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Agilent U1051A

Acqiris TC890 Time-to-Digital Converter

6 ch, 50 ps resolution

Agilent Technologies





Main Features

- 6-channel multistop time-to-digital converter (TDC) with multistart acquisition mode
- 50 ps timing resolution
- Ideal for measurement in time-of-flight applications including mass spectrometry and LIDAR and for various pulse-timing measurements
- Large internal memory buffer, with up to 4 million events
- Low jitter (< 3 ps rms) stable (±2 ppm) internal clock source
- External 10 MHz reference input
- FPGA-based data processing unit
- Fast DMA readout mode for increased data throughput
- Data streaming mode allows continuous acquisition and readout
- Built-in self test and status monitoring
- Low power consumption (< 25 W)

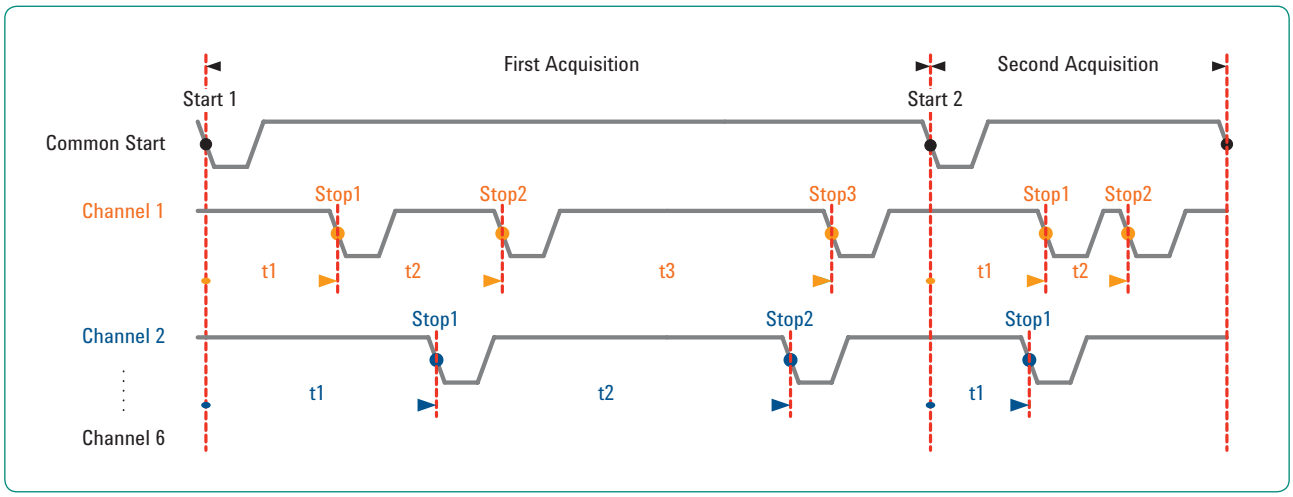


Figure 1. Multiacquisition, 6 channels, common start, multistop

Exceptional Performance for Precise Timing-Measurement Applications

The Agilent Acqiris U1051A (TC890) features six independent stopwatches for precise timing measurements from a common start event to multiple stop events at a high resolution.

The U1051A is ideal for time measurement applications including LIDAR for 3D mapping and navigation, fluorescence lifetime spectrometry and ion counting in time-of-flight mass spectrometry (TOFMS). Many pulse timing measurements, such as period, frequency and time interval analysis (TIA), also benefit from the new TDC's precise measurement technology.

The U1051A CompactPCI module records multiple events or hits on each of its six input channels, with a timing resolution of 50 ps and a mean dead time between sequential pulses on the same input (double pulse resolution) of less than 15 ns. Running at full speed, the U1051A offers a massive 25 million events-per-second data-throughput rate. The U1051A enables event counting or histogram creation for easy data and spectra comparison.

Six of the seven identical input channels are independent stop inputs and the seventh is the common start. The module operates in a multistart, multistop acquisition mode with the timing information of stop events on all independent channels encoded relative to the most recent start event on the common channel.

In standard mode, the recording range is up to 10 ms. If one channel can be dedicated to a fiducial signal, the 10 ms recording time can be extended to a much wider range. The large internal buffer allows the recording of up to four million stop-events per module.

On-Board Timing Calculation with Fast Data Readout

The timing information of the start and hit events on all channel inputs is obtained by combining a coarse-grain (5 ns) wide-range (21 bit) real-time counter with a much finer-grained interpolated result coming from the analysis of a ramp signal started by the event.

Each channel consists of a programmable comparator, an XOR gate used to select the active slope, a stable signal generator, and an analog-to-digital converter (ADC). Once digitized, the data are fed to a Xilinx Virtex-2 Pro FPGA-based data processing unit for processing, storage, and readout.
Data readout is achieved with a fast direct memory access (DMA) mode at up to 100 MB/s.

Each channel is processed to determine the time of each detected event, start and stop. The final relative time value is obtained by subtracting the start time from each stop time.
An additional auxiliary input for a common veto signal can be used to enable/disable all start and stop detection, as desired.



Self Calibration

To achieve the desired precision on all of the input channels, the U1051A time-to-digital converter has a powerful self calibration routine.

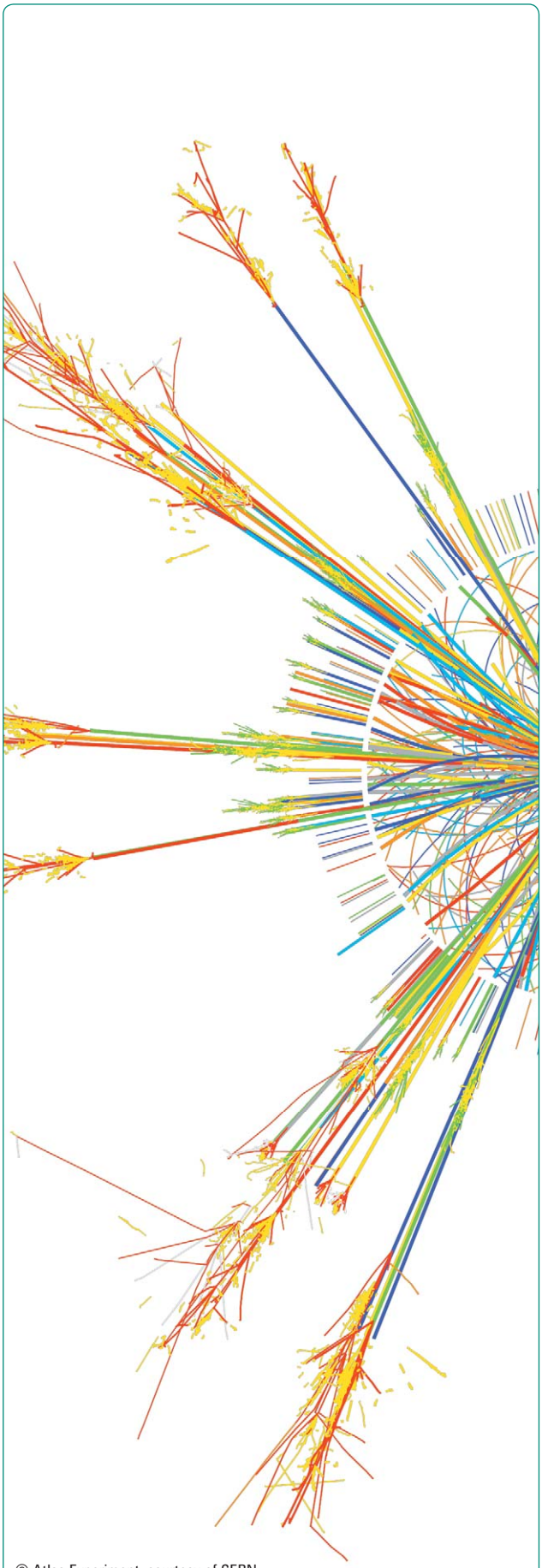
This self calibration is done simply through a software command available in the driver, so no extra programming is needed.

Easy Integration

Agilent Acqiris Time-to-Digital converters are supplied with software drivers for Windows® and application code examples for MATLAB®, C/C++ and LabVIEW.

These code examples provide card set up and basic acquisition functionality, and are easily modified, so that the card can quickly be integrated into a measurement system.

The flexibility of the driver means that, with minimum software adjustments, any Acqiris TDC can be swapped out, replaced, and upgraded over time, with the latest high-resolution Acqiris Time-to-Digital converter.



© Atlas Experiment, courtesy of CERN

High-Resolution Multistop Time-to-Digital Converter

Model TC890, 6 channel, 50 ps resolution

Signal input

Connectors
50 Ω K-lock
Lemo 00.250
QLA 00
NIM/CAMAC Standard CD/N549
50 Ω K-Lock (LEMO) type

Impedance
50 Ω ±1%

Threshold
Programmable from -1.5 V to +1.5 V, in 0.732 mV steps (12-bit)

Sensitivity
100 mV over threshold for 350 ps (minimum pulse to trigger)
Hysteresis 15 mV

Channels
One common start
Six inputs stop

Protection
Clamping diodes at ±2.5 V, 0.5 W max into 50 Ω

Propagation delay skew
Δtpd = 15 ps for 10 mV to 100 mV,
Δtpd = 40 ps for 100 mV to 2 V

VSWR (typ.)
< 1.5 from DC to 1 GHz

VETO IN
50 Ω input with programmable threshold

REF IN
50 Ω input for external high-precision 10 MHz source
0 to 3 V pkpk
Threshold at 1.5 V

Time resolution and range

Time resolution
50 ps

Time range
Up to 10.48 ms in standard operation. Can be extended to a much wider range.

Double pulse resolution
< 15 ns

Integral nonlinearity
±50 ps

Differential nonlinearity
±30 ps

Post-start dead time
10 ns

Clock accuracy
Better than ±2 ppm

Clock jitter
< 3 ps rms

Internal reference frequency
10 MHz

Acquisition and readout

Acquisition modes
Multistart - Multistop

DMA
100 MB/s

General

Host computer and operating system:
PC compatible (x86) systems running Microsoft Windows Vista, Windows XP, Windows 2003 Server, Windows 2000 or National Instruments LabVIEW RT.

For more information on which specific processors and operating system versions are supported, please contact us.

Transfer speed:
High-speed PCI bus transfers data at sustained rates to host computer:
Up to 100 Mbytes/s for 32-bit/33 MHz operation

Power consumption (typical)
< 25 W

Current requirements (typical)
12 V 0.10 A
5 V 4.1 A
3.3 V 0.80 A
-12 V 0.05 A

Warranty
1 year

Environmental and physical

Operating temperature
0 ° to 40 °C

Required airflow
> 2 m/s in situ

Relative humidity
5 to 95% (non-condensing)

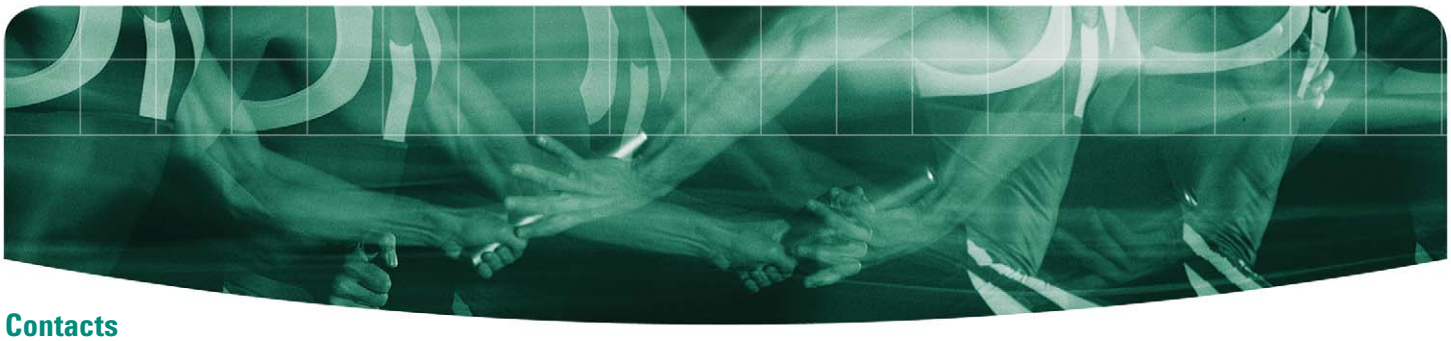
Safety
Complies with EN61010-1

EMC immunity
Complies with EN61326-1
Industrial Environment (TBC)

EMC emissions
Complies with EN61326-1 Class A for radiated emissions (TBC)

Dimensions
6U CompactPCI standard (PXI compliant)
233 mm x 160 mm x 20 mm

Front panel complies with IEEE1101.10
CE Certification and Compliance



Contacts

Acqiris Product Information

USA	**(800) 829-4444**
Asia-Pacific	**61 3 9210 2890**
Europe	**41 (22) 884 32 90**

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Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	01805 24 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201

Other European Countries:
www.agilent.com/find/contactus
Revised: March 27, 2008

For more information on the Acqiris product line, sales or services, see our website at:
www.agilent.com/find/acqiris

Ordering Information

Model	Description
U1051A	Six-channel high-resolution multistart, multistop cPCI time-to-digital converter, Acqiris TC890
U1051A-UK6	Calibration certificate

Acessories

U1092A-CB7	BNC to Lemo, 1m cable
U1092A-CB8	BNC to Lemo, 2m cable
U1092A-CB9	Lemo to BNC adapter

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