



## RVP900™

Vaisala Digital Receiver and Signal Processor



### Features

- Comprehensive digital IF and signal processing functions
- 100 MHz, 16-bit IF sampling improving sensitivity and dynamic range in 5 independent channels
- Ethernet interface allowing RVP900 to be PC independent.
- Independent and parallel FIR filtering allowing dual pulse width and dual frequency strategies on each receive channel
- Dual Polarization, Wide Dynamic Range, and Pulse Compression ready.
- Open Linux PC platform

RVP900 provides a full suite of weather radar signal processing functionality to support implementing a new weather radar or upgrading an existing system to the latest signal processing technology.

### RVP901 IF Digital Receiver

RVP901 IF Digital Receiver (IFDR) provides receive, transmit, and IF detector functionality in a single, compact network-attached FPGA-based product able to perform tens of billions of multiply accumulate cycles per second.

The IFDR samples up to 4 receive channels and 1 burst channel of IF inputs and computes **I** and **Q** data from them. The **I** and **Q** data is transmitted over Gigabit Ethernet to the RVP902 signal processor for further processing into moments.

The fully digital transmit functionality can produce outputs as simple as a COHO for a Klystron system or as complex as a pulse compression waveform for a solid state transmitter.

### RVP902 Signal Processor

RVP902 Signal Processor is server class computer with a dual processor multicore Xeon processor running Linux.

RVP902, running RDA software, computes the radar data moments (**Z,T,V,W**) from the **I** and **Q** data provided by the IFDR. The moments can be distributed internally on RVP902 or externally to other computers running IRIS or third party software.

### DAFC Digital Automatic Frequency Control Unit

RVP901 and RVP902 use comprehensive, configurable I/O interfaces to provide DAFC functionality in a magnetron system, generate triggers, monitor status, and control the radar.

### Installation or Upgrade

You can integrate RVP900 into your own software or you may purchase the IRIS software for Linux workstations.

# IF Digital Receiver

## IF Inputs

A/D conversion	<ul style="list-style-type: none"><li>Resolution: 16 bit with jitter &lt;1.0 picosec</li><li>Sampling rate: 50 ... 100 MHz (software selectable)</li></ul>
Dynamic Range (dependent on matched filter)	90 ... >105 dB
IF range	5 ... 120 MHz
Impulse response	Up to 80 µsec These very long filters are used with pulse compression.
Input Signals	<ul style="list-style-type: none"><li>IF Received Signal: 50 Ω, +8.0 dBm full-scale, +20 dBm absolute max</li><li>IF Burst or COHO: 50 Ω, +8.0 dBm full-scale, +20 dBm absolute max</li><li>Optional Reference Clock: 7.5 MHz ... 100 MHz, -20 dBm ... 6 dBm</li></ul>
Master clock jitter	<1.0 picosec
Maximum number of range bins	Full unambiguous range at minimum resolution or 8168 range bins per channel (whichever is less)
Maximum range	Up to 1024 km
Minimum range resolution	15 meters (accuracy of ±1.5 m)
Multiply/accumulate cycles per second	38.4 billion Hz
Pulse repetition frequency (PRF)	50 Hz ... 20 KHz, +0.1%, continuously selectable
Range resolution	Minimum bin spacing of 25 m, selectable in N*8 . 33 m steps. Bins can be positioned in a configurable range mask with resolution of N* the fundamental bin spacing, or arbitrarily to an accuracy of ±2.2 m.
Sampling rate	50 ... 100 MHz
Saturation level	+8.0 dBm @ 50 Ω
Optional single and dual polarization wide dynamic range	>120 dB

## Phase Stability

Klystron	Better than 0.1°
Magnetron (for 1.0 microsecond pulse)	Better than 0.5°

## RVP901 IFDR I/O

Analog input	6 differential pairs ±10V Signal must be low frequency with steps settling to 0.1% in 800 nanoseconds and a maximum sampling rate of 0.5 µsec.
AFC output	<ul style="list-style-type: none"><li>Digital AFC (DAFC) with up to 24 programmable output bits</li><li>Automatic 2D (time/frequency) burst pulse search and fine-tracking algorithms</li></ul>
Data output through Ethernet	<ul style="list-style-type: none"><li>16-bit floating I and Q values</li><li>16-bit raw IF samples</li></ul>
RS-422	20 differential line pairs
RVP901 to RVP902 link	The IFDR is connected to RVP902 Signal Processor by a CAT5e cable (up to 25 m in length), jumbo 8192-byte packets. Each digital I/O line is configurable with over-voltage, ESD, and EFT protection.
TTL/CMOS Lines	20 series terminated

## IF Band Pass Filter

IF band pass filter	Programmable Digital FIR with software selectable bandwidth. Built-in, filter design software with user interface.
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# Signal Processor

## Signal Processing

Azimuth averaging	2 ... 1024 pulses
Clutter filters	IIR, fixed, and adaptive width GMAP
Data outputs (8 and 16 bit)	Ah/v, Azdr, CCOR, CSP, CSR, dBT, dBZ, dBZt, KDP, LDR, LOG, PHIH/V, PHIDP, PMI, R, RHOHV, SNR, SQI, T, V, VC, W, Z, ZC, ZDR, ZDRC, Zh, Zv, Zhv Ah/v, Azdr, CCOR, CSP, CSR, dBT, dBZ, dBZt, LOG, R, SNR, SQI, T, V, VC, W, Z, ZC, Zh, Zv
Dual polarization	Alternating, Simultaneous, H-Only, V-Only
Dual PRF velocity de-aliasing	2:3, 3:4, or 4:5 for 2X, 3X, or 4X de-aliasing
High sensitivity Zhv STAR Rhv STARmode processing	> 3 dB improvement detection gain
IF digitizing	16 bits, 100 MHz in 5 channels
Number of range bins	Up to 8168 per channel
Optional data outputs	HCLASS, I/Q
Processing modes	PPP, FFT/DFT, Random Phase 2nd trip filtering/recovery
Range resolution	N*15 m
Range dealiasing by random phase	

## Physical and Environmental Characteristics

Packaging	<ul style="list-style-type: none"> <li>Dimensions IF Digitizer (w x l x h):           <ul style="list-style-type: none"> <li>16.9 cm x 24.3 cm x 8.2 cm</li> </ul> </li> </ul>
Input power	RVP901 IFDR: <ul style="list-style-type: none"> <li>100 VAC ... 240 VAC</li> <li>50 Hz ... 60 Hz auto-ranging ±5%</li> </ul>
Power consumption	<ul style="list-style-type: none"> <li>RVP902/Main Processor: 1300 W</li> <li>RVP901 IFDR maximum power consumption: 50 W</li> <li>RVP901 IFDR IF Digitizer: 50 W</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>RVP901 with DC Option: -40°C ... +50°C, 0% ... 95% R.H. (non-condensing) with a minimum of 20 cubic feet per minute of air-flow.</li> <li>RVP901 with AC Option: -40°C ... +45°C, 0% ... 95% R.H. (non-condensing) with a minimum of 20 cubic feet per minute of air-flow.</li> </ul>
Reliability	MTBF > 50,000 hours (at 25°C)
Digital receiver	< 1 hour MTTR

## Digital Waveform Synthesis

Analog Waveform Applications	<ul style="list-style-type: none"> <li>Digitally synthesized IF transmit waveform for pulse compression, frequency agility, and phase modulation applications.</li> <li>Master clock or COHO signal to the radar; can be phase locked or free running, arbitrary frequency.</li> </ul>
TxDAC Analog Output Waveform Characteristics	<ul style="list-style-type: none"> <li>Two independent, digitally synthesized, analog output waveforms (SMA).</li> </ul>
DDS Analog Output Waveform Characteristics	<ul style="list-style-type: none"> <li>Direct Digital Synthesis of analog waveforms that has simpler modulation requirements than are possible with TxDACs</li> <li>Can drive up to +13 dBm into 50Ω</li> <li>Outputs frequencies 5 MHz ... 105 MHz</li> </ul>



