

Automatic RLC Meter RLC 300

digimess® expert

Order No.: H.UC 35-00



The RLC 300 is a top-notch precision system RLC meter. With its basic accuracy of 0.1%, the RLC 300 is exactly the right instrument for measuring the parameters of passive components in development and research laboratories, in quality departments and automatic production processes etc. As a GPIB instrument with fully automatic measuring capabilities, the RLC 300 constitutes a cost-effective alternative to other more established precision RLC measuring instruments. The RLC 300's fully automatic selection of the measuring range and the component recognition facility also permit rapid operation in manual mode, even by less experienced personnel. The items to be measured are connected up via various adapters included in the scope of supply. Other special adapters are available on request. The tried and tested four-line connection technology provides effective suppression of stray capacitance. Besides compensating the adapter's residual capacitance by simply pressing a button, this feature ensures maximum measuring accuracy even with small L and C values. Four selectable measuring frequencies from 50 Hz to 10 Hz permit adjustment to each application. In the monitor mode the display shows the load on the item being measured.

The internal polarisation voltage allows the C measurement to be made on electrolytic capacitors. The RLC 300 is, of course, also ideally suitable for carrying out random tests of components. Deviations of tested objects from the reference components can be displayed either absolutely, i.e. directly in numerical values of the respective measuring unit, or relatively in percentage terms. A good/bad display with pre-set tolerance is possible.

Like all the other measuring instruments in the Grundig Instruments *digimess*® range, the RLC 300 is controlled by a microprocessor. This means simple operation by means of the extended "quattro key" operating concept, self-diagnosis of the measuring instrument and complete remote control via the standard interfaces IEEE 488.2 and RS 232 C.

The 16-digit alphanumeric LC display with background illumination keeps you well informed at all times about all measuring and setting values. Due to its excellent price-performance ratio this RLC meter will find wide acceptance in production, service, research and development.

Fully Automatic Feature

„Switch on and measure“ without the need for any presetting. That's the normal mode of operation of the RLC 300!

In the following example a component combination with an initially unknown impedance is connected to the terminals of the RLC 300. The RLC 300 automatically displays the dominant component, a capacitance of 146.85 Picofard:

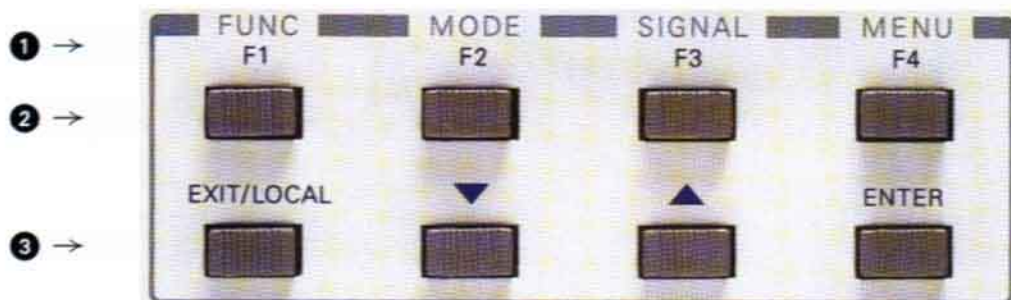


The RLC 300 also recognises that a parallel circuit (C_p) is involved and the dissipation factor D of the unknown component combination is 0.184 based on the selected measuring frequency. In many cases this result will suffice. It was not necessary thus far for the user to have any knowledge of the RLC 300 to obtain a measuring result.

The more "sophisticated" user will not be satisfied yet and will carry out more comprehensive analyses, eager to find out the reason for this relatively large dissipation factor. No problem for the RLC 300! Let's make a short excursion through the operating fields of the RLC 300.

The Operating Philosophy

Grundig **digimess**[®] instruments obey the rules of logic and so operating your RLC 300 is child's play, involving only 8 function keys.



The Function Levels

Firstly, and most importantly, this is the "secret" of the clearly arranged function levels of the RLC 300.

- 1 Choose the primary function group **FUNCTION**, a **MODE**, the **SIGNAL** parameters or the user **MENU** by pressing the corresponding function key.
- 2 Following the selection of a function group, the keys receive a new meaning (soft keys **F1**, **F2**, **F3**, **F4**) which is shown in the bottom line of the display.
- 3 Using the help keys in the second row, move the cursor, choose bigger or smaller and acknowledge your input. Using the LOCAL key, leave the current menu or put the RLC 300 into manual mode if you were previously in remote control mode.

The User Guide

There's no fooling the RLC 300 – it shows "plain text"! Simply follow the MENU guide in order to set individual special functions. Just press the **FUNCTION** key,

followed by **MAN**ual, to continue with our example.

The RLC 300 display offers you the following options:



Manual: |Z|φ
R L C |Z|φ

Select /Z/ to determine directly the modulus and phase angle of the connected complex impedance:



Z : 1.0641 MΩ
φ : -79.59 °

Select R to measure directly the value of the dissipation components:



Rp: 5.888 MΩ
D : 0.184

You think that's all too complicated for less experienced personnel?

We don't think so!

The Long-term Memory

The **User-menu** offers you 4 presettings which you can define yourself for special applications, save with the

STOre function and call up at any time via the **RCL** (Recall) function.

Yes, but what do I do if the measured results have to be evaluated automatically?



-- User menu --
STO RCL TEST LCD

No problem for the RLC 300!

Communication

Don't lose sight of your measured values. Like all instruments in the **digimess** series, the RLC 300 is extremely communicative. Not only PC freaks, but also serious

users will be highly delighted with the RLC 300 providing both RS 232 and IEEE 488.2 interfaces-standard and at no extra cost, needless to say!



Interface type:
GPIB

Choose the interface that suits you best!

Technical Data RLC 300

General Data

Nominal temperature:	+23 °C ± 2 °C
Operating temperature:	+5 °C a +40 °C
Relative humidity:	20% - 80%
Atmospheric pressure:	70 kPa - 106 kPa
Operating position:	horizontal or inclined by ± 15°
Operating voltage:	sinusoidal alternating voltage, distortion factor < 5% 230 V or 115 V (+10% -15%), internally switchable, 47 - 63 Hz
Power consumption:	max. 20 W
Fuses:	Miniature fuse T 100 L 250 V for mains voltage 230 V Miniature fuse T 200 L 250 V for mains voltage 115 V
Safety class:	I, according to DIN EN 6110 Part 1 (VDE 0411 Part 1, 3/94)
Radio interference suppression:	EN 55011 Class B, Vfg 1046/1984, VDE 0871 Category B
Dimensions (L x H x D):	291 mm x 120 mm x 259 mm
Dimensions of packing:	418 mm x 155 mm x 355 mm
Weight	
of RLC 300:	approx. 3,5 kg
incl. packing and accessories:	approx. 5,2 kg

Specifications

Measuring functions

Measuring parameters:

/Z/	modulus of impedance	D	dissipation factor
R	resistance	Q	quality factor
L	inductivity	φ	phase displacement (phase angle)
C	capacitance		

Measuring combinations:

Parameter	AUTO		MAN	
R	Q	Q	D	L, C
L	Q	Q	D	R
C	D	Q	D	R
Z	N/A	φ		

Tolerance measurement:

Δ	absolute deviation of the measured value from the reference value input
δ	relative deviation from the reference value input
COMP	good/bad comparison with reference value, tolerances adjustable

Variable equivalent circuit of the measured object:

- series circuit
- parallel circuit

Selection of measuring range:

- automatic
- manual (fixed range, switchover upwards, switchover downwards)

Selection of measuring function:

- automatic
- manual

Triggering of measurements:

- automatic
- single (manual)

Measuring time (applies to fixed range or following selection of measuring range):

- approx. 300 ms for measuring signal level of 1 V
- approx. 400 ms for measuring signal level of 50 mV

Averaging: 10 x**Connection type of measured object:** 4-line arrangement with earth terminal**Correction of residual parameters:**

- SHORT < 10 Ω
- OPEN > 100 k Ω

Einlaufzeit: 20 min**Measuring signal**

Measuring frequencies: 50 Hz, 100 Hz, 1 kHz, 10 kHz

Level of measuring signal: 1 V (normal)
50 mV (low)Output impedance: 100 Ω Polarisation of measured object: 2 V (internal)
0 - 30 V (external)

Level monitor of measuring signal and polarisation voltage:

Parameter	Range	Accuracy
Voltage	0.001 mV - 1.000 V	$\pm (3\% + 0.1 \text{ mV})$
Current	0.1 nA - 10.00 mA	$\pm (3\% + 10 \text{ nA})$
BIAS	0 - 30.00 V	$\pm (1\% + 10 \text{ mV})$

Measuring range

Measuring parameter	Measuring range	Resolution	Max. measured value (manual)
/Z/, R	20.00 m Ω - 20.000 M Ω	0.01 m Ω	199.9 M Ω
L	1.000 μ H - 20.000 kH	0.001 μ H	635.5 kH
C	1.000 pF - 20.00 mF	0.001 pF	399.9 mF
D	0.0001 - 9.9999	0.0001	
Q	0.01 - 199.9	0.01	
φ	-179.99° - +180.00°	0.01°	
δ	-99.99% - +199.9%	0.01%	

Measuring accuracy

The validity of the specifications depends on the following conditions:

- Warm-up time 20 min
- Connecting up the measured object via the adapters supplied; otherwise the error specifications are related to the plug connector level.
- Capacitance of the Li, Lu sockets against earth must not exceed 200 pF.
- The corrections short and open were carried out.

Measuring errors during /Z/, R, L, C measurement

The error is defined by the equation:

$$A = \pm (A_b + K_s + K_p) \times K_l \times K_t \quad [\%]$$

where:	A_b ... basic error	(see Table 0 - 1)
	K_s ... additional error for low impedances	(see Table 0 - 2)
	K_p ... additional error for high impedances	(see Table 0 - 2)
	K_l ... coefficient of measuring signal level	(see Table 0 - 3)
	K_t ... temperature coefficient	(see Table 0 - 4)

For R measurements the above error applies for $Q_m \leq 0.1$, where Q_m is the measured value.

When Q_m is > 0.1 , the error for resistance measurement is defined by the equation:

$$A \times \sqrt{1 + Q_m^2} \quad [\%]$$

For L, C measurement, the above equation applies to the error for $D_m \leq 0.1$, where D_m is the measured value.

When D_m is > 0.1 , the error for the L, C measurement is defined by the equation:

$$A \times \sqrt{1 + D_m^2} \quad [\%]$$

For converting C and L to the impedance Z, the following equations apply:

$$|Z| = 2 \pi f_{MeB} L$$

$$|Z| = \frac{1}{2 \pi f_{MeB} C}$$

Measuring error for dissipation factor D

The measuring error for the dissipation factor is defined by the equation:

$$D_A = \pm A/100 \quad [\text{absolute value } D]$$

The equation for the measuring error applies to $D_m \leq 0.1$, where D_m is the measured value for the dissipation factor D.

When D_m is > 0.1 , the measuring error is defined by the equation:

$$D_A \times (1 + D_m)$$

Measuring error for quality factor Q

The measuring error is defined by the equation:

$$Q_A = \pm \frac{Q_m^2 \times D_A}{1 + Q_m \times D_A}$$

where Q_m is the measured value of quality factor Q. The equation for the measuring error applies to $Q_m \times D_A < 1$.

Measuring error for phase displacement φ

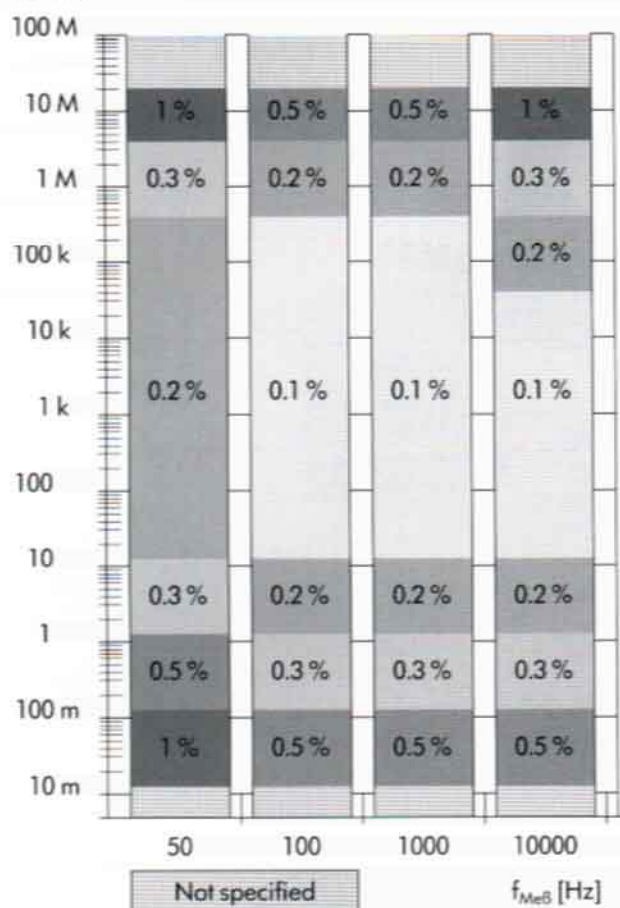
The measuring error is defined by the equation:

$$\frac{180}{\pi} \times \frac{A}{100} \quad [\text{grad}]$$

Table 0-1 Intrinsic error A_B

Basic accuracy

/Z/ [Ω]

**Table 0-2 Additional error**

Frequency	K_s [%]	K_p [%]
50 Hz	$2 \times \frac{0.1}{ Z_m }$	$2 \times Z_m \times 10^{-7}$
100 Hz - 10 kHz	$\frac{0.1}{ Z_m }$	$ Z_m \times 10^{-7}$

$|Z_m| \dots$ = Modulus of measured impedance.

The effect of the additional error K_s is negligible in the case of high frequencies while the effect of the additional error K_p is negligible in the case of low frequencies.

Table 0-3 Coefficient of measuring signal level

Measuring signal level	normal (1 V)	low (50 mV)
k_1	1	2

Table 0-4 Temperature coefficient

Temperature [°C]	5	11	21	25	35	40
k_t	—	2	1.5	1	1.5	2

Display panel

The RLC 300 is equipped with a two-line 16-digit alphanumeric LCD matrix display with background illumination. The display shows test results, error messages or the instrument's manu-guided settings.

Interface IEEE 488.2

Interface standards:	ANSI/IEEE Std 488.1-1987 and IEEE Std 488.2-1992
Interface functions:	SH1, AH1, SR1, T5, L4, RL1, PPO, DC1, DT1, E1
Length of input buffer:	64 characters
Length of output buffer:	256 characters
General instructions and inquiries:	*CLS, *ESE, *ESE?, *ESR?, *SRE, *SRE?, *STB?, *IDN?, *RST, *TST?, *TRG, *OPC, *OPC?, *WAI

Interface RS 232 C

Communication is based on the ASCII character set. The data transmission rate (baud rate) can be chosen from 1200 Bd to 9600 Bd.

Baud rate:	1200 Bd, 2400 Bd, 4800 Bd, 9600 Bd
Length of data character:	8 Bit
Number of STOP bits:	1
Parity:	none
Communication protocol:	RTS/CTS, none
Separator:	'CR' + 'LF', 13 dec. +10 dec.
Length of input buffer:	64 characters
Length of output buffer:	256 characters

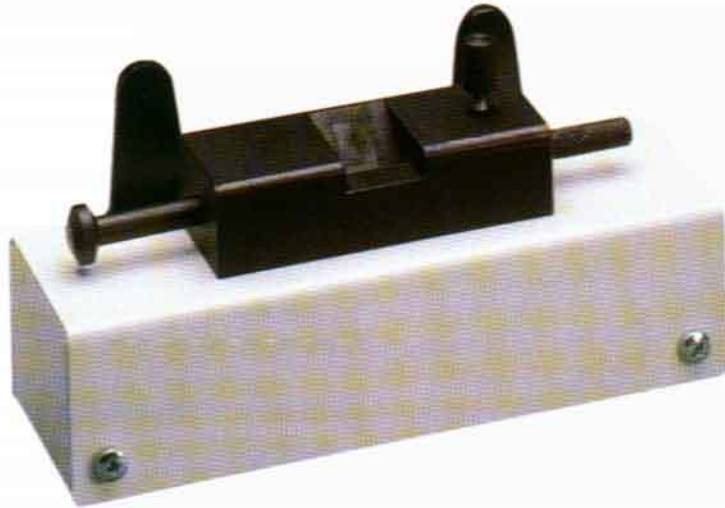
System interfaces of the RLC 300

The RLC 300 is equipped, as standard, with the IEEE 488.2 and RS 232 C interfaces for communication with a PC. All function and parameters can be set and the instrument's set values and conditions can be transmitted.

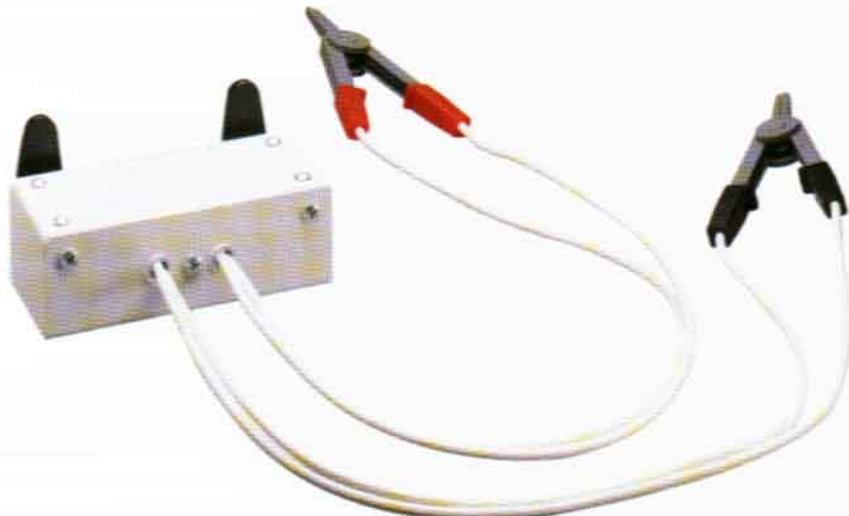
Scope of supply

The instrument comes complete with a power cable, replacement fuses and operating instructions, 4-lead RLC adapter for radial and axial components, 4-lead SMD adapter

adapter, e-lead adapter with Kelvin test terminals and measuring earth cable.



4-lead SMD adapter



4-lead adapter with Kelvin test terminals