



Hardware Details

Option Timestamp



Goals of this Presentation

- ◆ General information on timestamps
- ◆ Using timestamp option with the different card modes
- ◆ Details on the different timestamp modes
- ◆ Transferring timestamp data
- ◆ How to calculate the actual time from the stamps

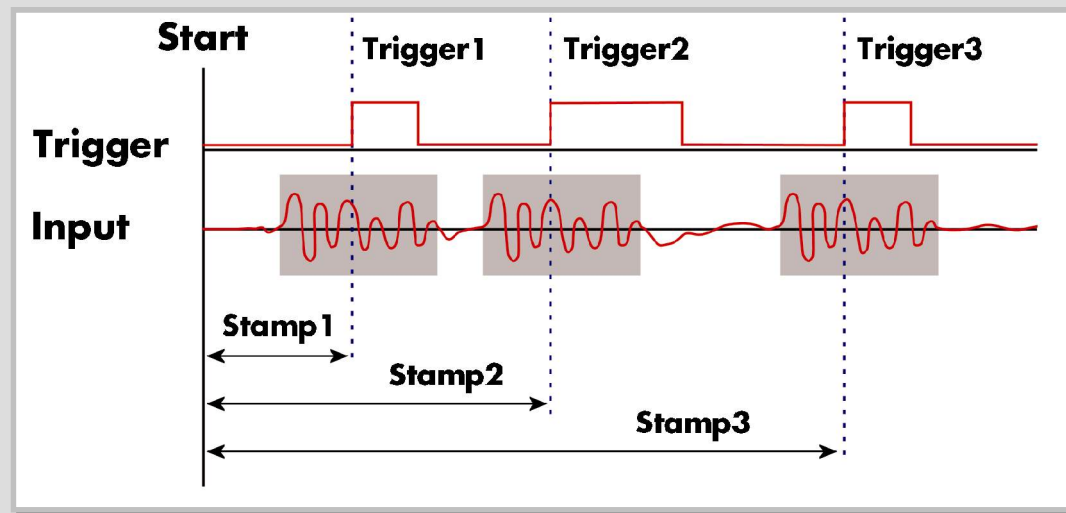


General Information on Timestamps

- ◆ Used to bring trigger events in relation with a certain point of time
- ◆ Realized in M2i and M3i as a 56 bit (occupying 64 bit) wide counter running with the current sampling rate
- ◆ Counter can have different reset conditions for relating the timestamps with certain events
- ◆ Can be used with all card modes (single recording, Multiple Recording and Gated Sampling)



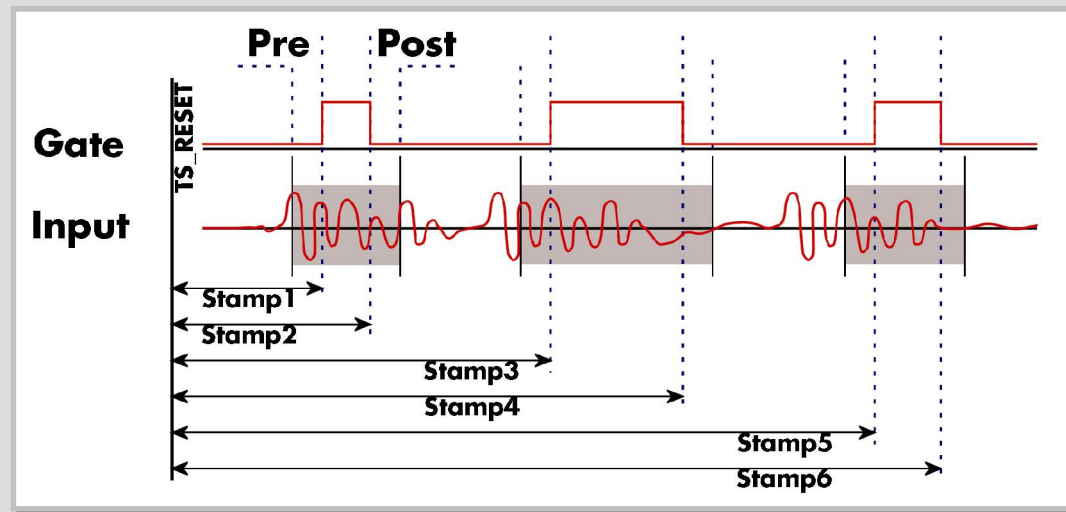
Timestamp with Multiple Recording



- ◆ Every trigger event stores one 64 bit value that contains a 56 Bit timestamp (leading zeros are added)
- ◆ Single mode can be seen as Multiple Recording with only one segment



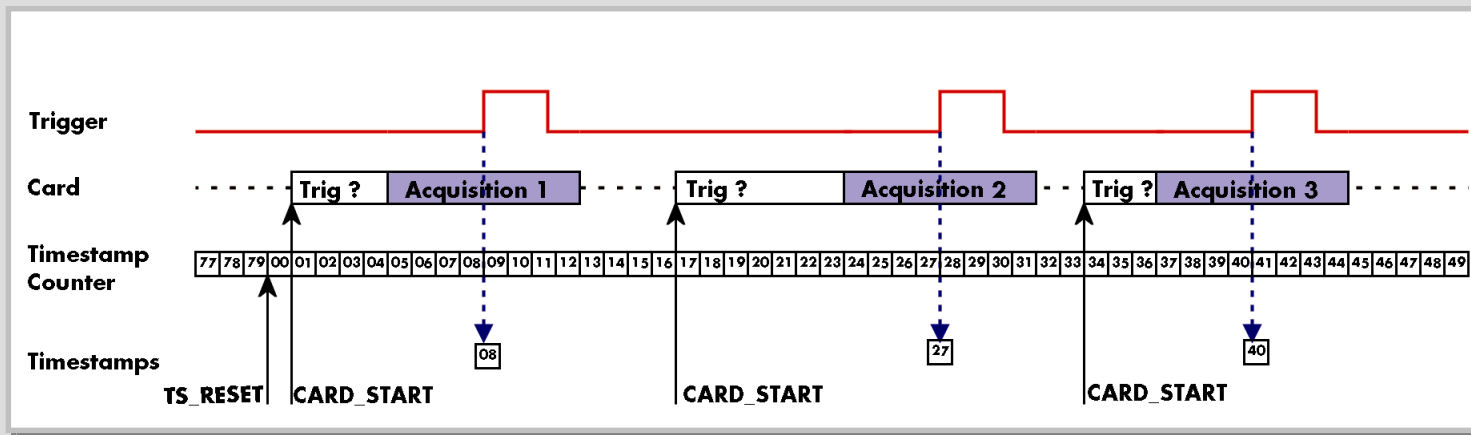
Timestamp with Gated Sampling (not M3i)



- ◆ Every gate stores two timestamps: One at its beginning and one at its end
- ◆ The stamps indicate the real gate signal; pre- and posttrigger samples need to be added or subtracted



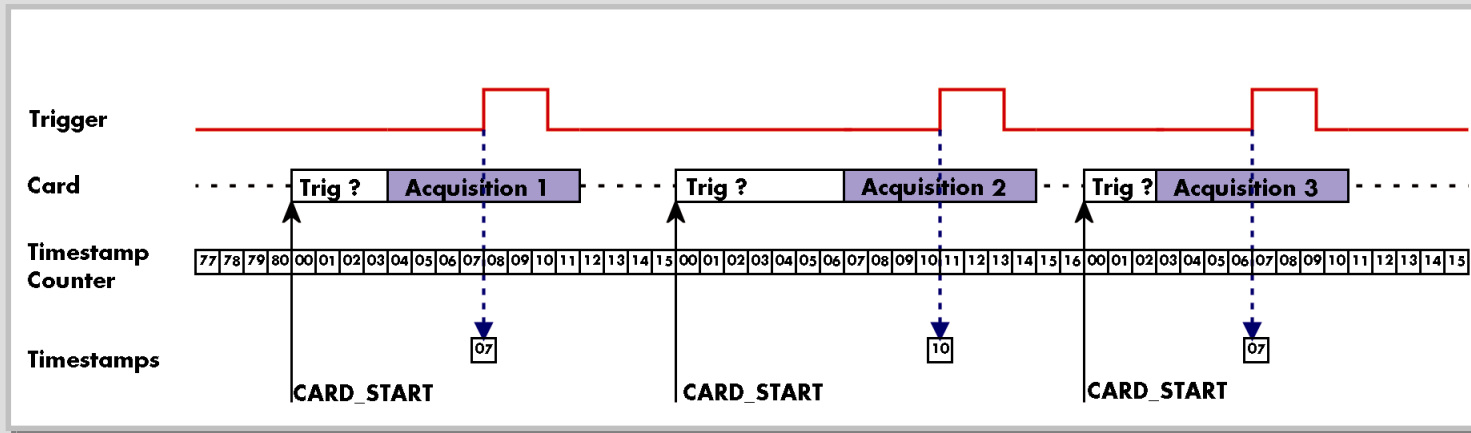
Standard Mode



- ◆ The counter is running as one 56 bit counter
- ◆ Counter is reset with the TS_RESET software command
- ◆ All stamps are relative to this timestamp reset



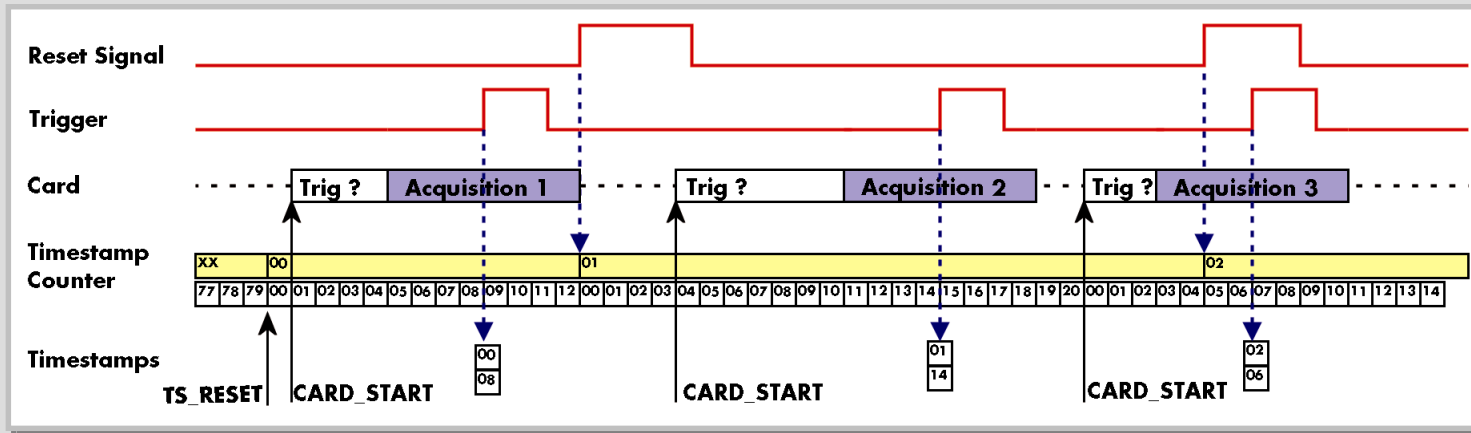
StartReset mode



- ◆ The counter is running as one 56 bit counter
- ◆ Counter is reset with every start of the card
- ◆ All stamps are relative to the start of the recording



RefClock Mode (needs BaseXIO option)



- ◆ Counter is split into 24 bit high and 32 bit low part
- ◆ An external RefClock signal, connected to a BaseXIO line, resets the low part and counts the high part
- ◆ Low part is running with sampling rate and stamps the position within the current high part



Calculating Time from the Stamps

$$t = \frac{\text{Timestamp}}{\text{Sample rate}}$$

$$\Delta t = \frac{\text{Timestamp}_{n+1} - \text{Timestamp}_n}{\text{Sample rate}}$$

- ◆ The time can be calculated relative to the counter reset by one of the above formulas
- ◆ In interlace mode (card types 30x5, 30x6 and 203x) the timestamp counter runs with 1/2 the sampling rate



Oversampling Factor and Timestamps

$$t = \frac{\text{Timestamp}}{\text{Sampling rate} * \text{Oversampling}} \quad \Delta t = \frac{\text{Timestamp}_{n+1} - \text{Timestamp}_n}{\text{Sampling rate} * \text{Oversampling}}$$

- ◆ If sampling rate is below the minimum A/D converter clock the M2i cards run in oversampling mode
- ◆ Oversampling does not apply to M3i cards
- ◆ The oversampling factor when it applies, can be read out from the driver and must be regarded within the calculations