



**Equotip 550**



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## Conversion Curve - Technical Note

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## Buttons



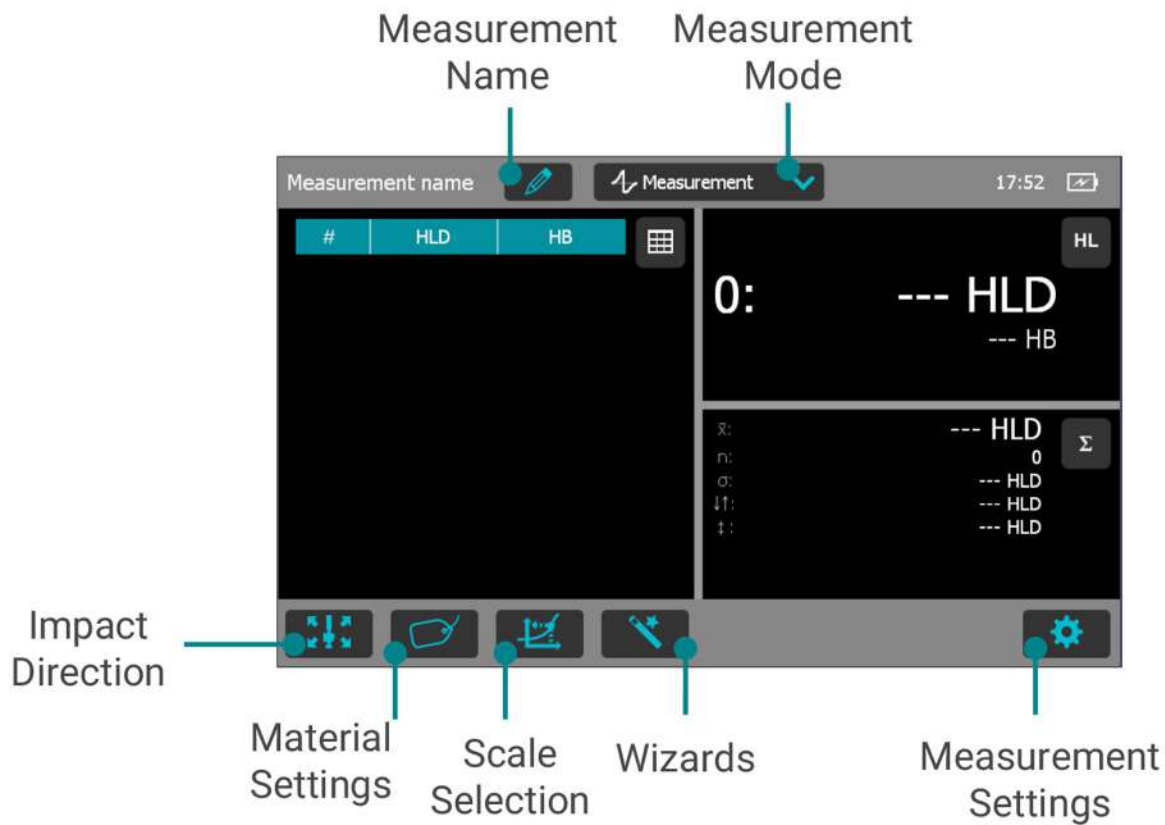
- Home screen / Power On & Off (2 sec.)
- Last document / Toggle Fullscreen (in measurement mode)

Previous menu

### NOTE

Leeb D and Leeb DC probes only!

## Measurement Screen



### NOTE

Leeb D and Leeb DC probes only!



# Conversion Unit & Material Selection Leeb Probes

Method 1

## Set Material

Measurement name: Measurement 17:52

0: --- HLD --- HB

--- HLD  
0  
--- HLD  
17  
--- HLD  
11

MATERIAL

- Steel and cast steel
- Work tool steel
- Stainless steel
- Gray cast iron (GG)
- Nodular cast iron (GGG)
- Cast Aluminium alloys
- Brass - Copper/Zinc-alloys
- Bronze
- Wrought Copper alloys
- High-alloy steels for power equipment

## Set Primary Scale

Measurement name: Measurement 17:53

0: --- HLD --- HB

--- HLD  
0  
--- HLD  
17  
--- HLD  
11

PRIMARY SCALE

- HLD Leeb D (native scale)
- HLS Leeb S
- HLE Leeb E
- HLDL Leeb DL
- HB Brinell
- HV Vickers
- HRB Rockwell B
- HRC Rockwell C

## Set Secondary Scale

Measurement name: Measurement 17:53

0: --- HLD --- HB

--- HLD  
0  
--- HLD  
17  
--- HLD  
11

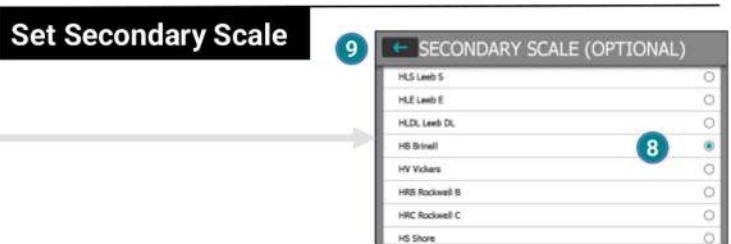
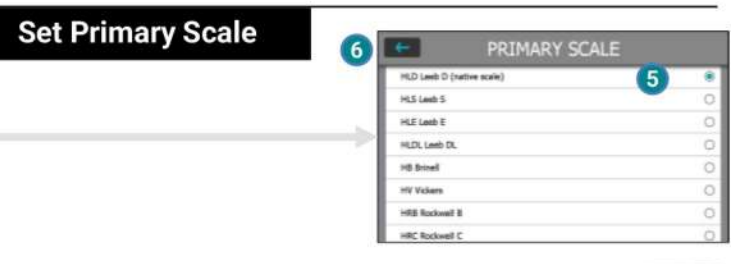
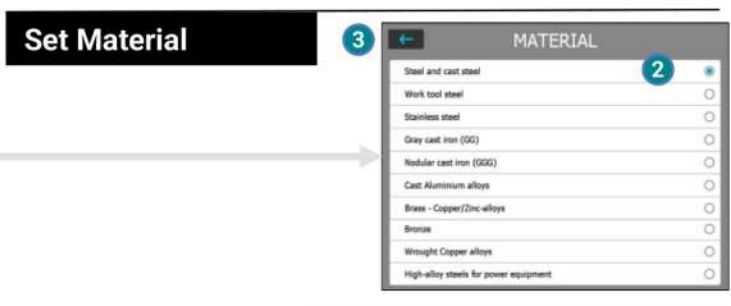
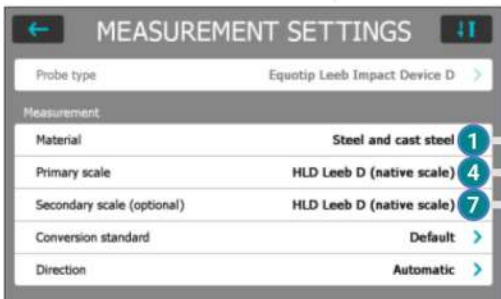
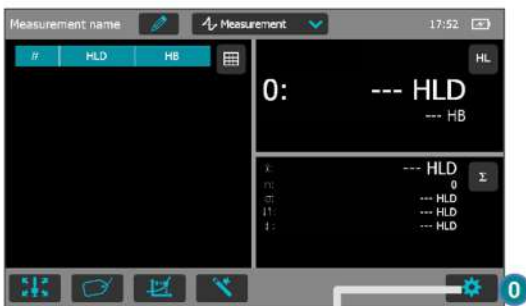
SECONDARY SCALE (OPTIONAL)

- HLS Leeb S
- HLE Leeb E
- HLDL Leeb DL
- HB Brinell
- HV Vickers
- HRB Rockwell B
- HRC Rockwell C
- HS Shore



# Conversion Unit & Material Selection Leeb Probes

Method 2





## Conversion Range - Datasheet Leeb probes



Material Class	Method	Unit	Leeb Probes					
			C	D/DC	DL	S	E	G
Steel and Cast Steel	Vickers	HV	81-955	80-950	101-964	101-964	*	81-1012
	Brinell	HB	81-654	81-646	101-640	83-686	90-646	81-694
	Rockwell	HRB	38-100	37-100	*	*	48-100	*
		HRC	20-68	21-68	22-70	20-72	*	20-70
		HRA	*	*	61-88	61-88	*	*
	Shore	HS	30-99	31-97	28-104	29-103	*	30-102
	R <sub>m</sub> σ <sup>1a</sup>	MPa	275-2194	275-2297	340-2194	283-2195	305-2194	275-2194
	R <sub>m</sub> σ <sup>2b</sup>	MPa	616-1148	614-1485	615-1480	616-1480	618-1478	615-1479
R <sub>m</sub> σ <sup>3c</sup>	MPa	449-847	449-847	450-846	450-846	450-847	450-846	
Work Tool Steel	Vickers	HV	80-900	80-905	102-924	82-1009	*	98-942
	Rockwell	HRC	21-67	21-67	22-68	23-70		20-67
Stainless Steel	Vickers	HV	85-802	*	119-934	88-668	*	*
	Brinell	HB	85-655	*	105-656	87-661	*	*
	Rockwell	HRB	46-102	*	70-104	49-102	*	*
		HRC	20-62	*	21-64	20-64	*	*
Grey Cast Iron (GG) Lamellar Graphite	Brinell	HB	90-664	*	*	*	*	*
	Vickers	HV	90-698	*	*	*	92-326	*
	Rockwell	HRC	21-59	*	*	*	*	*
Nodular Cast Iron (GGG)	Brinell	HB	95-686	*	*	*	127-364	*
	Vickers	HV	96-724	*	*	*	*	*
	Rockwell	HRC	21-60	*	*	*	19-37	*
Cast Aluminum Alloys	Brinell	HB	19-164	20-187	20-184	23-176	19-168	21-167
	Vickers	HV	22-193	21-191	22-196	22-198	*	*
	Rockwell	HRB	24-85	*	*	*	24-86	23-85
Brass Copper/Zinc Alloys	Brinell	HB	40-173	*	*	*	*	*
	Rockwell	HRB	14-95	*	*	*	*	*
Bronze CuAl/CuSn Alloys	Brinell	HB	60-290	*	*	*	*	*
Wrought Copper Alloys	Brinell	HB	124	*	*	*	*	*

**NOTE** The conversions are valid in the indicated range and scale for the respective probes and materials.

\* No Conversion

σ<sup>1a</sup> - Tensile strength for unalloyed or low-alloy steel

σ<sup>2a</sup> - Tensile strength of quenching and tempering steels in the quenched tempered conditions

σ<sup>3a</sup> - Tensile strength of quenching and tempering steels in the untreated, soft annealed or normalized conditions

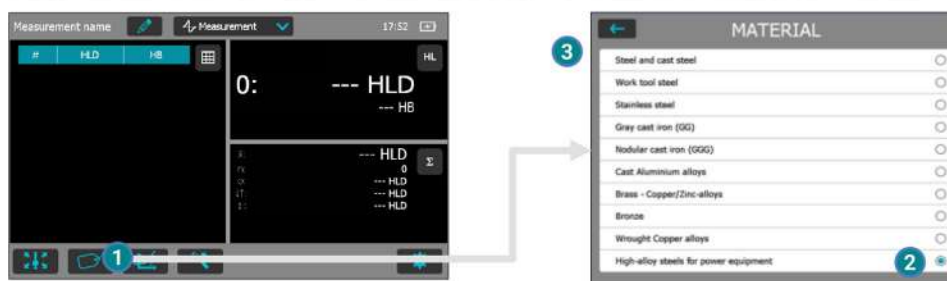


## Conversion Unit & Material Selection Leeb Probes on High-Alloy Steels (DL/T 1845)



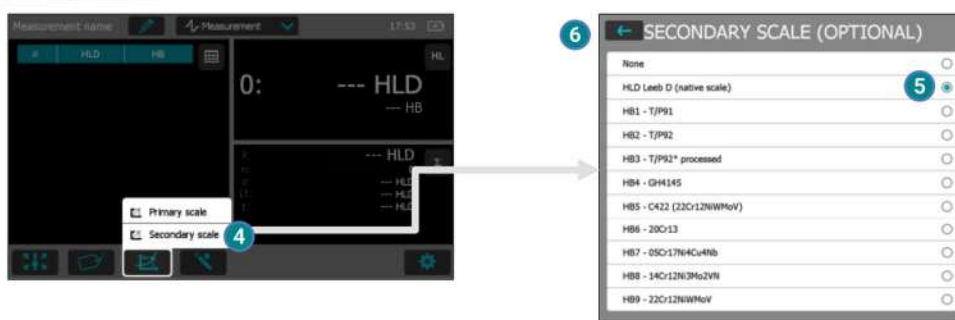
### Set Material

Choose High-Alloy Steels for Power Equipment as Material Group



### Set Secondary Scale

Choose Material HB1-HB9 as Secondary Scale to be Displayed in HBW Hardness Unit.



### NOTE

Leeb D and Leeb DC probes only!



## Conversion Range – Datasheet Leeb Probes on High-Alloy Steels (DL/T 1845)



← SECONDARY SCALE (OPTIONAL)

None	<input type="radio"/>
HLD Leeb D (native scale)	<input checked="" type="radio"/>
HB1 - T/P91	<input type="radio"/>
HB2 - T/P92	<input type="radio"/>
HB3 - T/P92* processed	<input type="radio"/>
HB4 - GH4145	<input type="radio"/>
HB5 - C422 (22Cr12NiWMoV)	<input type="radio"/>
HB6 - 20Cr13	<input type="radio"/>
HB7 - 05Cr17Ni4Cu4Nb	<input type="radio"/>
HB8 - 14Cr12Ni3Mo2VN	<input type="radio"/>
HB9 - 22Cr12NiWMoV	<input type="radio"/>

Material Class	Method	Unit	Leeb Probes
			D/DC
High-alloy steels			
P/T91 (10Cr9Mo1VNbN)			130-300
P/T92 (10Cr9moW2VNbBN)			130-281
P/T92 welded			140-330
GV4145	Brinell	HBW	280-390
C422 (22Cr12NiWMoV)			240-380
20Cr13			280-310
05Cr17Ni4Cu4Nb			265-333
14Cr12NiBmo2VN			280-403
22CR12NiWMoV			256-320

### NOTE

Leeb D and Leeb DC probes only!





# Conversion Unit & Material Selection



## UCI

Method 1

### Set Material

Measurement name: Measurement 17:52

0: --- HLD  
--- HB

1

3

MATERIAL

2

- Default conversion curve (Steel and cast steel)
- Quick Shift
- Cast Aluminium alloys
- GJS
- 304L / 1.4301
- Titanium Ti 6Al-4V
- Alloy 75 / 2.4630
- Incoloy 825 (2.4658)
- P91/T91

### Set Primary Scale

Measurement name: Measurement 17:53

0: --- HLD  
--- HB

4

6

PRIMARY SCALE

5

- HV Vickers (UCI) (native scale)
- HLD Leeb D
- HB Brinell
- HRA Rockwell A
- HRB Rockwell B
- HRC Rockwell C
- HR15N (N Brale diamond)
- HR15T (steel ball)

### Set Secondary Scale

Measurement name: Measurement 17:53

0: --- HLD  
--- HB

7

9

SECONDARY SCALE (OPTIONAL)

8

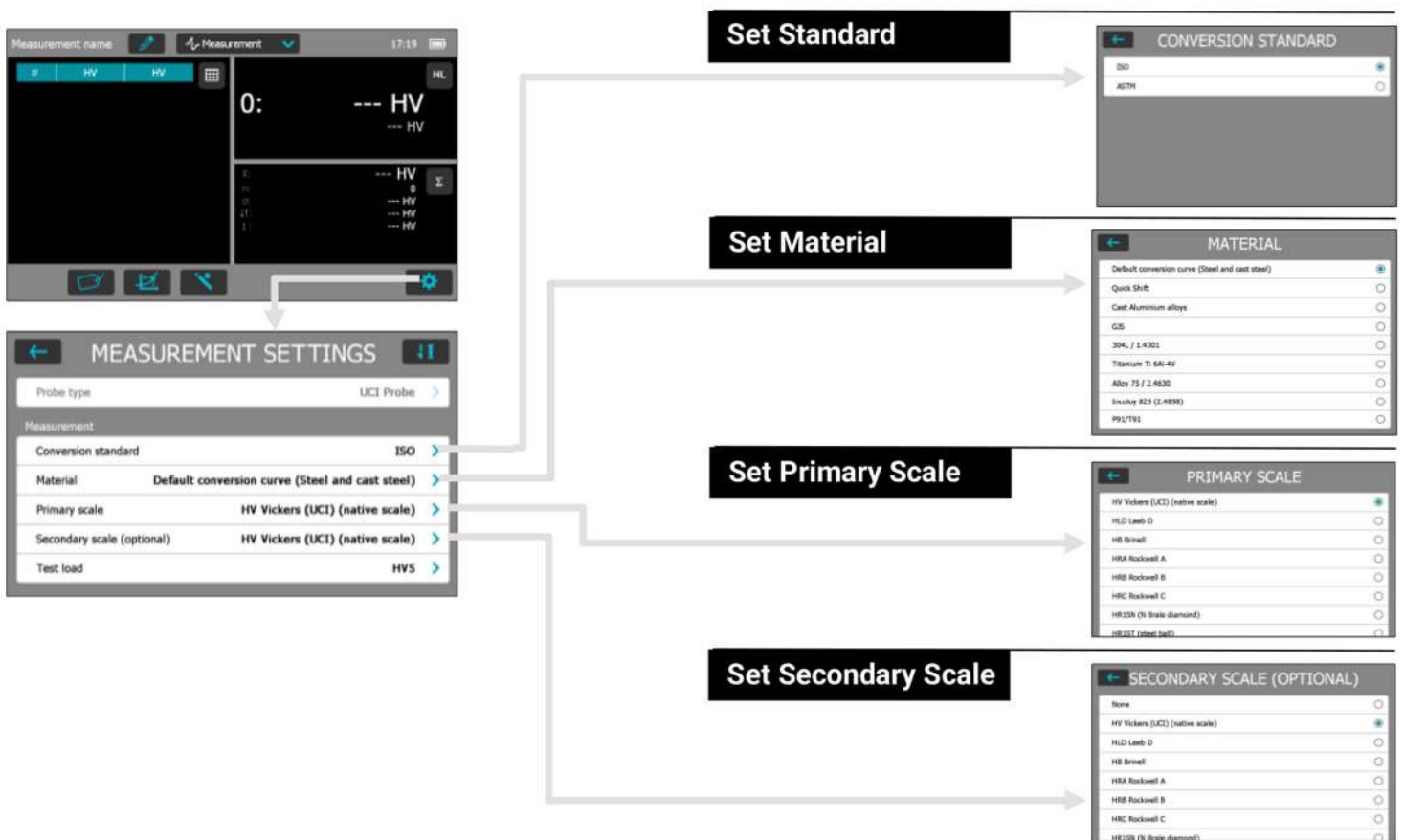
- None
- HV Vickers (UCI) (native scale)
- HLD Leeb D
- HB Brinell
- HRA Rockwell A
- HRB Rockwell B
- HRC Rockwell C
- HR15N (N Brale diamond)



# Conversion Unit & Material Selection

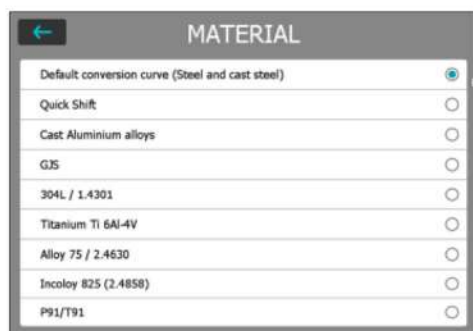
## UCI

Method 2





# Conversion Range Datasheet UCI



Material Class	Method	Unit	UCI Probes	
			Conversion Range	E Modulus GPa
Steel and cast Steel	Leeb	HLD	290 - 890	
	Brinell	HB	66 - 737	
	Rockwell	HRC	37 - 85	
		HRA	59 - 99	
	R <sub>m</sub>	HRB	20 - 70	210
		HR15N	69 - 94	
HR15T		78 - 96		
Aluminium	Vickers	MPa	220 - 2264	
		HV	30-200	75
<b>1-point quick-shift conversion curves:</b>				
Titanium Ti 6Al-4V		HV	263-406*	115
Cast Iron	Vickers	HV	141-193*	160
Incoloy 825 / 2.4858		HV	32-197*	195
304L/1.4307		HV	170-244*	200
P91/T91		HV	140-228*	218
Alloy 75/2.4630		HV	140-225*	221

## NOTE

\* Recommended conversion range base on 1-point quick shift conversions.

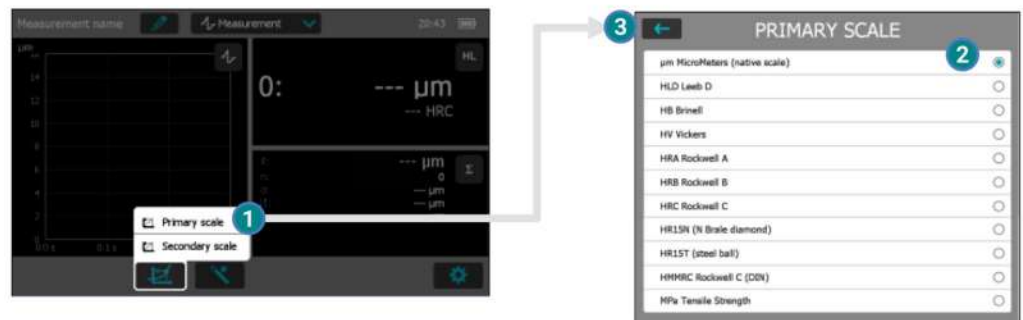
Measurements outside of this range may be prone to higher measurement errors.



# Conversion Unit & Material Selection Portable Rockwell

Method 1

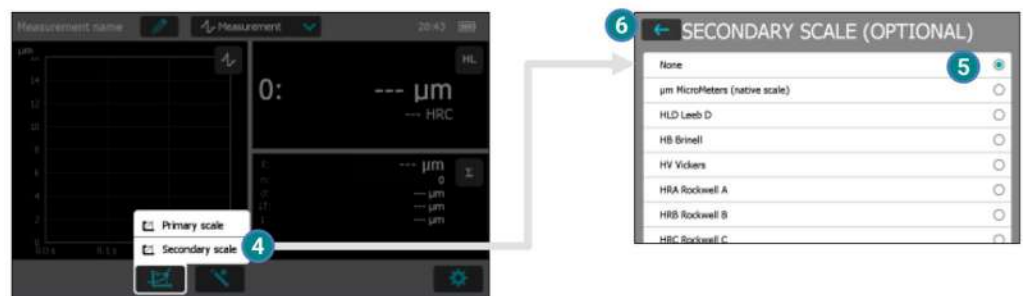
## Set Primary Scale



The screenshot shows the 'PRIMARY SCALE' selection menu. A callout box with a blue circle '1' points to the 'Primary scale' option in the bottom menu. A callout box with a blue circle '2' points to the 'µm MicroMeters (native scale)' option in the list. A callout box with a blue circle '3' points to the top of the list.

Scale	Selection
µm MicroMeters (native scale)	<input checked="" type="radio"/>
HLD Leeb D	<input type="radio"/>
HB Brinell	<input type="radio"/>
HV Vickers	<input type="radio"/>
HRA Rockwell A	<input type="radio"/>
HRB Rockwell B	<input type="radio"/>
HRC Rockwell C	<input type="radio"/>
HR15N (N Brale diamond)	<input type="radio"/>
HR15T (steel ball)	<input type="radio"/>
HMHR Rockwell C (COH)	<input type="radio"/>
MPa Tensile Strength	<input type="radio"/>

## Set Secondary Scale



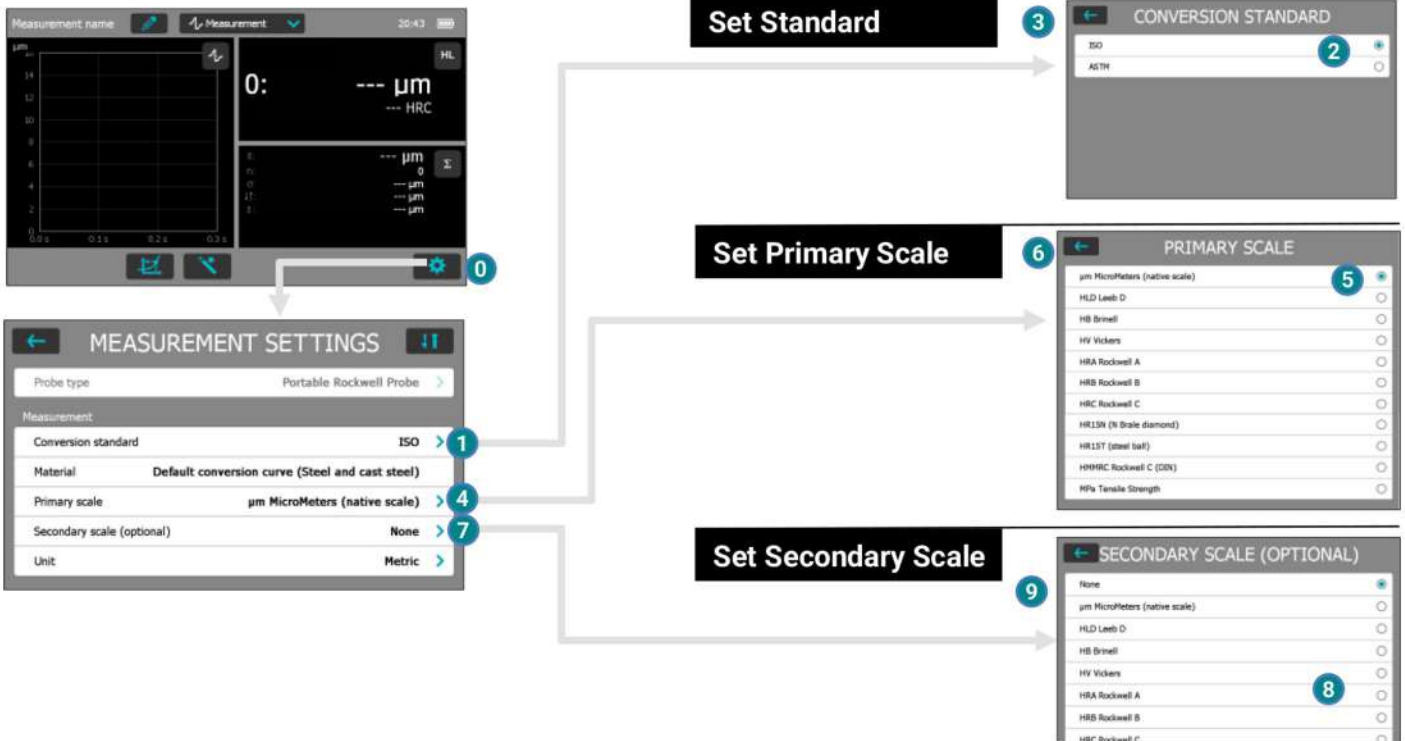
The screenshot shows the 'SECONDARY SCALE (OPTIONAL)' selection menu. A callout box with a blue circle '4' points to the 'Secondary scale' option in the bottom menu. A callout box with a blue circle '5' points to the 'None' option in the list. A callout box with a blue circle '6' points to the top of the list.

Scale	Selection
None	<input checked="" type="radio"/>
µm MicroMeters (native scale)	<input type="radio"/>
HLD Leeb D	<input type="radio"/>
HB Brinell	<input type="radio"/>
HV Vickers	<input type="radio"/>
HRA Rockwell A	<input type="radio"/>
HRB Rockwell B	<input type="radio"/>
HRC Rockwell C	<input type="radio"/>



# Conversion Unit & Material Selection Portable Rockwell

Method 2





# Conversion Range Datasheet Portable Rockwell

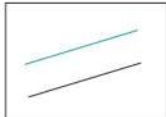
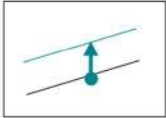


PRIMARY SCALE	
<input checked="" type="radio"/> $\mu\text{m}$ MicroMeters (native scale)	
<input type="radio"/> HLD Leeb D	
<input type="radio"/> HB Brinell	
<input type="radio"/> HV Vickers	
<input type="radio"/> HRA Rockwell A	
<input type="radio"/> HRB Rockwell B	
<input type="radio"/> HRC Rockwell C	
<input type="radio"/> HR15N (N Brale diamond)	
<input type="radio"/> HR15T (steel ball)	
<input type="radio"/> HMMRC Rockwell C (DIN)	
<input type="radio"/> MPa Tensile Strength	

Material Class	Method	Unit	Portable Rockwell	
			Conversion Range	
Steel and cast Steel	Leeb	HLD	290-890	
	Vickers	HV	30-1080	
	Brinell	HB	76-618	
		HRA	37-87	
	Rockwell	HRB	55-100	
		HRC	19-70	
		HR15N	69-93	
		HMMRC	19-70	
		Rm Nmm <sup>-2</sup>	MPa	255-2180



## User-Defined Conversion Curves Curve Types

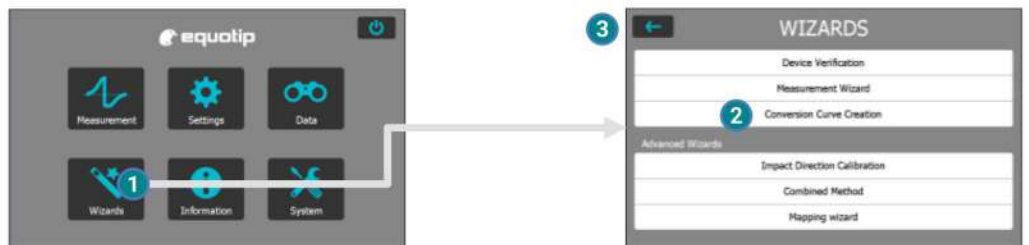


Type	Function		METHOD
<b>One Point</b>	<b>Offset of the existing conversion</b> Shifts the existing conversion to user-defined hardness value		LEEB, ROCKWELL, UCI
<b>One Point</b>	<b>Import quick shift value (UCI only)</b> Shifts the value in Vickers HV(UCI) to a new user-defined defined hardness value according to ASTM E140 and ISO 18265 standard		UCI
<b>Two Points</b>	<b>Rotation of existing conversion</b> Rotates the existing conversion curve with two user-defined hardness values		LEEB, ROCKWELL, UCI
<b>Two Points</b>	<b>Definition of curve through coefficients</b> Generates entire conversion curve from a polynomial equation by typing-in the equation coefficients		LEEB, ROCKWELL, UCI

# User-Defined Custom Conversion Conversion Curve Type Selection

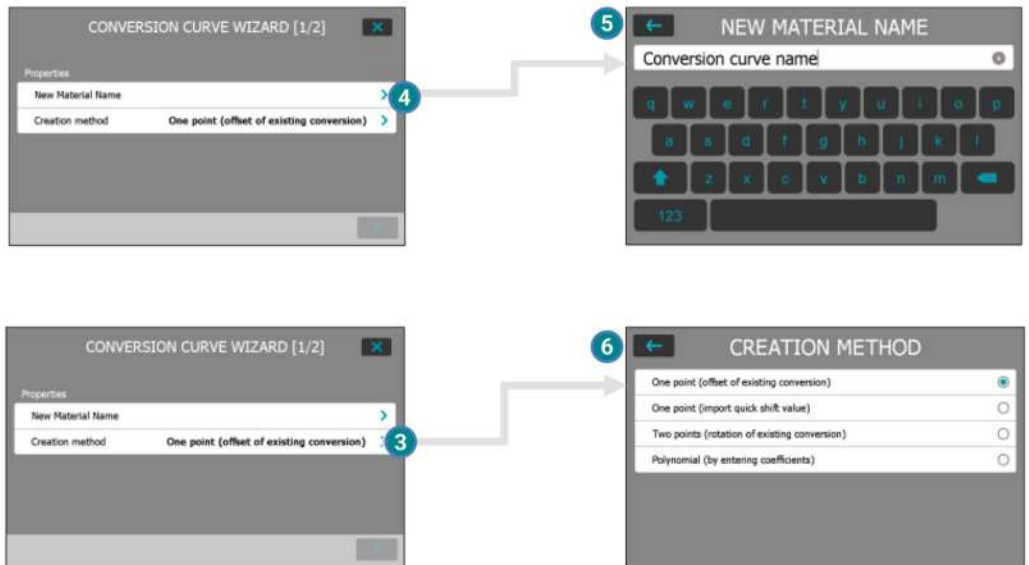


## Start Wizard



## Create Method

Type in the Name of Conversion Curve/Material

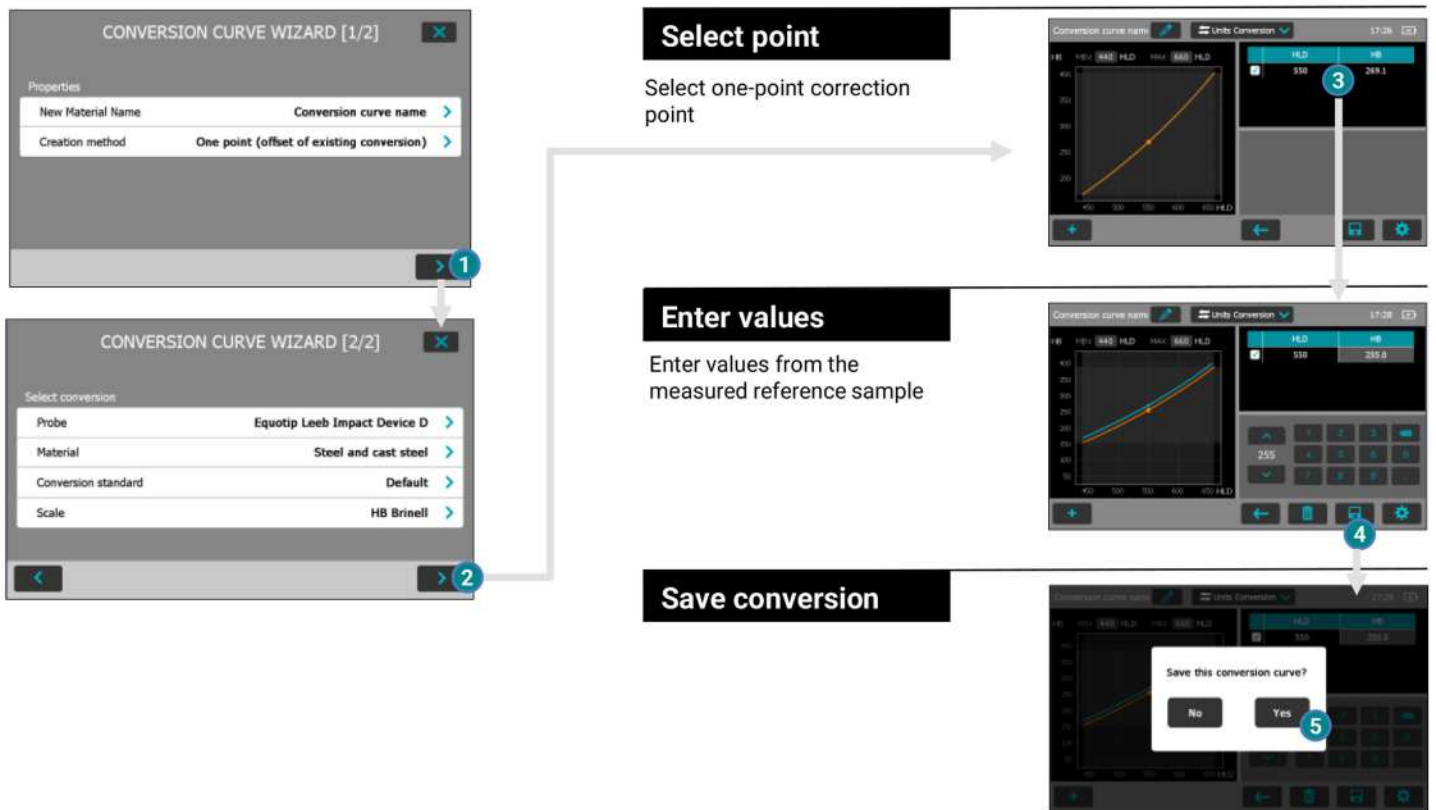




# User-Defined Conversion Curves

## One Point

Offset of Existing Conversion



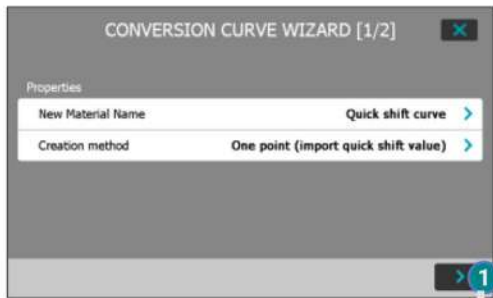


# User-Defined Conversion Curves

## One Point

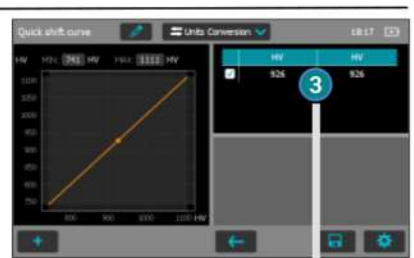


Import Quick Shift Value



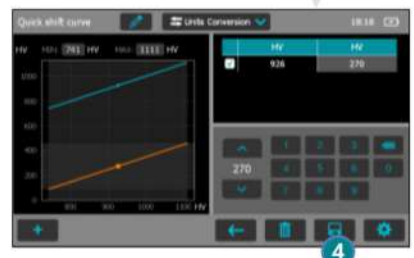
### Select point

Select one-point correction point



### Enter values

Enter values from the measured reference sample



### Save conversion

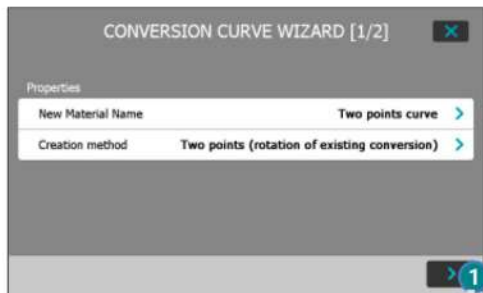




# User-Defined Conversion Curves

## Two Point Curve

Rotation of Existing Conversion



### Select point

Select first/second correction point



### Enter values

Enter values for the first/second point from the measured reference samples



### Save conversion



# Conversion Curves: Polynomial

Definition of Curve by Entering Coefficients

**Select point**

Select the polynomial equation coefficients: **A0, A1... A5**

**Enter values**

Enter the polynomial equation coefficients: **A0, A1... A5**

**Save conversion**

## Equation Format

$$ScaleB(HLD) = A0 + A1 \cdot HLD_1 + A2 \cdot HLD_2 + A3 \cdot HLD_3 + A4 \cdot HLD_4 + A5 \cdot HLD_5$$

## Example

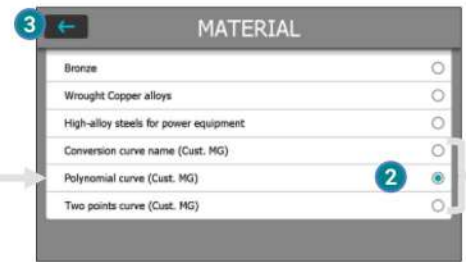
$$HB(HLD) = -2.7862E+02 - 2.3014E+00(HLD)^1 + 7.8978E-03(HLD)^2 - 9.5946E-06(HLD)^3 + 5.0641E-09(HLD)^4 + 0.00(HLD)^5$$

# Using the Custom Conversion Curves

## Example: Polynomial Curve HB(HLD)

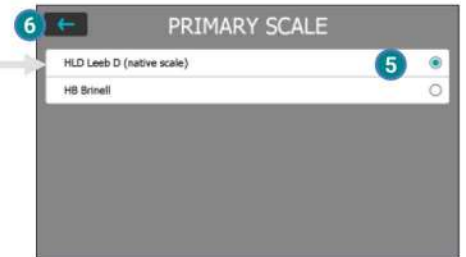
### Set Material

User-defined conversion curves:  
e.g. Polynomial curve (Cust. MG)



Custom  
Material Groups

### Set Primary Scale



### Set Secondary Scale

