

深达威® 里氏硬度计

Leeb Hardness Tester



用户手册
User Manual

SW-6200

中 文 ----- 01~27

English ----- 28~55

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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仪器生产厂家，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，本公司均不能予以保修。

(注明：产品外观以实物为准，说明书中图片效果仅供参考)

1. 装箱清单

请按下列清单认真检查仪器所有附件是否完整。如不完整，请及时联系经销商或仪器生产厂家。

序号	名称	数量	单位	备注
1	主机	1	台	
2	说明书	1	本	
3	保修卡	1	张	
4	布包盒	1	个	
5	USB Type-C数据线	1	条	

2. 概述

2.1 产品特点

- 小巧便携
- 黑白点阵背光屏
- 中英文显示界面
- 内置锂电
- DC5V 1A 充电 TYPE-C 接口
- 支持多种金属材料检测
- 支持多种硬度单位转换(HL、HRB、HRC、HB、HV、HS、HRA)
- 自动省电
- 软件校准

2.2 主要用途

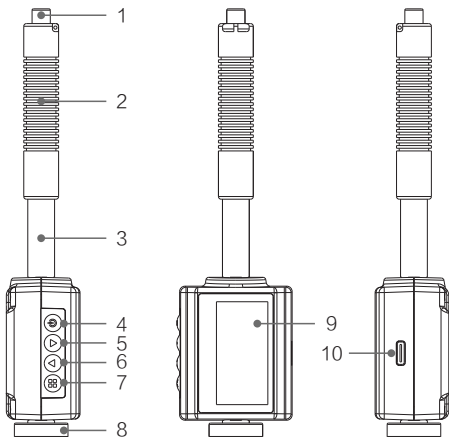
- 重型工件或大型工件大范围内多处测量部位的快速检验；
- 轴承及其它零件；
- 热处理工件的质量控制；
- 机床导轨，汽车底盘的硬度检测；
- 已安装的机械或永久性组装部件；
- 模具型腔等试验空间很狭小的工件；
- 压力容器、汽轮发电机组及其设备的失效分析；
- 要求对测试结果有正规的原始记录；
- 金属材料仓库的材料区分。

2.3 适用范围

适用范围见附表1、附表2

3. 结构特征与工作原理

3.1 主机



1、释放按钮

2、加载套

3、导管

4、开关、返回键

5、向下键

6、向上键

7、菜单键

8、支撑环

9、显示屏

10、Type-C充电端口

3.2 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：

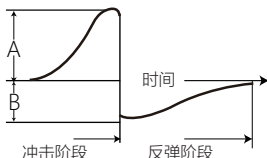
$$HL=1000 \cdot VB / VA$$

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方示意图：



4. 产品规格参数

● 示值误差和示值重复性（图表2）

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 HLDC 10 HLDC
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

4.1 技术参数

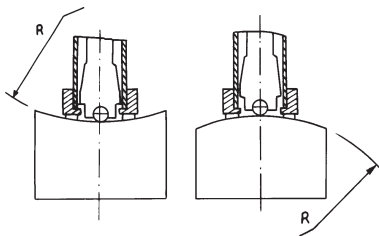
项目	SW-6200
显示屏幕	1.77寸 128x64黑白点阵屏
支持语言	中文/英文
冲击装置	标准D型
测量范围	170~960 HLD
示值误差	$\pm 6\text{HL}$ @760HLD, $\pm 10\text{HL}$ @530HLD
测量方向	支持垂直向下、斜下、水平、斜上、垂直向上
硬度测量材料	钢和铸钢、合金工具钢、不锈钢、灰铸铁、球墨铸铁、铸铝合金、铜锌合金(黄铜)、铜锡合金(青铜)、纯铜、锻钢
强度测量材料	低碳钢、高碳钢、铬钢、铬钒钢、铬镍钢、铬钼钢、铬镍钼钢、铬锰硅钢、超高强度钢、不锈钢
硬度制式	里氏(HL)、布氏(HB)、洛氏B(HRB)、洛氏C(HRC)、洛氏A(HRA)、维氏(HV)、肖氏(HS)
标准硬度块	√
电池	内置350mAh锂电
续航时长	约11小时
充电规格	DC5V 500mA Type-C接口
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°C ~ 40°C, 10% ~ 80%RH
存储温湿度	-10°C ~ 50°C, 10% ~ 70%RH
外形尺寸	165x42x27.5mm

5. 仪器使用的准备和检查

5.1 使用前的准备

(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°C ；
- 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、D型冲击装置）和小于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) 测量条件设置：参考<7.3 测量条件设置>

5.2 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

短按  键此时电源接通，仪器进入测量状态。

(2) 加载

向下推动加载套锁住冲击体，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

- 按下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 $\pm 15HL$ ；
- 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，欲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

(图表3)

(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示出硬度数值，不同冲击装置类型测得的HL值不同。

6. 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】。

7. 仪器操作详解

7.1 仪器开、关机

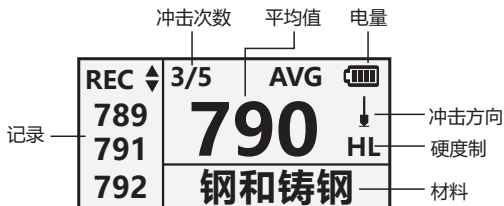
开机：短按  键开机。

关机：长按  键2秒关机，长按4秒重启；

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  键10秒以上，强制关机。

7.2 仪器概述



(1) 主显示界面说明

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

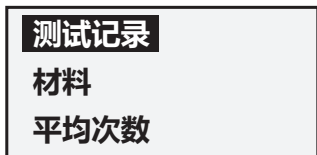
(2) 测量操作

在主界面下可以进行测量，每完成一次测量，显示本次测量值和平均值，冲击次数增 1。达到设定的冲击次数后，仪器“滴滴”响两声。

7.3 菜单功能

在主界面状态下，短按  键，进入菜单。仪器总共有8个菜单选项。其中，测试记录为进入菜单默认选项。

测试记录、材料、平均次数、硬度、冲击方向、校正、硬度强度、语言。



操作如下

- 1>按  键进入菜单；
- 2>按   键选择选项；
- 3>按  键返回主界面。

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。

(1) 数据存储记录

会显示仪器存储的数据；

仪器会自动存储每一轮测量的数据，最多存储10笔，超过10笔时会自动覆盖第一笔数据，从头开始记录。

测试记录

材料

平均次数

01 002 HL

02 003 HL

03 004 HL

04 005 HL

1>按  键进入记录详情；

2>按   键选择选项/换页；

3>按  键返回。

(2) 测试材料设置

- 【硬度/强度】设为【硬度】时，会显示以下可选材料：

- | | |
|----------|---------|
| 1. 钢和铸钢 | 6. 铸铝合金 |
| 2. 合金工具钢 | 7. 铜锌合金 |
| 3. 不锈钢 | 8. 铜锡合金 |
| 4. 灰铸铁 | 9. 纯铜 |
| 5. 球墨铸铁 | 10. 锻钢 |

测试记录

材料

平均次数

钢和铸钢

合金工具钢

不锈钢

灰铸钢

- 1>按  键，进入菜单页面，系统默认选项为材料，再按  键，进入材料页面；
- 2>按   键选择材料，按  键确认；
- 3>按  键返回主界面。

●【硬度/强度】设为【强度】时，会显示以下可选材料：

- | | |
|--------|----------|
| 1. 低碳钢 | 6. 铬钼钢 |
| 2. 高碳钢 | 7. 铬镍钼钢 |
| 3. 铬钢 | 8. 铬锰硅钢 |
| 4. 铬钒钢 | 9. 超高强度钢 |
| 5. 铬镍钢 | 10. 不锈钢 |

测试记录

材料

平均次数

低碳钢

高碳钢

铬钢

铬钒钢

- 1>按  键，进入菜单页面，系统默认选项为材料，再按  键，进入材料页面；
- 2>按   键选择材料，按  键确认；
- 3>按  键返回主界面。

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。

(3) 平均次数设置

可以在1 ~ 32次范围内修改平均次数。

测试记录

材料

平均次数

- 1>按  键进入菜单；
- 2>按   键选择平均次数选项后，再按  键进入设置页面，按   键，设置平均次数，再按  键确认。
- 3>按  键返回主界面。

(4) 硬度模式设置

硬度

冲击方向

校正

- 1>按  键进入菜单；
- 2>按   键选择硬度选项后，再按  键进入设置页面，按   键，设置硬度模式，再按  键确认。
- 3>按  键返回主界面。

注意：

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

(5) 冲击方向设置



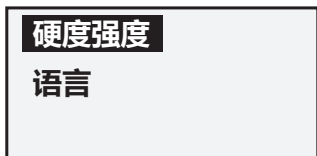
- 1>按  键进入菜单;
- 2>按   键选择冲击方向选项后, 再按  键进入设置页面, 按   键, 设置冲击方向, 再按  键确认。
- 3>按  键返回主界面。

(6) 自动校准



- 1>按  键进入菜单;
- 2>按   键选择校正选项后, 再按  键进入校准页面, 选择不同的测试点, 连续5次加载冲击后, 根据所测平均值和实测值, 参照标准硬度值, 通过   键分别调整实测值的3位数值, 再分别按  键完成校准确认。
- 3>按  键返回主界面。

(7) 硬度/强度设置



- 1>按  键进入菜单;
- 2>按   键选择该选项后, 再按  键进入设置页面, 按   键, 选择硬度或强度制式, 再按  键确认。
- 3>按  键返回主界面。

(8) 语言设置



- 1>按  键进入菜单;
- 2>按   键选择语言选项后, 再按  键进入设置页面, 按   键, 选择中文或ENGLISH, 再按  键确认。
- 3>按  键返回主界面。

7.4 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。

8. 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

9. 保养和维修

9.1 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。

9.2 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。

9.3 锂电池充电及保养

- 产品内置3.7V 350mAh 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 0.5A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。

9.4 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					

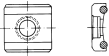
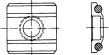
附表2

序号	材料	里氏硬度 HLD	强度 σ_b (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		11mJ	11mJ	2.7mJ	90mJ	11mJ
冲击体质量		5.5g/7.2g	7.8g	3.0g	20.0g	5.5g
球头硬度:		1600HV	1600HV	1600HV	1600HV	5000HV
球头直径:		3mm	3mm	3mm	5mm	3mm
球头材料:		碳化钨	碳化钨	碳化钨	碳化钨	金刚石
冲击装置直径:		20mm	20mm	20mm	30mm	20mm
冲击装置长度:		86(147)/ 75mm	162mm	141mm	254mm	155mm
冲击装置重量:		50g	80g	75g	250g	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 或圆柱筒内; 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~ ∞

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User Instruction

Please read this instruction intently before your first utilization.

1. Do not disassemble or repair this product by any means. Reforming is not allowed. Keep it properly from children and irrelevant people.
2. Do not use it near by plane or medical instrument which could be interfered by electromagnetic radiation of this product. Do not use it in flammable and explosive circumstance.
3. Do not throw away the used battery with the normal household waste, please deal with it by nation or local related law and regulations
4. If there are any troubles on quality, or any doubts about how to use, please contact that local agent or us, we will solve it as soon as possible.
5. The warranty service should be paid for any malfunction beyond the warranty time.
6. The warranty service is not available for any of those situations that include: disassembling the product by yourself; transportation damage; improperly keeping; wrong operation and altering warranty card.

Note: the product appearance is subject to the material object, the picture in the instruction is for reference only.

1.Packing List

Please check your accessories according to the below list. If there is anything missing, please contact the local agent or manufacturer immediately.

Standard configuration

No.	Names	Quantity	Remark
1	The tester	1pc	
2	User manual	1pc	
3	Container	1pc	
4	USB Type-C cable	1pc	

2.Summary

2.1 Product Feature

- Small size and portable;
- Black and white dot matrix backlit screen;
- Chinese & English display interface;
- Powered by lithium battery;
- DC5V 1A Charging Type-C port;
- Test hardness according to leeb hardness testing principle. Available for many kinds of metal material
- Switch between six hardness units (HL, HRB, HRC, HB, HV, HS, HRA);
- Functions of dormancy, auto-off for power save;
- Software calibration function.

2.2 Main Application

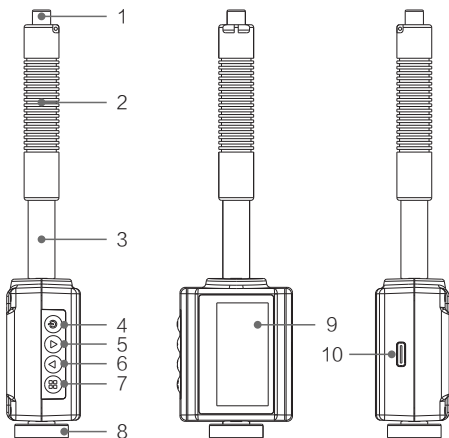
- Quick testing on many spots of heavy and thick work-pieces on a large-scale;
- Bearings and other parts;
- Quality control of heat treated parts;
- Hardness testing on lathe guide, automotive chassis;
- Installed machinery or permanently assembled parts;
- Work-pieces with small space, like mold cavity;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

2.3 Application Range

- Refer to attached 1 and 2

3. Structural Feature and Working Principle

3.1 The Tester



1. Release button

2. Load-adding sheath

3. Conduit

4. Back-up ring

5. Down key

6. Up key

7. MENU

8. Back-up ring

9. LCD display

10. Type-C charging port

3.2 Working Principle

Under the action of elastic force, the impact body with defined quality 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:

$$HL=1000 * VB / VA$$

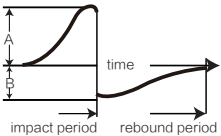
In this formula:

HL—Leeb hardness value

VB—the rebound velocity of the impact body

VA—the impact velocity

The output signal refers to the demonstrating chart in right side:



4.Specifications

● Reading error and repeatability(chart 2)

No.	Impact- device Type	Hardness Value for Standard Leeb Hardness Sample	Reading Error	Reading Repeatability
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 HLDC 10 HLDC
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

● Technology specifications

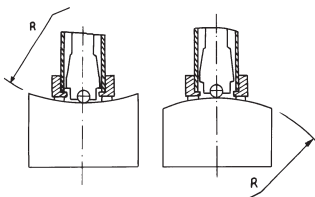
ITEM	SW-6200
Display screen	1.77 inch 128*64 black and white dot matrix screen
Language	Chinese/English
Impact device	Standard type D
Measuring range	170~960HLD
Reading error	$\pm 6\text{HL}$ @760HLD, $\pm 10\text{HL}$ @530HLD
Standard hardness sample	Optional
Measuring direction	Vertical down, diagonal down, horizontal, diagonal up, or 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
Battery	Built-in 350mAh lithium battery
Battery working life	11 hours
Charging specification	DC 5V 500mAh Type-C USB port
Work 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% ~ 80%RH
Storage temperature and humidity	-10°C ~ 50°C, 10% ~ 70%RH
Dimension	165 x 42 x 27.5mm

5.Preparation and Checking

5.1 Preparation

(1) The surface condition of sample should be eligible in attached table 3:

- The temperature on the surface should be below 120°C;
- The tested surface must have metallic luster and be flat, smooth, and no greasy dirt;
- Request of sample weight: No back-up for the sample when its weight is greater than 5kg; Back-up support for samples with the weight of 2–5kg, overhanging part or thin-wall samples, in order not to cause sample's transformation, bend and movement. For middle size sample, put it over flat, solid surface completely reposefully.
- Curved sample: It's better that the tested face is plane. Small or shaped back-up ring is used for samples of which the radius of curvature is below 30mm(D, DC, D+15, C, E, DL type impact device) and below 50mm (Gtype impact device);



- The proper thickness is requested and the minimum thickness should be eligible in attached table 3;
- The hardened layer of samples should be eligible in attached table 3;
- Coupling: The light-duty sample must be coupled tightly with solid bearing part, the coupling surfaces with a little coupling agent should be flat, smooth, and are vertical with testing direction. For extensive sheet material, pole and curved samples, strengthen or support the tested spot on back for accurate testing value, in spite of its high weight and large thickness which can cause transformation and unstability;
- The sample's magnetism should be below 30 gauss.

(2) Testing Condition Setting: Refer to < 7.3 chapter >

5.2 Measuring Method

First, use random hardness test block for verification, the reading error and repeatability should be below the defined value in chart 2.

Attention:

The hardness value of the random hardness test block is the arithmetic mean value of five readings, those readings comes from the calibrated Leeb hardness tester which test in straight down direction. Standardize it with calibration function if this mean value is out of limits.

(1) Activation

- Short press  key to start to test.

(2) Loading

- Push the load-adding sheath down to lock the impact body and complete the loading .

(3) Location

- According to the chosen testing direction, press tightly the back-up ring on the sample's surface which is vertical with the impact direction.



(4) Testing

- Press the release button to test. The sample, the impact device and operator, all should be unmovable and jarless, and the force direction should go through the device's axis;
- Each single spot should be tested for five times. The difference value should not beyond $\pm 15HL$ of the mean value;
- The distance between any two indentation centers or any indentation center and the edge of sample should be eligible in chart 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 way is: utilize standardized Leeb hardness tester and related tester on one same sample. For every single hardness value, five tested value are needed homogeneously around over three hardened indentation spots, use the mean value of Leeb hardness value and related mean value to make comparative curve which at least need over three group datum.

Impact device type	distance between any two indentation centers	distance between indentation center 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

(5) Tested Value

- Leeb hardness testing value is a mean value of many valid tested value.
- The hardness value shows before the Leeb hardness unit HL, different value for different impact device.

6. Special Tips

- Currently, this device only support D type impact device, please do not use others;
- In general, the current reading can not be saved if the set impact times are not reached;
- Can not set Hardness pattern(the cursor automatically skips the Hardness pattern) when Intensity pattern is already set;
- Not all materials are useful for all hardness patterns, it will converse into Leeb HL automatically if material is changed. So the first setting of testing conditions is to set Material, then Hardness pattern.

7.Detailed Operations Instruction

7.1 Power on/off

On: Short press  key to start the device;

Off: Long press  key for two seconds to power off.

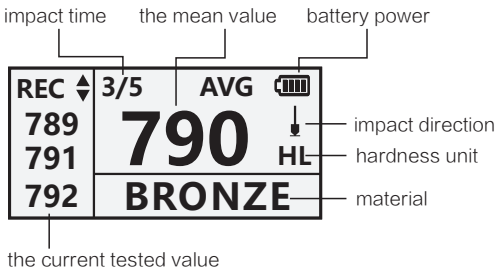
Long press  key for four seconds to restart;

Auto-off: Auto-off without operations in five minutes.

Forced shutdown: Long press  for more than ten seconds to shut down.

7.2 Product Description

On screen is the main display interface after power-on, as follows:



(1) Instruction About the Main Interface

Battery power: Left power

Impact direction: Current impact direction

Mean value: Current mean value

Hardness unit: Current hardness unit of reading

Tested value: Current single tested value

Material: Current set material

Impact time: It's the whole impact time in testing mode that is completed.

(2) Operation

Go through testing in main interface where shows the current tested value and mean value, the impact time increase by 1 at the same time. The device sounds "beep beep" when the impact time goes up to limit that is set.

7.3 MENU Function

In the main interface state, short press  key to enter the menu. There are six menu options. TEST RECORD is the default option for entering the menu.

TEST RECORD

MATERIAL

AVERAGE OF COUNTS

UNIT

DIRECTION

CALIBRATION

HARDNESS/STRENGTH

TEST RECORD

MATERIAL

AVERAGE OF COUNTS

1>Press  key to enter the menu;

2>Press   key to select options;

3>Press  key to return to the main interface.

Attention:

For special material, this conversion is a relative relation based on lots of tests of Leeb and others hardness. According to this relation, the device automatically converse Leeb hardness value into others hardness value.

(1) Data storage record

Display the stored data;

The instrument will automatically store the data of each measurement. It stores a maximum of 10 units data, more than 10 will automatically overwrite the first data, record from scratch.

TEST RECORD

MATERIAL

AVERAGE OF COUNTS

01 002 HL

02 003 HL

03 004 HL

04 005 HL

1>Press  key to enter Record details;

2>Press   key to select options/change pages;

3>Press  key to return.

(2) Testing Material Setting

- 【HARDNESS/STRENGTH】 The following optional materials are displayed when HARDNESS is set:

- | | |
|-------------|---------------|
| 1. ST & CST | 6. C ALUM |
| 2. CWT ST | 7. BRASS |
| 3. SS | 8. BRONZE |
| 4. GC IRON | 9. COPPER |
| 5. NC IRON | 10. FORGED ST |

TEST RECORD

MATERIAL

AVERAGE OF COUNTS

1 ST & CST

2 CWT ST

3 SS

4 GC IRON

1>Press  key to enter the MENU page. The default option is MATERIAL. Press  key again to enter the MATERIAL page;

2>Press   key to select material, and press  key to confirm;

3>Press  key to return to the main interface.

- **【HARDNESS/STRENGTH】** The following optional materials are displayed when STRENGTH is set:

- | | |
|------------|--------------|
| 1. MILD ST | 6. CRMO ST |
| 2. HC ST | 7. CRNIMO ST |
| 3. CR ST | 8. CRMNSI ST |
| 4. CRV ST | 9. SSST |
| 5. CRNI ST | 10. SS |

TEST RECORD

MATERIAL

AVERAGE OF COUNTS

1 MILD ST

2 HC ST

3 CRV ST

4 CRNI ST

- 1>Press  key to enter the menu page. The default option is MATERIAL. Press  key again to enter the MATERIAL page;
- 2>Press   key to select material, and press  key to confirm;
- 3>Press  key to return to the main interface.

Attention:

1. The hardness unit converse into HL unit automatically after changing material setting.
2. Please set material, then hardness unit.

(3) Average Time Setting

Alter average time in the range of 1~32 times.

TEST RECORD
MATERIAL
AVERAGE OF COUNTS

- 1>Press  key to enter the menu;
- 2>Press   key to select AVERAGE OF COUNTS and then press  key to enter the setting page.
Press   key to set the average time and then press  key to confirm.
- 3>Press  key to return to the main interface.

(4) Hardness Pattern Setting

UNIT
DIRECTION
CALIBRATION

Attention:
Can not set Hardness pattern(the cursor automatically skips the Hardness pattern) when Intensity pattern is already set;

- 1>Press  key to enter the menu;
- 2>Press   key to select UNIT and then press  key to enter the setting page. Press   key to set the hardness pattern and then press  key to confirm.
- 3>Press  key to return to the main interface.

(5) Impact Direction Setting



- 1>Press  key to enter the menu;
- 2>Press   key to select DIRECTION and then press  key to enter the setting page. Press   key to set the impact direction and then press  key to confirm.
- 3>Press  key to return to the main interface.

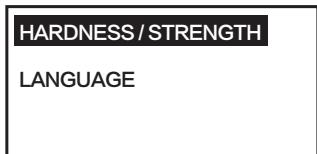
(6) Self-calibration



- 1>Press  key to enter the menu;
- 2>Press   key to select CALIBRATION, and then press  key to enter the CALIBRATION page.
Select different test points, after 5 times consecutive load impact, according to the measured average value and measured value, referring to the standard hardness value, adjust the 3 digit values of the measured value through   key, and then press  key to complete calibration.

3>Press  key to return to the main interface.

(7) HARDNESS/STRENGTH Setting

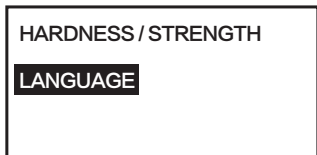


1>Press  key to enter the menu;

2>Press   key to select HARDNESS/STRENGTH and then press  key to enter the setting page. Press   key to choose HARDNESS or STRENGTH and then press  key to confirm.

3>Press  key to return to the main interface.

(8) LANGUAGE Setting



1>Press  key to enter the menu;

2>Press   key to select LANGUAGE and then press  key to enter the setting page. Press   key to choose 中文 or ENGLISH and then press  key to confirm.

3>Press  key to return to the main interface.

7.4 Auto-off

- The function of auto-off for saving power; the device will turn itself off without any operation in five minutes;
- On screen shows LOW signal  when power is low, and shut it down automatically.

8. Malfunction Analysis and Troubleshooting

Problem description	Cause	Solution
Power-on is failed	The battery is exhausted	Change batteries

9. Maintenance

9.1 About the Impact Device

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

9.2 About the Device

- Testing the standard Rockwell hardness block, all errors are more than 2HRC, the possible reason is the wear-out-failure of the head, changing it or the impact body should be considered;
- When the tester appears other abnormal phenomenon, please do not remove or adjust any fixed assembly parts. Please fill out the warranty card and submit it to our maintenance department to implement the warranty regulations.

9.3 About the Battery

- The product is powered by 3.7V 350mAh lithium battery, which is not removable. When the product cannot be turned on or the power display is blank, please charge it in time. Please use the DC 5V 0.5A charging adapter to charge the product, and the charging interface is Type-C.
- When charging, battery symbol scrolls through. When fully charged, the battery symbol is displayed as full battery  .

Attention:

When not used for a long time, fully charge the product and recharge it every six months to avoid battery damage.

9.4 Storage Condition, Transportation and Tips

- Store it in normal temperature and far away vibration, strong magnetic field, corrosive medium, humidity and dust;
- Transport it with original package in three-class 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	80~683	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
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		
Cast aluminum alloy	HB	19~164		23~210	32~168		
	HRB	23.8~84.6		22.7~85.0	23.8~85.5		
Copper-zinc alloy (Brass)	HB	40~173					
	HRB	13.5~95.3					
Copper-tin alloy (Bronze)	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	11mJ	11mJ	2.7mJ	90mJ	11mJ
impact body quality	5.5g/7.2g	7.8g	3.0g	20.0g	5.5g
bulb-head hardness	1600HV	1600HV	1600HV	1600HV	5000HV
bulb-head diameter	3mm	3mm	3mm	5mm	3mm
bulb-head material	tungsten carbide	tungsten carbide	tungsten carbide	tungsten carbide	adamas
impact device diameter	20mm	20mm	20mm	30mm	20mm
impact device length	86(147)/75mm	162mm	141mm	254mm	155mm
impact device quality	50g	80g	75g	250g	80g
sample max hardness	940HV	940HV	1000HV	650HV	1200HV
sample surface mean roughness	1.6 μ m	1.6 μ m	0.4 μ m	6.3 μ m	1.6 μ m
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 24 μ m	0.54mm 24 μ m	0.38mm 12 μ m	1.03mm 53 μ m	0.54mm 24 μ m
hardness 600HV indentation diameter indentation depth	0.54mm 17 μ m	0.54mm 17 μ m	0.32mm 8 μ m	0.90mm 41 μ m	0.54mm 17 μ m
hardness 800HV indentation diameter indentation depth	0.35mm 10 μ m	0.35mm 10 μ m	0.35mm 7 μ m	--- ---	0.35mm 10 μ m

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;

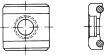
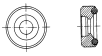
D+15 for groove or sunken surface due to its smaller contact area and lengthening;

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

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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