



Lumistar LS-18-M3-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-M3-P1 Series is Designed
Specifically to Support
IRIG Flight Test Operations**



LS-18-M3-P1 Series Features:

- Utilizes Lumistar's Third Generation LS-18-M3 Series Products 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 Case
- Flexible/Extensible Firmware-Based Personalities
 - Easy Field Upgrades to Add Additional Features
- Data Rates Support To 50 Mbps
 - Clock/Data TTL/422 Differential
- Internally Derived PCM PRN Patterns or Simulated Framed Data
 - Excellent for Loop Back Tests
 - 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 *(optional)*
 - UDP Streamed .C10 files
 - UDP Streamed LS-28/68 Recorded Files
 - UDP Streamed Raw Binary Files
 - UDP Streamed RCC-218 files
- Multi-Mode RF Modulation Formats
 - Group 1 Modulation Formats: Carrier Only, MS-PCMFM (Tier 0), SOQPSK (Tier 1), Multi-H CPM (Tier 2)
 - Group 2 Modulation Formats *(optional)*: Linear PM, BPSK, QPSK, OQPSK, SQPSK, AUQPSK/AQPSK, PM w BPSK/QPSK subcarriers
 - Group 3 Modulation Formats *(optional)*: AUQPSK, AQPSK
- Multiple Code Conversion Formats Available
 - NRZ-L/M/S, BIO-L/M/S, RZ, DM-M/S, MDM-M/S, DBIO-M/S,
 - PCM Output Randomizer Codes: 2¹¹-1, 2¹⁵-1, 2¹⁷-1, 2²³-1
- Configuration File Uploads made over TCP/IP Network Connection
- Data Playback can be from Internally Stored Configuration
 - Power-up auto Stored Setup recall
- Data Playback from Internally Stored Pre-Recorded Data *(Optional)*
 - Playback from .C10 files
 - Playback form LS-28/68 Recorded Files
 - Playback from Raw Binary Files



Lumistar LS-18-M3-P1 Series

Portable Data Re-Transmission System Specs

- **RF Power Output : +20 dBm (max. RF Band dependent) to -100 dBm**
 - Power Level adjustment accuracy as low as 0.25dB
 - Static and dynamic amplitude control; groups of up to 4096 values; groups can be chained; 24 independent groups; 8 correlated groups
- **Available in up to Five Standard RF Bands**
 - (S, E, Lower-L, Upper-L, lower and middle C bands)
 - Standard Tuning Resolution 500 KHz
- **Doppler Sweep and Noise Inject (*Optional*)**
- **Internal Bit Error Rate Reader for Loopback Testing**
- **Stored Data Playback (*Optional*)**
 - From Internal Memory; Approx. 16 hours at 10 Mbps
- **IRIG Time Code Reader / Generator**
 - Accepts IRIG A/B/G Time Code Inputs
 - Used for Time Stamping of Simulated Data
 - PTP IEEE 1588 (*Optional*)
- **No OS**
 - Control / Status over Ethernet (*Optional*: USB/232)
- **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 (cover closed) / Floats in Salt Water (cover closed)
- **AC or Optional Battery Operation**
 - Up to 8-hour battery life w/ hot swap AC<>DC (external)
 - 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 Software Lumistar Application with WIN 10/11**
- **Also Available in Single/Dual Data Channel Modular or 1U Rack Mounted Configurations**

Modulator Specifications

- **RF Modulation of PRN, Simulated or External Data**
 - Also provides modulation of internally stored data
- **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
- **RF LDPC FEC in accordance with IRIG-106 available (*optional*)**
- **RF Tuning Step Size:**
 - 500 kHz step size (typical); as low as to 100 KHz upon request
- **RF Output:**
- **Up to +20 dBm (max. RF Band dependent) adjustable over a > 80 dB dynamic range**
- **Frequency Accuracy:**
 - 0.002 ppm
- **RF Output Level Control / Multipath Fading Simulation:**
 - Software controlled; 20 kHz fade rate, >60 dB dynamic range
- **Transmitter Output Impedance:**
 - 50 ohms nominal
 - VSWR: 2:0: 1 (max), 1.5:1 typical
- **2nd RF Output is Optional**
 - Using same RF and data source
 - Allows for Multipath Simulation

Internal PCM Simulation:

- Frame Sync Pattern: 7 to 64 bits
- Frame Sync Polarity: Normal, Inverted
- Frame Sync Data Rate: 1kbps to 50Mbps (NRZ)
- 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 Output, Filtered, adjustable
- Digital Data Outputs: 5V TTL (50 ohm drive capable), High speed RS-422/485 enhanced; simultaneous operation

INTERNAL DATA SIMULATION SOFTWARE WINDOW

Test Sim	
Sim Enabled / Track Decom	ENA <input checked="" type="checkbox"/>
Bit Rate (Mbps)	10.000
Frame Sync Pattern Length	32
Frame Sync Pattern (hex)	0xFE6B2840
Common Word Length	16
Words per Minor Frame	256
Number of Minor Frames	64
First Bit of Word	LSB <input type="radio"/> MSB <input type="radio"/>
First Minor Frame Number	0 <input type="radio"/> 1 <input type="radio"/>
Frame Sync Location	Leads <input type="radio"/> Trails <input type="radio"/>
Subframe Mode	SFID Count Up
FAC Mode Enabled	FAC <input type="checkbox"/>
SFID Word Number	3
SFID Msb	5
SFID Locator	0000 0000 0011 1111
URC Sync Pattern (hex)	0xFE6B2840

- **PRN Pattern Generation Specifications**

- Enabled via Software Control
- Bit Rate values between 1000 and 50 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
- **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 can 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

The screenshot shows a software window with a dark blue background. It is divided into two main sections: TX1 BERT and RX1 BERT. Each section has a title with a checked checkbox. The TX1 BERT section includes fields for Bit Rate (12.0000), Pattern (PN15), User Pattern (Hex) (0x00000000), Data Invert (Norm selected), Clock Invert (Norm selected), Continuous BER (3.052e-005), Burst Errors (0), and Error Injection (Off selected). The RX1 BERT section includes fields for Pattern Select (PN15), PCM Input Decoder (NRZ-L), and Data Source (TX1 BERT).

Enable TX1 BERT <input checked="" type="checkbox"/>	
Bit Rate (Mbps)	12.0000
Pattern	PN15
User Pattern (Hex)	0x00000000
Data Invert	Norm <input checked="" type="radio"/> Inv <input type="radio"/>
Clock Invert	Norm <input checked="" type="radio"/> Inv <input type="radio"/>
Continuous BER	3.052e-005
Burst Errors	0
Error Injection	Off <input checked="" type="radio"/> Burst <input type="radio"/> Cont. <input type="radio"/>
Enable RX1 BERT <input checked="" type="checkbox"/>	
Pattern Select	PN15
PCM Input Decoder	NRZ-L
Data Source	TX1 BERT

● PRN Pattern Reading Specifications

- Enabled 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 average BER calculation section. Each stream can set up 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 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" value="-----"/>
	<input type="button" value="Stop Avg"/>
	<input type="button" value="Reset Stats"/>

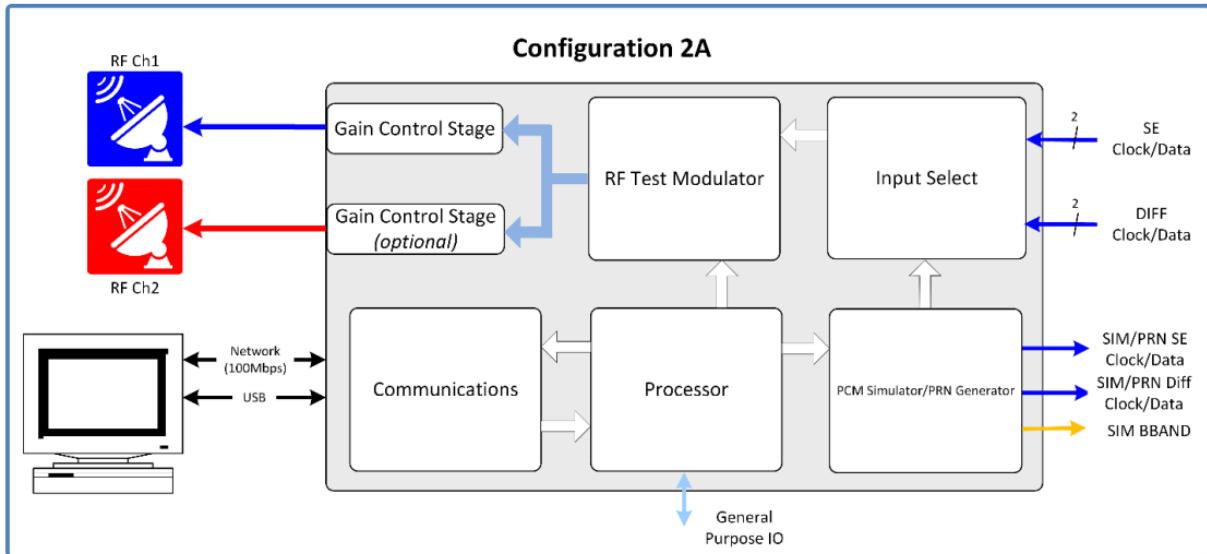


Figure 1
LS-18-M3 Series Block Diagram

Faceplate with Signal I/O (Dual RF Version)



For More Information, please refer to:

User Manual for the LS-18-M3

https://lumi-star.com/uploads/MANUALS/LS-18/LS-18-P_R1_UsersManual.pdf

Available in 1U rack mount and modular configurations

**LS-18-M3 System with Optional Battery
(laptop not included)**



A “high ambient temperature” version including an HVAC cooling option designed specifically for extreme operating environments is available.