



**163**

**Digital Multimeter  
Instruction Manual**



## TABLE OF CONTENTS

---

	<b>page</b>
<b>A. INTRODUCTION</b>	
1. Congratulations . . . . .	3
2. Product Description . . . . .	3
3. EC Declaration of Conformity . . . . .	4
<b>B. SAFETY CONSIDERATIONS</b> . . . . .	5
<b>C. TECHNICAL DATA</b>	
1. Features and Benefits . . . . .	6
2. Product Applications . . . . .	7
2. Specifications . . . . .	8
<b>D. MEASUREMENT TECHNIQUES</b>	
1. Controls and Functions . . . . .	10
2. Step by Step Procedures:	
a) Measuring DC Volts . . . . .	12
b) Measuring AC Volts . . . . .	15
c) Measuring DC Amps . . . . .	16
d) Measuring AC Amps . . . . .	17
e) Measuring Resistance . . . . .	19
f) Measuring Diodes . . . . .	20
g) Continuity Buzzer . . . . .	21
h) Data Hold . . . . .	21
<b>E. ACCESSORIES</b> . . . . .	22
<b>F. MAINTENANCE</b> . . . . .	22
<b>G. TROUBLE SHOOTING GUIDE</b> . . . . .	23

## A. INTRODUCTION

---

### 1. Congratulations!!

Thank you for purchasing TPI brand products. The meter is easy to use and is built to last. It is backed by a 3 year limited warranty. Please remember to complete and return your product warranty registration card.

### 2. Product Description

The 163 is a hand-held autoranging DMM. The 163 measures ACV, DCV, ACA, DCA, Resistance, Diodes and Continuity.

The 163 also features:

- **RANGE** Allows the user to manually range the 163 instead of autoranging.
- **Data Hold** Holds the reading on the display for easy viewing.
- **Auto Off** Preserves battery life.

The 163 comes complete with the following accessories:

**Rubber Boot**  
**Test Lead Set**  
**Instruction Manual**  
**Battery**

### 3. EC Declaration of Conformity

This is to certify that model 163 conforms to the protection requirements of the council directive 89/336/EEC, in the approximation of laws of the member states relating to Electromagnetic compatibility and 73/23/EEC, The Low Voltage Directive by application of the following standards:


EN 50081-1	1992 Emissions Standard
EN 50082-1	1992 Immunity Standard
EN61010-1	1993 Safety Standard
EN61010-2-031	1995 Safety Standard

To ensure conformity with these standards, this instrument must be operated in accordance with the instructions and specifications given in this manual.

#### **CAUTION:**

**Even though this instrument complies with the immunity standards, the accuracy can be affected by strong radio emissions not covered in the above standards. Sources such as hand held radio transceivers, radio and TV transmitters, vehicle radios and cellular phones generate electromagnetic radiation that could be induced into the test leads of this instrument. Care should be taken to avoid such situations or alternatively, check to make sure that the instrument is not being influenced by these emissions.**

## B. SAFETY CONSIDERATIONS

 **WARNING: Please follow manufacturers test procedures whenever possible. Do not attempt to measure unknown voltages or components until a complete understanding of the circuit is obtained.**

### GENERAL GUIDELINES

#### ALWAYS

- Test the 163 before using it to make sure it is operating properly.
- Inspect the test leads before using to make sure there are no breaks or shorts.
- Double check all connections before testing.
- Have someone check on you periodically if working alone.
- Have complete understanding of circuit being measured.
- Disconnect power to circuit, then connect test leads to the 163, then to circuit being measured.

#### NEVER

- Attempt to measure unknown high voltages.
- Attempt to measure current with the meter in parallel to the circuit.
- Connect the test leads to a live circuit before setting up the instrument.
- Touch any exposed metal part of the test lead assembly.

## INTERNATIONAL SYMBOLS



**CAUTION: RISK OF ELECTRIC SHOCK**



**AC (ALTERNATING CURRENT)**



**DC (DIRECT CURRENT)**



**REFER TO INSTRUCTION MANUAL**



**GROUND**



**FUSE**



**DOUBLE INSULATION**

## C. TECHNICAL DATA

---

### 1. Features and Benefits

<b>Safety</b>	Meets CE and IEC 1010 requirements. UL Listed to U.S. and Canadian Safety Standards.
<b>Data Hold</b>	Holds the reading on the display.
<b>Range</b>	Allows you to either manual range or use auto range to select the appropriate range.
<b>Auto Off</b>	Preserves battery life. LCD shows OFF when in this mode.
<b>Large LCD</b>	Easy to read at all angles and the majority of lighting levels.
<b>Rubber Boot</b>	Added protection when the instrument is dropped.

### 2. Product Applications

Perform the following tests and/or measurements with the TPI 163 and the appropriate function:

#### HVAC/R

##### FUNCTION

<b>DCmV</b>	• Thermocouples in furnaces or gas applications.
<b>ACA</b>	• Heat anticipator current in thermostats.
<b>ACV</b>	• Line voltage.
<b>ACV or DCV</b>	• Control circuit voltage.
<b>DC<math>\mu</math>A</b>	• Flame safeguard control current.
<b>OHMS</b>	• Heating element resistance (continuity).
<b>OHMS</b>	• Compressor winding resistance.
<b>OHMS</b>	• Contactor and relay coil resistance.
<b>OHMS</b>	• Continuity of wiring.
<b>DCmV</b>	• Temperature with optional temperature adapter (A310).
<b>ALL</b>	• Bar graph to indicate rapid fluctuations in measurements.

#### ELECTRICAL

##### FUNCTION

<b>ACV</b>	• Measure line voltage.
<b>OHMS</b>	• Continuity of circuit breakers.
<b>DCV</b>	• Voltage of direct drive DC motors.

### 3. Specifications

**CE** IEC 1010 Over Voltage:  
 CAT II - 1000V  
 CAT III - 600V  
 Pollution Degree 2



a. DCV			
Range	Resolution	Accuracy	Impedance
326mV	0.1mV	±0.5% of reading, ±2 digits	10MΩ
3.26V	0.001V		
32.60V	0.01V	±1.0% of reading, ±2 digits	
326V	0.1V		
1000V	1V		

b. ACV			
Range	Resolution	Accuracy	Impedance
3.26V	0.001V	±1.2% of reading, ±4 digits	10MΩ
32.6V	0.01V		
326V	0.1V		
750V	1V		

c. DCA			
Range	Resolution	Accuracy	Overload Protection
326μA	0.1μA	±1% of reading, ±2 digits	Fuse* (fast blow) F600V, .5A, 31CM
3260mA	0.001mA		
32.6mA	0.01mA	±1.5% of reading, ±2 digits	Fuse* (fast blow) F600V, 10A, 31CM
326mA	0.1mA		
10A	0.01A	±2% of reading, ±2 digits	

**Warning:** Use only correct size, voltage and current rated fuses.  
 Test Leads: Use only correct type and overvoltage category rating.

Fuse* (fast blow)			
3260mA	0.001mA	±2 digits	F600V, .5A, 31CM
32.6mA	0.01mA	±1.5% of reading, ±2 digits	Fuse* (fast blow) F600V, 10A, 31CM
326mA	0.1mA		
10A	0.01A	±2% of reading, ±2 digits	

Overload Protection			
326μA	0.1μA	±2% of reading, ±5 digits	Fuse* (fast blow) F600V, .5A, 31CM
3260μA	1μA		
32.60mA	0.01mA	±2.5% of reading, ±5 digits	Fuse* (fast blow) F600V, 10A, 31CM
326mA	0.1mA		
10A	0.01A		

Overload Protection			
326Ω	0.1Ω	±1% of reading, ±2 digits	450V DC or AC Peak
3.26kΩ	0.001kΩ		
32.6kΩ	0.01kΩ		

3.26MΩ	0.001MΩ	±2% of reading, ±2 digits	
32.6MΩ	0.01MΩ	±3.5% of reading, ±4 digits	

f. Diode Test		
Test Voltage	Max Test Current	Over Load Protection
3V	Approx. 0.5mA	600 V DC or Peak AC
Test Voltage	Threshold	Over Load Protection
1.2V	< 20Ω	600 V DC or Peak AC
Max. Volt. between any Input and Ground		1000V


**Warning:** Use only correct size, voltage and current rated fuses.  
 Test Leads: Use only correct type and overvoltage category rating.

<b>Fuse Protection</b>	<b>mA:</b> 0.5Amp/600VAC <b>A:</b> 10Amp/600VAC
<b>Display Type</b>	3260 Count, with 34 segment bargraph and low battery indication.
<b>Operating Temp.</b>	-0° to 40°C (32° to 104°F)
<b>Storage Temp.</b>	-10° to 50°C (14° to 122°F)
<b>Relative Humidity</b>	0% to 80%
<b>Power Supply</b>	2 each 1.5 Volt "AA" Batteries
<b>Battery Life</b>	200 hrs. Typical
<b>Size (H x L x W)</b>	33mm x 86mm x 187mm (1.3in x 3.4in x 7.4in)
<b>Weight</b>	340g (12oz)

## D. MEASUREMENT TECHNIQUES

### 1. Controls and Functions:

#### *Push Buttons*


**RANGE**  Activates manual ranging. Hold in for 3 seconds to return to autorange. Also selects between continuity buzzer and diode test.


**DATA-H** Holds the reading on the display until the button is pushed a second time.


#### *Rotary Switch*


**OFF (0)** Manually turns the 163 off.

**10A** Function for measuring DC Amps (A).

**mA**  Function for measuring milliamps (mA) DC.  
1 milliamp = 0.001 Amp

**µA**  Function for measuring microamps (µA) DC.  
1 microamp = 0.000001Amp

**V**  Function for measuring DC Volts.

**V**  Function for measuring AC Volts.

**µA** Function for measuring microamps (µA) AC.  
1 microamp = 0.000001Amp

**mA** Function for measuring milliamps (mA) AC.

**mA** Function for measuring milliamps (mA) AC.  
1 milliamp = 0.001Amp

**10A** Function for measuring AC Amps (A).  
Function for using audible Continuity Buzzer.

**Ω** Function for measuring Ohms (resistance) and testing Diodes.

**OFF (0)** Manually turns the 163 off.



### 1. Controls and Functions: (cont.)

#### *Input Jacks*

**A** Red test lead connection for current measurements on the 10A functions.

**mA $\mu$ A** Red test lead connection for current measurement on the mA and  $\mu$ A functions.

**COM** Black test lead connection for all functions.

**V $\Omega$**  Red test lead connection for all Volt, Ohm, Diode and Continuity measurements.



## 2. Step by Step Procedures:

### **CAUTION!**

**Do not attempt to make a voltage measurement if a test lead is plugged in the A or  $\mu$ A input jack. Instrument damage and/or personal injury may result.**

### **WARNING!**

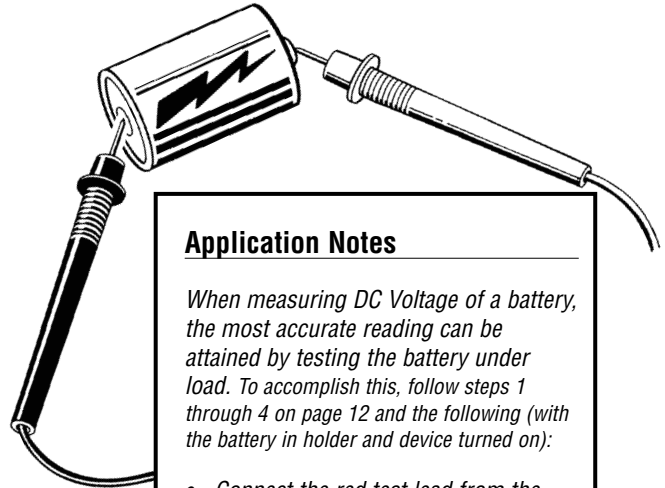
**Do not attempt to make a voltage measurement of more than 1000V or of a voltage level that is unknown.**



### Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
V	COM	V $\Omega$	0.1mV	1000V

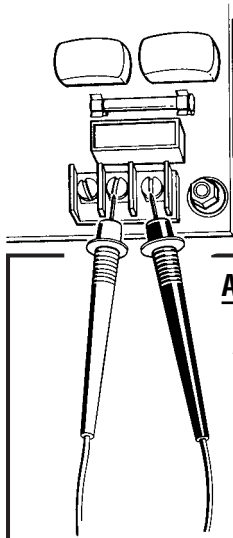
## a. MEASURING DC VOLTS (cont.)



### Application Notes

*When measuring DC Voltage of a battery, the most accurate reading can be attained by testing the battery under load. To accomplish this, follow steps 1 through 4 on page 12 and the following (with the battery in holder and device turned on):*

- Connect the red test lead from the meter to the positive (+) terminal of the battery.
- Connect the black test lead to the negative (-) terminal of the battery.
- Reconnect power to the circuit and read the voltage on the 163.



### Application Notes


Disconnect power from the terminal block, find the fuse or circuit breaker that controls the block and turn it off.

Set up the meter following the steps under "Measurement Procedure" on page 15. Then

proceed with the following:

- Connect the red test lead to the hot side of the block and the black lead to the neutral side of the block. Reconnect power to the block and read the voltage on the meter. The reading should be approximately 110V to 130V.
- Disconnect power from the block and move the red wire to ground. Reconnect power to the block and read the voltage on the meter. Typically less than 20V should exist from neutral to ground. If 110V or above exists, the block may be wired incorrectly.

### Measurement Procedure:

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug red test lead into the **V $\Omega$**  input jack.
4. Set rotary switch to the **V** range.
5. Connect the test leads to the circuit to be measured. 
6. Reconnect power to the circuit to be measured.
7. Read the voltage on the 163.

### CAUTION!

Do not attempt to make a voltage measurement if a test lead is plugged in the **A** or **mA** input jack. Instrument damage and/or personal injury may result.

### WARNING!

Do not attempt to make a voltage measurement of more than 750V or of a voltage level that is unknown.

### Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
V	COM	V $\Omega$	0.001V	750V



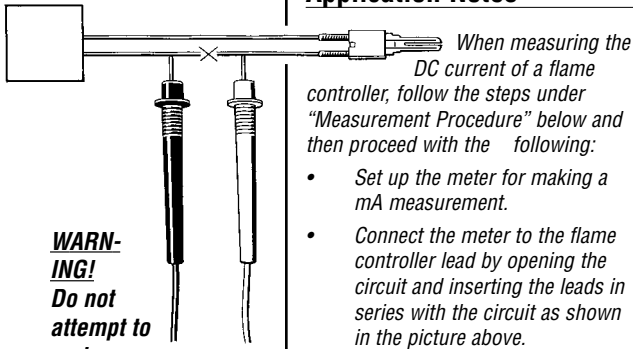
**Measurement Procedure:**

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug the red test lead into the **VΩ** input jack.
- ⚠ 4. Set the rotary switch to the **V** function.
5. Connect the test leads to the circuit to be measured.
6. Reconnect power to the circuit to be measured.
7. Read the voltage on the 163.

**CAUTION!**

*Do not attempt to make a current measurement with the test leads connected in parallel with the circuit to be tested. Test leads must be connected in series with the circuit.*

**Application Notes**



**WARNING!**  
Do not attempt to make a

current measurement of more than 600V present. Instrument

circuits with damage and

**Instrument set-up:**

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
μA	COM	mAμA	0.1μA	3260μA

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
μA	COM	mAμA	0.1μA	3260μA
mA	COM	mAμA	0.01mA	326mA
10A	COM	A	0.01A	10.00A

**Measurement Procedure:**

1. Disconnect power to circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug the red test lead into the **mAμA** or **A** input jack depending on the value of current to be measured.
4. Set the rotary switch to the **μA**, **mA**, or **10A** function.
5. Connect test leads in series to circuit to be measured.
6. Reconnect power to the circuit to be measured.
7. Read the current on the 163.

**CAUTION!**

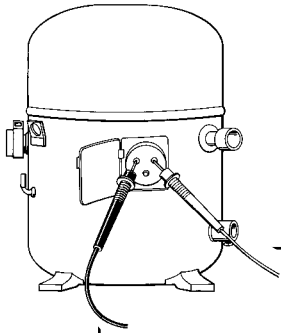
*Do not attempt to make a current measurement with the test leads connected in parallel with the circuit to be tested. Test leads must be connected in series with the circuit.*

**WARNING!**

*Do not attempt to make a current measurement of circuits with more than 600V present. Instrument damage and/or personal injury may result.*

**Instrument set-up:**

FUNCTION	BLACK	RED	MINIMUM	MAXIMUM
----------	-------	-----	---------	---------



### Application Notes

*When measuring resistance of a motor, make sure the power is disconnected prior to testing.*

*Set up the meter following the steps under "Measurement Procedure" on page 19, and then proceed with the following:*

- *Connect the red test lead to one power input line of the motor and the black test lead to the other power input line of the motor. In most applications if the reading is OFL, the motor winding is open.*
- *Connect the red test lead to the frame of the motor and the black test lead to the winding. In most applications if a reading of 0 Ohms is displayed, the winding is shorted to the motor frame (ground).*

	TEST LEAD	TEST LEAD	READING	READING
$\mu\text{A}$	COM	$\text{mA}\mu\text{A}$	$0.1\mu\text{A}$	$3260\mu\text{A}$
$\triangle$	$\text{mA}$	COM	$0.01\text{mA}$	$326\text{mA}$
	$10\text{A}$	COM	$0.01\text{A}$	$10.00\text{A}$

### Measurement Procedure:

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug the red test lead into the  **$\text{mA}\mu\text{A}$**  or **A** input jack depending on the value of current to be measured.
4. Set the rotary switch to the  **$\mu\text{A}$** ,  **$\text{mA}$**  or  **$10\text{A}$**  function.
5. Connect test leads in series to circuit to be measured.
6. Reconnect power to the circuit to be measured.
7. Read the current on the 163.



### **WARNING!**

**Do not attempt to make resistance measurements with circuit energized. For best results, remove the resistor completely from the circuit before attempting to measure it.**



### **NOTE:**

**To make accurate low ohm measurements, short the ends of the test leads together and record the resistance reading. Deduct this value from actual readings.**

**Instrument set-up:**

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
$\Omega$	COM	V $\Omega$	0.1 $\Omega$	32.6M

**Measurement Procedure:**

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug the red test lead into the **V $\Omega$**  input jack.
4. Set the rotary switch on the 163 to the  $\Omega$  function.
5. Connect the test leads to the circuit to be measured.
6. Read the resistance value on the 163.

**CAUTION!**

Do not attempt to make diode measurements with circuit energized. The only way to accurately test a diode is to remove it completely from the circuit before attempting to measure it.

**Instrument set-up:**

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
	COM	V $\Omega$	0.001V	2.000V

**Measurement Procedure:**

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.
3. Plug the red test lead into the **V $\Omega$**  input jack.

4. Set the rotary switch to the function.

5. Press the **Range/Diode/Continuity** button so that shows on the LCD.

6. Connect the black test lead to the banded end of the diode and the red test lead to the non-banded end of the diode.

7. Reading on the display should be between 0.3 and 0.8 volts.

8. Reverse test lead connections in 6 above.

9. Reading on the display should be OFL (Overload).

**NOTE:** If diode reads 0 in both directions, diode is shorted. If diode reads OFL in both directions, diode is open.

**WARNING!**

Do not attempt to make continuity measurements with circuit energized.

**Instrument set-up:**

FUNCTION	BLACK TEST LEAD	RED TEST LEAD
	COM	V $\Omega$

**Measurement Procedure:**

1. Disconnect power to the circuit to be measured.
2. Plug the black test lead into the **COM** input jack.

3. Plug the red test lead into the  $V\Omega$  input jack.

Standard Accessories	Part No.
2 Each 1.5 Volt "AA" Batteries	A002
Fuse, 0.5 Amp	A104
Fuse, 10 Amp	A110
Test Lead Set	A050
Rubber Boot	A101

Optional Accessories	Part No.
Deluxe Test Lead Set	SDK1C
IEC 1010 Deluxe Test Lead Kit	TLS2000BC
Temperature Adapter	A301
Boot Hook	A103
Soft Carrying Case	A100

\*These accessories have not been evaluated by UL and are not considered as part of the UL Listing of this product.

4. Set the rotary switch to the function.
5. Press the **Range/Diode/Continuity** button so that shows on the LCD.
6. Connect test leads to the circuit to be measured.
7. Listen for the buzzer to confirm continuity.

Press the **Data Hold** button at any time on any function or range to freeze the reading on the LDC display. This function is very useful when measuring in locations where the display is difficult to read.

## E. ACCESSORIES\*

## F. MAINTENANCE

1. **Battery Replacement:** The 163 will display BAT when the two internal 1.5 Volt "AA" batteries need replacement. Batteries are replaced as follows:
  - a. Disconnect and remove all test leads from live circuits and from the 163.
  - b. Remove 163 from protective boot.
  - c. Remove the three screws from back of housing.

- d. Carefully pull apart front and rear instrument housing.
- e. Remove old batteries and replace with new batteries.
- f. Reassemble instrument in reverse order from above.

2. **Fuse Replacement:** Both the A and mA $\mu$ A input jacks are fuse protected. Use only Fast Blow, 600 Volt fuses with correct current ratings. Failure to do so will void all warranties. If either do not function, replace as follows:
  - a. Disconnect and remove all test leads from live circuits and from the 163.
  - b. Remove 163 from protective boot.
  - c. Remove the three screws from back of housing.
  - d. Carefully pull apart the front and rear instrument housing.
  - e. Remove old fuse(s) and replace it with new fuse(s).
  - f. Reassemble instrument in reverse order from above.
3. **Cleaning your 163**

Use a mild detergent and a slightly damp cloth to clean the surfaces of the 163.

## G. TROUBLE SHOOTING GUIDE

<u>Problem</u>	<u>Probable Causes</u>
----------------	------------------------

### WARRANTY

Please refer to product warranty card for warranty statement.

## Test Products International, Inc.

9615 SW Allen Blvd., Ste. 104  
Beaverton, OR USA 97005  
503-520-9197 • Fax: 503-520-1225 • tpiusa@msn.com

## Test Products International plc

Longley House  
Eas Park  
Crawley, West Sussex RH10 6AP  
England  
Tel: 01293 561212 • Fax: 01293 813465

L163M • 10/28/02 copyright © 2002 Test Products International, Inc.

## 163 SPECIFICATIONS

±0.5% Basic DCV Accuracy (also see pages 8-9)

<u>Function</u>	<u>Range</u>	<u>Resolution</u>
<b>DCV</b>	326mV	0.1mV
	3.26V	0.001V
	32.6V	0.01V
	326V	0.1V
	1000V	1V
<b>ACV</b>	3.26V	0.001V
	32.6V	0.01V
	326V	0.1V
	750V	1V
<b>DCA</b>	326µA	0.1µA
	3260mA	0.001mA
	32.6mA	0.01mA
	326mA	0.1mA
	10A	0.01A
<b>ACA</b>	326µA	0.1µA
	3260µA	1µA
	32.6mA	0.01mA
	326mA	0.1mA
	10A	0.01A
<b>OHM</b>	326Ω	0.1Ω
	3.26kΩ	0.001kΩ
	32.6kΩ	0.01kΩ
	326kΩ	0.1kΩ
	3.26MΩ	0.001MΩ
	32.6MΩ	0.01MΩ
<b>Diode</b>	<u>Test Voltage</u>	<u>Max. Test Current</u>
	3V	Approx. 0.5mA
<b>Continuity</b>	<u>Test Voltage</u>	<u>Threshold</u>
	1.2V	<20Ω

## Test Products International, Inc.

L163M • 10/28/02 copyright © 2002 Test Products International, Inc.