

Triggered Scan Mode of KPCI3100 Driver

Preface

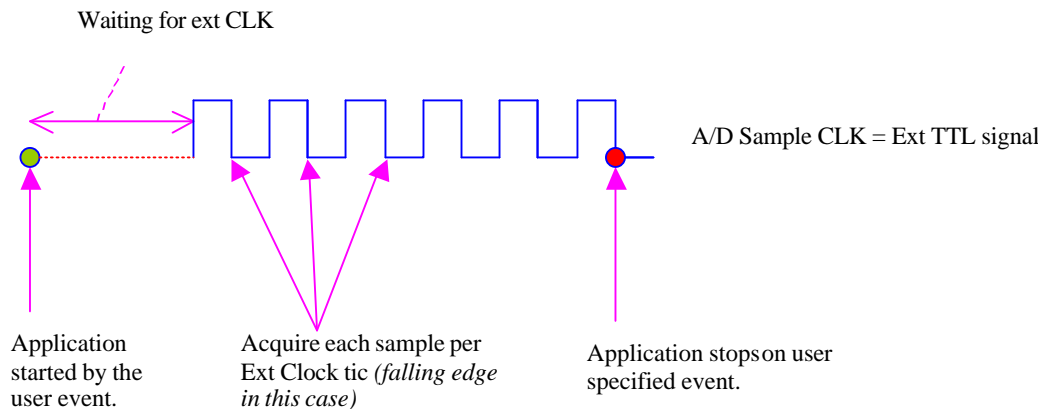
This note is intended to clarify use of external clocks and how to make use of the triggered scan mode of the boards covered by the KPCI3100 series driver: KPCI-3101/2/3/4 or KPCI-3116 or KPCI-3110.

Note: The example Visual Basic 6.0 code provided here is written for KPCI-3110. If you are using a different board please reference the corresponding DriverLINX manual, as some service request parameters may be different.

External Clocks

There are two scenarios to consider: Suppose the application requires one sample in response to an external pulse train. In this case, a straightforward use of external clock is called for. In a second situation, suppose the application requires multiple samples in response to each external pulse. In this case, an externally clocked burst mode type of acquisition should be used.

One Sample per External Pulse: Use this when you want the A/D to acquire one sample for each external clock pulse. Selection of rising or falling edge of the external clock is supported by some hardware. However, boards covered by the KPCI3100 driver uses only the falling edge of the external clock.



External Rate Clock

Below is some VB code for setting up a task that will acquire one data point for each external clock pulse. A total of 128 samples will be acquired (two buffers of 64 samples) from 4 channels at an estimated rate of 200 Hz. When both buffers have been filled, the task will stop automatically (TCEVENT). The external signal should be connected to the external clock input of the KPCI-3100 Series board.

This code snippet assumes the driver has already been loaded and the hardware initialized. It does not show processing of the data in the BufferFilled event. See the DriverLINX Tutorial Manual (web site document center) for a more complete coding discussion in both VC++ and VB, or check the download center of the web site for available example programs.

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VB Example for External Rate Clock Acquisition (Written for KPCI-3110)

```

With SR_AI
.Req_subsystem = DL_AI
.Req_mode = DL_DMA
.Req_op = DL_START
.Evt_Str_type = DL_COMMAND
.Evt_Stp_type = DL_TCEVENT
.Evt_Tim_type = DL_RATEEVENT
.Evt_Tim_rateMode = DL_RATEGEN      'choose the rate clock
.Evt_Tim_rateChannel = DL_DEFAULTTIMER

.Evt_Tim_rateClock = DL_EXTERNAL
'You need to connect your external CLK source to External A/D Clock line(Pin 76 of STP-3110)
'When you click start, the board will wait for the falling edge of external CLK Signal.

.Evt_Tim_ratePeriod = .DLSecs2Tics(DL_DEFAULTTIMER, 1 / 200)
' This value is NOT actually used. However, DriverLINX requires a valid hardware value in case the
'application requests a timebase operation and to optimize data transfer between the
'driver and the application.

.Evt_Tim_rateGate = DL_DISABLED
.Sel_chan_format = DL_tNATIVE
.Sel_chan_N = 2      ' There will be start and stop channel
.Sel_chan_start = 0  'start scanning ch 0
.Sel_chan_startGainCode = .DLGain2Code(-1) '-1 means bipolar input, unity gain
.Sel_chan_stop = 3   'stop at channel 3
.Sel_chan_stopGainCode = .DLGain2Code(-1)
.Sel_buf_N = 2      '# of buffers
.Sel_buf_samples = 64  '# of samples per buffer
.Sel_buf_notify = DL_NOTIFY ' send buffer filled messages
.Res_Sta_typeStatus = DL_IOSTATUS
.Refresh
End With

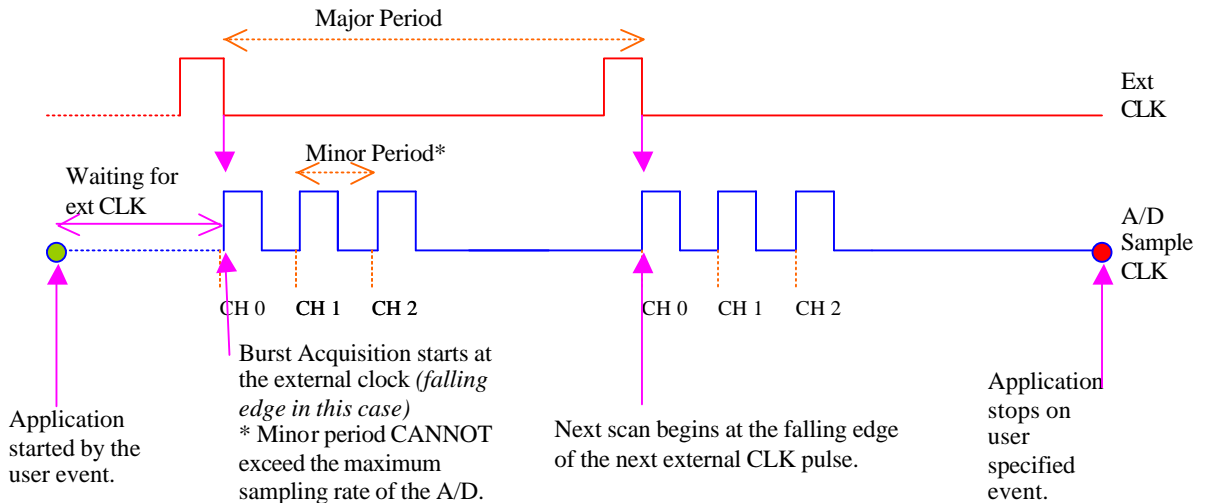
```

Note:

- The KPCI-3101/2/3/4 boards transfer data in no fewer than 16 samples. The KPCI-3110 and KPCI-3116 transfer data in no fewer than 32 samples. Therefore, the external clocking source should not suddenly stop at less than a multiple of the transfer size else data will be stranded in the board's FIFO.
- Even though the external clock controls the sample rate, DriverLINX requires an estimated rate (see the code snippet).

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Multiple Samples per External Pulse: Use this when you want to synchronize scanning through several channels (or multiple samples from a single channel) with a recurring external pulse. For example, you can use External Burst Clock when you want to scan channel 0,1 & 2 every time there is an external TTL pulse.

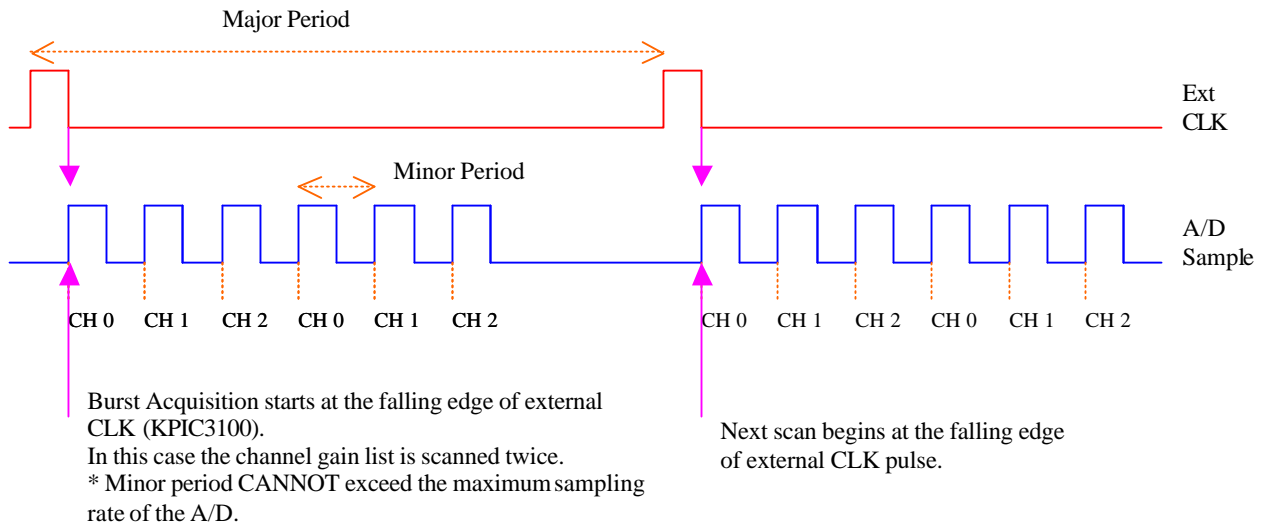


External Burst Clock

In the above diagram, major period of the burst is provided by the external clock tic, and the on-board clock at a specified rate provides the minor period (faster burst clock). KPCI-3100 series boards have an additional feature when using this external burst clock that allow it to repeat the scan up to 256 times. This is the triggered scan mode.

However, as with all burst mode acquisitions, the burst mode scan must be completed before the next external clock tic occurs.

Example: the following example (written for KPCI-3110/16) shows scanning the selected channels (channel 0 to 2) twice, in VB6.0. **When using external clock burst mode, the external signal is connected to the digital trigger not the external clock.**



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VB example for **External Burst Clock** with 2 scans through the channels. *(Written for KPCI-3110)*

```

With SR_AI
.Req_subsystem = DL_AI
.Req_mode = DL_DMA
.Req_op = DL_START
.Evt_Str_type = DL_COMMAND
.Evt_Stp_type = DL_TCEVENT 'stop when all buffers have been filled
.Evt_Tim_type = DL_RATEEVENT
.Evt_Tim_rateMode = DL_BURSTGEN 'choose the burst clock
.Evt_Tim_rateChannel = DL_DEFAULTTIMER

.Evt_Tim_rateClock = DL_EXTERNAL
'You need to connect your external signal to AD TTL Trigger line (Pin 77 of STP-3110), not the 'external
Clock line. Hardware will only work on the falling edge of the external signal.

.Evt_Tim_ratePeriod = .DLSecs2Tics(DL_DEFAULTTIMER, 1/200)
' This value is NOT actually used. However, DriverLINX requires a valid hardware value in case the
'application requests a timebase operation and to optimize data transfer between the
'driver and the application.

.Evt_Tim_ratePulses = 6 ' Total six burst tics, i.e. 2 scans for the 3 channels.
.Evt_Tim_rateOnCount = .DLSecs2Tics(DL_DEFAULTTIMER, 1 / 100000)
'Note that the minor period cannot exceed the maximum sampling rate of the A/D.

.Evt_Tim_rateGate = DL_DISABLED
.Sel_chan_format = DL_tNATIVE
.Sel_chan_N = 2 ' There will be start and stop channel
.Sel_chan_start = 0 ' start at channel 0
.Sel_chan_startGainCode = .DLGain2Code(-1) ' with bipolar gain of 1
.Sel_chan_stop = 2 ' stop at channel 2; total of 3 channels used
.Sel_chan_stopGainCode = .DLGain2Code(-1) ' with bipolar gain of 1
.Sel_buf_N = 3 ' 3 buffers
.Sel_buf_samples = 12 ' samples per buffer, two external pulses required for 12 samples
.Sel_buf_notify = DL_NOTIFY
.Res_Sta_typeStatus = DL_IOSTATUS
.Refresh
End With

```

Conclusion

Use of external clock (burst mode or not) is an important technique when trying to synchronize acquisition from one or more channels with an external pulse. When the pulse will repeat at a fast rate, use of external clock (burst mode) is a more robust implementation than use of a digital trigger to start the acquisition.

By making the number of pulses a multiple of the number of channels in the scan, the Triggered Scan Mode of the KPCI-3100 Series can be accessed.