



**SPECTRADYNAMICS, INC**



**HPDA-15RMi-CW  
1-100 MHz ISOLATION AMPLIFIER  
OPERATING MANUAL**



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## 1.0 Introduction

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The HPDA-15RMi-CW is a High Performance Distribution and Isolation Amplifier designed to distribute state-of-the-art atomic frequency standards. This wide range model with a frequency bandwidth of 1 to 100 MHz offers low additive phase noise, making it ideal for use without concern in time scale applications where phase stability is of paramount importance.

The amplifier is designed for maximum flexibility in system configuration in a 19 inch rackmount, 1U enclosure, and may contain up to three RF signal distribution modules. Each module takes a signal from 1 to 100 MHz and provides five buffered and isolated outputs. All the output power levels are monitored and compared to a preset threshold. If the signal level on any output drops below this threshold, the monitor LED for the corresponding module will turn off indicating a fault condition.

The HPDA-15RMi-CW is designed to be powered by a 100 to 240 VAC mains source and/or by a +12 to +36 VDC power source. The DC power may be used as a main power source for the instrument or in conjunction with the AC power as a backup power supply in case of loss of the main AC power. The instrument is designed to automatically switch from AC to DC supply operation using a Schottky diode network and charge storage capacitors to avoid any glitches and ensure uninterrupted continuous operation.

### HPDA-15RMi-CW Options:

Part Number	Number of Independent Inputs	Number of Outputs
HPDA-15RMi-CW	3	15 (five per input)
HPDA-15RMi-C1W	1	10
HPDA-15RMi-C2W	2	10 (five per input)
HPDA-15RMi-C3W	1	15

## 2.0 Safety and Preparation for Use

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The HPDA-15RMi-CW was designed for indoor use only and is not intended for operation outdoors or in a wet environment. The instrument may be mounted in a standard 19-inch instrumentation rack or may be used on a laboratory bench.

Inspect the instrument and power cords for damage before first use.

### 2.1 Electrical Safety and Preparation for Use

Voltages capable of causing injury or death are present in this instrument. Use extreme caution whenever the instrument cover is removed.

#### Line Voltage

This instrument is designed to operate with a 100 to 240 VAC, 47 to 63 Hz power source. DC operation with +12 to +36 VDC, +2 Amperes is also possible.

#### Fuse

A 1.0 Ampere 250 V 5X10 mm slow-blow fuse is used for 100 to 240 VAC operation.

A 2.0 Ampere 250 V 5X10 mm slow-blow fuse is used for the DC power protection.

Only replace fuse with the same type and specifications.

#### AC Power

The instrument has a detachable three wire power cord for connection to a grounded AC power source. The enclosure of the unit is directly connected to the outlet ground to protect against electrical shock. Always use an outlet with a protective ground and do not disable this safety mechanism. Detaching the AC power cord is the only option of disconnecting the unit from the AC mains supply. Make sure you have access to the rear panel or provide an external accessible AC disconnect means for the HPDA-15RMi-CW.

#### DC Power

The instrument has a RM12BRD-6PH(71) DC connector on the back panel with the following configuration:

Pin 1 NC

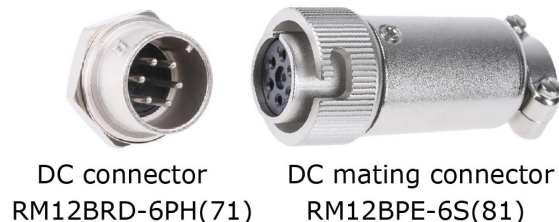
Pin 2 NC

Pin 3 NC

Pin 4 +12 to +36 VDC power return

Pin 5 +12 to +36 VDC power

Pin 6 Chassis GND /Earth GND



Please note that the power return (pin 4) is NOT connected to the instrument case ground internally, however both ground connections pin 4) and pin 6) are available at the DC power connector and may be connected together at this point.

## 2.0 Safety and Preparation for Use

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### Requirements for the external DC power supply

The following specifications should be used to ensure the optimum performance:

DC Supply voltage	+12 to +36 VDC, 2 Amps
Line regulation	+/- 0.05 % for a 10 % line change
Load regulation	+/- 0.05 % for a 50 % load change
Output ripple	< 5 mV peak-to-peak
Pin configuration	Same as RM12BRD-6PH(71) DC connector on the back panel

Verify that the connector of the DC power supply has the correct pin configuration. Do not apply AC voltage to the DC power connector. Failure to follow these directions may cause injury or death to personnel, cause irreparable damage to the instrument and voids all warranties.

### 2.2 Instrument Safety and Preparation for Use

The HPDA-15RMi-CW is designed to distribute RF signals with a frequency of 1 to 100 MHz. The recommended level for the RF input signal is 0 dBm to +15 dB.

Input signals must be kept below +20 dBm as greater power levels will damage the unit and void all warranties. The HPDA-15RMi-CW RF outputs are DC isolated from the chassis ground to prevent ground loops. These outputs are rated to a maximum of 50 V.

### Absolute Maximum Ratings

Input RF Power	+20 dBm Maximum
Reverse RF Power	+20 dBm Maximum
Voltage at the RF Input	+50 V Maximum
Voltage at the RF Output	+50 V Maximum
Storage Temperature	-10 to +75 °C
Operation Environment	0 to +50 °C

## 3.0 Front Panel Description

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### AC Power LED

The AC Power LED turns on when AC power is applied to unit.

### DC Power LED

The DC Power LED is on when DC power is applied to unit.

### Monitor 1, 2, 3, LEDs

The HPDA-15RMi-CW may contain up to three RF distribution modules, each module is monitored by the corresponding MONITOR LED labeled 1, 2 and 3.

All options of HPDA-15RMi-CW have three MONITOR LEDs installed on the front panel, only HPDA-15RMi-CW and HPDA-15RMi-C3W come with three functioning monitor LEDs, the other options will have a non-working monitor LED installed.

The monitor LEDs will turn on if the RF outputs of the corresponding module are greater than the threshold of *0 dBm, for 5 MHz and 10 MHz signals*, and a threshold of *+5 dBm for 100 MHz signals*. RF signal levels less than the threshold will trigger a fault condition and the monitor LED will not light up. However the HPDA-15RMi-CW will still provide five buffered copies per distribution module of the RF input signal on the back panel.



## 4.0 Back Panel Description



### AC Power

The HPDA-15RMi-CW is configured to operate on 100 to 240 VAC.

### DC Power

This instrument may also operate on DC power from +12 to +36 VDC as the main power supply. When the HPDA-15RMi-CW is set up to operate with both AC and DC power sources at the same time the DC power is used as backup power in case of AC power outages.

### INPUT

A RF Signal within the range of 1 MHz to 100 MHz may be connected to the SMA connector labeled INPUT.

Part number HPDA-15RMi-CW includes three independent RF distribution modules, each SMA input provides five buffered copies of the input signal as shown on the picture above. Other configurations are available and may be selected by the part numbers shown below.

### OUTPUTS

The number of available OUTPUTS per RF input are determined by the part number below. Any HPDA-15RMi-CW output may be used to drive the input of another distribution amplifier.

#### HPDA-15RMi-C1W



#### HPDA-15RMi-C2W



#### HPDA-15RMi-C3W



## 5.0 Installation

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### 5.1 Connecting power

The HPDA-15RMi-CW may be mounted in a standard 19-inch instrument rack or may be operated on a laboratory bench.

The instrument ships with a standard North American, European, or Chinese IEC power cord and a RM12BPE-6S(81) DC connector.

The DC connector may be used to prepare a cable to supply the unit with a DC voltage. The connector configuration is shown on page 2.

Once the HPDA-15RMi-CW has been placed in the desired location, locate the AC power entry module on the rear of the enclosure, connect the AC power cord to the instrument and plug the power cord into an appropriate AC power outlet. If a DC power cable was prepared, it can also be connected to the instrument and supplied with the correct DC voltage.

## 6.0 Operation

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Once the amplifier has been installed it is ready for operation. A power indicator LED, located on the front panel, will light up for each of the voltages that power the instrument.

The HPDA-15RMi-CW is designed to distribute signals from 1 MHz to 100 MHz. The RF input has a 50 ohm input impedance. Provide a signal within the mentioned frequency range to the any of the SMA connectors available on the back panel labeled INPUT. The monitor LEDs will turn on if the RF outputs of the corresponding module are greater than the threshold of 0 dBm for 5 and 10 MHz signals and +5 dBm for 100 MHz signals. RF signal levels less than the threshold will trigger a fault condition and the monitor LED will not light up. However the HPDA-15RMi-CW will still provide five buffered copies per distribution module of the RF input signal on the back panel.

The instrument threshold setting can be adjusted for each set of 5 channels by adjusting a potentiometer on the board. Remove the top lid of the instrument. Each distribution module will have a blue potentiometer on the board. Connect a signal to the distribution amplifier input with the signal power set to the desired threshold value. Carefully adjust this potentiometer until the corresponding led turns on and then go in the reverse direction until the led turns off again. Replace the lid of the amplifier once the desired setting has been reached. The threshold varies about 5 dB over the frequency range of 1 MHz to 100 MHz due to the non-linear nature of the detector.

Five buffered copies, per distribution module, of the RF signal(s) will be available on the SMA connectors labeled OUTPUTS located on the back panel. All outputs are AC coupled and the grounds are DC isolated to reduce the effect of ground loops. Make sure that the amplifier ground does not float to a potential greater than 50 VDC from the chassis ground. An output ground potential greater than 50 VDC will damage the amplifier and could cause injury or death to personnel.

## 7.0 Troubleshooting

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**Do not attempt to service or adjust the instrument unless another person, capable of providing first aid or resuscitation, is present.** If there are problems that cannot be resolved by the troubleshooting steps below please contact technical support.

Technical Support

Tel: +1 (303) 665-1852 , Fax: +1 (303) 604-6088

support@spectradynamics.com, www.spectradynamics.com

### **AC and/or DC Power LED does not turn on.**

Disconnect the power cords and remove the top cover. Check the main AC and/or DC power fuse and power cords. If any fuse is blown replace with same type and rating. Please contact SDI if the any of the fuses blow again or if the event that caused the fuse to blow is not known.

### **Monitor LEDs are off.**

Check to see if the RF signal provided to the instrument is greater than 0 dBm.

Check to see if a signal is present at all outputs of the signal distribution module.

The Monitor LED will remain off with a power level under 0 dBm, but will still provide buffered copies of the RF input signal. If the instrument is providing the copies of the input signals you may continue using the HPDA-15RMi-CW.

If the power level of the RF signal provided is greater than 0 dBm and the Monitor LEDs remain off, the instrument will have to be returned for repair.

## 8.0 Specifications

		HPDA-15RMi-CW HPDA-15RMi-C2W			HPDA-15RMi-C1W HPDA-15RMi-C3W			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
Bandwidth	+/- 1 dB		1 - 100	-		1 - 100	-	MHz
Impedance	Input Output	- -	50 50	- -	- -	50 50	- -	Ohms
Gain	@ 10 MHz	0	0.2	0.5	0	0.2	0.5	dB
Output level @ 10 MHz	1 dB compression	17	18	-	17	18	-	dBm
Return loss @ 10 MHz	Input (S11) Output (S22)	- -	-35 -35	-30 -30	- -	-35 -35	-30 -30	dB
Distortion @ 10 MHz	+13 dBm +17 dBm	- -	-48 -42	-45 -40	- -	-45 -42	-40 -40	dBc
Isolation @ 10 MHz	Output to output Output to input	130 140	140 145	- -	130 140	140 145	- -	dB
Phase noise At 10 MHz	1 Hz 10 Hz 100 Hz 1 kHz 10 kHz	- - - - -	-155 -165 -167 -170 -171	-150 -160 -166 -170 -170	- - - - -	-150 -160 -166 -169 -169	-147 -157 -165 -167 -167	dBc/Hz
Gain	@ 100 MHz	-1	-0.5	0.5	-1	-0.5	0.5	dB
Output level @ 100 MHz	1 dB compression	16	17	-	16	17	-	dBm
Return loss @ 100 MHz	Input (S11) Output (S22)	- -	-13 -25	-10 -20	- -	-13 -25	-10 -20	dB
Distortion @ 100 MHz	+10 dBm +13 dBm	- -	-33 -30	-31 -28	- -	-33 -30	-31 -28	dBc
Isolation @ 100 MHz	Output to output Output to input	80 80	90 90	- -	80 80	90 90	- -	dB
Phase noise @ 100 MHz	1 Hz 10 Hz 100 Hz 1 kHz 10 kHz	- - - - -	-136 -146 -154 -160 -161	-133 -143 -152 -158 -159	- - - - -	-136 -146 -154 -159 -160	-133 -143 -151 -156 -157	dBc/Hz
Allan Deviation	Averaging Time (s) 1 10 100 1000 10000	- - - - -	$4 \times 10^{-14}$ $5 \times 10^{-15}$ $2 \times 10^{-15}$ $6 \times 10^{-16}$ $4 \times 10^{-16}$	$5 \times 10^{-14}$ $7 \times 10^{-15}$ $3 \times 10^{-15}$ $1 \times 10^{-15}$ $5 \times 10^{-16}$	- - - - -	$4 \times 10^{-14}$ $5 \times 10^{-15}$ $2 \times 10^{-15}$ $6 \times 10^{-16}$ $4 \times 10^{-16}$	$5 \times 10^{-14}$ $7 \times 10^{-15}$ $3 \times 10^{-15}$ $1 \times 10^{-15}$ $5 \times 10^{-16}$	

All tests done at 10 MHz and +13 dBm input unless otherwise specified.

Rackmount chassis: 1U H, 19" W, 14" D, Weight: 4.5 kg, (10 lbs)

AC Input voltage range: 90 to 264 VAC, 22 W, 47 to 63 Hz

DC Input voltage range: 12 to 36 VDC, 13 W

Operation environment: 0 to +50 °C, Humidity: 5% to 95% Non-condensing.

Storage Temp: -10 to +75 °C

## 9.0 Warranty and Service

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### Warranty

The HPDA-15RMi-CW is warranted to be free of defects under normal operating conditions, as specified, for one year from date of original shipment from SpectraDynamics, Inc. (SDI). SDI's obligation and liability under this warranty is expressly limited to repairing or replacing, at SDI's option, any product not meeting the said specifications. This warranty shall be in effect for one (1) year from the date a HPDA-15RMi-CW is sold by SDI. SDI makes no other warranty, express or implied, and makes no warranty of the fitness for any particular purpose. SDI's obligation under this warranty shall not include any transportation charges or costs of installation or any liability for direct, indirect, or consequential damages or delay. Any improper use, operation beyond capacity, substitution of parts not approved by SDI, or any alteration or repair by others in such manner as in SDI's reasonable judgement affects the product materially and adversely shall void this warranty. No employee or representative of SDI is authorized to change this warranty in any way or grant any other warranty.

### Service

Do not attempt to service or adjust the instrument unless another person, capable of providing first aid or resuscitation, is present. *Please remember that any alteration or repair may void the warranty.* Contact SDI with any questions or to request an RMA if a repair is needed.

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USA

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support@spectradynamics.com  
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## EC Declaration of Conformity

All options of FS-100RM-10 Low Noise Frequency Multiplier has been designed and manufactured in accordance with the below referenced Standards and complies with all essential requirements of the Directives listed below.

### Directives:

**2014/35/EU** of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.

**2014/30/EU** The Electromagnetic Compatibility Directive and its amending directives.

**2011/65/EU** of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

### Standards:

**EN 55011:2009+A1:2010**, Product family standard for Industrial, Scientific and Medical (ISM) equipment.

**EN 61010-1:2010+A1:2019**, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements

**EN 61326-1:2013** Electrical Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements

