



# TX-DMM™ TX1 and TX3

## 真有效值数字万用表

## 用户手册

070-9880-01



070988001

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# General Safety Summary

## 通用安全指南

审查以下安全防范措施，以避免伤害和预防损坏本产品或连接到它的任何产品。为了避免潜在的危害，use this product only as specified. *Only qualified personnel should perform service procedures.* 只有专业人员才能进行维修服务。

### To Avoid Fire or Personal Injury 避免火灾或人身伤害

正确连接和断开连接。 当被连接到电源时，不能连接或断开探头或测试引线。

### Observe All Terminal Ratings. 观察所有终端额定值。

为避免火灾或电击的危险，观察产品的所有等级和标记。连接前，要查阅产品手册进一步评级信息。

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

### Replace Batteries Properly. 正确更换电池。

只能使用指定型号或相同型号的电池。

### Do Not Operate Without Covers. 禁止开盖操作。

覆盖或打开面板后请勿使用本产品。

### Use Proper Fuse. 使用适当的保险丝。

仅使用该产品的保险丝类型和额定值。

### Avoid Exposed Circuitry. 避免暴露电路。

当测量电源时，请勿触摸外露的连接件和部件。

### Do Not Operate With Suspected Failures. 存在疑问禁止操作。

如果怀疑产品有损坏，请专业服务人员检查。

### Do Not Operate in Wet/Damp Conditions. 请勿在潮湿环境中使用。

### Do Not Operate in an Explosive Atmosphere. 禁止在易爆环境中使用。

### Keep Product Surfaces Clean and Dry. 保持产品表面清洁和干燥。

**Safety Terms and Symbols 安全术语和符号**

本手册中的条款。这些术语可能出现在本手册中：



警告。  
警告可能导致伤害或伤亡。



注意。  
注意。可能对该产品或其他财产造成损害。

产品条款。 这些术语可能出现在产品上：  
警告指示包括该产品的属性。

产品上的符号

这些符号可能出现在产品上：



警告  
有电击休克风险

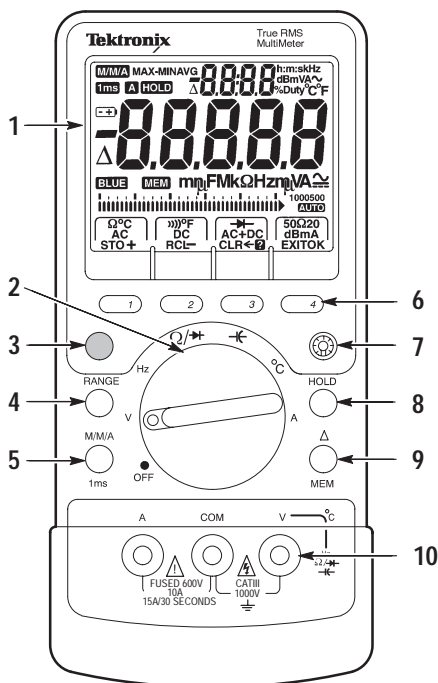


注意安全  
参考手册

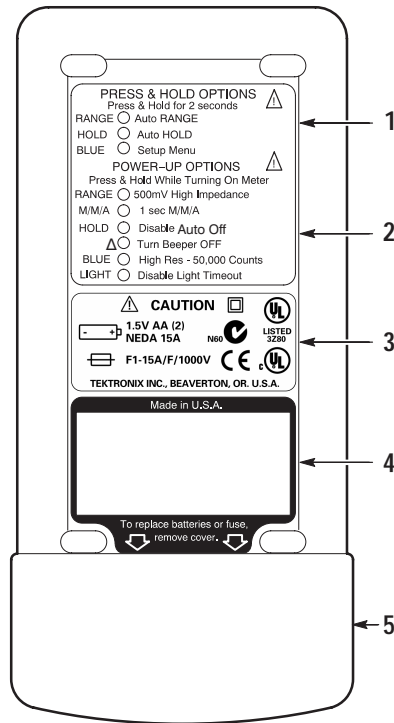


双重绝缘

# Front and Rear Panel Overview

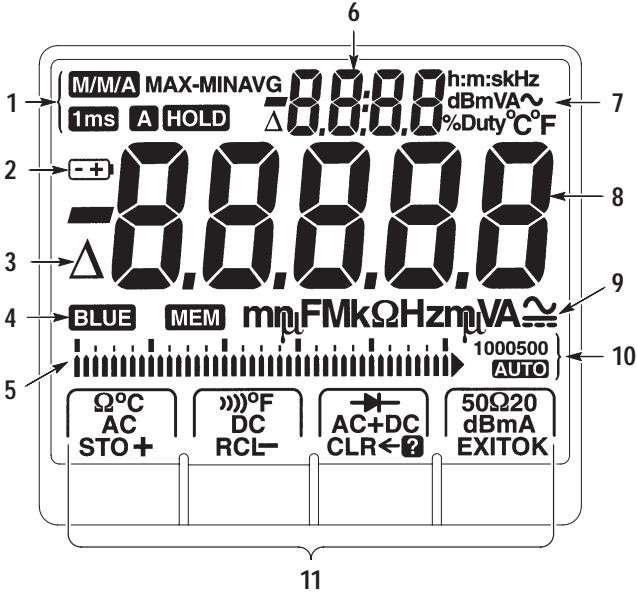


- 1 Extra large LCD display with dual numerical readout. 超大液晶显示器双数值显示。
- 2 Measurement function knob – Use to select a measurement. 测量功能旋钮-用于测量选择。
- 3 Blue Button – Use to access 1ms, MEM, and Setup menu. 蓝色按钮，用于1ms MEM 设置菜单。
- 4 RANGE Button – Use to set measurement range. 量程按钮用于设置测量范围。
- 5 M/M/A Button – Use to set meter to MIN/MAX/AVG or 1ms modes. 用于设置最小/最大/平均或1ms模式。
- 6 Softkeys – Use with measurement function knob to select measurements. 软键-用功能旋钮选择测量。
- 7 Backlight Button – Use to turn backlight on and off. 背光按钮-用于打开和关闭背光。
- 8 HOLD Button – Use to freeze display. 保持按钮用于冻结显示。
- 9 Δ Button – Use to make relative measurements and access the memory. 进行相对测量 访问存储器
- 10 Input connectors. 输入端口。



- 1 Press and hold options – Activate by holding down the specified button for two seconds while the meter is on. 开机时按下指定按钮2秒激活选项
- 2 Power-up options – Activate by holding down the specified button while turning on the meter. 电源选项-启动时按住指定按钮
- 3 Compliance and battery and fuse replacement information. 合规 电池 保险丝更换信息。
- 4 Serial number and barcode tag. 序列号和条形码标签。
- 5 Removable battery cover. 可拆卸电池盖。

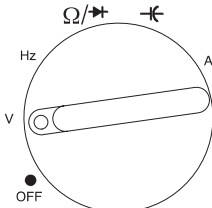
## Display Indicators



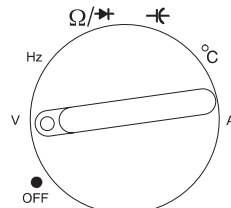
- 1 Special feature indicators 特殊功能指示
- 2 Low battery indicator 低电压指示
- 3 Delta indicator 相对值测量指示
- 4 Blue button and memory mode indicators 蓝色按钮和存储模式指示
- 5 Bargraph 条形图指示
- 6 Upper display 上屏显示
- 7 Upper display units 上显示单位符号
- 8 Main display 主显示
- 9 Main display units 主显示单位符号
- 10 Range indicators 量程指标
- 11 Softkey menus 软键菜单



## Measurement Function Knob 测量功能旋钮



TX1



TX3

**OFF.** Turns off the meter. Setup parameters and stored measurements are saved. 关机。设置参数和存储信息不丢失。

**V.** Volts AC RMS, Volts DC, Volts AC DC dual display, Volts AC+DC total RMS, dB, and dBm.

交流有效值/直流/交直流双显示/交流+直流总均方根值/dB和dBm。

**Hz.** Frequency measurements. Duty factor also shows if it is turned on in the Setup menu.

频率测量。如果在设置菜单中打开占空因数也显示

**Ω/⚡.** Access to resistance and continuity measurements and diode test. 电阻 / 通断测量 / 二极管测试。

**⚡.** Capacitance measurements. 电容测量。

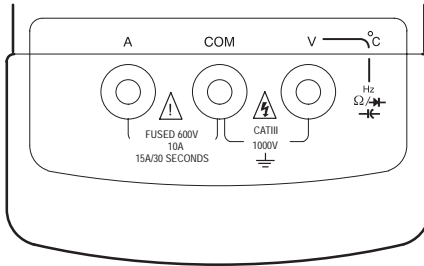
**°C.** Temperature measurements in degrees Celsius or Fahrenheit. 摄氏或华氏温度测量。

**A.** Amps AC RMS, Amps DC, Amps AC + DC total RMS, Amps AC DC dual display, and Amps DC 4-20 mA% (process control loop measurement).

电流测量：交流有效值 / 直流 / 交流+直流总有效值 /

交流直流双显示 / 直流4 ~ 20mA % (过程控制回路测量)

## Input Connectors 输入端口



**A.** Input connector for current measurements up to 10 A (15 A for 30 seconds). Rating is 600 V open circuit voltage. 电流测量量程10A (15A30秒)。额定电压为600伏开路电压。

**COM.** Common connector. All measurements are referenced to this connector. 公共端口

**V.** Input connector for volts, frequency, ohms, continuity, diode, capacitance, and temperature measurements. Rating is 1000V CAT III for all V. input connector measurements.

电压、频率、欧姆、通断、二极管，电容和温度测量输入端口。限制电压1000V。



**WARNING.** To avoid personal injury, do not attach meter leads with the battery cover removed.

为了避免人身伤害，电池盖打开时不要使用仪表连线测量。



**CAUTION.** To avoid damaging the meter, do not attempt to measure current with the batteries removed.

为了避免损坏仪表，电池取出时不要试图测量电流。

# 操作基础

Before you take any of the measurements described in this section, follow these steps: 在本节所描述的任何测量之前，参照下列步骤：

- For specified accuracy, allow the meter to stabilize for 30 seconds after you turn on the meter. 为保证精度,请在开机30秒后操作。
- Observe the safe test lead connections below when you remove the test leads from the meter. 从表上取下测试线时，注意另一端是否连接电源。
- Always disconnect power to the circuit when you measure resistors, capacitors, diodes, or continuity within the circuit. 测量电路中的电阻、电容、二极管或通断时，须将电路电源断开。
- Discharge capacitors before taking capacitance measurements. 电容测量前先放电。

## Safe Test Lead Connections 安全测试引线连接

To safely disconnect the test leads from the meter, first disconnect all test leads from the circuit being tested, then disconnect the leads from the input connectors.  
要从仪表上安全地断开测试引线，首先从被测电路中移开。



**WARNING.** To prevent electrical shock, do not insert unnecessary test leads or metal pins into the A (amps) connector. Voltages applied to any connector may be present at all other input connectors. Only use the test leads supplied or recommended (or their equivalent) with the meter. Refer to Accessories on page 43.

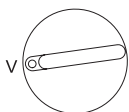
为防止电击，不要将不必要的测试引线或金属物插入到A（电流）端口。一个端口带电所有其他端口都有可能带电。只能使用所提供测试引线或推荐（或与其等效）的测试线。配件参考43页。

## 操作顺序

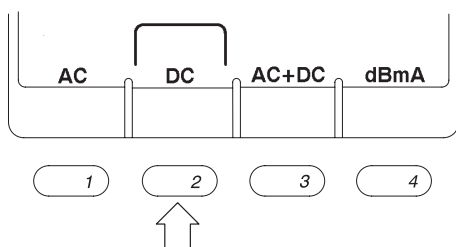
所有的测量是由功能旋钮到一个测量设置，然后选择一个测量软键。注意不是所有的旋钮设置有相应的软键设置。

例如，下面的步骤显示如何使测量直流电压：

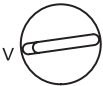
1. 设置测量功能旋钮到电压测量  $V$



2. 选择软键2直流电压。



3. 连接导线到测量点。

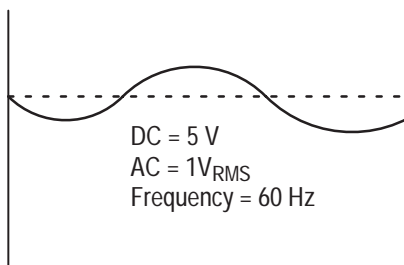


电压测量

测量	软键	连接导线	主显示	上显示
真有效值交流电压 (默认)	1 AC		AC	Hz
直流电压	2 DC		DC	--
交直流双显示	3 AC DC AC+DC		DC	AC
AC+DC 总有效值 <sup>1</sup>	按键切换		AC+DC	Hz

1  $V_{RMS} = \sqrt{VAC^2 + VDC^2}$

应用：使用交直流和交流+直流模式


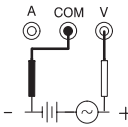


直流电源带有交流成份可能会导致电路问题。如果您设置直流电压测量模式，显示器出的直流分量为5 V，就有可能就忽视了是否存在交流成份。建议你把仪表定为交直流双显模式。主显示屏显示5伏直流电压上显示显示1伏交流电压。交直流模式还可以让你同时进行交流和直流测量而不用改变仪表设置。

另一个有用的测量是交流+直流总有效值。按软键3切换到交流+直流。上例中，主屏显示5.099V的总有效值，上屏显示60赫兹。计算电路元件的功率消耗时，这是很重要。  $V_{RMS} \cdot I_{RMS}$  这里 $V_{RMS}$ 是交流+直流总有效值。



**dB and dBm Voltage Measurements**    dB   dBm电压测量

Measurement 测量	Softkey 软键	Connect leads 连接导线	Main display 主显示	Upper display 上显示
dB (TX3 only) <sup>1</sup>	 dB or dBm (press to toggle)		AC	dB
dBm (TX3 only) <sup>2</sup>	( 按键切换 )		AC	dBm

- <sup>1</sup>    dB readout =  $20 \times \log (\text{main display readout}/\text{ref})$ , where ref = 1 V is the default.
- <sup>2</sup>    dBm readout =  $10 \times \log (\text{main display readout}^2/R)$ , where R=600  $\Omega$ .

**Application: Using a Reference Value Other than Default 1.000 V<sub>RMS</sub> in dB Mode**    应用：在dB模式不用默认1.000V

To manually change the reference voltage in dB mode, press and hold the blue button to display the Setup menu. Adjust the **REF (dB)** value to the value you want and press softkey 4 for OK. Subsequent dB measurements will use this stored value as the reference voltage until you turn off the meter.

要手动更改dB模式的基准电压，按住蓝色按钮显示设置菜单。调整到你想要的值，按OK键4。随后的分贝测量将使用此值作为参考电压，关机前不失效。

**Application: Using Voltage in a Circuit as the Reference Value in dB Mode**    应用：在分贝模式下以电路中的电压为参考值

An example of using a voltage in a circuit as the reference value is measuring the AC voltage gain of an amplifier. Set the meter to dB mode and measure the voltage that you want to use for the reference (the input of the amplifier). Press the  $\Delta$  button to save the measured value as the reference value. Next, measure the output of the amplifier. The voltage gain of the amplifier (in dB) shows in the upper display.

In both of these applications, the  $\Delta$  indicator shows in the upper display to indicate the reference is a voltage other than the default value of 1.000 V<sub>RMS</sub>. The reference value returns to 1.000 V when you exit dB mode.

使用电路中电压作为参考值测量放大器的交流电压增益的例子。设置表为（dB）分贝模式，测量你想作为参考值的电压（放大器输入端）。按 $\Delta$ 按钮保存测量值作为参考值。下一步，测量放大器的输出。上屏显示放大器的电压增益（in dB）。

在这两个应用程序中，该 $\Delta$ 指标显示在上显示，以表示该参考值不是默认1.000V。当您退出dB模式时，参考值回复默认1.000V。





Frequency Measurements 频率测量

Measurement	Softkey	Connect leads	Main display	Upper display
Frequency	(no selection)		Hz	- EdGE <sup>1</sup>
Frequency and duty factor dual display			Hz	% Duty <sup>2</sup>

- 1

Displayed when you set negative edge triggering in the Setup menu. **-EdGE** is active but not displayed when % duty is on.

在设置菜单中设置负边触发时显示负沿有效，但占空%模式不显示。
- 2

You must turn on positive or negative duty in Setup menu.

您必须打开设置菜单中的正或负设置。

Negative Edge Triggering 负边沿触发

To trigger on the negative edge of the waveform, set **EdGE** to **nEG** in the Setup menu. The word **-EdGE** shows in the upper display when you exit the Setup menu.

在设置菜单设置EdGE到nEG,实现波形的下降沿触发。退出设置菜单时，EdGE显示在上显示。

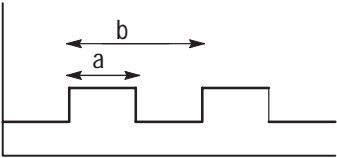
Positive and Negative Duty Factor 正、负占空因数

To measure duty factor, set duty (**POL** in the Setup menu) to either **POS** or **nEG**. When you measure negative duty factor, a “-” symbol shows in the upper display.

为测量占空系数,设置占空比（POL菜单中）要么POS或nEG。测量负占空因数时,“-”显示在上屏。

Positive duty factor: 正因数  
 $\% \text{ duty} = (a/b) \times 100$

Negative duty factor: 负因数  
 $\% \text{ duty} = (1-a/b) \times 100$



## AC vs. DC Coupled Frequency Measurements

### 交流-直流耦合频率测量

When the duty factor measurement mode is off, the frequency measurement is AC coupled; otherwise, it is DC coupled.  
当占空因数测量模式关闭时，频率测量是交流耦合的，否则是直流耦合。

## Changing Voltage Range in Frequency Mode

### 在频率模式改变电压量程

To change voltage range, press the RANGE button. The voltage range shows momentarily in the upper display. Continue pressing the RANGE button to cycle through the available voltage ranges until the range you want shows. The default voltage range is 5 V.

改变电压量程，按量程按钮。电压量程即时显示在上屏。继续按量程按钮循环显示电压量程，直到你想用的量程。默认电压量程为5 V。



Resistance Measurements 电阻测量  
(Ohms, Continuity, Diode, and 50Ω Range)  
(电阻，通断，二极管，50欧低阻量程)

Measurement	Softkey	Connect leads	Main display	Upper display
Resistance (default)	1 Ω		Ω	--
Continuity	2 )))		Ω	OPEn or Shrt (beeps on short)
Diode	3 ➡		V	--
50 Ω <sup>1</sup>	4 50 Ω		Ω	--

<sup>1</sup> See application below. 见下面的应用。

Application: Measuring Low Resistance Values 应用：测量低值电阻

To measure low resistance values to 0.01 Ω resolution, set the meter to 50 Ω mode and short the leads together to subtract the lead resistance. If you do not short the leads together, the meter will not enter 50 Ω mode. The lead resistance must be less than 5 Ω. The measured resistance shows on the main display.

测量低阻值用0.01欧分辨率，将仪表设置为50欧模式，并将表笔短接减去引线电阻。如果你不短接表笔，仪表将不会进入50欧模式。表笔电阻必须小于5欧。测量电阻在主屏显示。



**CAUTION.** To avoid damaging the meter, remove all power from the circuit before connecting the test leads.

注意：为了避免损坏仪表，在连接试验前，从电路中除去所有电源。



## Capacitance Measurement 电容测量

Measurement	Softkey	Connect leads	Main display	Upper display
Capacitance	(no selection)		F	---



**CAUTION.** To avoid damaging the meter, remove all power from the circuit before connecting the test leads.

**注 意：** 为了避免损坏仪表，在连接试验前，从电路中除去所有电源。

Measuring large-value capacitors may take several seconds.


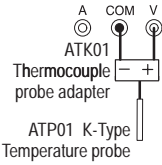

测量大电容可能需要几秒钟。

Follow the procedures below when making capacitance measurements: 按照下面的步骤进行电容测量：

- Remove capacitors from circuitry. 从电路中拆下电容器。
- Discharge capacitors before measuring them. 测量前给电容放电。
- Connect polarized caps as shown above. 如上所示的连接电极。
- To measure small values of capacitance accurately, press the  $\Delta$  button when the leads are open.  
要准确测量小电容，在表笔开路时按 $\Delta$ 按钮。



Temperature Measurements (TX3 only) 温度测量（仅TX3）

Measurement	Softkey	Connect leads	Main display	Upper display
Celsius temperature (default)	 °C	 A COM V ATK01 Thermocouple probe adapter ATP01 K-Type Temperature probe	°C	Ambient temp. °C
Fahrenheit temperature	 °F		°F	Ambient temp. °F

Before you take a temperature measurement, momentarily change the temperature of the thermocouple to verify a shorted or open thermocouple is not incorrectly displaying the ambient temperature. 温度测量前，改变温度验证热电偶没有短路或开路以确定能否正确显示环境温度。

**Helpful Tip: Increased Temperature Accuracy** 帮助提示：提高温度精度

To achieve high accuracy temperature measurements to  $\pm 1.0\text{ }^{\circ}\text{C}$  it is necessary to calibrate the meter to account for any thermocouple offset. Temperature accuracy without performing the following calibration is  $\pm 3\text{ }^{\circ}\text{C}$ :

为达到温度测量精度到 $\pm 1.0\text{ }^{\circ}\text{C}$ ，必须对仪表进行校准  
纠正热电偶的误差。温度精度不进行校准是 $\pm 3.0\text{ }^{\circ}\text{C}$ ：

1. Turn on the meter in the environment you will make the measurements. 在现场环境中打开仪表进行测量。
2. Fill a wide, shallow container with ice and water. Stir the ice and water mixture for two or three minutes to evenly distribute the temperature of the mixture. Place the container next to the meter and submerge the tip of the bead probe in the ice and water.  
用大口容器装满冰和水。搅拌冰水混合物二三分种  
使冰水混合物的温度均匀。将容器放在仪表旁边，测温探针置入冰水混合物中。

3. While in °C or °F mode, allow the temperature reading to stabilize on a value (this value should be very close to 0 °C for °C mode or 32.0 °F for °F mode). Any deviation from 0 °C or 32 °F represents the thermocouple's offset.  
温度测量模式，当温度读数稳定（这个值应该非常接近0°C或32°F）。偏离0°C或32°F的数值代表热电偶的误差。
4. Once the reading stabilizes, press and hold softkey 1 for °C mode or softkey 2 for °F mode for five seconds until the display shows 0000 or 0032.  
当读数稳定后，按软键1（°C）或2（°F）5秒直到显示0000或0032。

This calibrates the meter for the operating environment.  $\Delta$  shows in the upper display. If you hear an error beep, the offset is greater than  $\pm 5$  °C. You can repeat this calibration at any time. To undo this calibration, return the meter to factory settings by pressing both the blue button and M/M/A button while powering up the meter (see Table 2 on page 27).

本校准适用当前环境，上屏显示 $\Delta$ 。如果误差值大于5°C将听到错误提示，可以进行重复校准操作。要撤消此校准，开机时同时按下“蓝色”按钮和M/M/A按钮，返回到出厂设置（见27页表格2）。

To insure accuracy of temperature measurements, you should follow this procedure when using other K-type thermocouple probes with the TX Series DMMs because accuracy specifications vary in different types of probes.

要确保温度测量的准确性，使用其他的K型热电偶探头应该遵循本手册要求TX系列数字多用表因为精度不同要求使用不同类型的探针。

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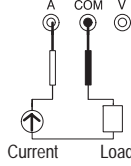
**NOTE.** Observe proper polarity on the probe adapter and do not calibrate the offset immediately following high amperage measurements.

确认探头适配器极性正确，不在进行大电流测量后立即进行校准操作。

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A Current Measurements 电流测量

Measurement	Softkey	Connect leads	Main display	Upper display
True RMS AC Amps	<div><div>1</div> AC</div>	 <div>Current source</div> <div>Load</div>	AC	Hz
DC Amps (default)	<div><div>2</div> DC</div>		DC	—
Amps AC DC dual display	<div><div>3</div> AC DC or AC+DC (press to toggle)</div>		DC	AC
Amps AC+DC total RMS <sup>1</sup>			AC+DC	Hz
4-20 mA current % <sup>2</sup> (TX3 only)	<div><div>4</div> 20 mA</div>		DC	%

1  $I_{RMS} = \sqrt{IAC^2 + IDC^2}$

- 2 4-20 mA measurement is used in process loop calibration.  
4-20 mA测量采用的是闭环校准过程。  
% = (measured current 测量电流 - 4 mA)/16 mA

When overrange occurs in manual range, the meter will uprange in order to protect the internal circuitry.  
在手动量程发生超量程时，仪表将自动切换到高档量程以保护内部电路。



**CAUTION.** To avoid damaging the meter, limit large current measurements to 15 A for 30 seconds and allow ten minutes of cooling between measurements. Do not connect to circuits with > 600 V.

为避免损坏仪表，限制15A电流测量不超过30秒，并冷却十分钟。不要测量超过600 V的电路。  
*Do not attempt to measure current with batteries removed.*  
电池取出时不要试图测量电流。

When you exit current measurement mode, the words **CHEC Probe** show on the display reminding you to remove your test lead from the A (amps) input connector.

When you make high current measurements, > 15 A, use a current clamp probe (optional accessory) connected to the volts input connector.

退出当前测量模式，CHEC Probe显示提醒你从A（电流）输入端口拆除测试连线。  
当进行大电流测量时，大于15A，可用分流器（可选配件）连接到电压端口。

# 按钮和软键概述

## 蓝色按钮

要访问蓝色文本的功能，按“蓝”按钮，然后按蓝色函数按钮显示参数五秒。按住蓝色按钮2秒进入设置菜单。关于设置菜单的更多信息见23页。

## 量程按钮

使用量程按钮手动选择量程。按住量程按钮两秒返回自动量程模式。仪表默认自动量程模式。量程和单位符号显示在条形图的右侧。

## M/M/A（最小、最大和平均）按钮

按 M/M/A 按钮在 最大 最小 最大-最小值和 平均值 之间切换。主屏显示最后测量数值，上屏显示初始测量值。

按住 M/M/A 按钮2秒退出M/M/A模式。

了解 M/M/A 操作更多信息见28页。



### 1ms (1 ms Peak Hold) ( 1毫秒峰值保持 )

To activate 1 ms peak hold, first press the blue button and then the M/M/A button while the **BLUE** indicator shows on the display. When in 1 ms mode, the LCD displays the **1ms** and **M/M/A** indicators. Display resolution in 1ms peak hold is 5,000 counts. Live and average (AVG) readings are not available in 1ms peak hold mode.

要激活1毫秒峰值保持，先按下蓝色按钮，然后M/M/A 按钮，显示指标。在1毫秒模式，在LCD上显示1ms和指标。在1ms峰值保持显示器的分辨率是5000字。实时数值和平均值（AVG）读数在1ms峰值保持模式下不可用。


You can use 1ms peak hold when you take AC or DC measurements. The meter only records events that have a pulse width that is greater than 1 ms. 可用1ms峰值保持进行交流或直流测量。仪表只能记录超过1毫秒的脉宽。


Press the M/M/A button to view 1ms peak hold minimum and maximum values. The MAX value shown is the value of the positive peaks and the MIN value shown is the value of the negative peaks.

按M/M/A查看1ms峰值保持的最小值和最大值。最大值是正峰值，最小值是负峰值。

Press and hold the M/M/A button for two seconds to exit 1ms peak hold mode. 按M/M/A 两秒退出1ms峰值保持模式。

### Backlight Button 背光按钮

Press the  button to turn the backlight on or off. Adjust the LOFF setting in the Setup menu to adjust the backlight timeout setting. Use the Setup menu information on page 23 to adjust the setting for the backlight.

按打开或关闭背光。通过设置菜单调整背光超时设置。调整背光设置更多信息见23页。

### HOLD Button 保持按钮

Press HOLD to turn hold mode on and off. When you activate the hold feature, the instrument beeps, freezes the display, and displays the **HOLD** indicator. Hold mode freezes the display so you can remove the probes from the test points without losing the measurement reading.

按HOLD打开和关闭读数保持功能。测量时按HOLD，听到蜂鸣，显示冻结，并显示提示。冻结读数，这样你就可以从测试点移开表笔而不会丢失测量值。

## Auto Hold 自动保持

To activate auto hold, press down on the HOLD button until **A HOLD** appears on the display. Auto hold is not available for capacitance or AC DC measurements.

按住HOLD直到显示 A,激活自动保持。自动保持不可用于电容或交直流测量。

In auto hold mode the display automatically freezes and the instrument beeps when the measurement reading stabilizes. The displayed value will be updated when the meter stabilizes on a new measurement value.

当测量读数稳定，发出蜂鸣并自动冻结读数。测量数值刷新并稳定后冻结数值自动更新。Auto hold is useful when it is not possible for you to press the HOLD button or see the meter display while probing and taking measurements.

当你不方便按下HOLD键或不能边测量边观察读数时，这个功能非常有用。

## $\Delta$ Button (Making Relative ( $\Delta$ DELTA) Measurements)

### 相对值测量

Use this button to set the meter to delta mode and make relative measurements. The reference value for the  $\Delta$  measurement can be a measured, a stored, or a programmed value.

使用  $\Delta$  按钮将仪表设置为“相对模式”，进行相对测量。测量的参考值可以是一个测量值，一个存储值，或一个预设值。

**$\Delta$  Relative to a Measured Value.** When you take the measurement and the meter settles on the measurement value, press the  $\Delta$  button. For subsequent readouts, the measured reference value is subtracted from the actual measurement.

关于测量值。当你进行测量数值稳定后，按下  $\Delta$  按钮，随后的测量读数是从实际测量值中减去参考值的。

**$\Delta$  Relative to a Saved Value.** Use the measurement function knob and softkeys to set the meter to the measurement function you want. Use the memory information on page 22 to recall (RCL) a reference value from memory, then press the  $\Delta$  button. To exit delta mode, press the  $\Delta$  button.

For subsequent readouts, the recalled reference value is subtracted from the actual measurement.

关于存储值。用功能旋钮和软键设置要用的测量功能。用22页的内存信息从内存中调出（RCL）参考值，然后按  $\Delta$ 。要退出相对模式，按  $\Delta$ 。

随后的读数，是从实际测量中减去参考值的。

**Δ Relative to a Programmed Value.** Use the measurement function knob and softkeys to set the meter to the measurement function and range you want and then press the Δ button. While the meter is in delta mode, press and hold the blue button until the Setup menu appears. Use the softkeys to edit *rEF* to the desired value and press softkey 4 for OK. To exit delta mode, press the Δ button.

For subsequent readouts the programmed reference value is subtracted from the actual measurement. The programmed reference value is lost when you turn off the meter.

关于预设值。用功能旋钮和软键设置仪表的测量功能和量程，然后按下 Δ。这时仪表处于相对模式，按住蓝色按钮直到出现设置菜单，用软键编辑所需数值并按软键4确定。退出相对模式，按 Δ。

随后的读数是从实际测量中减去预设值的。关机时预设值不保存。

You can also use the Δ button to make relative dB (ΔdB) measurements. See page 10 for more information.

也可以使用 Δ 进行相对分贝 (dB) 测量。了解更多信息查看第10页。

### MEM (Memory) 存储

Use the memory mode to store and recall measurement values. No data is lost during power cycles.

使用存储模式来存储和召回测量值。不更换电池数据不会丢失。

To activate the MEM (memory) mode, press the blue button and then the Δ button while **BLUE** shows on the LCD display. The display shows four softkey selections: STO, RCL, CLR, and EXIT.

激活存储模式，按蓝色按钮，LCD显示BLUE时按 Δ，LCD显示四个软键选项：STO, RCL, CLR, EXIT。

**STO.** Select STO to store the held value in the next available memory location. The memory location number momentarily shows on the upper display. If no memory locations are available, FULL shows on the upper display for two seconds and nothing is stored.

To overwrite an existing memory value, recall the memory location using the RCL button, press CLR, then press STO to store the new value in this location.

STO. 选择STO在下一个可用的内存地址存储当前数值。内存地址显示在屏。

如果没有可用内存地址，则上屏显示FULL2秒，不能存储。


覆盖存储，按RCL调出存储单元，然后按CLR清除存储内容，按STO在这个位置存储新值。


**RCL.** Select RCL to scroll through the stored values in reverse order. The upper display momentarily shows the memory location while the main display shows the value stored in that location.

按RCL，存储值以倒序滚动显示。LCD主显示存储值上屏同时显示内存地址。

**CLR.** Select CLR to clear the currently selected memory location. The location is replaced with “-----”.

按CLR清除当前选择内存地址的数据。此位置以“-----”取代。

To clear all memory locations, press and hold the CLR button for five seconds. A  shows on the display next to the CLR enunciator. The word **donE** shows on the display indicating that all memory locations are clear and you can release the button. If you release the button before the word **donE** shows, no data is cleared from the memory.

清除所有的内存位置，按CLR五秒， 号显示在CLR旁边。显示donE表示所有内存位置已被清除，可以放开CLR按钮。如果显示donE之前释放CLR按钮，则没有数据被从内存中清除。

**EXIT.** Select EXIT to exit memory mode. You can also exit memory mode by pressing any button.

## Softkeys 软键

Each setting on the measurement function knob may activate one or more softkey settings on the LCD. If there is more than one measurement for a function knob setting, a softkey menu appears on the display. Press the corresponding softkey to select the desired measurement.

每个功能旋钮位置可能会激活一个或多个LCD上的软键设置。如果有一个以上的软键菜单出现在显示屏上，可以按下相应的键来选择所需的测量。





## Setup Menu 设置菜单

The Setup menu allows you to customize default settings. To activate the Setup menu, press and hold the blue button for two seconds.

Use the softkeys as shown in the following table to edit setup values. Setup menu values are saved when you turn off the meter, except for reference values.

设置菜单允许自定义默认设置。按“蓝色”键2秒激活设置菜单。

使用软键编辑设置值如下表所示。菜单设置值关机不丢失，参考值除外。

Softkey	 +	 -	 ←	 OK
Function 功能	Press to increase setting value. 增加	Press to decrease setting value. 减少	Press to step to next digit in setting value. 退格	Press to save setting and move to next setup parameter. 保存设置并移到下一个设置参数。

The following table lists the setup menu prompts, the definition of parameters, and default values.

下表列出了设置菜单提示、参数定义和默认值。

Table 1: Setup prompts, definitions, and default values 设置提示、参数定义和默认值。

Upper display prompt 上屏显示“提示”	Definition of parameter (press OK to cycle through parameters)	Default value 默认值
<i>POFF</i>	Sets auto-off time (in minutes). 设置自动关机时间 (分钟)	30 minutes
<i>LOFF</i>	Sets backlight auto-off time (in seconds). 设置背光自动关闭时间 (秒)	60 seconds
<i>bBEEP</i>	Toggles beeper on and off. 蜂鸣器开关	ON
<i>HrES</i>	Changes display to 50,000 counts. 转换为50000字	OFF
<i>POL (Duty)</i>	Scrolls through OFF, POS (positive duty factor), and NEG (negative duty factor). 滚动切换OFF,POS(正占空比),NEG(负占空比)	OFF
<i>EdGE (Hz)</i>	Toggles between POS (positive edge) and NEG (negative edge) triggering in Hz measurement. 频率测量 POS (上升沿) 和NEG (负沿) 触发切换。	Positive (rising)
<i>rEF<sup>1</sup></i>	Changes the reference value for delta measurements. 改变相对测量的参考值。	Value before $\Delta$ button is pressed
<i>(<math>\Delta</math>)rEF(dB)<sup>1</sup></i>	Changes the reference value for dB measurements. 改变分贝测量的参考值。	1 V

<sup>1</sup> Meter must be in  $\Delta$  or dB mode to access these setup parameters.  
仪表必须是在  $\Delta$  或分贝模式下才能访问这些设置参数。

## Special Features 特殊功能

### High Resolution (HrES) 50,000-Count Mode

高分辨率 (HRES) 50000计数模式

By default, the meter is set to 5,000-count mode. For 50,000-count mode, press the blue button when you turn on the meter. To change the default resolution to 50,000-count mode, use the Setup menu information on page 23.

默认情况下, 该表被设置为5000计数模式。开机时按下蓝色按钮激活50000计数模式。要更改默认分辨率为50000计数模式, 使用23页上的设置菜单信息。

The following measurements are limited to 5,000-count mode: 50  $\Omega$ , 50 M $\Omega$ , 1 ms peak hold, AC + DC amps, AC DC amps, AC + DC volts, AC DC volts, capacitance, and Hertz dual display mode.

以下测量限于5000计数模式: 50 $\Omega$ , 50M $\Omega$ , 1毫秒峰值保持, 交流+直流电流, 交流直流电流, 交流+直流电压, 交流直流电压, 电容, 频率双显示模式。

### Beeper 蜂鸣器

A single beep indicates correct operation. You can turn the single-beep feature off in the Setup menu. A double beep indicates a warning or error condition. A triple beep indicates the meter will auto-off in one minute. Continuous beeping indicates there is circuit continuity while in continuity mode. You can not disable double, triple, or continuous beeps.

单声--正确操作。你可以在设置菜单中关闭单声"蜂鸣"功能。双声表示警告或错误操作。三声表示一分钟内自动关机。连续声表明在通断模式下电路导通。不能停用双声, 三声, 或连续声蜂鸣功能。

### Auto-Off 自动关机

The auto-off feature automatically turns off the meter if no controls or settings are changed within a set amount of time. To turn on the meter after auto-off, press any button. The meter will return to the state it was in before auto-off occurred, but held values are lost. Use the Setup menu to adjust the auto-off delay. The default auto-off time is thirty minutes. You can disable auto-off by pressing the **HOLD** button when you turn on the meter or by using the Setup menu.

Auto-off is disabled during M/M/A mode.

如果在一个设定的时间内没有操作或改变设置, 自动关机功能会自动关闭仪表。自动关机后, 按任意键返回关机前状态, 但之前测量数据将丢失。

可使用“设置”菜单调整自动关机延迟时间。默认自动关机时间为三十分钟。开机时按**HOLD**键或使用设置菜单可以关闭自动关机功能。

自动关闭在M/M/A模式无效。

Power-Up Options 开机选项

To activate power-up functions, press and hold a button or softkey when you turn on the meter. Hold the button or softkey until you hear a single beep and see a text acknowledgment on the display (see Table 2 below). The following table lists all power-up options. Most of the power-up option descriptions also appear on the rear panel.

When you turn off the meter, the power-up options are not saved. Use the Setup menu to change default settings.

启动开机选项，开机时按住任一键直到你听到一声蜂鸣并看到文本显示（见下表2）。下表列出了所有的开机选项。大多数的开机选项也出现在后面板上。

关机后，开机选项设置不保存。可使用设置菜单更改默认设置。

Table 2: Power-up options 开机选项

Button	Power-up function	Explanation 说明
RANGE ( <i>HI Ω mV</i> ) <sup>1</sup>	Sets meter to 500 mV high impedance mode 设置为500mV 高阻抗模式	Enables high impedance (> 10 MΩ) across the input jacks in the 500 mV DC range so that the device under test is not loaded when you measure small voltages. 激活高阻抗(> 10MΩ),测量小电压前设置仪表为直流500 mV档。
M/M/A ( <i>1 SEC</i> ) <sup>1</sup>	Sets meter to 1 second M/M/A mode 1秒 M/M/A模式	See <i>MAX/MIN/AVG Operation</i> on page 28 for more information. 了解更多信息见第28页
Δ ( <i>bEEP</i> ) <sup>1</sup>	Turns off beeper 关闭蜂鸣器	Double, triple, and continuity beeps are not affected. 不能停用双声，三声，或连续声蜂鸣功能。
BLUE ( <i>HrES</i> ) <sup>1</sup>	Sets meter to high resolution (50,000 count) mode 高分辨率（50000字）模式	See <i>High Resolution (HrES) 50,000-Count Mode</i> on page 25 for further information. 了解更多信息见第25页
LIGHT ( <i>LOFF</i> ) <sup>1</sup>	Disables light timeout 禁用背光关闭	--
Softkey 1	Displays software version and calibration date 显示软件版本和校准日期	Displays the software version (M.mm, where M is the major revision and mm is the minor revision). Press softkey 1 again to display the date the meter was last calibrated (upper display shows month and main display shows year). 显示软件版本（M.mm，其中M发布，mm修订）。再次按下软键1显示上次校正日期（上显示月和主显示年）。

Table 2: Power-up options (Cont.) 开机选项（续）

Button	Power-up function	Explanation
Softkey 2	Overall Diagnostics 开机自检	Displays all LCD segments. Press softkey 2 again to hear the beeper. Press softkey 2 again to perform button and knob diagnostics. The display shows two two-digit numbers. The numbers on the left confirm the knob location and the numbers on the right confirm the button operation. To exit diagnostics, turn off meter. 字符全显。再按软键2听到蜂鸣声。再按软键2执行按键和旋钮诊断，显示二个二位数，左边数字确认旋钮位置，右边数字确认按键操作。
Softkey 3	LCD test LCD测试	Displays all LCD segments so you can verify correct LCD operation and display. Compare this to the LCD figure on page 3. 显示所有的LCD字段，这样你就可以验证液晶显示和操作是否正确。可对比第3页图。
Softkey 4	Battery test 电池测试	Displays the voltage across the battery terminals. The meter will shut off at 1.5 V. 显示电池电压。低于1.5V关机。
HOLD (POFF) <sup>1</sup>	Disables auto-off 关闭自动关机	—
BLUE and M/M/A (rESEt)	Resets meter to factory default settings 重置到出厂默认设置	You must press both buttons at the same time while powering on the meter. 开机时必须同时按下两个按钮。

<sup>1</sup> The bolded text in parentheses in the Button column shows when the meter registers the power-up setting. Do not release the button until you either hear a single beep or see the text.

仪表进入开机设置时，显示按钮栏括号中的粗体字符。一直按住按钮，直到一声蜂鸣提示，字符显示。



MAX/MIN/AVG Operation    最大值/最小值/平均值操作

Press the M/M/A button to start recording M/M/A values. In 5,000 count mode the M/M/A default recording rate is 4 measurements per second. Press and hold the M/M/A button when turning on the meter to apply averaging, which reduces the recording rate to 1 measurement per second (1 sec M/M/A).

The M/M/A button cycles through the operations listed in the following table.

按 M/M/A开始记录 M/M/A值。5000字模式 M/M/A默认测速是4次/s。按住 M/M/A转到平均值，测速1次/s。 通过下表列出的操作实现M/M/A按钮功能。

Table 3: MIN/MAX/AVG operations

Display indicator    显示	Description    描述
M/M/A	The live signal value is shown. The upper display shows the elapsed time since the recording began. 显示实时信号值。上显示自开始记录所用时间。
MAX	The MAX indicator and maximum value are shown. The upper display shows the timestamp at which the maximum value occurred, relative to the start of the test. 显示MAX和最大值。上显示开始测试后最大值出现的时间。
MIN	The MIN indicator and minimum value are shown. The upper display shows the timestamp at which the minimum value occurred, relative to the start of the test. 显示MIN和最小值。上显示开始测试后最小值出现的时间。
MAX-MIN	The MAX-MIN indicator and maximum value minus minimum value are shown. The upper display shows the time difference between the MAX and MIN events. 显示MAX-MIN和最大减去最小之差。上显示最大最小之间的时间差。
AVG	The AVG indicator is shown and the value shown is the average value of all meter readings. The upper display shows the elapsed time since recording began. 显示AVG和读数平均值。上显示记录开始后运行时间。

Once you set the meter to M/M/A mode, the meter will uprange, or automatically increase range setting, but will not downrange. You must exit M/M/A mode to restore downranging abilities to the meter.

一旦设置 M/M/A 模式，仪表将上调量程，或自动增大设置，但不会下调量程。必须退出 M/M/A 模式才能恢复下调量程功能。

While in M/M/A mode, press the HOLD button to stop the recording and freeze the most recent M/M/A values. Press the M/M/A button to cycle through the held values. Press the HOLD button a second time to reset and restart the M/M/A recording.

M/M/A 模式，按下 HOLD 按钮停止记录，冻结最新的 M/M/A 值。按 M/M/A，调阅已有数据。按 HOLD 二次重置并重新启动 M/M/A 记录。

While in M/M/A mode, activate memory mode to hold the displayed M/M/A value for storage into memory without stopping or resetting the M/M/A recording.

To exit M/M/A mode and clear stored values, press and hold the M/M/A button for two seconds.

M/M/A 模式，thfc 激活存储模式，不需要停止或重置 M/M/A 记录。按住 M/M/A 2 秒，退出 M/M/A 模式并清除存储值。

#### **Auto Fuse Detection** 自动保险丝检测

The meter automatically verifies the integrity of the internal fuse when you set the measurement function knob to A. If an open fuse is detected, the word **FUSE** shows on the main display.

See page 48 for instructions on how to replace fuse F1.

将测量旋钮旋到 A 自动验证内部保险丝的完整性，显示 FUSE 字符保险丝开路。如何更换保险丝 F1 见 48 页说明。

# Specifications

All specifications are warranted, unless noted as typical, for the rated temperature range of  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  at less than 80% relative humidity.

Characteristics	Description
LCD display digits	$3\frac{4}{5}$ (default) or $4\frac{4}{5}$
Display counts	5,000 (default) or 50,000
Bargraph	20 segment, updated 20 times per second
Memory locations	TX1: 10, TX3: 30
Out of range indicator	<i>OL</i> : overrange <i>Ur</i> : underrange
Low voltage indicator	Battery symbol shows on LCD at 2.0 V. Meter powers down at 1.5 V.
Battery life	100 hours continuous use with backlight off (typical)
Auto-off	Adjustable, 30 minute default
Power source	Two AA 1.5 V alkaline batteries (NEDA 15A)
Maximum input voltage between terminals and between terminals and earth	1000 $V_{\text{RMS}}$ Installation Category III (CAT III) <sup>1</sup>
Maximum open circuit voltage when utilizing the A terminal	600 $V_{\text{RMS}}$ CAT III
Overload protection, V terminal	1000 $V_{\text{RMS}}$ (1500 $V_{\text{pk}}$ ) for all functions
F1 fuse protection	15 A (1000 V) service-replaceable
Backlight	Green LEDs

<sup>1</sup> If meter is exposed to water, have it inspected by qualified service personnel.

**Table 4: DC voltage characteristics**

Characteristic	Description
Settling time	3 readings (typical)
Reading rate	5,000 ct.: 4 readings per second 50,000 ct.: 1 reading per second
Rejection ratio	
Common mode	120 dB at DC or 50 Hz or 60 Hz
Normal mode	60 dB at 50 Hz or 60 Hz
Input impedance	10 M $\Omega$ (typical)

**Table 5: DC voltage range, resolution, and accuracy**

Range	Resolution		Accuracy <sup>1</sup>	
	5,000 counts	50,000 counts	TX1	TX3
0.5 V	100 μV	10 μV	± (0.07% + 1 count)	± (0.05% + 1 count)
5 V	1 mV	100 μV		
50 V	10 mV	1 mV		
500 V	100 mV	10 mV		
1000 V	1 V	100 mV		
Temperature coefficient		Add (0.005% + 0.1 ct.)/°C to accuracy beyond rated temperature range.		

<sup>1</sup> Accuracy in 50,000-count mode is % + 10 counts.

Table 6: AC voltage characteristics

Characteristic	Description
Input impedance	10 M $\Omega$ in parallel with 100 pF (typical)
Settling time	4 readings (typical)
Reading rate	5,000 ct.: 4 readings per second 50,000 ct.: 1 reading per second
Common mode rejection ratio	60 dB at DC to 60 Hz
Crest factor, maximum	Full scale: 3 Half scale: 6
AC+DC <sup>1</sup> total RMS volts accuracy	AC (RMS) accuracy + 0.1% + 1 count
AC DC <sup>1</sup> dual display accuracy	DC Accuracy + 0.05% + 1 count AC RMS Accuracy + 0.1% + 1 count
Upper display frequency (5,000 counts)	
Accuracy	$\pm(0.002\% + 1 \text{ count})$ for 20 Hz to 20 kHz
Sensitivity	10% of selected voltage range
dB reference <sup>2</sup>	1 V <sub>RMS</sub> (adjustable)
dBm reference <sup>2</sup>	775 mV across 600 $\Omega$ (1 mW)

<sup>1</sup> 5,000-count mode only.

<sup>2</sup> See page 10 for dB and dBm calculations.

Table 7: AC voltage range, resolution, and accuracy

Range	Resolution		Accuracy <sup>1</sup>	
	5,000 counts	50,000 counts	TX1	TX3
0.5 V	100 $\mu$ V	10 $\mu$ V	40 Hz – 20 kHz: $\pm (0.6\% + 2 \text{ counts})$	40 Hz – 20 kHz: $\pm (0.4\% + 2 \text{ counts})$
5 V	1 mV	100 $\mu$ V		
50 V	10 mV	1 mV		
500 V <sup>2</sup>	100 mV	10 mV		
1000 V <sup>2</sup>	1 V	100 mV	40 Hz – 10 kHz: $\pm (0.6\% + 2 \text{ counts})$	40 Hz – 10 kHz: $\pm (0.4\% + 2 \text{ counts})$
Temperature coefficient		AC: Add $(0.03\% + 0.1 \text{ ct.})/^{\circ}\text{C}$ beyond rated temperature range. AC+DC: Add $(0.06\% + 0.1 \text{ ct.})/^{\circ}\text{C}$ beyond rated temperature range.		

<sup>1</sup> Accuracy in 50,000-count mode is % + 20 counts.

<sup>2</sup> For voltages > 100 V, the maximum volts-Hz product is < 10 MVHz.

Table 8: DC current characteristics

Characteristics	Description
Burden voltage	5 mA to 5 A: 0.3 V max. 10 A: 0.5 V max.
Percent 4-20 mA (calculated in 50 mA range)	4 mA = 0% 20 mA = 100%
Settling time	4 readings (typical)
Reading rate	5,000 ct.: 4 readings per second 50,000 ct.: 1 reading per second

Table 9: DC current range, resolution, and accuracy

Range	Resolution		Accuracy	
	5,000 counts	50,000 counts	TX1	TX3
500 μA	100 nA	10 nA	± (0.2% + 4 counts) <sup>1</sup> ± (0.2% + 2 counts) <sup>2</sup>	
5 mA	1 μA	100 nA		
50 mA	10 μA	1 μA		
500 mA	100 μA	10 μA		
5 A	1 mA	100 μA	± (0.4% + 2 counts) <sup>2</sup>	
10 A (15 A for 30 sec.)	10 mA	1 mA	± (0.8% + 2 counts) <sup>2</sup>	
Temperature coefficient		Add (0.05% + 0.1 ct.)/°C beyond rated temperature range.		

<sup>1</sup> Accuracy in 50,000-count mode is % + 40 counts.

<sup>2</sup> Accuracy in 50,000-count mode is % + 20 counts.

**Table 10: AC current characteristics**

Characteristics	Description
Burden voltage	0.5 mA to 5 A: 0.9 V max. 10 A: 1.0 V max.
AC+DC <sup>1</sup> Accuracy	AC RMS amps accuracy + DC amps accuracy
Upper display frequency	
Accuracy	$\pm(0.002\% + 1 \text{ count})$ for 20 Hz to 5 kHz
Sensitivity	10% of range
Settling time	4 readings (typical)
Reading rate	5,000 ct.: 4 readings per second 50,000 ct.: 1 reading per second

<sup>1</sup> 5,000-count mode only.

**Table 11: AC current range, resolution, and accuracy**

Range	Resolution		Accuracy <sup>1,2</sup>	
	5,000 counts	50,000 counts	TX1	TX3
0.5 mA	100 nA	10 nA	40 Hz – 1 kHz: ± (0.6% + 2 counts)  1 kHz – 3 kHz: ± (1.0% + 2 counts)  3 kHz – 5 kHz: ± (2.0% + 2 counts)	
5 mA	1 μA	100 nA		
50 mA	10 μA	1 μA		
500 mA	100 μA	10 μA		
5 A	1 mA	100 μA		
10 A (15 A for 30 sec.)	10 mA	1 mA		
Temperature coefficient		Add (0.05% + 0.1 ct.)/°C beyond rated temperature range.		

<sup>1</sup> Accuracy in 50,000-count mode is % + 20 counts.

<sup>2</sup> > 5% of range.



Table 12: Resistance ( $\Omega$ ) characteristics

Characteristics	Description
Update rate	5,000 ct.: 2 readings per second 50,000 ct.: 1 reading per second 50 M $\Omega$ : 1 reading per second
Settling time	50 $\Omega$ to 5 M $\Omega$ range: 3 readings (typical) 50 M $\Omega$ range: 4 readings (typical)
Compliance voltages (typical)	0.6 V (50 $\Omega$ and 500 $\Omega$ range is 1.3 V)
Common mode rejection ratio	60 dB at DC, 50 Hz, or 60 Hz
Normal mode rejection ratio	20 dB at $\geq$ 50 Hz

Table 13: Resistance range, resolution, and accuracy

Range	Resolution		Accuracy	
	5,000 counts	50,000 counts	TX1	TX3
50 Ω	0.01 Ω <sup>1</sup>	--	± (0.1% + 10 counts)	
500 Ω	0.1 Ω	0.01 Ω	± (0.1% + 4 counts) <sup>2</sup>	
5 kΩ	1 Ω	0.1 Ω	± (0.1% + 2 counts) <sup>3</sup>	
50 kΩ	10 Ω	1 Ω		
500 kΩ	100 Ω	10 Ω		
5 MΩ	1 kΩ	100 Ω	± (0.4% + 4 counts) <sup>2</sup>	
50 MΩ	10 kΩ <sup>1</sup>	--	± (1.0% + 4 counts) <sup>2</sup>	
Temperature coefficient		50 Ω to 500 kΩ: Add (0.03% + 0.1 ct.)/°C beyond rated temperature range. 5 MΩ to 50 MΩ: Add (0.2% + 0.1 ct.)/°C beyond rated temperature range.		

<sup>1</sup> 5,000 count mode only.

<sup>2</sup> Accuracy in 50,000-count mode is % + 40 counts.

<sup>3</sup> Accuracy in 50,000-count mode is % + 20 counts.

**Table 14: Continuity characteristics**

Characteristics	Description
Continuity threshold	Beeper sounds when resistance is 100 $\Omega$ or less (typical)
Response time	< 1 ms

**Table 15: Diode test characteristics**

Characteristics	Description
Test current (typical)	0.35 mA
Test voltage	3.3 V maximum, open circuit
Accuracy	$\pm 1.0\%$

**Table 16: Capacitance range, resolution, and accuracy (5,000 counts only)**

Range	Resolution <sup>1</sup>	Accuracy <sup>2</sup>	
		TX1	TX3
5 nF	1 pF	± (1.0% + 5 counts) (using Δ mode)	
50 nF	10 pF	± (1.0% + 3 counts) (using Δ mode)	
500 nF	100 pF	± (1.0% + 3 counts)	
5 μF	1 nF		
50 μF	10 nF	± (3.0% + 3 counts)	
500 μF	100 nF		
5 mF	1 μF		
50 mF	10 μF		
Temperature coefficient	Add (0.05% + 0.1 ct.)/°C beyond rated temperature range.		

<sup>1</sup> 5,000 count mode only.

<sup>2</sup> > 1% of range.

Table 17: Frequency characteristics, resolution, and accuracy

Characteristics	Description
Signal coupling	AC
Minimum frequency	0.5 Hz
Maximum frequency	1 MHz
Accuracy	$\pm(0.002\%) + 1 \text{ count}$
Best resolution	10,000 count: 0.01 Hz 100,000 count: 0.001 Hz
Temperature coefficient	Add $0.00004\%/({}^{\circ}\text{C})^2$ beyond rated temperature range.

Table 18: Frequency voltage range

Range	Sensitivity, 10 Hz - 100 kHz	Sensitivity, 1 MHz <sup>1</sup>
500 mV	100 mV	—
5 V	500 mV	2 V
50 V	5 V	20 V
500 V	50 V	—

<sup>1</sup> For voltages > 100 V, the maximum volts-Hz product is < 10 MVHz.

**Table 19: Duty factor characteristics**

Characteristics	Description
Range	1 Hz to 100 kHz
Accuracy	$\pm(0.1\% + 0.05\% \text{ per kHz} + 1 \text{ count})$ for 5 V input (logic signals only)
Signal coupling	DC
Resolution	0.1%
Sensitivity	30% of range

**Table 20: Temperature characteristics**

Characteristics	Description
Main display	
Range	$-50^{\circ}\text{C}$ to $+980^{\circ}\text{C}$
Accuracy	$\pm 3^{\circ}\text{C}^1$ (typical)
Thermocouple type	K
Upper display	
Accuracy	$\pm 3^{\circ}\text{C}$ of ambient temperature (typical)

<sup>1</sup> Use the water and ice offset calibration method on page 16 for accuracy to  $\pm 1.0^{\circ}\text{C}$ .

**Table 21: 1ms peak hold characteristics**

Characteristics	Description
Accuracy <sup>1</sup>	Specified voltage or current measurement $\pm 30$ counts of the peak value of a single 1ms pulse.

<sup>1</sup> 5,000-count mode only.

Table 22: Physical characteristics

Characteristic	Description
Dimensions (H × W × D)	38 mm × 88 mm × 183 mm (without holster)
Weight (with batteries)	383 g (13.5 oz)
With holster	539 g (1 lb 3 oz)

Table 23: Environmental characteristics

Characteristic	Description
Temperature	
Operating	−10 to +50° C
Non-operating (storage)	−40 to +60° C
Humidity	−40 to +35° C: < 80%
	+35 to +40° C: < 70%
	+40 to +60° C: < 55%
Altitude	
Operating	2,000m (6,562 ft) For altitudes from 2,000 m up to 5,000 m (16,404 ft) derate voltage input to 600 VAC CAT III.
Non-operating (storage)	12,300 m (40,354 ft)
Vibration	
Operating	2.66 g <sub>RMS</sub> , 5 to 500 Hz, 3 axes (10 minutes each)
Non-operating	3.48 g <sub>RMS</sub> , 5 to 500 Hz, 3 axes (10 minutes each)

**Table 24: Certifications and compliances**

Category	Standards or description
EC Declaration of Conformity – EMC	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55011                      Class A Radiated Emissions</p> <p>EN 50082-1 Immunity:</p> <p>IEC 801-2                  Electrostatic Discharge Immunity</p> <p>IEC 801-3                  RF Electromagnetic Field Immunity<sup>1,2</sup></p>
Australia/New Zealand Declaration of Conformity – EMC	<p>Complies with EMC provision of Radiocommunications Act per the following standard(s):</p> <p>AS/NZS 2064.1/2      Class A Radiated Emissions</p>
EC Declaration of Conformity – Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC as amended by 93/69/EEC.</p> <p>EN 61010-1/A2:1995</p> <p>Safety requirements for electrical equipment for measuring control, and laboratory use.</p>
U.S. Nationally Recognized Testing Laboratory Listing	UL3111-1 – Standard for electrical measuring and test equipment
Canadian Certification	<p>CAN/CSA C22.2 No. 1010.1</p> <p>Safety requirements for electrical equipment for measurement, control, and laboratory use.</p>
Additional Compliance	<p>IEC61010-1/A2:1995</p> <p>Safety requirements for electrical equipment for measurement, control, and laboratory use.</p>

Table 24: Certifications and compliances (cont.)

Category	Standards or description
Installation Category Descriptions	<p>Terminals on this product may have different installation category designations. The installation categories are:</p> <p>CAT III    Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location</p> <p>CAT II    Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected</p>
Pollution Degree	<p>A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are tested.</p>
	<p>Pollution Degree 2</p> <p>Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.</p>
	<p>Pollution Degree 3</p> <p>Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.</p>

- 1

Add 25 counts (250 counts in 50,000 count mode) to the accuracy specifications when in the presence of an RF field as defined in IEC801-3.
- 2

Amps DC: Add 60 counts (600 counts in 50,000 count mode) to the amps accuracy specifications when in the presence of an RF field as defined in IEC801-3.

# Accessories

This section lists all standard and optional accessories for the TX1 and TX3 true RMS digital multimeters.

**Table 25: Standard accessories**

Standard accessory	Product or part number		
Test lead set	ATL01, or equivalent		
Test leads (1 red, 1 black)	Certified to 1000 V CAT III		
Alligator clips (1 red, 1 black)	Certified to 1000 V CAT III		
Protective boot	650-3681-XX, or equivalent		
User Manual			
Language	Part Number	Language	Part Number
English	070-9880-XX	Portuguese	070-9885-XX
French	070-9881-XX	Korean	070-9886-XX
German	070-9882-XX	Simplified Chinese	070-9887-XX
Italian	070-9883-XX	Traditional Chinese	070-9888-XX
Spanish	070-9884-XX	Japanese	070-9889-XX
Installed dry cell batteries	Two AA 1.5 V alkaline batteries (IEC LRG or ANSI/NEDA 15A)		
Fuse (installed)			
15 A, 1000 V <sub>RMS</sub>	159-0409-XX (Littelfuse®), or 11 A, 1000 V (Buss® DMM-B-11) (service-replaceable)		
Temperature probes (TX3 only)	ATK01, or equivalent, K-type thermocouple adapter and ATP01, or equivalent, bead probe.		



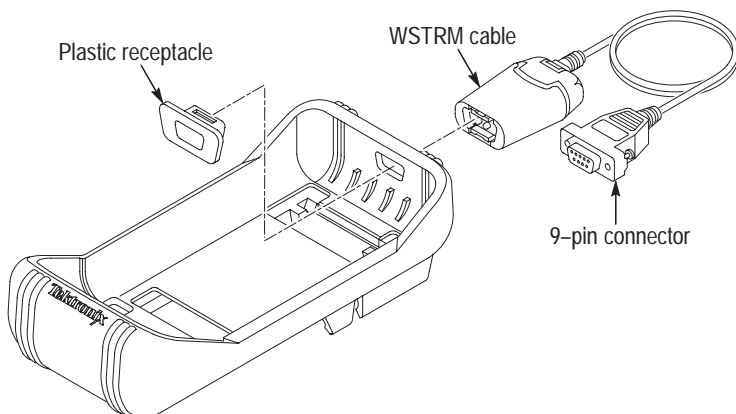
**Table 26: Optional accessories**

Optional accessory	Product or part number
Probing solutions	ATL21, ATL22, ATL23, ACL21, ACL22, ACL23, ACL24
Nylon softcases	AC12, AC13
Clamp-on current probes	A605, A621, A622
Cables and software	WSTRM
TX1 and TX3 Service Manual	070-9893-XX

## Setup for Optional Computer Interface Accessory (WSTRM)

Follow the steps below to set up the computer interface accessory:

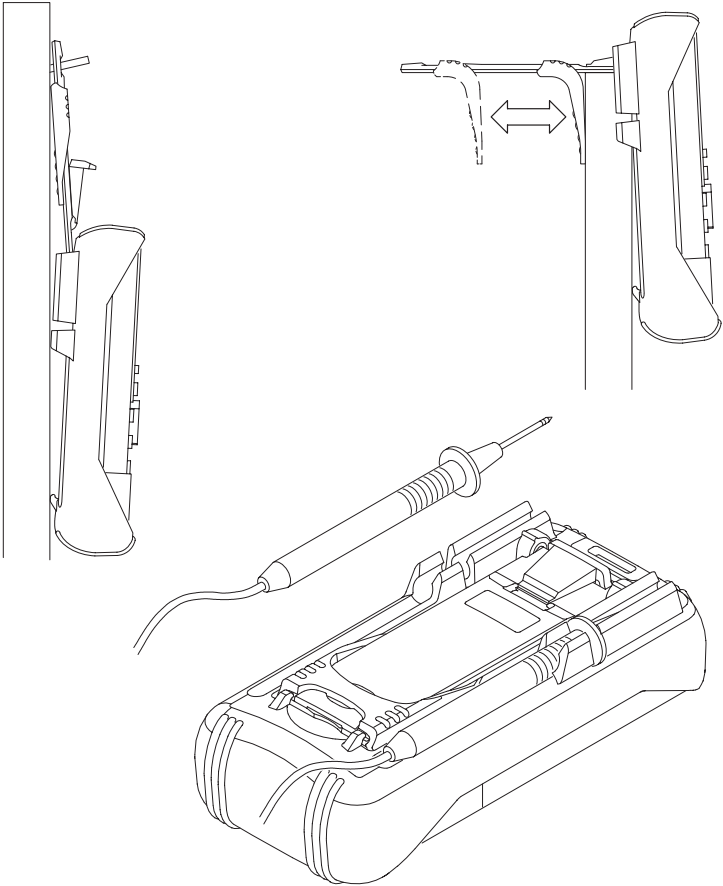
1. Press the plastic receptacle into place in the top of the DMM protective boot. Connect the WSTRM cable to the plastic receptacle.



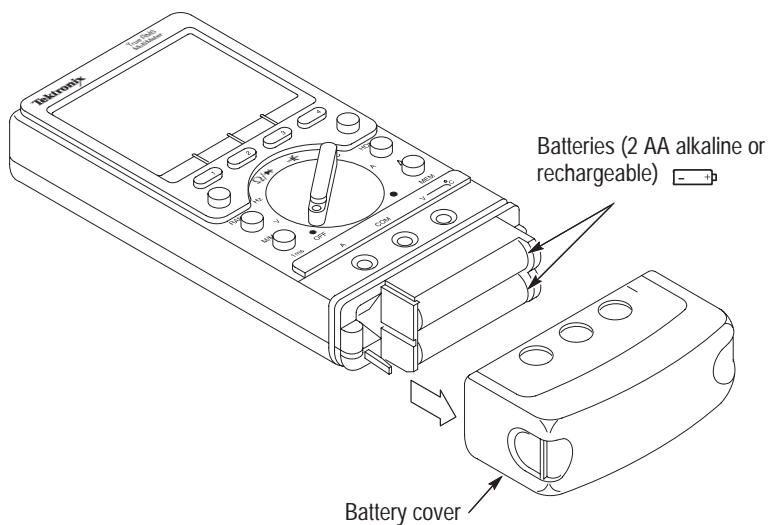
2. Connect the other end of the WSTRM cable to your computer using the 9-pin connector. If you require a 25-pin connection to your PC, you will need to use a 9-pin-to-25-pin adapter.
3. Insert WSTRM CD-ROM into your computer drive and proceed with software installation. Refer to the WSTRM documentation for further instructions on using WSTRM.

You can find further information about WSTRM features on the WSTRM CD-ROM.

# Using Protective Boot and Versa-Stand™



## Battery Replacement



When you replace a battery the multimeter calibration is not affected and the stored data is not lost.

Remove the battery cover only in a clean, dry environment.

See Table 25 on page 43 for the descriptions and part numbers of the replaceable batteries.

## Servicing TX Series Multimeters

The information in this section shows you how to replace fuse F1.

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

**Do Not Service Alone.** Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

**Use Care When Servicing with Power On.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Service only in a clean, dry environment.

Annual calibration verification is recommended.



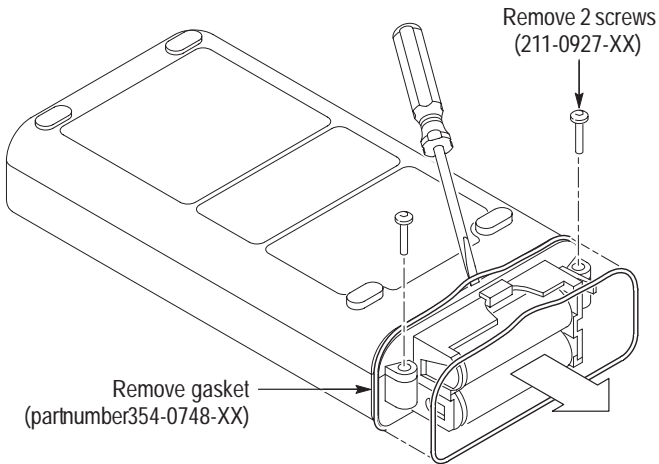
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**WARNING.** *Installing improper fuses can cause injury and product damage.*

---

Follow the steps below to access and replace the service-replaceable fuse:

1. Remove the battery cover. Remove the batteries and two screws on both sides of the batteries.
2. Carefully insert a screw driver between the gasket and meter case and gently lift and remove the gasket. You must remove the gasket before opening the meter case.



3. Carefully lift the rear panel of the meter up to access the fuse F1. Remove and replace the fuse. Refer to Table 25 on page 43 for more information on which fuse to use.

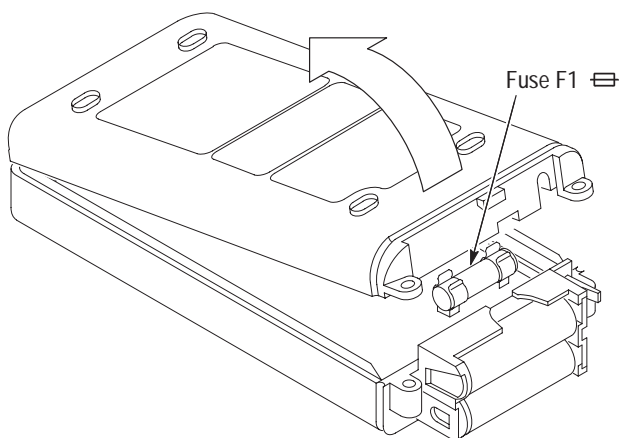


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**WARNING.** *Installing improper fuses can cause injury and product damage.*

---

4. Verify meter calibration after replacing F1.



## General Care and Cleaning

Protect the meter from adverse weather conditions.

Do not expose the LCD display to direct sunlight for long periods of time.



---

**CAUTION.** To avoid damage to the meter, do not expose the interior of the meter to sprays, liquids, or solvents.

---

Clean the exterior of the meter by removing dust with a lint-free cloth. Use care to avoid scratching the clear plastic display filter.

For further cleaning, use a soft cloth or paper towel dampened with water. You can use an alcohol-free glass cleaner for more efficient cleaning.



---

**CAUTION.** To avoid damage to the surface of the meter, do not use abrasive or chemical cleaning agents.

---



---

**WARNING.** The meter is not protected from exposure to water. Exposing the meter to water can create a shock hazard.

---

If the meter is exposed to water, open the case and allow the meter to fully dry. To open the meter, use the procedure in the *Servicing TX Series Multimeters* section.



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