SNDWAY

深达威® 里氏硬度计

用户手册

User Manual

SW-6210GT

中文

目 录

English

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产品执行标准：JB/T 9378-2001 GB/T 17394.4-2014

用户须知

初次使用仪器前，请先仔细阅读用户须知

一、不要用任何方式自行打开或修理仪器，严禁非法改装仪器。请妥善保管仪器，不要放在儿童可以接触到的地方，避免无关人员的使用。

二、仪器电磁辐射可能对其他设备和装置造成干扰，请不要在飞机或医疗设备附近使用本仪器，不要在易燃、易爆的环境中使用仪器。

三、仪器更换的废旧电池和报废的仪器不可与生活垃圾一同处理，请按国家或者当地的相关法律规定处理废旧电池和报废仪器。

四、仪器出现任何的质量问题，或对使用仪器有任何疑问时请及时联系当地经销商或深达威仪器厂家，我们将第一时间为您解决。

五、超过保修期的本公司产品出现故障，可以交由本公司维修产品，按公司规定收取维修费用。

六、凡因用户自行拆装本公司产品、因运输、保管不当或未按产品说明书正确操作造成产品损坏，以及私自涂改保修卡，无购货凭证，本公司均不负责予以保修。

装箱清单

	序号	名称	数量	备注
标准配置	1	主机	1台	
	2	D型冲击装置	1个	
	3	尼龙刷A	1个	
	4	小支承环	1个	
	5	说明书	1份	
	6	布包盒/仪器箱	1个	旗舰款用仪器箱
	7	保修卡	1份	
	8	数据线	1根	
	9	硬度块	1块	旗舰款带硬度块
选择配置	10	尼龙刷B		G型冲击装置时使用
	11	异型冲击装置和支承环		见附表3和附表4
	12	金属里氏硬度试验方法	1本	GB/T 17394.4-2014

1. 概述

1.1 产品特点

- 2.4 寸彩屏
- 中文 / 英文显示界面
- 内置 2000mAh 锂电
- 800 笔存储数据公差限测量
- DC5V 1A 充电 TYPE-C 接口
- 支持多种硬度单位转换 (HL、HRB、HRC、HB、HV、HS、HRA)

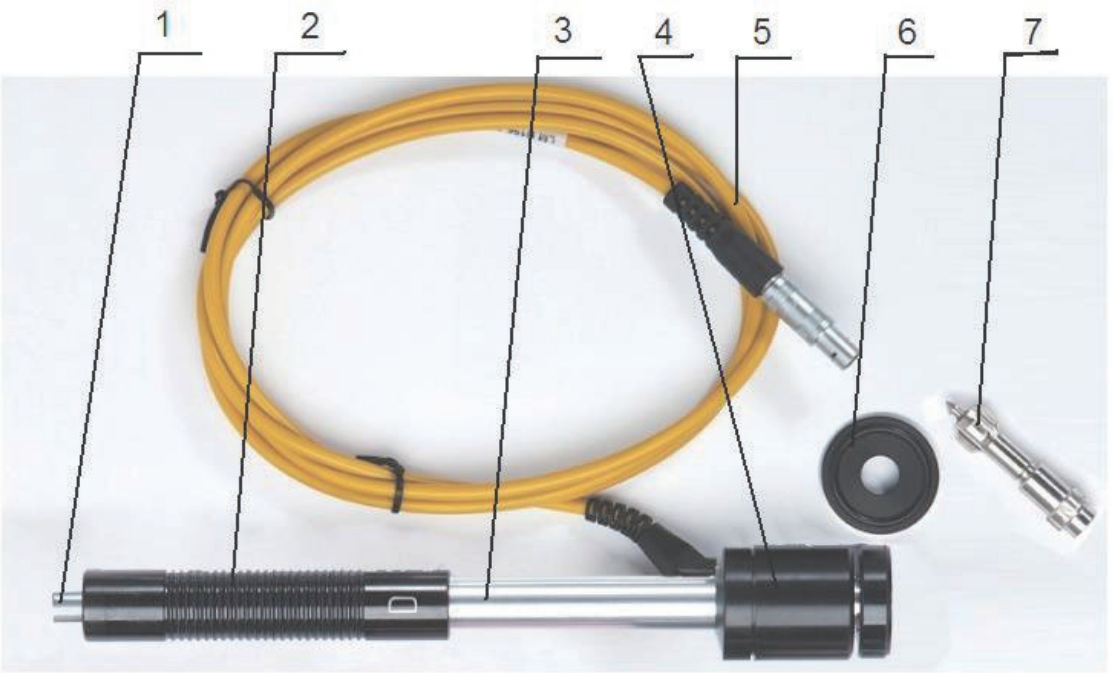
1.2 主要用途

- 重型工件或大型工件大范围内多处测量部位的快速检验;
- 轴承及其它零件;
- 热处理工件的质量控制;
- 机床导轨，汽车底盘的硬度检测;
- 已安装的机械或永久性组装部件;
- 模具型腔等试验空间很狭小的工件;
- 压力容器、汽轮发电机组及其设备的失效分析;
- 要求对测试结果有正规的原始记录;
- 金属材料仓库的材料区分。

2.结构特征与工作原理

2.1 主机

2.2 D型冲击装置



1 释放按钮　2 加载套　3 导管　4 线圈部件
5 导线　6 支承环　7冲击体

2.3 异型冲击装置

2.4 工作原理

用规定质量的冲击体在弹力作用下，以一定速度冲击试样表面，用冲头在距试样表面1mm处的回弹速度与冲击速度的比值计算硬度值。计算公式如下:

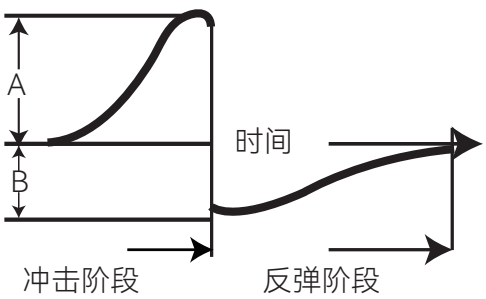
$$HL=1000 * VB / VA$$

式中：HL——里氏硬度值

VB——冲击体回弹速度

VA——冲击体冲击速度

冲击装置输出信号见右示意图:



3.产品规格参数

● 示值误差和示值重复性

序号	冲击装置类型	标准里氏硬度块硬度值	示值误差	示值重复性
1	D	760±30HLD 530±40HLD	±6 HLD ±10 HLD	6 HLD 10 HLD
2	DC	760±30HLDC 530±40HLDC	±6 HLDC ±10 HLDC	6 HLD 10 HLD
3	DL	878±30HLDL 736±40HLDL	±12 HLDL	12 HLDL
4	D+15	766±30HLD+15 544±40HLD+15	±12 HLD+15	12 HLD+15
5	G	590±40HLG 500±40HLG	±12 HLG	12 HLG
6	E	725±30HLE 508±40HLE	±12 HLE	12 HLE
7	C	822±30HLC 590±40HLC	±12 HLC	12 HLC

● 产品规格性能

显示屏幕	2.4寸彩屏
支持语言	中文/英文
冲击装置	标准D型
测量范围	170~960HLD
示值误差	±6HL @760HLD，±10HL @530HLD
标准硬度块	选配
测量方向	支持垂直向下、斜下、水平、斜上、垂直向上
硬度测量材料	钢和铸钢、合金工具钢、不锈钢、灰铸铁、球墨铸铁、铸铝合金、铜锌合金(黄铜)、铜锡合金(青铜)、纯铜、锻钢
强度测量材料	低碳钢、高碳钢、铬钢、铬钒钢、铬镍钢、铬钼钢、铬镍钼钢、铬锰硅钢、超高强度钢、不锈钢
硬度制式	里氏(HL)、布氏(HB)、洛氏B(HRB)、洛氏C(HRC)、洛氏A(HRA)、维氏(HV)、肖氏(HS)
存储容量	800组(冲击次数32~1)
数据导出	通过USB连接电脑导出
电池	内置3.7V 2000mAh锂电池
充电规格	DC 5V/1A Type-C USB接口
充电时长	约2.5小时
满电工作时长	约12小时
工作环境	周围环境无强烈振动、无强烈磁场、无腐蚀性介质及严重粉尘
工作温湿度	0℃ ~ 40℃，10%RH~80%RH
存储温湿度	-10℃ ~ + 50℃，10%RH~70%RH
外形尺寸	150x65x30mm

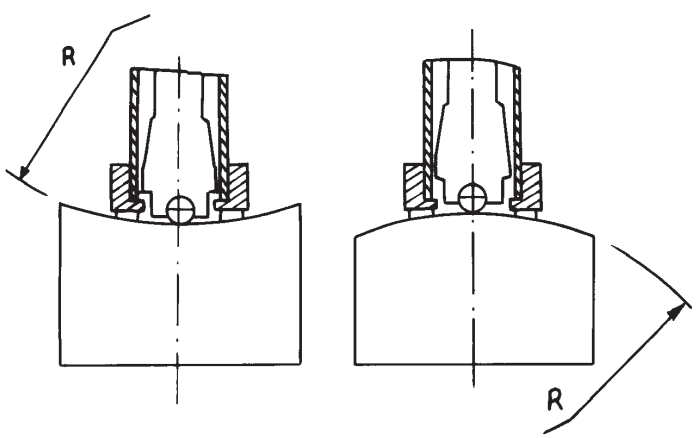
4.仪器使用前的准备和检查

4.1 使用前的准备

新购仪器请参照仪器配置的内容核对仪器及附件，如有不符或者仪器损坏请及时与厂家联系。

(1) 试样表面的状况应符合附表3中的有关要求:

- 试样表面温度不能过热，应该小于120℃;
- 试样表面粗糙度不能过大，否则会引起测量误差。试样的被测表面必须露出金属光泽，并且平整、光滑、不得有油污;
- 试样重量的要求：对重量大于5kg的重型试样，不需要支承;重量在2-5kg的试件有悬伸部分的试件及薄壁试件在测试时应用物体支撑，以避免冲击力引起试件变形、变曲和移动。对中型试样，必须置于平坦、坚固的平面上，试样必须绝对平稳置放，不得有任何晃动;
- 曲面试样：试样的试验面最好是平面。当被测表面曲率半径R小于30mm（D、DC、D+15、C、E、DL型冲击装置）和小小于50mm（G型冲击装置）的试样在测试时应使用小支承环或异型支承环;



- 试样应有足够的厚度，试样最小厚度应符合附表3规定;
- 对于具有表面硬化层的试样，硬化层深度应符合附表3的规定;
- 耦合：对轻型试样，必须与坚固的支承体紧密耦合，两耦合表面必须平整、光滑、耦合剂用量不要太多，测试方向必须垂直于耦合平面；当试样为大面积板材、长杆、弯曲件时，即使重量、厚度较大仍可能引起试件变形和失稳，导致测试值不准，故应在测试点的背面加固或支承;
- 试样本身磁性应小于30高斯;

(2) 仪器系统设置:参考第24页<6.7系统设置>

(3) 测量条件设置:参考第19页<6.5测量条件设置>

4.2 测量方法

测量前可先使用随机硬度块对仪器进行检验,其示值误差及重复性应不大于图表2的规定。

注 意:

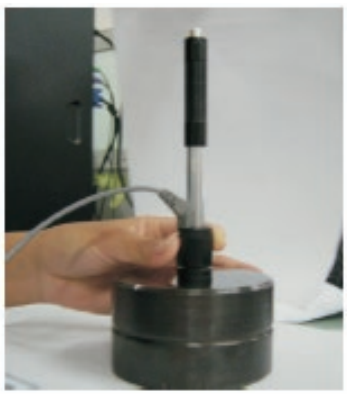
随机硬度块的数值是用标定过的里氏硬度计，在其上垂直向下测定 5 次，取其算术平均值作为随机硬度块的硬度值。如该值超标，可以使用用户校准功能进行校准。

(1)启动

- 将冲击装置插头插入位于仪器顶部的冲击装置插口；
- 长按 

键开机，仪器进入测量状态。

(2)加载


- 向下推动加载套锁住冲击体；对于DC型冲击装置，则可将加载杆吸于试验表面，将DC型冲击装置插入加载杆，直到停止位置为止，此时就完成了加载。

(3)定位

将冲击装置支承环按选定的测量方向紧压在试样表面上，冲击方向应与试验面垂直。

(4)测量

- 按动冲击装置上部的释放按钮，进行测量。此时要求试样、冲击装置、操作者均稳定，并且作用力方向应通过冲击装置轴线；
- 试样的每个测量部位一般进行五次试验。数据分散不应超过平均值的±15HL；
- 任意两压痕之间距离或任一压痕中心距试样边缘距离应符合图表3规定；
- 对于特定材料，将里氏硬度值较准确地换算为其它硬度值，必须做对比试验以得到相应换算关系。方法是：用检定合格的里氏硬度计和相应的硬度计分别在同一试样上进行试验，对于每一个硬度值，在三个以上需要换算的硬度压痕周围均匀分布地各测定五点里氏硬度值，用里氏硬度平均值和相应硬度平均值分别作为对应值，做出硬度对比曲线。对比曲线至少应包括三组对应的数据。

冲击装置类型	两压痕中心间距离	压痕中心距试样边缘距离
	不小于（mm）	不小于（mm）
D、DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

(5)读取测量值

- 用多个有效试验点的平均值作为一个里氏硬度试验数据。
- 在里氏硬度符号HL前示出硬度数值，不同冲击装置类型测得的HL值不同。

5.特别提示

- 仪器目前只支持D型冲击装置，请不要使用D型以外的冲击装置;
- 正常情况下，在未达到设定的冲击次数时，不能存储当前测量值;
- 当设定为【强度】测量时，将不能设置为硬度制，光标会从【硬度制】上跳过;
- 不是所有材料都可以转换成所有硬度制，更改材料后硬度制会自动恢复为里氏HL。所以，设置测量条件时要先设置【材料】，再设置【硬度制】。

6.仪器操作详解

6.1 仪器开、关机

开机：长按 返回 键开机；

关机：长按 返回 键关机；

自动关机：仪器在5分钟内无任何操作，系统会自动关机；

强制关机：长按 返回 键10秒以上，强制关机。

6.2 仪器概述

开机后会自动进入主显示界面，如下图所示：

(1)主显示界面说明

时间显示：显示当前时间

电池电量：显示剩余电量。

冲击方向：当前冲击方向。

平 均 值：显示当前平均值。

硬度制式：当前测量值的硬度制。

测 量 值：当前单次测量值。

材　料：当前设定的材料。

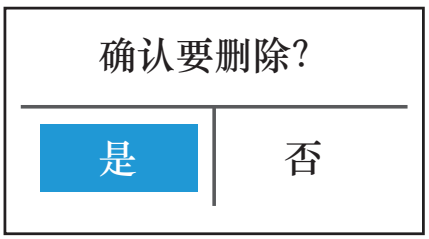
冲击次数：测量时显示已经完成的冲击次数，浏览单次测量值时显示单次测量值的对应次数。

(2) 测量操作

在主界面下可以进行测量，每完成一次测量，显示本次测量值，冲击次数增1。如果超出公差限，仪器短“滴”一声，达到设定的冲击次数后，仪器“滴滴”响两声。

(3) 按键操作

- 确认 存储 长按该键可以存储当前组数据，仅在达到设定的冲击次数后才有效，并且只能保存1次。
- ▶ 删除 短按该键可以删除最近一次的单次测量值，但需在如下显示界面确认：



1> 按 ◀ 单位 ▶ 删除 键将光标移到【是】，再短按 确认 存储 键可以确认删除最近一次的单次测量值。

2> 按 ◀ 单位 ▶ 删除 键将光标移到【否】，再短按 确认 存储 键可以取消删除操作。

3> 不管光标位置，按 返回 键也可以取消删除操作。

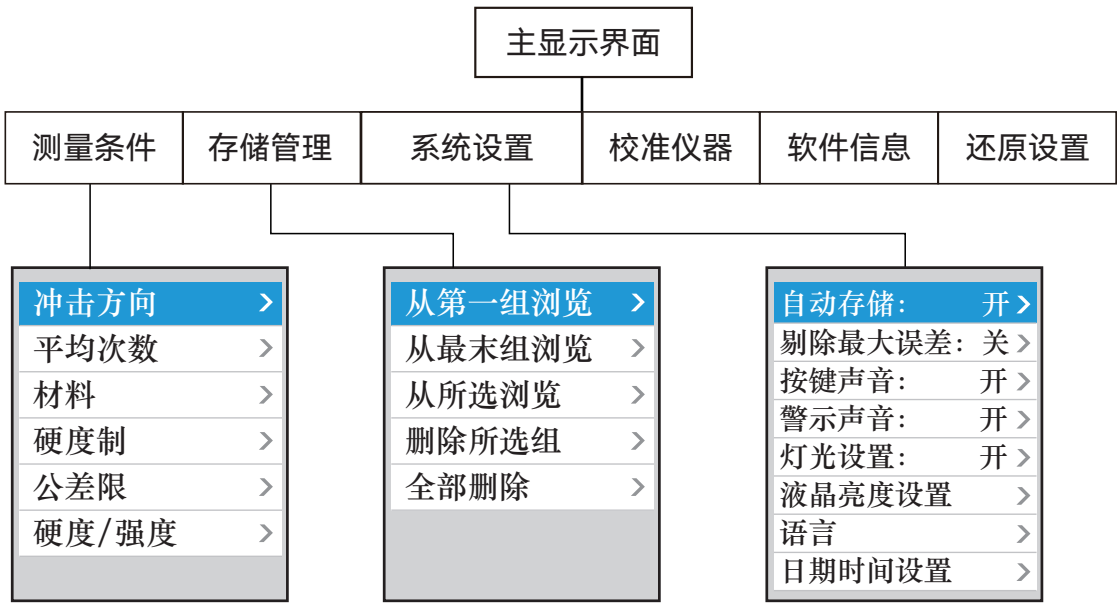
- 浏览 菜单 在主界面下，长按该键可以进入主菜单。
- ▲ 方向 短按该键可以改变冲击方向;
- ◀ 单位 短按该键可以改变硬度制，每按一次会在当前材料和冲击装置所有可以转换的各种硬度制之间循环;
- 材料 ▼ 短按该键可以改变材料，每按一次会在各材料之间循环，如果当前设置为硬度测量，每按一次会将硬度制改为里氏，所以测量时要先设材料，再设硬度制。

注 意:

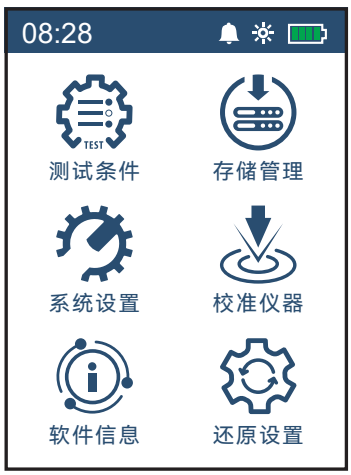
所谓“转换”是指对于某种材料，依据里氏硬度和其它硬度，在大量试验的基础上，建立的对应关系。根据这种关系，硬度计会自动将测量的里氏硬度值经过计算，换算成其它硬度制的硬度值。

6.3 菜单结构图

仪器参数的设置和附加功能均可通过菜单操作实现。



6.4 菜单操作



在主界面长按 浏览菜单 键，进入菜单。仪器总共有六个菜单选项：测量条件、存储管理、系统设置、校准仪器、软件信息、还原设置。具体操作如下：

1>按 ▲方向 向上选择选项；　2>按 材料▼ 向下选择选项；

3>按 ◀单位 向左选择选项；　4>按 ▶删除 向右选择选项；

5>按 确认存储 进入选项；　6>按 返回 返回主界面。

6.5 测量条件设置

进入菜单，选中测量条件 

，短按 确认存储 进入选项，参考<6.4菜单操作>。测量条件包括：冲击方向、平均次数、材料、硬度制、公差限、硬度/强度。

操作如下：

1>按 ▲方向 向上选择选项；

2>按 材料▼ 向下选择选项；

3>按 确认存储 进入该选项；

4>按 返回 返回主菜单。

注 意：

当【硬度 / 强度】设为【强度】时，不能再选择硬度制，所以，移动光标时，光标会从【硬度制】选项跳过。

(1) 冲击方向设置

1>按 ◀单位 删除▶ 键移动光标至欲设定的冲击方向；

2>按 确认存储 键完成更改；

3>按 返回 键取消更改。

(2) 平均次数设置

可以在1 ~ 32次范围内修改平均次数。

1>按 ▲方向 材料▼ 键修改数值大小;

2>按 ◀单位 删除▶ 键选择要修改的数字;

3>按 确认存储 键完成更改;

4>按 返回 键取消更改。

(3) 材料设置

【硬度/强度】设为硬度时会显示以下可选材料:

钢和铸钢、合金工具钢、不锈钢、灰铸铁、球墨铸铁、铸铝合金、铜锌合金、铜锡合金、纯铜、锻钢

设为强度时显示以下可选材料:

低碳钢、高碳钢、铬钢、铬钒钢、铬镍钢、铬钼钢、铬镍钼钢、铬锰硅钢、超高强度钢、不锈钢。

1>按 ▲方向 向上选择材料

2>按 材料▼ 向下选择材料

3>按 ◀单位 向左选择材料

4>按 删除▶ 向右选择材料

5>按 确认存储 完成更改

6>按 返回 取消更改

注 意:

1、更改材料设置后，硬度制设置自动恢复为HL。

2、选择硬度制前先选择材料。

(4) 硬度制设置

1>按 ◀单位 删除▶ 键移动光标到要设定的硬度制;

2>按 确认存储 键完成更改;

3>按 返回 键取消更改。

注 意:

1、这里仅显示当前选定的冲击装置和材料可以转换的硬度制，不能转换的硬度制不显示。

2、选择硬度制前请先选择材料。

3、更改材料设置后，硬度制设置自动恢复为 HL。

(5) 公差限设置

1>按 ▲方向 材料▼ 修改数值大小;

2>按 ◀单位 删除▶ 选择要修改的数字;

3>按 确认存储 完成更改;

4>按 返回 取消更改。

注 意:

1、如果设置超出测量范围，会提醒您重新设置。

2、所设下限大于上限则恢复为默认值，默认值下限170HL，上限960HL。

(6) 硬度/强度设置

1>按 单位 删除 键选择硬度模式还是强度模式;

2>按 确认存储 键完成更改;

3>按 返回 键取消更改。

6.6 存储管理

进入菜单，选中存储管理 ，短按 确认存储 键进入选项，参考<6.4菜单操作>。

存储管理菜单操作如下:

1>按 ▲方向 向上选择选项;

2>按 材料▼ 向下选择选项;

3>按 确认存储 进入该选项;

4>按 返回 进回主菜单。

(1) 从第一组浏览/从最末组浏览

- 从第一组浏览

  从第一组开始显示存储器数据，仪器将默认从第一组数据所在的页开始显示记录列表;

- 从最末组浏览

  从最后一组开始显示存储器数据，仪器将默认从最后一组数据所在的页开始显示记录列表。

具体数据浏览，参考第23页（5）数据浏览

(2) 从所选组浏览

1>按 ▲方向 材料▼ 键修改数值大小;

2>按 ◀单位 删除▶ 键选择要修改的数字;

3>按 确认 存储 键从输入的起始组开始显示存储器数据;

4>按 返回 键取消操作。

(3) 删除所选组

1>按 ▲方向 材料▼ 键修改数值大小;

2>按 ◀单位 删除▶ 键选择要修改的数字;

3>按 确认存储 键删除选定组;

4>按 返回 键取消操作。

注 意:

1、输入的数据不能超过实际存在的组。

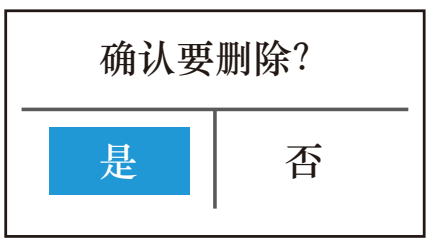
2、起始组不能大于末组。

3、删除后 , 存储数据组序号将重新排列。

4、当删除数据 , 特别是删除小组号数据时 , 因为要对后面的数据进行搬移 , 可能需要最多 30 秒左右的时间，这时请不要关机，以免造成数据混乱。

(4) 全部删除

● 全部删除菜单：将删除存储器的全部数据。



1>按 确认存储 键弹出【确定要删除?】提示框，按 ◀单位 删除▶ 键选择是，按 确认存储 键删除数据。

2>按 ◀单位 删除▶ 键选择否，按 确认存储 键可以取消删除操作。

3>在提示框页面，按 返回 键也可以取消删除操作。

(5) 数据浏览

● 数据菜单：页面显示1组或多组带编号的数据

1>按 ▲方向 材料▼ 键，选择不同编号的数据组；

2>按 确认存储 键，进入该数据组数据浏览页面，浏览数据记录；

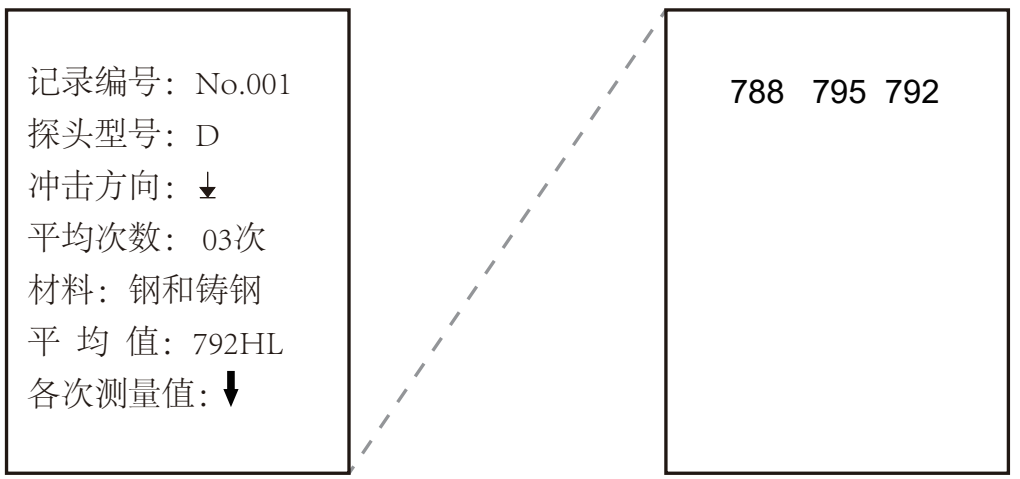
3>按 返回 键退出浏览。

No.001	800HL
No.002	827HL
No.003	878HL
No.004	821HL
No.005	880HL
No.006	876HL
No.007	819HL
No.008	863HL
No.009	850HL
No.010	912HL
No.011	863HL
No.012	850HL
No.013	912HL

● 数据浏览页：页面显示记录的测试数据

1>按 ▲方向 材料▼ 键，上下翻页浏览更多数据：平均值、测量条件或单次测值；

2>按 返回 键，返回数据选择页面。



(6) 传输数据

【传输数据】将存储器数据以文本方式从通讯口送出。
(只有在连接电脑时有效)

6.7 系统设置

系统设置菜单：选中系统设置  ，短按 确认存储 键进入选项，参考<6.4菜单操作>。系统设置菜单操作如下：

1> 按 ▲方向 键向上选择选项；

2> 按 材料▼ 键向下选择选项；

3> 自动存储、剔除最大误差、按键声音、警示声音、灯光设置直接通过 ◀单位 ▶删除 键设置，液晶亮度设置、语言、日期时间设置，按 确认存储 键进入设置；

4> 按 返回 键返回上一页面。

【剔除粗大误差】：原理是依据3σ准则，剔除分布在（μ-3σ, μ+3σ)之外的数值，其中μ为平均值，σ为标准差。

举例：本次测量16次，分别为x1，x2，x3，....，x16。

μ=(x1+x2+...+x16)/16

$$\sigma = \sqrt{\frac{1}{16}\sum_{i=1}^{16}(x_i - \mu)^2}$$

其中 xi 代表第 i 次数值。若 $|x_i-\mu| > 3\sigma$，则认为 xi 为最大误差，将剔除此次值。

【按键声音】：设为【开】时，每次按键时仪器都会“滴”一声。
【警示声音】：设为【开】时，在测量值超出公差限、删除数据等情况下仪器会“滴”一声。
【灯光设置】：设置为【开】时，在测量值超出公差限时，亮红灯，正常时，亮绿灯。
【液晶亮度设置】：

1> 按 ▲方向 键增加亮度;
2> 按 材料▼ 键降低亮度;
3> 按 确认 存储 键完成更改;
4> 按 返回 键取消更改。

【语言设置】：通过 ◀ 单位 ▶ 删除 键选择语言，按 确认 存储 键保存，按 返回 键退出。

【时间日期设置】：当前时间日期显示在屏幕上，日期格式为“年 / 月/ 日”，时间格式为“时 / 分 / 秒”。

1> 按 ▲方向 材料▼ 键修改数值大小;

2> 按 ◀单位 删除▶ 键选择要修改的时间日期;

3> 按 确认存储 键完成更改;

4> 按 返回 键取消更改。

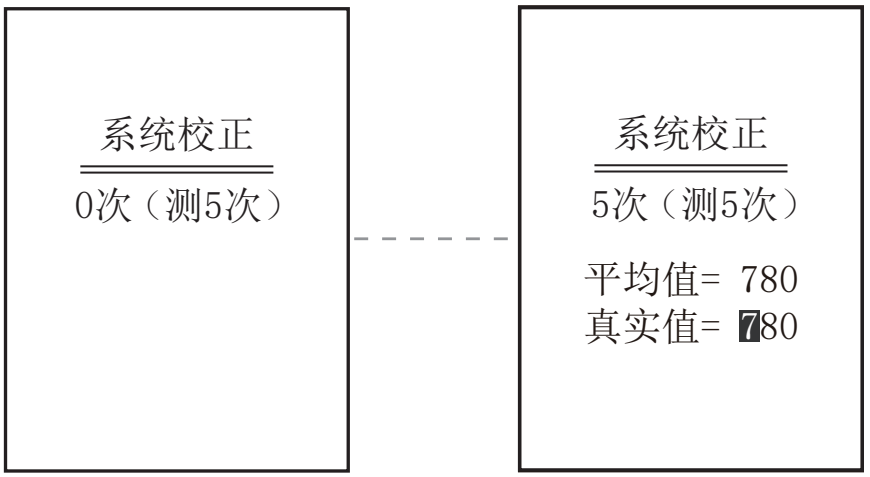
6.8 软件信息

进入菜单，选中软件信息 ，短按 确认存储 键进入选项，参考<6.4菜单操作>。

该界面显示有关仪器和嵌入软件的信息。内容随着软件升级而改变，此处不再更新。

6.9 校准仪器

进入菜单，选中校准仪器  ，短按 确认存储 键进入选项，参考<6.4菜单操作>。



校准需要用户测量5次，用5次的平均值作为校准值，用户每次测量相距3mm左右。测量完成后会显示平均值和真实值。

1>按 ▲方向 材料▼ 键修改数值大小;

2>按 ◀单位 ▶删除 键选择要修改的数字;

3>按 确认存储 键完成校准，再短按 返回 返回菜单;

4>按 返回 键取消校准操作。

6.10 恢复出厂设置

进入菜单，选中还原设置 ，短按 确认存储 键进入选项，参考<6.4菜单操作>。

1）按 单位 删除 选择是，或否；

2）按 确认存储 选择是，则恢复出厂设置，选择否，返回设置菜单；

3）不管光标位置，按 返回 也可以取消操作，直接返回设置菜单。

6.11 自动关机

- 仪器具有自动关机功能，以节省电池电能；如果在5分钟内既没有测量，也没有任何按键操作，仪器会自动关机；
- 当电池电压过低时，仪器会显示 ，然后自动关机；

故障分析与排除

故障现象	原因分析	排除方法
不开机	电池耗尽	及时充电
仪器无测值	传感器线缆故障	更换传感器线缆

保养和维修

1.冲击装置维护

- 在使用 1000-2000 次后，要用尼龙刷清理冲击装置的导管及冲击体，清洁导管时先将支承环旋下，再将冲击体取出，将尼龙刷以逆时针方向旋入管内，到底后拉出，如此反复 5 次，再将冲击体及支承环装上；
- 使用完毕后，应将冲击体释放；
- 冲击装置内严禁使用各种润滑剂。

2.仪器维修程序

- 当用标准洛氏硬度块进行检定时，误差均大于 2HRC 时，可能是球头磨损失效，应考虑更换球头或冲击体；
- 当硬度计出现其它不正常现象时，请用户不要拆卸或调节任何固定装配之零部件，填妥保修卡后，交由我公司维修部门，执行保修条例。

3.锂电池充电及保养

- 产品内置3.7V 2000mAh 锂电池供电，不可拆卸。当产品不能开机或显示电量为空格时请及时充电。请使用DC 5V 1A的充电适配器对产品充电，充电接口为Type-C。
- 充电时，电池符号滚动显示。充满电后，电池符号显示为 满格电量。

注 意:

长时间不使用时，先把产品充满电，并每半年再充电一次，以免电池损坏。

4.贮存条件、运输及注意事项

- 贮存时应远离振动、强烈磁场、腐蚀性介质、潮湿、尘埃，应在常温下贮存;
- 运输时在保证原包装的状态下，可在三级公路条件下进行。

附表1

材料	硬度制	冲击装置					
		D/DC	D+15	C	G	E	DL
钢和铸钢	HRC	17.9～68.5	19.3～67.9	20.0～69.5		22.4～70.7	20.6～68.2
	HRB	59.6～99.6			47.7～99.9		37.0～99.9
	HRA	59.1～85.8				61.7～88.0	
	HB	127～651	80～638	80～683	90～646	83～663	81～646
	HV	83～976	80～937	80～996		84～1042	80～950
	HS	32.2～99.5	33.3～99.3	31.8～102.1		35.8～102.6	30.6～96.8
锻钢	HB	143～650					
合金工具钢	HRC	20.4～67.1	19.8～68.2	20.7～68.2		22.6～70.2	
	HV	80～898	80～935	100～941		82～1009	
不锈钢	HRB	46.5～101.7					
	HB	85～655					
	HV	85～802					
灰铸铁	HB	93～334			92～326		
球墨铸铁	HB	131～387			127～364		
铸铝合金	HB	19～164		23～210	32～168		
	HRB	23.8～84.6		22.7～85.0	23.8～85.5		
铜锌合金（黄铜）	HB	40～173					
	HRB	13.5～95.3					
铜锡合金（青铜）	HB	60～290					
纯铜	HB	45～315					

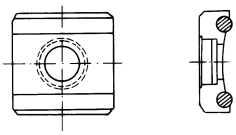
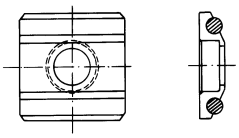
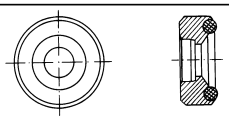
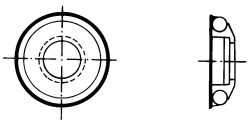
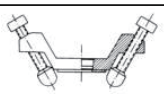
附表2

序号	材料	里氏硬度 HLD	强度σb(MPa)
1	C 低碳钢	350～522	374～780
2	C 高碳钢	500～710	737～1670
3	Cr 铬钢	500～730	707～1829
4	CrV 铬钒钢	500～750	704～1980
5	CrNi铬镍钢	500～750	763～2007
6	CrMo 铬钼钢	500～738	721～1875
7	CrNiMo 铬镍钼钢	540～738	844～1933
8	CrMnSi 铬锰硅钢	500～750	755～1993
9	SSST 超高强度钢	630～800	1180～2652
10	SST 不锈钢	500～710	703～1676

附表3

异型冲击装置		DC(D)/DL	D+15	C	G	E
冲击能量 冲击体质量		11mJ 5.5g/7.2g	11mJ 7.8g	2.7mJ 3.0g	90mJ 20.0g	11mJ 5.5g
球头硬度: 球头直径: 球头材料:		1600HV 3mm 碳化钨	1600HV 3mm 碳化钨	1600HV 3mm 碳化钨	1600HV 5mm 碳化钨	5000HV 3mm 金刚石
冲击装置直径: 冲击装置长度: 冲击装置重量:		20mm 86(147)/ 75mm 50g	20mm 162mm 80g	20mm 141mm 75g	30mm 254mm 250g	20mm 155mm 80g
试件最大硬度		940HV	940HV	1000HV	650HB	1200HV
试件表面平均粗糙度 Ra:		1.6μm	1.6μm	0.4μm	6.3μm	1.6μm
试件最小重量: 可直接测量 需稳定支撑 需密实耦合		>5kg 2～5kg 0.05～2kg	>5kg 2～5kg 0.05～2kg	>1.5kg 0.5～1.5kg 0.02～0.5kg	>15kg 5～15kg 0.5～5kg	>5kg 2～5kg 0.05～2kg
试件最小厚度 密实耦合 硬化层最小深度		5mm ≥0.8mm	5mm ≥0.8mm	1mm ≥0.2mm	10mm ≥1.2mm	5mm ≥0.8mm
球头压痕尺寸						
硬度 300HV 时	压痕直径 压痕深度	0.54mm 24μm	0.54mm 24μm	0.38mm 12μm	1.03mm 53μm	0.54mm 24μm
硬度 600HV 时	压痕直径 压痕深度	0.54mm 17μm	0.54mm 17μm	0.32mm 8μm	0.90mm 41μm	0.54mm 17μm
硬度 800HV 时	压痕直径 压痕深度	0.35mm 10μm	0.35mm 10μm	0.35mm 7μm	-- --	0.35mm 10μm
冲击装置适用范围		**DC** 型测量孔或园柱筒内；**DL** 型测量细长窄槽或孔；D 型用于常规测量	**D**+15 型接触面细小，加长，适宜测量沟槽或凹入的表面	C 型冲击力小，对被测表面损伤很小，不破坏硬化层，适合测量小轻薄部件及表面硬化层。	**G** 型测量大厚重及表面较粗糙的铸锻件	**E** 型测量硬度极高材料

附表4

序号	型　号	异型支承环简图	备注
1	Z10-15		测外圆柱面 R10～R15
2	Z14.5-30		测外圆柱面 R14.5～R30
3	Z25-50		测外圆柱面 R25～R50
4	HZ11-13		测内圆柱面 R11～R13
5	HZ12.5-17		测内圆柱面 R12.5～R17
6	HZ16.5-30		测内圆柱面 R16.5～R30
7	K10-15		测外球面 SR10～SR15
8	K14.5-30		测外球面 SR14.5～SR30
9	HK11-13		测内球面 SR11～SR13
10	HK12.5-17		测内球面 SR12.5～SR17
11	HK16.5-30		测内球面 SR16.5～SR30
12	UN		测外圆柱面，半径可调 R10～∞

Notes for User

Before using the instrument for the first time, you are requested to read the notes for the user carefully

1. Do not open or repair the instrument by yourself in any way, and illegal modification of the instrument is strictly prohibited. Please keep the instrument properly and put it in a place beyond the reach of children, and avoid the use of it by unrelated personnel.

2. The electromagnetic radiation of the instrument may cause interference to other equipment and devices. Please do not use this instrument near aircraft or medical equipment, and do not use it in flammable and explosive environments.

3. Waste batteries and scrapped instruments after replacement of the instruments must not be disposed of together with household waste. Please dispose of waste batteries and scrapped instruments in accordance with relevant national or local laws and regulations.

4. If any quality problems with the instrument occur or if you have any questions about using the instrument, please contact your local distributor or instrument manufacturer in time, and we will solve them for you as soon as possible.

5. If our company's products fail beyond the warranty period, they can be repaired by our company and the repair fee will be charged according to the company's regulations.

6.We are not responsible for any damage of products caused by user’s disassembling our company's products, improper transportation, storage, or improper operation not in accordance with the user manual of the product, as well as unauthorized alteration of the warranty card and no purchase vouchers.

Packing List

No.	Name	QTY	Note
Standard Configuration			
1	The tester	1PC	
2	D-type impact device	1PC	
3	Nylon brush A	1PC	
4	Little support ring	1PC	
5	User manual	1PC	
6	Cloth bag/ Instrument container	1PC	Instrument container for flagship model
7	USB cable	1PC	
8	Hardness block	1PC	Flagship model with hardness block
Optional Configuration			
9	Nylon brush B		For G-type impact device
10	Special-shaped impact device & support ring		Refer to Attached Table 3&4
11	Test method for Leeb hardness of metals	1PC	GB/T 17394.4-2014

(Chart 1)

1. Overview

1.1 Product Features

- 2.4" color screen
- Chinese/English display interface
- Built-in 2000mAh lithium battery
- 800 data storage tolerance measurements
- DC5V 1A Charging, Type-C port
- Unit conversion： HL, HRB, HRC, HB, HV, HS, HRA

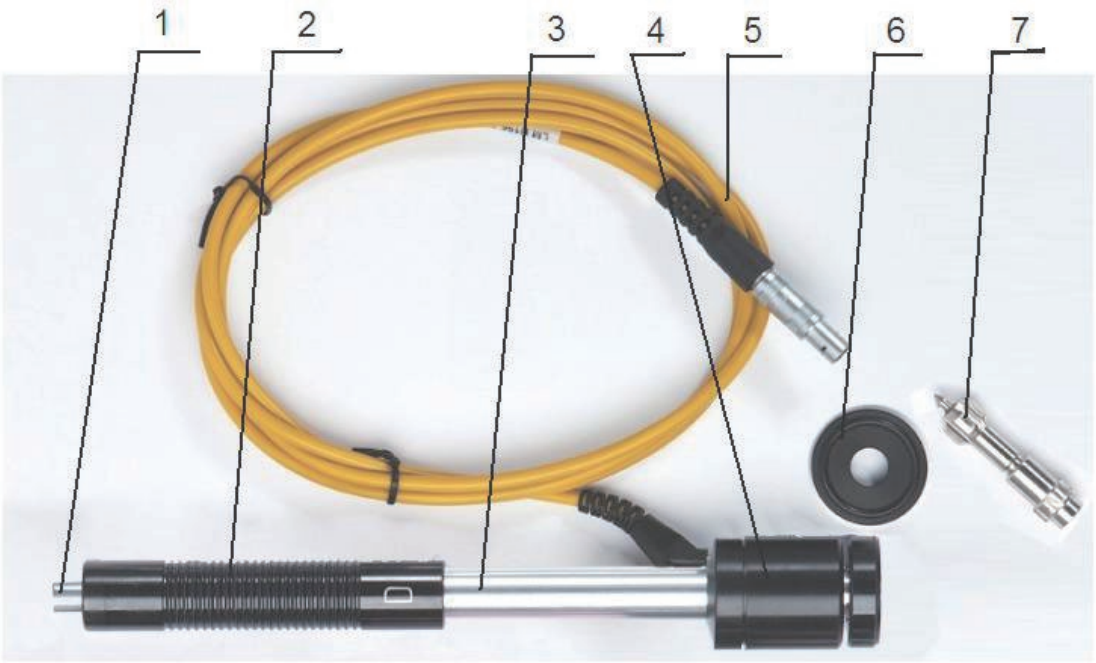
1.2 Main Application

- Quick testing on many spots of heavy and thick work-pieces on a large-scale;
- Bearings and other parts;
- Quality control of heat treated parts;
- Hardness testing on lathe guide,automotive chassis;
- Installed machinery or permanently assembled parts;
- Work-piececs with small space, like mold cavity;
- Failure analysis of pressure vessel, steamer motor and its parts;
- Request for standard original record of testing results;
- Material differentiation of metallic warehouse.

2. Structural Feature and Working Principle

2.1 The Tester

2.2 D-type Impact Device



1. Release button
2. Loading sheath
3. Conduit
4. Coil components
5. Wire
6. Support ring
7. Impact body

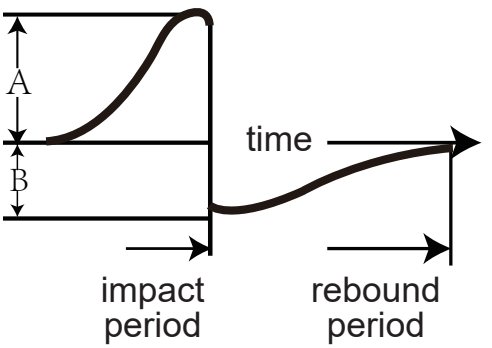
2.3 Special-shaped Impact Device

2.4 Working Principle

Under the action of elastic force, use the impact body with defined quality to impact the surface of sample with a given speed, the hardness value is the ratio of between rebound velocity in where the head had 1mm distance with the surface of sample and impact velocity. Calculation formula as follows:

$$HL=1000 * VB / VA$$

In this formula:
HL - Leeb hardness value
VB - the rebound velocity
VA - the impact velocity
The output signal refers to the demonstrating chart in right side:



3. Specifications

- **Reading error and repeatability (chart 2)**

No.	Impact Device Type	Hardness Value for Standard Leeb Hardness Block	Reading Error	Reading Repeatability
1	D	760±30 HLD 530±40 HLD	±6 HLD ±10 HLD	6 HLD 10 HLD
2	DC	760±30 HLDC 530±40 HLDC	±6 HLDC ±10 HLDC	6 HLD 10 HLD
3	DL	878±30 HLDL 736±40 HLDL	±12 HLDL	12 HLDL
4	D+15	766±30 HLD+15 544±40 HLD+15	±12 HLD+15	12 HLD+15
5	G	590±40 HLG 500±40 HLG	±12 HLG	12 HLG
6	E	725±30 HLE 508±40 HLE	±12 HLE	12 HLE
7	C	822±30 HLC 590±40 HLC	±12 HLC	12 HLC

● Technology specifications

Screen	2.4" color screen
Language	Chinese/English
Impact device	Standard type D
Measuring range	170 ~ 960HLD
Reading error	±6HL @760HLD，±10HL @530HLD
Standard hardness block	Optional
Measuring direction	Vertical down, Diagonal down, Horizontal, Diagonal up, Vertical up
Hardness measuring material	Steel and cast steel, Alloy tool steel, Stainless steel, Gray cast iron, Nodular cast iron, Cast aluminum alloy, Copper-zinc alloy (Brass), Copper-tin alloy (Bronze), Copper, Forged steel
Intensity measuring material	Low carbon steel, High carbon steel, Chromium steel, Chromium vanadium steel, Chromium nickel steel, Chromium molybdenum steel, Chromium nickel molybdenum steel, Chromium manganese silicon steel, Ultra high strength steel, Stainless steel
Hardness unit	HL, HB, HRB, HRC, HRA, HV, HS
Max storage	800 units (impact times: 30-1)
Data export	Export data via USB connection to computer
Battery	Built-in 3.7V 2000mAh Li-ion battery
Charging specification	DC 5V/1A Type-C USB port
Charging Time	About 2.5 hours
Battery Life	About 12 hours
Working environment	No strong vibration, strong magnetic field, corrosive medium and serious dust in the surrounding environment
Working temperature and humidity	0˚C~40˚C，10%RH~80%RH
Storage temperature and humidity	-10˚C~+50˚C，10%RH~70%RH
Dimension	150x65x30mm

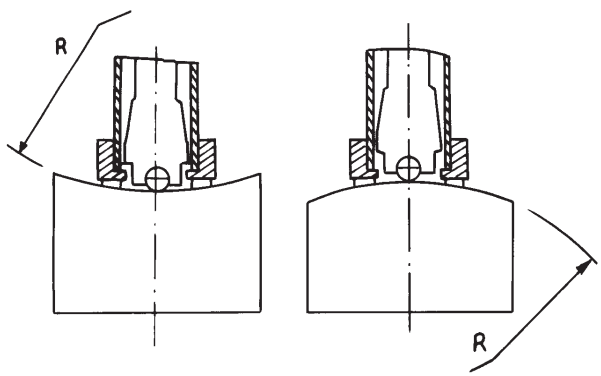
4. Preparation and Checking before Operating

4.1 Preparation Before Use

Please check the tester and accessories according to the packing list. If there is any inconsistency or damage to the tester, please contact the manufacturer in time.

(1) The surface condition of the sample should comply with the relevant requirements in attached table 3:

- The temperature on the surface of the sample should be below 120°C;
- The surface roughness of the sample should not be too large, otherwise the measurement error will be caused. The surface of the sample must have metallic luster and be flat, smooth, and no greasy dirt;
- Requirements for sample weight: heavy samples weighing more than 5kg do not need support; The test piece with the weight of 2-5kg, the test piece with the overhanging part, and the thin-wall test piece should be supported by the object during the test, so as to avoid the deformation, bending and movement of caused by the impact force. Medium sample must be placed on a flat and firm plane, and the sample must be placed smoothly without any shaking;
- Curved sample: It's better that the tested face is flat. Small or special-shaped ring is used for samples when the curvature radius of tested surface is below 30mm(type D, DC, D+15, C, E, DL impact device) and below 50mm (G-type impact device);



- The proper thickness is requested and the minimum thickness should comply with the requirements in attached table 3;
- The depth of the hardened layer of samples should comply with the requirements in attached table 3;
- Coupling: for light samples, it must be tightly coupled with the strong supporting body. The two coupling surfaces must be flat and smooth, the amount of coupling agent should not be too much, and the test direction must be perpendicular to the coupling plane. When the sample is a large area sheet material, long rod or bending parts, even if its weight and thickness is large, it may cause deformation and instability of the sample, resulting in inaccurate test value. So it should be strengthened or supported on the back of the test point;
- The sample's magnetism should be below 30 gauss.

(2) Instrument System Setting: Refer to page 57 <6.7 System Setting>

(3) Testing Condition Setting: Refer to page 50 <6.5 Testing Condition Setting>

4.2 Measuring Method

Before measurement, use random hardness blocks to test the instrument , and the reading error and repeatability should not be greater than that specified in Attached Table 2.

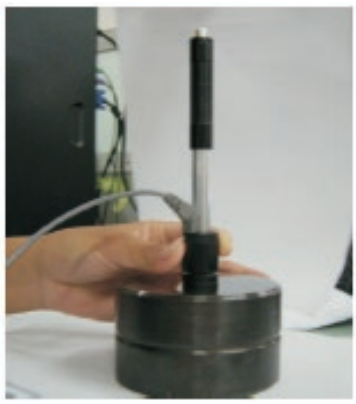
Note:

The hardness value of the random hardness block comes from the arithmetic mean value of five readings by using the calibrated tester to measure vertically and downward. Standardize it with calibration function if this mean value is out of limits.

(1) Starting

- Insert the impact device plug into the impact device socket located at the top of the instrument;
- Long Press 返回 to start the instrument, and the instrument enters the measuring state.

(2) Loading


- Push down the loading sleeve to lock the impact body. For the DC type impact device, the loading rod can be adsorbed on the surface of the sample, and the DC type impact device can be inserted into the loading rod until the stop position, then the loading is completed.

(3) Location

Press the support ring of the impact device tightly on the sample surface according to the selected measurement direction, and the impact direction should be perpendicular to the sample surface.

(4) Measuring

- Press the release button on the upper part of the impact device to measure. At this time, the sample, the impact device and the operator are required to be stable, and the direction of the force should pass through the axis of the impact device;
- Five tests are generally carried out on each measuring part of the sample. Data dispersion should not exceed +15HL of the average;
- The distance between any two indentations or the distance between the center of any indentation and the edge of the sample shall comply with the stipulations in Attached Table 3.
- To special material, comparative trial is necessary for related conversion relation which is to converse accurately Leeb hardness value into different hardness value. The method is: use the qualified Leeb hardness tester and the corresponding hardness tester to test respectively on one sample. For every single hardness value, five value are tested homogeneously around more than three hardened indentation needed to be converted. The average value of Leeb hardness and the corresponding average value of hardness were used as corresponding values respectively to make a hardness comparison curve, which should include at least three corresponding sets of data.

Impact Device Type	Distance between Two Indentation Centers	Distance between Indentation and Edge of Sample
	no less than (mm)	no less than (mm)
D,DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

(Chart 3)

(5) Test Value

- The average value of multiple valid test points is used as one Leeb hardness test data.
- Hardness values are shown in front of the Leeb hardness symbol HL, and HL values are different for different impact device types.

5. Special Tips

- Currently, this device only support D type impact device, please do not use other impact devices;
- In general, the current reading can not be saved if the set impact times are not reached;
- When [Intensity] pattern is set, hardness pattern can not be set, and the cursor will automatically skips the hardness pattern;
- Not all materials can be converted to hardness unit. If material is changed, the hardness unit will converse into Leeb HL automatically. So when setting measuring condition, user should set the [Material] fistly, then set [Hardness unit].

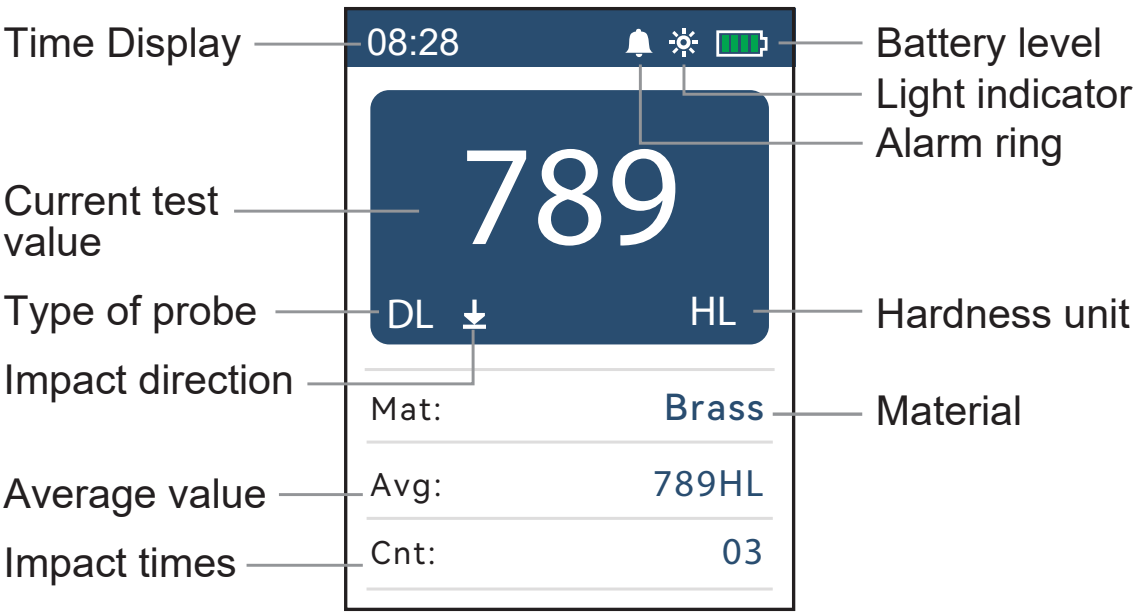
6. Detailed Operation Guide

6.1 Power on/off

Power on: Long press 返回 to start the device;
Power off: Long press 返回 to turn the device off;
Auto-off: The device will automatically shut down without operations within 5mins.
Forced shutdown: Long press 返回 for more than 10s to shut down it.

6.2 Instrument Description

The device will automatically enter the main display interface after starting, as shown in the figure below:



(1) Description of Main Display Interface

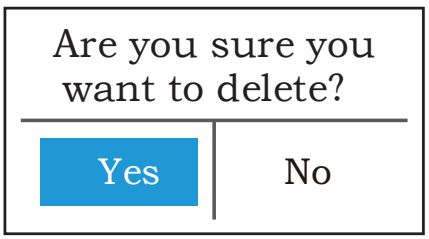
Time Display: Display the current time.
Battery level: Display the remaining power.
Impact direction: Current impact direction.
Average value: Current avarage value.
Hardness unit: Hardness unit of current test value.
Test value: Current single test value.
Material: Current set material.
Impact times: Displays the impact times that have been completed. When viewing a single measurement value, the screen displays the corresponding times of the single measurement.

(2) Operation of Measurement

Measurement can be carried out under the main interface. After each measurement is completed, the measured value will be displayed, and the number of impact will be increased by 1. If the tolerance limit is exceeded, the instrument will "beep" once, after reaching the set impact times, the instrument will "beep" twice.

(3) Operation of Keys

- Long press 确认 存储 to store the current data, which can only be saved once. It is valid only after the set impact times is reached.
- Press ▶ 删除 to delete the last single measurement value, but confirm it in the following display interface:



1> Press 单位 删除 to move the cursor to [Yes] and then short press 确认 存储 to confirm deletion of the last single measurement value.

2> Press 单位 删除 to move the cursor to [No] and then short press 确认 存储 to cancel the deletion.

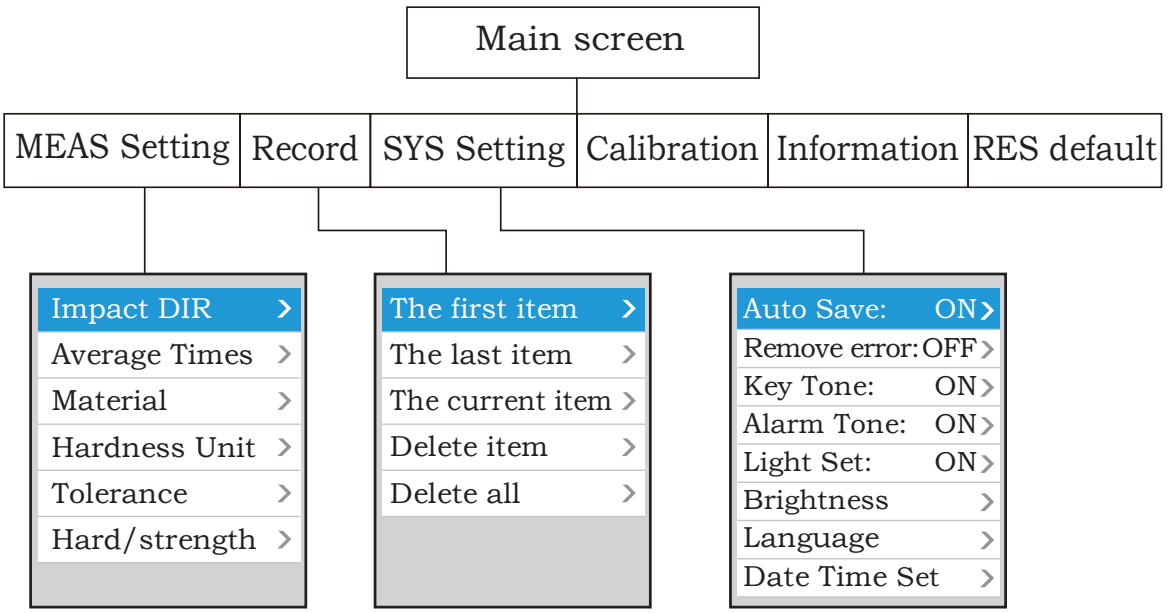
3> Regardless of the cursor position, pressing 返回 can cancel the deletion, too.

- In the main screen, long press 浏览 菜单 to enter the main menu;
- Short press ▲方向 to change the impact direction;
- Short press 单位 can change the hardness unit, it can converse in a variety of hardness units circularly;
- Press 材料▼ to change the material, which can be circularly selected from a variety of alternative materials. If the current setting is hardness measurement, the hardness unit will be changed to HL every time user press 材料▼ . So user should set the material first and then the hardness unit when measuring.

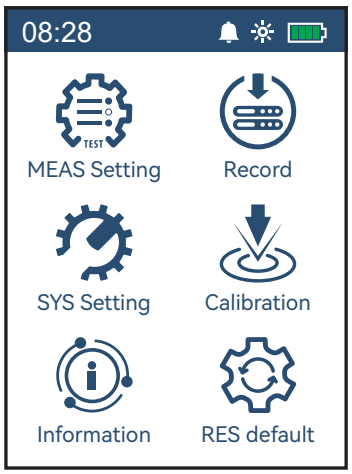
Note:
The so-called "transformation" refers to the corresponding relationship established for a material according to the Richter hardness and other hardness on the basis of a large number of tests. Based on this relationship, the hardness tester automatically converts the measured Leeb hardness value to the hardness value of other hardness unit.

6.3 Menu Structure Chart

The setting of instrument parameters and additional functions can be realized through menu operation.



6.4 Menu Operations



Long press 浏览 菜单 on the main screen to enter the menu. The instrument has six menu options: MEAS Setting, Record, SYS Setting, Calibration, Information, RES default.

The specific operations are as follows:

1> Press ▲方向 to move cursor upward;

2> Press 材料▼ to move cursor downward;

3> Press ◀ 单位 to move cursor leftward;

4> Press ▶ 删除 to move cursor rightward;

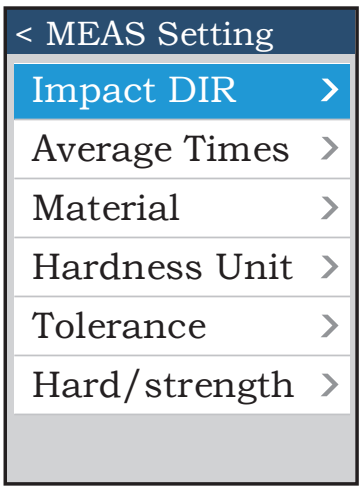
5> Press 确认 存储 to enter options;

6> Press ⏻ 返回 to back to the main screen.

6.5 Testing Condition Setting

Enter the menu, select measurement condition , and press 确认 存储 to enter the options, refer to <6.4 Menu Operation>;
The measurement conditions include: Impact DIR, Average Times, Material, Hardness Unit, Tolerance limit, Hardness/strength.

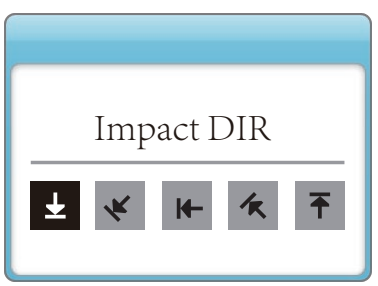
Operations are as follows:



1> Press ▲方向 to move cursor upward;
2> Press 材料▼ to move cursor downward;
3> Press 确认 存储 to enter the option;
4> Press 返回 to back to the main menu.

Note:
When [strength] pattern is set, user can not set [Hardness Unit] pattern, so the cursor will automatically skip the [Hardness Unit] pattern.

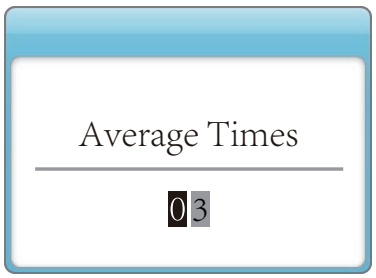
(1) Setting of Impact Direction



1> Press ◀ 单位 ▶ 删除 to move the cursor to the impact direction to be set;
2> Press 确认 存储 to confirm the setting;
3> Press 返回 to cancel the setting.

(2) Setting of Average Times

User can alter average times in the range of 1~32 times.



1> Press ▲方向 材料▼ to modify the value;
2> Press ◀单位 ▶删除 to select the number to be modified;
3> Press 确认存储 to complete the modification;
4> Press 返回 to cancel the modification.

(3) Setting of Material

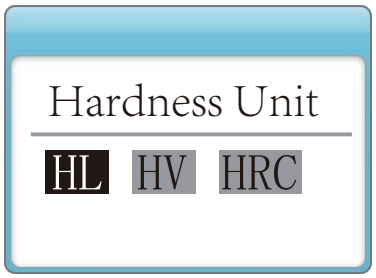
The following optional materials are displayed when 【HARDNESS】 is set: steel/cast steel, alloyed tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloys, copper-zinc alloy(brass), copper-tin alloy(bronze), copper and forged steel.

The following optional materials are displayed when 【STRENGTH】 is set: mild steel, high carbon steel, chrome steel, chrome vanadium steel, chromium-nickel steel, chrome-molybdenum steel, Cr-Ni-Mo steel, chromansil, super-strength steel and stainless steel.

1> Press ▲方向 to select material upward;
2> Press 材料▼ to select material downward;
3> Press ◀单位 to select material leftward;
4> Press ▶删除 to select material rightward;
5> Press 确认存储 to complete the modification;
6> Press 返回 to cancel the modification.

Note: 1. After changing material setting, the hardness unit automatically converse into HL unit.
2. Set the material first, then set the hardness unit.

(4) Setting of Hardness Unit

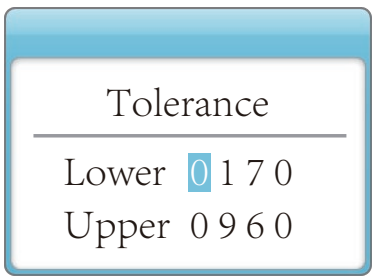


1> Press ◀ 单位 ▶ 删除 key to move cursor over the needed hardness unit;
2> Press 确认 存储 key to confirm;
3> Press ⏻ 返回 key to cancel operation.

Note:

1. The hardness unit will display only when the selected impact device and material can be converted, otherwise it will not display.
2. Set the material first, then set the hardness unit.
3. The hardness unit automatically restores to HL unit after changing material setting.

(5) Setting of Tolerance Limit

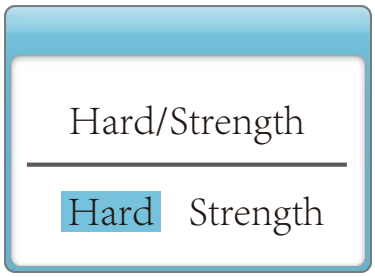


1> Press ▲方向 材料▼ to modify the value;
2> Press ◀ 单位 ▶ 删除 to select the number to be modified;
3> Press 确认 存储 to complete the modification;
4> Press ⏻ 返回 cancel the modification.

Note:

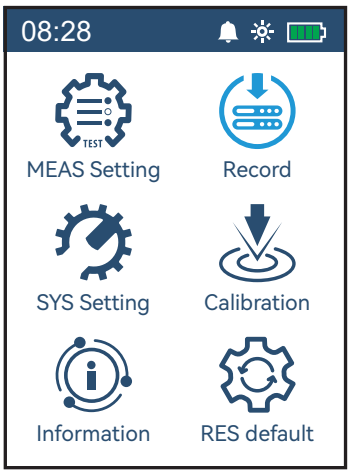
1. Resetting will be reminded if the set value is out of the measuring range.
2. If the lower limit is larger than the upper limit, they will automatically swap. The default lower limit is 170HL and the upper limit is 960HL.

(6) Setting of Hardness/Intensity



1> Press 单位 删除 to select Hardness pattern or Intensity pattern;
2> Press 确认 存储 to complete the modification;
3> Press 返回 to cancel the modification.

6.6 Storage Management



Enter the menu, select storage management , and short press 确认 存储 to enter the options, referring to < 6.4 Menu Operations>.

Operations are as follows:
1> Press ▲方向 to select option upward;
2> Press 材料▼ to select option downward;
3> Press 确认 存储 to enter the option;
4> Press 返回 to back to the main menu.

(1) Browse from the first group/ Browse from the last group

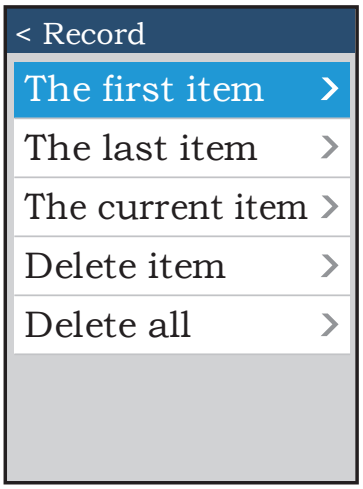
- **Browse from the first group**

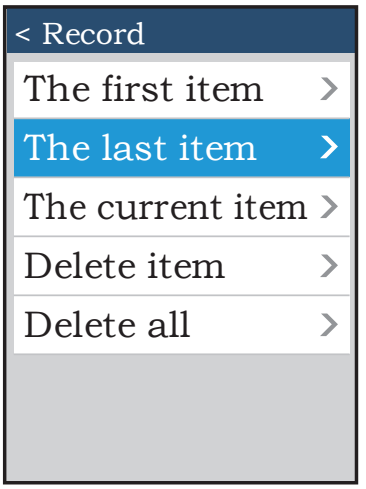
Display storage data from the first group. By default, the instrument displays the record list from the page where the first group of data is located;

- **Browse from the last group**

Display storage data from the last page. By default, the instrument displays the record list from the page where the last group of data is located;

For specific data browsing, refer to Page 56 (5) Data Browsing

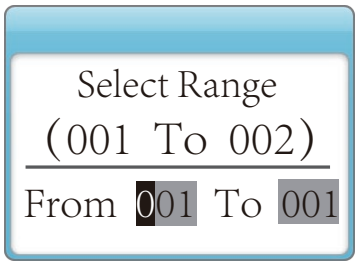




(2) Browse from the selected group

1> Press ▲方向 材料▼ to modify the value;
2> Press ◀单位 ▶删除 to select the number to be modified;
3> Press 确认存储 to display memory data from the input initial group;
4> Press 返回 to cancel the operation.

(3) Delete the selected group



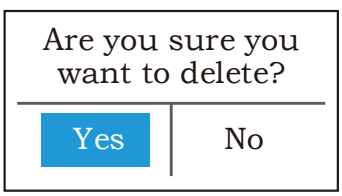
1> Press ▲方向 材料▼ to modify the value;
2> Press ◀ 单位 ▶ 删除 to select the number to be modified;
3> Press 确认 存储 to delete the selected group;
4> Press ⏻ 返回 to cancel the operation.

Note:

1. The input data cannot exceed the figure of existing groups.
2. The initial group cannot be larger than the last group.
3. After the selected group is deleted, the serial numbers of all stored data are rearranged.
4. When deleting data, especially the data of the little group number, it may take about 30s at most to move the following data. At this time, please do not shut down the instrument to avoid data chaos.

(4) Delete all data

Delete all data: Delete all data in the memory.



1> Press 确认 存储 to display the dialog box 【Delete or not?】. Press ◀ 单位 ▶ 删除 to select Yes, and press 确认 存储 to delete data.
2> Press ◀ 单位 ▶ 删除 to select No. Press 确认 存储 to cancel the deletion operation.
3> In the prompt box page, pressing ⏻ 返回 can also cancel the deletion operation.

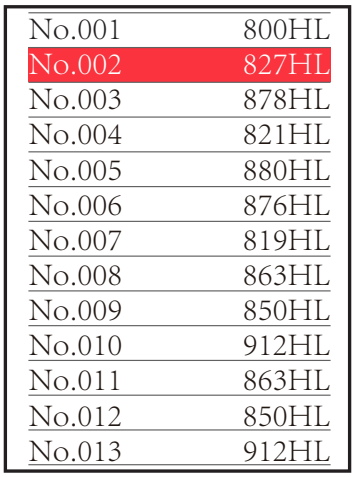
(5) Data Browsing

● Data menu: The page displays one or more groups of numbered data

1> Press ▲方向 材料▼ to select data groups with different numbers ;

2> Press 确认 存储 to enter the data browsing page of the data group and browse the data records;

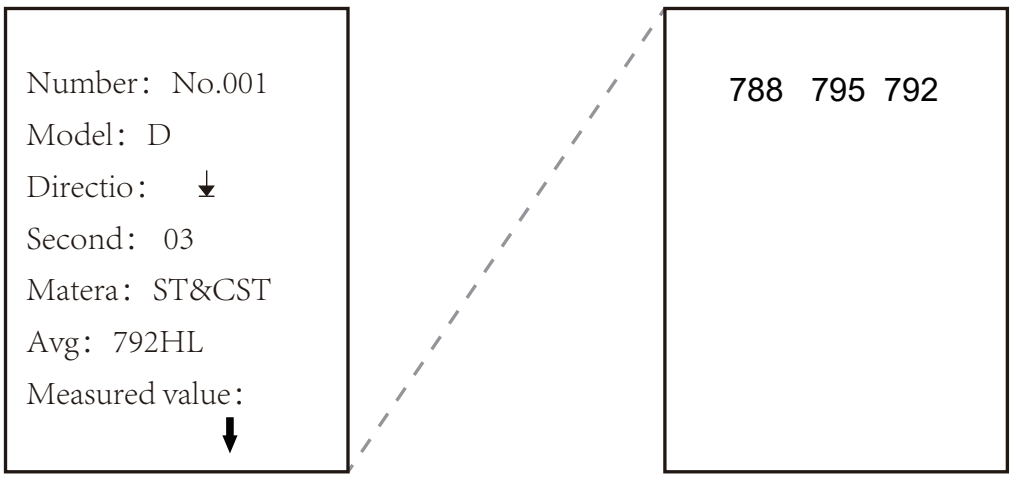
3> Press 返回 to exit browsing.



● Data browsing page: The page displays the recorded test data

1> Press ▲方向 材料▼ to turn the page up and down for more data: average value, measurement conditions, or single measurement value;

2> Press 返回 to return to the data selection page.

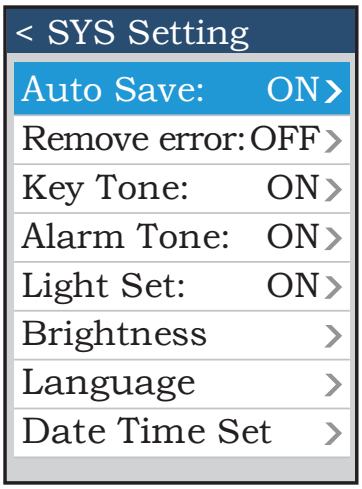


(6) Transfer data

[Transfer Data] Send memory data in text format from the communication port. (Only valid when connecting to a computer)

6.7 System Setting

System setting menu: Select system setting , press 确认存储 to enter the options, referring to <6.4 Menu Operations>. Operations are as follows:



1> Press ▲方向 to select option upward;
2> Press ▲方向 to select option downward;
3> Auto Save, Remove error, Key Tone, Alarm Tone and Light Set are directly set with ◀单位 ▶删除 key, and Brightness, Language and Date Time Set are set by pressing the 确认存储 key to enter;
4> Press 返回 to return to the previous page.

[Remove error]: It works by 3σ code to delete values that are not within the range of (μ-3σ, μ+3σ), μ is the average value, and σ is the standard difference.
For instance: 16 measurements are made, which are x1, x2, x3..., x16.

μ=(x1+x2+...+x16)/16

$$\sigma = \sqrt{\frac{1}{16}\sum_{i=1}^{16}(x_i - \mu)^2}$$

In the formula, Xi means the ith value. If |Xi -μ|>3σ, Xi is considered to be the largest error, and this value will be deleted.

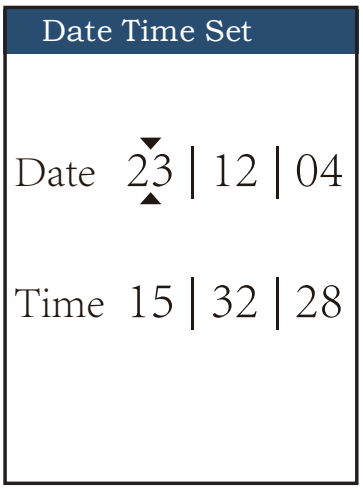
[Key Tone]: When it's ON, the device will "beep" once every time the key is pressed;
[Alarm Tone]: When it's ON, the device will "beep" once if the test value is out of the tolerance limit or the data is deleted.
[Light Set]: When it's ON, when the measured value exceeds the tolerance limit, the red light will light up, and when normal, the green light will light up.

[Brightness]:

1. Press ▲方向 to increase brightness;
2. Press 材料▼ to reduce brightness;
3. Press 确认 存储 to complete the change;
4. Press 返回 to cancel the change.

[Language]: Press ◀ 单位 ▶ 删除 to select language, press 确认 存储 to save the setting, press 返回 to exit.

[Date Time Set]: The current time and date are displayed on the screen in the date format of "year/month/date", in the time format of "hour/minute/second".



1> Press ▲方向 材料▼ to modify the value;

2> Press ◀单位 ▶删除 to select the time and date to be modified;

3. Press 确认存储 to complete the change;

4. Press 返回 to cancel the change.

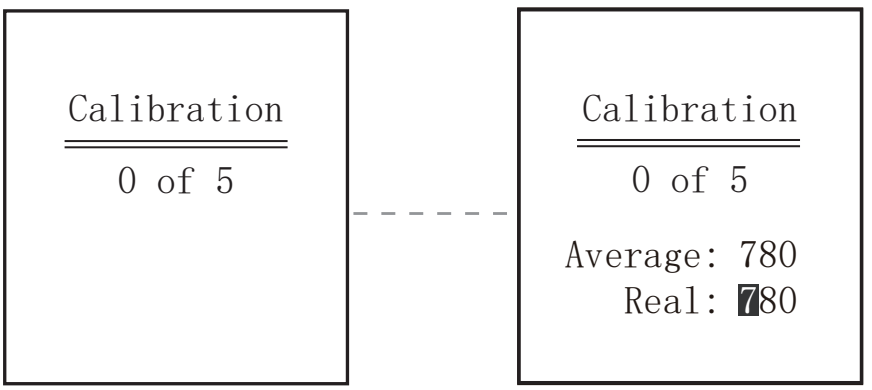
6.8 Software Information

Enter menu, select software information and short press 确认存储 to enter options, referring <6.4 Menu Operation>.

This interface displays information about the instrument and embedded software. Content changes with software upgrades and is not updated here.

6.9 Instrument Calibration

Enter menu, select instrument calibration and short press 确认存储 to enter options, referring <6.4 Menu Operation>.

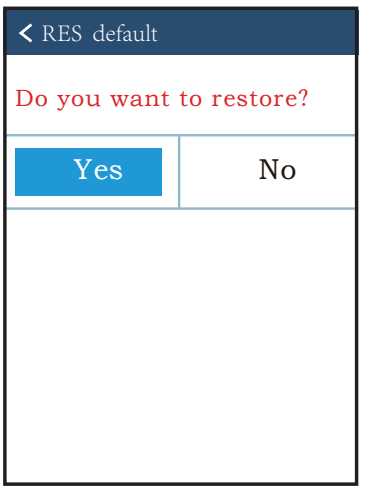


Calibration requires the user to measure 5 times and use the average value of 5 measurements as the calibration value. The distance between each measurement is about 3mm. The average and true values are displayed when the measurement is completed.

1> Press ▲方向 材料▼ to modify the value;
2> Press ◀单位 删除▶ to select the value to be modified;
3> Press 确认存储 to complete the calibration, then short press 返回 to return to the menu;
4> Press 返回 cancel calibration.

6.10 Factory Reset

Enter menu, select factory reset and short press 确认存储 to enter options, referring <6.4 Menu Operation>.



1> Press ◀单位 删除▶ to select Yes or No;
2> Press 确认存储 to select Yes, then restore factory settings, select no to return to the setting menu;
3> Regardless of the cursor position, pressing 返回 can also cancel the operation and return to the setting menu directly.

6.11 Auto-off

- The instrument has automatic shutdown function to save battery power; If there is neither measurement nor any key operation within 5 minutes, the instrument will shut down automatically.
- When the battery voltage is too low, the instrument will display  , and then automatically shut down.

Fault Analysis and Troubleshooting

Problem	Reason	Solution
Fail to turn on	Batteries are exhausted	Charge them in time
No readings shown	Sensor cable malfunction	Change sensor cable

Maintenance and Repair

1. Maintenance of Impact Device

- Clean the conduit and the impact body of the impact device with nylon brush after utilizing 1000~2000 times. First screw the back-up ring off, take the impact body out, screw nylon brush inside conduit counterclockwise till the end, then pull it out. Repeat 5 times, then install the impact body and back-up ring;
- Release the impact body after using;
- All kinds of lubricants are not allowed inside the impact device.

2. Repair of Instrument

- When the standard Rockwell hardness blocks are used for test and all errors are greater than 2HRC, the possible reason is that the head is worn out. So the ball head or impact body should be replaced.
- Please do not disassemble or adjust any fixed parts if there is any abnormal phenomenon with the device. Please fill in the warranty card and send it to our maintenance department for after service.

3. Charging and Maintenance of Li-ion Battery

- The built-in 3.7V 2000mAh lithium battery is non-removable. Please charge the device in time when it fails to start or the battery level is low. Please charge it with adapter of DC 5V 1A whose charging port is Type-C.
- When charging, a scrolling battery symbol is displayed. After a full charge, the battery symbol  is displayed as full power.

Note: When user don't use the device for a long time, charge it fully and recharge it every six months to avoid battery damage.

4. Storage Condition, Transportation and Notes

- The instrument should be far away from vibration, strong magnetic field, corrosive media, moisture, dust, and stored at room temperature;
- Under the condition that the original packaging is maintained, the transportation can be carried out on the tertiary highway.

Attached Table 1

Material	Unit	Impact device					
		D/DC	D+15	C	G	E	DL
Steel/ Cast steel	HRC	17.9~68.5	19.3~67.9	20.0~69.5		22.4~70.7	20.6~68.2
	HRB	59.6~99.6			47.7~99.9		37.0~99.9
	HRA	59.1~85.8				61.7~88.0	
	HB	127~651	80~638	80~638	90~646	83~663	81~646
	HV	83~976	80~937	80~996		84~1042	80~950
	HS	32.2~99.5	33.3~99.3	31.8~102.1		35.8~102.6	30.6~96.8
Forged steel	HB	143~650					
Alloyed Tool steel	HRC	20.4~67.1	19.8~68.2	20.7~68.2		22.6~70.2	
	HV	80~898	80~935	100~941		82~1009	
Stainless steel	HRB	46.5~101.7					
	HB	85~655					
	HV	85~802					
Gray Cast iron	HB	93~334			92~326		
Nodular Cast iron	HB	131~387			127~364		
Alloys	HB	19~164		23~210	32~168		
	HRB	23.8~84.6		22.7~85.0	23.8~85.5		
Copper-Zinc Alloys (Brass)	HB	40~173					
	HRB	13.5~95.3					
Copper-tin Alloys	HB	60~290					
Copper	HB	45~315					

Attached Table 2

NO.	Material	HLD	σ b(MPa)
1	mild steel	350~522	374~780
2	high carbon steel	500~710	737~1670
3	chrome steel	500~730	707~1829
4	Cr-V steel	500~750	704~1980
5	Cr-Ni steel	500~750	763~2007
6	Cr-Mo steel	500~738	721~1875
7	Cr-Ni-Mo steel	540~738	844~1933
8	Cr-Mn-Si steel	500~750	755~1993
9	SSST steel	630~800	1180~2652
10	SST steel	500~710	703~1676

Attached Table 3

Shaped impact device	DC(D)/DL	D+15	C	G	E
impact energy impact body quality	11mJ 5.5g/7.2g	11mJ 7.8g	2.7mJ 3.0g	90mJ 20.0g	11mJ 5.5g
bulb-head hardness bulb-head diameter bulb-head material	1600HV 3mm tungsten carbide	1600HV 3mm tungsten carbide	1600HV 3mm tungsten carbide	1600HV 5mm tungsten carbide	5000HV 3mm adamas
impact device diameter impact device length impact device quality	20mm 86(147)/ 75mm 50g	20mm 162mm 80g	20mm 141mm 75g	30mm 254mm 250g	20mm 155mm 80g
sample max hardness	940HV	940HV	1000HV	650HB	1200HV
sample surface mean roughness	1.6μm	1.6μm	0.4μm	6.3μm	1.6μm
sample min quality testing directly stable support tight coupling	>5kg 2~5kg 0.05~2kg	>5kg 2~5kg 0.05~2kg	>1.5kg 0.5~1.5kg 0.02~0.5kg	>15kg 5~15kg 0.5~5kg	>5kg 2~5kg 0.05~2kg
sample min thickness tight coupling harden layer min depth	5mm ≥0.8mm	5mm ≥0.8mm	1mm ≥0.2mm	10mm ≥1.2mm	5mm ≥0.8mm
bulb-head indentation dimension					
hardness 300HV indentation diameter indentation depth	0.54mm 24μm	0.54mm 24μm	0.38mm 12μm	1.03mm 53μm	0.54mm 24μm
hardness 600HV indentation diameter indentation depth	0.54mm 17μm	0.54mm 17μm	0.32mm 8μm	0.90mm 41μm	0.54mm 17μm
hardness 800HV indentation diameter indentation depth	0.35mm 10μm	0.35mm 10μm	0.35mm 7μm	--- ---	0.35mm 10μm

the range of impact device application:

DC-type for hole or inner cylindrical surface;

DL-type for spindly narrow groove or hole;

D-type for regular testing;

D+15 for groove or sunken surface due to its smaller contact area and lengthening;

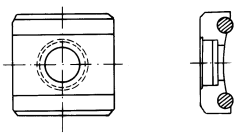
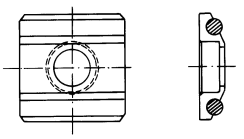
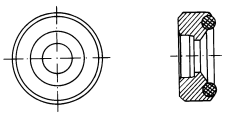
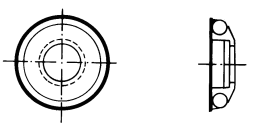
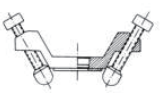
C-type for hardened layer and samples with minor diameter and thinner wall due to its smaller impact force which usually cause damage on surface;

G-type for larger thickness and more rough casting samples;

E-type for highest hardness materials.

Attached Table 4

Note: When measuring cylinder or sphere, please use the corresponding special-shaped supporting ring to ensure the measurement accuracy.

No.	Model No.	Shaped back-up ring sketch	Remark
1	Z10-15		test outside cylindrical surface R10~R15
2	Z14.5-30		test outside cylindrical surface R14.5~R30
3	Z25-50		test outside cylindrical surface R25~R50
4	HZ11-13		test inner cylindrical surface R11~R13
5	HZ12.5-17		test inner cylindrical surface R12.5~R17
6	HZ16.5-30		test inner cylindrical surface R16.5~R30
7	K10-15		test outside sphere surface SR10~SR15
8	K14.5-30		test outside sphere surface SR14.5~SR30
9	HK11-13		test inner sphere surface SR11~SR13
10	HK12.5-17		test inner sphere surface SR12.5~SR17
11	HK16.5-30		test inner sphere surface SR16.5~SR30
12	UN		test outside cylindrical surface, adjustable radius R10~∞

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