

**Model No. PHT-3300 & 3340**

## **Integrated Hardness Tester**



**21 Industrial Ave Upper Saddle River, NJ. 07458**

**P (201) 962-7373 F (201) 962-8353**

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1 OVERVIEW .....	3
1.1 Advantages.....	3
1.2 Main Application &Testing Range.....	4
1.2.1 Main Application .....	4
1.2.2 Testing Range.....	4
1.3 Technical Specifications.....	5
1.4 Configuration.....	6
1.5 Working Conditions.....	6
1.6 Safety Instructions.....	6
2 STRUCTURE FEATURE &TESTING PRINCIPLE.....	7
2.1 Structure Feature .....	7
2.1.1 The Hardness Tester Appearance.....	7
2.1.2 D Type Impact Device .....	7
2.1.3 Different Types of Impact Device .....	8
2.2 Main Screen .....	8
2.3 Keypad Definitions .....	9
2.4 Leeb Hardness Testing Principle .....	9
3 PREPARATION .....	10
3.1 Instrument Preparation and Inspection .....	10
3.2 Preparation of the Sample Surface .....	11
4 TESTING PROGRAM .....	12
4.1 Start-Up .....	12
4.2 Loading.....	12
4.3 Localization .....	12
4.4 Testing.....	12
4.5 Read Measured Value.....	13
4.6 Notification .....	13

5 OPERATION DETAIL .....	14
5.1 Power On/Off.....	14
5.2 Material Setting .....	14
5.3 Hardness/Strength testing switch .....	15
5.4 Hardness Scale Setting.....	16
5.5 Impact Direction Setting .....	16
5.6 Average Times Setting .....	16
5.7 Saving testing result.....	16
5.8 Data logging .....	16
5.9 System Reset.....	17
5.10 Auto Powering Off.....	18
5.11 Battery Charge .....	18
5.12 Connecting to a Computer.....	19
5.13 Error Code Reference .....	19
6 MAINTENANCE & SERVICING .....	19
6.1 Impact Device Maintenance .....	19
6.2 Instrument Maintenance Program.....	19
6.3 Fault Analysis & Evacuation .....	<b>Error! Bookmark not defined.</b>
6.4 Notice of Transport and Storage Conditions...	<b>Error! Bookmark not defined.</b>
APPENDIX.....	20
Table 1.....	20
Table 2.....	21
Table 3.....	22
Table 4.....	23

# 1 Overview

## 1.1 Advantages

- PHT-3300 is an advanced mini integrated hardness tester, characterized by its high accuracy, wide measuring range and simplicity for operation. It is suitable for testing hardness of most metals and widely applied in many industrial fields, such as petroleum, chemistry, machinery, castings, forgings, etc..
- Large screen LCD, showing all functions and parameters.
- Test at any angle, even upside down.
- Direct conversion display of hardness scales HRB, HRC, HRA, HV, HB, HS, HL.
- Large memory could store 100 groups (Relative to average test times 32~1 ) Information including single measured value, mean value, impact direction, impact times, material and hardness scale can be displayed.
- Battery information showing the current capacity of the battery and the charge status.
- User calibration function.
- Software to connect to PC via USB port.
- Li-Ion rechargeable battery power supply.
- Continuous working period of no less than 200 hours.
- Auto power off to save energy.
- Outline dimensions: 148mm×33mm×28mm

## **1.2 Main Application & Testing Range**

### **1.2.1 Example of possible applications**

- Large moulds
- Bearings and other large hard parts
- Failure analysis of pressure vessel, steam generator and other heavy equipment
- Large, heavy work pieces
- Installed machinery and permanently assembled parts
- Testing surface of a tight space on large part
- Material identification in the warehouse of metallic materials
- Rapid testing in large range

### **1.2.2 Testing Range**

The PHT-3300 integrates the standard “D” impact device which covers most common applications. Other devices such as the “DL” are available for testing in tight spaces..

Testing range refer to Table 1 and Table 2 in the Appendix.

### 1.3 Technical Specifications

- Error and repeatability of displayed value see Table1-1 below.

Table 1-1

No.	Type of impact device	Hardness value of Leeb standard hardness block	Error of displayed value	Repeatability
1	D	760±30HLD 530±40HLD	±6 HLD ±10 HLD	6 HLD 10 HLD
2	DL	878±30HLDL 736±40HLDL	±12 HLDL	12 HLDL

- **Measuring range:** HLD (170~960) HLD
- **Measuring direction:** 0°~360°
- **Hardness Scale:** HL、HB、HRB、HRC、HRA、HV、HS
- **Display:** LCD
- **Data memory:** 100 groups max. (relative to impact times 32~1)
- **Battery:** 3.7V Li-Ion, Rechargeable
- **Battery charger:** 5V/500mA
- **Continuous working period:** about 200 hours (With backlight off, no printing)
- **Communication interface:** USB1.1

## 1.4 Configuration

Table 1-2

	No.	Item	Quantity	Remarks
Standard Config.	1	Main unit	1	D type
	2	Standard test block	1	
	3	USB cable	1	For comm. And charging
	4	Battery Charger	1	5V 500mA
	5	Cleaning brush I	1	
	6	Small support ring	1	
	7	Li-Ion battery	1	
	8	Manual	1	
	9	DataPro software	1	
	10	Carry Case	1	

## 1.5 Working Conditions

Working temperature:  $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$

Storage temperature:  $-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$

Relative humidity:  $\leq 90\%$ ;

The surrounding environment should void of vibration, strong magnetic field, corrosive medium and heavy dust.

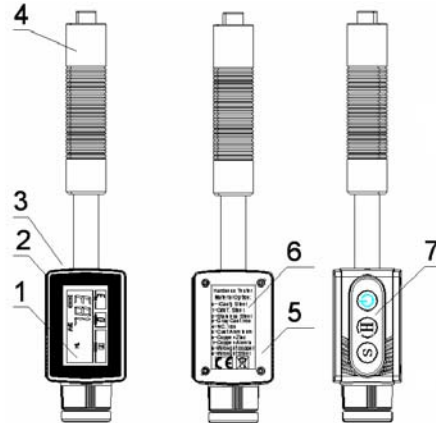
## 1.6 Safety Instructions

- The instrument can only work with the specially designed battery pack and power adapter (charger) supplied in your unit. Using unauthorized equipment may result in damage to the instrument, battery leakage, fire or even explosion.

## 2 Structure Feature & Testing Principle

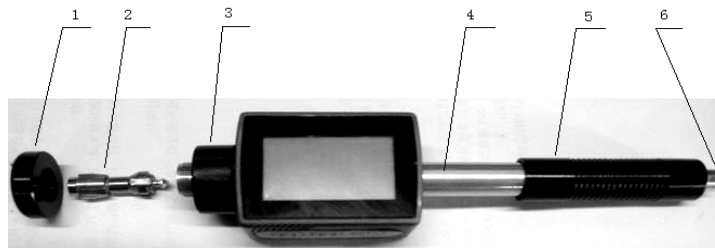
### 2.1 Structure Feature

#### 2.1.1 The Hardness Tester Appearance



1 LCD display   2 Main unit   3 USB Port   4 Impact device  
5 Battery compartment cover   6 Product label   7 Keypad

#### 2.1.2 D Type Impact Device



1 Support ring   2 Impact body   3 Coil unit   4 Guide tube  
5 Loading tube   6 Release button

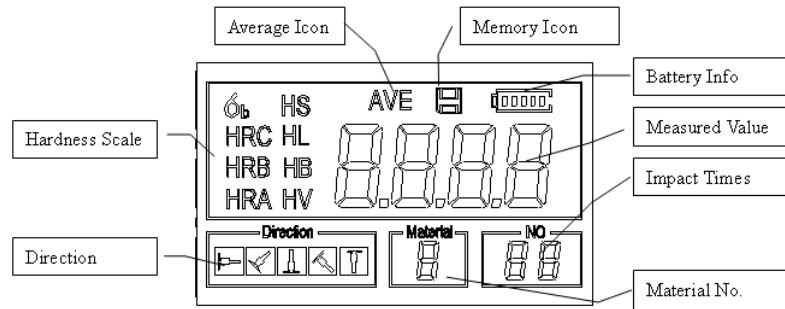


### 2.1.3 Different Types of Impact Device

The instrument can be converted to a “DL” type impact device.  
Please refer to Table 1 and Table 3 for details.

## 2.2 Main Screen

Below is the main display screen:



Instruction of the Main Display Screen:

**Material:** The present presetting material.

**Impact direction:** The present impact direction.

**Hardness scale:** Hardness scale of the present measured value.

**Battery information:** Showing the capacity of the battery and the charging status.


**Measured value:** Display present single time measured value (without showing average icon), or display the present mean value (with average icon prompting). “-HI-” means over conversion value or measure range. “-LO-” means lower than conversion value or measure range.


**Impact times :** Times that have been impacted.

**Average Icon :** It will appear when showing the mean value of the measured values after reaching the presetting impact times.

**Memory Icon :** It appears when operating the instrument memory.

### 2.3 Keypad Definitions

The instrument has three keys: 、S and H.

Key  - Turning on/off the instrument.

Key S and H – Selecting or modifying the instrument parameters.

Key actions:

Short-press: Press on a key lasting for not more than one second.

Long-press: Press on a key lasting for more than one second

### 2.4 Leeb Hardness Testing Principle

An impact body with a spherical test tip made of tungsten carbide is propelled against the sample surface by a spring force and then rebounds back. At a distance of 1mm from the sample surface, the impact and rebound velocity of the impact body are measured by the following method: A permanent magnet embedded in the impact body, when passing through the coil in its coil holder, induces in the coil an electric voltage proportional to the velocities of the magnet. Leeb hardness is expressed by the following formula:

$$HL=1000 \times VB / VA$$

Where, HL—— Leeb hardness value

VB—— Rebounding velocity of the impact body


VA—— Impacting velocity of the impact body

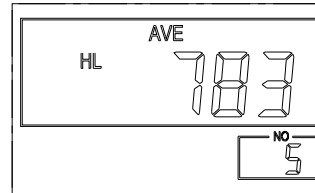
### 3 Preparation

#### 3.1 Instrument Preparation and Inspection

Verification of the instrument is achieved by performing tests on the supplied standard test block. The error and repeatability of displayed value should be within the regulation of Appendix table 2.

##### Calibration:

Press  key, while pressing down the S key to power on the system. Then the user calibration screen will be shown on the display.



Take 5 tests on the standard hardness block. The unit will display the average measured value. Short-press S to increase or short press H to decrease the digit to its nominal value shown on the test block.

Long-press S to confirm the calibration finally. Or long-press H to cancel the calibration.

Range of adjustment:  $\pm 30\text{HL}$ .

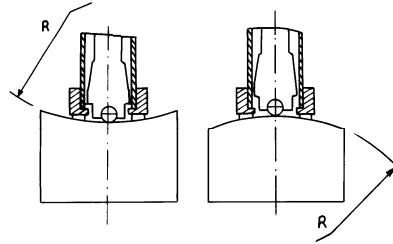
The measurement parameters, including the material setting, the hardness scale and the impact direction can't be changed during calibration.

### 3.2 Preparation of the Sample Surface

Preparation for sample surface should conform to the relative requirement in Appendix Table 3.

- Avoid extreme hot or cold temperatures as this will affect the readings.
- Surface finish should be close to  $Ra2\mu$ . Clean and smooth surfaces yield the most stable and consistent results.
- Support of test sample. Support is not necessary for heavy samples. Smaller parts must be coupled to a part with a very large mass. Surface of both large and small sample should be very smooth to prevent motion and vibration during testing.


- Curved surface: The best testing surface of sample is flat. When the curvature radius  $R$  of the surface to be tested is smaller than 30mm, the small support ring should be installed.



- For the sample with hardened layer on surface, the depth of hardened layer should conform to Table 3.
- Strong magnetic force should be avoided.

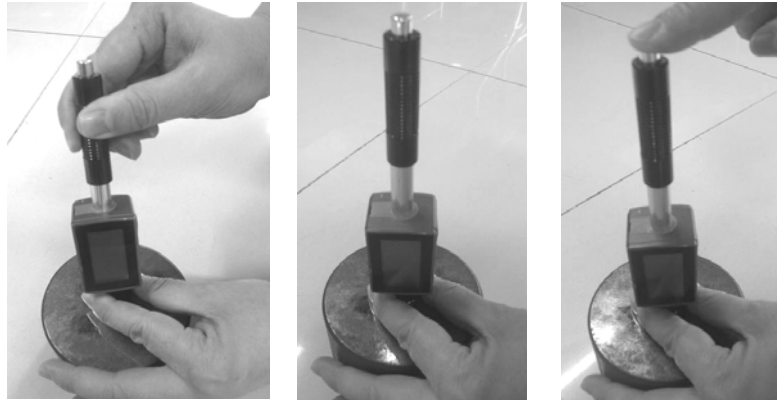
## 4 Testing Program

### 4.1 Start-Up

Press the  key to power up the instrument. The instrument will go directly to the main measurement screen.

### 4.2 Loading

Pushing the loading-tube downwards until contact is felt. Then allow it to slowly return to the starting position



### 4.3 Localization

Place the impact device support ring firmly on the surface of the sample, the impact direction should be vertical to the testing surface.

### 4.4 Testing

- Press the release button on the top of the impact device to take a test. ASTM requires the average of 5 tests in a given area to determine the actual hardness.

- The distance between any two impact points or from the center of any impact point to the edge of testing sample should conform to the regulation of Table 4-1.

Table 4-1

Type of Impact Device	Distance of center of the two indentations	Distance of center of the indentation to sample edge
	Not less than (mm)	Not less than (mm)
D	3	5
DL	3	5

#### 4.5 Read Measured Value


After each test, the LCD will display the current measured value, impact times plus one, the buzzer will sound if the measured value is not within the valid range. The unit will beep when the average of your set test results have been achieved and will be displayed.


#### 4.6 Notification

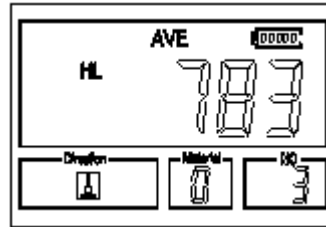
- You could only save test results AFTER the average has been obtained.
- Only type D of the impact device has the function of strength test option. You can't change the setting to strength testing when using the instrument with other types of impact device.
- Not all materials could convert to all hardness scale value. The hardness scale is reset to HL automatically after changing the material. So select material prior to changing the hardness scale.

## 5 Operation Detail

### 5.1 Power On/Off

Press  to turn on the instrument. The system would automatically detect the type of the impact device during power up, and would display this information on the screen. After pausing for several seconds, the screen will enter the main display screen as shown below:

The instrument can be turned off by pressing the  key while it is working. All settings will be saved.



*Note: If the instrument is powered off, it will turn on automatically during charging*

### 5.2 Material Setting

Short-press S key several times to select MTL option. Then short-press H to change the material to the one you want to set. Hardness scale recovers to HL automatically after material setting is changed. Please select material first, then select hardness scale.

In hardness testing mode, you can select the following materials: Steel and Cast Steel, Cold Work Tool Steel, Stainless Steel, Gray Cast Iron, Nodular Cast Iron, Cast Aluminum Alloys, Copper-Zinc Alloys, Copper-Aluminum Alloys, Wrought Copper and Wrought Steel. The relationship between the material index number displayed on the instrument screen and the material is as follows:

TABLE 5-1

Index	MATERIAL	Index	MATERIAL
0	Steel and cast steel	5	Cast aluminum alloys
1	Cold work tool steel	6	Copper-Zinc alloys
2	Stainless steel	7	Copper –Aluminum alloys
3	Gray cast iron	8	Wrought copper
4	Nodular cast iron	9	Wrought steel

In tensile strength testing mode, the following materials are selectable: Mild Steel、High-Carbon Steel、Cr Steel、Cr-V Steel、Cr-Ni Steel、Cr-Mo Steel、Cr-Ni-Mo Steel、Cr-Mn-Si Steel、Super Strength Steel and Stainless Steel. The relationship between the material index number displayed on the instrument screen and the material is as follows:

TABLE 5-2

Index	MATERIAL	Index	Material
0	Mild steel	5	Cr-Mo steel
1	HIGH CARBON STEEL	6	Cr-Ni-Mo steel
2	Cr steel	7	Cr-Mn-Si steel
3	Cr-V steel	8	Super strength steel
4	Cr-Ni steel	9	Stainless steel

### 5.3 Hardness/Strength testing switch

Long-press S key to switch between hardness testing and tensile strength testing (5b) .

***Note: Only the D type instrument has the function of strength testing.***

In hardness testing mode, the supported hardness scales includes: HL, HV, HB, HRC, HS, HRB and HRA.



**Note :**

- *The gauge will not display the hardness scale which is invalid.*
- *Please select material first, then select hardness scale.*
- *This unit will default back to HL scale after changing material.*

#### **5.4 Hardness Scale Setting**

Short-press S several times to scroll through the available hardness scales. The hardness scale currently in use will begin to flash. Then short-press H to change the hardness scale to the one you want to set.

#### **5.5 Impact Direction Setting**

Short-press S several times to select the DIR item. Then short-press H to change the impact direction to what you want to set.

#### **5.6 Average Times Setting**

You could modify average times within the range of 1 to 32 as following:

Short-press S several times to select the NO item. Then short-press H to set the average times to the number you want.

#### **5.7 Saving testing result**

By simply short-pressing H after you have obtained an average, the measured hardness/strength group values will be saved to memory. The newly saved file is appended as the last file of the memory.

At most one hundred files (F00-F99, one group as one file) can be stored inside the tester.

#### **5.8 Data logging**

This function provides the user with the ability to view/delete a

file/group previously saved in memory.

#### **Viewing stored file/Group**

To view the memory data, follow these steps:

- 1) Long-press H to activate the data logging function. The memory icon will appear. The instrument will display the current file name, the test parameter of the group data and the mean value of the group. If there is no data in the memory, it will display: <E04>, which means no memory data, and then return back.
- 2) Short-press S and H to select the desired file to view.
- 3) Long-press S to see details of that group data.
- 4) Short-press S and H to view each single measured data in that group while viewing details.

#### **Deleting selected file/Group**

The user may require deleting a file from the instrument memory. The procedure is outlined in the following steps.

- 1) Long-press H to activate the data logging function. The memory icon will appear. It will display the current file name, the test parameter of the group data and the mean value of the group. If there is no data in the memory, it will display: <E04>, which means no memory data, and then return back.
- 2) Short-press S and H to scroll to the file that will be deleted.
- 3) Long-press H on the desired file. It will automatically delete the file, and display “-DEL”.


***Note :*** *Do not shut down the instrument while deleting data. It may cause loss of all saved data.*

### **5.9 System Reset**

Press down H while powering on the instrument to restore factory

defaults. The only time this might possibly helpful is if the parameter in the instrument was somehow corrupted.


### 5.10 Auto Power Off



The instrument features an auto power off function designed to conserve battery life. If the tool is idle (neither measuring nor any key operation) for 5 minutes, it will turn itself off. Before powering off, the LCD display of the instrument will begin flashing for 20 seconds. Press any key Except , to prevent the gauge from powering off.

If the voltage of the battery is too low, the display will show <E00>, then power off automatically.

When the instrument is being charged, the Auto Power Off will not function.

### 5.11 Battery Charge

The instrument uses a Rechargeable battery as its power source. When the battery becomes drained, the battery symbol on the display will appear like this. . The unit should be charging as soon as possible. Try to drain your battery pack as fully as possible before it is charged for longer battery service.

- Plug the power adapter into the main supply power socket. Then plug one end of the USB cable into the USB port of the instrument and the other end to the adapter. If the instrument is in power off condition, it will turn on automatically after the USB cable is inserted into the adapter. The battery symbol will alternately shows between  and  when charging.
- When the battery is fully charged, the charging process will be automatically stopped.

- Please use the supplied AC-DC adapter to charge the battery.

*An alternative charging method is connecting the instrument to PC via the USB cable.*

### 5.12 Connecting to a Computer

Insert one connection plug of the USB cable into the USB socket on the top side of main body, and insert the other plug into the USB port of the PC.

### 5.13 Error Code Reference

Error Code	Explanation
E00	Battery drained
E01	Value out of range
E02	Measurement not finished
E03	Data already saved
E04	No memory data

## 6 Maintenance & Servicing

### 6.1 Impact Device Maintenance

- After the impact device has been used for 1000--2000 times, please use the nylon brush provided to clean the guide tube and impact body. When cleaning the guide tube, unscrew the support ring first, then take out the impact body, spiral the nylon brush in counter-clock direction into the bottom of guide tube and take it out for 5 times, and then install the impact body and support ring again. ***NEVER USE LUBRICANT INSIDE TUBE!***
- Release the impact body after use.

### 6.2 Instrument Maintenance Program

- If the gauge is reading more than +/- 2 HRC points, it may be a sign that the impact body is worn and must be replaced.
- If the gauge powers on normally but will not display test results, its time to replace the cable.

## APPENDIX

**Table 1**

Material	Method	Impact device		
		D	C	DL
Steel and cast steel	HRC	20~68.5	20.0~69.5	20.6~68.2
	HRB	38.4~99.6		37.0~99.9
	HRA	59.1~85.8		
	HB	127~651	80~683	81~646
	HV	83~976	80~996	80~950
	HS	32.2~99.5	31.8~102.1	30.6~96.8
Cold work tool steel	HRC	20.4~67.1	20.7~68.2	
	HV	80~898	100~941	
Stainless steel	HRB	46.5~101.7		
	HB	85~655		
	HV	85~802		
Grey cast iron	HRC			
	HB	93~334		
	HV			
Nodular cast iron	HRC			
	HB	131~387		
	HV			
Cast aluminum alloys	HB	19~164	23~210	
	HRB	23.8~84.6	22.7~85.0	
BRASS(copper-zinc alloys)	HB	40~173		
	HRB	13.5~95.3		
BRONZE(copper-aluminum/tin alloys)	HB	60~290		
Wrought copper alloys	HB	45~315		

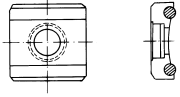
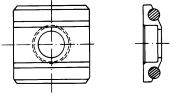


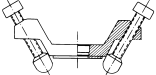
**Table 2**

No.	Material	HLD	Strength $\sigma_b$ (MPa)
1	Mild steel	350~522	374~780
2	High-Carbon steel	500~710	737~1670
3	Cr steel	500~730	707~1829
4	Cr-V steel	500~750	704~1980
5	Cr-Ni steel	500~750	763~2007
6	Cr-Mo steel	500~738	721~1875
7	Cr-Ni-Mo steel	540~738	844~1933
8	Cr-Mn-Si steel	500~750	755~1993
9	Super strength steel	630~800	1180~2652
10	Stainless steel	500~710	703~1676

**Table 3**

Type of impact device		D/DL	C
<b>Impacting energy</b>		11mJ	2.7mJ
<b>Mass of impact body</b>		5.5g/7.2g	3.0g
<b>Test tip hardness:</b>		1600HV	1600HV
<b>Dia. Test tip:</b>		3mm	3mm
<b>Material of test tip:</b>		Tungsten carbide	Tungsten carbide
<b>Impact device diameter:</b>		20mm	20mm
<b>Impact device length:</b>		86(147)/ 75mm	141mm
<b>Impact device weight:</b>		50g	75g
<b>Max. hardness of sample</b>		940HV	1000HV
<b>Mean roughness value of sample surface Ra:</b>		1.6μm	0.4μm
<b>Min. weight of sample:</b>		>5kg	>1.5kg
<b>Measure directly</b>		2~5kg	0.5~1.5kg
<b>Need support firmly</b>		0.05~2kg	0.02~0.5kg
<b>Need coupling tightly</b>			
<b>Min. thickness of sample Coupling tightly</b>		5mm	1mm
<b>Min. layer thickness for surface hardening</b>		≥0.8mm	≥0.2mm
<b>Size of tip indentation</b>			
<b>Hardness 300HV</b>	<b>Indentation diameter</b>	0.54mm	0.38mm
	<b>Depth of indentation</b>	24μm	12μm
<b>Hardness 600HV</b>	<b>Indentation diameter</b>	0.54mm	0.32mm
	<b>Depth of indentation</b> 压痕深度	17μm	8μm
<b>Hardness 800HV</b>	<b>Indentation diameter</b>	0.35mm	0.35mm
	<b>Depth of indentation</b>	10μm	7μm
<b>Available type of impact device</b>		DC: Test hole or hollow cylindrical; DL: Tests slender narrow groove or hole	C: Test small, light, thin parts and surface of hardened layer

**Table 4**

No.	Type	Sketch	Remarks
1	Z10-15		For testing cylindrical outside surface R10~R15
2	Z14.5-30		For testing cylindrical outside surface R14.5~R30
3	Z25-50		For testing cylindrical outside surface R25~R50
4	HZ11-13		For testing cylindrical inside surface R11~R13
5	HZ12.5-17		For testing cylindrical inside surface R12.5~R17
6	HZ16.5-30		For testing cylindrical inside surface R16.5~R30
7	K10-15		For testing spherical outside surface SR10~SR15
8	K14.5-30		For testing spherical outside surface SR14.5~SR30
9	HK11-13		For testing spherical inside surface SR11~SR13
10	HK12.5-17		For testing spherical inside surface SR12.5~SR17
11	HK16.5-30		For testing spherical inside surface SR16.5~SR30
12	UN		For testing cylindrical outside surface, radius adjustable R10~∞



# Global Connections



## **Main Headquarters: U.S.A**

### **Phase II Machine & Tool, Inc.**

21 Industrial Avenue

Upper Saddle River NJ 07458 USA

Tel: (201) 962-7373

Fax: (201) 962-8353

General E-Mail: [phase2@comcast.net](mailto:phase2@comcast.net)

## **BEIJING, CHINA**

### **Phase II Measuring Instruments (Beijing) Ltd.**

Room 301, Bldg 2 Qing Yuan Xi Li, Haidian District, Beijing 100192, China

Tel: +86-10-59792409

Fax: +86-10-59814851

General E-mail: [info@phase2china.com.cn](mailto:info@phase2china.com.cn)

## **MEXICO**

### **Phase II de Mexico**

Calle A No. 4 Promer Piso

Col. San Marcos Azcapotzalco

C.P 02020 Mexico

Tel: 011-525-5538-39771

Fax: same

General E-mail: [phase2mexico@hotmail.com](mailto:phase2mexico@hotmail.com)

## **VENEZUELA**

### **Phase II Herramientas Universales EDCM.CA**

Av. Francisco Lazo Marti CC

Plaza Santa Monica PB Local

Santa Monica, Caracas 1040 Venezuela

Tel: 212-690-28-21 Fax: 212-693-29-16

E-mail: [edcphm@movistar.net](mailto:edcphm@movistar.net)