







**Laptop Not Included*


Operation Manual





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iVision-HB Automatic Brinell Hardness Indentation Measurement

1. **Install iVision-HB:** Double click the installer file **iVision_v1.0.0_TZ00xxxx_installer.exe** on the installation CD, answer yes to the prompts, the application and the driver of the USB camera should be installed.
2. **Open iVision-HB:** Insert the USB to USB adapter in your PC and plug in the USB cable to the adapter and the camera. Wait until the camera driver is installed. Push the red button on the camera to start the application or just start the application from the desktop. In case the HB user interface does not show, select menu HB->HB measurement. For first time use, use mouse dragging to resize the main window, the splitter panes, and the table column widths etc to user's preference.
3. **Start the camera:** Click on the video preview  button in upper right of the main window to start the USB camera. If a wrong camera is started by the PC, select menu Capture->Open image capture window, go to menu Device and select the system camera **Digital microscope**.
4. **Set measurement parameter(s):** At the bottom right of the main window, click on button **Settings -> Test Settings** to open the HB Measurement Settings dialog. To set the indentation force for the test sample, select F/D2 and the indentation ball diameter, the test force will be calculated automatically. For the USB camera, the **Auto-measure method** should be set to the default **Brightness**. Only set **Auto-measure method** to **Edge** in cases of high sample image background.
5. **Calibrate the camera:** At first time use or after calibration is unloaded as described below, the system needs to be calibrated for HB measurement. A Brinell hardness test block can be used to calibrate the system. To use the test block, set the test force as described above. To start automatic measurement, push the camera button, or press the Space key on the keyboard, or click the **Auto Measure**  button in the upper right part of the user interface. If the system can't find the indentation automatically, click on the manual measurement button (**Measure by circle**  or **Measure by major-minor axes** ).

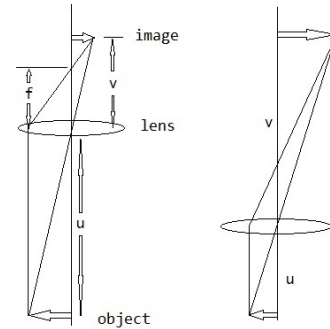
In case of measurement by circle, mouse press on one end of the indentation diameter and drag to the other end. If the indentation shape is elliptical, then measurement by major-minor axes applies, mouse press on one end of the indentation major axis and drag to the other end, and then do the same on the minor axis. Enter the known HB value of the sample at the prompt; the system should be calibrated and ready for measurement. To re-calibrate the system, it is necessary to unload the calibration. To do so, select menu **Calibration->Calibration viewer**, enter password if set or click OK to pass, click **Unload** button and close the viewer, the system should be at un-calibrated state. Do calibration as described above. Note: the formula to calculate HB is: $HB = 2 \times F / (\pi \times D_b \times (D_b - (D_b^2 - D_i^2)^{1/2}))$, where F is the test force in Kg, D_b is the indenter ball diameter in mm, and D_i is the indentation diameter in mm. To obtain better accuracy, user may re-calibrate with the average of multiple indentations on the calibration sample, to do so click on the Re-calibrate with sample average button  in the Settings tab, and enter the HB value of the calibration sample. The re-calibrated data is activated and saved automatically.

- 6. Measure:** If the camera is still (e.g, after a measurement), push the camera button, or press the Space key on the keyboard, or click on the **Video Preview** button to start camera preview. Move the camera or the sample to make the indentation appear in the middle of the preview. Make the measurement as described above.
- 7. Correct the measurement:** If correction of measurement is needed, mouse press and drag the label circle (in case of Measure by circle) or the four vertices (in case of Measure by major-minor axes) to align the label with the indentation, and release. Measurement value and statistics etc will update automatically.
- 8. Report:** Click on the **Generate Report**  button to generate report in Word format. User may opt not to report the indentation images or the data by checking the Report Settings on the HB measurement settings dialog.
- 9. Start a new sample:** Click on the New Sample  button to clear the measurement results to start the measurement on a new sample.

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Appendix: Change the camera magnification

1. **Basics of the camera optics:** The camera lens magnifies the indentation with the image projected on the camera photo sensor. According to the principle of optics, $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$, $mag = \frac{v}{u}$. For each object to camera sensor distance (larger than 2f), there is one set of (u,v) and u & v can change places. Therefore, at a fixed object to camera sensor distance, there are only two lens locations to focus giving two inverse magnifications. The photo sensor of the system camera is 1/3" image format with the size of 3.6mmX4.8mm.



2. **Four magnifications:** For better measurement accuracy, the system provides two caps, i.e, two distances between sample and camera sensor, thus four magnifications to cover the Brinell indentation ranging from 1.2mm to 6.0mm. The 75mm cap provides magnification #1 that covers indentation diameters from 3 to 6mm (with indentation image between half and full image frame size), and magnification #2 from 0.8mm to 1.6mm. The 70mm cap provides magnification #3 that covers from 2 to 4mm and magnification #4 from 1 to 2mm. User may decide and change to either one of the 4 magnifications according the measured indentation size. If not specified, the system is shipped at the most often used magnification #3 (2-4mm).



3. Change magnification:

- a) **Step 1:** Unscrew the camera cap
(the black tube and the stainless base together).



- b) **Step 2:** If the same cap is to be used (just a different magnification with the same cap), then skip to step 5, otherwise loose the M3 set screw on the base and take the base off the 4 beam rods.



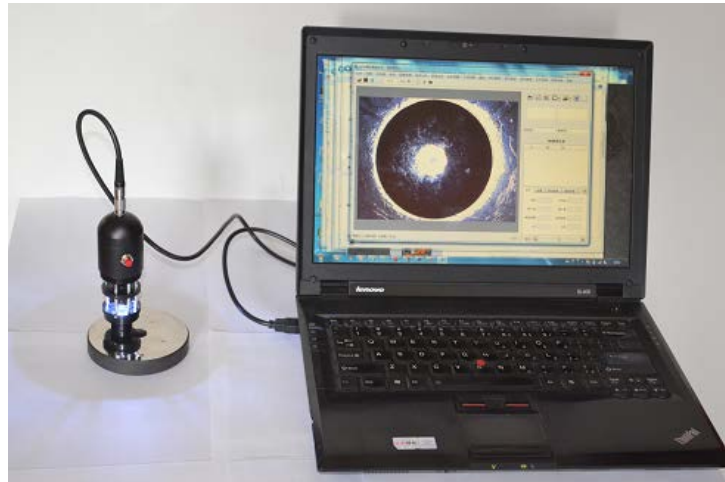
- c) **Step 3:** Remove the two length fixing rods and replace with the ones with new length for the new cap (31mm rod for 70mm cap and 36mm rod for the 75mm cap).



- d) **Step 4:** Slide the base onto the 4 beam rods until stopped by the length fixing rods, and tighten the M3 set screw. The purpose of the length fixing rods is to make sure the base flushes with the stainless steel base when the cap is in place.



- e) **Step 5:** Attach the USB cable and plug in the camera head to the PC. Open the system software for video preview, sit the base on a sample, loosen the M3 set screw on the lens fixture, slide the length fixture to one of the two focal positions (the upper one has smaller magnification than the lower one), fine adjust to focus and finally tighten the M3 set screw on the lens fixture.



- f) **Step 6:** Screw in the corresponding cap. The stainless steel base and the internal base should be flush to ensure the same focal plane. The camera head should be ready for the new magnification.





Optical Brinell Scan System

Model No. PHT-5000

*Laptop not included

Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell C Hardness Range)^A

Rockwell C 150kgf (HRC)	Vickers (HV)	Brinell Hardness Number ^c		Knoop 500-gf and Over (HK)	Rockwell		Superficial Rockwell Number			Scleroscope Hardness _s
		10-mm Standard ball 3000kgf (HBS)	10-mm Carbide ball 3000kgf (HBW)		A Scale 60 kgf (HRA)	D Scale 100kgf (HRD)	15-N Scale 15-kgf (HR15N)	30-N Scale 30-kgf (HR30N)	45-N Scale 45-kgf (HR45N)	
68	940	...	...	920	85.6	76.9	93.2	84.4	75.4	97.3
67	900	...	...	895	85.0	76.1	92.9	83.6	74.2	95.0
66	865	...	...	870	84.5	75.4	92.5	82.8	73.3	92.7
65	832	...	(739)	846	83.9	74.5	92.2	81.9	72.0	90.6
64	800	...	(722)	822	83.4	73.8	91.8	81.1	71.0	88.5
63	772	...	(705)	799	82.8	73.0	91.4	80.1	69.9	86.5
62	746	...	(688)	776	82.3	72.2	91.1	79.3	68.8	84.5
61	720	...	(670)	754	81.8	71.5	90.7	78.4	67.7	82.6
60	697	...	(654)	732	81.2	70.7	90.2	77.5	66.6	80.8
59	674	...	634	710	80.7	69.9	89.8	76.6	65.5	79.0
58	653	...	615	690	80.1	69.2	89.3	75.7	64.3	77.3
57	633	...	595	670	79.6	68.5	88.9	74.8	63.2	75.6
56	613	...	577	650	79.0	67.7	88.3	73.9	62.0	74.0
55	595	...	560	630	78.5	66.9	87.9	73.0	60.9	72.4
54	577	...	543	612	78.0	66.1	87.4	72.0	59.8	70.9
53	560	...	525	594	77.4	65.4	86.9	71.2	58.6	69.4
52	544	(500)	512	576	76.8	64.6	86.4	70.2	57.4	67.9
51	528	(487)	496	558	76.3	63.8	85.9	69.4	56.1	66.5
50	513	(475)	481	542	75.9	63.1	85.5	68.5	55.0	65.1
49	498	(464)	469	526	75.2	62.1	85.0	67.6	53.8	63.7
48	484	451	455	510	74.7	61.4	84.5	66.7	52.5	62.4
47	471	442	443	495	74.1	60.8	83.9	65.8	51.4	61.1
46	458	432	432	480	73.6	60.0	83.5	64.8	50.3	59.8
45	446	421	421	466	73.1	59.2	83.0	64.0	49.0	58.5
44	434	409	409	452	72.5	58.5	82.5	63.1	47.8	57.3
43	423	400	400	438	72.0	57.7	82.0	62.2	46.7	56.1
42	412	390	390	426	71.5	56.9	81.5	61.3	45.5	54.9
41	402	381	381	414	70.9	56.2	80.9	60.4	44.3	53.7
40	392	371	371	402	70.4	55.4	80.4	59.5	43.1	52.6
39	382	362	362	391	69.9	54.6	79.9	58.6	41.9	51.5
38	372	353	353	380	69.4	53.8	79.4	57.7	40.8	50.4
37	363	344	344	370	68.9	53.1	78.8	56.8	39.6	49.3
36	354	336	336	360	68.4	52.3	78.3	55.9	38.4	48.2
35	345	327	327	351	67.9	51.5	77.7	55.0	37.2	47.1
34	336	319	319	342	67.4	50.8	77.2	54.2	36.1	46.1
33	327	311	311	334	66.8	50.0	76.6	53.3	34.9	45.1
32	318	301	301	326	66.3	49.2	76.1	52.1	33.7	44.1
31	310	294	294	318	65.8	48.4	75.6	51.3	32.5	43.1
30	302	286	286	311	65.3	47.7	75.0	50.4	31.3	42.2
29	294	279	279	304	64.8	47.0	74.5	49.5	30.1	41.3
28	286	271	271	297	64.3	46.1	73.9	48.6	28.9	40.4
27	279	264	264	290	63.8	45.2	73.3	47.7	27.8	39.5
26	272	258	258	284	63.3	44.6	72.8	46.8	26.7	38.7
25	266	253	253	278	62.8	43.8	72.2	45.9	25.5	37.8
24	260	247	247	272	62.4	43.1	71.6	45.0	24.3	37.0
23	254	243	243	266	62.0	42.1	71.0	44.0	23.1	36.3
22	248	237	237	261	61.5	41.6	70.5	43.2	22.0	35.5
21	243	231	231	256	61.0	40.9	69.9	42.3	20.7	34.8
20	238	226	226	251	60.5	40.1	69.4	41.5	19.6	34.2



Optical Brinell Scan System

Model No. PHT-5000

*Laptop not included

Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell B Hardness Range)^A

Rockwell B 100kgf (HRB)	Vickers (HV)	10-mm Standard ball 3000kgf (HBS)	Knoop 500-gf and Over (HK)	Rockwell Superficial Rockwell Number				
				A Scale 60 kgf (HRA)	F Scale 60kgf (HRF)	15-T Scale 15-kgf (HR15T)	30-T Scale 30-kgf (HR30T)	45-T Scale 45-kgf (HR45T)
100	240	240	251	61.5	...	93.1	83.1	72.9
99	234	234	246	60.9	...	92.8	82.5	71.9
98	228	228	241	60.2	...	92.5	81.8	70.9
97	222	222	236	59.5	...	92.1	81.1	69.9
96	216	216	231	58.9	...	91.8	80.4	68.9
95	210	210	226	58.3	...	91.5	79.8	67.9
94	205	205	221	57.6	...	91.2	79.1	66.9
93	200	200	216	57.0	...	90.8	78.4	65.9
92	195	195	211	56.4	...	90.5	77.8	64.8
91	190	190	206	55.8	...	90.2	77.1	63.8
90	185	185	201	55.2	...	89.9	76.4	62.8
89	180	180	196	54.6	...	89.5	75.8	61.8
88	176	176	192	54.0	...	89.2	75.1	60.8
87	172	172	188	53.4	...	88.9	74.4	59.8
86	169	169	184	52.8	...	88.6	73.8	58.8
85	165	165	180	52.3	...	88.2	73.1	57.8
84	162	162	176	51.7	...	87.9	72.4	56.8
83	159	159	173	51.1	...	87.6	71.8	55.8
82	156	156	170	50.6	...	87.3	71.1	54.8
81	153	153	167	50.0	...	86.9	70.4	53.8
80	150	150	164	49.5	...	86.6	69.7	52.8
79	147	147	161	48.9	...	86.3	69.1	51.8
78	144	144	158	48.4	...	86.0	68.4	50.8
77	141	141	155	47.9	...	85.6	67.7	49.8
76	139	139	152	47.3	...	85.3	67.1	48.8
75	137	137	150	46.8	99.6	85.0	66.4	47.8
74	135	135	147	46.3	99.1	84.7	65.7	46.8
73	132	132	145	45.8	98.5	84.3	65.1	45.8
72	130	130	143	45.3	98.0	84.0	64.4	44.8
71	127	127	141	44.8	97.4	83.7	63.7	43.8
70	125	125	139	44.3	96.8	83.4	63.1	42.8
69	123	123	137	43.8	96.2	83.0	62.4	41.8
68	121	121	135	43.3	95.6	82.7	61.7	40.8
67	119	119	131	42.8	95.1	82.4	61.0	39.8
66	117	117	129	42.3	94.5	82.1	60.4	38.7
65	116	116	127	41.8	93.9	81.8	59.7	37.7
64	114	114	125	40.9	93.4	81.4	59.0	36.7
63	112	112	124	40.4	92.8	81.1	58.4	35.7
62	110	110	122	40.0	92.2	80.8	57.7	34.7
61	108	108	120	39.5	91.7	80.5	57.0	33.7
60	107	107	118	39.0	91.1	80.1	56.4	32.7
59	106	106	117	38.6	90.5	79.8	55.7	31.7
58	104	104	115	38.1	90.0	79.5	55.0	30.7
57	103	103	114	37.7	89.4	79.2	54.4	29.7
56	101	101	112	37.2	88.8	78.8	53.7	28.7
55	100	100	111	36.8	88.2	78.5	53.0	27.7
...	...	...	110	36.3	87.7	78.2	52.4	26.7
...	...	...	109	35.9	87.1	77.9	51.7	25.7
...	...	...	108	35.5	86.5	77.5	51.0	24.7
...	...	...	107	35.0	86.0	77.2	50.3	23.7
...	...	...	106	34.6	85.4	76.98	49.7	22.7
...	...	...	105	34.1	84.8	76.6	49.0	21.7
...	...	...	104	33.7	84.3	76.2	48.3	20.7
...	...	...	103	33.3	83.7	75.9	47.7	19.7
...	...	...	102	32.9	83.1	75.6	47.0	18.7
...	...	...	101	32.4	82.6	75.3	46.3	17.7
...	...	...	100	32.0	82.0	74.9	45.7	16.7
...	...	...	99	31.6	81.4	74.6	45.0	15.7
...	...	...	98	31.2	80.8	74.3	44.3	14.7
...	...	...	97	30.7	80.3	74.0	43.7	13.6
...	...	...	96	30.3	79.7	73.6	43.0	12.6
...	...	...	95	29.9	79.1	73.3	42.3	11.6
...	...	...	94	29.5	78.6	73.0	41.6	10.6
...	...	...	93	29.1	78.0	72.7	41.0	9.6
...	...	...	92	28.7	77.4	72.3	40.3	8.6
...	...	...	91	28.2	76.9	72.0	39.6	7.6
...	...	...	90	27.8	76.3	71.7	39.0	6.6
...	...	...	89	27.4	75.7	71.4	38.3	5.6
...	...	...	88	27.0	75.2	71.0	37.6	4.6
...	...	...	87	26.6	74.6	70.7	37.0	3.6
...	...	...	...	...	74.0	70.4	36.3	2.6

Approximate Leeb (Type D) Hardness Conversion for Non-Austenitic Steels (Rockwell C Hardness Range)^A

Leeb Hardness, Type D Impact Device (HLD)	Rockwell C Hardness 150kgf (HRC)	Vickers Hardness (HV 10)	Brinell Hardness 10mm Steel Ball 3000kgf (HBS)
828	62	762	(721)
819	61	737	(699)
809	60	711	(675)
800	59	688	(654)
791	58	667	634
782	57	645	614
773	56	625	595
764	55	605	577
755	54	586	559
746	53	568	542
737	52	550	526
729	51	534	511
720	50	517	496
712	49	503	482
703	48	487	467
695	47	473	455
687	46	460	442
679	45	447	430
671	44	434	418
663	43	422	407
655	42	410	395
647	41	398	385
640	40	388	375
632	39	377	365
625	38	368	356
618	37	358	347
611	36	349	338
603	35	339	328
596	34	330	320
590	33	323	313
583	32	314	305
576	31	306	297
570	30	299	291
563	29	291	283
557	28	284	276
551	27	277	270
545	26	271	264
539	25	264	258
533	24	258	252
527	23	251	246
521	22	245	240
516	21	240	235
510	20	234	229

Global Connections



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Warranty /Return Policy

Warranty Policy:

All portable and stationary material testing instruments manufactured for/by Phase II shall be free from defects in material and workmanship for a period of 1 to 5 full years (depending upon model) from date of purchase. Parts found to be defective shall be replaced or repaired at Phase II's sole discretion. Products found by Phase II to be misused, abused or neglected are not covered under this warranty. Parts not covered by this warranty are normal wear and consumable items such as (but not limited to) impact balls, impact bodies, diamond indentors, carbide ball indentors, impact springs, cables and connectors, batteries, diamond stylus, contact probes, points and test blocks.

**Consumable(wearable) items such as cables and probes
have a 90 day warranty from date of purchase.**

This warranty is exclusive and in lieu of all other warranties whether written, oral or implied, including any implied warranties or merchantability or fitness for a particular purpose. In no event shall Phase II be liable for any incidental, special or consequential damages of any nature.

Any attempts to "open, modify, or tamper with" this device by anyone other than Phase II will result in a voided warranty.

Return Policy:

All Phase II products must have authorization prior to return.

If product is not acceptable for any reason including application issues and demonstrations, authorization for return must be obtained within 5 days of receipt of product. Unit must be in same new condition it was received. Failure to do so will result in an automatic 15% restocking fee. Returns after 30 days will not be accepted.