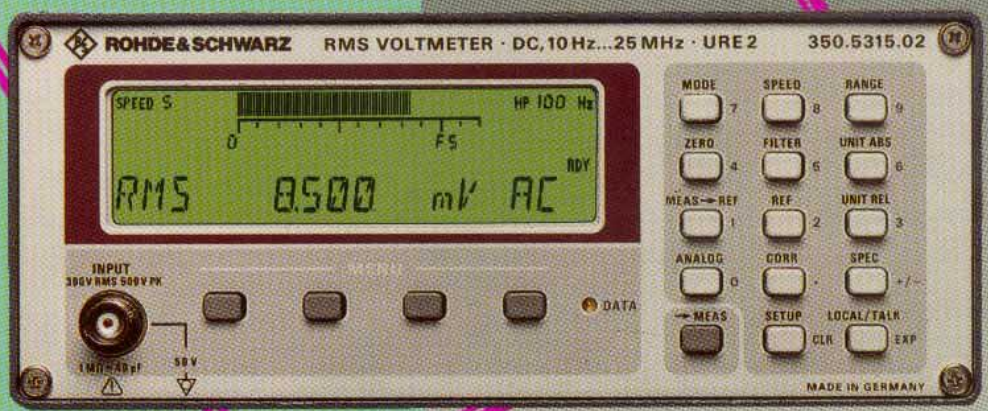
ROHDE&SCHWARZ

RMS Voltmeter URE 2

For any waveform

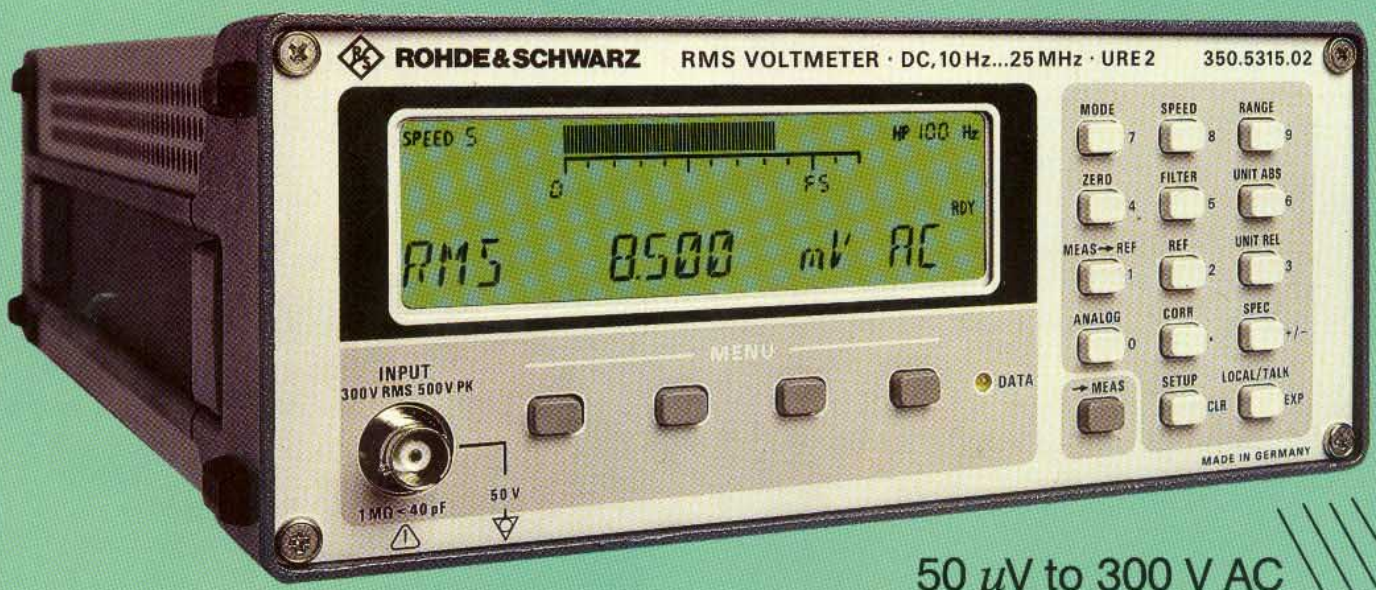


IEC625Bus

IEEE 488

PD 756.8526.21

RMS VOLTMETER URE 2



50 μV to 300 V AC

DC, 10 Hz to 25 MHz

0 to 300 V DC

Photo: STEREO

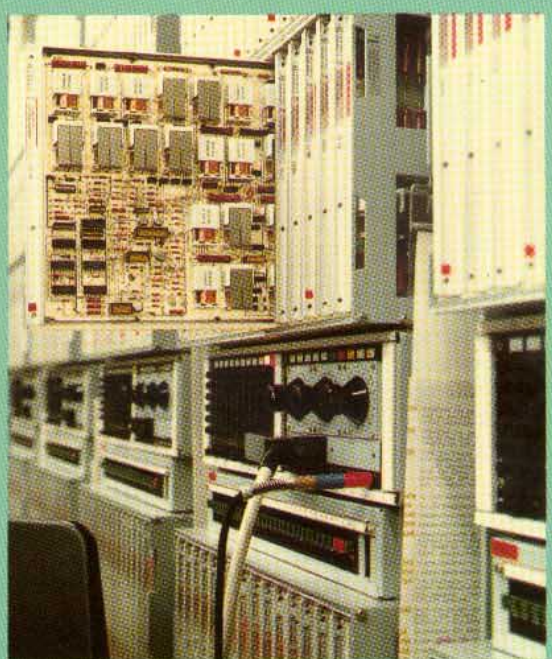


Photo: DBP/Kleß, Bad Honnef

High measuring accuracy and true rms weighting for noise voltage measurements are the requirements a voltmeter has to meet for **audio measurements.** This is where the URE 2 comes in. Frequency response and linearity measurements on components, modules and whole devices are its main audio applications.

The possibility of measuring the DC and AC components of (AC+ DC) voltages separately as well as the high measurement speed mean that in **telephone measurements** the URE 2 can simultaneously measure the voltage of dialling signals and the power supply carried on a single telephone line.

For any waveform

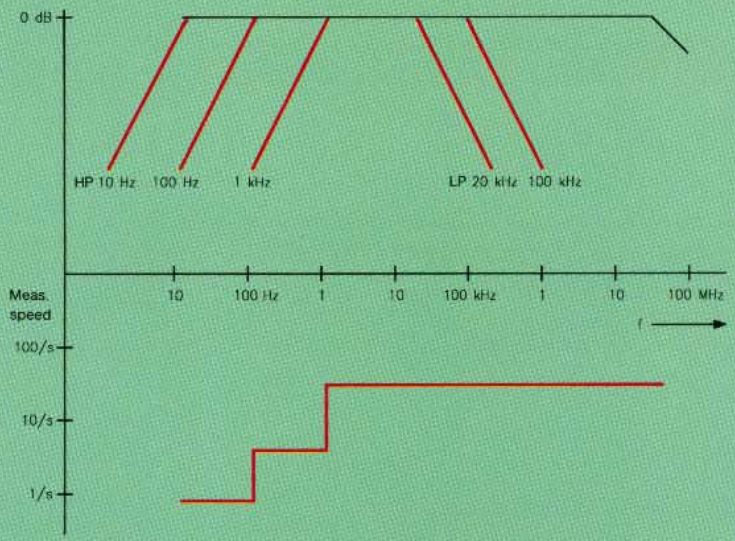
The URE 2 measures DC voltages as well as the rms value of AC and (AC+DC) voltages in the frequency range between 10 Hz and 25 MHz.

Since the URE 2 has a common input impedance of 1 MΩ, commercial probes can be used and their division ratio be taken into account in the displayed result.

Three measurement speeds

Automatic test systems call for a high measurement speed of the instruments used. With more than 30 measurements/s from 1 kHz, the URE 2 leaves nothing to be desired, in particular since the results are settled values and not the rapidly changing readouts which some other instruments use to give an impression of speed.

The slower modes are for measurements down to 10 Hz.



Digital and analog displays

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

Highpass and lowpass filters can be switched in to suppress AC hum or high-frequency noise (see graphs).

Maxima and minima as well as tolerance limits can be determined automatically. Relative display is possible as a difference, as a ratio of measured value to reference value or as deviation in dB or % to provide an overview. Reference values can be entered or measured values used as references.

The additional, high-resolution bargraph display is ideal for quick overview measurements and precise adjustments. Its scale and unit either follow the digital display or can be set manually, and its resolution is better than that of any pointer meter.

Convenient operation

Operation of the URE 2 is very simple and functional. The measuring and system parameters can be selected via a few, programmed keys and the associated softkey menus.

All instrument functions can be remote-controlled via the built-in IEC/IEEE bus using plain-text commands, which may be abbreviated as long as they are unambiguous. The remote-control commands fully comply with the IEC 625-2 standard.

High accuracy

A patented rectifier circuit with microprocessor-controlled autocalibration is the basis of the excellent URE 2 characteristics.

To enhance the measuring accuracy even further, **correction factors** are determined for each instrument and each measurement range, which the URE 2 automatically takes into account in the result.

The **zero function** is particularly efficient at low levels as it „cancels out" noise voltages and inherent noise using a special algorithm.

Specifications

Measurement functions	DC, AC, AC+DC voltages
Frequency range	DC, 10 Hz to 25 MHz
Voltage range	DC: ±0 to 300 V AC, AC+DC: 50 µV to 300 V
Range selection	AUTO, HOLD, FIX
Input	BNC connector, floating
Input impedance	1 MΩ shunted by 40 pF
Maximum input voltage	300 V_{rms}, 500 V_p max. 1×10^8 V·Hz
Display	LCD, 4½ digit result display, digital and analog readout in V, W, dBV, dBm, dBµV or dBu; difference, deviation in % or dB and ratio to a reference value
IEC/IEEE bus	fitted as standard, all functions

AC voltage measurement

Voltage range	50 µV to 300 V		
Ranges and resolution	1 mV to 300 V, 10-dB steps, maximum reading 3800 or 12000 ±1 digit, maximum resolution 1 µV		
Selectable lowpass filters	20 kHz, 100 kHz Butterworth, (3-dB cutoff frequency, 40 dB/decade)		
Selectable highpass filters	10 Hz, 100 Hz, 1 kHz (lower meas. limit, AC component in AC+DC)		
Measurement speed at lower frequency limit[1] (AC component in AC+DC)	time of triggered measurement	readout rate	min. meas. frequency
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 „cancelled out" by zero function)		
Maximum crest factor	7		
Weighting error	crest factor <3: included in basic error crest factor <5: 1% crest factor <7: 3% for spectral components up to 25 MHz		

Temperature effect	% of rdg/°C	frequency (MHz)
	≤0.1	<10 (<10)
	≤0.15	<20 (<12)
	≤0.3	<25 (<15)
	≤0.8	– (<20)
	values in parentheses refer to V_{in}	
	<3 mV	

DC voltage measurement

Voltage range	±0 to 300 V	
Ranges and resolution	10 mV to 1000 V, 20-dB steps, maximum reading 12000 ±1 digit, maximum resolution 1 µV	
Measurement speed	time of triggered measurement	readout rate
Speed 4	1.3 s	10/s
Speed 5	250 ms	10/s
Speed 6	32 ms	20/s
Error limits	±(0.1% of rdg + 10 digits)	
Temperature effect	<(0.01% of rdg + 1 digit)/°C	

General data

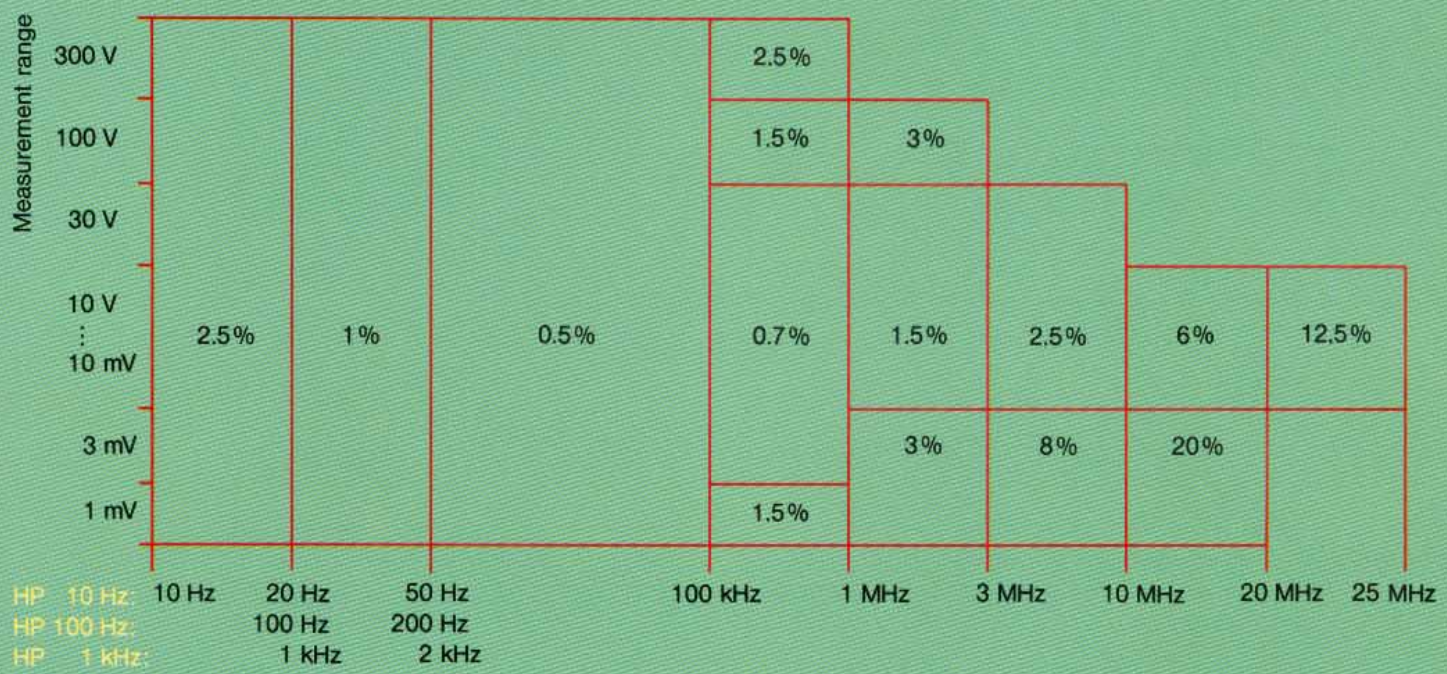
Operating temperature range	0 to +50 °C, for use in class 1 to IEC 359
Storage temperature range	−40 to +70 °C
Permissible humidity	20 to 80% (no condensation)
Mechanical strength	to IEC 359 class 1
RFI suppression	to DBP regulations 1046/1984
Power supply	100/120/220/240 V ±10%, 47 to 440 Hz (25 VA), safety class 1 to VDE 0411 and IEC 348
Dimensions (W x H x D)	219 mm x 103 mm x 350 mm
Weight	4.5 kg

Ordering information

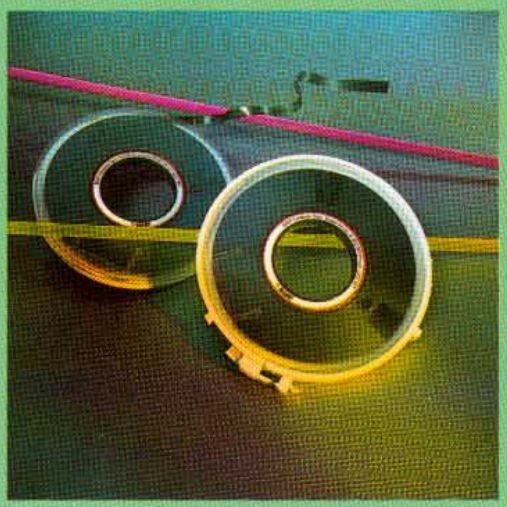
Order designation ▶ RMS Voltmeter URE 2 350.5315.02

[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. There are no speeds 0 to 3.

Error limits of RMS measurement (23 ±5 °C)



- True rms weighting for AC and AC+DC
- More than 30 measurements/s
- Digital display and analog readout with selectable scale
- Highpass and lowpass filters
- Relative measurement, maxima/minima
- IEC/IEEE bus for all functions
- Convenient menu operation
- High measurement accuracy



Automatic **quality control of audio and video tapes** calls for fast, system-compatible measuring instruments to ensure a high throughput. The broadband characteristics of the measuring instrument are a main point of interest in digital **magnetic storage** and optical data storage, where the high data rates require high-frequency measurements on sampling probes and storage media.

The URE 2 is ideal for use in both applications.

The RMS Voltmeter URE 2 combines a logical system design with ergonomical operation and demonstrates its high performance for everyday use in labs or service shops as well as in automated measurements.

ROHDE&SCHWARZ

D-8000 München 80
Mühldorfstraße 15, P.O.B. 80 14 69
Telephone (089) 4129-0 · Int. (4989) 4120-0
Telex 523703 (rs d) · Teletex 897487=RSD
Telefax (089) 4129-2050

Printed in the Federal Republic of Germany
Subject to change
Data without tolerances:
order of magnitude only

989 (B ba)

RMS/Peak Voltmeter URE 3

At the peak of speed and precision

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

The RMS/Peak Voltmeter URE 3 from Rohde & Schwarz is an extremly 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 ergonomical 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-perfomance 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 ergonomical 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 testing 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 µV to 300 V
Range selection	AUTO, HOLD, FIX
Input	BNC connector, either floating or grounded, switch-selectable
Input impedance	1 MΩ shunted by 40 pF
Maximum input voltage	300 V_{rms} (max. 1 x 10^8 V·Hz), 500 V_p
Display	illuminated LCD, $4^1/_2$ digit level display, 5 digit frequency display, digital and analog readout in V, W, dBV, dBm, dBµV, 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 kΩ voltage range 0 to 3 V (EMF) resolution 1 mV error ≤3 mV frequency input (TTL, 0.1 Hz to 30 MHz) trigger input (TTL, active low) ready output (TTL, active high)
IEC/IEEE bus	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 µV

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	±(0.1% of reading + 10 digits)
Temperature effect	<(0.01% of reading + 1 digit)/°C

RMS measurement

Voltage measurement range	50 µV to 300 V
Ranges and resolution	1 mV to 300 V, 10-dB steps, maximum reading 3800 or 12000 digits, maximum resolution 1 µV
Frequency range	
AC coupling	0.02 Hz to 30 MHz
AC+DC	DC to 30 MHz
Selectable lowpass filters	20 kHz, 100 kHz Butterworth, 1 MHz Bessel (3-dB cutoff frequency, 40 dB/decade)
Selectable highpass filters	10 Hz, 100 Hz, 1 kHz (lower meas. limit, AC component in AC+DC)

Measurement speed and lower frequency limit [1] (AC component in AC+DC)	time of triggered measurement	readout rate	min. meas. frequency
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/°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 µV
Frequency range	
AC coupling	10 Hz to 10 MHz
AC+DC	DC to 10 MHz
Selectable lowpass filters	20 kHz, 100 kHz Butterworth, 1 MHz Bessel (3-dB cutoff frequency, 40 dB/decade)
Selectable highpass filters for AC coupling	10 Hz, 100 Hz, 1 kHz (lower measurement limit)

Measurement speed and lower frequency limit [1][2] for AC coupling	time of triggered measurement	readout rate	min. meas. frequency
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	time of triggered measurement	readout rate	min. meas. frequency
Speed 1 to 3	depend. on meas. time		0.02 Hz
Speed 4	215 ms	5/s	10 Hz
Speed 5	95 ms	10/s	100 Hz
Speed 6	65 ms	20/s	1 kHz

(speed 1 to 3 similar to RMS measurement, however without synchronization)

Error limits	see table for peak measurement (inherent noise taken into account by zero function)
Temperature effect	0.1% of rdg/°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 measurement 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	±(0.005% + 1 digit), add 100 µs/(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.

1293/1094 (Bi we) Printed in Germany
PD 756.8326.22 · Printed on chlorine-free paper · Subject to change · Data without tolerances: order of magnitude only

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

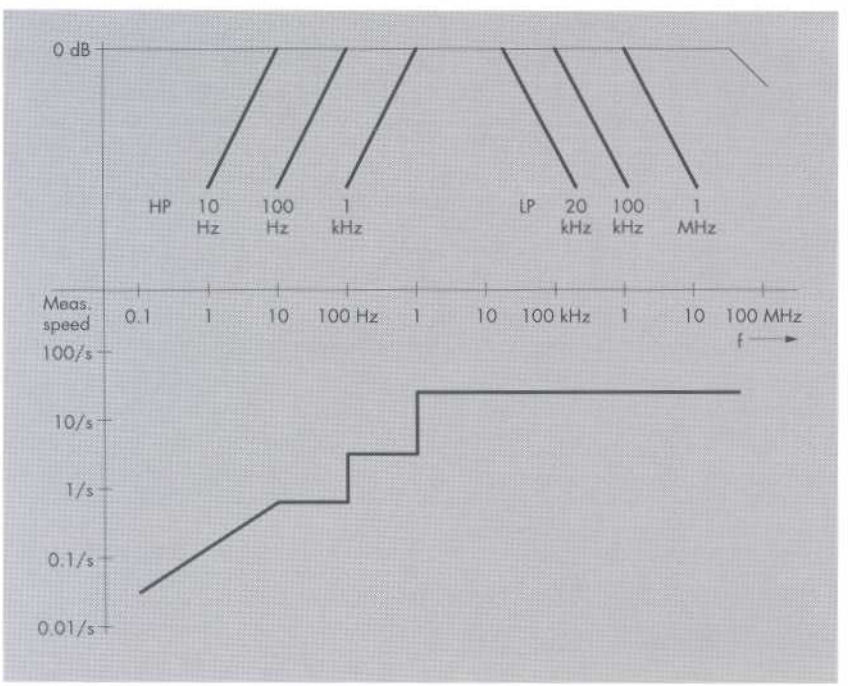
Measurement speed: unparalleled

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.

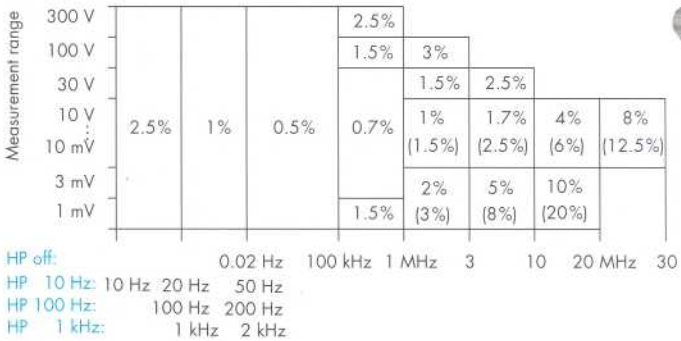
For upper band limiting, eg for suppressing high-frequency noise, lowpass filters with 20-kHz, 100-kHz and 1-MHz cutoff frequencies are fitted in the URE3. Due to their slight overshoot, the 1-MHz Bessel lowpass filter and the special highpass filters ensure high accuracy of peak-value measurement.



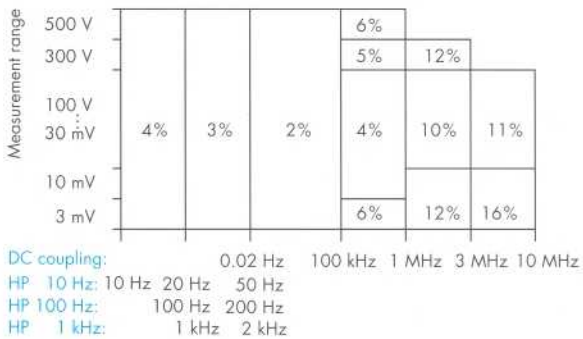
Selectable filters of URE3 and relationship between measurement speed and lower cutoff frequency

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 ±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



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



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

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

Certified Quality System
ISO 9001
DQS REG. NO 1954-02

1293/1094 (Bi we) Printed in Germany

ROHDE & SCHWARZ

ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · D-81671 München
P.O.B. 801469 · D-81614 München · Telephone +4989 4129-0 · Fax +4989 4129-3567