POTOMAC INSTRUMENTS

TYPE 19

ANTENNA MONITORS AND ANCILLARY EQUIPMENT

AM-19(204)

- ACCURATE
- FIELD PROVEN RELIABILITY
- PUSH BUTTON OPERATION
- REMOTE MONITORING
- UP TO 12 TOWERS, DA-3

The AM-19 (204) is the current model of the industry's most widely used solid state antenna monitor. It provides direct meter readout of phase angle and loop current ratio. Tower selection is accomplished with push buttons on the front panel or by external contact closure in remote operation. Directional antenna arrays of from 2 to 12 towers with DA-1, DA-2 or DA-3 patterns may be monitored with this instrument.

Compatible with virtually every type of wire or wireless remote control system, the AM-19 (204) requires no external line interface equipment. Analog or digital remote metering panels are available for studio readout (see last page) and may be added at any future date.

- AM-19 (204) FEATURES PLUS. . .
- NUMERIC READOUT
- PHASE RESOLUTION 0.1°
- RATIO RESOLUTION 0.1%
- MODULAR CONSTRUCTION
- RATIOS TO 199.9%

The AM-19D (210) is identical to the AM-19 (204) except for the digital panel meters and associated circuitry. Four digit LED numeric displays provide resolution of 1/10 of one degree (phase angle) and 1/10 of one percent (current ratio). The digital readout feature of this instrument virtually eliminates operator error related to meter interpretation. Remote switching and readout are accomplished as in the AM-19 (204).

Inherently stable circuit design, modular construction, simplicity of operation and moderate cost make the AM-19D(210) the truly optimum monitor for directional stations utilizing lessor grade operators.

AM-19D(210)

PMA-19

- CURRENT DEVIATION MODE
- ULTIMATE PRECISION
- UP TO 12 TOWERS, DA-3

The PMA-19 Precision Monitor Adaptor is used in conjunction with either of the above monitors. This unit is required, for the most part, in very critical arrays. The current deviation mode provides a third measured parameter which displays directly the deviation of the current ratio from the licensed ratio.

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SPECIFI

AM-19(204)

Frequency Range	540 kHz to 1600 kHz
Meter Type, Phase Angle, Current Ratio	4-3/4" mirrored scale, taut band, 1/2% tracking
Phase Angle Range	0 to 180 degrees, leading or lagging angles
Phase Angle Accuracy	± 1.0 degree
Phase Resolution	0.5 degree
Phase Repeatability (Note 1)	0.5 degree
Current Ratio Range (Note 2)	5.0% to 110% (Note 3)
Current Ratio Accuracy (Note 2)	± 1.0% (20% to 110%)
Current Ratio Resolution (Note 2)	0.5%
Current Ratio Repeatability (Note 1, 2)	0.5% (20% to 110%)
Current Deviation Range	–
Current Deviation Resolution	–
R.F. Input Impedance (Note 3)	50 or 72 ohms
R.F. Input Level Range	0.5 to 20 volts rms
Reference Tower Input Level	2.0 volts minimum for 100% reference
R.F. Input Connector	UHF Female (SO-239)
Number of Towers	2 to 12
Number of Patterns	1 to 3
Remote Switching Requirements	–24 volts DC or contact closure
Sample Source	Sampling loop or current transformer
Outputs: Phase	0 to 5 volts DC for 0 to 180°, adjustable
Current Ratio	0 to 5 volts DC for 0 to full scale, adjustable
Audio	1 volt rms (typ), 1% THD, 600 ohms
Current Deviation	–
Operating Environment	32°F to 122°F, 0 to 95% RH
Dimensions	19" rack, 7" high, 12-3/4" deep
Line Input Power	105 to 130 volts AC, 50 - 60 Hz, 60 VA
Weight	20 pounds (approx.)
F.C.C. Type Approval #	3–204

Notes: (1) Long term repeatability with proper calibration; based on actual factory test data.
(2) Expressed as percent of reference tower current.
(3) Alternatives available on special order.

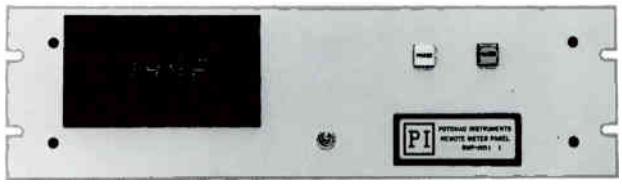
CATIONS

AM-19D(210)	PM-19 SYSTEM
540 kHz to 1600 kHz 4 digit LED numeric display 0 to 180 degrees, leading or lagging angles ± 1.0 degree	540 kHz to 1600 kHz PMA–19: 5 digit LED numeric display 0 to 180 degrees, leading or lagging angles ± 1.0 degree
0.1 degree 0.3 degree 5.0% to 199.9% 1.0% (20% to 110%), 2.0% (110% to 190%)	0.1 degree 0.3 degree 5.0% to 199.9% 1.0% (20% to 110%), 2.0% (110% to 190%)
0.1% 0.4% (20% to 190%) – –	0.1% 0.4% (20% to 190%) 0.0 to ± 25.0 % with polarity indication 0.1%
50 or 72 ohms 0.5 to 20 volts rms 2.0 volts minimum for 100% reference UHF Female (SO-239)	50 or 72 ohms 0.5 to 20 volts rms 2.0 volts minimum for 100% reference UHF Female (SO-239)
2 to 12 1 to 3 –24 volts DC or contact closure Sampling loop or current transformer	2 to 12 1 to 3 –24 volts DC or contact closure Sampling loop or current transformer
0 to 5 volts DC for 0 to 180°, adjustable 0 to 6.5 volts DC for 0 to 190%, adjustable 1 volt rms (typ), 1% THD, 600 ohms –	0 to 5 volts DC for 0 to 180°, adjustable 0 to 5 volts DC for 0 to full scale, adjustable 1 volt rms (typ), 1% THD, 600 ohms Optional (Analog or BCD)
50°F to 104°F, 0 to 95% RH 19" rack, 7" high, 12-3/4" deep 105 to 124 volts AC, 60 Hz, 62 VA 20 pounds (approx.)	50°F to 104°F, 0 to 95% RH 19" rack, 14" High, 15-3/4" deep 105 to 130 volts AC, 60 Hz, 80 VA 40 pounds (approx.)
3-210	Approved by station license

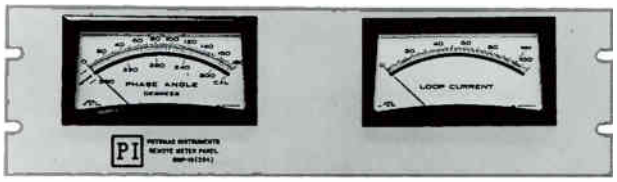
REMOTE METERING PANELS

REMOTE METERING

F.C.C. rules require the use of a type approved remote indicating device for phase and amplitude if the station is operated by remote control. The two panels shown at right are designed for this purpose and are compatible with wire and wireless studio-transmitter links.



RMP-19D(210)



RMP-19(204)

RMP—19D(210)

This instrument provides remote LED numeric readout of phase and current ratio and may be used in conjunction with any type 19 monitor. A third "auxiliary" input is available (on special order) which may be used to provide numeric display of any normalized parameter. Display input is selected by front panel push buttons or remote contact closure.

SPECIFICATIONS

INPUT RESISTANCE:
(3 inputs) 46K ohms min.

INPUT LEVEL:
0—2 Vdc min for full scale deflection (199.9), 20 Vdc max.

RESOLUTION:
0.1°, 0.1%

DIMENSIONS:
5-1/4" X 19" X 10"

POWER:
115 VAC, 20 VA

RELAY VOLTAGE:
specified by customer

INPUT CONNECTOR:
21 pin Cinch-Jones mating connector supplied.

RMP-19 (204)

This panel contains meters which duplicate those of the AM-19 (204) for direct display of phase angle and current ratio. A switching relay is provided to conserve the required number of remote control channels.

SPECIFICATIONS

INPUT LEVEL:
0—100 micro amps

INPUT RESISTANCE:
34.4K ohms

METER TRACKING ACCURACY:
0.5%

RELAY VOLTAGE:
specified by customer

DIMENSIONS:
5-1/4" X 19" X 5"

INPUT CONNECTOR:
6 terminal barrier strip-mating 33 pin Cinch-Jones connector supplied for monitor.

ORDERING INFORMATION

Antenna Monitor prices listed under the appropriate specifications reflect the cost of 2 tower, 2 pattern monitors. The cost of more complex monitors is correspondingly higher. Price quotations pertaining to your particular requirements may be obtained from Potomac Instruments.

DA-2 (2 pattern) monitors are supplied unless otherwise specified. DA-D and DA-N stations will therefore be able to monitor the sampling loop current during non-directional operation.

When ordering antenna monitors, please specify the following:

Number of towers in the array
Number of patterns (i.e.: DA-N, DA-2, etc.)
Sampling line impedance.

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POTOMAC INSTRUMENTS

SOLID STATE FIELD STRENGTH METERS

Design Features

- 6 POSITION (20 dB PER STEP) ATTENUATOR
- HIGH Q DOUBLE-TUNED RF INPUT FOR MAXIMUM IMAGE REJECTION
- MULTI-POLE HYBRID I.F. FILTER WITH SHAPE FACTOR (6 dB TO 60 dB) OF 2.2:1
- FULLY TEMPERATURE COMPENSATED CIRCUITRY PLUS VOLTAGE REGULATION FOR LONG TERM STABILITY
- FOUR-INCH, MIRRORED SCALE, TAUT-BAND METER WITH INTERNAL LIGHTING
- FRONT PANEL SPEAKER WITH WEATHER-TREATED CONE OR HEADPHONE OUTPUT
- RF COAXIAL INPUT FOR MEASURING TERMINAL VOLTAGE BETWEEN 10 uV AND 10 V
- MECHANICAL "VERNIER" IS INTEGRAL PART OF RECEIVER TUNING CONTROL
- DIFFERENTIAL COMPARISON CIRCUIT FOR BALANCING OSCILLATOR AND RECEIVER OUTPUT FOR PRECISE CALIBRATION
- CAPABLE OF SIGNAL RATIO MEASUREMENTS (INCLUDING HARMONICS) TO −80 dB

Description

The Models FIM-21, FIM-22, and FIM-41 represent a new generation of precision instruments for direct measurement of electromagnetic fields in the 200 kHz to 5.0 MHz frequency spectrum. These units are intended for portable field use and include a laboratory quality receiver, integral shielded loop antenna, precision attenuator, internal calibration source, and voltage regulated battery power supply. With calibration accuracy traceable to the National Bureau of Standards, these instruments are capable of meeting the most exacting requirements of government and industry. Cases are of ruggedized drawn aluminum with a hinged cover containing the loop antenna. With the cover in the vertical position, the antenna terminals are connected to the receiver by maintenance-free gold-plated contacts. An interlock switch prevents inadvertent battery discharge when the cover is closed.

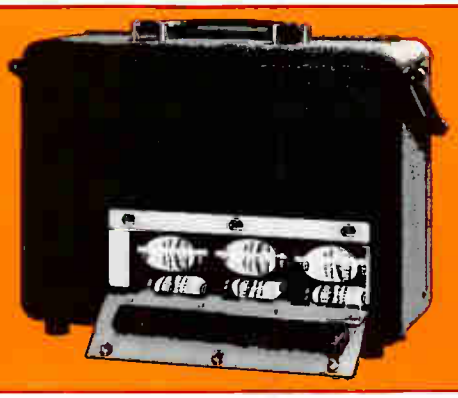
Operation

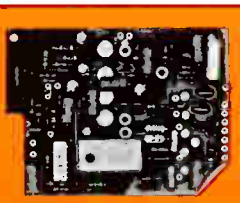
A simplified calibration procedure assures measurement accuracy. Frequency is easily resolved on an illuminated expanded dial with large numerals. When the receiver is tuned, the calibrating oscillator is simultaneously tuned to within a few kHz of the selected frequency with vernier tuning provided by a separate control. Proper gain calibration is precisely indicated by a sharp null on the meter when the ten turn gain control is adjusted for an exact balance between the detected outputs of the receiver and calibrating oscillator. Field strength is displayed by the front panel meter on a logarithmic scale calibrated in increments from 1 to 10. Full scale meter sensitivity is determined by the attenuator range switch. Signal ratio (i.e., harmonic) measurements are easily resolved using the dB scale of the meter in conjunction with the 20 dB per step range switch. A DC analog voltage proportional to meter deflection is provided for recording purposes.

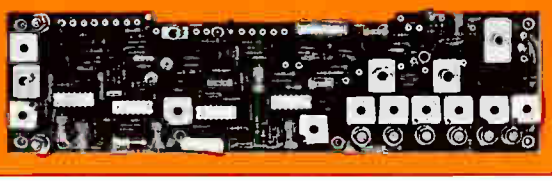
SPECIFICATIONS — FIM-21

FREQUENCY RANGE	535 kHz to 1605 kHz
FIELD INTENSITY RANGE	10 microvolts per meter to 10 volts per meter
ACCURACY OF CALIBRATION	1 Percent, referenced to NBS Standard Field*
ACCURACY OF RANGE ATTENUATOR	2 Percent over entire FI range and tuning band
SELECTIVITY	
Bandwidth (6 dB)	7 kHz nominal with multi-pole hybrid filter
Bandwidth (60 dB)	15 kHz nominal
IF Rejection	35 dB minimum
Image Rejection	65 dB minimum
IF FREQUENCY	455 kHz
PANEL METER	4" mirrored scale, logarithmic graduations 1 to 10, taut band meter movement, 3% linearity
ANTENNA	Shielded loop, integral part of hinged cover
AUDIO OUTPUTS	Front panel loudspeaker, weather treated cone Headphone jack, high and low Z (disconnects speaker)
RECORDER OUTPUT	0.4 to 4 volts DC proportional to field intensity for each attenuator range, source resistance 2200 ohms
LIGHTS	Frequency dial and meter; panel switch for night use
BATTERIES (6 Required)	Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures
BATTERY LIFE	Greater than 1000 FI readings (reduced life with frequent use of lights and/or high speaker volume)
ENVIRONMENTAL	Continuous exposure -10^0F to $+130^0$F; lower temperature operation practical for "reading time" exposures
DIMENSIONS	8¾ in. high, 11½ in. wide, 5-1/8 in. deep with cover closed; 3-7/8 in. deep with cover open (gripping width)
WEIGHT	Approximately 11½ pounds (includes batteries)
EXTERNAL RF INPUT	535 kHz to 1605 kHz, 10 microvolts to 10 volts
RF INPUT SWITCH	Selects loop antenna (ANT) or panel connector (EXT)
METER SWITCH	Selects normal linear (LIN) or logarithmic (LOG) operation
LOGARITHMIC DYNAMIC RANGE	60 dB compressed input range for FI meter and recorder input

*Calibrated at 220 millivolts per meter







FIM-22	FIM-41
200 kHz to 550 kHz	540 kHz - 5.0 MHz in two bands Band "A" .54 - 1.61 MHz Band "B" 1.58 - 5.0 MHz
10 microvolts per meter to 10 volts per meter	10 microvolts per meter to 10 volts per meter
1 Percent, referenced to NBS Standard Field*	1 Percent, referenced to NBS Standard Field*
2 Percent over entire FI range and tuning band	2 Percent over entire FI range and tuning band
4 kHz nominal with multi-pole hybrid filter 10 kHz maximum 70 dB minimum; 40 dB minimum at 455 kHz 60 dB minimum	7 kHz nominal with multi-pole hybrid filter 15 kHz nominal 35 dB minimum 65 dB (minimum) at 540 kHz decreasing to 45 dB (minimum) at 5.0 MHz
455 kHz	455 kHz
4" mirrored scale, logarithmic graduations 1 to 10, taut band meter movement, 3% linearity	4" mirrored scale, logarithmic graduations 1 to 10 and linear dB scale; taut band meter movement, 3% linearity
Shielded loop, integral part of hinged cover	Shielded loop, integral part of hinged cover
Front panel loudspeaker, weather treated cone Headphone jack, high and low Z (disconnects speaker)	Front panel loudspeaker, weather treated cone Headphone jack, high and low Z (disconnects speaker)
0.4 to 4 volts DC proportional to field intensity for each attenuator range, source resistance 2200 ohms	0.4 to 4 volts DC proportional to field intensity for each attenuator range, source resistance 2200 ohms
Frequency dial and meter; panel switch for night use	Frequency dial and meter; panel switch for night use
Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures	Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures
Greater than 1000 FI readings (reduced life with frequent use of lights and/or high speaker volume)	Greater than 1000 FI readings (reduced life with frequent use of lights and/or high speaker volume)
Continuous exposure -10^0F to $+130^0$F; lower temperature operation practical for "reading time" exposures	Continuous exposure -10^0F to $+130^0$F; lower temperature operation practical for "reading time" exposures
8¾ in. high, 11½ in. wide, 5-1/8 in. deep with cover closed; 3-7/8 in. deep with cover open (gripping width)	8¾ in. high, 11½ in. wide, 5-1/8 in. deep with cover closed; 3-7/8 in. deep with cover open (gripping width)
Approximately 11½ pounds (includes batteries)	Approximately 11½ pounds (includes batteries)
200 kHz to 550 kHz, 10 microvolts to 10 volts	540 kHz to 5.0 MHz, 10 microvolts to 10 volts
Selects loop antenna (ANT) or panel connector (EXT)	Selects loop antenna (ANT) or panel connector (EXT)
Selects normal linear (LIN) or logarithmic (LOG) operation	Selects normal linear (LIN) or logarithmic (LOG) operation
60 dB compressed input range for FI meter and recorder input	60 dB compressed input range for FI meter and recorder input

ACCESSORIES AND SERVICE

Meter Carrying Case MCC-21

The MCC-21 Meter Carrying Case is an accessory specifically designed for storing and protecting the FIM-21, FIM-22, and FIM-41 Field Strength Meters when in transit. This attractive, dent-resistant case is constructed of hard wood and finished in a clear epoxy, both inside and out. Within the case, foam inserts, cut to the shape of the meter, provide full support and minimize shock. Overall dimensions of the MCC-21 Case, 15 in. wide by 11 in. high by 7½ in. deep, make it convenient for transporting.

Unipod

A particularly useful accessory for Field Strength Meters is the unipod. Equipped with a ¼-20 threaded stud, the unipod easily screws into the mating tri-pod adaptor at the base of the instrument. The telescoping leg is adjustable to any convenient height and becomes a rigid support for the instrument while making field strength measurements. Antenna orientation is easily rotated about a single axis yielding precise calibration.

LENGTH:

Fully extended	62 in.
Collapsed	25 in.
WEIGHT	1¼ lbs.

Calibration and Repair Service

For the convenience of customers, Potomac Instruments offers a complete factory service program for the following types of Field Strength Meters:

Potomac Instruments	All
RCA	WX-2 Series
Nems-Clarke	All

Service options offered include:

1. ACROSS-THE-BAND ALIGNMENT AND CALIBRATION. This service is intended to restore the field meter to the original factory specified performance. Each unit is refurbished to the extent practicable and the useful service life of the instrument is greatly extended.

2. SINGLE FREQUENCY ALIGNMENT AND CALIBRATION. This service is essentially the same as No. 1 except that the field meter is optimally adjusted for a correction factor of 1.0 at a single customer specified frequency; no other frequencies are calibrated. This service has the advantage of lower cost when across-the-band calibration is not required.

3. INCOMING CALIBRATION. This service consists of calibrating the Field Strength Meter at one or more customer specified frequency. No repairs or adjustments are made nor is the instrument certified to meet the original factory specified performance. An Incoming Calibration is most useful in reaffirming meter accuracy or correcting data previously obtained.

Every Field Strength Meter is returned with a notarized Certificate of Calibration containing the appropriate calibration data. All meters are certified in a Standard RF Field. This field is regularly calibrated by direct comparison with the Primary Standard Field maintained by the National Bureau of Standards.

PI

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Design Features

- 6 POSITION (20 dB PER STEP) ATTENUATOR
- HIGH Q DOUBLE-TUNED RF INPUT FOR MAXIMUM IMAGE REJECTION
- MULTI-POLE HYBRID I.F. FILTER WITH SHAPE FACTOR (6 dB TO 60 dB) OF 2.2:1
- FULLY TEMPERATURE COMPENSATED CIRCUITRY PLUS VOLTAGE REGULATION FOR LONG TERM STABILITY
- FOUR-INCH, MIRRORED SCALE, TAUT-BAND METER WITH INTERNAL LIGHTING
- FRONT PANEL SPEAKER WITH WEATHER-TREATED CONE OR HEADPHONE OUTPUT
- RF COAXIAL INPUT FOR MEASURING TERMINAL VOLTAGE BETWEEN 10 uV AND 10 V
- MECHANICAL "VERNIER" IS INTEGRAL PART OF RECEIVER TUNING CONTROL
- DIFFERENTIAL COMPARISON CIRCUIT FOR BALANCING OSCILLATOR AND RECEIVER OUTPUT FOR PRECISE CALIBRATION
- CAPABLE OF SIGNAL RATIO MEASUREMENTS (INCLUDING HARMONICS) TO −80 dB

Description

The Models FIM-21, FIM-22, and FIM-41 represent a new generation of precision instruments for direct measurement of electromagnetic fields in the 200 kHz to 5.0 MHz frequency spectrum. These units are intended for portable field use and include a laboratory quality receiver, integral shielded loop antenna, precision attenuator, internal calibration source, and voltage regulated battery power supply. With calibration accuracy traceable to the National Bureau of Standards, these instruments are capable of meeting the most exacting requirements of government and industry. Cases are of ruggedized drawn aluminum with a hinged cover containing the loop antenna. With the cover in the vertical position, the antenna terminals are connected to the receiver by maintenance-free gold-plated contacts. An interlock switch prevents inadvertent battery discharge when the cover is closed.

Operation

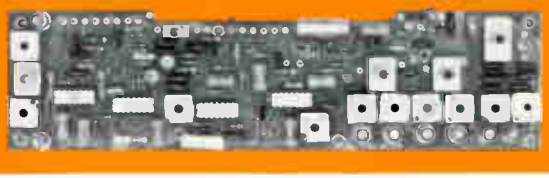
A simplified calibration procedure assures measurement accuracy. Frequency is easily resolved on an illuminated expanded dial with large numerals. When the receiver is tuned, the calibrating oscillator is simultaneously tuned to within a few kHz of the selected frequency with vernier tuning provided by a separate control. Proper gain calibration is precisely indicated by a sharp null on the meter when the ten turn gain control is adjusted for an exact balance between the detected outputs of the receiver and calibrating oscillator. Field strength is displayed by the front panel meter on a logarithmic scale calibrated in increments from 1 to 10. Full scale meter sensitivity is determined by the attenuator range switch. Signal ratio (i.e., harmonic) measurements are easily resolved using the dB scale of the meter in conjunction with the 20 dB per step range switch. A DC analog voltage proportional to meter deflection is provided for recording purposes.

SPECIFICATIONS

FIM-21

FREQUENCY RANGE	535 kHz to 1605 kHz
FIELD INTENSITY RANGE	10 microvolts per meter to 10 volts per meter
ACCURACY OF CALIBRATION	1 Percent, referenced to NBS Standard Field*
ACCURACY OF RANGE ATTENUATOR	2 Percent over entire FI range and tuning band
SELECTIVITY	
Bandwidth (6 dB)	7 kHz nominal with multi-pole hybrid filter
Bandwidth (60 dB)	15 kHz nominal
IF Rejection	35 dB minimum
Image Rejection	65 dB minimum
IF FREQUENCY	455 kHz
PANEL METER	4" mirrored scale, logarithmic graduations 1 to 10, taut band meter movement, 3% linearity
ANTENNA	Shielded loop, integral part of hinged cover
AUDIO OUTPUTS	Front panel loudspeaker, weather treated cone Headphone jack, high and low Z (disconnects speaker)
RECORDER OUTPUT	0.4 to 4 volts DC proportional to field intensity for each attenuator range, source resistance 2200 ohms
LIGHTS	Frequency dial and meter; panel switch for night use
BATTERIES (6 Required)	Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures
BATTERY LIFE	Greater than 1000 FI readings (reduced life with frequent use of lights and/or high speaker volume)
ENVIRONMENTAL	Continuous exposure -10^0F to $+130^0$F; lower temperature operation practical for "reading time" exposures
DIMENSIONS	8¾ in. high, 11½ in. wide, 5-1/8 in.deep with cover closed; 3-7/8 in. deep with cover open (gripping width)
WEIGHT	Approximately 11½ pounds (includes batteries)
EXTERNAL RF INPUT	535 kHz to 1605 kHz, 10 microvolts to 10 volts
RF INPUT SWITCH	Selects loop antenna (ANT) or panel connector (EXT)
METER SWITCH	Selects normal linear (LIN) or logarithmic (LOG) operation
LOGARITHMIC OYNAMIC RANGE	60 dB compressed input range for FI meter and recorder input

*Calibrated at 220 millivolts per meter



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455 kHz	455 kHz
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Frequency dial and meter; panel switch for night use	Frequency dial and meter; panel switch for night use
Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures	Standard 1½ volt C-Z_n "D" cells or 1½ volt Alkaline cells for extended life at very low temperatures
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Selects normal linear (LIN) or logarithmic (LOG) operation	Selects normal linear (LIN) or logarithmic (LOG) operation
60 dB compressed input range for FI meter and recorder input	60 dB compressed input range for FI meter and recorder input

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2. SINGLE FREQUENCY ALIGNMENT AND CALIBRATION. This service is essentially the same as No. 1 except that the field meter is optimally adjusted for a correction factor of 1.0 at a single customer specified frequency; no other frequencies are calibrated. This service has the advantage of lower cost when across-the-band calibration is not required.

3. INCOMING CALIBRATION. This service consists of calibrating the Field Strength Meter at one or more customer specified frequency. No repairs or adjustments are made nor is the instrument certified to meet the original factory specified performance. An Incoming Calibration is most useful in reaffirming meter accuracy or correcting data previously obtained.

Every Field Strength Meter is returned with a notarized Certificate of Calibration containing the appropriate calibration data. All meters are certified in a Standard RF Field. This field is regularly calibrated by direct comparison with the Primary Standard Field maintained by the National Bureau of Standards.

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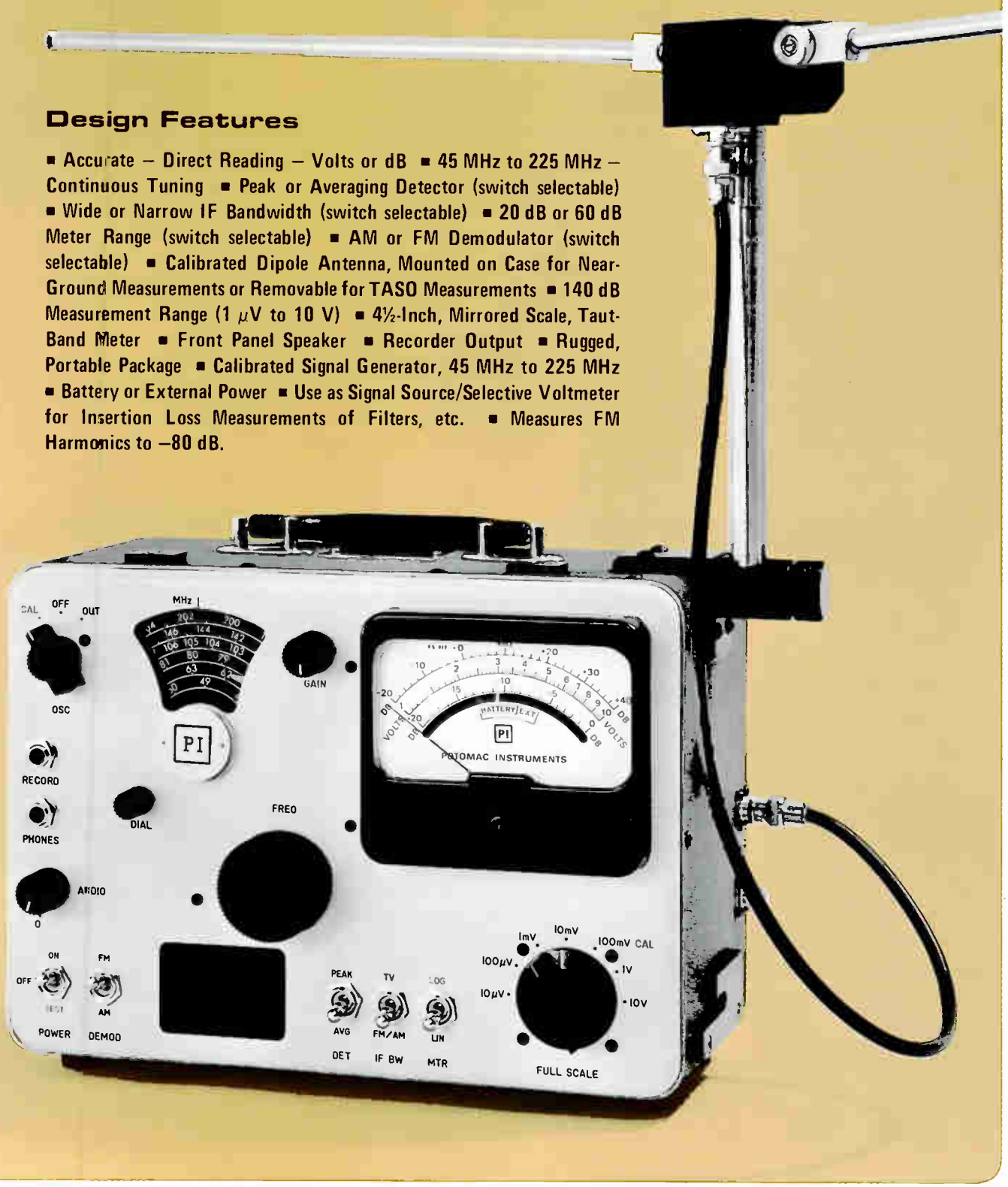
POTOMAC INSTRUMENTS

FIM 71

SOLID STATE VHF FIELD STRENGTH METER

Design Features

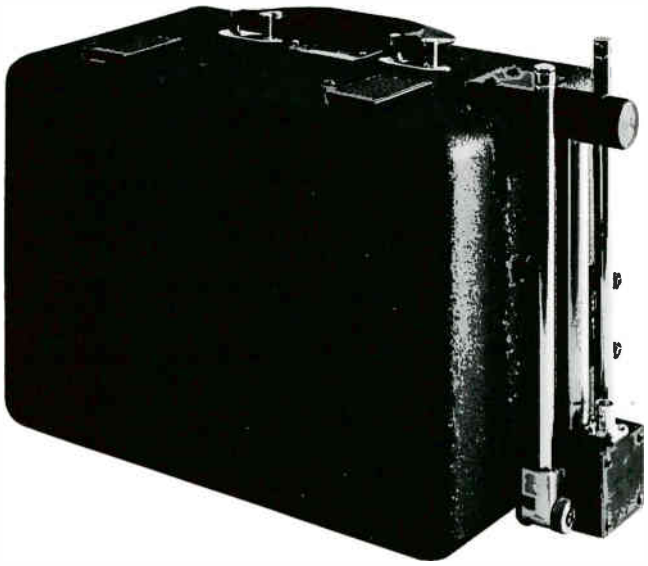
■ Accurate – Direct Reading – Volts or dB ■ 45 MHz to 225 MHz – Continuous Tuning ■ Peak or Averaging Detector (switch selectable) ■ Wide or Narrow IF Bandwidth (switch selectable) ■ 20 dB or 60 dB Meter Range (switch selectable) ■ AM or FM Demodulator (switch selectable) ■ Calibrated Dipole Antenna, Mounted on Case for Near-Ground Measurements or Removable for TASO Measurements ■ 140 dB Measurement Range (1 μV to 10 V) ■ 4½-Inch, Mirrored Scale, Taut-Band Meter ■ Front Panel Speaker ■ Recorder Output ■ Rugged, Portable Package ■ Calibrated Signal Generator, 45 MHz to 225 MHz ■ Battery or External Power ■ Use as Signal Source/Selective Voltmeter for Insertion Loss Measurements of Filters, etc. ■ Measures FM Harmonics to –80 dB.



Description

The FIM-71 Field Strength Meter is a truly portable test instrument of laboratory quality which is designed to withstand the rigors of extended field use. Combining a calibrated half-wave dipole antenna and a highly accurate tuned voltmeter with a range of 140 dB, this instrument is suitable for practically all types of RF emission measurements in the 45 MHz to 225 MHz frequency spectrum. Depending upon the characteristic of the signal to be measured, the operator can switch select wide or narrow bandwidth, peak or average value of TV or pulse modulated signals, AM or FM demodulation, and meter dynamic range of either 20 dB or 60 dB. A DC analog voltage, proportional to meter indication, is provided for the purpose of driving a chart recorder or similar device. A leveled output from the calibrating oscillator (which is automatically tracked to the tuned frequency) is available for a variety of test purposes such as measuring cable insertion loss, filter response, amplifier gain, and other signal ratio measurements. The 4½ inch, taut band, mirrored scale meter is calibrated in Volts and dB for precise measurements in field or laboratory environments.

The tuned voltmeter is a solid state, single conversion, super-heterodyne receiver with carefully tailored sensitivity, selectivity, gain, and linearity characteristics. The RF input is double tuned and designed for minimum VSWR and maximum out-of-band signal rejection. Uniform gain, independent of IF bandwidth, is provided by temperature compensated RF & IF amplifiers utilizing a combination of MOSFET, J-FET, bipolar, and monolythic integrated circuit devices. The linear detector is followed by a logarithmic shaping circuit which drives the meter in the LIN (20 dB) mode. In the LOG mode DC feedback is applied to the receiver in such a manner that the meter indication (in dB) varies linearly over a one thousand to one range of input levels.



SPECIFICATIONS

FIM-71

FREQUENCY RANGE	45 MHz - 225 MHz, continuous
RF INPUT IMPEDANCE/VSWR	50 ohms/1.2:1, 100 μV full scale and greater /1.5:1, 10 μV full scale BNC Connector
VOLTAGE MEASUREMENT RANGE	1 microvolt to 10 volts rms in seven switch-selected ranges
METERING	4-1/2 inch meter, mirror-backed scale
Indication Modes	LIN (linear) and LOG (with receiver dc feedback), switch selected
Scales	LIN Scales: 1-10 logarithmic and 0-20 dB linear LOG Scale: −20 to +40 dB linear (60 dB range) Battery voltage/external supply voltage scale
METERING DETECTORS	Average-responding and Peak-responding (for television sync pulse), switch selected
RECEIVER BANDWIDTHS	AM/FM, 190 kHz at −3 dB, and TV, 450 kHz at −3 dB, switch selected
ABSOLUTE ACCURACY	Voltage: ±1.5 dB (LIN), ±2.0 dB (LOG), for voltage >1.5 μV (AM/FM) or >3 μV (TV) Field Strength: ±3.0 dB (LIN), ±3.5 dB (LOG); for field strengths >1.8 μV/M (AM/FM) or >3.7 μV/M (TV) at 45 MHz; >9.1 μV/M (AM/FM) or >18.1 μV/M (TV) at 225 MHz; using the ANT-71 Antenna These figures apply when using the Average Detector; for the Peak Detector, noise correction factors (supplied) are required below 10 mV

SPECIFICATIONS Cont.

RELATIVE ACCURACY	±1 dB at one frequency, for voltage or field strength, LIN mode, for voltages >10 μV, with noise correction factors
HARMONIC MEASUREMENT RANGE	Measures second harmonic field strength of 87.5 MHz - 108 MHz signals to −80 dB for fundamental voltage less than 100 mV
CALIBRATING OSCILLATOR	Output switched to receiver for internal calibration, to external output (BNC connector) or OFF. Tracks receiver frequency when connected to receiver
Output Level and Accuracy (45 MHz to 225 MHz)	100 mV ±0.3 dB across 50.0 ohms
FREQUENCY DIAL	Six-turn spiral, continuous tuning, movable cursor
Accuracy	±0.5% of indicated frequency without cursor correction ±200 kHz typical, 87.5 MHz - 108 MHz, after setting cursor on known signal
RECEIVER SPURIOUS RESPONSES	Image Rejection, 55 dB typical; IF Rejection, 100 dB typical
LOCAL OSCILLATOR RADIATION	45 MHz, 2 μV; 225 MHz, 35 μV; typical values across 50 ohm load at RF input connector
DEMODULATORS	AM and FM, switch selected, phone jack (.25 in.) output connector
Video Frequency Responses	50 Hz - 100 kHz, 3 dB max. variation
Output Level	4.5V p-p max. across 75-ohm load, variable by AUDIO control
AUDIO MONITORING	Internal loudspeaker; headphones plug into demodulator output jack, disconnecting speaker; AM or FM selected by DEMOD switch; level control with disabling switch
RECORD OUTPUT	Two-circuit phone jack (.25 in.) output Tip Contact: dc analog of meter indication 0.8 V - 8 V open circuit, 2000 ohm source resistance Ring Contact: dc output from FM discriminator, −5 V ±3 V, 2000 ohm source resistance Single-circuit phone plug provides tip contact output only
POWER SUPPLY	
Internal Batteries	1.5 volt size "D" batteries, ten required
Battery Life	1500 readings or 24 hours continuous operation using Eveready No. 950 batteries at 70°F
External Supply	11.5 volts to 19.0 volts dc, positive ground, 120 mA, Switchcraft No. 760 Connector
TEMPERATURE RANGE, OPERATING	+15°F to +105°F (−10°C to +40°C)
DIMENSIONS, INCHES (CM)	Without Antenna: 9-1/2 (24) high, 12-1/4 (31) wide, 7-1/4 (18.4) deep With Antenna attached and retracted, 9-7/8 (25) high, 13-1/2 (34.3) wide, 7-1/4 (18.4) deep
WEIGHT, POUNDS (KG)	16 (7.3) with batteries and antenna

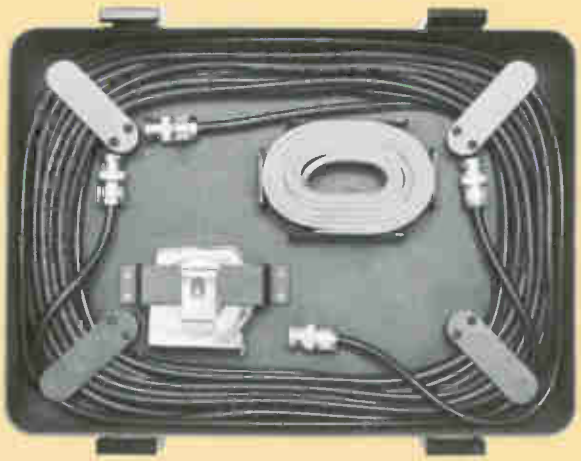
Notes: Values without limits are typical only
Field strength data are with ANT-71 Antenna

Antenna Ant-71

TYPE	Tunable half-wave dipole with continuously adjustable telescoping elements.
FREQUENCY RANGE	45 - 225 MHz
CALIBRATION	Antenna Factor data supplied based on NBS calibration; overall error including NBS calibration uncertainty, ±1.5 dB max.
LOAD IMPEDANCE	50 ohms
MOUNTING	Mounts on FIM-71 case for hand-held measurements at an antenna height of approx. 7 ft.; has 1/4-20 threaded hole for mounting to other masts

ACCESSORIES

Accessories Supplied



Coaxial Cable, RG 223/U, double shielded, 50 ohms, BNC Connectors, 34 ft., approx. (10.36 m) long.

Coaxial Cable, RG 223/U, double shielded, 50 ohms, BNC Connectors, 45 in. (114.3 cm) long.

Tape Measure to set antenna element length.

Leather Neck Strap for hand-held measurements.

Antenna Element Length vs. Frequency data.

Antenna Factor vs. Frequency data.

Optional Accessories

AC-71 (117) AC Power Adapter (117 VAC ±10%, 60 Hz)

AC-71 (234) AC Power Adapter (234 VAC ±10%, 50 Hz)

BK-71 Rechargeable Battery Kit (Includes BC-71 Battery Charger and BP-71 Battery Pack)

ANT-71 Antenna Elements and Balum (spare)

HS-71 Headset

RO-71 Phone plug with internal potentiometer for adjustable record output.

Unipod

A particularly useful accessory for Field Strength Meters is the unipod. Equipped with a ¼-20 threaded stud, the unipod easily screws into the mating tripod adaptor at the base of the instrument. The telescoping leg is adjustable to any convenient height and becomes a rigid support for the instrument while making field strength measurements. Antenna orientation is easily adjusted about a single axis yielding precise measurements.

Meter Carrying Case

The Meter Carrying Case is an accessory specifically designed for storing and protecting the FIM-71 Field Strength Meter when in transit. This attractive, dent-resistant case is constructed of hard wood and finished in a clear epoxy, both inside and out. Within the case, foam inserts, cut to the shape of the meter, provide full support and minimize shock.

LENGTH:

Fully extended . . . . . 62 in. (157 cm)

Collapsed . . . . . 25 in. (64 cm)

WEIGHT: . . . . . 1¼ lbs. (.56 kg)

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POTOMAC INSTRUMENTS

AT 51

AUDIO TEST SYSTEM

AA-51
AUDIO
ANALYZER

AG-51
AUDIO
GENERATOR

MEASURES

Harmonic Distortion, Intermodulation Distortion, Volts, dB, Signal + Noise/Noise Ratio, Wow and Flutter, Stereo Phasing, Differential Gain in Stereo Channels.

FEATURES

Separate Generator and Analyzer – Transformerless Stereo Outputs (Balanced or Unbalanced; switch selectable) – Source Resistance 150 ohms or 600 ohms (switch selectable) – Automatic Signal Leveling – Precision 10 dB, 1.0 dB and 0.1 dB Step Attenuators – RFI Shielding – Automatic "Set Level" and "Balance" Circuits – Scope Display of distortion products – Output Level Monitor.

The AT-51 is an innovative audio test system which facilitates the measurement of critical parameters in monophonic and stereophonic audio equipment. Designed primarily for commercial broadcast proof-of-performance measurements and equipment maintenance, the AT-51 exhibits features which are unique and well suited to laboratory type measurements by design engineers, quality control facilities and professional high fidelity service centers. The AG-51 Audio Generator and AA-51 Audio Analyzer are packaged separately for remote measurements requiring physical separation of signal source and signal analyzer. Both units are RFI shielded to enable accurate measurements in high level radio frequency environments typical to broadcast transmitter facilities. Signal input and output connectors are also RFI shielded.

DESCRIPTION

The AA-51 Audio Analyzer is an AUTOMATIC multi-purpose test instrument designed to accurately measure total harmonic distortion, intermodulation distortion, wow and flutter, frequency response, signal-to-noise ratio, RMS voltage level, stereo phasing, and a differential gain (ratio) of signals in the audio frequency spectrum. There are no "Set Level" or "Balance" controls. Input signals between 0.1 V RMS and 80 V RMS are automatically leveled to the proper reference for distortion measurements. Out-of-range lights are provided for indicating that input levels are within the usable 58 dB range.

For total harmonic distortion measurements, automatic nulling is accomplished via internal feedback circuitry. The operator merely coarse-tunes the input frequency, switches the function switch to THD and reads the meter. Accurate harmonic distortion measurements at various discrete frequencies and different power levels can be made much faster than with conventional distortion analyzers.

Intermodulation distortion measurements are performed with equal simplicity. Utilizing the SMPTE Standard intermodulation signal provided by the AG-51 generator, the AA-51 displays percent IM for input levels between 0.1 V RMS and 50V RMS. Again, measurements are automatic – no level or balance adjustments are required. With the function switch in the IM position, variations in intermodulation distortion may be observed over a wide dynamic range – automatically. This feature makes the AA-51 a very useful test instrument for troubleshooting audio systems.

Signal + Noise/Noise ratio measurements are made with the function switch in the "NOISE" position. In this mode, the voltmeter bandwidth is restricted to 20 kHz. S+N/N measurements are accomplished by reading the difference in audio output level between reference signal corresponding to 100% modulation and the residual noise of an unmodulated signal.

Accurate frequency response measurements are facilitated by a wideband voltmeter which exhibits a flat response (±0.1 dB) from 20 Hz to 200 kHz. Input level range is from 1 mV to 100 V full scale. The average responding meter is calibrated to the RMS value of a sine-wave.

Incidental frequency modulation termed "Wow and Flutter" is usually associated with record and playback equipment such as tape decks, cart machines and turntables. The AA-51 measures weighted peak flutter as specified by IEEE standard 193. Wow and flutter measurements are automatic. Test signals may be derived from a prerecorded standard test tape or record; or from the 3.15 kHz signal provided by the AG-51.

Stereo signals and mono signals derived from a stereo source are often degraded by phase errors and differential gain variation between LEFT and RIGHT channels of a given audio system. The AA-51 contains both Phase and Ratio measuring circuitry which enables the operator to evaluate these characteristics quickly and accurately throughout the complete audio spectrum and over a wide dynamic range. Phase angle is displayed with a zero center scale indication and full scale sensitivity of either ±54 degrees or ±180 degrees as determined by a front panel switch. The ratio meter is also a zero center scale device with ±6 dB full scale deflection.

The Phase and Ratio measurement features of the AA-51 are particularly useful for line equalization measurements, azimuth alignment of stereo tape heads, and troubleshooting of audio consoles, amplifiers and networks.

SPECIFICATIONS

THD DISTORTION METER

Fundamental Frequency Range: 20 Hz to 20 kHz in 3 decade ranges
Bandwidth: 100 kHz
Distortion Range: 0.1% to 100% (full scale) 10 dB steps
Accuracy: ±5% (full scale)
Dynamic Range: 0.1 V RMS to 80 VRMS with automatic leveling
Input Impedance: 500K Ω shunted by 105 pF
Scope Output: 100 mV p-p (full scale)
Internal Distortion & Noise: <0.04%

IM DISTORTION METER

Input Signal Required: 60 Hz & 7 kHz @ 4:1 ratio (SMPTE Standard)
Distortion Range: 0.1% to 100% (full scale) 10 dB steps
Accuracy: ±5% (full scale)
Dynamic Range: 0.1 V RMS to 80V RMS with automatic leveling
Input Impedance: 500K Ω shunted by 105 pF
Scope Output: 100 mV p-p (full scale)
Internal Distortion & Noise: <0.03%

AUDIO INSTRUMENTATION

AA-51	Automatic Audio Analyzer: RFI shielded, stereo inputs, 117 VAC (230 VAC option)	$2,125.00
	Total Harmonic Distortion Meter: 0.1% to 100% 20 Hz to 20 KHz, automatic set level and balance	Included
	Intermodulation Distortion Meter: 0.1% to 100% 60 Hz and 7 KHz composite (other frequencies optional), automatic set level	Included
	AC Voltmeter: 5 Hz to 200 KHz, 1 mV to 100 V	Included
	S + N/N Meter: 20 Hz to 20 KHz	Included
	Phase Meter: ± 180 degrees, 20 Hz to 20 KHz	Included
	Wow and Flutter: 0.01% to 1% peak weighted, automatic set level	Included
	Ratio Meter: ± 6 dB, 20 Hz to 20 KHz	Included
AG-51	Audio Generator: RFI shielded, transformerless stereo outputs, balanced and unbalanced, 600 ohms and 150 ohms, automatic signal leveling with self test feature. 117 VAC (230 VAC option)	$ 1,875.00
	Stereo Matrix Switch: L, R, L + R, L - R	Included
	Precision Attenuators: 10 dB, 1.0 dB, 0.1 dB steps	Included
	Low Distortion Sine Wave Generator: 20 Hz to 200 KHz	Included
	Composite Intermodulation Test Generator: 60 Hz & 7 KHz @ 4:1 (other frequencies optional)	Included
	3.15 KHz SMPTE Wow and Flutter Frequency Standard	Included
AT-51	Audio Test System: Includes AA-51 Analyzer and AG-51 Generator at single purchase price	$ 3,575.00

AUDIO TEST ACCESSORIES

TC-51	Fiberglass reinforced Transport Case Houses both AA-51 and AG-51 Dimensions 21" x 19" x 14"	$ 310.00
DX-51	Low Distortion AM Detector	$ 175.00
IX-51	Balanced to Unbalanced Audio Transformer with switch selectable line termination of 600 ohms, 150 ohms or open circuit	$ 175.00
RK-51	19" Rack Mounting Kit for AA-51 or AG-51	$ 35.00

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PRODUCT PRICE LIST

Effective 15 August 1984

Terms: Net 30 days with credit approval. F.O.B. Silver Spring Md.

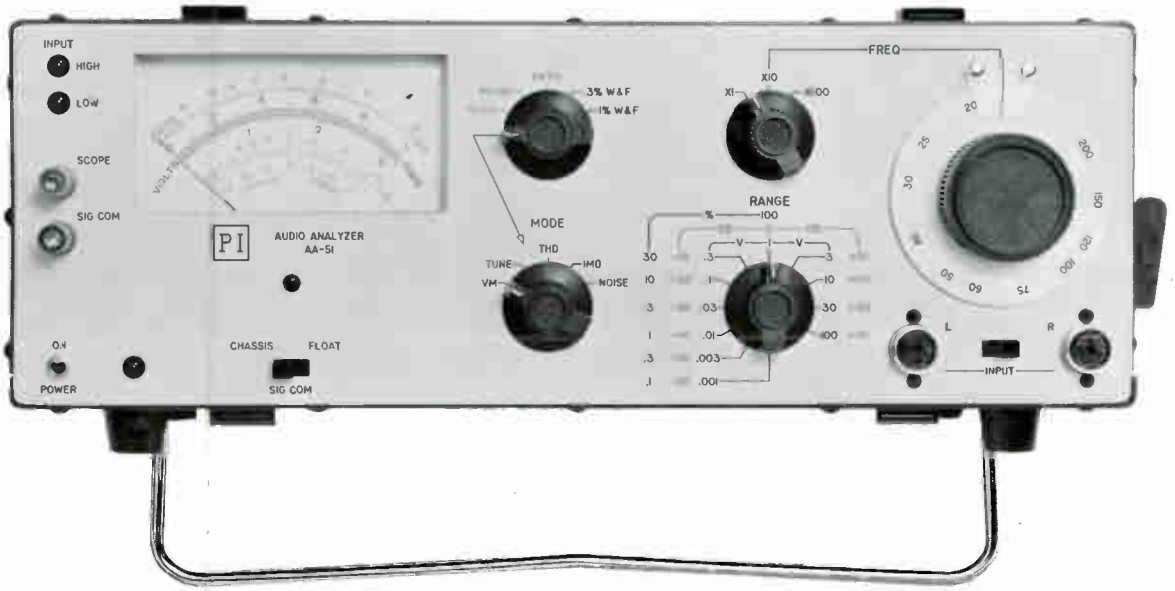
WARRANTY FOR EQUIPMENT AND ACCESSORIES

Potomac Instruments Inc. warrants each new equipment to be free of defects in material and workmanship, for a period of one (1) year after date of original shipment, except for fuses, transistors, diodes, and integrated circuits, which are warranted for a period of ninety (90) days. Any instrument which is found within one year not to meet the foregoing standards after examination by our factory, will be repaired or at the option of Potomac Instruments replaced without charge. This warranty does not apply to equipment which has been altered, improperly handled, or damaged in any way.

CHANGES IN SPECIFICATIONS AND PRICES

The right is reserved to change the published specifications and prices of equipment at any time, and to furnish merchandise with current specifications, without incurring any liability to modify equipment previously sold.

ANALYZER



A.C. VOLTMETER

Frequency Range: 20 Hz to 200 kHz
Voltage Range: 1 mV to 100 V RMS (full scale) 10 dB steps
Voltmeter Accuracy: ±3% (full scale) 20 Hz to 200 kHz
Input Impedance: 330K Ω shunted by 150 pF
Scope Output: 100 mV p-p (full scale)

SIGNAL PLUS NOISE METER

Frequency Range (–3 dB): 20 Hz to 20 kHz
Voltage Range: 1 mV to 100 V RMS (full scale)
Signal + Noise/Noise Accuracy: ±5% (full scale)
Residual Hum & Noise: <–80 dB
Input Impedance: 330 KΩ shunted by 150 pF
Scope Output: 100 mV p-p (full scale)

PHASE METER

Range: ±54 degrees F.S. and ±180 degrees F.S.; switch selected
Bandwidth: 20 Hz to 20 kHz
Accuracy: ±5% (full scale)
Resolution: 3 degrees
Dynamic Range: 0.3 V RMS to 6 V RMS
Input Impedance: 500 KΩ shunted by 180 pF
Scope Output: 0.5 V pulse train, pulse width proportional to phase angle

RATIO METER

Range: ±6 dB
Bandwidth: 20 Hz to 20 kHz
Accuracy: ±5% (full scale)
Resolution: ±0.25 dB
Dynamic Range: 0.3 V RMS to 6 V RMS
Input Impedance: 500 KΩ shunted by 180 pF
Scope Output: DC voltage proportional to ratio

WOW AND FLUTTER METER

Range: 0.3% F.S. and 1.0% F.S.; switch selected
Input Frequency: 3.15 kHz ±10%
Accuracy: ±5% (full scale)
Dynamic Range: 0.1 V RMS to 80 V RMS
Input Impedance: 500 KΩ shunted by 180 pF
Internal Distortion and Noise: <0.01%
Scope Output
Bandwidth: 0.2 Hz to 200 Hz
Sensitivity: 500 mV p-p/%

External Power: 117 VAC (230 VAC option) 50 or 60 Hz, 10 Watts
Weight with cover; kg (lbs): 5.44 (12)
Dimensions with cover, cm (in): 38.74 (15-1/4) wide, 13.34 (5-1/4) high, 25.72 (10-1/8) deep
Rack mount space with rack mount option: 5-1/4 inches

Specifications subject to change without notice.

AG-51 AUDIO GENERATOR

Tilt Stand Provided But Not Shown

The AG-51 Audio Generator contains a low distortion 20 Hz to 200 kHz sine wave generator, an SMPTE standard intermodulation signal generator and a fixed frequency sine wave generator at 3.15 kHz for wow and flutter tests. Signal outputs are simultaneously available at levels of up to +20 dBm (equivalent sine wave power for complex signals) at separate LEFT and RIGHT output connectors. Outputs may be switch selected for LEFT only, RIGHT only, LEFT and RIGHT in phase (L+R), and LEFT and RIGHT in phase opposition (L−R). Front panel switches enable the operator to select fully balanced or unbalanced outputs at impedance levels of 150 ohms or 600 ohms. A dynamic range of 99.9 dB in 0.1 dB steps utilizing a combination of 10 dB, 1.0 dB and 0.1 dB precision attenuators is provided. Attenuator dials display output level directly in dBm in the 150 ohm source impedance configuration. Automatic output leveling circuitry with a built-in self-test feature provides a constant output level thereby eliminating the need for output metering. In the TEST mode the generator output level is reduced to zero, a useful feature during noise measurements.

The time constant of the leveling control loop is determined by a front panel switch. For rapid frequency response measurements, this switch is set to the FAST RESPONSE position. This feature enables the operator to evaluate frequency response of the device under test (amplifier, filter, etc.) with a manual sweep of the frequency dial and multiplier switch. For distortion measurements, the switch is set to the LOW DIST position. This mode of operation provides minimum distortion with a slightly longer control loop time constant for accurate signal analysis at any specific frequency.

SPECIFICATIONS

Frequency Range: 20 Hz to 200 kHz in four decade ranges

Outputs: LEFT only, RIGHT only, LEFT AND RIGHT in phase (L&R), or LEFT and RIGHT 180° out of phase (L-R); switch selected IM composite 60 Hz and 7 kHz @ 4:1 ratio (SMPTE standard) 3.15 kHz fixed wow & flutter signal (IEEE Standard 193-1971)

Output Impedance
- **Unbalanced:** 150 ohms or 600 ohms; switch selected
- **Fully balanced:** 150 ohms or 600 ohms; switch selected;

Output Level: (No attenuation)
- **Sine Wave Signals:** +20 dBm (7.75V) across 600 ohm load, 15.5V open circuit. 0 dBm (.387V) across 150 ohm load, 0.774V open circuit
- **IM Signal:** Peak-to-peak voltage of composite waveform is equal to peak-to-peak voltage of +20 dBm sine wave across 600 ohm load, 0 dB sine wave across 150 ohm load

Output Level Accuracy: 20 Hz - 100 kHz, ±0.2 dB, 100 kHz - 200 kHz, ±0.5 dB

Attenuator Range: 0 to 99.0 dB in 0.1 dB steps

Attenuator Accuracy
- **0 to 10 dB:** ±1.5% of attenuation in dB
- **>10 dB:** ±0.2 dB (max.)

Intrinsic Distortion *:

Harmonic	Low Distortion	Fast Response
20 Hz to 10 kHz	< .05%	< 1%
10 kHz to 20 kHz	< .08%	< 1%
Intermodulation		
Incidental FM (3.15 kHz)	< .03%	
	< 0.01%	

Hum and Noise: >80 dB below rated output

Dial Accuracy: ±3%

External Power: 117 VAC, (230 VAC option) 50 or 60 Hz, 9 Watts

Dimensions with cover, cm (in): 38.74 (15-1/4) wide, 13.34 (5-1/4) high, 25.75 (10-1/8) deep

Rack mount space with rack mount option: 5-1/4 inches

Weight with cover, kg (lbs): 5.44 (12)

*Slightly higher at R output in L-R, UNBAL mode.

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