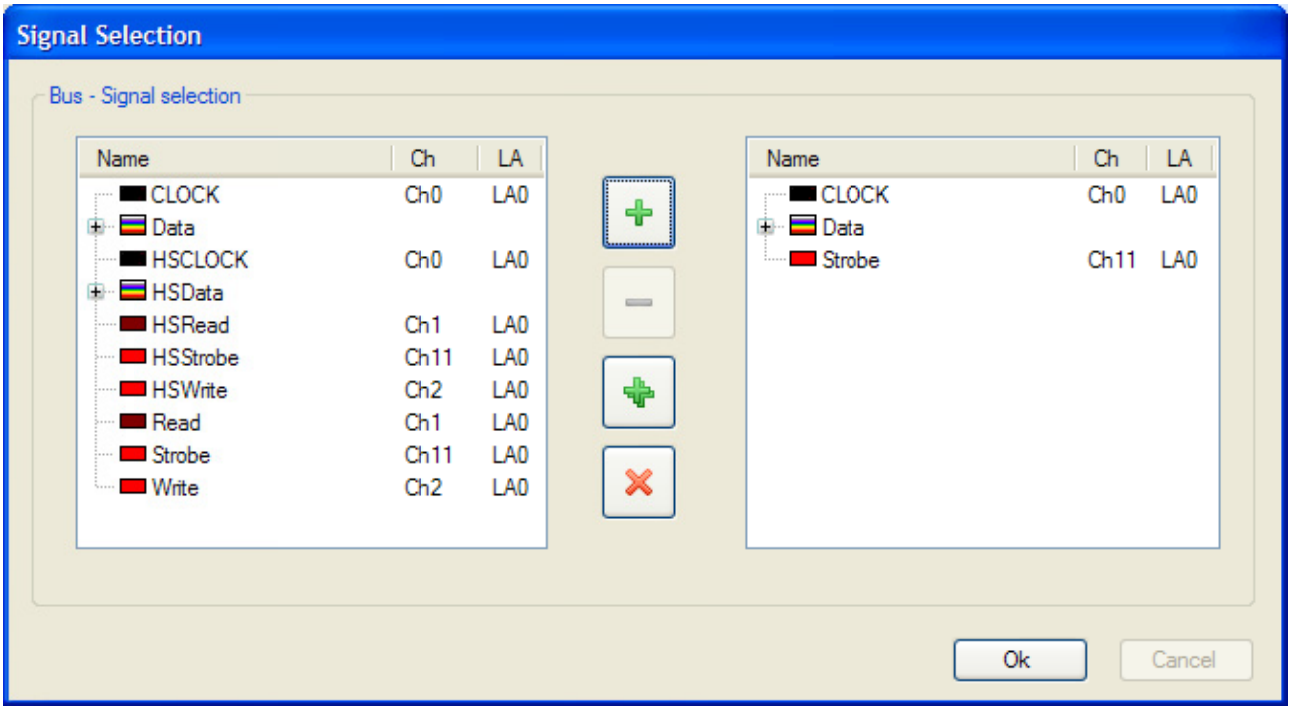
Protocol	Interpreted operations
I^2C	**START**: Start bus condition detected; **Addr**: Hexadecimal indication of the I^2C address; **R**: Read operation; **W**: Write operation; **ACK**: Acknowledged operation; **NACK**: Not acknowledged operation; **Data**: Hexadecimal indication of the I^2C data; **STOP**: Stop bus condition detected.
SPI	**START**: Start bus condition detected; **MOSI**: Hexadecimal indication of the data transferred on the MOSI line; **MISO**: Hexadecimal indication of the data transferred on the MISO line; **STOP**: Stop bus condition detected.
UART	**TxD**: Hexadecimal indication of the data transferred on the TxD line. If possible, an ASCII representation is also shown; **RxD**: Hexadecimal indication of the data transferred on the RxD line. If possible, an ASCII representation is also shown.

State Listing

In the *State Listing* window acquired data are visualized numerically in columns, each one representing a signal or a group of signals.
Additional columns indicate the sample number (*Samples* column), the absolute time (*Time* column) and the interpretation of the serial protocol bus operations, if this trigger option has been selected.

Create a State Listing window

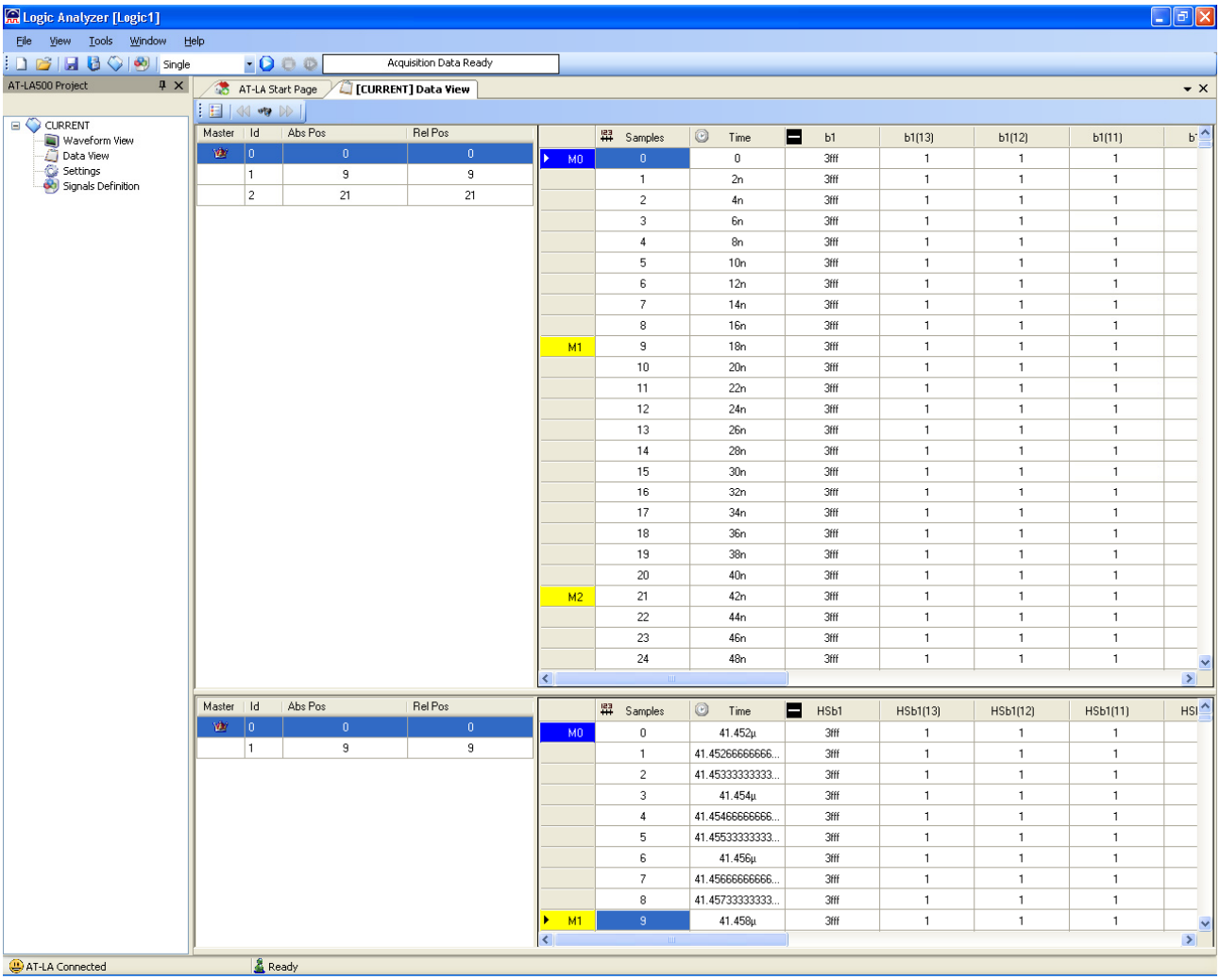
To open the State Listing window, double click on the icon in the Solution Explorer. If the State Listing window is not yet open, a *Signal Selection* window will appear to select which signals or groups of signals among those that have been acquired are to be visualized, then the State Listing window will be shown.



***Note**: The High Speed signals acquired will appear with the user defined name and the "HS" prefix.*

To add a signal or a bus to the list of the ones that will be shown in the State Listing window, select it on the left side table and click on .
To add all signals at a time, just click on .
To remove a signal from the visualization list, select it on the right side table and click on .
To remove all signal at a time, just click on .

If some High Speed data are added, the State Listing will be split in two independent sections.



***Note**: Signals can be added in (removed from) the State Listing window at any time by clicking on the icon in the State Listing window toolbar.*

***Note**: When the trigger is set on a serial protocol mode, the signal protocol names are automatically shown. They can't be removed from the State Listing window.*

In the State Listing, a bus is indicated by a ⊞ icon on the left of its name. It is possible to click on it to open a bus. The icon of an opened bus becomes ⊟. Click on it to close a bus.
The *Samples* column contains the progressive number of the acquired samples. It is indicated by the icon.
The *Time* column contains the progressive absolute time of every sample. It is indicated by the icon.
To resize the columns amplitude, just drag the line between signals name.

Cursors

Cursors (also called markers) are useful to identify and enlighten data that, therefore, may be recognized or found easier. In addition cursors can be used to measure and to analyze acquired data.

On the left side of the State Listing window are listed all available cursors. The master cursor is identified by the icon. All relative positions will be calculated respected to the position of the

master cursor. Furthermore, the master cursor is moved automatically during a data search operation to show results.

It is possible to operate with cursors by clicking with the right mouse button on the cursor list and select one of these options in the shortcut menu that will appear:

- **Add marker** Add a cursor to the State Listing Window;
- **Delete marker** Remove the selected cursor;
- **Set master** Set the selected cursor as the master;
- **Clear marker list** Delete all cursors but one;
- **Go to this marker** Move the State Listing list to show the position of the selected cursor;
- **Representation…** Allows to select the Absolute and Relative Position representation. It is possible to choose between *Time* and *Samples*.

***Note**: It is possible to remove all the cursors but one. The user, however, can create as many cursors as needed.*

The markers are indicated by the string M*n* in the first column of the State Listing, where *n* is the progressive identification number.

Browse the State Listing window and export data

To jump quickly to the desired position of the State Listing list, it is possible to click with the right mouse button on the data and to select one of these options in the shortcut menu that will appear:

- **Add marker** Add a cursor in the selected point of the State Listing window;
- **Move selected marker here** Places the selected cursor to the specified position of the State Listing;
- **Show this sample on Waveform View** Center the Waveform View on the selected sample (only if the Waveform View is already open);
- **Go to selected marker** Move the State Listing list to show the position of the selected cursor;
- **Go to trigger** Move the State Listing list to show the trigger position;
- **Go to samples…** Move the State Listing list to show the samples which number is specified in the *Go to sample…* window that will appear;
- **Go to time…** Move the State Listing list to show the samples which absolute time is specified in the *Go to time…* window that will appear;
- **Save to txt file…** Allows to export data in text file. A window will appear to select which rows and column have to be

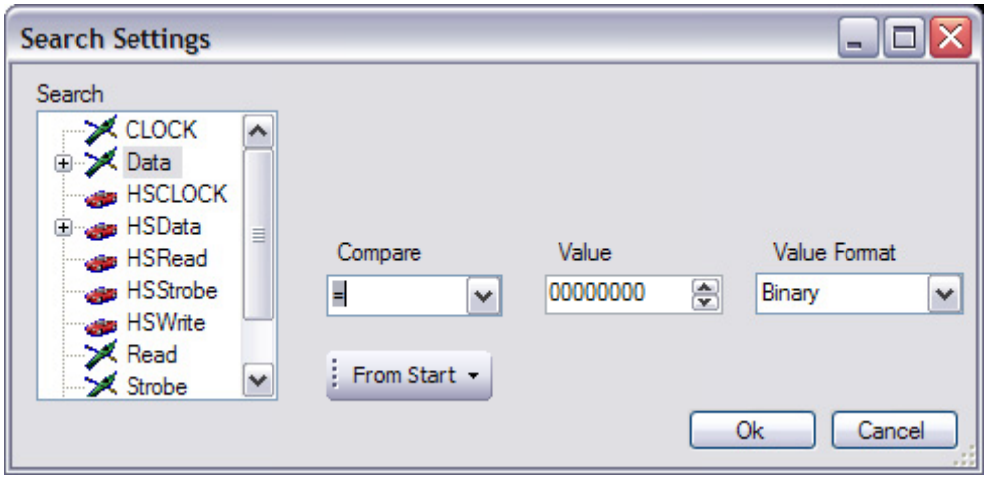
exported.

Note: *Exporting the entire acquisition may require a long time to be completed.*

Search

In the State Listing window, as in the Waveform View, it is possible to search a value related to a bus or, for a single signal, a rising edge or a falling edge.

To activate the search option, click on the *Search Settings* key and the Search Settings window will be opened, and search criteria can be entered.



In the *Search* list, all defined signals and bus (also the High Speed signals) are shown. It is possible to select the signal or bus where to search a specified value.
In the *Value* box, the value or the edge to search can be entered.

The menu ring allows selecting the start location for searching. Possible options are:

- From Start: Search starts from the acquisition begin;
- From End: Search starts from the acquisition end;
- From Trigger: Search starts from the trigger position;
- Master Marker: Search starts from the master market;

Depending on the signal type selected in the *Search* list, the *Compare* and the *Value* menu ring contains different options.

If a single signal is selected, the *Value* box can assume these values:

- 0 Search for a logic 0;
- 1 Search for a logic 1;
- HiZ Search for a High Impedance (only for Pattern Generator Mode);
- Rise Search for a rising edge;
- Fall Search for a falling edge;
- Change Search for any edge;

The *Compare* menu ring allows to select between the search option:

- = Find if equal;
- != Find if not equal;
- > Find greater values (enabled only if a bus is selected);
- < Find minor values (enabled only if a bus is selected);
- HiZ High Impedance (only for Pattern Generator Mode);

To make active the selected criteria, click the *OK* button and the *Search Settings* window will be closed.

In the visualization window, click on the *Search Forward* key or on the *Search Backward* key. The master cursor will move to the next found value.

Serial Protocol Interpreter

When a Serial Protocol trigger is selected, the serial bus acquired data are interpreted and visualized in a Command column of the State Listing window: coloured cells will show where the bus operations begin and end; a string will specify which operation is represented.

AT-XSS Expansion BUS

To increase the number of available channels **without degrading** performance or sampling frequency, up to 8 AT-LA500 can be connected by using the AT-XSS Expansion bus which allows synchronizing and controlling all AT-LA500.

The software controls all AT-LA500 without any additional operation by the user. The presence of AT-XSS connection is automatically recognized by the control software which manages all connected AT-LA500 as a single Logic Analyzer with a higher channel number.

AT-XSS Expansion bus allows also synchronizing and controlling an external device. A specific driver and the AT-scope card are needed to perform this operations. For example, it's possible to connect AT-LA500 with a oscilloscope, set the trigger on it (the logic analyzer will wait an external trigger), transfer analog data to the pc when the trigger event occurs on the oscilloscope and visualize digital and analog waveforms on the Waveform View window.

Note: *When a data acquisition is performed using several AT-LA500 connected together via the AT-XSS expansion cable, it is convenient to use the same probe type for each instrument to minimize propagation skews among the different AT-LA500.*

Note: *For a better acquisition it is suggested to connect all AT-LA500 in consecutive slots of the AT-XSS expansion bus and to set the trigger event on an AT-LA500 positioned in an intermediate location.*