优利德®

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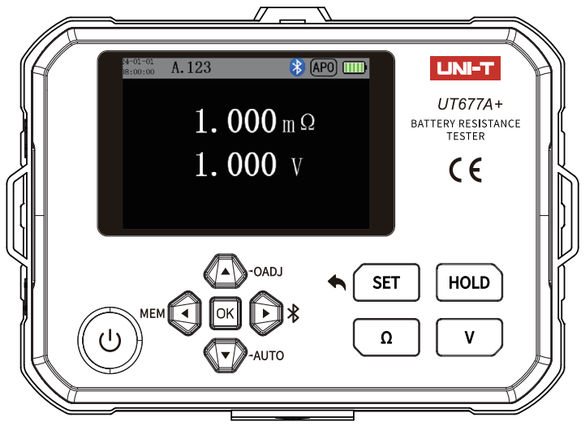


电池内阻测试仪

UT677A+

User manual

目录

一、安全规则及注意事项

感谢您购买了本公司**通用型充电电池内阻测试仪**，在你初次使用该仪器前，为避免发生可能的触电或人身伤害，请一定：**详细阅读并严格遵守本手册所列出的安全规则及注意事项。**

- ✧ 请注意电池的+/-极性，请勿反向安装。
- ✧ 测量电池电压不要超过本仪表的上量限。
- ✧ 仪表显示电池电压低符号“▭”，应及时充电,否则会引起测量误差。
- ✧ 长时间不使用时，每三个月充满电一次以保证电池健康。
- ✧ 在充电时不要测量，有信号干扰。
- ✧ 本仪表根据 IEC61010 安全规格进行设计、生产、检验。
- ✧ 测量时，移动电话等高频信号发生器请勿在仪表旁使用，以免引起误差。
- ✧ 注意本仪表机身的标贴文字及符号。
- ✧ 使用前应确认仪表及附件完好，才能使用。
- ✧ 请勿于高温潮湿，有结露的场所及日光直射下长时间放置和存放仪表。
- ✧ 注意本仪表所规定的测量范围及使用环境。
- ✧ 使用、拆卸、校准、维修本仪表，必须由有授权资格的人员操作。
- ✧ 由于本仪表原因，继续使用会带来危险时，应立即停止使用，并马上封存，由有授权资格的机构处理。
- ✧ 仪表及手册中的“⚠”安全警告标志，使用者必须严格依照本手册内容进 行安全操作。
- ✧ 任何情况下，使用本仪表应特别注意安全。

二、简介

通用型充电电池内阻测试仪 简称：**电池内阻测试仪**，是用于测量铅蓄电池、锂电池等充电电池的内阻、电压,以判断电池健康状态的测量仪器,同时可以作为测量电解电容 ESR 参数的仪表（仅供参考）。本仪表使用交流 4 端子测试法测量电池内阻，可不受测试线、端子与电池电极之间接触电阻影响测量正确的测量值。同时还具有数据存储、数据查阅、报警、自动关机等功能。整机高档美观，量程宽广，分辨率高，操作便捷，携带方便，准确、可靠、性能稳定，抗干扰能力强。是电池生产、电池安装、设备生产、设备维修等场景必不可少的仪器。

通用型充电电池内阻测试仪由微处理器控制，内部 16 位 ADC 可准确检测电池内阻、电压。其特点在不停止 UPS 系统的状态下进行测量，使用交流低电阻测量和降噪技术，不需要停止被测设备的正常工作，在运转状态下进行测量，极大的缩短了测试时间。同时带有数据存储、柱状图显示、数据上传电脑、手机平板等智能设备蓝牙连接进行无线测量、查阅数据等功能。

三、量程及精度

精度保证条件	精度保证温湿度范围：23℃±5℃、80%RH 以下 预热时间：不需要
温度特性	使用温度范围内加上测试精度 × 0.1/℃（18℃~28℃之外）
激励信号精度	测量电流精度：±25% 普通模式：1000Hz ± 5Hz 回避噪音频率模式：920Hz ~ 1080Hz 自动变频 （使用多阶降噪技术，有效滤除异频或近同频的噪声干扰）

3.1、电阻测量精度

量程	最大显示	分辨率	测试精度	测量电流
3 mΩ	3.100 mΩ	1 uΩ	±1 % fs. ±20 dgt.	200 mA
30 mΩ	31.00 mΩ	10 uΩ	±0.5 % fs. ±15 dgt.	200 mA
300 mΩ	310.0 mΩ	100 uΩ		20 mA
3 Ω	3.100 Ω	1 mΩ		2 mA

3.2、电压测量精度

量程	最大显示	分辨率	测试精度
7 V	±7.100 V	1 mV	±0.2 % fs. ±10 dgt.
70V	±72.00 V	10mV	

提示：

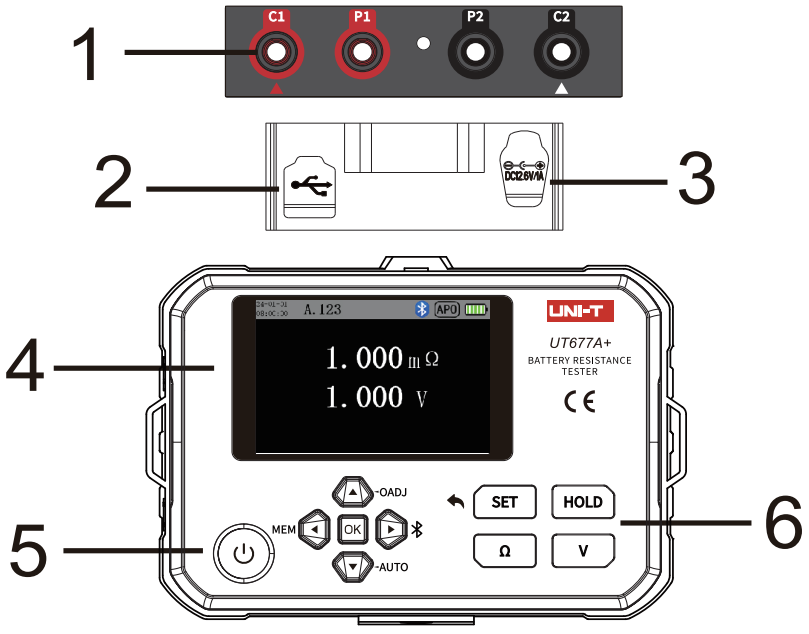
以上精度保证仅限出厂标配测试线，在使用非标配测试线或延长线时，调零后也适用本精度表。

四、技术规格

功 能	电池内阻测量，电池电压测量
回避噪音频率	有，自动变频范围 920Hz~1080Hz
精度保证温度湿度	23℃±5℃，75%rh 以下
充电适配器	输入：100-240V AC/50Hz/60Hz 输出：0.8A/12.6V DC
电池	DC 11.1V 锂电池 2600mAh
电阻分辨率	1 uΩ
电压分辨率	1 mV
测量范围	内阻测量：0.000mΩ~3.000 Ω （4 档量程构成）
	电压测量：0.000V~±70.00V （2 档量程构成）

最大输入电压	DC 70V（+测量端子与-测量端子之间）不可输入交流
测量方式	内阻测量：1kHz 交流 4 端子测试法、开路端子电压 3V max 测量电流：2.0mA~200mA（不同量程档位不同测量电流） A/D 转换方式：逐次逼近型 显示更新频率：5 次/每秒
响应时间	200ms
测量时间	约 2 秒
LCD 尺寸	73.4mm×48.9mm / 3.5 英寸（480*320 分辨率 16 位真彩屏）
仪表尺寸	长宽高：170mm×115mm×65mm
Type-C 接口	具有 Type-C 接口，存储数据可以上传电脑，保存打印
蓝牙连接	有
保持和存储功能	有手动保持与存储、自动保持与存储
测量判定功能	可预设定通过、警告、失败判定阈值
电量显示	电池电量 5 格显示，电池电压低时提醒及时充电
自动关机	开机无操作，默认 15 分钟后自动关机（可在设置中改时间或关闭）
功　　耗	150mA MIN / 250mA MAX
质　　量	仪表质量：674.0g（含电池）
工作温湿度	-10℃～40℃；80%RH 以下
存放温湿度	-20℃～60℃；70%RH 以下
绝缘电阻	20MΩ以上（电路与外壳之间 500V）
耐　　压	AC 3700V/RMS（电路与外壳之间）
外部磁场	＜40A/m
外部电场	＜1V/m
适合安规	IEC 61010

五、仪表结构



1. **接线端口**
2. **TYPE-C**
3. **充电接口**
4. **屏幕**
5. **电源开关键与电源指示灯**
6. **按键**

六、界面显示

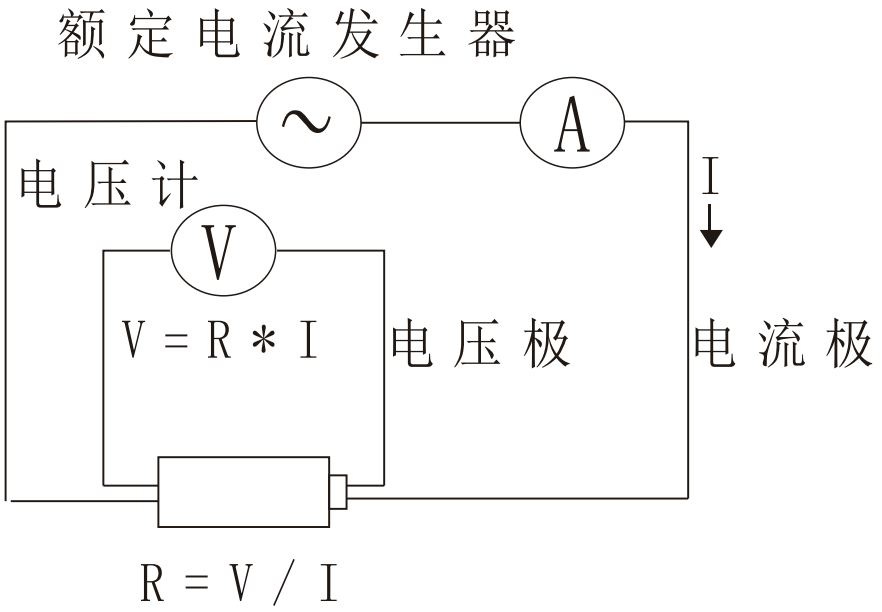
6.1、界面图标及符号说

	表示仪表电池的剩余电量和充电状态
	表示当前仪器已开启自动关机功能
	表示当前仪器已开启蓝牙数据，开机默认关闭
	表示仪器已自动保持数据
	表示仪器已手动保持数据
A.21	表示当前使用存储器为 A，A 存储器内有 21 组数据
FULL	如果单个存储器存满 500 组还继续测量时，屏幕将显示“FULL”并不再存储数据
	表示当前测量结果判定为失败
	表示当前测量结果判定为警告
	表示当前测量结果判定为通过
	表示当前测量结果已减去初始线阻
	该标志闪烁表示正在变频与正在识别干扰频率
	**普通模式：**表示已开启软件滤波功能，数字变化比普通模式较慢，默认关闭。 **NOICE 模式：**表示已开启滚动模式，即循环识别干扰频率、避开干扰频率测试；如果不开启就只是首次识别干扰频率，然后一直避开干扰频率测试，开机默认关闭。
	表示当前为规避干扰模式
	表示仪器已经开启自动换挡功能，开机默认开启
	表示当前被测电压已超过人体安全电压，请注意安全

七、测量原理

7.1、交流 4 端子测试法原理

在电池正负电极之间流动频率为 1kHz 的 AC 电流 I，测量电池正负极之间的交流电压差 V，并根据公式 R=V/I 计算电池内阻，为保证测量精度两电流极（C）、两电压极（P）应独立接触电池正负极，可不受导线电阻或接触电阻，得到正确的测量值。



7.2、电压测量原理

采样电阻分压，滤除噪声后，ADC 采样并通过程序计算与修正后得到测量值。

八、操作方法

8.1、开关机及自动关机

● 长按 ⏻ 实现开关机。

● 开启了自动关机功能，在开机后无按下任意按键的操作，到达设置的时间时，仪表则会自动关机以节约电量，如在期间有按下任意键的操作则会重新计算关机时间。该功能可在设置中关闭自动关机功能或更改自动关机时间，出厂默认 15 分钟关机，开启后状态栏显示 APO 图标。

8.2、测试界面操作

在测试界面中可查看当前仪器的时间、测量值和仪器的状态信息，操作按键的功能如下：

按键符号	短按	长按
HOLD	保持数据	
SET	进入设置菜单	
Ω	电阻测量换挡	
V	电压测量换挡	显示电压（+按下 OK 归零）
▲	调零或取消调零	
▼	开启或关闭自动换挡（关机不记忆）	
◀	进入数据阅读模式	在 HOLD 模式时删除最新缓存的一组数据
▶	开启或关闭蓝牙	
OK	开启或关闭软件滤波	NOICE/普通模式切换

8.3、设置菜单界面操作

在测试界面按 SET 进入设置目录界面，在设置目录界面可选择需要设置的项目和查看仪器基本信息。其中菜单界面的 1：语言设置、2：阈值设置、3：报警器设置、4：存储设置、5：换挡方式、6：时钟设置、7：节能设置、8：关于仪表。

操作流程实例：先按下 SET 进入菜单界面（要确保是在测试界面下按下 SET ） -> 按下 ▲ / ▼ 移动光标选择（该界面的 1：语言设置、2：阈值设置、3：报警器设置、4：存储设置、5：换挡方式、6：时钟设置、7：节能设置、8：关于仪表的选项）-> 按下 OK 可以进入光标所在的选项。取消设置可通过按下SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	选择需要设置的项
OK	选择进入
SET	返回

1） 语言设置

语言设置用于更改显示的语言文字，支持简体中文和 English。

设置流程实例：首先要进入到该界面（菜单界面的 1(语言设置)）-> 通过按下▲/ ▼ 切换光标选择设置选项（简体中文)/(English) -> 通过按下 OK 可以保存更改并返回菜单界面。取消设置可通过按下 SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	选择设置项
OK	保存并返回
SET	返回

2） 阈值设置

阈值设置界面可设置判定测试结果通过、警告与失败的阈值，设置合适的阈值可提高判断效率提高测试效率。其中电阻的阈值设置范围为 0-3000 mΩ，电压的设置范围为 0-70.0V。 可设置的阈值有电阻：通过、失败、警告阈值，电压：警告、通过阈值。

设置流程实例：首先要进入到该界面（菜单界面的 2(阈值设置)）-> 通过按下 ◀ / ▶ 来切换要设置的设置项（电阻：通过、警告与失败阈值 / 电压：警告、通过阈值）-> 通过按下 OK 进入需要的设置项 -> 通过按下◀ / ▶可以选择阈值的千、百、十、个位进行设置 -> 通过按下 ▲ / ▼ 实现加减数值 -> 通过按下 OK 实现阈值保存并返回上一个界面 -> 通过按下 SET 可以保存并返回菜单界面。取消设置可通过按下SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
◀ ▶	切换设置项
OK	进入或退出当前设置项
◀ ▶	数字位移
▲ ▼	加减数值
SET	保存并返回/返回

3） 报警器设置

报警器设置界面可设置在测试完成时蜂鸣器提示方式。可选报警器类型有 1：通过（ON（开启）/OFF(关闭)）、2：警告/失败（ON（开启）/OFF(关闭)）。

设置流程实例：首先要进入到该界面（菜单界面的 3(报警设置)-> 通过按下 ▲ / ▼来切换光标选择报警器的功能选项（通过）/（警告/失败）->（通过）通过按下 OK 切换（ON 开启/OFF(关闭)->（警告/失败）通过按下 OK 切换（ON 开启/OFF(关闭)->通过下 SET 可以保存并返回菜单界面。取消设置可通过按下SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	切换报警器功能
OK	改变设置
SET	保存并返回/返回

4） 存储设置

存储设置界面可设置保持、储存方式，存储器的选择，共有 ABCDEFGHIJ 十个存储器可选，如当前存储器已存储满 500 组数据，存储数据时提示存储器已满（FULL 符号），需要手动设置其他存储器或者删除当前存储器数据后才可存储新的测量数据。可设置的功能有三个，1：自动保持（ON（开启）/OFF(关闭)）、2：保持存储（ON（开启）/OFF(关闭)）、3：当前存储器（可选择 ABCDEFGHIJ 其中任意一个）。

设置流程实例：

自动保持： 首先要进入到该界面（菜单界面的 4(存储设置)） -> 通过按下 ▲ / ▼ 来切换光标到自动保持的选项 -> 通过按下 OK 可以切换自动保持的状态(ON(开启)/OFF(关闭)-> 通过按下SET 可以保存并返回菜单界面。

保持存储： 首先要进入到该界面（菜单界面的 4(存储设置)） -> 通过按下 ▲ / ▼ 来切换光标到保持存储的选项 -> 通过按下 OK 可以切换保持存储的状态(ON(开启)/OFF(关闭)-> 通过按下SET 可以保存并返回菜单界面。

当前存储器： 首先要进入到该界面（菜单界面的 4(存储设置)） -> 通过按下 ▲ / ▼ 来切光标到当前存储器的选项 ->通过按下 OK 显示出存储器编号->通过按下 ◀ / ▶改变光标选择存储器（例如：右下角

个

的数字表示选择当前存储器缓存了多少组数据，一共可以切换 10 存储器 ABCDEFGHIJ）-> 通过按下 OK 选择光标显示的存储器做为当前的存储器并且返回到上一级界面 ->通过按下SET 可以保存 并 返回菜单界面。取消设置可通过按下SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	选择设置项
OK	改变设置或选择存储器
◀ ▶	选择其他存储器
SET	保存并返回/返回

5） 换挡方式

换挡方式设置界面可选择手动换挡或自动换挡测量方式。

测试界面显示 Auto 图标表示机器已开启自动换挡功能。

设置流程实例：首先要进入到该界面（菜单界面的 5(换挡方式)）-> 通过按下▲ / ▼ 切换光标选择设置选项（自动换档)/(手动换档）-> 通过按下 OK 保存并返回菜单界面。取消设置可通过按下 SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	切换设置项选择状态
OK	保存并返回
SET	返回

6） 时钟设置

时钟设置界面可设置仪器的时间，本仪器时间显示的格式为 XX(年)-XX（月）-XX（日）XX（时）：XX（分）：XX（秒），也可通过本公司配套软件连接电脑或手机一键同步仪器时间。

设置流程实例：首先要进入到该界面（菜单界面的 6(时钟设置)） -> 通过按下 ▲ / ▼ / ◀ / ▶ 可以选择年、月、日、时、分、秒（光标表示当前选择项）-> 通过按下 OK 可以进入当前选择项（年、月、日、时、分、秒）的数值修改界面 -> 通过按下 ◀ / ▶ 可以选择十位或个位 -> 通过按下 ▲ / ▼ 可以修改十位或个位上的数值 -> 通过按下 OK 可以保存下当前的设置值（此时并未生效）并返回上一级界面 -> 通过按下 HOLD 可以生效当前设置时间（可以根据自己的需求设置好年、月、日、时、分、秒，再按 HOLD 也是可以的）显示（已生效）表示设置成功 -> 通过按下 SET 可以返回菜单界面。取消设置可通过按下 SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼ ◀ ▶	选择需要设置的项目
OK	设置选择项目
▲ ▼	更改选中值的数值
◀ ▶	选中其他值
HOLD	生效当前设置时间
SET	返回

7） 节能设置

节能设置界面可设置仪器显示亮度或仪器自动关机功能的开启与关闭。显示 APO 图标表示机器已开启自动关机功能。

设置流程实例：首先要进入到该界面(菜单界面的 7(节能设置))-> 通过按下 ▲ / ▼ 切换光标选择设置选项（背光)/(自动关机）-> (背光)通过按下 ◀ / ▶ 改变背光亮度-> (自动关机)通过按下 ◀ / ▶ 设置自动关机时间(5、15、30 分钟或关闭)-> 通过按下 SET 可以保存并返回菜单界面。取消设置可通过按下 SET 返回。

该界面的按键功能具体如下表：

按键符号	短按
▲ ▼	选择设置项
◀ ▶	改变背光亮度或改自动关机时间
SET	保存并返回/返回

8） 关于仪表

在此页面可查看当前仪器基本信息，按下 SET 可返回设置菜单界面。

8.4、测量步骤

内阻测量：

1）将测试线接到仪表上，测试线的指示标识（小箭头）与机器上的指示标识（小箭头）对应按颜色接好。

2）设置好仪器参数，参考 8.3.1 与 8.3.2。

3）如使用标配以外的测试线，将测试线四线夹短接，然后按下 ▲ 键调零校准。

4）将测试线夹到电池的电极上仪器开始测试。

5）等待数值稳定读取测试结果。

电压测量：

本仪表也可以作为直流电压表使用，只需接中间两个红黑接口即可测量直流电压，注意勿测交流电压，以及超过 70V 的直流电压。

（当电阻显示“-----”时，电压需大于 0.1V 才显示数值，否则也仅显示“-----”符号）。

（当短接表笔 V+ V-有剩余电压或测量有偏差时，可人工电压调零，操作方法是先短接表笔 V+ V-，然后长按“V”键不放，接着按下 OK 键，听到蜂鸣器滴一声，调零完成）。

8.5、数据存储

数据存储功能需要在设置中开启“保持存储”功能（请参考 8.3 小节），出厂时默认开启。每次手动 HOLD 或自动 HOLD 时会自动编号并存储一组数据，本仪表有 10 个数据存储器，编号 A~J 可在设置中选择，所有存储器存满能存 5000 条数据记录。

需要注意的是，当某个存储器存满 500 组后还继续测量时，HOLD 的数据不再保存到内存里，用户需要手动切换到另外的存储器或将该存储器数据删除后方可进行保存。

存储器编号	可存储记录/条
A	500
B	500
C	500
D	500
E	500
F	500
G	500
H	500
I	500
J	500

8.6、数据查阅与删除

在测试页面按  键进入选择阅读器界面，可根据页面提示操作仪器选择阅读器进入柱状图界面，在选择阅读器界面按下  键删除当前阅读器数据，可根据提示选择是否删除。

如图 8-1 所示，柱状图界面中每页可显示 10 条测量记录，可直观分析批量电池的内阻大小。可通过  键或  键左右移动阅读光标，光标选中的项可阅读电池内阻、电压与测试时间具体信息，也可通过  键或  键翻页阅读。通过按下 SET 可返回。

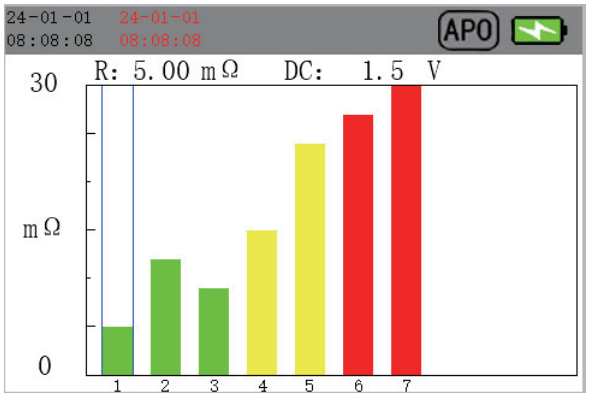


图 8-1 数据阅读界面

8.7、与 PC 通讯

使用前应确认： 1、USB 驱动已安装。
2、电脑中安装有上位机软件和 EXCEL 软件。

使用附带的 USB Type-C 通讯线连接仪表和电脑，打开软件后会自动搜寻 COM 口并自动连接，期间可能需要稍等数秒到十几秒，连接成功后可实现读取实时测量值、读取历史测量记录、同步电脑时间到仪表等功能。

8.8、与智能手机或平板电脑通讯

使用前应确认： 1、手机或平板电脑系统版本是安卓 5.0 以上。
2、智能设备中安装了《电池内阻测试仪》APP。

在仪表的测量界面按 键打开蓝牙功能，智能手机也要打开蓝牙，然后打开 APP。搜寻到“BRT”（Battery Resistance Tester 简写）并连接，连接成功后可实现无线测量与数据浏览等功能。

九、噪音频率回避功能

9.1、适用场合

一般测量 UPS 不间断电源的电池、电池不断电测试，由于负载产生的 1000Hz 或邻近 1000Hz 的噪音频率与本机的测量频率重叠，导致测量不稳定，可开启本功能自动回避噪音频率。

9.2、开启/关闭

在普通模式下长按 OK 键开启，再次长按就退出。

开启后显示 NOISE 图标表示当前为回避噪音频率模式， FREQ 闪烁表示正在变频与正在识别干扰频率，FREQ 停止闪烁并消失表示已回避噪音频率正在测试内阻中，一次完整测试的进度在屏幕下方红色进度条表示。

（测一轮最长用时：1.5s*3*18+1=82s 最长约 82 秒测一轮，这种情况是没有干扰的时候）。
（测一轮最快用时:1.5s*2+1=4s 最短约 4 秒测一轮,这种情况是干扰离 1000Hz 很近的时候）。

提示：该模式测试时间较长，如果确定没有噪音频率情况下，请不要使用该功能。

完成一次测量后，在 NOISE 图标下方有 4 个频率测试显示，依次为：

1、首轮输出频率与噪音频率之差。
2、第二轮输出频率与噪音频率之差。
3、推算出的噪音频率。
4、本次测试频率。

有时可能会因噪音的具体情况，而无法回避所有的噪音频率，当识别噪音频率失败时，上述 1/2/3 项显示 Fail，进度条变为黄色，此时可通过长按 ◁ 键或 ▷ 键手动选择测量频率，选比较稳定的值为结果。

9.3、单次/循环 识别噪声频率

开启回避噪音频率模式后，短按 OK 键开启或关闭滚动测量，即循环识别干扰频率、避开干扰频率测试，开启后显示 SF 图标；如果不开启就只是首次识别干扰频率，然后一直避开干扰频率测试，默认关闭。

十、维护和服务

10.1、电池充电

本产品内置可充电锂电池组（11.1V,2600mAh），请使用随产品标配的专用锂电池充电器（12.6V,0.8A）进行充电。（图 10-1）

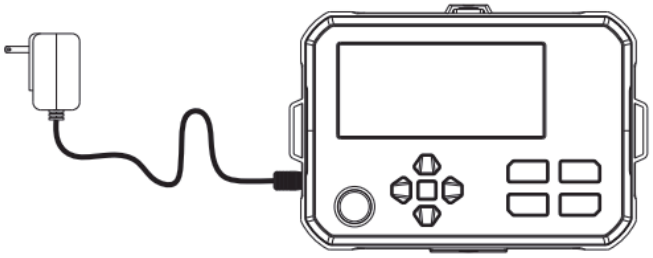


图 10-1 充电示意图

充电时，产品开机状态下，电源指示灯会变成呼吸灯状态（不充电时常亮状态）。屏幕右上角也会显示充电指示符号“”。当电池充满后，屏幕右上角的电池电量符号变为满电状态“”。

电池电量标识与电池电压对应关系如下表：

符号	电池电压
	9.6~10.1V
	10.1~10.6V
	10.6~11.1V
	11.1~11.6V
	11.6~12.1V
	>12.1V

注：关机状态下充电，电源灯无提示，屏幕无任何充电信息，电池是否充满需开机观察屏幕上的电池电量信息。

1） 当电池电压低 9.6V 时，电量符号“  ”闪烁提示电量低，一分钟后会强制关机以保护电池,请及时充电以保证测量准确度。
2） 充电从  电充到  大约 5 小时。
3） 满电状态下可连续使用 4~8 小时，屏幕亮度和不同的负载功耗也不同；假定一直使用 3Ω 量程挡和屏幕亮度调节到最低，由于输出电流最小，所以最长可使用大约 8 小时。
4） 开机屏幕一闪就黑屏，可能是电池电量不足以开机，请充满电再进行开机测量。
5） 新仪表的电池寿命可充放电约 500 次，当电池不耐用时可联系仪表经销商更换，切勿自行更换。

10.2、修理、检查与清洁

⚠ 警告

请客户不要进行改造、拆卸或修理。负责可能会引起火灾、触电事故或人员受伤。如有自行拆卸或改造，视用户放弃一年免费质保服务。

1）校正

校正周期因客户的使用状况或环境等而异。建议根据客户的使用状况或环境确定校正周期，并委托本公司定期进行校正。

2）清洁

清除仪表脏污时，请用柔软的布沾少量的水或中性洗涤剂之后，轻轻擦拭。请用干燥的软布轻轻擦拭显示区。

请不要使用汽油、酒精、丙酮、乙醚、甲酮、稀释剂以及含有汽油类的洗涤剂。否则会引起仪表变形变色等等。

3）运输

为避免运输时的撞击导致二次伤害，请务必进行双重包装。对于运输所造成的破坏我们不加以保证。

返修时，请用纸写明故障内容及寄回地址和联系人、电话等必要信息附在仪表一同寄回我们。

10.3、常见问题

问题	回答
为什么仪表的时间不准？	内部的时钟系统由仪表电池供电，并非纽扣电池，因此需要保证电量充足时钟系统才能正常工作，长期不使用时也要每 3 个月充电一次。
为什么测量时一直显示“-----”？	请检查测试线是否有导通良好，以及接口插接是否到底，一般回路不通时才会显示“-----”
显示 OL 是什么意思？	测量已超出量程范围
可以测量多大容量（Ah）的电池的内阻和电压？	本仪表采用交流信号进行测量，直流电流不会流入本仪表，因此，对于被测电池的容量（Ah）没有限制。

十一、装箱单

名称	规格	数量
仪表	UT677A+电池内阻	1 台
测试线	双头夹子测试线长：1.5 米	1 套
通讯线	USB Type-C 线长：1 米	1 条
充电适配器	输入：100-240V AC/50Hz/60Hz 输出：0.8A/12.6V DC	1 个
电池	DC 11.1V 锂电池 2600mAh	1 个（已装入机子内）
说明书	中英文说明书	1 套
彩盒	*	1 个
保修证 合格证	*	1 张

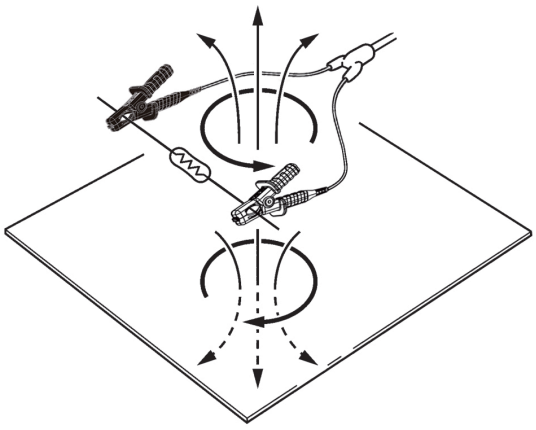
附录

附 1 涡电流的影响

本仪器产生的交流电流会在附近的金属板上诱发涡电流。受这种涡电流的影响，在测试线上会诱发感应电压。

由于该感应电压与交流电流（基准信号）相差 180 度的相位角，因此不能通过同步检波进行消除，从而导致了测量误差。

涡电流的影响是进行交流测量的电阻仪特有的现象。为了避免这种影响，请勿在测试线（分叉为两股之处）附近放置金属板，也应避免靠近金属板。



附 2 延长测试线与感应电压的影响

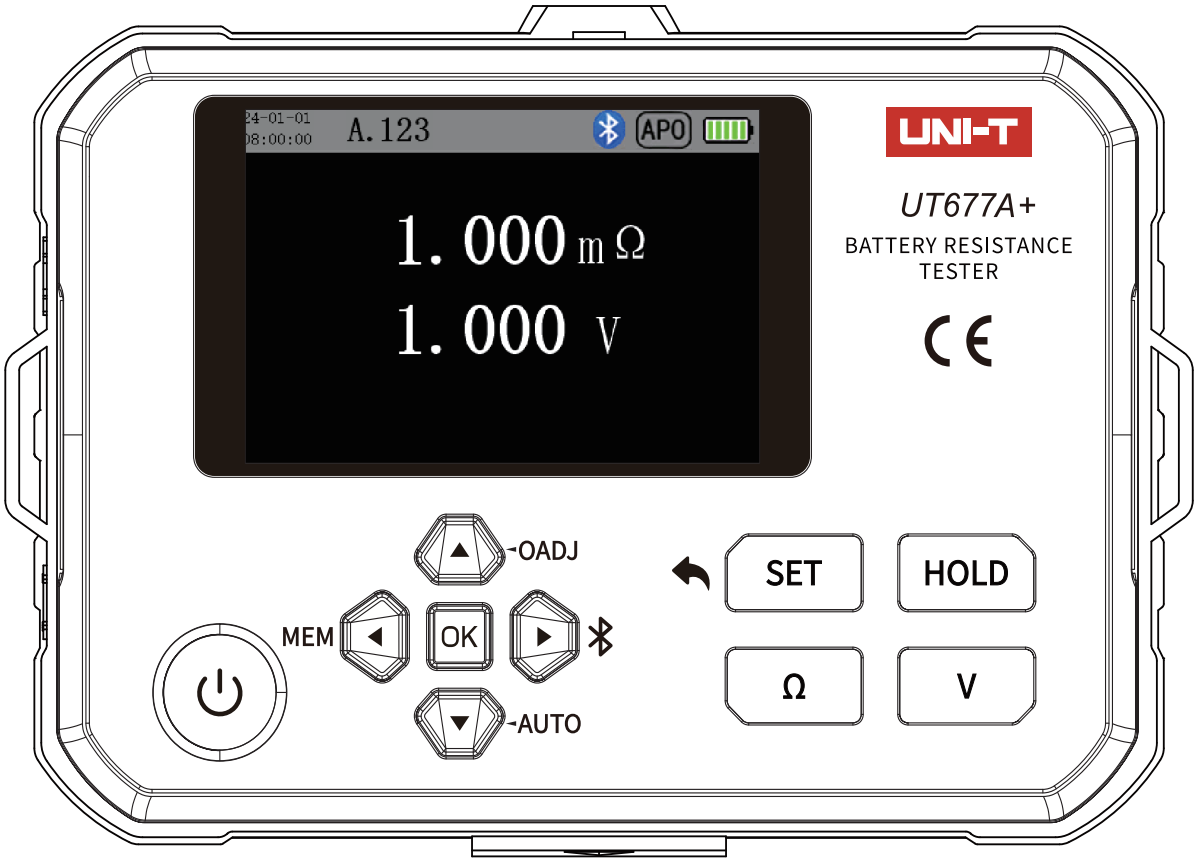
测试线缆的质量和形态结构对测量结果有一定影响，如需延长测试线，请使用本公司推荐的测试线缆。

感应电压的降低方法

由于本仪表使用交流来测量微小电阻，因此易受感应电压的影响。这里所说的感应电压，是指本仪表产生的电流通过在导线内部形成的电磁耦合而对信号系统产生影响的电压。

由于感应电压与交流电流（基准信号）相差 90 度相位角，因此电平较小时，可通过同步检波电路完全消除，但在电平较大时，则会导致信号畸变，无法进行正确的同步检波。测试线的延长会导致感应电压增大，因此，要降低感应电压的电平，必须尽可能缩短测试线的长度。尤其是缩短分叉为两股的部分，效果更佳。即使使用标准测试线，但在 3mΩ量程下，如果调零时与量程时的导线配置发生较大变化，测量值会受感应电压的影响而产生约 20dgt. 的波动。

BATTERY RESISTANCE TESTER



UT677A+

User manual

Table of contents

1. Safety rules and precautions

Thank you for purchasing our company's **universal rechargeable battery internal resistance tester** . Before you use the instrument for the first time, in order to avoid possible electric shock or personal injury , please be sure to: **carefully read and strictly abide by the safety rules and precautions listed in this manual.**

- ✧ Please pay attention to the +/- polarity of the battery and do not install it in reverse.
- ✧ The measured battery voltage should not exceed the upper limit of the instrument.
- ✧ If the meter displays the low battery voltage symbol "▭", it should be charged in time, otherwise it will cause measurement errors.
- ✧ When not in use for a long time, fully charge it every three months to ensure battery health.
- ✧ Do not measure while charging as there will be signal interference.
- ✧ This instrument is designed, manufactured and tested according to IEC61010 safety standards.
- ✧ When measuring, do not use high-frequency signal generators such as mobile phones near the instrument to avoid errors.
- ✧ Pay attention to the labels and symbols on the instrument body.
- ✧ Before use, make sure the instrument and its accessories are in good condition.
- ✧ Do not place or store the instrument for a long time in a hot and humid place, a place with condensation or under direct sunlight.
- ✧ Pay attention to the measuring range and operating environment specified for this instrument.
- ✧ The use, disassembly, calibration and maintenance of this instrument must be performed by authorized personnel.
- ✧ If continued use of the instrument is dangerous due to the instrument's condition, stop using it immediately and seal it up immediately.Handled by an authorized agency.
- ✧ The "⚠" safety warning signs in the instrument and manual indicate that users must strictly follow the contents of this manual.Perform safe operations.
- ✧ In any case, special attention should be paid to safety when using this instrument.

2. Introduction

The universal rechargeable battery internal resistance tester is referred to as **The battery internal resistance tester**. It is a measuring instrument used to measure the internal resistance and voltage of rechargeable batteries such as lead-acid batteries and lithium batteries to determine the health status of the battery. It can also be used as an instrument to measure the ESR parameters of electrolytic capacitors (for reference only). This instrument uses the AC 4-terminal test method to measure the internal resistance of the battery. It can measure the correct measurement value without being affected by the contact resistance between the test line, terminals and battery electrodes. It also has functions such as data storage, data review, alarm, and automatic shutdown. The whole machine is high-end and beautiful, with a wide range, high resolution, convenient operation, easy to carry, accurate, reliable, stable performance, and strong anti-interference ability. It is an indispensable instrument for battery production, battery installation, equipment production, equipment maintenance and other scenarios.

The universal rechargeable battery internal resistance tester is controlled by a microprocessor, and the internal 16-bit A DC can accurately detect the battery internal resistance and voltage. Its features are that it can measure without stopping the UPS system, using AC low resistance measurement and noise reduction technology, and it does not need to stop the normal

operation of the device under test. It can measure in the running state, which greatly shortens the test time. It also has the functions of data storage, bar graph display, data upload to computers, mobile phones, tablets and other smart devices through Bluetooth connection for wireless measurement, data access, etc.

3. Range and accuracy

Accuracy guarantee conditions	Accuracy guaranteed temperature and humidity range: 23 ° C ±5 °C, 80 % RH or less Warm-up time: No need
Temperature characteristics	The operating temperature range plus the test accuracy of ×0.1/ ℃ (outside 18 ℃~ 28 ℃)
Excitation signal accuracy	Measuring current accuracy: ±25% Normal mode: 1000Hz ± 5Hz Noise avoidance frequency mode: 920Hz ~ 1080Hz automatic frequency conversion (Use multi-stage noise reduction technology to effectively filter out noise interference of different frequencies or nearly the same frequencies)

3.1 Resistance measurement accuracy

Range	Maximum display	Resolution	Test accuracy	Measuring current
3 mΩ	3.100 mΩ	1 uΩ	±1 % fs . ±20 dgt.	200 mA
30 mΩ	31.00 mΩ	10 uΩ	±0.5 % fs . ±15 dgt.	200 mA
300 mΩ	310.0 mΩ	100 uΩ		20 mA
3 Ω	3.100 Ω	1 mΩ		2 mA

3.2 Voltage measurement accuracy

Range	Maximum display	Resolution	Test accuracy
7 V	± 7.100 V	1 m V	± 0.2 % fs . ± 10dgt .
70V	± 72.00 V	10mV	

Hint:

The above accuracy guarantee is only limited to the factory standard test lead. When using non-standard test leads or extension leads, this accuracy table is also applicable after zero adjustment.

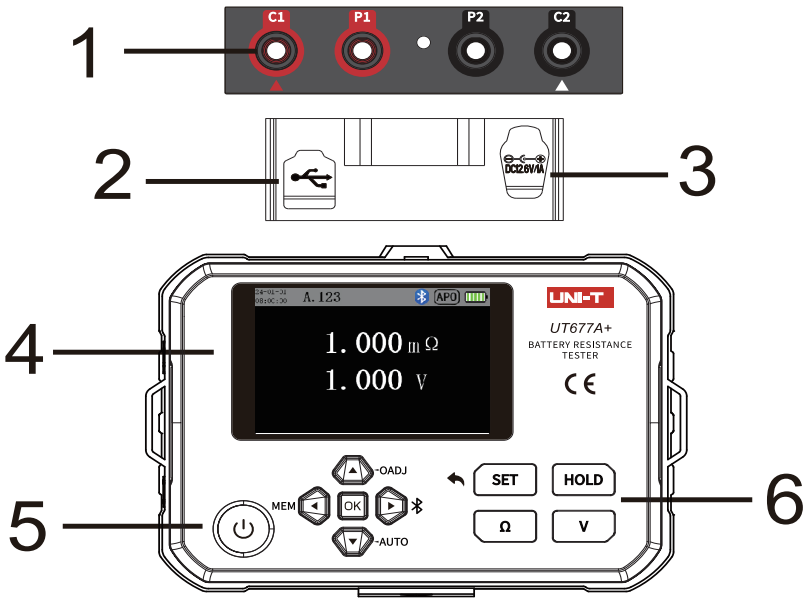
4. Technical Specifications

Function	Battery internal resistance measurement, battery voltage measurement
Avoid noise frequency	Yes, automatic frequency conversion range 920Hz~1080Hz
Accuracy guaranteed temperature and	23℃±5℃, below 75%rh

humidity	
Charging adapter	Input: 100-240V AC/50Hz/60Hz Output: 0.8A/12.6V DC
Battery	DC 11.1V Lithium Battery 2600mAh
Resistance resolution	1 uΩ
Voltage resolution	1 mV
Measuring range	Internal resistance measurement: 0.000mΩ~3.000Ω (4 ranges)
	Voltage measurement: 0.000V~±70.00V (2 ranges)
Maximum input voltage	DC 70V (between + and - terminals) AC input is not allowed
Measurement method	Internal resistance measurement: 1kHz AC 4-terminal test method, open circuit terminal voltage 3 V max Measuring current: 2.0mA ~ 200mA (different measuring currents for different ranges) A/D conversion method: Successive approximation type Display update frequency: 5 times per second
Response time	2 00m s
Measure time	About 2 seconds
LCD Size	73.4mm×48.9mm / 3.5 inches (480 * 320 resolution 1 6 -bit true color screen)
Instrument size	Length, width and height: 170 mm × 115 mm × 65 mm
Type-C interface	With Type-C interface, the stored data can be uploaded to the computer, saved and printed
Bluetooth connection	Have
Hold and store functions	Manual hold and storage, automatic hold and storage
Measurement judgment function	Preset pass, warning, and fail thresholds
Power display	The battery level is displayed in 5 bars, and it reminds you to charge in time when the battery voltage is low
Automatic shut-down	If the device is powered on and no operation is performed, it will automatically shut down after 15 minutes by default (you can change the time or turn it off in the settings)
Power consumption	150 mA MIN / 250 mA MAX
Quality	Instrument weight: 674.0g (including battery)
Working temperature and humidity	-10℃～40℃; below 80%RH
Storage temperature and humidity	-20℃～60℃; below 70%RH
Insulation resistance	20MΩ or more (500V between circuit and housing)

Pressure resistance	AC 3700V/RMS (between circuit and housing)
External magnetic field	＜40A/m
External electric field	＜1V/m
Suitable for safety regulations	IEC 61010

5. Instrument structure



1. Connection port
2. TYPE-C
3. Charging port
4. Screen
5. Power switch and power light
6. Buttons

6. Interface display

6.1 Interface Icons and Symbols

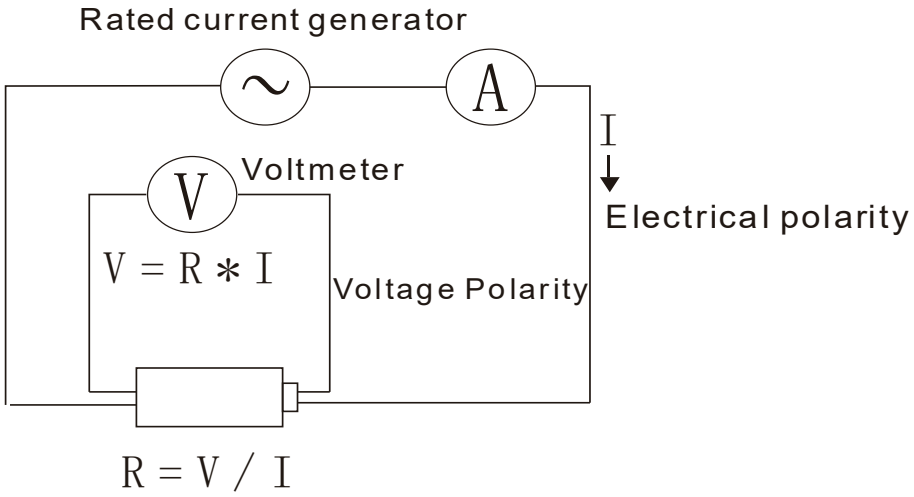
	Indicates the remaining power and charging status of the instrument battery
APO	Indicates that the automatic shutdown function is currently turned on for the instrument
	Indicates that the Bluetooth data is turned on for the current instrument, and is turned off by default when powered on
AHOLD	Indicates that the instrument has automatically saved data
HOLD	Indicates that the instrument has manually saved data
A.21	Indicates that the current storage is A, and there are 21 groups of data in storage A
FULL	If a single storage is full and 500 groups are stored and measurement is continued, the screen will display "FULL" and no more data will be stored.
FAIL	Indicates that the current measurement result is judged as

	failed
	Indicates that the current measurement result is judged as a warning
	Indicates that the current measurement result is judged as passed
	Indicates that the initial line resistance has been subtracted from the current measurement result
	The flashing symbol indicates that the frequency is changing and the interference frequency is being identified.
	**Normal mode:** Indicates that the software filtering function has been turned on. The digital changes are slower than in normal mode and are turned off by default. **NOICE mode:** indicates that the rolling mode is turned on, that is, the interference frequency is identified cyclically and the interference frequency test is avoided. If it is not turned on, the interference frequency is only identified for the first time, and then the interference frequency test is avoided all the time. It is turned off by default when the power is turned on.
	Indicates that the current mode is to avoid interference
	Indicates that the instrument has turned on the automatic shift function, which is turned on by default when the instrument is turned on.
	Indicates that the current measured voltage has exceeded the human safety voltage, please pay attention to safety

7. Measurement principle

7.1 Principle of AC 4-terminal test method

An AC current I with a frequency of 1kHz flows between the positive and negative electrodes of the battery, and the AC voltage difference V between the positive and negative electrodes of the battery is measured. The internal resistance of the battery is calculated according to the formula **R=V/I**. To ensure the measurement accuracy, the two current electrodes (C) and the two voltage electrodes (P) should contact the positive and negative electrodes of the battery independently, so as to obtain the correct measurement value without being affected by the wire resistance or contact resistance.



7.2 Voltage Measurement Principle

After sampling the resistor voltage division and filtering out the noise, ADC sampling is performed and the measured value is obtained through program calculation and correction.

8. Operation method

8.1 Power on/off and automatic shutdown

- Long press ⏻ Realize power on and off.
- The automatic shutdown function is turned on. If no key is pressed after the power is turned on , the meter will automatically shut down when the set time is reached to save power. If any key is pressed during this period, the shutdown time will be recalculated. This function can be turned off in the settings or the automatic shutdown time can be changed. The factory default is 15 minutes to shut down. When turned on, the status bar displays APO icon .

8.2 Test interface operation

In the test interface, you can view the current instrument time, measurement value and instrument status information. The functions of the operation buttons are as follows:

Key Symbols	Short press	Long Press
HOLD	Data hold	
SET	Enter the settings menu	
Ω	Resistance measurement shift	
V	Voltage measurement shift	Display voltage (+ press OK to reset)
▲	Zero or cancel zero	
▼	Turn automatic shifting on or off (No storage when power off)	
◀	Enter data reading mode	Delete the latest cached data in HOLD mode

	Turn Bluetooth on or off	
OK	Enable or disable software filtering	NOICE/Normal mode switch

8.3 Setting menu interface operation

On the test interface, press SET Enter the setting directory interface, where you can select the items to be set and view the basic information of the instrument . The menu interface includes 1:Language setting, 2: Threshold setting, 3: Alarm setting, 4: Storage setting, 5: Shift mode, 6: Clock setting, 7: Energy saving setting, and 8: About the instrument .

Operation flow example: first press to SET enter the menu interface (make sure to press in the test interface SET) -> press ▲ / ▼ Move cursor to select (1: Language setting, 2: Threshold setting, 3: Alarm setting, 4: Storage setting, 5: Shift mode, 6: Clock setting, 7: Energy saving setting, 8: Instrument options) -> Press OK to enter the option where the cursor is. You can cancel the setting by pressing SET return.

The key functions of this interface are as follows:

Key Symbols	Short Press
▲ ▼	Select the item you want to set
OK	Enter into
SET	Return

1） Language settings

The language setting is used to change the displayed language and supports Simplified Chinese and English.

Set the process instance: First enter the interface (1 (language setting) of the menu interface) -> press ▲ / ▼ Switch the cursor to select the setting option (Simplified Chinese)/(English) -> By pressing OK The changes can be saved and the user can return to the menu.SET return.

key functions of this interface are as follows:

Key Symbols	Short press
▲ ▼	Select Settings
OK	Save and return
SET	Return

2） Threshold settings

The threshold setting interface can set the thresholds for judging the test results as pass, warning, and fail. Setting appropriate thresholds can improve the judgment efficiency and test efficiency. The resistance threshold setting range is 0-3000 mΩ, and the voltage setting range is 0-70.0V. The settable thresholds are resistance: pass, fail , warning thresholds, and voltage: warning, pass thresholds.

To set a process instance : First, enter this interface (2 (threshold setting) in the menu interface) -> press ◁ / ▷ to switch the setting item to be set (Resistance: Pass , Warning and Fail Thresholds / Voltage: Warning, Pass Thresholds) -> By pressing OK Enter the required setting item -> By pressing ◁ / ▷ You can choose to set the threshold in thousands, hundreds, tens, or units ->By pressing △ / ▽ Implementing addition and subtraction of values -> By pressing OK Save the threshold and return to the previous interface -> By pressing SET You can save and return to the menu interface. You can cancel the setting by pressing SET return.

The key functions of this interface are as follows:

Key Symbols	Short press
◁ ▷	Toggle Settings
OK	Enter or exit the current setting item
◁ ▷	Digital displacement
△ ▽	Add or subtract values
SET	Save and Return/Return

3） Alarm settings

The alarm setting interface can be used to set the buzzer prompt mode when the test is completed. The optional alarm types are 1: pass (ON(open) / OFF (closed)), 2: warning / failure (ON (open) / OFF (closed)).

Set the process instance: First enter this interface (3 (Alarm Settings) in the menu interface -> press △ / ▽ To switch the cursor to select the alarm function options((Pass)/(Warning/Failure) -> (Pass) By pressing OK Switch (ON/OFF） -> (Warning/Failure)) by pressing OK Switch (ON/OFF) -> By pressing SET You can save and return to the menu interface. You can cancel the setting by pressing SET return.

The key functions of this interface are as follows:

Key Symbols	Short press
△ ▽	Switch alarm function
OK	Change settings
SET	Save and Return / Return

4） Storage Settings

The storage setting interface can set the hold, storage mode, and storage selection. There are ten memories A BCDEFGHIJ to choose from. If the current storage has stored 500 sets of data, it will prompt that the storage is full (**FULL** symbol) when storing data. You need to manually set other memories or delete the current storage data before storing new measurement data. There are three functions that can be set, 1: automatic hold (ON (open) / OFF (closed)), 2: hold storage (ON (open) / OFF (closed)), 3: current

storage (you can choose any one of A BCDEFGHIJ).

Set up the process instance:

Auto hold: First enter this interface (4 (Storage Settings) on the menu interface) -> Press ▲ / ▼ To switch the cursor to auto-hold option -> By pressing OK Can switch Automatic hold status (ON/OFF -> By pressing SET Can be saved and Return to the menu interface.

Hold storage: First enter this interface (4 (Storage Settings) of the menu interface) -> press ▲ / ▼ To switch the cursor to the option to hold the storage-> by pressing OK Can switch hold the storage status (ON/OFF -> by pressing SET Can be saved and Return to the menu interface.

Current storage: First enter this interface (4 (Storage Settings) of the menu interface) -> press ▲ / ▼ To switch the cursor to the current storage option -> press OK to display the storage number -> press ◀ / ▶ Change the cursor to select storage (for example:the number in the lower right corner indicates how many groups of data are cached in the current storage, and a total of 10 memories can be switched:ABCDEFGHIJ) - > By pressing OK Select the storage indicated by the cursor as the current storage and return to the previous interface -> By pressing SET Can be saved And return to the menu interface.Cancel the setting by pressing SET return.

The key functions of this interface are as follows:

Key Symbols	Short press
▲ ▼	Select Settings
OK	Change settings or select storage
◀ ▶	Select Other storage
SET	Save and Return / Return

5） Shift mode

The shift mode setting interface allows you to select manual shift or automatic shift measurement mode.

Test interface display 

The icon indicates that the machine has turned on the automatic shift function.

Set the process instance: First enter this interface (5 (shift mode) of the menu interface) -> press ▲ / ▼ Toggle cursor to select setting option (Automatic shift) /(Manual shift) -> By pressing OK Save and return to the menu interface. To cancel the setting , SET press return.

The key functions of this interface are as follows:

Key Symbols	Short press
▲ ▼	Toggle setting item selection status
OK	Save and return

SET	Return

6） Clock Settings

The clock setting interface can be used to set the instrument time. The time display format of this instrument is XX (year)-XX (month)-XX (day) XX (hour): X X (minute): X X (second). You can also connect the computer or mobile phone to synchronize the instrument time with one click through our company's supporting software.

Set the process instance : First enter this interface (6 (Clock Setting) of the menu interface) -> press ▲ / ▼ / ◀ / ▶ You can select year, month, day, hour, minute, second (the cursor indicates the current selection) -> By pressing OK , You can enter the value modification interface of the current selection (year, month, day, hour, minute, second) -> By pressing ◀ / ▶ You can select the tens or ones -> by pressing ▲ / ▼ You can modify the value of the tens or ones digit -> By pressing OK, You can save the current setting value (not effective at this time) and return to the previous interface -> By pressing HOLD The current setting time can be effective (you can set the year, month, day, hour, minute, and second HOLD according to your needs , and then press It is also possible) Display (effective) indicates that the setting is successful -> By pressing SET You can return to the menu interface. You can cancel the setting by pressing SET return.

The key functions of this interface are as follows:

Key Symbols	Short press
▲ ▼ ◀ ▶	Select the item you want to set
OK	Set selection items
▲ ▼	Change the value of the selected value
◀ ▶	Select other values
HOLD	The current setting time takes effect
SET	Return

7） Energy saving settings

The energy saving setting interface can set the instrument display brightness or turn the instrument's automatic shutdown function on or off.
Show APO The icon indicates that the machine has turned on the automatic shutdown function.

Setting process instance: First enter this interface (7 (Energy saving settings) of the menu interface) -> press ▲ / ▼ Switch the cursor to select the setting option (Backlight)/(Auto Power Off) -> (Backlight) by pressing ◀ / ▶ Change backlight

brightness -> (Auto Power Off) by pressing / Set the automatic shutdown time (5, 15, 30 minutes or off) -> By pressing SET You can save and return to the menu interface. You can cancel the setting by pressing SET return .

The key functions of this interface are as follows:

Key Symbols	Short press
	Select Settings
	Change backlight brightness or auto-off time
SET	Save and Return / Return

8） About the instrument

On this page, you can view the basic information of the current instrument. Press SET You can return to the settings menu interface.

8.4 Measurement steps

Internal resistance measurement:

1) Connect the test line to the instrument, and connect the indicator mark (small arrow) of the test line to the indicator mark (small arrow) on the instrument according to the color.

2) Set the instrument parameters, refer to 8.3.1 and 8.3.2 .

3) If you use a test lead other than the standard one, short-circuit the four-wire clamps of the test lead and press Key zero calibration.

4) Clip the test leads to the battery electrodes and the instrument starts testing.

5) Wait for the value to stabilize and then read the test result.

Voltage measurement:

This meter can also be used as a DC voltmeter. Just connect the two red and black interfaces in the middle to measure the DC voltage. Be careful not to measure AC voltage or DC voltage exceeding 70V.

(When the resistance displays “-----”, the voltage must be greater than 0.1V to display the value, otherwise only the “-----” symbol will be displayed) .

(When there is residual voltage or measurement deviation after short-circuiting the test leads V+ V-, you can manually adjust the voltage to zero. The operation method is to first short-circuit the test leads V+ V-, then long-press the “**V**”key, then press the “**OK** ”key, and when you hear a beep from the buzzer, the zero adjustment is complete).

8.5 Data Storage

The data storage function requires the "Hold storage" function to be turned on in the settings (please refer to Section 8.3), which is turned on by default at the factory. Each time a manual HOLD or automatic HOLD is performed, a set of data will be automatically numbered and stored.

This instrument has 10 data storage devices, numbered A~ J can be selected in the settings, and all storage devices can store 5,000 data records when they are full .

It should be noted that when a storage is full of 500 groups and continues to measure, the HOLD data is no longer saved in the storage. The user needs to manually switch to another storage or delete the data in the storage before saving.

Storage number	Can store records/items
A	500
B	500
C	500
D	500
E	500
F	500
G	500
H	500
I	500
J	500

8.6 Data access and deletion

On the test page, press Press the key to enter the Reader Selection interface. You can operate the instrument according to the page prompts to select the reader and enter the bar graph interface. In the Reader Selection interface, press key to delete the current reader data. You can choose whether to delete according to the prompt.

As shown in Figure 8-1, the bar graph interface can display 10 measurement records per page, which can intuitively analyze the internal resistance of batch batteries. key or The key moves the reading cursor left and right. The item selected by the cursor can read the specific information of battery internal resistance, voltage and test time. key or By pressing SET Can be returned.

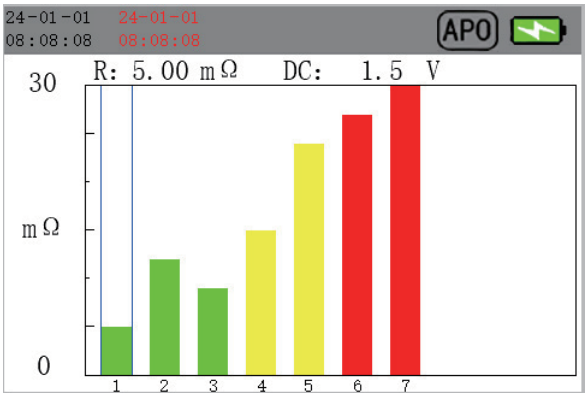


Figure 8-1 Data reading interface

8.7 Communicate with PC

Before use, please confirm:

1. The USB driver has been installed.
2. The computer has the host computer software and EXCEL software installed.

Use the included USB Type-C communication cable to connect the meter and the computer. After opening the software, it will automatically search for the COM port and connect automatically. You may need to wait for a few seconds to more than ten seconds. After the connection is successful, you can realize functions such as reading real-time measurement values, reading historical measurement records, and synchronizing computer time to the meter.

8. 8 Communicate with your smartphone or tablet

Please confirm before use:

1. The system version of your mobile phone or tablet is Android 5.0 or above.
2. The "Battery Internal Resistance Tester" APP is installed in the smart device.

In the measurement interface of the instrument, press Turn on the Bluetooth function on the smartphone and open the APP. Search for "BRT " (Battery Resistance Tester) and connect. After the connection is successful, wireless measurement and data browsing functions can be realized.

9. Noise frequency avoidance function

9.1 Applicable occasions

Generally, when measuring the battery of a UPS or battery uninterruptible power supply, the noise frequency of 1000Hz or near 1000Hz generated by the load overlaps with the measurement frequency of this unit, resulting in unstable measurement. This function can be turned on to automatically avoid the noise frequency.

9.2 Open/Close

In normal mode, long press the button OK to turn it on, and long press it again to exit.

After turning on, NOISE the icon displayed indicates that the current mode is to avoid noise frequency. FREQ Flashing means that the frequency is being changed and the interference frequency is being identified. FREQ Stopping flashing and disappearing means that the noise frequency has been avoided and the internal resistance is being tested. The progress of a complete test is indicated by the red progress bar at the bottom of the screen.

(The longest time for one round of measurement: 1.5s*3*18+1=82s. The longest time for one round of measurement is about 82 seconds. This is when there is no interference) .

(The fastest time for one round of measurement: 1.5s*2+1=4s. The shortest time for one round of measurement is about 4 seconds. This is when the interference is very close to 1000Hz) .

Tip: This mode takes a long time to test. If you are sure there is no noise frequency, please do not use this function.

After completing a measurement, NOISE there are 4 frequency test displays below the icon, in order:

1. The difference between the first round output frequency and the noise frequency.
2. The difference between the second round output frequency and the noise frequency.
3. The estimated noise frequency.
4. The frequency of this test.

Sometimes, due to the specific situation of the noise, it may not be possible to avoid all noise frequencies. When the noise frequency identification fails, the above 1/2/3 items will display Fail, and the progress bar will turn yellow. At this time, you can press and hold ◁ key or ▷ Use the key to manually select the measurement frequency and choose a relatively stable value as the result.

9.3 Single/Cycle Identification of Noise Frequency

After turning on the noise avoidance frequency mode, short press OK the key to turn on or off the rolling measurement, that is, cyclically identify the interference frequency and avoid the interference frequency test SF. The icon will be displayed after turning it on; if it is not turned on, it will only identify the interference frequency for the first time, and then avoid the interference frequency test all the time. It is turned off by default.

10. Maintenance and Service

10.1 Battery Charging

This product has a built-in rechargeable lithium battery pack (11.1V,2600mAh), please use the special lithium battery charger (12.6V,0.8A) that comes with the product standard to charge. (Figure 10-1)

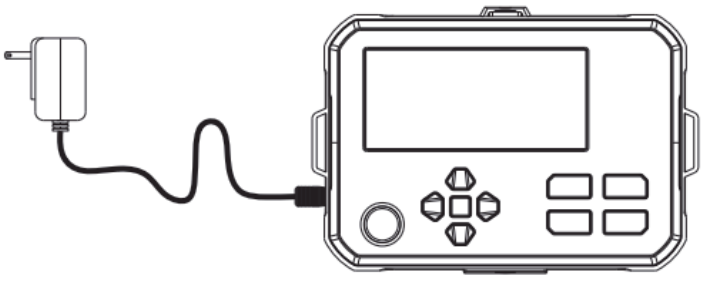


Figure 10-1 Charging diagram

When charging, when the product is turned on, the power indicator will turn into a breathing lamp state (it is always on without charging). The charging symbol "" will also appear in the upper right corner of the screen. When the battery is fully charged, the battery status symbol“”in the upper right corner of the screen changes to Full charge.

The mapping between the battery charge identifier and the battery voltage is as follows:

Symbol	Battery voltage

	9.6~10.1V
	10.1~10.6V
	10.6~11.1V
	11.1~11.6V
	11.6~12.1V
	>12.1V

Note: When charging in the off state, the power lamp has no prompt, and there is no charging information on the screen. If the battery is full, please turn on and observe the battery power information on the screen.

1) When the battery voltage is lower than 9.6V, the battery symbol "  " flashes to indicate that the battery is low. After one minute, the battery will be forcibly shut down to protect the battery. Please charge the battery in time to ensure the measurement accuracy.
2) Charging from  Charge to  About 5 hours.
3) When the battery is fully charged, it can be used continuously for 4 to 8 hours . The screen brightness and power consumption under different loads are also different. Assuming that the 3Ω range is always used and the screen brightness is adjusted to the lowest , the maximum usage time is about 8 hours due to the minimum output current.
4) If the screen flashes and then goes black when the device is turned on, the battery may not be sufficient to turn it on. Please fully charge the device before starting measurement.
5) The battery life of a new meter is about 500 charge and discharge cycles. When the battery is no longer durable, contact the meter dealer for a replacement. Do not replace it by yourself.

10.2 Repair , inspection and cleaning

⚠warn

Please do not modify, disassemble or repair the product. This may cause fire, electric shock or personal injury. If you disassemble or modify the product yourself, you will be deemed to have waived the one-year free warranty service.

1) Correction

The calibration cycle varies depending on the customer's usage conditions and environment. We recommend that you determine the calibration cycle based on the customer's usage conditions and environment and entrust us to perform calibration regularly.

2) Clean

To remove dirt from the instrument, use a soft cloth dampened with a small amount of water or neutral detergent and wipe it gently. Use a dry soft cloth to gently wipe the display area.
Please do not use gasoline, alcohol, acetone, ether, ketone, thinners and detergents containing gasoline. Otherwise, it will cause the instrument to deform or discolor.

3) Transportation

To avoid secondary damage caused by impact during transportation, please be sure to double pack. We do not guarantee damage caused by transportation.
When returning the instrument for repair, please write down the fault details, return address, contact person, telephone number and other necessary information on a piece of paper and

attach it to the instrument and send it back to us.

10.3 Frequently Asked Questions

Question	Answer
Why is the instrument time inaccurate?	The internal clock system is powered by the instrument battery, not the button battery, so the clock system needs to be fully charged to work properly. It should be charged every 3 months when not in use for a long time.
“----- ” always appear during measurement ?	Please check whether the test line is well connected and whether the interface is plugged in to the bottom. Generally, "- ---- " will be displayed only when the circuit is not connected.
What does it mean when it says O L ?	The measurement is out of range.
What battery capacity (Ah) can have its internal resistance and voltage measured?	This instrument uses AC signal for measurement, and DC current will not flow into this instrument. Therefore, there is no limit on the capacity (Ah) of the battery being tested.

11. Packing List

Name	Specification	Quantity
Meter	UT677A+ Battery internal resistance	1 set
Test line	Double-ended clip test line length: 1.5 meters	1 set
Communication line	USB Type-C Cable length: 1 meter	1
Charging adapter	Input: 100-240V AC/50Hz/60Hz Output: 0.8A/12.6V DC	1
Battery	DC 11.1V Lithium Battery 2600mAh	1 (installed in the machine)
Manual	Instructions in Chinese and English	1 set
Color Box	*	1
Warranty certificate	*	1 piece

12. Appendix

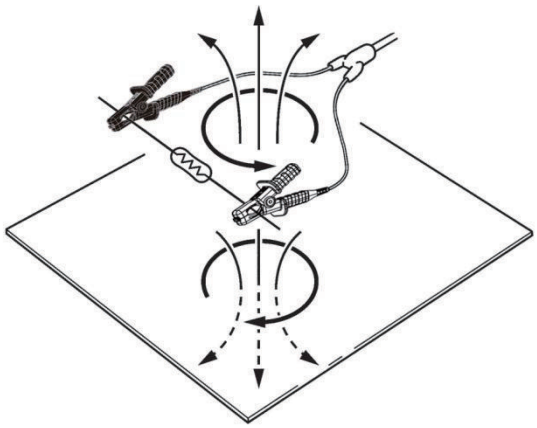
Appendix 1 Effects of Eddy Currents

The AC current generated by this instrument induces eddy currents in nearby metal plates.

This eddy current induces an induced voltage in the test line.

Since the induced voltage has a phase angle of 180 degrees different from the AC current (reference signal) , it cannot be eliminated by synchronous detection, resulting in measurement errors.

The influence of eddy current is a phenomenon unique to resistance meters that perform AC measurements. To avoid this influence, do not place a metal plate near the test lead (where it branches into two), and avoid getting close to a metal plate.



Appendix 2: Effect of Extended Test Leads and Inductive Voltage

The quality and shape of the test cable have a certain impact on the measurement results. If you need to extend the test line, please use the test cable recommended by our company.

Methods for reducing induced voltage

Since this instrument uses AC to measure small resistances, it is susceptible to the influence of induced voltage. The induced voltage here refers to the voltage that the current generated by this instrument affects the signal system through the electromagnetic coupling formed inside the wire.

Since the induced voltage and the AC current (reference signal) have a 90 - degree phase difference, the synchronous detection circuit can completely eliminate it when the level is small, but when the level is large, it will cause signal distortion and cannot perform correct synchronous detection. The extension of the test line will increase the induced voltage, so to reduce the level of the induced voltage, the length of the test line must be shortened as much as possible. In particular, shortening the bifurcated part will have a better effect. Even if a standard test line is used, if the lead configuration changes significantly between zero adjustment and range adjustment at the 3 mΩ range, the measured value will fluctuate by about 20dgt. due to the influence of the induced voltage.