# GC2200 SERIES

TIME INTERVAL COUNTER CARD

- 14 measurement functions
- DC to 225 MHz (GC2210), DC to 1.3 GHz (GC2220), DC to 2.0 GHz (GC2230)
- 100 ps resolution without averaging (GC2220 and GC2230 only)
- Fast measurement mode: 2300 readings / sec
- External reference clock & arming signal inputs
- Gate signal output
- Self-calibration feature ensures highest accuracy
- Software selectable input impedence (1M ohm or 50 ohm) and coupling (AC or DC) for each input channel
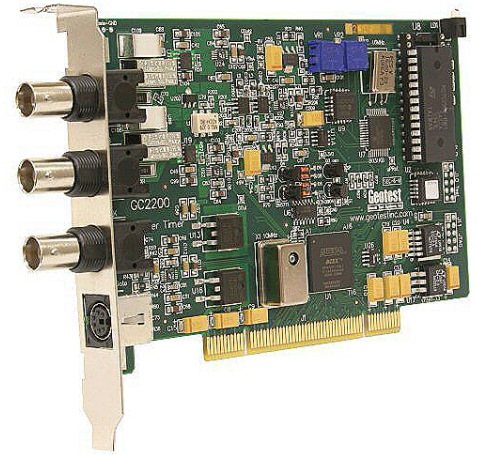
DESCRIPTION

The GC22x0 family of PCI universal time interval counters offer many of the measurement and timing functions of high-end stand-alone frequency counters, including accumulate, auto ratio, frequency, fast frequency (GC2220 and GC2230 only), period, ratio, single period, test clock, time interval, time interval delay, totalize, totalize gated, totalize gated once, and pulse width.

There are three models available: the GC2210, GC2220 and GC2230. The GC2210 frequency range operates to 225 MHz, the GC2220 covers frequencies up to 1.3 GHz, and the GC2230 covers frequencies up to 2.0 GHz.

FEATURES

The GC22x0 series counters have two signal input channels via BNC connectors, an external timebase input, arm input, and a gate signal output. The separate input signals can be used for arming and gating the circuitry, and controlling the timing of the analysis (start / stop duration) for maximum measurement flexibility.

The GC22x0 series counters use an on-board microprocessor with embedded firmware to off-load processing tasks from the main CPU. The counters use high-density, low-power field programmable gate arrays (FPGA) to perform complex logic tasks. Reciprocal counting techniques are used to achieve high resolution measurements on lower frequency signals without sacrificing measurement time. These techniques provide a fixed number of digits of resolution for all frequencies rather than a fixed resolution in Hz for the same gate time.

The GC2220 and GC2230 can measure frequencies to 0.1 parts per million (seven digits) in just 1 ms and resolve each time measurement to 100 ps. This ability to precisely resolve frequency and time allows for increased accuracy as well as reduced measurement time. When combined with 2,300 measurements / sec, one of the fastest rates available, more data can be acquired in a single second than a typical GPIB counter can acquire in one minute.

Additionally, the counters include an on-board 10 MHz TCXO for internal frequency reference. An external 10 MHz input is also available for use with external timebases.

SOFTWARE

The board is supplied with the GXCNT software, a software package that includes a virtual instrument panel, and a Windows 32/64-bit DLL driver library and documentation. The virtual panel can be used to interactively program and control the instrument from a window that displays the instrument's current settings and status. In addition, interface files are provided to support access to programming tools and languages such as ATEasy, LabView, LabView/Real-Time, C/C++, Microsoft Visual Basic®, Delphi, and Pascal. An On-Line help file and PDF User's Guide provides documentation that includes instructions for installing, using and programming the board.

A separate software package - GtLinux - provides support for Linux 32/64 operating systems.

APPLICATIONS

- ATE Systems
- Event timing measurements
- Frequency measurements
- Time interval measurements
- Metrology

MEASUREMENT

GC2200 SERIES

SPECIFICATIONS

INPUT CHARACTERISTICS

Impedance	Below 225 MHz: 1 MΩ or 50 Ω channel independent and software selectable 225 MHz and above: 50 Ω
Coupling	DC or AC channel independent and software selectable
Trigger	Positive or Negative channel independent and software programmable, automatic level or hold last
Maximum Signal Input	50 Ω : 5 V_{RMS} 1 MΩ : DC to 1 MHz - 15 V_{RMS} (GC2210); 30 V_{RMS} (GC2220 / GC2230) Above 1 MHz - 5 V_{RMS}

FREQUENCY RANGE

GC2210	Channels A and B: DC to 225 MHz

GC2220
GC2230
	Channel A: Selectable DC to 225 MHz OR
	    100 MHz to 1.3 GHz (GC2220)
	    100 MHz to 2.0 GHz (GC2230)
	Channel B: DC to 225 MHz

SENSITIVITY

Sine	25 mV_{RMS} DC – 20 MHz 50 mV_{RMS} 20 MHz – 50 MHz 200 mV_{RMS} 50 MHz – 225 MHz 250 mV_{RMS} 225 MHz – 1.3 GHz (GC2220 / GC2230) 500 mV_{RMS} 1.3 GHz – 2.0 GHz (GC2230 only)
Pulse	500 mV_{PP} at 5 ns pulse width

TRIGGER (THRESHOLD) LEVEL

Range	±5.00 V in 40 mV steps
Accuracy	±3% of setting ±0.04 V
Auto Trigger	Automatic selection of optimum trigger level Signal repetition rate: 100 Hz to 75 MHz

EXTERNAL REFERENCE CLOCK INPUT

Impedance	2 KΩ in series with 47 nF
Maximum Input Voltage	5 V_{RMS}
Coupling	AC
Sensitivity	150 mV_{RMS} sine, 450 mV_{PP} pulse
Duty Ratio	40% to 60%
Frequency	10 MHz only
Connector	Front panel BNC

EXTERNAL ARM INPUT

Input Signal Characteristics	DC Coupled, TTL compatible (1.4 V threshold)
Minimum Pulse Width	15 ns
Impedance	2 KΩ
Connector	Front panel DIN

EXTERNAL GATE OUTPUT

Output Signal Characteristics	DC Coupled, TTL compatible (1.4 V threshold)

MAXIMUM MEASUREMENT RATE

GC2210	200 readings / second for all modes
GC2220 GC2230	2300 readings / second for Fast Frequency and all time modes 1400 readings / second for Frequency and Period modes

FREQUENCY

Range	DC to 225 MHz (GC2210) DC to 1.3 GHz (GC2220) DC to 2.0 GHz (GC2230)
Gate Time	GC2200 / GTX2200: 250 us to 3200 s with 0.75 ms resolution (plus up to one signal period)
Number of Significant Digits	GC2210: 8 per second of gate time, e.g., 5 digits in 1 ms GC2220 and GC2230: 10 per second of gate time, e.g., 7 digits in 1 ms
Least Significant Digit (LSD)	GC2210: Freq x (10 ns / Gate Time) GC2220: Freq x (100 ps / Gate Time) GC2230: Freq x (100 ps / Gate Time)
Resolution (Hz)	±LSD ± Freq x (Freq x (300 pSRMS+(1.4 x Trigger Error))) / Gate Time
Accuracy (Hz)	±Resolution ± TimeBaseError

FAST FREQUENCY (GC2220 AND GC2230)

Range	DC to 225 MHz
Gate Time	4 signal periods, fixed
Accuracy (Hz)	±(Freq x (500 pS+300 pS RMS+(1.4 x Trigger Error))) / (Gate Time) ± Time Base Error

TIME INTERVAL

Range	-1 ns to 100,000 s (> 25 hr)
Least Significant Digit (LSD)	GC2210: 10 ns GC2220: 100 ps GC2230: 100 ps
Resolution	±LSD ± 300 ps RMS ±StartTriggerError ±StopTrigger Error

MEASUREMENT

MARVIN TEST SOLUTIONS

GC2200 SERIES

Accuracy	±Resolution ±TimeBaseError ±TriggerLevelTimingError ±2 ns
Minimum Pulse Width	8 ns
Delay	Recognition of stop events is inhibited for a set time GC2210 range: 30 μs to 5000 s GC2220 range: 20 μs to 3200 s GC2230 range: 20 μs to 3200 s

TOTALIZE AND GATED TOTALIZE

Control	Count gate can be controlled by software, or by events on the second input channel (Gated Totalize). In Gated Totalize, start and stop event slopes are selectable.
Count Rate	DC to 50 MHz, 10 ns (min) pulse width
Modes	Software gate: Gate and count reset are controlled by software Hardware gate: Count is reset before every gate Accumulative: Count is totalized over multiple gates
Range	0 to 2.8 x 10^{14} counts
Accuracy	±1 count, reading allowed while counting

PERIOD (SINGLE PERIOD)

Range	25 ns to 100,000 s See Time Interval for resolution and accuracy

PERIOD (MULTIPLE PERIOD AVERAGE)

Range	See Frequency
Gate Time	See Frequency
Least Significant Digit (LSD)	GC2210: Period x 10 ps / Gate Time GC2220: Period x 100 ps / Gate Time GC2230: Period x 100 ps / Gate Time
Resolution	±LSD ± (Period x (300 ps + (1.4 x Trigger Error))) / Gate Time
Accuracy	±Resolution ±TimeBaseError
Gate Time	250 ms to 3200 s with 0.75 ms resolution (plus up to one signal period)
Range	DC - 225 MHz on either input. DC - 25 MHz on second input
Least Significant Digit (LSD)	(Ratio) / (FREQhi x Gate Time) , FREQlow = lower frequency input
Resolution and Accuracy	±LSD ±((Ratio x FREQlow Trigger Error) / (Gate Time)) FREQlow = lower frequency input

WIDTH

Accuracy	Same as Time Interval, plus 3 ns

PACER

Time Controlled	0.8 ms to 3200 s

ARMING

Available on all modes except Totalize
Source: Internal (alternate channel) of External Input
Arm setup time: Minimum 40 ns before selected event

TIME BASE

Standard	10 MHz TCXO
Accuracy	Temperature: ±5 ppm, 0 °C to +50 °C Aging: < 2 ppm / year Supply voltage: < 1 x 10^{-8} for 10% change Short term: < 5 x 10^{-10} RMS with a 1 second averaging time
External Reference Input	External Reference Input (all modes). Alternate signal channel when making single-channel measurements

SUPPLEMENTAL DEFINITIONS

Trigger Error	Error due to noise superimposed on the input signal from both internal and external sources Trigger Error = (√ 50 μN^2 + E ^{2}) / (input signal slew rate) seconds RMS En = RMS noise of input signal (225 MHz bandwidth)
Trigger Level Timing Error	Time error due to threshold uncertainty Tigger Level Timong Error = < 250 mV / (input signal slew rate)
Time Base Error	Fractional frequency error of time-base reference, times the measurement result
Power Requirements (Typical)	+5 V @ 0.3 A -3.3 V @ 0.05 A +12 V @ 0.1 A -12 V @ 0.05 A
Storage Temperature	-20 °C to +70 °C
Size	PCI
Weight	12 oz

Note: Specifications are subject to change without notice

GC2200 SERIES

ORDERING INFORMATION

GC2210	225MHz PCI Time Interval Counter with 10MHz TCXO
GC2220	1.3GHz PCI Time Interval Counter with 10MHz TCXO
GC2230	2GHz PCI Time Interval Counter with 10MHz TCXO
GX92012	Cable, BNC Male to BNC Male, 50 Ohm, 2'
GX92015	Cable, BNC Male to BNC Male, 50 Ohm, 5'
GC22x0-CAL	GC22x0 Calibration/Verification Service. Includes pre-verification data (post calibration data provided if applicable)
GC22x0-CAL-3	GC22x0 Calibration/Verification Service - 3 Years. Includes pre-verification data (post calibration data provided if applicable)
GC22x0-CAL-5	GC22x0 Calibration/Verification Service - 5 Years. Includes pre-verification data (post calibration data provided if applicable)

MEASUREMENT