

BOONTON

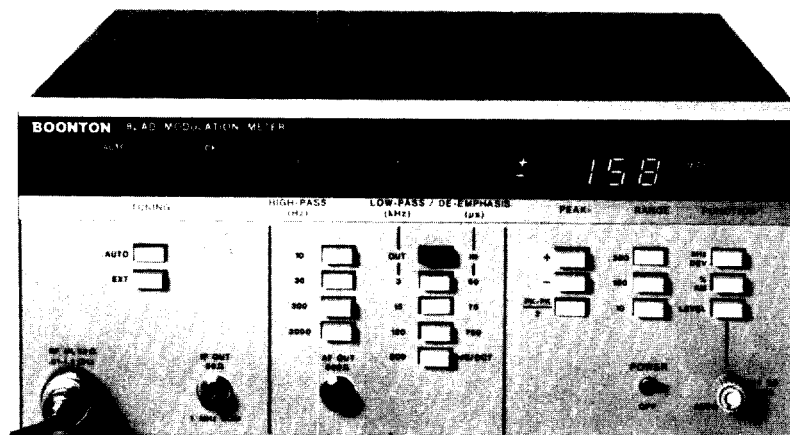
MODULATION METERS & ANALYZER

Modulation Meter
Model 82AD



- Carrier Frequency Range, 10 MHz to 1.3 GHz.
- Basic Accuracy 2% for AM/FM.

- Comprehensive Selection of Post-Detection Filters.
- Automatic Tuning and Leveling.
- Optional IEEE-488 Bus Interface.



Description

The Boonton Model 82AD Modulation Meter combines the easy to operate features of automatic tuning and automatic leveling found in service type modulation meters with the accuracy and versatility of high quality, laboratory type manual meters. In addition, the 82AD offers the advantages of digital display and full programmability through an optional IEEE-488 bus interface.

Automatic Operation

Manual modulation meters require that an internal local oscillator be accurately tuned to a frequency close to the carrier frequency to produce a low frequency IF, which can then be analyzed by the measuring circuits. In addition, the level of the carrier must be adjusted to a calibrated amplitude for AM measurement. The 82AD, with completely automatic tuning and leveling, eliminates the need for readjustment of these controls. The strongest RF carrier in the frequency range from 10 MHz to 1.3 GHz is automatically captured and normalized in level to produce a 1 MHz IF replica of the modulated RF carrier. The modulation component of the input signal is recovered and converted to a proportional DC level, which drives the four digit LED display to provide calibrated indications of amplitude modulation or frequency modulation.

Function and Range

Selection of either FM deviation (10, 100 and 300 kHz fs) or % AM depth (10 and 100% fs) is by front panel pushbuttons. Readings are displayed as plus or minus FM deviation, or peak or trough % AM, or peak averaged.

Adjustable Filters

The ability to adjust the post-detection bandwidth is provided by a series of high-pass and low-pass filters selected

by front panel pushbuttons. The widest bandwidth is 10 Hz to 200 kHz which can then be narrowed with 3 dB lower cutoff frequencies of 30, 300 or 3000 Hz and upper cutoff frequencies of 3, 15 or 120 kHz. The lowpass filter buttons can also be used in an alternate function to insert de-emphasis of 50, 75 or 750 microseconds. A 6 dB per octave position referred to 1 kHz permits phase modulation to be shown directly on the FM display (1 kHz deviation = 1 radian).

High Accuracy

The 4 digit display of the Model 82AD provides remarkable accuracy and resolution. FM deviation accuracy is 2% of reading with full scale ranges of 10, 100 and 300 kHz at rates from 30 Hz to 100 kHz. AM accuracy is 2% of reading from 10% to 90% AM and 5% of reading below 10% and above 90%. Full scale AM ranges are 10% and 100%, at rates from 30 Hz to 100 kHz. Resolution for either FM or AM is 0.1% of full scale.

Full accuracy is maintained over an operating temperature range of 0 to 55°C. A special close tolerance AM specification for air navigation applications, (0.7% of reading at 20, 30 and 40% AM and less than 0.4% difference in indicated AM between 20% and 40% with modulation rates of 90 and 150 Hz), meets FAA requirements over a temperature range from 15 to 35°C.

GPIB Capability

The 82AD has full systems capability through the IEEE-488 bus. The field installable, plug in 01A bus interface option provides completely interactive programming by either the bus controller or the 82AD panel controls. In addition to the normal functions, the interface provides a software-configured service request and the ability to select message termination characters.

MODULATION METERS & ANALYZER

Modulation Meter Model 82AD (Continued)



Specifications

RF Input

Carrier Frequency Range: 10 MHz - 1.3 GHz.

Tuning: Automatic, typical acquisition time 100 ms at 100 MHz.

Sensitivity: 10 mV RMS, 10 MHz - 520 MHz.
30 mV RMS, 520 MHz - 1.3 GHz.

Level Set: Manual or automatic for levels up to 1 V RMS. Automatic acquisition time, 2 s typical.

Maximum Safe Input: 7 V RMS.

Input Impedance: 50 Ω nominal.

Frequency Modulation

Deviation Ranges: 10, 100, 300 kHz full scale.

Deviation Accuracy: 2% of reading for deviations up to 300 kHz and modulation frequencies between 30 Hz and 100 kHz.

NOTE: Peak residuals must be subtracted to obtain full accuracy.

Modulation Frequency Range: 30 Hz to 100 kHz.

Residual FM: <26 Hz RMS at 1.3 GHz, decreasing linearly with frequency to a floor of <3 Hz RMS, 30 Hz to 3 kHz bandwidth.

<65 Hz RMS at 1.3 GHz, decreasing linearly with frequency to a floor of <7.5 Hz RMS, 30 Hz to 15 kHz bandwidth.

AM Rejection: <100 Hz deviation at 50% AM (f_{mod} 1 kHz or less), 30 Hz to 3 kHz bandwidth.

Stereo Separation:

- >46 dB; 200 Hz - 15 kHz.
- >35 dB; 100 Hz - 200 Hz.
- >30 dB; 50 Hz - 100 Hz.
- >46 dB; 50 Hz - 200 Hz (with external local oscillator).

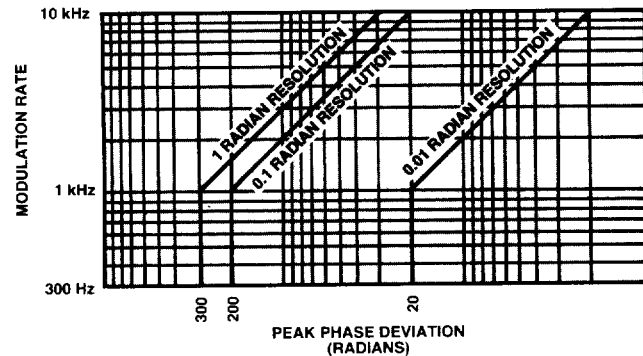
NOTE: 10 Hz - 200 kHz measurement bandwidth for above stereo separation.

Phase Modulation

Carrier Frequency: 10 MHz to 1.3 GHz.

Rates: 300 Hz to 10 kHz; typically usable to 100 kHz with degraded performance.

Deviation and Maximum Resolution:



Accuracy: $\pm 4\%$ of reading ± 1 digit.

AM Rejection: <0.1 radian peak for 50% AM at 1 kHz rate (30 Hz to 3 kHz BW).

Amplitude Modulation

Modulation Depth Ranges: 10%, 100%, 300% fs (300% range reads to 100% with reduced resolution).

Depth Accuracy: 2% of reading, 10% to 90% AM, 5% of reading below 10% and above 90% AM.

NOTE: Peak residual AM must be subtracted for above accuracy.

Modulation Frequency Range: 30 Hz to 100 kHz.

Residual AM (RMS):

- <0.05% for input levels above 100 mV.
- <0.15% for input levels from 30 to 100 mV.
- <0.45% for input levels from 10 to 30 mV.

NOTES: Frequency <520 MHz. 30 Hz-15 kHz measurement bandwidth. Above 520 MHz residuals increase linearly with frequency.

FM Rejection: <0.5% AM at ± 50 kHz deviation, f_{mod} <100 kHz.

Avionics

Depth Accuracy: $\pm 0.7\%$ of reading at 20, 30, and 40% AM, f_{mod} 30 Hz-3 kHz (Filter, 10 Hz-15 kHz).

Detector Flatness: Indicated AM within $\pm 0.4\%$ for constant % AM between 20% and 40% and f_{mod} of 90 to 150 Hz.

NOTES: 10 Hz to 15 kHz measurement bandwidth. Temperature 25°C $\pm 10^\circ$ C. Frequency <520 MHz. RF level 100 mV-1 V. 20% AM is read on 10 range.

Audio Frequency Response

Filters:

High Pass	Low Pass	De-emphasis
<10 Hz	3 kHz	50 μ s
30 Hz	15 kHz	75 μ s
300 Hz	120 kHz	750 μ s
3 kHz	200 kHz	6 dB/Oct (ref. 1 kHz)

Shape Factor: All filters are three-pole Butterworth except 10 Hz and 200 kHz. De-emphasis time constant and 3 dB filter frequencies have an accuracy of $\pm 4\%$ (except 10 Hz).

Audio Distortion: <0.1% thd for ± 100 kHz deviation.

<0.2% thd for 30% AM.

<0.5% thd for 90% AM.

f_{mod} <100 kHz.

Audio Output Level: 1 V RMS nominal into 600 Ω load at 1000 counts on DPM.

ANNUNCIATORS

Back-lighted display for all switch settings.

LEVEL High (▲), LEVEL Low (◆).

LOCK flashes when instrument is unlocked.

RANGE flashes when display is overranged.

REMOTE indicates remote operation via IEEE 488 Bus Interface.

IF Output

Frequency: 1 MHz nominal.

Level: 0.223 V RMS nominal into 50 Ω load (0 dBm).

DC Output

1.00 V DC from 1000 Ω source at 1000 counts on DPM.

Display

Modulation: 4 digit LED display indicates true peak; 1000 counts + 100% overrange; + peak, - peak, or peak average indication.

FM Resolution:

Range	Resolution
300 kHz	1 kHz
100 kHz	100 Hz
10 kHz	10 Hz

AM Resolution:

Range	Resolution
300%	1%
100%	0.1%
10%	0.01%

Power Consumption: 15 VA; 100, 120, 220, or 240 V $\pm 10\%$, 50-400 Hz.

Operating Temperature: 0 to 55°C, Storage; -40 to +75°C.

Weight: 14 lbs (6.36 kg).

Dimensions: 5.25 in (13.34 cm) high, 12.5 in (31.75 cm) wide, and 14.5 in (36.83 cm) deep.

Options

-01A IEEE-488 Bus Interface. Allows remote operation of all front panel controls except line switch and manual level set. Outputs panel settings, displayed readings, and status. It is compatible with IEEE-488-1978 digital interface standards. Implements SH1, AH1, T6, L4, SR1, RL1, DC1 and DT1.

-03 RF Fuse. Fuse capsule behind front panel. Protection to 50W.

-04 Rear Panel RF Input. N connector on rear in place of front panel connector.

-S/2 120 kHz Butterworth filter replaced by a 20 kHz Bessel filter.

-S/10 ME525A (NSN 6625-01-161-1459).

-S/12 50 kHz Butterworth filter.

Accessories Available

82-1A Rack Mount Kit. Two flanges with handles mount to both sides to adapt to 19 inch rack.

82-2A Extender Card. Allows plug-in boards to be operated in elevated position for servicing.