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*Electronic Product Design*

# **Automatic Modulation Meter Model RF257 Operator Manual**



## **Model RF257 Automatic Modulation Meter**

The model RF257 modulation meter has been designed to simplify the task of modulation measurement. The model RF257 always locks to the highest level signal available, ignoring spurious signals and harmonics. AM and FM measurements can be made over the full frequency range of 1.5MHz to 2.0GHz. The unit operates usefully with reduced sensitivity to at least 4GHz.

FM measurement of peak positive, peak negative or mean deviation, with 5 deviation ranges from 1kHz to 100kHz full scale. AM measurement of peak, trough or mean in percentage modulation with 5 ranges from 1% to 100% full scale. The audio measurement bandwidth is selectable and the demodulated audio is available at the front panel. The IF is available on a BNC connector on the rear panel.

The unit is small and lightweight, making it ideal for the bench or field work, especially with the internal battery option installed.

# Operating Instructions

## Power Requirements.

### AC MAINS OPERATION

<b>WARNING</b>
<b>INCORRECT SUPPLY RANGE SELECTION COULD CAUSE SERIOUS DAMAGE TO THE INSTRUMENT</b>

Two AC power ranges are available, 102V - 130V and 205V - 260V. Make sure any mains connection is removed from the unit. Remove the four bottom case screws and remove cover. Select the appropriate range on the mains selector switch. This is located adjacent to the mains transformer on the bottom PCB inside the instrument and is identified as W1. Replace bottom cove and screws.

Connect the power lead to the local AC supply socket. The instrument is switched on by switching the front panel rotary switch to 'ON'. The instrument is immediately ready for use; no warm-up time is required. At power on, the RF257 defaults to the FM 100kHz range with the mean detector and the 3.5kHz filter selected.

## Input Signal.

Connect the signal source to the 'INPUT' socket, the 'LOCK' LED should immediately illuminate if the signal is within the range 2mV to 1V. The 'LOCK' LED shows that the instrument is correctly tuned to the incoming signal. The measuring circuits are inhibited when the 'LOCK' indicator is not lit. DO NOT APPLY MORE THAN 1V (2.8V p-p), the input circuitry will be damaged.

The instrument locks to the highest level signal applied to the input. It will not lock to a harmonic or other spurious signal provided that the intended carrier has the highest level signal and that it is within the specified frequency range. The tuning mechanism provides a continuous dynamic frequency lock that permits accurate modulation measurements to be taken even on a slowly sweeping carrier.

In general, the instrument provides good selectivity against interference from spurious signals. However, the broadband nature of the input circuit implies that the possibility of such interference cannot be completely eliminated. If it is suspected that a reading is being affected by high level interfering signals, make a check by disconnecting and reconnecting the signal source several times; any change in the modulation reading implies interference. Normal harmonic levels, even in the worst case, are unlikely to have any effect on measurements.

## **FM Measurement.**

Select the FM mode with the 'MODE FM' pushbutton.

Select the appropriate 'RANGE' with the < > pushbuttons. Five ranges are available with full scale deviations of 1, 3, 10, 30 and 100kHz.

Select the required 'AF FILTER' with the < > pushbuttons. Five filter functions are available; three bandpass filters with nominal upper cut-off frequencies of 60kHz, 15kHz and 3.5kHz; a psophometric filter complying to the CCITT standard and a 750  $\mu$ s de-emphasis network.

Select the required 'DETECTOR' mode with the '+', 'MEAN' and '-' pushbuttons. '+' gives peak positive deviation, '-' gives peak negative deviation and 'MEAN' gives the average of peak positive and peak negative deviations.

## **AM Measurement.**

Select the AM mode with the 'MODE AM' pushbutton.

Select the appropriate 'RANGE' with the < > pushbuttons. Five ranges are available with full scale modulation percentages of 1%, 3%, 10%, 30% and 100.0%. The demodulator is highly linear and allows accurate AM readings up to 100%.

Select the required 'AF FILTER' with the < > pushbuttons. Five filter functions are available; three bandpass filters with nominal upper cut-off frequencies of 60kHz, 15kHz and 3.5kHz; a psophometric filter complying to the CCITT standard and a 750  $\mu$ s de-emphasis network.

Select the required 'DETECTOR' with the '+', 'MEAN' or '-' pushbuttons. '+' gives peak percentage modulation, '-' gives trough percentage modulation and 'MEAN' gives the average between the peak and trough modulation.

## **Internal Battery Operation (Option 03).**

To operate from the internal battery, switch the front panel rotary switch to 'Bat'. This will give at least 8 hours of continuous use from a fully charged battery. The battery state during mains or battery operation can be determined by pressing the 'Bat Chk' pushbutton. A reading between 8 and 10 on the scale is required for normal operation. To charge the battery, switch the front panel rotary switch to 'Chge'. Allow 14 hours for a complete charge. A yellow LED shows that the battery is on charge. During normal mains operation the battery is trickle charged.

## **Demodulated Audio Output.**

The demodulated audio output is available on the front panel via a BNC connector. This is a 600  $\Omega$  output impedance with a level of 0dBm for FSD.

## **IF Output.**

The IF output is available on the rear panel via a BNC connector. This is approximately 420kHz at a level of 100mV with a nominal 50  $\Omega$  output impedance.

# RF257 SPECIFICATION

## RF Input

Frequency Range	1.5MHz to 2.0GHz and a useful response, with reduced sensitivity, to at least 4GHz.
Impedance	50 $\Omega$ nominal.
Level	2mV to 1V rms Full specification for noise, accuracy etc applies over the input range 10mV to 1.0V
Max Input	0.5W continuous.
Tuning	Automatic tuning selects the largest available signal. Correct operation requires spurious signals to be >10dB below the wanted signal.
Acquisition	Typically < 100ms. Settling time for the AF circuits is additional and is typically 1s for a reading > 75% of meter range.
L.O Feedout	-60dBm typically.

## FM Measurement

FSD Ranges	Five ranges with full scale deviations of 1kHz, 3kHz, 10kHz,30kHz and 100kHz.
Modes	Peak Positive, Peak Negative and Mean deviation.
Accuracy	$\pm 2\%$ of Full scale $\pm 1\%$ of reading with a 1kHz tone. See audio filter specification for additional error due to AF response. Residual FM is additional.
Residual FM	<20Hz at 100MHz <100Hz at 500MHz <200Hz at 1000MHz  Measured with 3.5kHz AF bandwidth.
Distortion	<1% at 100kHz deviation with a 1kHz tone.

## AM Measurement

FSD Ranges	Five ranges with full scale indications of 1%, 3%, 10%, 30%, 100%.
Modes	Peak, Trough and Mean of peak and trough.
Accuracy	$\pm 2\%$ of Full scale $\pm 2\%$ of reading with a 1kHz tone. See audio filter specification for additional error due to AF response. Residual AM is additional.
Residual	AM <0.5% ( 15kHz bandwidth selected )
Distortion	<1% for 80% AM with a 1kHz tone.

## Audio Filters

60kHz Filter	250Hz - 60kHz $\pm 0.5$ dB 12Hz - 72kHz $\pm 3$ dB typically. HF roll off at 80 dB/decade.
15kHz Filter	250Hz - 15kHz $\pm 0.5$ dB 12Hz - 19.5kHz $\pm 3$ dB typically. HF roll off at 60 dB/decade.

3.5kHz Filter	250Hz - 3.5kHz $\pm$ 0.5 dB 12Hz - 4.0kHz $\pm$ 3 dB typically. HF roll off at 100 dB/decade.
Psophometric	Complies with CCITT Volume V P53
De-emphasis	750 $\mu$ s de-emphasis. 3 dB bandwidth typically 12Hz - 212Hz. HF roll off at 12dB/decade.

### Front Panel

AF Output	Front panel BNC. Level 0dBm approx. for FSD. Impedance 600 $\Omega$ nominal.
Display Type	Moving coil meter with 60mm mirror scale.
Overload	Fully protected against over-ranging.

### Rear Panel

IF Output	Rear panel BNC. Level 100mV, 50 $\Omega$ nominal. Frequency is approximately 420kHz.
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### Power Requirements

AC Line	Internal selection of line voltage
115V	102V to 130V
230V	205V to 265V
Power	6VA Approx.
Frequency	48 to 60Hz.
Fuse	100mA fast blow on rear panel.

### Environmental

#### Temperature

Operating	0°C to 55°C. Full specification over the range 5°C to 45°C.
Storage	-20°C to 55°C.
Humidity	Max 95% RH at 30°C.

#### Mechanical

Size	H105, W215, D305 mm
Weight	Approx. 1.7kg. Approx. 2.6kg with battery option.

### Internal Battery (Option -03)

Discharge Time	>8 hours. Typically, 10 hours for a fully charged battery.
Recharge Time	14 hours.
Battery Test	Pressing the Bat Chk push button displays the battery condition on the display. A reading of between 8 and 10 is required for normal operation.
Fuse	1A slow blow on rear panel.