



133

**Digital Multimeter
Instruction Manual**



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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 133 is a hand held manual ranging DMM. It features extra large numerals on the LCD, and Data Hold for all functions and ranges. The 133 is an affordable choice offering measurements in all of the basic electrical functions.

The 133 comes complete with the following:

133 Instrument
Rubber Boot (133NB does not include boot)
Test Lead Set
Instruction Manual
Battery

3. EC Declaration of Conformity

This is to certify that model 133 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 133 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 133, 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. |
| Rubber Boot | Added protection when the instrument is dropped. (133NB 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 133 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.
- 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

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



| a. DCV | | | |
|--------|------------|--------------------------------|-----------|
| Range | Resolution | Accuracy | Impedance |
| 200mV | 0.1mV | ±0.5% of reading, ±2 digits | 10M |
| 2V | 0.001V | | |
| 20V | 0.01V | | |
| 200V | 0.1V | | |
| 1000V | 1V | | |

| b. ACV (45Hz to 450Hz) | | | |
|------------------------|------------|--------------------------------|-----------|
| Range | Resolution | Accuracy | Impedance |
| 200mV | 0.1mV | ±1.2% of reading, ±3 digits | 10M |
| 2V | 0.001V | | |
| 20V | 0.01V | | |
| 200V | 0.1V | | |
| 750V | 1V | | |

| c. DCA | | | |
|--------|------------|-------------------------------|---------------------------|
| Range | Resolution | Accuracy | Overload Protection |
| 200µA | 0.1µA | ±0.5% of reading, ±1 digit | Fuse* F600V, 2A, 31CM |
| 2mA | 0.001mA | | |
| 20mA | 0.01mA | | |
| 200mA | 0.1mA | ±1.2% of reading, ±1 digit | Fuse* F600V, 10A, 31CM |
| 2A | 0.001A | | |
| 10A | 0.01A | | |
| | | ±2% of reading, ±5 digits | |

*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 |
| 200µA | 0.1µA | ±1% of reading, ±3 digits | Fuse* F600V, 2A, 31CM |
| 2mA | 0.001mA | | |
| 20mA | 0.01mA | | |
| 200mA | 0.1mA | ±1.8% of reading, ±3 digits | Fuse* F600V, 10A, 31CM |
| 2A | 0.001A | | |
| 10A | 0.01A | | |
| | | ±3% of reading, ±7 digits | |

| e. OHM (Resistance,) | | | |
|-----------------------|------------|-------------------------------|-----------------------|
| Range | Resolution | Accuracy | Overload Protection |
| 200 | 0.1 | ±0.5% of reading, ±1 digit | 600V DC or AC Peak |
| 2k | 0.001k | | |
| 20k | 0.01k | | |
| 200k | 0.1k | | |
| 2M | 0.001M | | |
| 20M | 0.01M | ±1% of reading, ±2 digits | |

| f. Diode Test | | |
|---------------|------------------|----------------------|
| Test Voltage | Max Test Current | Over Load Protection |
| 2.5V | Approx. 1mA | 600 V DC or Peak AC |

| g. Continuity Buzzer | | |
|----------------------|-----------|----------------------|
| Test Voltage | Threshold | Over Load Protection |
| 2.5V | <100 | 600 V DC or Peak AC |

| h. 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.

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:

Push Buttons

⏻ Turns the 133 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.

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 \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 \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 \rightarrow** input jack.
4. Set the rotary switch on the 133 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 133.



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 133.

b. Measuring AC Volts

CAUTION!

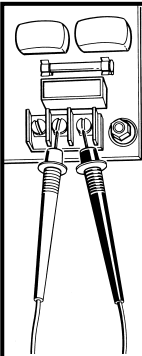
Do not attempt to make a voltage measurement if a test lead is plugged in the A or μ A input jack. Instrument damage and/or personal injury may result.

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 \rightarrow | 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 \rightarrow** input jack.
4. Set the rotary switch on the 133 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 133.

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.

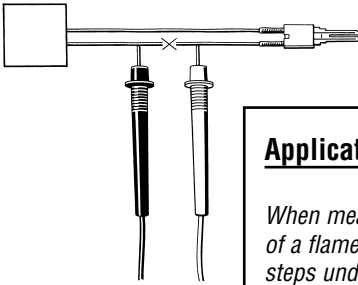
Instrument set-up:

| 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 133 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 133.



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 mA 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!

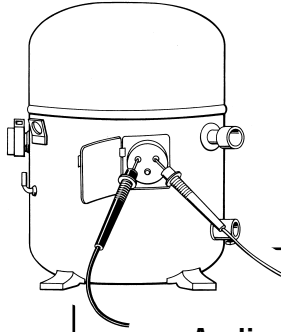
Do not attempt to make a current measurement of circuits with more than 600V present. Instrument damage and/or personal injury may result.

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 133 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 133.



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 | V → | 0.1 | 19.99M |

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 **V →** input jack.
4. Set the rotary switch on the 133 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 133.

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 \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 \rightarrow** input jack.
4. Set the rotary switch on the 133 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. Continuity Buzzer

WARNING!

Do not attempt to make continuity measurements with circuit energized.

Instrument set-up:

| FUNCTION | BLACK TEST LEAD | RED TEST LEAD |
|-------------------|-----------------|-----------------|
| OHM(\bullet)) | COM | V \rightarrow |

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 \rightarrow** input jack.
4. Set the rotary switch on the 133 to the \bullet) position.
5. Connect the test leads to the circuit to be measured.
6. Listen for the buzzer to confirm continuity.

h. 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 | A040 |
| Rubber Boot (133 only) | 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.

F. MAINTENANCE

- Battery Replacement:** The 133 will display BAT when the internal 9 Volt battery needs replacement. The battery is replaced as follows:
 - Disconnect and remove all test leads from live circuits and from the 133.
 - Remove the 133 from its protective boot.
 - Remove the three screws from back of 133 housing.
 - Carefully pull apart front and rear instrument housing.
 - Remove old battery and replace it with new battery.
 - Reassemble instrument in reverse order from above.
- Fuse Replacement:** Both of the 133 "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:
 - Disconnect and remove all test leads from live circuits and from the 133.
 - Remove the 133 from its protective boot.
 - Remove the three screws from the back of the 133 housing.
 - Carefully pull apart the front and rear instrument housing.
 - Remove the old fuse(s) and replace it with new one(s).
 - Reassemble the instrument in reverse order from above.
- Cleaning your 133**
Use a mild detergent and slightly damp cloth to clean the surfaces of the 133.

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.



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133 SPECIFICATIONS

±0.5% Basic DCV Accuracy (also see pages 9-11)

| Function | Range | Resolution |
|-------------------|---------------------|--------------------------|
| DCV | 200mV | 0.1mV |
| | 2V | 0.001V |
| | 20V | 0.1V |
| | 200V | 0.1V |
| | 1000V | 1V |
| ACV | 200mV | 0.1mV |
| | 2V | 0.001V |
| | 20V | 0.01V |
| | 200V | 0.1V |
| | 750V | 1V |
| DCA | 200µA | 0.1µA |
| | 2mA | 0.001mA |
| | 20mA | 0.01mA |
| | 200mA | 0.1mA |
| | 2A | 0.001A |
| | 10A | 0.01A |
| ACA | 200µA | 0.1µA |
| | 2mA | 0.001mA |
| | 20mA | 0.01mA |
| | 200mA | 0.1mA |
| | 2A | 0.001A |
| | 10A | 0.01A |
| OHM | 200 | 0.1 |
| | 2k | 0.001k |
| | 20k | 0.01k |
| | 200k | 0.1k |
| | 2M | 0.001M |
| | 20M | 0.01M |
| Diode | <u>Test Voltage</u> | <u>Max. Test Current</u> |
| | 2.5V | Approx. 1mA |
| Continuity | <u>Test Voltage</u> | <u>Threshold</u> |
| | 2.5V | <100 |

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