196

Digital Multimeter
Instruction Manual

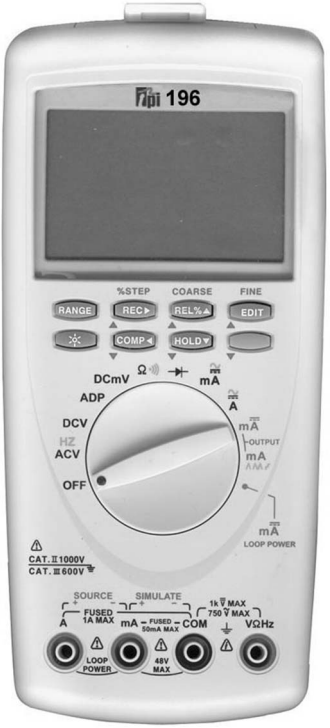


TABLE OF CONTENTS

A. INTRODUCTION

INTRODUCTION

1. Congratulations!!

Thank you for purchasing a TPI Digital Multimeter. The Triple Display196 is an innovative new concept in DMM design. The unique display enables you to view more than one event at a time. This eliminates the hassle of switching back and forth to review minimum, maximum or preset comparative values. The meter is also easy to use and built to last.

2. Production Description

The DMM 196 is a hand-held autoranging DMM. The backlit LCD can display three readings at one time. In addition to basic function of AC/DC V, AC/DC A, Ohm, Diode test, continuity, Capacitance, Frequency, there is the adaptor function. The DMM 196 also has RS232 output and software for recording information into a PC.

The DMM 196 also features:

- **REC** Records Min/Max and Average readings during specified measurement intervals.
- **COMP** Compare actual reading to preset HI and LOW value for Pass/Fail testing of component.
- **HOLD** Tow hold system automatically holds the previous stable reading when a new one is obtained.

The DMM 196 comes complete with the following accessories:

Battery
Rubber Boot
Test Lead Set
Instruction Manual

3. EC Declaration of Conformity

This is to certify that model DMM 196 conforms to the protection requirement 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**

To ensure conformity with these standards, this instruction must be operated in accordance with the instruction 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 the 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 DMM 196 before using to make sure it is operating property.
- 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 under test.
- Disconnect power to circuit, and then connect test leads to the DMM 196, and then to circuit being measured.

NEVER

- Attempt to measure unknown high voltage.
- Attempt to measure current with the meter in parallel to the circuit.
- Connect to the test leads to a live circuit before setting up the instrument.
- Touch any exposed metal part of the test lead assembly.

INTERNATION SYMBOLS

 **CAUTION: RISK OF ELECTRIC SHOCK**

 **AC (ALTERNATING CURRENT)**

 **DC (DIRECT CURRENT)**

 **REFER TO INSTRUCTION MANUAL**

 **GROUND**

 **FUSE**

 **DOUBLE INSULATION**

C. TECHNICAL DATA

1. Features and benefits

Safety	Meets CE and IEC 1010 requirements. UL Listed to U.S. and Canadian Safety Standards.
True RMS	Needed to accurately measure non-sinusoidal AC voltage and current waveforms found on many controls and circuits.
Triple Display	Shows more than one reading simultaneously.
Two-Hold System	Holds two readings on the display at thesame time.
Auto Power Off	Automatically powers instrument down after 15 minutes of inactivity, yet will continue acquiring data in its various modes.
Record	Records Min/Max and Average values
Compare	Compares stored value with measured value for matching components.
Relative Percentage	Displays measured value as a % 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.
Auto range	Automatically selects the best range for the measurement.

2. Product Applications

Perform the following tests and/or measurements with the DMM196 and the appropriate function:

HVAC/R

DC mV	• Gas application.
ACA	• Heat anticipator current in thermostats.
ACV	• Line voltage.
ACV or DCV	• Control circuit voltage.
DcuA	• Flame safeguard control current.
OHMS	• Heating element resistance (continuity).
OHMS	• Compressor winding resistance.
OHMS	• Contactor and relay coil resistance.
OHMS	• Continuity of wiring.
Hz/FREQ	• Frequency of line and control voltage.
CAP	• Motor start and run capacitance.
REC	• Record min/max voltage of controls and line voltages.

ELECTRICAL

ACV	• Measure line voltage.
OHMS	• Continuity of circuit breakers.
Hz/FREQ	• Frequency of line and control voltage.
DCV	• Voltage of direct drive DC motors.

ELECTRONIC

ACV	• Measure power supply voltage.
OHMS	• Continuity of circuit breakers.
REL%	• Match components
COMP	• Compare readings in circuit or components
Hz/FREQ	• Frequency of line and control voltage.

3. Specifications

IEC 1010 Over Voltage:
CAT II-1000VDC, 750VAC
CATIII-600V
Pollution Degree 2

c UL us
LISTED
UL 3111-1

※ **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 INSTALLTION CATEGORY **IV**.

3. Specifications (cont.)

General Specifications

a. DCV

Range	Resolution	Accuracy	Impedance
5V	0.0001V	+/-0.05% of reading, +/- 4digits	10MΩ
50V	0.001V		
500V	0.01V		
1000V	0.1V	+/-0.1% of reading, +/- 10digits	

b. DCmV

Range	Resolution	Accuracy	Impedance
50mV	0.001mV	+/-0.1% of reading, +/- 10digits	
500mV	0.01mV		

c. ACV(45Hz to 450Hz)

Range	Resolution	Accuracy	Impedance
5V	0.0001V	+/-0.4% of reading, +/- 40digits	10MΩ
50V	0.001V		
500V	0.01V		
1000V	0.1V		

3. Specifications (cont.)

d. DCA

Range	Resolution	Accuracy	Overload protection
5mA	0.0001mA	+/-0.5% of reading,	Fuse(fast blow)
50mA	0.001mA	+/- 5digits	F600V, 0.5A 31CM
500mA	0.0001A	+/-0.75% of reading,	Fuse(fast blow)
1A	0.01mA	+/- 5digits	F600V, 1A 31CM

e. ACA

Range	Resolution	Accuracy	Overload protection
5mA	0.0001mA	+/-0.75% of reading,	Fuse(fast blow)
50mA	0.001mA	+/- 5digits	F600V, 0.5A 31CM
500mA	0.0001A	+/-1.5% of reading,	Fuse(fast blow)
1A	0.01mA	+/- 5digits	F600V, 1A 31CM

f. OHM(Resistance)

Range	Resolution	Accuracy	Overload protection
500Ω	0.01Ω	+/-0.05% of reading,	600V DC or AC
5KΩ	0.0001KΩ	+/- 5digits	peak
50KΩ	0.001KΩ		
500KΩ	0.01KΩ		
5MΩ	0.0001MΩ	+/-1.0% of reading,	
50MΩ	0.001MΩ	+/- 10digits	

g. Diode test

Range	Resolution	Accuracy	Overload protection
3V	Approx. 1mA		600V DC or AC peak

3. Specifications (cont.)

h. Continuity Buzzer

Test voltage	Threshold	Overload protection
3V	30digits	600V DC or AC peak

i. Current Output

Mode	Range	Accuracy
Source	0~24mA	0.1% of reading, +/- 10digits
Smulate	0~24mA	

j. Frequency

Range	Resolution	Accuracy	Overload protection
500Hz	0.01Hz	+/-0.05% of reading, +/- 5digits	600V DC or AC peak
5Khz	0.0001Khz		
50Khz	0.001Khz		
500Khz	0.01Khz		

k. Adaptor

Model		Display
A301(Temp Adaptor C/F)	1mV/C, 1mV/F	0000.0 C/F
A254(Current Adaptor 10/60A)	100mV/A, 10mV/A	00.000A 000.00A
A256(Current Adaptor 40/400A)	1mV/A	0000.0A
A296(Current Adaptor 400/1000A)	1mV/A	0000.0A

3. Specifications (cont.)

I. General Specifications	
Max. volt. between any input and Ground	1000V
Fuse protection	**mA :** 0.5A/600VAC; **A :** 10A/600VAC
Display Type Digital :	50000 count, 4 times/S update Bar graph : 51 segment
Operating temp.	0°C to 40 °C (32°F to 113°F)
Storage Temp.	-20°C to 60°C (-4°F to 140°F)
Relative Humidity	0% to 80% (0° ~ 35 °C/ 32° ~ 95°F) 0% to 70% (35° ~ 55 °C/ 95° ~ 131°F)
Power Supply	9Volt battery
Battery Life	
Size(H x L x W)	
Weight	

D. MEASUREMENT TECHNIQUES

1. Controls and function:

Push Button

RANGE	Activates manual range
REC	Activates the Min/Max/Avg mode.
REL %	Activates REL% mode.
EDIT	Activates the EDIT mode for the compare and relative % function.
	Activates Backlight for the LCD(Automatically turns off after approx. 35 sec.)
COMP	Activates Compare mode.
HOLD	Activates two-hold data hold mode

Rotary Switch

OFF	Turns the instrument off.
DCmV	Selects the DC mV function
DCV	Selects the DCV function
ACV	Selects the ACV function
	Selects the Diode test function
	Selects the Ohm function (Push ORANGE button to activate continuity buzzer.)
HZ	Selects the Frequency function
	Selects the DC mA function (Push ORANGE button to activate AC mA.)

≅ A	Selects the DC A function (Push ORANGE button to activate AC A.)
Adp	Can use A254, A256, A296 and A301 (Push ORANGE button to activate AC adaptor, and push RANGE button to choose kind of adaptor)

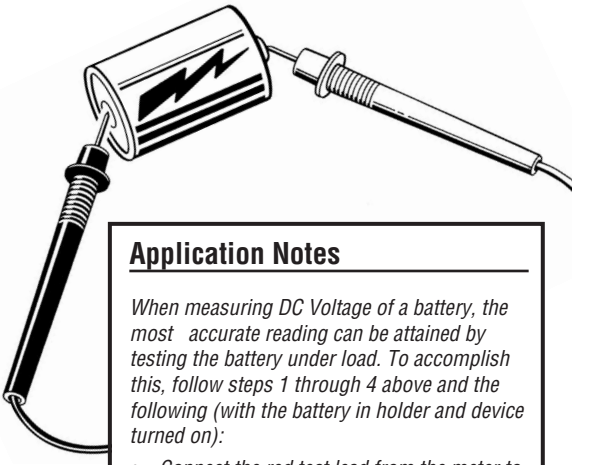
Input Jacks

V/Ohm	Red test lead connection for all Volt, Ohm, Diode, and Continuity measurement.
COM	Black test lead connection for all functions.
uA/mA	Red test lead connection for current measurement on the AC/DC uA and AC/DC mA.
A	Red test lead connection for current measurement on the AC/DC A.

RS-232	See section on RS-232C interface

2. Power on Options:

Disable Auto Off	Hold down the REC button while turning on the instrument.
Current output	Hold down the Range button while turning on the instrument.



Application Notes

When measuring DC Voltage of a battery, the most accurate reading can be attained by testing the battery under load. To accomplish this, follow steps 1 through 4 above and the following (with the battery in holder and device turned on):

- *Connect the red test lead from the meter to the positive (+) terminal of the battery.*
- *Connect the black test lead to the negative (-) terminal of the battery.*
- *Reconnect power to the circuit and read the voltage on the 190.*

3. Step by step procedure

a. Measuring DC Volts

CAUTION

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

⚠ ***WARNING!***

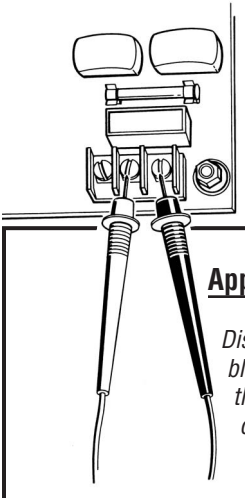
Do not attempt to make a voltage measurement of more than 1000V or of voltage level that is unknown.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
mV⎓	COM	VΩ	0.001mV	500.00mV
V⎓	COM	VΩ	0.0001V	1000.0V

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 **VΩHz** input jack.
4. Set rotary switch to either the **DCmV** or **DCV** range, depending on the voltage to be measured.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the LCD.



Application Notes

Disconnect power from the terminal block, find the fuse or circuit breaker that controls the block and turn it off.

Set up the meter following the steps under "Measurement Procedure" on page 13. Then proceed with the following:

- *Connect the red test lead to the hot side of the block and the black lead to the neutral side of the block. Reconnect power to the block and read the voltage on the meter. The reading should be approximately 110V to 130V.*
- *Disconnect power from the block and move the red wire to ground. Reconnect power to the block and read the voltage on the meter. Typically less than 20V should exist from neutral to ground. If 110V or above exists, the block may be wired incorrectly.*

b. Measuring AC Volts

CAUTION

Do not attempt to make a voltage measurement if a test lead is plugged in the A or umA 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 than is unknown.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
$\tilde{V}$Hz	COM	VΩHz	0.0001V	750.0V

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 **VΩHz** input jack.
4. Set the rotary switch to the **ACV** function depending on the voltage to be easured.
5. Connect test leads to circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the voltage on the LCD.

c. Measuring DC Amps

CAUTION

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

⚠ ***WARNING!***

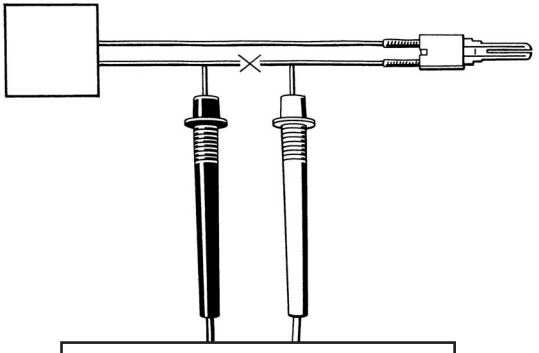
Do not attempt to make a current measurement of circuits with more than 600V present. Instrument damage and/or personal injury may result.

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
mA⎓	COM	mA	0.001mA	500.00mA
A⎓	COM	A	0.0001A	10.000A

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 **mA** or **A** input jack depending on the value of current to be measured.
4. Set the rotary switch to the mA⎓ or A⎓ function.
5. Connect the test leads in series to the circuit to be measured.
6. Reconnect power to circuit to be measured.
7. Read the current on the LCD.



Application Notes

When measuring the DC current of a flame controller, follow the steps under "Measurement Procedure" above and then proceed with the following:

- *Set up the meter for making a µA measurement.*
- *Connect the meter to the flame controller lead by opening the circuit and inserting the leads in series with the circuit as shown in the picture above.*

d. Measuring AC Amps

CAUTION

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

⚠ ***WARNING!***

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

Instrument set-up:

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
mA~	COM	mA	0.001mA	500.00mA
A~	COM	A	0.0001A	10.000A

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 into the **mA** or **A** input jack depending on the value of current to be measured.
4. Set the rotary switch to the mA~ or A~ function.
5. Press the orange push 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 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 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	**VΩHz**	0.01Ω	50.000MΩ

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 **VΩHz** input jack.
4. Set the rotary switch to the Ω•))) function.
5. Connect the test leads to the circuit to be measured.
6. Read the resistance value 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	2.0000V

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 **VΩHz** input jack.
4. Set the rotary switch to the →| function.
5. Connect the black test lead to the banded end of the diode and the red test lead to the non-banded end of the diode.
6. Reading on the display should be between 0.5 and 0.8 volts.
7. Reading test lead connections in 5 above.
8. Reading on the display should be OFL(Overflow).

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**
Ω•)))	COM	**VΩHz**

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 **VΩHz** input jack.
4. Set the rotary switch to the Ω•))) function.
5. Press the orange push 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 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 source before connecting the instrument in frequency mode.

FUNCTION	BLACK TEST LEAD	RED TEST LEAD	MINIMUM READING	MAXIMUM READING
HZ	COM	**VΩHz**	0.01Hz	500.00KHz

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 **VΩHz** input jack.
4. Set the rotary switch to the **HZ ACV** function.
5. Press the orange push button.
6. Reconnect power to circuit to be measured.
7. Read the frequency on the LCD.

i. Record Mode

The record mode saves minimum (MIN) and maximum (MAX) values measured for a series of readings. The main part of the LCD displays the actual reading, the MAX value is constantly displayed on the lower left hand sub-display while the MIN value is constantly displayed on the lower right hand sub-display. Activate the function as follows:

1. Depress the **REC** button on the 196.
2. The DMM 196 will immediately start to record and display MIN/MAX values on the two lower sub-displays.
3. Press **REC** button a second time and the AVG(average) reading will be displayed.
4. Press the **REC** button again to return to normal record mode.

j. Compare Mode

The compare mode takes the actual reading on the main display and compares it to LOW and HIGH values, programmed by the user, on the sub-displays. This is used to compare components or measurements for acceptable readings. Activate the function as follows:

1. To use **Compare Mode** manually select the correct range for the function.
2. Depress the **COMP** button.
3. Depress the **EDIT** button the right hand digit under the HIGH sub-display will start to flash.
4. Depress the **REL**% or **HOLD** buttons until the correct number is selected for the position.
5. Depress the **REC** button. The next digit to the right of 3 above will start to flash.
6. Repeat steps 4 and 5 until the correct values for all eight digits under LOW and HIGH sub-display are entered.
7. After the correct LOW and HIGH values are entered, depress the **EDIT** button.
8. Measure the circuit or component being compared to the programmed values. Results will be displayed as PASS for the acceptable readings, LO for low readings, and HI for high readings.
9. Depress the **COMP** button or turn the rotary switch to exit the function.

k. Relative % Mode

The Relative % mode takes the actual reading on the main display and compares it to a reference value programmed by the user on the right hand sub-display. The left hand sub-display will show the percentage the actual reading varies from the reference value. Activate the function as follows:

1. To use **Relative** % mode manually select the range for the function.
2. Depress the **REL**% button.
3. Depress the **EDIT** button. The right hand digit under the **REF** sub-display will start to flash.
4. Depress **REL**% or **HOLD** buttons until correct number is selected for that display position.
5. Depress the **REC** button. The next digit to the right of 3 above will start to flash.
6. Repeat steps 4 and 5 until correct values for all four digits under **REF** sub-display are entered.
7. After the correct **REF** value is entered, depress the **EDIT** button.
8. Measure the circuit or component being compared to the programmed reference value. Results will be displayed as a percentage in the lower left hand left hand sub-display.
9. Depress the **REL**% button or turn the rotary switch to exit the function.

I. Two-Hold System

The two-hold system is a data hold feature that will automatically store a stable reading under the 1 HOLD sub-display in the lower left hand corner of the LCD. When a new, stable reading is obtained, the reading under 1 HOLD will be moved to 2 HOLD and the new reading will be displayed under 1 HOLD

Depress the **HOLD** button to activate the feature.

Push the button again to de-activate the feature.

m. Using the Current Output Functions

The meter provides steady, stepped, and ramped current output for testing 0-20 mA and 4-20 mA current loops. Choose source mode, in which the meter supplies the current, simulate mode, in which the meter regulates

1) Source Mode

Source mode is selected automatically by inserting the test leads into the **SOURCE + and - jacks**. Use source mode whenever it is necessary to supply current into a passive circuit such as a current loop with no loop supply. Source mode depletes the battery faster than simulate mode, so use simulate mode whenever possible. The display looks the same in source and simulate modes. The way to tell which mode is in use is to see which pair of output jacks is in use.

2) Simulate Mode

Simulate mode is so named because the meter simulates a current loop transmitter. Use simulate mode when an external dc voltage of 15 to 48 V is in series with the current loop under test.

CAUTION

Set the rotary function switch to one of the mA output settings BEFORE connecting the test leads to a current loop. Otherwise, a low impedance from the other rotary function switch positions could be presented to the loop, causing up to 35 mA to flow in the loop.

Simulate mode is selected automatically by inserting the test leads into the **SIMULATE + and - jacks**. Simulate mode conserves battery life, so use it instead of source mode whenever possible. The display looks the same in source and simulate modes. The way to tell which mode is in use is to see which pair of output jacks is in use.

Changing the Current Span
The meter's current output span has two settings (with overrange to 24 mA):

- 4 mA = 0 %, 20 mA = 100 %
- 0 mA = 0 %, 20 mA = 100 %(factory default)

To find out which span is selected, short the **OUTPUT SOURCE + and - jacks**, turn the rotary function switch to **OUTPUT** [mA, and observe the 0 % output level. To toggle and save the current output span in nonvolatile memory (retained when the power is turned off):

1. Turn off the meter.

2. Hold down **RANGE** while turning the meter on.

3. Wait at least 2 seconds, then release **RANGE**.

3) Producing a Steady mA Output

When the rotary function switch is in the **OUTPUT** [mA position, and the **OUTPUT** jacks are connected to an appropriate load, the meter produces a steady mA dc output. The meter begins sourcing or simulating 0 %. Use the pushbuttons to adjust the current as shown in Table 1. Select either sourcing or simulating by choosing the **SOURCE** or **SIMULATE** output jacks.

Note
The STEP pushbuttons described Table 9 are available when the meter is producing a steady mA output. The STEP pushbuttons go to the next multiple of 25 %.

Table 1. mA Output Adjust Pushbuttons

Buttons	Adjustment	Buttons	Adjustment
COARSE			FINE
REL	Adjusts up 0.1mA	**EDIT**	Adjusts up 0.001mA
HOLD	Adjusts Down 0.1mA	**ORANGE**	Adjusts Down 0.001mA

Table 2. mA Stepping Pushbuttons

Buttons	Adjustment
STEP	
REC	Adjusts up to the next higher 25 % step
COMP	Adjusts up to the next lower 25 % step

4) Manually Stepping the mA Output

When the rotary function switch is in the **OUTPUT** [mA position, and the **OUTPUT** jacks are connected to an appropriate load, the meter produces a steady mA dc output. The meter begins sourcing or simulating 0 %. Use the pushbuttons to step the current up and down in 25 % increments as shown in Table 2. See Table 3 for mA values at each 25 % step. Select either sourcing or simulating by choosing the **SOURCE** or **SIMULATE** output jacks

Note

The COARSE and FINE adjustment pushbuttons described in Table 1 are available when manually stepping the mA output.

Table3. mA step Value

STEP	Value(for each span setting)	
	4 to 20mA	0 to 20mA
0 %	4.000mA	0.000mA
25 %	8.000mA	5.000mA
50 %	12.000mA	10.000mA
75 %	16.000mA	15.000mA
100 %	20.000mA	20.000mA
120 %		24.000mA
125 %	24.000mA	

Auto Ramping the mA Output

Auto ramping gives the ability to continuously apply a varying current stimulus from the meter to a transmitter, while hands remain free to test the response of the transmitter. Select either sourcing or simulating by choosing the **SOURCE** or **SIMULATE** jacks.

When the rotary function switch is in the **OUTPUT mA** ⩘ ⩘ position, and the output jacks are connected to an appropriate load, the meter produces a continuously repeating 0 % - 100 % - 0 % ramp in a choice of four ramp waveforms:

⩘ 0 % - 100 % - 0 % 40-second smooth ramp

⩘ 0 % - 100 % - 0 % 15-second smooth ramp

⌐ 0 % - 100 % - 0 % Stair-step ramp in 25 % steps, pausing 5 seconds at each step. Steps are listed in Table 3.

The ramp times are not adjustable.

n. Loop Power Supply Mode

The Loop Power Supply Mode can be used for powering up a process instrument (transmitter). While in Loop Power Mode, the meter acts like a battery. The process instrument regulates the current.

o. RS-232C interface

Demonstration software is provided with the DMM. The program is written for windows using MFC. For you own applications, consult the following;

1. Specification

Baud rate	19200 baud
Parity	none
Data length	8 bit
Stop bit	1 bit

2. Transmitte format(DMM to PC)

Output and Input of all data are ASCII String.
Send Format(DMM to PC)
"fun b sign value b unit b cr lf"

fun	Function(ASCII code)
b	blank(0x20)
Sign	-(0x2E)/ (0x20)
Value	Measured value(ASCII string)
unit	Unit(ASCII string)
cr	Carriage Return
lf	Line Feed

Function code

Function	Function code	Unit
DCmV	DCV	mV
DCV	DCV	V
ACV	ACV	V
Diode	DIO	V
Ohm/Continuity	OHM/BEP	Ohm/ Kohm/ Mohm
Capacitance	CAP	uF/mF
Frequency	FRQ	Hz/ Khz
uA	DCA/ACA	uA
mA	DCA/ACA	mA
A	DCA/ACA	A
Adaptor	AC/DC1,2,3 TMP	A / tC/ tF
Current out	mA 0, A, B, C, 2	mA

Push button code

Push key	Code
RANGE	RANGE AUTO/ RANGE MANUAL
REC	REC ON/ REC AVG/ REC OFF
REL	REL ON ref2/ REL OFF
COMP	COMP ON ref1 ref2/ COMP OFF
HOLD	HOLD ON/ HOLD OFF

★) ref1 is the sub display on the left lower part of the LCD, ref2 is the sub display value on the right lower part of the LCD.

ex)"1 DCV 12.345 mV HIGH 10.000 11.000 crlf"

: "1" indicates the push button is being operated and mean the DCV function. The real value is 12.345mV. The main display shows "HI". The left lower part of the LCD shows 10.000mV and the right lower part of the LCD shows 11.000mV.

"2 DCV -1.2345 mV crlf"

"2 mA 0 + 04.000mA + 000.00 crlf"

: "2" indicates the push button is being off and Outputs the value being displayed on the Main display.

"3 REL ON crlf"

: Indicates the REL % key is being pressed.

Receive Format(PC to DMM)

REL ON ref2 Activates REL %.(If the value is input on ref2, it sets with value)

REL OFF Deactivates REL %

REC ON Activates the record mode to the normal mode.

REC AVG Activates the record mode to the AVG mode.

REC OFF	Deactivates Record mode
COMP ON ref1 ref2	Activates COMP.(If value is input on the meter uses these as high & low limit of compare)
COMP OFF	Deactivates COMP mode
HOLD ON	Activates HOLD mode
HOLD OFF	Deactivates HOLD mode
SKEY f	Indicates status of the function f is REL, REC, COMP, HOLD, RANGE.
DMM STOP	Set the RS-232C to stop mode.
DMM GO	Set the RS-232C to start mode.
DMM SINGLE	Output only one single data(one string) on the DMM(you can keep getting data by using this command)

E. ACCESSORIES

Standard Accessories	Part NO.
9 Volt Alkaline Battery	
Fuse 0.5A	
Fuse 10A	
Test lead	
Rubber boot	
Optional Accessories	

Accessories	Part NO.
Demonstration Software	
Deluxe Test lead set	
IEC 1010 Deluxe test lead kit	
Temperature Adaptor	A301
Current Adaptor 10/60A	A254
Current Adaptor 40/400A	A256
Current Adaptor 400/1000A	A296
Carrying case	

F. MAINTENANCE

1. **Battery Replacement:** The DMM 196 will display AT when the 9 volt battery needs replacement. Battery replaced as following:

   a. Disconnect and remove all test leads from live circuit and from DMM 196.

   b. Remove DMM 196 from protective boot.

   c. Remove the three screws from battery cover of back

   d. Remove old batteries and replace with new batteries.

   e. Reassemble instrument in reverse order from above.

2. **Fuse Replacement:** Both the A and mA/uA input jacks are fuse protected. Use only Fast blow, 600V fuses with correct current ratings. Failure to do so will void all Warranties. If either do not function, replace as Following:

   a. Disconnect and remove all test leads from live circuit and from DMM 196.

   b. Remove DMM 196 from protective boot.

   c. Remove the three screws from battery cover of back

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

   e. Reassemble instrument in reverse order from above.

   f. Fuse must be changed by replacement in service center.

3. **Cleaning your DMM 196**

   Use a mild detergent and a slightly damp cloth to clean the surfaces of the DMM 196.

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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196 Specifications ±0.05% Basic DCV Accuracy

Function	Range	Resolution
DCV	50mV	0.001mV
	500mV	0.01mV
	5V	0.0001V
	50V	0.001V
	500V	0.01V
	1000V	0.1V
ACV	5V	0.0001V
	50V	0.001V
	500V	0.01V
	750V	0.1V
DCA/ACA	5mA	0.0001mA
	50mA	0.001mA
	500mA	0.01mA
	1A	0.0001A
OHM	500Ω	0.1Ω
	5kΩ	0.0001kΩ
	50kΩ	0.001kΩ
	500kΩ	0.01kΩ
	5MΩ	0.0001MΩ
	50MΩ	0.001MΩ
Current out	0~24mA	0.001mA
Frequency	500Hz	0.01Hz
	5KHz	0.0001KHz
	50KHz	0.001KHz
	500KHz	0.01KHz

	Test Voltage	Test Current
Diode	Approx. 3V	Approx. 1mA

	Test Voltage	Threshold
Continuity	Approx. 3V	30 Digits

See pages 10~13 for detail specifications.