



135

Digital Multimeter Instruction Manual



TABLE OF CONTENTS

	page
A. INTRODUCTION	
1. Congratulations	3
2. Product Description	3
3. EC Declaration of Conformity	4
B. SAFETY CONSIDERATIONS	5
C. TECHNICAL DATA	
1. Features and Benefits	6
2. Product Applications	7
2. Specifications	8
D. MEASUREMENT TECHNIQUES	
1. Controls and Functions	10
2. Step by Step Procedures:	
a) Measuring DC Volts	11
b) Measuring AC Volts	12
c) Measuring DC Amps	13
d) Measuring AC Amps	15
e) Measuring Resistance	17
f) Measuring Diodes	18
g) Measuring Capacitance	19
h) Continuity Buzzer	20
i) Data Hold	20
E. ACCESSORIES	21
F. MAINTENANCE	22
G. TROUBLE SHOOTING GUIDE	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 135 is a hand held manual ranging DMM. It features extra large numerals on the LCD, and Data Hold for all functions and ranges. The 135 is an affordable choice offering measurements in all of the basic electrical functions.

The 135 comes complete with the following:

135 Instrument
Rubber Boot
Test Lead Set
Instruction Manual
Battery

3. EC Declaration of Conformity

This is to certify that model 135 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 135 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 a complete understanding of circuit being measured.
- Disconnect power to circuit, then connect test leads to the 135, 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
	ON/OFF, PUSH BUTTON SWITCH

C. TECHNICAL DATA

1. Features and Benefits

Safety	Meets CE and IEC 1010 requirements. UL Listed to U.S. and Canadian Safety Standards.
Large LCD	Easy to read at all angles and the majority of lighting levels. 4000 Count.
Rubber Boot	Added protection when the instrument is dropped. (135NB does not include boot.)
Multi-function	Measure all electrical characteristics with one meter.

2. Product Applications

Perform the following tests and/or measurements with the TPI 135 and the appropriate function:

HVAC/R

FUNCTION

DCmV	• Thermocouples in furnaces or gas applications.
ACA	• Heat anticipator current in thermostats.
ACV	• Line voltage.
ACV or DCV	• Control circuit voltage.
CAP	• Motor start and run capacitance.
DCµA	• Flame safeguard control current.
OHMS	• Heating element resistance (continuity).
OHMS	• Compressor winding resistance.
OHMS	• Contactor and relay coil resistance.
OHMS	• Continuity of wiring.
DCmV	• Temperature with optional temperature adapter (A310).

ELECTRICAL

FUNCTION

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

3. Specifications



IEC 1010 Over Voltage:

CAT II - 1000V

CAT III - 600V

Pollution Degree 2

a. DCV

Range	Resolution	Accuracy	Impedance
400mV	0.1mV	±0.5% of reading, ±2 digits	10MΩ
4V	0.001V		
40V	0.01V		
400V	0.1V		
1000V	1V		

b. ACV (60Hz to 400Hz)

Range	Resolution	Accuracy	Impedance
400mV	0.1mV	±0.8% of reading, ±3 digits	10MΩ
4V	0.001V		
40V	0.01V		
400V	0.1V		
750V	1V		

c. DCA

Range	Resolution	Accuracy	Overload Protection
40μA	0.1μA	±0.5% of reading, ±3 digits	Fuse* F600V, 2A, 31CM
400μA	0.001mA		
40mA	0.01mA		
400mA	0.1mA		
2A	0.1mA	±1.2% of reading, ±3 digit	Fuse* F600V, 10A, 31CM
10A	0.01A		

8

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

d. ACA

Range	Resolution	Accuracy	Overload Protection
40μA	0.1μA	±0.8% of reading, ±3 digits	Fuse* F600V, 2A, 31CM
400μA	0.001mA		
40mA	0.01mA		
400mA	0.1mA		
2A	0.001A	±3% of reading, ±7 digits	Fuse* F600V, 10A, 31CM
10A	0.01A		

e. OHM (Resistance, Ω)

Range	Resolution	Accuracy	Overload Protection
400Ω	0.1Ω	±0.75% of reading, ±3 digits	600V DC or AC Peak
4kΩ	0.001kΩ		
40kΩ	0.01kΩ		
400kΩ	0.1kΩ		
4MΩ	0.001MΩ	±1% of reading, ±3 digits	
40MΩ	0.01MΩ		

f. Diode Test

Test Voltage	Max Test Current	Over Load Protection
3V	Approx. 1mA	600 V DC or Peak AC

g. Continuity Buzzer

Test Voltage	Threshold	Over Load Protection
3V	<100Ω	600 V DC or Peak AC

h. Capacitance

Range	Resolution	Accuracy	Overload Protection
400μF	0.01μF	±2% of reading, ±3 digits	600V DC or Peak AC
20000μF	0.1μF		

i. General Specifications

Power Supply	9 Volt Battery
Battery Life	560 hrs. Alkaline
Size (H x L x W)	33mm x 86mm x 187mm (1.3" x 3.4" x 7.4")
Weight	340g (12 oz)

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

9

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:

Push Buttons

⏻ Turns the 135 on and off.

Data-H Activates the Data Hold function.

Rotary Switch

DCV Used for measurement of DC Volts. Select the best range for the voltage to be measured.

ACV Used for measurement of AC Volts. Select the best range for the voltage to be measured.

DCA Used for measurement of DC Amps. Select the best range for the current to be measured.

ACA Used for measurement of AC Amps. Select the best range for the current to be measured.

OHM Used for measurement of Resistance, Diode Test and Continuity Buzzer. Select the best range for the resistance to be measured.

CAP Used for measurement of Capacitance Select the best range for the capacitance to be measured.

Input Jacks

A Red test lead connection for current measurements on the 2 and 10 ACA and DCA functions.

mA μ A Red test lead connection for current measurement on the mA and μ A DCA and ACA functions.

COM Black test lead connection for all functions.

V Ω $\rightarrow$ Red test lead connection for OHM, DCV and ACV functions.

2. Step by Step Procedures:

a. Measuring DC Volts

CAUTION!

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

⚠ WARNING!

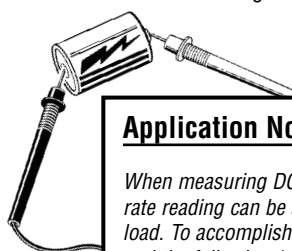
Do not attempt to make a voltage measurement of more than 1000V or of a voltage level that is unknown.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
DCV	COM	V Ω $\rightarrow$	0.1mV	1000V

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into **V Ω $\rightarrow$** input jack.
4. Set the rotary switch on the 135 to the desired range in the **DCV** function depending on the voltage to be measured.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the 135.



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 above 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 135.

b. Measuring AC Volts

CAUTION!

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

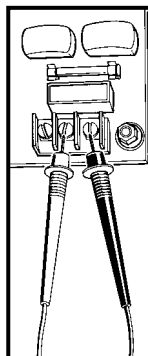


WARNING!

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
ACV	COM	V Ω	0.1mV	750V



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 13. 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.*

b. Measuring AC Volts (cont.)

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into **COM** input jack.
3. Plug red test lead into **V Ω** input jack.
4. Set the rotary switch on the 135 to the desired range in the **ACV** function depending on the voltage to be measured.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the 135.

c. Measuring DC Amps

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.

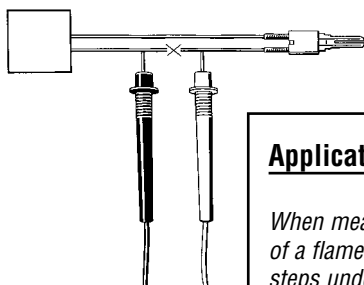
Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
DCA (up to 2mA range)	COM	mA μ A	0.1 μ A	1.999A
DCA (10A range only)	COM	A	0.01A	10.00A

c. Measuring DC Amps (cont.)

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into **mA μ A** or **A** input jack depending on value of current to be measured.
4. Set the rotary switch on the 135 to the desired range in the **DCA** function depending on the current to be measured and the input jack the red test lead is inserted into.
5. Connect test leads in series to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the current on the 135.



Application Notes

When measuring the DC current of a flame controller, follow the steps under "Measurement Procedure" above and then proceed with the following:

- Set up the meter for making a μ A measurement.
- Connect the meter to the flame controller lead by opening the circuit and inserting the leads in series with the circuit as shown in the picture above.

d. Measuring AC Amps

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!

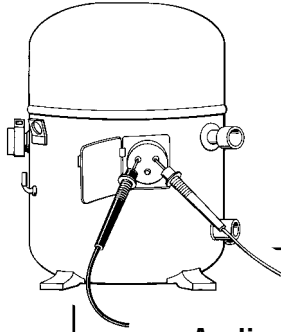
Do not attempt to make a current measurement of circuits with more than 600V present. Instrument damage and/or personal injury may result.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
ACA (up to 2A range)	COM	mA μ A	0.1 μ A	1.999A
ACA (10A range only)	COM	A	0.01A	10.00A

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into **mA μ A** or **A** input jack depending on value of current to be measured.
4. Set the rotary switch on the 135 to the desired range in the **ACA** function depending on the current to be measured and the input jack the red test lead is inserted into.
5. Connect the test leads in series to the circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the current on the 135.



Application Notes

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

Set up the meter following steps under "Measurement Procedure" on page 17, 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).

e. Measuring Resistance

⚠ 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 test leads together and record resistance reading. Deduct this value from actual readings.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
OHM	COM	VΩ ➡	0.1Ω	19.99MΩ

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into the **VΩ ➡** input jack.
4. Set the rotary switch on the 135 to the desired range in the **OHM** function depending on the voltage to be measured.
5. Connect test leads to circuit to be measured.
6. Read the resistance value on the 135.

f. Measuring Diodes

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
OHM($\rightarrow$)	COM	V Ω $\rightarrow$	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 Ω $\rightarrow$** input jack.
4. Set the rotary switch on the 135 to the $\rightarrow$ position.
5. 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.
6. Reading on the display should be between 0.3 and 0.8 volts.
7. Reverse test lead connections in 5 above.
8. 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.*

g. Measuring Capacitance

WARNING!

All capacitance measurements are to be made on de-energized circuits with all capacitors discharged only. Failure to de-energize and discharge capacitors before attempting to measure them could result in instrument damage and/or personal injury.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
μ F	COM	V Ω μ F	0.01 μ F	20000 μ F

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Remove capacitor from the circuit and discharge it.
3. Plug black test lead into the **COM** input jack.
4. Plug the red test lead into the **V Ω μ F** input jack.
5. Set the rotary switch to the μ F function.
6. Connect test leads to capacitor to be measured.
7. Read the capacitor value on the LCD.

h. Continuity Buzzer

⚠ WARNING!

Do not attempt to make continuity measurements with circuit energized.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD
OHM()	COM	VΩ 

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**  input jack.
4. Set the rotary switch on the 135 to the  position.
5. Connect the test leads to the circuit to be measured.
6. Listen for the buzzer to confirm continuity.

i. Data Hold

Press the **DATA-H** button at any time on any function or range to freeze the reading on the LCD display. This function is very useful when measuring in locations where the display is difficult to read.

E. ACCESSORIES*

Standard Accessories	Part No.
9V Battery	A009
Fuse, 2 Amp	A102
Fuse, 10 Amp	A110
Test Lead Set	A050
Rubber Boot (135 only)	A101

Optional Accessories	Part No.
Deluxe Test Lead Set	SDK1C
IEC 1010 Deluxe Test Lead Kit	TLS2000B
Temperature Adapter	A301
Boot Hook	A103
Soft Carrying Case	A100
Screw-on Alligator Clips	A150
CO Attachment	A701
CO Attachment w/Alarm	A702
CO Attachment w/zero adjust	A711

F. MAINTENANCE

1. **Battery Replacement:** The 135 will display BAT when the internal 9 Volt battery needs replacement. The battery is replaced as follows:
 - a. Disconnect and remove all test leads from live circuits and from the 135.
 - b. Remove the 135 from its protective boot.
 - c. Remove the three screws from back of 135 housing.
 - d. Carefully pull apart front and rear instrument housing.
 - e. Remove old battery and replace it with new battery.
 - f. Reassemble instrument in reverse order from above.
2. **Fuse Replacement:** Both of the 135 “A” and “mA μ 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 the fuse as follows:
 - a. Disconnect and remove all test leads from live circuits and from the 135.
 - b. Remove the 135 from its protective boot.
 - c. Remove the three screws from the back of the 135 housing.
 - d. Carefully pull apart the front and rear instrument housing.
 - e. Remove the old fuse(s) and replace it with new one(s).
 - f. Reassemble the instrument in reverse order from above.
3. **Cleaning your 135**
Use a mild detergent and slightly damp cloth to clean the surfaces of the 135.

G. TROUBLE SHOOTING GUIDE

Problem

Probable Causes

Does not power up

- Dead or defective battery
- Broken wire from battery snap to PCB

Won't display current readings

- Open fuse
- Open test lead
- Improperly connected to circuit under test

All functions except ohms read high

- Very weak battery that will not turn on the low battery indicator on the LCD

ACV do not read

- Very weak battery that will not turn on the low battery indicator on the LCD

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, Ltd.

342 Bronte Road South, Unit 9
Milton, Ontario L9T5B7 Canada
905-693-8558 • Fax: 905-693-0888

135 Specifications (also see pages 8-9.)

<u>Function</u>	<u>Range</u>	<u>Resolution</u>
DCV	400mV	0.1mV
	4V	0.001V
	40V	0.1V
	400V	0.1V
	1000V	1V
ACV	400mV	0.1mV
	4V	0.001V
	40V	0.01V
	400V	0.1V
	750V	1V
DCA	40μA	0.1μA
	400μA	0.001mA
	40mA	0.01mA
	400mA	0.1mA
	2A	0.1mA
	10A	0.01A
ACA	40μA	0.1μA
	400μA	0.001mA
	40mA	0.01mA
	400mA	0.1mA
	2A	0.001A
	10A	0.01A
OHM	400Ω	0.1Ω
	4kΩ	0.001kΩ
	40kΩ	0.01kΩ
	400kΩ	0.1kΩ
	4MΩ	0.001MΩ
	40MΩ	0.01MΩ
CAP	400μF	0.01μF
	20,000μF	1μF
Diode	<u>Test Voltage</u>	<u>Max. Test Current</u>
	2.5V	Approx. 1mA
Continuity	<u>Test Voltage</u>	<u>Threshold</u>
	2.5V	<100Ω
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