tpi

440 Scope *Plus!*

Instruction Manual

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A. INTRODUCTION

1. Congratulations!!

Thank you for purchasing TPI brand products. The product you have just purchased in an innovative new concept in Digital Oscilloscope/Multimeter design – The Scope Plus. This hand-held meter is easy to use and is built to last. It is backed by a three (3) year limited warranty.

2. Product Description

The TPI 440 is a hand-held oscilloscope plus autoranging DMM. The instruments large, backlit LCD display shows a reading and waveform simultaneously. In addition to the standard functions of ACV, DCV, ACA, DCA, Ω, Diode Test and Continuity Buzzer; the 440 measures Frequency (Hz), Capacitance, Logic and Component test functions.

The 440 also has RS232 output and software for interfacing with a PC is offered as an optional accessory.

The 440 comes complete with the following accessories:

- **440 instrument**
- **Rechargeable batteries**
- **Set of standard test leads**
- **Charger/adapter**
- **Operating instructions**

3. EC Declaration of Conformity

This is to certify that model 440 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 440 before using to ensure proper operation.
- 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 the circuit, then connect the test leads to the 440, then to the 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**

 **EITHER DC OR AC**

C. TECHNICAL DATA

1. Features and Benefits

Approvals	Meets CE and IEC 1010 requirements.
True RMS	Needed to accurately measure non-sinusoidal AC voltage and current waveforms found on many controls and circuits.
Auto Set	440 automatically sets-up the scope depending on the magnitude of the signal being measured.
Real Time Update	Tracks events as they happen.
Glitch Capture	Finds spikes in signals.
Relative Mode	LCD displays the difference between the measured value and a stored value.
Trend Mode	Graphs signals to find problems with circuits.
Record Mode	Records Min/Max and Average values. Time reference when value was obtained.
Compare Mode	Compares stored value with measured value for matching components.
Relative % Mode	Displays measured value as a percentage of stored value for checking component tolerances.
RS232 Output	Transfers data directly to a PC while measuring.
Back Light	Allows viewing in any light condition.
Autorange	Automatically selects best range for measurement.
Low Battery Indication	Battery should be charged when battery symbol displays on LCD.

2. Specifications

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

OSCILLOSCOPE FUNCTIONS

Horizontal	
Sample Rate	20 Megasamples/second
Record Length	256 in all modes(pixel).
Samples/Division	20
Update rate	Real time.
Modes	Single shot
Accuracy	±0.01%
Sweep Rate	1µS to 1S in 1,2,5 sequence

Vertical	
Bandwidth	1 MHz
Resolution	8 Bits
Channels	Single
Coupling	AC, DC
Input Impedance	1.11 M Ohm
Accuracy	±3%
Max. Input Volts	1000 Vp-p

OSCILLOSCOPE FUNCTIONS (cont.)

Triggering	
Type	Internal
Coupling	AC, DC, Glitch Capture
Slope	+ or - edge
Internal Trigger Sensitivity	2/20 Division

Other	
Glitch Capture	Over 0.05 Horizontal division, 0.25 Vertical division spike. Minimum time 1µS.
Digital Trigger Delay Time	0-512 Samples
Logic Test Display	3V & 5V CMOS, TTL

DIGITAL MULTIMETER FUNCTIONS

a. DCV

Range	Resolution	Accuracy	Impedance
400mV	0.1mV	±0.3% of reading, ±2 digits	more then 100MΩ
4V	0.001V		10MΩ
40V	0.01V		
400V	0.1V		
1000V	1V		

b1. ACV (20Hz to 50Hz)

Range	Resolution	Accuracy	Impedance
300mV	0.1mV	±1.5% of reading, ±10 digits	1.11MΩ
3V	0.001V		
30V	0.01V		
300V	0.1V		
750V	1V		

*__NOTICE__: Digit fluctuates at AC 20Hz~ 40Hz range. in 1~2 minutes after input.

b2. ACV (50Hz to 1kHz, 1kHz to 10kHz)

Range	Resolution	Accuracy	Impedance
300mV	0.1mV	±0.75% of reading, ±10 digits (N/A for 1kHz to 10kHz)	1.11MΩ
3V	0.001V		
30V	0.01V		
300V	0.1V		
750V	1V		

b3. ACV (10kHz-30kHz, 30kHz-100kHz, 100kHz-200kHz)

Range	Resolution	10-30kHz	30-100kHz	100-200kHz	Impedance
300mV	0.1mV	±2.5% of reading, ±30 digits	±4% of reading, ±200 digits	±10% of reading, ±300 digits	1.11MΩ
3V	0.001V				
30V	0.01V				
300V	0.1V				
750V	1V	N/A	N/A	N/A	

c. DCA

Range	Resolution	Accuracy	Overload Protection
400µA	0.1µA	±0.5% of reading, ±5 digits	Fuse* (fast blow) F600V, 0.5A, 31CM
4000µA	1µA		
40mA	0.01mA		
400mA	0.1mA		
4A	0.001A	±0.75% of reading, ±5 digits	F600V, 10A, 31CM
10A	0.01A		

d. ACA

Range	Resolution	20-50Hz	50Hz-3kHz	3-10kHz	10-30kHz
300µA	0.1µA	±1.0% rdg, ±10 digits	±0.75% rdg, ±10 digits	±2.0% rdg, ±20 digits	±2.0% rdg, ±40 digits
3000µA	1µA				
30mA	0.01mA				
300mA	0.1mA				N/A
3A	0.001A			N/A	
10A	0.01A				

e. OHM (Resistance, Ω)

Range	Resolution	Accuracy	Overload Protection
400Ω	0.1Ω	±0. 3% of reading, ±10 digits	600V DC or AC Peak
4kΩ	0.001kΩ	±0.3% of reading, ±2 digits	
40kΩ	0.01kΩ		
400kΩ	0.1kΩ		
4MΩ	0.001MΩ	±1.0% of reading, ±10 digits	
30MΩ	0.01MΩ	±1.5% of reading, ±20 digits	

f. Continuity Buzzer

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

g. Diode Test

Test Voltage	Max Test Current	Over Load Protection
3V	Approx. 2.5mA	600 V DC or Peak AC

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

i. Capacitance

Range	Resolution	Accuracy	Over Load Protection
400.0nF	100pF	±3% of reading, ±5 digits	600 V DC or Peak AC
4.0µF	0.001µF		
40.0µF	0.01µF		
400.0µF	0.1µF		

j. Frequency

Range	Resolution	Accuracy	Over Load Protection
100.00Hz	0.01Hz	±0.05% of reading, ±1 digit	600 V DC or Peak AC
1.0000kHz	0.1Hz		
10.000kHz	1Hz		
100.00kHz	10Hz		
1.0000MHz	100Hz		
2.0000MHz	100Hz		

**Sensitivity(square wave)

1Hz below	N/A
2Hz to 1kHz	1V
1kHz to 2MHz	1.5V

General Specifications

Max. Volt. between any Input and Ground	1000V
Basic DC Accuracy	0.3%
Frequency Counter Range	2 MHz
Meter AC Bandwidth	200 kHz
Waveform Display Bandwidth	1 MHz
Fuse Protection	**mA:** 0.5Amp/600VAC; **A:** 10Amp/600VAC
Display Type	Super-twist LCD, 160 x 240 pixels
Operating Temp.	0° to 50°C (32° to 122°F)
Storage Temp.	-20° to 60°C (-4° to 140°F)
Relative Humidity 0% to 80%:	(0°-35°C/32°-95°F) **0% to 70%:** (35°-55°C/95°-131°F)
Temp. Coefficient	0.1 x (Specified Accuracy) per °C for temperature <18°C to >28°C
Power Supply	Nicad Battery 7.2V, AA Cell x 8
Battery Life Time	5 Hours
Battery Charge Time	3 Hours
Safety Designed	Pollution degree 2, Overvoltage Cat. II 1000V, Cat. III 600V per IEC 1010, UL3111 and C22.2 No. 1010-1
Size (H x L x W)	52 x 220 x 100mm
Weight	1 lb. 6 oz

D. MEASUREMENT TECHNIQUES

1. Controls and Functions:

Push Buttons

F1-F5 Selects additional functions displayed across the bottom of the LCD.

D Mode Selects digital scope mode with functions displayed across the bottom of the LCD.

Hold A Freezes the analog reading on the LCD.

RGE Push once to select manual ranging, push again to return to functions.

PROG Push once to select REC, REL% and COMPARE functions. Once selected, use the EDIT button to set parameters.

T.BASE Push once to select time base, push again to return to functions.

MEM Push once to waveform and setup memory, push again to return to functions.

 Turn back light on and off.

 Select help text.

Rotary Switch

OFF Turns the instrument off.

V Selects the DCV function.

V Selects the ACV function.

Ω Selects resistance or continuity buzzer function.

Selects the diode test function.

μA Selects DC or AC microamps.

mA Selects DC or AC milliamps.

A Selects DC or AC amps.

Hz Selects the Frequency function.

LOGIC Selects the Logic Test function.

1. Controls and Functions: (cont.)

⊣(Selects the Capacitance function.

COMP Selects the Component Test function.

OFF Turns the instrument off.

Input Jacks

A Red test lead connection for current measurements on the $\widetilde{A}$ function (AC and DC amps).

µmA Red test lead connection for current measurement on the µ$\widetilde{A}$ and m$\widetilde{A}$ functions (AC and DC micro and milliamps).

COM Black test lead connection for all functions.

VΩ⊣(Red test lead connection for Volts, Ohms, Capacitance, Logic and Component Test functions.

RS-232C Output

DB9on top of 440 See section M on RS-232C interface.

a. Measuring DC Volts (V)

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
$\overline{\overline{V}}$	COM	VΩ⊣⊢	0.1mV	1000V

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 the **VΩ⊣⊢** input jack.
4. Set the rotary switch to the $\overline{\overline{\mathbf{V}}}$ function.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the 440.

Optional DMM Functions **(refer to page 27)**

REL	PEAK HOLD	FREQ	PERI	FULL AUTO
F1	F2	F3	F4	F5

PROG **(refer to page 27)**

REC	REL%	COMP	EDIT	EXIT
F1	F2	F3	F4	F5

Optional D Mode Functions **(refer to page 29)**

COMBO	METER	SCOPE	TREND	EXIT
F1	F2	F3	F4	F5

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 1000V 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⊣⊢	0.1mV	750V

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into the **VΩ⊣⊢** input jack.
4. Set the rotary switch to the **$\tilde{V}$** function.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the 440.

Optional DMM Functions (refer to page 27)

REL	PEAK HOLD	FREQ	PERI	FULL AUTO
F1	F2	F3	F4	F5

PROG (refer to page 27)

REC	REL%	COMP	EDIT	EXIT
F1	F2	F3	F4	F5

Optional D Mode Functions (refer to page 29)

COMBO	METER	SCOPE	TREND	EXIT
F1	F2	F3	F4	F5

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	mA	0.1μA	4000μA
mA⎓	COM	mA	10μA	400mA
A⎓	COM	A	1mA	10.00A

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug the red test lead into the **mA** 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. Connect test leads in series to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the current on the 440.

Optional DMM Functions (refer to page 27)

REL	PEAK HOLD	DC FREQ	AC FREQ	FULL AUTO
F1	F2	F3	F4	F5

PROG (refer to page 27)

REC	REL%	COMP	EDIT	EXIT
F1	F2	F3	F4	F5

Optional D Mode Functions (refer to page 29)

COMBO	METER	SCOPE	TREND	EXIT
F1	F2	F3	F4	F5

d. Measuring AC 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
μÃ	COM	mA	0.1μA	3000μA
mÃ	COM	mA	10μA	300mA
Ã	COM	A	1mA	10.00A

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug the red test lead into the **mA** or **A** input jack depending on the value of current to be measured.
4. Set the rotary switch to the **μÃ, mÃ** or **Ã** function.
5. Push the **F4** button
6. Connect test leads in series to circuit to be measured.
7. Reconnect power to circuit to be measured.
8. Read the current on the 440.

Optional DMM Functions (refer to page 27)

REL	PEAK HOLD	DC FREQ	AC FREQ	FULL AUTO
F1	F2	F3	F4	F5

PROG (refer to page 27)

REC	REL%	COMP	EDIT	EXIT
F1	F2	F3	F4	F5

OPTIONAL D MODE FUNCTIONS (refer to page 29)

COMBO	METER	SCOPE	TREND	EXIT
F1	F2	F3	F4	F5

e. Measuring Resistance

⚠ ***WARNING!***

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

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
Ω•)))	COM	VΩ⊣⊢	0.1Ω	30.00MΩ

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 **VΩ⊣⊢** input jack.
4. Set the rotary switch on the 440 to the Ω•))) function.
5. Connect the test leads to the circuit to be measured.
6. Read the resistance value on the 440.

Optional DMM Functions (refer to page 27)

REL	☐☰			FULL AUTO
F1	F2	F3	F4	F5

PROG (refer to page 27)

REC	REL%	COMP	EDIT	EXIT
F1	F2	F3	F4	F5

Optional D Mode Functions (refer to page 29)

	METER		TREND	EXIT
F1	F2	F3	F4	F5

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 circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into **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 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 OUCH (Overload).

NOTE: If diode reads 0 in both directions, diode is shorted. If diode reads OUCH in both directions, diode is open.

Optional DMM Functions **(refer to page 27)**

	◖⋮		**POLA. CHECK**	
F1	**F2**	**F3**	**F4**	**F5**

g. Continuity Buzzer

⚠ ***WARNING!***

Do not attempt to make continuity measurements with circuit energized.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD
Ω •)))	COM	VΩ ⊣⊢

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug 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 Ω •))) function.
5. Press the **F2** button to activate the continuity buzzer.
6. Connect test leads to circuit to be measured.
7. Listen for the buzzer to confirm continuity.

h. Measuring Capacitance

⚠ ***WARNING!***

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

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
⊣⊢	COM	VΩ ⊣⊢	0.1nF	400.0µF

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 **VΩ⊣⊢** input jack.
5. Set the rotary switch to the ⊣⊢ function.
6. Connect test leads to capacitor to be measured.
7. Read the capacitor value on the LCD.

Optional D Mode Functions (refer to page 27)

	METER		TREND	EXIT
F1	F2	F3	F4	F5

i. Measuring Frequency

⚠ ***WARNING!***

Never attempt a frequency measurement with a voltage source greater than 600V. Determine the voltage of any unknown frequency source before connecting the instrument in frequency mode.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
Hz	COM	VΩ⊣⊢	0.01Hz	2.0000MHz

Measurement Procedure:

1. Disconnect power to circuit to be measured.
2. Plug black test lead into the **COM** input jack.
3. Plug red test lead into the **VΩ⊣⊢** input jack.
4. Set the rotary switch to the **Hz** function.
5. Reconnect power to circuit to be measured.
6. Read the frequency on the LCD.

Optional DMM Functions

			PERIOD	
F1	F2	F3	F4	F5

F4 Period Push F4 to display the Period (1/time) of measured frequency.

Optional D Mode Functions (refer to page 29)

COMBO	METER	SCOPE	TREND	EXIT
F1	F2	F3	F4	F5

j. Component Test

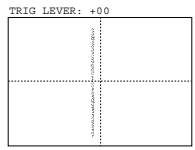
Use Component Test to measure the characteristics of a passive component (in or out of circuit, no power applied). The 440 provides an AC stimulus signal to the component and plots the voltage drop against the current measurement. The resulting pattern provides information about passive circuit condition.

2Hz	20Hz	200Hz		
F1	F2	F3	F4	F5

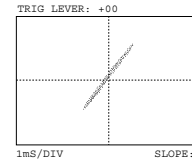
Diagrams are displayed on the LCD that can be used to roughly identify components being measured. The diagrams below show typical signatures for the components that are indicated. Some components may be difficult to distinguish due to similarities in pattern, however, the determination of a good or bad component can be made.

NOTE:

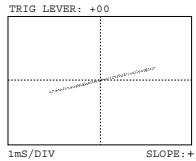
RESISTOR 0Ω



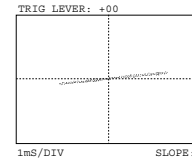
RESISTOR 1kΩ



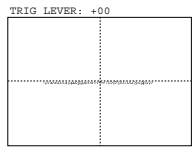
RESISTOR 10kΩ



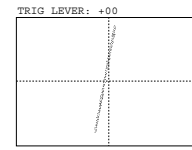
RESISTOR 20kΩ



RESISTOR 100kΩ

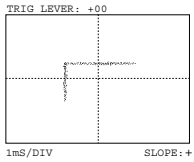


RESISTOR 200Ω

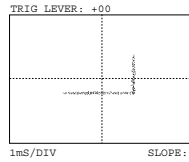


NOTE:

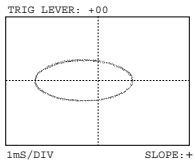
DIODE FORWARD



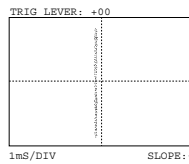
DIODE REVERSE



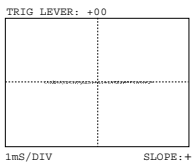
ELEC/CAP. 0.33uF



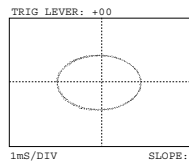
ELEC/CAP. 47uF



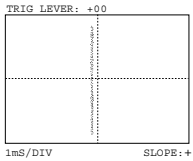
METAL CAP. 0.22uF



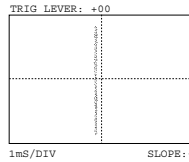
MYLAR CAP. 103



TANTAL CAP. 0.47uF



INDUCTOR



k. Logic Test

The logic state of IC's can easily be determined with the 440. Use the function buttons to select TTL, 3V CMOS or 5V CMOS logic chips. The 440 will display high and low logic levels.

TTL	3V CMOS	5V CMOS		
F1	F2	F3	F4	F5

This function is designed to check the HI/LOW logic states of IC's and circuits by direction of the arrow on the LCD. For TTL circuits, the arrow will point downward at or below 2.9 volts and upward at or above 3.2 volts. For 3V CMOS the arrow will point downward at or below 1.7 volts and upward at or above 2.0 volts. For 5V CMOS the arrow will point downward at or below 3.1 volts and upwards at or above 3.4 volts. When the BZ is also activated, the 440 buzzer will sound when HI logic levels are measured.

E. SPECIAL DMM FEATURES AND FUNCTIONS

1. REL:{Range- ACV,DCV, OHM, DC/AC(µA,mA,A)}

REL stands for relative. When a reading is measured that is wanted as a standard, pushing the REL function will display the variance from the standard for all subsequent readings. This is useful for matching components in circuits.

a) Obtain a stable reference reading on the 440.

b) Push the REL (F1) button on the 440.

c) The REL value will be displayed just above the function button menu on the lower portion of the LCD.

d) Measure subsequent items.

e) The LCD will display the difference between the REL stored value and the measured value.

2. PEAK HOLD:{Range- ACV,DCV, DC/AC(µA,mA,A)}

The 440 displays the MAX and MIN readings for the main function being measured.

3. **:**(Range-OHM, DIODE, LOGIC)

Pushing the BZ button activates the **Continuity Buzzer**. The buzzer sounds when the resistance measured is <100 Ohms.

Note: The following items are accessed by pushing the PROG button on the 440.

{Range-ACV,DCV, OHM, DC/AC(µA,mA,A)}

REC	REL%	COMP		EXIT

4. REC PRESS

REC	REL%	COMP		EXIT

Pushing this button activates the **Min/Max** record function. The minimum and maximum values of readings over a period of time are displayed on the LCD.

5. REL%

REC	REL%	COMP	EDIT	EXIT

Pushing this button activates the **REL%** function.

EDIT PRESS

←	→	↑	↓	EXIT

A reference value is entered using the edit button and all subsequent readings are displayed as a percentage to the reference value.

6. COMP

REC	REL%	COMP	EDIT	EXIT

Pushing the COMP buttons enters the 440 into the **Compare Mode**.

←	→	↑	↓	EXIT

A reference value is entered using the edit button and all subsequent readings are displayed compared to the reference value.

NOTE: The first line edited is the HI value. To access the line for LO value, push the F1 key to scroll to the lower line.

F. D MODE FEATURES AND FUNCTIONS

1. TREND {Range-Cap., Freg., ACV,DCV, AC/DC(µA,mA,A)}

The TREND mode allows you to measure a specific function for a predetermined length of time so you can look for trends in the circuit being monitored. The following functions are enabled when TREND mode is entered.

RS232	TIME SET	TREND TYPE	RE-START	
F1	F2	F3	F4	F5

a) **RS232** Enables the RS232 port on the top of the 440. Allows for interface between the 440 and a PC.

b) **TIME SET** Allows you to edit the time per division for the trend graph.

	SLOW	FAST		EXIT
F1	F2	F3	F4	F5

Slow or Fast selects the interval to use on the horizontal scale as data points are plotted on the trend graph. (Seconds: 1, 2, 5, 10, 15, 30, 45; Minutes 1, 2, 3)

c) **TREND TYPE**

AVG	SAMPLE			EXIT
F1	F2	F3	F4	F5

Average: Plots the average of all samples taken by the 440 during the plot interval.
Sample: Plots the last sample taken by the 440 at the time the data point is plotted.

d) **RE-START** Starts plotting a new trend graph as new samples are acquired. Primary readings are displayed and plotted; there are no secondary readings in Trend Mode.

NOTE: The following is an example of setting up TREND mode for a 10 ACV signal:

Push the D MODE button and then the TREND(F4) button. Set the sampling time by pushing the TIME SET(F2) button to the desired rate. Push EXIT to return to previous menu.

Push the TREND TYPE(F3) button. select from the following: AVERAGE(F1)-Draws plot of the sampled data at the end of the sample time.

RESTART starts the plotting process retaining the above settings.

Display will show all data points in recording time.

2. SCOPE (PRESS D MODE)

Pushing the SCOPE button (F3) enters the 440 in the oscilloscope mode. The following function is displayed:

TIME BASE	TRIG	SINGL	GLITCH CAP	FULL AUTO
F1	F2	F3	F4	F5

a) **TIME BASE** Allows the user to adjust the time base for the displayed waveform. Push the F2 button to decrease the time and F3 to increase the time {sweep speed(1, 2, 5, 10, 20, 50uS, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50mS, 0.1, 0.2, 0.5, 1S)}. F5 exits the menu.

	SLOW	FAST		EXIT
F1	F2	F3	F4	F5

b) **TRIG** Allows the user to set the slope and level of the trigger. Push F1 to set the slope + or -; push F2 to increase trigger level; push F3 to decrease the trigger level. F5 exits the menu.

SLOPE	UP	DOWN		EXIT
F1	F2	F3	F4	F5

c) **SINGL** This mode will force the 440 to show one single sweep of the measured parameter based on the time and trigger settings.

d) **GLITCH CAPTURE** An excellent troubleshooting tool for finding spikes in circuits. Set the trigger to a level above the normal peak value of a circuit and let the 440 baby-sit the line until a spike is encountered. The 440 will display only this event showing a problem with the line.

G. WAVEFORM MEMORY & SET-UP MEMORY

WAVEFORM MEMORY: 8 Pages (locations)
Set-up Memory: 8 Pages (locations)

1. Using Waveform Memory

a) Press **MEM** Key($\overline{\overline{\text{V}}}$, $\tilde{\text{V}}$, $\overline{\tilde{\mu\text{A}}}$, $\overline{\tilde{\text{mA}}}$, $\overline{\tilde{\text{A}}}$)

RANGE UP	RANGE DOWN	WAVE MEM	SETUP MEM	EXIT
F1	F2	F3	F4	F5

F3: Waveform Memory
F4: Setup Memory

b) Press **WAVE/MEM** Key

PAGE UP	PAGE DOWN	SAVE	LOAD	EXIT
F1	F2	F3	F4	F5

F1, F2: Page Up, Down; Select Memory Location (0,1,2,3,4,5,6,7 Page)
F3: Save the present waveform to a memory location
F4: Load and Display from selected Memory

2. Using Set-up Memory

a) Press **MEM** Key($\overline{\overline{\text{V}}}$, $\tilde{\text{V}}$, $\overline{\tilde{\mu\text{A}}}$, $\overline{\tilde{\text{mA}}}$, $\overline{\tilde{\text{A}}}$)

		WAVE MEM	SETUP MEM	EXIT
F1	F2	F3	F4	F5

F1, F2: RANGE UP, DOWN
F3: Waveform Memory
F4: Setup Memory

b) Press **MEM** Key(⭢|, Hz, Logic, ⫴, COMP)

			SETUP MEM	EXIT

c) Press **MEM** Key(OHM)

			SETUP MEM	EXIT

d) Press **SETUP/MEM** Key

PAGE UP	EDIT	SAVE	LOAD	EXIT
F1	F2	F3	F4	F5

F1: Page Up, Down; Select Memory Location (0,1,2,3,4,5,6,7 Page)
F2: New Edit (Range, Contrast, D Mode, Baud Rate, etc.)
F3: Save the present setup status
F4: Load and setup from selected Memory

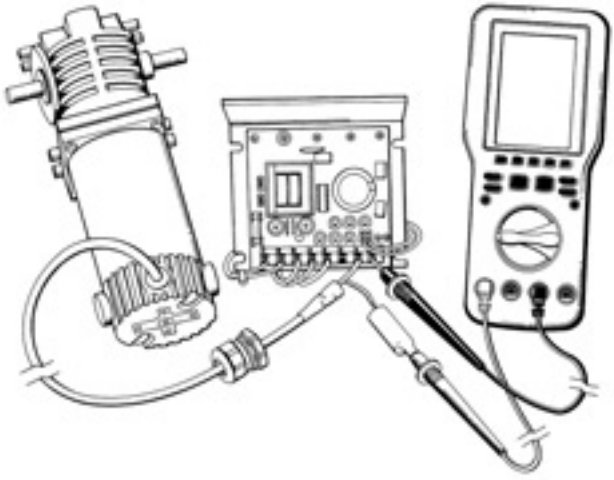
e) **EDIT** Press

NEXT	←	→		EXIT

NEXT: Menu selection
←, →: Mode level and function selection.

f) Adjusting REL% and COMP reference value is as follows

1. Enter the REL% key COMP mode by pushing PROG key
2. Push the REL% key(F2) to adjust REL% reference value and then push EDIT key(F4).
3. Set the digit by right and left direction key and set the figure by up to down direction key and then push the EXIT key.
4. Enter the COMP mode by pushing F3 key and push the EDIT key(F4).
5. Set the digit by right and left direction key and set the figure by up and down direction key and then push the EXIT key(HI,LO,setting).
6. Push the RGE key and SETUP/MEM key.
7. Save the adjusted value with page up key(F1) to memory page.



Measure DC Drive Motor Current

The 440 can measure the start-up, running and drop-out current of DC drive motors. Connect the 440 in series with motor and controller at the controller, and proceed by following instructions to measure DC amps.

H. NORMAL MODE 440 APPLICATIONS

Note: Scope sets up automatically for all applications below. For best performance, leave 440 in default COMBO scope/DMM mode.

1. Industrial Motor Control

a) Start-up inrush current
b) Waveform symmetry
c) Variable frequency drive signals
d) Pulse width modulation
e) Noise
f) AC and DC speed control signals

2. Power Quality

a) Noise on industrial feeds
b) AC voltage waveshape
c) Current waveforms

3. NC Machines

a) Power quality
b) Sensor outputs
c) Control circuits
d) Safety circuits
e) Calibration and adjustments

4. Uninterruptible Power Supplies

a) Sensing and monitoring circuits
b) Output waveforms
c) Current waveforms

5. Audio

a) Public address feeds
b) Amplifiers
c) Mixers
d) Preamps

H. NORMAL MODE 440 APPLICATIONS (cont.)

6. Video

a) Horizontal and vertical scan rates
b) Z axis blanking
c) Sync pulses
d) Luminance

7. Factory Automation

a) Robot control signals
b) Machine Vision
c) Machine and control sensing circuits
d) Calibration of positioning systems
e) Analog controllers
f) Servo controls

8. Line Conditioners

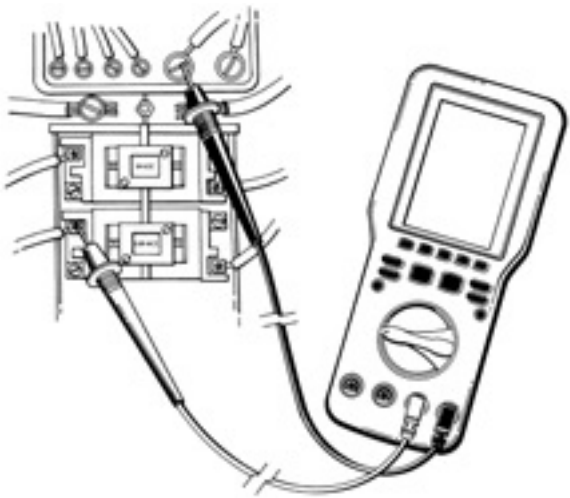
a) Quality

9. Voltage Regulators

a) Noise
b) Stability

10. Inverters

a) Waveform Quality



Monitoring Power Quality

The 440 can monitor power quality on branch circuits from the breaker box. This helps to identify existing or potential circuit instability. Connect the 440 at the breaker box and follow instructions to measure AC Voltage.

I. TREND MODE 440 APPLICATIONS

The 440 trend mode is used to look at signals over a period of time to see if they changes or get interrupted. Set-up the 440 as follows:

Set-up Procedure:

1. Set the rotary switch to the desired function depending on the device being measured (ACV, DCV, ACA, DCA,Cap,Freq).
2. Push the button to manually select the correct range by pushing the **F1** or **F2** buttons then push **EXIT.**
3. Press the **D MODE** button.
4. Press the **TREND (F4)** button.
5. Set **TIME SET (F2)** and **TREND TYPE (F3)** for the trend being measured and RESTART (F4) press.
6. The 440 will display the trend graph on the LCD.

Applications:

1. Industrial Furnace Controls
2. Climate Control

   a)Waveform quality

J. GLITCH CAPTURE 440 APPLICATIONS

The 440 Glitch Capture feature can be used to look at the applications listed below. Set-up the 440 as follows:

Set-up Procedure:

1. Set the rotary switch to the desired function depending on the device being measured (ACV, DCV, ACA, DCA).
2. Push **RGE** button to manually select the correct range by pushing the **F1** or **F2** buttons then push **EXIT.**
3. Press the **D MODE** button.
4. Press the **SCOPE (F3)** button.
5. Adjust the **TIME BASE (F1)** and **TRIGGER LEVEL(F2).** (Note: Trigger level must be set slightly above normal signal level to capture a spike.)
6. Push **GLITCH CAP (F4)**.
6. 440 will display the waveform measured when triggered.

Applications:

1. **Industrial Motor Controls**
   a) SCR trigger pulses
2. **Power Quality**
   a) Machine Start-up
   b) Power quality interference and noise
3. **Programmable Logic Controls**
   a) Input and output signals
   b) Control signals
   c) Signal conditioning circuits
   d) Communication lines
   e) Power supply
4. **Uninterruptible Power Supplies**
   a) Switching circuits
5. **Industrial Lighting Controls**
   a) SCR's
   b) Solid State circuitry
6. **Line Conditioners**
   a) Noise
   b) Quality

K. ACCESSORIES*

Standard Accessories	Part No.
Charger/Adapter	A401
Test Lead Set	A050
7.2 V Battery Pack	A004

Optional Accessories	Part No.
Deluxe Carrying Case	A900
Software and RS232 Cable	A402
Fuse, 0.5 Amp	A104
Fuse, 10 Amp	A110
Temperature Adapter	A301
Pressure adapter	A620
AC amp adapter (0~400)	A251
AC/DC amp adapter (0~400)	A256
AC/DC amp adapter (0~1000)	A296
Deluxe test lead set	TLS2000B
Screw-on alligator clips	A150
CO adapter (0~1999ppm)	A701
CO adapter w/Alarm	A702
CO Adapter w/Push button zero	A711
Thermocouple adapter	A115

*These accessories have not been evaluated by UL and are not considered as part of the UL Listing of this product.

L. MAINTENANCE

1. **Battery Replacement:** The 440 battery pack needs replacement when it will no longer hold a charge. Battery is replaced as follows:

a. Disconnect and remove all test leads from live circuits and from the 440.

b. Remove the five screws from back of the housing.

c. Carefully pull apart the front and rear instrument housing.

d. Remove old battery pack and replace with new.

e. Reassemble instrument in reverse order from above.

WARNING:

- Replace old battery with new 7.2V battery pack.
- Make sure that replaced battery part number is A004.
- To charge the battery, battery eliminator 'A401' should be used.

2. **Fuse Replacement:** Both the A and µmA input jacks are fuse protected. If either does not function, replace fuse as follows:

a. Disconnect and remove all test leads from live circuits and from the 440.
b. Remove the five screws from the back of housing.
c. Carefully pull apart front and rear instrument housing.
d. Remove old fuse(s) and replace with new fuse(s).
e. Reassemble instrument in reverse order from above

3. **Cleaning your 440:**

Use a mild detergent and slightly damp cloth to clean the surfaces of the 440.

M. OPTIONAL RS232 COMMUNICATION AND SOFTWARE INSTALLATION /OPERATION GUIDE

HARDWARE REQUIREMENTS

- IBM PC or compatible.
- Microsoft Windows version 3.X or Windows 95.
- Serial communications port.

SOFTWARE INSTALLATION.

1. Insert the 3.5" floppy disk provided in to disk drive A(B).
2. WINDOWS 3.1
   From program Manger Click "File"
   Click "RUN" and type A(B):\SETUP.EXE
   Click the "OK" button or press enter.
3. WINDOWS 95
   Click start
   Click "RUN" and type A(B):\SETUP.EXE
   Click the "OK" button or press enter.
4. "Initializing setup" will be displayed.
5. "Install to C:\VDMM box will be displayed.
   This is the default location for this program. If you would like to install this program into a different directory type in the new directory at this time.
6. Press the "continue" button.
7. The installation status will be displayed
   This shows the progress of the installation.
8. "Scope Plus Installation is complete!" will be displayed when the installation program is complete.
   Press "OK"

The program been completely installed and is ready for use.

ESTABLISHING COMMUNICATION BETWEEN SCOPE PLUS AND YOUR PC.

1. Double click the "scope plus" icon.
2. Connect the 9 pin male connector of the RS232 cable to a top of the 440.
   Connect the 9 pin female connector of the RS232 cable to a serial COM port on your computer.
3. Select the COM port that is being used in the"COM ports" box.(com port 1,2,3 or 4)

4. Click the “START” button in the “Communication” box.

The scope plus will being to communicate with the computer at this time and readings will be displayed in the upper left corner of the screen.
Click “Stop” to cancel.

DESCRIPTIONS

START	Begins communication between the Scope plus and the PC.
STOP	Ends communication between the Scope plus and the PC.
DATE	Current date based on internal clock.
TIME	Current time based on internal clock.
S/TIME	Use to set the sampling time.
COMM PORTS	Select the communication port being used .
BAUD RATE	Select the baud rate.

SAVE IN FILE MANAGEMENT(DMM/SCOPE)BOX.
: Stores recorded data to a specific file for meter(scope).

LOAD IN THE FILE MANAGEMENT(DMM/SCOPE)BOX.
: Retrieves saved data from a specific file for meter(scope).

WAVEFORM MEMORY LOAD BOX.
: Retrieves saved waveform memory from the scope plus.

PRINTER BOX.

: RDG DATA	Start/stop printing data.
SCREEN	Print main screen.

N. TROUBLE SHOOTING GUIDE

Problem	Probable Causes
Does not power up	• Dead or defective battery • Broken wire from battery pack to PCB
Won't display current readings	• Open fuse • Open test lead • Improperly connected to circuit under test

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