P635

8-Channel 100 kHz Frequency Counter

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KineticSystems' P635 is a single-width 3V PXIbus module with 8 frequency measurement channels.

TYPICAL APPLICATIONS

Monitoring shaft encoders and other devices to measure RPM from shafts on automotive and aircraft engines

Monitoring flow meters

General-purpose frequency counting

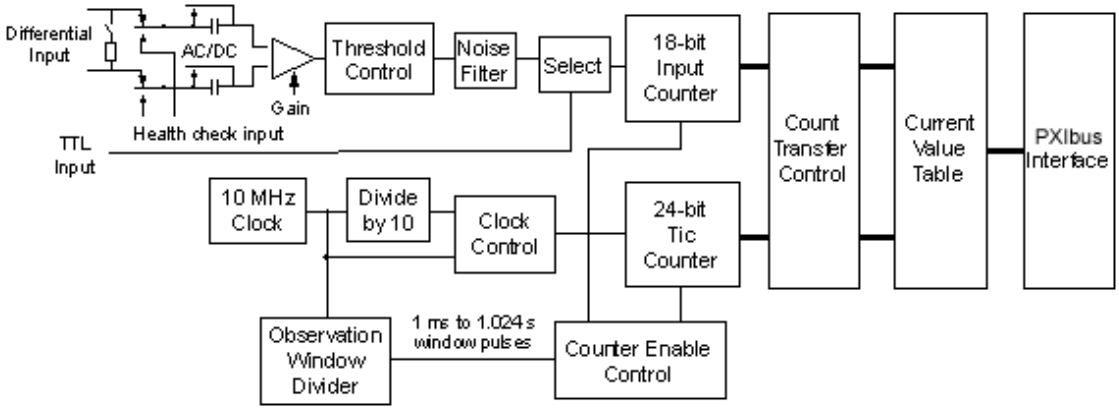
FEATURES

- Eight frequency counter channels
- Frequency range from 0.06 Hz to 100 kHz
- Differential and TTL inputs provided
- Differential input range 20 mV to 20 V
- Programmable SAC/DC differential inputs
- Programmable observation window: 1 ms to 1.025 sec
- Precision time base (1 ppm, 10^{o}C to 50^{o}C)

GENERAL DESCRIPTION

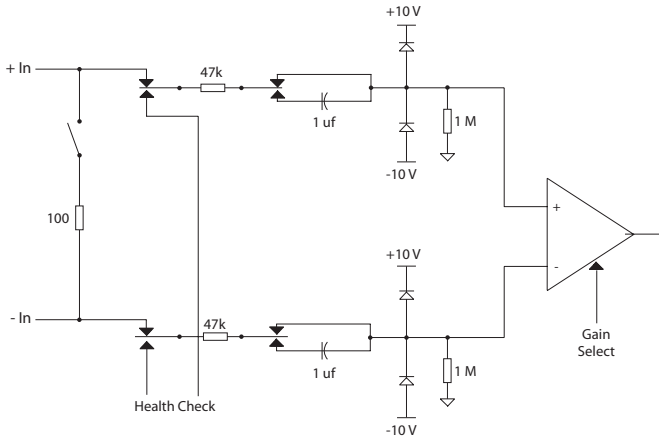
The P635 is a single-width, 3U, PXIbus module with eight frequency measurement channels. This counter module can be used to monitor a variety of pulse sources. Moreover, its unique circuitry allows the monitoring of a wide range of frequencies without changing any module settings. TTL inputs are provided as well as differential input circuits with filtering and hysteresis to provide high noise immunity. The switching threshold is programmable, and the input voltage should be at least twice the threshold voltage for noise immunity. AC or DC coupling of the differential inputs is programmable on a per-channel basis.

The internal clock for the module is driven from a 10 MHz clock having a 1 ppm accuracy from 10°C to 50°C. The internal clock can be set to 1 MHz or 10 MHz under program control. The 10 MHz clock provides an order of magnitude increase in counting resolution over the 1 MHz clock and is the general choice. The only disadvantage of the 10 MHz clock is that it causes a faster rollover of the tick count and limits the lowest frequency to be measured to 0.6 Hz, compared to 0.06 Hz when the 1 MHz clock is used.



BASIC CIRCUIT OPERATION

The module provides for two types of signal sources, analog and TTL. The analog input paths are differential for high noise immunity. These inputs can be unterminated (high impedance) or terminated with 100 ohms, selected by an on-board switch. The analog input coupling can be DC (the normal setting for most applications) or AC (with a series capacitor in each leg of the input path). The analog path also includes a gain control and a high-frequency noise filter. Both are programmable. The gain control sets the input switching threshold, while the filter provides a 3 dB rolloff at 50 kHz. The selection of analog or TTL input is programmable on a per-channel basis.



All input channels on the module are monitored over a single user-selectable period, called the observation window.

This window period is programmable from 1 millisecond to 1.024 seconds, in increments of 1 millisecond. The basic resolution of the measurement is ±1 clock period. Making the observation window period longer will generally increase the counting accuracy because the measurement period will be longer compared with the period of one cycle of the internal clock. The window period would be shortened to provide faster updates on an input signal whose frequency is changing.

At the end of each window period, 24 bits of data, containing the count from the internal clock, as well as 18 bits, containing the number of whole periods observed, are stored in the Tick Count register and the Period Count register for that channel. If the period of the input pulse stream is longer than the window period, the window remains "open" until one whole period of the input signal is observed. This "elastic" observation window that allows the module to count over a wide range of frequencies. The P635 can operate in a single-scan or in a continuous mode. If the module is operating in continuous mode (the normal selection), the registers can be read by software at any time, with the data from the latest observation being read. The frequency can be calculated by host computer software using the following formula:

Frequency = clock rate x whole input Periods / internal clock counts

The clock rate is 1 MHz or 10 MHz, the whole input periods are represented by the Period Count data for that channel, and the internal clock counts are represented by the Tick Count data for that channel. For example, a period count of 500, a clock rate of 10 MHz and a tick count of 100,000 will result in the following:

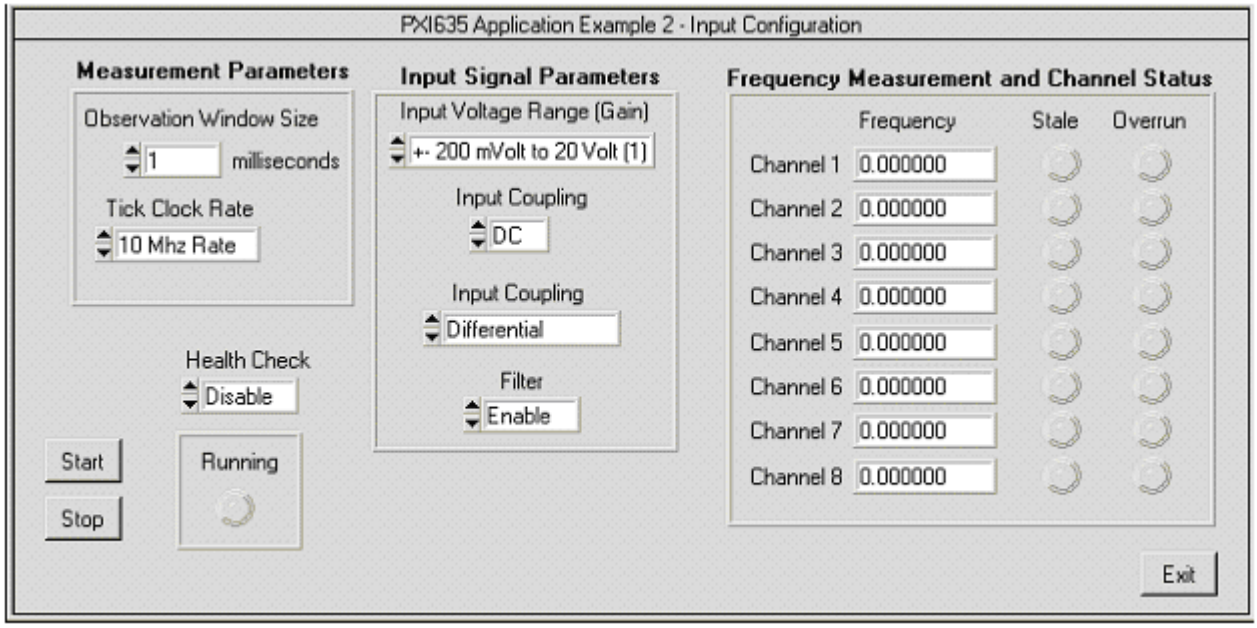
50,000 Hz = 10,000,000 x 500 / 100,000

SOFTWARE
The P635 comes with a Plug and Play driver and application examples for configuring and using the device.

APPLICATION EXAMPLE
The following shows the user interface for an application example provided with the P635. This example demonstrates the capability of the P635 and provides a convenient utility for module verification. From this application example, the user has the following capability:

- Start and Stop Acquisition
- Set the input full scale range on a global basis
- Set the Window Clock time
- Enable/Disable Health check
- Set inputs to AC or DC coupling on a global basis
- Set inputs to TTL or Differential
- Enable/Disable input Filtering on a global basis
- Select the Tick Clock rate

Once acquisition is enabled, the user interface will display each channel's resultant frequency as well as the status of Stale Data and Overrun flags.



Item	Specifications
Inputs	
Number of input channels	8
Type	Differential and TTL
Differential inputs:	
Coupling	AC or DC, per-channel programmable
Input impedance (switchable)	1 MΩ/100Ω(DC coupling) >10 MΩ/100Ω(AC coupling)
Input range (per-channel programmable)*	P635-AA21: ±20, 40, 100, 200 mV to ±20 V (all ranges) (Max further limited to ±5 V with the 100Ω termination active)
Switching threshold*	30% of input range minimums as shown above (typical)
Hysteresis*	After a positive-going signal passes the positive threshold, the signal must pass the negative-going threshold to cause switching.
Input protection	47kΩ series resistors followed by ±10 V diode clamps
Common-mode input voltage	±10 V MAX (operating)
Maximum safe input voltage	±50 V, continuous (AC or DC coupling)
Frequency measurement range	0.06 Hz to 100 kHz (1 MHz clock) 0.6 Hz to 100 kHz (10 MHz clock)
Filtering	
Filter type	Single-pole, low-pass RC type, programmable (filter in/out)
-3 dB cutoff frequency (fc)	50 kHz
Time Base	
Clock rate	1 MHz or 10 MHz, programmable
Stability	±1 ppm, 0°C to +50°C ±1 ppm/year
Observation Window	From 1 ms to 1.024 s, in 1 ms increments
Counter Sizes	
Time base counter	16,777,215 (24 bits)
Input pulse counter	262,140 (18 bits)
Input Connector Types	50 Position High Density SCSI Connector
Power Requirements	
+5 V	225 mA
+3.3V	755 mA
+12 V	175 mA
-12 V	175 mA
Environmental and Mechanical	
Temperature range	
Operational	0°C to +50°C
Storage	-25°C to +75°C
Relative humidity	0 to 85%, non-condensing to 40°C
Cooling requirements	10 CFM
Dimensions	100 mm x 160 mm (3U PXIbus module)
Front-panel potential	Chassis ground

KineticSystems

ORDERING INFORMATION

MODEL	DESCRIPTION
P635-AA21	8-channel, 100 kHz Frequency Counter

Specifications contained within this data sheet are subject to change without notice

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