

Integrated Time/Frequency Counter ITC-200

High Performance Instrument on a Single Chip

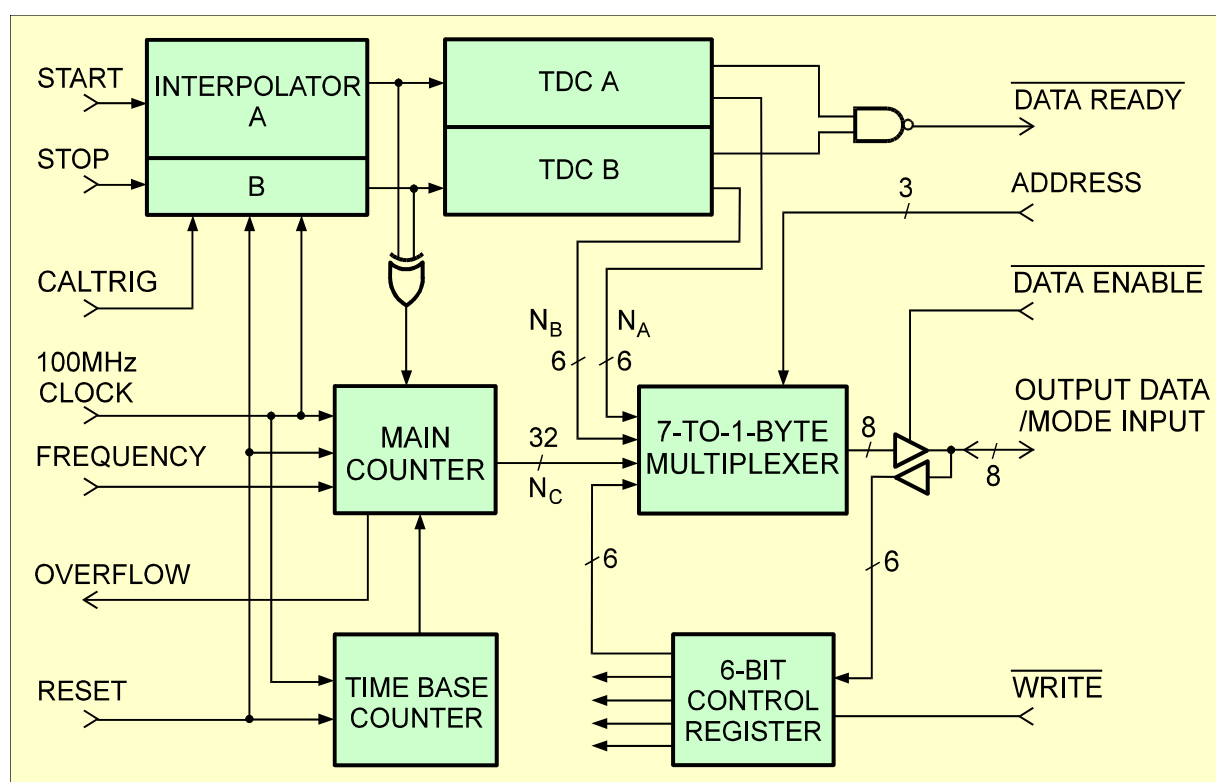
Features

- ◆ Complete Interpolation Time Counter on a Single-Chip
- ◆ Time Interval Measurement Range: 0 – 43 seconds
- ◆ *200 ps Resolution in Single-Shot Time-Interval Measurements (without averaging)*
- ◆ 1 ps Resolution with Averaging
- ◆ Maximum Random Error less than 150 ps (after nonlinearity correction)
- ◆ Dead Time less than 300 ns
- ◆ External Gating of Input Pulses
- ◆ Frequency Measurement Range up to 150 MHz
- ◆ Supply Voltage: +5 V
- ◆ Low Power: 390 mW max (at 5 V supply voltage and 100 MHz clock)

- ◆ 0.65 μm CMOS FPGA Technology (pASIC1[®], QuickLogic[®])
- ◆ 84-pin PLCC Package
- ◆ Low Cost
- ◆ Easy to Use

Applications

- ◆ Industrial and Research Laboratories
- ◆ Precision Time Interval Measurements in Laser Ranging Systems and Physics Research
- ◆ Navigation and Geodesy
- ◆ Robotic Systems
- ◆ ATE Systems
- ◆ Process Control

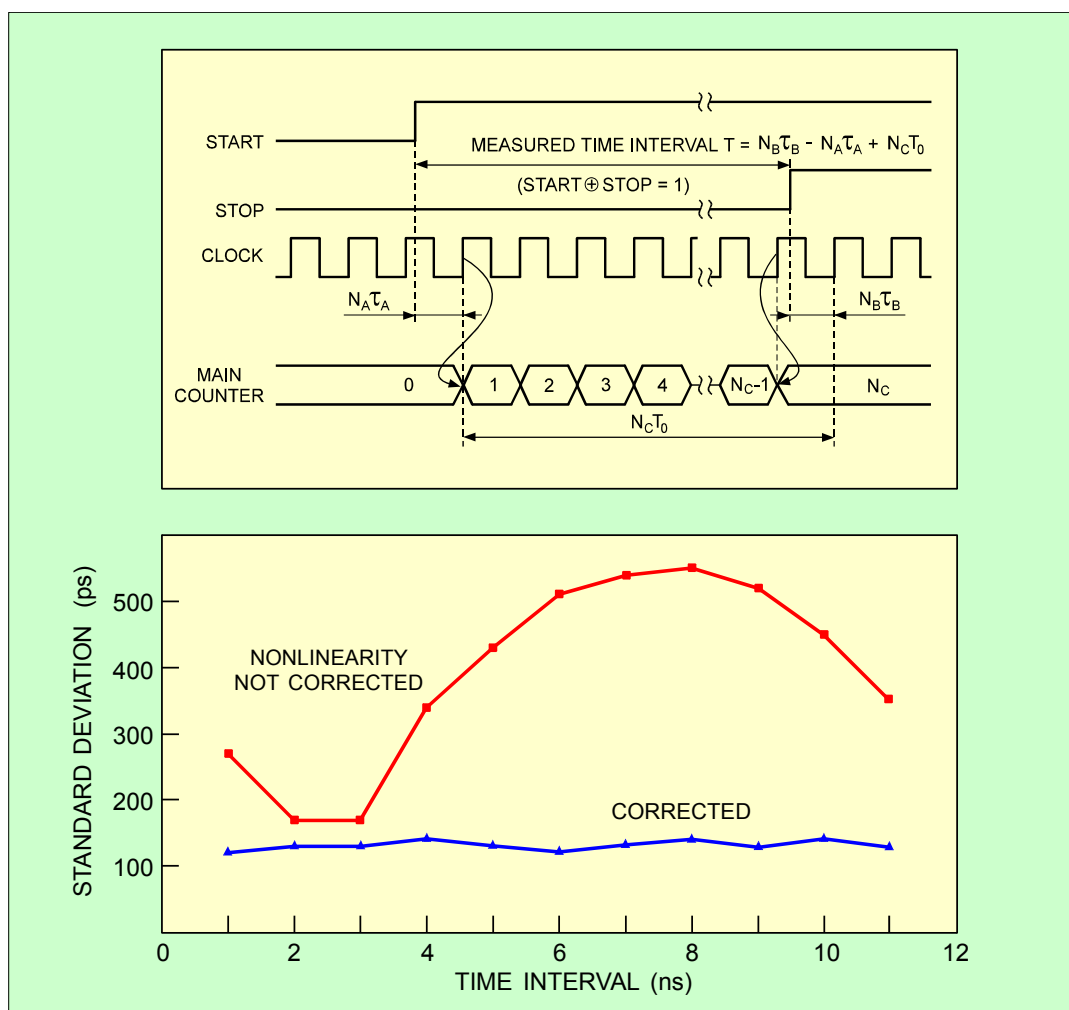


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The ITC-200 is a complete, fully-integrated, interpolation time counter featuring high resolution and precision as well as wide measurement range, what so far was possible to obtain only in advanced desktop instruments. The ITC-200 contains two precision Time-to-Digital Converters (TDC) with vernier digital delay lines and the 32-bit real-time counter (Main Counter) driven by the 100 MHz base clock. The Time Base Counter is used for frequency measurements. The counter ITC-200 is implemented on a Field Programmable Gate Array (FPGA) device manufactured in 0.65 μm 2-layer metal CMOS technology (QuickLogic[®], USA). Thanks to the low power consumption and low weight the counter can also be used in mobile applications. The relatively low cost of the counter allows to use it even in small volume applications. The counter chips are supplied with nonlinearity correction data (on the diskette) to be used in final application. *The ITC-200 was awarded with Gold Medal with Distinction at the 46th World Exhibition of Innovation, Research and New Technology, EUREKA'97 in Brussels, Belgium.*



Upper figure: Interpolation method for precise measurement of time intervals, used in ITC-200.

Lower figure: Standard uncertainty of the counter obtained with and without correction of TDC's nonlinearity for different time intervals measured within one clock period (that behaviour is repetitive also for longer time intervals).

Publications (reprints available on request):

1. J. Kalisz, R. Szplet, R. Pelka, and A. Poniecki, „Single-chip interpolating time counter with 200-ps resolution and 43-s range”, *Proc. IEEE I&MT Conference*, Brussels, June 1996
2. J. Kalisz, R. Szplet, J. Pasierbiński, and A. Poniecki, „Field-Programmable-Gate-Array-Based Time-to-Digital Converter with 200-ps Resolution”, *IEEE Trans. Instrum. Meas.*, vol. 46, pp. 51-55, February 1997
3. J. Kalisz, R. Szplet, R. Pelka, and A. Poniecki, „Single-chip interpolating time counter with 200-ps resolution and 43-s range”, *IEEE Trans. Instrum. Meas.*, vol. 46, pp. 851-856, August 1997
4. J. Kalisz, R. Szplet, R. Pelka, and A. Poniecki, „Single-chip low-cost time counter for distance measurement with 3 cm resolution”, *J. Opt.*, vol. 29, pp. 199-205, 1998