



RMS/Peak Voltmeter URE 3

At the peak of speed and precision

- DC, 0.02 Hz to 30 MHz
- 50 μ V to 300 V AC
- 0 to 300 V DC

The RMS/Peak Voltmeter URE 3 from Rohde & Schwarz is an extremely fast

rms- and peak-responding voltmeter suitable for a countless number of applications. A patented rectifier circuit with microprocessor-controlled autocalibration makes for unparalleled measurement characteristics.

System compatibility together with ergonomic operation result in a mature concept, whose benefits are manifested in very day's use in labs and in automated measurements alike.



ROHDE & SCHWARZ



- True rms-value measurement for AC and AC+DC
- Peak-value measurement (positive, negative, peak-to-peak)
- Frequency measurement up to 30 MHz
- DC voltage measurement
- Unmatched measuring accuracy through automatic frequency response error correction
- More than 30 measurements/s
- Highpass and lowpass filters
- Digital and analog displays
- Relative measurements, maxima/minima
- Convenient menu operation
- In/Out option with dual-channel analog output, ready output, trigger input, TTL frequency counter input
- IEC/IEEE bus for all functions

Accuracy: unrivalled

The measured frequency value is used for an internal frequency response error correction, the required correction factors being determined at the works for each instrument and each measurement range and stored in a nonvolatile memory. This method, which increases the accuracy mainly at the higher frequencies, and the high-performance patented rectifier circuit make for a measuring accuracy that is setting new standards.

Measurement functions: the multitalent

The RMS/Peak Voltmeter URE3 measures the true rms value of AC and mixed (AC+DC) voltages up to 30 MHz as well as DC voltages. A zero function allows noise voltages and the inherent noise to be compensated for calculating the rms value, the measuring accuracy being thus increased in particular at low levels.

The built-in peak-value rectifiers permit measuring the positive, negative and peak-to-peak value of any signal.

In addition to the voltage, the frequency of the applied signal can be measured and displayed alone or together with the voltage value.

Since the URE3 has an input impedance of 1 MΩ, commercial probes can be used and their division ratio be taken into account in the displayed result.

Operation: as easy as pie

The URE3 is convincing by its clear ergonomic configuration which enables the user to work with the instrument within a few minutes.

Remote control is effected via the built-in IEC (IEEE 488) bus using plain-text commands. Remote control fully complies with the IEC 625-2 standard and applies to all equipment functions.

Applications: all under control

In **audio and telephone measurements**, frequency response and linearity measurements on components, modules and instruments are everyday routine tasks. High measurement speed, true rms weighting for noise voltage measurements and high absolute accuracy are good reasons for choosing the URE3.

For **video measurements**, and to an increasing extent in high-definition television (HDTV), broadband voltmeters with peak weighting like the URE3 are indispensable, since video signals (eg the sync level) are defined as peak values.

For all analog recording techniques, the quality of audio and video tapes must be guaranteed and therefore continuously controlled.

For digital **magnetic storage** as well as optical data storage, data transfer rates are used which require high-frequency measurements on sampling probes and amplifiers. The characteristics of the storage media must be determined in the MHz range and a suitable broadband measuring instrument is required for this purpose. With hard-disk memories being mass-produced to an increasing extent, their production is aimed to be more cost-effective by reducing the test-

ing time and increasing the measurement speed, both of which can be achieved with the features of the URE3.

Due to its excellent immunity to interference, the URE3 is ideally suited for **use in industrial environments**. Further applications can be found in **training, R&D** and in the field of **service**. Ease of operation, versatility and accuracy are the main points in favour of the URE3.



Three typical uses of URE3: magnetic storage, video measurements (also HDTV) and computer-controlled measurements and testing



Specification

Overview

Measurement functions	rms value, peak value, DC voltage, frequency
Frequency range	RMS: 0.02 Hz to 30 MHz PEAK: 10 Hz to 10 MHz
Voltage measurement range	DC: 0 to ± 300 V AC, AC+DC: 50 μ V to 300 V
Range selection	AUTO, HOLD, FIX
Input	BNC connector, either floating or grounded, switch-selectable
Input impedance	1 M Ω shunted by 40 pF
Maximum input voltage	300 V _{rms} (max. 1×10^8 V/Hz), 500 V _p
Display	illuminated LCD, 4 $\frac{1}{2}$ digit level display, 5 digit frequency display, digital and analog readout in V, W, dBV, dBm, dB μ V, dBu or Hz, deviation in % or dB and ratio to a reference value
In/Out option	two simultaneous analog outputs (level and frequency) output impedance 1 k Ω voltage range 0 to 3 V (EMF) resolution 1 mV error ≤ 3 mV
IEC/IEEE bus	frequency input (TTL, 0.1 Hz to 30 MHz) trigger input (TTL, active low) ready output (TTL, active high) fitted as standard to IEC 625-2, functions: SH1, AH1, L4, T6, SR1, PP1, RL1, DC1, DT1

DC voltage measurement

Voltage measurement range	0 to ± 300 V
Ranges and resolution	10 mV to 1000 V, 20-dB steps, maximum reading 12000 digits, maximum resolution 1 μ V
Measurement speed	time of triggered meas. readout rate
Speed 4	1.3 s 10/s
Speed 5	250 ms 10/s
Speed 6	32 ms 20/s
Speed 0 to 3	as for RMS measurement
Error limits	$\pm (0.1\% \text{ of reading} + 10 \text{ digits})$
Temperature effect	$< (0.01\% \text{ of reading} + 1 \text{ digit})/^{\circ}\text{C}$

RMS measurement

Voltage measurement range	50 μ V to 300 V
Ranges and resolution	1 mV to 300 V, 10-dB steps, maximum reading 3800 or 12000 digits, maximum resolution 1 μ V
Frequency range	0.02 Hz to 30 MHz
AC coupling	DC to 30 MHz
AC+DC	20 kHz, 100 kHz Butterworth, 1 MHz Bessel (3-dB cutoff frequency, 40 dB/decade)
Selectable lowpass filters	10 Hz, 100 Hz, 1 kHz (lower meas. limit, AC component in AC+DC)
Selectable highpass filters	
Measurement speed and lower frequency limit ¹⁾	time of triggered meas. readout rate min. meas. frequency
(AC component in AC+DC)	
Speed 0	selectable time 10 ms to 60 s
Speed 1	selectable time 10 ms to 60 s
Speed 2	fixed time 10 s
Speed 3	fixed time 1 s, with speed 1, 2 and 3 automatic synchronization to whole number of signal periods; due to synchronization, measurement takes 2 or 3 times the time selected
Speed 4	1.3 s 10/s 10 Hz
Speed 5	250 ms 10/s 100 Hz
Speed 6	32 ms 20/s 1 kHz
Error limits	see table for RMS measurement, plus 10 digits for DC coupling (inherent noise taken into account by zero function)
Maximum crest factor	7 at nominal range

Weighting error

crest factor < 3 : included in basic error
crest factor < 5 : 1%
crest factor < 7 : 3%
for spectral components up to 30 MHz

Temperature effect

% of rdg/ $^{\circ}\text{C}$	frequency (MHz)
≤ 0.1	< 10 (< 10)
≤ 0.15	< 20 (< 12)
≤ 0.3	< 25 (< 15)
≤ 0.6	< 30 (< 20)

values in parentheses refer to $V_{in} < 3$ mV

Peak measurement

Voltage measurement range	0.1 mV to 500 V
Ranges and resolution	3 mV to 1000 V, 10-dB steps, maximum reading 1200 or 3800 digits, maximum resolution 1 μ V
Frequency range	10 Hz to 10 MHz
AC coupling	DC to 10 MHz
AC+DC	20 kHz, 100 kHz Butterworth, 1 MHz Bessel (3-dB cutoff frequency, 40 dB/decade)
Selectable lowpass filters	
Selectable highpass filters for AC coupling	10 Hz, 100 Hz, 1 kHz (lower measurement limit)
Measurement speed and lower frequency limit ¹⁾²⁾	time of triggered meas. rate min. meas. frequency
for AC coupling	
Speed 1 to 3	depending on meas. time 10 Hz
Speed 4	1.3 s 5/s 10 Hz
Speed 5	315 ms 10/s 100 Hz
Speed 6	65 ms 20/s 1 kHz

Measurement speed and lower frequency limit for DC coupling

Speed 1 to 3	time of triggered meas. depend. on meas. time
Speed 4	215 ms 5/s 0.02 Hz
Speed 5	95 ms 10/s 10 Hz
Speed 6	65 ms 20/s 100 Hz
(speed 1 to 3 similar to RMS measurement, however without synchronization)	1 kHz
Error limits	see table for peak measurement (inherent noise taken into account by zero function)
Temperature effect	0.1% of rdg/ $^{\circ}\text{C}$

Frequency measurement

Frequency range	0.02 Hz to 30 MHz, 0.1 Hz to 30 MHz (rear input)
Display	5 digits, max. resolution 0.1 mHz
Measurement speed and lower frequency limit ³⁾	time of triggered meas. with feeding on front rear readout rate min. meas. frequency
Speed 1 to 3	depend on meas. time 0.02 Hz
Speed 4	2.4 s 1.4s 2/s 10 Hz
Speed 5	430 ms 330 ms 5/s 100 Hz
Speed 6	80 ms 75 ms 30/s 1 kHz
Error limits	$\pm (0.005\% + 1 \text{ digit})$, add 100 μ s/ (0.75 x measurement time) with RMS measurement and HP filter switched off
Sensitivity	better than 10 dB below nominal range

- 1) When the measurement speed is increased, the required highpass filter is automatically switched into circuit. At lower measurement speeds, the higher-frequency highpass filters can be selected as desired.
- 2) The measurement speed increases when higher-frequency highpass filters are switched into circuit
- 3) The specified settling times are maximum values. They may be reduced by selection of a suitable detector and highpass filter.

Display: at a glance

The measured value is read out in up to five digits with unit and additional information on a large liquid crystal display. Readout in volts, watts, dBV, dB μ V, dBu or dBm can be selected; readout in watts and in dBm can be referred to any impedance value.

Relative display is possible in dB or %, as a ratio of measured value to reference value, or as a difference. Reference values can be entered or measured values be used as reference values. Minimum and maximum values as well as tolerance limits can be determined automatically.

For quick informative measurements and precise adjustments, a high-resolution bargraph indicator is additionally provided on the display. Due to the se-

lectable scale (automatically following the digital display or manually adjusted), this bargraph display is extremely versatile and outperforms any pointer instrument.

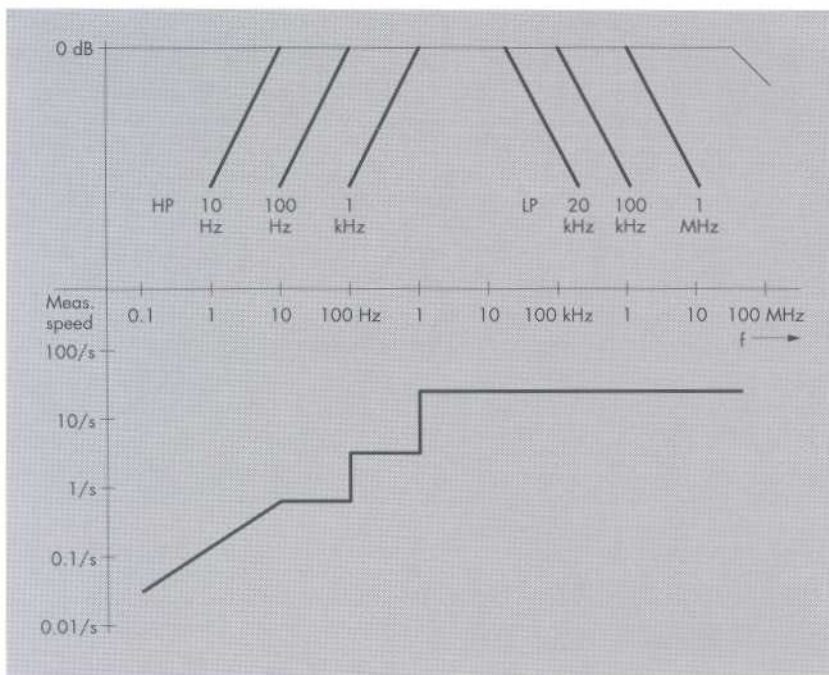
Measurement speed: unparalleled

The measurement speed for AC voltage measurements is an important criterion for a voltmeter's usability in automatic systems. With more than 30 measurements/s in the fast mode, the URE3 fully satisfies even the most exacting requirements. Unlike many other instruments, the measurement rate of the URE3 refers to settled values and not to rapidly changing readouts which provide no real information in system operation.

The lower cutoff frequency and, hence, the attainable measurement speed, is determined by the selection of the highpass filters. Irrespective of this, maximum display stability can be achieved by selecting a lower than the maximum speed.

Due to automatic synchronization, lowest-frequency AC voltages from 0.02 Hz can be measured within two signal cycles. If the signal frequency is known, a further mode without synchronization even allows measurement within one cycle, the physically shortest possible period length.

For upper band limiting, eg for suppressing high-frequency noise, low-pass filters with 20-kHz, 100-kHz and 1-MHz cutoff frequencies are fitted in the URE3. Due to their slight overshoot, the 1-MHz Bessel lowpass filter and the special highpass filters ensure high accuracy of peak-value measurement.



Selectable filters of URE3 and relationship between measurement speed and lower cutoff frequency

General data

Temperature range	to DIN IEC 68-2-1/68-2-2
Operating	0 to +50 °C
Storage	-40 to +70 °C
Permissible humidity	max. 80%, without condensation
Sinusoidal vibration	5 to 55 Hz, max. 2 g, 55 to 150 Hz, 0.5 g continuous; DIN IEC 68-2-6, IEC 1010-1 and MIL-T-28800 D, Class 5 complied with
Random vibration	10 to 500 Hz, 1.9 g rms, to DIN IEC 68-2-36
Shock	40 g shock spectrum, to MIL-STD 810 D, DIN IEC 68-2-27 complied with
EMC	complying with EN 50081-1 and 50082-1, EMC directive of EU (89/336/EEC) and EMC law of the Federal Republic of Germany, VDE 0843, part 1 to 4, IEC 801, part 1 to 5, degree of severity 4 and NAMUR recommendations, part 1
Safety	EN 61010-1 complied with
Power supply	100/120/220/240 V $\pm$ 10%, 47 to 440 Hz (25 VA)
Dimensions (W x H x D)	219 mm x 103 mm x 350 mm
Weight	4.5 kg

Ordering information

Order designation

RMS/Peak Voltmeter	URE3	0350.5315.03
In/Out Option	URE3-B2	0351.1513.02

Recommended extras

Carrying Strap Set	ZZT-96	0396.9813.00
Accessory Bag	ZZT-91	0827.6365.00
Carrying Case	UZ-24	1029.3379.02
19" Rack Adapter	ZZA-97	0827.4527.00

Measurement range	2.5%	1%	0.5%	0.7%	1.5%	3%	2.5%	1%	1.7%	4%	8%
300 V											
100 V											
30 V											
10 V											
10 mV											
3 mV											
1 mV											

HP off:

HP 10 Hz: 10 Hz 20 Hz 50 Hz

HP 100 Hz: 100 Hz 200 Hz

HP 1 kHz: 1 kHz 2 kHz

Error limits (% of rdg) of RMS measurement (23 $\pm$ 5 °C, sinewave signal, automatic range selection); values in parentheses: without frequency response error correction

Measurement range	4%	3%	2%	4%	10%	11%
500 V						
300 V						
100 V						
30 mV						
10 mV						
3 mV						

DC coupling:

HP 10 Hz: 10 Hz 20 Hz 50 Hz

HP 100 Hz: 100 Hz 200 Hz

HP 1 kHz: 1 kHz 2 kHz

Error limits (% of rdg) of peak measurement (23 $\pm$ 5 °C, sinewave signal, automatic range selection)



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