153

Digital Multimeter

Instruction Manual

TABLE OF CONTENTS

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 153 is a hand-held autoranging DMM. The 153 measures ACV, DCV, ACA, DCA, Resistance, Diodes and Continuity.

The 153 also features:

- **REC** Records Min/Max readings during specified measurement intervals.
- **RANGE** Allows the user to manually range the 153 instead of autoranging.
- **Data Hold** Holds the reading on the display for easy viewing.
- **Auto Off** Preserves battery life.

The 153 comes complete with the following accessories:

153 Instrument
Rubber Boot
Test Lead Set
Instruction Manual
Battery

3. EC Declaration of Conformity

This is to certify that model 153 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 153 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 153, 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

 **DANGEROUS VOLTAGE**

 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

Agency Approval	Meets CE and IEC 1010 requirements. UL Listed to U.S. and Canadian Safety Standards.
Sleep	Instrument automatically powers down after 30 minutes of inactivity, however, it will continue acquiring data in its various modes. Pressing any push button or turning the rotarty switch returns the 153 back to normal.
Record	Records Min/Max values.
Range	Allows you to either manual range or use auto range to select the appropriate range.
Auto Off	Preserves battery life. LCD shows oFF when in this mode.
3 Year Warranty	Covered by a standard 3 year warranty.

2. Product Applications

Perform the following tests and/or measurements with the TPI 153 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

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

c UL us LISTED
UL 3111-1

a. DCV

Range	Resolution	Accuracy	Impedance
400mV	0.1mV	±0.3% of reading, ±2 digits	10MΩ
4V	0.001V		
40V	0.01V		
400V	0.1V		
1000V	1V		

b. ACV (45Hz to 450Hz)

Range	Resolution	Accuracy	Impedance
4V	0.001V	±0.8% of reading, ±3 digits	10MΩ
40V	0.01V		
400V	0.1V	±1.2% of reading, ±3 digits	
750V	1V		

c. DCA

Range	Resolution	Accuracy	Overload Protection
400µA	0.1µA	±0.5% of reading, ±2 digits	Fuse 0.5Amp/600V
4mA	0.001mA		
40mA	0.01mA		
400mA	0.1mA		
4A	0.001A	±1.2% of reading, ±2 digits	Fuse 10Amp/600V
10A	0.01A		

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

d. ACA (45Hz to 450Hz)

Range	Resolution	Accuracy	Overload Protection
400µA	0.1µA	±0. 8% of reading, ±3 digits	Fuse 0.5Amp/600V
4000µA	1µA		
40mA	0.01mA		
400mA	0.1mA		
4A	0.001A	±1. 5% of reading, ±3 digits	Fuse 10Amp/600V
10A	0.01A		

e. OHM (Resistance,Ω)

Range	Resolution	Accuracy	Overload Protection
400Ω	0.1Ω	±0. 5% of reading, ±2 digits	600V DC or AC Peak
4kΩ	0.001kΩ		
40kΩ	0.01kΩ		
400kΩ	0.1kΩ		
4MΩ	0.001MΩ	±1% of reading, ±2 digits	
40MΩ	0.01MΩ		

f. Diode Test

Test Voltage	Max Test Current	Over Load Protection
3V	Approx. 30µA	600 V DC or Peak AC

g. Continuity Buzzer

Test Voltage	Threshold	Over Load Protection
3V	< 50Ω	600 V DC or Peak AC

h. General Specifications

Max. Volt. between any Input and Ground	1000V
Fuse Protection	**mA:** 0.5Amp/600VAC **A:** 10Amp/600VAC
Display Type	4,000 Count, 2 times per second update
Operating Temp.	0° to 40°C (32° to 104°F)
Storage Temp.	-10° to 50°C (14° to 122°F)
Relative Humidity	0% to 80%
Power Supply	2 Each 1.5 Volt "AA" Batteries
Battery Life	200 hrs. Typical
Size (H x L x W)	33mm x 86mm x 187mm (1.3in x 3.4in x 7.4in)
Weight	340g (12oz)

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:

Push Buttons

⏻ Turns the 153 on and off.

REC Activates the Min/Max mode. Hold in for 3 seconds to deactivate.

RANGE Activates manual ranging. Hold in for 3 seconds to return to autorange.

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

Rotary Switch

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

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

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

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

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

10A~ Function for measuring AC Amps (A).

mV⎓ Function for measuring millivolts (mV) DC. 1 millivolt = 0.001 Volt.

V⎓ Function for measuring DC Volts.

V~ Function for measuring AC Volts.

Ω Function for measuring Ohms (resistance.)

⏭ Function for testing Diodes.

Function for using audible Continuity Buzzer.

1. Controls and Functions: (cont.)

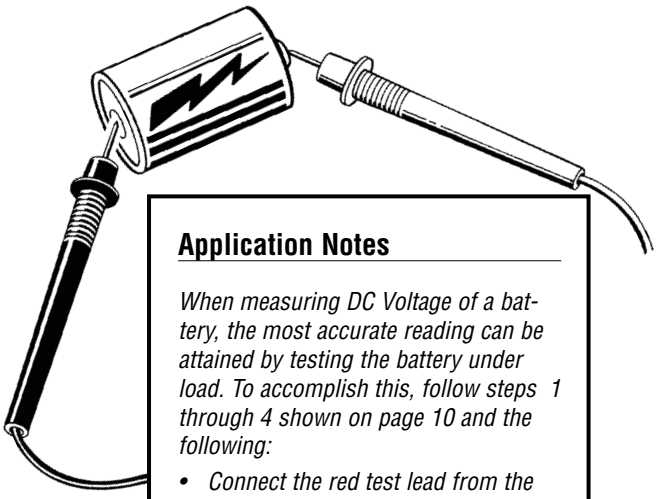
Input Jacks

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

mAμA Red test lead connection for current measurement on the mA and mA functions.

COM Black test lead connection for all functions.

VΩ ⏭ Red test lead connection for all Volt, Ohm, Diode and Continuity measurements.



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 shown on page 10 and the following:

- *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 153.*

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 µmA input jack. Instrument damage and/or personal injury may result.

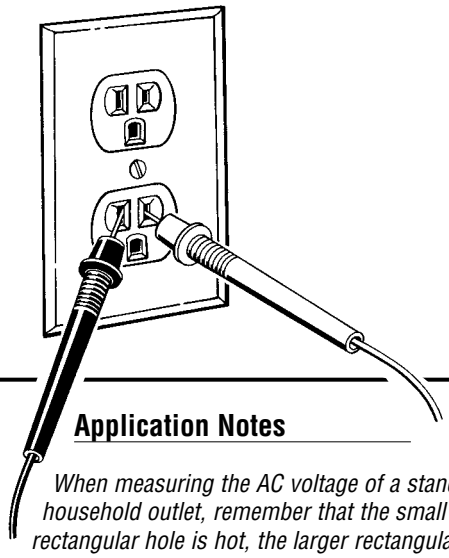
⚠ ***WARNING!***
Do not attempt to make a voltage measurement of more than 1000V or of a voltage level that is unknown.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
$m\overline{\overline{V}}$	COM	VΩ⏭	0.1mV	400.0mV
$\overline{\overline{V}}$	COM	VΩ⏭	0.001V	1000V

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**Ω⏭ input jack.
4. Set rotary switch to either the **mV** or **V** range, depending on the voltage to be measured.
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 153.



Application Notes

When measuring the AC voltage of a standard household outlet, remember that the small rectangular hole is hot, the larger rectangular hole is neutral and the round hole is ground.

To disconnect power from the outlet, find the fuse or circuit breaker that controls the outlet 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 outlet and the black lead to the neutral side of the outlet. Reconnect power to the outlet and read the voltage on the meter. The reading should be approximately 110V to 130V.*
- *Disconnect power from the outlet and move the red wire to the ground hole. Reconnect power to the outlet and read the voltage on the meter. Typically less than 20V should exist from neutral to ground. If 110V or above exists, the outlet may be wired incorrectly.*

b. MEASURING AC VOLTS

CAUTION!
Do not attempt to make a voltage measurement if a test lead is plugged in the A or µmA 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
$\tilde{V}$	COM	VΩ⇥	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 $\tilde{\mathbf{V}}$ function depending on the voltage to be measured.
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 153.

C. MEASURING DC AMPS

CAUTION!

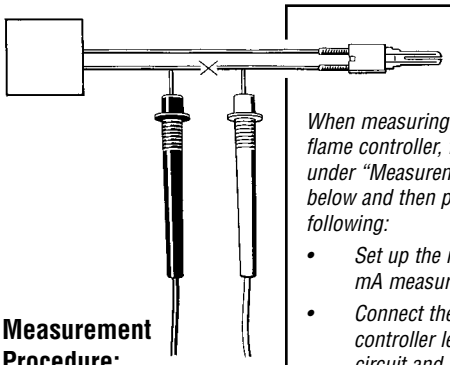
Do not attempt to make a current measurement with the test leads connected in parallel with circuit to be tested. Test leads must be connected in series with the circuit.

⚠ ***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
μA⎓	COM	mAμA	0.1μA	4000μA
mA⎓	COM	mAμA	0.01mA	400mA
10A⎓	COM	A	0.001A	10.00A



Application Notes

When measuring the DC current of a flame controller, follow the steps under "Measurement Procedure" below 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.*

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 153.

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!***

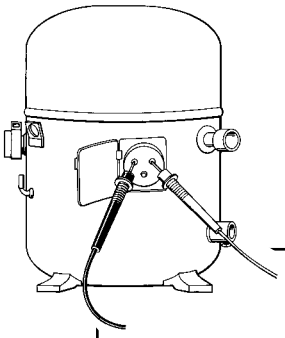
Do not attempt to make a current measurement of circuits with more than 600V present. Instrument damage and /or personal injury may result.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
μA~	COM	mAμA	0.1μA	4000μA
mA~	COM	mAμA	0.01mA	400mA
10A~	COM	A	0.001A	10.00A

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 **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 153.



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 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 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
Ω	COM	VΩ⏭	0.1Ω	40.00MΩ

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 on the 153 to the **Ω** function.
5. Connect the test leads to the circuit to be measured.
6. Read the resistance value on the 153.

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
⇥	COM	VΩ⇥	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 **VΩ⇥** input jack.
4. Set the rotary switch to the ⇥ function.
5. Connect 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 0.5 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
•)))	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 **VΩ⇥** input jack.
4. Set the rotary switch to the •))) function.
5. Press yellow push button to activate continuity buzzer.
6. Connect the test leads to the circuit to be measured.
7. Listen for the buzzer to confirm continuity.

h. DATA HOLD

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.

i. RECORD MODE

The record mode saves minimum (MIN) and maximum (MAX) values measured for a series of reading. Activate the function as follows:

1. Depress the **REC** button on the 153.
2. The 153 will immediately start to record MIN/MAX values. REC will be on the LCD to show record mode has been activated. The reading on the LCD will be the actual reading. The 153 will give a confirmation beep every time a new value is recorded.
3. Press the **REC** button a second time and the MIN reading will be displayed.
4. Press the **REC** button a third time and the MAX reading will be displayed on the LCD.
5. To terminate the record mode, hold the REC button down for approximately 2 seconds or turn the rotary switch to a different function.

E. ACCESSORIES*

Standard Accessories	Part No.
9V Battery	A009
Fuse, 2 Amp	A102
Fuse, 10 Amp	A110
Test Lead Set	A040
Rubber Boot (153 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

1. **Battery Replacement:** The 153 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 153.
   b. Remove 153 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 mAμA input jacks are fuse protected. If either do not function, replace fuse as follows:
   a. Disconnect and remove all test leads from live circuits and from the 153.
   b. Remove 153 from protective boot.
   c. Remove the three screws from back of housing.
   d. Carefully pull apart the front and rear instrument housing.
   e. Remove the old fuse(s) and replace it with new fuse(s).
   f. Reassemble the instrument in reverse order from above.

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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153 SPECIFICATIONS

±0.3% Basic DCV Accuracy **(also see pages 8-9)**

Function	Range	Resolution
DCV	400mV	0.1mV
	4V	0.001V
	40V	0.01V
	400V	0.1V
	1000V	1V
ACV	4V	0.001V
	40V	0.01V
	400V	0.1V
	750V	1V
DCA	400µA	0.1µA
	4mA	0.001mA
	40mA	0.01mA
	400mA	0.1mA
	4A	0.001A
	10A	0.01A
ACA	400µA	0.1µA
	4000µA	1µA
	40mA	0.01mA
	400mA	0.1mA
	4A	0.001A
	10A	0.01A
OHM	400Ω	0.1Ω
	4kΩ	0.001kΩ
	40kΩ	0.01kΩ
	400kΩ	0.1kΩ
	4MΩ	0.001MΩ
	40MΩ	0.01MΩ

	Test Voltage	Max. Test Current
Diode	3V	Approx. 30µA

	Test Voltage	Threshold
Continuity	3V	<50Ω

Test Products International, Inc.

Controls / Functions / International Symbols

TPI offers a complete line of…

- CO, Combustibles & Combustion (CEA)
- Refrigerant Leak Detectors
- Digital Manometers
- Temperature Contact & IR Instruments
- IAQ: Air Flow / Humidity
- Handheld Oscilloscopes
- Digital Multimeters & Clamp-on Meters
- Accessories & Kits

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Controls and Functions

Push Buttons

	Activates back light for LCD (automatically turns off after approx. 70 sec.)
REC	Activates the Min/Max/Ave mode
COMP	Activates the Compare mode
REL%	Activates the REL% mode
Range	Activates manual ranging
EDIT	Activates the EDIT mode for Compare and Relative% functions
HOLD	Activates two-hold data-hold mode
▭	Activates special dual functions on LCD. (Min/MAx time references)
ON/OFF	Turns DMM on and off
Data-H	Activates the data hold function

Rotary Switch

V⎓	Selects the DCV function. Select the best range for the voltage to be measured
V~	Selects the ACV function. Select the best range for the voltage to be measured
A⎓	Selects the DCA function. Select the best range for the current to be measured
A~	Selects the ACA function. Select the best range for current to be measured Selects resistance, diode, or continuity function
OFF	Turns the instrument off
mV⎓	Selects the DC mV function
V⎓	Selects the DCV function
V~Hz	Selects the ACV function (Push the yellow button to display frequency of measured voltage on lower display

Rotary Switch cont'd

⊣◀	Selects the diode test function
Ω •)))	Selects resistance function. (Push the yellow button to activate continuity buzzer)
mA⎓	Selects the DC mA function
A⎓	Selects the DCA function (10A max.)
A~	Selects the ACA function (10A max.)
mA~	Selects the AC mA function
⊣⊢	Selects the Capacitance function
Hz	Selects the Frequency function

Input Jacks

A	Red test lead connection for current measurements on the 2 and 10 ACA and DCA functions
mAµA	Red test lead connection for current measurement on the mA and A DCA and ACA functions
COM	Black test lead connection for all functions
V	Red test lead connection for all OHM, DCV, and ACV functions

International Symbols

- CAUTION: RISK OF ELECTRICAL SHOCK
- AC (ALTERNATION CURRENT)
- DC (DIRECT CURRENT)
- REFER TO INSTRUCTION MANUAL
- GROUND
- DOUBLE INSULATION
- EITHER DC OR AC
- FUSE

Distributed By:

To learn about the entire line of TPI products visit:

www.tpi-thevalueleader.com

DMM FAQ

1. Is there a way to measure higher current with a TPI DMM?

TPI DMMs (except the 120 and 126) have the capacity to read up to 10A AC/DC. Optional adapters are available for all models to increase the current range. Our shunt adapters are available to increase the range up to 1,000A AC/DC.

2. What other adapters are available for TPI DMMs?

Various adapters including carbon monoxide (A771), pressure (A620/630), and clamp-on low current (A254) are available. Contact TPI for additional information.

3. Which of the TPI DMMs will measure temperature?

All TPI DMMs can measure temperature by using the optional A301 K-Type thermocouple temperature adapter.

4. Which TPI DMMs can measure DC millivolts?

All TPI DMMs measure millivolts. Models are available with 1 or 0.1 millivolt resolution.

5. Which TPI DMMs can measure DC microamps?

The TPI 126, 133, 135, 153, 163, 183, 190, 194, 196, and 440 all have this capability.

6. Which TPI DMMs will measure capacitance?

The TPI 135, 183, 190, 192, 194, and 440 all have this capability.

7. What is continuity?

Continuity refers to a test performed on wires and circuits to see if a break(open) exhists. If the wire or circuit is continuous, the resistance reading will be at or near zero. The continuity range on a meter provides audible indication of a continuous circuit, allowing quicker tests without having to take your eyes off the circuit or wire under test.

DMM Selection Guide

Palm Size
100, 120, 122, 126

Full Size
133, 135, 153, 163, 183, 190, 192, 194, 196

True Rms
183, 190, 192, 194, 440

50,000 Count High Resolution
190, 192, 194, 196

Wave Form Display
440

Process Loop Calibration
196

True RMS Plus Waveform
440

100 120 122 126 133 135 153 163 183 190 ~ 196 440

1. Determine the maximum over voltage installation category (CAT I ~ CAT IV) the multimeter will be used in and narrow your choice to those meters meeting the requirement. The Category rating for each meter is listed on page 2 in the specifications table.
2. Narrow your choice by selecting meters with the features required for your intended applications. For example, if your applications require a CAT III meter with true RMS, frequency, and RS232 output capabilities, the TPI 183 or TPI190 would be good choices. See applications listed below.
3. Finally, select a meter with enough range, accuracy, and resolution for the tests you will perform. For example: the TPI 183 and the TPI 190 meet your application needs, but you require precision high-resolution measurements. Then the 50,000 count TPI 190 would be the better choice.

The Value Leader™

See page 3 inside for ranges, specifications, and features.

APPLICATIONS

Application	Market				Function	100	120	122	126	133	135	153	163	183	190	192	194	196	440
	HVACR	Electrical	Electronic	Industrial															
Thermocouples in furnaces and gas appliances	•				DCmV		◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Heat anticipator current in thermostats	•				ACA					◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Line voltages	•	•	•	•	ACV	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Control voltages	•	•	•	•	ACV/DCV	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Flame safety control current	•				DCuA				◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Heating element resistance	•				Ohms	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Compressor winding resistance	•				Ohms	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Contactor and relay coil resistance	•	•		•	Ohms	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Motor run and start capacitors	•	•			CAP					◉				◉	◉		◉		◉
Use bar graph to indicate rapid fluctuations	•	•	•	•	ALL								◉	◉	◉	◉	◉	◉	
Continuity of wiring	•	•	•	•	Ohms	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Measure frequency on control and line voltage	•	•	•	•	Hz									◉	◉	◉	◉		◉
Record minimum and maximum of measurements	•	•	•	•	REC				◉			◉		◉	◉	◉	◉	◉	◉
Measure temperature*	•	•	•	•	DCV		◉*	◉*	◉*	◉*	◉*	◉*	◉*	◉*	◉*	◉	◉	◉*	◉*
Measure True RMS of distorted or non-linear signals	•	•	•	•	ACV/ACA									◉	◉	◉	◉		◉
Measure line current up to 10 amps	•	•		•	ACA					◉	◉	◉	◉	◉	◉	◉	◉		◉
Test continuity of circuit breakers and fuses		•	•	•	Ohms	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Measure voltage of direct drive DC motors		•		•	DCV	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Measure power supply voltage			•		ACV/DCV	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Measure power supply current			•		ACA/DCA				◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
High resolution, high accuracy	•	•		•	ALL													◉	◉
High resolution, high accuracy			•		ALL											◉			
Category IV tests	•	•		•	ACV/DCV												◉		
Process loop calibration				•	mA Out													◉	
Power Quality		•	•	•	ACV/ACA														◉
Audio			•		ACV/ACA														◉
Video			•		ACV														◉
Logic Tests			•		LOGIC														◉
Waveform Display		•	•		•AC+DCV+A														◉

*Requires either the A301single input or A312 dual input temperature adapters

TPI DIGITAL MULTIMETER TERMINOLOGY

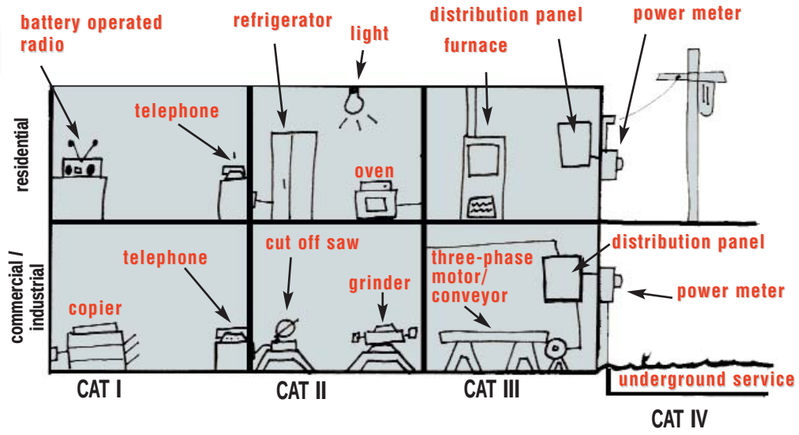
CATEGORY RATINGS

>> Category I: Usually electronic equipment or equipment where measures have been taken to limit transient over voltages.

>> Category II: Single phase loads like appliance personal computers, television sets, and other household loads. Outlets located more than 30 feet from a CAT III source or more than 60 feet from a CAT IV source.

>> Category III: Distribution level fixed installations like distribution panel devices, short branch and feeder circuits, three phase loads, and single phase commercial lighting.

>> Category IV: Equipment and lines located on the power line side of a service panel or where a low voltage connection is made to utility power



Terminology

>> Agency Approval: Test equipment with the CE or UL mark have passed through tests and are designed with operators safety in mind.

>> Record Mode: Record and display the minimum and maximum readings measured. This feature is useful when looking for trends over a long period of time.

>> Auto Range: Meter automatically selects the appropriate range after the function has been selected.

>> Backlight: Feature allowing the display to be illuminated for easier viewing in low light conditions.

>> Basic DC Accuracy: Important specification affecting the overall accuracy of all functions on a DMM.

>> Resolution: A measurement of how small of a signal a meter can display. This specification must be taken into account with accuracy to determine the overall capability of a DMM.

>> True RMS: Allows accurate measurement of non-sinusoidal AC voltage and current found in many control and switching power supply circuits.

>> Analog Bar Graph: Provides the ability to see rapidly changing signals too fast for the digital display to see.

>> Triple Display Simultaneosly display more than one reading at the same time. This feature is useful when measuring AC volts beacuse the frequency can be displayed at the same time without having to switch ranges

>> Sleep/Auto Off: Automatically powers instrument down after 30 minutes of inactivity to preserve battery life. Meters with sleep mode will still acquire data during this time

>> Data Hold: Freezes the reading on the display. This feature is useful when recording readings on paper or when in hard to see locations. Triple display meters can hold two readings on the display at the same time.

>> Input Impedance: Total resistance of the meter as measured at the input terminals. Meters with high impedance, 10MΩ or more, cause negligible loading of the circuit under test. This is important because circuit loading can adversely influence the displayed reading and can cause damage to the circuit under test.

>> Record Mode: Record and display the minimum and maximum readings measured. This feature is useful when looking for trends over a long period of time.

>> Relative Mode: Displays measured value as a percentage of the stored value. This feature is useful for component checking.

>> Compare Mode: Compares measured value with stored value. This feature is useful when component matching.

>> Audible Continuity: Audible beep indicating a complete circuit connnection

>> RS-232 Output: Transfer data directly to a PC while performing tests

>> Process Output: Supply 0 ~ 24mADC for testing current loops and current loop devices

>> Waveform Display: The ability to see the actual waveform under test. This feature is useful for determining the quality of the input signal.

>> Duty Cycle: The total "on" time of the device under test. This feature is useful in preventing component overheating

>> Pulse Width: Measurement of the duration of a pulse. This feature is useful when testing pulse width modulation drive motors.

>> Logic Test: Measurement transitions of logic circuits. This feature is useful when testing CMOS and TTL logic circuits.

>> Two Hold System: Meters with this feature can hold two readings on the display at the same time

>> Digits: Total number of digits that can be displayed. For example, a 3½ digit meter can display a maximum of 1,999. A 3¾ digit meter can display a maximum of 3,999. This means the 3¾ digit meter has beter resolution capability.

>> Counts: Total number of display steps a meter has. This is determined by adding one to the maximum display value. For example, a 3½ digit meter can display a maximum of 1,999 and therefore has 2,000 count capability. Both digits and counts must be taken into account when determining resolution. In general, the more counts a meter has the higher the resolution will be.

TPI DIGITAL MULTIMETER SPECIFICATIONS

DMM Model Part Number

	100	120	122	126	133	135	153	163	183	190	192	194	196	440
Range Selection														
Manual		•			•	•								
Auto*/Manual	•		•	•			•	•	•	•	•	•	•	•
Display Specifications														
2,000 Count		•	•		•									
3,260 Count								•						
4,000 Count	•			•		•	•							
4,000 Count w/ Triple Display									•					
4,000 Count w/ Waveform Display														•
50,000 Count Triple display										•	•	•	•	
Analog Bar Graph								•	•	•	•	•	•	
Backlight									•	•	•	•	•	•
Basis Features														
AC Volts	•	•	•	•	•	•	•	•	•	•	•	•	•	•
DC Volts	•	•	•	•	•	•	•	•	•	•	•	•	•	•
AC Amps				•	•	•	•	•	•	•	•	•	•	•
DC Amps				•	•	•	•	•	•	•	•	•	•	•
Resistance	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Diode Test				•	•	•	•	•	•	•	•	•	•	•
Audible Continuity		•	•	•	•	•	•	•	•	•	•	•	•	•
Additional Features														
True RMS									•	•	•	•		•
Frequency									•	•	•	•		•
Capacitance						•			•	•	•	•		•
Inductance											•			
Data Hold		•	•	•	•	•	•	•	•	•	•	•	•	•
Two Hold System									•	•	•	•	•	
Min/Max Record				•			•		•	•	•	•	•	•
Relative Mode									•	•	•	•	•	•
Compare Mode									•	•	•	•	•	•
RS-232 Output									•	•	•	•	•	•
Oscilloscope Functions														•
Duty Cycle														•
Pulse Width														•
Logic Test														•
Process Output (0~24mA)													•	
Sleep Mode/Auto Off				•			•	•	•	•	•	•	•	•
Range & Resolution														
Basic DC Accuracy	0.5%	0.5%	0.5%	0.3%	0.5%	0.5%	0.3%	0.5%	0.3%	0.05%	0.05%	0.05%	0.05%	0.05%
DC Voltage (maximum)	600V	600V	600V	600V	1,000V	1,000V	1,000V	1,000V	1,000V	1,000V	1,000V	1,000V	1,000V	1,000V
Input Impedance	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ
Resolution (maximum)	1mV	1mV	1mV	0.1mV	0.1mV	0.1mV	0.1mV	0.1mV	0.1mV	0.001mV	0.001mV	0.001mV	0.001mV	0.1mV
AC Voltage (maximum)	600V	600V	600V	600V	750V	750V	750V	750V	750V	750V	750V	750V	750V	1,000V
Input Impedance	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	10MΩ	1.11MΩ
Resolution (maximum)	1mV	100mV	1mV	1mV	0.1mV	0.1mV	1mV	1mV	1mV	100µV	100µV	100µV	100µV	1mV
DC Amps (maximum)	-	-	-	400mA	10A	10A	10A	10A	10A	10A	10A	10A	10A	10A
Resolution (maximum)	-	-	-	0.1mA	0.1µA	0.01µA	0.1µA	0.1µA	0.1µA	0.01µA	0.01µA	0.01µA	0.01µA	0.1µA
AC Amps (maximum)	-	-	-	400mA	10A	10A	10A	10A	10A	10A	10A	10A	10A	10A
Resolution (maximum)	-	-	-	0.1mA	0.1µA	0.01µA	0.1µA	0.1µa	0.1µA	0.01µA	0.01µA	0.01µA	0.01µA	0.1µa
Resistance (maximum)	40MΩ	2KΩ	2KΩ	40MΩ	20MΩ	40MΩ	40MΩ	32.6MΩ	40MΩ	50MΩ	50MΩ	50MΩ	50MΩ	40MΩ
Resolution (maximum)	0.1Ω	1Ω	1Ω	0.1Ω	0.1Ω	0.1Ω	0.1Ω	0.1Ω	0.1Ω	0.01Ω	0.01Ω	0.01Ω	0.01Ω	0.1Ω
Frequency (maximum)	-	-	-	-	-	-	-	-	200KHz	500KHz	500KHz	500KHz	-	2MHz
Resolution (maximum)	-	-	-	-	-	-	-	-	0.01Hz	0.001Hz	0.001Hz	0.001Hz	-	0.01Hz
Capacitance (maximum)	-	-	-	-	-	20,000µF	-	-	10,000µF	20,000µF	100µF	20,000µF	-	400µF
Resolution (maximum)	-	-	-	-	-	0.1µF	-	-	0.01µF	0.001µF	0.1nF	0.001µF	-	100pF
Inductance (maximum)	-	-	-	-	-	-	-	-	-	-	500mH	-	-	-
Resolution (maximum)	-	-	-	-	-	-	-	-	-	-	0.01mH	-	-	-
Agency Approval														
CE IEC 1010	CAT III 600V	CAT III 600V	CAT III 600V	CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V	CAT III 1,000V / CAT IV 600V	CAT II 1,000V / CAT III 600V	CAT II 1,000V / CAT III 600V
CULus 3111		•	•	•	•		•	•	•		•	•	•	

*the range selection for the 100 DMM is auto only