



**Lumistar LS-18-P1 Series
Portable Telemetry Data Simulation
& RF Transmission Test System**

**A Complete
Data Simulation and RF Broadcasting System
In a Small Lightweight Lunchbox Case!**

**The LS-18-P1 Series is Designed
Specifically to Support
IRIG Flight Test Operations**



LS-18-P1 Series Features:

- Utilizes Lumistar's LS-68-M Super Simulation & LS-18-M Technology Mated Together To Create a Dynamic *"Data Simulation and RF Transmission System"*
- Ground, Mobile, Airborne/Shipboard & Remote Operations
- AC or Rechargeable Battery Power, Operable w/Hot Swap
- IP-67 Rated "Pistol" Case
- Flexible/Extensible Firmware-Based Personalities
 - Easy Field Upgrades to Add Additional Features
- Data Rates Up To 50 Mbps (with RF Modulation)
 - 60 Mbps Clock/Data TTL/422 Differential
- Internally Derived PCM PRN Patterns or Simulated Framed Data
 - Excellent for Loop Back Tests /Ground Station Validation
 - Internally Generated IRIG Chapter 4 Framed Data Simulation
 - Supports IRIG 106 Ch 4 Class I and Class II formats
- Accepts Clock and Data for Modulation from External Sources
- Accepts Data for Modulation via UDP Ethernet Connection
- Multi-Mode RF Modulation Formats
 - ARTM Tier 0/1/2 (PCM/FM/SOQPSK-TG/MultiH CPM)
 - BPSK, QPSK, other formats also available upon request
- Multiple Code Conversion Formats Available
 - Such as NRZ/Biphase, and Randomized Codes
- Configuration File Uploads made over TCP/IP Network
- Data Playback can be from Internally Stored Configuration
 - Only Need to Power On The Unit to Run Last State
- Data Playback from Internally Stored Pre-Recorded Data
 - Playback from optional internal memory, 64 GB capacity
 - Allows playback of CH 10 files



Lumistar LS-18-P1 Series

Portable Data Re-Transmission System Specs

- **RF Power Output : +10 dBm (max) to less than -70 dBm**
 - Power Level adjustment accuracy of 0.25 dB
- **Available in up to Five Standard RF Bands**
 - (S, E, Lower-L, Upper-L, lower and middle C bands)
 - Standard Tuning Resolution 500 KHz
- **Internal Bit Error Rate Reader for Loopback Testing**
- **O-scope Display for Externally Provided Data**
- **Data Playback (Optional)**
 - 64GB provides up to 18 hours at 8 Mbps per channel
- **IRIG Time Code Reader / Generator**
 - Accepts IRIG A/B/G Time Code Inputs
 - Used for Time Stamping of Simulated Data
 - PTP IEEE 1588 (Optional, for higher accuracy)
- **No OS**
 - Control / Status over Ethernet (Optional USB)
- **Small Size and Weight**
 - 16.5" x 13.0" x 6.8"
 - Approx. 16 pounds
 - IP 67, ATA Specification 300, Military Standard C-4150J
 - BUOYANCY: Waterproof (lid closed) / Floats in Salt Water
- **AC or Optional Battery Operation**
 - Up to 8 hour battery life w/ hot swap AC<>DC
 - 80 watts power dissipation (typical)
 - Power: 110-240 VAC, 46-63 Hz
- **Auto-Boot to Last Saved Configuration on Power On Mode**
 - No Operator Intervention Needed in this Mode
 - Enhances Remote Operability
- **Setup / Control Using Ethernet Connection and Lumistar Application**
- **Also Available in Modular or 1U Rack Mounted Configurations**

Modulator Specifications

- **RF Modulation of PRN, Simulated or External Data**
 - Optional Internally stored data playback
- **Standard RF Frequencies (MHz):**
 - 1435-1535 (LL), 1710-1850 (UL), 2200-2395 (S), 2185-2485 (E), 4400-4950 C-low), 5091-5250 (C-mid)
(Custom Bands Available, Please Consult Lumistar)
- **Number of RF Bands per unit:**
 - 1, 2, 3, 4 or 5
- **LDPC encoding (optional)**
- **RF Tuning Step Size:**
 - 100 kHz step size (typical); as low as to 10 KHz Hz upon request
- **RF Output:**
 - +10 dBm max. adjustable over a > 80 dB range
 - One or Two Outputs available
 - 2nd RF Output is Optional Using same data source
- **Frequency Accuracy:**
 - 0.002 ppm
- **RF Output Level Control / Fading:**
 - Software controlled; 20 kHz fade rate, >60 dB dynamic range, with 14-bit resolution
- **Doppler Sweep and Noise Injection: Future (optional)**
- **Transmitter Output Impedance:**
 - 50 ohms nominal
 - VSWR: 2:0: 1 (max), 1.5:1 typical

Internal PCM Simulation and Bit Sync Specifications:

- Frame Sync Pattern: 7 to 64 bits
- Frame Sync Polarity: Normal, Inverted
- Frame Sync Data Rate: Up to 50Mbps (NRZ)
- Forward Error Correction Encoding (FEC): LDPC (all six codes in accordance with IRIG 106, Convolutional R1/2, Reed-Solomon)
- IRIG 106 Support: Class I and II Data
- First Bit: MSB or LSB
- First Minor Frame Number: 0 or 1
- Frame Sync Location: Leads or Trails
- Simulator Variable Word Length: 3 to 16 bits
- Simulator Minor Frame Length: 3 to 65,536 Words
- Simulator Major Frame Length: 1 to 65 536 Minor Frames
- Simulator Sub Frame Sync: FCC, FAC, SFID, URC
- Time Reader Inputs: External IRIG AM, 1PPS , Internal IRIG Generator, PTP (IEEE-1588)
- Time Reader IRIG200 Formats: A, B and G
- Time Reader Input Termination: 100 Ohms, >10K Ohms; Software selectable
- Time Generator: A, B and G;
 - Battery Backed Real-time Clock and Calendar (optional)
- PCM Simulator Baseband Outputs: Maximum of Two Data Streams
- Digital Data Outputs: 5V TTL (50 ohm drive capable), High speed RS 422/485 enhanced; simultaneous operation
- Input Data Range (V p-p): 200 mV to 20V
- Input Data Offset Range: +/- 8V
- Input Data Rate: Up to 50Mbps (NRZ); Up to 25 Mbps (Non-NRZ)
- Input PCM Codes: NRZ-L/M/S, BIO-L/M/S, RZ, DM-M/S , M2-M/S , RNRZ-11/15/17/23

INTERNAL DATA SIMULATION SOFTWARE WINDOW

Simulator	Simulator		Simulator	
Sim Enabled / Track Decom	ENA <input checked="" type="checkbox"/>	TRK <input type="checkbox"/>	ENA <input checked="" type="checkbox"/>	TRK <input type="checkbox"/>
Bit Rate (Mbps)	50.000		1.000	
FEC Code	No FEC Encoding		No FEC Encoding	
Frame Sync Pattern Length	32		32	
Frame Sync Pattern (hex)	0xFE6B2840		0xFE6B2840	
Common Word Length	16		16	
Words per Minor Frame	624		624	
Number of Minor Frames	96		96	
First Bit of Word	LSB <input type="radio"/>	MSB <input checked="" type="radio"/>	LSB <input type="radio"/>	MSB <input checked="" type="radio"/>
First Minor Frame Number	0 <input checked="" type="radio"/>	1 <input type="radio"/>	0 <input checked="" type="radio"/>	1 <input type="radio"/>
Frame Sync Location	Leads <input checked="" type="radio"/>	Trails <input type="radio"/>	Leads <input checked="" type="radio"/>	Trails <input type="radio"/>
Subframe Mode	SFID Count Up		SFID Count Up	
FAC Mode Enabled	FAC <input type="checkbox"/>		FAC <input type="checkbox"/>	
SFID Word Number	3		3	
SFID Msb	6		6	
SFID Locator	0000 0000 0111 1111		0000 0000 0111 1111	
URC Sync Pattern (hex)	0x123456789ABCDEF		0x123456789ABCDEF	

- **PRN Pattern Generation Specifications**

- **Enable via Software Control**
- **Bit Rate values between 1000 and 60 Mbps are available**
- **Data Patterns: Data patterns for the PRN Pattern Generation can be selected via Software Control. The pattern options are**
 - **All 0's, All 1's, Alternating 0's and 1's, PN3, PN4, PN5, PN6, PN7, PN9, PN10, PN11, PN15, PN17, PN18, PN20, PN21, PN22, PN23 and a selectable User Pattern.**
- **User Pattern (Hex): A user defined pattern of up to 31 bits can be entered in hexadecimal for in to the Software GUI. For this pattern to be active, the Data Pattern window must be set to "User Pattern".**
- **Data Invert: The PRN Generator output polarity can be altered via Software Control.**
- **Clock Invert: Output clock polarity can be altered via Software Control to be 0/90/180/270 degrees relative to the data bit period**
- **Error Injection: Random bit errors can be added to the PRN Pattern using Software Control. The user may select between the three TX BERT injection modes: Off, Continuous and Burst.**
- **Burst Errors: The user is able to program bursts of errors to inject in the PRN stream via Software Control. These burst errors are limited to a maximum of 64. Burst errors are injected each time the BURST error button is selected in Software.**

PRN PATTERN GENERATION SOFTWARE WINDOW

Test Bert

Enable TX BERT

Bit Rate (Mbps)

Tx Pattern Select

User Pattern (Hex)

Data Invert Norm Inv

Clock Invert Norm Inv

FEC Code

Continuous BER

Burst Errors

Error Injection Off Burst Cont.

Enable RX BERT

Rx Pattern Select

PCM Input Decoder

Data Source

● PRN Pattern Reading Specifications

- Enable via Software Control
- The Lock State of the PRN Reader indicator provides the present state of the BERT pattern correlator.
 - A green indication indicates that the receive correlator is locked to the selected pattern.
 - If the indicator is yellow, the correlator is unable to establish lock.
- Data Invert State: This LED indicator provides the present status as to whether the data that the RX correlator is receiving is presently polarity inverted or non-inverted. In the inverted state, the LED indicator will be yellow. If the pattern is not inverted, the LED will contain no color.
- Lock Loss Count: This status box contains a count of the number of times the RX BERT has lost lock since the last reset.
- Inversion Count: This status box contains a count of the number of times the RX BERT has detected a pattern inversion since the last reset. This count includes all inversion counts including one to an inverted state and from an inverted state.
- Total Bit Count: This status box contains the total number of bits that the RX BERT has counted since the last reset condition.
- Total Error Bits: This status box contains the total number of error bits that the RX BERT has counted since the last reset condition.
- BER: This status box contains a calculation of the Bit Error Rate (BER). For this status box, the BER calculation takes the total number of errors counted and divides that number by the total number of bits counted. This calculated value is not a time-averaged value but a long-term trend calculation.
- Bit Rate (Mbps): This status box provides the present bit rate being received for the specified stream. Values are provided in Mbps.

- **Loopback:** Selection of this check box internally loops the PRN Pattern generator (or TX BERT) to the PRN Pattern Reader (or RX BERT).
- **Sample (Secs):** The lower area of the right pane contains an averaged BER calculation section. Each stream can setup a sample period and calculate the average BER over a given period. To set the averaging period, enter a value in seconds between 2 and 86400 (1 day) in the resulting dialog box.
- **Sample Error Count:** The number of errors counted over the averaged period will be displayed in this status box.
- **Avg BER:** The calculated average BER figure will be displayed in this status box. This will be a calculation of the number of bit errors accumulated in the Sample period divided by the number of bits counted in the averaging period.
- **Progress:** The progress status bar provides a visual feedback of the progress on averaging process. As the process progresses, a bar will fill from the left to the right of the display area.
- **Stop/Start Avg:** This toggle button is used to initiate and halt the averaged BER calculations for a selected RX BERT stream.
- **Reset Stats:** This toggle button is used to clear the bit error and clock counts used for BER calculations on a selected RX BERT stream.
- **Start Avg:** This toggle button is used to initiate and halt the BER calculations for the connected RX BERT stream.
- **Reset Stats:** This toggle button is used to clear the bit error and clock counts used for all BER calculations.

PRN PATTERN GENERATION SOFTWARE WINDOW

Lock State	<input checked="" type="radio"/>
Data Invert State	<input type="radio"/>
Lock Loss Count	<input type="text" value="0"/>
Inversion Count	<input type="text" value="0"/>
Total Bits Count	<input type="text" value="2.044E+008"/>
Total Error Bits	<input type="text" value="0"/>
BER	<input type="text" value="0.000e+0"/>
Bit Rate (Mbps)	<input type="text" value="12.000"/>
LoopBack	<input type="checkbox"/>
BER Averaging	
Sample (secs)	<input type="text" value="5"/>
Sample Error Cnt.	<input type="text" value="-----"/>
Avg BER	<input type="text" value="-----"/>
Progress	<input type="text"/>
	<input type="button" value="Stop Avg"/>
	<input type="button" value="Reset Stats"/>

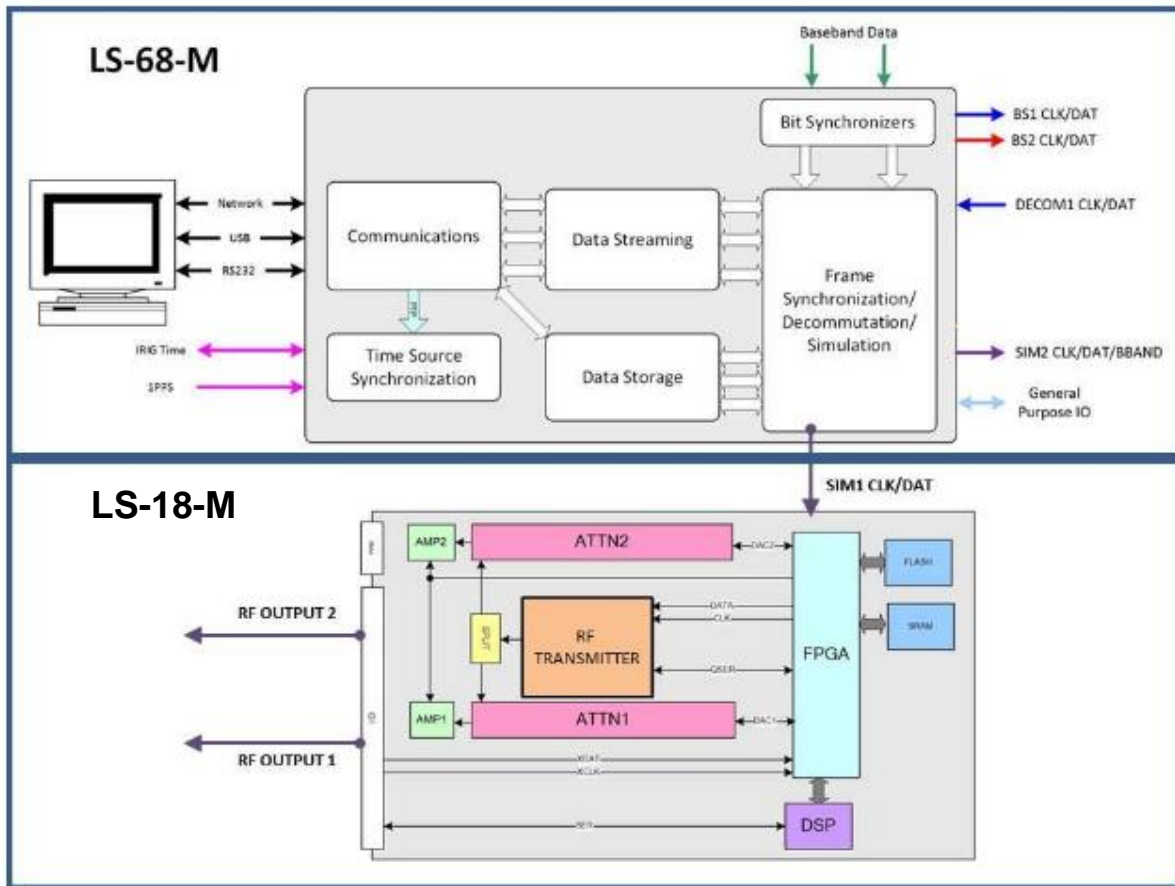


Figure 1

LS-18-M Series Block Diagram

Outline and Dimensions - with Signal I/O (Dual RF Version)



(Cover Closed)



Available in 1U Rack Mount, Modular, and Portable (shown here) Configurations

For More Information, please refer to:

User Manual for the LS-68-M

https://lumi-star.com/uploads/MANUALS/LS-68-M/LS-68-M_UserManual.pdf

**SCD for the Lumistar LS-18-M Module
See Appendix A Herein**

APPENDIX A

APPENDIX B

LS-18-M1 System with Optional Battery *(laptop not included)*

