1-9 DATA ENTRY AND DISPLAY

Unless the FM/AM-1600S is configured for remote testing, all data received by the operator is in the form of screens and menus. Each major test operation has a dedicated operation screen with subordinate setup menus. The microprocessor edits operation screens to reflect changes in parameters imposed by the operator or reflects changes in data delivered by the Unit Under Test (UUT). Individual meters also have dedicated operation screens and subordinate setup menus. The Meter Operation Screens can be accessed through the Mode Operation Screen that is being supported by that specific Meter Operation or through the Meter Menu. Refer to 3-3-9 for a description of the different Meters.

On selecting a specific Mode of Operation, the Operation Screen will appear on the CRT. The parameters shown reflect the parameters last entered in that operation. This specific operation screen is accessed with one of six dedicated MODE Keys. Setup menus on all mode operation screens are accessed from the specific Operation Screen by pressing the SETUP Key. Operator entry and edit of data is performed on the operation screen or on the setup menu. The operation screen and menu have active cursors which the operator can use to access a specific parameter. Once the parameter is accessed, data can be selected with DATA SCROLL Spinner or DATA SCROLL Keys or by using the alphanumeric DATA ENTRY Keypad. Multitask "Soft" Function Keys are also available to perform setup, edit and entry. Each operation screen defines "Soft" Function Keys to fit the specific needs for that operation. These definitions are displayed on the screen above the defined key. Each Operation Screen may have several definitions for each "Soft" Function Key or make a definition unavailable depending on the parameters of the operation. Various functions performed by these multitask keys include toggling between two values, selecting connectors for access, entering data or selecting a field to be edited.

1-10 SPECIFICATIONS

NOTE: A warm-up time of five minutes is required for the following performance requirements:

RF measurements are referenced to 50 Ω.

Accuracy and Resolution stated in percent are referenced to measured or selected value unless otherwise stated.

Where specified resolution exceeds specified accuracy, specified resolution takes precedence.

RF SIGNAL GENERATOR AND MODULATION

RF SIGNAL GENERATOR (T/R CONNECTOR)

Frequency:

Range:	400.0 kHz through 999.9999 MHz
Resolution:	100 Hz
Accuracy:	Same as Master Oscillator

Level:

Range:	-137.0 to 0.0 dBm, -40 dBm Max with Reverse Power Present

Resolution:	0.1 dB
Accuracy:	±1.5 dB, 0.0 to ≥-90.0 dBm ±2.5 dB, <-90.0 to -127.0 dBm
Output Impedance:	50 Ω (See Power Meter for return loss).

Spectral Purity:

Residual FM:	(Post Detection BW: 300 Hz to 3 kHz) <10 Hz RMS from 1.0 to 500.0 MHz <20 Hz RMS for <1.0 and >500.0 MHz
S.S.B. Phase Noise:	<-90 dBc/Hz at 20 kHz from carrier <-80 dBc/Hz for <1.0 MHz <-85 dBc/Hz for ≥930 MHz
Harmonics:	<-26 dBc
Non-Harmonics:	<-50 dBc
Residual AM:	(Post Detection BW: 300 Hz to 3 kHz) <0.10% RMS, 1 to 999.9999 MHz
Input Protection:	See Power Meter.

DUPLEX GENERATOR (DUPLEX OUT CONNECTOR)

Frequency (Independent of Receiver Frequency Setting):

Range:	400.0 kHz to 999.9999 MHz
Resolution:	100 Hz
Accuracy:	Same as Master Oscillator

Level:

Range:	-120.0 to +10 dBm, CW or FM -120.0 to + 7 dBm, AM
Resolution:	0.1 dB
Accuracy:	±1.5 dB, 0.0 to ≥-90.0 dBm ±2.5 dB, <-90.0 to -120.0 dBm
Output Impedance:	50 Ω Nominal (<1.38 VSWR)

Spectral Purity:

Residual FM:	(Post Detection BW: 300 Hz to 3 kHz) <10 Hz RMS from 1.0 to 500.0 MHz <20 Hz RMS for <1.0 and >500.0 MHz
S.S.B. Phase Noise:	<-90 dBc/Hz at 20 kHz from carrier

Harmonics:	<-26 dBc
Non-Harmonics:	<-50 dBc
Residual AM:	(Post Detection BW: 300 Hz to 3 kHz) <0.10% RMS, 1 to 999.9999 MHz
Input Protection:	Up to 65 W for 15 sec with Alarm

RF SIGNAL MODULATION (T/R AND DUPLEX OUT CONNECTORS)

Internal FM:

Deviation:

Range:	Off, ±100 Hz to ±100.0 kHz
Accuracy:	<5% from ±1.0 to ±25.0 kHz <7% for <±1.0 and >±25.0 kHz
Resolution:	100 Hz (≤25.0 kHz) 500 Hz (>25.0 kHz)

Modulation:

Rate:	Off, 30.0 Hz to 40.0 kHz up to 20 kbs Digital
Waveforms:	Sine, Square, Triangle, Ramp or Pulse

NOTE: Reference AF Generator for modulation rate accuracy and resolution.

Distortion (Sine Wave only):	<1.0%, at 1 kHz, 0.3 to 3 kHz BW)

Internal AM:

RF Generator Range:	500 kHz to 999.9999 MHz

Amplitude Modulation:

Range:	Off, 1% to 90%
Accuracy:	5% of setting for 30% to 90% modulation, at 1 kHz 10% of setting for <1 MHz
Resolution:	1%

Modulation:

Rate:	100.0 Hz to 10.0 kHz
Waveforms:	Sine, Square, Triangle, Ramp or Pulse

NOTE: Reference AF Generator for modulation rate accuracy and resolution.

Distortion (Sine Wave Only):

For 30% to 70% Modulation:	<0.7%, (700 Hz to 1.1 kHz) <1.0% (100 Hz to 6.0 kHz) <1.5% (>6.0 to 10.0 kHz) <3.0% (0.5 to 1 MHz [RF]; 0.1 to 10 kHz [AF])

Internal Phase:

Phase Modulation

Range:	Off, 0.1 to 10.0 radians
Accuracy:	<5% at 1 kHz
Resolution:	0.1 radians

Modulation:

Rate:	Off, 30.0 Hz to 6.0 kHz
Wave Forms:	Sine, Square, Triangle, Ramp or Pulse

NOTE: Reference AF Generator for modulation rate accuracy and resolution.

Distortion: <2.0%

External:

NOTE: External signals input with the same characteristics as the referenced internal modulation sources are supported.

FM Deviation Sensitivity:	5.0 kHz/Vpeak for <25 kHz 20.0 kHz/Vpeak for ≥25 kHz
AM Modulation Sensitivity:	20%/Vpeak
Phase Modulation Sensitivity:	2.0 radians/Vpeak

FREQUENCY AGILITY (FOR BOTH RF GENERATOR AND RECEIVER)

Settling Time:	1.5 ms to within 1.0 kHz of desired frequency from 1.0 to 100 MHz (25.0 kHz steps) 2.5 ms to within 1.0 kHz of desired frequency from 250.0 kHz to 999.9999 MHz (100 Hz steps)

SIGNAL GENERATORS

AF GENERATORS #1 AND #2

Frequency:

Range:	10.0 Hz to 40.0 kHz
Resolution:	0.1 Hz ≤2.0 kHz 1.0 Hz >2.0 kHz
Accuracy (150 Ω load):	0.1%

Level:

Range:	0.7 mVRMS to 2.5 VRMS (150 Ω), up to 3.0 VRMS (600 Ω)
Resolution:	0.1 mV for 10.0 to 200.0 mV 3% for >200.0 mV or >10.0 kHz
Accuracy (150 Ω load):	±0.1 mV or 3% for 10 kHz <5% for >10 to <25 kHz

Spectral Purity:

Total Harmonic Distortion (Sine Wave only):	<0.25%, from 700 Hz to 1.1 kHz <1.0%, for <700 Hz and >1.1 kHz
Waveshape:	Sine, Square, Triangle, Ramp or Pulse

DIGITAL DATA GENERATOR AND PATTERN GENERATOR FOR BER

Data Rates:	75, 150, 300, 600, 1200, 2400 and 4800 bps; and 16 kbps
Data Pattern Size:	100 to 100,000 bits
Data Pattern Type:	Random, Fixed and User Defined
Accuracy:	1×10^{-8}

Level:

Range:	Digital 0.1 to 5.0 V
Resolution:	0.1 V
Accuracy:	3%

AUDIO FREQUENCY COUNTER

Frequency:

Range:	10.0 Hz to 40.00 kHz (In four decade ranges)
Accuracy:	Same as Master Oscillator
Resolution:	0.1 Hz from 10.0 Hz to ≤ 2.0 kHz 1.0 Hz from > 2.0 to ≤ 20.0 kHz 10.0 Hz from > 20.0 to 40.0 kHz
Input Waveform:	Sine or Square Wave

External:

Level:	0.1 to 10.0 VRMS
Impedance:	1.0 MΩ
Internal Signal Selections:	Demod Audio AF Generators External Audio

RF ERROR METER/RF COUNTER

RADIO FREQUENCY COUNTER

Frequency:

Range:	250000 to 999,999,990 Hz
Accuracy:	Same as Master Oscillator
Resolution:	1 Hz, <20 MHz 10 Hz, ≥20 MHz
Level:	-10 to +50 dBm at T/R Connector -80 to +10 dBm at ANTENNA IN Connector

RADIO FREQUENCY ERROR COUNTER/FREQUENCY METER

Frequency:

Counter Range:	0 Hz to ±150.000 kHz
Meter Range:	0 to ±100.0 kHz, in four decade ranges and Autorange: ±100 Hz, ±1 kHz, ±10 kHz and ±100 kHz
Counter/Meter Accuracy:	Same as Master Oscillator
Counter/Meter Resolution:	1 Hz from ±1 Hz to ≤±10.0 kHz 10 Hz from >±10 to ±150.0 kHz

NOTE: Receiver Bandwidth determines the upper limits.

Counter/Meter Level:	-10 to +50 dBm at T/R Connector -80 to +10 dBm at ANTENNA IN Connector

RF POWER METER

Frequency:	
Range:	1.5 to 999.9999 MHz
Level:	
Input Level:	0.2 mW to 200.0 W
Ranges:	20.0 mW, 200.0 mW, 2.0 W, 20.0 W 200.0 W (Full Scale)
Resolution:	1% or 0.1 mW
Accuracy:	10%, ±1 count
Return Loss:	0.25 to 100.0 MHz, <1.15 VSWR >100.0 to 400.0 MHz, <1.23 VSWR >400.0 to 999.9999 MHz, <1.38 VSWR
Operating Conditions:	Continuous On at 50 W and 25.0°C Ambient 30.0 Sec ON, 2.0 Min OFF (at 100 W and 50.0°C Ambient) 15.0 Sec ON, 2.0 Min OFF (at 200 W and 50.0°C Ambient)

NOTE: Over Temperature Alarm provided for all input levels.

RECEIVER

Frequency Range:	400.0 kHz to 999.9999 MHz
Sensitivity:	Typically 2 µV for 10.0 dB SINAD in 30 kHz IF Bandwidth (1.0 kHz Tone, 3 kHz Deviation, 10 kHz Audio Bandwidth)

Selectivity:

Mode	Rec. IF BW	Audio BW
FM 4	300 kHz	75 kHz
FM 3	300 kHz	20 kHz
FM 2	30 kHz	10 kHz
FM 1	30 kHz	3.0 kHz
PM	30 kHz	3.0 kHz
AM 1	2.9 kHz	3.0 kHz
AM 2	30 kHz	10 kHz
USB	2.9 kHz	3.0 kHz
LSB	2.9 kHz	3.0 kHz

NOTE: 30 kHz BW is standard, 12.5 or 20 kHz BW Hardware Option is available.

NOTE: 2.9 kHz BW is standard, 6 kHz BW Hardware Option is available. No USB or LSB comes with this option.

Adjacent Channel Rejection:

Receiver Nominal 3.0 dB Bandwidth	> 30.0 dB Down
300 kHz	±485 kHz Max
30 kHz	±52 kHz Max
2.9 kHz	±2.5 kHz Max

NOTE: For USB or AM1 Operation Center Frequency is shifted -1825 kHz according to mode of operation.

Demodulation Output:

Impedance: 600 Ω

Output Level:
AM; 80% = 1.02 ±0.06 VRMS
FM1; ±10 kHz = ±2.5 Vp-p, 10%
FM2; ±20 kHz = ±2.5 Vp-p, 10%
FM3; ±50 kHz = ±2.5 Vp-p, 10%
FM4; ±100 kHz = ±2.5 Vp-p, 10%
SSB; Beat Tone = 1.15 ±0.10 VRMS
PM1; 18.25 Volt/radians, ±10%
PM2; 36.5 Volt/radians, ±10%
PM3; 91.2 Volt/radians, ±10%
PM4; 182.5 Volt/radians, ±10%

Receiver, Antenna Connector:

Input Protection: ≤65 W for 15 Seconds With Alarm

FM DEVIATION METER

Deviation:

Range: +100 kHz and -100 kHz (+Peak and -Peak), in six ranges and Autorange: ±2 kHz, ±5 kHz, ±10 kHz, ±20 kHz, ±50 kHz and ±100 kHz

Resolution: 50 Hz, ≤20 kHz Ranges
1 kHz, >20 to 100 kHz Ranges

Accuracy: ±3.0% full scale, ±1 count, applies for the following conditions:

Deviation Rate	Receiver IF	Post Audio	Carrier Level
≤1 kHz	30 kHz	3 kHz	-80 dBm
≤3 kHz	30 kHz	15 kHz	-70 dBm
≤10 kHz	300 kHz	20 kHz	-70 dBm

Modulation Rate: 100.0 Hz to 40.0 kHz

Carrier Range:	400.0 kHz to 999.9999 MHz
Carrier Level:	-10 to +50 dBm on T/R Connector -70 to +10 dBm on ANTENNA IN Connector

PM DEVIATION METER

Deviation Range:	0 to 10.0 radians (Peak)
Resolution:	0.02 radians; ≤8.0 radians 0.1 radians; >8.0 radians
Accuracy:	±3.0% full scale, ±1 count
Modulation Rate:	300.0 Hz to 4.0 kHz
Carrier Range:	400.0 kHz to 999.9999 MHz
Carrier Level:	-10 to +50 dBm on T/R Connector -80 to +10 dBm on ANTENNA IN Connector

AM MODULATION METER

Modulation Range:	1% to 100%
Resolution:	1%
Accuracy:	5% full scale, ±1 count from 30% to 90%
Modulation Rate:	100.0 Hz to 10.0 kHz
Carrier Range:	400.0 kHz to 999.9999 MHz
Carrier Level:	-10 to +50 dBm on T/R Connector -80 to +10 dBm on ANTENNA IN Connector

DISTORTION METER

Distortion Range:	0.1% to 20.0%
Resolution:	0.1%
Accuracy:	±0.5% Distortion, ±1 count from 1.0% through 10.0%, ±2.0% Distortion, ±1 count from 10.0% through 20.0%
Signal Frequency:	600 Hz to 1.4 kHz (770 Hz and 1.0 kHz Std.)
Signal Level:	0.1 to 30.0 VRMS, SINAD/BER IN Connector

SINAD METER

Range:	3.0 to 30.0 dB
Resolution:	0.1 dB

Accuracy:	±1.0 dB, ±1 count (@ 12 dB SINAD)
Signal Frequency:	600 Hz to 1.4 kHz (770 Hz and 1.0 kHz Std.)
Signal Level:	0.1 to 30.0 VRMS, SINAD/BER IN Connector

DIGITAL MULTIMETER

VOLTMETER (DC/AC)

Ranges:	200.0 mV, 2.000 V, 20.00 V, 200.0 V, 2000 V (full scale) and Autorange (1 MΩ)

NOTE: Maximum voltage is 1000 Vdc or 500.0 VAC (true RMS)

Resolution:	3.5 digit display, Max. resolution 0.1 on 200.0 mV Scale
Accuracy:	±5%, full scale (ac), ±1 count ±1%, full scale (dc), ±1 count

NOTE: AC accuracy applies for AC Volts times kHz product <140.

Frequency:	dc, ac mode 50 Hz to 20 kHz
Input Impedance:	Selectable ±5% 150 Ω 600 Ω (line load) 1 MΩ User. 1 to 999 Ω (requires external load)

OHMMETER

Ranges:	200.0 Ω, 2.000 kΩ, 20.00 kΩ, 200.0 kΩ, 2.000 MΩ or 20.00 MΩ (full scale)
Resolution:	3.5 digit display, Max. resolution 0.1 Ω on 200.0 Ω Scale
Accuracy:	±5% or 0.1 W, ±1 count

CURRENT METER (DC/AC)

Ranges:	20.00 mA, 200.0 mA, 2.000 A (full scale) (20.0 A possible using an External Shunt and setting the voltmeter to 0.2 V scale)

NOTE: 10 A dc or 5 A ac (true RMS) is maximum allowable current.

Resolution:	3.5 digit display, Max. resolution 0.01 mA on 20.0 mA Scale.
Accuracy:	±5% or 0.10 mA, ±1 count

OSCILLOSCOPE

Display Size: 3.4 inches x 3.8 inches (8.6 x 9.7 cm)
Approx. Full Size

Vertical Bandwidth (-3dB): 1.0 MHz

Input Ranges: Units per div (8 div on the screen)

2 mV	5 mV	10 mV
20 mV	50 mV	100 mV
200 mV	500 mV	1 V
2 V	5 V	10 V
20 V	50 V	

Max Input Voltage: 200 V

Accuracy: ±5% of full scale (±10% with x10 probe)

Resolution: 1% of full scale, (digital scope data range 0 to 255, in 8 div)

Coupling: dc, ac, GND

Horizontal Sweep:

Rate: Units per div (10 div on the screen)

1 µs	2 µs	5 µs
10 µs	20 µs	50 µs
100 µs	200 µs	500 µs
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

Accuracy: ±1% of full scale

Resolution: 1%, (digital scope data sweep, 400 points displayed per sweep)

External Input:

Impedance: 1.0 MΩ, shunted by 27 pF

Internal Signals (DC Coupled): 425.0 kHz IF
Demod Audio
Function Generator
SINAD/BER
RF Power
External Audio

SPECTRUM ANALYZER

Display Size: 3.4 x 3.8 inches (8.6 x 9.7 cm), Approx. Full Size

Range: 250.0 kHz to 999.9999 MHz

Frequency Span:

- Range: 0, 1, 2, 5, 10, 20, 50, 100, 200 and 500 kHz
  1, 2, 5, 10, 20, 50 and 100 MHz/div
- Accuracy: ±5% of Span Width
- Reference Accuracy: See Master Oscillator

Level:

- Vertical Range: 2 or 10 dB/div
- Vertical Resolution: 1 dB (1/2 of a major div)
- Range (Dynamic): 70 dB (1 kHz, 0 dB atten.) at ANTENNA IN Connector
- Bandwidth Switching Error: <2 dB (5 kHz to 100 MHz mode)
  <4 dB (1 kHz to 2 kHz mode)
- Overall Accuracy: ±2 dB (normalized)
  ±4 dB (250 kHz to 400.0 MHz),
  ±5 dB (400.0 to 999.9999 MHz)
  ±2.5 dB (>400 MHz normalized)
- Attenuator: 0, 20, 40 dB at ANTENNA IN Connector
  40, 60, 80, 100 dB at T/R Connector

Modes:

Scan Width	Resolution Bandwidth
100 MHz/div	3 MHz
50 MHz/div	3 MHz
20 MHz/div	300 kHz
5 MHz/div	300 kHz
2 MHz/div	300 kHz
1 MHz/div	300 kHz
500 kHz/div	30 kHz
200 kHz/div	30 kHz
100 kHz/div	30 kHz
50 kHz/div	30 kHz
20 kHz/div	3 kHz
10 kHz/div	3 kHz
5 kHz/div	3 kHz
2 kHz/div	300 Hz
1 kHz/div	300 Hz
0 kHz/div	3 kHz

NOTE: The receiver is fixed on the Center Frequency for monitoring while the analyzer scans as specified.

Receiver Operation Screen Analyzer Display is not available with 1 MHz Scan Width.

BIT ERROR RATE METER (BER)

Data generated by Digital Data Generator. Inputs to BER meter from received RF or from front panel connector.

Range:	1×10^{-1} to 1×10^{-5}
Data Rates:	75, 150, 300, 600, 1200, 2400 and 4800 bps; and 16 kbps
Data Pattern Size:	100 to 100,000 bits
Data Pattern Type:	Random, Fixed, User Definable
Accuracy:	1×10^{-6}
External Input Level:	
Signal Level:	0.1 through 30.0 VRMS, SINAD/BER IN Connector

INPUT/OUTPUT (I/O) CONNECTORS

IEEE-488.1-1987 CONNECTOR	(24 pin Champ Connector)
Interface Capabilities:	SH1, AH1, TEO, L2, LEO, SR1, RL2, PP0, DC1, DT1,C0
RS-232 CONNECTOR (Asynchronous)	(9 pin sub-miniature D, male connector)
Operations Mode:	Off, PC (Input/Output), Printer (Output)
Baud Rates:	300, 600, 1200, 2400, 4800 and 9600 bps
Stop Bits:	1, 2
Parity:	Odd, Even, Mark, Space, None
AUXILIARY BOX INTERFACE (SCSI-1)	(50 pin Champ connector)
Auxiliary Box Interface Connector:	Per ANSI X3.131-1986 standard
EXTERNAL VIDEO	(9 pin sub-miniature D, female connector)
External Computer Monitor Interface:	EGA (Enhanced Graphic Adapter)

MASTER OSCILLATOR

TCXO

Temperature Stability:	±0.2 ppm (0 to 50°C)
Aging:	±0.5 ppm per year
Accuracy:	±0.5 ppm
Adjustment Resolution:	0.005 ppm over 4.0 ppm adjustment range

OPTIONAL OVEN

Temperature Stability:	±0.05 ppm (0 to 50°C)
Aging:	±0.25 ppm per year
Accuracy:	±0.30 ppm

GENERAL CHARACTERISTICS

Dimensions:

(Without Bail Handle):	7.4" (18.8 cm) High, 17" (43.2 cm) Wide 22" (55.9 cm) Deep (With front panel cover on)
(With Bail Handle):	7.4" (18.8 cm) High, 18.8" (47.8 cm) Wide 25" (63.5 cm) Deep (With front panel cover on)
Weight:	48 lbs (21.8 kg)
Operating Temperature Range:	0 to 50°C

POWER REQUIREMENTS

Line:	85 to 135 VAC or 180 to 260 VAC 50 to 400 Hz at 180 W typical

DISPLAY

Type:	Color, 70° deflection, inline
Size:	6.8" (17.3 cm) Diag., 5.6" (14.2 cm) H, 5.2" (13.2 cm) V
Resolution:	640 pixels X 350 Lines