

# Lineup of Hardness Testing Machines

Hardness testing machines provide the simplest and most economical testing methods among many material testing machines, playing an important role in research activities, production activities, and commercial transactions. Mitutoyo offers a choice of standard hardness testing machines that are optimal for hard materials such as metals to soft materials such as plastic and rubber, as well as custom-designed testers such as in-line type automatic machines and labor-saving machines required on the shop floor.



## Technical Data

Test force range:

HM-210A: 9 steps + arbitrary test force

HM-220A: 19 steps + arbitrary test force

Load dwell time: 0 - 999s

Manual XY stage unit

Stage size: 100x100mm

Travel range: 25x25mm

with Digimatic in/mm micrometer heads

Resolution: 0.001mm

Max. specimen height: 133mm (Stage size: 25 x 25mm)

Max. specimen height: 121mm (Stage size: 50 x 50mm)

Max. specimen depth: 160mm (from the center of indenter)

Optical path: 4-port objectives switching system of

Infinity-correction optical system

Resolution: 0.01µm (When using objectives of X40 or more)

Data output: Serial interface (RS-232),

Digimatic interface, USB 2.0

Power supply: 39VA 100-125/220-240V AC, 50/60Hz

Dimensions: (W x D x H): 315x671x595mm

Mass: 43kg

## Optional Accessories (Factory-installed option)

**11AAC104:** Objective lens unit 2X

**11AAC105:** Objective lens unit 5X

**11AAC106:** Objective lens unit 10X

**11AAC107:** Objective lens unit 20X

**11AAC108:** Objective lens unit 100X

**11AAC129:** Measuring microscope (Digital ocular)

**11AAC109:** Knoop Indenter Assembly (HM-210 Series)

**11AAC110:** Knoop Indenter Assembly (HM-220 Series)

## Optional Accessories

**810-454A:** TV camera unit (8.4 inch LCD)

**19BAA058:** Diamond indenter for Vickers (HM210 Series standard test force)

**19BAA059:** Diamond indenter for Vickers (HM220 Series low test force)

**19BAA061:** Diamond indenter for Knoop (HM210 Series)

**19BAA062:** Diamond indenter for Knoop (HM220 Series)

**810-017:** Vise

**810-013:** Specimen (thin plate) holder

**810-014-1:** Specimen (wire) holder

**810-015-1:** Specimen (wire or ball) holder

**810-016:** 50 mm Vise

**810-017:** 100 mm Vise

**810-019:** Specimen tilting holder

**810-020:** Universal specimen holder

**810-018:** Rotary table

**810-084:** Rotatable universal specimen holder

**810-085:** Adjustable specimen (thin plate) holder

**810-095:** Rotatable specimen stage

**375-056:** Stage Micrometer (glass) Micro-scale

**810-650-1:** Resin mold specimen stage ø25.4

**810-650-2:** Resin mold specimen stage ø30

**810-650-3:** Resin mold specimen stage ø31.75

**810-650-4:** Resin mold specimen stage ø38.1

**810-650-5:** Resin mold specimen stage ø40

**810-641:** Vibration Isolator

**810-870A:** Sample Heating Device HST-250

**810-420:** 25x25mm stage (metric only)

**810-423:** 50x50mm stage (metric only)

**810-424:** 1"x1" in/mm stage (standard)

**810-427:** 2"x2" in/mm stage



Power turret with up to 2 indenter mounts and 4 objective mounts (manual operation possible)

Touch-screen type control panel

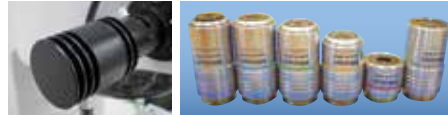


# HM-210 / 220 Type A

## SERIES 810 — Micro Vickers Hardness Testing Machines

### FEATURES

- The electromagnetic force motor used in the loading mechanism enables the test force to be freely selected (see test force specifications) over the wide range of 0.4903mN to 19610mN (0.05gf to 2 kgf). It is also possible to freely set load dwell times. Now your desire for absolute control over the indentation size in Vickers hardness testing can be satisfied. The HM-200 series always offers the test force most appropriate for the specimen material and shape.
- The long working distance objectives used enable a comfortable working distance between the objective and the specimen surface. This greatly reduces the possibility of collision between the specimen and the objective during focusing operations. (e.g. for 50X objectives: 1.1mm for conventional models, 2.5mm for HM-200 series)
- Newly-designed 'MH Plan' objectives are optimized for measuring indentation images. The lineup includes 6 types of long working distance objectives: 10X, 20X, 50X and 100X for measuring indentation images, and 2X and 5X for enabling wide-range measurement around indentations.
- LEDs, which have a longer life, produce less heat, consume less power and are more energy efficient than incandescent bulbs, are employed for the illumination system.
- The motorized turret allows for up to 4 objective lenses and 2 indenter assemblies to be mounted at the same time.



Observation image of the indentation (50X)



Stray light reduction around the indentation



HM-210A

### SPECIFICATIONS TYPE A Digital Hardness Tester

Model No.	HM-210 Type A	HM-210 Type A V/K	HM-220 Type A	HM-220 Type A V/K
<b>Part No.</b>	<b>64AAB305A</b>	<b>64AAB306A</b>	<b>64AAB307A</b>	<b>64AAB308A</b>
Fixed test force (mN)	98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf)		0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf)	
Arbitrary test force	≤100 gf in 1 gram increments, > 100gf in 10 gram increments		< 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments	
Test force control	Force generation by electromagnetic and automatic control (load, dwell, unload)			
Control unit	Color LCD Touch Screen			
Loading rate	60 µ/sec		60µm/s, Variable between 2 and 60µm/s. ≤ 30 gf.	
Load dwell time	0-999 sec			
Indenter	Vickers	Vickers and Knoop	Vickers	Vickers and Knoop
Objective lenses	10x, 50x	10x, 20x, 50x	10x, 50x, 100x	10x, 50x, 100x
Objective turret	Motor driven and manual operation			
Filar eye piece	Dual Line, 10X, .01µ min			

### With TV camera unit 810-454A (selectable with HM-210A/220A)

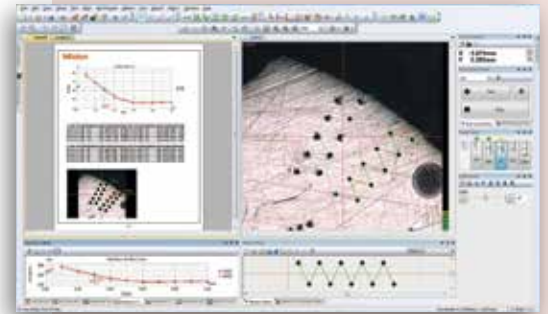
Measurement of indentation dimensions on a TV monitor reduces eye fatigue, which leads to improvement in operation efficiency in multi-point testing.



Mitutoyo

# HM-200 Series with AVPAK software

For semi and fully automatic Type B and D Systems



AVPAK Software

## System B (HM-210B/220B)

System B is equipped with **AVPAK-10**, a the software package that automatically measures the diagonal length of an indentation and calculates the corresponding hardness value. This means that measurement error caused by variation in operator interpretation is eliminated, thereby reducing costs.

Automatic measurement of indentation/ manual stage



Indentation-reading example



## System D (HM-210D/220D)

In addition to the functions of System B, System D is equipped with the autofocus function and motorized x-y stage. This function allows for automatic hardness testing, thereby increasing efficiency and reducing labor costs.

Automatic measurement of indentation / motorized XY stage / Autofocusing

## System D Technical Data

Motorized X-Y Stage	Travel Max	50 x 50 mm
	Travel Min	1μ
	Table Size	130 x 130mm
Motorized Focusing Stage	Speed Max	25mm/ sec
	Max Range	1.4mm
	Min Unit	.1μ
Joystick Controller Functions	Max Speed	1mm/ sec
	Functions	X and Y Lock out
	Axis	X, Y and Z (Focus)
	Speed Control	Adjustable H,M,L
	Tester Control	Indent, Turret Position
Other	Emergency Stop	

## SPECIFICATIONS

**TYPE B** PC-Driven Test System    **TYPE D** PC-Driven Test System with motorized stage and auto focus

Model No.	HM-210 Type B	HM-210 Type B V/K	HM-220 Type B	HM-220 Type B V/K
Part No.	64AAB323A	64AAB324A	64AAB325A	64AAB326A
Model No.	HM-210 Type D	HM-210 Type D V/K	HM-220 Type D	HM-220 Type D V/K
Part No.	64AAB380A	64AAB381A	64AAB382A	64AAB383A
Fixed test force (mN)	98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf)		0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf)	
Arbitrary test force	≤100 gf in 1 gram increments, > 100gf in 10 gram increments		< 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments	
Test force control	Force generation by electromagnetic and automatic control (load, dwell, unload)			
Control unit	None, By PC*			
Loading rate	60 μ/ sec		60μm/s, Variable between 2 and 60μm/s. ≤ 30 gf.	
Load dwell time	0-999 sec			
Indenter	Vickers	Vickers and Knoop	Vickers	Vickers and Knoop
Objective lenses	10x, 50x	10x, 20x, 50x	10x, 50x, 100x	10x, 50x, 100x
Objective turret	Motor-driven and manual operation			
Filar eye piece	None			
CCTV camera	3 megapixel, 1/2"		3 megapixel, 1/2"	
Software	AV Pak		AV Pak	

\*Must use specified PC

# MZT-500

## SERIES 810 — Micro Zone Test System

### FEATURES

When it comes to evaluating mechanical properties of ultra-small regions of ultra-fine specimens, the MZT-500 Series models are exceptionally powerful tools in the fields of research and development and quality control. The MZT-500 can evaluate mechanical properties, which conventional

hardness testing machines for fine specimens cannot measure, such as various CVD and PVD-deposited or generated films, including ion-plated films; hardness of ultra-fine cross-sections; bonding mechanical properties; and mechanical wear properties of carbon fibers, glass fibers, whiskers, etc.

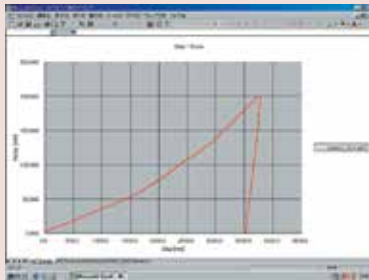
- Test data  
The indentation factor can be obtained, which is related to the hardness value (partially) shown in Martens hardness test (ISO14577) and Young's modulus. Deformation characteristics in the load, dwell, and unload phases are also obtainable for use in determining properties of the specimen material.
- Hardness tests such as Vickers and Knoop hardness tests are supported.
- The balance lever vibration isolation mechanism reduces the effect of external vibrations on measurements.
- Indenter indentation depth can be measured up to a maximum of 20 $\mu$ m with a resolution of 0.1nm.
- Test forces between 0.1mN and 1000mN can be applied electromagnetically for evaluation of material properties in submicroscopic areas.
- Field-compatible form with cover for protection against dust and wind.



### SPECIFICATIONS

Model No.	MZT-500L	MZT-500P
<b>Order No.</b>	<b>810-813A</b>	<b>810-814A</b>
Basic system	✓	✓
Data analysis / control device	✓	✓
Manual type XY stage (Travel range 25x25mm)	✓	—
Automatic XY stage (Travel range: 50x50mm)	—	✓

Test force loading device	Test force range: 0.1 to 1000mN
	Control resolution: 0.916 $\mu$ N
	Loading speed: 0.01 to 100mN/s
Indentation depth measurement	Range: 0 to 20 $\mu$ m
	Resolution: 0.1nm
Indenter	Type: Bercovich triangular pyramid indenter
Sample surface observation method	Camera: 1/3 inch black and white (410,000 pixels)
	Objective (monitor magnification): 100X (2500X), Optional: 10X (250X), 40X (1000X)
Specimen dimensions	Maximum height: 90mm
	Maximum depth: 90mm (From the center of the indenter axis)
Test type	Indentation test (with preliminary test force)
	Indentation test (without preliminary test force)
	Indentation depth setting test, continuous indentation test, repeated indentation test



# HV110 / HV120

## Series 810—Vickers Hardness Testing Machines – Type A

### FEATURES

- Heavy load Vickers testing machines feature motorized force selection from 1-50kgf or .3 to 30kgf. Fully adjustable long-life LED illumination runs cool.
- A dual-line filar eyepiece combines with a color touch-screen LCD to create accurate measurements with the touch of a button.
- The motorized turret can accommodate up to 3 long working distance objective lenses for an even wider range of materials and a wide variety of anvils and x-y stages are also available.



HV120 show with optional 810-454A CCTV Camera

### SPECIFICATIONS

Model	HV110	HV120
Order No.	810-440A	810-445A
Test force	9.807N (1kgf), 19.61N (2kgf), 29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf), 294.2N (30kgf), 490.3N (50kgf)	2.942N (0.3kgf), 4.903N (0.5kgf), 9.807N (1kgf), 24.51N (2.5kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf), 294.2N (30kgf)
Supported test method	HV, HK, HB (Light Force*), Kc	
Test force selection	Motorized	
Loading accuracy	±1%	
Load control	60µs, 150µs Automatic (loading, duration, unloading)	
Load rate	5~999 sec.	
Objective lens	2X, 5X, 10X (standard), 20X, 50X, 100X	
Measuring microscope	10X Dual-line filar	
Total magnification	20-1000X (100X Standard)	
Field of view	1,400µ (10X Lens) Type A	
Minimum reading	< 50x = 0.1µm, ≥50x = 0.01µm	
Display	Color LCD touch-screen	
Scaled conversion:	8 Types (ASTM, ISO, JIS, SAE and BS)	
Statistics:	N, Max., Min., Average, Range, High, Low, Good, Over, Under, SD(n-1), SD(n-1), SD(n) go/no-go judgment,	
Curvature correction;	0.01 to 200.00mm	
Maximum sample height	210mm Type A	
Maximum sample depth	160mm	
Maximum sample weight	20 Kg Anvil, 10 Kg with x-y Stage	
Optical path	100% Eyetube or Camera	
Output	Rs232, SPC, USB2.0	
Power supply	120 Volt AC/ 60 Hz	
Dimensions main unit (WxDxH)	9.9" x 24.7" x 30.7" (252x627x781mm)	
Mass	110lbs. (50kg)	

\* Optional test forces may be required.

### Optional Accessories

#### Lens:

- 11AAC712 OBJECTIVE LENS 2X
- 11AAC713 OBJECTIVE LENS 5X
- 11AAC714 OBJECTIVE LENS 20X
- 11AAC715 OBJECTIVE LENS 50X
- 11AAC716 OBJECTIVE LENS 100X

#### Stage

- 810-423 MANUAL STAGE 50X50
- 810-427 MANUAL STAGE 2" X 2" (In/mm)

- 959149 SPC cable (1m / 40")

#### Optical

- 11AAC711 "C" mount CAMERA ADAPTER
- 810-454A CCTV System

#### Indenters

- 19BAA060 DIAMOND INDENTER (VICKERS TYPE)
- 19BAA063 KNOOP DIAMOND INDENTER
- 19BAA281 CARBIDE-ALLOY BALL 1MM DIA.
- 19BAA277 CARBIDE-ALLOY INDENTER, 1MM DIA.
- 19BAA283 CARBIDE-ALLOY BALL, 2.5MM DIA.
- 19BAA279 CARBIDE-ALLOY INDENTER, 2.5MM DIA.

#### Additional Test Force

- 11AAC697 0.5 kg Brinell Weight
- 11AAC698 1.25 kg Brinell Weight
- 11AAC699 5.625 kg Brinell Weight
- 11AAC700 12.5 kg Brinell Weight

# HV110 / HV120

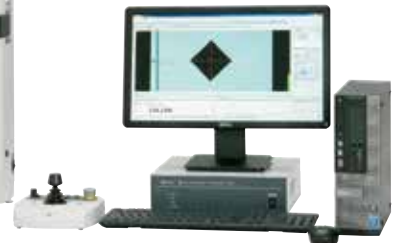
## Series 810—Vickers Hardness Testing Machines – Type B / D

### FEATURES

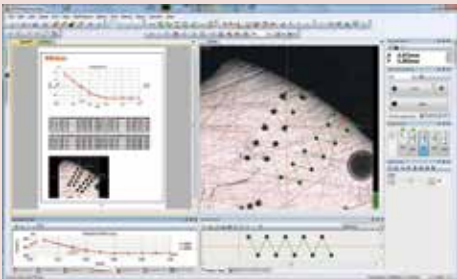
- The Type B HV110/ HV120 Vickers hardness testers add computer control to make measurements even more repeatable.
- A high-resolution 3 mega-pixel camera produces crisp images that are automatically measured in less than .3 seconds.
- Various software functions such as automatic light intensity, simple to use report generator and programming wizards make tedious and repetitive testing requirements more accurate than manual testing and eliminates common operator errors.
- The Type D HV110 / 120 adds a motorized X-Y stage with up to 100mm x 100mm of travel for large samples. A motorized focusing platform is also utilized for a complete walk away system.



**Type B System**  
show with optional PC



**Type D System**  
show with optional PC



### SPECIFICATIONS

Model	HV110 Main Unit Only	HV120 Main Unit Only
<b>Order No.</b>	<b>810-443A</b>	<b>810-448A</b>
Test force	9.807N (1kgf), 19.61N (2kgf), 29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf) 294.2N (30kgf), 490.3N (50kgf)	2.942N (0.3kgf), 4.903N (0.5kgf), 9.807N (1kgf), 24.51N (2.5kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf) 294.2N (30kgf)
Supported test method	HV, HK, HB (Light Force**), Kc	
Measuring microscope	Optional	
Field of View w/ 10X Lens	590 x 443 μm	
Display	Via PC	
Curvature correction;	0.01 to 200.00mm	
Maximum sample height	172mm Type B, 132mm Type D	
Maximum sample depth	160mm	
Maximum sample weight	10 Kg Type B, 3 kg Type D	
Optical path	100% Eyetube or Camera	
Output	USB2.0	
Mass	110lbs. (50kg)	

\*Other specifications as Type A testers

\*\* Optional test forces may be required

Basic Configuration	Type B	Type D
Main Unit	810-443A or 810-448A	810-443A or 810-448A
AVPak-10 Software	11AAC664	11AAC664
PC***	***	***
Automatic Focus Stage		810-465
Motorized X-Y Stage 50x50		810-461A
Motorized X-Y Stage 100x100		810-462A

\*\*\* PC not included

# Optional Accessories

## Micro-Vickers/Vickers Hardness Testing Machine

### Test Blocks

Order No.	Description	Load
64BAA173	Vickers 100HV Test Block	100gf
64BAA174	Vickers 200HV Test Block	100gf
64BAA175	Vickers 300HV Test Block	100gf
64BAA176	Vickers 400HV Test Block	100gf
64BAA177	Vickers 500HV Test Block	100gf
64BAA178	Vickers 600HV Test Block	100gf
64BAA179	Vickers 700HV Test Block	100gf
64BAA180	Vickers 800HV Test Block	100gf
64BAA181	Vickers 900HV Test Block	100gf
64BAA182	Vickers 100HV Test Block	500gf
64BAA183	Vickers 200HV Test Block	500gf
64BAA184	Vickers 300HV Test Block	500gf
64BAA185	Vickers 400HV Test Block	500gf
64BAA186	Vickers 500HV Test Block	500gf
64BAA187	Vickers 600HV Test Block	500gf
64BAA188	Vickers 700HV Test Block	500gf
64BAA189	Vickers 800HV Test Block	500gf
64BAA190	Vickers 900HV Test Block	500gf
64BAA191	Vickers 100HV Test Block	1000gf
64BAA192	Vickers 200HV Test Block	1000gf
64BAA193	Vickers 300HV Test Block	1000gf
64BAA194	Vickers 400HV Test Block	1000gf
64BAA195	Vickers 500HV Test Block	1000gf
64BAA196	Vickers 600HV Test Block	1000gf
64BAA197	Vickers 700HV Test Block	1000gf
64BAA198	Vickers 800HV Test Block	1000gf
64BAA199	Vickers 900HV Test Block	1000gf
64BAA200	Knoop 200HK Test Block	100gf
64BAA201	Knoop 300HK Test Block	100gf
64BAA202	Knoop 400HK Test Block	100gf
64BAA203	Knoop 500HK Test Block	100gf
64BAA204	Knoop 600HK Test Block	100gf
64BAA205	Knoop 700HK Test Block	100gf
64BAA206	Knoop 800HK Test Block	100gf
64BAA207	Knoop 250HK Test Block	500gf
64BAA208	Knoop 300HK Test Block	500gf
64BAA209	Knoop 400HK Test Block	500gf
64BAA210	Knoop 500HK Test Block	500gf
64BAA211	Knoop 600HK Test Block	500gf
64BAA212	Knoop 700HK Test Block	500gf
64BAA213	Knoop 800HK Test Block	500gf
64BAA214	Knoop 250HK Test Block	1000gf
64BAA215	Knoop 300HK Test Block	1000gf
64BAA216	Knoop 400HK Test Block	1000gf
64BAA217	Knoop 500HK Test Block	1000gf
64BAA218	Knoop 600HK Test Block	1000gf
64BAA219	Knoop 700HK Test Block	1000gf
64BAA220	Knoop 800HK Test Block	1000gf

\*Other hardness ranges and test forces available

### Bulbs

Order No.	Description
513667	Bulb, 12v/50w, halogen double pin type, HM series with box style illuminators
19BAA219	Bulb, 6v/20w, halogen double pin type, Later H series
19BAA095	Bulb, 6v/15w, halogen bayonet type, all E, G and early H series testers

### Indenters

Order No.	Type	Model
19BAA061	Knoop Indenter	H, HM Standard Series
19BAA058	Vickers Indenter	H, HM Standard Series
19BAA062	Knoop Indenter	MVK-H2, H3, HM114, HM220
19BAA059	Vickers Indenter	MVK-H2, H3, HM114, HM220
19BAA060	Vickers Indenter	HV, AVK-C Series

### Universal Specimen Holder



Used to secure a specimen that has a measuring surface that is hard to stabilize, perpendicular to the indenter axis.

810-020

### Mounted Specimen Vise



1.5" (39mm) Max Height

810-650-1

810-650-2

810-650-3

810-650-4

810-650-5

Diameter

1" 25.4mm

30mm

1.25" 31.75mm

1.5" 38.1mm

40mm

### 50x50mm travel stage



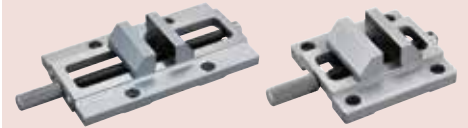
Manual XY Stage Unit 50 x 50

Manual XY Stage Unit 2"x 2"

810-423 Metric

810-427 Inch/Metric

### Clamping devices (Vises)



Vise

Max. opening: 3.94"(100mm)

810-017

Vise

Max. opening: 2"(51mm)

810-016

### Rotary Table



Rotary Table

810-018

### Round Tables



Dimensions: 7.08"(180mm)

810-037

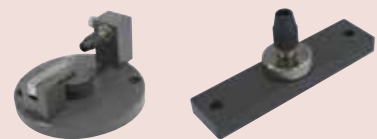
### Specimen (thin plate) Holder



Secures a plate with a thickness of .197"(5mm) or less, or foil-like specimens.

810-013

### Specimen (wire) Holder



Used to horizontally or vertically secure a wire or needle specimen that has a diameter of .126"(3.2mm) or less.

810-014-1 horizontal

810-015-1 vertical