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V635

8-channel, 100 kHz Frequency Counter

The V635 is a single-width, C-size, register-based, VXIbus module with eight frequency measurement channels. "D" connector and BNC connector options are available.

This counter module can be used to monitor a variety of pulse sources. Its unique circuitry allows the monitoring of a wide range of frequencies without changing any module settings.



Counts from 0.06 Hz to 100 kHz without changing ranges

APPLICATIONS

Monitoring shaft encoders and other devices to measure RPM from shafts on automotive and jet aircraft engines
Measurement of flow meters
General-purpose monitoring of input pulses

FEATURES

- Contains eight frequency counter channels
- "D" and BNC input options available
- Frequency range from 0.06 Hz to 100 kHz
- Differential and TTL input options (TTL inputs not provided on BNC module options)
- Inputs programmable on a per-channel basis:
- Differential input range options: 20 mV - 20 V peak-to peak (V635-AA21) 100 mV - 20 V peak-to peak (V635-AB21)
- AC/DC differential inputs
- Programmable observation window: 1 ms to 1.024 s
- Precision time base (±1 ppm, 10°C to 50°C)

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GENERAL DESCRIPTION

The V635 is a single-width, C-size, register-based, VXIbus module with eight frequency measurement channels. "D" connector and BNC connector options are available. This counter module can be used to monitor a variety of pulse sources. Its unique circuitry allows the monitoring of a wide range of frequencies without changing any module settings. Differential input circuits with filtering and hysteresis 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. TTL inputs are also provided on the "D" connector options.

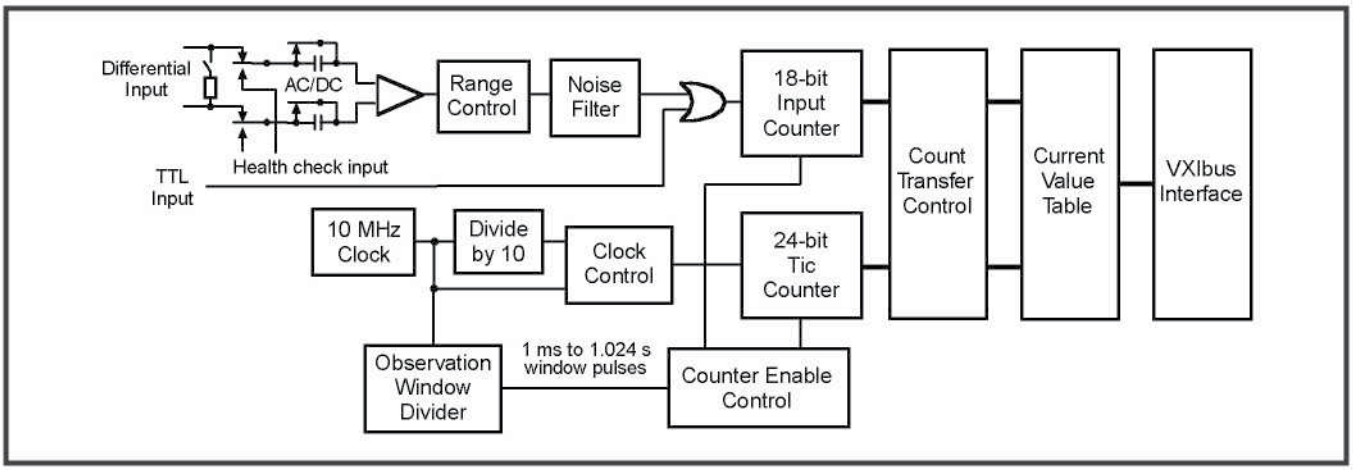
Frequency measurement is armed by software command, and begins when the first "edge" of the input signal is received. The input pulse stream for each channel is sampled during a user-selected observation window. The window period is programmable, and the selection is common to all eight channels. At the end of each window period, 24 bits of data representing the timebase count from the master clock, as well as 18 bits representing the number of whole periods observed are stored in the Current Value Table (CVT) 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. The CVT memory 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 = whole input periods x clock rate/timebase counts

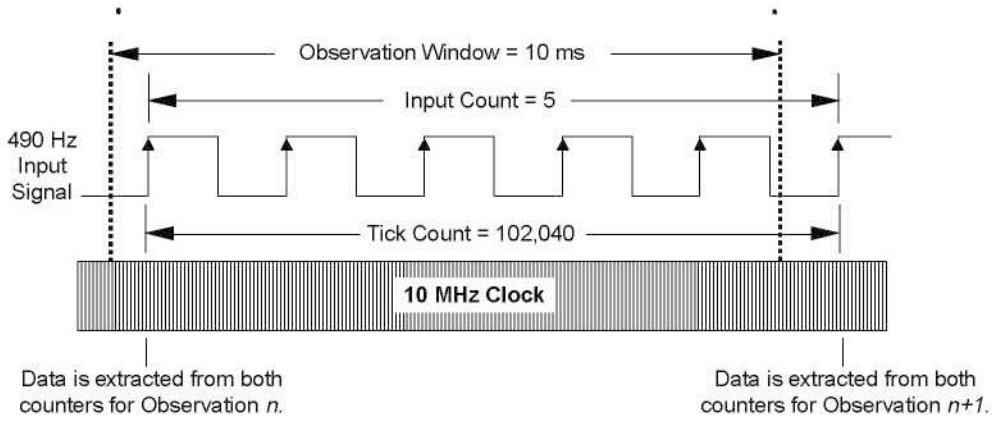
The V635 can operate in a single-scan or in a continuous mode. The clock rate for the module is programmable to provide a tick rate of 1 MHz or 10 MHz with a clock accuracy of ±0.0001%. The counting accuracy depends on the time base accuracy as well as the monitoring resolution. The longer the observation window, the higher the accuracy. A 10 ms observation window will result in an accuracy of approximately ±0.01% with a 1 MHz clock, and ±0.001% with a 10 MHz clock. A 100 ms window will provide accuracies in order of magnitude better. Programming the clock to 1 MHz allows a measurement down to 0.06 Hz, while a 10 MHz clock increases the resolution by a factor of 10, but makes the lower counting limit 0.6 Hz. An overflow status bit is asserted for that channel whenever the input frequency is below the measurable limit.

A separate input connector is provided for a "health check" signal. The input circuitry can be switched— under program control—from each of the channels to this input, providing a test of the operating characteristics of that channel. Maskable interrupt source bits are set by an overflow from the time base clock counter. An interrupt can be generated by any one or a combination of these bits. The V635 supports both static and dynamic configuration. Access to the data is through memory locations indicated by the Offset Register within the VXIbus Configuration Register set, using A32/A16, D32/D16 data transfers.

V635 Block Diagram (one channel shown)



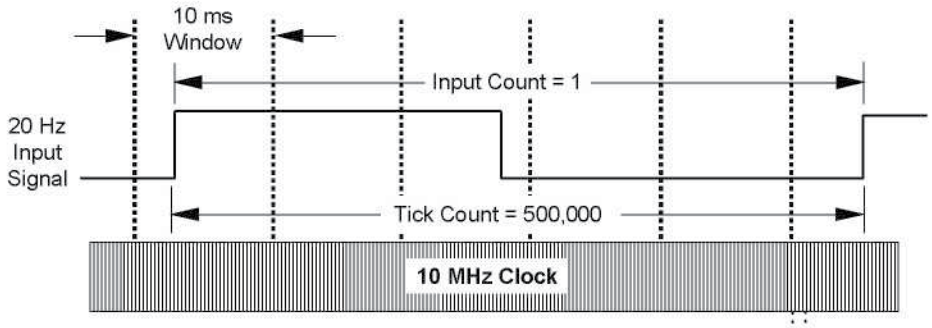
Typical Timing Sequences



Notes: 1. The frequency calculation is: 5 x 10,000,000 / 102,040 = 490.0039 Hz. The clock resolution of ±1 count could result in readings from 489.999 to 490.0087 Hz. A 100 ms window will reduce this error by a factor of 10.

2. The counting for an observation window period starts at the first input signal low-to-high transition after a window edge and stops with the first such transition after the next window edge.

3. The observation window timing is not included in the calculation. The window only controls the minimum observation time for frequencies whose period is equal to or less than one window time.



Notes: 1. The frequency calculation is: 1 x 10,000,000 / 500,000 = 20.00000 Hz with a ±0.00004 Hz resolution "jitter."

2. For a 10 ms observation window, any input signal whose period is greater than 10 ms (a frequency less than 100 Hz) will result in an input count of 1. The tic count will not terminate until one whole input period is counted or the tic counter for that channel overflows (after a count of 16,777,215).

3. The previous count will be in the current value table until another whole period is measured.

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Item	Specification
Inputs	
Number of input channels	8
Type	Differential and TTL ("D" option); Differential (BNC option)
Differential inputs:	
Coupling	AC or DC, per-channel programmable
Input impedance (switchable)	1 MΩ/100Ω (Decoupling), >10 MΩ/100Ω (AC coupling)
Input range (per-channel programmable)	V635-wAyz: ±20, 40, 100, 200 mV to ±20 V (all ranges) V635-wByz: ±100, 200, 500, 1000 mV to ±20 V (all ranges) (Max further limited to ±5 V with the 100 Ω. termination active)
Switching threshold	30% of input range minimums as shown above (typical)
Hysterisis	After a positive-going signal passes the positive threshold, the signal must pass the negative-going threshold to cause switching.
Input protection	47kΩ 2 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, +10°C to+50°C
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	
V635-wAyz	
Differential input connector	25P "D"
TTL input connector	15P"D"
Calibration connector	9P "D"
V635-wByz	
Differential input connectors	BNC
Calibration connector	2-contact LEMO
Power Requirements	
+5V	1000 mA
+24 V	100 mA (V635-wx1z); 150 mA (V635-wx2z)
-24 V	100 mA (V635-wx1z); 150 mA (V635-wx2z)
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	10CFM
Dimensions	340 mm x 233.35 mm x 30.48 mm (C-size VXIbus)
Front-panel potential	Chassis ground

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RELATED PRODUCTS

Model 5911-Z1A	Connector—2-contact LEMO
Model 5930-Z1A	Connector—9S "D"
Model 5936-Z1A	Connector—15S "D"
Model 5932-Z1A	Connector—25S "D"

ORDERING INFORMATION

MODEL	DESCRIPTION
V635-AA21	8-channel, 100 kHz Frequency Counter, ±20 - 200 mV to ±20 V Range, "D" Connectors
V635-AB21	8-channel, 100 kHz Frequency Counter, ±100 - 1000 mV to ±20 V Range, "D" Connectors
V635-BA21	8-channel, 100 kHz Frequency Counter, ±20 - 200 mV to ±20 V Range, BNC Connectors
V635-BB21	8-channel, 100 kHz Frequency Counter, ±100 - 1000 mV to ±20 V Range, BNC Connectors

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