

# CM87 CLAMP METERS



## Instruction Manual



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### ALWAYS READ THESE INSTRUCTIONS BEFORE PROCEEDING

Thank you for buying one of our products. For safety and full understanding of its benefits please read this manual before use. Technical support is available from 01923 441717 and support@martindale-electric.co.uk.

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### 1 SAFETY INFORMATION

#### REMEMBER: SAFETY IS NO ACCIDENT

These instructions contain both information and warnings that are necessary for the safe operation and maintenance of this product. It is recommended that you read the instructions carefully and ensure that the contents are fully understood. Failure to understand and to comply with the warnings and instructions can result in serious injury, damage or even death.

Particular attention should be paid to the Warnings, Precautions and Technical Specifications.

Please keep these instructions for future reference. Updated instructions and product information are available at: [www.martindale-electric.co.uk](http://www.martindale-electric.co.uk)

#### 1.1 Meaning of Symbols and Markings



Caution - risk of danger & refer to instructions



Caution - risk of electric shock



Equipment protected by double or reinforced insulation (Class II)



Application around and removal from hazardous live conductors is permitted.

**CAT II** (Measurement Category II) is applicable to test and measuring equipment connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.

**CAT III** (Measurement Category III) is applicable to test and measuring equipment connected to the distribution part of the building's low-voltage MAINS installation.

**CAT IV** (Measurement Category IV) is applicable to test and measuring equipment connected at the source of the building's low-voltage MAINS installation.

For further information on measurement categories visit [www.martindale-electric.co.uk/measurement\\_categories.php](http://www.martindale-electric.co.uk/measurement_categories.php) or refer to page 18.



Equipment complies with relevant EU Directives



End of life disposal of this equipment should be in accordance with relevant EU Directives

### 1.2 Precautions

This product has been designed with your safety in mind, but please pay attention to the following warnings and cautions before use.

#### Warnings

In order to avoid the danger of electrical shock, it is important that proper safety measures are taken when working with voltages exceeding 30V AC rms, 42V AC peak or 60V DC.

Where applicable other safety measures such as the use of protective gloves, goggles etc. should be employed.

The current clamp must only be used by a skilled and competent person who is familiar with the relevant regulations, the safety risks involved and the consequent normal safe working practices, and under the conditions and for the purposes for which it has been constructed and specified.

Before each use the current clamp and any associated test leads and accessories should be examined for damage, cracks, cuts or scratches. **Do not use** if damaged in any way.

Make sure the current clamp and test leads are dry, clean and free from dust, grease and moisture while in use to avoid the danger from electric shock due to surface leakage.

Always test this unit on an appropriate proving device or a known good voltage source before and after using it to determine if a hazardous

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voltage exists in a circuit to be tested. **Do not use** the unit if it does not function correctly during proving.

Measuring/testing for a voltage/current that exceeds the specified limits of the unit may damage the unit and may expose the operator to a shock hazard. Always check the unit's specified limits before use.

The clamp meter must only be used on CAT IV installations up to 600V to earth, CAT III and CAT II installations up to 1000V to earth, and within the operating temperature and humidity range specified.

The CAT III 1000V marking does not mean the clamp meter can be used to 1000V AC rms, but that it will be safe to the user if inadvertently connected across a voltage up to 1000V AC rms to earth.

If the removable probe tip caps are not fitted to the probes of the test leads, their measurement category becomes CAT II 1000V, and they must not be used on CAT III or CAT IV installations to avoid the risk of shorting high energy circuits and arc flash.

When this unit is used in combination with test leads, the measurement category of the combination is the lower measurement category of either this unit or the test leads used. Likewise if test lead accessories such as crocodile clips are also used, the measurement category will be the lowest measurement category in that combination.

**Do not use** if the battery compartment cover is not fitted.

When using test leads, **always** keep your fingers behind the finger guard on the test lead probe.

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When positioning the clamp jaws around a hazardous live conductor **always** keep your fingers behind the clamp finger guard.

To avoid electrical shock, and damage to the clamp meter, do not use the clamp meter and the associated temperature probe when voltages at the measurement surface exceed 30V AC rms or 60V DC.

#### Cautions

Avoid severe mechanical shock or vibration and extreme temperature.

When using test leads avoid excessive stresses to the cable entry points at the probe and 4mm plug connector.

To avoid burns or damage to equipment, do not take temperature measurements inside microwave ovens.

To avoid corrosion from a leaking battery, remove the battery when the unit is not in use for an extended period.

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## 2. INTRODUCTION

### 2.1 Inspection

Examine the shipping carton for any sign of damage. Inspect the unit and any accessories for damage. If there is any damage then consult your distributor immediately.

### 2.2 Description

The Martindale CM87 has the following measurement functions:

- ◆ True RMS AC current to 1500A
- ◆ DC current to 2000A
- ◆ Inrush current
- ◆ True RMS AC voltage to 750V
- ◆ DC voltage to 1000V
- ◆ Resistance to 66 MΩ
- ◆ Capacitance to 6.6mF
- ◆ Frequency to 1MHz
- ◆ Duty cycle
- ◆ Temperature (Type K thermocouple)
- ◆ Continuity with audible indication
- ◆ Diode testing

Further functions are:

- ◆ Display hold
- ◆ Max/Min indication
- ◆ DC current zeroing
- ◆ Relative function
- ◆ Display backlight
- ◆ Auto power off

### 2.3 Accessories

The CM87 comes with the following accessories:

- ◆ Set of TL16 test leads
- ◆ Type K thermocouple
- ◆ 9V PP3 battery (Installed)
- ◆ Carry case and Instructions


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### 3. OPERATION







#### 3.1 General

If the clamp meter displays **OL** or **-OL** then the measurement limits of the range have been exceeded.

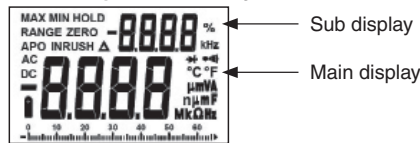
#### 3.2 Low Battery Indication

If the battery symbol  is displayed, the battery needs replacing as measurement accuracy can no longer be guaranteed. (See section 4.1 Battery Replacement).

#### 3.3 Description of Press Buttons





	Selects display hold
	Turns backlight on/off
	Zero's DC current ranges and selects the relative function
	Selects max/min function
	Selects inrush current measurement
	Selects between the resistance, continuity and diode test functions

#### 3.4 Description of LCD Symbols



<b>MAX</b>	Maximum indication is displayed
<b>MIN</b>	Minimum indication is displayed
<b>HOLD</b>	Display hold is activated

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<b>ZERO</b>	Indicates DC current zero is activated
<b>APO</b>	Auto power off is activated
<b>INRUSH</b>	Inrush current measurement is selected
	Relative function is activated
	Diode testing function is selected
	Continuity function is selected
<b>mV, V, A, nF, μF, mF, Ω, kΩ, MΩ, Hz, kHz, MHz, °C, °F, %</b>	Units of measurement being displayed
	Low battery indication
<b>AC</b>	Indicates AC measurement
<b>DC</b>	Indicates DC measurement

#### 3.5 Auto Power Off

If the clamp meter is inactive for a period of 30 minutes it will automatically power off.

If any button is pressed after the clamp meter has automatically powered off, the clamp meter will turn back on.

To disable the auto power off function hold the **MAX/MIN** button at the same time as turning the rotary switch from **OFF** to any position. The **APO** symbol will no longer be displayed on the LCD.

#### 3.6 Backlight

To switch on the backlight press the  button. Press again to turn the backlight off.

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#### 3.7 Display Hold

To hold a displayed value, press the **HOLD** button. The LCD will display **HOLD**.


To exit display hold, press the **HOLD** button again.


#### 3.8 Max/Min

To activate the Max/Min function, press the **MAX/MIN** button. To alternate between displaying the maximum and minimum measured values, press the **MAX/MIN** button as required.

To exit the Max/Min function, hold down the **MAX/MIN** button for 2 seconds.

#### 3.9 DC Current Zero and Relative Function


The  button is dual function and dependant on the measurement function selected.

When the DC current ranges are selected, pressing the  button will zero the selected range.


The LCD will display **ZERO**.


Press the  for 2 seconds to remove the zero.

When the AC current, AC and DC voltage, capacitance and temperature measurement functions are selected the relative function can be used to remove an offset/residual value from a measurement.

To activate the relative function, press the  button to store the offset/residual value. This will now be removed from all consequent readings until the relative mode is deactivated.

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The LCD will display .

Press the  button again to deactivate the relative function.

#### 3.10 Use of the TL16 Leads

Where access to test points may require extended probe tips, the probe tip caps may be removed by gently pulling them forward until they unclip from the probe body.



#### 3.11 AC Current Measurements

Set the rotary switch to the  $\tilde{660A}$  or  $\tilde{1500A}$  position as required.

Taking all necessary safety precautions, press the clamp meter trigger to open the clamp jaws, position the jaws around the conductor to be measured, and release the trigger to close the jaws.

Position the clamp meter so the conductor is central within the clamp jaws.

Read the measured ac current from the main display.


Read the frequency of the measured ac current from the sub-display.

Note: To avoid the possibility of an incorrect measurement only clamp around the conductor being measured.

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### 3.12 DC Current Measurements

Set the rotary switch to the  $\overline{660A}$  or  $\overline{2000A}$  position as required.

If required, with the clamp meter positioned away from any live conductors, zero the selected DC current range by pressing the  button.

Taking all necessary safety precautions, press the clamp meter trigger to open the clamp jaws, position the jaws around the conductor to be measured, and release the trigger to close the jaws.


Position the clamp meter so the conductor is central within the clamp jaws.

Read the measured DC current from the display.

Note: To avoid the possibility of an incorrect measurement only clamp around the conductor being measured.

### 3.13 Inrush Current Measurements

Set the rotary switch to the  $\widetilde{660A}$  or  $\widetilde{1500A}$  position as required.

Press the  button to select the inrush current measurement function. The LCD will display **INRUSH**.

Taking all necessary safety precautions, press the clamp meter trigger to open the clamp jaws, position the jaws around the conductor to be measured, and release the trigger to close the jaws.

Position the clamp meter so the conductor is central within the clamp jaws.

The clamp meter will display “- - -” until the device being measured has powered up and the clamp meter has detected and measured the inrush current. 10


A single measurement is made and the measured inrush current is held on the main display.

To exit the inrush current measurement function, press the **INRUSH** button for 2 seconds.

Note: To avoid the possibility of an incorrect measurement only clamp around the conductor being measured.

Note 2: The clamp meter will not respond to an inrush current of less than 10 A on the 660A range and 100A on the 1500A range.

### 3.14 AC Voltage Measurements


Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the **V~** position.

Taking all necessary safety precautions connect the test leads to the circuit being measured and read the measured ac voltage from the main display.


Read the frequency of the measured ac voltage from the sub-display.

### 3.15 DC Voltage Measurements

Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the **V---** position.

Taking all necessary safety precautions connect the test leads to the circuit being measured and read the measured DC voltage from the display. 11

Press the  button twice. The LCD will display  $\rightarrow+$ .

Taking all necessary safety precautions connect the test leads to the diode being tested.


If the diode is good a forward bias will give a display reading of around 0.6 V (silicon diode) and a reverse bias will give a display of **OL**. If the diode is shorted or open circuit the display will indicate approx. 0V or **OL** respectively for both forward and reverse bias.

### 3.19 Temperature Measurements


Set the rotary switch to the **Temp 1000°C** or **Temp 1832°F** position as required, and set the **TEMP** switch to the **TEMP** position. Connect a Type K thermocouple probe, suitable for the type of temperature measurement and temperature range being made, to the **K-TYPE** sockets.

Taking all necessary safety precautions position the thermocouple at the surface or in the medium to be measured and read the measured temperature from the display.

### 3.20 Continuity Testing

Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the  $\rightarrow+ \bullet))$   $\Omega$  position.


Press the  button once. The LCD will display  $\bullet))$ .

Taking all necessary safety precautions connect the test leads to the circuit being tested.

If the resistance is < 30 $\Omega$ , the buzzer will sound continuously. The resistance value will be displayed if  $\leq 660\Omega$ .


### 3.21 Diode Testing


If the diode to be tested is in circuit, be sure the circuit power is switched off.

Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the  $\rightarrow+ \bullet))$   $\Omega$  position. 13


### 3.16 Resistance Measurements


Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.


Set the rotary switch to the  Ω position.

Taking all necessary safety precautions connect the test leads to the circuit being measured and read the measured resistance from the display.

### 3.17 Capacitance Measurements

 Be sure the capacitor being tested is completely discharged before connecting the test leads.


Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the  position.

Taking all necessary safety precautions and observing the correct polarity for electrolytic capacitors, connect the test probes to the capacitor to be measured.

Read the measured capacitance from the display.

### 3.18 Frequency and Duty Cycle Measurements

Connect the black test lead to the **COM** terminal and the red test lead to the **VΩHz**  terminal.

Set the rotary switch to the **Hz %** position.


Taking all necessary safety precautions connect the test leads to the circuit being measured and read the measured frequency from the main display.

Read the measured duty cycle from the sub-display.

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## 4. MAINTENANCE

### 4.1 Battery Replacement

 To avoid shock or injury, disconnect the clamp meter from any external circuits and remove the test leads before proceeding.


The battery compartment is underneath the unit and can be accessed by undoing the 2 screws.

Fit a new 9V, PP3 carbon-zinc battery (IEC 6F22, NEDA 1604D) observing correct polarity.

Replace the battery compartment cover and screws.

### 4.2 Test Lead Replacement

If the test leads become damaged they should be replaced.

 The replacement test leads must have the same (or better) overvoltage category rating as the TL16 leads supplied.

### 4.3 Calibration


To maintain the integrity of measurements made using your instrument, Martindale Electric recommends that it is returned at least once a year to an approved Calibration Laboratory for recalibration and certification.

Martindale Electric is pleased to offer you this service. Please contact our Service Department for details.


Email: [service@martindale-electric.co.uk](mailto:service@martindale-electric.co.uk)

Tel: 01923 650660

### 4.4 Cleaning

 To reduce the risk of surface leakage, this instrument must be kept in a clean condition.

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 Prior to cleaning, ensure that the instrument is disconnected from any voltage source.

If contamination is found, clean with a damp soft cloth and if necessary a mild detergent or alcohol. Do not use abrasives, abrasive solvents, or detergents which can cause damage to the unit. If a mild detergent is used, the unit should subsequently be thoroughly cleaned with a water dampened soft cloth. After cleaning, dry and allow to remain in a dry environment for 2 hours before use.

### 4.5 Repair & Service

There are no user serviceable parts in this unit other than those that may be described in section 4. Return to Martindale Electric if faulty. Our service department will quote promptly to repair any fault that occurs outside the guarantee period.

Before the unit is returned, please ensure that you have checked the unit, battery, leads and poor connections.

### 4.6 Storage Conditions

The instrument should be kept in warm dry conditions away from direct sources of heat or sunlight, and in such a manner as to preserve the working life of the unit. It is strongly advised that the unit is not kept in a tool box where other tools may damage it.

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## 5. WARRANTY AND LIMITATION OF LIABILITY

This Martindale product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is 2 years and begins on the date of receipt by the end user. This warranty extends only to the original buyer or end-user customer, and does not apply to fuses, disposable batteries, test leads or to any product which, in Martindale's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation, handling or storage.

Martindale authorised resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Martindale.

Martindale's warranty obligation is limited, at Martindale's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to Martindale within the warranty period.

This warranty is the buyer's sole and exclusive remedy and is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. Martindale shall not be liable for any special, indirect, incidental or consequential damages or losses, including loss of data, arising from any cause or theory.

Since some jurisdictions do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any part of any provision of this warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision or other part of that provision.

Nothing in this statement reduces your statutory rights.

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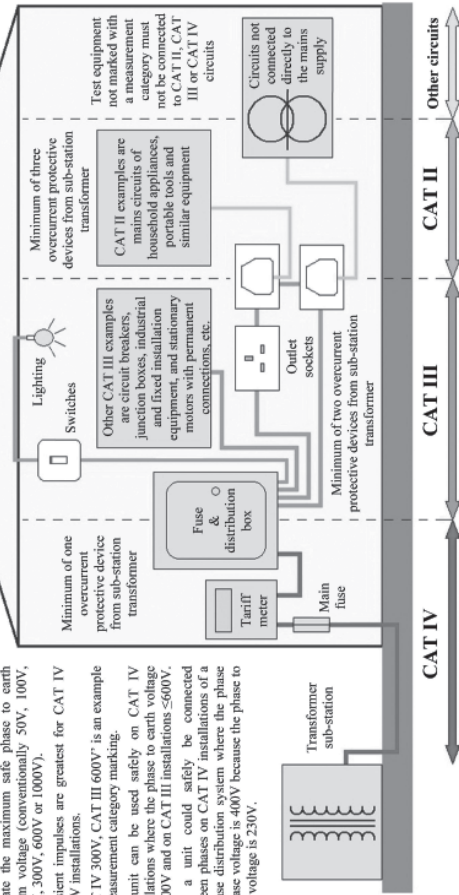
### Measurement Categories

Measurement categories are determined by the potential for dangerous transient impulses on the mains supply system, the magnitude of which depends on the amount of dumping of the transient energy due to the location within the system and the system voltage. Short-circuit current levels are also a factor. Test equipment used for measuring mains circuits will be marked with one or more of three measurement categories, CAT II, CAT III or CAT IV, to identify on which installations of a mains supply system it can safely be used.

Each category has a voltage rating marked to indicate the maximum safe phase to earth system voltage (conventionally 50V, 100V, 150V, 300V, 600V or 1000V). Transient impulses are greatest for CAT IV 1000V installations.

\*CAT IV 300V, CAT III 600V is an example of measurement category marking.

The unit can be used safely on CAT IV installations where the phase to earth voltage is  $\leq 500V$  and on CAT III installations  $\leq 600V$ . Such a unit could safely be connected between phases on CAT IV installations of a 3-phase distribution system where the phase to phase voltage is 400V because the phase to earth voltage is 230V.



CAT IV measurements are extremely dangerous. All proper safety measures must be taken to avoid the risk of shorting high energy circuits and arc flash.



### Specification CM87 Clamp meters



All specified accuracies are at 23°C ± 5°C, <70% RH for 1 year.  
**Temperature Coefficient:** 0.1 x (specified accuracy) per °C. (0°C to 18°C, 28°C to 50°C).

All accuracies below are expressed as ± (percentage of reading + digits)

#### DC Voltage

Range	Resolution	Input impedance	Accuracy
6.6V	0.001V	10MΩ	0.5% + 2
66V	0.01V	9.1MΩ	
660V	0.1V		
1000V	1V		

Overload Protection: 1000V DC or 750V AC rms

#### AC Voltage (True RMS)

Range	Resolution	Input impedance	Accuracy (50Hz to 500Hz)
6.6V	0.001V	10MΩ	1.5% + 8
66V	0.01V	9.1MΩ	
660V	0.1V		
750V	1V		

True rms AC voltage accuracy is specified from 5% of range to 100% of range.

Crest factor:  $\leq 3$

Frequency measurement accuracy (50Hz to 1kHz): 0.1% + 5

Minimum input voltage: >500 dgts

Overload Protection: 1000V DC or 750V AC rms



### Specification CM87 Clamp meters

#### Resistance

Range	Resolution	Open circuit voltage	Accuracy
660Ω	0.1Ω	-3.2V dc	1.0% + 5
6.6kΩ	0.001kΩ		
66kΩ	0.01kΩ		
660kΩ	0.1kΩ		
6.6MΩ	0.001MΩ	-1.1V dc	2.0% + 5
66MΩ	0.01MΩ		3.5% + 5

Overload Protection: 600V DC or AC rms

#### Capacitance

Range	Resolution	Accuracy
6.6nF	0.001nF	3.0% + 30
66nF	0.01nF	3.0% + 10
660nF	0.1nF	3.0% + 30
6.6μF	0.001μF	3.0% + 10
66μF	0.01μF	
660μF	0.1μF	
6.6mF	0.001mF	5.0% + 10

Overload Protection: 600V DC or AC rms



### Specification CM87 Clamp meters

#### AC Current (True RMS)

Range	Resolution	Accuracy	
		50Hz to 60Hz	60Hz to 400Hz
660A	0.1A	2.0% + 10	3.0% + 10
1500A	1A	2.5% + 10 ( $\leq 1000A$ )	3.5% + 10 ( $\leq 1000A$ )
		5.0% + 10 (>1000A)	

True rms AC current accuracy is specified from 5% of range to 100% of range.

Crest factor:  $\leq 3$

Frequency measurement accuracy (50Hz to 1kHz): 0.1% + 5

Minimum input current: >500 dgts

Overload Protection: 1500A AC rms

#### DC Current

Range	Resolution	Accuracy
660A	0.1A	2.0% + 5
2000A	1A	3.0% + 5 ( $\leq 1000A$ )
		5.0% + 5 (>1000A)

Overload Protection: 2000A DC for 60 seconds maximum



Specification  
CM87  
Clamp meters

**Frequency**

Range	Resolution	Accuracy
66Hz	0.01Hz	0.1% + 5
660Hz	0.1Hz	
6.6kHz	0.001kHz	
66kHz	0.01kHz	
660kHz	0.1kHz	
1MHz	0.001MHz	

Sensitivity (10Hz to 1MHz): >3.5V AC rms  
Minimum input frequency: 10Hz  
Minimum pulse width: >1µs  
Duty cycle limits: >30% and <70%  
Overload protection: 600V DC or AC rms

**Duty Cycle**

Range	Frequency range	Resolution	Pulse width	Accuracy (5V logic)
5% to 95%	40Hz to 20kHz	0.1%	> 10µs	2.0% + 10

Overload protection: 600V DC or AC rms

**Temperature** (Type K Thermocouple)

Range	Resolution	Accuracy
0°C to 400°C	1°C	1.0% + 2
-20°C to 0°C, 400°C to 1000°C		2.0% + 3
32°F to 750°F	1°F	1.0% + 4
-4°F to 32°F, 750°F to 1832°F		2.0% + 6

Overload protection: 60V DC or 30V AC rms



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**Continuity**

Range	Resolution	Response time	Open circuit voltage	Audible indication
660Ω	0.1Ω	100ms approx.	-3.2V dc	<30Ω

Overload protection: 600V DC or AC rms

**Diode Test**

Range	Resolution	Test current	Open circuit voltage	Audible indication	Accuracy
2V	1 mV	0.8mA	3.2V dc typical	<0.25V	1.5% + 5

Overload protection: 600V DC or AC rms

**GENERAL**

Display: Liquid crystal display  
Digital, 6600 counts, updates 2.8/sec  
Polarity: automatic, positive implied, '-' for negative polarity indication  
Overrange: (OL) or (-OL) is displayed  
Bar-graph, 66 segments, updates 28/sec

Power: 9V, PP3 carbon-zinc battery (IEC 6F22, NEDA 1604D)

Battery life: 75 hours typical with carbon zinc

Low battery indication: symbol displayed

Auto power off: after 30 minutes

Jaw opening capability: conductor diameter 57mm  
bus bar 70 x 18mm

Dimensions: 281 x 108 x 53mm

Weight: 585g approx. including battery

Includes: carrying case, set of TL16 test leads, Type K thermocouple, 9V PP3 battery (installed), instructions



Specification  
CM87  
Clamp meters

**ENVIRONMENTAL**

Temperature & humidity: (Operating): 0°C to 50°C <70% R.H.  
(Storage): -20°C to 60°C < 80% R.H.

Altitude: up to 2000m

Pollution degree 2, indoor use

**SAFETY**

Conforms to BS EN 61010-1, BS EN 61010-2-032, CAT IV 600V, CAT III 1000V

Class II, Double insulation

**EMC**

Conforms to BS EN 61326-1

**SPECIFICATION FOR TL16 TEST LEADS**

Maximum voltage: 1000V AC/DC

Maximum current: 10A continuous

Connector: 4mm banana plug with fixed shroud

**Environmental**

Temperature (Operating & Storage): 0°C to 40°C

Altitude: up to 2000m

Pollution degree 2

**Safety**

Conforms to BS EN 61010-031,

CAT IV 600V, CAT III 1000V, 10A (Probe tip caps fitted)

CAT II 1000V, 10A (Probe tip caps removed)

Class II, Double insulation

Check out what else you can get from Martindale:

- 18th Edition Testers
- Accessories
- Calibration Equipment
- Continuity Testers
- Electricians' Kits
- Environmental Products
- Full Calibration & Repair Service
- Fuse Finders
- Digital Clamp Meters
- Digital Multimeters
- Labels
- Microwave Leakage Detectors
- Motor Maintenance Equipment
- Multifunction Testers
- Non-trip Loop Testers
- Pat Testers & Accessories
- Phase Rotation Testers
- Proving Units
- Socket Testers
- Thermometers & Probes
- Test Leads
- Voltage Indicators
- Specialist Metrohm Testers (4 & 5kV)
- Specialist Drummond Testers



Martindale Electric Company Limited  
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