Ultrasonic Hardness Tester

Model No: MET - U1A / MET-U1A50

Instruction Manual

Non-Destructive Hardness Tester!

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Ultrasonic Transducer

Ultrasonic Testing (UCI)Method information:

UCI method Ultrasonic Contact Impedance, a hardness testing method developed by Dr. Claus Kleesattel in 1961 based on the measurement of the frequency shift of a resonating rod caused by the essentially elastic nature of a of the finite area of contact between the indenter and the test piece during the penetration.

In the mobile hardness test under applied load according to the UCI method, the size of the produced indents are not determined optically. Instead the contact area is derived from the electronically measured shift of an ultrasonic resonance frequency. To carry out the UCI test, a probe containing the rod with the indenter is excited into a longitudinal ultrasonic oscillation of about 70 kHz by piezo-electric ceramics- the so called zero frequency, which occurs when the indenter is vibrating in air. A spring inside the probe applies the specified test load, the vibrating tip penetrates into the material creating an elastic contact, which results in a positive frequency shift of the resonating rod. This shift is related to the size of the indent area. The size, in turn, is a measure for hardness of the test material at a given modulus of elasticity.

Functions of the Phase II MET-U1A Hardness Tester

The Phase II MET-U1A is a state of the art, handheld hardness tester that provides high accuracy and simplicity of operation for a wide measuring range. It is suitable for testing the hardness of most metals and is widely applied in many industries including the petroleum, chemical, industrial machining and electric power industries, etc. Test direction (upside down) does not influence the readout.

Typical Applications MET-U1A

- Capable of checking hardness on a variety of metals with varying mass and thickness.
- Especially suited for checking finished articles with a polished surface since there is no visible imprint left after testing
- Restrictions include all coarse grain structured metals such as Cast Iron or items that are less than 1mm in thickness.

The MET-U1A portable hardness tester is designed to measure hardness of metals and alloys in the most popular hardness scales, such as Rockwell C (HRC), Rockwell B (HRB), Brinell (HB), Vickers (HV). Calibration on these scales are carried out directly by Phase II prior to shipment of each unit.

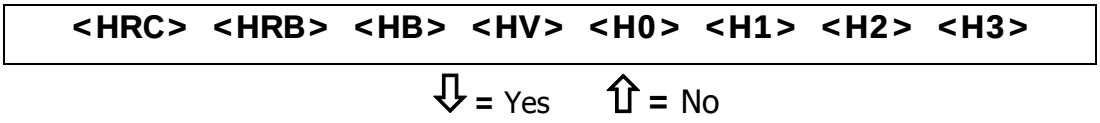
The MET hardness tester offers additional "open" scales (H0, H1, H2, H3) that provide the opportunity to:

● Calibrate and conduct hardness tests in other scales (i.e., Superficial Rockwell (HRN and HRT) or any other common hardness scale)

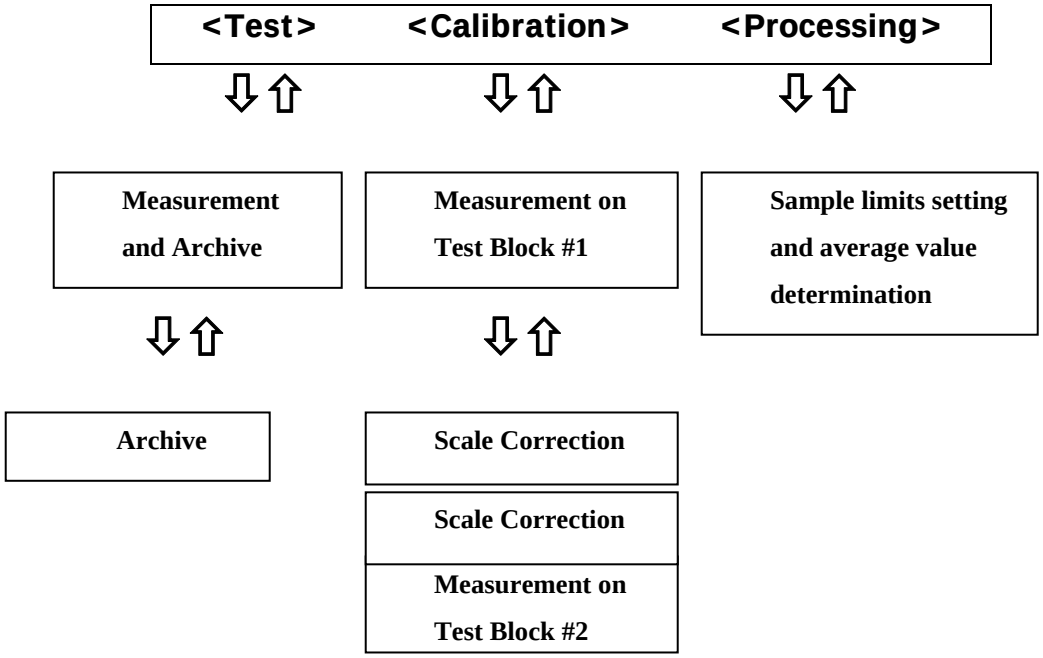
● Conduct hardness test of metals that have significantly different properties from steel (iron, aluminum and copper alloys etc.).

Setting Test Parameters

1) **Scale Selection** (Press Left or Right Arrow for selections)



2) **Operation Mode Selection** (Press Left or Right Arrow for selections)



Every level of the menu allows the selection of parameters or modes of operation.

- The first level – 'scale' – allows you to choose the current (operational) hardness scale from the following: HRC, HB, HV, H0, H1, H2 or H3.
- The second level – 'measurement-calibration-processing' – allows you to select the current (operational) hardness tester mode: measurement, calibration or processing.
- The third level – 'YES/NO' allows you to confirm or cancel the selected operation and get back to the former operations by pushing ↑ button.

By pushing the ↑ and ↓ buttons it allows you to choose the menu level and by pushing the ←→ buttons it allows you to select a parameter within the chosen level.

MET Power Supply

The NiMh battery compartment is located on the back side of the electronic module. To access this compartment, remove the two rubber covers and loosen the two hex screws using the supplied hex wrench. Please note that this unit is sealed using very small O-rings for each screw. Be sure they are in place when putting the battery cover back in place. When installing the new batteries, be sure to pay attention to the polarity of the battery. Be sure to dispose of the batteries according to local regulations.

The battery capacity indicator is shown on the right side of the display. Three dark squares inside the battery symbol show the battery condition. As the battery discharges, the squares disappear one by one from top to bottom. **APPROX. CHARGE TIME IS 3 HRS**

Battery charging can be done with the supplied a/c adapter or via USB connection to your PC.

The MET is capable of all functions while being charged.

Be sure that the battery is installed prior to connecting the charger. Failure to follow this may result in possible damage to the charging and/or electronics system and void any stated warranty.

Please note that that the 4-pin female port on the left side of the hardness tester is used for charging and output. Once the charger is plugged in, you will see the lights in the battery symbol ascend from bottom to top. When the battery symbol is fully lit, the unit is completely charged and you should proceed to remove the charger from the hardness tester.

Procedure of Operation

Preparation for Operation

Visual Inspection

Make visual inspection of the device, making sure that there is no mechanical damage to the electronic transducer, connective cable.

Surface Preparation

Prepare the area of the tested surface by removing moisture, lubricants, scale, oxidation, rust, etc.
The roughness of the part to be tested and radius of curvature of the tested surface and also mass and size parameters of the article shall correspond to the parameters given in the hardness tester data sheet.

Transducer Connection

Transducer shall be connected to the electronic module by a five-pin plug. The transducer plug is equipped with a threaded connector for positive connection.
To connect the transducer, make the following steps:

- make sure the 5 pin plug lines up with the connector on the base instrument.
- Insert the plug of the transducer into the 5-pin female port by pushing slightly and then turn clockwise to tighten plug into female connector. Snug only. Do not over tighten.

Power Unit On

- Press 🡻 button to power on the hardness tester
- The MET will automatically recognize the type of transducer and will show the results on the display by showing **'ultrasonic sensor'**
- after the hardness tester performs this start up procedure, the hardness tester will show the last parameters used and start up in the "Archive" section.

Power Supply Switching Off

- The MET will automatically shut off after a 3 minute period of non-usage.
- To Manually shut off the unit, Press the 🡸🡺 buttons simultaneously.

Display Lighting

Display lighting is switched on and off by pushing ↑ button from the first level in the "Scale" menu. Operation with display lighting will slightly reduce the time the device can operate on a full charge.

Operation with Electronic Module

Choosing parameters

Power Unit on according to instructions:

Scale Selection

- Begin by pressing the ↑ button to get to the – 'scale' – parameter. In the display upper part, words 'XXX scale' will appear, where 'XXX' can be HRC, HRB, HB, etc
- Select the hardness scale you need by pushing ← and → buttons.
- Confirm the selection of the required for you hardness scale by pushing ↓ button. After that you will automatically advance to the second level "TEST"

Operation Mode Selection

- Select the required operation mode – 'TEST' or 'CALIBRATE', or 'PROCESS' by pushing either ← and → buttons.
- when you are in the parameter that you need, press the ↓ button to confirm this procedure. The hardness tester is now ready for that operation.

Operation Canceling

To cancel an operation or to return to the previous one press the ↑ button.

'Test' Mode

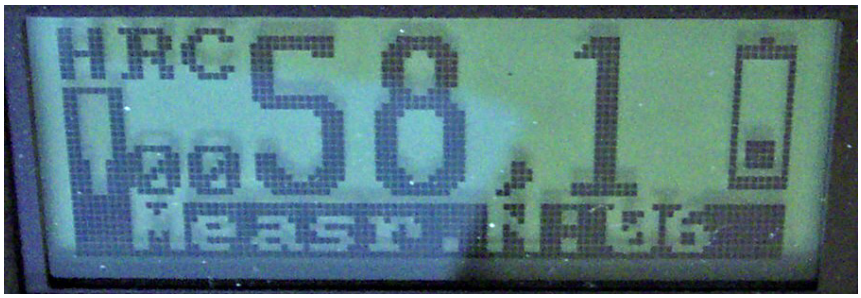
'Test' mode and all operations within this mode shall be conducted separately for U1 ultrasonic transducer. The given below operations can be performed in this mode.

- Archive
- Measurement and recording

'Archive' Operation

Hardness tester operation in 'measurement' mode always starts with the 'Archive' operation.

Attention! During the first operation it is recommended to skip the 'archive' operation and proceed with 'measurement and recording' operation. For this purpose, push 🡻 button.



View of Display *(Measurement Mode)*

Explanation of display

'HRC' = Rockwell C Scale;

'58.1' = the measured value on HRC scale;

"00" is the number of tests taken to be stored in the 06 archive (as each test is taken, this number will increase from 00 to 01 to 02, etc.

'Measure #06 is the number of the archive cell in which 58.1 HRC will be stored;

'battery' symbol is battery power indicator

View of Display *(Archive Mode)*

Archive cell number changing

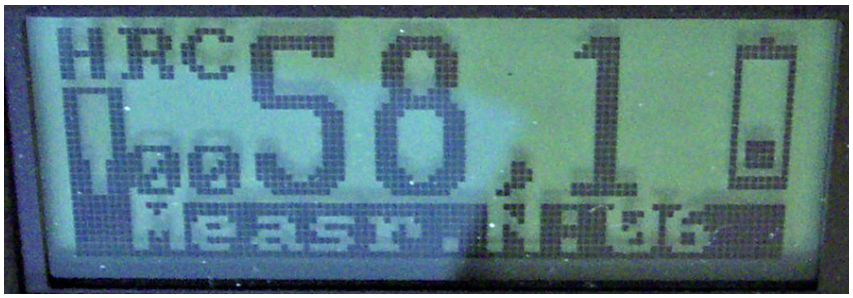
While in the Archive mode (Display is shown above) you need to push either the ← or → buttons to change the archive cell number. The change of the archive cell number will result in the change of the readings of the measured value (58.1) into the readings of another measured value saved under the relevant archive number (#06, 07, 08, etc.). The hardness scale (HRC), however, will remain unchanged.

To look through the archive in the other hardness scales (HRB, HB, etc.), it is necessary to set the scale you need by pressing the appropriate buttons

‘Measurement and Recording’ Operation

Start ‘measurement and recording’ operation by pushing 🡻 button in order to finish and go out from the ‘archive’ operation. Indication on the display is shown on the figure below.

🡻



To obtain the mean value of your latest archived results, press the 🡻 button.

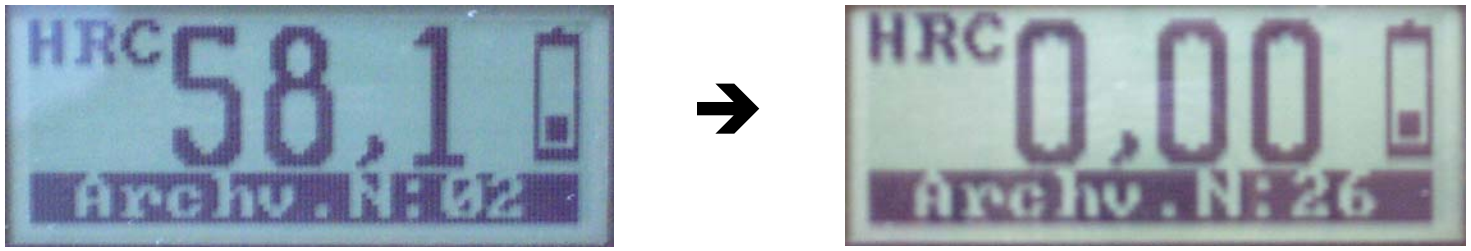
After the mean value computation, the hardness tester will automatically start the ‘archive’ operation for you to save the obtained results. If you do not want to save the results and want to continue your measurement, push 🡻 button to switch to ‘measurement and recording’ operation.

Deleting Test Results *(Measurement mode only)*

After you have taken a test you should push the 🡸 button. This will delete that test result and the display will then show the previous test result. If your test result is erroneous for any reason, you should delete that result so it does not skew the overall average of your testing.

Recording in archive (starting point)

The screen below shows how the display will appear when in the archive mode. As shown, the tester is in archive no.2. If this is acceptable, you should press the 🡻 button to proceed to measurement mode and begin testing. The results will be displayed in archive no.2 . Example: if the unit is showing archive no. 2 and you wish to start your archive in another location such as No. 26, you would press the ➔ button to change the archive location by increasing numbers.



Once you have selected your archive starting point, you need to press the 🡻 button to bring you to the Measurement mode. At this point, you may begin taking tests.

Recording measurements in the archive *(after choosing starting point)*

- recording the measured hardness value (58.1) or mean value into

the archive is done by pushing the ➔ button. In doing so, the number of the archive cell for measurement recording (measure №01) will be automatically increased by 1 (measure №2).

- it is recommended to set '00' in the current measurement number for every new set of measurements.

Calibration Procedures

Special Code Required to Perform this Procedure!

This procedure should be performed by highly skilled personnel only! If you are experiencing erratic results with your MET, you should contact Phase II and arrange for an inspection prior to making any changes.

Hardness tester calibration means that that the unit in question will be adjusted to fall within NIST tolerances on calibrated test blocks.

For hardness tester calibration by user, it is necessary to have two reference hardness blocks with maximum and minimum values in the hardness scale.

Examples:

- for calibration along the whole 'C' Rockwell scale, two reference hardness blocks are required with the values of (25±5) HRC and (65±5) HRC.
- If you do not use the whole range of 'C' Rockwell but only the range of 20÷40 HRC, perform the calibration on reference hardness blocks with the values of (25±5) HRC and (45±5) HRC.

Reasons to perform a calibration:

- If the hardness tester verification **on** the reference hardness blocks differ from the nominal value of the reference hardness block; example: (Block is HRC 45.5 and results are 49.3)
- after long periods of storage (more than 3 months);
- after intensive operation (more than 200.000 measurements for U1 ultrasonic transducer
- in case of considerable change in the conditions of operation (temperature, humidity etc.)

'Calibration' Operation

Select the scale you wish to calibrate the hardness tester in and press the 🡻 button to enter next mode. The display will be blinking "Test". Press the ➔ button to enter into 'Calibration' mode. Press the 🡻 button and the display will ask you for your code.

Enter the code and then push the 🡻 button The display indication in the 'Calibration' mode is shown on the figure below.

Hardness scale

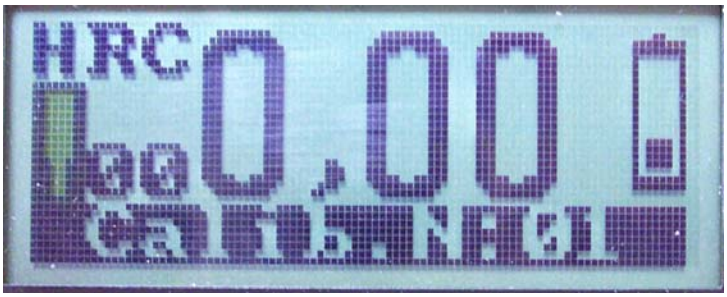
Measurement hardness value

Battery indication

Transducer

Current measurement number

Operation duty



The meaning of words and symbols on the display

'HRC' = Rockwell C hardness scale;

'00' the current measurement number *(this will increase with each test taken)*

'0.00' = the measured value on Rockwell hardness scale (HRC); *(no test taken yet)*

'Calib №1' = calibration tests performed *(will increase after each Set)*

Blinking symbol = Transducer is ready

Battery symbol = charge remaining in battery

Measurement on reference hardness block #1 (step 1) – obtaining of mean hardness number. Take one reference hardness block. Conduct at least FIVE measurements! Average the obtained values by pushing the 🡻 button.

Correction (step 2) –Adjust the value shown on the display to match the value of your test block. In other words, if your test block value is HRC 25.5 and your mean value is HRC19.5 you must adjust the tester by pressing the ➔ button to increase the value shown on the display. Match the display reading to your test block value. When the values are equal, press 🡻 button to save the adjusted result.

Measurement on reference hardness block №2 (step 3) –repeat the actions described in the previous paragraph.

Correction (step 4) –Repeat the actions described in step 2. When you have completed the correction, press the 🡻 button to complete and save the new calibration. Pushing the 🡻 button will lead to the completion of the steps and going out from 'Calibration' mode.

Verification of the hardness tester readings after the conducted calibration

Measure the hardness of reference hardness block №1 (not less than 5 measurements) and compute its mean value. The obtained value should be within acceptable tolerances for the scale.

If the obtained value exceeds the tolerance of the nominal value then you need to perform **'CLEAR CALIBRATION**' function and repeat the CALIBRATION' procedure.

'Clear Calibration' Operation

Hardness tester calibration by users requires highly skilled professional personnel. If you failed to introduce the correction to the hardness tester calibration for the second time or if you doubt the results of the conducted 'Calibration' operation, it is recommended to perform 'clear cal.' Operation.

To clear calibration correction introduced independently, perform the following steps:

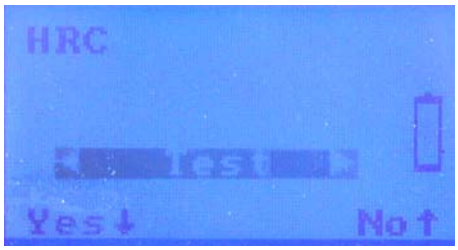
- select the scale
- enter 'Calibration'
- enter the code;
- Push 🡺 button

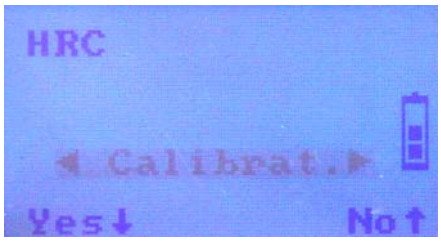
NOTE: By performing the Clear Cal, the unit will automatically default to the factory preset calibration.

'Processing' Mode

Within this mode the listed below operations can be carried out:

- compute mean value;
- clear archive



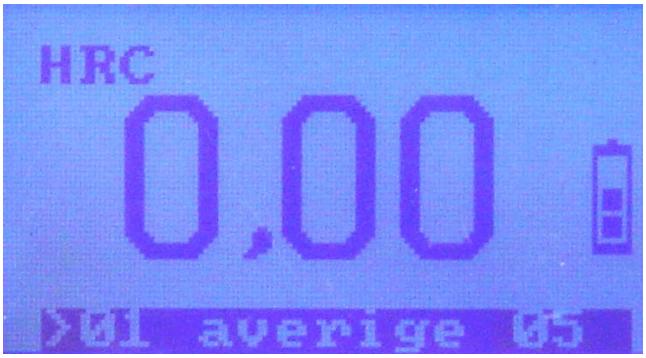


Select the scale. Press the 🡻 button. The display will show Test (blinking) Press the Enter the 🡺 button to scroll over to "Process" and then press 🡻 button to enter 'processing mode Select your operation by 🡸 or 🡺 button and confirm your selection by the 🡻 button.

'Mean Value' Operation

'Mean Value' operation is used for mean value computation within any interval of the archive cell (sample interval).

Display indication is shown on the figure.



Hardness scale

Mean hardness value on HRC scale

Battery charge symbol

Sample interval

<u>The meaning of words and symbols on the display</u>

- '**HRC**' = Rockwell C hardness scale
- 0.00 = mean hardness value in HRC
- **0 avrg 05 =**' sample interval
- '**Battery symbol** = battery strength

The display shows the result of the hardness mean value 53.6 on Rockwell C scale (**HRC**) for the archive cells from number two through number eight (**<02 mean 08**)

Setting the limits for sample mean value computation:

• Push 🡻 button to move < or > sign to the left initial (>02) and the right (<08) number of the sample limits by one;

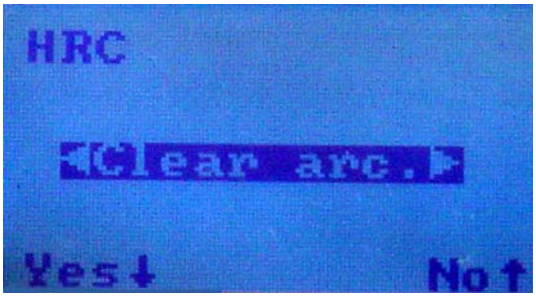
• Every push of 🡸 or 🡺 button will decrease or increase the left (>01) and the right (<07) number of the sample limits by one.

• The sample mean value is computed and shown on the display automatically ('53.6 mean val). Operation does not change the archive cells content. 'Mean val.' operation is performed only for filled in cells within the sample limits.

'Clear Archive' Operation

'Clear archive' operation is designed for deleting **ALL** stored content in the archive cells.

In the 'Processing' operation mode, select 'clear archive' operation by pushing 🡸 or 🡺 button. Push 🡻 (yes) button. The words 'Please, wait, clear archive' will appear and in two seconds the archive will be deleted.



<u>The First Measurement</u>

U1 ultrasonic hardness transducer

• Blinking of 'transducer' symbol on the display means that the hardness tester is ready to conduct measurements.

• **Place the transducer** on the area to be tested. Hold the transducer extremely steady by using your fingers to hold the flat brass footing as shown in the picture below.

• Gently press straight down on the transducer body slightly until the diamond pyramid makes initial contact with the surface of your part. Using a little more force, increase the downward pressure immediately until the diamond pyramid is forced into the surface*. (The Blinking Transducer light will now stay on constantly showing that you are making a good connection to the part)*.

The effort should be made smoothly. Be sure that your hand does not shake because the transducer body must remain stable during the test. For the proper transducer operation, it is necessary to apply an effort of not less than 14.7 N (1.5 kgf) to its body and keep it stable during the process of measurement. Do not be afraid to apply an excessive effort to the transducer body as it will be limited by the built-in stop.

DO NOT JAM PROBE ONTO ANY SURFACE!

• Keep constant pressure on the transducer body during 2-3 seconds. 'Transducer' symbol on the display will stop blinking.

• After the sound signal and appearance of the hardness value on the electronic transducer display, stop holding pressure on the transducer body. The 'transducer' symbol on the display will start blinking again, and the transducer body will return to the initial position.

The first measurement has been completed, and the hardness tester is ready for the next measurement.

Experimental Measurement

It is advisable to consider the first measurement as experimental measurement. In order to acquire some experience of how to use the transducer, it is recommended to conduct a number of experimental measurements.

Acquiring some experience working with the transducer

To acquire some experience of working with the transducer, it is recommended to use reference hardness blocks. Measure the hardness of a reference hardness block (not less than 10-20 measurements) and compute its mean value. If the obtained value does not correspond to the number of the reference hardness block, conduct more measurements.

If the hardness tester readings are stable and the obtained mean value corresponds to the reference hardness blocks rated value you can begin testing your particular application.

In the process of working with the transducer, make sure that the cable (connecting the transducer with the electronic module) is not twisted.

Maintenance and Repair
Avoid placing the MET near locations where it can be exposed to shock, heavy dust, dampness, strong magnetic fields and any form of viscous fluids.

Battery Replacement:

- Remove two rubber plugs on the back side Bottom half of the MET-U1A. Use the supplied hex wrench to loosen the two hex screws. Lift the metal battery cover off to expose the 4-AA batteries. It is recommended that you replace the batteries with a high quality NiMh set of rechargeable batteries. Standard AA batteries can also be used but life expectancy will not be very long. Pay careful attention to the polarity when installing new batteries. Please be sure and dispose of the NiMh batteries properly and according to local recycling laws.

- **DO NOT** open the **MET** or dismount any of its fixed parts. This precision instrument should only be serviced by a factory trained service representative.
- **If the unit is opened, its warranty will automatically become void**.

Trouble Shooting Chart:

Problem	Reason	Solution
Display does not switch on	The battery is discharged	Charge or replace
	The battery is not installed correctly	Reinstall, observe the indicated polarity
Readings on the display do not change	There is no contact in the connector of the transducer with the electronic module	Check the connection reliability
	Break in the connecting cable or connector; fault of the transducer of electronic module	Contact the service center
Measurement results are stable but differ from reference hardness block nominal value	The spring of the transducer might be worn out	Calibrate the hardness tester independently on the reference hardness blocks
Big range of the measurement results	The tested material is not uniform in its structure	Increase the number of measurements to obtain average
	Tested area has not been prepared properly	Smooth out surface finish
	The diamond pyramid is dirty	Clean using rubbing alcohol
	The diamond pyramid tip is damaged	Contact the service center

UCI- Ultrasonic Contact Impedance Method

Terminology:

Definitions:

UCI Method*:* UCI method Ultrasonic Contact Impedance, a hardness testing method developed by Dr. Claus Kleesattel in 1961 based on the measurement of the frequency shift of a resonating rod caused by the essentially elastic nature of a of the finite area of contact between the indenter and the test piece during the penetration.

UCI Hardness Test: a hardness testing practice using a calibrated instrument by pressing a resonating rod with a defined indentor, for example, a Vickers Diamond, with a fixed force against the surface of the part to be tested.

Calibration: determination of the specific values of the significant operating parameters of the UCI instrument by comparison with values indicated by a standardized workbench hardness tester or by a set of certified test blocks.

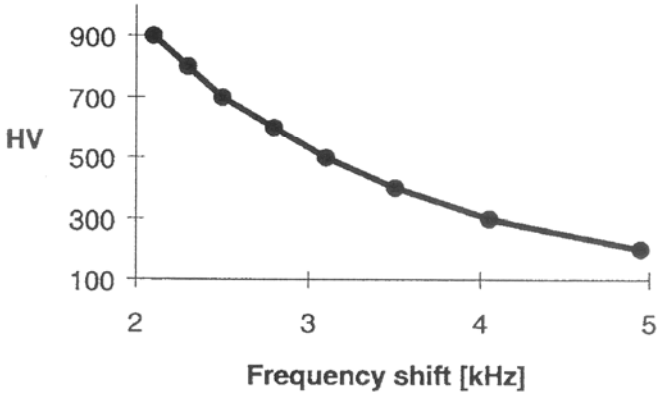


FIG. 2 Hardness Value versus Frequency Shift of the Oscillating Rod

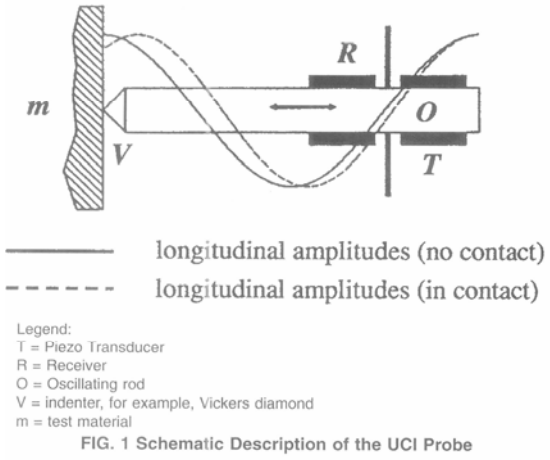


FIG. 1 Schematic Description of the UCI Probe

Verification according to ASTM A 1038-10

Check the UCI hardness testing instrument by making at least 5 measurements on a standard reference test block of the selected hardness scale.

The instrument shall be considered verified if each hardness reading falls within +/- 3% of the actual reference test block value.

ASTM Hardness Conversion Chart

Rockwell C Hardness Range

Approximate Hardness Conversion Numbers for Non-Austenitic Steels, According to ASTM E-140

The Conversion Values contained herein should be considered approximate only and may be inaccurate for specific applications

C 150 kgt diamond	**A** 60 kgt diamond	**D** 100kgt diamond	**15N** 15kgt diamond	**30N** 30 kgt diamond	**45N** 45 kgt diamond	**Vickers** Hardness	**Knoop** Hardness 500gr and over	**Brinell** Hardness 3000kgt 10mm ball	**Tensile** Strength 1000 lbs/ square in
68	85.6	76.9	93.2	84.4	75.4	940	920	..	..
67	85.0	76.1	92.9	83.6	74.2	900	895	..	..
66	84.5	75.4	92.5	82.8	73.3	865	870	..	..
65	83.9	74.5	92.2	81.9	72.0	832	846	(739)	
64	83.4	73.8	91.8	81.1	71.0	800	822	(722)	
63	82.8	73.0	91.4	80.1	69.9	772	799	(705)	
62	82.3	72.2	91.1	79.3	68.8	745	776	(688)	
61	81.8	71.5	90.7	78.4	67.7	720	754	(670)	
60	81.2	70.7	90.2	77.5	66.6	697	732	(654)	
59	80.7	69.9	89.8	76.6	65.5	674	710	(634)	351
58	80.1	69.2	89.3	75.7	64.3	653	690	615	338
57	79.6	68.5	88.9	74.8	63.2	633	670	595	325
56	79.0	67.7	88.3	73.9	62.0	613	650	577	313
55	78.5	66.9	87.9	73.0	60.9	595	630	560	301
54	78.0	66.1	87.4	72.0	59.8	577	612	543	292
53	77.4	65.4	86.9	71.2	58.6	560	594	525	283
52	76.8	64.6	84.4	70.2	57.4	544	576	512	273
51	76.3	63.8	85.9	69.4	56.1	528	558	496	264
50	75.9	63.1	85.5	68.5	55.0	513	542	481	255
49	75.2	62.1	85.0	67.6	53.8	498	526	469	246
48	74.7	61.4	84.6	66.7	52.5	484	510	455	237
47	74.1	60.8	83.9	65.8	51.4	471	495	443	229
46	73.6	60	83.5	64.8	50.3	458	480	432	221
45	73.1	59.2	83.0	64.0	49.0	446	466	421	215
44	72.5	58.5	82.5	63.1	47.8	434	452	409	208
43	72.0	57.7	82.0	62.2	46.7	423	438	400	201
42	71.5	56.9	81.5	61.3	45.5	412	426	390	195
41	70.9	56.2	80.9	60.4	44.3	402	414	381	188
40	70.4	55.4	80.4	59.5	43.1	392	402	371	182
39	69.9	54.6	79.9	58.6	41.9	382	391	362	177
38	69.4	53.8	79.4	57.7	40.8	372	380	353	171
37	58.9	53.1	78.8	56.8	39.6	363	370	344	166
36	68.4	52.3	78.3	55.9	38.4	354	360	336	161
35	67.9	51.5	77.7	55.0	37.2	345	351	327	156
34	67.4	50.8	77.2	54.2	36.1	336	342	319	152
33	66.8	50.0	76.6	53.3	34.9	327	334	311	149
32	66.3	49.2	76.1	52.1	33.7	318	326	301	146
31	65.8	48.4	75.6	51.3	32.5	310	318	294	141
30	65.3	47.7	75.0	50.4	31.3	302	311	286	138
29	64.8	47.0	74.5	49.5	30.1	294	304	279	135
28	64.3	46.1	73.9	48.6	28.9	286	297	271	131
27	63.8	45.2	73.3	47.7	27.8	279	290	264	128
26	63.3	44.6	72.8	46.8	26.7	272	284	258	125
25	62.8	43.8	72.2	45.9	25.5	266	278	253	123
24	62.4	43.1	71.6	45.0	24.3	260	272	247	119
23	62.0	42.1	71.0	44.0	23.1	254	266	243	117
22	61.5	41.6	70.5	43.2	22.0	248	261	237	115
21	61.0	40.9	69.9	42.3	20.7	243	256	231	112
20	60.5	40.1	69.4	41.5	19.6	238	251	226	110

Hardness values in Brackets are outside the range recommended for Brinell testing in ASTM E-10.
The above tables is from ASTM E-110 except values for E-scale and Tensile Strength which are not from or according to ASTM Standards.
Reprinted from the Annual Book of ASTM Standards,

ASTM Hardness Conversion Chart

Rockwell B Hardness Range

Approximate Hardness Conversion Numbers for Non-Austenitic Steels, according to ASTM E-140

The conversion values contained herein should be considered approximate only and may be inaccurate for Specific applications.

	Rockwell		**Superficial** Rockwell			**Vickers**	**Knoop**	**Brinell**	**Tensile**	**Brinelll**
B	**A**	**E**	**15T**	**30T**	**45T**	Hardness	Hardness	Hardness	Strength	Hardness
100kgf	60 kgf	100 kgf	15 kgf	30 kgf	45 kg f		500gf	3000 kgf	1000 lbs/	500 kgf
1/16"ball	diamond	1/8" ball	1/16" ball	1/16"ball	1/16" ball		and over	10mm ball	square in	10mm ball
100	61.5		93.1	83.1	72.9	240	261	240	116	201
99	60.9		82.8	82.5	71.9	234	246	234	114	195
98	602		92.5	81.8	709	228	241	228	109	189
97	59.5		92.1	81.1	699	222	236	222	105	184
96	58.9		91.8	80.4	689	216	231	216	102	179
95	58.3		91.5	79.8	67.9	210	226	210	100	175
94	57.6		91.2	79.1	669	205	221	205	98	171
93	57		90.8	784	659	200	216	200	94	167
92	56.4		90.5	77.8	64.8	195	211	195	92	163
91	55.8		90.2	77.1	63.8	190	206	190	90	160
90	55.2		89.9	76.4	62.8	186	201	186	89	157
89	54.6		89.5	76.8	61.8	180	196	180	88	164
88	64.0		89.2	75.1	60.8	176	192	176	86	151
87	53.4		88.9	74.4	59.8	172	188	172	84	148
86	52.8		88.6	73.8	58.8	169	184	169	83	145
85	52.3		88.2	73.1	57.8	165	180	165	82	142
84	51.7		87.9	72.4	56.8	162	176	162	81	140
83	51.1		87.6	71.8	55.8	159	173	159	80	137
82	50.6		87.3	71.1	54.8	156	170	156	76	135
81	50		86.9	70.4	53.8	153	167	153	73	133
80	49.5		86.6	69.7	52.8	150	164	150	72	130
79	48.9		86.3	69.1	51.8	147	161	147	70	128
78	48.4		86.0	68.4	50.8	144	158	144	69	126
77	47.9		85.6	67.7	49.8	141	155	141	68	124
76	47.3		85.3	67.1	48.8	139	152	139	67	122
75	46.8		86.0	66.4	47.8	137	150	137	66	120
74	46.3		84.7	65.7	46.8	135	147	135	66	118
73	45.8		84.3	65.1	45.8	132	145	132	64	116
72	45.3		84.0	64.4	44.8	130	143	130	63	114
71	44.8	100	83.7	63.7	43.8	127	141	127	62	112
70	44.3	99.5	83.4	63.1	42.8	125	139	125	61	110
69	43.8	99.0	83.0	62.4	41.8	123	137	123	60	109
68	43.3	98.0	82.7	61.7	40.8	121	135	121	59	108
67	42.8	97.5	82.4	61	39.8	119	133	119	58	106
66	42.3	97.0	82.1	60.4	38.7	117	131	117	57	104
65	41.8	96.0	81.8	59.7	37.7	116	129	116	56	102
64	41.4	95.5	81.4	59	36.7	114	127	114		100
63	40.9	95.0	81.1	58.4	35.7	112	125	112		99
62	40.4	94.5	80.8	57.7	34.7	110	124	110		98
61	40.0	93.5	80.5	57.0	33.7	108	122	108		96
60	39.5	93.0	80.1	56.4	32.7	107	120	107		95
59	39.0	92.5	79.8	55.7	31.7	106	118	106		94
58	38.6	92.0	79.5	55	30.7	104	117	104		92
57	38.1	91.0	79.2	54.4	2.97	103	115	103		91
56	37.7	90.6	78.8	53.7	28.7	101	114	101		90
55	37.2	90.0	78.6	53.0	27.7	100	112	100		89
54	36.8	89.5	78.2	52.4	26.7		111			87
53	36.3	89.0	77.9	51.7	26.7		110			86
52	35.9	88.0	77.5	51.0	24.7		109			85
51	35.5	87.6	77.2	50.3	23.7		108			84
50	35.0	87.0	76.9	49.7	22.7		107			83
49	34.6	86.5	76.6	49.0	21.7		106			82

48	34.1	85.5	76.2	48.3	20.7	105	81
47	33.7	85	75.9	47.7	19.7	104	80
46	33.3	84.6	76.6	47.0	18.7	103	80
45	32.9	84	76.3	46.3	17.7	102	79
44	32.4	83.5	74.9	45.7	16.7	101	78
43	32.0	82.5	74.6	45.0	15.7	100	77
42	31.6	82	74.3	44.3	14.7	99	76
41	31.2	81.5	74.0	43.7	13.6	98	75
40	30.7	81	73.6	43.0	12.6	97	75
39	30.3	80	73.3	42.3	11.6	96	74
38	29.9	79.5	73.0	41.6	10.6	95	73
37	29.5	79	72.7	41.0	9.6	94	72
36	29.1	78.5	72.3	40.3	8.6	93	72
35	28.7	78.0	72.0	39.6	7.6	92	71
34	28.2	77.0	71.7	39.0	6.6	91	70
33	27.8	76.6	71.4	38.3	5.6	90	69
32	27.4	76.0	71.0	37.6	4.6	89	69
31	27.0	75.5	70.7	37.0	3.6	88	68
30	26.6	75.0	70.4	36.3	2.6	87	67

Hardness values in brackets are outside the range recommended for Brinell testing in ASTM E-10.
The above table is from ASTM E-110 except values for E-scale and Tensile Strength which are not from or according to ASTM Standards.

Quick Set-Up Guide

Take advantage of our great tech support team!

It is highly recommended that you contact us as soon as you receive your MET.
We will get you up and running in minutes.

Your MET-U1A/U1A50 has been Opened, Inspected and Calibrated to perform at Optimum Accuracy and Repeatability. If you have any questions, please call Tech Support.

Calibrated in HRC Scale (Steel) **Scale Selection = HRC**

Note: Your hardness tester has had all parameters pre-programmed to read in the hardness scale and material for your personal application. If this is the scale you will be testing in, you do not need to go through all of the steps to set parameters for the MET. You can begin your testing procedures immediately. However, you should spend some time getting acquainted to the usage and methodology of the UCI transducer and related components.

a) Power unit on by pressing the 🡻 button. This will bring you to the "archive" screen.
b) Press the 🡻 button again and that will put you in the measurement screen.
c) Place the UCI transducer on the top of one of the supplied test blocks. Hold the footing at the bottom of the transducer firmly flat against the block. This must be held extremely steady during this test procedure.
d) Gently Press down on the transducer until you feel the diamond tip touch the block. At that point, using more force, press down further on the transducer until you feel it bottom out. Be sure to hold the transducer steady. At that moment, the transducer symbol on the display will stop blinking and will stay lit. This tells you that you have made contact and the test is being performed. After approx. 3-4 seconds, the tester will beep and give you the hardness value on the display.

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