APS Custom Voltage to Freq Converter

Designed and built by

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Features

- Standard NIM instrument
- 4 independent channels
- Analog inputs have separate grounds
- Up to 50MHz output frequency
- 0-10V input range
- Channels have 2MHz, 10MHz, 25MHz, 50MHz ranges
- 16 or 24 bit A/C converters (2 versions of instrument)
- Controllable with menus/LCD display
- Calibration stored in internal FLASH
- FPGA reprogrammable by USB port on back
- Over/Under Voltage Indicator

Operation

Connections

Each of the four channels has an input and output BNC. The input range is from 0V to 10V DC, with 600ohm input impendence. Each input is individually grounded and connected to the chassis with a 10k resistor (or basically isolated). The output BNC supplies a pulse of 10ns in width at TTL levels. The output impedance is 50ohm. The unit performs best if the output is terminated at the scalar (not at the V2F) with 50ohm. The voltage source should be low impedance, of 50 ohm or less. The unit is calibrated with a 50ohm voltage source. Differing impedances will cause the unit to have a gain error.

Power up

The unit powers up as the NIM crate powers up. The LCD display backlight should glow green when powered. On power up, the unit will immediately produce frequencies at the 4 outputs based on the 4 analog inputs. The 50MHz range is default, for a 0V to 10V input.

Navigating Menus

To change settings in the unit, a knob for changing the menu and button for selecting the menu is provided. For basic operation, it is sufficient to simply connect the input and output cables and power on the unit. To descend the menu tree, turn the knob to desired menu and hit select. A lower level menu will appear. Each lower level menu has an "Up Menu" choice that can be selected to ascend the menu hierarchy. Turn the knob clockwise, and the "Up Menu" will eventually appear.

DC Offset calibration

Because of conditions in an experimental hutch, the performance of the V2F can be optimized by measuring DC offset, caused by grounding etc. Connect the input and output cabling. Set the input signal level to 0V, or no signal. On the main menu, rotate the knob to select the DC offset menu. Select the menu, and then select the channel to measure the DC offset. For channel 1, select channel 1. The DC offset will be calibrated. A new cabling setup will require a new DC offset calibration. Powering down the NIM crate will require a new DC offset calibration. After calibration of DC offset, select Up Menu to return to main menu.

If no DC offset calibration is done, the unit is precalibrated for a 50ohm source. Generally, no calibration should be needed.

Frequency Ranges

For alternate frequency ranges, each channel can be independently set to alternate frequency ranges, or the largest frequency generated for a 10V input. The ranges are 50MHz, 25MHz, 10MHz, 2MHz, and 0MHz (to disable the channel).

Over/Under Signal Indicator

If the input voltage is above 10V or below 0V, the LCD will flash the channel number that is over or under voltage. The frequency output will peg at 50MHz (or its highest range) or 0Hz.

Viewing signal levels

The input and output signals can be viewed in the LCD. The signals include:

- ADC values (calibrated or raw values)
- Voltage at input
- Frequency Outputs

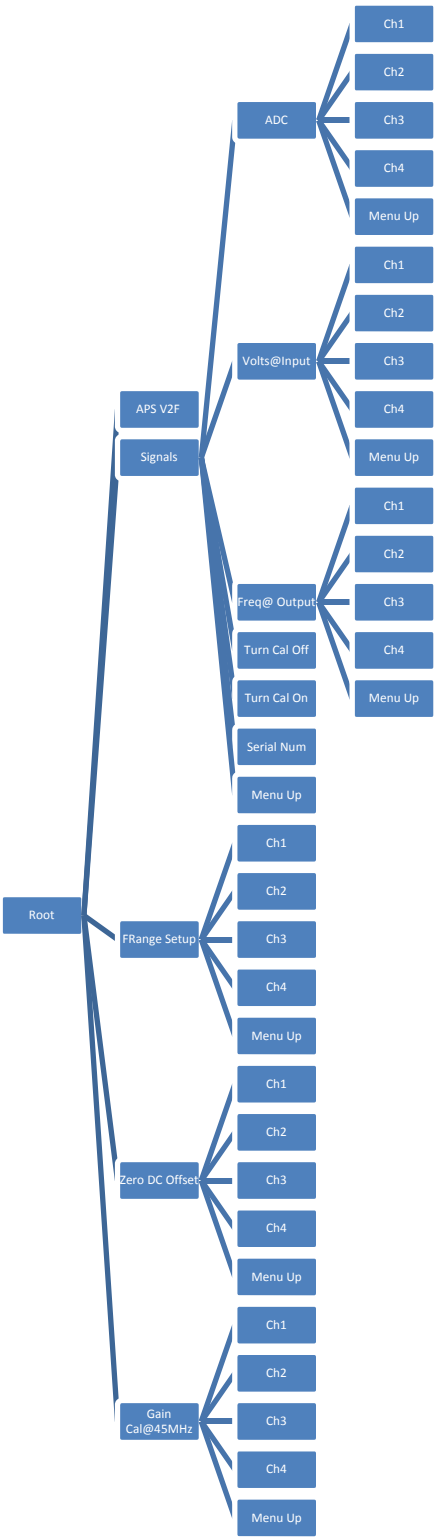
Further, the calibration can be turned on or off for debugging purposes. If calibration is turned off, the raw ADC values can be observed. The frequency output will be out of calibration of cal is turned off.

Gain Calibration

Selecting the Gain at 45MHz menu allows recalibration of gain. Feed a 9V signal into the unit and select the channel to calibrate. The factory calibration will be restored on power up. This setting is not recommended for novice users. DC Offset Cal should be done first with a 0V signal for best results.

Menu Structure

The menu structure is diagrammed below.


Root
APS V2F
Signals
ADC
Ch1
Ch2
Ch3
Ch4
Menu Up
Volts@Input
Ch1
Ch2
Ch3
Ch4
Menu Up
Freq@ Output
Ch1
Ch2
Ch3
Ch4
Menu Up
Turn Cal Off
Turn Cal On
Serial Num
Menu Up
FRange Setup
Ch1
Ch2
Ch3
Ch4
Menu Up
Zero DC Offset
Ch1
Ch2
Ch3
Ch4
Menu Up
Gain Cal@45MHz
Ch1
Ch2
Ch3
Ch4
Menu Up

Specs, for 50ohm Input Source

Input Voltage Range	0V-10V
Input impedance	600ohm
Input absolute offset	300uV with 50ohm Input
Output Freq Range	50MHz, 25MHz, 10MHz, 2MHz
Output impedance	50ohm
Output voltage levels	TTL
Pulse width	10ns
Sample Rate	15Hz
Linearity error	30ppm (by design)
Thermal drift	TBD
Abs Freq error	1.6kHz 50MHz range. DC offset cal improves to 800Hz