



Data Sheet

8201 AM / FM Modulation Meter



Taking performance to a new peak

FM / AM Modulation Meter Model 8201

The Boonton Model 8201 Modulation Analyzer offers a unique combination of measurements including:

- AM, FM and ϕ M (AM and FM 1%, ϕ M 3% of readings)
- Carrier level and frequency (0.01 dB level and 10 Hz carrier resolution)
- Signal, noise and distortion power (SINAD)

This eliminates the need for several different pieces of equipment.

Modulation is detected using peak, while residuals are measured using RMS and referenced to a specific level. These values are displayed in %, dB or quasi-peak, and the highest values are stored using the peak-hold function.

Signal frequency and level can be acquired automatically or input via the keyboard or remote command. The 8201 is a cost effective measurement tool for an ATE system, signal generator calibration or mobile radio production testing.



Provides Versatile Audio Filters

- 4 Low pass
- 4 High pass
- 4 De-emphasis networks

Specifications

| | |
|---|---|
| RF Input | |
| Frequency Range | 100 kHz to 2.5 GHz |
| Tuning | |
| Automatic, typical acquisition time one second. Manual, from keyboard or IEEE-488 bus ⁽⁶⁾ | |
| Sensitivity | |
| 10 mV | 100 kHz to 520 MHz |
| 15 mV | 520 MHz to 1.0 GHz |
| 28 mV | 1.0 GHz to 1.5 GHz |
| 50 mV | 1.5 MHz to 2.0 GHz |
| Carrier acquisition level is typically -40 dBm (2.3 mV) | |
| Level Set | |
| Automatic, typical acquisition time one second for levels up to 7 V RMS. Manual, from keyboard or IEEE-488 bus ⁽⁶⁾ | |
| Maximum Input | 1 watt (7 V RMS, +30 dBm) ⁽⁶⁾ |
| Maximum Safe Input | 40 V dc, 35 V ac (25w for source SWR<4) ⁽⁶⁾ |
| Input Impedance | 50 Ω nominal, SWR <1.5 |

Carrier Frequency

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|----------------------|--|
| Resolution | 10 Hz for carriers <1.0 GHz, 100 Hz for carriers >1 GHz |
| Accuracy | Reference accuracy \pm three digits |
| Reference Oscillator | 10 MHz, temperature compensated. Aging rate less than $\pm 1 \times 10^{-6}$ /year. Temperature influence less than $\pm 1 \times 10^{-6}$ from 0 to 50 degrees centigrade |

Carrier Level

| | |
|------------|---|
| Range | -47.0 to +30.0 dBm (1 mV to 7 V) |
| Resolution | 0.01 dBm or .1 mV |
| Accuracy | ± 1 dB from 100 kHz to 520 MHz, ± 2 dB from 520 MHz to 1500 MHz, ± 3 dB from 1500 MHz to 2500 MHz |

FM Modulation

Measurement: + peak, -peak, peak average, quasi-peak and RMS

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|--|---|---|--|
| Carrier Range | 0.2 MHz to 0.5 MHz | 0.5 MHz to 10 MHz | 10 MHz to 2.5 GHz |
| Deviation Range ⁽⁷⁾ | 0 to C.F./10 kHz | 0 to 150 kHz | 0 to 500 kHz |
| Deviation Accuracy ⁽¹⁾⁽²⁾ At specified mod. rates | 1% of reading, 30 Hz to 5 kHz; 2% of reading, 5 kHz to 7.5 kHz. | 1% of reading, 30 Hz to 15 kHz; 2% of reading, 15 kHz to 30 kHz | 1% of reading, 30 Hz to 100 kHz; 2% of reading, 100 kHz to 150 kHz |
| Modulation Frequency Range | 20 Hz to 15 kHz | 20 Hz to 50 kHz | 20 Hz to 220 kHz |
| AF output distortion | <0.1% @ <30 kHz dev | <0.1% at <75 kHz | <0.1% at <100 kHz dev |

Residual FM

<15 Hz RMS at 2.0 GHz decreasing linearly to a floor of <1 Hz RMS at 100 MHz, with 3 kHz low-pass filter. <30 Hz RMS at 2.0 GHz decreasing linearly to a floor of <2 Hz RMS at 100 MHz, with 15 kHz low-pass filter

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| Incidental FM | <20 Hz peak deviation at 50% AM 30 Hz to 3 kHz filter |
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Display Resolution⁽⁸⁾

1 Hz for deviations from 0 to 5 kHz. 10Hz for deviations from 5 to 50 kHz. 100 Hz for deviations above 50 kHz

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| Stereo Separation ⁽³⁾ | >48 dB 50 Hz to 15 kHz modulation rates |
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AM Modulation

Measurement: + peak, - peak, peak average, quasi-peak, and RMS

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|--|-------------------------------|--------------------------------|---------------------------------|
| Carrier Range | 0.1 MHz to 0.5 MHz | 0.5 MHz to 10 MHz | 10 MHz to 2.5 GHz |
| Depth Range | 0 to 99% | 0 to 99% | 0 to 99% |
| Depth Accuracy ⁽¹⁾⁽²⁾ At specified mod. Rates | 1% of reading, 30 Hz to 5 kHz | 1% of reading, 30 Hz to 15 kHz | 1% of reading, 30 Hz to 100 kHz |
| Modulation Frequency Range | 20 Hz to 15 kHz | 20 Hz to 50 kHz | 20 Hz to 220 kHz |
| AF output Distortion | <0.3% for 90% AM | <0.3% for 90% AM | <0.3% for 90% AM |

Residual AM

<0.05% RMS for input levels >100 mV, 15 kHz low-pass filter; <0.02% RMS for input levels >100 mV, 3 kHz low-pass filter; carrier frequency <520 MHz. Above 520 MHz, residuals increase linearly with frequency

Incidental AM (3 kHz low-pass)

| | | |
|--------------------|---|---|
| Carrier | >10 MHz <0.2% AM <10 MHz <0.2% AM | peak at 50 kHz peak deviation peak at 5 kHz peak deviation |
| Display Resolution | .001 % for depths from 0 to 5% .01 % for depths from 5 to 50% .1 % for depths above 50% | |

ØM Modulation

Measurement: + peak, - peak, peak average, quasi-peak, and RMS

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|--|--|--|--|
| Carrier Range | 0.2 MHz to 0.5 MHz | 0.5 MHz to 10 MHz | 10 MHz to 2.5 GHz |
| Deviation Range ⁽⁴⁾ | 0 to C.F./10 rad | 0 to 150 rad | 0 to 500 rad |
| Deviation Accuracy ⁽¹⁾⁽²⁾ At specified mod. Rates | 3% of reading, 200 Hz to 30 kHz rates. | 3% of reading, 200 Hz to 30 kHz rates. | 3% of reading, 200 Hz to 30 kHz rates. |
| Modulation Frequency Range | 1000 Hz to 15 kHz | 20 Hz to 50 kHz | 20 Hz to 100 kHz |
| AF Output Distortion | <0.1% at <30 rad dev. | <0.1% at <75 rad dev. | <0.1% at <100 rad dev. |

Residual PM

<0.1 rad RMS at 2.0 GHz decreasing linearly to a floor of less than 0.005 rad RMS at 100 MHz

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| Incidental PM | <0.02 rad deviation at 50% AM, 30 Hz to 3 kHz filter |
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Display Resolution⁽⁵⁾

0.001 rad for deviations from 0 to 5 radww
0.01 rad for deviations from 5 to 50 rad
0.1 rad for deviations above 50 rad

Audio Frequency Display

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|------------|--|
| Range | 10Hz to 220 kHz |
| Resolution | 100 Hz for frequencies >100 kHz. 10Hz for frequencies between 10kHz and 100 kHz. 1 Hz for frequencies between 1 kHz and 10kHz. 0.1 Hz for frequencies <1 kHz |
| Accuracy: | Reference accuracy \pm one count |

Audio Distortion/SINAD

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| Distortion Range | 0.01 % to 100% THD or 0 to 80 dB SINAD |
| Distortion Accuracy | $\pm 10\%$ of reading or ± 1 dB SINAD. (The residual AM/FM or ØM must be accounted for in distortion measurements) |
| Frequency Range | 20 Hz to 20 kHz. Automatic operation when modulation frequency is within this range |
| Residual Noise and Distortion | Less than 0.1 % (60 dB SINAD) distortion |

Resolution

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|----------------|------------------|
| 0.01 %, range | 0.01 to 9.99% |
| 0.1 %, range | 10.0 to 99.9% |
| 0.01 dB, range | 0 to 80 dB SINAD |

Audio Filters

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| High-pass | <10Hz, Gaussian response and 30, 300 and 3000 Hz, three pole Butterworth response |
| Low-pass | 220 kHz and 50 kHz, seven pole Butterworth response, 20 kHz, three pole Bessel response and 3 and 15 kHz three pole Butterworth response |
| De-emphasis | 25, 50, 75, and 750 μ S |
| Filter Response | 3 dB corner & time constant accuracy, $\pm 4\%$ |
| Square Wave Response | <10 Hz High-Pass <10% droop with 5 Hz square wave |

Internal Calibrator

The 8201 may be calibrated to its full accuracy for AM/FM/ØM through the use of internal calibrators that are actuated via front panel or over the IEEE Bus.

Calibrator Accuracy

AM, 50.0% depth, 0.1 %; FM, 125.0 kHz deviation, 0.1 %; PM, 136.3 RAD deviation, 1.0%

Audio Frequency Output

Range

Uncalibrated, approximately 1 V RMS into 600 Ω at 5000 counts on display. Source impedance 600 Ω

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| Power Requirements | 65 VA; 100, 120, 220, or 240 V $\pm 10\%$, 50 to 400 Hz |
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| Operating Temperature | 0° to 55°C |
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| Weight | 281bs (12.7 kg) |
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| Dimensions | 17.25 in (43.8 cm) wide 5.75 in (14.6 cm) high 18.75 in (47.6 cm) deep |
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| Accessories Included | Spare input fuses Fuse replacement wrench |
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Remote Control

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| GPIO | Standard |
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Notes

(1) Peak residuals must be accounted for to obtain above accuracy

(2) For RMS detector, add $\pm 1\%$ of reading. For quasi-peak add $\pm 6.0\%$ of reading, 20 Hz to 20 kHz

(3) <10 Hz - 220 kHz filters

(4) Up to 1 kHz modulation rate. Above 1 kHz range, decreases linearly with modulation frequency.

(5) Up to 1 kHz modulation rate. Above 1 kHz, resolution is determined by product of deviation and modulation rate.

(6) These specifications are for application purposes and although typical are not guaranteed.

(7) With 750 μ s de-emphasis and pre-display selected the deviation is limited to 50 kHz peak.

(8) Resolution is ten times greater with 750 μ s de-emphasis and pre-display selected.

Options

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| 01 | Avionics Specification Certification |
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| 02 | Rear Panel RF Input |
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| 03 | CCITT Filter |
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| 05 | Amplitude Calibrator (0 dBm 50 MHz) |
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| 07 | Audio Loop-through. Used with external filters to allow user-defined filtering. Option 07 excludes Option 03 and vice versa. |
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| 08 | CCIR Filter |
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| 09 | C-MSG Filter |
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Accessories Available

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|---------------------------------|---------------|
| Rack Mount Kit (Ears & Handles) | PIN 95004492A |
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