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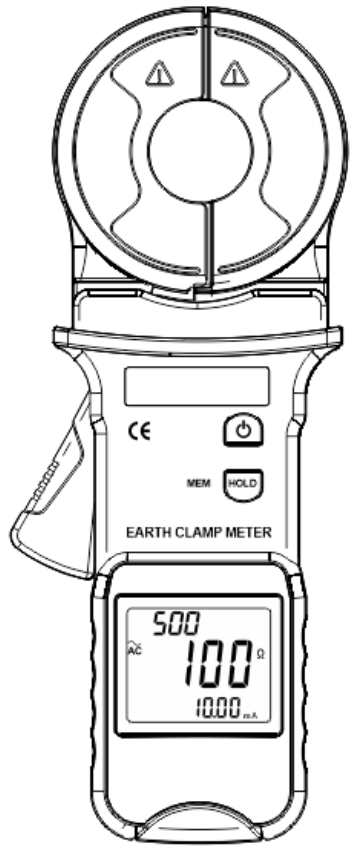

UT271系列

使用手册

Operating Manual

钳形接地电阻测试仪

Clamp Earth Resistance Tester

优利德®

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2025.02.08 REV.0

目　　录

注意

感谢您购买了本公司的 UT271 系列钳形接地电阻测试仪，为了更好地使用本产品，请一定：

——详细阅读本用户手册。

——遵守本手册所列出的操作注意事项。

◆ 任何情况下，使用本钳表应特别注意安全。

◆ 注意本钳表所规定的测量范围及使用环境，禁止钳测动力线。

◆ 注意本钳表面板及背板的标贴文字。

◆ 开机前，扣压扳机一两次，确保钳口闭合良好。

◆ 开机自检过程中，不要扣压扳机，不能钳任何导线。

◆ 必须等待自检完成，显示“OL Ω”符号后，才能钳测被测对象。

◆ 钳口接触平面必须保持清洁，不能用腐蚀剂和粗糙物擦拭。

◆ 避免本钳表受冲击，尤其是钳口接合面。

◆ 危险场合，强烈推荐选用本公司的防爆型钳形接地电阻测试仪。

◆ 本钳表在测量电阻时钳头会发出连续的轻微“嗡--”声，这是正常的。

◆ 测量导线电流不要超过本钳表的上量限。

◆ 长时间不用本钳表，请取出电池。

◆ 拆卸、校准、维修本钳表，必须由有授权资格的人员操作。

◆ 由于本钳表原因，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。

◆ 本用户手册中标有“*”的内容仅限于 B/C 型。

一．简介

UT271 系列钳形接地电阻测试仪是传统接地电阻测量技术的重大突破，广泛应用于电力、电信、气象、油田、建筑及工业电气设备的接地电阻测量。

UT271 系列钳形接地电阻测试仪在测量有回路的接地系统时，不需断开接地引下线，不需辅助接地极，安全快速、使用简便。

UT271 系列钳形接地电阻测试仪能测量出用传统方法无法测量的接地故障，能应用于传统方法无法测量的场合，因为 UT 系列钳形接地电阻测试仪测量的是接地体电阻和接地引线电阻的综合值。

另外，B/C 型钳形接地电阻测试仪还能测量接地系统的泄漏电流和中性线电流。

二．规格

1. 系列型号

型号	钳口尺寸	电阻量程	电流量程
UT271A	Φ32mm	300Ω	----
UT271B	Φ32mm	500Ω	20A
UT271C	Φ32mm	1000Ω	20A

2. 量程及准确度

测量模式	测量范围	分辨力	准确度
电　阻	0.010Ω-0.099Ω	0.001Ω	± (1%rdg + 0.01Ω)
	0.10Ω-0.99Ω	0.01Ω	± (1%rdg + 0.01Ω)
	1.0Ω-49.9Ω	0.1Ω	± (1%rdg + 0.1Ω)
	50.0Ω-99.5Ω	0.5Ω	± (1.5%rdg + 0.5Ω)
	100Ω-199Ω	1Ω	± (2%rdg + 1Ω)
	200Ω-395Ω	5Ω	± (5%rdg + 5Ω)
	400Ω-590Ω	10Ω	± (10%rdg + 10Ω)
	600Ω-1000Ω	20Ω	± (20%rdg + 20Ω)

*电　流	0.00mA -9.99mA	0.01mA	± (2.5%rdg + 1mA)
	10.0mA -99.9mA	0.1mA	± (2.5%rdg + 5mA)
	100mA -299mA	1mA	± (2.5%rdg + 10mA)
	0.30A-2.99A	0.01A	± (2.5%rdg + 0.1A)
	3.0A-9.9A	0.1A	± (2.5%rdg + 0.3A)
	10.0A-20.0A	0.1 A	± (2.5%rdg + 0.5A)

注①： 电流功能仅 UT271B、UT271C 带有;

3. 技术规格

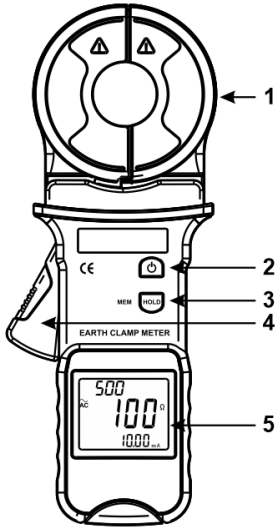
功　　能	接地电阻测试、回路电阻测试、漏电流测试
电　　源	DC 6V，5 号碱性干电池（LR6 1.5V×4）
测量方式	互感方式
电阻分辨力	0.001Ω
电流分辨力	0.01mA
钳口尺寸	Φ32mm
Ω + A 同步显示	Ω + A 同屏显示
显示模式	4 位 LCD 显示
LCD 尺寸	46mm×36mm
仪表尺寸	260mm×105mm×60mm
测量时间	1 次/秒
数据存储	500 组，“MEM”存储指示，闪烁显示“MEM”符号表示存储已满。
数据查阅	查阅数据时“MR”符号指示
溢出显示	超量程溢出时“OL”符号指示
干扰测试	自动识别干扰信号，干扰电流大时“NOISE”符号指示
电池电压	电池电压低符号提醒
功　　耗	Max 约 60mA
钳表质量	约 818g(含电池)
工作温湿度	-10℃～40℃；70%RH 以下

存放温湿度	-20℃～60℃；80%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	IEC61010-1(CAT Ⅲ 300V、CAT IV 150V、污染度 2)；IEC61010-031；IEC61557-1(接地电阻)；JJG 1054-2009 钳形接地电阻仪检定规程

注：“*”仅限于 B/C 型。

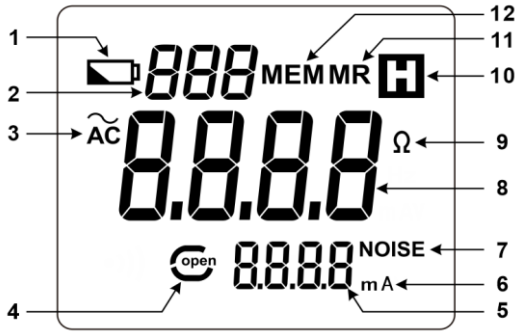
三．钳表结构

1. 钳口：Φ32mm
2. 开机/关机/退出键
3. 锁定/解除显示键
4. 扳机：控制钳口张合
5. 液晶显示屏



四．液晶显示

1. 液晶显示屏



序号	说明	序号	说明
1	电池电压低符号	7	干扰符号
2	存储数据组编号数字	8	四位电阻数据
3	交流 AC 符号	9	电阻单位符号
4	钳头张开符号	10	数据锁定符号
5	四位数字指示电流	11	数据查阅符号
6	电流单位符号	12	数据存储符号

2. 特殊符号说明

⑴.  钳口张开符号，钳口张开时，该符号显示。此时，可能人为扣压扳机；或钳口已污染导致闭合不好，不能再继续测量，可清洁钳头金属面后再次开机测试。

⑵. “Er”开机出错符号，可能开机时扣压扳机或开机时钳口已污染导致闭合不好，不能再继续测量，可清洁钳头金属面后再次开机测试。

⑶.  电池电压低符号，当电池电压低于 4.8V，此符号显示，此时不能保证测量的准确度，应更换电池。

⑷. “OL Ω”符号，表示被测电阻超出了钳表的上量程。

⑸. “L0.01Ω”符号，表示被测电阻超出了钳表的下量程。

*⑹. “OL A”符号，表示被测电流超出了钳表的上量程。

(7). 报警符号，当被测量值大于设定报警临界值时该符号闪烁显示，同时仪表发出间歇“嘟--嘟--嘟--”声。

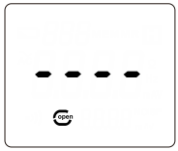
(8). MEM 存储数据已满符号，内存数据已满 99 组，不能再继续存储数据，MEM 符号闪烁。

(9). MR 查阅数据符号，在查阅数据时显示，同时显示所存数据的编号。

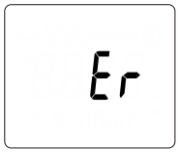
(10). NOISE 符号，当被测试接地回路有较大干扰电流时此符号闪烁显示，同时仪表发出“嘟--嘟--嘟--”提示声。此时不能保证测试的准确性。

3. 显示示例

(1) ——钳口处于张开状态，不能测量



(2) ——开机出错指示 Er(Error)



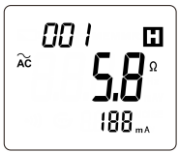
(3) ——被测量的电阻为：5.8Ω

——被测量的电流为：188mA

——锁定当前测量值：5.8Ω

——锁定当前测量值：188mA

——自动存储为第 001 组数据



五．功能速查表

功能	按键
开机/关机/延时关机/退出	POWER
测试界面，锁定存储/解除锁定	短按 HOLD
查阅界面，数据翻阅	短按 HOLD
删除数据选择界面，NO 和 YES 选项切换	短按 HOLD
测试界面，进入查阅界面	长按 HOLD
查阅界面，进入删除选择界面	长按 HOLD
删除选择界面，NO 代表不删除，YES 代表删除	长按 HOLD

六．操作方法

1. 开机

注 意	开机时，不能扣压扳机，不能张开钳口，不能钳任何导线
	开机完成，显示“OLΩ”后，才能扣压扳机，打开钳口，钳被测导线
	开机前，扣压扳机一两次，确保钳口闭合良好
	开机时，要保持钳表的自然静止状态，不能翻转钳表，不能对钳口施加外力，否则不能保证测量的准确度

按“⏻”键开机，首先自动测试液晶显示器，其符号全部显示，见图 1，同时，仪表自动校准，开机完成后中间显示“OLΩ”，自动进入测量模式，见图 2，若没有正常开机自校准，仪表会显示“Er”符号，表示开机出错，见图 3。

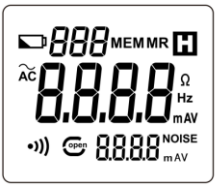


图 1

图 2

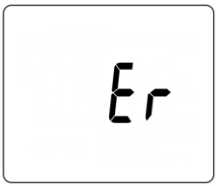


图 3

开机出错可能是钳口平面脏污，或开机时给扳机施加了外力，或钳口闭合不好，或开机时钳入了回路电阻等，请检查原因再重新开机。

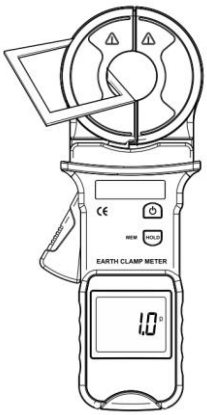
如果开机自检后未出现“OLΩ”，而是显示一个较大的阻值，见图 4。但用测试环检测时，仍能给出正确的结果，这说明钳表仅在测大阻值时（如大于 100 欧）有较大误差，而在测小阻值时仍保持原有准确度，用户仍可放心使用。

图 4

2. 关机

钳表在开机后，按“⏻”键关机。钳表在无操作 5 分钟后，液晶显示屏进入闪烁状态，闪烁状态持续 30 秒后，自动关机，以降低电池消耗。在闪烁状态按任何键可延时关机，钳表继续工作。

在 HOLD 状态下，需先按 HOLD 键退出 HOLD 状态，再“⏻”按键关机，其它状态都可直接关机。



3. 测试

开机自检完成后，中间显示“OLΩ”，即可进行测量。此时，扣压扳机，打开钳口，钳住待测回路，读取电阻值。

用户认为有必要，可以用标准附件中的检定电阻进行自行校准，如图所示，读数应与检定电阻上的标称值一致。(1.0Ω)。

检定电阻的标称值是在温度为 20°C 的条件下测得的，显示值与标称值相差一个字的数值是正常的。

例如：检定电阻的标称值为 1.0Ω，显示 0.9Ω 或 1.1Ω 都是正常的，可以接受。显示‘OLΩ’表示测量的电阻值超过了本仪表的上限。

显示“OLΩ”，表示被测电阻超出了钳表的上量程。

***显示“OL A”，表示被测电流超出了钳表的上量程。**

显示“L0.01Ω”，表示被测电阻超出了钳表的下量程。

4. 数据锁定/解除/存储

在测试模式下，按 HOLD 键锁定当前显示值，显示 HOLD 符号，同时，将此锁定值作为一组数据依次自动编号并存储，再按 HOLD 键取消锁定，HOLD 符号消失，可继续测量。循环操作，能存储 500 组数据。若存储已满，显示 MEM 符号。

见图 5，锁定被测电阻 5.8Ω，锁定被测电流 188mA，并作为第 001 组数据存储。

见图 6，锁定被测电阻 1.8Ω，并作为第 500 组数据存储，此时内存已满，MEM 符号显示。

关机后再开机，不会丢失所存数据。

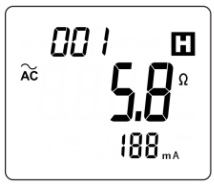


图 5

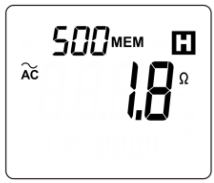


图 6

5. 数据查阅与数据清除

长按 HOLD 键进入查阅存储数据模式，若无存储数据，则显示如图 7，当有存储数据时，默认显示所存的第 001 组数据，见图 8。

短按 HOLD 键，向下步进 1 翻阅所存数据

在数据查阅模式下，长按 HOLD 键，进入数据删除选择界面，按短按 HOLD 键选择“no”或“yes”。显示“no”，再长按 HOLD 键，则返回数据测试界面，显示“yes”，

再长按 HOLD 键，则清除所有存储数据。数据清除完毕后返回数据测试界面。并且数据清除后不能再恢复。

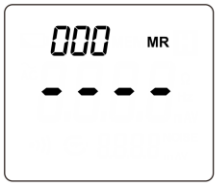


图 7

图 8

七．测量原理

1. 电阻测量原理

钳形接地电阻测试仪测量接地电阻的基本原理是测量回路电阻。见图 9。钳表的钳口部分由电压线圈及电流线圈组成。电压线圈提供激励信号，并在被测回路上感应一个电势 E。在电势 E 的作用下将在被测回路产生电流 I。钳表对 E 及 I 进行测量，并通过公式 R=E/I 即可得到被测电阻 R。

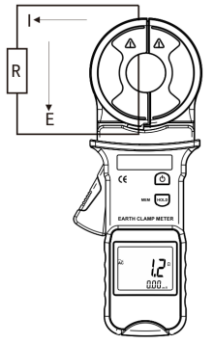


图 9（电阻测量原理图）

（1）．回路电阻定义（结合图 10 说明）：

回路电阻包括 A 点对地的接地电阻值、接地引下线金属导体的阻值、金属架空线的阻值、接地引下线与金属架空线之间的连接电阻值(接触电阻)、B 点对地的接地电阻值的综合值。

（2）．若仪表测试出的地网 A、地网 B 回路的综合值为 5 欧，即：RA+RB+R 架空线+R 接地引下线=5.0Ω，那地网 A、地网 B 两个并联起来对地的实际接地电阻值一定小于等于 2.5Ω，据此可以判断地网 A 并联了地网 B 后的实际接地电阻值是否合格。

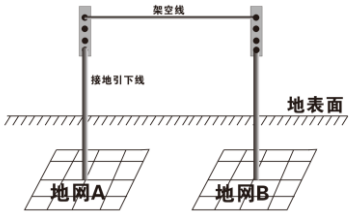


图 10（回路电阻定义图）

（3）．金属回路的联结电阻检测：

地网 A、地网 B 为不同的地网，若地网 A、地网 B 在地下连接在一起，则仪表测试出的是金属回路的电阻值，其值一般很小，零点几欧姆，不是接地电阻值，是金属回路的联结电阻值，即等电位联结电阻值，据此可以判断接地引下线与地网的联结（焊接）可靠性。

（4）．单点接地系统：

上图中地网 A、地网 B 之间若没有架空线，则地网 A、地网 B 为独立的单点接地。仪表不能直接测试单点接地系统的接地电阻值，此时测试地网 A、地网 B 的接地电阻值会显示“OL”溢出符号，表示超出仪表的上量限。对于近距离内有 2 个或 2 个以上的单点接地系统，将就近的 2 个单点接地系统的接地引下线在地面上用测试线连接起来可以检测。

总之，对于单点接地系统，可以借助周围的其他接地极形成回路来检测，如消防栓、金属自来水管、建筑接地等等，也可以打两辅助地极，构成回路用 2 点法或 3 点法进行检测（详见后述 2 点法、3 点法）。

2. 电流测量原理

测量电流的基本原理与电流互感器的测量原理相同。见图 11。被测量导线的交流电流 I，通过钳口的电流磁环及电流线圈产生一个感应电流 I_1，钳表对 I_1 进行测量，通过下面的公式即可得到被测电流 I。

$$I = n \cdot I_1$$

其中：n 为副边与原边线圈的变比系数。

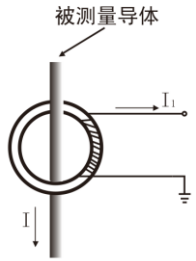
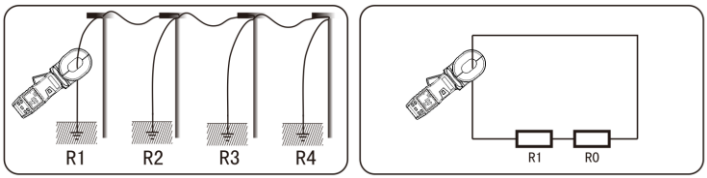


图 11（电流测量原理图）

八．接地电阻测量方法

1. 多点接地系统

对多点接地系统(例如输电系统杆塔接地、通信电缆接地系统、某些建筑物等)，它们通过架空地线（通信电缆的屏蔽层）连接，组成了接地系统。见下图。当用钳表测量时，其等效电路如下：



其中：R1 为预测的接地电阻。

R0 为所有其它杆塔的接地电阻并联后的等效电阻。

虽然，从严格的接地理论来说，由于有所谓的“互电阻”的存在，R0 并不是通常

的电工学意义上的并联值（它会比电工学意义上的并联值稍大），但是，由于每一个杆塔的接地半球比起杆塔之间的距离要小得多，而且毕竟接地点数量很大，R0 要比 R1 小得多。因此，可以从工程角度有理由地假设 R0=0。这样，我们所测的电阻就应该是 R1 了。

多次不同环境、不同场合下与传统方法进行对比试验，证明上述假设是完全合理的。

2. 有限点接地系统

这种情况也较普遍。例如有些杆塔是 5 个杆塔通过架空地线彼此相连；再如某些建筑物的接地也不是一个独立的接地网，而是几个接地体通过导线彼此连接。

在这种情况下，如果将上图中的 R0 视为 0 则会对测量结果带来较大误差。

出于与上述同样的理由，我们忽略互电阻的影响，将接地电阻的并联后的等效电阻按通常意义上的计算方法计算。这样，对于 N 个（N 较小，但大于 2）接地体的接地系统，就可以列出 N 个方程：

$$R_1 + \frac{1}{\frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_N}} = R_{1T}$$

$$R_2 + \frac{1}{\frac{1}{R_1} + \frac{1}{R_3} + \cdots + \frac{1}{R_N}} = R_{2T}$$

$$\vdots$$

$$R_N + \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_{(N-1)}}} = R_{NT}$$

其中：R1、R2、…….RN 是我们要求得的 N 个接地体的接地电阻。

R1T、R2T、……RNT 分别是用钳表在各接地支路所测得的电阻。

这是一个有 N 个未知数，N 个方程的非线性方程组。它是有确定解的，但是人工解它是十分困难的，当 N 较大时甚至是不可能的。

为此，请选购我公司的有限点接地系统解算程序软件，用户即可使用办公电脑或手提电脑进行机解。

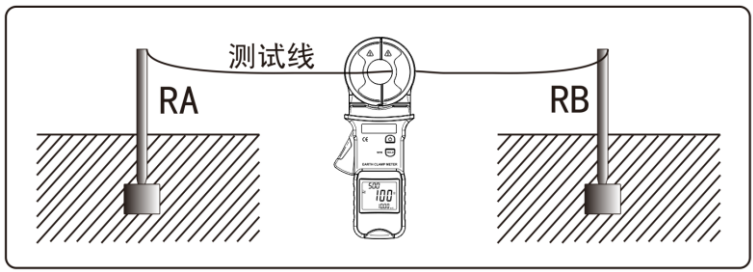
从原理上来说，除了忽略互电阻以外，这种方法不存在忽略 R0 所带来的测量误差。 但是，用户需要注意的是：您的接地系统中，有几个彼此相连接的接地体，就必须测量出同样个数的测试值供程序解算，不能或多或少。而程序也是输出同样个数的接地电阻值。

3. 单点接地系统

从测试原理来说，钳表只能测量回路电阻，对单点接地是测不出来的。但是，用户完全可以利用一根测试线及接地系统附近的接地极，人为地制造一个回路进行测试。下面介绍二种用钳表测量单点接地的方法，此方法可应用于传统的电压-电流法无法测试的场合。

⑴．二点法

见下图，在被测接地体 RA 附近找一个独立的接地较好的接地体 RB（例如临近的自来水管、建筑物等）。将 RA 和 RB 用一根测试线连接起来。



由于钳表所测的阻值是两个接地电阻和测试线阻值的串联值。

RT=RA+RB+RL

其中：RT 为钳表所测的阻值。

RL 为测试线的阻值。

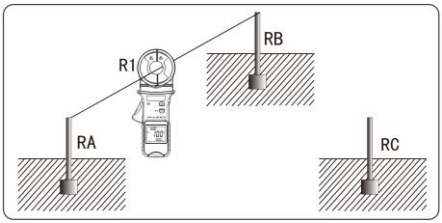
将测试线头尾相连即可用钳表测出其阻值 RL。

所以，如果钳表的测量值小于接地电阻的允许值，那么这两个接地体的接地电阻都是合格的。

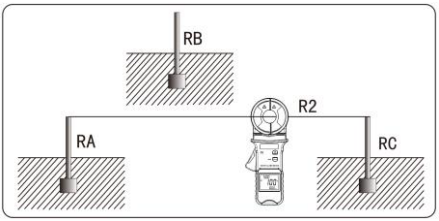
(2)．三点法

如下图，在被测接地体 RA 附近找二个独立的接地体 RB 和 RC。

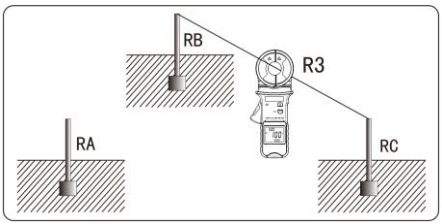
第一步，将 RA 和 RB 用一根测试线连接起来，见下图。用钳表读得第一个数据 R1。



第二步，将 RA 和 RC 连接起来，见下图。用钳表读得第二个数据 R2。



第三步，将 RB 和 RC 连接起来，见下图。用钳表读得第三个数据 R3。



上面三步中，每一步所测得的读数都是两个接地电阻的串联值。这样，就可以很容易地计算出每一个接地电阻值：

由于： R1=RA+RB R2=RB+RC R3=RB+RC

所以： RA=（R1+R3-R2）÷2

这就是接地体 RA 的接地电阻值。为了便于记忆上述公式，可将三个接地体看作一个三角形，则被测电阻等于邻边电阻相加减对边电阻除 2。

其它两个作为参照物的接地体的接地电阻值为：

RB=R1-RA RC=R2-RA

九．装箱单

仪表	1 台
测试环 1Ω　10Ω	各 1 个
1.5V 电池 AA（碱性）	4 节
彩盒	1 个
用户手册	1 份
保修卡/合格证	1 张

本公司不负责由于使用时引起的其他损失。

本用户手册的内容不能作为将产品用做特殊用途的理由。

本公司保留对用户手册内容修改的权利。若有修改，将不再另行通知。

CONTENT

Precaution For Use

Thank you for purchasing our **Clamp Earth Resistance Tester of UT271 series**. In order to better for use of the product, please be certain:

-- Read this user manual carefully.

-- Comply with the operating cautions in this manual.

- ◆ Under any circumstance, shall pay special attention on safety in using this tester.
- ◆ Pay attention to measuring range and usage environment stipulated for the tester. Do not clamp and test power line.
- ◆ Pay attention to the text labeled on the panel and backplane of the Meter.
- ◆ Before boot up, Withhold the trigger one or two times to make sure the jaws are closed well.
- ◆ In booting up, do not withhold the trigger, nor clamp any wires.
- ◆ Must wait the auto inspection finished and display "**OL Ω**" symbol, and then clamp and test measurement object.
- ◆ The jaw planes contact surfaces must keep clean, cannot rubbed with caustics and coarse material.
- ◆ Avoid any impact onto this meter, especially the jaw contact planes.
- ◆ In dangerous site, it is strongly recommended to use our explosion-proof type clamp grounding resistance meter.
- ◆ It is strictly forbidden to disassembled and replaced battery in hazardous locations for the explosion-proof type product.
- ◆ It is normal that the meter clamp will have some buzzing sound in measuring resistance.
- ◆ Measuring wire current should not exceed the meter range upper limit.
- ◆ Please take out the batteries if the meter will not use in a long time.
- ◆ Disassembly, calibration, and repair of this tester must be performed by authorized personnel.
- ◆ Due to the reason of this instrument, if it is dangerous to continue using, should stopped and sealed immediately ,and handled by an authorized institution.

The contents marked with "*" in this user manual are limited to the B/C type

Introduction

UT271 series of Clamp Earth Resistance Tester is a major breakthrough in traditional grounding resistance measurement. It is widely used in the grounding resistance measurement of the power, telecommunications, meteorology, oilfield, construction and the industrial and electrical equipment.

UT271 series of Clamp Grounding Resistance Tester, in the measurement of a grounding system with loop, does not require breaking down the grounding down lead, and no need the auxiliary grounding electrode. It is safe, fast and simple in use.

UT271 series clamp grounding resistance meter can measure ground faults which cannot be measured by traditional methods. It can be used in applications where traditional methods cannot be measured, because the **UT** series clamp grounding resistance meter measures the combined value of grounding body resistance and grounding lead resistance. .

In addition, the B/C type Clamp Grounding Resistance Tester is also able to measure the leakage current and the neutral current in the grounding system.

2. Specification

2.1. Series Model

Model	Jaw Size (mm)	Resistance Range (Ω)	Current Range (A)
UT271A	Φ32mm	300Ω	--
UT271B	Φ32mm	500Ω	20A
UT271C	Φ32mm	1000Ω	20A

2.2. Ranges & Accuracy

Mode	Range	Resolution	Accuracy
Resistance Range	0.010Ω~0.099Ω	0.001Ω	±（1%rdg＋0.01Ω）
	0.10Ω~0.99Ω	0.01Ω	±（1%rdg＋0.01Ω）
	1.0Ω~49.9Ω	0.1Ω	±（1%rdg＋0.1Ω）
	50.0Ω~99.5Ω	0.5Ω	±（1.5%rdg＋0.5Ω）
	100Ω~199Ω	1Ω	±（2%rdg＋1Ω）
	200Ω~395Ω	5Ω	±（5%rdg＋5Ω）
	400~590Ω	10Ω	±（10%rdg＋10Ω）
	600Ω~1000Ω	20Ω	±（20%rdg＋20Ω）

*Current Range	0.00mA~9.99mA	0.01mA	±（2.5%rdg＋1mA）
	10.0mA~99.9mA	0.1mA	±（2.5%rdg＋5mA）
	100mA ~299mA	1mA	±(2.5%rdg+10mA）
	0.30A~2.99A	0.01A	±（2.5%rdg＋0.1A）
	3.0A~9.9A	0.1 A	±（2.5%rdg＋0.3A）
	10.0A~20A	0.1 A	±（2.5%rdg＋0.5A）

Note: with "*" item is limited to UT271B, UT271C type

2.3. Technical Specifications

Function	Ground resistance test, loop resistance test, leakage current test
Power	DC6V Alkaline dry battery (LR6 1.5VX 4PCS)
Measure Method	Mutual induction
Resistance Resolution	0.001Ω
Current Resolution①	0.01mA
Jaw Size(mm)	Φ32mm
Ω + A Synchronous display	Ω + A displayed on same screen
Display Mode	4-bit LCD digital display
LCD Size	46mmX36mm
Meter Size	260mm(L)X105mm(W)X60 mm(H)
Measurement Time	1 time/second
Data Storage	500 groups, The flashing "**MEM**" symbol indicates that the store is full.
Data Review	Viewing data function:The "**MR**" symbol display
Overflow Display	Exceed measurement range overflow function: "**OL**" symbol display
Interference Test	Automatically identify interference signals, and indicate with the "**NOISE**" symbol when the interference current is large
Battery Voltage	Low battery voltage symbol reminder
Power Consumption	Max about 60mA
Weight	About 818g (including battery);
Working Environment & Humidity	-10℃~40℃; below 80%RH

Storage Environment & Humidity	-20˚C~60˚C; below 70%RH
Insulation Resistance	Above 20MΩ (between circuit and outside shell is 500V)
Withstand Voltage	AC 3700V/rms. (Between circuit and outside shell)
External Magnetic Electric field	＜40A/m; ＜1V/m
Protection Type	IEC61010-1 (CAT Ⅲ 300V, CAT IV 150V, Pollution 2); IEC61010-031; IEC61557-1 (Earth resistance);

Note: with "*" item is limited to B/C type

3. Meter Structure

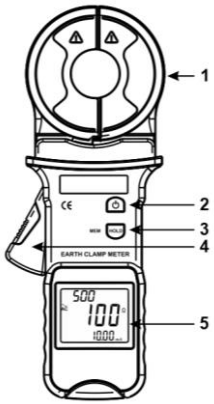
3.1. Clamp: Φ32mm

3.2. POWER Key: Boot Up / Shutdown /Quit

3.3. HOLD Key: Lock / Release display

3.4. Trigger: Control the clamp open and close

3.5. Liquid Crystal Display (LCD)



4. LCD Display

4.1. LCD Screen

4.1.1.Low battery symbol

4.1.2.No.of data storage

4.1.3. AC symbol

4.1.4. Clamp opening symbol

4.1.5. 4-digit current indication

4.1.6. Current unit symbols

4.1.7. Interference symbol

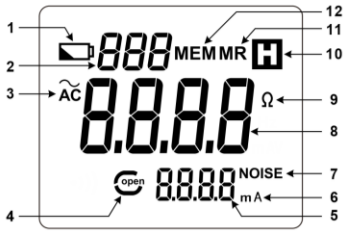
4.1.8. 4-digit resistance data

4.1.9. Resistance unit symbol

4.1.10.Data lock symbol

4.1.11. Data lookup symbol

4.1.12.Data storage symbols



4.2. Special Symbols Description

4.2.1. open Clamp opening symbol: the clamp is in the open state, the symbol shows. At this point, trigger may be artificially pressed, or the clamps have been seriously polluted, and can no longer continue to measure.

4.2.2. "**Er** "The boot-up error symbol, the trigger may be artificially pressed when booting or the clamp opening

4.2.3. Low battery voltage symbol: when the battery voltage is lower than 4.8V, the symbol shows. At this time, it cannot guarantee accuracy of the measurements. Batteries should be replaced.

4.2.4." OL Ω" symbol indicates that the measured resistance has exceeded the upper limit range of the meter.

4.2.5. "**L0.01Ω"** symbol indicates that the measured resistance has exceeded the lower limit range of the meter.

***4.2.6. "OL A"** symbol indicates that the measured current has exceeded the upper limit range of the meter.

4.2.7. Alarm symbol: when the alarm function is turned on, the symbol is displayed. When the measured value is greater than the critical value of alarm setting, the symbol flashes, and the meter make intermittent "beep--beep –beep--" sound.

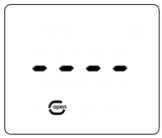
4.2.8.MEM Full data storage symbol: memory is full of data units of 99, and cannot continue to store data.

4.2.9.MR Data access symbol: data access display, and display the number of the saved data at the same time.

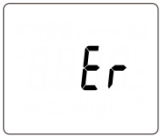
4.2.10.NOISE symbol. When the earth circuit tested has a large interference current, this symbol flashes, and the meter gives a warning sound of "bee-bee-bee-bee-".The accuracy of the test cannot be guaranteed at this time

4.3. Display Examples

4.3.1. ---Clamp is in open state, and cannot measure



4.3.2. ---Boot error instructions Er (Error)



4.3.3. ---The tester resistance is: 5.8Ω

---Measured current is: 188mA

--- Lock present measurement value: 5.8Ω

---Lock present measurement value:188mA

---Automatically stored as group 001 data

5. Function Quick Checking

Function	**Key**
Boot Up / Shutdown / Shutdown Delay/Exit	**POWER**
Test interface, lock storage/Release lock	**HOLD key short press**
View interface, data reading	**HOLD key short press**
Delete data selection interface, **NO** and **YES** option switch	**HOLD key short press**
Test interface, enter the review interface	**HOLD key long press**
View interface, enter the delete selection interface	**HOLD key long press**
Delete selection interface, **NO** isn't delete, **YES** is delete	**HOLD key long press**

6. Operating Method

6.1. Start Up

⚠	In booting, user cannot withhold the trigger ,cannot open jaw, and cannot clamp any wires
	After boot up and display "**OL Ω**", then withhold the trigger, open jaws and clamp the measured wire.
	Before booting up, the trigger should withhold one or two times to ensure the jaws are well closed.
	In booting, must be sure to keep the natural static state of the Meter; do not overturn the Meter, nor impose any external force on the clamp. Otherwise, the accuracy of measurement cannot be guaranteed.

Press ⏻ to Starting up, first will automated testing LCD; display all of symbols (Figure 1). Meanwhile the instrument auto-calibration, after starting up displayed "**OL Ω**" and "**0.00mA**", automatically enter the Resistance + Current measurement mode (Figure 2).If abnormal boot and self-calibration, instrument will display "**Er**" symbol, indicate boot error. (Figure 3).

Figure1

Figure2

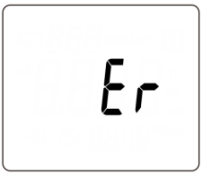


Figure3

The boot error may be the jaw surface is dirty, or apply an external force in booting, or the jaws are not closed properly, or clamp the loop resistance in booting. Please check the problems and then restart.

If after boot up and self-test not display "**OL Ω**", but shows a large resistance (Figure 4).

Figure 4

However, when measured with the test ring, still gives the correct result, This shows that the tester only has a large error when measuring large resistance value (such as more than 100Ω), and still maintains the accuracy when measuring small resistance value, the user still safe for use.

6.2. Shutdown

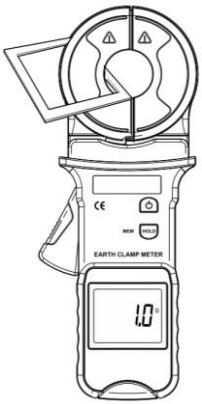
After the meter is switched on, press ⏻ key to shut it down.

After the meter started up 5 minutes, the LCD screen entered flashing state, and would automatically shut down after the flashing state is sustained for 30 seconds to reduce battery consumption. Press **POWER** key in flashing state may delay the shutdown and keep it working.

In **HOLD** state, it is required to first press **HOLD** key or Power key to quit from the **HOLD** state, then press **POWER** key to shut it down.

6.3. Resistance Measurement

After the booting and auto-inspection, display "OL Ω" and will be able to proceed with resistance measurement. At this point, press the trigger and open the jaws, clamp the measured loop, reading and getting the resistance value.



If user thinks it necessary, the test can be done with the test ring as shown in the following figure. It shows value should be consistent with the normal value on the test ring .

Nominal value of test ring is in condition of temperature of 20 °C. It is normal to find the difference of numerical 1 word between the shown value and the nominal value.

For instance: If nominal value of test ring is 1.0Ω, showing 0.9 Ω or 1.1 Ω is normal and accepted.

Display "OL Ω", indicate that the measured resistance value exceeded the upper limit range of Meter.

Display"OL A", indicate that the measured current value exceeded the upper limit range of the Meter.

Display "L0.01Ω", indicate that the measured resistance value exceeded the lower limit range of Meter.

6.4. Data Lock/Release/Storage

In test model, press **HOLD** key to lock the present display value and display **HOLD** symbol. This lock value is automatically numbered and stored as a set of data .Then press **HOLD** key to release locking, **HOLD** symbol would disappear and return to measurement state. By repeat the above operations, it can store 500 sets of data. If the memory is full, the **MEM** symbol will flash display.

As indicate in figure 5, lock the measured resistance 5.8Ω, lock the measured current 188mA. and save it as data unit No.001.

As indicated in figure 6, lock the measured resistance 1.8Ω, and save it as data unit No.500.

If the storage is full, the **MEM** symbol flashes.

After turning off and then on, the stored data will not be lost.

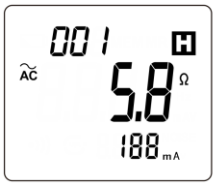


Figure 5

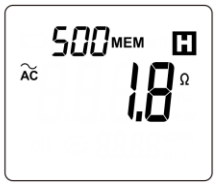


Figure 6

6.5. Data review /Clear

Long press **HOLD** key, enter the stored data review mode. If there is no stored data, it will be displayed as Figure 7. When there is stored data, the default display is the 001st group of stored data, as Figure 8.

Short press the HOLD key and step down 1 to review the stored data

In the data review mode, long press **HOLD** key to enter the data deletion selection interface, and press **HOLD** key to select "**no**" or "**yES**". Display "**no**", long press **HOLD** key again to return to the data test interface, and display "**yES**" . Long press **HOLD** key again to clear all stored data. After the data is cleared, return to the data test interface. And the data cannot be restored after it is cleared.

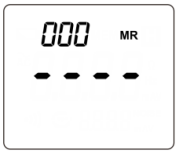
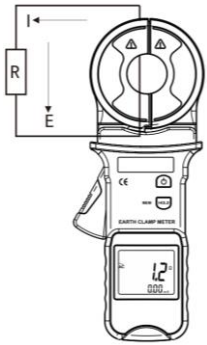


Figure 7

Figure 8

7. Measurement Principle



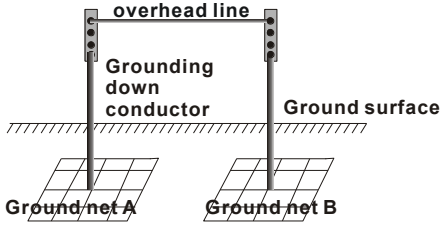
7.1. Resistance Measurement Principle

The basic principle of **UT271 series Clamp Earth Resistance tester** measuring grounding resistance is measuring the loop resistance, as shown below figure. The jaw part of the meter is comprised of voltage coil and current coil. The voltage coil provides drive signal, and will induce a electric potential E in the measured loop. With the effects of the potential **E**, the current **I** can generate in the measured loop. The meter can measure **E** & **I**, and the measured resistance R can be obtained by the formula R=E/I.

7.1.1. Loop Resistance Definition

The loop resistance includes the value of ground resistance of point A, the metal conductor of the grounding lead, the overhead wire resistance, the connection resistance between the grounding lead and the overhead wire (contact resistance), and the comprehensive value of the ground resistance of point B.

7.1.2. If the instrument test out loop of network A and network B comprehensive value is 5.0Ω, which is RA + RB + R overhead wire + R grounding down lead = 5.0 Ω, then the parallel actual grounding resistance value of ground network A and the ground network B must less than or equal to 2.5 Ω, and can judged the parallel actual grounding resistance value of ground network A and the ground network B l is qualified or not.



7.1.3. Metal loop connection resistance detection

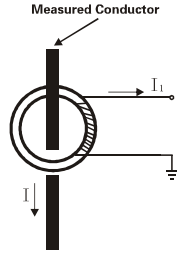
The ground network A and the ground network B are different ground networks. If the ground network A and the ground network B are connected together underground, the tester measure the resistance value of the metal circuit, and generally is small, just a few ohms, not the grounding resistance value but the connection resistance value of the metal circuit, the equipotential connection resistance value, which could according to judge the connection reliability (solder) of the grounding down lead and the grounding net.

7.1.4. Single point grounding system:

If hasn`t overhead line between the ground network A and the ground network B in the above figure, the ground network A and the ground network B are independent single-point grounding. The instrument cannot test the grounding resistance value of the single-point grounding system directly. Here measure the grounding resistance value of the grounding network A and grounding network B will display the “OL” overflow symbol, indicating that over upper limit range of the meter. For two or more single-point grounding systems in close proximity, it can be detected by connecting the grounding leads of two nearby single-point grounding systems on the ground with test wires.

Overall, for single-point grounding system, it can be detected by forming a circuit with other surrounding grounding poles, such as fire hydrants, metal water pipes, building grounding, etc., or build two auxiliary ground poles to form a loop with 2-pole or 3-pole method to detect (refer the 2-point method and the 3-point method described later).

7.2. Current Measurement Principle



The basic principle of **the C style grounding resistance tester** measure current is the same with the principle of current sensor measurement, as shown below figure.

The AC current **I** of the measured wire, through the current magnetic loop and coil of jaw, can generate an induction current $\mathbf{I_1}$; The meter will measure $\mathbf{I_1}$, and the

measured current **I** can be obtained by the following formula.

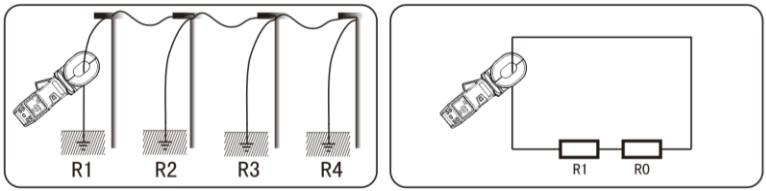
$$I = n \cdot I_1$$

Note: **n** is the turn ratio of the secondary side and primary side coil.

8. Grounding Resistance Measurement Method

8.1. Multi-Point Grounding System

For the multi-point grounding system (such as electricity transmission tower grounding system, communications cable grounding systems, certain buildings, etc.), it usually connect overhead ground wire (communications cable shielding layer) to form a grounding system. As follow figure:



As the meter is in the above measurement, its equivalent electric circuit is shown as follow figure:

Where: $\mathbf{R_1}$ is the target measurement grounding resistance.

$\mathbf{R_0}$ is the equivalent resistance of the other entire tower grounding resistances were paralleled.

Although strictly on the theoretical grounding, because of the existence of so-called "mutual resistance", $\mathbf{R_0}$ is not the usual parallel value of electrotechnology (slightly larger than parallel value of electrotechnology). But because each grounding radius of tower was much less than the distance between the towers, and with a great number of grounding point, $\mathbf{R_0}$ is much smaller than $\mathbf{R_1}$. Therefore, it can be justified to assume $\mathbf{R_0=0}$ from an engineering perspective. In this way, the resistance should be R1 which measured.

Many times of comparing tests in different environments and different occasions with the traditional method proved that the above assumption is entirely reasonable.

8.2. Limited Point Grounding System

This situation also quite common. For example, some of towers which are five towers connected with each other through overhead ground wire; Besides, some of the buildings is not an independent grounding grid, but several grounding bodies connected with each other through the wire.

Under such circumstances, the R_0 of above figure regarded as 0, will get more error results of the measurement.

Due to the same reasons mentioned above, we ignore the impact of the mutual resistance; and the parallel equivalent resistance of the grounding resistance is calculated by the usual theory.

Thus, for the grounding system of N sets (N is less, but more than 2) grounding bodies, it can offer N equations:

$$R_1 + \frac{1}{\frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_N}} = R_{1T}$$

$$R_2 + \frac{1}{\frac{1}{R_1} + \frac{1}{R_3} + \cdots + \frac{1}{R_N}} = R_{2T}$$

.

.

$$R_N + \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_{(N-1)}}} = R_{NT}$$

Where: **R1、R2、……R_N** are grounding resistances of the N sets grounding bodies.

R_{1T}、R_{2T}、……R_{NT} are the resistances which measured in the different grounding branches by the meter.

It is nonlinear equations with **N** unknown numbers and **N** equations.

In principle, in addition to ignoring the mutual resistance, this method cannot ignore the measurement error caused by **R_0**.

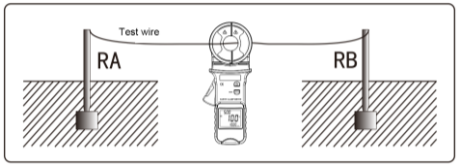
However, users need to pay attention: In your grounding system, there are several grounding bodies connected to each other, and you must measure the same number of test values, not more or less.

8.3. Single-Point Grounding System

From the measuring principle, **UT271** series meter can only measure the loop resistance, and the single-point grounding cannot measured. However, users will be able to use a test wire and nearly earth electrode of the grounding system to artificially create a loop for testing. The following presented two kinds of methods for the single-point grounding measurement by use of the Meter. These two methods can be applied to the occasions beyond the reach of the traditional voltage-current testing methods.

8.3.1. Two-Point Method

As shown below figure, in the vicinity of the measured grounding body RA, look for an independent better grounding body RB (for example, nearby water pipe, fire hydrant or a building). RA and RB connect with a single test wire.



As the resistance value measured by the meter is the value of the series resistance from the test wire and two grounding resistances.

RT=RA + RB + RL

And: **RT** is the resistance value measured by the Meter

RL is the resistance value of the test wire.

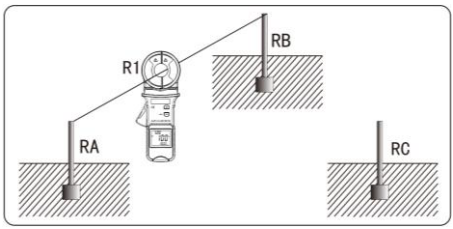
Meter can measure out the resistance value **RL** by connecting the test wires with both ends.

So, if the measurement value of the meter is smaller than the grounding resistance allowable value, then the two grounding bodies are qualified for grounding resistance.

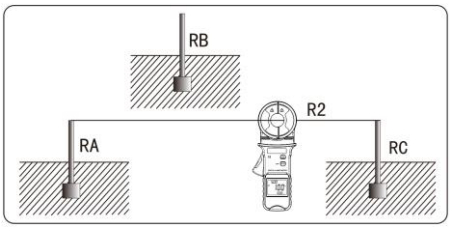
8.3.2. Three-Point Method

As shown below figure, in the vicinity of the measured grounding body RA, look for two independent grounding bodies RB and RC.

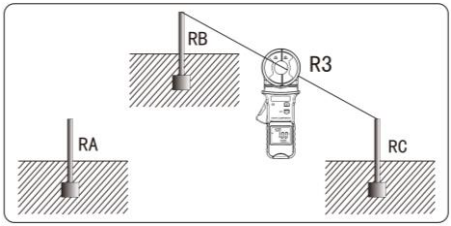
First step, connect RA and RB with a test wire, use the meter to get the first data R1.



Second step, connect **RC** and **RA** , as shown below figure, clamp and test with the meter to get the second data **R2**.



Third step, connect **RB** and **RC**, as shown below figure, clamp and test with the meter to get the third data **R3**.



In the above three steps, the measured data in each step is the series value of the two grounding resistance. In this way, we can easily calculate each grounding resistance value:

From:R1=RA+RB; R2=RC+RA;R3=RB+RC

We get:RA=(R1+R2-R3)/2

This is the grounding resistance value of the grounding body **RA**. To facilitate the memory of the above formula, these three grounding bodies can be viewed as a triangle; then the measured resistance is equivalent to the value of the resistance values of the adjacent edges plus or minus resistance value of the opposite sides, and divided by 2.

As the reference points, the grounding resistance values of the other two grounding bodies are:

RB=R1-RA RC=R2-RA

9. Accessories

Clamp Grounding Tester	1 PCS
Test Ring 1Ω and 10 Ω	1 PCS
Alkaline dry battery (LR6 1.5V)	4 PCS
Color Box	1 PCS
User's Manual	1 SET
Warranty card/certificate	1PCS

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