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History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>1.00</td>
<td>22 Feb 2012</td>
<td>Initial revision</td>
</tr>
<tr>
<td>1.01</td>
<td>12 April 2012</td>
<td>Update for LOG Storm / LOG Storm Studio Release</td>
</tr>
<tr>
<td>1.02</td>
<td>20 Nov 2012</td>
<td>Added I2C and SPI decoders</td>
</tr>
<tr>
<td>1.03</td>
<td>02 Jan 2013</td>
<td>Update for LOG Storm Studio 1.1.4 release – Turned 'getting started guide' into 'user’s guide'.</td>
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</table>
1 Introduction

2 Starting up a LOG Storm Studio

2.1 What do you need to get started?

To start using LOG Storm, you need:

- A LOG Storm Device;
- LOG Storm Studio Software;
- A PC installed with Microsoft Windows XP or Microsoft Windows 7 (32 bit or 64 bit version);
- .NET 4.0 or .NET 4.0 client profile framework installed (or a more recent version) – download link: http://www.microsoft.com/downloads/en/details.aspx?FamilyID=e5ad0459-cbcc-4b4f-97b6-fb17111cf544
- One free USB port.

2.2 Connecting and configuring your LOG Storm device

1) Install LOG Storm Studio software, including USB driver and license file (please refer to LOG Storm Studio Installation guide)
2) Start LOG Storm Studio Software
3) Open the device selection window:
   a. Locate and click on the 'Select Device' icon in the main toolbar:
   - or:
   b. Click on device status:
   - or:
   c. Go to Tools > Select Device
4) Click on your device in the device selection window and click on button “Connect”.
If your device is not physically connected to your PC or if the USB driver is not properly installed, the device won't be recognized and the list in the 'Select Device' Window will be empty.

After a few seconds, the device is properly configured and ready to be used. The 'device selection window disappears and the device status turns green:

REMARC: LOG Storm device is now properly configured to run with a 3.3V LVCMOS signaling standard.

To use a different voltage for the I/Os, you must:
1) Select the right range in the 'Select LOG Storm Device' window
2) Supply the proper corresponding voltage through the I/O external voltage connector.

! If you don't supply the external voltage, the device will automatically switch back to 3.3V voltage for the I/Os!
3 Using LOG Storm for the first time

3.1 LOG Storm Device at a glance

There are 3 main parts to the LOG Storm device connector:

<table>
<thead>
<tr>
<th>Port name</th>
<th>Number of I/O pins</th>
<th>I/O names</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA PORT</td>
<td>20</td>
<td>P0 ... P19</td>
<td>LOG Storm input data port. Logged data is sampled from this port.</td>
</tr>
<tr>
<td>CLOCK PORT</td>
<td>2</td>
<td>CKI</td>
<td>CKO mirrors an internally generated clock signal; CKI can be used as an input pin for providing an external reference clock signal.</td>
</tr>
<tr>
<td>Ground pins</td>
<td>8</td>
<td>GND</td>
<td>Ground pins – LOG Storm device and slave devices must share the same ground signals.</td>
</tr>
</tbody>
</table>

3.2 What is a “Project” in LOG Storm Studio?

A ‘Project’ in LOG Storm Studio is a set of settings and definitions that can be saved as a .lsp file and later recalled. Each .lsp file encloses:
- The configuration / setup of a LOG Storm Studio session. It includes: trigger setup, logging setup, data grouping setup, ...
- Pointers to past saved trace data (logging history).
3.3 LOG Storm Studio interface at a glance

- Access to waveform viewer
- Status
- Logging control
- Jobs history
- Trigger & data filters definition
- Index of Runs
- List of samples and event flags
- Data organized as user-defined groups
- Output log
3.4 Step-by-Step: define your project

3.4.1 Setting up the 'Logging session'

Locate the 'logging' tab in LOG Storm Studio (see picture below). It has got the following parameters:

- **Logging type**: this defines how you will use LOG Storm.
  - Number of triggers: once started, LOG Storm will detect this number of triggers (see further on about 'trigger definition') and stop once this number is reached.
  - Fixed duration: LOG Storm will run during the time specified.
  - Run until stopped: LOG Storm will run until the STOP button is hit.

- **Number of triggers**: this is where the number of triggers to be detected is specified in the corresponding logging type.

- **Clock source**: internal or external. Choose 'Internal' for using LOG Storm's internal reference clock for data sampling. Choose 'External' if you wish to supply a reference clock onto the CKI pin. External clock should be of the same voltage standard as the I/Os (by default: 3.3V) and be a continuously toggling signal applied before using the device.

- **Clock division**: a clock divider uses this value to generate the sampling clock. The sampling clock frequency will be: 100 MHz / Clock division.

- **Split size**: this specifies the maximum size of each stored file.

3.4.2 Setting up the 'trigger'

Locate the 'trigger' tab in LOG Storm Studio (see picture below).

2 types of 'trigger' are available:

- **'Fixed length' trigger** defines a START trigger condition and a capture length. LOG Storm starts recording data upon the detection of the START condition and collects the specified number of samples. After this, it waits until the detection of a new START condition. Events occurring before the START condition can be recorded too, by defining a PREFETCH length. In addition, expressions defining which data must be recorded can be defined (green area on the figure).

- **'Variable length' trigger** does not define a capture length, but a STOP condition and optionally a POSTFETCH length. LOG Storm data logger stops after the POSTFETCH length and waits until a new START condition. Similarly to the fixed length, a data capture condition can be defined.

The START, STOP and CAPTURE conditions are defined as logic expressions built on the input digital signals probed on P0 to P19. To enable them, click on 'Start', 'Stop' and 'Capture' buttons in the user interface. Then, select the 'trigger mask', which defines if the values should be combined as a 'AND' or a 'OR' expression.
The logic values that can be detected from any of the 20 input bits are:

- 1 or 0 as high or low logic levels
- R or F as 'rising edge' or 'falling edge' to detect a transition from low to high or high to low.
- T for 'toggling' = any type of transition
- X for don't care.

Text boxes allow entering the 'samples per trigger', pre-fetching and post-fetching, according to the chosen trigger type.

3.4.3 Saving the project

Once logging and trigger are defined, you can save the project by clicking onto the 'save icon', or going to the 'File' menu > Save or Save As.

Saving a project file also defines the directories where your logged data will be saved. At the location where you save your project file, a directory with the name of the project will be created.
Each LOG Storm RUN will be stored in its own subdirectory. It is named after the time it was run (see screenshot below).

Each run directory will contain a .dat file. This is where the raw data are stored.

Once your project file is saved, you are ready for running your first capture. Status icons at the bottom of the window should turn green.
3.4.4 Grouping data
You can group data bits to ease readability and data organization.

- Locate the 'Groups' tab
- Click on 'Define Groups'
3.4.5 Using the waveform viewer

Locate and click on GTK Wave icon.

Once the file to display is generated, your GTK Wave viewer opens:

- Select the range to display
- Add the groups that you want to display
4 Using the serial protocols decoders

4.1 I2C Decoder

4.1.1 How to set up I²C decoder

– Open the 'Decoders window' by clicking on its button in the toolbar.

A window opens:

This window gives the list of the existing decoders. A 'decoder' is used to decode a specific protocol from specific LOG Storm Studio inputs. In this case, a I²C protocol decoder will be defined. Click on 'Add' button.
The ‘New Decoder’ window appears and prompts for the decoder's characteristics. The following items must be specified:

- Decoder name: this is a user-defined name that will be used to specifically recognize the defined decoder during LOG Storm Studio operation.
- Type: protocol type. Choose I2C.
- Click on ‘Add’ button.

A new window appears, prompting for the LOG Storm device's probes used for the decoding. For I²C protocol, only 2 probes will be used: one probe connected to SCL and the other one connected to SDA. We choose P0 and P1 and specify it in this window.

Probe's numbering can be found on the connector label of LOG Storm device:

Label with probe numbers: P0 to P19.
Click on 'Done' button.
Now, the I²C decoder setup is over, and it appears in the 'Serial Decoders' window.

![Serial Decoders window](image)

Now click on 'Close'.

**Remark:** serial decoders can be defined before or after data capture, as they analyze sets of data captured with LOG Storm data logger / logic analyzer device.

### 4.1.2 Capturing data

I²C decoders defined in LOG Storm Studio decode the I²C protocol based on raw data sampled with LOG Storm Studio. To capture the raw data, LOG Storm must be set up and run.

Specifically, the session settings, trigger and capture characteristics must be set up. Please refer to LOG Storm documentation for more details about this. In this guide, we'll propose a simple step-by-step example of such a setup.

We suppose we intend to capture I²C bus traffic. We would like to start capturing data when we detect the first 'start condition' on the I²C bus. Once this condition is detected, we would like to collect a buffer of 10,000 samples, which we estimate would be sufficient to see the I²C traffic and decode what we would like to decode.

**Remark:** LOG Storm's full trigger and capture capabilities can be used here (see below for an overview). LOG Storm Studio's trigger and capture definition can be more complex in order to properly filter the bus traffic that you're interested in.
**4.1.2.1 Session setup ('Logging subtab' in the main window):**

![Picture 1: LOG Storm Studio trigger definition - overview]

Here are the parameters of the capture:

<table>
<thead>
<tr>
<th>Logging Type</th>
<th>Number of trigger</th>
<th>Data capture is based in trigger condition (and not capture length)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of triggers: 1</td>
<td>We would like to detect the trigger condition one time.</td>
</tr>
<tr>
<td></td>
<td>Clock source: Internal</td>
<td>We use LOG Storm device internal clock reference to sample data.</td>
</tr>
<tr>
<td></td>
<td>Clock division: 10</td>
<td>This sets up the sampling clock to 10 MHz (100 MHz / 10). 10 MHz is sufficient to sample the i²C bus, which is supposed to toggle at 1 Mbit/s</td>
</tr>
<tr>
<td></td>
<td>Split size: 1 Msamples</td>
<td>We keep the default setting for the file size.</td>
</tr>
</tbody>
</table>
4.1.2.2 Trigger setup

**Fixed length trigger:** upon occurrence of the trigger condition, we'll collect a fixed number of samples and then stop.

**Samples per trigger:** set to 10000

**Pre-fetching:** we leave this to the default 8 samples.

**Trigger:** trigger is set up to detect a falling edge on P1 while P0 is held at 1 – which corresponds to a 'START condition' on the I²C bus.

4.1.2.3 Capturing data

Having connected LOG Storm to the I²C bus, click on **run button** to capture data:

Having defined 'groups' on P0 and P1, we can see that traffic has been captured (refer to 'Getting started guide to know how to define groups').
4.1.3 Decoding the I²C protocol

Open the 'Serial decoders window again, select the decoder and click on 'Apply'.

The following tab opens:

![Decoder Details and Decoder Actions]

- **List of decoded transfers during the selected run**
- **Detailed transfer view: viewing single decoded transfer**
Clicking on the "Open Waves" button allows viewing the capture and decoding:

General view on the capture:

Zoom on a specific transfer.
4.2 Using the SPI Decoder

4.2.1 How to set up SPI decoder

- Open the 'Decoders window' by clicking on its button in the toolbar.

A window opens:

This window gives the list of the existing decoders. A 'decoder' is used to decoder a specific protocol from specific LOG Storm Studio inputs. In this case, a SPI protocol decoder will be defined. Click on 'Add' button.

The 'New Decoder' window appears and prompts for the decoder's characteristics. The following items must be specified:
– Decoder name: this is a user-defined name that will be used to specifically recognize the defined decoder during LOG Storm Studio operation.
– Type: protocol type. Choose SPI.
– Click on 'Add' button.

A new window appears, prompting for the LOG Storm device's probes and settings used for the decoding.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock probe number</td>
<td>Defines the probe number on which the SPI clock (SCLK) signal is connected.</td>
</tr>
<tr>
<td>Clock sampling edge</td>
<td>Specifies on which edge of SCLK dat must sampled and decoded.</td>
</tr>
<tr>
<td>Serial line(s) probe number(s)</td>
<td>Specifies which probes should be decoded as serial data. Multiple lines can be decoded, in which case they are separated with commas.</td>
</tr>
<tr>
<td>Slave select probe number(s)</td>
<td>Defines the slave select line – if applicable. This enables the decoder to find the accesses boundaries. Multiple probes can be used, in which case they are separated with commas.</td>
</tr>
<tr>
<td>Slave select polarity</td>
<td>(Active when a slave select probe is specified). Defines the active level of the slave select line.</td>
</tr>
<tr>
<td>Define idle time</td>
<td>(Alternative to using slave select probe).</td>
</tr>
<tr>
<td>Define frame size</td>
<td>(Alternative to using slave select and/or idle time): defines the size of one frame on the data line. The serial data will be decoded in groups of this size.</td>
</tr>
</tbody>
</table>

Once defined, the decoder is applied by clicking the 'Apply' button.
List of decoded transfers during the selected run

Detailed transfer view: viewing single decoded transfer
Clicking on the “Open Waves” button allows viewing the capture and decoding:

View on the decoded capture:
### 4.3 Decoders controls

<table>
<thead>
<tr>
<th>Decoder Details</th>
<th>Decoder Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>History Item</td>
<td>120927_16h:08m:54s_0</td>
</tr>
<tr>
<td>Selected Decoder</td>
<td>MySPIDecoder</td>
</tr>
</tbody>
</table>

**Decoder Details**: provides details on the applied decoder and the data set used for decoding.

**Open Waves**: opens the waveform viewer.

**Edit Decoder**: allows changing the characteristics of the decoder.

**Export as CSV**: allows exporting the decoded data to a comma-separated value file.

**Refresh**: Forces refreshing the decoded data (e.g.: when the characteristics of a decoder have been updated).