Time to Digital Converter - TDC2 by S-Fifteen Instruments

1   Features

- 4 independent inputs
- $< 8\,\mathrm{ps}$ timing resolution
- $< 80\,\mathrm{ps}$ timing jitter
- $2\,\mathrm{MHz}$ maximum count rate
- 50ns timing between detectable events
- Small form factor

Applications: Ultra-sensitive fluorescence measurements, Environmental analysis, Biomedical devices, Quantum key distribution

2   General Description

The TDC2 is a timestamping/timetagging device for processing electrical pulses in four independent inputs. It can accept standardized signal standards including (NIM and TTL) and requires an external $+12\mathrm{V}$ power input . The internal clock source can be disciplined by an external 10 MHz timing reference for precise absolute timing.

The device registers the absolute time of the leading edge every signal event (pulse) at any of the input lines with a resolution of 8ps (30ps jitter) for pulses separated by more than 50ns.

The TDC2 requires a driver which is available for Linux OS for now.

3 Specifications

Table 1: Device Specifications

Signal Inputs	
Impedance	50 Ohm
Input standards	TTL, NIM, custom (positive or negative pulses with a trigger level between -1V and +2V)
Minimal pulse width	10 ns
Minimal pulse separation	50 ns (30ps jitter), 10 ns (> 30ps jitter)
Connector	LEMO00 or SMA
Clock Reference	
External reference frequency	10 MHz nominal (accepts 9...11 MHz)
External reference amplitude	100 mVpp min, 2.3 Vpp max
Clock selection	automatic
Internal clock accuracy	< 100 ppm, temperature drift TBD
Timestamp Mode Parameters	
Timing resolution	< 8 ps
Timing jitter	< 80 ps (nominal)
Maximal counting rate	> 2 Mevents/s average
Time between detectable events	50ns (events < 50ns interval will have jitter up to minimum of 10ns interval)
Interface	
Host connection	Requires minimum Linux Kernel 4.4. Driver will be provided
Data format	Text or binary
Physical Parameters	
Size (W x L x H)	70 mm x 124 mm x 21 mm
Weight	300 g
Power consumption	7 W
Power Socket	+12V (accepts 2.1mm barrel plugs)

4 Software Control Commands

4.1 Python Library for S-Fifteen Instruments

Device driver for Linux will be provided. A python class encapsulating all serial commands can be found on https://github.com/s-fifteen-instruments/pyS15. To install the library follow the instructions on GitHub.

Here a code example to count events for 1 second, and return the output from all four channels:

```python
from S15lib.instruments import TimestampTDC2
counter = TimestampTDC2('/dev/ioboards/usbtmst0','~/programs/usbtst4/apps/readevents7')
[counts_ch1,counts_ch2,counts_ch3,counts_ch4] = counter.get_counts(1)
```

Note that the exact device path depends on the serial number of the device.