FEATURES

- Direct Time Measurement of Pulse Trains
- Measure Jitter, Frequency, Time Interval (Skew), Pulse Width, Risetime, Event Timing, Time Interval Error (TIE), and More
- 2 ps Single-Shot Resolution (13 Digits/s Frequency)
- DC to 500 MHz Frequency Range for all Measurement Functions Including Pulsewidth, Plus an optional Prescaler for Frequency and TIE Measurements to 6.0 GHz
- Up to 20 Million Continuous Zero Dead Time Measurements Per Second
- 100 ps Minimum Pulse Width
- Highly Sophisticated and Flexible Arming (Triggering)
- PXIe interface (Single Slot, 4-lane)
- On-board Memory for up to 128 Million Measurements – Can Be Read Continuously During Measurements

More Tests in Less Time

The NK732 is a high performance time and frequency measurement instrument. Its high resolution and throughput, combined with continuous measurement capability, allow you to make measurements that are not possible with traditional time-interval counters. For example, it can timetag events (edges of an input pulse train) at a rate of 20 million per second continuously to on-board memory, while each of the edges is measured with 2 ps resolution. This provides it with the capability to analyze the dynamic variations in pulse timing, pulse width, or frequency. In other words, the difference between time interval analyzers and traditional counter/timers is analogous to the difference between voltmeters and scopes. Measurements can also be streamed continuously **in real-time** over the PXIe interface allowing unlimited acquisition at high rates. The NK732 measures frequency on both channels simultaneously.

Full-Featured Instrument

The NK732 is a full instrument-on-a-card with all the features and capabilities you would expect in bench-top instruments including high quality inputs, built-in NIST traceable calibration, and software and hardware that deliver fully computed results. The instrument has 10 measurement functions such as Frequency, Time Interval and Pulsewidth. All functions work directly on the input signal at frequencies up to 500 MHz without any prescaling. This means that you can measure pulses as narrow as 1 ns, occurring at frequencies up to 500 MHz, or the skew between two signals at 500 MHz. There is also an optional prescaler for each input channel which allows frequency, period, and TIE measurements to 6.0 GHz.

The inputs of the instrument include programmable termination voltages. This feature is seldom found even in the best of the bench-top instruments. The 50 ohm inputs are terminated to an accurately programmable voltage between -2 V and +3 V. This allows you to connect ECL, PECL, or CML sources directly to the instrument with the proper loading. This feature is especially useful in semiconductor ATE and other test systems.

APPLICATIONS

- PLLs and frequency modulation – measure jitter, time interval error and settling time
- Serial interface timing and characterization
- Ultrasonic and radar pulse timing
- Photon Counting – Measure Time of Arrival to 2 ps
- Optical and magnetic disk drive – measure jitter, risetime, and bit timing directly
- Oscillators and crystals – measure frequency, start-up time and time interval error
- Lidar – Timestamp pulses at up to 20 MHz
- Pulse width modulated signals – measure variations over time
- Time stamping of events in real time
- Nuclear physics

NK732

Easy to Use Software

The software for the NK732 is designed for ease of use and extremely high performance. The driver software (Windows and Linux) automatically manages the streaming of measurements at the high rates which are possible with the x4 PXIe interface. The front panel software for Windows allows you to easily set up multiple simultaneous displays of the measurements. This gives multiple views of the same data, or different functions from the same data. For example, you can set up the display to show a graph of the frequency of the signal vs. time, plus a tabular display of the same results, plus a graph of the time deviation of the signal vs. time, all from the same measurement acquisition run. The front panel can also run multiple instruments simultaneously. All instrument models use the same driver for easy migration between models.

The screen images below are from actual measurements of a 62.5 MHz clock. In the first one the instrument was set up to take a measurement every 3 periods of the signal (every 48 ns) for 1 thousand measurements. The second one has 10 measurements taken every 300 periods of the signal (every 4.8 µs). The total acquisition time for both measurement runs is 48 µs.

The display on the top-left is the frequency of the signal. Notice the standard deviation of the frequency measurements. When taken every 4.8 μs the standard deviation is about 20 Hz which is 0.3 ppm.

The display on the top-right is the Continuous Time Interval (CTI), which is the time between sequential measurements. Notice the standard deviation of 1.6 ps.

The display on the bottom-left is a graph of the CTI. The resolution of the graph is 1 ps per division.

The display on the bottom-right is a table of frequency measurements but it also shows the times and event numbers when each measurement was taken. This additional timestamp information can be very powerful tool to analyze detail about your signal.

A New Level of Performance

The NK732 employs a new architecture for this type of instruments which isolates the channels from each other. This eliminates completely the crosstalk which exists in all counters with the traditional architecture. The effect of the crosstalk was most noticeable when measuring time interval between two signals. As the skew between the signals approached 0, there was an error in the measurements. In some counters it was in the hundreds of ps. You will not see any of this effect in the NK732.

Another important improvement is the accuracy of threshold voltages (trigger levels). The voltages are calibrated to 1 mV accuracy (the resolution is a fraction of a mV). This is particularly important with today's high speed signals with swing as low as 200 mV. It is also important when measuring pulsewidth since the trigger level affects the accuracy of the time measurement.

The NK732 includes a 1 Msa/s 16-bit analog to digital converter which you can use to measure DC voltages at the input with accuracy comparable to a 4 ½ digit DMM. You can also measure low frequency signals of up to 100 kHz.
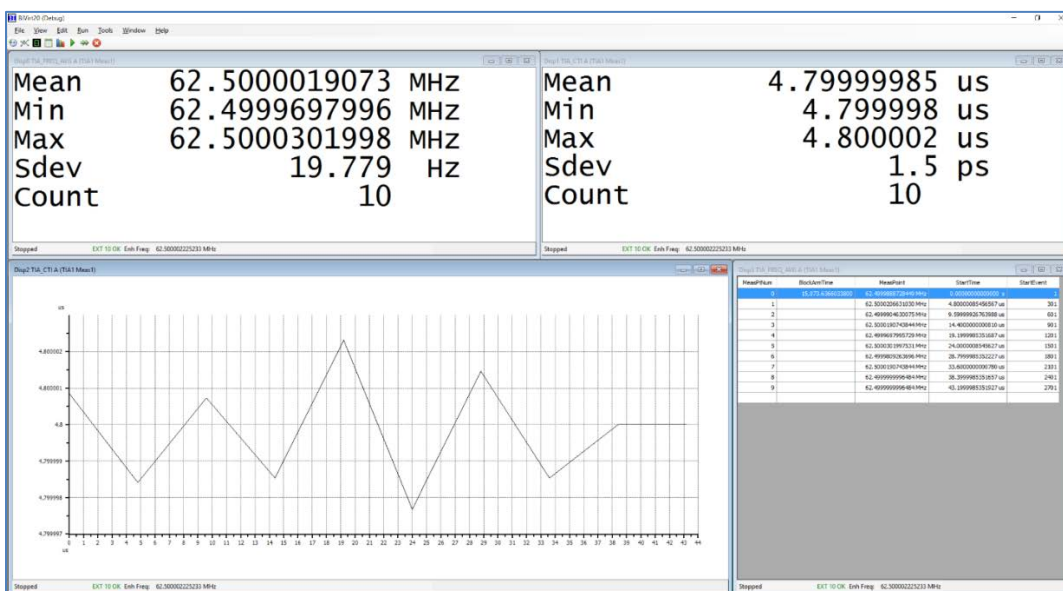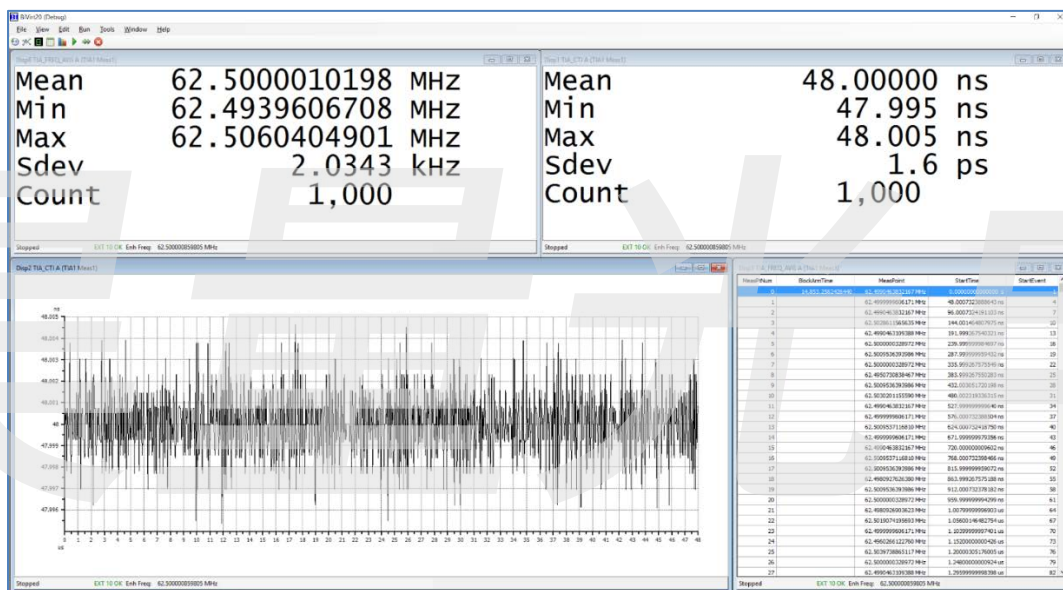
HOW DOES IT WORK?

The simplified block diagram below shows the key components of the instrument from the user's point of view. The input signal is terminated by 50 ohms to a user-programmable voltage (Vt) and fed to a comparator. The comparator output goes high when the signal crosses a user-programmable threshold voltage (Vth). At this point the signal is a digital waveform whose rising or falling edges are considered to be "events". These events are continuously counted by the Event Counter, while the Arming System selects the edges which are to be timetagged according to the user configuration. For example, you can set up the instrument to timetag every N events, or every T seconds.

When an event is timetagged, the event count (pulse number) and the time of the occurrence are logged to memory. The Timetag Circuits require a recovery time of 50 ns to be ready for another timetag. Note, however, that the signal is still counted by the Event Counter, so no information is lost. This recovery time means that up to 20 million timetags (or pairs of timetags) can be logged per second. From this timetag data the instrument calculates the measurement results.
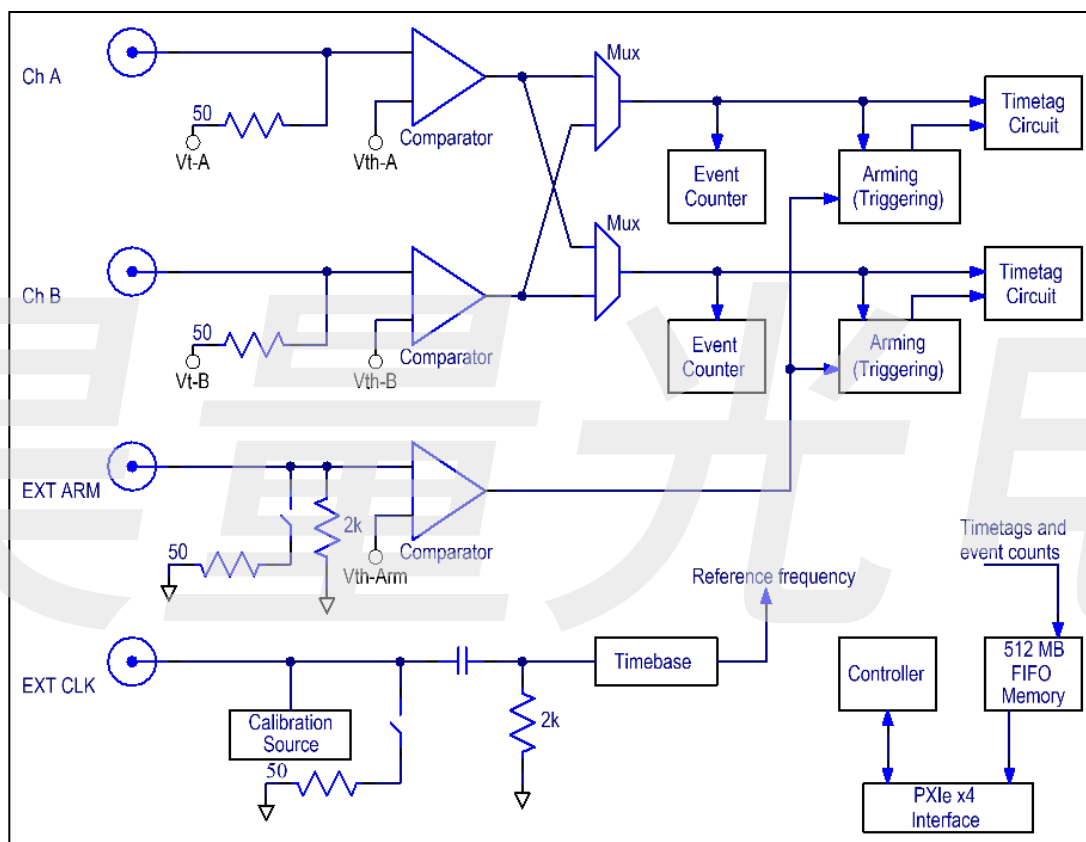

Figure 1: Simplified block diagram

There are three groups of measurement functions – 1C1E, 1C2E, and 2C2E. The timing diagrams below illustrate the operation of the instrument for each group.

One-Channel-One-Edge Functions

The 1C1E functions (one-channel-one-edge) operate on a single channel (either A or B) and use only one timetagging circuit. That is, each timetag contains only one edge time and one event count. The recovery time of 50 ns is the minimum time between timetags. That is, for frequencies below 20 MHz it is possible to measure every rising or falling edge. The equations for the first measurement point in the timing diagram are shown in the table below. For example, in the equation for Frequency Average E1 and E2 are event counts while T1 and T2 are the time information from the first two timetags. Note that you can make up to 20 million frequency measurements per second on a continuous zero-dead-time basis. The measurements are back to back since the end of one measurement is the start of the next one.
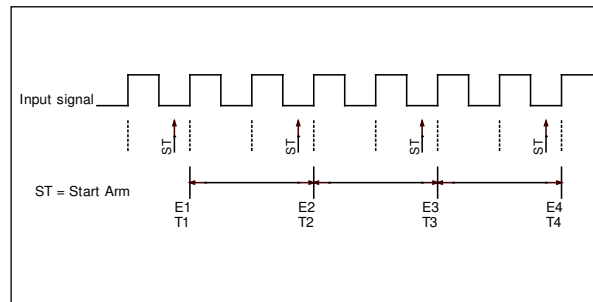

Figure 2: 1C1E functions

| Function	Calculation	Notes
Frequency Average	$FreqAvg = \dfrac{\Delta E}{\Delta T} = \dfrac{E2-E1}{T2-T1}$	Average frequency of the input signal
Frequency Average Omega Method	Uses Omega method to improve frequency resolution	The optimal frequency averaging method with a data reduction factor set by user. Compatible with ADEV calculations
Period Average	$PeriodAvg = \dfrac{\Delta T}{\Delta E} = \dfrac{T2-T1}{E2-E1}$	Average period of the input signal
Continuous Time Interval	$CTI = \Delta T = T2 - T1$	The actual time between pairs of timetags
Time Interval Error	$TIE = T1 - ExpectedTime$	The deviation in time of each of the timetags from an expected value. The user supplies the reference period of the signal
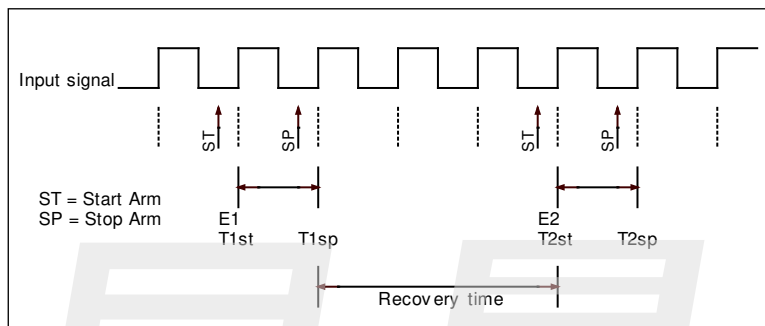
Figure 3: 1C2E functions

One-Channel-Two-Edge Functions

The 1C2E functions (one-channel-two-edge) operate on a single channel (either A or B) and use both timetagging circuits. That is, each timetag contains two edge times and one event count. The recovery time of 50 ns is the minimum time between the stop timetag and the next start timetag. For all these functions the result is the difference in time from the start to the stop. The associated event count is for the start event. The arming that the user specifies is for the Start Arm, while the Stop Arm is dictated by the function.

Function	Stop Arm	Notes
Period	Next edge, same polarity	Measures single periods of the input signal
Pulsewidth	Next edge, opposite polarity	Measures individual pulsewidths of the input signal
One-Channel Time Interval	Next signal edge	The polarity of the start and stop edges is specified by the user
Risetime, Falltime	Same signal edge	Measures a single edge with two thresholds, usually 20% and 80%

Two-Channel-Two-Edge Functions

The 2C2E functions (two-channel-two-edge) operate on both channels (A to B or B to A) and use both timetagging circuits. That is, each timetag contains two edge times and one event count. The recovery time of 50 ns is the minimum time between the stop timetag and the next start timetag. For the 2-Ch Time Interval function the result is the difference in time from the start to the stop. The associated event count is for the start event. The user can specify the polarity of the start edge and the stop edge and a delay for the Stop Arm. The delay provides for the selection of the stop edge. For example, when the Stop Arm Delay is set to 0, the instrument will measure to the next stop edge. See the specifications for the minimum time interval.

The 2-Ch Time Interval function always measures positive time intervals. If the ±TI option is selected, negative time intervals can be measured where the Stop edge can occur before or after the Start edge.
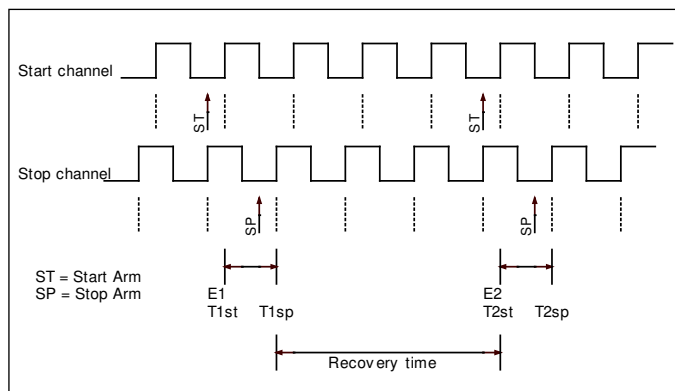

Figure 4: 2C2E functions

SPECIFICATIONS

General
- See "Definitions" below for explanation of the terms in the specifications
- Warranty: 2 years

Measurement Functions
- Fully symmetrical operation – all functions are the same for channel A or B
- One-Channel One-Edge (1C1E) Functions:
  - Frequency Average
  - Frequency Average (Omega Method)
  - Period Average
  - Continuous Time Interval (CTI)
  - Time Interval Error (TIE)
- One-Channel Two-Edge (1C2E) Functions:
  - Period (Per)
  - Pulsewidth (PW)
  - 1-Ch Time Interval (TI1)
  - Risetime
  - Falltime
- Two-Channel Two-Edge (2C2E) Functions:
  - 2-Ch Time Interval (TI2)
  - ±2-Ch Time Interval (±TI2)
- In addition to the measurement results, all functions provide the actual timetag in absolute time and the event count for each measurement (using the Table display)

Frequency Average A or B (or Both)
- Measures the average frequency between pairs of events on a zero-dead-time basis (measurements are back to back)
- Type: 1C1E (One-Channel One-Edge)
- Both channels can run independently to measure two signals simultaneously
- Frequency range (direct): DC to 500 MHz
- Frequency range (with optional prescaler): DC to 6.0 GHz
- Measurement time ("gate time"): 50 ns to 26 days
- Number of events per measurement: 1 to 1.8×10^{16}
- Number of significant digits: 12 digits/s regardless of input frequency
  - 9 digits (1 ppb) in 1 ms
  - 6 digits (1 ppm) in 2 us
- Resolution (in Hz rms):

$$\pm \frac{Freq \times (2\,ps(rms) + 1.4 \times TriggerErr)}{Meastime}$$

- Accuracy (in Hz): ±Resolution ± TimebaseErr
- ADEV noise floor: 7×10^{-12} with 1 s tau

Frequency Average A or B (or Both), Omega Method
- Takes multiple measurements of the standard Frequency Average function above, then reduces the data based on an Averaging Factor set by the user
- Algorithm: Uses Least Square Fit to provide an optimal estimate of the frequency. Fully compatible with ADEV

- Averaging Factor: 1 to 1 million (1 is the same as standard Frequency Average). Resolution is improved by the square root of the Averaging Factor
- Type: 1C1E (One-Channel One-Edge)
- Both channels can run independently to measure two signals simultaneously
- Frequency range (direct): DC to 500 MHz
- Frequency range (with optional prescaler): DC to 6.0 GHz
- Measurement time ("gate time"): 50 ns to 26 days
- Number of events per measurement: 1 to 1.8×10^{16}
- Number of significant digits: 13 digits/s regardless of input frequency
  - 10 digits (0.1 ppb) in 1 ms
  - 6 digits (1 ppm) in 1 us
- Resolution (in Hz rms):

$$\pm \frac{Freq \times (2\,ps(rms) + 1.4 \times TriggerErr)}{Meastime\sqrt{AveragingFactor}}$$

- Accuracy (in Hz): ±Resolution ± TimebaseErr

Period Average A or B (or Both)
- Measures the average period between pairs of events on a zero-dead-time basis (measurements are back to back)
- Type: 1C1E (One-Channel One-Edge)
- Both channels can run independently to measure two signals simultaneously
- Range (direct): 2 ns to 26 days
- Range (with optional ÷16 prescaler): 160 ps to 25 days
- See Frequency Average function for measurement time, number of events, and significant digits
- Resolution (in seconds rms):

$$\pm \frac{Period \times (2\,ps(rms) + 1.4 \times TriggerErr)}{Meastime}$$

- Accuracy (in seconds): ±Resolution ± TimebaseErr

Continuous Time Interval (CTI) A or B (or Both)
- Measures the time between pairs of events on a zero-dead-time basis (measurements are back to back)
- Type: 1C1E (One-Channel One-Edge)
- Both channels can run independently to measure two signals simultaneously
- Frequency range (direct): DC to 500 MHz
- Frequency range (with optional ÷16 prescaler): DC to 6 GHz
- Range: 50 ns to 26 days
- Measurement time: 50 ns to 26 days (can comprise multiple periods of the input signal)
- Number of events per measurement: 1 to 1.8×10^{16}
- Resolution:

  ±2 ps(rms) ± 1.4 x TriggerErr
- Accuracy: ±Resolution ± TimebaseErr ± 10 ps

Time Interval Error (TIE) A or B (or Both)
- Measures the time of occurrence of events, then calculates the deviation from the expected period of the signal
- Type: 1C1E (One-Channel One-Edge)

- Both channels can run independently to measure two signals simultaneously
- Frequency range (direct): DC to 500 MHz
- Frequency range (with optional ÷16 prescaler): DC to 6 GHz
- Measurement repetition rate: 50 ns to 26 days
- Number of events per measurement: 1 to 1.8×10^{16}
- Resolution:

  ± 2 ps(rms) ± 1.4 x TriggerErr
- Accuracy: $\pm$Resolution $\pm$ TimebaseErr $\pm$ 10 ps

Period A or B
- Measures single periods of the signal
- Type: 1C2E (One-Channel Two-Edge)
- Range: 2 ns to 26 days
- Frequency range: DC to 500 MHz
- Time between measurements: 50 ns to 26 days
- Resolution: ± 2 ps(rms) ± 1.4 x TriggerErr
- Accuracy: $\pm$Resolution $\pm$ TimebaseErr $\pm$ 20 ps

Pulsewidth A or B
- Measures pulse widths of the signal
- Type: 1C2E (One-Channel Two-Edge)
- Range: 1 ns to 26 days
- Frequency range: DC to 500 MHz
- Time between measurements: 50 ns to 26 days
- Resolution: ± 2 ps(rms) ± 1.4 x TriggerErr
- Accuracy:

  $\pm$Resolution $\pm$ TimebaseErr $\pm$ TriggerLevelTimeErr $\pm$ 20 ps

1-Ch Time Interval A or B
- Measures time intervals between edges of the input signal, with selectable polarity
- Type: 1C2E (One-Channel Two-Edge)
- Range: 1 ns to 26 days
- Frequency range: DC to 500 MHz
- Time between measurements: 50 ns to 26 days
- Resolution: ± 2 ps(rms) ± 1.4 x TriggerErr
- Accuracy:

  $\pm$Resolution $\pm$ TimebaseErr $\pm$ TriggerLevelTimeErr $\pm$ 20 ps

Risetime A or B, Falltime A or B
- Measures risetime or falltime of the input signal
- Type: 1C2E (One-Channel Two-Edge)
- Two thresholds (trigger) levels are set
- Range: 0 ps to 26 days
- Frequency range: DC to 500 MHz
- Time between measurements: 50 ns to 26 days
- Resolution: ± 2 ps(rms) ± 1.4 x TriggerErr
- Accuracy:

  $\pm$Resolution $\pm$ TimebaseErr $\pm$ TriggerLevelTimeErr $\pm$ 20ps

2-Ch Time Interval (TI2) A-to-B or B-to-A
- Measures the time between edges of signals from two channels
- Type: 2C2E (Two-Channel Two-Edge)
- Range: 1 ns to 26 days

- Frequency range: DC to 500 MHz
- Time between measurements: 50 ns to 26 days
- Resolution:

  ± 2 ps(rms) $\pm$ StartTriggerErr $\pm$ StopTriggerErr
- Accuracy:

  $\pm$Resolution $\pm$ TimebaseErr $\pm$ TriggerLevelTimeErr $\pm$ 20 ps

Inputs and Outputs

Channel A and B
- Each channel can optionally include a prescaler which is selectable by software on each channel individually
- Direct input (prescaler not selected):
  - Frequency range: DC to 500 MHz
  - Minimum pulse width: 100 ps
  - Coupling: DC
  - Input impedance: 50 Ω into a user programmable termination voltage
  - Sensitivity: 30 mV rms sine, 30 mVp-p pulse
- Prescaled input (prescaler selected by software):
  - Frequency range: DC to 6.0 GHz
  - Minimum pulse width: 100 ps
  - Coupling: DC
  - Input impedance: 50 Ω into a user programmable termination voltage
  - Sensitivity:
    - DC to 2 GHz: 30 mV rms
    - 2 GHz to 4 GHz: 40 mV rms
    - 4 GHz to 6 GHz: 55 mV rms
- Connector: SMA
- Termination voltage (Vt): -2 V to +3 V
  - Resolution: 100 μV
  - Accuracy: 5 mV
- Trigger Threshold voltage (Vth): -3 V to +5 V
  - Resolution: 200 μV
  - Accuracy: 5 mV
- Input voltage range:
  - Operating: -4 V to +5 V
  - Maximum: -5 V to 5 V DC or 5 Vrms AC (+27 dBm)
- Slope: Positive or negative
- Hysteresis:
  - Prevents false triggering by having separate threshold levels for rising and falling edges
  - User programmable from 1 mv to 50 mV

EXTARM Input
- Connector: SMA
- Frequency range: DC to 500 MHz
- Minimum pulse width: 1 ns
- Hysteresis (sensitivity): 100 mV typical, fixed
- Setup time: 10 ns
- Impedance: Programmable 2 kΩ or 50 Ω to ground
- Coupling: DC
- Trigger Threshold voltage (Vth): -5 V to +5 V

- Resolution: 5 mV
- Accuracy: 20 mV
- Input voltage range:
  - Operating: -5 V to +5 V
  - Maximum: -10 V to +10 V (2 kΩ setting only)
- Slope: Positive or negative

EXTCLK Input / CAL Output
- Connector: SMA
- Input for external timebase reference
  - Coupling: AC
  - Impedance: Programmable 2 kΩ or 50 Ω to ground
  - Amplitude:
    - Square wave – 200 mVp-p to 5 Vp-p
    - Sine wave – 200 mVp-p to 5 Vp-p
  - Input voltage range:
    - Operating: -5 V to +5 V
    - Maximum: -10 V to +10 V (2 kΩ setting only)
- Output for calibration signal (see manual for instructions)

Definitions
- TriggerErr or StartTriggerErr or StopTriggerErr
  - Error due to noise superimposed on the input signal from both internal and external sources
  - $$TriggerErr = \frac{\sqrt{440\mu V^2 + E_n^2}}{InputSignalSlewRate} \quad \text{s rms}$$
    - En = RMS noise of input signal (8 GHz bandwidth)
    - InputSignalSlewRate = Slew rate of input signal (V/s) at the threshold point
- TriggerLevelTimeErr
  - Time error due to threshold uncertainty
  - $$TriggerLevelTimeErr = \frac{<5mV}{InputSignalSlewRate} \quad \text{s rms}$$
  - Example: For input signal slew rate = 100V/μs TriggerLevelTimeErr = 50 ps
- TimebaseErr
  - Fractional Frequency error of timebase reference, times the measurement result

Arming
Each measurement run is composed of multiple blocks with multiple measurements in each block. For example, 200 blocks of 1000 pulsewidth measurements can be taken, for a total of 200,000 measurements. Statistical results are provided for each block, and for the whole set of blocks.

There are two separate arming settings – one for enabling blocks and one for enabling individual measurements.

Block Arm
- Mode
  - On Channel A edge (rising or falling edge)
  - On Channel B edge (rising or falling edge)
  - On EXT ARM (rising or falling edge)
  - By Time – every 1 μs to 1 hour, 4 ns resolution

- Immediate – run as quickly as possible
- By software command
- Number of blocks: 1 to 2.8×10^{14}

Start Arm
Arms the start of each measurement
- Mode
  - By events – every set number of edges of the input signal
    - Number of events: 1 to 1.0×10^{12}
    - Maximum frequency: 300 MHz
  - On Channel A edge (1C2E functions on Ch A only)
  - On Channel B edge (1C2E functions on Ch B only)
  - On EXT ARM rising or falling edge
  - By Time – every 52 ns to 4300 s, 4 ns resolution
  - Immediate – run as quickly as possible
  - By software command
- Number of measurements per block: 1 to 2.8×10^{14}

Stop Arm
- 1C1E functions: Not used
- 1C2E functions: Automatically configured for the specific function
- 2C2E functions: Stop Arm can be selected to occur either before or after the start edge of the signal

Measurement Rate and Throughput
- Measurement Rate for all measurement functions:
  - On each channel, with both channels operating: 20 million measurements per second
- Data throughput to computer memory:
  - On-board memory operates as a FIFO so data is transferred during measurements and can run continuously forever.
  - Measurement data transfer rate to the PXIe bus: 100 million measurements per second
  - Software processing speed on a typical PC with i7 processor operating with a single core: 8 million measurements per second

Timebase
- Standard internal oscillator:
  - TCXO (temperature compensated crystal oscillator)
  - Over full temperature range: ±1 ppm
  - Aging: ±2 ppm/year
- Optional NIST traceable internal 10 MHz oven oscillator (ultra-low phase noise):
  - Over full temperature range: ±0.005 ppm (5 ppb)
  - Aging: ±0.05 ppm/year (50 ppb)
  - Warm-up time: 5 minutes
  - Phase noise -135 dBc @ 10 Hz offset
- External 10 MHz or 100 MHz reference input
  - Frequency range:
    - 10 MHz ±30 ppm (±300 Hz)
    - 100 MHz ±30 ppm (±3 kHz)
  - See "Inputs and Outputs" for signal characteristics

- PXIe CLK100
  - Frequency requirements same as for External 100 MHz

Memory

- 512 MB on-board
  - Up to 128 million measurements
- Memory can be read out while measurements are accumulating, allowing unlimited continuous measurements

Math and Statistics

- Performs additional mathematical operations on the measurement results
  - Scaling and normalizing
  - Calculating relative error
- Calculates statistics on blocks of measurements and on the total set of blocks
  - Mean, Min, Max, and Standard Deviation

Software

- Windows® and Linux driver
  - Provides a powerful set of functions for controlling the instruments and for data analysis
  - Includes tools for high speed reading of the instrument which take advantage of the PXIe interface without burdening the user with the details
  - Windows® NT/95/98/2000/XP, 32 bit
  - Windows® Vista/7/8/10, 32/64-bit
  - Linux with 2.4/2.6 kernels (e.g. Redhat 3, Redhat 5), 32-bit
  - VBA (for use from excel®, used on some Teradyne testers)
  - Written in plain C++ for easy porting to other environments
- Virtual Front Panel (Windows® based)
  - Provides multiple simultaneous displays for the same measurement. The displays can even be different functions, as long as they are from the same group (1C1E, 1C2E, or 2C2E)
    - Graphs of results vs. time
    - Histogram
    - Numerical results (digital display)
    - Table of results and internal data
    - Streaming of results to a file
  - Can run multiple instruments of any model simultaneously
  - Compatible with Windows® XP/Vista/7/8/10 32/64-bit
  - Requires Microsoft™ .NET Framework 3.5 (included)

Computer Requirements

- One PXIe slot x1, x2, or x4 lanes
- Size: 3U PXIe

Calibration

- Traceable calibration
  - Requires a voltmeter and a frequency reference
  - Calibration period: 1 year
- Internal calibration
  - Automatically calibrates the instrument against the internal voltage and frequency references
  - Calibration period:
    - 1 month
    - Temperature change of more than 5 deg C
    - New installation or change in PXIe chassis configuration which changes internal temperature
  - Run time: Less than 15 seconds
- External calibration
  - The instrument outputs calibration signals on EXTCLK
  - The user connects EXTCLK to the input channels as directed by the software
  - Calibrates skew for 2-Ch Time Interval, threshold voltages, hysteresis, and termination voltages
  - Calibration period:
    - Same as internal calibration

Power, Cooling and Physical

- Power supply requirements from PXI bus (typical):
  - 3.3V @ 2.0A
  - 12V @ 2.0A (2.2A with oven oscillator, 2.4A warm-up)
- Total power consumption: 31W typical (33W with oven)
- Operating ambient temperature range: 0°C to 45°C
- Weight: 7 Oz (200 g)

Ordering Information

PN	Description
NK732	NK732 Time Interval Analyzer instrument, including software
Opt-10	NIST traceable, ultra-low phase noise timebase (oven oscillator)
Opt-20	6.0 GHz prescalers for both channels