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# **Chapter One**

# **Overview**

## **1.1 Brief Introduction**

Cast-in-place floor and wall thickness is the important index in evaluating the safety performance of the architecture and has been given emphasis by quality control departments at national and various levels. The traditional borehole survey belongs to the type of damage detection, which requires high labor intensity but lacks test precision. For imported equipments, the input of sound velocity is required, so the degree of test precision is relatively low due to the difference in sound velocity of different concrete. The non-damage detection method from the perspective of electromagnetics has nothing to do with the sound velocity of concrete. This method has the test precision below 2mm according to on-site test, so it is a very effective method. It can be used to automatically test the thickness of non metal plate such as concrete, rock-soil and glass pane, etc., and boasts of the functions of thickness testing, data analysis, data storage and input. It is a kind of portable intelligent thickness admeasuring apparatus with high degree of test precision and convenience in application.

## **1.2 Operating Principle**

As is shown in Diagram 1-1, the non metal plate thickness admeasuring apparatus comprises of five parts :transmitting probe, receiving transducer, received signal processing system, display system and data storage system. The transmitting probe gives off electromagnetic signal with certain frequency on one side of the non metal plate; then the receiving transducer receives the signal on the other side of the plate, transforms it into electrical signal and transmits it into the received signal processing system. The test result is displayed and stored by the received signal processing system.

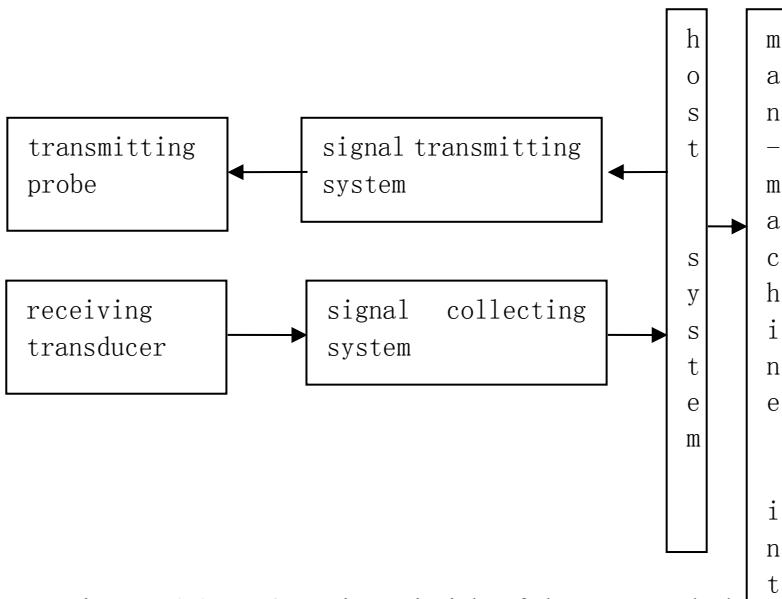


Diagram 1-1 Operating Principle of the non metal plate thickness admeasuring apparatus

### 1.3 Component of Instrument



Diagram 1-2 Component of Instrument

As is shown in the above diagram, the instrument comprises of host machine, received signal wire, walkie-talkie, probe supporting rod, transmitting probe and receiving transducer, etc.

#### **1.4 Performance Index of Instrument**

- 1、Thickness Measuring Range: 40mm~800mm
- 2、Indication of Maximum Error : 40 ~ 600mm ±1mm  
601 ~800mm ±2mm
- 3、Capacity of Data Storage: 32 000 measure points
- 4、Requirement of Working Environment
  - ambient temperature: -10°C ~ +40°C
  - relative humidity: <90%RH
  - electromagnetic interference : no strong alternating electromagnetic field
  - no exposure to sunshine projectivity for a long time
- 5、Battery
  - 6 alkaline batteries in size 5
  - More than 30 hours power-on time

#### **1.5 Cautions**

1. Avoid water inflow.
2. Avoid high temperature. ( >50°C )
3. Stay away from very strong magnetic field, such as electromagnet of large size, and large transformers, etc.
4. When the instrument is not in use for a long time, please take out the batteries to avoid the damage to the circuit caused by

battery leakage.

5. The transmitting probe can only be put into use after the battery is fully charged. (When the light of the charger turns from red to green.)
6. When the sketch map for battery on the lower side of the startup picture is displayed as blank, please change the batteries. Do make sure that the polarity of the batteries is not put in the wrong position.
7. Please do not open the enclosure of the instrument without permission, otherwise the outcome have to be borne on your own.

## Chapter Two    Operating Instruction of Instrument

The key instruction of the instrument is shown in Table 2.1.

Table 2.1 Key Instruction

Key	Function
	Power switch of the instrument
	Confirmation of operation in function selection and parameter setting; retest in thickness test
	Save estimated value.
	Returning to the previous picture in operation; cancelling in function selection
	Switching on or off the background light
	Auxiliary functions such as menu selection, number regulation, cursor move

### 3、 Starting up

Press  on the instrument panel, then the instrument is electrified and starts to run. The startup interface is shown in Diagram 2-1.

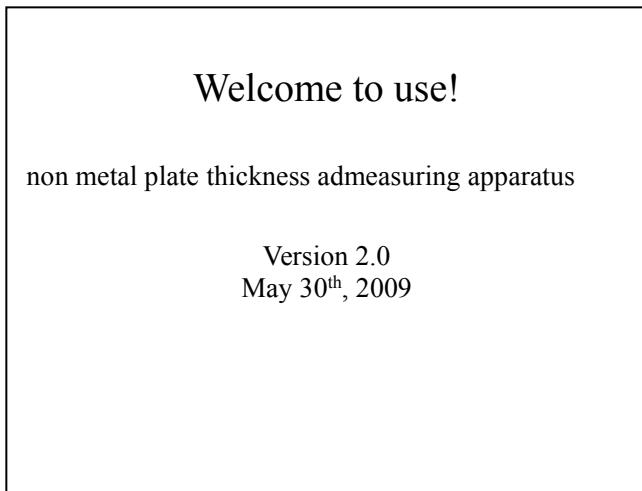
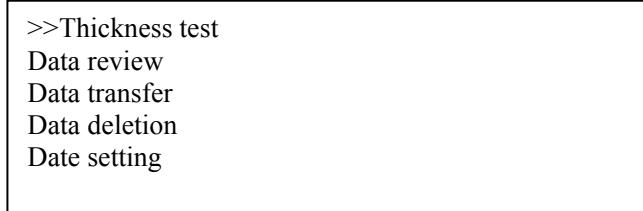


Diagram 2-1 Startup Interface

### 2.2 Function Selection Interface

Press any key(except ) on the startup interface, then enter into the function selection interface, as is shown in Diagram 2-2.



## Diagram 2-2 Function Selection Interface

There are functions like thickness test, data review, data deletion and data transfer on the function selection interface. Select relevant function by pressing  $\uparrow$  and  $\downarrow$ ; Enter relevant function interface by pressing **Enter**.

### 2.3 Thickness Test

The thickness test interface is shown in the Diagram 2-3.

Component part 0001	Design value 0030
Signal value Stored 00000 Current distance Thickness of measure point	

## Diagram 2-3 Thickness Test Interface

The thickness test interface comprises of two parts, engineering information area and testing area. The testing procedure is shown in Diagram 2-4.

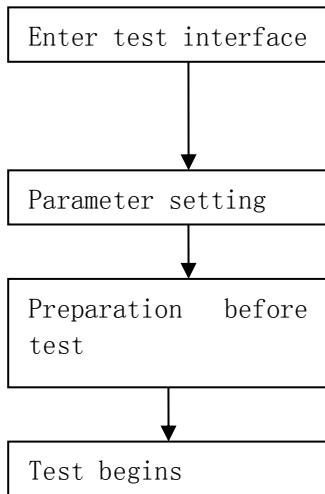


Diagram 2-4 Test Procedure

### 2.3.1 Parameter Setting

The engineering parameter in thickness test includes component name and the design value of components.

- ❖ **component name:** set by keyboard, 4 digits, signified by characters between 0 and 9, A and Z.
- ❖ **design value:** the design value of the component thickness, between 0 and 999, in the unit of mm.

**Operation:** move the cursor location by pressing **←** and **→**; adjust the number of the cursor location by pressing **↑** and **↓**; confirm the setting by pressing **Enter**. Return to the previous interface by pressing **Return**. If there is no change in component name and design value, continue testing the data by pressing **Enter**.

### 2.3.2 Preparation before Test

Connect the receiving transducer and host machine with signal wire; connect the joint lever to the transmitting probe, switch on the power and put it under the non metal panel. The

sketch map of test is shown in Diagram 2-5. When the power indicator light of the transmitting probe is green, it means the transmitting probe is working properly; when it is red and the transmitting probe gives off warning sound or the indicator light is dark, it means the power of the probe is not sufficient and it can only be used again after being charged.

- ❖ Switch on the power of the two walkie-talkies, and tune the middle channel of the two walkie-talkies into the same one. (The concrete operation is shown in the operation instruction of the walkie-talkie.)

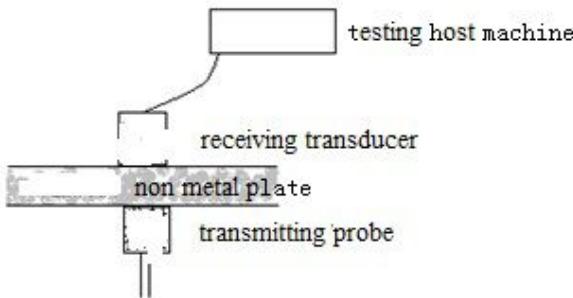


Diagram 2-5 Sketch Map of Test

testing host machine  
transmitting probe  
receiving transducer  
non metal plate

### 2.3.3 Thickness Test

When the preparation is done, the test can start. First, the meaning of the parameters in the testing zone is introduced here:

- ❖ Number of Measure Point: the sequence number of the

- current measure point in the component (starting from 1)
- ❖ **Signal Value:** Real-time display of the original value of the received signal; reflecting the strength of the original signal.
- ❖ **Current Thickness :** Real-time display of the thickness value acquired after treatment to the signal value.
- ❖ **Thickness of Measure Point:** Display the thickness value of the current measure point after analysis of the current thickness.

The testing procedure is as follows:

Step 1 : The transmitting probe is fixed under the non metal plate. Report the location of the transmitting probe to the operator of the host machine and receiving transducer above the non metal plate by the walkie-talkie installed with the instrument. The transmitting probe is fixed. Move the receiving transducer.

Step 2 : After hearing the warning sound in the moving process, draw a random path line AB of the receiving transducer in the area with receiving signal. (shown in Diagram 2-6) Move the receiving transducer along AB, find Point O<sup>1</sup> with the highest signal value and the lowest thickness value and record this point.

Step 3: Draw a straight line CD which is vertical to AB and passes Point O<sup>1</sup>, as the second path line of the receiving transducer. Move the receiving transducer along CD, and find Point O with the highest signal value and the lowest thickness value. This point is the middle vertical point of the receiving transducer and the transmitting probe, the real thickness value of the panel. At the moment, press **Save** to save the thickness of this point. When the number of the measure point is increased by 1, this means the saving is over, so the testing of the component number can be continued. Press **Enter**, the thickness of the measure point is cleared away, and the current thickness can be retested. Press **Return**, return to the previous interface.

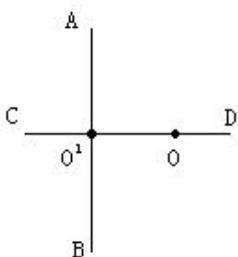


Diagram 2-6 Sketch Map of Scanning Path

Notes: When the distance between the receiving transducer and the transmitting probe is below the lower limit of the instrument testing, <40 is displayed on the screen; When the distance between the receiving transducer and the transmitting probe is above the upper limit of the instrument testing, >800 is displayed on the screen

#### 2.3.4 Data Review

The data review interface is shown in Diagram 2-7. The component part area is on the left, and the thickness data and results area is on the right. The thickness data and results of the current component is displayed in the thickness data area. The judgment of qualification ratio is calculated according to the relevant regulations in *Inspection Specification of Construction Quality in Concrete Structure Projects*. (GB 50204-2002)

Press  $\uparrow$  and  $\downarrow$ , and you can select different components in the component area. The arrow indicates the current component. Press

and , and you can review the data of the component. In the state of data review, press  and the occupying percentage of the saving area is displayed. Press , and return to the function selection interface.

Component	Date: March 10 <sup>th</sup> , 2009
>1010	Design Value: 0060 Average Value: 0084 Qualification Ratio: 000%
	0066 0073 0073 0072 0071 0067

Diagram 2-7 Data Review Interface

### 2.3.5 Data Deletion

The data deletion interface is shown in Diagram 2-8. Press , delete all the data. When the deletion is over, it will indicate successful deletion. Press , stop deleting data and return to the function selection interface.

Are you sure to delete it ?  
 To cancel;  to delete

Diagram 2-8 Data Deletion interface

**Notes: All the data can not be restored after being deleted, so be careful with this function.**

### 2.3.6 Data Transfer

The data transfer interface is shown in Diagram 2-9. Press

and , select the relevant way of transfer. Then press , enter into the relevant interface and wait for the exterior software to ask for data transfer. Press , return to the function selection interface.

>>USB Method  
Gorge line method

Diagram 2-9 Data Transfer Interface

### 2.3.7 Shutdown

Press and shut down the instrument.