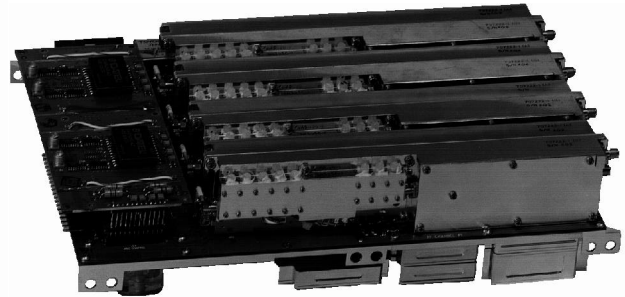


March 1997

## 12-channel HF/VHF/UHF Tuner WJ-9130



The WJ-9130 is a 12-channel HF/VHF/UHF tuner designed for airborne platforms. WJ provides a coherent Local Oscillator (LO) to all channels making the unit ideal for Direction Finding (DF) and beamforming applications.

The unit accepts 12 RF inputs. Each input passes through a switched suboctave preselector before the unit converts it to a 70-MHz IF. There are two separate RF paths:

- HF path (2 to 29.996 MHz)
- VHF/UHF path (29.997 to 2000 MHz).

The unit first routes the HF path through a suboctave preselector and then upconverts it to a 70-MHz IF. The unit routes the VHF/UHF path through a suboctave preselector, upconverts it to a 3745-MHz IF, and then downconverts it to a 70-MHz IF. The 12-wideband (4-MHz bandwidth) 70-MHz IFs are available as outputs from the unit. A separate path downconverts the 70-MHz IF to 75 kHz with a 25-kHz bandwidth (or to 600 kHz with a 200-kHz bandwidth for the WJ-9130/200-kHz option). The unit then samples at 100 kHz (800 kHz for the WJ-9130/200-kHz option) and outputs the sampled data as 12 serial outputs. WJ also provides a clock and sync for synchronization of the serial data.

### Features

- Frequency Range: 2 to 2000 MHz in 1-kHz steps
- High Performance: +4dBm IIP3 typical
- Low Phase Noise
- Suboctave Preselectors
- RS-232 external control

HEIGHT 10 in (25.4 cm) DEPTH 22 in (56.9 cm)<sup>(1)</sup>  
WIDTH 9 in (22.9 cm) WEIGHT 53 lbs (23.6 kg)

<sup>(1)</sup> Excluding connectors & fans.

### \*Restricted International Distribution\*

#### WATKINS-JOHNSON COMPANY

700 Quince Orchard Road, Gaithersburg, Maryland 20878-1794  
Phone: (800) WJHELPS or +(301) 948-7550  
FAX: +(301) 921-9479 Email: wj.helps@wj.com Website: www.wj.com

All International sales of WJ equipment are subject to USA export license approval.

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 WJ-9130 has four LOs for frequency conversion:

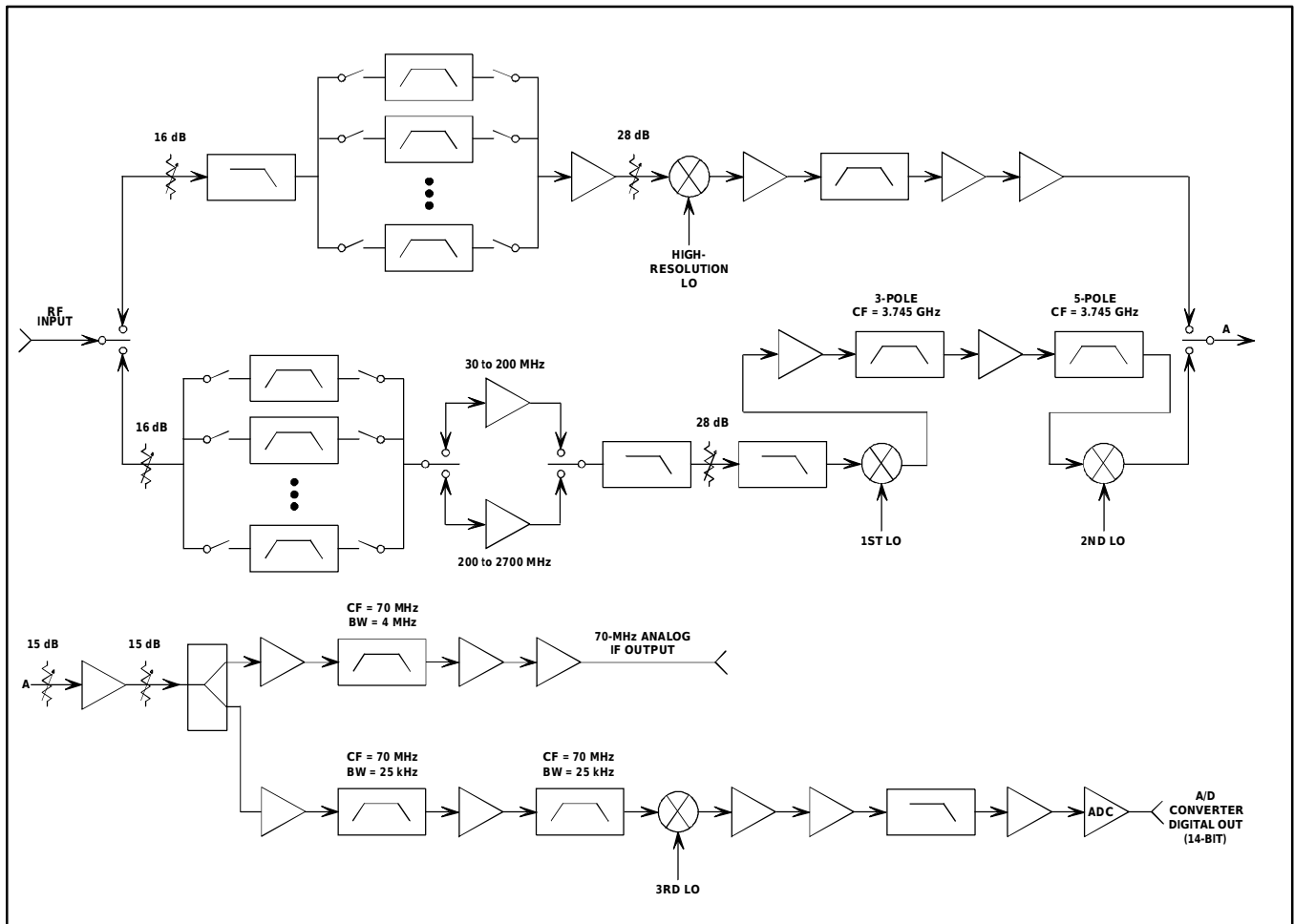
- **First LO** — tunes from 3745 to 5745 MHz in 2.5-MHz steps and upconverts the VHF/UHF input to a 3745-MHz IF
- **Second LO** — tunes from 3672.5 to 3675 MHz in 1-kHz steps and downconverts the 3745-MHz IF to a 70-MHz IF
- **Third LO** — fixed at 69.925 MHz (69.4 MHz for the WJ-9130/200 kHz option) and downconverts the 70-MHz IF to 75 kHz, which is then sampled at 100 kHz
- **High-resolution LO** — tunes from 72 to 100 MHz in 1-kHz steps and upconverts the HF path to a 70-MHz IF. (Also acts as the high-resolution LO in the second LO synthesizer.)

The WJ-9130 has a calibration channel that generates a CW or noise signal at the tuned frequency. The operator can adjust the level of the calibration output.

A programmable gate array on the digital control board allows external control of:

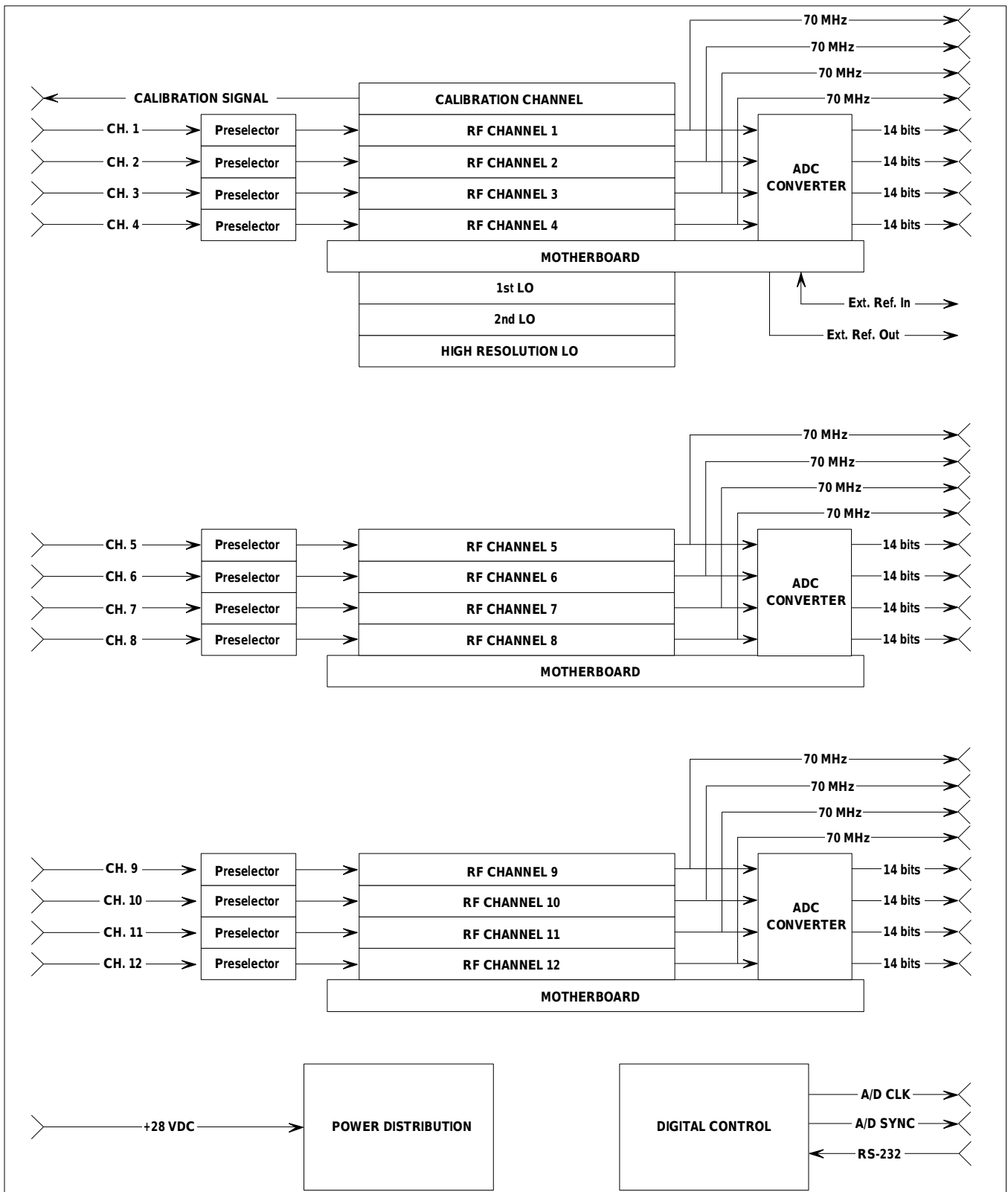
- Synthesizer LOs
- Preselector band
- Calibration and RF channel gains
- Analog-to-Digital (A/D) converter start/stop control (continuous or preset number of points).

The interface also provides query of the external reference status, LO lock status, and power supply status. It generates and synchronizes the clock and frame sync for the A/D converters. The digital interface is a low-level device that accepts raw bit streams over an RS-232 interface containing routing and data information. To set the tuned frequency, the operator must send commands to set the first LO, second LO, and preselector band. The unit does not support ASCII string parsing or settings queries. It will support bite commands to the extent that it can read a status byte.



WJ-9130 RF Converter Block Diagram

WPG110A



WJ-9130 Functional Block Diagram

WPG110

## Specifications

<b>Frequency Range</b> .....	2 to 2000 MHz
<b>Tuning Resolution</b> .....	1 kHz
<b>Tuning Speed</b> .....	<12 mS, typical after receipt of last-tune bit
<b>Input Impedance</b> .....	50Ω nominal
<b>Dual RF Path</b>	
<b>HF</b> .....	2 to 29.996 MHz
<b>VHF/UHF</b> .....	29.997 to 2000 MHz
<b>Input VSWR</b>	
<b>HF</b> .....	<2:1 at tuned frequency
<b>VHF/UHF</b> .....	<3:1 at tuned frequency
<b>Maximum Input Signal</b> .....	+20 dBm without damage
<b>3rd-order Input Intercept Point (IIP3)</b>	
<b>HF</b> .....	+5dBm, min +8dBm, typical (50-kHz tone separation)
<b>VHF/UHF</b> .....	-5dBm, min +4 dBm, typical (50-kHz tone separation)
<b>2nd-order Input Intercept Point</b>	
<b>HF</b> .....	+37 dBm, min +55 dBm, typical
<b>VHF</b> .....	+40 dBm, min +55 dBm, typical
<b>UHF</b> .....	+50 dBm, min +55 dBm, typical
<b>Noise Figure</b>	
2 to 1000 MHz .....	16 dB maximum, 14 dB typical
1000 to 2000 MHz (0 to 30°C) .....	17 dB, max 15 dB, typical
1000 to 2000 MHz (30 to 50°C) .....	18 dB, max 16 dB, typical
<b>Gain Control</b> .....	58 dB in 1-dB steps
<b>Dynamic Range</b> .....	75 dBFS, typical 80 dBFS, typical
<b>Phase Noise HF</b>	
100 Hz .....	-100 dBc/ Hz typical
1 kHz .....	-100 dBc/ Hz typical
10 kHz .....	-113 dBc/Hz typical
100 kHz .....	-133 dBc/Hz typical
1 MHz .....	-144 dBc/Hz typical
10 MHz .....	-150 dBc/Hz typical
<b>Phase Noise VHF/UHF</b>	
1 kHz .....	-70 dBc/ Hz typical
10 kHz .....	-94 dBc/ Hz typical
100 kHz .....	-118 dBc/Hz typical
1 MHz .....	-145 dBc/Hz typical
10 MHz .....	-150 dBc/Hz typical

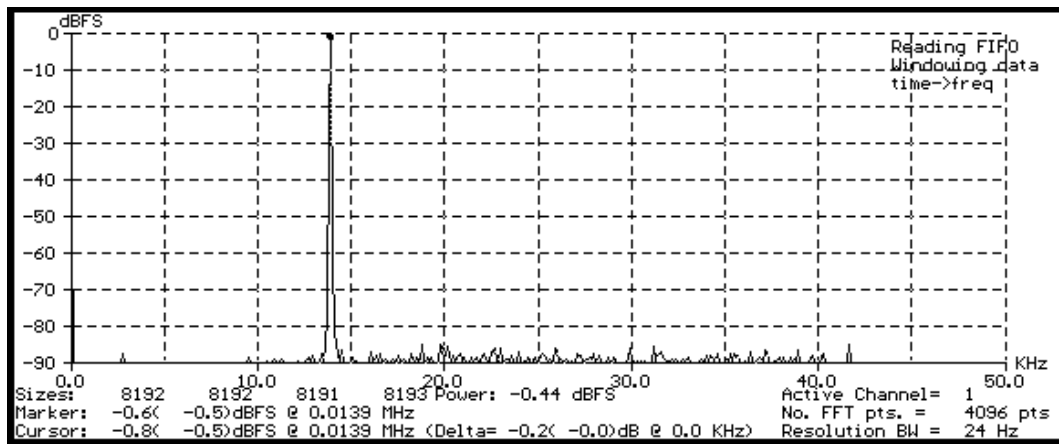
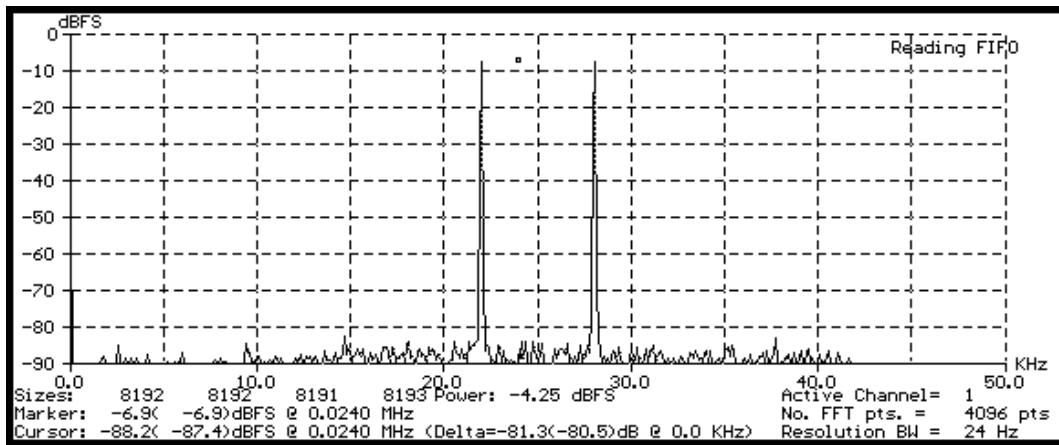
<b>LO Reradiation</b> .....	<-90 dBm maximum
<b>Channel-to-channel Isolation</b> .....	75 dB, min
<b>External Reference</b> .....	10 MHz, 0 dBm $\pm$ 3 dB
<b>Digitized Bandwidth</b> .....	25 kHz typical
<b>Sample Rate</b> .....	100 kHz 800 kHz for 9130/200-kHz option
<b>Narrowband Filter Response</b>	
3 dB .....	25 kHz, typical (200 kHz for 9130/200-kHz option)
60 dB .....	75 kHz, typical (600 kHz for 9130/200-kHz option)
<b>Wideband IF Output</b>	
Center Frequency .....	70 MHz
Noise Figure	
2 to 1000 MHz .....	16 dB, max 14 dB, typical
1000 to 2000 MHz (0 to 30°C) .....	17 dB, max 15 dB, typical
1000 to 2000 MHz (30 to 50°C) .....	18 dB, max 16 dB, typical
OIP3 .....	+20 dBm, min
OIP2 .....	+60 dBm, min
P1dB @ output .....	+10 dBm, min
Bandwidth (3 dB) .....	4 MHz, typical
Bandwidth (60 dB) .....	16 MHz, typical
Impulse Response (1/BW) .....	30 dB, typical
<b>Power Requirements</b> .....	+28 Vdc per MIL-STD-704D 350 W, typical
<b>Calibration Channel</b>	
Frequency .....	Exact-tuned frequency
CW Output Level .....	-4 to +3 dBm
Gain Control .....	62 dB in 2-dB steps

### Environmental Specifications

<b>Operating Temperature Range</b> .....	0 to 50°C
<b>Storage Temperature Range</b> .....	-40 to +70°C
<b>Humidity</b> .....	5 to 95% non-condensing

## External Control Format

Command	Routing Byte	Data Description
Set VHF/UHF Frequency	01 0001 11	[11:0] - FTSN, Fine-tune step number (1-kHz steps) [22:12] - CTSN, Course-tune step number (2.5-MHz steps) The tuned frequency given by $\text{Freq. (MHz)} = \text{CTSN} * 2.5 + \text{FTSN} * .001$
Set HF Frequency	01 0010 10	[14:0] - HFSN, HF step number The tuned frequency given by $\text{Freq. (MHz)} = \text{HFSN} * .001$
Set Calibration	01 0011 01	[4:0] - Gain setting [5] - not used [7:6] - 00 $\Rightarrow$ off 01 $\Rightarrow$ CW on 11 $\Rightarrow$ Noise on
Set RF Attenuation	01 0100 01	[5:0] - Attenuation setting [7:6] - not used
Set A/D Conversion	01 0101 10	[15:0] - number of conversions +1 0000 - stop FFFF - continuous
Request Status	01 0110 00	3 bytes of data returned with MSB first 23 (MSB) - 1st-LO Lock 22 - 2nd-LO Lock 21 - 3rd-LO Lock 20 - Hi-res LO Lock 19 - Reference Sense 18 - Reference Lock 17 - Temperature A (~70°C) 16 - Temperature B (~80°C) 15 - RF 3 14 - RF 2 13 - RF 1 12 - RF 0 11 - Calibration On 10 - +12Vdc BIT 9 - +8Vdc BIT 8 - spare 7 - -5Vdc BIT 6 - -12Vdc BIT 5-0 - spares
Null Command	00 1111 00	Software reset



WPG110B

WJ-9130 Single-tone & two-tone SFDR