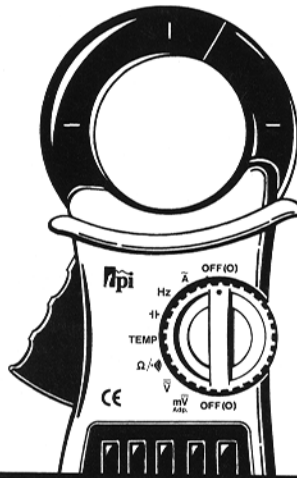


api

290

**Digital Clamp-on
Meter *Amp Plus*
Instruction Manual**



3. EC Declaration of Conformity

This is to certify that TPI Model 290 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
EN 61010-1	1993 Safety Standard
EN 61010-2-031	1995 Safety Standard
EN 61010-2-032	1995 Safety Standard

To ensure conformity with these standard, 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, it's 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 influence by these emissions.*

CAUTION: *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.*

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 290 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 the circuit being measured.
- Disconnect power to circuit, then connect test leads to the 290, 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**
-  **DC (DIRECT CURRENT)**
-  **REFER TO INSTRUCTION MANUAL**
-  **GROUND**
-  **DOUBLE INSULATION**
-  **EITHER DC OR AC**

C. TECHNICAL DATA

1. Features and Benefits

- Agency** UL Listed to U.S. and Canadian Safety Standards. Meets CE and IEC 1010.
- 4000 Count** Improves the resolution on all functions and ranges.
- Data Hold** Maintains the reading on the display for hard to reads areas.
- Trim Mode** Averages the readings for more stable output on LCD.
- Record Mode** Records Min/Max and Average value of the function being measured.
- Sleep Mode** Automatically powers down after 30 minutes of inactivity.
- Frequency** Measures the frequency of the current being measured.
- Dual Display** When measuring frequency, the bar graph indicates the current level.
- Bar Graph** Shows rapidly changing input signals that the normal display will not.

2. Product Applications

Perform the following tests and/or measurements with the 290 and the appropriate function:

HVAC/R

- ACA** • Line current.
- ACV** • Line voltage.
- ACV or DCV** • Control circuit voltage.
- OHMS** • Heating element resistance (continuity).
- OHMS** • Compressor winding resistance.
- OHMS** • Contactor and relay coil resistance.
- ACA** • Motor and compressor start up current.
- OHMS** • Continuity of wiring.
- Hz** • Frequency on control and line voltages.
- REC** • Record min/max voltage of controls and line voltages.
- ALL** • Bar graph to indicate rapid fluctuations.

ELECTRICAL

- ACV** • Measure line voltage.
- ACA** • Measure line current.
- OHMS** • Continuity of circuit breakers.
- DCV** • Voltage of direct drive DC motors.
- ACA** • Start up current of motors, relays, contactors and transformers.
- ALL** • Harmonics detection on line voltages.

ELECTRONIC

- ACV** • Measure power supply voltage.
- ACA** • Measure power supply current.
- OHMS** • Continuity of circuit breakers and fuses.

3. Specifications

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



* INSTALLATION I · II · III

INSTALLATION CATEGORY(OVERVOLTAGE CATEGORY) I

: Signal level, special equipment or parts of equipment, telecommunication, electronic etc., with smaller transient overvoltages than INSTALLATION CATEGORY II .

INSTALLATION CATEGORY(OVERVOLTAGE CATEGORY) II

: Local level, appliances, PORTABLE EQUIPMENT etc., with smaller transient overvoltages than INSTALLATION CATEGORY III .

INSTALLATION CATEGORY(OVERVOLTAGE CATEGORY) III

: Distribution level, fixed installation, with smaller transient overvoltages than INSTALLATION CATEGORY IV .

3. Specifications (cont.)

a. DCV			
Range	Resolution	Accuracy	Impedance
400mV	0.1mV	±0.75% of reading, ±3 digits	10MΩ
4V	0.001V		
40V	0.01V		
400V	0.1V		
600V	1V		

b. ACV (45Hz to 450Hz)			
Range	Resolution	Accuracy	Impedance
4V	0.001V	±1.2% of reading, ±3 digits	10MΩ
40V	0.01V		
400V	0.1V		
600V	1V		

c. ACA (45Hz to 450Hz)		
Range	Resolution	Accuracy
40.00A	0.01A	±1.5% of reading,
400.0A	0.1A	±5 digits
700A	1A	

⚠ ***Warning:** Test Leads. Use only correct type and overvoltage category rating.

3. Specifications (cont.)

d. OHM (Resistance, Ω)			
Range	Res.	Accuracy	Overload Protection
400.0Ω	0.1Ω	±0.75% of reading, ±10 digits	600V DC or AC Peak
4.000kΩ	0.001kΩ		
40.00kΩ	0.01kΩ		
400.0kΩ	0.1kΩ		
4.000MΩ	0.001MΩ		
40.00MΩ		±1.5%	
40MΩ	0.01MΩ	±1% of reading, ±3 digits	

e. Continuity Buzzer		
Test Voltage	Threshold	Over Load Protection
3V	< 100Ω (100 digits)	600 V DC or Peak AC

f. Temperature		
Range	Resolution	Accuracy
-40° to 1,300°C	1°C	±1.5°C +5 digits
-40° to 2,372°F	1°F	±3°F +5 digits

g. Frequency			
Range	Res.	Accuracy	Sensitivity
1KHz	0.1Hz	±0.2% of reading,	approx. <1.5A
10KHz	0.001kHz	±3 digits	

h. Capacitance			
Range	Res.	Accuracy	Overload Protection
1uF	0.001uF	±1.2% of reading,	600V DC or AC Peak
10uF	0.01uF	±5 digits	
100uF	0.1uF		
1000uF	1uF	±3% of reading,	
10000uF		±5digits	

i. General Specifications	
Max. Volt. between any Input and Ground	600V
Display Type	4,000 Count, 4 times per second update
Operating Temp.	-10° to 45°C (14° to 113°F)
Storage Temp.	-20° to 55°C (-4° to 131°F)
Relative Humidity	0% to 80% (0° - 35°C/32° - 95°F) 0% to 70% (35° - 50°C/95° - 122°F)
Altitude operating	6,562ft. (2,000meter)
Non-operating	40,000Ft. (12,000meter)
Power Supply	9 Volt Battery
Battery Life	80 hrs. Alkaline
Size (H x L x W)	40mm x 190mm x 65mm (1.5in x 7.25in x 2.5in)
Weight	315g (11.1oz)

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:

Push Buttons

FUNC Toggles between AC and DC volts, Temp(°C or °F) and Ω or \bullet functions.

RNG Activates manual ranging. Hold in for 2 seconds to return to autorange.

REC Activates the Min/Max/Record mode.

HOLD Holds the reading on the display until the button is pushed a second time.

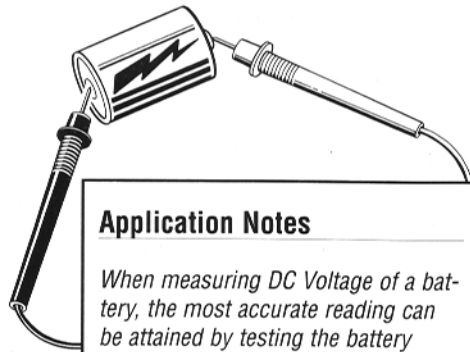
1. Controls and Functions (cont.):

Rotary Switch

OFF	Turns the 290 completely off.
\tilde{A}	Used to measure AC amps.
Hz	Used to measure frequency.
μ	Used to measure capacitance.
TEMP	Used to measure temperature.
Ω •	Used to measure resistance and use the continuity buzzer.
\tilde{V}	Used to measure AC and DC volts.
m\tilde{V}	Used to measure DC millivolt.
OFF	Turns the 290 completely off.

Input Jacks

COM	Black test lead connection for ACV, DCV, Ω , Continuity Buzzer Capacitance functions.
TEMP V/Ω/μ	Red test lead connection for all ACV, DCV, Ω , Continuity Buzzer Capacitance and TEMP functions.



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 16 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 290.*

2. Step by Step Procedures:

a. Measuring DC Volts

⚠ WARNING!

Do not attempt to make a voltage measurement of more than 600V or of a voltage level that is unknown.

Instrument set-up:

FUNC.	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAXI READING
$m\bar{V}$	COM	V/ Ω / \bar{A}	0.1mV	399.9mV
\bar{V}	COM	V/ Ω / \bar{A}	0.001V	600V

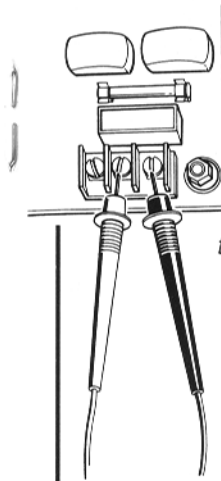
Measurement Procedure:

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/ Ω / \bar{A}** input jack.
4. Set rotary switch to the $m\bar{V}$ or \bar{V} range.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the 290.

Optional Modes

- **TRIM:** Push TRIM button to stabilize reading.
- **HOLD:** Freezes the reading on the LCD.
- **RANGE:** Manually ranges the instrument.
- **REC:** Record minimum, maximum.
- **FUNC:** Press the func button and A will be displayed on LCD and the meter reads low DC current.

16



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 18. 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.

17

b. Measuring AC Volts

⚠ WARNING!

Do not attempt to make a voltage measurement of more than 600V or of a voltage level that is unknown.

Instrument set-up:

FUNC.	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
\tilde{V}	COM	V/ Ω / μ	0.001V	600V

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 / μ** input jack.
4. Set the rotary switch to the \tilde{V} function.
5. Press the **FUNC** button until AC is on LCD.
6. Connect test leads to circuit to be measured.
7. Reconnect power to circuit to be measured.
8. Read the voltage on the 290.

Optional Modes

- **TRIM:** Push **TRIM** button to stabilize reading.
- **HOLD:** Freezes the reading on the LCD.
- **RANGE:** Manually ranges the instrument.
- **REC:** Record minimum, maximum.

c. Measuring AC Amps

CAUTION!

Do not attempt to make a current measurement with the test leads. The 290 measures the current by clamping the jaw around one conductor (wire). Clamping around more than one wire will result in erroneous readings.

Instrument set-up:

FUNC.	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
\tilde{A}	NOT USED	NOT USED	0.01A	700A

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Set rotary switch to \tilde{A} function.
3. Clamp the jaws around one conductor of the circuit to be measured.
4. Reconnect power to circuit to be measured.
5. Read the current on the 290.

Optional Modes

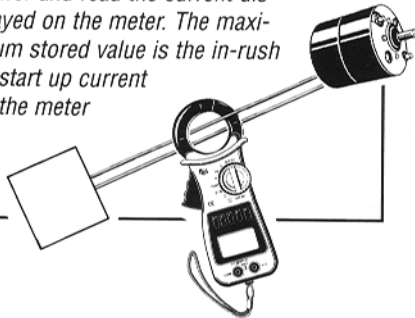
- **TRIM:** Push **TRIM** button to stabilize reading.
- **HOLD:** Freezes the reading on the LCD.
- **RANGE:** Manually ranges the instrument.
- **REC:** Record minimum, maximum.

Application Notes

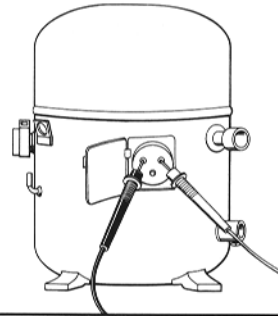
When measuring AC Amps of a motor there are two types of measurements that can be made, running current and in-rush or start-up current. Start-up current will usually be much higher than running current.

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

- Clamp the meter around a single wire and reconnect power to the device. Read the current displayed on the meter. This is the running current of the motor.
- Disconnect power to the motor and put the meter in REC mode. Reconnect the power and read the current displayed on the meter. The maximum stored value is the in-rush of start up current of the meter



20



Application Notes (Resistance)

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

Set up meter following steps under "Measurement Procedure" on page 22, and 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).

21

d. Measuring Resistance

⚠ WARNING!

Do not attempt to make resistance measurements with circuit energized. For best results, remove the resistor completely from 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:

FUNC.	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
Ω	COM	V/ Ω / μ	0.1 Ω	39.99M Ω

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 / μ input jack.
4. Set the rotary switch to the Ω function.
5. Connect test leads to circuit to be measured.
6. Read the resistance value on the 290.

Optional Modes

- **HOLD:** Freezes the reading on the LCD.
- **RANGE:** Manually ranges the instrument.
- **TRIM:** Push TRIM button to stabilize reading.
- **REC:** Record minimum, maximum.

e. Continuity Buzzer

⚠ WARNING!

Do not attempt to make continuity measurements with circuit energized.

Instrument set-up:

FUNC.	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
Ω	COM	V/ Ω / μ	0.001K Ω	4.000K Ω

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 / μ input jack.
4. Set the rotary switch to the Ω function.
5. Press the FUNC button until is on the LCD.
6. Connect test leads to circuit to be measured.
7. Listen for the buzzer to confirm continuity.

Optional Modes

- **HOLD:** Freezes the reading on the LCD.
- **TRIM:** Push TRIM button to stabilize reading.

f. Measuring Frequency

CAUTION!

Do not attempt to make frequency measurements with test leads. The 290 measures the frequency by clamping the jaw around one conductor (wire). Clamping around more than one wire will result in erroneous readings.

Instrument set-up:

FUNC	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
Hz	NOT USED	NOT USED	0.5Hz	10KHz

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Set the rotary switch to the **Hz** function.
3. Clamp the jaws around one conductor of the circuit to be measured.
4. Reconnect power to circuit to be measured.
5. Read the frequency on the 290.

Optional Modes:

- **HOLD:** Freezes the reading on the LCD.
- **RANGE:** Manually ranges the instrument.

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:

FUNC	BLACK TEST LEAD	RED TEST LEAD	MIN READING	MAX READING
⌚	COM	V/Ω/⌚	0.001uF	9999uF

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/⌚** input jack.
5. Set the rotary switch to the **⌚** function.
6. Connect test leads to capacitor to be measured.
7. Read the capacitor on the 290.

j. Measuring Temperature

Instrument set-up:

FUNC	- TERMINAL OF TEMP. ADAPT.	+ TERMINAL OF TEMP. ADAPT.	MINIMUM READING	MAXIMUM READING
TEMP	COM	VΩ⎓	-40°F/C	2,498°F (1370°C)

Measurement Procedure:

1. Plug the temperature probe into the temperature adapter observing the correct polarity.
2. Plug temperature adapter into the **COM** and **VΩ⎓** input jack.
3. Set the rotary switch to the **TEMP** function.
4. Press set the 290 to measure in °F or °C.
5. Touch the welded end of the thermocouple wire to the item to be measured.
6. Read the temperature on the display.

h. Data Hold

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

i. Trim

(Average sensing mode for ACV, ACA, OHM, ⎓, TEMP and Continuity.)

Press the **TRIM** button when measuring unstable signals to stabilize the reading. The 290 will average the measured value approximately every 1.25 seconds to obtain a clearer picture of the current or voltage being measured.

l. Disable Sleep Mode

1. Set the 290 to the **OFF** position.
2. Push and hold down the **HOLD** button while turning the rotary switch to the desired function.
3. Release the **HOLD** button.
4. Check the LCD to see if the HOLD function is activated. If "H" is on the display, push the **HOLD** button to deactivate the DATA HOLD mode.
5. Sleep mode is now deactivated.

E. ACCESSORIES*

Standard Accessories	Part No.
9 Volt Alkaline Battery	A009A
Test Lead Set	A040
Soft Carrying Pouch	A200
Microamp Adapter	A212
Temp Probe	GK11M
Temp Input Connector	A106

Optional Accessories	Part No.
Test Lead set W/Alligator Clip	A050
Thermocouple Adapter(gas value)	A115
Boot Hook	A120
Push On Alligator Clips	A140
Screw On Alligator Clips	A150
Soft Carrying Pouch	A255
Pressure Adapter(500psi)	A620
CO Adapter(0-1999ppm)	A701
CO Adapter W/Alarm	A702
CO Adapter W/Push Button Zero	A711
Multipurpose Carrying Case	A900
Deluxe Test Lead Set	SDK1C
IEC 1010 Deluxe Test Lead Kit	TLS2000BC

*These accessories are not approved from UL

F. MAINTENANCE

- Battery Replacement:** The 290 will display a battery symbol 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 290.
 - Loosen the screw from the back of the 290 battery cover.
 - Remove the battery compartment cover.
 - Remove old battery and replace with new battery, observing the correct polarity.
 - Reassemble the instrument in reverse order from above.
- Cleaning your 290:**

Use a mild detergent and slightly damp cloth to clean the surfaces of the 290.

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 with uA adapter

- 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
- Open test lead

AC Volts 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

Test Products International, Ltd.

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

Test Products International

15/23 Greenhill Crescent
Watford Business Park
Watford England WD1 8QU
Tel: 01923 693300 • Fax: 01923 693301

Visit us on the World Wide Web at
www.testproductsintl.com for additional
product information.

290 SPECIFICATIONS ±0.75% Basic DCV Accuracy

<u>Func.</u>	<u>Range</u>	<u>Res.</u>
DCV	400mV	0.1mV
	4V	0.001V
	40V	0.01V
	400V	0.1V
	600V	1V
ACV	4V	0.001V
	40V	0.01V
	400V	0.1V
	600V	1V
ACA	40A	0.01A
	400A	0.1A
	700A	1A
OHM	400Ω	0.1Ω
	4kΩ	0.001kΩ
	40kΩ	0.01kΩ
	400kΩ	0.1kΩ
	4MΩ	0.001MΩ
Temperature	-40° to 1300°C	1°C
	-40° to 2372°F	1°F
Capacitance	1uF	0.001uF
	10uF	0.01uF
	100uF	0.1uF
	1000uF	1uF
	10000uF	1uF
Frequency	1KHz	0.1Hz
	10KHz	0.001KHz
Continuity	<u>Test Voltage</u>	<u>Threshold</u>
	3V	< 100Ω (100 digits)
Diode Test	<u>Test Voltage</u>	<u>Max Test Current</u>
	3V	Approx. 2.5mA

Test Products International, Inc.