IFR MLS-800

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 $0.5^{\circ}, 1^{\circ}, 2^{\circ}, 3^{\circ}, 4^{\circ}$ or $5^{\circ}$
- 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 IFR 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

## FREQUENCY

Frequency Range
5031.0 to 5090.7 MHz

## Steps

0.3 MHz

Accuracy

$$
\pm 1.0 \mathrm{kHz}
$$

OUTPUT POWER

## Level Range

-17 to $-122 d B m$
Level Accuracy

$$
\pm 2.0 \mathrm{~dB}
$$

Level Flatness

$$
\pm 0.5 \mathrm{~dB} \text { at }-20 \mathrm{dBm} \quad \text { (Note } 1 \text { and 2) }
$$

Attenuator Accuracy

$$
\pm 1.0 \mathrm{~dB}
$$

Attenuator Monotonicity

$$
\pm 0.5 \text { to } 1.5 \mathrm{~dB} \text { (Each Step) }
$$

Spectral Purity
Noise Floor
Offset $\pm 0.3$ to 1.2 MHz from Cf $-105 \mathrm{dBc} / \mathrm{Hz}$ (Note 3 and 4)

## Residual FM Modulation

$$
<1 \mathrm{kHz} \text { peak, } 0.01 \text { to } 15 \mathrm{kHz} \text { BW }
$$

## Residual Phase Modulation

$$
\text { <0.5 radians peak, } 0.3 \text { to } 15 \mathrm{kHz} \text { BW }
$$

Spurious Signal Rejection (in-band)
From $\pm 0.3$ to 1.2 MHz 45 dBc
From $\pm 1.2$ 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)

MAIN PATH FUNCTIONS
BEAM ANGLES
Azimuth $\pm 62^{\circ}$
High Rate Azimuth

$$
\pm 42^{\circ}
$$

Elevation

$$
-1.5^{\circ} \text { to } 29.5^{\circ}
$$

Flare

$$
-2^{\circ} \text { to } 10^{\circ}
$$

Back Azimuth

$$
\pm 42^{\circ}
$$

Angle Resolution $\pm 0.05^{\circ}$ steps
Angle Accuracy

## 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 $0.5^{\circ}, 1^{\circ}, 2^{\circ}, 3^{\circ}, 4^{\circ}, 5^{\circ}$

## Accuracy

$$
\pm 10 \% \text { of setting }
$$

## Beam Level

Adjustable relative to preamble

## Range

-3.0 to $+13.0 d B$ (Note 6)

## Resolution

1.0 dB steps

## Accuracy

$$
\pm 1.0 \mathrm{~dB}
$$

## Side Lobes

Relative to beam level
Level
$-20.0 \mathrm{~dB}, \pm 1.0 \mathrm{~dB}$
OCI Pulses (Right, Left, Rear)
Width
$100 \mathrm{~ms}, \pm 10 \mathrm{~ms}$
Level
Adjustable relative to preamble

## Range

-4.0 to $+7.0 d B$
RESOLUTION
1.0 dB steps

ACCURACY
$\pm 1.0 \mathrm{~dB}$
DPSK MODULATION
Phase Shift
Logic Zero (0)
No transition
Logic One (1)

$$
180^{\circ}, \pm 10^{\circ}
$$

Amplitude Balance

$$
\pm 0.4 \mathrm{~dB}
$$

TRANSITION TIME
$<10 \mu \mathrm{~s}, 10 \%$ to $90 \%$
MULTI-PATH FUNCTION
ANGLE
Selectable to maximum angle for selected function
ANGLE RESOLUTION
$0.05^{\circ}$ steps
ANGLE ACCURACY
$\pm 0.05^{\circ}$

## 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 $0.5^{\circ}, 1^{\circ}, 2^{\circ}, 3^{\circ}, 4^{\circ}, 5^{\circ}$

## Accuracy

$\pm 10 \%$ of setting
Beam Level
Adjustable relative to preamble (Note 6, 8 and 10)

## Range

-14.0 to $+13.0 d B$

## Resolution

1.0 dB steps

## Accuracy

$\pm 1.0 \mathrm{~dB},-3.0$ to +13.0 dB
$\pm 2.0 \mathrm{~dB},-14.0$ to -4.0 dB

## SIDE LOBES

Relative to beam level
Level
$-20.0 \mathrm{~dB}, \pm 1.0 \mathrm{~dB}$
Main Path to Multi-path
$\pm 1.0 \mathrm{~dB}$ tracking error

## FADE RATE

Frequency Range
Selectable 0.05, 1 and 1000 Hz

## Accuracy

$$
\pm 1.0 \text { \% }
$$

## Steps

Eight discrete steps that approximate a sine wave
Clearance Pulses (Note 9)

## Position

Two pulses spaced equidistant from $0.0^{\circ}$

## Angle Resolution

$\pm 0.05^{\circ}$
Angle Accuracy
$\pm 0.05^{\circ}$

## Pulse Width

$50.0 \mu \mathrm{~s}, \quad \pm 5.0 \mu \mathrm{~s}$

## AMPLITUDE

## Range

-3.0 to $+13.0 d B$

## Resolution

1.0 dB steps

Accuracy
$\pm 1.0 \mathrm{~dB}$

## ADDITIONAL FUNCTIONS

## AZ to EL RATIO

Selectable so Azimuth to Elevation function ratio is 0 or $-75 d B$

## Accuracy

$\pm 2 d B$
Interference Modulation
Propeller Modulation
Frequency
Variable 1 to 199 Hz

## Resolution

1.0 Hz steps

Accuracy

Duty Cycle
$-12 d B, \pm 2 d B$ applied for $15 \%, \pm 1 \%$

Sync
Not in sync with any function

### 6.75 HZ MODULATION

Frequency

$$
6.75 \mathrm{~Hz}
$$

Accuracy

$$
\pm 1 \%
$$

Level
Selectable $\pm 6.0 \mathrm{~dB}$ square wave modulation to main beam (Note 6 and 10)

## Accuracy

$$
\pm 1.0 \mathrm{~dB}
$$

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 $14 \mu$ s 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

| $\pm 3.9 \%$ |  |  |
| :--- | :--- | :--- |
| FUNCTION | UPDATE RATE | AVERAGE RATE OVER 10 |
| SECONDS |  |  |
| AZ | $100 \%$ | $13.0 \pm 0.5 \mathrm{~Hz}$ |
| HiAZ | $100 \%$ | $39.0 \pm 1.5 \mathrm{~Hz}$ |
| BAZ | $100 \%$ | $6.5 \pm 0.25 \mathrm{~Hz}$ |
| EL | $100 \%$ | $39.0 \pm 1.5 \mathrm{~Hz}$ |

## 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), $\pm 60 \mu \mathrm{~s}$ in $1 \mu$ s steps referenced to proper timing from pre-

## External Reference Input

Variable 9.999940 to 10.000060 MHz at 3.0 dBm nominal

## ARINC 429 RECEIVER

## 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 $<1.5 \mu \mathrm{~s}$

## GPIB

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

## POWER

## 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

## Weight

## 22.7 kg (50 lbs.) Maximum

## Dimension (with lid)

234.9 mm wide $\times 539.75 \mathrm{~mm}$ high $\times 355.6 \mathrm{~mm}$ deep
9.25 in. wide $\times 21.25$ in. high $\times 14.0$ in. deep

## Operating Temperature

$+10^{\circ} \mathrm{C}$ to $+40^{\circ} \mathrm{C}$

## Storage Temperature

$-40^{\circ} \mathrm{C}$ to $+71^{\circ} \mathrm{C}$

## REFERENCE NOTES

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 $=0 \mathrm{~dB}$, Main Path $=0 F F$.
Note 3: $-105 \mathrm{dBc} / \mathrm{Hz}$ 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 $0.5^{\circ}$ and $1.0^{\circ}$ according to following table:

| FUNCTION | RANGE 0.5 | RANGE $\mathbf{1 . 0 ^ { \circ }}$ |
| :--- | :--- | :--- |
| AZ | $-61^{\circ}$ to $61^{\circ}$ | $-61.95^{\circ}$ to $61.95^{\circ}$ |
| EL | $-1.0^{\circ}$ to $29.5^{\circ}$ | $-1.0^{\circ}$ to $29.5^{\circ}$ |
| BAZ | $-41.75^{\circ}$ to $41.75^{\circ}$ | $-41.75^{\circ}$ to $41.75^{\circ}$ |
| FL | $-1^{\circ}$ to $9^{\circ}$ | $-1^{\circ}$ to $9^{\circ}$ |
| HiAZ | $-41^{\circ}$ to $41^{\circ}$ | $-41.95^{\circ}$ to $41.95^{\circ}$ |

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

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

Note 8: When clearance is selected, each pulse is individually selectable in amplitude.
Note 9: Selectable for $A Z$, HiAZ and BAZ functions only. Angular range is $\pm 1^{\circ}$ to $\pm 61^{\circ}$ for $A Z$ and $\pm 41^{\circ}$ for $H i A Z$ and $B A Z$.

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

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

