173A

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 7 year limited warranty. Please remember to complete and return your product warranty registration card.

2. Product Description

The 173A is a hand held autoranging DMM. The 173A measures ACV, DCV, ACA, DCA, Resistance, Frequency, Duty Cycle, Diodes and Continuity.

The 173A also features:

- REC — Records Min/Max readings during specified measurement intervals.
- RANGE — Allows the user to manually range the 173A instead of autoranging.
- HOLD — Holds the reading on the display for easy viewing.
- REL — Displays the value as a difference to a reference value.
- AUTO OFF — Preserves battery life.

The 173A comes complete with the following accessories:

173A Instrument
Zippered Vinyl Carrying Case
Rubber Boot
Test Lead Set
Instruction Manual

3. EC Declaration of Conformity

This is to certify that model 173A 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:

EN61326 : 1997 + A1 + A2 : 2001
EN61010-1 :2001 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.

Read instructions before operating:
Be sure these instructions accompany the tool when passed from one user to a new or inexperienced user.

Equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

GENERAL GUIDELINES

ALWAYS

- Test the 173A 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 173A, 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

C. TECHNICAL DATA

1. Features and Benefits

Agency Approval	Meets CE and IEC 61010-1 requirements. UL Listed to U.S. and Canadian Safety Standards.
Auto Power OFF	Active when APO is on the left side of the LCD display. Instrument automatically powers off after 15 minutes of inactivity. You must return the rotary switch to the OFF position to restart the meter.
Record Mode	Records Min/Max values.
Relative Mode	Displays
Range	Allows you to either manual range or use auto range to select the appropriate range.
7 Year Warranty	Covered by a standard 7 year warranty.

2. Product Applications

Perform the following tests and/or measurements with the TPI 173A 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.

ELECTRICAL

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

AUTOMOTIVE

DCV	• Battery and circuit voltage.
OHMS	• Continuity of wires and fuses.
ACV	• ABS brake sensors.
DCmA	• Circuit current draw

3. Specifications

IEC 61010-1 Over Voltage:
CAT II - 750Vac/1000Vdc
CAT III - 600Vac/dc
Pollution Degree 2

c UL us
LISTED
MEASURING EQUIPMENT

E188344 UL61010-1
28DK CAT II 750VAC/1000VDC
CAT III 600VAC/DC

a. DCV

Range	Resolution	Accuracy	Impedance
40mV	0.01mV	±(0.5% + 2 digits)	10MΩ
400mV	0.1mV		
4V	0.001V		
40V	0.01V		
400V	0.1V		
1000V	1V		

b. ACV

Range	Resolution	Accuracy	Impedance
40mV	0.01mV	±(1.5% + 5 digits)	10MΩ
400mV	0.1mV		
4V	0.001V	±(0.75% +5 digits)	
40V	0.01V		
400V	0.1V		
750V	1V	±(1.0% + 5 digits)	

c. DCA

Range	Resolution	Accuracy	Overload Protection
40µA	0.01µA	±(0.8% +2 digits)	Fuse 0.5Amp/600V
400µA	0.1µA	±(0.8% +5 digits)	
4mA	0.001mA		
40mA	0.01mA		
400mA	0.1mA		
4A	0.001A	±(1.2% +5 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

Range	Resolution	Accuracy	Overload Protection
400µA	0.1µA	±(1.2% +5 digits)	Fuse 0.5Amp/600V
4000µA	1µA		
40mA	0.01mA		
400mA	0.1mA		
4A	0.001A	±(1.5% +10 digits)	Fuse 10Amp/600V
10A	0.01A		

e. OHM (Resistance,Ω)

Range	Resolution	Accuracy	Overload Protection
400Ω	0.1Ω	±(1.0% +5 digits)	600V DC or AC Peak
4kΩ	0.001kΩ	±(0.5% +3 digits)	
40kΩ	0.01kΩ		
400kΩ	0.1kΩ		
4MΩ	0.001MΩ	±(1.0% +3 digits)	
40MΩ	0.01MΩ	±(1.5% +10 digits)	

g. Duty Cycle / Hz

Range	
0.1 ~99.9%	(0.5Hz to 500kHz, Width > 2uS)
Accuracy	
((0.1% + 0.05% / kHz) +1 Count	

h. Diode Test

Test Voltage	Max Test Current	Over Load Protection
2.7V	Approx. 1mA	600 V DC or Peak AC

i. Continuity Buzzer

Test Voltage	Threshold	Over Load Protection
0.4 ~ 0.6V	< 30Ω	600 V DC or Peak AC

j. Capacitance

Range	Resolution	Accuracy	Overload Protection
40nF	0.01nF		600V DC or AC Peak
400nF	0.1nF		
4uF	0.001nF	±(3.0% +10 digits)	
40uF	0.01uF		
400uF	0.1uF		
4000uF	1uF	±(7.0% +10 digits)	

k. Frequency (Hz)

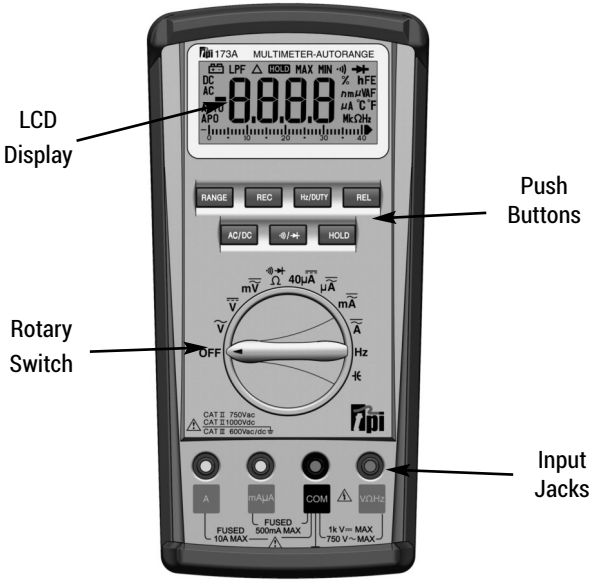
Range	Resolution	Accuracy	Overload Protection
10Hz	0.01Hz		600V DC or AC Peak
100Hz	0.1Hz		
1KHz	0.001KHz	±(0.05% +3 digits)	
10KHz	0.01KHz		
100KHz	0.1KHz		
1MHz	0.001MHz		
10MHz	0.01MHz		

l. 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)	1.3in x 3.4in x 7.4in (33mm x 86mm x 187mm)
Weight	340g (12oz)

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:



a. Push Buttons

RANGE	Activates manual ranging. Hold in for 3 seconds to return to autorange.
REC	Activates the Min/Max mode. APO (Auto Power Off) is disabled in this function. Hold in for 3 seconds to deactivate.
Hz/DUTY	Toggles the ACV or ACA measurement mode to Hz or Duty Cycle mode.
REL	Displays value as a difference of reference value.
AC/DC	Toggles between AC or DC on the mV function and all current functions.
/	Toggles between continuity buzzer or diode test on the resistance function.
HOLD	Holds the reading on the display until the button is pushed a second time.

b. Rotary Switch

OFF	Turns the 173A off.
Ṽ	Function for measuring AC voltage (ACV).
V̄	Function for measuring DC voltage (DCV).
mV̄	Function for measuring AC/DC millivolts (mV).
Ω	Funtion for measuring resistance, diode testing and continuity buzzer
40μĀ	Function for measuring up to 40 DC micoamps (uA)
μĀ	Function for measuring up to 4000 AC/DC microamps.
mĀ	Function for measuring up to 400 AC/DC milliamps.
Ā	Function for measuring up to 10 AC/DC amps
Hz	Function for measuring Frequency
CAP	Function for measuring Capacitance

c. Input Jacks

VΩHz	Red test lead connection for all Volt, Ohm, Frequency and Capacitance functions.
COM	Black test lead connection for all functions.
uAmA	Red test lead connection for current measurements on the uA and mA functions.
A	Red test lead connection for current measurements on the A function.

d. Disable Auto Power Off (APO)
With the rotary switch in the OFF position Press and hold down the AC/DC push button while turning the instrument on.

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
mV	COM	VΩHz	0.1mV	400.0mV
V	COM	VΩHz	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 VΩHz input jack.
4. Set rotary switch to either the mV or 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 173A.

Optional Functions:

RANGE	Manually select the appropriate range.
REC	Activate MIN/MAX record mode (page 22).
REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

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
V̈	COM	VΩHz	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 VΩHz input jack.
4. Set the rotary switch to the V AC 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 173A.

Optional Functions:

RANGE	Manually select the appropriate range.
REC	Activate MIN/MAX record mode (page 22).
Hz/DUTY	Scroll between Hz, Duty, and Volts.
REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

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
40µA	COM	µAmA	0.01µA	40µA
µA	COM	µAmA	0.1µA	4000µA
mA	COM	µAmA	0.01mA	400mA
10A	COM	A	0.001A	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 µAmA or A input jack depending on the value of current to be measured.
4. Set the rotary switch to the 40µA, µA, mA, or 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 173A.

Optional Functions:

RANGE	Manually select the appropriate range.
REC	Activate MIN/MAX record mode (page 22).
REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

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	µAmA	0.1µA	4000µA
mA	COM	µAmA	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 µAmA or A input jack depending on the value of current to be measured..
4. Set the rotary switch to the µA, mA or A function.
5. Press the AC/DC pushbutton to set to AC mode.
6. Connect test leads in series to circuit to be measured.
7. Reconnect power to the circuit to be measured.
8. Read the current on the 173A.

Optional Functions:

RANGE	Manually select the appropriate range.
REC	Activate MIN/MAX record mode (page 22).
Hz/DUTY	Scroll between Hz, Duty, and Volts.
REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

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 press the REL pushbutton. This value will automatically be deducted from your reading.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
Ω	COM	VΩHz	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 VΩHz input jack.
4. Set the rotary switch on the 173A to the Ω function.
5. Connect the test leads to the circuit to be measured.
6. Read the resistance value on the 173A.

Optional Functions:

RANGE	Manually select the appropriate range.
REC	Activate MIN/MAX record mode (page 22).
REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

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	VΩHz	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 VΩHz 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	VΩHz

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 VΩHz 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. MEASURING CAPACITANCE

CAUTION!
Disconnect power to the circuit(s) to be meaured. Discharge the capacitorto be measured completely before attempting to measure.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
CAP	COM	VΩHz	0.01nF	4000uF

Measurement Procedure:

1. Disconnect power and discharge the capacitor to be measured.
2. Plug the black test lead into the COM input jack.
3. Plug the red test lead into the VΩHz input jack.
4. Set the rotary switch to the CAP function.
5. Connect the test leads to the capacitor to be measured.
6. Read the capacitance on the 173A.

Optional Functions:

REL	Activate REL mode (page 22).
HOLD	Freeze the reading on the LCD.

i. MEASURING FREQUENCY

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

WARNING!
Never attempt a frequency measurement with a voltage source reater than 600V

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
Hz	COM	VΩHz	0.001Hz	10MHz

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 VΩHz input jack.
4. Set the rotary switch to the Hz function.
5. Connect the test leads to the circuit to be measured.
6. Reconnect power to the circuit to be measured.
7. Read the frequency on the 173A.

Optional Functions:

Hz/DUTY Scroll between Hz and Duty %.

HOLD Freeze the reading on the LCD.

j. 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 173A.
2. The 173A 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 173A 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.

k. RELATIVE MODE

The Relative mode compares readings to a known value and displays it as a difference to that value on the LCD.

1. Measure the known value on the 173A and press the REL button, the LCD will display zero.
2. Measure next device for comparison.
3. The LCD will display the difference between the new device and the stored reference value.
5. To terminate the Relative mode, hold the REL button down for approximately 2 seconds or turn the rotary switch to a different function.

F. MAINTENANCE

1. Testing Fuses In Circuit: Both the A and mAμA input jacks are fuse protected. The fuses can be tested without removing them from the instrument as follows:

   a. Set the 173A to the diode test function.

   b. Insert the red test lead into the V input jack.

   c. Touch the tip of the red test lead into the A input jack making sure you contact the metal.

   d. If the display reads any number, the fuse is good. If the display reads .OL, the fuse is open and must be replaced.

   e. Repeat the same procedure for the uAmA input jack.

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 173A.

   b. Remove 173A from protective boot.

   c. Remove the three screws from the lower back of housing holding the compartment cover in place.

   d. Remove the compartment cover.

   e. Remove the old fuse(s) and replace it with new fuse(s).

   f. Reassemble the instrument in reverse order from above.

3. Battery Replacement: The 173A will display a battery symbol in the upper left corner of the LCD when the two internal 1.5 Volt "AAA" batteries need replacement. Batteries are replaced as follows:

   a. Disconnect and remove all test leads from live circuits and from the 173A.

   b. Remove 173A from protective boot.

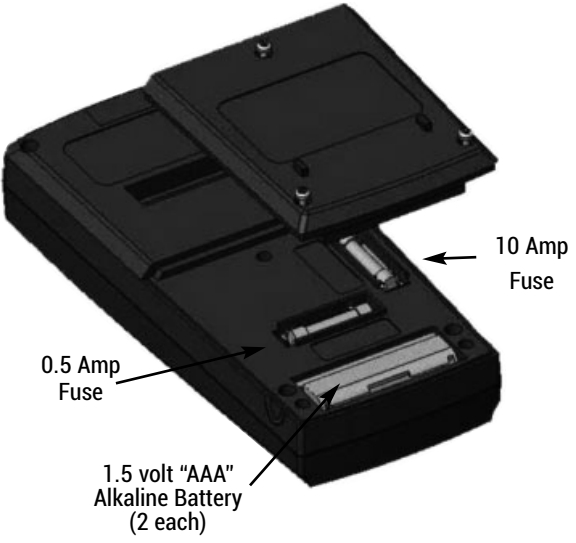
   c. Remove the three screws from the lower back of housing holding the compartment cover in place.

   d. Remove the compartment cover.

   e. Remove old batteries and replace with new batteries.

   f. Reassemble instrument in reverse order from above.

Battery/Fuse Compartment



3. Cleaning Your Meter: The 173A can be wiped clean with a damp cloth and mild detergent. Do not submerse in water.

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

Notes:

Notes:

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