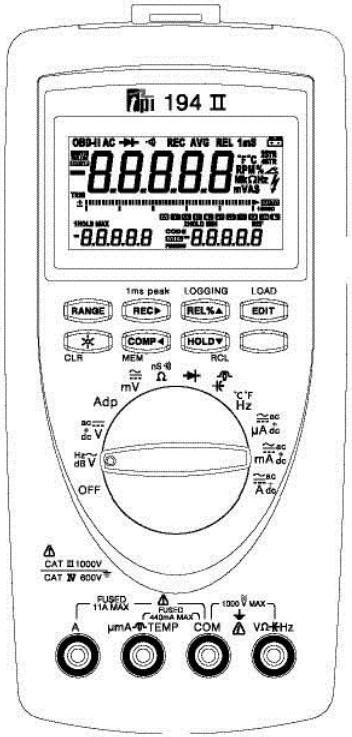
192II 194II

True RMS Multimeter

Instruction Manual



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A. SAFETY INSTRUCTIONS

This manual contains safety messages and warnings that must be obeyed to use the instrument safely and properly. Please follow the manufacturer's procedures through out this manual. Improper use may lead to damage the safety protection provision.

1. Safety Information
   - TPI192II
   a) Over Voltage 1000Vdc / 750Vac (Category II)
   b) Over Voltage 600V (Category III)
   - TPI194II
   a) Over Voltage 1000V (Category III)
   b) Over Voltage 600V (Category IV)
2. International Symbols
   a) ~ Alternating Current (AC)
   b) ⎓ Direct Current (DC)
   c) ⚠ WARNING!
   d) ⚠ CAUTION!: RISK OF ELECTRIC SHOCK
   e) ⏚ GROUND
   f) ⧈ DOUBLE INSULATION
   g) ⊟ FUSE

B. PRODUCT DESCRIPTION

a) Main Body
b) Test Lead
c) Protection Boot
d) RS-232 Cable and CD
e) Accessory
- K type thermocouple probe
- Current Adapter A254 (10/60A)
- Current Adapter A256 (40/400A)
- Current Adapter A296 (400/1000A)

C. SPECIFICATION

1. Basic Specification
   a) DC Voltage:0~1000V
   b) AC Voltage: 15mV~1000V
   c) Accuracy
   - DC Voltage: ± (0.05% + 5)
   - AC Voltage: ± (0.4% + 40)
   d) DC Current: 0-10A
   e) AC Current : 20μA~10A

   f) Resistance : 0Ω~50MΩ
   g) Capacitance: 0.01nF~20mF
   h) Coil : 0.01mH~300mH
   i) Temperature : -50 °C - 1350 °C (-54 °F - 2462 °F)
   j) Frequency : 0.5Hz~5MHz
2. Features
   a) Triple Display: 50000 count
   b) Analog Bar Graph : 51 segments
   c) Back Light : Allows viewing the display in dark.
   d) MIN/MAX Mode: Displays Minimum and Maximum Average Values
   e) Compare : Compares the measured value to reference value and displays the result as HI, LO, or PASS
   f) Hold : Holds the readings on LCD (Two readings will be held automatically)
   g) Record with Time Stamp: Stores the measured values in preset time intervals with its measured time.
   h) Storage and Reading
   i) Transfer the measured Values to Computers (RS-232C)
3. Digital Multimeter Specification
   a) DC millivoltage

Range	Resolution	Accuracy
50mV	1μV	0.05%+5
500m	10μV	

   b) DC Voltage

Range	Resolution	Accuracy
5V	100μV	0.05%+5
50V	1mV	
500V	10mV	0.1%+5
1000V	100mV	

   c) AC Voltage

Range	Resolution	Accuracy	
		50Hz ~ <450Hz	450Hz~ <5KHz
5V	100μV	0.4%+40	0.6%+40
50V	1mV		
500V	10mV		
1000V	100mV		

* Frequency sensitivity : more then 20% of F/S

Range	Resolution	Accuracy	
		5KHz~ <20KHz	20KHz~ 50KHz
5V	100μV	0.8%+40	0.8%+60
50V	1mV		
500V	10mV		------
1000V	100mV	------	

d) Resistance

Range	Resolution	Accuracy
50Ω	1mΩ	1%+10
500Ω	10mΩ	0.05%+10
5KΩ	100mΩ	
50KΩ	1Ω	
500KΩ	10Ω	
5MΩ	100Ω	1%+10
50MΩ	1KΩ	

e) DC Current

Range	Resolution	Accuracy
500μA	0.01μA	0.15%+10
5000μA	0.1μA	
50mA	1μA	
500mA	10μA	
5A	100μA	0.3%+5
10A	1mA	

f) AC Current

Range	Resolution	Accuracy
500μA	0.01μA	0.75%+10
5000μA	0.1μA	
50mA	1μA	
500mA	10μA	
5A	100μA	1.5%+5
10A	1mA	

g) Capacitance

Range	Resolution	Accuracy
5nF	0.01nF	2%+10
50nF	0.1nF	
500nF	1nF	
5μF	10nF	
50μF	100nF	
500mF	1μF	
5mF	10μF	
20mF	100μF	

h) Inductance

Range	Resolution	Accuracy
50mH	0.01mH	5%+80
300mH	0.1mH	5%+50

i) Temperature

Range	Resolution	Accuracy
-50℃ ~ 1350℃	0.1℃	2%+/-1℃
-54℉ ~ 2462℉	0.1℉	3%+/-1℉

j) Diode

Range	Test Current	Drop Out Voltage
5V	1mA	3V

k) Continuity Test

Range	Response Time	Drop Out Voltage
500Ω	< 1mS	3V

• Standard Level : Beeps under 10Ω and stops over 60Ω

l) Frequency

Range	Resolution	Accuracy
50Hz	0.001Hz	0.05%+5
500Hz	0.01Hz	
5KHz	0.1Hz	
50KHz	1Hz	
500KHz	10Hz	
5MHz	100Hz	

* Minimum Frequency : 0.5Hz
* Sensitivity : 0.5Hz ~ 5Hz : 600mV
5Hz ~ 500kHz : 250mV
500KHz ~ 5MHz : 400mV

m) Duty Cycle

Range	Resolution	Accuracy
0.1 ~ 99.9%	0.1%	Note

4. General Specification

a) Max. Voltage between any Input and Ground
- 1000V ACDC~194II
- 1000VDC, 750VAC~192II

b) Fuse Protection
- A Input
  11A/1000V~194II
  10A/600V~192II
- umA Input
  440mA/1000V~194II
  500mA/600V~192II

c) Altitude : Operating - up to 2000m
  Storage - 10000m

d) Operating Temperature : 0°C - 40°C (32°F - 113°F)

e) Storage Temperature : -20°C - 60°C (-4°F - 140°F)

f) Temperature coefficient
  0.05 x (specified accuracy) / °C (<18°C or >28°C)

g) Relative Humidity
- 0~80% (0°C - 35°C /32°F - 95°F)
- 0~70% (35°C - 40°C /95°F - 113°F)

h) Power Supply: 9V (NEDA 1604, JIS 006P or IEC 6F22)

i) Battery Life: 50 hrs

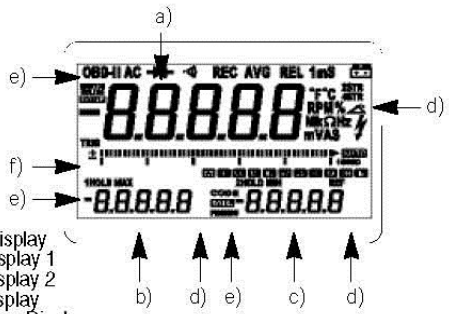
j) Calibration Interval : 1 year

k) Size
- 210mm x 95mm x 47mm
- 220mm x 110mm x 65mm (with boots)

l) Weight : 570g
  850g (with boots)

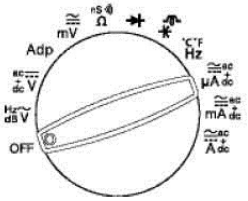
D. PARTS AND NAMES

1. Display



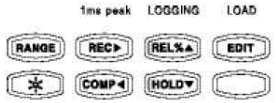
a) Main Display
b) Sub-Display 1
c) Sub-Display 2
d) Unit Display
e) Functions Display
f) Analog Bar Graph Display

2. Rotary Switch



OFF	Turns the instrument off. When not use the instrument, set the rotary switch at OFF
Hz dB V	Measures 0-1000V AC. Press button to change the functions in orders of ACV → dB → Hz → ACV.
ac dc V	Measures 0-1000V DC. Press button to Change the functions in order of DCV → ac+dc → DCV
Adp	Uses to select the Adapters. Press button to change AC to DC and press RANGE button to select the Adapter.
mV	Measures 0-500mV. Due to the high input impedance in this range, the 0.000mV would not be displayed when the input is open. should not be a problem when measuring an actual value. Press RANGE button to select AC or DC.
nS Ω	Measures 0-50MΩ. Press button to select the function in orders ofΩ → nS → Beep.
	Measures forward voltage drop of the diode
	Measures o.o1nF-20mF capacitor or 0.01mH-300mH coil. Press button to select coil or capacitor.
°C °F Hz	Measures frequency or temperatures using K-type thermocouple. Pressbutton to select the function in orders of Hz → C → F.
ac dc μA	Measures 0-5000uA DC or AC current. Press button to change the function in orders of DCuA → AcuA → ac + dc uA.
ac dc mA	Measures 0 - 500mA DC or AC current. Press button to change the function in orders of DcmA → AC mA → ac + dc mA.
ac dc A	Measures 0-10A DC or AC current. Press button to change the function in orders of DCA → ACA → ac + dc A.

3. Push Buttons



RANGE	To select the measuring ranges.
REC	To get MIN, MAX, AVG of the measured values
REL%	To get relative value as a % of reference value
EDIT	Use with REL% and COMP buttons. To set up the reference, high, low value.
✳	To turn on the backlight
COMP	To compare the actual reading to LOW and HIGH values.
HOLD	To hold and display the measured value on the display.
	To change the functions or features on rotary switch. (Both black and orange colored prints)
LOGGING	A mode to store the measured value and its measured time periodically.
LOAD	To re-display the stored values in LOGGING
MEM	To store the measured value by user during the measurement
RCL	To recall and display the stored value in MEM.
CLR	To erase (clear) the all stored values in MEM.

E. MEASUREMENT TECHNIQUE

1. Measuring AC/DC voltage

WARNING!	Do not attempt to make a voltage measurement of more than 1000V AC (194II) or 750V AC (192II) and 1000V DC or of a voltage level that is unknown.

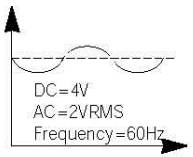
Measuring Range
mV : 50mV, 500mV(DC), 500mV (AC)
ACV/DCV : 5V, 50V, 500V, 1000V

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
⎓V	COM	VΩ⊣Hz
~V dBV		
~mV		

a) To measure the voltage, set up the rotary switch and the test lead as shown above.
b) Connect the test leads to the circuit to be measured
c) To measure frequency or dBm(dbV) in AC volt, press button. (function will be changed in orders of ACV -> dB -> frequency)
d) In measuring DC voltage, Both AC and DC in a signal that contains ac and dc can be measured at the same time. Press button in orders of DC V → ac + dc
e) In measuring mV, press to change ac to dc.

- dBm = 10 x log (display value / stored value)
  Reference value can be re-set by user in SETUP mode, and preset value is 600Ω
- dBV = 20 x log (display value / stored value)
  Reference value can be re-set by user in SETUP mode, and preset value is 1V
- ac + dc function



To measure the source shown above, 4.4721 will be displayed in main LCD for AC + DC, 2.0000 in lower left hand side sub-display for AC value, and 4.0000 in lower right hand side sub-display for DC value.

2. Measuring AC/DC Current

WARNING!	Do not attempt to make a current measurement of circuits with more than 1000V (194II) or 600V (192II) present.

CAUTION	Do not attempt to make a current measurement with the test lead connected in parallel with the circuit or parts to be tested. Set up the right positions of rotary switch and test leads.

Measuring Range
uA : 500μA, 5000μA

mA : 50mA, 500mA
A : 5A, 10A

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
μA dc	COM	μmA-Ω-TEMP
mA dc		
A dc		A

a) Disconnect the power to the circuit to be measured.
b) To measure the current, set the rotary switch and connect the test lead as shown above.
c) Connect the test leads in series to the circuit to be measured
d) Reconnect the power to the circuit to be measured and read the main display.
e) Press button to change the function. (in orders of DC → AC → ac + dc)

3. Measuring Resistance and Continuity Test

WARNING!	Do not attempt to make resistance measurements or continuity test with circuit powered.

Measuring Range
OHM : 50Ω, 500Ω, 5KΩ, 50KΩ, 500KΩ, 5MΩ, 50MΩ
Conductance : 50nS
Beep : 500Ω

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
nS Ω	COM	VΩ-Hz

a) To measure the resistance, set up the rotary switch and the test lead as shown above.
b) Connect the test leads to the resistor to be measured, and read the display.
c) Press button to change the function. (in orders of resistor → conductance → continuity test)
d) To measure small resistance, any resistance in test leads should be removed. To do this, press REL button.

e) In continuity test, it beeps under 10(and stops over 60Ω.
f) The response time of continuity test is within 1mS
g) Conductance is the opposite of resistance. The unit is Siemens (S).

4. Measuring Diode

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.

Measures forward voltage drop of a semiconductor like diodes or transistors. Working diode shows about 0.3~0.9V forward voltage drop. Shorted diode displays 0, opened diode displays "OFL".

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
→|	COM	VΩ-Hz

f) To measure the diode, set up the rotary switch and the test lead as shown above.
g) Connect the test leads to the diode to be measured, and read the display.

5. Measuring Capacitance and Inductance

CAUTION!	Disconnect power to the circuits to be measured. Discharge the capacitor to be measured completely before attempting to measure.

Measuring Range
Capacitance : 5nF, 50nF, 500nF, 5μF, 50μF, 500μF, 5mF, 20mF
Inductance : 50mH, 300mH

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
|(	COM	VΩ-Hz
-Ω-	COM	μmA-Ω-TEMP

a) To measure the current, set up the rotary switch and the test lead as shown above.
b) Connect the test leads to the circuit to be measured and read the display.
c) Press button to change the function. (in orders of capacitor -> coil)

d) To remove any capacitance remained between the instrument and test leads in measuring small capacitance, press REL% button.

6. Measuring frequency and temperature
Measuring Range
Frequency : 50Hz, 500Hz, 5KHz, 50KHz, 500KHz, 5MHz
Temperature : -50 - 1350 °C (-54 - 2462 °F)

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
Hz	COM	VΩ-⊣⊢Hz
°C °F	COM	µmA-⊣⊢TEMP

a) Measuring frequency
- To measure the frequency, set up the rotary switch and the test lead as shown above.
- Connect the test leads to the circuit to be measured, and read the display.

b) Measuring Temperature
- Connect the K type thermocouple adapter to COM (-) and µmA-⊣⊢TEMP (+) input.
- Connect the K type probe and read the display.

c) Press ⬭ to change frequency to temperature. (in orders of frequency → C → F)

7. Using Adapters
Adapters
A254 (Current Adapter 10/60A) 100mV/A, 10mV/A
A256 (Current Adapter 40/400A) 1mV/A
A296 (Current Adapter 400/1000A) 1mV/A

Test Lead and Rotary Switch set-up

Rotary Switch	Black Test Lead	Red Test Lead
Adp	COM	VΩ-⊣⊢Hz

a) To measure the high current using the clamp adapter, set up the rotary switch and the test lead as shown above.
b) To select the adapter, press RANGE button. It is possible to read directly for A254 when the displays are 00.000A in 10A range, and 000.0A in 60A, for A256 & A296 when the displays are 0000.0A.
c) Measures the current with a clamp in the adapter
d) Press ⬭ button to change the AC and DC current.

F. Additional Functions

1. Data Logging
a) Stores the measured value and its measured time in time intervals.
b) Depress REL% button for few seconds, it starts to store in time intervals as programmed in SETUP mode. At this time, LOG in upper right hand side of LCD, and M with the stored quantity on lower left hand side will be displayed.
c) To finish the Logging, depress REL% button for few seconds, or reset the rotary switch.
d) To display the stored value, depress EDIT button for few seconds. The first stored value with its address, LOG, and R will be displayed.
e) Use REL% and HOLD buttons to see stored values by changing its addresses.
f) Stores up to 1000 values.
g) Automatic Power off can be programmed by user in SETUP mode.

2. Memory/Recall
a) To store the values manually and recall the values later.
b) Depress COMP button for few seconds, the value obtained when the button was pressed will be stored in Memory. Its address and M will be displayed in the lower left hand side of the LCD.
c) Stores the value whenever COMP button is pressed.
d) To exit the Memory mode, reset the rotary switch or depress COMP button.
e) When goes back to Memory mode, it stores next to the last saved address. It saves in orders until user erases the data. (up to 100)
f) To display the measured value, depress HOLD button for few seconds. To change the address, use REL% and HOLD buttons. (while in Memory or Logging mode, exit the each mode before starts Recall mode)

g) To erase the stored value, ✱ button for few seconds in Recall mode.

3. Relative
   a) Measures the relative value that compares it to the reference value.
   b) When press REL%Δ button, REL is displayed in upper side of LCD, and reference value in lower right hand side, % of compared value in lower left hand side will be displayed.
   c) To exit REL mode, press REL%Δ button again.
   d) Changing the reference value
   Press EDIT button until lower right hand sub-display starts flashing. Use REL%Δ and HOLD▼ buttons to change the value. Use COMP◄ and REC► buttons to change the decimal points.

4. Compare
   a) Sets up the Low and High limit and compares the result as" HI"," PASS", and" LO".
   b) Press COMP◄ button. LOW value in lower left hand side and HIGH value in lower right hand side will be displayed.
   c) Main display shows the compared value to LOW and HIGH
   d) To exit the COMP mode, press COMP◄ button again.
   e) To change the set up values, repeat the item d) in section 3. Relative.

5. Record
   a) Calculates minimum, maximum and average of measured values and display.
   b) Press REL%Δ button. Main display shows the measuring value, while lower left hand side displays maximum, and right hand side displays minimum value.
   c) Depress REL%Δ button for few seconds again, main display shows the average value. To goes back to measuring value, press REC button again
   d) To exit the Record mode, depress REL%Δ button again for few seconds.

6. Data Hold
   a) Stores a stable reading under 1 HOLD sub-display in the lower left hand side of the LCD. When a new stable reading is obtained, the reading under 1 HOLD will be moved to 2 HOLD in the lower right hand side and the new reading will be displayed under 1 HOLD.
   b) When no reading is obtained, the last measured value will be held.

7. Auto/Manual Range
   a) Use when the user selects the measuring range
   b) Press RANGE button until the best range for the measurement selected
   c) Depress RANGE button for few seconds, it changes to Auto range

8. RS-232 Interface
   a) Transfers data directly to a computer or controls the instrument, and explains how to do.
   b) Communication Protocol
   • Baud Rate : 19200 Baud
   • Parity : None
   • Data Bit : 8 bit
   • Stop Bit : 1 bit
   c) Transferring Format (from the instrument to a computer)
   " 1 b fun b sign Value b unit b sub1 b sub2 b crlf"
   " 2 b fun b sign Value b unit b crlf"
   " 3 b Keyname b control b crlf"
   • fun : Function (DCV, ACV ..)
   • b : Blank (0x20)
   • sign : - (0x2D) or + (0x2B)
   • value : Measured value
   • unit : measured unit
   • sub1 : sub-display in lower left hand side of LCD
   • sub2 : sub-display in lower right hand side of LCD
   • Keyname : Push button names
   • Control : Status of button (ON or OFF)
   • Cr : Carriage Return (0x0D)

• lf : Line Feed (0x0A)

d) Control Receiving Format (from a computer to the instrument)

• " REC b OFF b crlf"
Use to exit Record mode
Send this command," REC b OFF b crlf" comes back.

• " REC b crlf"
Change from average to measured value or vice versa in Record mode. When the instrument receives this command, it sends" REC b ON b crlf" or" REC b AVG b crlf"

• " HOLD b crlf"
To on and off the Hold mode
When the instrument receives this command, it sends " HOLD b ON b crlf" or" HOLD b OFF b crlf"

• " REL b crlf"
To ON and OFF the Relative mode.
When the instrument receives this command, it sends " REL b ON b RefValue b crlf" or" REL b OFF b crlf"
RefValue is the reference value.

• " COMP b ON b Hv b Lv b crlf"
To activate Compare mode. Hv is high limit, Lv is low limit

• " COMP b OFF b crlf"
To exit Compare mode.

• " RANGE b AUTO b crlf "." RANGE b UP b crlf ", " RANGE b DOWN b crlf"
To change the measuring range with Range control command. When the instrument receives this command, it sends" RANGE b AUTO b crlf " or " RANGE b MANUAL b crlf"

• YELLOW b crlf"
To use the button.

• " SKEY b REL b crlf"
To request of the status of button to the instrument

• " SKEY b REC b crlf"
To request of the status of button to the instrument

• " SKEY b HOLD b crlf"
To request of the status of button to the instrument

• " SKEY b COMP b crlf"
To request of the status of button to the instrument

• " SKEY b RANGE b crlf"
To request of the status of button to the instrument

• " DMM b GO b crlf"
When the instrument receives this command, it send out the measured values to Serial port.

• " DMM b STOP b crlf"
When the instrument receives this command, it stops output.

• " DMM b SINGLE b crlf"
When the instrument receives this command, it sends out one measured value at a time.

e) Communication Code

• Rotary Switch Code

Code	Rotary Switch
11	ACV
10	DCV
9	ADP
8	mV
7	Ω
6	Diode
5	Capacitance
4	Hz
3	μA
2	mA
1	A

• Decimal Points Code

Code	Ω/Hz	V/A	CAP
0	-	-	5.00
1	50.000	50.000	50.0
2	500.00	500.00	500
3	5.0000	5.0000	5.00
4	50.000	50.000	50.0
5	500.00	500.00	500
6	5.0000	5000.0	5.00
7	50.000	-	50.0

• Unit Code

Code	Unit
1	mV
2	V
3	µA
4	mA
5	A
6	Adp
10	Ohm
11	Kohm
12	Mohm
13	Hz
14	Khz
15	Mhz
16	TempC
17	TempF
18	nF
19	µF
20	mF
21	nH
22	µH
23	mH
24	nS

G. Set up Mode

※ To activate the Set up Mode, press EDIT button then turn the power on

※ Press EDIT button to change the mode.

To set up the time intervals of the measured value. To select minutes and seconds, use COMP and REC buttons. To change the value, use REL and HOLD buttons. The preset value is 00:10

To select the dB mode. REC button is for dBm, COMP button is for dBV. The preset value is dBm

To set up the reference value in dB mode. To select the position, use COMP and REC buttons. To change the value of the position, use REL and HOLD buttons. The preset value is 0600Ω

To set up the time to off the back light. To select minutes and seconds, use COMP and REC buttons. To change the value, use REL and HOLD buttons. The preset value is 00:10

To select Auto Power Off function. Press REC to activate(En) the function, press COMP to deactivate(dIS). The preset value is En.

To select the Auto Power Off time. To select minutes and seconds, use COMP and REC buttons. To change the value, use REL and HOLD buttons. The preset value is 00:15.

To set up the hours. To select minutes and seconds, use COMP and REC buttons. To change the value, use REL and HOLD buttons.

To change the date. To select month and date, use COMP and REC buttons. To change the value, use REL and HOLD buttons.

To change the year. To select the position to change use COMP and REC buttons. To change the value, use REL and HOLD buttons.

To set up all values at preset values. Press REL% button for Yes, HOLD button for No. Except hour, date, month and year, all values will be set at preset values.

H. Maintenance

WARNING! Disconnect the power and remove all test leads before attempting to change battery or fuse. Must use only fuses with correct current ratings and battery specified in this manual to avoid any damages or personal injury.

1. Cleaning
   a) Please clean the case of the instrument regularly with mild detergent and a slightly damp cloth. Do not use an abradant.
   b) When not use for a long time, please remove battery.

2. Fuse Replacement
   a) Use correct volt fuse with correct current ratings only.
   b) Please refer to the specification in C-4 for the correct fuse type.

3. Battery Replacement
   a) Use the battery only specified by the manufacturer.
   b) Please refer to the specification in C-4 for the correct battery type.

4. Battery

⚠ "**CAUTION** : Danger of explosion if battery is incorrectly replaced.
Replace only with the same or equivalent type recommended by the manufacturer.
Dispose of used batteries according to the manufacturer's instructions."

The Value Leader™
www.tpi-thevalueleader.com

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