

# twilight

INSTRUMENTOS DE MEDICIÓN INDUSTRIAL

## Localizador de varillas de concreto, Galaxy

GL-A60+

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# **Rebar Scanner with Scanning Trolley**

**A60+**

**Instruction Manual**

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**Conventions used in this manual:**

- 1、 Words in box represent the key, e.g. **ENTER** indicates the confirmation key.
- 2、 The words with gray shading indicate the item on the interface, e.g. **Serial number** indicates the “No.” item on corresponding interface.
3. Words with gray shading without box in data processing software indicate control name (check box and input box etc.) in the pop-up window on the screen, e.g. file name input box in the window of opening file.
4. Chinese characters or characters with gray shading in box represent the button in data processing software, e.g. Confirm indicates the confirmation button in dialog box.

## Chapter I Overview

### 1.1 Brief introduction

Rebar Scanner A60+ is used to detect current reinforced concrete project and new reinforced concrete structure construction quality and determine the location and layout of rebar. If the diameter is known, it will be used to detect the thickness of concrete covering layer. If the diameter is not known, it will be used to detect rebar diameter and thickness of concrete covering layer at the same time. Besides, it possesses the function of scanning path. And it can detect the location of magnetic substance and electric conductor in non-magnetic and non-conductive medium, e.g. cable inside wall body and water & heating pipe etc. This instrument is a kind of intelligent nondestructive test equipment possessing the functions of automatic detection, data memory and output.

### 1.2 Main functions

- 1、 Detect the location and direction of rebar in concrete structure;
- 2、 Detect covering layer thickness of rebar (diameter is known);
- 3、 At the same time, estimate diameter of rebar and thickness of covering layer;
- 4、 Detect the thickness of covering layer under the same measuring surface and display grid pattern image;
- 5、 Detect the thickness of covering layer under the same measuring line and display section plane image;
- 6、 Self-calibration function of probe;
- 7、 Memory and view of detected data;

### 1.3 Main features


- 1、 Accurate location of rebar and detection of rebar diameter and covering layer thickness;
- 2、 Possess scanning functions of grid pattern and section plane to detect accurately covering layer thickness of rebar;
- 3、 Multiple location modes of rebar: Voice alarm prompt, black indicator, thickness and signal value, which are used for accurate location of rebar;
- 4、 Sensor is placed above the rebar in parallel. One detection attitude can estimate rebar diameter and covering layer thickness at the same time. Without switching detection attitude, quick detection of rebar diameter and covering layer thickness can be achieved;
- 5、 High detection accuracy of rebar diameter and covering layer thickness;
- 6、 Show grid pattern and section plane images of rebar visually;
- 7、 Interface of software is succinct and operation is simple;

## **Chapter II Instrument composition and maintenance requirements**

### **2.1 Instrument composition**

The instrument is composed of main unit, two signal cable, transducer and scanning trolley etc.

### **2.2 Preparation before operation**

Firstly, take the instrument out of the casing. During Thickness Test and Diameter Test, connect the main unit to the main unit. During Rebar Scan, the main unit is connected with the probe and scanning trolley. Then press the  key on the keyboard. Start-up screen appears.

### **2.3 Replace battery**














When insufficient electric quantity or voltage is less than 7.0V are showed on start-up screen, please replace the battery. Pay attention not to reverse the battery polarity.

### **2.4 Precautions**

1. Avoid water in.
2. Avoid high temperature (  $>50^{\circ}\text{C}$  ) .
3. Avoid being near very strong magnetic field, e.g. large electromagnet and transformer etc.
4. When the instrument is not used for a long time, please take out of the battery to avoid damaging the circuit due to battery leakage.
5. Without permission, please not open the instrument casing. Otherwise, user will responsible for the consequence!


## Chapter III Instruction of operation interface

### 3.1 Keyboard introduction

There are 9 keys in total on the keyboard.  key is used as power switch of instrument;  key is used to confirm operation in parameter setting and automatic calibration operation of instrument;  key is used to store measured values;  key is used to return last menu in operation;  key is used to switch the first nominal range and the second nominal range;  --the first nominal range, used in the condition of less thickness of covering layer,  --the second nominal range, used in the condition of larger thickness of covering layer; , ,  and  keys are used respectively in auxiliary functions like menu selection, digit add & subtract and cursor movement etc.

### 3.2 Brief introduction of operation

#### 3.2.1 Start-up

Press the  key on instrument panel to switch on the instrument. Then begin operation. Start-up interface is shown as figure 3-1.

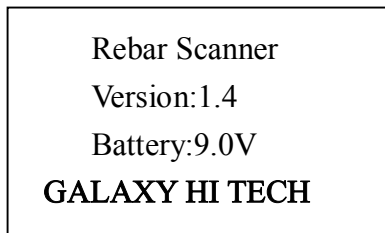





Figure 3-1 Start-up interfaces



### 3.2.2 Interface of function selection

Press any key on start-up interface to enter into the interface of function selection, as figure 3.2 shows. It includes functions of Thickness Test detecting covering layer thickness, Diameter Test detecting reinforced bar diameter, Rebar Scan detecting covering layer thickness of grid pattern or multiple parallel rebar, Transfer Data, View Data, and Delete Data, through  and  keys, select corresponding functions and press  key to enter into corresponding functional interfaces.

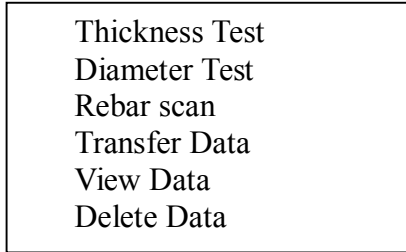







Figure 3-2 Interface of function selection

### 3.2.3 Thickness test

Interface of thickness test is shown as figure 3-3. Firstly, project information is set. During setting, if Diameter (default is 16mm) and No. (the initial position is fixed as 1) are known, press  and  keys to move the cursor and press  and  keys to adjust the value of cursor position. After above setting is end, press the  key to confirm the setting. Then probe is self-calibrated. At this time, probe should be placed in the air and away from the strong magnetic field interference. At the same time, **wait!** is showed on the screen. After **wait!** is missing, it indicates self-calibration of probe is end, as figure 3-4

shows. Then enter into detection status.


Dia. =16mm	No. =
Signal	
Memory	
Thickness	

Figure 3-3 interface of thickness test

During detection, current signal value of probe is showed on the right side of Signal; the number of saved detecting covering layer thickness is showed on the right side of Memory; covering layer thickness of detected rebar is showed on the right side of Thickness; length of black scroll bar above the Signal indicates the trend which probe is close to the top of rebar. When black scroll bar is lengthened, it indicates that probe is close to the top of rebar. When black scroll bar is shortened, it indicates that probe is away from the top of rebar. When probe is scanning over the rebar, the instrument gives the audible alarm. At the same time, covering layer thickness of detected rebar is showed on the position on the right side of Thickness in large print. At this time, press the **SAVE** key to save the data. The value on the right side of Memory is added 1 automatically and the save is end.

No. =	
<div style="background-color: black; height: 15px; width: 250px; margin-bottom: 5px;"></div> Signal Memory Thickness	

Figure 3-4 interface of thickness test

**During detection**, press the **ESC** key to return the status of setting project information; **press the ENTER key to self-calibrate probe. At this time, probe must be placed in the air and away from rebar and strong magnetic field.** After **wait!** on the screen is missing, self-calibration is end. At this time, continue detection. Press the **RANGE** key to switch between the first nominal range and the second nominal range. **After switching nominal range, it is necessary to press the ENTER key to self-calibrate probe. Otherwise, detection results are wrong.**

**To find the position on the top of rebar**, firstly, scan roughly. After hearing the alarm, shift the probe backwards. Because the speed of shifting the probe for the first time is too much, it is possible to miss the data during collecting the data. Therefore, after audible alarm, during shifting the probe backwards, slow down as much as possible. When audible alarm is heard for the second time, data on the right side of **Signal** are changed. Repeat such operation till the value on the right side of **Signal** is the maximum. At this time, center of diamond pattern on the probe is just on the top of rebar.

**Note:** When covering layer thickness is beyond the lower limit of nominal range of covering layer thickness,  $\leq XX$  is showed on the screen. When covering layer thickness detected by the first nominal range is more than 50mm, to improve the detection accuracy, switch into the second nominal range to carry out detection.

### 3.2.4 Diameter test

Interface of diameter test is shown as figure 3-5. Firstly, project No is set (the initial position is fixed as 2). Press  $\leftarrow$  and  $\rightarrow$  keys to move the cursor and press  $\uparrow$  and  $\downarrow$  keys to adjust the value of cursor position. After above setting is end, press the **ENTER** key to confirm the setting. **Then probe is self-calibrated. At this time, probe should be placed in the air and away from the strong magnetic field interference.** At the same time, **wait!** is showed on the screen. After **wait!** is missing, it indicates self-calibration of probe is end, as figure 3-6 shows. At this time, enter into detection status.

No.=0000	
Signal	
Memory	
Diameter	
Thickness	

Figure 3-5 interface of diameter test

During detection, current signal value of probe is showed on the

right side of **Signal**; saved amount of information is showed on the right side of **Memory**; estimated rebar diameter at the current probe is showed on the right side of **Diameter**; equivalent covering layer thickness at the current probe is showed on the right side of **Thickness** . Length of black scroll bar indicates the trend which probe is close to the top of rebar. When black scroll bar is lengthened, it indicates that probe is close to the top of rebar. When black scroll bar is shortened, it indicates that probe is away from the top of rebar.

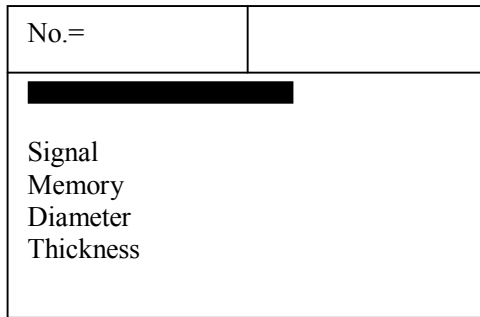


Figure 3-6 interface of diameter test

To find the position on the top of rebar and detect accurately detected rebar diameter and covering layer thickness, firstly, roughly scan. After hearing the alarm, shift the probe backwards. Because the speed of shifting the probe for the first time is too much, it is possible to miss the data during collecting the data. Therefore, after audible alarm, during shifting the probe backwards, slow down as much as possible. When audible alarm is heard for the second time, data on the right side of **Signal** are changed. Repeat such operation till the value on the right side of **Signal** is the maximum and black scroll bar is the longest. At this time, center of diamond pattern on the probe is just on the top of rebar. Then press the **RANGE** key and slightly wait for a

while so that detected rebar diameter and covering layer thickness can be estimated and showed correspondingly in the position on the right side of **Diameter** and **Thickness** in large print. At this time, press the **SAVE** key to save the data. The value on the right side of **Memory** is added 1 automatically indicating the number of this project information is saved. At this time, continue detection. Press the **ESC** key to return the status of setting project information.

During detection, press the **ENTER** key to self-calibrate probe. At this time, probe must be placed in the air and away from rebar and strong magnetic field. After **wait !** on the screen is missing, self-calibration is end. At this time, continue detection.

Note: If covering layer thickness is less than the corresponding minimum of measurable covering layer thickness value in table 3.1, **Diameter** will show **Too Thin** ; if covering layer thickness is more than the corresponding maximum of measurable covering layer thickness value in table 3.1, **Diameter** will show **Too Thick** . At this time, diameter cannot be detected.

Table 3.1 Nominal range of rebar diameter unit: mm

Rebar diameter	The minimum measurable covering layer thickness	The maximum measurable covering layer thickness
6	7	60
8	10	60
10	11	65
12	14	65
14	15	65
16	16	65
18	16	65
20	18	65
22	18	65

25	19	65
28	21	65
32	21	65

### 3.2.5 Rebar scan







Before entering into Rebar Scan, firstly, connect scanning trolley and assemble probe and trolley (probe is inserted into the trolley). Interface of rebar scan is showed as figure 3-7, through  and  keys, select corresponding functions and press  key to enter into corresponding functional interfaces.



Figure 3-7 interface of rebar scan

#### 3.2.5.1 Grid pattern scan

Interface of grid pattern scan is showed as figure 3-8, through  and  keys, select length and width requiring detection and press  key to enter into corresponding functional interfaces.

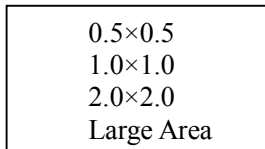


Figure 3-8 interface of grid pattern scan

Interface of 0.5×0.5m grid pattern & rebar scan is shown as figure 3-9. Firstly, project information is set including known Diameter of horizontal (Y) and vertical (X) rebar (default is XΦ16mm and YΦ08 mm) and project No. (The initial position is fixed as 3).

Press  $\leftarrow$  and  $\rightarrow$  keys to move the cursor and press  $\uparrow$  and  $\downarrow$  keys to adjust the value of cursor position. After above setting is end, press the **ENTER** key to confirm the setting. Then probe is self-calibrated. **At this time, probe should be placed in the air and away from the strong magnetic field interference.** At the same time, **wait!** is showed on the screen. After **wait!** is missing, it indicates self-calibration of probe is end. At this time, enter into detection status.

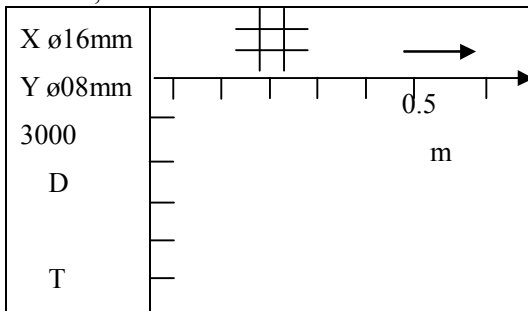


Figure 3-9 interface of 0.5×0.5m grid scan

There is one wheel and the plug on the positive direction of the trolley. During detection, the trolley only forwards the positive direction. During going forward, the number under the **D** is increased.

During detection, the number under the **D** is horizontal distance that the probe is relative to the zero point. Unit is mm. Current covering layer thickness of rebar is showed under the **T**. Scanning direction of trolley is showed on the right upper corner. According to design data or experience, direction of rebar is determined. If direction of rebar is not determined, position of rebar will be determined according to detection method of rebar. According to  $\rightarrow$  shown, longitudinal rebar of grid pattern is detected. Detected point should



select the position in the middle of crossing point of grid pattern horizontal rebar to avoid the influence on detected longitudinal rebar by grid pattern horizontal rebar. The trolley held by hand is moved horizontally from the left to the right (the trolley is vertical to extension direction of longitudinal rebar and forward speed is not more than 20mm/s). One black block shown on the screen is moved horizontally from the left to the right. After hearing the alarm, it indicates there is rebar under the probe and rebar is showed on the screen in the formation of being vertical to X-axis. At the same time, covering layer thickness is showed under the **T**. During continuing to move the trolley forwards, when horizontal length that the trolley moves is not less than 500, it is prompted by means of continuous alarm. At this time, press the **↓** key to change the direction into **↓**. Then detect the horizontal rebar of grid pattern. Similarly, detected point should select the position in the middle of crossing point of grid pattern longitudinal rebar to avoid the influence on detected horizontal rebar by grid pattern longitudinal rebar. The trolley held by hand is moved from up to down (pay attention to the direction of trolley). One black block shown on the screen is also moved from up to down. After hearing the alarm, detected rebar is showed on the screen in the formation of being parallel to X-axis. At the same time, covering layer thickness is showed under the **T**. During continuing to move the trolley downwards, when longitudinal length that the trolley moves is not less than 500, it is prompted by means of continuous alarm. At this time, press the **SAVE** key to save the data.

During detection, press the **RANGE** key to switch the first nominal range ( ) and the second nominal range ( ). After switching the nominal range, the probe must be self-calibrated by means of pressing the **ENTER** key. **Otherwise, detecting results are wrong.** When the direction is  $\rightarrow$ , press the  $\downarrow$  key to change it into  $\downarrow$ . At this time, horizontal rebar of grid pattern is detected. Press the **SAVE** key to save the data (only the direction is  $\downarrow$ ). Press the **ENTER** key to self-calibrate probe. At this time, the probe must be placed in the air and away from rebar and strong magnetic field. After wait on the screen is missing, self-calibration is end. Then continue detection.



The difference between  $1.0 \times 1.0\text{m}$  &  $2.0 \times 2.0\text{m}$  and  $0.5 \times 0.5\text{m}$  lies in that horizontal & longitudinal distances of probe relative to the zero point are respectively  $\leq 1.0\text{m}$  and  $\leq 2.0\text{m}$ . Detection method is the same.

No boundary scan is convenient for user to carry out a large area scanning. It gets rid of the limitation of scanning boundary. At the same time, the maximum scanning range is extended to  $10\text{m} \times 10\text{m}$ . For no boundary scan, the region shown on each screen is  $2.0 \times 2.0\text{m}$ . When the distance is beyond this range, this system will switch display region automatically. The difference between no boundary scan and  $0.5 \times 0.5\text{m}$  lies in that horizontal & longitudinal distances of probe relative to the zero point are  $\leq 10\text{m}$ . Detection method is the same.

**During using no boundary scan, please follow strictly the regulation that forward speed of trolley is not more than 20mm/s.**

Otherwise, missing rebar and display confusion will occur possibly. If probable scanning range is known, scanning with boundary is recommended because layout of rebar can be showed more visually.

### 3.2.5.2 Profile scan

Section plane scan is used for detection of multiple parallel rebar. Interface of section plane scan is showed as figure 3-10. Through  and  keys, according to horizontal length that requires being detected, press the **ENTER** key to enter into the interface of detecting this length.

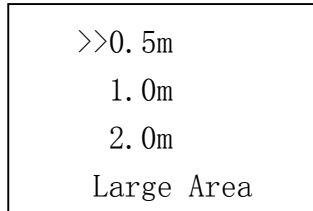






Figure 3-10 interface of Profile scan

Interface of 0.5m section plane rebar scan is shown as figure 3-11. Firstly, project information is set including **Diameter** of longitudinal rebar (default is 16mm) and **No.** (The initial position is fixed as 4). Press  and  keys to move the cursor and press  and  keys to adjust the value of cursor position. Press the **ESC** key to return the function selection interface. After above setting is end, press the **ENTER** key to confirm the setting. Then probe is self-calibrated. **At this time, probe should be placed in the air and away from the strong magnetic field interference.** At the same time, **wait!** is showed on the screen. After **wait** is missing, it indicates self-calibration of probe is end. At this time, enter into detection status.

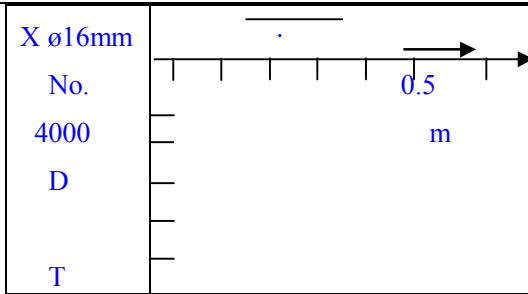


Figure 3-11 0.5m scanning interface of section plane rebar

During detection, the number under the **D** is the distance that the probe is relative to the zero point. Unit is mm. Current covering layer thickness of rebar is showed under the **T**. Scanning direction of trolley is showed on the right side of **D**. According to design data or experience, direction of rebar is determined. If direction of rebar is not determined, position and direction of rebar will be determined according to detection method of rebar. The trolley held by hand is moved horizontally from the left to the right (the probe is parallel to direction of rebar) and the speed is not more than 20mm/s. (At the same time, one black block shown on the screen is moved horizontally from the left to the right.) After hearing the alarm, it indicates there is rebar under the probe and rebar is showed on the screen in the formation of black block. At the same time, covering layer thickness is showed under the **T**. During continuing to move the trolley horizontally, when horizontal length that the trolley moves is not less than 500, it is prompted by means of continuous alarm. At this time, press the **SAVE** key to save the data.

During detection, press the **RANGE** key to switch the first

nominal range ( ) and the second nominal range ( ). After switching the nominal range, the probe must be self-calibrated by means of pressing the **ENTER** key. **Otherwise, detecting results are wrong.** Press the **SAVE** key to save the data and press the **ENTER** key to self-calibrate probe. However, the probe must be placed in the air and away from rebar and strong magnetic field. After **wait** on the screen is missing, self-calibration is end. Then continue detection.

The difference between 1.0m & 2.0m and 0.5m lies in horizontal distances of probe relative to the zero point are respectively  $\leq 1.0\text{m}$  and  $\leq 2.0\text{m}$ . Detection method is the same.

No boundary scan is convenient for user to carry out a large area scanning. It gets rid of the limitation of scanning boundary. At the same time, the maximum scanning range is extended to 10m. For no boundary scan, the region shown on each screen is 2.0m. When the distance is beyond this range, this system will switch display region automatically. The difference between no boundary scan and 0.5m lies in that horizontal & longitudinal distances of probe relative to the zero point are  $\leq 10\text{m}$ . Detection method is the same.

**During using no boundary scan, please follow strictly the regulation that forward speed of trolley is not more than 20mm/s. Otherwise, missing rebar and display confusion will occur possibly. If probable scanning range is known, scanning with boundary is recommended because layout of rebar can be showed more visually.**

### 3.2.6 Transfer data

Interface of transferring data is shown as figure 3-12. Through **↑** and **↓** keys, select corresponding transferring modes. Then

---

press the **ENTER** key to enter into corresponding function interface.

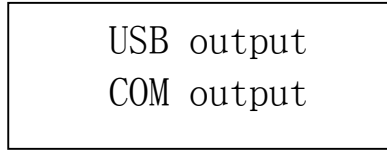


Figure 3-12 interface of transferring data

### 3.2.6.1 USB transfer

USB transfer interface is shown as figure 3-13. Press the **ENTER** key to carry out transfer and press the **ESC** key to return function selection interface without transferring data. During transfer, prompt **Transferring...**, as figure 3-14 shows. After transfer is finished, prompt **Transfer end**, as figure 3-16 shows. Then press any key to return function selection interface.

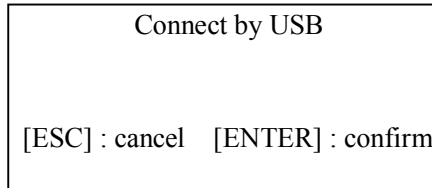


Figure 3-13 USB transfers

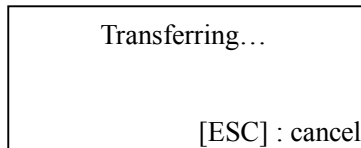


Figure 3-14 USB transferring

### 3.2.6.2 COM port transfer

COM port transfer interface is shown as figure 3-15. Press the **ENTER** key to carry out transfer and press the **ESC** key to return function selection interface without transferring data. After transfer is end, prompt **Transfer End**, as figure 3-16 shows. Then press any key to return function selection interface.

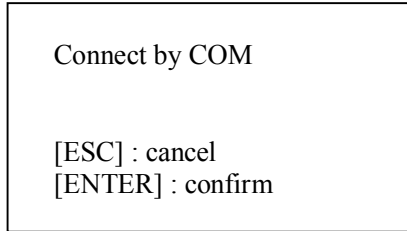


Figure 3-15 COM port transfers

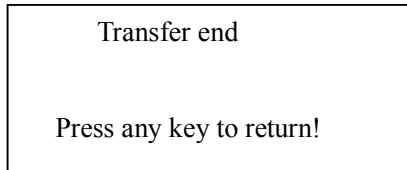


Figure 3-16 Transfer end

### 3.2.7 View data

Interface of viewing data is showed as figure 3-17, figure 3-18, figure 3-19 and figure 3-20. **Project No.** region is on the left side. Selected project **data region** is on the right side. Project whose No. is begun with **1XXX** includes data of detecting covering layer thickness under the condition of known rebar diameter. Project whose No. is begun with **2XXX** includes data of detecting rebar diameter and covering layer thickness at the same time under the condition of unknown rebar diameter. Project whose No. is begun with **3XXX**

includes data of grid pattern scan. Project whose No. is begun with 4XXX includes data of section plane scan. Press the  $\uparrow$  and  $\downarrow$  keys to select different projects in project No. region. Arrowhead indicates current selected project. Data of current selected project is in right data region.

No.	Data
=>1002	Known Dia.16
1005	27 28 27 27
2003	28 27
3001	
4001	
4003	
3002	

Figure 3-17 Interface of viewing thickness

Look up data of this project by means of pressing  $\leftarrow$  and  $\rightarrow$  keys.  $\rightarrow$  key is used to look up data of current project backwards through the full screen turning.  $\leftarrow$  key is used to look up data of current project forwards through the full screen turning. Press the **ESC** key to return the function selection interface.

When project No. begun with 1XXX is selected through  $\uparrow$  and  $\downarrow$  keys, that is to say, interface of viewing the thickness as figure 3-17 shown, **Dia. known** is the set diameter during detection according to design data. Following data are those of detecting covering layer thickness in this project.

When project No. begun with 2XXX is selected through  $\uparrow$  and  $\downarrow$ ,



that is to say, interface of viewing diameter as figure 3-18 shows, saved rebar diameter and covering layer thickness of this project are showed in right data region. Rebar diameter corresponds to covering layer thickness one by one. By following coincidence relation of geometric location, that is to say, the first data of No. line in **T** data column corresponds to the first data of No. line in **Dia.** data column. The second data in the same line is also corresponding.

No.	Data(mm)			
	T		Dia.	
1002				
1005	23	23	12	12
=> 2003	22	23	10	12
3001				
4001				
4003				
3002				

Figure 3-18 interface of viewing diameter

When project No. begun with **3XXX** is selected through **↑** and **↓** keys, that is to say, interface of viewing data of grid pattern scan as figure 3-19 shown. Saved rebar diameter, covering layer thickness and the distance that rebar is relative to the zero point in this project are showed in right data region. **NO** indicates the serial number of detected rebar. **XΦ16** indicates preset diameter of longitudinal rebar for this project No., which corresponds to following data including data of detecting covering layer thickness of longitudinal rebar in the first line and the distance that this rebar is relative to the zero point in

the second line. **YØ08** indicates preset diameter of horizontal rebar for this project No., which corresponds to following data including data of detecting covering layer thickness of horizontal rebar in the first line and the distance that this rebar is relative to the zero point in the second line.

When project No. begun with **4XXX** is selected through **↑** and **↓** keys, that is to say, interface of viewing data of section plane scan as figure 3-20 shown. Detected rebar No., covering layer thickness and the distance that rebar is relative to the zero point in this project are showed in right data region. Serial number of detected rebar is showed under the **NO.** Data of detecting covering layer thickness are showed under the **H/16** under the condition of known rebar diameter (16mm). Horizontal distance that rebar is relative to the zero point is showed under the **Dx.**

No.	Data(mm)		
	No	XØ16	YØ08
1002			
1005	01	034	030
2003		0086	0098
=> 3001	02	026	031
4001		0159	0277
4003	03	024	
3002		0288	
	04		

Figure 3-19 interface of viewing grid scan

No.	Data(mm)		
	No	H/ 16	Dx
1002			
1005	01	028	0109
2003	02	029	0278
3001	03	028	0459
=> 4001	04		
4003	05		
3002	06		
	07		
	08		

Figure 3-20 interface of viewing profile scan

### 3.2.8 Delete data


Interface of deleting data is showed as figure 3-21. Press the **ENTER** key to delete all data. After deleting all data, then return automatically to function selection interface. Press the **ESC** key to return the function selection interface without deleting data.

<p>Confirm delete?</p> <p>[ESC]:Cancel</p> <p>[ENTER]:Delete</p>
--

Figure 3-21 Delete data

**Notice: After all data are deleted, they cannot be restored. Please be cautious to use this function.**

### 3.2.9 Shut down

Press the  key to achieve the shut down.

**Notice:** To reduce the impact on the screen, after shut down, about 30s later, the instrument can be started again.

---

## Chapter IV Detection

### Precautions:

1. During entering into detection status (Thickness Test, Diameter Test and Rebar Scan) each time, system can calibrate the probe automatically again. At this time, the probe should be placed in air or away from magnetic medium like metal etc.
2. Detected surface is flat as much as possible to improve the detection accuracy and avoid wrong interpretation.
3. During detection, the probe is moved at uniform speed as much as possible to avoid moving in reverse direction before finding the rebar, that is to say, avoid moving the probe to and fro before finding the rebar. Otherwise, it is easy to cause wrong interpretation.
4. The speed of moving the probe should not be more than 20mm/s. Otherwise, it is easy to cause larger error even rebar missing.
5. If continuous working time is longer, to improve the detection accuracy, pay attention that the probe should be placed in air and away from the rebar every other about 5mins. Press the **ENTER** key to reset once and eliminate all errors (when detection results are doubted, after resetting it, detect it again).
6. When Thickness Test function of detecting covering layer thickness under the condition of known rebar diameter, to assure detection accuracy of covering layer thickness, user should set the rebar diameter value corresponding to actual rebar diameter because rebar with different diameters responds the probe differently. Therefore, when the same rebar is detected by means of different rebar diameter setting values, detection results are sure to be different.
7. **Range** key is used to switch the first nominal range and the second nominal range to increase the accuracy of detecting covering layer thickness. After switching, confirm key must be pressed to reset once.
8. Pay attention to the scanning direction of trolley to avoid moving in reverse direction. Otherwise, it is easy to cause wrong interpretation.

#### 4.1 Reset

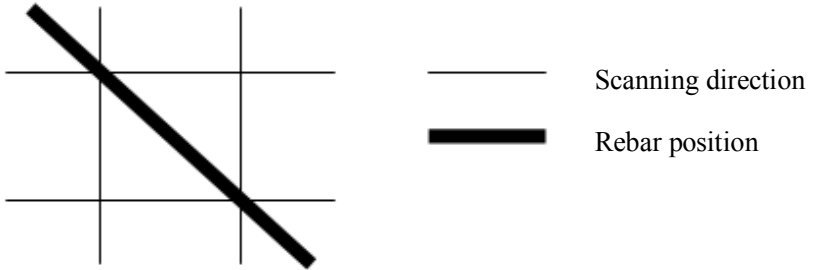
1. The probe is placed in air and away from the metal (at least 0.5m away from the metal).
2. On the interfaces of Thickness Test, Diameter Test and Rebar Scan, press the **ENTER** key to reset and eliminate the environmental influence.
3. About 3seconds later, after **wait!** on the screen is missing, reset is end. At this time, enter into normal detection status. If stronger electromagnetic field interference is in the environment, reset time is longer possibly.

**Notice: Do not reset at the position that is near the rebar. Otherwise, it will cause serious distortion of detection results.**

#### 4.2 Location of single rebar and detection of covering layer thickness and rebar diameter

##### **Detect covering layer thickness under the condition of known rebar diameter**

1. Take out of the instrument and connect the probe;
2. Turn on the instrument power and select the function of Thickness Test. According to design data, rebar diameter is set as known diameter. Project No. of this detection is set.
3. The probe is placed in air and away from the metal (at least 0.5m away from the metal). Press the **ENTER** key to reset and eliminate the environmental influence.
4. According to design data or experience, the rebar direction is determined. If rebar direction is not determined, multiple points scanning on two orthogonal directions should be carried out to determine the rebar position as following figure shows.



5. The probe is placed on the surface of detected body and moved at uniform speed in parallel with rebar and along the direction that is vertical to rebar direction. **The speed should be less than 20mm/s.** When the probe reaches the top of detected rebar, the instrument gives the humming to prompt that rebar is under this position and show covering layer thickness automatically. At this time, press the **SAVE** key to save detection results into current set project No. The probe is moved to and fro at nearby position in reverse direction. At the same time, two-digit value on the right side of screen can be observed. The position that the minimum occurs and **Signal** is the maximum is accurate position of rebar. Center of rebar is coincident with that of diamond pattern on the probe.

#### **Value determination**

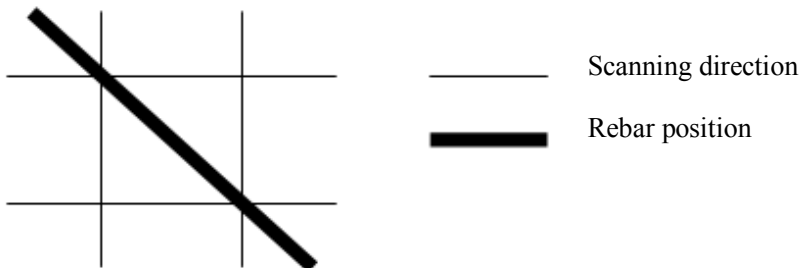
When covering layer thickness is more than certain value, detection signal of probe is rather weak. At this time, to reduce wrong interpretation, rebar position is not determined automatically by means of general procedure. It requires that user determines the rebar position according to change laws of current value. Such determination is called as value determination. Observe the two-digit value in small print shown on the right side of the screen. When this value is changed from large to small, it indicates that the probe is near the rebar gradually. Continue to move the probe. When this value is changed from small to large, it indicates that the probe

is away from the rebar gradually. The probe is moved to and fro at nearby position in reverse direction. The position that the minimum of value occurs and Signal is the maximum is accurate position of rebar.

### **Detect covering layer thickness and rebar diameter under the condition of unknown rebar diameter**

Under the condition of unknown rebar diameter, this instrument can detect rebar diameter and covering layer thickness at the same time. Steps are as follows:

1. Take out of the instrument and connect the probe;
2. Turn on the instrument power and select the function of Dia. Test. Project No. of this detection is set.
3. The probe is placed in air and away from the metal (at least 0.5m away from the metal). Press the **ENTER** key to reset and eliminate the environmental influence.
4. According to design data or experience, the rebar direction is determined. If rebar direction is not determined, multiple points scanning on two orthogonal directions should be carried out to determine the rebar position as following figure shows.





5. The probe is placed on the surface of detected body and moved at uniform speed in parallel with rebar and along the direction that is vertical to rebar direction. **The speed should be less than 20mm/s.** When the probe reaches the top of detected rebar, the instrument gives the humming to prompt that rebar is under this position. The probe is moved to and fro at nearby position in reverse direction. At the same time, Signal on the screen can be observed. The position that Signal is the maximum is accurate position of rebar. Probe position is kept unchangeable. Press the **RANDE** key. After a while, detect the diameter and covering layer thickness of detected rebar, which are showed correspondingly on the positions on the right side of Rebar Diameter and Covering Layer Thickness in large print. At this time, press the **SAVE** key to save detection results into current set project No.

### **4.3 Location of multiple rebar and detection of covering layer thickness**

Multiple rebar uses layout of multiple parallel rebar (main rebar) plus stirrups generally (e.g. beam and column etc.) or grid pattern layout (e.g. plate and wall etc.).

#### **4.3.1 Detection of grid pattern rebar**


1. Take out of the instrument and connect the trolley to the probe.
2. Turn on the instrument power and select the function of Rebar Scan. Enter into the function of Grid Scan and select corresponding function according to required dimension. According to design data, rebar diameter is set as known diameter. If rebar diameter is not known,

---

default will be set as known diameter. Project No. of this detection is set.

3. The probe is placed in air and away from the metal (at least 0.5m away from the metal) and strong electromagnetic field interference. Press the **ENTER** key to reset and eliminate the environmental influence.

4. According to design data or experience, the rebar direction is determined. If rebar direction is not determined, horizontal & longitudinal direction and position of grid pattern rebar are detected according to detection method of rebar.

5. The trolley and probe are placed on the surface of detected body and the probe is moved at uniform speed in parallel with detected rebar. **The speed should be less than 20mm/s.** According to  shown on the right upper corner, firstly, longitudinal rebar of grid pattern is detected. Detected point should select the position among crossing points of grid pattern horizontal rebar to avoid the influence on detected longitudinal rebar by grid pattern horizontal rebar. The trolley held by hand is moved horizontally from the left to the right (the speed is not more than 20mm/s). One black block shown on the screen is moved horizontally from the left to the right. After hearing the alarm, it indicates there is rebar under the probe and rebar is showed on the screen in the formation of being vertical to X-axis. At the same time, covering layer thickness of current detected rebar is showed under the **T**. During continuing to move the trolley to the right, when **D** (distance that the trolley moves) is not less than 500/1000/2000, it is

prompted by means of continuous alarm. At this time, press the **↓** key to change the direction into **↓**. Then detect the horizontal rebar of grid pattern. Similarly, detected point should select the position among crossing points of grid pattern longitudinal rebar to avoid the influence on detected horizontal rebar by grid pattern longitudinal rebar. The trolley held by hand is moved from up to down (pay attention to the direction of trolley). One black block shown on the screen is also moved from up to down. After hearing the alarm, detected rebar is showed on the screen in the formation of being parallel to X-axis. At the same time, covering layer thickness of current detected rebar is showed under the **T**. During continuing to move the trolley downwards, when **D** (distance that the trolley moves) is not less than 500/1000/2000, it is prompted by means of continuous alarm. At this time, press the **SAVE** key to save detection results into current set project No.

#### **4.3.2 Detection of section plant rebar**

1. Take out of the instrument and connect the trolley and probe.
2. Turn on the instrument power and select the function of **Rebar Scan**. Enter into the function of **Profile Scan** and select corresponding length according to required dimension. According to design data, rebar diameter is set as known diameter. If rebar diameter is not known, default will be set as known diameter. Project No. of this detection is set.
3. The probe is placed in air and away from the metal (at least 0.5m away from the metal) and strong electromagnetic field interference.

Press the **ENTER** key to reset and eliminate the environmental influence.

4. According to design data or experience, the rebar direction is determined. If rebar direction is not determined, horizontal & longitudinal direction and position of grid pattern rebar are detected according to rebar location function of instrument.

5. The trolley and probe are placed on the surface of detected body and the probe is moved at uniform speed in parallel with detected rebar. **The speed should be less than 20mm/s.** According to the direction shown on the right upper corner, rebar that is vertical to the direction of moving trolley is detected. At this time, one black block shown on the screen is moved horizontally from the left to the right. After hearing the alarm, detected rebar is showed on the screen in the formation of small black block. At the same time, covering layer thickness of current detected rebar is showed under the **T**. During continuing to move the trolley to the right, when **D** that the trolley moves is not less than 500/1000/2000, it is prompted by means of continuous alarm. At this time, press the **SAVE** key to save detection results into current set project No. and press the **ESC** key to return the interface of selecting scanning mode.

## **Chapter V Detection method of rebar**

In actual rebar concrete structure, layout of multiple parallel rebar (main rebar) plus stirrups (e.g. beam and column etc.) or layout of grid pattern (e.g. plate and wall etc.) is usually used. What's more, buried position of rebar in concrete cannot be determined in advance usually. Therefore, to improve detection efficiency and accuracy, we need follow certain principle and summarize a great amount of experience of actual detection. Finally, we generalize a set of detection method applicable for rebar.

### **Step 1 Obtain material**

Obtain design & construction material of detected component and determine the approximate position, direction and diameter of rebar in detected component. Rebar diameter parameter of instrument is set as design value. If above material is not obtained, rebar diameter is set as default. Rebar diameter and covering layer thickness are detected by means of the functions of Grid scan or Profile scan and Diameter Test.

### **Step 2 Determine detection regions**

One region on detected component is selected as detection region according to the demand. Region whose surface is relatively smooth is selected as much as possible to improve the detection accuracy.

### **Step 3 Determine the position of main rebar (or top rebar)**

Select one starting point and scan the main rebar or top rebar along the direction that is vertical to the main rebar (for beam and

column etc.) or the top rebar (for plate and wall of grid pattern rebar) to determine the position of main rebar or top rebar. Then move the certain distance horizontally to carry out another scanning as figure 5.1 shows. Points scanned twice are connected together by means of straight line. Notice: If scanning line is just above the stirrups or lower rebar as figure 5.2 shows, the condition that rebar is not found or rebar position is not determined accurately will occur possibly. The phenomenon is determination deviation of rebar position is larger during repeating scanning. At this time, this scanning line should be shifted the distance of two rebar diameters for scanning again.

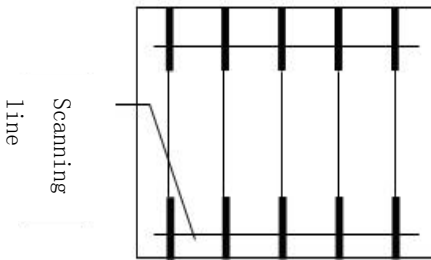
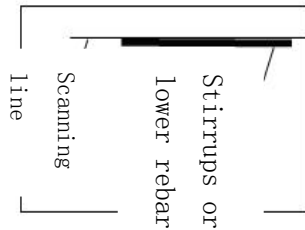


Figure 5-1



Figures 5-2

**Step 4 Determine the position of stirrups (or lower rebar)**

Carry out scanning along the direction that is vertical to stirrups (or lower rebar) in the middle position of determined two pieces of rebar to determine the position of stirrups (or lower rebar). Then select the middle position of another two pieces of rebar to scan it as figure 5.3 shows. Points scanned twice are connected together by means of straight line.

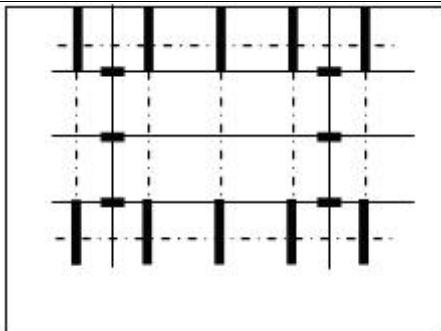


Figure 5-3

### Step 5 Detect covering layer thickness and rebar diameter

**Detect covering layer thickness under the condition of known rebar diameter:** Select the function of Thickness Test of instrument and **set No. and rebar diameter properly**. Carry out scanning in the middle position of two pieces of stirrups (lower rebar) along the direction that is vertical to main rebar (top rebar) to determine the covering layer thickness of detected main rebar (top rebar). Carry out scanning in the middle position of two pieces of stirrups (top rebar) along the direction that is vertical to stirrups (lower rebar) to determine the covering layer thickness of detected stirrups (lower rebar). Pay attention to setting the status of corresponding grid pattern rebar.

**Detect covering layer thickness and rebar diameter under the condition of unknown rebar diameter:** Select the function of Diameter Test of instrument and **set No properly**. Carry out scanning in the middle position of two pieces of stirrups (lower rebar) along the direction that is vertical to main rebar (top rebar) by means of probe in parallel to the rebar to determine the accurate position of detected

main rebar (top rebar). Then the probe is placed above the detected rebar in parallel to detect rebar diameter and covering layer thickness of this point. Carry out scanning in the middle position of two pieces of main rebar (top rebar) along the direction that is vertical to stirrups (lower rebar) to determine the accurate position of detected stirrups (lower rebar). Then the probe is placed above the detected rebar in parallel to set status of corresponding grid pattern rebar and detect rebar diameter and covering layer thickness of this point.

The end.



# twilight

INSTRUMENTOS DE MEDICIÓN INDUSTRIAL



LLÁMANOS

+52(81) 8115-1400 / +52 (81) 8173-4300

LADA Sin Costo:  
01 800 087 43 75

E-mail:  
[ventas@twilight.mx](mailto:ventas@twilight.mx)

[www.twilight.mx](http://www.twilight.mx)



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