

### Description

The 5636 is a programmable four-channel dual-input Frequency-to-Voltage converter that provides signal conditioning for frequency output transducers. This includes magnetic pickups, optical encoders, and other rotation or position-sensing devices. The input pulses are converted to a filtered DC output voltage between 0 and  $\pm 10$ v, based on the input frequency, the user-selected Hz/V conversion factor, and the direction of rotation.

### Design Features

The 5636 provides input signal isolation to prevent ground-loop problems, programmable gain to accommodate input signal levels from 25 mV to 250 Volts, a secondary fully conditioned input for direction-sense which configures the output voltage polarity to indicate forward or reverse rotation, programmable low-pass output filtering, and programmable excitation voltage. To assist with setup and troubleshooting, the conditioned input pulses can be monitored at the DC output connector. Front-panel LEDs indicate signal presence and activity level, and warn of module operational problems.

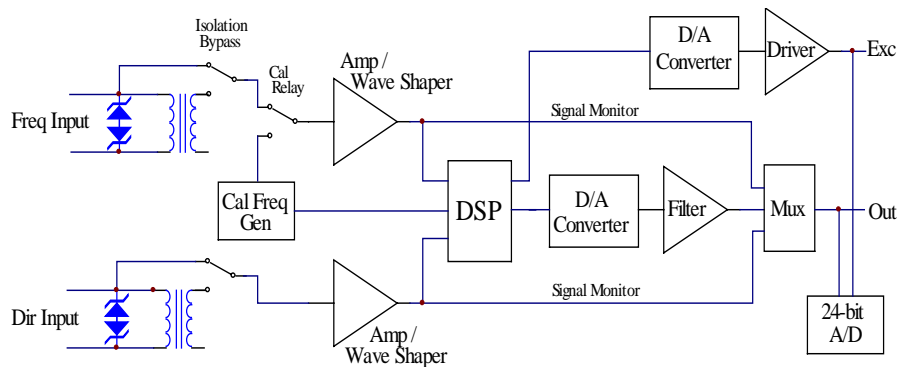
To verify channel operation and accuracy, an on-board programmable frequency generator can be switched into the input with a high-accuracy 24 bit A/D converter used to calibrate the analog outputs. Low temperature-coefficient components are used to maintain system accuracy over a wide temperature range, and all circuitry is housed in a shielded enclosure for improved reliability and noise reduction.



5636 Four Channel F to V Module

### Dual Input Stages

Each sensor channel contains input signal conditioning for two isolated signal sources allowing for direction sensing in addition to base frequency-to-voltage conversion. Both signal inputs are zener-clipped and fed through isolation transformers to prevent ground-loop problems and provide up to 250v of common-mode rejection. For input frequencies below 100 Hz (the isolation transformer minimum), a bypass relay is provided for direct coupling to each wave-shaper amplifier.



5636 Technical Diagram

### Features

- **Extended Conversion Range**  
0.01 Hz to 100 kHz
- **Dual Inputs per Channel**  
25 mV to 250 Volts  
Isolated: 100 Hz to 100 kHz  
Non-isolated: DC to 100 kHz
- **Integral Calibration Source**  
Accuracy: 0.001%  
Stability: 50 ppm/°C
- **Sensor Voltage Excitation**
- **LED Status Indicators**
- **Compact Rugged Enclosure**

### Wave-Shaper

This stage converts input signals of various amplitudes and wave-shapes into a conditioned square wave. The signal is first amplified to a suitable level using a programmable-gain amplifier and then converted to a square-wave using a comparator with programmable voltage hysteresis. The shaped signal is then fed to the DSP for processing, and to an output multiplexer allowing direct output of the shaped input signal.

## DSP Frequency Conversion

The Digital Signal Processor is the heart of the 5636 Frequency to Voltage converter. Using an internal reference clock that is accurate to 0.001%, the input signal frequency is accurately measured and converted to an equivalent 0 to  $\pm 10$ v digital value, based on the user-selected conversion range and the calibration constants stored in memory. The digital values generated by the DSP are then averaged and filtered according to user-selected parameters, including output bandwidth and slew rate. This allows for a wide conversion range without sacrificing accuracy or depending on the tolerances of matched analog components.

## Output Circuit

This circuit consists of 16 bit Digital-to-Analog converter followed by a 4-pole smoothing filter which removes any digital steps in the output signal generated by the DSP filter and skew rate controls. In addition, an output multiplexer allows the user to monitor either the DC output voltage or shaped input signals.

## Voltage Excitation with Remote Sense Capability

The 5636 provides four independent programmable excitation voltage sources for use in powering input sensors. Each source is controlled by a 16 bit DAC with an output range from 0 to 10 Volts and 100 mA output buffering. Remote sense can also be selected to provide feedback accounting for IR losses over conductor lines between amplifier and sensor.

## System Calibration

High accuracy is obtained during the conversion process by implementing a unique end-to-end calibration scheme within the 5636 Converter. The DSP chip generates a calibration signal that is accurate to 0.001%. This signal is switched into the input, processed by the normal input wave-shaping circuit, counted by the DSP processor, and converted to an analog output voltage by the D/A converter and smoothing filter. An accurate 24-bit A/D converter is then used to measure the actual DC output voltage allowing correction factors to be calculated and stored in the DSP memory for enhanced conversion accuracy.

## Specifications

### General

Conversion range	DC to 100 kHz
Conversion scale	10 Hz/V to 10 kHz/V, programmable
Accuracy	0.01%
Linearity	0.01%
Input voltage range	25 mV to 250v peak
Frequency response	DC to 100 kHz (non-isolated input) 100 Hz to 100 kHz (isolated input)
Common-Mode Rejection	90 dB @ 100 Hz
Common Mode Voltage	200v max (isolated) 10v max (non-isolated)
Max input voltage	250v peak
Output voltage range	$\pm 10$ v @ 50 mA
Output impedance	50 ohms
Output Noise	0.5 mV rms

### Direction Sense

Input voltage range	25 mV to 250v peak
Frequency response	DC to 100 kHz (non-isolated input) 100 Hz to 100 kHz (isolated input)
Common-Mode Rejection	90 dB @ 100 Hz
Common Mode Voltage	200v max (isolated) 10v max (non-isolated)
Max input voltage	250v peak

### Low-Pass Filter

Type	Digital, programmable
Range	0.1Hz to 1 kHz
Roll-off	96 dB/octave, programmable
Signal Overload	
Indicator	Front-panel LED
Trip level	0 to 10v, Programmable

### Calibration Source

Type	Internal Crystal Oscillator
Frequency range	1 Hz to 100 kHz
Accuracy	0.001%
Stability	50 ppm/ $^{\circ}$ C

### Excitation

Type	Programmable Voltage
Voltage range	0 to 10v @ 100 mA
Sense	Local or Remote
Accuracy	0.02%
Short protection	Yes

### Environmental

Operating temperature	0 to 50 $^{\circ}$ C
Storage temp	-25 to 85 $^{\circ}$ C
Humidity	0 to 90% non condensing

### Physical Characteristics

Package	Shielded, 6 sides
Dimensions	0.8" x 4.2" x 9.5"
Weight	1.3 lbs