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1. Overview

1.1 Introduction

Integrated Rebar Detector is mainly used to test the position of rebar, thickness of cover to reinforcement, rebar spacing and rebar diameter in concrete structures, and can accurately produce a full map of the rebar location, providing high-precision, high-speed detection data; it adopts the integrated structure of main unit and sensor coil, which is convenient and fast for carrying and on-site operation; it adopts multi coil structure design, which can achieve faster speed, higher precision and better resolution.

1.2 Functions and Features

1.2.1 Main functions

1. Thickness inspection of cover to reinforcement, procedure scan, grid scan, profile scan, fine scanning, image scanning and other detection functions;
2. Determine the location, direction and distribution of rebar;
3. Measure rebar cover to reinforcement and estimate rebar diameter;
4. Storage, viewing and transmission of inspection data.

1.2.2 Key Features

1. The thickness of cover to reinforcement, the position and spacing of the rebars are displayed on the same screen;
2. When detecting, each detection module completely realizes the backward-deletion of erroneous detection data and graphics, which is convenient for on-site detecting;
3. With the fine scanning function, for the case of closely spaced rebar, the

detection accuracy for the number of rebars and the thickness of the cover to reinforcement is greatly improved;

4. During the grid scanning detection, the X-axis and Y-axis (that is, the direction of the vertical and horizontal axes) can be staggered and switched at any time. After random switching, the data and the distribution map of rebars will automatically sustain the previous information for follow-up detecting, thereby improving the flexibility of on-site detection;

5. Horizontal and vertical laser positioning, real-time display of rebar position, multiple reminders of aiming frame and indicator light, which is convenient for rebar positioning;

6. The detection data is automatically stored to avoid data loss caused by operational errors.

7. Eight-level backlight brightness adjustment and five-theme setting functions, enabling the screen and data to be clearly seen even in the case of strong outdoor sunlight;

8. Using Type-C port, which enables data transmission and charging to be more convenient and faster;

9. Chinese and English bilingual interface;

10. The automatic shutdown time can be set to prevent the instrument from being turned on for a long time, which may cause the battery to be under voltage, thus, bringing inconvenience to subsequent use.

1.2.3 Main Features

1. 2.8-inch high-resolution color LCD screen (320×240 pixels);

2. Multi-coil structure design with faster speed, higher precision and better resolution;

3. The built-in large-capacity lithium battery is designed to achieve low power consumption, and its normal stand duration can reach 16 hours when the battery is fully charged;

4. In the data management mode, the data storage, viewing, deletion and other functions can store the data of about 200,000 measuring points for rebar;

5. Professional and uniquely designed standard calibration detection blocks can be configured;

6. It adopts the integrated design of the main unit and the sensor coil, which is small in size, light in weight and easy to carry;

7. Equipped with professional rebar detection software, which is convenient for professional data analysis as well as data processing, and can generate complete report on the PC.

1.3 Main Technical Indicators

Table 1.1 Main technical indicators

Items	Indicators
Rebar applicable range (mm)	ϕ6～ϕ50
Cover to reinforcement thickness range (mm)	Small range: 1～120; Large range: 5～210
Display	320×240
Power supply mode	Built-in high-capacity lithium battery
Operating hours	≥16h
Communication mode	Type-C transmission interface
Storage capacity	200,000 measuring points for rebar
Operation method	Silicone keys
Overall volume (mm)	219×92×106
Machine weight (Kg)	0.60 (with lithium battery)

Table 1.2 Measuring range for rebars with different diameters

Range / Rebar diameter (mm)	Small range（mm）	Large range（mm）
φ6～Φ8	1～60	5～120
Φ10～Φ20	1～80	5～160
Φ22 and above	1～120	5～210

Table 1.3 Error range for different thicknesses

Range / Error range	Small range（mm）	Large range（mm）
±1	1～80	5～80
±2	81～120	81～120
±4	\	121～210

1.4 Precautions

For your better use of this product, please read this manual carefully before use to fully understand the usage and precautions of the instrument and software.

1. Working environment requirements
   - Ambient temperature: -10℃～+50℃
   - Relative humidity: <90%RH
   - Electromagnetic interference: no strong alternating electromagnetic field is allowed
   - Do not use it in direct sunlight or exposure to sunlight for a long time, otherwise the instrument may not work properly.
   - Anti-corrosion: necessary protective measures should be taken when using in damp, dust and corrosive gas environments.

2. Storage Environment Requirements
   - Ambient temperature: -20℃～+50℃
   - Relative humidity: <90%RH
   - When not in use, please place the product in the instrument box and place it in a ventilated, cool and dry place with room temperature environment; if it is not used for a long time, it should be powered on and checked regularly.

3. Avoid water.

4. Anti-magnetic: Avoid using it in a strong magnetic environment, such as the place with nearby large electromagnets, transformers, etc.

5. Shockproof: During use and handling, severe vibration and impact should be avoided.

1.5 Repair and maintenance

1. Instrument operation

When pressing the keys to operate, it is not advisable to use excessive force, and it is not advisable to operate the instrument keyboard with hands stained with excessive oil and mud, so as not to affect the service life of the keyboard.

2. Power

This instrument is powered by built-in special rechargeable lithium battery, if fully charged, its stand by duration can reach more than 16 hours. Please pay attention to the power indicator when using it. If the power is low, you should turn off the instrument as soon as possible and use the charger to charge the instrument in time. Otherwise, the detection data may be lost or even the instrument may be damaged due to sudden power failure.

Do not use other batteries or power sources to power the instrument, otherwise cause instrument damage, battery leakage, fire, may be incurred. For any details, please contact our Company or dealer.

Friendly reminder: When the battery capacity is low after a period of time, the battery symbol in the upper right corner of the screen will be displayed. The more the green parts , the more battery power; if only the white box is left to be displayed, it means that the power is exhausted and must be charged.

3. Charging

The instrument has built-in lithium battery, it is recommended to charge it in power-off state. It supports Type-C port charging, when charging with the charger, please connect the charging plug to AC220±10%V power outlet, while connect Type-C plug at the other end to the instrument USB port. The

charging of the instrument can also be accomplished by directly plugging into the computer with a USB cable. When charging, the charging indicator of the instrument is red, indicating that the built-in lithium battery is being charged; when the indicator changes from red to green, indicating that the built-in lithium battery is fully charged, the charger or USB cable should be unplugged in time to avoid overcharging the battery and affecting the battery life. During the charging process, the instrument battery and charger will generate a certain amount of heat, which is a normal phenomenon, so it is recommended that the instrument be placed in a well-ventilated place where it is easy to dissipate heat.

Friendly reminder: In order to ensure that the battery is fully charged at one time, please keep charging continuously for about 4 hours, and do not charge the instrument in an environment exceeding 50°C; due to the large charging current, it is recommended that you use the manufacturer's original charger and cable to charge, otherwise the instrument may be damaged.

4. Lithium battery

The average service life of the rechargeable battery is about 500 times of charge-discharge. If it is close to the service life and if the battery cannot work normally and be charged, or cannot be fully charged, or has a short use time even if it is fully charged, it indicates that the rechargeable battery may be damaged or the end of the service life. Please contact the after-sales service department of our Company to replace the new battery in time. It is forbidden to short-circuit the battery or put it close to a high temperature or heat source, etc.

5. Storage\Cleaning

When the instrument is not in use, please store it in the instrument box and place it in a ventilated, cool and dry room temperature environment (with relative humidity of less than 90%). If you do not use it for a long time, the rechargeable battery will discharge naturally, resulting in a decrease in power. Therefore, please charge it before use, and regularly power on the instrument

to check it. In general circumstance, it is better to charge it once a month.

After each use of the instrument, the instrument should be properly cleaned to prevent water, oil, mud, and dust from entering the connector, thereby affecting the detection performance leading to poor measurement.

☞ **Friendly reminder:**

Do not put instruments and accessories in water or wipe them with a damp cloth!

Do not rinse the instrument and accessories with organic solvents or acid-base liquids!

Please wipe the instrument with a clean, soft, dry cloth, and clean the socket with a soft brush!

6. Faults and Troubleshooting

The instrument cannot be started: Check whether the battery power is sufficient or directly connect to the power adapter and turn on the instrument; connect the power adapter and turn on the instrument power soft switching. If the above methods still cannot start the instrument, connect the power adapter to charge the battery for half an hour and then turn on the instrument.

Instrument automatic shutdown: The instrument has battery power detection capability, when the battery power is too low, the instrument will automatically shut down; charge the battery for a period of time or directly connect to the power adapter and then turn on the instrument.

☞ **Friendly reminder:**

Our company provides one-year warranty and lifetime maintenance services for this instrument; please contact our Company or the instrument dealer for instrument maintenance, and self-repair of the instrument is not recommended.

1.6 Liability

This instrument is a precision detection instrument. When the user has the following behaviors or there is man-made damage, the Company shall not bear the following relevant responsibilities:

1. Abnormal operation of the instrument.

2. Turn on the instrument and disassemble any parts of it without permission.

3. In violation of the above working environment requirements or storage environment requirements.

4. Severe damage caused by man-made or accidental impact.

2. Instrument introduction

The Integrated Rebar Detector mainly includes the main unit, charger, USB cable and other accessories.

2.1 Main unit

The appearance of the Integrated Rebar Detector is shown in Figure 2.1.

Figure 2.1 Schematic diagram of the appearance of the main unit

Friendly reminder: The actual instrument may be different from the schematic diagram, please refer to the actual instrument.

2.1.1 Button Description

Table 2.2 List of function keys

Key Identification	Function Description
[⏻/Fn]	Long press to power on or off the instrument. Short press for grid/profile/waveform measurement; to clear the displayed content and re-test; the function selection or parameter setting interface is the same as those for the OK key.
[▲]	Move-up option for setting to increase numbers.
[▼]	Move-down option for setting to decrease numbers.
[▶]	Move-to-right option
[◀]	Move-to-left option
[OK]	Confirm the currently selected menu item or parameter; the test interface for saving detection data.
[⮌]	**Return to previous menu**

Friendly reminder: Individual buttons have different functions in different interfaces, see related descriptions for details.

2.1.2 LCD screen

Installed on the upper panel of the instrument, it is used to display the operation interface and detected data and other information.

2.1.3 Indicator lights

Indicates the charging status when it is turned off: red indicator light indicates that it is in the charging state, and green indicator light indicates that the charging is complete.

Indicate the position of the rebar during power-on measurement

process: red indicator light indicates that the sensor is located directly above the rebar, and green indicator light or flashing light indicates that the sensor is located above the middle of the two rebars.

2.1.4 Type-C interface

The Type-C interface is located on the right panel of the instrument, which is shared by data transmission and charging.

2.1.5 Laser Indicator lights

They are located on the left and right sides and the front of the instrument, and the horizontal and vertical laser beams are displayed during the measurement, which is more convenient to locate the rebar;

2.1.6 Right-side arrow

The arrow on the right side of the main unit marks its coil test area.

2.1.7 Protective cover

The protective cover on the Type-C interface is mainly used to protect the interface.

2.1.8 Nameplate

It is located at the bottom of the instrument, indicating the company name, product model, product number, inspection date, etc.

2.2 Type-C cable and charger

The Type-C cable is used to connect the instrument and the computer for data uploading; it is also used to connect the instrument and the charger to charge the instrument, as shown in Figure 2.3.

Figure 2.3 Appearance diagram of Type-C cable and charger

2.3 Other accessories

See product packing list for details

3. Instrument Operation

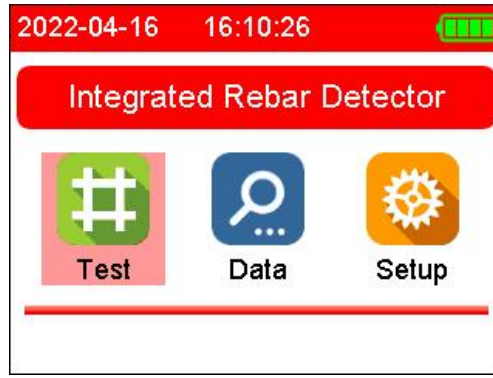
3.1 Introduction to Operating Procedures

The program software of Integrated Rebar Detector mainly achieves the functions of each function menu of the instrument, instrument test status, measurement data and result display.

3.1.1 Start-up and main menu interface

Press and hold the [⏻/Fn] key of the instrument to turn on/off the instrument, and then the instrument will enter the main menu 3 seconds after it is turned on, as shown in Figure 3.1(a)(b).

(a) Start-up interface



(b) Main menu interface

Figure 3.1 Start-up and main menu interface

3.1.2 Main function selection

In the main menu interface, press the keys of [◀]and[▶]to select the rebar detection module, the data management module and the system setting module. Move the cursor to the selected mode, press the [OK] or [ ] key to enter the processing interface of the currently selected menu, and press the [ ] key to return to the main menu interface.

3.2 Operating Instructions for Rebar Detection Module

Select the rebar detection module under the main menu to enter the sub-item detection menu, as shown in Figure 3.2

Figure 3.2 Sub-item detection function

3.2.1 General scan

In the sub-item detection menu, move the cursor to the general scan, and press the [OK] key to enter the setting interface, as shown in Figure 3.3.

Figure 3.3 General scan settings interface

In the setting interface, press [▲], [▼] keys to select the desired operation,

and press [OK] key to enter.

Take the name and number as examples. Press [OK] key to enter the interface to modify name and number, as shown in Figure 3.4.

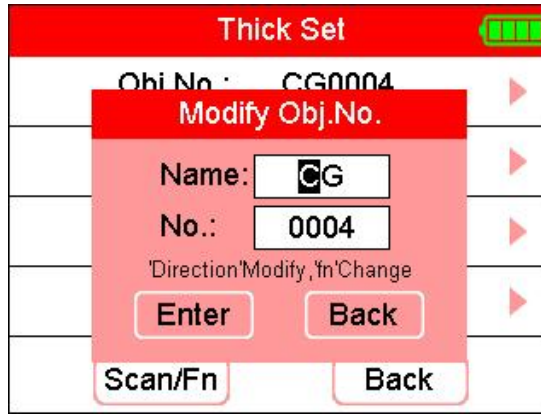


Figure 3.4 Modify the name and number

Press [▲], [▼] key to adjust numbers and letters, press [⏻/Fn] key to make the cursor toggle between options of name and number, press [OK] key to confirm, press [⮌] key to return. For modifying design diameter; design thickness; component type operation, repeat the above operation.

How to adjust parameters in the parameter setting interface is summarized as follows:

(1) Rebar diameter

The directly selectable range for setting the rebar under detection is 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 50, totaling 15 rebar specifications.

(2) Component name

The component name consists of 2 English letters and 4 numbers.

3.2.1.1 Start detection

In the general scan setting interface, press the [⏻/Fn] key to enter the detection interface, as shown in Figure 3.5.

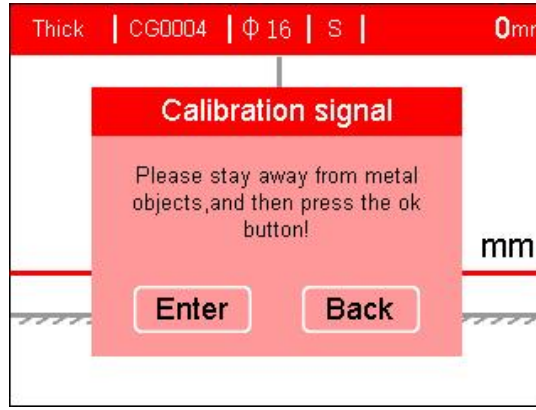


Figure 3.5 General detection interface

At this time, the screen will pop up the calibration interface, take the instrument in the air, away from the ferromagnetic medium, press the [OK] key to calibrate the instrument, waiting for the screen to display: Signal calibration completed, and then press the [OK] key again or[⮌] key to start detection.

When detecting, slide the instrument to the right slowly and at a constant speed. When the instrument is directly above the steel bar, the aiming frame coincides with the center line, and the aiming frame turns green, at the same time, the laser beam at the front of the instrument will light up, accompanied by a beeping sound, indicating that rebars have been detected. There is a rebar just below the center line of the instrument screen, and the value displayed in the lower right corner of the aiming frame is the thickness of the cover to reinforcement. At the same time, the bottom of the screen will display the thickness of the cover to reinforcement of the currently measured rebar. As shown in Figure 3.6.

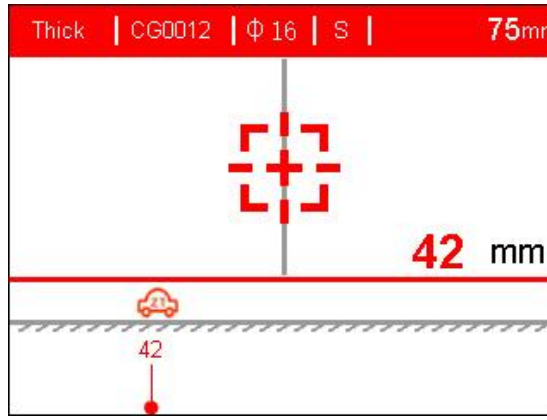


Figure 3.6 General detection interface

According to the operation process, continue to slide the instrument to the right slowly and at constant speed. When the next rebar is detected, the thickness of cover to reinforcement of each rebar and the separation distance between rebars will be displayed on the lower edge of the screen. As shown in Figure 3.7, the thickness of cover to reinforcement of the rebar is 42mm, the thickness of cover to reinforcement of the last rebar is 42mm, and the separation distance between the two rebars is 103mm.

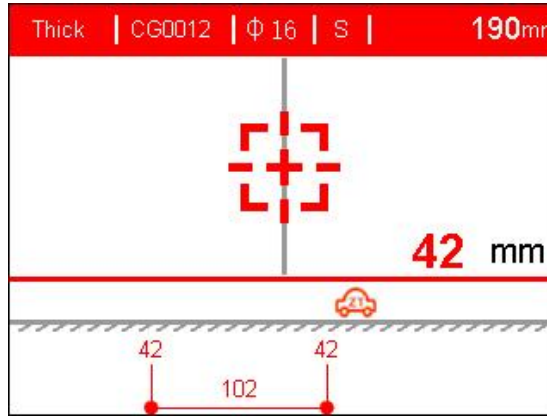


Figure 3.7 Measurement interface

Taking Figure 3.7 as an example, the upper part of the screen in the current

interface indicates that this is a general detection, the project name is CG0012, the diameter of the rebar to be detected is φ16, the small range is used, the current moving distance of the trolley is 190mm, and the thickness of the cover to reinforcement is 42mm.

Two rebars have been detected, the thickness of cover to reinforcement of the first rebar is 42mm, the thickness of the cover to reinforcement of the second rebar is 42mm, and the separation distance between the two rebars is 103mm.

In the general detection mode, the default display distance of each page is 300mm. During the measurement and scanning, when the screen display range is exceeded, the system will automatically turn the page. The trolly on the screen represents the current position of the instrument, and the value in the upper right corner of the LCD screen indicates the moving distance of the instrument from the starting point to the current position.

The following key functions are supported during thickness detection:

[▼] key: Signal calibration

[▶] key: switch between large/small range

[⮌] key: Exit the current measurement

Friendly reminder:

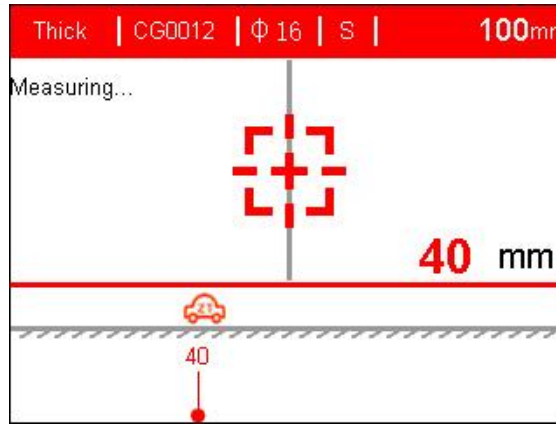
The general detection mode is fully realized during the detection process. when there are inaccurate measurements and detection operation errors, one can undo and cancel the current erroneous data.

In addition, the detection data will be automatically stored, and there is no need to save it separately. After each exit, the project number will be automatically added one to the previous project number.

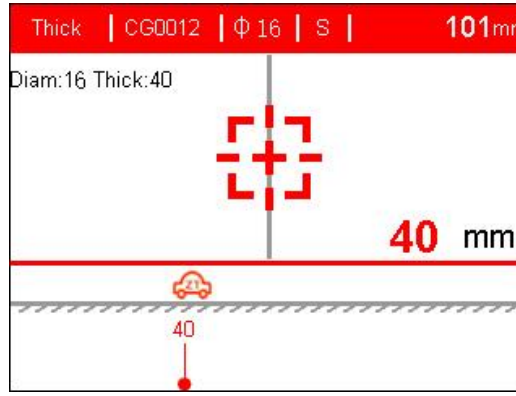
3.2.1.2 Estimate diameter

In the thickness detection mode, slide the instrument to the right slowly and at constant speed, when the red aiming frame and the gray center line are displayed coincidently, and the indicator light on the front of the screen becomes green, accompanied by a buzzing, indicating that rebars are detected;

at this time, after press [▲] key, the measured diameter is displayed as shown in Figure 3.8 (a, b), wait for about 3 seconds to complete the diameter detection, and display the diameter and cover to reinforcement of the rebar are displayed respectively. At this time, measurement of the thickness of the cover to reinforcement can be continued.



(a) During measurement



(b) Measurement completed

Figure 3.8 Estimated diameter interface

Friendly reminder:

The estimated diameter is generally more accurate when the separation

distance between rebars is large and the interference of nearby magnetic objects is small. And the cover to reinforcement of the rebar to be detected should be in the range of 15mm-50mm.

3.2.2 Procedure scan

In the sub-item detection menu, move cursor to the procedure, and press the [OK] key to enter the setting interface, as shown in Figure 3.9.

Figure 3.9 Procedure detection setting interface

After completing setting, press [Ⓘ/Fn] key to enter the detection interface. As shown in Figure 3.10

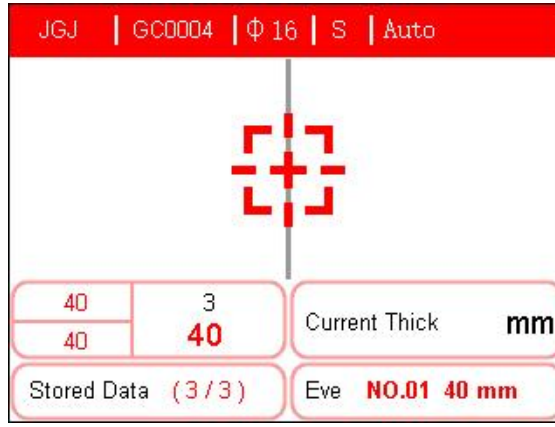


Figure 3.10 Procedure scan detection interface

Procedure scanning introduction: According to the requirements of "Technical standard for test of reinforcing steel bar in concrete" (JGJ/T152-2019), the three different locations of the same rebar is selected for detection, and each location is detected twice, and take the averaged value to obtain thickness value of the cover to reinforcement.

Taking Figure 3.10 as an example, the upper part of the screen is the parameter area, which means that a procedure scan is being performed at this time, the file name is GC0004, the diameter of the rebar to be detected is φ16, the small range is selected, and the storage method is automatic storage.

The lower part of the screen is the data display area. The upper left table cell indicates that the thickness of the cover to reinforcement at the third position of the rebar is 40mm in both detections, and the averaged thickness of the cover to reinforcement at the third position is 40mm; the lower left cell indicates that the thickness of the cover to reinforcement at the three positions of the same rebar has been stored; the upper right cell represents the thickness of the cover to reinforcement at the current position; the lower right cell represents the averaged thickness of the cover to reinforcement of this rebar, (The average value will only be displayed when the thickness of the cover to reinforcement measured twice at each of the three positions of the same rebar has been stored.)

The following key functions are supported during procedure scanning:

[▼] key: signal calibration

[◀] key: switch between manual storage/automatic storage function

[▶] key: switch between large/small range

[⮌] key: Exit the current measurement

[⏻/Fn] key: save the current thickness measurement value

3.2.3 Grid scan

In the sub-item detection menu, move cursor to the grid scan, and press the [OK] key to enter the setting interface, as shown in Figure 3.11.

Figure 3.11 Grid scan setting interface

After completing setting, press [Fn] key to enter the detection interface. As shown in Figure 3.12

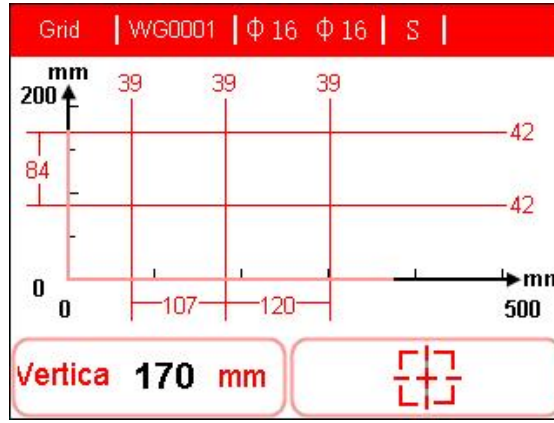


Figure 3.12 Grid scan detection interface

Taking Figure 3.12 as an example, the upper part of the screen is the parameter area, which means that a grid scan is being performed at this time, the file name is WG0001, the diameter of the measured rebar along the X direction is φ16, and the diameter of the measured rebar along the Y direction is φ16, and the small range is selected.

The middle of the screen is the distribution map of the rebars generated by the grid scan, indicating the thickness of the cover to reinforcement of each steel bar and the separation distance between the rebars respectively.

The lower part of the screen indicates the moving direction of the instrument and the moving distance of the instrument.

The following key functions are supported during grid scanning:

[▼] key: signal calibration

[▶] key: switch between large/small range

[OK] key: switch landscape/portrait

[⮌] key: exit the current measurement

3.2.4 Profile Scan

In the sub-item detection menu, move the cursor to the profile scan, and press the [OK] key to enter the setting interface, as shown in Figure 3.13.

Figure 3.13 Profile scan setting interface

After completing setting, press [⏻/Fn] key to enter the detection interface. As shown in Figure 3.14

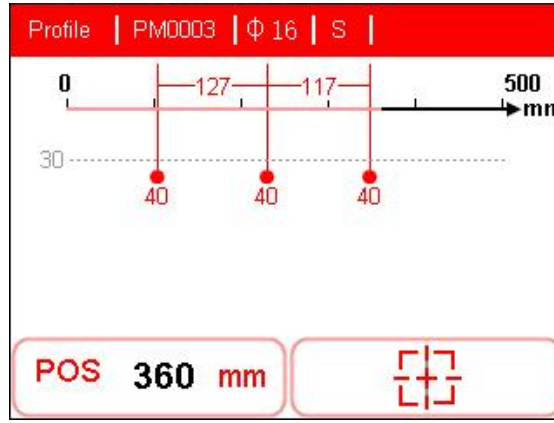


Figure 3.14 Profile scanning detection interface

Taking Figure 3.14 as an example, the upper part of the screen is the parameter area, indicating that a profile scan is being performed at this time, the file name is PM0003, the diameter of the rebar to be measured is φ16, and the small range is selected.

The middle of the screen is the distribution map of the rebars generated by the profile scanning, indicating the thickness of the cover to reinforcement of each rebar and the separation distance between rebars respectively. The dotted line represents the design thickness value, which can be used to see whether the distribution of the cover to reinforcement is uniform in a more intuitive manner.

The lower part of the screen indicates the moving distance the instrument.

The following key functions are supported during profile scanning:

[▼] key: signal calibration

[▶] key: switch between large/small range

[⮌] key: exit the current measurement

3.2.5 Fine Scan

In the sub-item detection menu, move the cursor to the fine scan, and press the [⏻/Fn] key to enter the setting interface, as shown in Figure 3.15.

Figure 3.15

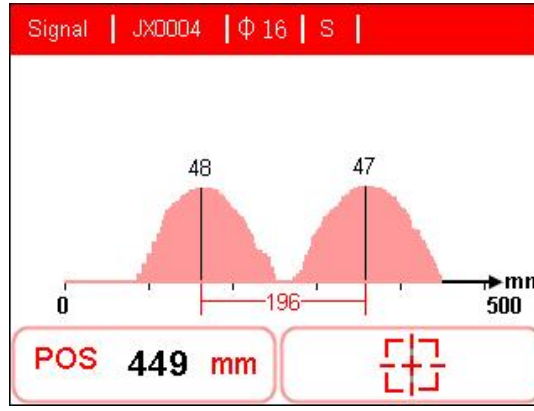


Figure 3.16 Fine scan detection interface

Taking Figure 3.16 as an example, the parameter area is at the top of the screen, indicating that a fine scan is being performed at this time, the file name is JX0004, the diameter of the rebar to be measured is φ16, and the small range is selected.

In the middle of the screen is the rebar distribution waveform generated by fine scanning, which respectively indicates the thickness of the cover to reinforcement of each rebar and the separation distance between rebars .

The lower part of the screen indicates the moving distance the instrument.

The following key functions are supported during fine scan:

[▼] key: signal calibration

[▶] key: switch between large/small range

[⮌] key: exit the current measurement

3.2.6 Image Scanning

In the sub-item detection menu, move the cursor to the image scan, and press the [OK] key to enter the setting interface, as shown in Figure 3.17.

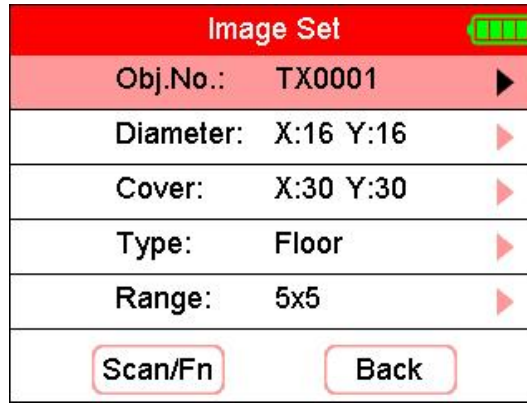


Figure 3.17 Image scan setting interface

After completing setting, press [⏻/Fn] key to enter the detection interface. As shown in Figure 3.18(a)(b)

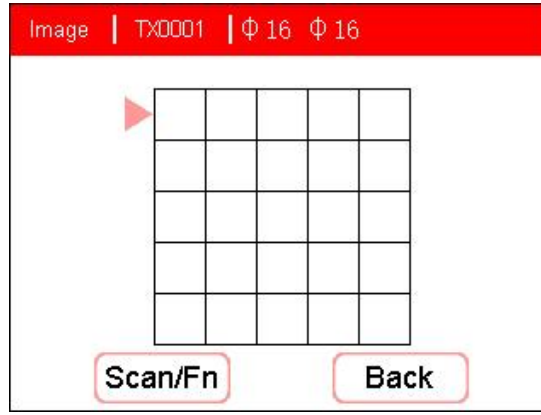


Figure 3.18(a) Image scanning grid interface

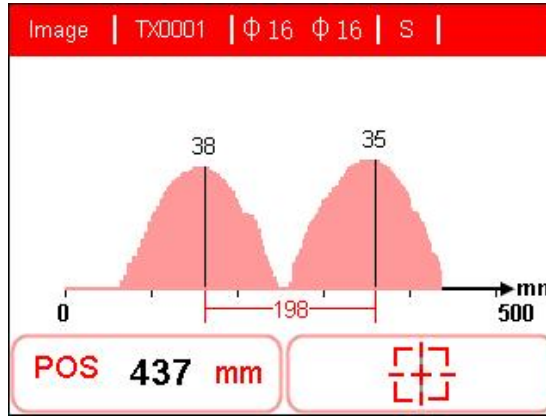


Figure 3.18(b) Image scanning detection interface

Detection method (taking the number of points to be 5 as an example

First draw a measuring area of 1m x 1m on the test piece, and divide the area into 5 rows x 5 columns horizontally and vertically. Make sure that the starting point position of the instrument is the same for each row and column during the detection. Move the equipment along the vertical direction of the main reinforcement. When the rebar is detected, the instrument will beep automatically and the waveform of the rebar below the instrument position will be displayed on the instrument. After completing the movement, press [ ] key to repeat the previous steps. At the beginning, the instrument will

display the X direction. After moving horizontally once, press the key to switch to the next line, and then continue to test, and so on in a similar fashion. After 5 lines are measured, the instrument will automatically switch to the vertical direction, and the instrument will display the Y direction at this time. the detection method is the same as before. After all the tests are completed, you can observe whether the rebars are inclined or bent in the data view.

The following key functions are supported during image scanning:

[▼] key: signal calibration

[▶] key: switch between large/small range

[⮌] key: exit the current measurement

3.3 Operation Instructions for Data Management Module

Select the data management module under the main menu to enter the sub-item data view menu, as shown in Figure 3.19

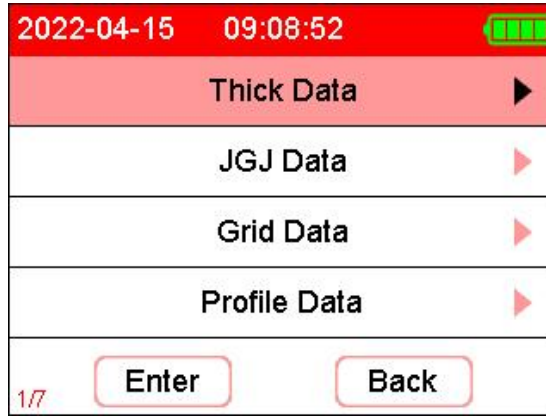


Figure 3.19 Sub-item data view menu

Press [▲], [▼] keys to move the cursor to select the data type to be viewed, and press [OK] key to view.

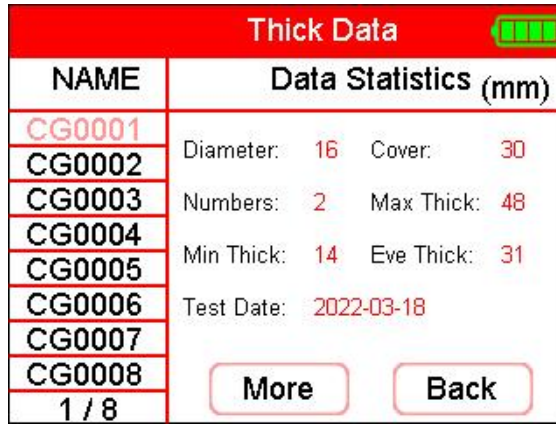


Figure 3.20 General data view

Taking general data view as an example, the left side of the screen is the component name list, press [▲], [▼] keys to move the cursor, press [◀], [▶] keys to turn pages, after selecting, press [OK] key to view specific data , as shown in Figure 3.21.

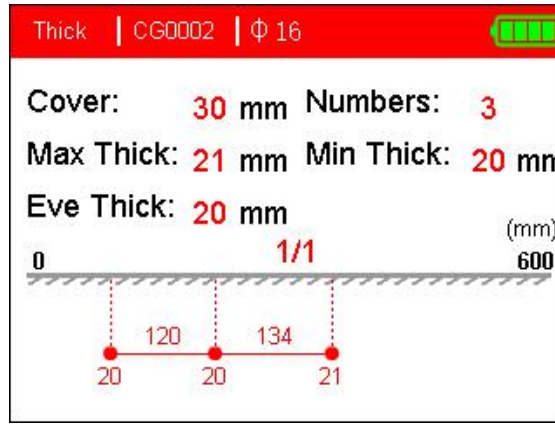


Figure 3.21 Specific data view interface

3.4 Operating Instructions for System Setting Module

Select the data management module under the main menu to enter the sub-item data view menu, as shown in Figure 3.22

Figure 3.22 Sub-item setting menu

Press [▲], [▼] keys to move the cursor to select the data type to be viewed, and press [OK] key to view.

3.4.1 Time Setting

Press [▲], [▼], [◀], [▶] keys to move the cursor, press [⏻/Fn] key to switch hour, minute and second setting, press [OK] key to confirm, press [⮌] key to return.

3.4.2 Date Setting

Press [▲], [▼], [◀], [▶] keys to move the cursor, press [⏻/Fn] key to switch year, month, day setting, press [OK] key to confirm, press [⮌] key to return.

3.4.3 Backlight brightness setting

Press [◀]and[▶] keys to adjust the screen brightness, eight levels can be selected to adjust, press [OK] key to confirm, press [⮌] key to return.

3.4.4 Language setting

Press [▲], [▼] keys to select Simplified Chinese or English, press [OK] key to confirm, press [⮌] key to return.

3.4.5 Theme Settings

Press [▲], [▼] key to select five background color themes, press [OK] key to confirm, press [⮌] key to return.

3.4.6 Automatic shutdown setting

Press [▲], [▼] keys to select the automatic shutdown time, press [OK] key to confirm, press [⮌] key to return.

3.4.7 Laser settings

Press [▲], [▼] keys to choose whether to turn off the laser beam or not, press [OK] key to confirm, press [⮌] key to return.

3.4.8 Thickness correction

Press [▲], [▼][◀], [▶] keys to modify thickness correction value, press [OK]to confirm, press [⮌]to return.

Friendly reminder:

Due to long-term work in a complex outdoor environment, and the interference factors of the external magnetic fields, temperature, etc., it is recommended to conduct self-inspection (or calibration) on the instrument from time to time. If it is found that the error is not within the scope of the specification requirements, the thickness error correction function built in the instrument can be used to properly fine-tune the correction value to ensure the normal use of the instrument; There is no need to return the instrument to the factory for calibration, thus enabling to reduce tedious workload.

3.5 Data Management

3.5 .1 Upload data

The instrument provides a USB transmission interface, and users can upload the measurement data according to their needs; the instrument can be connected to a PC using the standard Type-C USB transmission cable.

First, run the rebar scanner data processing software, and connect the USB data cable, then click import data in the rebar scanner analysis software, and then click transfer, as shown in Figure 3.23; if the connection is successful, the data will be begun to transfer. After the data transfer is completed the rebar scanner analysis software will automatically display the transferred data.

Friendly reminder:

The storage capacity of this instrument is about 200,000 measuring points values for rebar. It is recommended that after the test is completed or when the test data is close to the prescribed limit, please upload and save the data to the PC in time, and delete the data regularly to avoid insufficient storage space, which otherwise can affect the normal measurement and use of the instrument.

3.5.2 Data deletion

When you need to delete data, select the data deletion function of data management in the main menu, and enter the data deletion interface, as shown in Figure 3.24 (a) (b). Press [OK] key to confirm the deletion of data files, press [⮌] key to return to the previous menu interface.

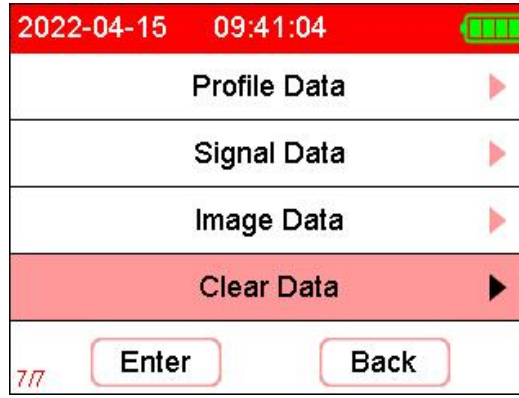


Figure 3.24(a) Data deletion interface

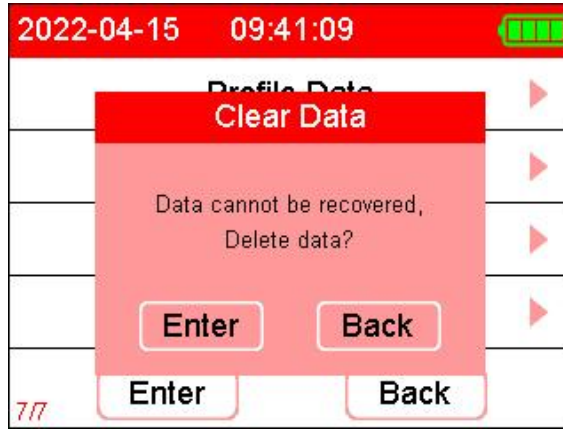


Figure 3.24(b) Data deletion interface

Friendly reminder:

Please ensure that the data upload is correct because the deleted data files cannot be recovered after the data is deleted.

During the process of deleting data, the instrument does not have support key to cancel.

3.5.3 About this unit

This instrument main interface displays the relevant information of the current instrument, as shown in Figure 3.25.

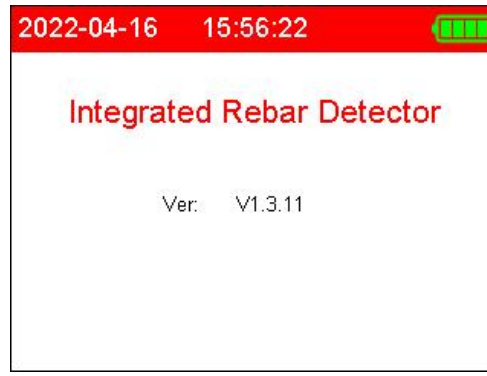


Figure 3.25 The instrument main interface

3.5.4 Turning off the power

The instrument supports several ways of shutting down, including, shut down by pressing the power-off button; automatic shutdown by the system; forcibly shutdown by pressing the [⏻/Fn] key in any start-up interface, and shutdown due to low battery of the instrument.

3.5.4.1 Automatic shutdown by the system

The instrument program provides the function of automatic shutdown under the set time for the circumstance where any key is not pressed for a long time, which is designed for low power consumption. The specific automatic shutdown time is determined by the automatic shutdown time setting parameter in the system setting interface.

3.5.4.2 Automatic shutdown due to low-voltage of the instrument

When the instrument is turned on, it will display the electric quantity of the detection system in real time. When the electric quantity is too low, the green icon of the battery power in the upper right corner of the instrument interface will not be displayed and will turn into a red frame. At this time, it is recommended to stop using the instrument and charge it in time; If one continues to use the instrument, it may automatically shut down after detecting a low battery level.

4. Quick Operation Guide

4.1 Preparation before the test

4.1.1 On-site preparation

Before the test, the component (concrete surface) to be detected should be cleaned and smoothed, the roughness of the concrete surface affects the measurement accuracy, thus, the surface of the component to be detected should be as smooth as possible. Before testing, it is advisable to combine the design data to understand the reinforcement arrangement. When testing, ferromagnetic substances such as rebar joints, binding wires, pre-embedded iron parts and metal pipes should be avoided.

4.1.2 Starting-up

First, press the [O/Fn] key on the instrument keyboard to start the instrument, and then the interface will be displayed for 3 seconds, as shown in Figure 4.1, accompanied by prompts of red light and buzzing.

Figure 4.1 Startup interface

After the startup interface is displayed, it will automatically enter the main menu display interface of the instrument, as shown in Figure 4.2.

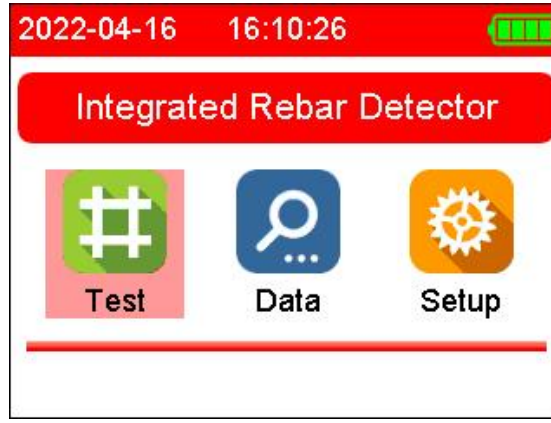


Figure 4.2 Main menu interface

4.2 Component Testing

In the main menu, press the [▼], [▲], [◀], [▶] keys to select the menu mode, the default is the start-detection mode, press the [OK]or[⏻/Fn] key to enter the start-detection mode interface, as shown in Figure 4.3 Show.

Figure 4.3 Start-detection interface

4.2.1 Parameter setting

In the start-detection mode, firstly press the [▼], [▲] keys to select the desired scan mode, then press the [▶] key to enter the corresponding parameter setting item, and then press the [▶] key again, the parameter value will be displayed with blue background, press [▼], [▲] keys to select and adjust the parameter value, after completing, press [OK] key to return to the previous state (taking the thickness detection setting as an example), as shown in Figure 4.4.

Figure 4.4 Thickness detection setting interface

4.2.2 Measurements

In the thickness detection mode, the instrument collects the current signal and displacement value in real time which will be automatically calculated and processed by the instrument to display the thickness of the cover to reinforcement of the rebar, the position and separation distance of the rebar in real time, at the same time, display the corresponding interface results with the prompts of indicator light and buzzer. The user only needs to slide the instrument slowly to scan the rebar, and press the [OK] key after the scan to save the measurement data; for the detailed introduction of rebar scan, please refer to the description in chapter 3.2.1.

The following key functions are supported during the thickness detection process:

[OK] key: save the measurement data, and restart the next group of measurement.

[ ] key: clear the measurement data and restart the measurement.

[ ] key: exit the measurement mode without saving the measurement data.

[▼], [▲] key: start the diameter measurement function.

4.3 Data processing

After completing the on-site data measurement, the measurement data is stored on the instrument, and the user can upload the measurement data to the PC as required; use the analysis and processing software under the Windows platform to analyze and process the measurement data and issue a test report.

After analyzing all the measurement data and confirming that there is no problem, the data stored in the instrument can be deleted to save the space inside the instrument.

4.4 Precautions for on-site detection

1. Since the test is performed on a concrete surface, the detection surface is generally rough with bumps and undulations, which will affect the detection accuracy. Therefore, the scanning surface should be kept flat and free of protrusions. If the detection surface is too rough to be cleaned, a non-magnetic thin plate (such as a wooden board) can be placed on the scanning surface, and the thickness of the plate can be subtracted from the measurement result;
2. The scanning direction of the instrument should be perpendicular to the direction of the rebar (the instrument and the rebar are at a 90-degree angle), otherwise it may cause misjudgment or deviation in the thickness of the judgment.
3. During the scanning process with the instrument, try to keep the four wheels of the instrument sliding slowly and uniformly.
4. For the measurement of the double-layer rebar distribution network,

generally detect the outer rebar first, and then detect the cover to reinforcement and position of the inner rebar in the middle of the two outer rebars.

5. When the detection environment is changed or there is a large error in the measurement results, the instrument calibration operation should be performed. It is recommended to perform an instrument calibration operation before each scan to eliminate the influence factors of the external environment on the measurement results.

6. When measuring the diameter of the rebar in the measurement parameters, please input the correct value according to the drawing, so as to reduce the deviation of the corresponding thickness.

5. Introduction of analyzing software

5.1 Introduction to the software

Rebar Detector analysis software is developed by the company for the analysis of the protective layer of steel reinforcement testing data processing software, post-processing analysis of the data collected on-site was achieved, and generate inspection reports and data preservation and other functions.

The software can run under Windows XP, Windows 7, Windows 8, Windows 10 and other systems.

5.2 Software Installation

Double-click the rebar scanning and analyzing software installation file, and follow the software prompts to install. As shown in Figure 5.1.

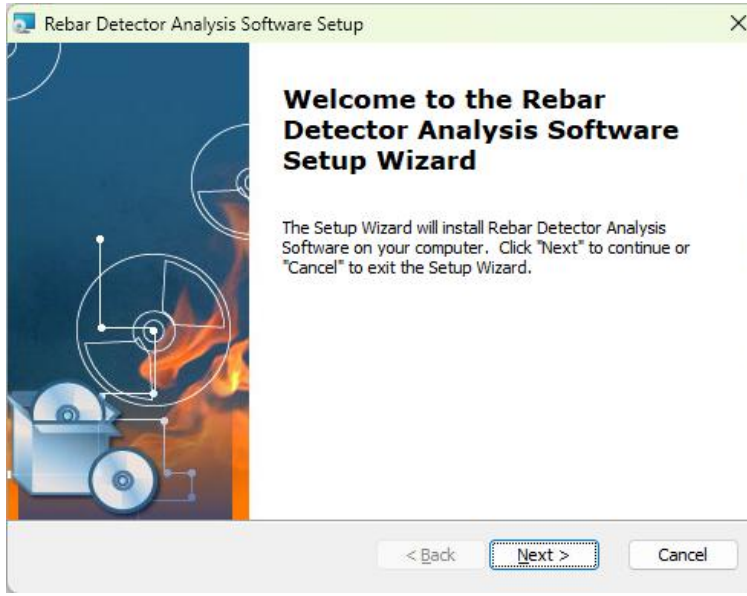


Figure 5.1 Installation Program

Finally, the serial port driver that must be installed for USB to data transfer pops up. If it has been installed before, it cannot be selected for installation. As shown in Figure 5.2.

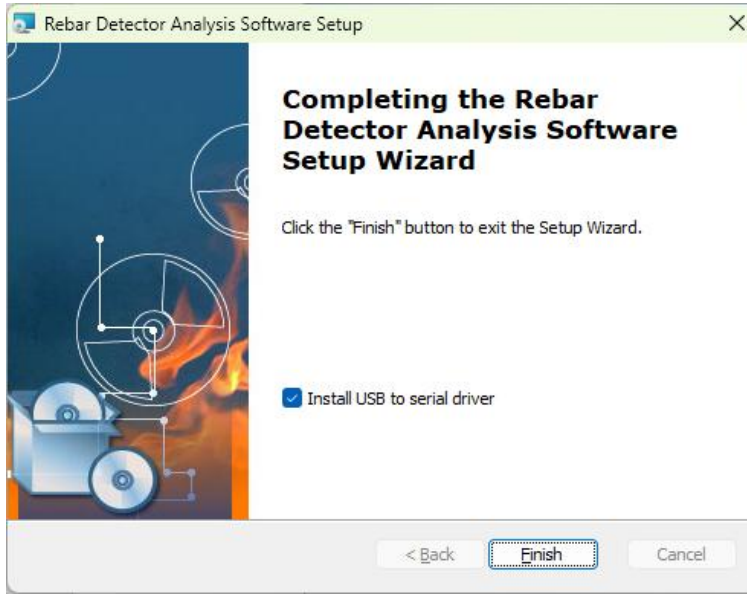


Figure 5.2 Driver Selection

If you choose to install the driver, please check the option of "USB to Serial Driver". Click Finish, as shown in Figure 5.3, click Install.

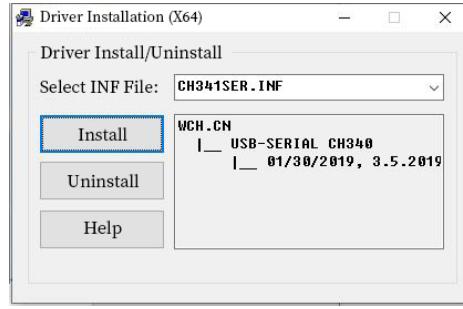


Figure 5.3 Driver Installation

If you have previously installed the driver will be prompted, the driver pre-installation failed, click on the uninstallation, and then click on the installation.

After successful installation of the software, click on the desktop steel scanning and analyzing software can automatically open the software, software interface shown in Figure 5.4.

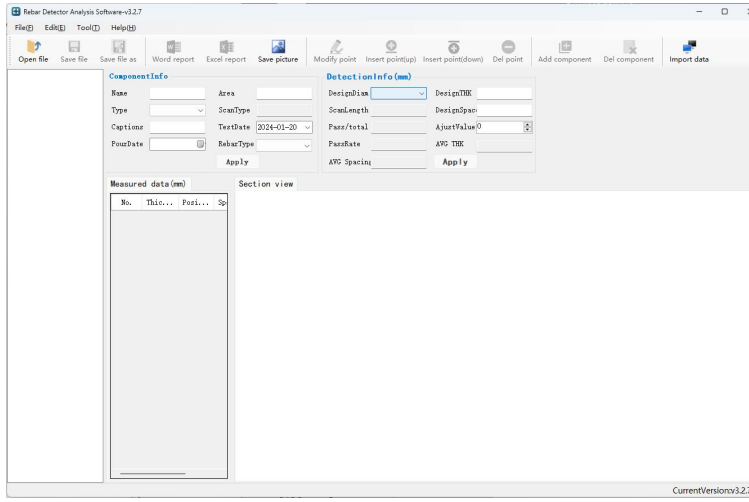


Figure 5.4 Run the software interface

5.3 Introduction to the software interface

Please double-click the steel scanner analysis software, select the steel data analysis as shown in Figure 5.5.

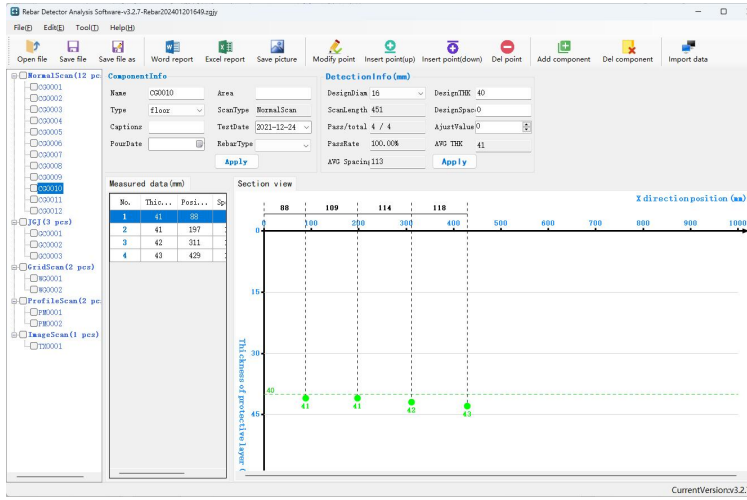


Figure 5.5 Rebar Detector analysis software interface

5.4 Software description

5.4.1 Read inspection data

1. When transferring the rebar scanning data, please use the USB connection cable to connect the PC and the instrument communication port, and then the software clicks on the import data -> transfer, the instrument selects the data management -> data transfer -> press OK to transfer.

2. After successful data transfer, the software will load the transferred data.

5.4.2 Open File

In the rebar data analysis, click "Open File" to open the file, pop-up "Open File" dialog box; select *. Zgjy file saved in the path to be analyzed and processed.

5.4.3 Browse data files

After opening the preprocessed file, select the type of detection that you want to analyze and process, as shown in Figure 5.8.

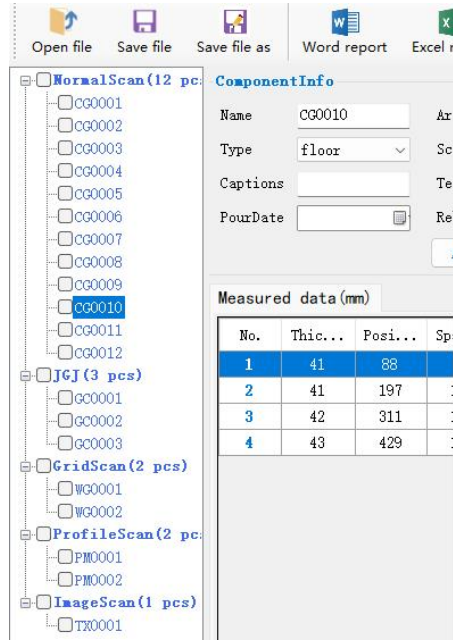


Figure 5.8 Analyzing and Processing Diagram

1. Select the type of data to be analyzed. The software processing is divided into four types, the same as the instrument: single point test (thickness test), single line test, profile test, grid test, and plane test.
2. The component list shows all the component numbers of the current type.

3, right-click and want to browse the component, component information box displays the basic information of the component, according to the actual construction drawings or specifications set the appropriate parameters.

4. Data list displays the component data, including the measurement position, the thickness of the protective layer and whether it is qualified.

5. Image area displays the corresponding type of data and graphics.

Friendly Tips.

Positive deviation and negative deviation can be adjusted automatically according to the different upper and lower limit values for the selected component type, and can also be adjusted according to the corresponding different situations.

5.4.4 Save Picture

Click Save Image to bring up the pop-up, select the save path, enter the file name of the saved graphic, and click Save to save the graphic displayed in the image in *.bmp format under the specified path.

5.4.5 Generate Report

1, in the list of components, select the component number to handle the generation of inspection reports, as shown in Figure 5.10.

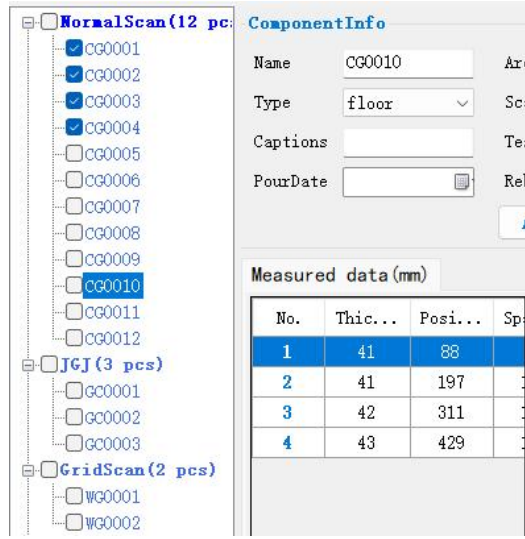


Figure 5.10 Selecting the component number

2. Click Generate Report to bring up the Generate Report dialog box as shown in Figure 5.11, fill in the basic information of the generated report and click OK.

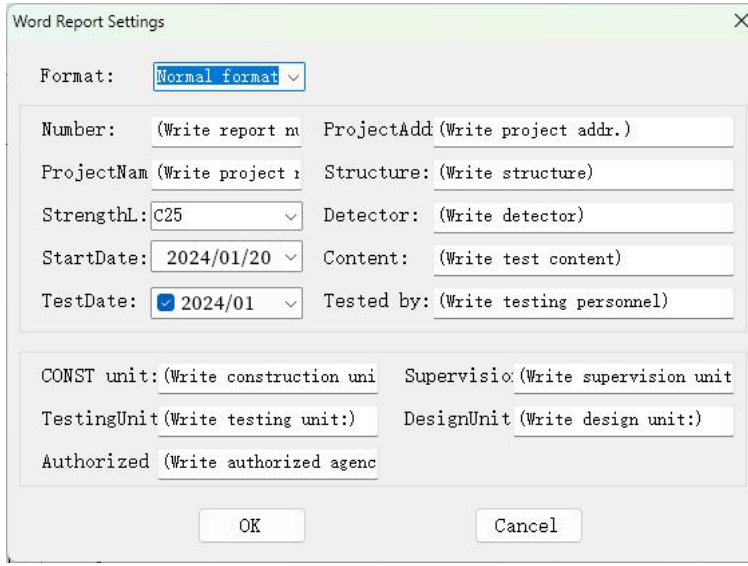


Figure 5.11 Generate report interface Friendly

Tips.

Generate a report file, different test methods, can not be generated in the same report.

Appendix 1 Quick Index to Menu

Main menu	Submenu	Function Description
Rebar detection	General scan	The most commonly used detection mode, according to the requirements of the specification, detection of the cover to reinforcement, thickness, position and separation of the rebar at the measuring point.
	JGJ scan	Carry out the detection in accordance with the requirements of the "Technical standard for test of reinforcing steel bar in concrete" (JGJ/T152-2019).
	Grid scan	The rebar scanning test is carried out in the form of a grid diagram, which can be scanned once in the X direction and once in the X direction.
	Profile scan	The rebar scanning test is carried out in the form of engineering drawings and section drawings.
	Fine scan	The rebar scanning test is carried out in the form of a waveform diagram, which is especially suitable for closely spaced rebar circumstance where it is difficult to identify the number of rebars. The number, position and thickness of rebars can be accurately determined through waveform.
	Image scan	In the range of 1m×1m, carry out horizontal and vertical tests at several points to determine whether the rebars are inclined or bent.
	Instrument calibration	Clear and reset the instrument.
	Data management	View the measurement data information stored in the instrument.

Data management	Data deletion	Delete instrument internal test data
	Time setting	Set time.
	Date setting	Set the date.
	Backlight brightness	Adjust the display brightness of the LCD screen.
	Language settings	"Simplified Chinese" and "English" can be selected.
	Theme settings	There are a total of 5 themes to choose from.
	Automatic shut-down	Set the time for automatic shutdown.
	Laser settings	Set the laser on/off.
	Thickness correction	Set instrument calibration error
	About this unit	View the instrument name, instrument model, version number, and contact information.

Appendix 2 Measurement and Verification

Before leaving the factory, the Integrated Rebar Detector has been verified according to relevant standards, and can only leave the factory after the verification is passed.

The detection content and steps are as follows:

F2.1 Verification Environment

1. Room temperature environment;
2. No strong electromagnetic field interference;
3. There is no corrosive gas in the air, and the relative humidity is less than 80%.

F2.2 Verification Equipment

1. A set of plexiglass sheets;

2. The length is not less than 500mm, and the diameters are Φ12, Φ16, Φ20 conventional grade II threaded rebars;

3. A set of brackets with standard thickness.

F2.3 Verification items and verification methods

1. Appearance

a. There is no looseness for connector assembly and fasteners, and the contact is reliable;

b. The surface treated by electroplating and oxidation treatment should be smooth, consistent in color and luster, without peeling, corrosion, scratches and other defects;

c. The text symbols and signs are clear.

2. Verification method

a. Carry out random inspection of a specification of rebars from conventional grade II threaded rebars of Φ12, Φ16, and Φ20, and use a rebar scanner to measure the thickness of the cover to reinforcement 3 to 6 times consecutively on three key points, and then compute the averaged value or check the qualification rate.

b. Measure the thickness value area of common cover to reinforcement: when each type of rebar diameter area is generally three values of 20, 30, and 50, measure the diameter of the rebar consecutively for 3 to 6 times, and then compute the averaged value of the diameter of the rebar.

Appendix 3 Related Standards

The relevant standards on which this instrument is based are as follows:

1. "Code for Quality Acceptance of Concrete Structure Construction" (GB50204-2015)
2. "Technical Specification for Test of Reinforcing Steel Bar in Concrete" (JGJ/T152—2008)

3. "Technical Standard for Inspection of Building Structure" (GB/T50344-2004)
4. "Technical Standard for In-Situ Inspection of Concrete Structure" GBT50784-2013
5. "Technical Specification for Inspection of the Depth of Coverage and the Diameter of Reinforcing Bars in Concrete by Electromagnetic Method" (DB11/T365-2006)
6. "Calibration Specification for Reinforced Concrete Cover meter and Floorslab Thickness Tester" JJF1224-2009

Appendix 4 Configuration List

No.	Description	Size	QTY	Remark
1	Integrated Rebar Detector		1	
2	Software CD		1	
3	Charger		1	
4	USB data cable		1	
5	Qualified Certification		1	
6	Warranty Card		1	
7	Instrument box		1	