

# LUMISTAR

## LS-33-P Diversity Combiner

### Two 70 MHz IF Receivers with Diversity Combining FM & SOQPSK Demodulation, Bit Synchronization and Multi-function Decommulation Data Sheet

#### Description:

The Lumistar LS-33-P is designed for high density receiver applications and provides two 70 MHz IF Receivers with FM demodulation, Pre and Post-Detection Diversity Combining, Bit Synchronization, and Multi-function PCM Decommulation in a single PCI board.

The 70 MHz IF inputs are typically from two Lumistar LS-25-D2 Tri-Band Down Converters or one LS-27 Dual-Band Dual-Channel Down Converter. The Down Converters transform the RF input from the antenna to 70 MHz IF signals which are applied to the LS-33-P. The LS-33-P digitizes these 70 MHz IF signals in the Analog Front End, performs FIR filtering, FM or SOQPSK demodulation, bit synchronization and multi-function decommulation including time code reader and generator, PCM simulator/BERT, and PCM decom.



The LS-25-D2 is available with 1, 2, or 3 frequency bands and the dual channel LS-27 is available in 1 or 2 frequency bands. Both down converters contain pre-selection SAW filters working in concert with the digital FIR filtering in the LS-33-P resulting in 21 IF Bandwidths.

#### Key Features:

- Dual IF Receivers, Diversity Combining, optional Bit Synchronizer and Multi-function Decom in a single PCI board
- IF Receivers digitize at the 70 MHz IF and all processing including FIR filtering, demodulation, bit synchronization, and multi-function Decommulation are done in FPGA
- Each IF Receiver provides 21 IF Bandwidths when used with the Lumistar LS-25-D6 Tri-Band Down Converter or LS-27 Dual or Quad-Band Dual Down Converter
- The Multi-function Decom provides IRIG Time Code Reader, Time Code Generator, PCM Simulator/BERT, and PCM Decom
- Firmware License allows you to purchase a configuration now and upgrade in the future
- 70 MHz Spectral and Oscilloscope display through software (optional)
- 70 MHz reconstructed IF output allows ARTM Demodulator capability for Multi-Symbol FM, SOQPSK and Multi-h CPM

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#### SPECIFICATIONS:

#### Compatible Down Converters:

LS-25-D6	Single channel; 1, 2, or 3 bands
LS-27-P	Two channel; 1 or 2 bands
LS-27-Q	One channel; 4 bands

#### Analog Front End Inputs:

Two 70 MHz IF Inputs from two LS-25-D6 Tri-Band Down Converter or one LS-27 Dual-Band Dual Channel Down Converter are digitized in the Analog Front End daughterboard.

#### 70 MHz IF Receiver:

Demodulation Licenses Available	
FM, SOQPSK, BPSK, QPSK, AQPSK	
Input Frequency	Two 70 MHz IF from Lumistar from Two LS-25-D6 Series Tri-Band Down Converters or one LS-27 Dual Band Dual Channel Down Converter
Input Signal Level	-20 dBm Nominal
IF Bandwidths	The Down Converter has 6 SAW filters, followed by the FIR digital filtering in the LS-33-P resulting in 21 IF Bandwidths: 200K, 300K, 500K, 750K, 1M, 1.3M, 1.5M, 2M, 2.4M 3M, 3.3M, 4M, 4.7M, 6M, 8M, 10M, 13M, 15M, 20M, 27 M, and 30 MHz
Maximum Data Rates	FM: 20 Mbps SOQPSK: 40 Mbps
Video Filters (FM)	14 software selectable filters: 50K, 100K, 250K, 500K, 1M, 1.5M, 2M, 3M, 4M, 5M, 6M, 8M, 10M, 17M Hz, (bypass).

#### Bit Synchronizers:

IF Receiver Outputs	Demodulator outputs are applied to internal bit synchronizers and achieve extremely high performance. Data and Clock outputs are provided.
Inputs	1 Bit Synchronizer Input is available for tape playback.
Number of Bit Syncs	1 for Pre-D Combined version 3 for Pre & Post-D Combined version
Viterbi Decoding	Rate $\frac{1}{2}$ K=7

#### Bit Sync Input Codes:

NRZ codes:	NRZ-L, NRZ-M, NRZ-S
RZ codes	RZ
Split phase codes	BI $\phi$ -L, BI $\phi$ -M, BI $\phi$ -S
Miller codes	DM-M, DM-S, M <sup>2</sup> -M, M <sup>2</sup> -S
Randomized codes	RNRZ-L, RNRZ-M, RNRZ-S
Randomization sequence:	2 <sup>11</sup> -1, 2 <sup>15</sup> -1, 2 <sup>17</sup> -1, 2 <sup>23</sup> -1

#### Bit Sync Input & Tape Output Codes:

NRZ codes:	NRZ-L, NRZ-M, NRZ-S
RZ codes	RZ
Split phase codes	BI $\phi$ -L, BI $\phi$ -M, BI $\phi$ -S
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#### Bit Sync Bit Error Rate Performance:

Bit error rate degradation from theory for Eb/No from 0dB to 10 dB will be less than the values below:

Bit Error Rate Degradation from Theory (Preliminary Data)			
Data Rate	FM	BPSK	QPSK
10 Kbps	<0.4 dB	<0.4 dB	<0.7 dB
100 Kbps	<0.4 dB	<0.4 dB	<0.4 dB
1 Mbps	<0.7 dB	<0.7 dB	<0.7 dB
10 Mbps	<1 dB	<1.0 dB	<1.0 dB
20 Mbps	<1 dB	<1.0 dB	<1.3 dB
40 Mbps	N/A	N/A	<2.0 dB

#### Output Signals:

Data	TTL and RS-422 Driven
Selectable Phase Clock	TTL and RS-422 Driven
Selectable for	0, 90, 180, 270 degrees
Tape Outputs	1 V pp into 50 $\Omega$ (code programmable) TTL and RS-422
Lock Status	In Status Register
Es/No >5dB Status	In Status Register

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Preliminary Data Sheet, specifications are subject to change

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