



**LP-DC212**  
**LP-DC234**

**LASER PLUS 4 BAND BLOCK DOWNCONVERTER SYSTEM**  
**INSTRUCTION MANUAL**

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## SAFETY WARNINGS

### LASER RADIATION



Laser transmitters emit invisible radiation that can cause permanent eye damage. ***AVOID DIRECT EXPOSURE TO BEAM.*** Operate only with the proper optical fiber installed in the transmitter optical connector.



The laser transmitter should be disabled with the front panel switch whenever the optical connector is empty. ***NEVER*** look into the end of a fiber optic cable, even at the LP-DC212 optical input.

### HIGH VOLTAGE

The Laser Plus power supply contains no user serviceable parts. There is exposed high voltage inside the supply. The power supply housing should be opened only by factory service technicians.

### FIRE HAZARD

The Laser Plus rear power supply fuse is a 3AG, 3.25A, slow blow fuse. To avoid a risk of fire, this fuse should be replaced only with an identically rated fuse.

### SHIPPING ALERT

The Laser Plus main chassis is **not** intended as a shipping container. Shipping the chassis with any module installed can cause severe physical damage.

## SPECIFICATIONS

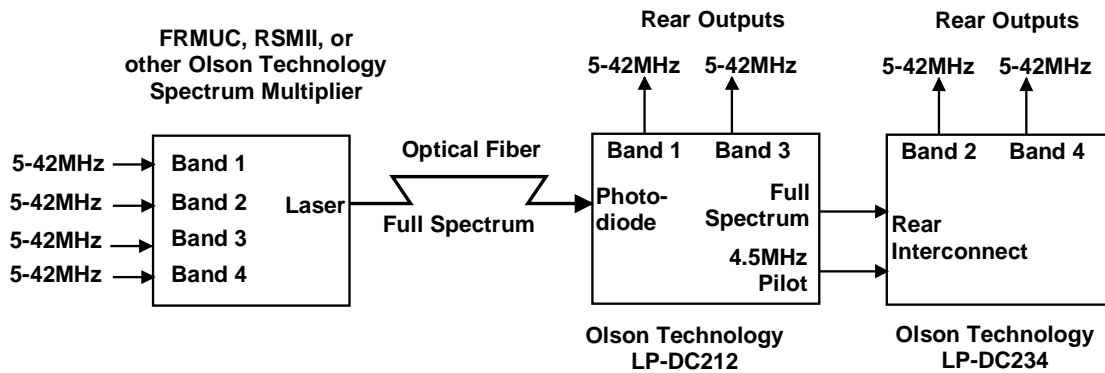
Input Frequency Range.....	5MHz to 206.5MHz Band 1: 5MHz to 42MHz Band 2: 51.5MHz to 88.5MHz Band 3: 121.5MHz to 158.5MHz Band 4: 169.5MHz to 206.5MHz
Optical Input Range.....	-10dBm to 0dBm
Optical Connector.....	SC/APC (standard) FC/APC (optional)
Down Converter Response.....	5-42MHz: $\pm 1.5$ dB 7-40MHz: $\pm 1.0$ dB
RF Output and Test Connectors.....	75 $\Omega$ Type F
Rear Interconnections.....	4.5MHz pilot, RF: 75 $\Omega$ Type SMB
Output Level (6 carriers).....	+35dBmV per carrier
Output Frequency Range.....	4 outputs of 5-42MHz
Output Return Loss.....	>15dB
Output Frequency Accuracy.....	Phase locked to input via pilot carrier
Pilot Frequency.....	4.5MHz $\pm$ 150Hz
Phase Noise.....	<-110dBC/Hz @ 10KHz
Noise Power Ratio (NPR).....	>14dB range @ 40dB threshold (Measured with all bands loaded, 3mW OT DFB laser into 10dB of fiber.)
3 <sup>rd</sup> Order Distortion.....	<-55dBC (U/C input: 6 CXRs @ +15dBmV)
2 <sup>nd</sup> Order Distortion.....	<-55dBC (U/C input: 6 CXRs @ +15dBmV)
Power Requirements.....	LP-DC212: 5.2V @ 1.25A LP-DC234: 5.2V @ 0.9A
Dimensions.....	Laser Plus Chassis LP-DC212: 1 Slot LP-DC234: 1 Slot
Operating Temperature.....	0°C to 45°C
Humidity.....	<95%, non-condensing

## OVERVIEW

The LP-DC212 and LP-DC234 are the receive sections of a return spectrum multiplier system. They can double or quadruple the bandwidth of any optical return link. The LP-DC212 by itself can function as a bandwidth doubler. Both units together will quadruple the return bandwidth. The LP-DC234 requires an LP-DC212 in order to function. All outputs are phase locked to their inputs, providing transparent operation.

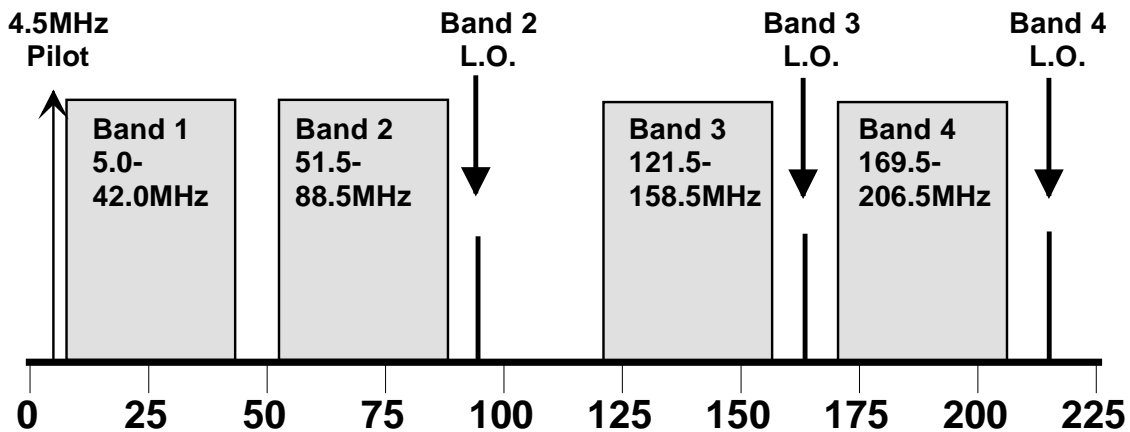
The units plug into an Olson Technology high density Laser Plus chassis. Each unit occupies one slot. The following diagram shows the overall system.

### System Overview

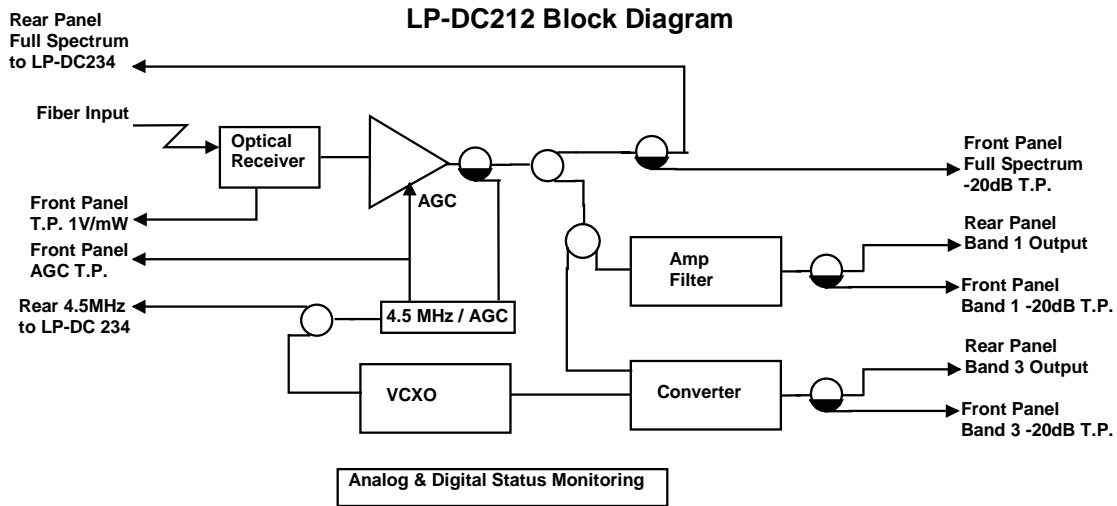


The next diagram shows the full RF spectrum as it is at both ends of the optical link. Some local oscillator presence is normal. It will not cause in-band distortion products or degrade NPR.

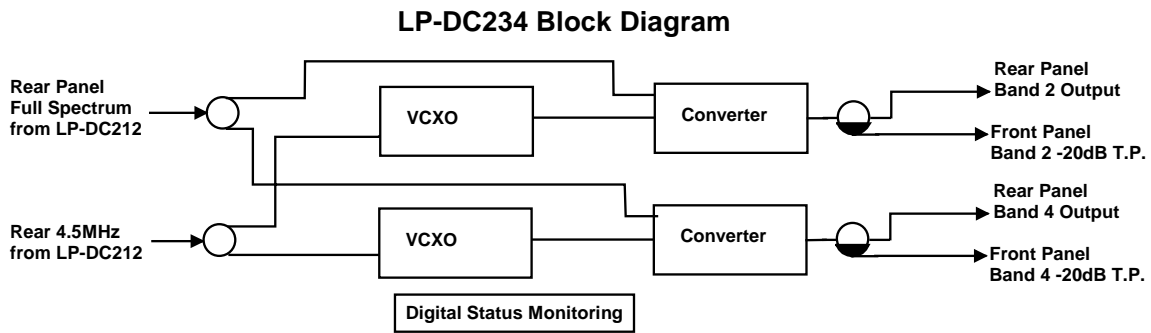
### Return Path Spectrum



The next picture is a block diagram of the LP-DC212. This unit contains the optical receiver and the band 3 converter. It also contains the 4.5MHz pilot extraction circuitry, which is used for AGC and phase lock. It supplies the pilot and the full RF input spectrum to the LP-DC234.



The next picture is a block diagram of the LP-DC234. This unit contains the band 2 and band 4 converters. This unit does not have an optical receiver and is not a self-contained unit. It must be connected to a LP-DC212 to function.



## INSTALLATION

### OPTICAL CONNECTORS AND CLEANING

The standard optical connector is an SC/APC. The fiber ends can be damaged by the insertion of contaminated connectors. Some types of customer damage to connectors or fiber are not covered under warranty. Fiber connectors should never be left uncovered. Reel cleaners or prepackaged alcohol wipes are the most convenient means of cleaning optical connectors. Clean alcohol and lint free wipes or swabs may also be used.

## INSTALLATION IN CHASSIS

The Laser Plus main chassis should be rack mounted before the modules are installed. This chassis should **never** be used as a shipping container. The modules should be gently slid into the chassis. To avoid damage to the internconnect cables, install the LP-DC's from the right to the left, as shown below. The LP-DC212 should always be to the left of the LP-DC234 in which it is connected to. Connect the rear SMB cables.

Note that while the main chassis slots are numbered from the left on the front, they are numbered from the **right** on the rear. This could cause confusion relating to which LP-DC212 is connected to which LP-DC234.



Measure the incoming optical level with a power meter before connecting the fiber. The test point readings should be recorded for historical reference. The following chart shows the test point readings versus optical input levels.

T.P. Volts	Optical Input mW	Optical Input dBm
3.02	3.02	4.8
2.51	2.51	4
2	2	3
1.58	1.58	2
1.26	1.26	1
1	1	0
0.79	0.79	-1
0.63	0.63	-2
0.5	0.5	-3
0.4	0.4	-4
0.32	0.32	-5
0.25	0.25	-6
0.2	0.2	-7
0.16	0.16	-8
0.13	0.13	-9
0.1	0.1	-10
0.08	0.08	-11
0.06	0.06	-12
0.05	0.05	-13

## REMOVAL FROM CHASSIS

If possible, turn the source laser off. Always put a dust cover over the optical connector. **NEVER** look into the end of the fiber.

Disconnect the rear panel SMB cables before removing the modules. Pull each module slightly forward with the handle until it hits the stop. Lift the front end of the module and remove it. **Never** use the optical connector as a handle.

# LP-DC212

## FRONT PANEL

The standard optical input connector is type SC/APC.

There are 3 front panel –20dB RF test points. The receiver T.P. depicts the full spectrum RF output from the optical receiver. The other 2 test points reflect the rear panel sub-band outputs. Typical 4.5MHz pilot levels are +14dBmV at the RX T.P. and +10dBmV at the band 1 T.P. There is no pilot at the band 3 T.P.

For level setting, the accuracy of these band 1 and band 3 test points is  $\pm 1$ dB.

The power LED should always be on and green. The alarm LED is always on. It is green unless a failure occurs. It monitors optical input levels, RF AGC, and VCXO unlock.

The DC test points should be used with a high impedance meter. The optical input T.P. is calibrated for 1V/mW @ 1310 nm. A correction factor must be applied for other wavelengths.

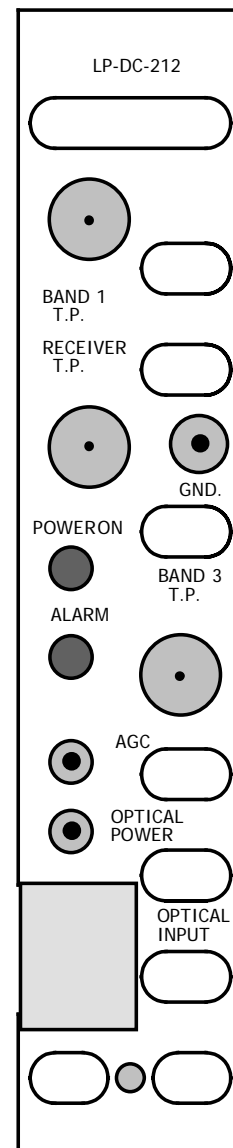
The AGC test point reflects the strength of the 4.5MHz pilot signal. A higher voltage indicates less signal.

## REAR PANEL

The rear panel has the 2 RF F output connectors and the 2 SMB connectors that connect to the LP-DC234. Typical pilot levels are +50dBmV at the pilot connector and +32dBmV at the RF connector.

## FUSE

The module has an internal miniature 3A SB fuse in a holder. The Littelfuse part number is 0454003. The Olson Technology P/N is 286-000009.





# LP-DC234

## FRONT PANEL

There are 2 front panel -20dB RF test points. For level setting, the accuracy of these band 2 and band 4 test points is  $\pm 1$ dB. No 4.5 MHz pilot is present at these test points.

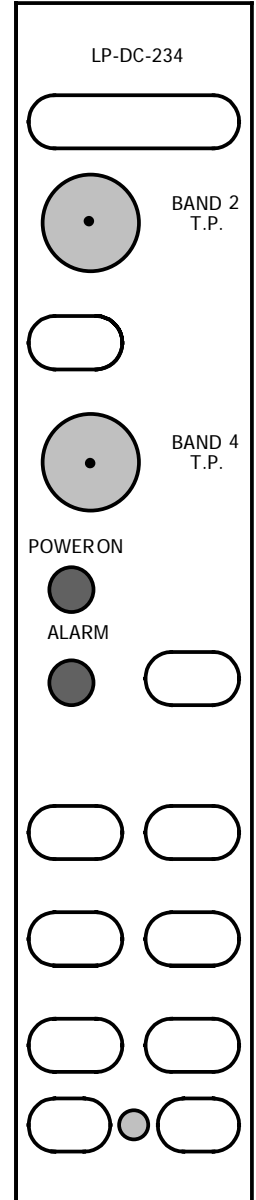
The power LED should always be on and green. The alarm LED is always on. It is green unless a failure occurs. It monitors VCXO unlock.

## REAR PANEL

The rear panel has the 2 RF F output connectors and the 2 SMB connectors that connect to the LP-DC212.

## FUSE

The module has an internal miniature 3A SB fuse in a holder. The Littelfuse part number is 0454003. The Olson Technology P/N is 286-000009.



## TROUBLESHOOTING

This is a complex system and troubleshooting requires some thought.

The primary problems at turn on are poor optical connections due to contamination and reversed or incorrectly connected cables. Confusion between the main chassis slot numbering convention from front to rear is not uncommon.

Intermittent operational problems are probably due to laser transmitter overload. This can be due to RF ingress. It could also be because the up converter input levels are too high. This problem tends to be much worse during periods of high system usage.

Problems may also be caused by damaged SMB connectors at both the transmit and receive ends. Always remove these connectors with care. Never pull on the cable or exert torque on the connector.

The band one transmitter input has a 4.5 MHz trap. Excessive 4.5MHz signals at this input can interfere with both receiver AGC and phase lock. This problem normally appears when bench testing the units, not during normal operation. Another 4.5MHz trap in the band 1 input will fix this problem during sweeping or NPR testing.