

PROSPECTOR PRO-8010

Frequency Converter



Data Sheet

intelligentRF solutions

FEATURES

- **DSP based versatile signal converter**
- **Up-or down-conversion of 10 kHz to 50 MHz to any output frequency in the range of 1 MHz to 200 MHz**
- **Supports all standard IF outputs:
10.7/21.4/70/140/160 MHz**
- **14-bit ADC resolution at input**
- **16-bit DAC resolution at output**
- **Selectable digital filter bandwidth from 3 kHz to 50 MHz**
- **Low differential group delay**
- **1 kHz tuning resolution**
- **Ethernet control**
- **Single channel; optional dual channel operation**
- **Custom bandwidth sets available**



traditional analog, or modern digital signal recorders. The signal can be digitally frequency-translated to any standard IF frequency in the range of 1 MHz to 200 MHz. This includes the ability to down-convert input signals to an alternate frequency within the range of 10 kHz to 50 MHz. A user-selectable digital filter converts only the signal within the bandwidth of interest and provides high rejection of adjacent signal energy.

Unlike traditional analog products that rely on image rejecting mixers and banks of discrete filters to meet signal filtering and rejection requirements, the PRO-8010 DSP-based design implements the shaping filter digitally, thereby providing superior selectivity and transition band performance (1.125:1 shape factor) without the group delay distortion typical of analog filters. The PRO-8010 provides selectable bandwidths ranging from 3 kHz to 50 MHz.

Digital frequency conversion rejects unwanted output signals, offering superior sideband suppression and LO rejection compared to analog techniques. This allows the output signal spectrum to overlap the input frequency spectrum without compromising dynamic range, and it permits the output signal spectrum to remain upright or be inverted as desired. Tuning resolution of 1 kHz is readily achieved without the need for multi-loop frequency synthesizers.

Control is effected via a host computer running control software via the standard Ethernet 100BaseT interface. Optionally, the unit is available with a full-function front panel (see photo on first page), allowing the unit to be used in a stand alone mode, ideal for lab applications. In both configurations, the unit is provided as a single unit, full-width, 19-inch rack package.

DESCRIPTION

The PRO-8010 Signal Converter is the first member of Intelligent RF Solutions Prospector family of DSP-based, signal processing products. Built on a flexible FPGA-based hardware platform the Prospector Signal Converter offers the flexibility of all-digital frequency conversion and digital filtering, as well as the ability to incorporate software-based upgrades available in the future.

The Prospector PRO-8010 series converters are capable of processing signals with bandwidths as wide as 50 MHz, and have been tailored to meet the requirements of versatile frequency translation useful for post-processing and lab applications. Specifically, the PRO-8010 provides selectable up-conversion, from baseband, of bandpass signals that have been stored on

This equipment does not contain provisions for the installation of an intelligence database (i.e. threat signal parametric data).

This equipment may be subject to U.S. Government export controls. Consult factory for details.

PRO-8010

Designed to provide flexibility of Baseband-to-IF signal conversion, the PRO-8010 input is compatible with input signals as high as +13 dBm (analog tape levels), and it will also interface with lower operating level digital recorders while still providing the optimum dynamic range available from the input A/D Converter. The maximum output level of the standard unit is -7 dBm, which can be downwardly adjusted to meet the requirements of specific digital recorders, or it can be further attenuated to as low as -37 dBm for compatibility with IF post-processing equipment.

Applications

As a Baseband-to-IF Converter, the PRO-8010 is a superior replacement for the legacy Model 391 Product series, which offered a maximum of two signal bandwidths, a single IF output frequency, no remote communications, and the limitations of a single-conversion, analog approach. The PRO-8010 extends beyond this capability by permitting down-conversion, digital filtering, and versatile tuning. Digital techniques allow the input frequency range to extend to near-DC, thereby making it possible to up-convert audio-range signals from a sound card to IF for simulation, testing and processing.

The architecture of the digital converter and high-selectivity digital filter permit the PRO-8010 to function as a channel extractor, whereby any signal in the input range of 10 kHz to 50 MHz can be selectively bandpass filtered (as narrow as 3 kHz) and down- or up-converted. This finds applications in selection of single channels or groups from the video output of an FDM or other multi-channel communications signal. Further, if the input and output frequencies are selected to be identical, then the PRO-8010 simply functions as a selectable bandpass filter with adjustable input and output levels, useful for lab applications.

Future configurations within the PRO-8010 series will permit limited-bandwidth frequency down-conversion from standard IF input frequencies of 70, 140 and 160 MHz, with slight degradation in SNR performance. In this configuration, the unit will effectively offer a superior replacement to the Model 391 IF-to-IF Converter as well as the Model 388 IF-to-Tape Converter products.

Additional features planned for future development include digital input and digital output interface ports (LVDS). A digital input will allow the PRO-8010 to accept digital data samples directly from a digital recorder without adding potential distortions from the additional A/D and D/A stages. As an IF-to-Recorder converter, the digital output samples can be directly sent to the digital recorder, thereby eliminating additional digital/analog conversion stages. Essentially, the PRO-8010 adds the functionality of a high-performance D/A and A/D converter.

With both digital input and output capability, the PRO-8010 can be used as a digital-in/digital-out processor. In this mode, live digital signals, or a pre-recorded input signal from a digital recorder may be selectively filtered and optionally frequency-shifted and/or re-sampled, and sent back to the recorder for storage of only the desired signals of interest. A full-function GUI, supplied by Intelligent RF Solutions, is instrumental in this implementation.

While the PRO-8010 is a single input channel frequency converter, future configurations will include both dual analog inputs as well as dual analog outputs. With dual analog inputs, the user may select two different signals from two sources that are each filtered, frequency

shifted and added to form a composite test signal. This is useful for testing susceptibility and measuring the performance of target demodulators and processors in the presence of interfering signals.

The addition of a second analog output allows additional functions to be implemented in software. One such function is the I/Q Output mode, where the input signal is converted to I and Q components.

With the Dual analog input option, the unit will offer an additional Quadrature Modulator option. In this mode, analog I and Q signals are applied to the dual inputs, and the output frequency is specified by the user. The real I and Q signals are multiplied by cosine and sine digitally-generated signals, and the results added to produce a modulated signal at the desired IF output frequency. This makes the PRO-8010 useful as a test signal generator.

The addition of spectral monitoring capability will allow the user to graphically monitor the results of his filtering and frequency translation selections.

For further information on the Prospector line of DSP-based signal products and their capabilities, please refer to the Prospector Product Family Data Sheet.

SPECIFICATIONS

Input ports	Two, selectable
Input center frequency 3 dB bandwidth	10 kHz to 50 MHz DC to 52.5 MHz
Tuning resolution	1 kHz
Input ADC rate/resolution	125 MS/s, 14-bit
Input operating signal level	-10 dBm to +21.5 dBm (200 mVp-p to 7.5 Vp-p)
Maximum input without damage	+23 dBm
Input VSWR	≤1.1:1 (to 50 MHz at input level >0 dBm) ≤1.5:1 (input level ≤0 dBm)
Input impedance	50 Ω, nominal
Input connectors	BNC
Output center frequency 3 dB bandwidth	1 MHz to 200 MHz 200 kHz to 205 MHz
Maximum output bandwidth	50 MHz
Tuning resolution	1 kHz

3.0 kHz	15.0 kHz	60 kHz	300 kHz	1.0 MHz	5.0 MHz	20.0 MHz
3.5 kHz	17.5 kHz	70 kHz	350 kHz	1.25 MHz	6.0 MHz	22.5 MHz
4.0 kHz	20.0 kHz	80 kHz	400 kHz	1.5 MHz	7.0 MHz	25.0 MHz
4.5 kHz	22.5 kHz	90 kHz	450 kHz	1.75 MHz	8.0 MHz	30.0 MHz
5.0 kHz	25.0 kHz	100 kHz	500 kHz	2.0 MHz	9.0 MHz	35.0 MHz
6.0 kHz	30 kHz	125 kHz	600 kHz	2.25 MHz	10.0 MHz	40.0 MHz
7.0 kHz	35 kHz	150 kHz	700 kHz	2.5 MHz	12.5 MHz	45.0 MHz
8.0 kHz	40 kHz	175 kHz	800 kHz	3.0 MHz	15.0 MHz	50.0 MHz
9.0 kHz	45 kHz	200 kHz	900 kHz	3.5 MHz	17.5 MHz	
10.0 kHz	50 kHz	225 kHz		4.0 MHz		
12.5 kHz		250 kHz		4.5 MHz		

**PRO-8010-01 Selectable BW digital shaping filters
(other bandwidths available as custom configuration)**

Output DAC 500 MS/s playback rate
16-bit resolution

Output signal level -7 dBm to -37 dBm
adjustable in 1 dB increments

Output spurious
In band ≤ -60 dBc (output ≤ 50 MHz)
≤ -57 dBc (output > 50 MHz)

Out of band ≤ -65 dBc (output ≤ 70 MHz)
≤ -45 dBc (output > 70 MHz)

Unwanted sideband suppression ≥ 60 dB

SNR > 72 dB (1 MHz bandwidth)

Output connectors BNC

Output VSWR ≤ 2.0:1 (200 kHz to 200 MHz)

Output impedance 50 Ω, nominal

Filter shape factor 1.125:1 (60 dB/3 dB)
> 70 dB ultimate rejection

Digital bandpass filter flatness < 0.1 dB

Gain range (absolute) +3 dB to -58.5 dB

Group delay variation ≤ 2 ns pk-pk over 5 MHz BW
≤ 35 ns pk-pk over 50 MHz input BW
≤ 14 ns pk-pk over 40 MHz input BW

Two-tone third order intermodulation products ≤ -70 dBc for Fin=5 MHz to 50 MHz
≤ -55 dBc for Fin=1 MHz to 5 MHz

Phase noise < 0.10° rms

Harmonics at output ≤ -57 dBc

External reference input Sinewave, 10 MHz
Input level 0 dBm ± 6 dB
VSWR ≤ 1.2:1
Impedance 50 Ω, nominal

Local control Front panel (optional)

Remote control Ethernet 100BaseT

Input power 100-240 Vac, 72 W, 47-63 Hz

Power factor > 0.95 at 110 Vac
> 0.60 at 220 Vac

Operating temperature 0° to 50° C

Storage temperature -10° to +65° C

Size 1.75" H x 20.16" D x 17" W
4.38 cm H x 51.2 cm D x 43.18 cm W
Mounts in Standard 19" rack
Note: D dimension is panel to panel and does not include connectors.

Weight 12 lbs 6 oz (5.61 kg)

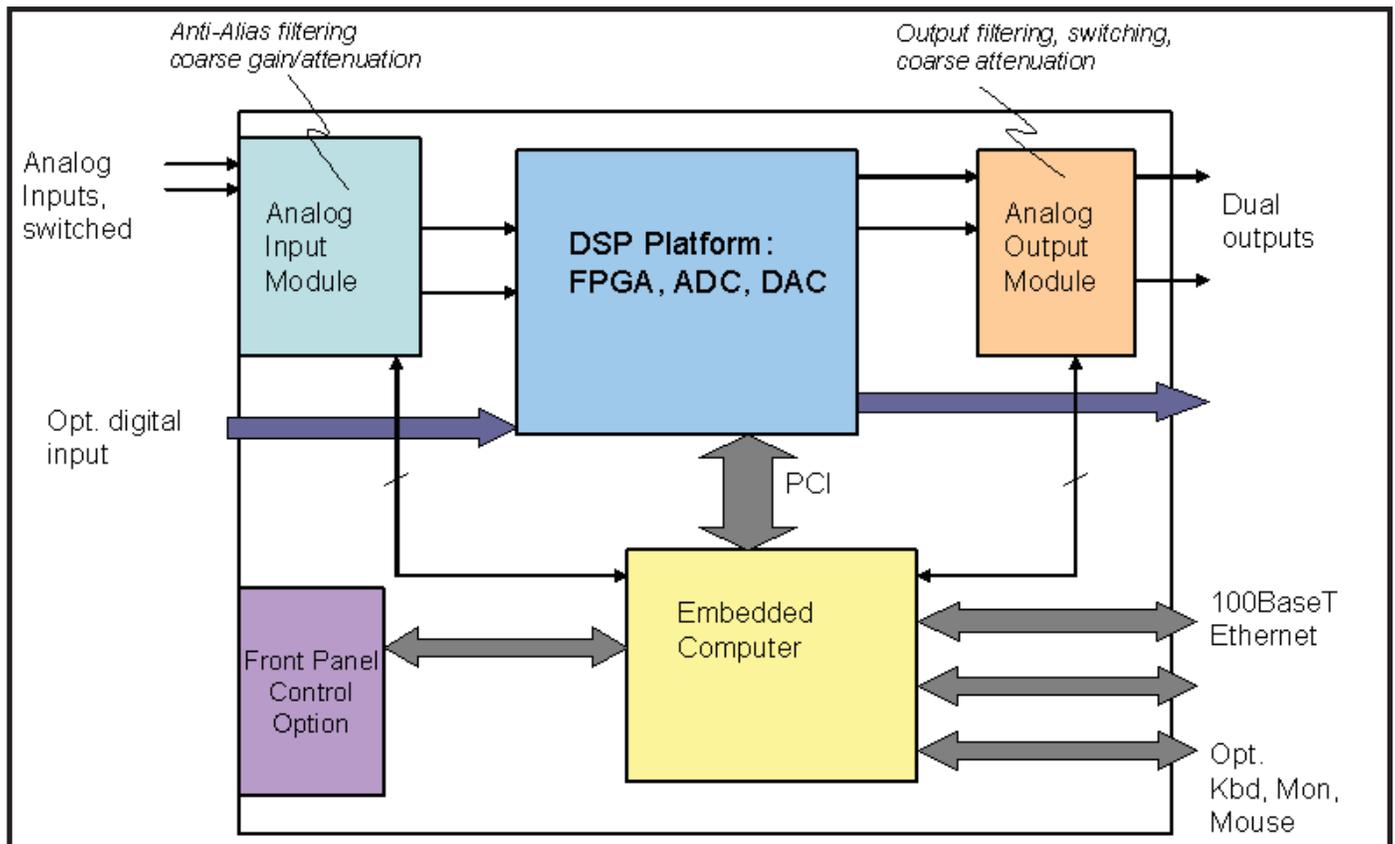
Specifications guaranteed at 25°C.
Specifications are subject to change without notice.

ORDERING INFORMATION

PRO-8010-01 Baseband analog input, 50 MHz BW, IF analog output

OPTIONS

- Integrated front panel control
- Custom filter bandwidth sets
- Dual channel configuration
- Quadrature modulator
- Digital input interface
- Digital output interface
- Extended input IF range



PROSPECTOR 8010 block diagram

WARRANTY

All [intelligentRFsolutions](http://www.intelligentRFsolutions.com) equipment is warranted for one year, except for damage caused by accident or misuse, provided the equipment is returned for repair to the plant in Sparks, Maryland U.S.A

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