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# Tunable Demodulator WJ-9497



The WJ-9497 Tunable Demodulator utilizes advanced Digital Signal Processing (DSP) and surface mount technology to provide precision tuning, filtering, and demodulation of received signals. Input to the unit can be digital, in the form of a 50 megasamples-per-second (MSPS) or slower word parallel data stream, or analog. The use of direct digital synthesis techniques provides accurate tuning with resolution down to 1 Hz. Automatic and manual gain control are provided with a range of 50 dB.

When a user installs an optional Analog Input Module (AIM), the unit can process an analog input. The frequency range of the analog input is 0 to 90 MHz. The AIM can also accept a 20-MHz bandwidth signal centered at 160 MHz. The signal level can range from -60 to 0 dBm.

For the digital input, the demodulator accepts word-parallel data with rates up to 50 MSPS. The unit also requires the sample clock for the incoming data. The word size of incoming data is 12 bits.

**HEIGHT** 3.5 in (8.89 cm)      **DEPTH** 21 in (53.34 cm)  
**WIDTH** 8.5 in (21.59 cm)      **WEIGHT** 21 lbs (9.5 kg)

Excluding connectors, knobs & handles

## Features

- Precision tuning, filtering & demodulation
- Analog & digital inputs & outputs
- 0 to 90 MHz tuning range for analog signal inputs; also accepts 20-MHz bandwidth analog input centered at 160 MHz
- Up to 50 megasample-per-second data rate for digital input signals with 12 bits of precision
- AM, FM, DSB, SSB, ISB demodulation standard
- 1-Hz tuning resolution
- AGC or manual gain control
- 24 programmable IF bandwidths ranging from 100 Hz to 20 MHz
- Programmable video filtering
- Tunable analog predetection IF output: 0 to 21.4 or 160 MHz
- Low phase noise, passband ripple & differential group delay
- IEEE-488 remote control; other interfaces optional
- Built-in test capability to detect faults to circuit card level

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This material provides up-to-date general information on product performance and use. It is not contractual in nature, nor does it provide warranty of any kind.

The flexibility of the WJ-9497 DSP-based architecture allows for implementation of any IF bandwidth between 100 Hz and 20 MHz. The standard set of filters supplied with the unit provides 24 bandwidths from 100 Hz to 20 MHz. A corresponding set of video filters is also standard.

The WJ-9497 provides digital output signals including predetection IF, video, and audio. Digital predetection IF and video are word-parallel data with sample clock. Digital audio outputs are in a commercial digital audiotape (DAT) format.

Analog outputs are also available including video and predetection IF. The predetection IF signal is a variable IF tunable from baseband to 21.4 MHz in 100-kHz steps. The predetection IF can alternatively be output at a 160-MHz center frequency. An analog audio output is standard.

Demodulation modes supported by the WJ-9497 include AM, FM, USB, LSB, DSB, and ISB. AM and FM modes are available for all IF bandwidths. USB, LSB, and DSB modes are available for conventional voice-grade bandwidths and for standard IF bandwidths up to 20 kHz. ISB mode is available for standard IF bandwidths up to 10 kHz.

Utilization of 32-bit microprocessor circuitry allows for powerful local or remote control. A complete set of front-panel controls allows manual operation of the unit, while an IEEE-488 interface allows control from an external source. Status of the unit is obtainable through the front-panel display or through the remote interface.

## Functional Description

The functional block diagram shows the standard and optional modules that make up a WJ-9497 Tunable Demodulator. The unit accepts either analog or digital input. If users desire analog input, they must incorporate the optional Analog Input Module (AIM). The AIM tunes (if necessary), filters, and then digitizes the analog input signal. The resulting digital baseband signal consists of 10-bit data at a sampling rate of 50 MSPS.

Depending on whether the input signal is an analog or digital input, the WJ-9497 selects either the digitized baseband from the AIM or the external digital baseband input, which is buffered by the Input Buffer Module. A Resampler Module synchronously converts the selected data stream to a data rate compatible with subsequent processing, and

passes the data to the Digital Receiver Module (DRM). The DRM is the heart of the WJ-9497. It performs the tuning and IF filtering required to extract the desired signal from the input digital or analog baseband.

Using the predetection IF output from the DRM, an optional Digital Tunable Notch Filter Module (DTNF) allows a user to place a tunable notch within the received signal passband. The DTNF module is useful when it is desirable to remove narrowband interfering signals from the passband.

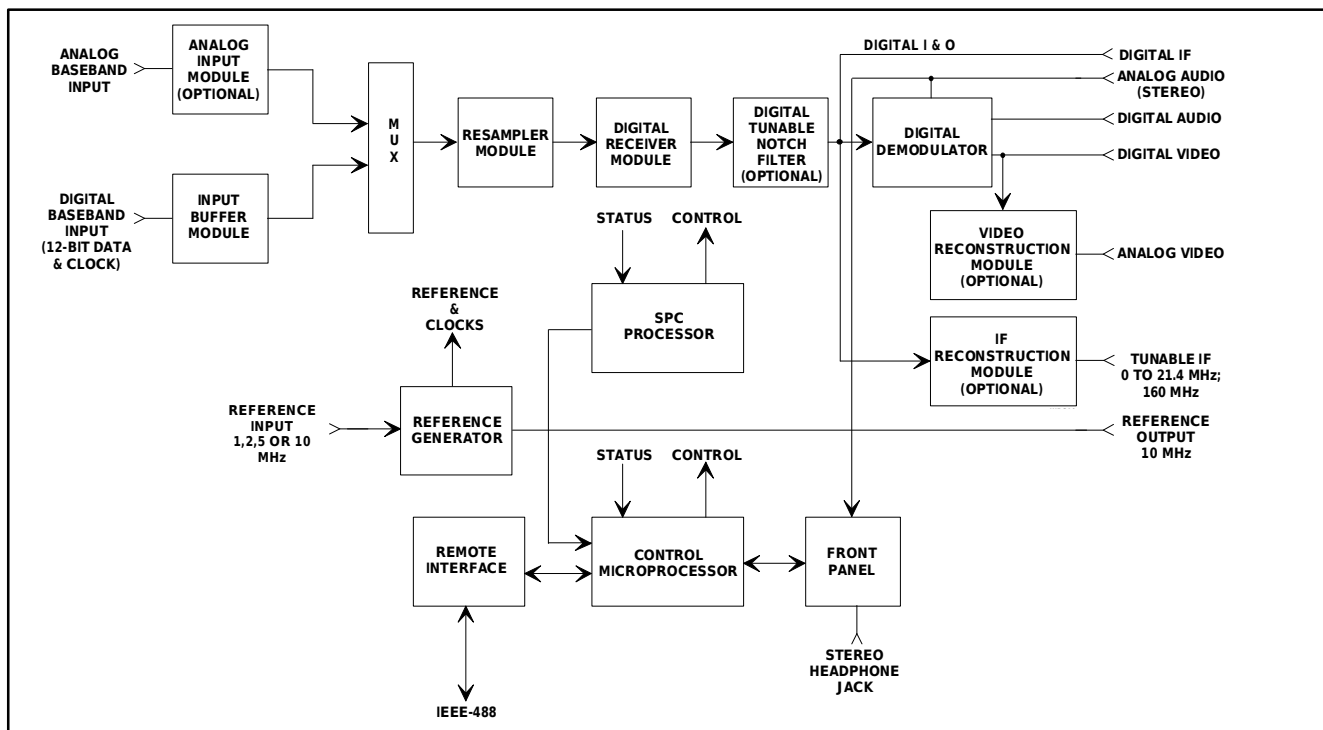
If installed, the optional IF Reconstruction Module (IFRM) accepts the digital predetection IF signal, and creates a single analog IF output. The analog IF output can be a fixed 160-MHz frequency, or a user can tune it from baseband to 21.4 MHz with a tuning resolution of 100 kHz.

A Digital Demodulator provides AM, FM, DSB, SSB, and ISB demodulation of the predetection IF signal from the DRM. Post-detection video filtering is also provided. The Digital Demodulator outputs are the selected digital video output, the digital audio output, and two analog audio outputs. The optional Video Reconstruction Module (VRM) accepts the selected digital video signal, and reconstructs an analog representation of the signal.

A 32-bit control microprocessor interprets remote and local commands to provide overall high-level control of the unit. The microprocessor sends commands to the 24-bit SPC processor that controls the processing functions and provides gain control supervision. A full-function front panel supports full manual control.

## System Applications

The WJ-9497 design incorporates several features that facilitate the integration of the unit within a system. The modular construction makes it easy to maintain with a minimum of down time. A key advantage of the modular construction is the ability to configure the WJ-9497 to best satisfy the operational requirements of the system. A user can incorporate off-the-shelf or custom options, in many cases eliminating the need for additional demodulation or post-processing equipment. The remote modular control function also allows the incorporation of different remote control interfaces.



WJ-9497 Functional Block Diagram

WPG10

Options\*

Model #	Functions	Physical Characteristics
<b>9497/AIM</b> Analog Input Module	<ul style="list-style-type: none"> <li>Processes analog signals in the 0 to 90 MHz frequency range</li> <li>Accepts signals centered within a 20-MHz bandwidth around 160 MHz</li> <li>Inputs baseband &amp; IF signals with levels from -60 to 0 dBm</li> <li>Supports automatic or manual gain control, with a 50-dB range</li> </ul>	<ul style="list-style-type: none"> <li>Installs in a dedicated option slot inside the chassis</li> <li>Consists of:                             <ul style="list-style-type: none"> <li>Printed Circuit (PC) Assembly</li> <li>Cable Assembly</li> <li>Rear-panel BNC Connector</li> </ul> </li> <li>Derives power &amp; control from basic WJ-9497</li> </ul>
<b>9497/DTNF</b> Digital Tunable Notch Filter Module	<ul style="list-style-type: none"> <li>Allows the placement of a tunable notch within the received-signal passband</li> <li>Provides selectable tuning Step size: 1 to 100 kHz</li> <li>Provides:                             <ul style="list-style-type: none"> <li>Notch width proportional to IF bandwidth</li> <li>Notch depth: 40 dB, min</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Installs in a dedicated option slot inside the chassis</li> <li>Consists of a single PC Assembly</li> <li>Derives power &amp; control from basic WJ-9497</li> </ul>
<b>9497/IFRM</b> IF Reconstruction Module	<ul style="list-style-type: none"> <li>Reconstructs &amp; outputs an analog version of the predetected IF signal</li> <li>IF-output center frequency tunable from 0 to 21.4 MHz in 100-kHz steps or fix-tuned at 160 MHz</li> </ul>	<ul style="list-style-type: none"> <li>Installs in a dedicated option slot inside the chassis</li> <li>Consists of:                             <ul style="list-style-type: none"> <li>PC Assembly</li> <li>Cable Assembly</li> <li>Rear-panel BNC Connector</li> </ul> </li> <li>Derives power &amp; control from basic WJ-9497</li> </ul>
<b>9497/VRM</b> Video Reconstruction Module	<ul style="list-style-type: none"> <li>Reconstructs &amp; outputs an analog version of the selected video signal</li> </ul>	<ul style="list-style-type: none"> <li>Installs in a dedicated option slot inside the chassis</li> <li>Consists of:                             <ul style="list-style-type: none"> <li>PC Assembly</li> <li>Cable Assembly</li> <li>Rear-panel BNC Connector</li> </ul> </li> <li>Derives power &amp; control from basic WJ-9497</li> </ul>

\* The base WJ-9497 accepts digital inputs, and provides digital and analog outputs. Except where noted, users can install option cards in any combination. Some options may require an upgrade of the control-microprocessor software.

## Specifications

<b>Digital Input Characteristics</b>	
Input Sample Rate .....	48.8, 97.7, 195, 391, 781 ksp/s, 1.56, 3.125, 6.25, 12.5, 25, 50 Msps
Input Format .....	12-bit word parallel & sample clock
<b>Analog Input Characteristics (with WJ-9497/AIM Option)</b>	
Frequency Range .....	0 to 90 MHz, 160 MHz with 20-MHz bandwidth
Input Levels .....	-60 to 0 dBm
Noise Figure .....	27 dB, max
Input VSWR .....	2:1, max
Input Overload .....	+20 dBm, with no damage
Input Impedance .....	50 ohms
Image Rejection .....	70 dB
Gain Control .....	Manual or AGC
Manual Gain Control Range .....	50 dB, nominal
<b>Tuner Characteristics</b>	
Tuning Step Size .....	1 Hz to 1 MHz, selectable
IF Bandwidths .....	20, 10, 5, 2, 1, 2.5 & 1.3 MHz 750, 600, 500, 200, 100, 50, 20, 10, 5, 3.8, 3.2, 2.6, 2, 1 kHz 500, 200, 100 Hz Other Filters Optional
IF Shape Factor .....	1.8:1 (3 to 70 dB)
Passband Ripple .....	0.3 dB, max
Image Rejection .....	70 dB, min
IF Rejection .....	70 dB
Output Spectrum .....	Normal or inverted
<b>Demodulator Characteristics</b>	
Detection Modes .....	AM, FM, SSB, ISB, DSB
Video Bandwidths .....	10, 5, 2.5, 1 MHz 500, 250, 100, 50, 25, 10, 5, 2.5, 1.9, 1.6, 1.3, 1 kHz 500, 250, 100, 50 Hz Other Filters Optional
Audio Bandwidths .....	20, 10, 5, 3.8, 3.2, 2.6, 2.5, 2, 1.9, 1.6, 1.3, 1 kHz 500, 250, 200, 100, 50 Hz
<b>Notch Filter Characteristics (with 9497/DTNF Option)</b>	
Tuning Range .....	Full width of passband
Tuning Step Size .....	1 Hz to 100 kHz, selectable
Notch Width (-3 dB), nominal	
20-MHz IFBW .....	2.6 MHz
10-MHz IFBW .....	900 kHz
5-MHz IFBW .....	225 kHz
2.5-MHz IFBW .....	225 kHz
2-MHz IFBW .....	55 kHz
1.3-MHz IFBW .....	55 kHz
1-MHz IFBW .....	27 kHz
750-kHz IFBW .....	27 kHz
600-kHz IFBW .....	27 kHz
500-kHz IFBW .....	14 kHz
200-kHz IFBW .....	14 kHz
100-kHz IFBW .....	14 kHz
<50-kHz IFBW .....	1.8 kHz
<b>Digital Output Characteristics</b>	
Digital Outputs .....	Predetection IF, Selected Video, Audio
Output Format .....	16-bit word parallel & sample clock for predetection IF & video Commercial Digital Audiotape (DAT) format for audio
<b>Analog Output Characteristics</b>	
Analog Outputs .....	2 Audio, Tunable IF (With 9497/IFRM option), Selected Video (with 9497/VRM option)
Output Impedance .....	600 ohms for audio; 50 ohms for others
IF Output Levels (9497/IFRM option) .....	-10 dBm, nominal
IF Passband Ripple (9497/IFRM option) .....	2.0 dB, max
Headphone Audio (Standard) .....	Toll-quality stereo; independent channel selection & volume control for each side
<b>Control</b>	
Local Control .....	LCD display (8 x 40 characters), keypad, cursor & edit control knobs, headphone volume controls
Remote Control .....	IEEE-488 interface, standard Consult factory for alternate interfaces
<b>Frequency Reference</b>	
Internal Reference Stability .....	+5 x 10 <sup>-7</sup> , max
External Reference Input .....	Will accept 1, 2, 5, or 10 MHz +1 PPM, 200 mV peak-to-peak, min. into a high-impedance load; automatically switches to external reference upon application of signal
Reference Output .....	10 MHz (0 dBm, nominal into 50 ohms)
<b>Physical Environmental</b>	
<b>Temperature Range</b>	
Operating .....	0 to 50°C
Meets All Specifications .....	10 to 40°C
Operating Altitude (50°C Ambient) .....	10,000 ft (3,048 meters) max
Power Requirements .....	115/230 Vac +10%, 50 to 400 Hz
Power Consumption .....	265 W, max