



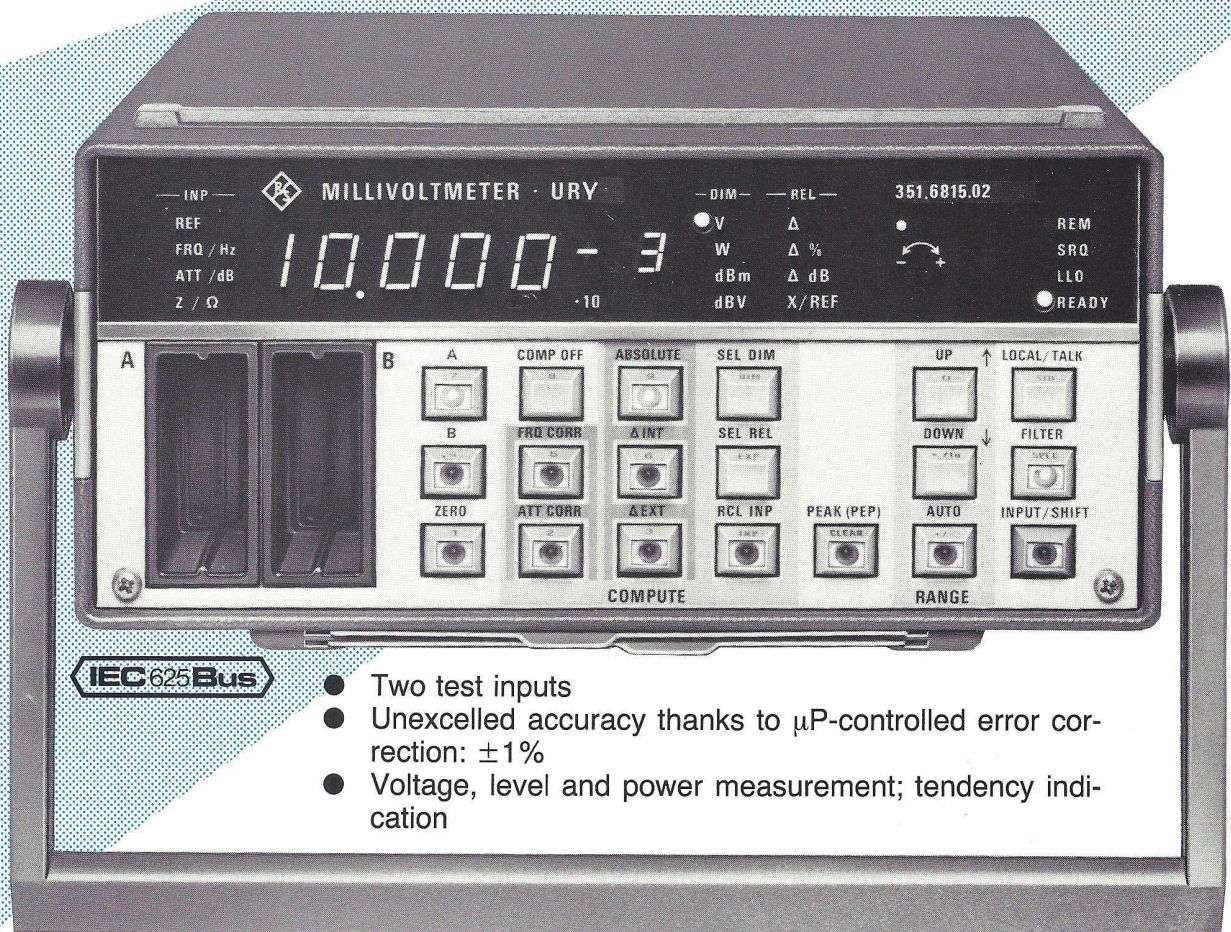
ROHDE & SCHWARZ

URY

Millivoltmeter URY

9 kHz to 2 GHz

200 μ V to 1000 V
-60 to 73 dBm
(50 Ω)



- Two test inputs
- Unexcelled accuracy thanks to μ P-controlled error correction: $\pm 1\%$
- Voltage, level and power measurement; tendency indication

- Probes, insertion units and power sensors may be exchanged as required
- Readout in all conventional units with freely selectable reference impedance; relative measurements
- Frequency-dependent calibration factors are taken into account
- DC output as option

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Scale 1:2.5

IEC 625 Bus

The **Millivoltmeter URY** is a broadband, sensitive voltage, level and power meter of unprecedented accuracy and versatility. Depending on the measuring head the frequency range extends from 9 kHz to 2 GHz.

Measuring heads The measuring heads are individually calibrated and therefore interchangeable without affecting the error limits.

RF probe without plug-on divider
200 μ V to 10 V, 20 kHz to 1 GHz

+ **20 dB plug-on divider**
2 mV to 100 V, 1 to 500 MHz

+ **40 dB plug-on divider**
20 mV to 1000 V, 500 kHz to 500 MHz

+ **BNC adapter** (with or without plug-on divider)
RF voltage measurement in coaxial systems

+ **50- Ω adapter**
200 μ V to 10 V, 20 kHz to 1 GHz
RF voltage measurement in coaxial 50- Ω systems

+ **75- Ω adapter**
200 μ V to 10 V, 20 kHz to 500 MHz
RF voltage measurement in coaxial 75- Ω systems (adaptable connectors)

10-V insertion unit
200 μ V to 10 V, 9 kHz to 2 GHz
RF voltage measurement with **low reflection coefficient** in 50- Ω coaxial systems

100-V insertion unit 50 Ω
2 mV to 100 V, 100 kHz to 2 GHz
RF voltage measurement in 50 Ω coaxial systems with **extreme requirements for reflection** or with higher voltages; power measurement up to 200 W with suitable termination.

Measurement functions The URY recognizes automatically which measuring head is connected in the selected channel.

Readout One or two measuring heads can be connected to the URY. The values measured in the two channels can be displayed separately, set off against one another or referred to any reference.

Four units of indication can be selected:

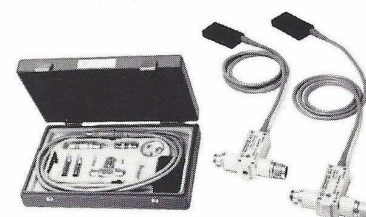
volt V
watt W ($Z = 10^{-4}$ to $10^4 \Omega$)
dBm ($Z = 10^{-4}$ to $10^4 \Omega$)
dBV

Four types of conversion are possible, each either referring to an internal reference or to the second measuring channel (A/REF, B/REF, A/B, B/A) with the result displayed as Δ , $\Delta\%$, Δ dB, $X \div \text{REF}$.

Because of the wide range of indication the units can be displayed or output in steps of $\times 10^3$.

Tendency indication The millivoltmeter has a tendency indication which quickly follows the variations of measured values, thus facilitating adjustments and maxima-minima settings.

Measuring heads and case with accessories and recommended extras

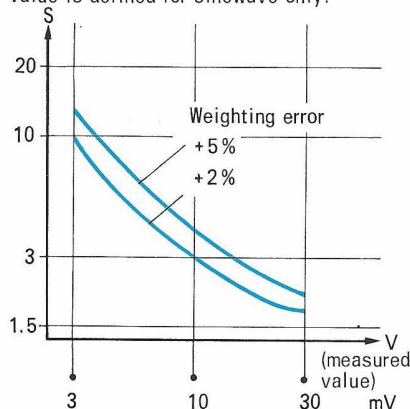


Waveform weighting

Rms measurement At voltages up to about 30 mV the URY measures and reads out the rms value. The diagram below shows the maximum permissible crest factor as a function of test voltage for weighting errors of +2% and +5%.

Maximum permissible crest factor S

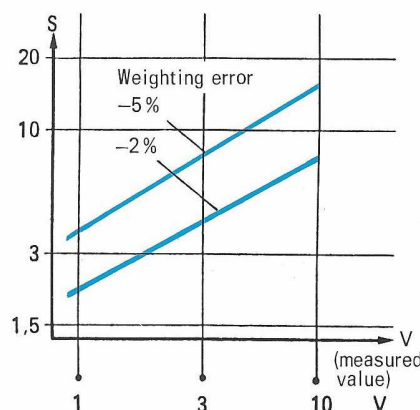
for rms-value measurement (left) and peak-value measurement (right); in the transition region rms/peak measurement the measured value is defined for sinewave only.



◀ Rms-value measurement

Peak-value measurement ▶

Measurement with probe
or 10-V insertion unit



30 100 300 mV

Measurement with probe and 20-dB divider
or 100-V insertion unit

10 30 100 V

300 1000 3000 mV

Measurement with probe
and 40-dB divider

100 300 1000 V

PEP measurement The PEAK PEP key is used for reading the peak envelope power of a modulated signal. The gate time of the μ P-based peak-responding meter is switchable, so modulation frequencies down to 0.1 Hz can be handled.

Measurement rate The measurement rate is selectable in two steps using the FILTER key or in six steps using a special function or IEC-bus control. Thus the URY can be adapted to any measurement task, especially in the most sensitive range. The user can choose whether he puts up with a certain amount of noise at the highest test rate or obtains a steadied readout with a slight increase in the duration of measurement.

Frequency-response correction Each measuring head is individually calibrated. The test frequency need only be entered via the keyboard or the IEC bus and the URY takes account of the calibration factor in the result. The frequency-response correction can be switched on and off with the FRQ CORR key.

Attenuation correction The URY takes automatically account of the division factors of the measuring heads. If a plug-on divider or attenuator pad is connected ahead of the measuring head, the corresponding attenuation can be entered and is taken into account in the result by pressing the ATT CORR key. Range of entry -199.99 to +199.99 dB.

Range setting There are three ways of setting the measurement range.

1. Automatic range selection
– AUTO key depressed
2. Retention of selected range
– AUTO key released
3. Stepwise variation using UP↑ and DOWN↓ keys; when these keys are actuated the nominal value of the new range is shortly inserted in the display.

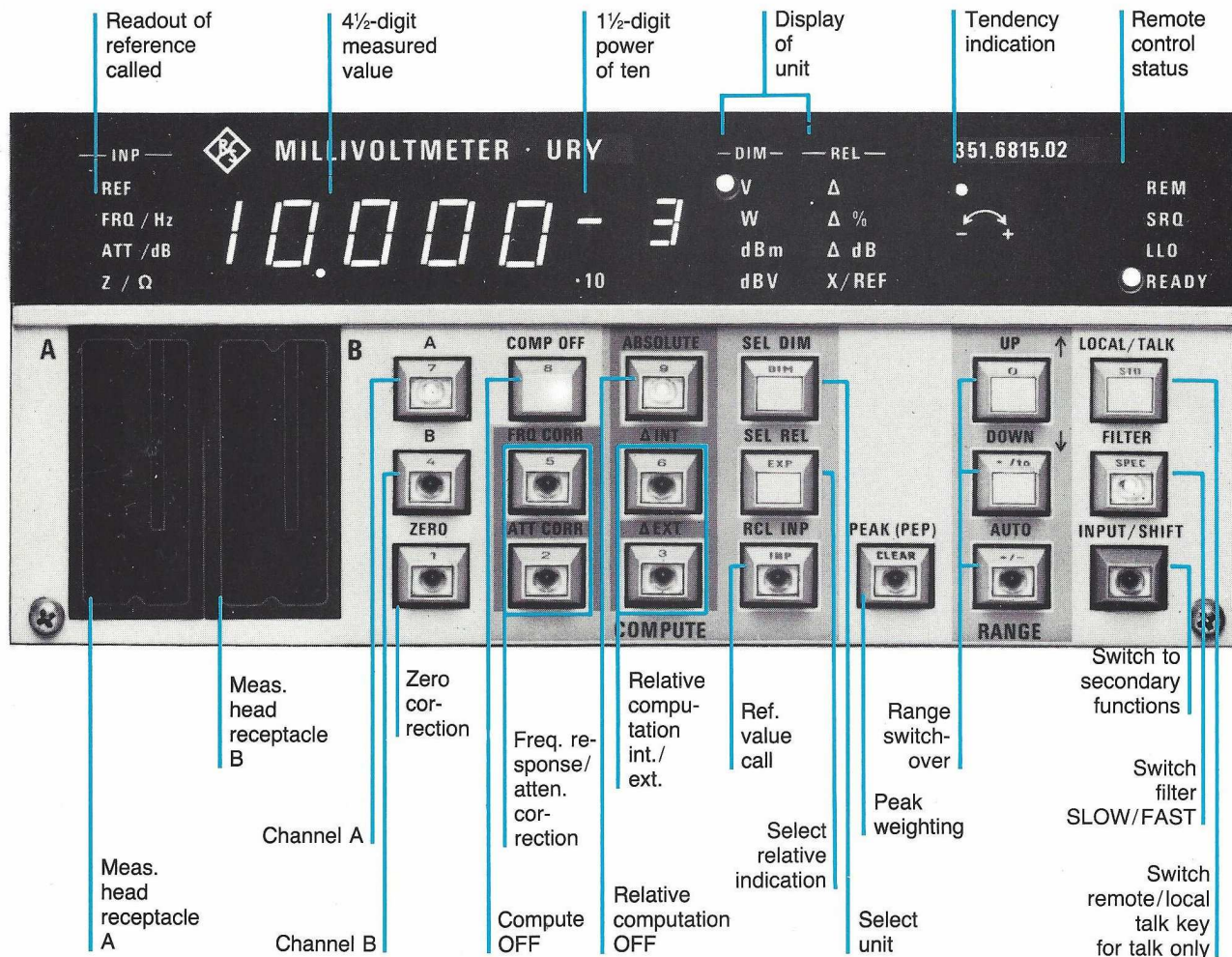
Secondary functions With the SHIFT key depressed, a decimal key array is available for data entry for the secondary functions and by pressing the SPEC key, for the **special functions**:

display test,
entry and check of IEC-bus address,
nonvolatile storage of reference values,
selection of filters F0 to F5,
calibration date/calibration programs,
error message,
software check,
reference-value transfer channel A to B and vice versa.

DC output option This output delivers a DC voltage proportional to the numerical readout. A linear or logarithmic scale is possible thanks to the versatile conversion capability of the URY.

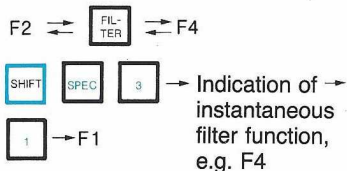
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URY – Operation



Selection of filter functions

SLOW (F2) ↔ FAST (F4)
F0 to F5



Call of a special function e.g. LED test

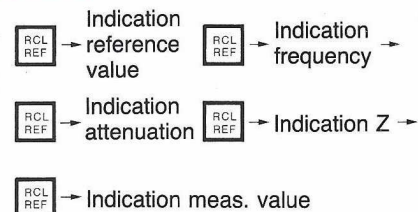


IEC-bus address indication of address set

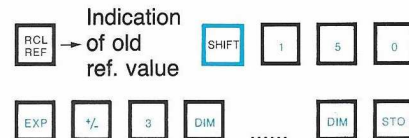


Reference correction values

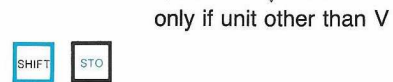
Indication: reference or correction values for selected channel



Storage of reference value, e.g. 150 mV for channel set



Transfer of instantaneous meas. value as reference



Nonvolatile storage of all reference, correction and impedance values (both channels)



Remote control (IEC-bus programming)

Input pointer

Command code	Function
IA	Input for channel A valid
IB	Input for channel B valid
Note: With commands marked by * it is possible to define the input channel – independent of the selected measurement channel – for all subsequent commands by sending IA or IB once in the command string (resetting by delimiter or PA, PB).	

Setting commands

Command code	IA, IB	Function
C0	–	Reading in of test data into basic unit (=DCL, SDC after addressing)
C1	–	Basic setting: PA (PB), E0, F2, KA0, KF0, RG0, U0—, H0, N0, Q0, W3, Y1 Note: Resetting of input pointers IA, IB
E0	*	Off
E1	*	On PEAK (PEP) measurement
F0	*	(AC)
F1	*	16 s
F2	*	4 s
F3	*	1 s SLOW
F4	*	250 ms
F5	*	80 ms FAST
	*	35 ms SUPERFAST 3½-digit display
KF0	*	FRQ CORR off
KF1	*	FRQ CORR on
KA0	*	ATT CORR off
KA1	*	ATT CORR on
		(It is also possible to send KF01 instead of e.g. KF1)
N0	–	Output with
N1	–	Output without
		alpha header
O1	*	Triggering
		ZERO meas.
PA	–	Probe A
PB	–	Probe B
		Setting of measurement channel
		Note: Resetting of input pointers IA, IB
RG, RG0	*	Autorange
RG1	*	10 mV
RG2	*	100 mV
RG3	*	1 V
RG4	*	10 V
		100 mV 1 V 10 V 100 V
		AC probe, 10-V insertion unit
		100-V insertion unit
		(It is also possible to send RG03 instead of e.g. RG3)
U0	*	V
U1	*	dBm
U2	*	dBV
U7	*	W
		Output unit (ABSOLUTE)
U3 [W] [X]	*	Δ lin
U4 [W] [X]	*	Δ %
U5 [W] [X]	*	Δ dB
U6 [W] [X]	*	X/Ref
		in V referred to internal reference value
		Output unit (relative)
		Note: The letters X and/or W can be added to the commands U3 to U6. X = Δ EXT (reference = second channel) W = relative readout in W, e.g. U3X or U6WX
Y0	–	off
Y1	–	on
YX	–	Triggering
		Cyclical temperature measurement
Y?	–	Read-out of set status, i.e. if cyclical temperature measurement is switched on or off (output via SRQ).

Data input commands

DU <DATUM>	*	Reference value in V	
DV <DATUM>	*	Reference value in V	
DB <DATUM>	*	Reference value in dBV	Data input
DM <DATUM>	*	Reference value in dBm	
DW <DATUM>	*	Reference value in W	
DR <DATUM>	*	Reference impedance in Ω	

Data input commands (cont'd)

Command code	IA, IB	Function
DZ <DATUM>	*	Reference impedance in Ω
DA <DATUM>	*	Correction attenuation in dB
DF <DATUM>	*	Correction frequency in Hz
D =	*	Data copying to channel IA, IB
D = AA	–	Data copying values B same as in channel A
D = BB	–	Data copying values A same as in channel B

Interface commands

W0	–	NL	
W1	–	CR	
W2	–	ETX	
W3	–	CR + NL	Delimiters for string output
W4	–	EOI	
W5	–	NL + EOI	
W6	–	CR + EOI	
W7	–	ETX + EOI	
W8	–	CR + NL + EOI	
Q0	–	off	
Q1	–	on	(all SRQ)
Q2	–	on	(except for SRQ (80) = meas. value ready, all SRQ (only error SRQ, >=96)
Q3	–	on	Call of SRQ
H0	–	off	Auxiliary mode
H1	–	on	(PET time-out correction)

Trigger commands

X0	–	Reset command for commands X3/X4
X1	–	Trigger command (= GET)
X2	*	Trigger command + storage of measured value as reference value
X3	–	Setting command for triggering measurement upon a service request
X4	–	Setting command for continuous triggering
X8	–	Trigger command for both measurement channels (measured values are separated by delimiters [corresponding to W0 to W8])
Z0	*	Output of reference value
Z1	*	Output of reference impedance
Z2	*	Output of correction frequency
Z3	*	Output of correction attenuation

Special commands

S0	–	LED test of display
S4	–	Indication of date under which the calibration values have been stored
S5	–	Output of error code according to hardware function errors occurred
S6	–	Checksum output of program memory
ST	*	Status output of all device settings for the selected channel

Keywords

CALIBRATION	Switchover between measurement and calibration mode: only commands for calibration are valid (CA..)
SERVICE	Keyword for enabling commands that are only used for testing in case of an error

Separators and delimiters

Symbol	Designation	ASCII decimal equivalent	Recommended use
,	Comma	44	Separator between commands
CR	Carriage Return	13	
NL	New Line	10	
ETX		3	Delimiters
EOI	If the EOI line is set during the transfer of the last character, this is also accepted as delimiter.		

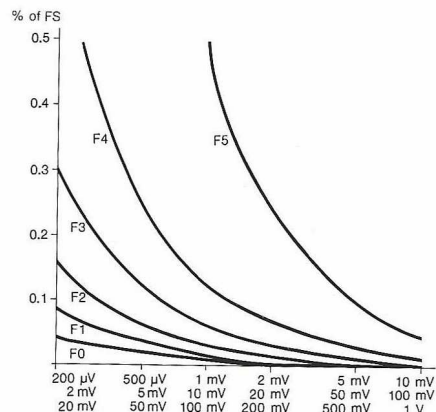
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URY – Specifications

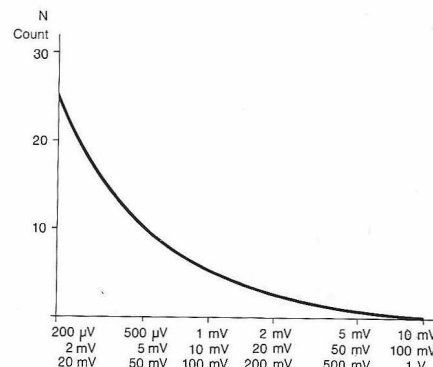
AC voltage measurement

— general data

Error limits $\pm(0.5\% \text{ of rdg} + 3 \text{ counts} + \text{frequency-response error} + N)$ referred to voltage;
 N = offset in most sensitive subrange, depending on test level; see curve below
 (1 hour after zero adjustment, rated temperature $\pm 1^\circ\text{C}$, after 4 hours of run-in)



◀ Noise in most sensitive subrange
 (observation time 1 min, 2 standard deviations, temperature of measuring head 18 to 28°C, about double values at 0°C)



Probe, 10-V insertion unit
 Probe + 20-dB divider, 100-V insertion unit
 Probe + 40-dB divider

Measurement rate (without range selection, level variation <20 dB)

	F0	F1	F2	F3	F4	F5
Manual operation (display)	0.8/s	1.5/s	3/s	5/s	10/s	20/s
Computer control, trigger to output of 1st byte	22 s	5.3 s	1.3 s	330 ms	80 ms	50 ms
Temperature effect	instr.					
Range 18 to 28°C	0					
10 to 40°C	0.5% of rdg					
0 to 50°C	1% of rdg					
				pr., l. u.		
				2% of rdg		
				5% of rdg		

— using Insertion Unit URY-Z2 or URY-Z4

Frequency-response error in % of rdg

	10-V Insertion unit URY-Z2	100-V i. u. URY-Z4
Voltage range	200 μV to 10 V	2 mV to 100 V
Level range 50 Ω	-60 to +33 dBm	-40 to +53 dBm
Power range 50 Ω	1 nW to 2 W	100 nW to 200 W
Frequency range	9 kHz to 2 GHz	100 kHz to 2 GHz
Characteristics impedance	50 Ω	50 Ω
Max. input voltage rms (sine)	15 V	150 V
peak	22 V	220 V
DC	50 V	1000 V

	9	20	50	100	200	500 KHz	1	20	100	200	500 MHz	1	1.6	2 GHz
10-V ins. unit	6 ¹⁾	2				0.5		1.5	2	3	5	7 ⁴⁾		2)
	6 ¹⁾	2				0.5		1.5	2	5	11	18		3)
100-V ins. unit 50 Ω				15 ¹⁾	6	2	1	1.5	2	4	6	8 ⁵⁾		2)
				15 ¹⁾	6	2	1	2	5	7	10	18		3)

Reflection coefficient and VSWR

	DC	100	200	500 MHz	1	1.6	2 GHz
10-V ins. unit	r/%			1			
	VSWR			1.02			
					2	7	10
					1.04	1.15	1.22
							1.35
100-V ins. unit 50 Ω	r/%			1			
	VSWR			1.02			
					2	3	
					1.04	1.06	

1) The lower cutoff frequency depends on the probe temperature; at temperatures above 28°C these values may be exceeded; normally the actual error is much smaller.

2) With frequency-response correction.

3) Without frequency-response correction.

4) +3% for 1 to 10 V.

5) +5% for 10 to 100 V.

AC voltage measurement

— using RF Probe URY-Z7

RF probe	without plug-on divider	with 20-dB plug-on divider	with 40-dB plug-on divider	with 50-Ω adapter	with 75-Ω adapter
Voltage range	200 μV to 10 V	2 mV to 100 V	20 mV to 1000 V	200 μV to 10 V	200 μV to 10 V
Level range 50 (75) Ω	–60 to +33 dBm	–40 to +53 dBm	–20 to +73 dBm	–60 to +33 dBm	–62 to +31 dBm
Power range 50 (75) Ω	1 nW to 2 W	100 nW to 200 W	10 μW to 20 kW	1 nW to 2 W	(500 pW to 1.3 W)
Frequency range	20 kHz to 1 GHz	1 to 500 MHz	0.5 to 500 MHz	20 kHz to 1 GHz	20 kHz to 500 MHz
Input impedance $C_{in} R_p$ ($f = 10$ MHz)	2.5 pF >80 kΩ	1 pF >1 MΩ	0.5 pF >10 MΩ	50 Ω	75 Ω
Max. input voltage rms (sin)	15 V	150 V	1050 V	10 V	12 V
peak	22 V	220 V	1500 V	15 V	17 V
DC	400 V	1000 V	1000 V	10 V	12 V

Frequency-response error in % of rdg

	20	50	100	200	500 kHz	1	2	20	100	200	500 MHz	1	GHz
RF probe with 50-Ω adapter	10 ¹⁾	2	1,5			1		2	3	7	11	5 ²⁾	
	10 ¹⁾	2	1,5			1		2	4	10	20	3 ¹⁾	
75-Ω adapter	10 ¹⁾	2	1,5			1		2	4	12			
RF probe with BNC adapter	10 ¹⁾	2	1			0,5		1,5	3	12			
and with 20-dB plug-on divider						20 ¹⁾		12	15	20			
40-dB plug-on divider						20 ¹⁾		7	10	15			

Reflection coefficient and VSWR

	DC	50	100	200	500	700 MHz	1 GHz
50-Ω adapter	r/%	1,5	3	5	10	18	
	VSWR	1,03	1,06	1,11	1,22	1,44	
75-Ω adapter	r/%	1,5		3	10		
	VSWR	1,03		1,06	1,22		

- 1) The lower cutoff frequency depends on the probe temperature; at temperatures above 28 °C these values may be exceeded; normally the actual error is much smaller.
2) With frequency-response correction.
3) Without frequency-response correction.
4) +3% for 1 to 10 V.
5) +7% for 1 to 10 V.
6) +5% for 10 to 100 V.
7) +3% for 30 to 300 mV; +6% for 0.3 to 1 V.

General data

Option DC output URY-B2	
Output impedance	1 kΩ
Output voltage range	–2 to +2 V, resolution 1 mV/10 counts
Error limits	<±2 mV
Operating temperature range	–5 to +55 °C (no dewing)
Storage temperature range	–40 to +75 °C
Power supply	100/120/210/240 V ±11%, 45 to 440 Hz (30 VA)
Dimensions, weight	241 mm×110 mm×340 mm, 4.4 kg

Ordering information

Order designation	► Millivoltmeter URY 351.6815.02 includes URY-Z2
Measuring heads and accessories	
10-V Insertion unit 50 Ω .. URY-Z2	351.7111.55
100-V Insertion unit 50 Ω URY-Z4	351.7063.55
RF Probe Set .. URY-Z7	351.6967.02
50 Ω Adapter .. URY-Z50	351.7263.50
75 Ω Adapter .. URY-Z3	351.7211.75
Option DC output .. URY-B2	351.7011.02



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