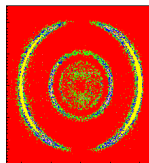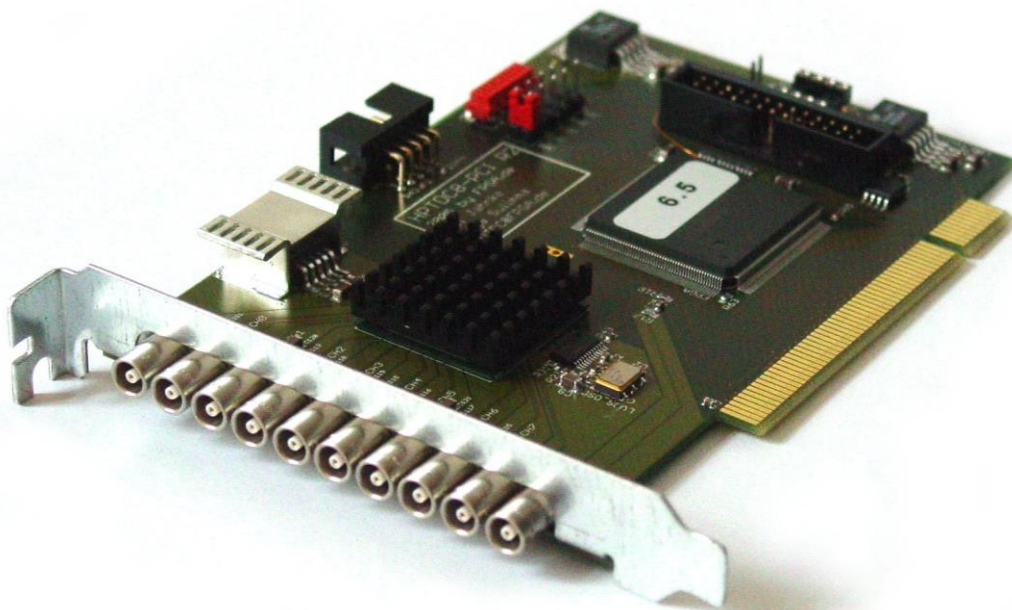# The TDC8HP(i) multi-hit Time-to-Digital Converter

RoentDek
Handels GmbH

Supersonic Gas Jets
Detection Techniques
Data Acquisition Systems
Multifragment Imaging Systems

The **TDC8HP** is the latest version of the well-established TDC8-series (www.roentdek.com). It is similar in function but has superior performance characteristics:

- 8 channels with high time resolution < 35 ps RMS with 25 ps LSB
- unlimited number of hits per channel
- range between -209 μs to +209 μs or unlimited in "wrap around" mode
- throughput up to 2.000.000 particles/s [1]
- double hit dead-time < 10 ns [2]
- 10 additional low resolution TDC channels (12.8 ns bin size) that can also be used to record the high/low states of control levels.
- supports Windows 7 to Windows 10 (32bit and 64bit)
- supports LabView

The **TDC8HP** has 8 high-resolution multi-hit inputs for NIM signals and one low-resolution input[*]. A 10th input channel is reserved for an external clock signal to synchronize up to three **TDC8HP** cards.
The TDC8HP can be seamlessly synchronized with the **RoentDek** fADC4 digitizers.

Notes:
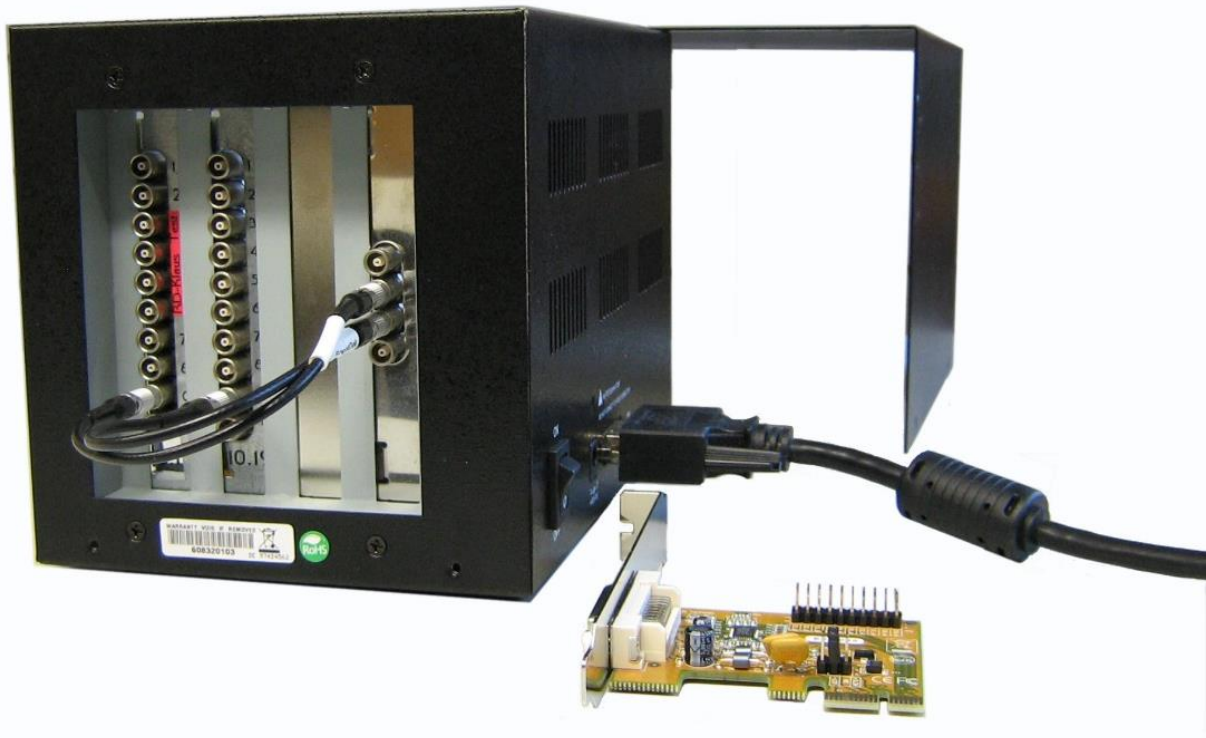[1] this is an upper limit, which depends on the computer hardware and data acquisition mode.

[2] the dead-time between two hits may be as low as 5 ns, but once more than four hits are registered, every 100 ns only four additional hits can be collected (with 100 ps time precision).

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[*] The bin-size of the low-res channels is with 12.8 ns. 10 additional low-resolution channel can be addressed.

TDC8HPi

The product combination of **TDC8HP** and the **RoentDek PCI2PCIe** is defined as **TDC8HPi.**

The **PCI2PCIe** crate allows operation of up to three **TDC8HP** cards via PCIe bus. The package contains a plug-in card to a desktop PC's PCIe bus or to an equivalent input port of a Laptop/Notebook computer.

PCI2PCIe crate, here with two TDC8HP boards and clock card inserted for synchronization. A PCIe adapter card and cable connection is shown on the lower right side. Not shown is the mains adapter (12V, 3A) with cable.

Using the **PCI2PCIe** crate does not require any other software or driver beyond the standard **TDC8HP** program package when operated via the internal PCI bus of a desktop PC.

Since a PCI bus is not a standard on modern PC any more or has slow chipsets, **RoentDek** provides the **PCI2PCIe** crate standardly with newly purchased **TDC8HP**.
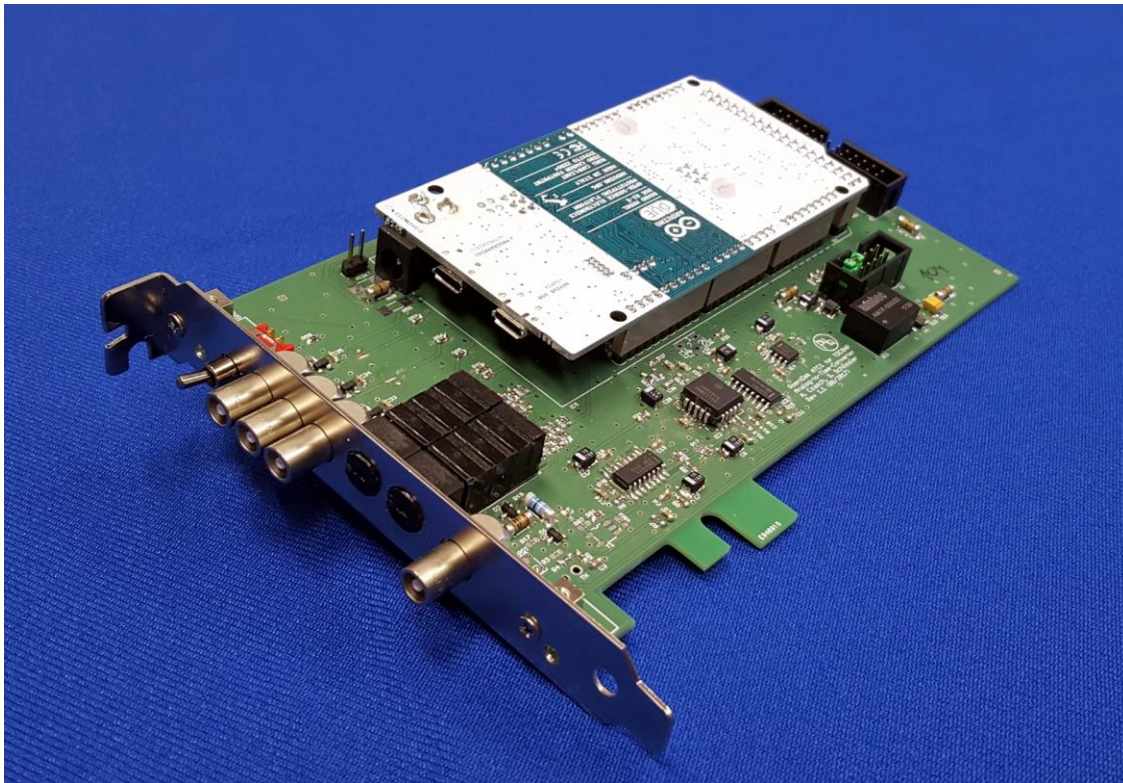
The size of the **PCI2PCIe** box is 140[*] x 150 x 205 mm³.
The PCI-crate is not compatible with PCs from HP.

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[*] not taking into account the sideway cable connection

Accessories:

The **TDC8HP** has 10 additional low resolution channel accessible on the board. They can be used as additional low-resolution TDC channels with a precision of 12.8 ns. **RoentDek** can supply a flat ribbon cable for the input (far end open for custom confection).

The **RoentDek** **ATC1** is a "slow" 3-channel ADC board which is read out through connection with the **TDC8HP.** At least one channel (#1) can operate at up to 100 kHz, its read-out triggered by a NIM signal and at least one channel (#3) is read out independently every second. Channel #2 can be selected to operate either like channel #1 or channel #3. The minimum width of the analog signal must be 3.3 µs. For the triggered channel(s) the delay between conversion moment and trigger signal can be varied by several microseconds, backward and forward in time.

For details please refer to the **ATC1** manual.

The analog sampling data can be correlated time-tagged to TDC timing data.

Examples of applications:
- measurement of the laser intensity shot by shot.
- measurement of the synchrotron ring current or of an ion gauge.