

# GTX2200 SERIES

## TIME INTERVAL COUNTER PXI CARD

- 14 measurement functions
- Frequency measurement from DC to 2.0 GHz (GTX2230)
- 100 ps resolution without averaging (GTX2220 and GTX2230)
- Fast measurement mode: 2300 readings / second
- In-system automatic calibration of time base and trigger levels



## DESCRIPTION

The GTX22x0 family of PXI 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 (GTX2220 and GTX2230 only), period, ratio, single period, test clock, time interval, time interval delay, totalize, totalize gated, totalize gated once, & pulse width.

There are three models available: the GTX2210, GTX2220 and GTX2230. The GTX2210 frequency range operates to 225 MHz, the GTX2220 covers frequencies up to 1.3 GHz, and the GTX2230 covers frequencies up to 2.0 GHz. The card is also available in PCI format (GC22xx).

## FEATURES

The GTX22x0 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 GTX22x0 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 GTX2220 and GTX2230 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 / second, 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 timebase for internal frequency reference. As an option, a high precision 10 MHz OCXO is available for the GTX2220 and GTX2230 models. An external 10 MHz input is also available for use with external timebases.

## PROGRAMMING AND 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

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## SPECIFICATIONS

INPUT CHARACTERISTICS	
Impedance	Below 225 MHz: 1 M $\Omega$ or 50 $\Omega$ channel independent and software selectable 225 MHz and above: 50 $\Omega$
Coupling	DC or AC, channel independent and software selectable
Trigger	Positive or Negative edge, channel independent and software programmable, automatic level or hold last
Maximum Signal Input	50 $\Omega$ : 5 V <sub>RMS</sub> 1 M $\Omega$ : DC to 1 MHz - 15 V <sub>RMS</sub> Above 1 MHz - 5 V <sub>RMS</sub>
Connectors	Front panel BNCs for Channel A & B
FREQUENCY RANGE	
GTX2210	Channels A and B: DC to 225 MHz
GTX2220 GTX2230	Channel A: Programmable, DC to 225 MHz OR 100 MHz to 1.3 GHz (GTX2220) 100 MHz to 2.0 GHz (GTX2230) Channel B: DC to 225 MHz
SENSITIVITY	
Sine	25 mV <sub>RMS</sub> DC – 20 MHz 50 mV <sub>RMS</sub> 20 MHz – 50 MHz 200 mV <sub>RMS</sub> 50 MHz – 225 MHz 250 mV <sub>RMS</sub> 225 MHz – 1.3 GHz (GTX2220 or GTX2230) 500 mV <sub>RMS</sub> 1.3 GHz – 2.0 GHz (GTX2230 only)
Pulse	500 mV <sub>pp</sub> at 5 ns pulse width
TRIGGER (THRESHOLD) LEVEL	
Range	$\pm 5.00$ V in 1 mV steps (rev C version) $\pm 5.00$ V in 40 mV steps (rev A & B versions)
Accuracy	$\pm 3\%$ of setting $\pm 0.001$ V
Auto Trigger	Automatic selection of optimum trigger level Signal repetition rate: 100 Hz to 75 MHz
EXTERNAL REFERENCE CLOCK INPUT	
Impedance	2 k $\Omega$ in series with 47 nF
Maximum Input Voltage	5 V <sub>RMS</sub>
Coupling	AC
Sensitivity	150 mV <sub>RMS</sub> sine, 450 mV <sub>pp</sub> 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), programmable active slope (rising or falling)
Minimum Pulse Width	15 ns
Impedance	2 k $\Omega$
Connector	Front panel DIN connector
EXTERNAL GATE OUTPUT	
Output Signal Characteristics	DC Coupled, TTL compatible (1.4 V threshold)
Connector	Front panel DIN
MAXIMUM MEASUREMENT RATE	
GTX2210	200 readings per second for all modes
GTX2220 GTX2230	2300 readings per second for Fast Frequency and all time modes, 1400 reading per second typical 1400 readings per second for Frequency and Period modes, 1100 readings per second typical Actual reading rate depends on system CPU, system configuration, an number of applications executing simultaneously.
FREQUENCY	
Range	DC to 225 MHz (GTX2210) DC to 1.3 GHz (GTX2220) DC to 2.0 GHz (GTX2230)
Gate Time	250 $\mu$ s to 3200 s with 0.75 $\mu$ s resolution (plus up to one signal period)
Number of Significant Digits	GTX2210: 8 per second of gate time, e.g., 5 digits in 1 ms GTX2220 and GTX2230: 10 per second of gate time, e.g., 7 digits in 1 ms
Least Significant Digit (LSD)	GTX2210: Freq x (10 ns / Gate Time) GTX2220: Freq x (100 ps / Gate Time) GTX2230: Freq x (100 ps / Gate Time)
Resolution (Hz)	$\pm$ LSD $\pm$ (Freq x (300 ps RMS + (1.4 x Trigger Error))) / Gate Time
Accuracy (Hz)	$\pm$ Resolution $\pm$ TimeBaseError
FAST FREQUENCY MODE(GTX2220 AND GTX2230)	
Range	DC to 225 MHz
Gate Time	4 signal periods, fixed
Accuracy (Hz)	(( $\pm$ Freq x (500 ps + 300 ps RMS + (1.4 x trig error))) / gate time) $\pm$ timebase error

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TIME INTERVAL	
Range	-1 ns to 100,000 sec (> 25 hr)
Least Significant Digit (LSD)	GTX2210: 10 ns GTX2220: 100 ps GTX2230: 100 ps
Resolution	$\pm$ LSD $\pm$ 300 ps RMS $\pm$ StartTriggerError $\pm$ StopTrigger Error
Accuracy	$\pm$ Resolution $\pm$ TimeBaseError $\pm$ TriggerLevelTimingError $\pm$ 2 ns
Minimum Pulse Width	8 ns
Delay	Recognition of stop events is inhibited for a set time range: 20 $\mu$ s to 3200 seconds
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 minimum 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 $2.8 \times 10^{14}$ counts
Accuracy	$\pm$ 1 count, reading allowed while counting
PERIOD (SINGLE PERIOD)	
Range	25 ns to 100,000 seconds. See Time Interval for resolution and accuracy
PERIOD (MULTIPLE PERIOD AVERAGE)	
Range	See Frequency
Gate Time	See Frequency
Least Significant Digit (LSD)	GTX2210: Period x 10 ps / Gate Time GTX2220: Period x 100 ps / Gate Time GTX2210: Period x 100 ps / Gate Time
Resolution	$\pm$ LSD $\pm$ (Period x (300 ps + (1.4 x trig error))) / gate time
Accuracy	$\pm$ Resolution $\pm$ TimeBaseError

RATIO A/B OR B/A	
Gate Time	GC2200 / GTX2200: 250 $\mu$ s to 3200 seconds with 0.75 $\mu$ s 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) FREQhi is the higher frequency input
Resolution and Accuracy	$\pm$ LSD $\pm$ (Ratio x FREQlo x Trigger Error) / Gate Time FREQlo is the lower frequency input
PULSE WIDTH A OR B	
Accuracy	Same as Time Interval, plus 3 ns
PACED MEASUREMENT FUNCTION	
Time Controlled	Interval between measurements can be programmed from 0.8 ms to 3200 sec for time interval measurements and 1 ms to 3200 sec for frequency and period measurements. Accuracy: 200 $\mu$ s
ARMING	
Available on all modes except Totalize	
Source: Internal (alternate channel) or External Input	
Arm setup time: Minimum 40 ns before selected event	
TIME BASE	
Standard	10 MHz TCXO
Accuracy	$\pm$ 1ppm, 0 °C to +50 °C Aging: < 1 ppm / year Supply voltage: < $3 \times 10^{-8}$ for 1% change Short term: < $5 \times 10^{-10}$ RMS with a 1 second averaging time
Source	Internal standard External Reference Input PXI 10 MHz from backplane
Time Base Output	When installed in the PXI Star Trigger Controller slot (slot 2) the module's 10 MHz time base can source the PXI 10 MHz backplane clock

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SUPPLEMENTAL DEFINITIONS	
<b>Trigger Error</b>	Error due to noise superimposed on the input signal from both internal and external sources $\text{Trigger Error} = ((500 \mu\text{V} * 2 + E_n * 2) * .5) / (\text{input signal slew rate})$ En is RMS noise of input signal (225 MHz bandwidth)
<b>Trigger Level Timing Error</b>	Timing error due to threshold uncertainty $\text{Trigger Level Timing Error} = (< 250 \text{ mV}) / (\text{input signal slew rate})$
<b>Time Base Error</b>	Fractional frequency error of time-base reference, times the measurement result
<b>Power Requirements (Typical)</b>	+5 V @ 0.3 A -3.3 V @ 0.1 A +12 V @ 0.2 A -12 V @ 0.05 A
<b>Operating Temperature</b>	0 °C to +50 °C
<b>Storage Temperature</b>	-20 °C to +70 °C
<b>Size</b>	3U PXI
<b>Weight</b>	12 oz

Note: Specifications are subject to change without notice

## ORDERING INFORMATION

<b>GTX2210</b>	225MHz Time Interval Counter with 10MHz TCXO
<b>GTX2220</b>	1.3GHz Time Interval Counter with 10MHz TCXO
<b>GTX2230</b>	2GHz Time Interval Counter with 10MHz TCXO
OPTION	
<b>GTX2200-OCXO</b>	A 100 ppb Oven-Controlled Crystal Oscillator for GTX2220
<b>GTX2300-OCXO</b>	A 100 ppb Oven-Controlled Crystal Oscillator for GTX2230
ACCESSORY	
<b>GX92012</b>	Cable, BNC Male to BNC Male, 50 Ohm, 2'
<b>GX92015</b>	Cable, BNC Male to BNC Male, 50 Ohm, 5'
<b>GX93005</b>	DIN Mating Connector for GTX22xx
<b>GX93006</b>	3' Harness for GTX22xx DIN connector (DIN to Header)
CALIBRATION	
<b>GX92605</b>	Calibration Software for GTX22xx Rev C Counters
<b>GTX2210-CAL</b>	GTX2210 Calibration Service (includes pre/post data analysis)
<b>GTX2210-CAL-3</b>	GTX2210 Calibration Service - 3 Years (includes pre/post data analysis)
<b>GTX2210-CAL-5</b>	GTX2210 Calibration Service - 5 Years (includes pre/post data analysis)
<b>GTX2220-CAL</b>	GTX2220 Calibration Service (includes pre/post data analysis)
<b>GTX2220-CAL-3</b>	GTX2220 Calibration Service - 3 Years (includes pre/post data analysis)
<b>GTX2220-CAL-5</b>	GTX2220 Calibration Service - 5 Years (includes pre/post data analysis)
<b>GTX2230-CAL</b>	GTX2230 Calibration Service (Includes Pre/Post Data Analysis)
<b>GTX2230-CAL-3</b>	GTX2230 Calibration Service - 3 Years (includes pre/post data analysis)
<b>GTX2230-CAL-5</b>	GTX2230 Calibration Service - 5 Years (includes pre/post data analysis)