

The logo features a stylized, multi-line graphic on the left that resembles a sine wave or a current waveform. It starts as a horizontal line, dips into a V-shape, and then returns to a horizontal line. To the right of this graphic, the word "VOLTcraft" is written in a bold, italicized, sans-serif font. The "V" is significantly larger than the other letters, and a registered trademark symbol (®) is placed at the end of the word.

**VOLTcraft®**

## **VC-539 AC/DC CURRENT CLAMP**

Ⓞ OPERATING INSTRUCTIONS

Page 24 – 44

Best.-Nr. / Item No. / N° de commande / Bestnr.:

323491



Version 01/14

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# 1. INTRODUCTION

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Dear Customer,

In purchasing this Voltcraft® product, you have made a very good decision for which we would like to thank you.

Voltcraft® - In the field of measuring, charging and network technology, this name stands for high-quality products which perform superbly and which are created by experts whose concern is continuous innovation.

From the ambitious hobby electronics enthusiast to the professional user, products from the Voltcraft® brand family provide the optimum solution even for the most demanding tasks. And the remarkable feature is: we offer you the mature technology and reliable quality of our Voltcraft® products at an almost unbeatable price-performance ratio. In this way, we aim to establish a long, fruitful and successful co-operation with our customers.

We wish you a great deal of enjoyment with your new Voltcraft® product!

**All company names and product names are trademarks of their respective owners. All rights reserved.**

**If there are any technical questions, contact:**

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                    Mon. to Thur. 8.00am to 4.30pm, Fri 8.00am to 2.00pm

## 2. INTENDED USE

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Use this product to measure and display electrical values for Overvoltage Category III (up to max. 600 V against ground potential, in compliance with EN 61010-1) and all lower categories. The product has the following measuring functions/ranges:

- Direct current voltages and alternating current voltages up to max. 600 V (CAT III)
- Direct current and alternating current up to max. 80 A
- Resistance up to max. 40 M $\Omega$
- Capacitance up to max. 100  $\mu$ F
- Frequencies up to max. 10 MHz
- Diode test
- Continuity test
- Duty cycle

Current is measured using a magnetic sensor. All other measurements are conducted using the included safety test leads (in compliance with EN 61010-031). The product has an LC display with 4000 counts and backlighting, automatic range selection and a HOLD function to freeze the displayed measurement.

The product is supplied with power via two AAA batteries.

It is intended for indoor use only. Do not use it outdoors. Contact with moisture, e.g. in bathrooms, must be avoided under all circumstances.

This product complies with the statutory national and European requirements.

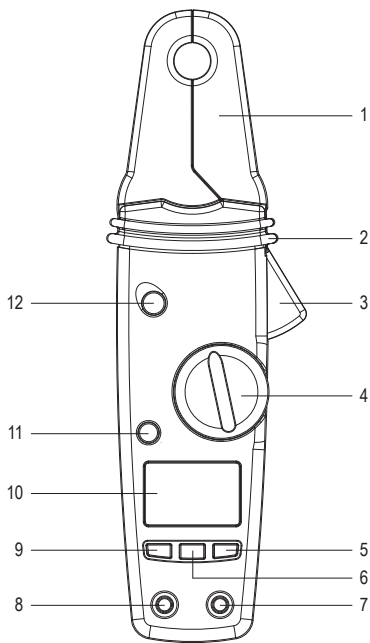
For safety and approval purposes (CE), you must not rebuild and/or modify this product. If you use the product for purposes other than those described above, the product may be damaged. In addition, improper use can cause hazards such as short circuiting, fire, electric shock etc. Read the instructions carefully and keep them. Make this product available to third parties only together with its operating instructions.



**Observe all safety instructions and information within this operating manual.**

### 3. OPERATING ELEMENTS

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1 Current clamp sensor

2 Handle marking

3 Opening lever

4 Mode switch

5 Hz% button

6 RANGE button

7 Red test lead jack

8 Black test lead jack

9 **MODE** button

10 LC display

11 **HOLD** button

12 **ZERO** button

## 4. SYMBOL EXPLANATION

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An exclamation mark in a triangle indicates important notes in these operating instructions that must be strictly observed.



The triangle containing a lightning symbol warns against danger of electric shock or impairment of the electrical safety of the device.



The arrow symbol alerts the user to the presence of important tips and notes on using the device.



This device is CE compliant and fulfills all applicable European guidelines.



A square containing a lightning bolt indicates that extreme caution is necessary for use on non-insulated wires (dangerous live wires).



Protection Class 2 (double or reinforced insulation)

**CAT III**

Overvoltage Category III for measurements in building installation (i.e. wall power outlets or distribution boards). This category includes all lower categories (i.e. CAT II for measurements on electrical devices).



Ground potential

## 5. SAFETY INSTRUCTIONS

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**Read the operating instructions carefully and especially observe the safety information. If you do not follow the safety instructions and information on proper handling in this manual, we assume no liability for any resulting personal injury or damage to property. Such cases will invalidate the warranty/guarantee.**



### a) Persons / Product

- The device is not a toy. Keep it out of the reach of children and pets.
- For installations in industrial facilities, follow the accident prevention regulations for electrical systems and equipment of the government safety organization or the corresponding authority for your country.
- In schools and training facilities and hobby and self-help workshops, the use of measuring devices must be monitored by trained and responsible personnel.

- Do not operate the device immediately after transferring it from a cold to a warm room. This can cause condensation which may, under adverse circumstances, destroy the device. Leave the device turned off until it has reached room temperature.
- Do not leave packaging material lying around carelessly. These may become dangerous playing material for children.
- Protect the product from extreme temperatures, direct sunlight, strong jolts, high humidity, moisture, flammable gases, vapours and solvents.
- Do not place the product under any mechanical stress.
- If it is no longer possible to operate the product safely, take it out of operation and protect it from any accidental use. Safe operation can no longer be guaranteed if the product:
  - is visibly damaged,
  - is no longer working properly,
  - has been stored for extended periods in poor ambient conditions or
  - has been subjected to any serious transport-related stresses.
- Please handle the product carefully. Jolts, impacts or a fall even from a low height can damage the product.
- Also observe the safety and operating instructions of any other devices which are connected to the product.

## **b) Batteries / Rechargeable batteries**

- Correct polarity must be observed while inserting the batteries.
- Batteries should be removed from the device if it is not used for a long period of time to avoid damage through leaking. Leaking or damaged batteries might cause acid burns when in contact with skin, therefore use suitable protective gloves to handle corrupted batteries.
- Batteries must be kept out of reach of children. Do not leave the battery lying around, as there is risk, that children or pets swallow it.
- All the batteries should be replaced at the same time. Mixing old and new batteries in the device can lead to battery leakage and device damage.
- Batteries must not be dismantled, short-circuited or thrown into fire. Never recharge non-rechargeable batteries. There is a risk of explosion.

## **c) Miscellaneous**

- Consult an expert when in doubt about operation, safety or connection of the device.
- Maintenance, modifications and repairs are to be performed exclusively by an expert or at a qualified shop.

If you are not sure about the correct connection or use, or if questions arise which are not covered by these operating instructions, please do not hesitate to contact our technical support or another qualified specialist.

## 6. DELIVERY CONTENT

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- AC/DC current clamp
- Safety test leads
- 2 x AAA battery
- Storage bag
- Operating instructions

## 7. INSERTING/REPLACING BATTERIES

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**Before changing the batteries, disconnect any test leads that might still be connected to the device. Failure to do so poses the risk of electric shock.**



**Never open the product while it is opened. Risk of fatal injury!**

1. Use a Phillips screwdriver to remove both screws from the battery compartment cover and remove the battery compartment cover.
  2. Insert two AAA batteries into the battery compartment. Heed correct polarity as indicated in the battery compartment.
  3. Replace the battery compartment cover and fasten it using the two Phillips screws.
- ➔ Replace the batteries as soon as the battery symbol on the right-hand side of the LC display (10) appears.



## 8. TURNING ON/OFF



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- Turn on the product by turning the mode switch (4) clockwise.
- Turn off the product by turning the mode switch (4) counter clockwise until the arrow points to OFF.

➔ The product turns off automatically after approx. 25 minutes of inactivity.

## 9. DISPLAY SYMBOLS

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AC	Alternating current/voltage
DC	Direct current/voltage
AUTO	Automatic range selection
	Diode test
	Audible continuity test
HOLD	HOLD function
ZERO	Zero position
A	Ampere (unit of electric current)
mV	Millivolt
V	Volt (unit of electric voltage)
$\Omega$	Ohm (unit of electrical resistance)
k $\Omega$	Kiloohm
M $\Omega$	Megaohm
nF	Nanofarad (unit of electrical capacitance)
$\mu$ F	Microfarad
Hz	Hertz (unit of frequency)
kHz	Kilohertz
MHz	Megahertz
%	Duty cycle

## 10. CONDUCTING MEASUREMENTS

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Never exceed the maximum permissible input values. Do not touch any circuitry or connection points when voltages exceeding 25 V/ACrms or 35 V/DC might be applied. Risk of fatal injury!



The voltage between the meter's connection points and ground potential may not exceed 600 V DC/AC in CAT III.

Before conducting measurements, check both the safety test leads and the current clamp for damages. Do not operate the product if it or the test leads are damaged. Risk of fatal injury!

Hold the test leads by the grooved grips only. Never hold the test leads directly near the test prods.

Always hold the current clamp beneath the handle marking (2). Never hold the current clamp directly near the current clamp sensor (1).

Always remove the test prods from the object under test before changing the measurement range or mode.

Disconnect the test leads from the test lead jacks as soon as you have finished conducting measurements with the test leads.

Exercise extreme caution when conducting measurements on busbars and non-insulated wires. Risk of electric shock!

Wear appropriate protective clothing (i.e. safety gloves) to prevent injury due to electric shock, flashover, etc.

When measuring current, make sure that the safety leads are not connected to the product.

Do not use the product directly before, during or shortly after a thunderstorm. Lightning may cause power surges. Make sure that your hands, shoes, clothing, the floor, circuitry and connection points, etc. are dry.

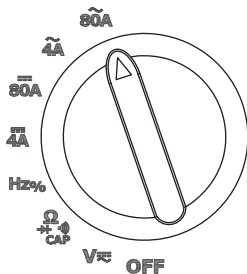
Do not use any meter accessories that do not match the product's specifications.

Avoid use in the direct vicinity of:

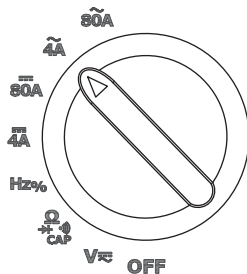
- strong magnetic or electromagnetic fields and
- transmitting antennas or high-frequency generators.

Failure to do so may falsify readings.

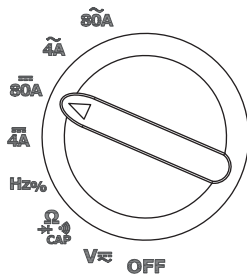
## a) Current



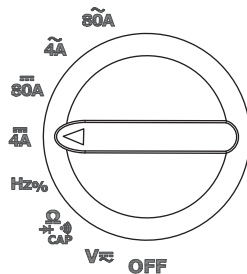
Measuring alternating current to 80 A (AC)



Measuring alternating current to 4 A (AC)



Measuring direct current to 80 A (DC)

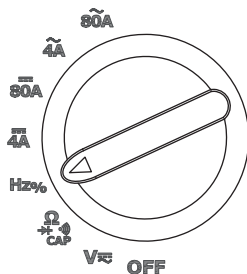


Measuring direct current to 4 A (DC)

1. Use the mode switch (4) to select the desired measurement range. If you are not sure of the appropriate range, first select the 80 A range and switch to 4 A if necessary.
2. Open the current clamp (1) by the opening lever (3).
3. Place the clamp around the conductor under test and release the opening lever (3). Make sure that the conductor is not jammed. The conductor must move freely inside the current clamp sensor's (1) round opening.  
→ Place the clamp around one conductor at a time. If the clamp is in contact with more than one conductor simultaneously, the currents will cancel each other out and you will receive no reading.
4. The reading is shown on the LC display (10).

- Due to the current clamp sensor's (1) permanent magnetism, the LC display (10) may show a low reading before measurement. This is possible even if no conductor is present. To reset the display to zero, push the **ZERO** button (12) before measurement.
5. Remove the current clamp from the object under test after measurement and turn off the current clamp.

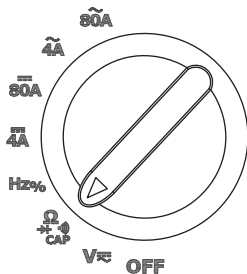
## b) Frequency (Hz) / Duty cycle (%)



Measuring frequency / duty cycle

1. Use the mode switch (4) to select the measurement mode for frequency / duty cycle.
2. Remove the safety caps from the L-shaped test lead jacks.
3. Connect the red test lead to the red test lead jack (7).
4. Connect the black test lead to the black test lead jack (8).
5. Push the **Hz%** button (5) to select frequency or duty cycle measurement. In the upper right-hand corner of the LC display (10), the corresponding symbol:
  - **Hz** for frequency
  - **%** for duty cycle
6. Connect the test prod to the object under test.
7. The reading is shown on the LC display (10).
8. Remove the test leads from the object under test after measurement and turn off the current clamp.

### c) Resistance / Diode test / Continuity test / Capacitance



Measuring resistance / diode test / continuity / capacitance



Make sure that in all circuitry, circuitry components, components and other objects under test no voltage is present. Risk of electric shock!



1. Use the mode switch (4) to select the measurement mode for resistance / diode test / continuity / capacitance.
2. Remove the safety caps from the L-shaped test lead jacks.
3. Connect the red test lead to the red test lead jack (7).
4. Connect the black test lead to the black test lead jack (8).
5. Repeatedly push the **MODE** button (9) to select the measurement mode for resistance, diode test, continuity or capacitance. In the upper right-hand corner of the LC display (10), the corresponding symbol:
  - $\Omega$  for resistance
  - $\blacktriangleright$  for diode test
  - $\cdot\cdot\cdot$  for continuity test
  - **F** for capacity

### Resistance

1. Connect the test prods to the object under test.  
→ Make sure that the object under test is free of dirt, oil, soldering varnish, etc. as the presence of such residue may falsify readings.
2. The reading is shown on the LC display (10). Wait until the reading stabilizes.  
→ If the LC display shows **OL** (overload), the measurement range was exceeded or the measuring circuit interrupted.
3. Remove the test leads from the object under test after measurement and turn off the current clamp.

### Diode test

1. Connect the test prods to the diode under test.
2. The forward voltage is shown in volt (V) on the LC display (10). The value should be between 0.4 V and 0.7 V.  
→ If the LC display shows **OL** (overload), the diode is being measured in the reverse direction or is defective. For checking purposes, conduct a measurement on the opposing poles.
3. Remove the test leads from the object under test after measurement and turn off the current clamp.

### Continuity test

1. Connect the test prods to the object under test.
2. An acoustic signal sounds for resistances  $<150 \Omega$ .  
→ If the LC display shows **OL** (overload), the measurement range was exceeded or the measuring circuit interrupted.
3. Remove the test leads from the object under test after measurement and turn off the current clamp.

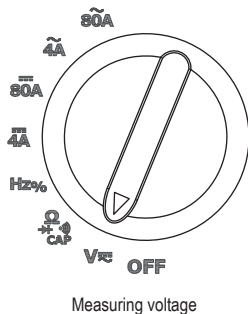
## Capacitance



To prevent the risk of electric shock, make sure that the capacitor under test is completely discharged and voltage-free. Risk of electric shock!

1. To reset the display to zero, push the **ZERO** button (12) before measurement.
2. Connect the test prods to the object under test.
3. The reading is shown on the LC display (10). Wait until the reading stabilizes.  
→ If the LC display shows **OL** (overload), the measurement range was exceeded.
4. Remove the test leads from the object under test after measurement and turn off the current clamp.

## d) Voltage



1. Use the mode switch (4) to select the measurement mode for voltage.
2. Remove the safety caps from the L-shaped test lead jacks.
3. Connect the red test lead to the red test lead jack (7).
4. Connect the black test lead to the black test lead jack (8).

5. Push the **MODE** button (9) to select the measurement mode for direct current voltage or alternating voltage. In the upper right-hand corner of the LC display (10), the corresponding symbol:
  - **DC** for direct current voltage
  - **AC** for alternating voltage
6. Connect the test prods to the object under test.
7. The reading is shown on the LC display (10).
  - ➔ If a minus sign appears before the reading when measuring direct current voltage, the measured voltage is either negative or the test leads are reversed.
8. Remove the test leads from the object under test after measurement and turn off the current clamp.

### e) Analog signal output (voltage)

1. Use the mode switch (4) to select one of the four current measurement ranges.
2. Remove the safety caps from the L-shaped test lead jacks.
3. Connect the red test lead to the red test lead jack (7).
4. Connect the black test lead to the black test lead jack (8).
5. Connect the test prods to the input jacks of a multimeter or oscilloscope.
6. Open the current clamp sensor (1) by the opening lever (3).
7. Place the clamp around the conductor under test and release the opening lever (3). Make sure that the conductor is not jammed. The conductor must move freely inside the current clamp sensor's round opening.
  - ➔ Place the clamp around one conductor at a time.
8. The analog reading is shown on the multimeter / oscilloscope.
  - ➔ When measuring direct current with the current clamp, the multimeter / oscilloscope shows DC voltage.  
When measuring alternating current with the current clamp, the multimeter / oscilloscope shows AC voltage.



## 11. AUTO RANGE

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- Auto range is activated as a default factory setting. When auto range is activated, the symbol **AUTO** appears in the upper left-hand corner of the LC display (10).
- If you wish to manually select the measurement range, push the **RANGE** button (6) until the desired measurement range is shown in the upper section of the LC display (10). Manual range selection is not possible for alternating voltage measurement, diode tests and continuity tests.
- To return to auto range mode, push and hold the **RANGE** button (6) for approx. two seconds until **AUTO** appears in the upper left-hand corner of the LC display (10).

## 12. HOLD FUNCTION

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- Use the **HOLD** function to freeze the current reading on the LC display (10).
- Push the **HOLD** button (11) to freeze the most recent reading on the LC display (10). When the **HOLD** function is activated, the **HOLD** symbol appears in the upper section of the LC display.
- Push the **HOLD** button again to deactivate the **HOLD** function.

## 13. BACKLIGHT

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- Push and hold the **HOLD** button (11) for approx. one second to activate the LC display's (10) backlight.
  - To deactivate the backlight, push and hold the **HOLD** button for approx. one second until the backlight turns off.
- ➔ When you activate or deactivate the backlight, the **HOLD** function is also activated. In this case, push the **HOLD** button once to deactivate the **HOLD** function. This will have no effect on the status of the backlight.

## 14. MAINTENANCE AND CLEANING

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Before cleaning, disconnect the test leads from the product and turn the product off.

Remove the product from the measurement range.

- The product is maintenance-free apart from occasional cleaning.
- Do not use any cleaning agents containing carbon, benzene, alcohol or the like. Such substances may corrode the meter's surface. Moreover, the fumes are harmful and explosive.
- Do not use any sharp tools, screwdrivers, metal brushes, etc. to clean the product.
- To clean the product and the test leads, use a clean, lint-free, antistatic and slightly damp cleaning cloth.

## 15. DISPOSAL

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### a) Product



Electronic devices are recyclable waste and must not be disposed of in the household waste.

At the end of its service life, dispose of the product according to the relevant statutory regulations.

Remove any inserted (rechargeable) batteries and dispose of them separately from the product.

### b) (Rechargeable) batteries

You as the end user are required by law (Battery Ordinance) to return all used batteries/rechargeable batteries. Disposing of them in the household waste is prohibited.



Contaminated (rechargeable) batteries are labelled with this symbol to indicate that disposal in the domestic waste is forbidden. The designations for the heavy metals involved are: Cd = Cadmium, Hg = Mercury, Pb = Lead (name on (rechargeable) batteries, e.g. below the trash icon on the left).

Used (rechargeable) batteries can be returned to collection points in your municipality, our stores or wherever (rechargeable) batteries are sold.

You thus fulfil your statutory obligations and contribute to the protection of the environment.

## 16. TECHNICAL DATA

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Operating voltage .....	2 x 1.5 V/DC AAA battery
Overvoltage category .....	CAT III 600 V
Protection class .....	II
Display .....	4000 Counts
Measurement interval .....	2 measurements per second
Measurement impedance .....	7.8 M $\Omega$ (for voltage measurement)
Opening width .....	approx. 12 mm
Operating temperature .....	-10 to +50 °C
Storage temperature .....	-30 to +60 °C
Operating altitude .....	max. 3000 m
Storage altitude .....	max. 10000 m
Humidity .....	max. 90 % (for 0 to +30 °C) max. 75 % (for +30 to +40 °C) max. 45 % (for +40 to +50 °C)
Dimensions (W x H x D) .....	70 x 215 x 37 mm
Weight .....	200 g

### Measurement tolerances

Measuring accuracy shown in  $\pm$  (% reading + indication error in counts (= number of minimum digits)). This measuring accuracy is guaranteed for one year at a temperature of +23 °C ( $\pm 5$  °C) and relative humidity <75 %, non-condensing.

### Direct current

Range	Accuracy	Resolution
4.000 A/DC	$\pm(3.5 \% + 13 \text{ Counts})$	1 mA
80.0 A/DC	$\pm(4.0 \% + 10 \text{ Counts})$	100 mA

**Alternating current (50/60 Hz)**

Range	Accuracy	Resolution
4.000 A/AC	$\pm(4.0 \% + 10 \text{ Counts})$	1 mA
80.0 A/AC	$\pm(4.0 \% + 10 \text{ Counts})$	100 mA

**Direct current voltage**

Range	Accuracy	Resolution
400.0 mV/DC	$\pm(1.3 \% + 15 \text{ Counts})$	0.1 mV
4.000 V/DC	$\pm(1.3 \% + 3 \text{ Counts})$	1 mV
40.00 V/DC	$\pm(1.8 \% + 5 \text{ Counts})$	10 mV
400.0 V/DC	$\pm(1.8 \% + 5 \text{ Counts})$	100 mV
600 V/DC	$\pm(2.0 \% + 5 \text{ Counts})$	1 V

**Alternating voltage (50/60 Hz)**

Range	Accuracy	Resolution
400.0 mV/AC	$\pm(1.2 \% + 40 \text{ Counts})$	0.1 mV
4.000 V/AC	$\pm(2.0 \% + 5 \text{ Counts})$	1 mV
40.00 V/AC	$\pm(2.0 \% + 5 \text{ Counts})$	10 mV
400.0 V/AC	$\pm(2.0 \% + 5 \text{ Counts})$	100 mV
600 V/AC	$\pm(2.0 \% + 5 \text{ Counts})$	1 V

## Resistance

Range	Accuracy	Resolution
400.0 $\Omega$	$\pm(1.5\% + 6 \text{ Counts})$	100 m $\Omega$
4.000 k $\Omega$	$\pm(1.5\% + 2 \text{ Counts})$	1 $\Omega$
40.00 k $\Omega$	$\pm(1.5\% + 2 \text{ Counts})$	10 $\Omega$
400.0 k $\Omega$	$\pm(1.5\% + 2 \text{ Counts})$	100 $\Omega$
4.000 M $\Omega$	$\pm(2.5\% + 3 \text{ Counts})$	1 k $\Omega$
40.00 M $\Omega$	$\pm(3.5\% + 5 \text{ Counts})$	10 k $\Omega$

## Capacitance

Range	Accuracy	Resolution
40.00 nF	$\pm(6.0\% + 40 \text{ Counts})$	0.01 nF
400.0 nF	$\pm(4.0\% + 5 \text{ Counts})$	0.1 nF
4.000 $\mu$ F	$\pm(3.5\% + 5 \text{ Counts})$	1 nF
40.00 $\mu$ F	$\pm(3.5\% + 5 \text{ Counts})$	10 nF
100.0 $\mu$ F	$\pm(6.0\% + 5 \text{ Counts})$	100 nF

## Frequency (sensitivity min. 10 Vrms, for 20 – 80 % duty cycle)

Range	Accuracy	Resolution
5.000 Hz	$\pm(1.5\% + 7 \text{ Counts})$	1 mHz
50.00 Hz	$\pm(1.5\% + 2 \text{ Counts})$	10 mHz
500.0 Hz	$\pm(1.5\% + 2 \text{ Counts})$	100 mHz
5.000 kHz	$\pm(1.5\% + 2 \text{ Counts})$	1 Hz
50.00 kHz	$\pm(1.5\% + 2 \text{ Counts})$	10 Hz
500.0 kHz	$\pm(1.5\% + 2 \text{ Counts})$	100 Hz
5.000 MHz	$\pm(1.5\% + 2 \text{ Counts})$	1 kHz
10.00 MHz	$\pm(1.5\% + 2 \text{ Counts})$	10 kHz

### Duty Cycle

Range .....	0.5 – 99.0 %
Accuracy .....	$\pm(1.2 \% + 5 \text{ Counts})$
Resolution.....	0.1 %
Pulse width .....	100 $\mu\text{s}$ – 100 ms
Frequency.....	5 Hz – 150 kHz
Sensitivity .....	min. 10 Vrms

### Continuity test

Threshold value .....	<150 $\Omega$
Test current.....	<1 mA

### Diode test

Test voltage .....	1.5 V/DC
Test current.....	0.3 mA

### Analog output (for A/AC and A/DC)

Signal output.....	0 – max. 4 A (AC/DC): 10 mV/A
	4 – max. 80 A (AC/DC): 1 mV/A
Accuracy.....	$\pm(4.5 \% + 1 \text{ mV})$
Output impedance .....	approx. 3 k $\Omega$