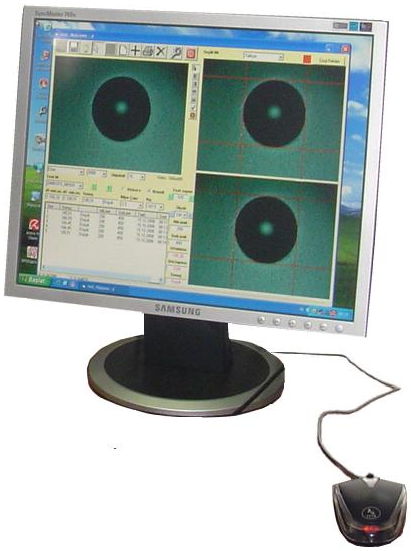
OPERATIONAL MANUAL

DIGIROCK-RBOV

DIGITAL ROCKWELL,BRINELL&VICKERS
HARDNESS TESTER



CE

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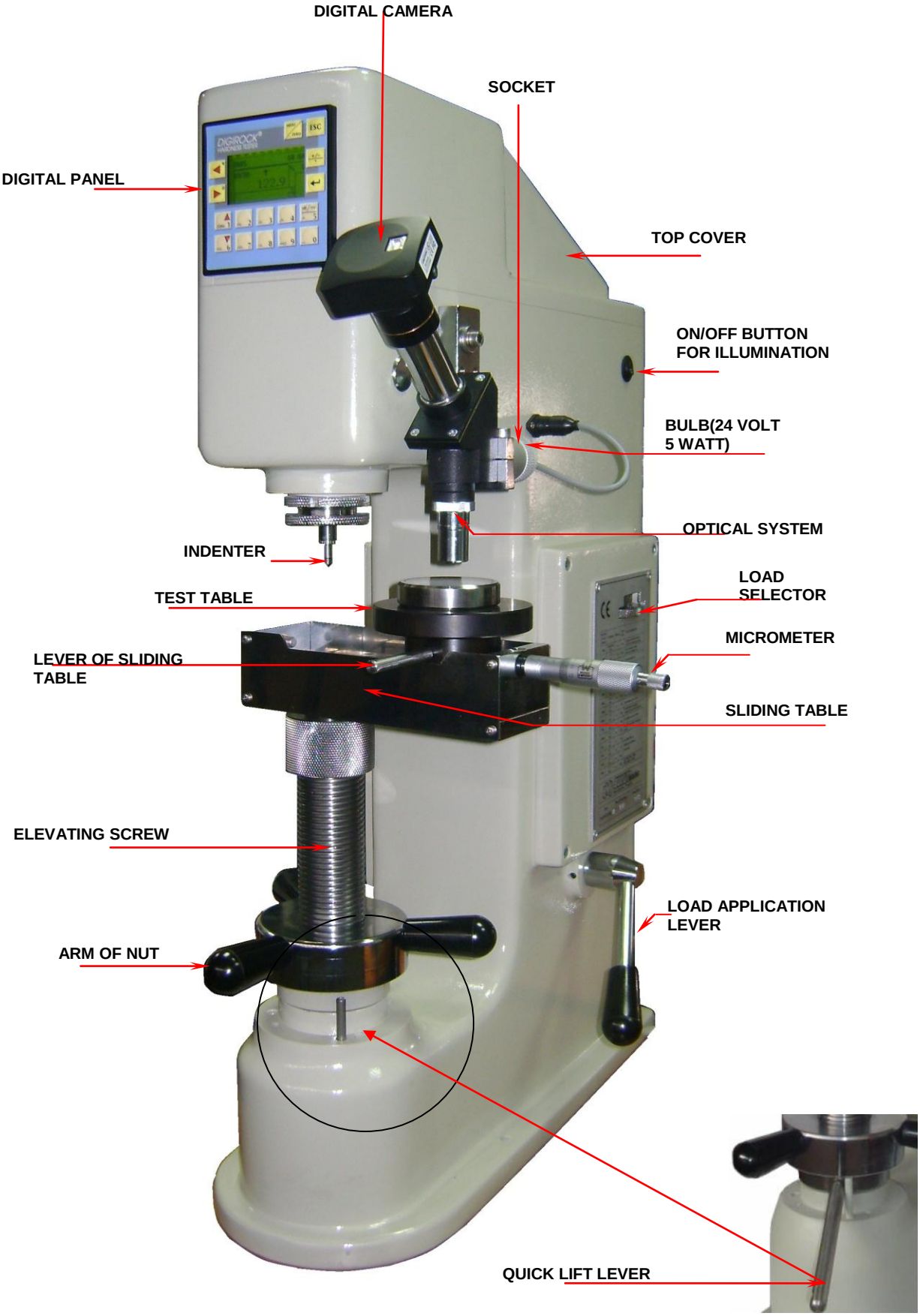

DIGITAL CAMERA
SOCKET
DIGITAL PANEL
TOP COVER
ON/OFF BUTTON
FOR ILLUMINATION
BULB(24 VOLT
5 WATT)
OPTICAL SYSTEM
INDENTER
LOAD
SELECTOR
TEST TABLE
MICROMETER
LEVER OF SLIDING
TABLE
SLIDING TABLE
ELEVATING SCREW
LOAD APPLICATION
LEVER
ARM OF NUT
QUICK LIFT LEVER

1.Technical Features

Pre-load(kgf)	***10***
Loads (kgf)	***60,100,150 kgf Rockwell*** ***62.5 ,187.5 kgf Brinell*** ***30 kgf Vickers***
Load selection	***By load selector disc***
Test methods	***Rockwell,Brinell & Vickers***
Load application	***Hydraulic***
Max.testing height	***With sliding table 140 mm , without sliding table 240 mm***
Throat	***145 mm***
Machine dimensions	***780X550X360 mm***
Case dimensions	***950x700x350 mm***
Weight (net/gross)	***95 / 125 kg***
Optical System	***75X magnification for Brinell*** ***150X magnification for Vickers***
Power	***220 V, 50Hz***

2.Standart Accessories

Rockwell Diamond cone indenter
Vickers Diamond pyramide indenter
1/16" ball indenter
2.5mm ball indenter
HRC test block
HRB test block
HB 2.5 / 187.5 Brinell test block
Flat testing table
V anvil for round parts
Hardness Conversion Table
Wooden case for accessories
Cover
Allen spanners
Operational Manual
Calibration Certificate
Digital Camera

2.1 Optional Accessories

1/8" , 1/4" , 1/2" ball indenters
250,200,130,100 mm test tables
Spot testing anvil
Spring loaded clamping device

3.Unpacking Of Equipment

Unscrew fixing steel sheet plates of upper side to wooden base of case and hold up upper side of wooden case by means of carrying handles. Take out two M8 bolts fastening equipment to lower wooden case. Locate equipment on a special table (see drawing of table enclosed) and fasten two M8 bolts by means of eye bull putting on flat testing table. Open left cover. Take out wooden safety parts. Take out also 3 off M6 bolts of top cover by means of 5 mm special alyen key which is in accessory box.Hold top cover up with care. Pay attention not to touch Rockwell Dial gauge. Take out plastic safety parts. Equipment is now ready for testing.

4.Setting Into Operation For Rockwell Hardness Testing

Before starting to test, load aplication lever (KL2) (8)has to be in starting position (see drawing and picture). Locate part to be tested on testing table, insert indenter to holder (ML3) (5) and choose load by means of load selector disc (VL1) (14) (according to testing method in attached table)

5.Testing

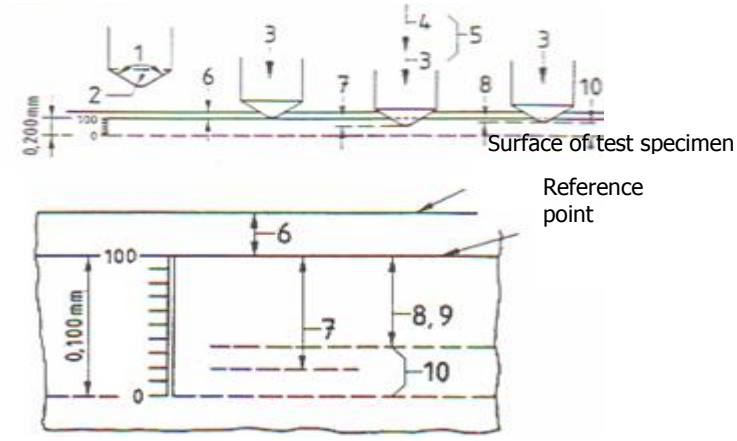
As soon as indenter touches on part, actuating main spindle (ML1) (12) by means of arms (SM1) (13) , bar graph starts to increase.
When %100 position achived, APP.TOTAL LOAD message shown.Then apply total load application lever (KL2) to forward (see drawing) and follow the message on display .You will see DWELLING TIME when total load fully obtained. Wait until RELEASE THE LOAD message shown and then take back lever (KL2) to starting position. And read TEST RESULT on display.

6.Adjusting Loading Speed

Load application is adjusted by hydraulic system. Hydraulic oil is filled at our works and hydraulic application speed is adjusted at our works. (But, working at extremely high temperatures or during transportation due to wrong handling if oil is reduced you may add some oil again. To do this, open left cover. There are two bolts on hydraulic piston (PS1) Take out bolt on the left. **(A1)** Add some oil (Tellus 37 or similiar) While adding oil, you can use load application lever (KL2) (8) forward and backward. This helps oil to settle down easly. You can adjust hydroulic speed, by allen bolt on the right. **(B1)** If you turn this bolt clockwise laod application speed is decreased,If you turn anti clockwise it is increased.

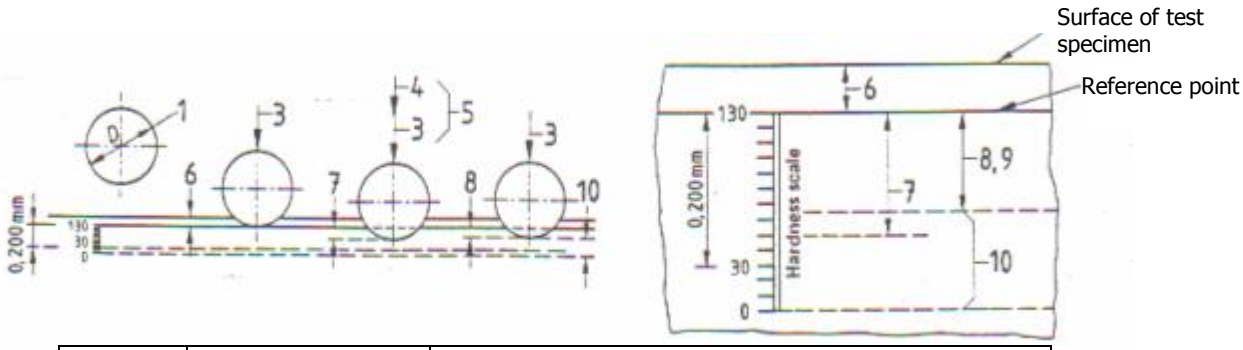
7.Rockwell Hardness Testing (EN 6508-1,ASTM E18)

Rockwell Hardness testing method is evaluated from penetration depth of 120° diamond cone or ball indentor with different dias (please refer to table enclosed).
Below application shows working procedures using Rockwell diamond cone (HRC-HRA etc)



Nr	Symbol	Description
1	0	120 ° Diamond cone
2	0	Radius of diamond tip= 0,2 mm
3	F_0	Pre-Load
4	F_1	Additional Load
5	F	Total load F_0+ F_1
6	t_0	Depth of penetration under pre-load, mm
7	t_1	Depth of penetration under additional load, mm
8	t_b	Increase in depth of penetration from F_1 to F_0, mm
9	e	Equality as of 0,002 mm increase of depth of penetration e= tb / 0,002
10	0	Rockwell hardness = 100-e

Below application shows working procedures using 1/16” ball indenter (HRB etc)



Nr	Symbol	Description
1	D	Ball dia=1/16 “ =1,5875 mm
3	F_0	Pre-load
4	F_1	Additional load
5	F	Total load =F_0+F_1
6	t_0	Depth of penetration under pre-load, mm
7	t_1	Depth of penetration under additional load, mm
8	t_b	Increase in depth of penetration from F_1 to F_0, mm
9	e	Equality as of 0,002 mm increase of depth of penetration e= tb / 0,002
10	HRB/HRF	Rockwell hardness= 130-e

8.Brinell Hardness Testing (EN 6506-1,ASTM E10)

Brinell Hardness testing method is made by different balls depending (for DIGIROCK-RBOV only 2,5 mm ball) on material type, thickness and loads applied. Diameters of ball indentations can be evaulated by optical system built-in hardness tester.

Relations with thickness of specimen,ball dia and material shown in related the table

Thickness of material (mm)	Ball dia(mm)	P=30D2 Steel,iron, cast iron	P=10D2 Brass, Bronze, Cupper, Aluminium	P=D2 Soft cupper	P=5D2 Lead
6 mm and up	**10**	**3.000 kgf**	**1.000 kgf**	**500 kgf**	**250 kgf**
3 mm and up	**5**	**750 kgf**	**250 kgf**	**125 kgf**	**62,5 kgf**
1,2 mm and up	**2,5**	**187,5 kgf**	**62,5 kgf**	**31,25 kgf**	**15,625 kgf**
0,5 mm and up	**1**	**30 kgf**	**10 kgf**	**5 kgf**	**-**

9.Setting Into Operation For Brinell Hardness Testing

Locate 5X objective (16) on optical system.
Before starting to test,load aplication lever (KL2) (8) has to be in starting position (see drawing and picture) Locate part to be tested on testing table (10), **Moving lever of sliding table (11) to the left, assure testing table (10) to touch stoping bolt.**
Insert 2,5 mm ball indenter to holder (ML3) (5) and choose load by means of load selector disc (VL1) (14) (according to table shown above)
IMPORTANT: For Brinell and Vickers tests quick lift lever (7) always must be in forward position touching the stop pin.
Apply pre-load and total load as described in Rockwell testing.
Follow movement of big pointer until it stops. Wait 3-5 sec.more. Then take back lever (KL2) (8) to starting position. Move quick lift lever (7) from right to left until it touchs stop pin.
Move quick lift lever (7) from right to left until it touchs stoping pin. (in this case indentor to be separated from the surface of the part to be tested)
In this case, move the lever of sliding table to the right carefully (11) until testing table touchs micrometer.

10.Sample of Reading Indentation

Drawing : OP-2
Adjust, mesuring moving line by means of micrometer of digital camera (2) until it touchs leftest side of indentation. Then, move, measuring line from left to right until it touchs rightest side of indentation. Than calculate value.

11.Vickers Hardness Testing (EN-6507-1,ASTM E-92)

Vickers Hardness testing method is made by 136° Vickers pyramid indenter. Vickers indentation can be evaulated by optical system built-in hardness tester.

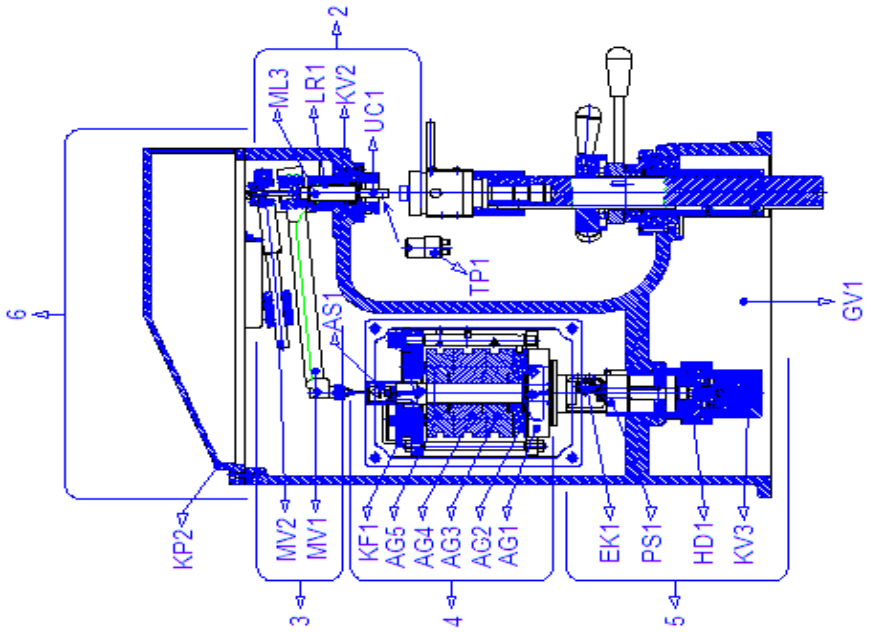
12.Setting Into Operation For Vickers Hardness Testing

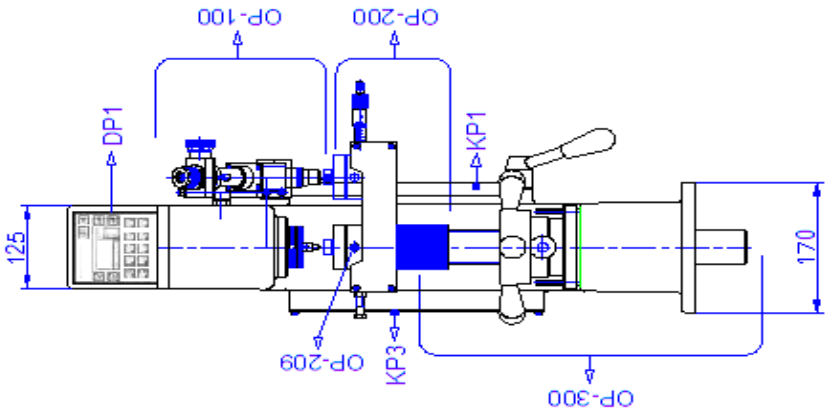
Locate 10X objective (16) on optical system
Assure all points same as Brinell test before start to operation.
Insert Vickers diamond indenter to holder (ML3) (5) and choose 30 kgf load by means of load selector disc (VL1) (14)
Actuate Vickers test using same steps as per mentioned for Brinell test.

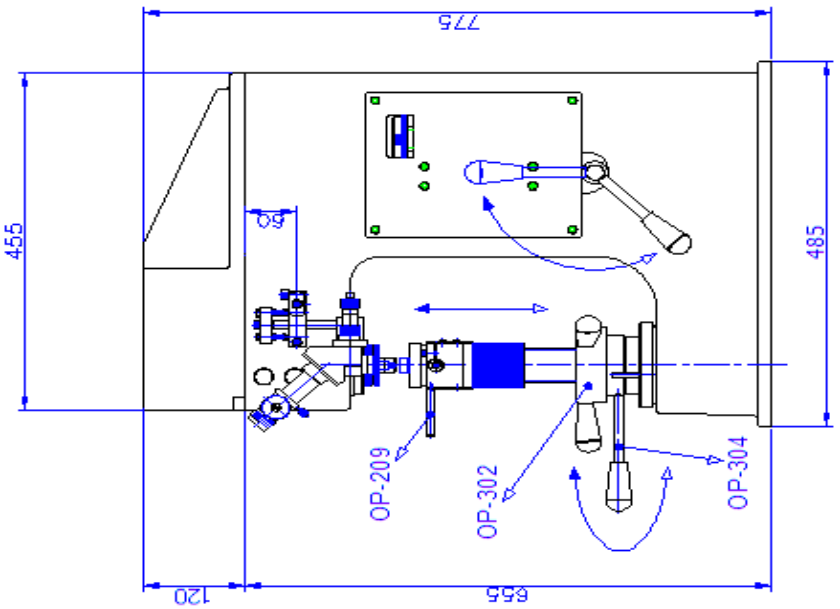
13.Sample Of Reading Indentation

Drawing : OP-3
Adjust, mesuring moving line by means of micrometer of digital camera (2) until it touchs leftest side of indentation. Then, move, measuring line from left to right until it touchs rightest side of indentation. Than calculate value.

DIGIROCK-RBOV



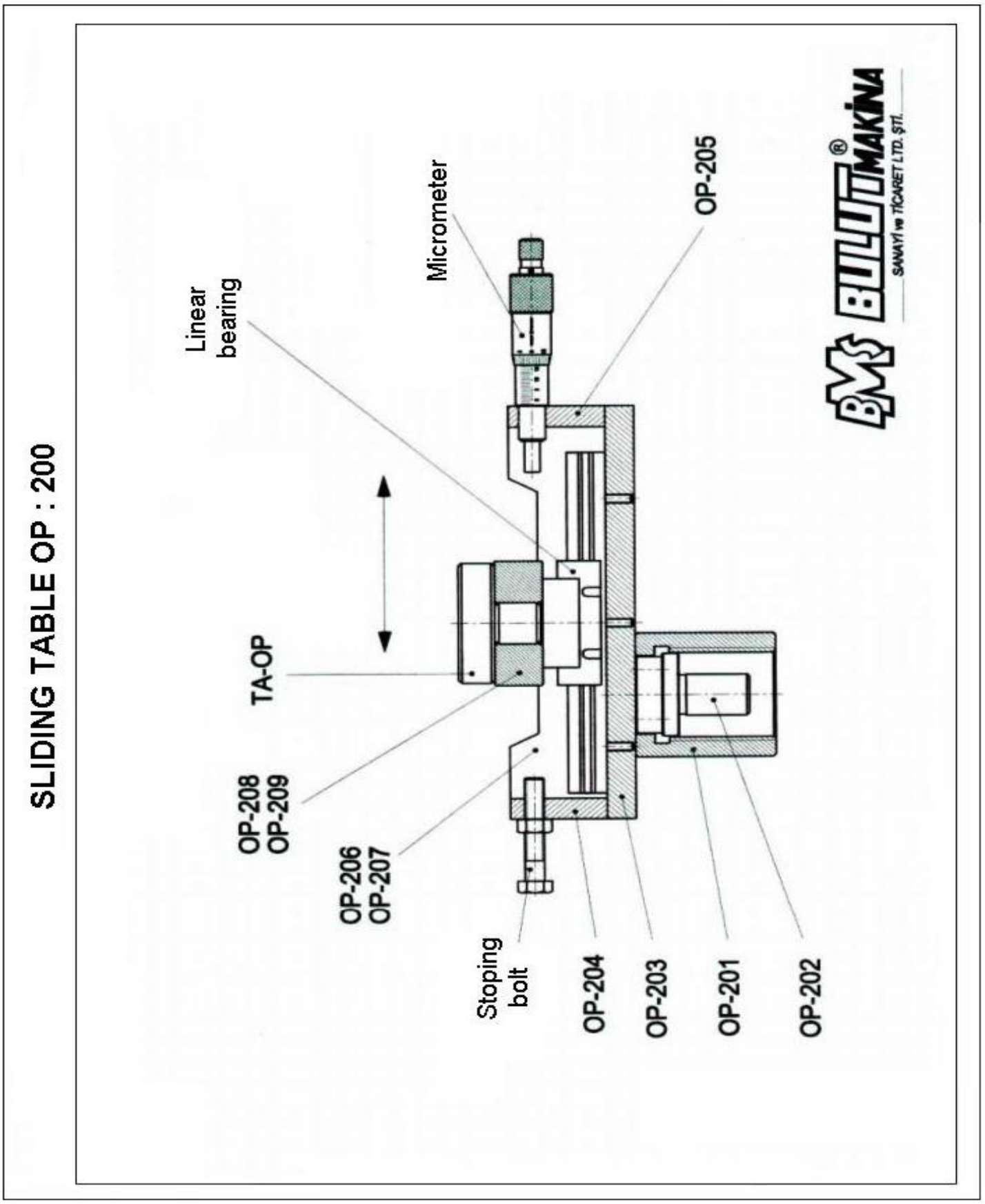




14.Part List

DIGIROCK-RBOV	
2	
ML3	Indenter holder
LR1	Linear bearing
KV2	Bush for linear bearing
UC1	Indentor
TP1	Clamping cap
3	
MV1	Lever
MV2	Pre-load lever
ML3	Side bushings
AS1	Hook
4	
KF1	Cage
KP1	Right cover
KP3	Left cover
VL1	Load selector disc
AG1	30 kg. Weight
AG2	60 kg. :Weight
AG3	62,5 kg. Weight
AG4	100 kg. Weight
AG5	150 kg. Weight
AG6	87,5 kg. Weight
5	
EK1	Load application system
PS1	Hydraulic damper piston
HD1	Hydraulic oil
KV3	Damper pot
KL2	Load application lever
6	
KP2	Top cover
SP1	Rockwell dial gauge
OP-200 and 300	
OP-201	Fixing bushing for optical system
OP-209	Lever of sliding table
OP-301	Elevating screw
OP-302	Nut
OP-304	Quick lift lever

15.SLIDING TABLE OP : 200



16.Test Method

Test Method	Indentor	Pre-load (kgf	Total load (kgf)	Field of application
HRA	Diamond cone	10	60	Surface hardened parts with thin cases (≥0,4 mm)
HRB	1/16" ball	10	100	Non ferrous metals,unhardened steels
HRC	Diamond cone	10	150	Hardnened steels
HRD	Diamond cone	10	100	Surface hardnened parts with medium cases
HRE	1/8" ball	10	100	Aluminium amd magnesium alloys,antifriction metals,synetic metals
HRF	1/16" ball	10	60	Annealed cupper alloys,thin sheet metals (≥ 0,6 mm)
HRG	1/16" ball	10	150	Phospor-bronze,melleable iron of medium hardness
HRH	1/8" ball	10	60	Aluminium,zinc,lead,grinding stones
HRK	1/8" ball	10	150	Antifriction and other metals of very low hardness
HRL	1/4" ball	10	60	As HRK and hard rubber
HRM	1/4" ball	10	100	As HRK and HRL,laminated wood
HRP	1/4" ball	10	150	HRK,HRL or HRM and syntetic materials
HRR	1/2" ball	10	60	
HRS	1/2" ball	10	100	
HRV	1/2" ball	10	150	As HRK,HRL,HRM,HRP,HRR or HRS
HR 15 N HR 30 N HR 45 N	Diamond cone	3	15 30 45	As HRA,HRC or HRD ,but especially thin case depth (≥ 0,18 mm)
HR15T HR30T HR45T	1/16" ball	3	15 30 45	As HRB,HRF or HRG but especially for thin sheet metals (≥ 0,25 mm)
HR15W HR30W HR45W	1/8" ball	3	15 30 45	For metals with very low hardness and for very thin cases,for example thin linings of antifriction metals,HRX and HRY especially for sintered metals
HR15X HR30X HR45X	1/4" ball	3	15 30 45	
HR15Y HR30Y HR45Y	1/2" ball	3	15 30 45	

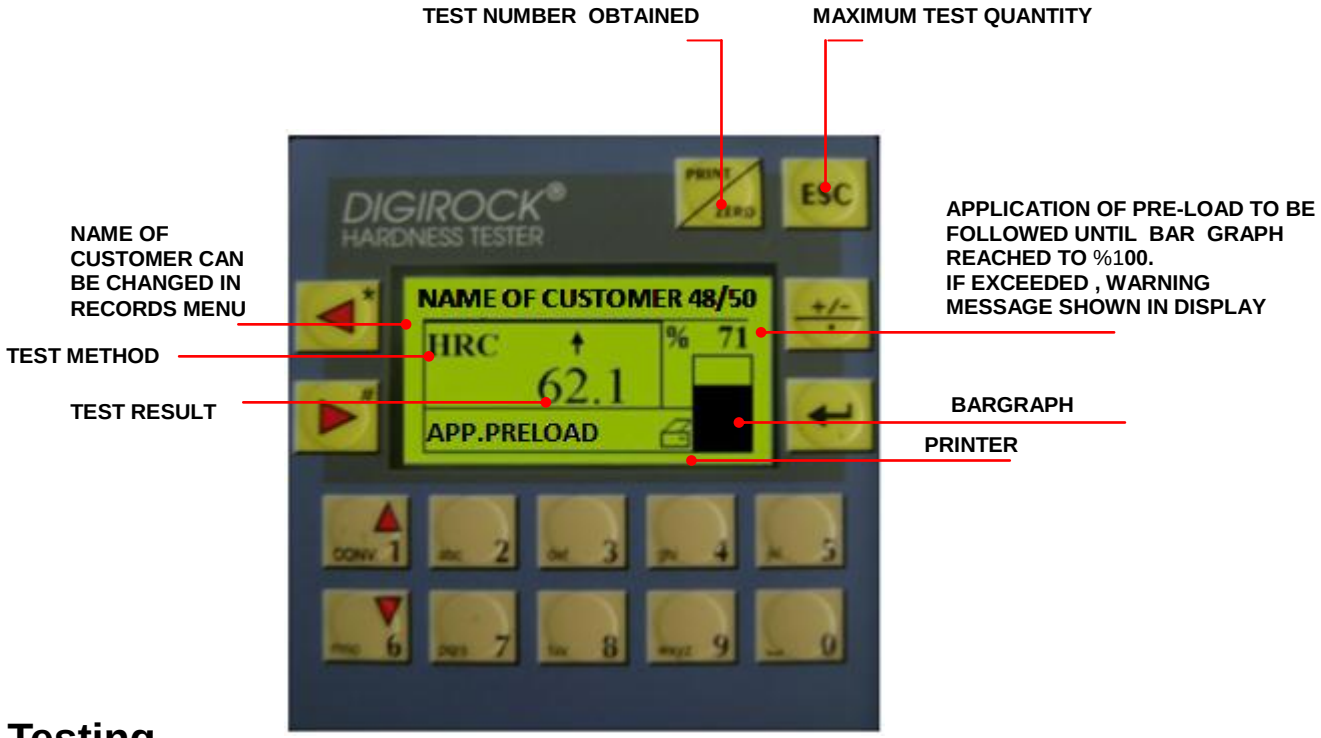
17.Prior To Test

Pay attention load application lever (KL2) is in starting position. Using table, choose suitable indentor according to test method to be applied. Locate indenter on holder (ML3) carefuly and gently tighten allen screw using allen key.

18.Choosing The Test Load

Choose suitable Rockwell test load according to table 2 using load selector disc (VL1) **(In this position, load application lever (KL2) must be in starting position)**. Locate part to be tested on testing anvil. (TA1)

18.1 Main Screen



19.Testing

Swich on equipment by ON/ OFF button.To raise main spindle (ML1) by means of arms (SM1), as soon as indenter touches on part to be tested, bar graph starts to increase.
When %100 position achived, APP.TOTAL LOAD message shown. Then apply total load application lever (KL2) to forward (see drawing) and follow the message on display .You will see DWELLING TIME when total load fully obtained. Wait until RELEASE THE LOAD message shown and then take back lever (KL2) to starting position. And read TEST RESULT on display.

When TESTING message with DWELLING TIME is over, RELEASE THE LOAD message shown. When you take back lever (KL2) to start position, TEST RESULT shown on display, When required, by pushing symbol 1 button, conversion of existing test method is indicated as shown. Using mno 6 or symbol 1 buttons others converted test methods can be reached.

If ESC button pressed ,only existing test method shown.

19.1 Brinell Test

For optical reading, press button 5  and write value shown on eyepiece. Press buton.  Then, press button 5  again and write value shown on eyepiece once more.Then press  button. HB Brinell value will be shown .

For Brinell tests 5X magn. objective to be used.

19.2 Vickers Test

For optical reading, press button 5 and write value shown on eyepiece.

Press buton. Then, press button 5 again and write value shown on eyepiece once more.Then press button

Vickers value will be shown

For Vickers tests 10X magn. objective to be used.

20.Test Method

Using buttons, TEST METHOD menu obtained. And pressing or buttons required test method can be reached.

21.Records

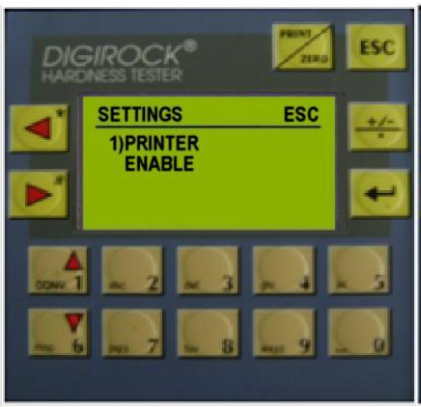
Using ► ◄ bottons RECORDS menu reached.Using mno 6 or symbol 1 Buttons, **NO, NAME, REC NO, DELETE** and **INSP** positions obtained. For example to change RECORD NO, ↵ button pressed, using mno 6 or symbol 1 buttons, RECORD NO changed. Pushing. ↵ button, it is recorded. Recording for **NAME, REC NO, DELETE** and **INSP** can be actuated by similiar procedures.

When required, pressing mno 6 or symbol 1 buttons, INS position obtained. Pushing ↵ button,all records reached. At the same time Min, Max. And Avg values can be seen accoriding to avarage value.

When you push PRINT ZERO, you can print all datas in the memory, page by page.

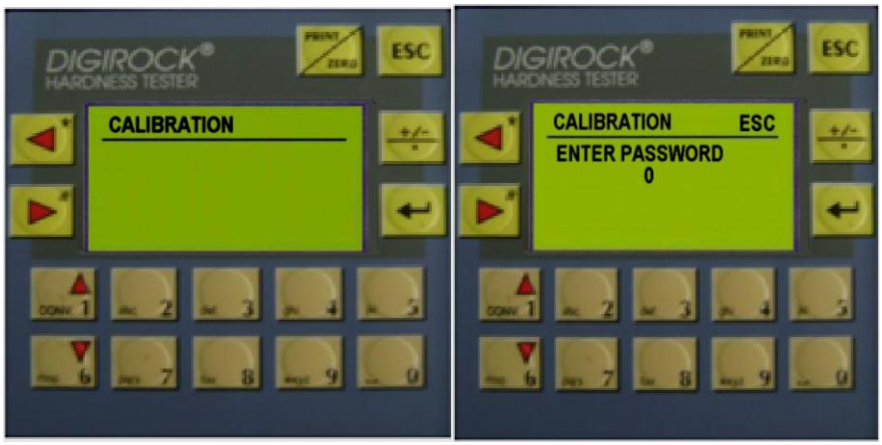
NOTICE: Memory capacity 2500 datas in 50 blocks.

22.Settings



By pressing,  buttons **SETTINGS** menu reached**.** Using  or  buttons, settings for **printer, date/time, avarage qty, dwelling, factory settings, lower test limit, upper test limit, language** can be made as shown in related pictures

23.Calibration



Using ► ◄ buttons, **CALIBRATION** reached. If you push ↵ button, ENTER PASSWORD message shown. İf you enter correct password, using ► ◄ buttons, method for calibration choosen. Pushing ↵ button, uppest block value chosen and pushing ↵ button,block value entered.
4 tests made on test block, if values suitable, accepted.
As of next step, in same test method, lowest test block chosen and block value entered. Now calibration finished.

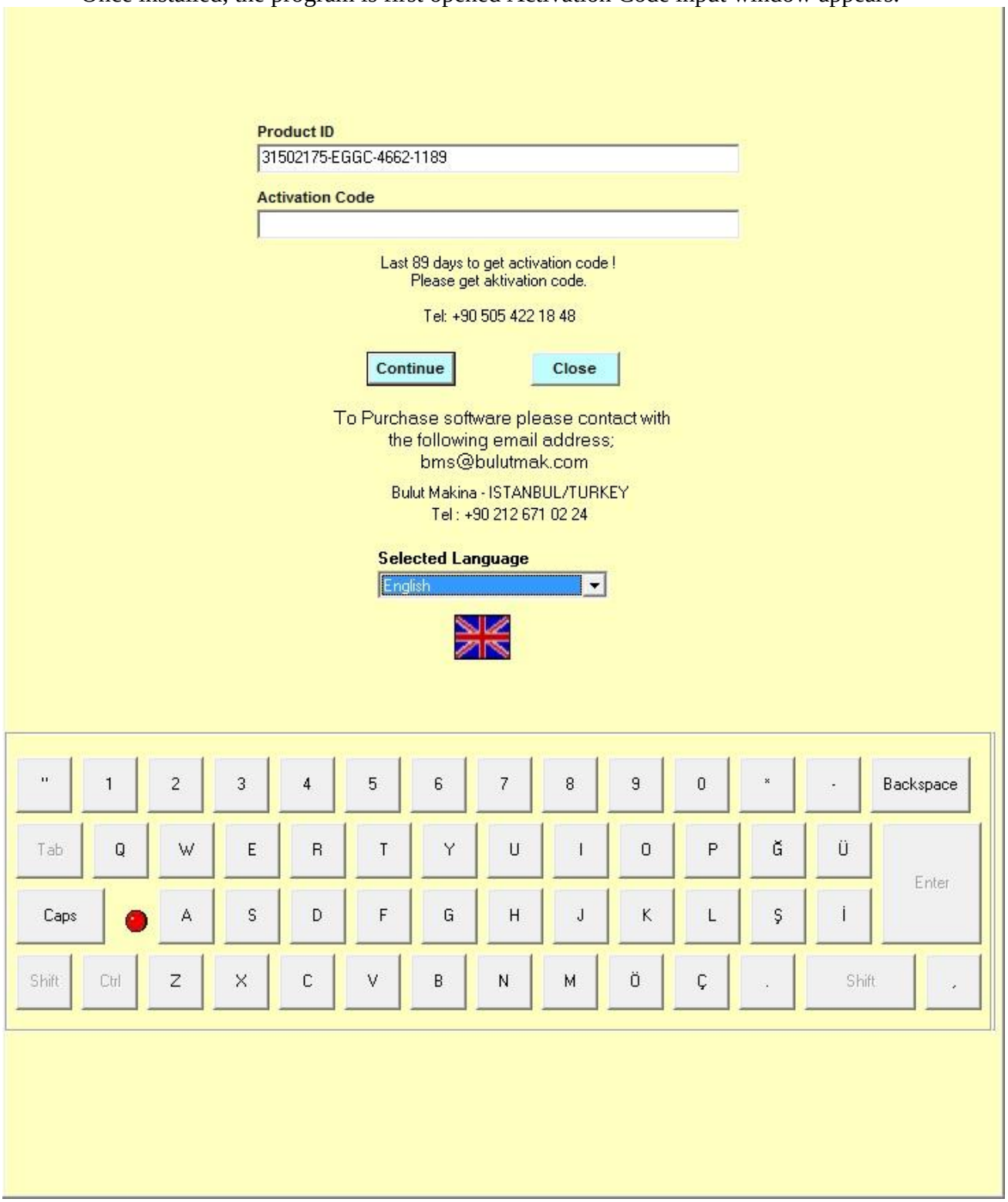
24.Important Notice

During calibration, 2 point calibration system used. Therefore, for each calibration, uppest and lowest test blocks must be choosen according to test meothods. For example, for HRC method, uppest block value 62-65 HRC, lowest block value 22-25 HRC arasında can be choosen.
Your equipment is calibrated under related EN norms.You do not need to calibrate the equipment again. *But, if required, calibration can be made using EN norms by expert persons under suitable conditions. In case of making mistakes during calibration, we recommend to go SETTINGS menu and use FACTORY SEETINGS fonction. Then, you can return original calibrated values.*

25.Directions

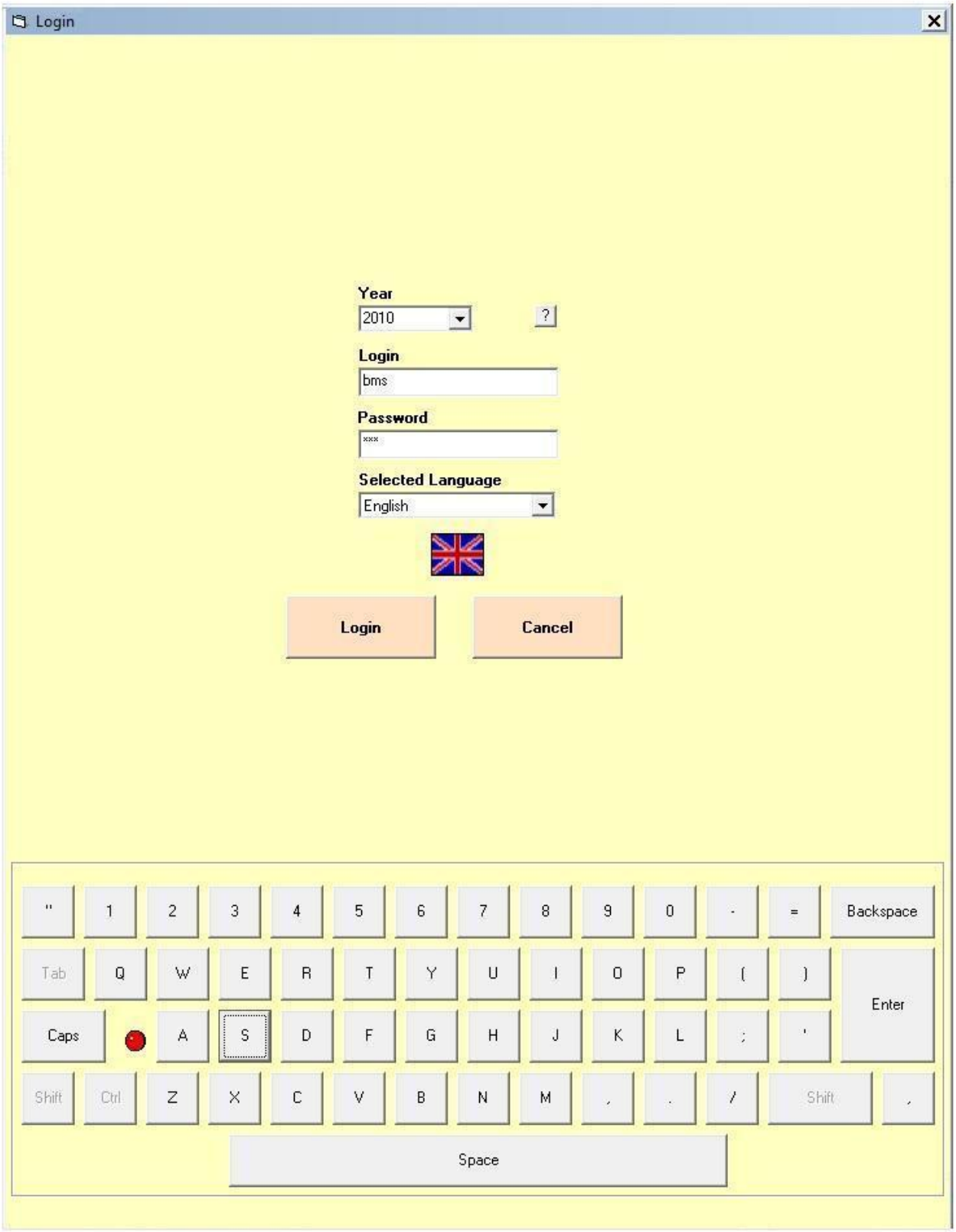
Hardness Tester software OPTOBUL3

Once installed, the program is first opened Activation Code input window appears.



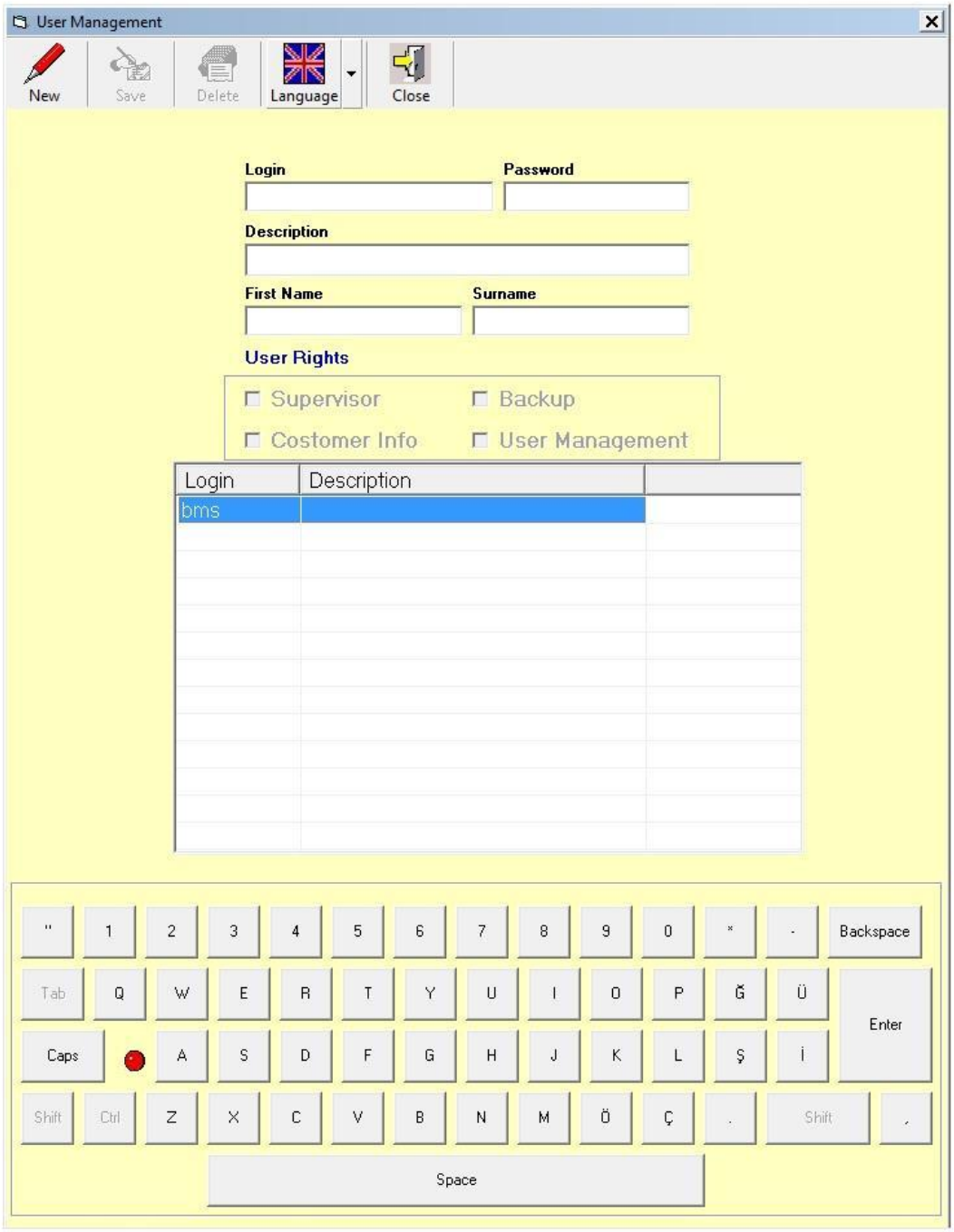
After entering this code "Continue" button.

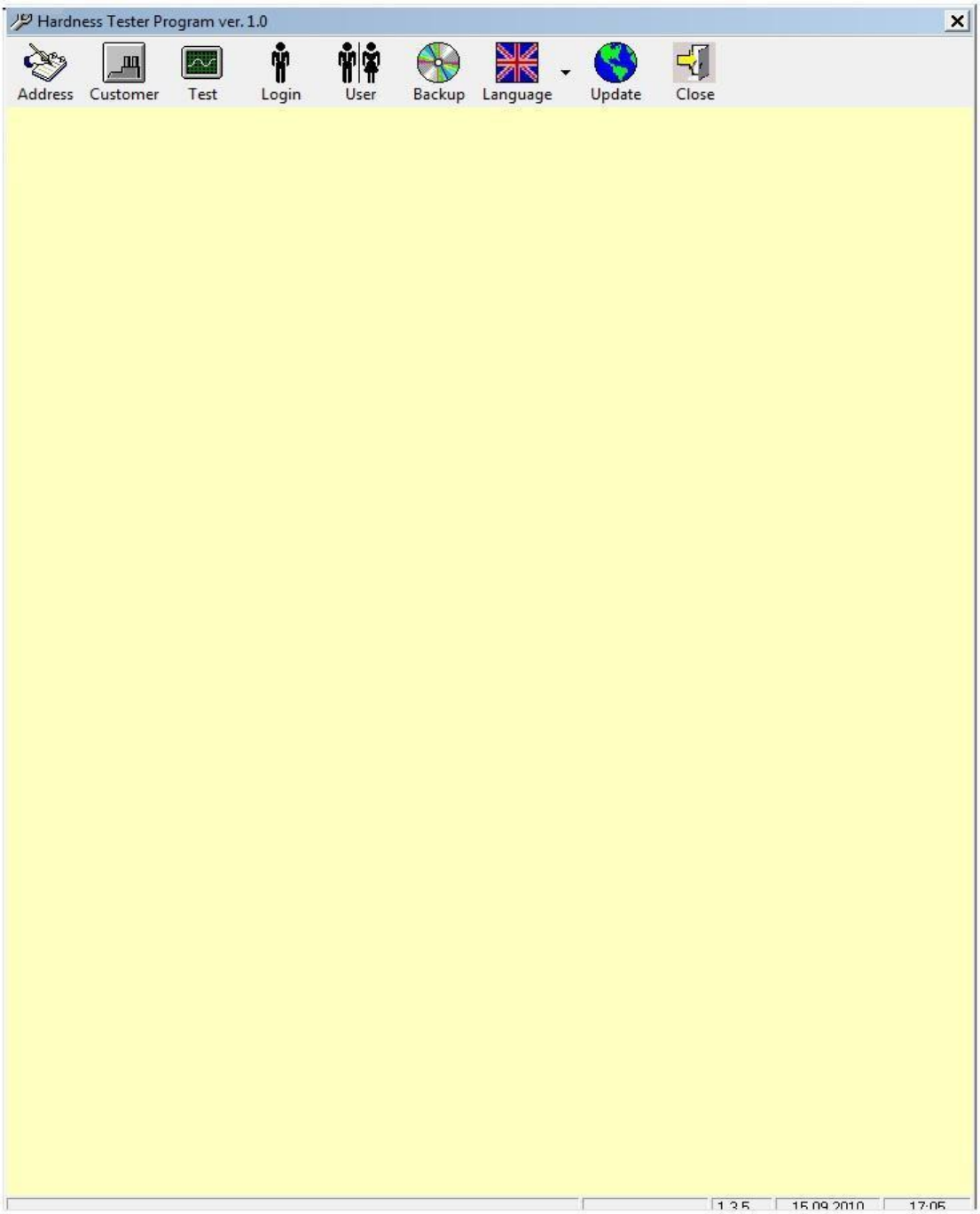
Login window, the first user to setup the following window: BMS, Password: Enter BMS. (In later entries, pre-defined user name and password to enter).



Main Window the following menu headings Optobul3 are common;

1-Address information
2-Customer Information
3-Hardness Test procedures,
4-Logged; program user,
5-User management,
6-Database Backup and Restore
7-Language Selection,
8-Program update,
9-Program exit





The first step, go to Main Window from the user and the program will use the item of the menu descriptions of people do. Name and Surname details will be written here, test reports "test," information will be used as.

To define a new user, press 

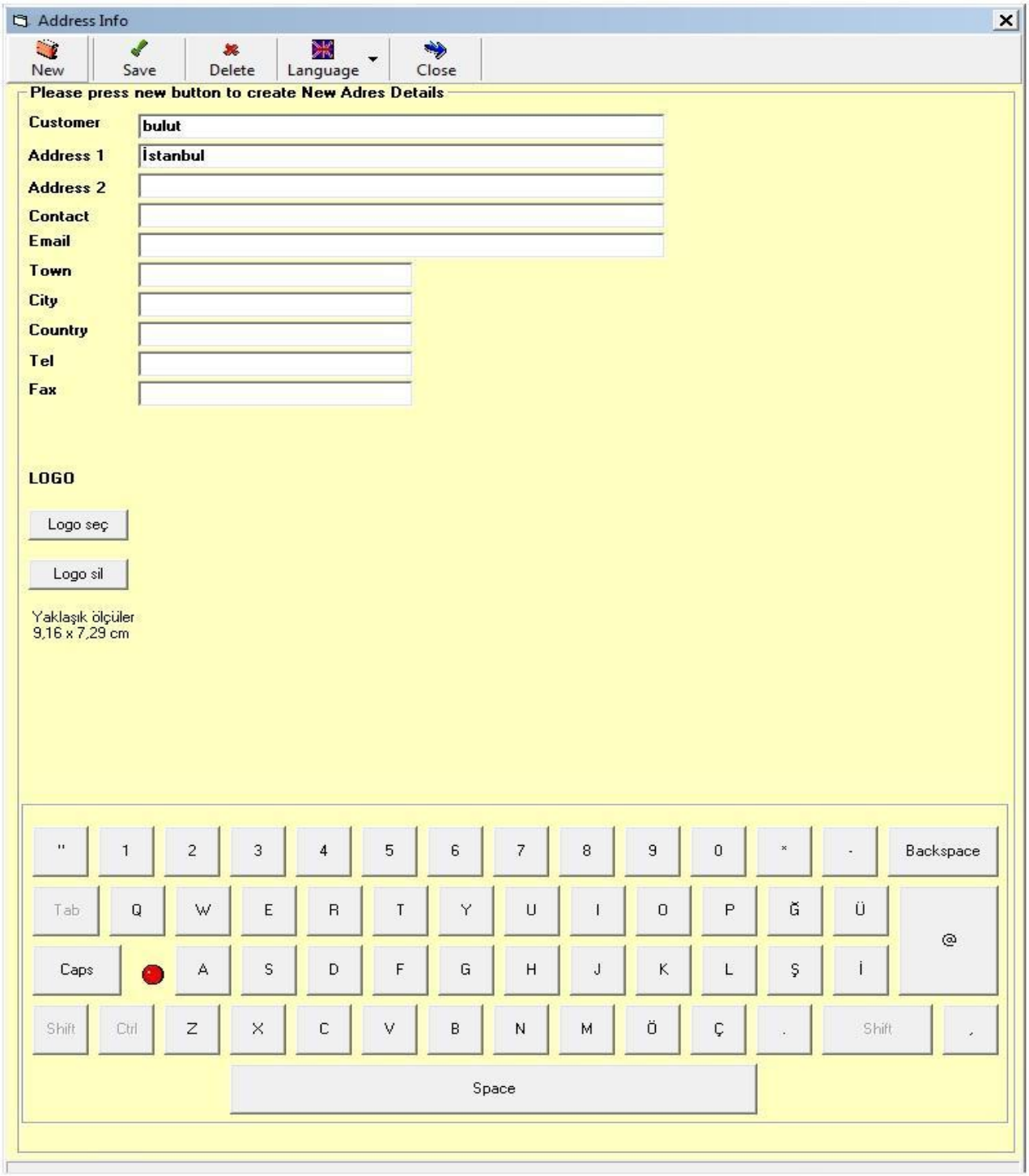
New button once, then Login, Password, Name and Last Name boxes to fill. User rights determine and record button.

To change a user's information registered in the list below select the name you want and make changes and 

save them press.

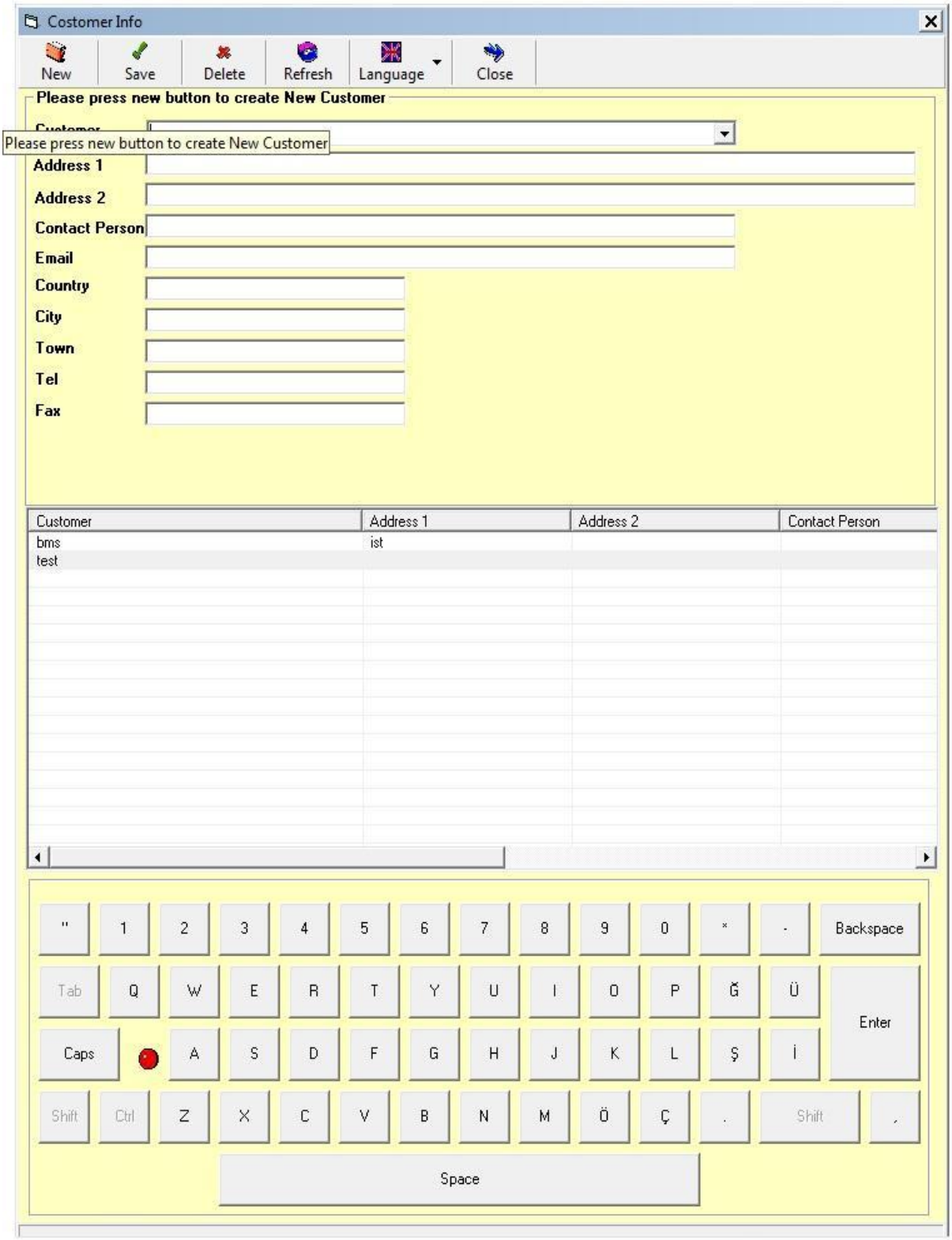
25.1 ADDRESS

From the main menu by pressing the Address button, enter your company address information. First, press the New button, fill in the blank field and press the Save button.



25.2 CUSTOMER

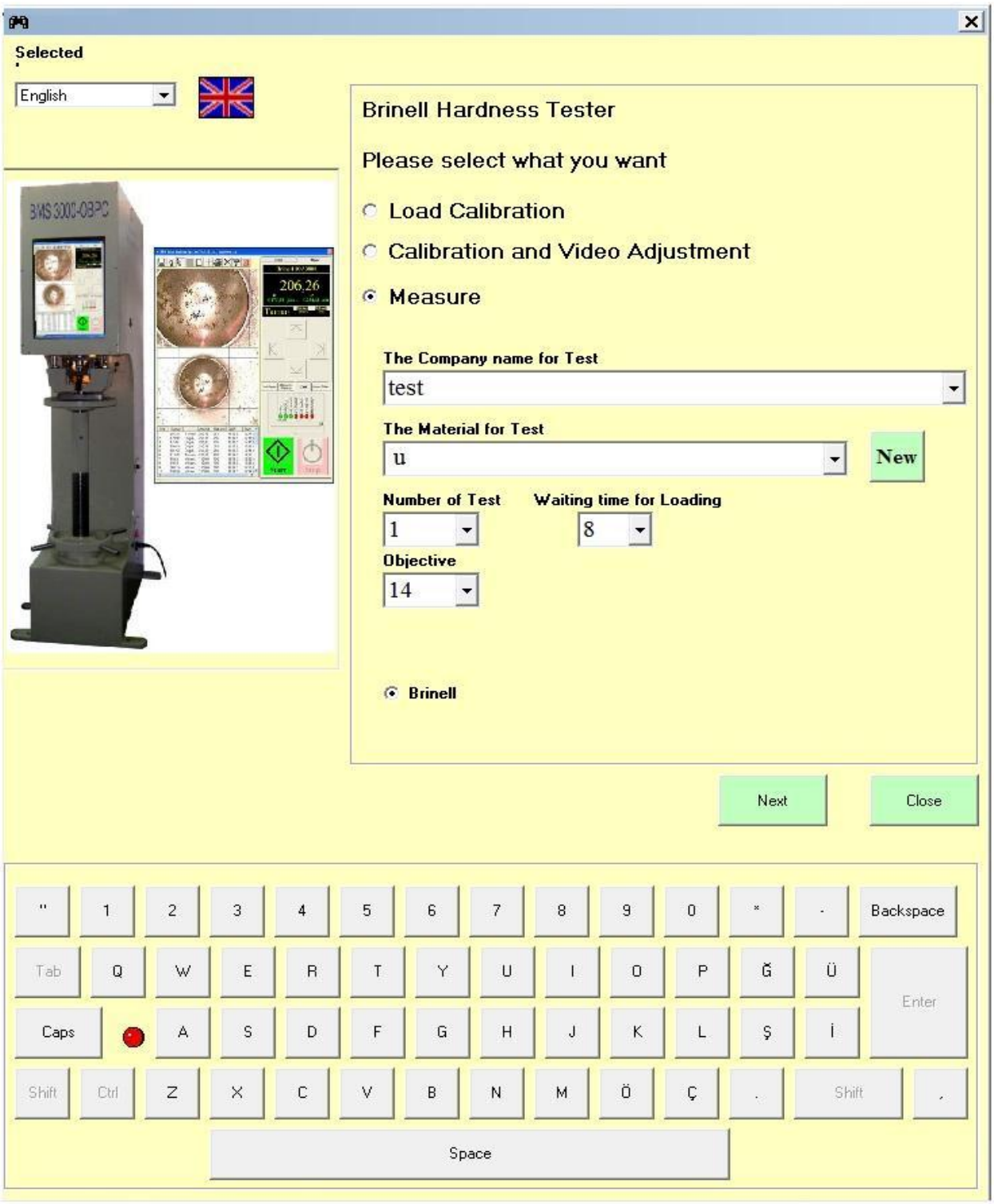
From the main menu by pressing customer, enter the customer address information.First, press the New button, Fill in the blank field and press the Save button.



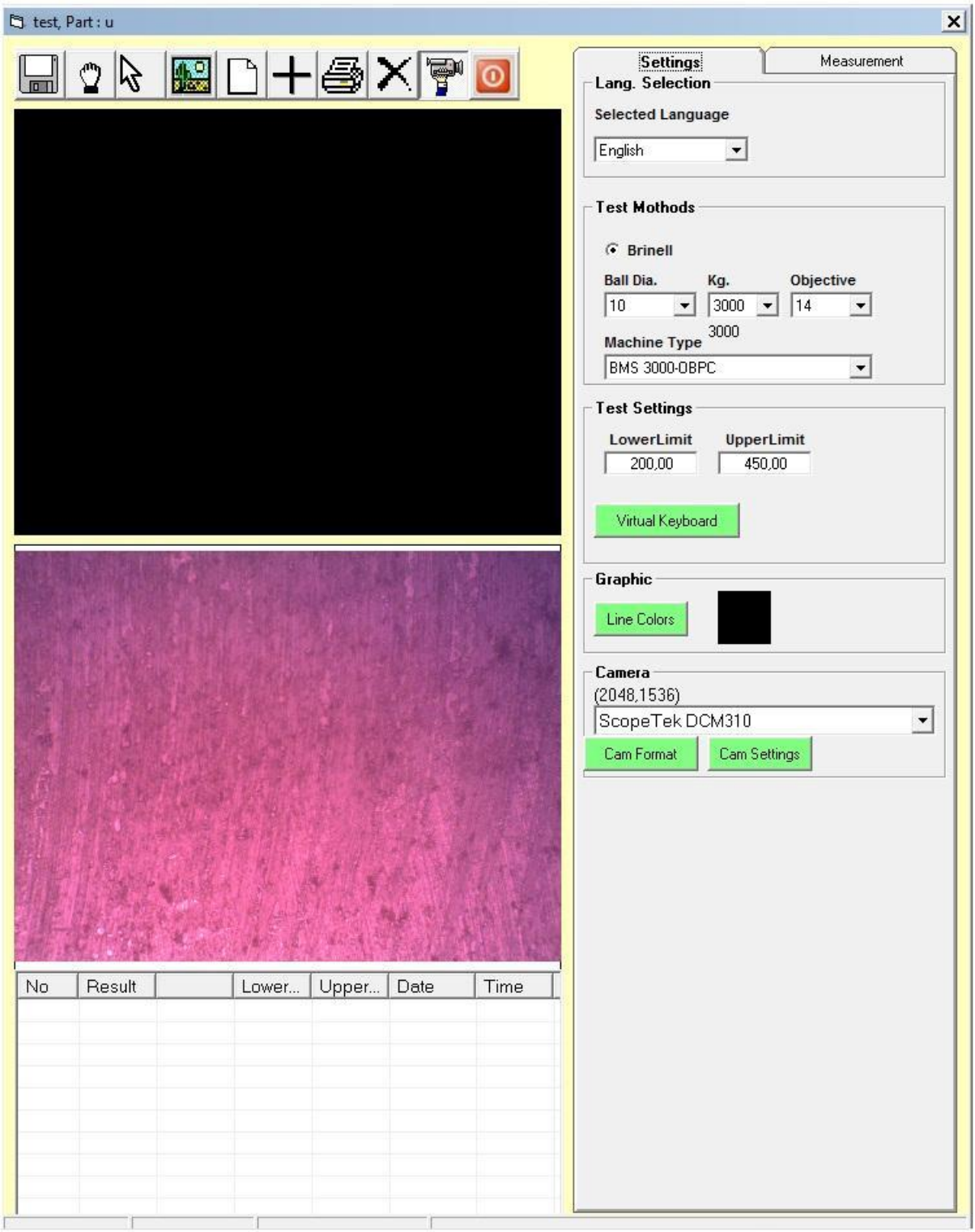
25.3 HARDNESS TEST

From the main menu, press the test and measurement from the screen you make the transition to the screen the following window fill in the fields and "forward" button.

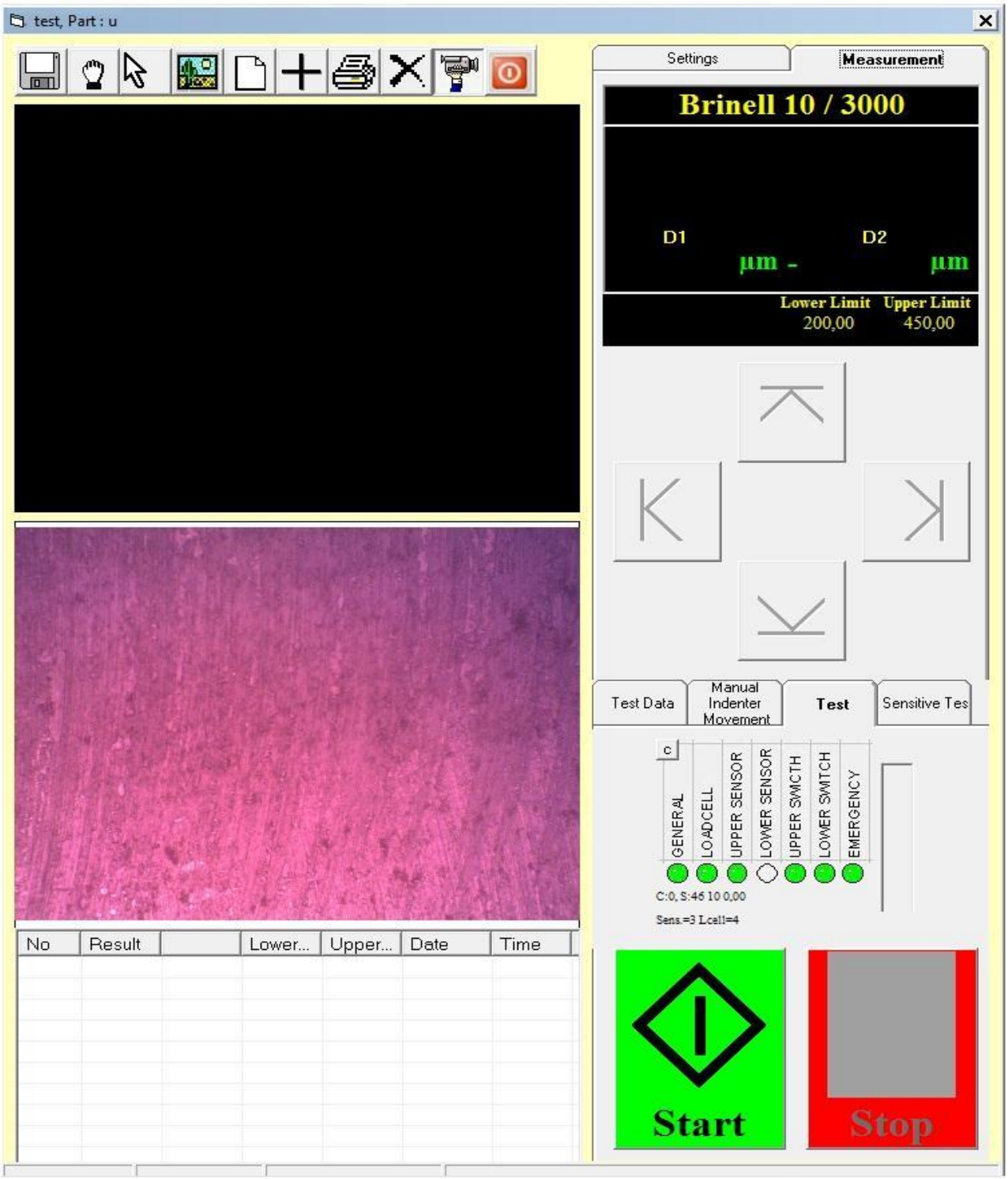
System, load calibration and calibration as will be made with the display settings. Do not need them to do initial setup.



Test Method section ball-diameter, Load, objective, lower limit and upper limit, check their values.

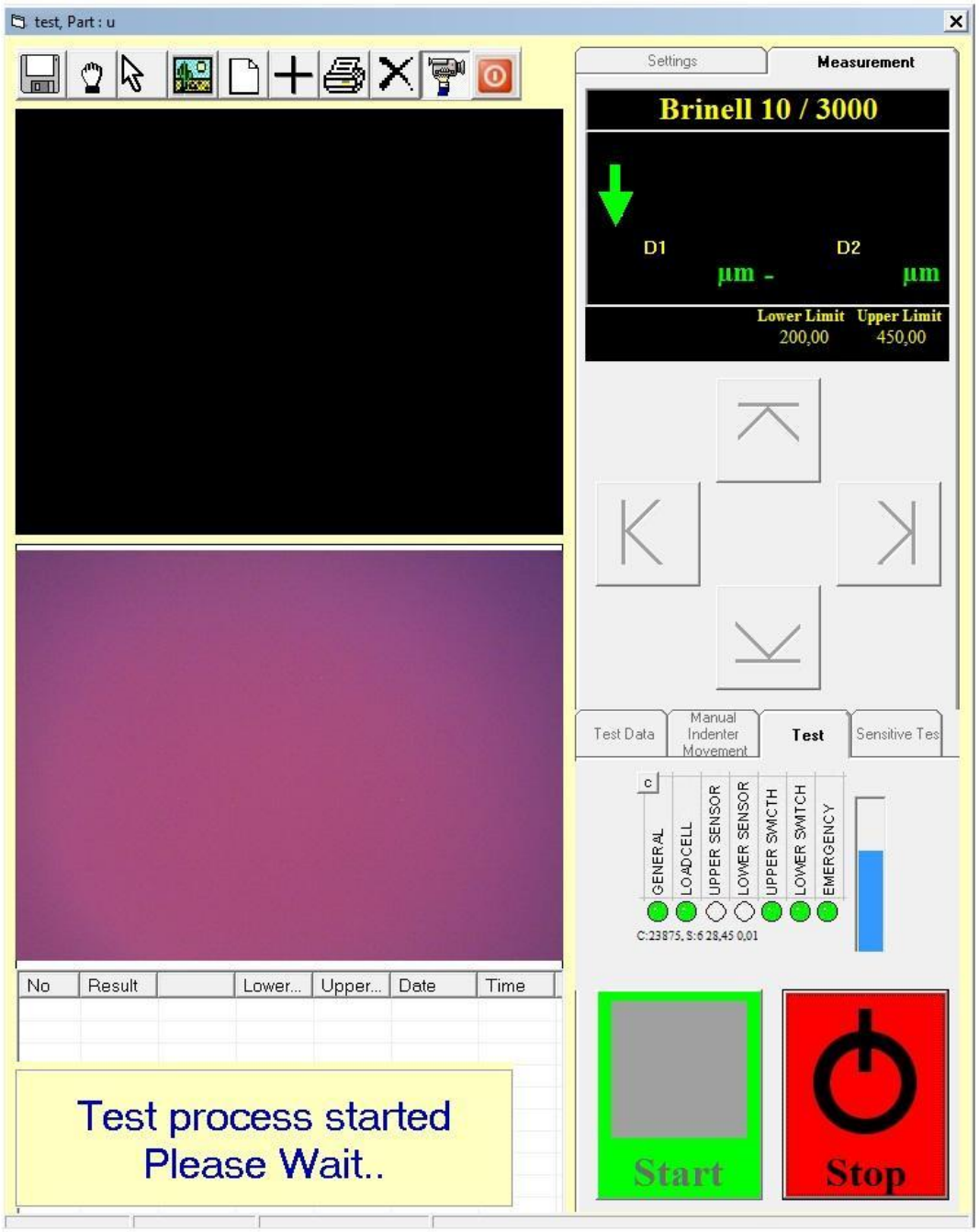


Measurement and Test tab, you can make measurement by pressing Test button. After pressing Test button please waituntilthe machine completes itsprocess and shows you the figure below.

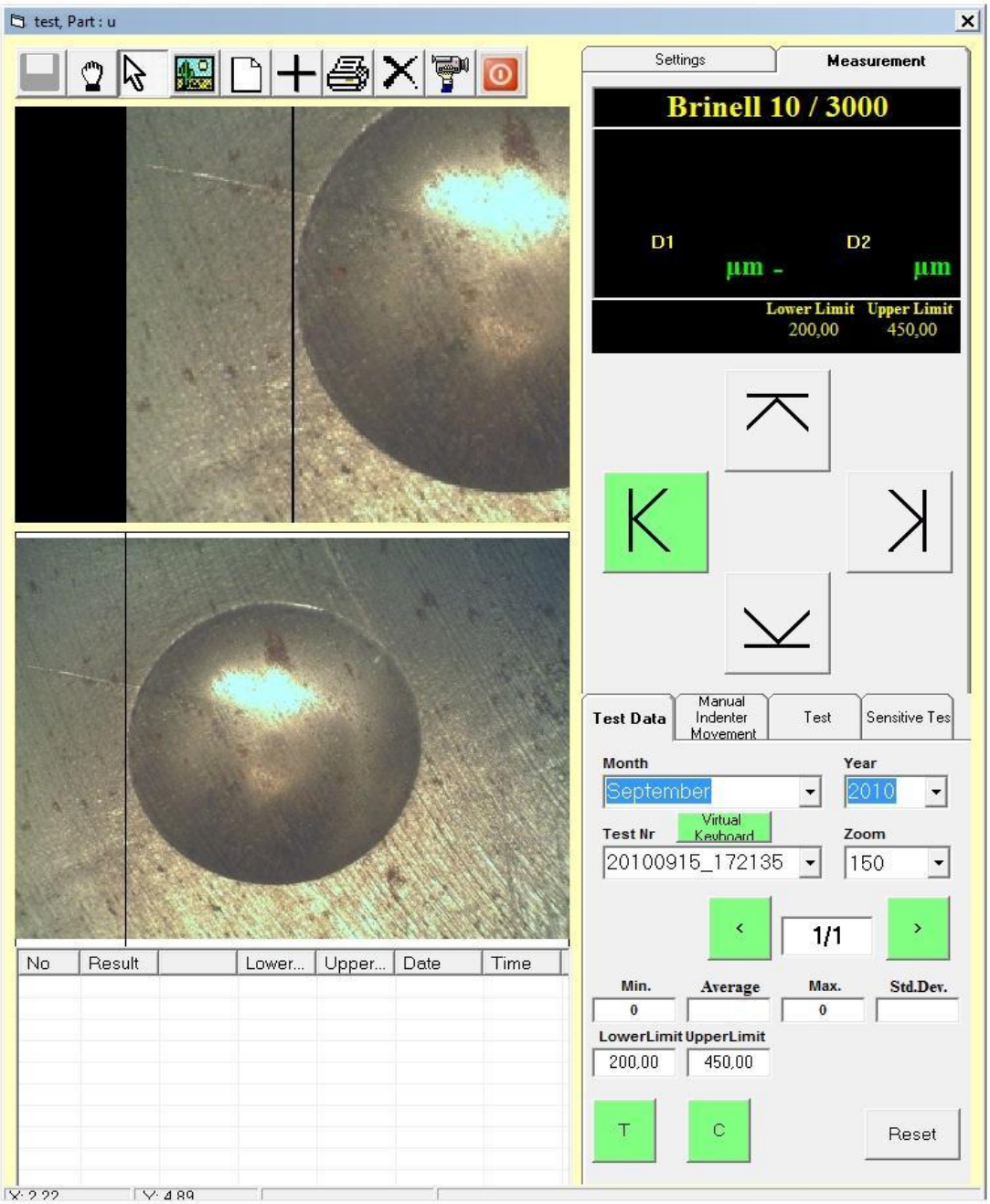


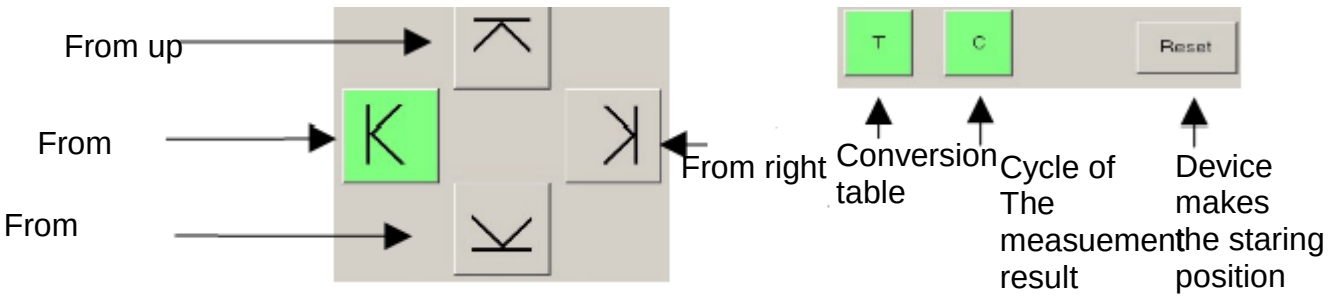
Measurement process starts by creating traces on the material	Monitoring the process of creating a starting position and the device returns to its stops.

Press Start button to start measurement

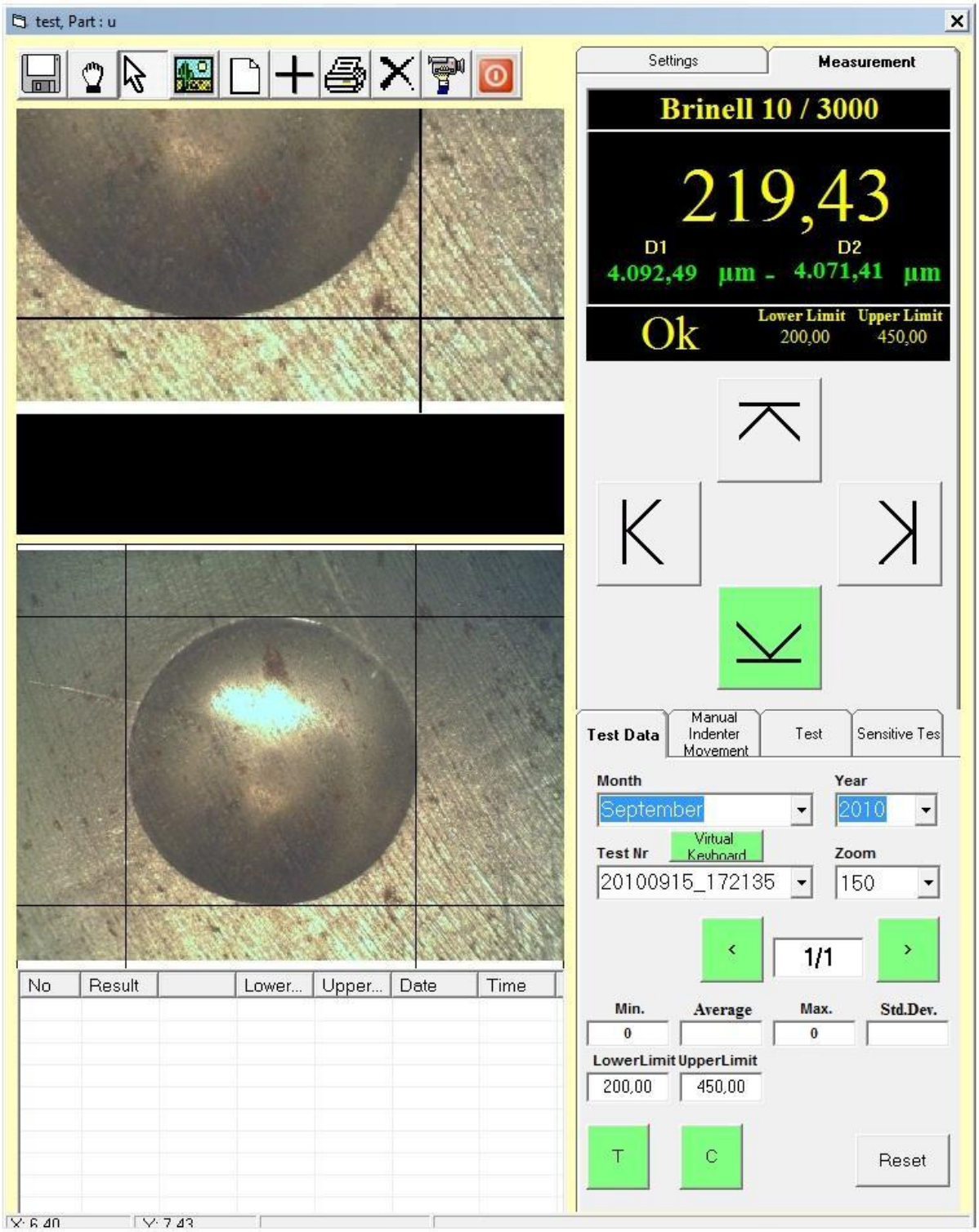


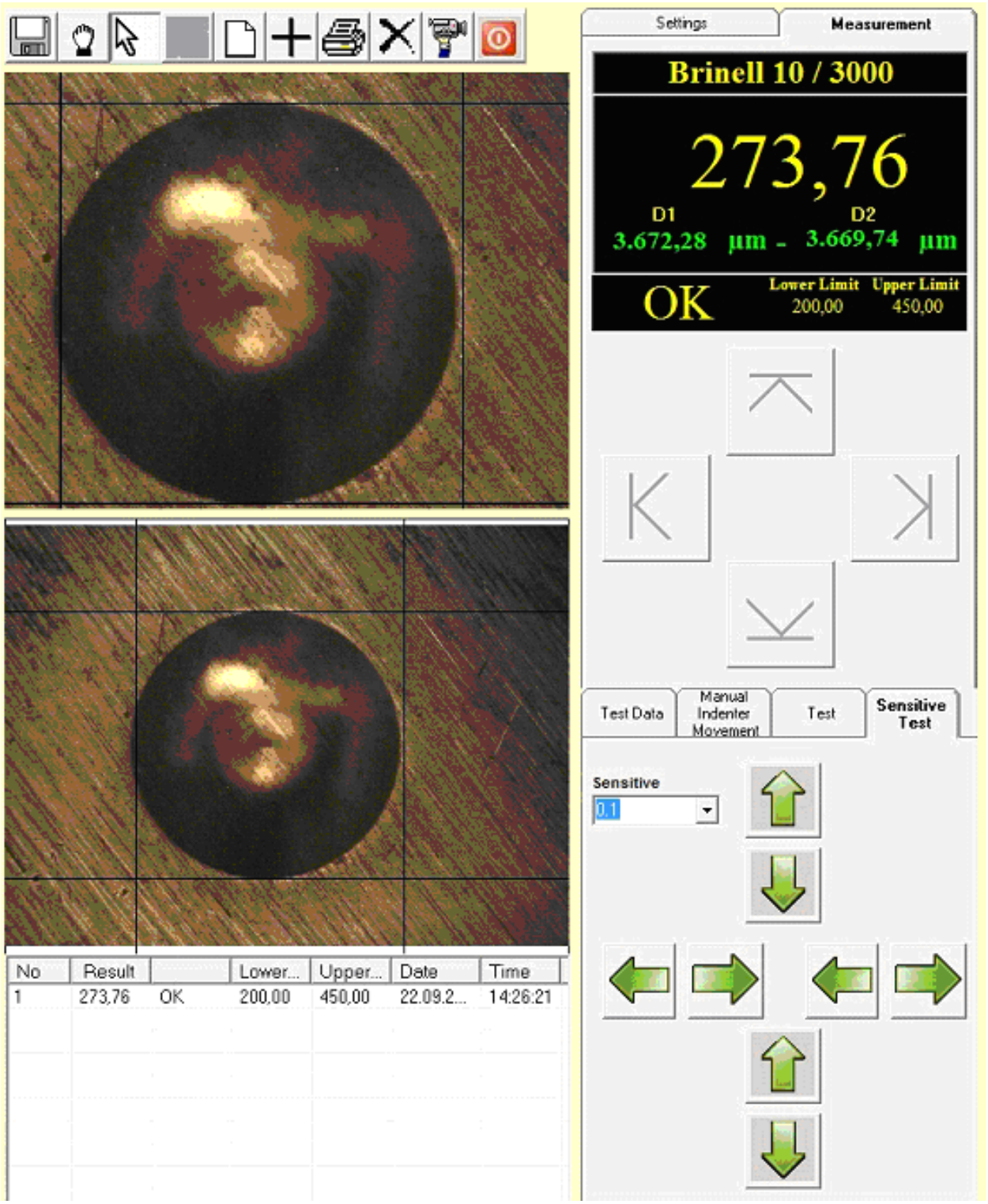
After you create something like the following figure in the window to create the image. From left to right and from top down approach from the buttons to perform the measurement.

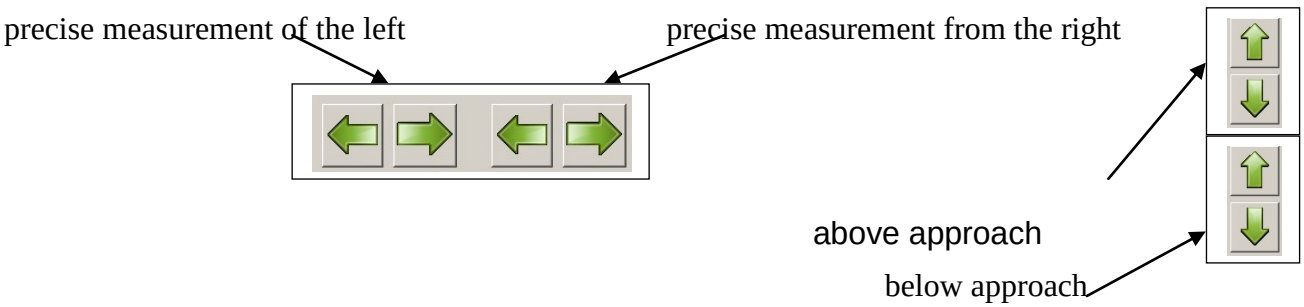

test, Part : u
Settings
Measurement
Brinell 10 / 3000
D1
D2
µm -
µm
Lower Limit
Upper Limit
200,00
450,00
Test Data
Manual Indenter Movement
Test
Sensitive Tes
Month
September
Year
2010
Test Nr
Virtual Keyboard
20100915_172135
Zoom
150
1/1
Min.
Average
Max.
Std.Dev.
0
0
LowerLimit
UpperLimit
200,00
450,00
T
C
Reset
No
Result
Lower...
Upper...
Date
Time


From up
From
From
From right
T
C
Reset
Conversion table
Cycle of The measuement result
Device makes the staring position

To make precise measurements must be measured normal once, then tab precise measurement precision approach allows you to make more accurate your measurements you can use the button.




Settings
Measurement
Brinell 10 / 3000
273,76
D1
D2
3.672,28 µm - 3.669,74 µm
OK
Lower Limit
Upper Limit
200,00
450,00
Test Data
Manual Indenter Movement
Test
Sensitive Test
Sensitive
0,1
No
Result
Lower...
Upper...
Date
Time
1
273,76
OK
200,00
450,00
22.09.2...
14:26:21


precise measurement of the left
precise measurement from the right
above approach
below approach

25.4 REPORTS

Measuring the job is complete, press the button with the picture above menu printer and

BMS Bulut Makina San. ve Tic Ltd. Şti.

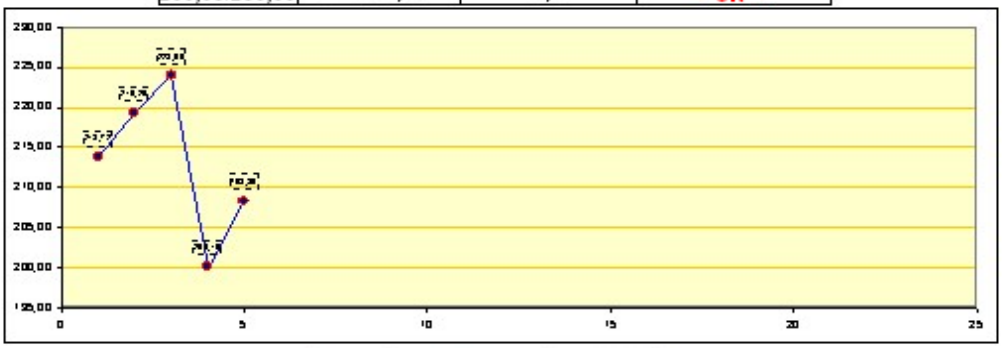
TEST PROTOCOL

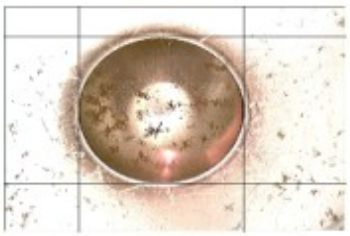
USER	
DATE	06.08.2009
Material	a

TEST RESULTS

Row No	Measurement	Test Method	Result
1	213,72	10, 3000	OK
2	219,29	10, 3000	OK
3	223,90	10, 3000	OK
4	200,15	10, 3000	OK
5	208,35	10, 3000	OK

Limit	Average	Std. Devation	Result
200,05/250,00	213,08	9,3	OK





Test From The Signature

Test Approver's Signature

prepare your report. in Microsoft excel program if it installed in PC.. Otherwise program will show above window toreport and you can print out by pressing over print button in this window.