

# Avionics

## MLS-800 Microprocessor Controlled Ground Station Simulator

**AEROFLEX**  
A passion for performance.



The MLS-800 provides diagnostic test capabilities for microwave landing system angle receivers.

- Test Operational Menu supports ICAO 1985 and EUROCAE ED-53A and ED-36A
- Complete Main Path Simulation: Approach (AZ) and High Rate Azimuth (HiAZ) Elevation (EL) Back Azimuth (BAZ) Flare (FL)
- Complete Multi-path (MP) Simulation Capability: Interference Pulses Selectable Fade Rate Modulation of 0.05, 1 and 1000 Hz
- Control of all Beam Parameters: Angular Position Beam Amplitude Referenced to the Preamble Norm and Half Width Pulse Selectable Beam Width at 0.5°, 1°, 2°, 3°, 4° or 5°
- Sync Capability for: External Monitoring Designating PFE and CMN Function Designating Multi-path Function
- Preamble Parity, Symmetry and Percent Update
- Simulates all Basic Data Words plus Auxiliary Data Words with Parity Selection
- Full Range of MLS Channels

*Aeroflex is a leader in the design, manufacture and marketing of Avionics test systems.*

The MLS-800 is a microprocessor controlled Ground Station Simulator designed to operate from a bench test environment. Test parameters are selected via a 44-position keyboard and displayed on test operational menus.

### Other Features

- OCI Control for Right (RT), Left (LT) and Rear (RR)
- 75 dB AZ to EL Ratio Capability Propellor/Rotor Modulation at 1 to 100 Hz Variable in 1 Hz steps Morse Code Identification Capability
- ARINC 429 Receiver with PFE and CMN calculations
- External RF Reference Input
- Clearance Pulse Simulation
- 6.75 Hz Modulation
- IEEE-488-1978 Interface for Remote Control Operation

## **SPECIFICATION**

### **GENERAL REQUIREMENTS**

- Unless otherwise noted the following equipment performance characteristics are warranted over the specified environmental conditions following a 20 minute warm-up period.
- All RF measurements are referenced to 50  $\Omega$ .
- Accuracy and resolution stated in percent are referenced to measured or desired values.
- Where resolution exceeds accuracy, resolution takes precedence.
- Notes are intended to provide information useful in applying the instrument by giving specific setup information. Notes are found in the notes section of this specification.

## RF SIGNAL GENERATOR

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### FREQUENCY

#### Frequency Range

5031.0 to 5090.7 MHz

#### Steps

0.3 MHz

#### Accuracy

±1.0 kHz

### OUTPUT POWER

#### Level Range

-17 to -122 dBm

#### Level Accuracy

±2.0 dB

#### Level Flatness

±0.5 dB at -20 dBm (Note 1 and 2)

#### Attenuator Accuracy

±1.0 dB

#### Attenuator Monotonicity

±0.5 to 1.5 dB (Each Step)

#### Spectral Purity

#### Noise Floor

#### Offset ± 0.3 to 1.2 MHz from Cf

-105 dBc/Hz (Note 3 and 4)

#### Residual FM Modulation

<1 kHz peak, 0.01 to 15 kHz BW

#### Residual Phase Modulation

<0.5 radians peak, 0.3 to 15 kHz BW

#### Spurious Signal Rejection (in-band)

#### From ±0.3 to 1.2 MHz

45 dBc

#### From ±1.2 to 30 MHz (band end)

65 dBc

#### Spurious Signal Rejection (out of band)

#### From 5120 to 5250 MHz

50 dBm

#### From 50 kHz to 12.4 GHz (excluding 5000 to 5250 MHz)

35 dBm

### MODULATION (Note 5, 6 and 7)

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#### MAIN PATH FUNCTIONS

#### BEAM ANGLES

#### Azimuth

±62°

#### High Rate Azimuth

±42°

#### Elevation

-1.5° to 29.5°

#### Flare

-2° to 10°

#### Back Azimuth

±42°

#### Angle Resolution

±0.05° steps

#### Angle Accuracy

±0.005°

#### Basic Data

All functions selectable on menu with selectable data values and parity

#### Auxiliary Data

All auxiliary data words selectable

#### BEAM SHAPE

Approximately  $\sin x/x$  or  $1/2 \sin x/x$  waveforms at  $1/2$  width that fills time slot. Sidelobes for  $1/2 \sin x/x$  are present on pulse side only.

#### BEAM WIDTH

Selectable to 0.5°, 1°, 2°, 3°, 4°, 5°

#### Accuracy

±10% of setting

#### Beam Level

Adjustable relative to preamble

#### Range

-3.0 to +13.0 dB (Note 6)

#### Resolution

1.0 dB steps

#### Accuracy

±1.0 dB

#### Side Lobes

Relative to beam level

#### Level

-20.0 dB, ±1.0 dB

#### OCI Pulses (Right, Left, Rear)

#### Width

100 ms, ±10 ms

#### Level

Adjustable relative to preamble

#### Range

-4.0 to +7.0 dB

#### RESOLUTION

1.0 dB steps

#### ACCURACY

±1.0 dB

#### DPSK MODULATION

#### Phase Shift

#### Logic Zero (0)

No transition

#### Logic One (1)

180°, ±10°

#### Amplitude Balance

±0.4 dB

#### TRANSITION TIME

<10  $\mu$ s, 10% to 90%

#### MULTI-PATH FUNCTION

#### ANGLE

Selectable to maximum angle for selected function

#### ANGLE RESOLUTION

0.05° steps

#### ANGLE ACCURACY

±0.05°

#### BEAM SHAPE

Approximately  $\sin x/x$  or  $1/2 \sin x/x$  waveforms at  $1/2$  width that fills time slot. Sidelobes for  $1/2 \sin x/x$  are present on pulse side only.

#### BEAM WIDTH

Selectable to 0.5°, 1°, 2°, 3°, 4°, 5°

**Accuracy**

±10% of setting

**Beam Level**

Adjustable relative to preamble (Note 6, 8 and 10)

**Range**

-14.0 to +13.0 dB

**Resolution**

1.0 dB steps

**Accuracy**

±1.0 dB, -3.0 to +13.0 dB

±2.0 dB, -14.0 to -4.0 dB

**SIDE LOBES**

Relative to beam level

**Level**

-20.0 dB, ±1.0 dB

**Main Path to Multi-path**

±1.0 dB tracking error

**FADE RATE****Frequency Range**

Selectable 0.05, 1 and 1000 Hz

**Accuracy**

±1.0 %

**Steps**

Eight discrete steps that approximate a sine wave

**Clearance Pulses (Note 9)****Position**

Two pulses spaced equidistant from 0.0°

**Angle Resolution**

±0.05°

**Angle Accuracy**

±0.05°

**Pulse Width**

50.0 μs, ±5.0 μs

**AMPLITUDE****Range**

-3.0 to +13.0 dB

**Resolution**

1.0 dB steps

**Accuracy**

±1.0 dB

**ADDITIONAL FUNCTIONS****AZ to EL RATIO**

Selectable so Azimuth to Elevation function ratio is 0 or -75 dB

**Accuracy**

±2 dB

**Interference Modulation****Propeller Modulation****Frequency**

Variable 1 to 199 Hz

**Resolution**

1.0 Hz steps

**Accuracy**

±1%

**Duty Cycle**

-12 dB, ±2 dB applied for 15%, ±1%

**Sync**

Not in sync with any function

**6.75 HZ MODULATION****Frequency**

6.75 Hz

**Accuracy**

±1%

**Level**

Selectable ±6.0 dB square wave modulation to main beam (Note 6 and 10)

**Accuracy**

±1.0 dB

**Sync**

Not in sync with any function

**MORSE CODE****Selection**

Off, selectable or Continuous Tone

**OSCILLOSCOPE SYNC****Selection**

Selectable to occur at start of any function, basic or auxiliary data word

**Amplitude**

Positive TTL pulse approximately 14 μs wide.

Note: Sync control specifies to which function or data word the tests in Table 1 apply.

FUNCTION	APPLICATION
P PARITY	CONTROLS PREAMBLE PARITY
6.75 Hz	ENABLES OR DISABLES 6.75 Hz MODULATION
UPDATE	CONTROLS % UPDATE RATE
FADE RATE	CONTROLS FADE RATE (APPLIED TO MULTI-PATH BEAM)
SYMMETRY	CONTROLS BEAM SYMMETRY
PROP MOD	CONTROLS PROPELLER MODULATION FREQUENCY
PFE	MEASUREMENT OF PATH FOLLOWING ERROR
CMN	MEASUREMENT OF CONTROL MOTION NOISE

Table 1 - Oscilloscope Sync

**FUNCTION UPDATE RATE****Selection**

100%, 75%, 55%, 45%, 25% and 0%

**Accuracy**

±3.9 %

FUNCTION SECONDS	UPDATE RATE	AVERAGE RATE OVER 10
AZ	100 %	13.0 ±0.5 Hz
HiAZ	100 %	39.0 ±1.5 Hz
BAZ	100 %	6.5 ±0.25 Hz
EL	100 %	39.0 ±1.5 Hz

**FUNCTION PREAMBLE PARITY****Selection**

Function identified by Oscilloscope Sync selection is candidate to have its parity bits individually inverted to provide a change in parity.

**SCANNING BEAM TIME SYMMETRY****Selection**

0 (OFF), ±60 μs in 1 μs steps referenced to proper timing from pre-

amble Receiver Time Reference Code

### External Reference Input

Variable 9.999940 to 10.000060 MHz at 3.0 dBm nominal

## ARINC 429 RECEIVER

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### Rates

12.5 and 100 kbps data rates

### Format

Return to Zero (RZ)

### Levels

Logic "1" = +5 to 10 V input, typical

Logic "0" = -5 to -10 V input, typical

### Transitions

Rise and fall times <1.5  $\mu$ s

## GPIB

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Conforms to IEEE-488-1978 Standard for Talker/Listener

## POWER

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### AC

#### Voltage

103.5 to 240 VAC

#### Frequency

45.0 to 440 Hz

#### Power Consumption

85.0 W, maximum

#### Fuse Requirements

2.5 A, 250 V, Type F

### DC

#### Voltage

11.0 to 30.0 VDC

#### Fuse Requirements

7.5 A, 32 V min., Type F

## BATTERY

### Time Out

10 minute time out circuit to prevent accidental discharge. Low voltage detect turns unit off prior to performance being affected.

### Charge Cycle

At least 3 cycles or 30 minutes of charge life before recharge

## ENVIRONMENTAL

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### Weight

22.7 kg (50 lbs.) Maximum

### Dimension (with lid)

234.9 mm high x 539.75 mm deep x 355.6 mm wide

9.25 in. high x 21.25 in. deep x 14.0 in. wide

### Operating Temperature

+10° C to +40° C

### Storage Temperature

-40° C to +71° C

## REFERENCE NOTES

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Note 1: Measured with 1000 Hz Fade Rate applied to Multi-path with Multi-path OFF, 14 dB Pad applied, and Main Path in CW, 0 dB modulation

Note 2: 0.2 to 0.4 dB variation in level at Fade Rate is normal operation and is due to residual component of Multi-path signal. 0.8 dB variation is normal for Multi-path signal at Multi-path = 0 dB, Main Path = OFF.

Note 3: -105 dBc/Hz is approximately equal to -60 dBc in a 30 kHz bandwidth.

Note 4: Total spurious power should not exceed -15 dBc or -35 dBm at -20 dBm level setting from 50.0 kHz to 12.4 GHz.

Note 5: Angular range is limited to slightly less than maximum range for beam widths of 0.5° and 1.0° according to following table:

FUNCTION	RANGE 0.5°	RANGE 1.0°
AZ	-61° to 61°	-61.95° to 61.95°
EL	-1.0° to 29.5°	-1.0° to 29.5°
BAZ	-41.75° to 41.75°	-41.75° to 41.75°
FL	-1° to 9°	-1° to 9°
HiAZ	-41° to 41°	-41.95° to 41.95°

Note 6: RF preamble level plus modulation level should not exceed - 10.0 dBm.

Note 7: Beam modulation level of +6 dB above preamble is assumed unless specified.

Note 8: When clearance is selected, each pulse is individually selectable in amplitude.

Note 9: Selectable for AZ, HiAZ and BAZ functions only. Angular range is  $\pm 1^\circ$  to  $\pm 61^\circ$  for AZ and  $\pm 41^\circ$  for HiAZ and BAZ.

Note 10: Combined modulation level in a given time slot not to exceed +15 dB relative to preamble. Includes main path and multi-path +6.75 Hz modulation.