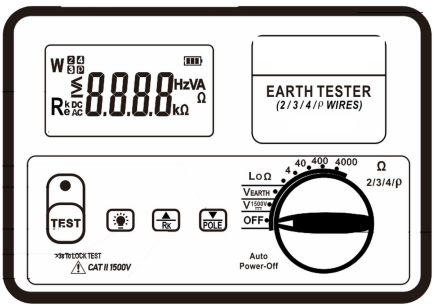
接地电阻测试仪

接地电阻 / 土壤电阻率测试 · 光伏 / 交流电压测量

EARTH RESISTANCE TESTER · USER MANUAL

型号 / Model

□ **ET-23** □ **ET-234A** □ **ET-234B**



接地电阻 / 土壤电阻率 · 光伏 1500 V · 交流 750 V

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关于本说明书

本说明书介绍接地电阻测试仪（以下简称「本仪器」）的安全操作、使用方法与技术规格。

本说明书为通用版本，同时适用于 **ET-23**、**ET-234A** 与 **ET-234B** 三款接地电阻测试仪。三者的区别在于测量功能与标准配置：**ET-23** 支持二线法 / 三线法接地电阻测量；**ET-234A** 增加四线法与低电阻（Lo Ω）测

量；**ET-234B** 在 ET-234A 基础上再增加土壤电阻率（ρ）测量。具体参数以第 5 章技术规格表与第 8.1 节标准配置为准。请在封面勾选本机型号。

随机文件

使用说明书 × 1。若发现包装内物品缺失或仪器在运输中受损，请立即与供货方联系。

1 安全须知

1.1 符号含义

⚠	重要安全信息——使用前请仔细阅读本说明书。
ϟ	高压或触电危险。
⧈	双重绝缘 / 加强绝缘保护。
CE	表示符合欧盟安全指令。
∼	交流（AC）。
⎓	直流（DC）。
▭	低电量指示；屏幕显示此符号时请尽快更换电池。
WEEE	产品受 WEEE 指令约束，请按当地法规处置。

1.2 基本安全规则

- 请勿测量对地电压超过 **1500 V 直流或 750 V 交流（有效值）**的电路。
- 转动功能 / 量程旋钮前，请先将测试线或鳄鱼夹与被测电路断开。
- 被测电路带有外部电压时，不得进行电阻测量；尽管仪器具有保护功能，过高电压仍可能导致故障。
- 不得触碰测试探头导电端、辅助鳄鱼夹、未使用端子及任何外露导电金属部件。
- 测试线绝缘须完好无损，无变形、擦伤或裂纹；发现破损应立即更换。
- 不得在阳光直射、高温、高湿、易燃、易爆、蒸汽或粉尘环境中使用或存放本仪器。
- 不得用湿手操作；在潮湿场所（如工地、游泳池）测量 24 V 以上、或在一般环境中测量 50 V 以上电压时须格外谨慎，此类电压可能导致触电。
- 屏幕出现低电量符号时应尽快更换电池，以免读数错误；发现仪器破损、变形、漏液或显示不全，应立即停止使用。
- 测量完成后将功能旋钮置于 **OFF**；长期存放时请取出电池（见第 6.3 节）。

1.3 预期用途

正确使用：测量变压器、防雷系统、中高压输电铁塔、铁路轨道、油罐、工业基础及通信设备等的接地电阻（ET-234B 另可用于接地系统设计所需的土壤电阻率测量），以及光伏电压、交流电压测量。

各型号测量功能：

- **ET-23**：二线法（2W）/ 三线法（3W）接地电阻、地电压、光伏电压（最高直流 1500 V）、交流电压。
- **ET-234A**：在 ET-23 基础上增加四线法（4W）接地电阻与低电阻（Lo Ω）测量。
- **ET-234B**：在 ET-234A 基础上增加土壤电阻率（ρ）测量。

禁止使用：潜在爆炸性环境；擅自改装、拆解或自行维修——检修应由具备资质的人员进行。

2 部件与端子

三款型号机身与按键布局相同，下图适用于全部型号；旋钮量程档位与接线方式的型号差异见第 4、5 章。

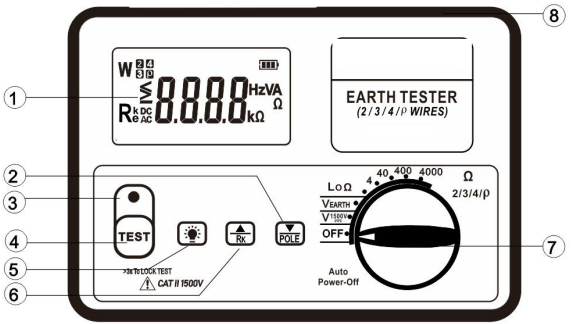


图 1　前面板与按键布局

① 液晶显示屏　　⑤ 背光键

② ▼ / POLE 键——翻页；长按（>3 秒）切换接线方式　⑥ ▲ / Rk 键——翻页；长按（>3 秒）保存 / 清除线阻 Rk

③ 接地电阻测试指示灯　　⑦ 功能 / 量程旋钮

④ TEST 键——启动测量　　⑧ 防护橡胶套

2.1 输入端子

ET-23

V	电压测量端子（直流 1500 V / 交流 750 V，CAT II 1500 V）

S	三线法接地电阻测量的电位 / 检测端子
E	接地 / 公共端子
H	电流 / 辅助接地端子

ET-234A / ET-234B

ES	四线法接地电阻（ET-234B 含土壤电阻率）测量的辅助接地 / 电位端子
S	三线法、四线法接地电阻测量的电位 / 检测端子
E	接地 / 公共端子
H/V	电流 / 辅助接地端子；同时也是电压测量端子（直流 1500 V / 交流 750 V，CAT II 1500 V）

2.2 显示区

三款型号使用**同一块液晶**（图为 ET-234B 全显状态）；ET-23 / ET-234A 的部分指示项不点亮，适用型号见下列说明。

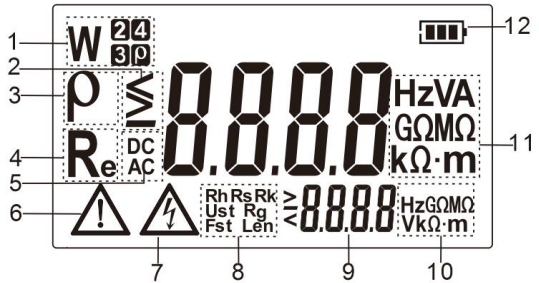


图 2　LCD 显示区（三型号同一液晶，图为全部指示项）

① 接线方式指示（ET-23：二线 / 三线；ET-234A / ET-234B：二线 / 三线 / 四线 / ρ）

② 极性 / 超量程指示（-）/（>）/（<）

③ 土壤电阻率符号（ρ，仅 ET-234B 点亮）

④ 接地电阻符号（Re）

⑤ 直流 / 交流指示

⑥ 安全警告符号

⑦ 带电电压警告符号

⑧ 辅助指示（ET-23 / ET-234B：Rh / Rs / Rk / Ust；ET-234A：Rk / Ust / Rg）

⑨ 辅助数字显示区

⑩ 辅助单位符号

⑪ 主单位符号

⑫ 电池电量指示

屏幕采用标准七段码及字母数字字符。

3 快速上手

3.1 接地电阻测量（4 步）

1. 按封面勾选的型号确认接线方式：**ET-23** 为二线法 / 三线法，**ET-234A / ET-234B** 另有四线法。
2. 将测试线接入端子：**ET-23** 用 **E / S / H**，**ET-234A / ET-234B** 用 **E / ES / S / H/V**，鳄鱼夹按第 4 章对应接线图连接接地棒与被测电极。
3. 将功能 / 量程旋钮置于所需接地电阻量程：**ET-23** 为 40 / 400 / 4000 Ω，**ET-234A / ET-234B** 为 4 / 40 / 400 / 4000 Ω；通常先从最高量程开始。
4. 按 **TEST** 键测量，读取稳定读数。

> 为获得更高精度，测试前请使用 Rk 功能去除测试线残余电阻（见第 4.9 节）。

3.2 电压测量（2 步）

1. 将电压表笔与测试线分别接入 **V 与 E** 端子（ET-23）或 **H/V 与 E** 端子（ET-234A / ET-234B），再接至被测电源两端。
2. 旋钮置于 **PV 1500 V** 档（光伏直流）或 **V EARTH AC** 档（交流，自动量程），读取屏幕数值。

4 操作说明

4.1 二线法（2W）接地电阻测量

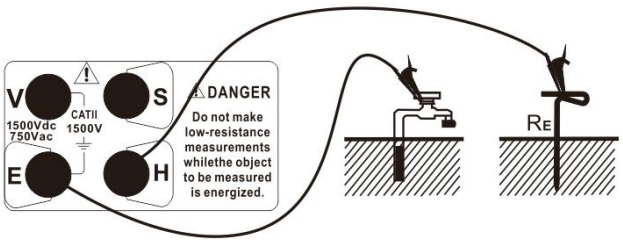


图 3　二线法接地电阻测量（ET-23）

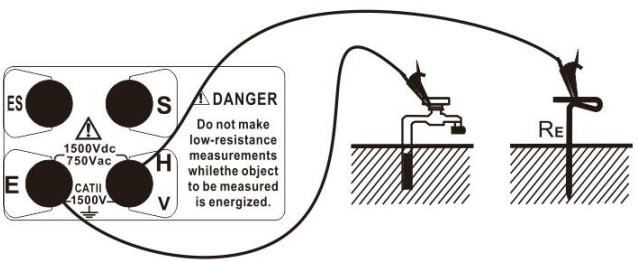


图 4　二线法接地电阻测量（ET-234A / ET-234B）

当条件不允许打入辅助接地棒进行三线法测量时（例如建筑物密集区），请使用二线法。该方法需要一个合适的辅助接地电极；该电极须

为低阻值，且不得与被测接地电极电气连通。图中以水管作为辅助接地体——只要满足上述两个条件，埋入地下的任何金属物体均可使用。

1. 将两根测试线的香蕉插头（黑色与黄色）分别接入仪器的 **E** 和 **H** 端子（ET-23）或 **E** 和 **H/V** 端子（ET-234A / ET-234B）。
2. 按对应接线图连接两个鳄鱼夹。
3. 将功能 / 量程旋钮置于所需接地电阻量程（量程见第 3.1 节），通常先从最高量程开始。
4. 按 **TEST** 键测量并读取结果。

4.2 三线法（3W）接地电阻测量

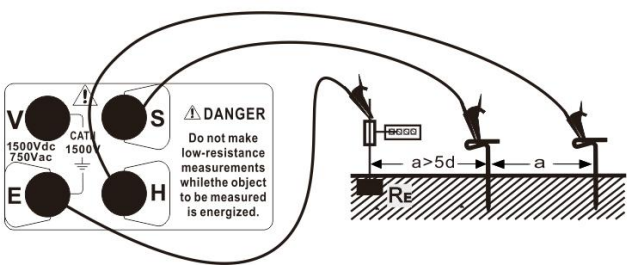


图 5　三线法接地电阻测量（ET-23）

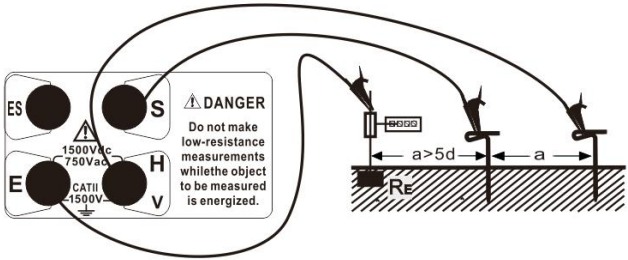


图 6　三线法接地电阻测量（ET-234A / ET-234B）

1. 将三根测试线的香蕉插头（黑色、黄色、红色）分别接入仪器的 **E、S、H** 端子（ET-23）或 **E、S、H/V** 端子（ET-234A / ET-234B）。
2. 按对应接线图连接三个鳄鱼夹，注意电极间距 **a > 5d**。
3. 将功能 / 量程旋钮置于所需接地电阻量程（量程同第 4.1 节），先从最高量程开始。
4. 按 **TEST** 键测量并读取结果。

4.3 四线法（4W）接地电阻测量（ET-234A / ET-234B）

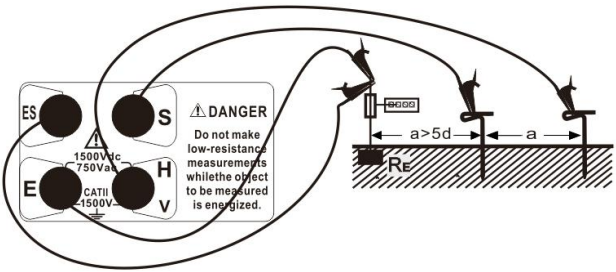


图 7　四线法接地电阻测量（ET-234A / ET-234B）

1. 将四根测试线的香蕉插头（黑色、绿色、黄色、红色）分别接入仪器的 **E**、**ES**、**S**、**H/V** 端子。
2. 按图示连接四个鳄鱼夹。
3. 将功能 / 量程旋钮置于所需接地电阻量程（4 / 40 / 400 / 4000 Ω），先从最高量程开始。
4. 按 **TEST** 键测量并读取结果。

> 0.030 – 4.000 Ω 档仅适用于三线法、四线法且无辅助电阻的场合（见第 5.1 节）。

4.4 土壤电阻率测量（ET-234B）

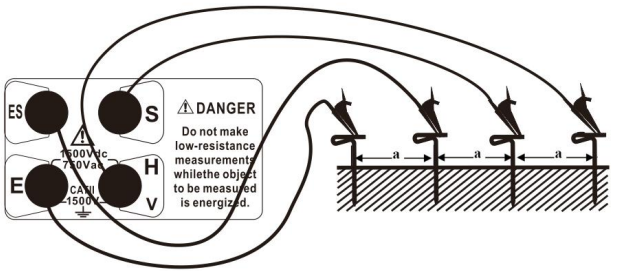


图 8　土壤电阻率测量（四极 Wenner 法，ET-234B）

采用四极 Wenner 法：仪器在 **E**（电流电极）与 **H/V**（电流电极）之间注入交流电流，并测量 **S** 与 **ES**（电位电极）之间的电位差。测得接地电阻 Rg 后，土壤电阻率按 **ρ = 2 × π × a × Rg**（Ω·m）计算，其中 a 为电极间距（米）。

1. 将 4 根接地棒以等间距 a（通常 1 – 30 m）直线插入地面；间距决定测量深度。在不同间距下重复测量以找到最低电阻率。
2. 将四根测试线接入 **E、ES、S、H/V** 端子，按图示连接鳄鱼夹。
3. 将功能 / 量程旋钮置于所需接地电阻量程（如 40 Ω），长按 **POLE** 键（>3 秒）切换至土壤电阻率测量功能。
4. 按 **TEST** 键进入电极间距设置界面，用 **▲ / ▼** 键选择间距 a，再按 **TEST** 键测量并显示结果。

结果界面显示 ES–S 端口间测得的电阻 Rg 及计算得到的土壤电阻率 ρ；用方向键可滚动查看其他参数（Rk、Rg、Ust、Len）。

> 当屏幕显示「----」时，仪器正在测量。此时请勿触碰鳄鱼夹或任何金属部件，以免触电。

4.5 地电压测量

进行接地电阻测量时，仪器会自动测量地电压。若检测到地电压过高或超限，仪器将不执行接地电阻测量。仪器会自动识别地电压为交流。

4.6 光伏电压与交流电压测量

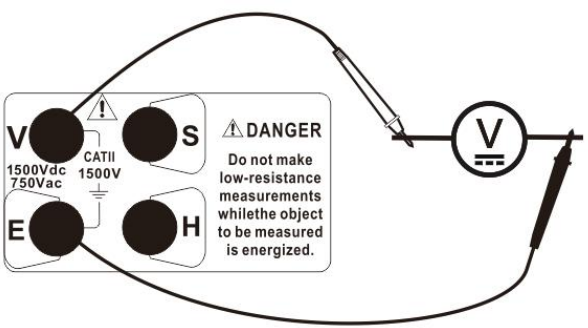


图 9　光伏电压 / 交流电压测量（ET-23）

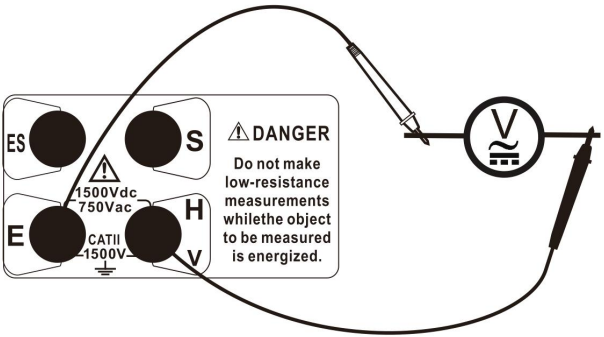


图 10　光伏电压 / 交流电压测量（ET-234A / ET-234B）

1. 将电压表笔与测试线的香蕉插头（红色与黑色）分别接入仪器的 **V 与 E** 端子（ET-23）或 **H/V 与 E** 端子（ET-234A / ET-234B）。
2. 按对应接线图连接表笔与鳄鱼夹以测量电压。
3. 测量光伏电压时，将旋钮置于 **PV 1500 V** 档（自动量程）。
4. 测量交流电压时，将旋钮置于 **V EARTH AC** 档（自动量程）。

4.7 低电阻（Lo Ω）测量（ET-234A / ET-234B）

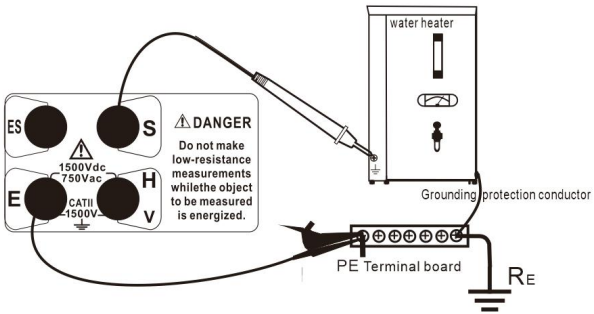


图 11　二线法低电阻测量（ET-234A / ET-234B）

本功能用于测量接地电极及设备连接线的电阻。连接仪器前请确认被测对象不带电。

1. 将黑色测试线的香蕉插头接入 **E** 端子，红色表笔接入 **S** 端子。
2. 按图示连接鳄鱼夹或表笔。
3. 将功能 / 量程旋钮置于任意 Lo Ω 档位（自动量程）。
4. 先执行归零：将测试线接入 **E**、**S** 端子，并将两根表笔（或鳄鱼夹）短接、确保金属部分接触良好；按 **TEST** 键进行测量前归零校准，再按 **Rk** 键保存归零数据。

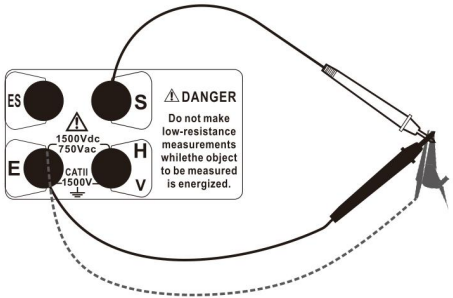


图 12　低电阻归零校准接线（ET-234A / ET-234B）

归零后，仪器显示存储界面。若需清除已存储的归零值，请按第 4.9 节的 Rk 清除步骤操作。

4.8 POLE 接线方式设置

将功能 / 量程旋钮置于任意接地电阻量程，长按 **POLE** 键在接线方式之间切换：**ET-23** 在二线法 / 三线法（W_2 / W_3）之间切换；**ET-234A** 在 W_2 / W_3 / W_4 之间切换；**ET-234B** 在 W_2 / W_3 / W_4 / ρ（土壤电阻率）之间切换。

4.9 残余测试线电阻（Rk）设置

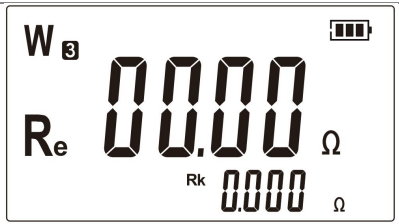


图 13　Rk 在 LCD 上的显示（三款型号相同）

在接地电阻测量中，测试线具有一定的残余电阻；被测接地电阻较小时会显著影响结果。Rk 功能可测量并存储残余电阻，在后续测试中自动扣除。

Rk 测量与保存：

1. 按拟采用的接线方法将测试线接入仪器端子（见第 4.1 – 4.3 节）。

2. 将测试线自由端（鳄鱼夹）短接。

3. 按 **TEST** 键测量线阻。

4. 长按 **Rk** 键（>3 秒）保存 Rk 值。

5. 用 ▲ / ▼ 键确认 Rk 值已存储。

Rk 清除：

1. 存储的 Rk 值不会因关机或其他操作自动清除，须手动复位。

2. 在显示 Rk 存储界面时长按 **Rk** 键超过 3 秒可清除。

3. 用 ▲ / ▼ 键确认数值已清除。

5 技术规格

5.1 接地电阻

测量频率约 820 Hz；开路端电压 ≤ 48 V 有效值。精度适用于归零调整后的显示值，归零调整前需另加 ±0.3 Ω（4 Ω 档为 ±0.05 Ω 项外条件）。

ET-23（二线法 / 三线法）　测量电流：40 Ω 档约 3 mA、400 Ω 档约 2 mA、4000 Ω 档约 1 mA。

量程	分辨率	精度
0.03 – 40.00 Ω	0.01 Ω	±(2 % + 3 字)
0.3 – 400.0 Ω	0.1 Ω	±(2 % + 3 字)
3 – 4000 Ω	1 Ω	±(2 % + 3 字)

ET-234A / ET-234B（二线法 / 三线法 / 四线法）　测量电流：4 Ω 档约 4 mA、40 Ω 档约 3 mA、400 Ω 档约 2 mA、4000 Ω 档约 1 mA。

量程	分辨率	精度
0.030 – 4.000 Ω *	0.001 Ω	±(2 % + 0.05 Ω)
0.03 – 40.00 Ω	0.01 Ω	±(2 % + 3 字)
0.3 – 400.0 Ω	0.1 Ω	±(2 % + 3 字)

3 – 4000 Ω	1 Ω	±(2 % + 3 字)

* 0.030 – 4.000 Ω 档适用于三线法、四线法且无辅助电阻的场合。

5.2 地电压

量程（交流）	分辨率	精度	频率响应
0 – 750 V	1 V	±(2 % + 5 字)	40 Hz – 500 Hz

5.3 光伏电压

量程（直流）	分辨率	精度
0 – 1500 V	1 V	±(2 % + 3 字)

5.4 土壤电阻率 ρ（仅 ET-234B）

四极 Wenner 法：在 E 与 H/V 之间注入交流电流，测量 ES 与 S 之间的电位差，得 Rg 后按 ρ = 2 × π × a × Rg 计算（a 为电极间距，米）。测量频率约 820 Hz；开路端电压 ≤ 48 V 有效值。

量程	测量范围	分辨率
4 Ω	0.188 Ω·m – 753.6 Ω·m	0.01 Ω·m

40 Ω	0.188 Ω·m – 7.536 kΩ·m	0.001 kΩ·m
400 Ω	1.884 Ω·m – 75.36 kΩ·m	0.01 kΩ·m
4000 Ω	18.84 Ω·m – 753.6 kΩ·m	0.1 kΩ·m

5.5 低电阻 Lo Ω（仅 ET-234A / ET-234B）

开路电压 4.0 – 6.9 V；测量电流 ≥ 200 mA（Rk 前显示值 ≤ 16 Ω 时）。精度适用于 Rk 清除后的显示值；环境温度变化 1 °C 以上时需重新归零。

量程	分辨率	精度
0.00 – 99.99 Ω	0.01 Ω	±(2 % + 2 字)
100.0 – 120.0 Ω	0.1 Ω	±(2 % + 3 字)

5.6 通用规格

显示屏	LCD 69 × 42 mm，最大 4000 字
背光	LED
自动关机	30 分钟无操作后
数据保持	接地电阻测量自动保持

低电量指示	有（屏幕符号）
电源	1.5 V × 6 节 5 号电池
尺寸	168（长）× 118（宽）× 70（高）mm
重量（含电池）	约 760 g

5.7 环境条件与安全标准

参数	规格
参考温度	23 °C ± 5 °C
工作温度	-10 °C 至 50 °C
工作湿度	< 75 % RH
储存温度	-20 °C 至 60 °C
储存湿度	< 70 % RH
海拔	最高 2000 m
绝缘等级	II 类，双重绝缘
污染等级	2
过电压类别	CAT II 1500 V（电压测量）

安全标准	IEC 61010-1、IEC 61557-1 / -5、IEC 61000-4-2、IEC 61326-1

6 维护与保养

6.1 更换电池

> 仅允许具备资质的技术人员执行此操作。更换电池前，请将鳄鱼夹从被测电路断开以防触电。

1. 将测试线从输入端子全部断开，功能旋钮置于 **OFF**。
2. 拧下电池仓盖螺钉并取下仓盖。
3. 取出全部旧电池，按极性标记装入 6 节新的 1.5 V 5 号电池。
4. 装回电池仓盖并拧紧螺钉。

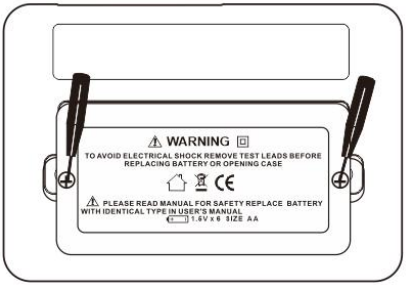


图 14　拧下电池仓盖螺钉

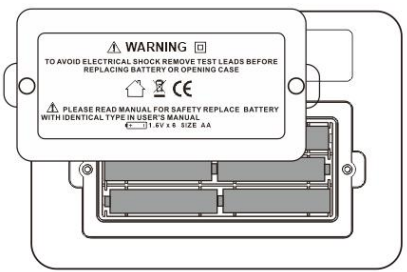


图 15　安装 6 节 1.5 V 5 号电池

6.2 清洁

请使用干净、柔软、干燥的棉布擦拭仪器。请勿使用湿布、清洁剂、水或溶剂。

6.3 储存与运输

- 运输与储存温度 -20 °C 至 60 °C，湿度 < 70 % RH。
- 避免强烈冲击、震动、阳光直射、腐蚀性气体和粉尘。
- 若仪器存放超过一个月，请取出电池。
- 在严苛环境中长期存放后，使用前请使仪器恢复至正常工作状态。

7 故障排除

下表列出常见现象及处理措施。若按表中方法仍无法排除，请停止使用并联系具备资质的人员检修。

现象	可能原因	处理
「LOW BTRY」闪烁	电池电压过低	更换全部 6 节 5 号电池（第 6.1 节）。
超量程 / 辅助电阻过高指示	辅助电阻过高或所选量程过低	检查辅助接地电极；选择更高量程。
干扰电压报警	地干扰电压过大	检查测试现场并排除干扰源。
无显示	电池耗尽或装反	检查 / 更换电池；确认极性。

不得自行拆解或改装本仪器。擅自拆修将使保修失效，并可能造成触电危险。

8 标准配置与保修

8.1 标准配置

ET-23：仪表 × 1、接地棒 × 2、带香蕉插头和鳄鱼夹的测试线 × 3（红色 15 m、黄色 10 m、黑色 5 m）、1.5 V 5 号电池 × 6、尼龙便携包 × 1、使用说明书 × 1。

ET-234A / ET-234B：仪表 × 1、接地棒 × 4、带香蕉插头和鳄鱼夹的测试线 × 4（红色 15 m、黄色 10 m、绿色 5 m、黑色 5 m）、1.5 V 5 号电池 × 6、尼龙便携包 × 1、使用说明书 × 1。

实际配置以包装清单为准。请按封面勾选的型号核对配件。

8.2 保修范围

正常使用情况下，本仪器对因材料及工艺缺陷导致的故障提供保修；自购买之日起一年内保证性能符合本说明书所列标准，保修期内可免费更换缺陷部件。

联系售后前，请先确认测试线与电源正常，并复核本说明书中的操作步骤。

8.3 不在保修范围内的情况

- 未经授权的维修、附件改动，或使用不符合规格的电池。
- 因误用或在不适用设备上使用导致的故障。
- 因包装不当造成的运输损坏；返修运费由客户承担。
- 由未经授权人员进行的维修，或未经制造商授权对原设计进行改动。

为持续改进产品，制造商保留在未事先通知的情况下修改规格与技术参数的权利。

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This manual is a generic version covering the ET-23, the ET-234A and the ET-234B. The English section is identical in content and layout to the Chinese section.

1 Safety

1.1 Symbols

⚠	Important safety information. Read this manual carefully before use.
ϟ	Hazardous voltage. Risk of electric shock.
⧈	Double or reinforced insulation.
CE	Complies with applicable EU directives.
~	Alternating current (AC).
⎓	Direct current (DC).

	Low battery. Replace the batteries promptly.
WEEE	Subject to the WEEE directive; dispose of per local regulations.

1.2 Basic safety rules

- Do not measure circuits at more than **1500 V DC or 750 V AC (rms)** to earth.
- Disconnect the test leads or clips from the circuit before turning the function / range dial.
- Do not measure resistance while external voltage is present; despite the built-in protection, excessive voltage may damage the instrument.
- Do not touch the conductive tips of the probes, the auxiliary alligator clips, unused terminals or any exposed metal parts.
- Test lead insulation must be intact, without deformation, abrasion or cracks. Replace damaged leads immediately.
- Do not use or store the instrument in direct sunlight, high temperature, high humidity, flammable, explosive, vapour-laden or dusty atmospheres.
- Do not operate with wet hands. Take extra care when measuring voltages above 24 V in damp locations (e.g. construction sites, swimming pools) or above 50 V in general — such voltages may cause electric shock.
- Replace the batteries as soon as the low-battery symbol appears. Stop using the instrument immediately if it is damaged, deformed, leaking, or the display is incomplete.
- After measurement return the dial to **OFF**; remove the batteries for long-term storage (see section 6.3).

1.3 Intended use

Intended use: measuring the earth resistance of transformers, lightning protection systems, HV transmission towers, railway tracks, tanks, foundations and telecommunications equipment (the ET-234B is additionally intended for soil resistivity measurements for earthing-system design), as well as photovoltaic and AC voltage measurements.

Functions by model:

- **ET-23**: 2-wire (2W) / 3-wire (3W) earth resistance, earth voltage, PV voltage (up to 1500 V DC), AC voltage.
- **ET-234A**: adds 4-wire (4W) earth resistance and low-resistance (Lo Ω) measurement.
- **ET-234B**: adds soil resistivity (ρ) measurement on top of the ET-234A.

Prohibited use: potentially explosive atmospheres; unauthorised modification, disassembly or repair — servicing must be carried out by qualified personnel.

2 Parts and terminals

All three models share the same housing and key layout; the figure below applies to all. Model differences in dial ranges and wiring modes are given in chapters 4 and 5.

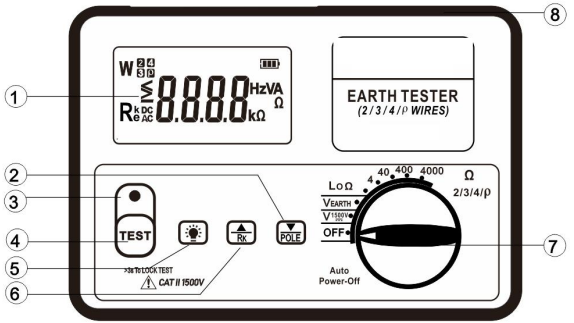


Fig. 1 Front panel and controls

① Display (LCD) ⑤ Backlight key

② ▼ / POLE key — page turn; hold (>3 s) to change the wiring mode ⑥ ▲ / Rk key — page turn; hold (>3 s) to save / clear the lead resistance Rk

③ Earth resistance test indicator ⑦ Function / range dial

④ TEST key — start measurement ⑧ Protective rubber holster

2.1 Input terminals

ET-23

V	Voltage measurement terminal (1500 V DC / 750 V AC, CAT II 1500 V)
S	Potential / detection terminal for 3-wire earth resistance measurement

E	Earth / common terminal
H	Current / auxiliary earth terminal

ET-234A / ET-234B

ES	Auxiliary earth / potential terminal for 4-wire earth resistance (and soil resistivity on the ET-234B)
S	Potential / detection terminal for 3-wire and 4-wire earth resistance measurement
E	Earth / common terminal
H/V	Current / auxiliary earth terminal; also the voltage measurement terminal (1500 V DC / 750 V AC, CAT II 1500 V)

2.2 Display

All three models use the **same LCD** (shown with all indicators, ET-234B); on the ET-23 / ET-234A some indicators never light up — see the notes below.

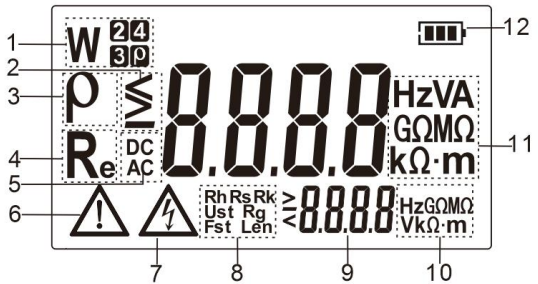


Fig. 2 LCD display (same LCD for all three models, all indicators shown)

① Wiring-mode indicator (ET-23: 2-wire / 3-wire; ET-234A / ET-234B: 2-wire / 3-wire / 4-wire / ρ) ⑦ Live-voltage warning symbol

② Polarity / overload indicators (-) / (>) / (<) ⑧ Auxiliary indicators (ET-23 / ET-234B: Rh / Rs / Rk / Ust; ET-234A: Rk / Ust / Rg)

③ Soil resistivity symbol (ρ, lights up on ET-234B only) ⑨ Auxiliary digits

④ Earth resistance symbol (Re) ⑩ Auxiliary unit symbols

⑤ DC / AC indicator ⑪ Main unit symbol

⑥ Safety warning symbol ⑫ Battery indicator

The display uses standard 7-segment and alphanumeric characters.

3 Quick start

3.1 Earth resistance measurement (4 steps)

1. Confirm the wiring modes of your model marked on the cover: **ET-23** offers 2-wire / 3-wire; **ET-234A / ET-234B** additionally offer 4-wire.
2. Connect the test leads: **ET-23** uses **E / S / H**, **ET-234A / ET-234B** use **E / ES / S / H/V**; attach the clips to the earth rods and the electrode under test as shown in the wiring diagrams of chapter 4.
3. Set the dial to the required earth resistance range: **ET-23** 40 / 400 / 4000 Ω, **ET-234A / ET-234B** 4 / 40 / 400 / 4000 Ω; start from the highest range.
4. Press **TEST** and read the settled value.

> For higher accuracy, remove the residual lead resistance with the Rk function before testing (see section 4.9).

3.2 Voltage measurement (2 steps)

1. Connect the probe and test lead to the **V and E** terminals (ET-23) or the **H/V and E** terminals (ET-234A / ET-234B), then across the supply under test.
2. Set the dial to **PV 1500 V** (PV direct voltage) or **V EARTH AC** (AC, auto ranging) and read the display.

4 Operation

4.1 2-wire (2W) earth resistance measurement

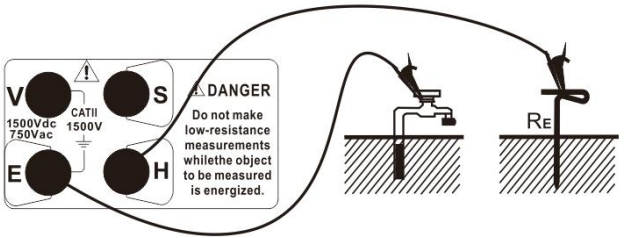


Fig. 3 2-wire earth resistance measurement (ET-23)

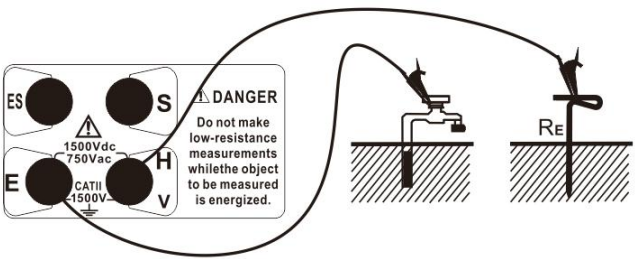


Fig. 4 2-wire earth resistance measurement (ET-234A / ET-234B)

Use the 2-wire method when driving auxiliary earth rods for the 3-wire method is impractical (e.g. densely built-up areas). The method requires a suitable auxiliary earth electrode of low resistance that is not electrically connected to the earth electrode under test. A water pipe is used in the diagrams — any metal object buried in the ground may be used provided both conditions are met.

1. Plug the banana plugs of the two test leads (black and yellow) into the **E** and **H** terminals (ET-23) or the **E** and **H/V** terminals (ET-234A / ET-234B).

2. Connect the two alligator clips as shown.
3. Set the dial to the required earth resistance range (see section 3.1), normally starting from the highest.
4. Press **TEST** and read the result.

4.2 3-wire (3W) earth resistance measurement

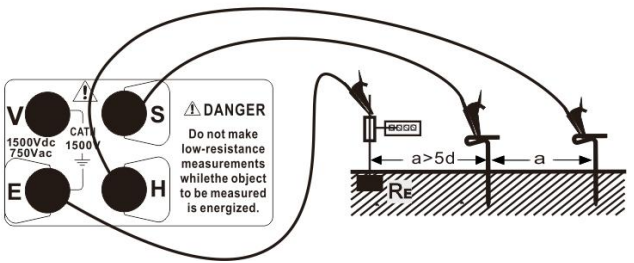


Fig. 5 3-wire earth resistance measurement (ET-23)

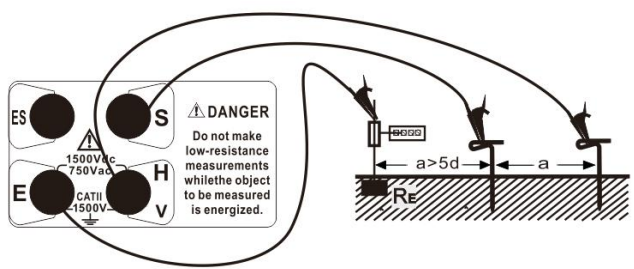


Fig. 6 3-wire earth resistance measurement (ET-234A / ET-234B)

1. Plug the banana plugs of the three test leads (black, yellow, red) into the **E, S, H** terminals (ET-23) or the **E, S, H/V** terminals (ET-234A / ET-234B).
2. Connect the three alligator clips as shown, keeping the electrode spacing **a > 5d**.
3. Set the dial to the required range (as in section 4.1), starting from the highest.
4. Press **TEST** and read the result.

4.3 4-wire (4W) earth resistance measurement (ET-234A / ET-234B)

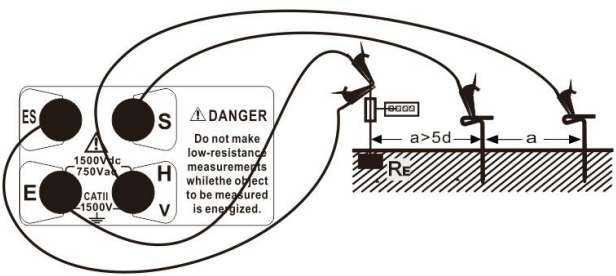


Fig. 7 4-wire earth resistance measurement (ET-234A / ET-234B)

1. Plug the banana plugs of the four test leads (black, green, yellow, red) into the **E, ES, S, H/V** terminals.
2. Connect the four alligator clips as shown.
3. Set the dial to the required range (4 / 40 / 400 / 4000 Ω), starting from the highest.
4. Press **TEST** and read the result.

> The 0.030 – 4.000 Ω range applies only to the 3-wire and 4-wire methods without auxiliary resistance (see section 5.1).

4.4 Soil resistivity measurement (ET-234B)

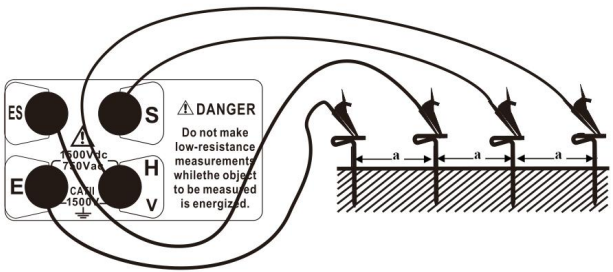


Fig. 8 Soil resistivity measurement (four-terminal Wenner method, ET-234B)

The four-terminal Wenner method is used: the instrument injects an AC current between **E** (current electrode) and **H/V** (current electrode) and measures the potential difference between **S** and **ES** (potential electrodes). Having obtained the earth resistance Rg, the soil resistivity is calculated as **ρ = 2 × π × a × Rg** (Ω·m), where a is the electrode spacing in metres.

1. Drive the 4 earth rods in a straight line at equal spacing a (typically 1 – 30 m); the spacing determines the measurement depth. Repeat at different spacings to find the lowest resistivity.
2. Connect the four test leads to the **E, ES, S, H/V** terminals and attach the clips as shown.
3. Set the dial to the required earth resistance range (e.g. 40 Ω) and hold **POLE** (>3 s) to switch to soil resistivity measurement.

4. Press **TEST** to enter the spacing setting, select the spacing a with ▲ / ▼, then press **TEST** to measure and display the result.

The result screen shows the resistance Rg measured between the ES–S ports and the calculated soil resistivity ρ; use the arrow keys to scroll through the other parameters (Rk, Rg, Ust, Len).

> While "----" is shown the instrument is measuring. Do not touch the clips or any metal parts — risk of electric shock.

4.5 Earth voltage measurement

During an earth resistance measurement the instrument measures the earth voltage automatically. If an excessive or out-of-range earth voltage is detected, the earth resistance measurement is not performed. The earth voltage is recognised as AC.

4.6 PV voltage and AC voltage measurement

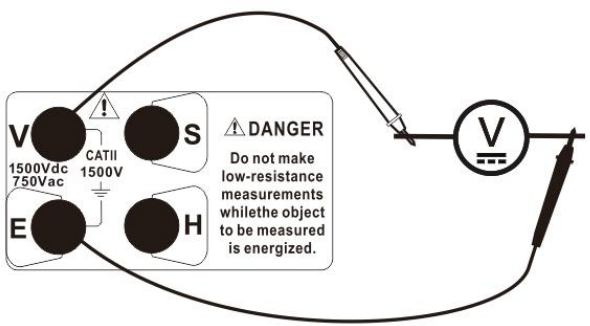


Fig. 9 PV voltage / AC voltage measurement (ET-23)

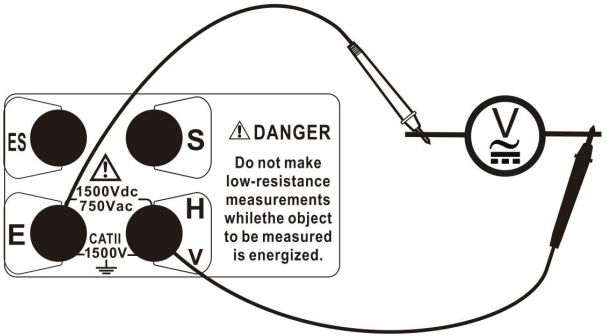


Fig. 10 PV voltage / AC voltage measurement (ET-234A / ET-234B)

1. Plug the banana plugs of the probe and test lead (red and black) into the **V and E** terminals (ET-23) or the **H/V and E** terminals (ET-234A / ET-234B).
2. Connect the probe and clip as shown to measure the voltage.
3. For PV voltage set the dial to **PV 1500 V** (auto ranging).
4. For AC voltage set the dial to **V EARTH AC** (auto ranging).

4.7 Low-resistance (Lo Ω) measurement (ET-234A / ET-234B)

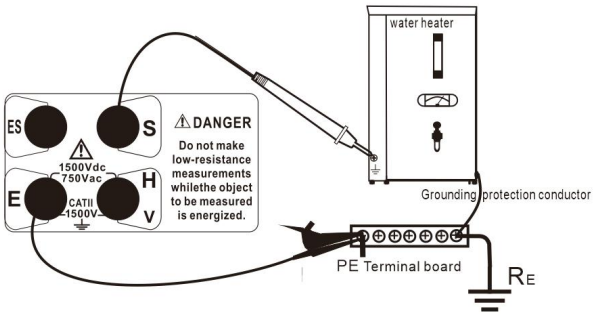


Fig. 11 2-wire low-resistance measurement (ET-234A / ET-234B)

This function measures the resistance of earth electrodes and equipment connecting leads. Make sure the object is de-energised before connecting the instrument.

1. Plug the black test lead into the **E** terminal and the red probe into the **S** terminal.
2. Connect the clips or probes as shown.
3. Set the dial to any Lo Ω position (auto ranging).
4. Zero first: connect the leads to the **E, S** terminals and short the two probes (or clips), ensuring good metal-to-metal contact; press **TEST** to run the zeroing calibration, then press **Rk** to save the zero data.

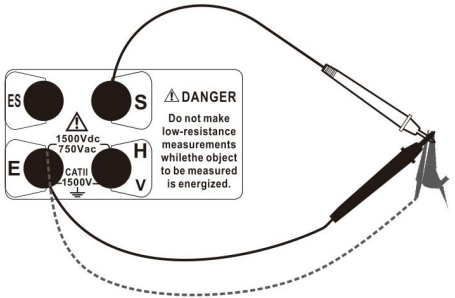


Fig. 12 Low-resistance zeroing connections (ET-234A / ET-234B)

After zeroing the instrument shows the storage screen. To clear a stored zero value, follow the Rk clearing procedure in section 4.9.

4.8 POLE wiring-mode setting

Set the dial to any earth resistance range and hold **POLE** to toggle the wiring mode: **ET-23** toggles between 2-wire / 3-wire (W_2 / W_3); **ET-234A** toggles between W_2 / W_3 / W_4; **ET-234B** toggles between W_2 / W_3 / W_4 / ρ (soil resistivity).

4.9 Residual test-lead resistance (Rk) setting



Fig. 13 Rk shown on the LCD (same for all models)

Test leads have a residual resistance that significantly affects results at low earth resistance. The Rk function measures and stores this residual resistance and subtracts it automatically in subsequent measurements.

Measuring and saving Rk:

1. Connect the test leads for the intended wiring method (sections 4.1 – 4.3).
2. Short the free ends of the test leads (alligator clips).
3. Press **TEST** to measure the lead resistance.
4. Hold **Rk** (>3 s) to save the Rk value.
5. Confirm with the ▲ / ▼ keys that the value is stored.

Clearing Rk:

1. A stored Rk value is not cleared by power-off or other operations; it must be reset manually.
2. On the Rk storage screen, hold **Rk** for more than 3 seconds to clear it.
3. Confirm with the ▲ / ▼ keys that the value is cleared.

5 Specifications

5.1 Earth resistance

Measurement frequency approx. 820 Hz; open-circuit voltage ≤ 48 V rms. Accuracy applies to the zeroed display; before zeroing add ±0.3 Ω (in addition to the ±0.05 Ω term of the 4 Ω range).

ET-23 (2-wire / 3-wire) Test current: approx. 3 mA on 40 Ω, 2 mA on 400 Ω, 1 mA on 4000 Ω.

Range	Resolution	Accuracy
0.03 – 40.00 Ω	0.01 Ω	±(2 % + 3 d)
0.3 – 400.0 Ω	0.1 Ω	±(2 % + 3 d)
3 – 4000 Ω	1 Ω	±(2 % + 3 d)

ET-234A / ET-234B (2-wire / 3-wire / 4-wire) Test current: approx. 4 mA on 4 Ω, 3 mA on 40 Ω, 2 mA on 400 Ω, 1 mA on 4000 Ω.

Range	Resolution	Accuracy
0.030 – 4.000 Ω *	0.001 Ω	±(2 % + 0.05 Ω)
0.03 – 40.00 Ω	0.01 Ω	±(2 % + 3 d)
0.3 – 400.0 Ω	0.1 Ω	±(2 % + 3 d)
3 – 4000 Ω	1 Ω	±(2 % + 3 d)

* The 0.030 – 4.000 Ω range applies to the 3-wire and 4-wire methods without auxiliary resistance.

5.2 Earth voltage

Range (AC)	Resolution	Accuracy	Frequency response
0 – 750 V	1 V	±(2 % + 5 d)	40 Hz – 500 Hz

5.3 PV voltage

Range (DC)	Resolution	Accuracy
0 – 1500 V	1 V	±(2 % + 3 d)

5.4 Soil resistivity ρ (ET-234B only)

Four-terminal Wenner method: AC current is injected between E and H/V and the potential difference between ES and S is measured; having obtained Rg, ρ = 2 × π × a × Rg (a = electrode spacing in metres). Frequency approx. 820 Hz; open-circuit voltage ≤ 48 V rms.

Range	Measuring range	Resolution
4 Ω	0.188 Ω·m – 753.6 Ω·m	0.01 Ω·m
40 Ω	0.188 Ω·m – 7.536 kΩ·m	0.001 kΩ·m
400 Ω	1.884 Ω·m – 75.36 kΩ·m	0.01 kΩ·m
4000 Ω	18.84 Ω·m – 753.6 kΩ·m	0.1 kΩ·m

5.5 Low resistance Lo Ω (ET-234A / ET-234B only)

Open-circuit voltage 4.0 – 6.9 V; test current ≥ 200 mA (display value before Rk ≤ 16 Ω). Accuracy applies to the display after Rk clearing; re-zero when the ambient temperature changes by more than 1 °C.

Range	Resolution	Accuracy
0.00 – 99.99 Ω	0.01 Ω	±(2 % + 2 d)

100.0 – 120.0 Ω	0.1 Ω	±(2 % + 3 d)

5.6 General specifications

Display	LCD 69 × 42 mm, 4000 counts
Backlight	LED
Auto power off	After 30 minutes of inactivity
Data hold	Automatic in earth resistance measurement
Low battery indication	Yes (on-screen symbol)
Power supply	1.5 V × 6 AA batteries
Dimensions	168 (L) × 118 (W) × 70 (H) mm
Weight (with batteries)	Approx. 760 g

5.7 Environmental conditions and safety standards

Parameter	Specification
Reference temperature	23 °C ± 5 °C
Operating temperature	-10 °C to 50 °C
Operating humidity	< 75 % RH
Storage temperature	-20 °C to 60 °C
Storage humidity	< 70 % RH
Altitude	Up to 2000 m
Insulation class	Class II, double insulation
Pollution degree	2
Overvoltage category	CAT II 1500 V (voltage measurement)

Safety standards	IEC 61010-1, IEC 61557-1 / -5, IEC 61000-4-2, IEC 61326-1

6 Maintenance

6.1 Replacing the batteries

This operation must be performed by qualified personnel only. Disconnect the clips from the circuit before replacing the batteries to avoid electric shock.

1. Disconnect all test leads from the input terminals and set the dial to **OFF**.
2. Unscrew the battery cover screw and remove the cover.
3. Remove all old batteries and fit 6 new 1.5 V AA batteries observing the polarity marks.
4. Refit the battery cover and tighten the screw.



Fig. 14 Unscrew the battery cover screw

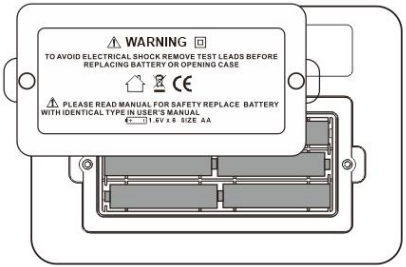


Fig. 15 Fit six 1.5 V AA batteries

6.2 Cleaning

Wipe the instrument with a clean, soft, dry cloth. Do not use a damp cloth, detergents, water or solvents.

6.3 Storage and transport

- Transport and store at -20 °C to 60 °C, < 70 % RH.
- Avoid strong shocks, vibration, direct sunlight, corrosive gases and dust.
- Remove the batteries if the instrument is stored for more than one month.
- After prolonged storage in harsh conditions, allow the instrument to return to normal condition before use.

7 Troubleshooting

The table lists common symptoms and remedies. If the fault cannot be cleared, stop using the instrument and contact qualified service personnel.

Symptom	Possible cause	Action
«LOW BTRY» flashing	Battery voltage too low	Replace all six AA batteries (section 6.1).
Overrange / auxiliary resistance too high	Auxiliary resistance too high or range too low	Check the auxiliary earth electrode; select a higher range.
Interference voltage alarm	Earth interference voltage too large	Check the site and eliminate the interference source.
No display	Batteries exhausted or fitted reversed	Check / replace the batteries; check the polarity.

Do not disassemble or modify the instrument. Unauthorised repair voids the warranty and may create a risk of electric shock.

8 Standard accessories and warranty

8.1 Standard accessories

ET-23: instrument × 1, earth rods × 2, test leads with banana plugs and alligator clips × 3 (red 15 m, yellow 10 m, black 5 m), 1.5 V AA batteries × 6, nylon carrying pouch × 1, user manual × 1.

ET-234A / ET-234B: instrument × 1, earth rods × 4, test leads with banana plugs and alligator clips × 4 (red 15 m, yellow 10 m, green 5 m, black 5 m), 1.5 V AA batteries × 6, nylon carrying pouch × 1, user manual × 1.

Contents are as listed on the packing slip. Check the accessories against the model marked on the cover.

8.2 Warranty coverage

Under normal use the instrument is warranted against faults caused by defects in materials and workmanship; performance to the standards stated in this manual is guaranteed for one year from the date of purchase, and defective parts are replaced free of charge within the warranty period.

Before contacting service, check that the test leads and power supply are in order and review the operating steps in this manual.

8.3 Exclusions

- Unauthorised repair or modification of accessories, or use of batteries not meeting the specification.
- Faults caused by misuse or use on unsuitable equipment.
- Transport damage caused by inadequate packaging; return freight is borne by the customer.
- Repair by unauthorised personnel, or alteration of the original design without the manufacturer's authorisation.

The manufacturer reserves the right to change specifications without prior notice.

9 合规性声明

9.1 废弃处置与环境保护（WEEE）

- 本产品受欧盟 WEEE（废弃电气电子设备）指令约束，达到使用寿命后须单独收集并送至经批准的回收处理机构，**不得与生活垃圾一同丢弃。**

▪ 电池须取出并按当地法规处置，切勿焚烧。

Waste electrical and electronic equipment must be collected separately and taken to approved recycling facilities. Do not dispose of it with household waste. Remove the batteries and dispose of them in accordance with local regulations; do not burn them.

9.2 符合的指令与标准

指令 / 标准	编号
低电压指令（LVD）	2014/35/EU
电磁兼容指令（EMC）	2014/30/EU
安全——通用要求	EN 61010-1
接地电阻测量	EN 61557-1 / -5
电磁兼容——通用抗扰度	EN 61326-1
静电放电抗扰度	EN 61000-4-2

备注　Notes

可用于记录校准日期、测试数据与维护记录。For calibration dates, test results and service history.　版本 V1.0