Rebar Corrosion Measuring

Chapter One Overview

1.1 Brief Introduction

Steel corrosion in structural concrete has a direct impact on the safety and durability of the structure by reducing the adhesion between steel and concrete and causing damage like concrete expansion and spalling, etc. Therefore, detection of steel corrosion is quite necessary in identification and reliability diagnosis of the completed structure.R61 Steel Corrosion Meter is an instrument for nondestructive measurement of steel corrosion in concrete by means of electrochemical detecting method. There are various functions such as corrosion measurement, data analysis, save and output of results. It is portable, accurate, convenient and intelligentialized.

1.2 Detecting Principles

Electrochemical detecting method is applied to determine the corrosion penetration and rate of steel by electrochemical property test of the corrosion system in the concrete. Due to the electrochemical nature of steel corrosion, this method has proven to be the major steel corrosion detection method which explores the essence of the problem. It features in high detection speed, high sensitivity, consecutive tracking and in situ measurement.

In the detecting process, take the steel for half a battery pack, and connect it with proper reference electrode (copper, cupric sulfate or others) into a full cell system. The concrete is the electrolyte. The potenzialwert of the reference electrode is relatively constant, whereas the corrosion potential varies a lot in the steel, which is dependent on the degree of corrosion. Thus the change in electric potential of the full cell system occurs. In reality, the corrosion of steel is detected by means of the electric potential in various points of the steel.

1.3 Instrument Composition

Diagram 1-1 Instrument Composition

From top to bottom: main engine, joint lever, cupric sulfate reference electrode, metal electrode

The instrument is composed of main engine, extension line, metal electrode, cupric sulfate reference electrode and jointlever, etc. (shown in Diagram 1-1)

1.4 Instrument Property Indicator

1. Automatically monitor the ambient temperature without the help of thermometer.

2. Permanently fixed cupric sulfate-copper electrode. No need to perfuse and change cupric sulfate saturated solution both before and after the test, in order to avoid damage to the environment and testers.

3. Two measurement methods: potential method and gradient method, with potential electrode and gradient electrode respectively.

4. Measuring Potential: ±2000mV；

5. Test accuracy: ± 1mV;

6. Measuring Space: 1-99 cm (adjustable)

7. Environment Requirement:

Ambient Temperature:-10℃ ～ ＋ 40℃, to avoid direct exposure to the sun for a long time.

Relative Humidity:<90%RH；

Electromagnetic Interference: no strong alternating electromagnetic field

1.5 Tips

1. Avoid water penetration and high temperature（>50℃）.
2. No need to dump liquid inside the electrode after the test. For permanent use.
3. Avoid approaching extremely strong magnetic field, such as large-scale electromagnet and transformers, etc.
4. Take out the battery if the instrument is idle for long, in order to avoid damage to the circuit caused by battery leakage.
5. Never open the instrument case without permission, otherwise please bear your own consequences.

Chapter Two Instrument Operation

The button instruction is shown in Table 2.1

Buttons	Function
⏻	Switch on/off the power
OK	Confirm an operation or start the test on Test Interface
SAVE	Save measuring value
ESC	Return to the previous interface or cancel operation
Chng	Make shift between displays of parameters and icons in the Test Interface
↑ ↓ ← →	Respectively used for menu selection, number change, cursor movement and other auxiliary functions ←is also used to switch on or off the background light

Table 2.1 Button Instruction

2.1 Function Interface

Press any button (the ← button can be used to switch on the background light) on the Startup Interface, and enter Function Interface, as is shown in Diagram 2-2.

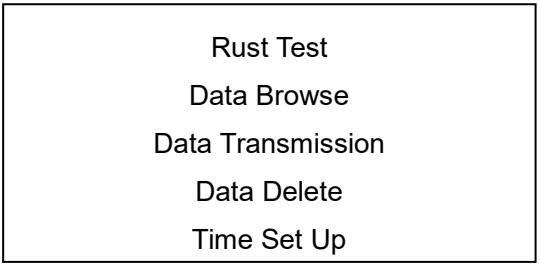

Diagram 2-2 Function Interface

On the Function Interface, there are items such as Corrosion Test, Data Check, Data Transmission, Data Deletion and Date Setting. Press the ↑、↓ buttons and select functions. Then press OK button and enter correspondent interface.

2.2 Corrosion Test

The Corrosion Test Interface is shown in Diagram 2-3. It is composed of two parts: Engineering Information Area and Test Area.

Test District 0001	X= Y= 0000 mV Direction→
Potential Space X20 Y20 Temperature +30℃	+ + ++

Diagram 2-3 Corrosion Test Interface

In Engineering Information Area, users can set the parameters or display the test icons. Icons are mainly used to display the degree of corrosion in a visualized way. The higher the degree of corrosion, the darker the color of the icons. Therefore, users can see the seriously corroded areas in the process of test. Just as is shown in Diagram 2-4 and 2-5, users can make a shift between parameter setting and icon display by ALTER button. For potential test, the icon is shown in Diagram 2-4; for gradient test, the icon is shown in Diagram 2-5.

Test Area	X= Y=
0001	0000 mV Direction→
Potential	+ + ++
>0	
≤0	
≤-50	
≤-100	
≤-150	
≤-200	
≤-250	
≤-300	
≤-350	
≤-400	

Diagram 2-4 Icon for Potential

Test Area	X= Y=
0001	0000 mV Direction→
Gradient	+ + ++
≥0	
≥50	
≥75	
≥100	
≥125	
≥150	
≥175	
≥200	
≥225	
≥250	

Diagram 2-5 Icon for Gradient

The corrosion test procedure is shown in Diagram 2-6.

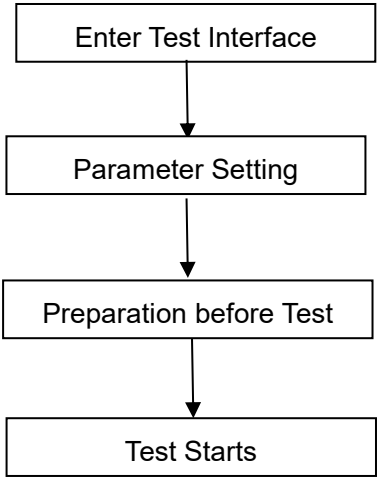

Diagram 2-6 Test Procedure

2.2.1 Parameter Setting

In corrosion test, the engineering parameters cover test area, test mode selection, space and temperature.

A. Test Area: set by keyboard, 4 digits together, signified by numbers between 0-9 and letters between A-Z.

B. Potential/Gradient: shift between potential test and gradient test.

C. Space: set by keyboard, between 0-99.

D. Temperature: automatically detect the ambient temperature and display it in the lower area.

Operation: Press ←、→ buttons to move the cursor; ↑、↓ buttons to adjust the number where the cursor is located; OK button to confirm the setting and start the test; ESC button to return to the previous interface; If the test area remains the same, press OK button to continue testing the data following the original component.

2.2.2 Preparation before Test

A. Arrangement of the Test Point and Test Area

Find the steel and mark the location and trend with chalk. The crossing point of the steel is the test point, as is shown in Diagram 2-7.

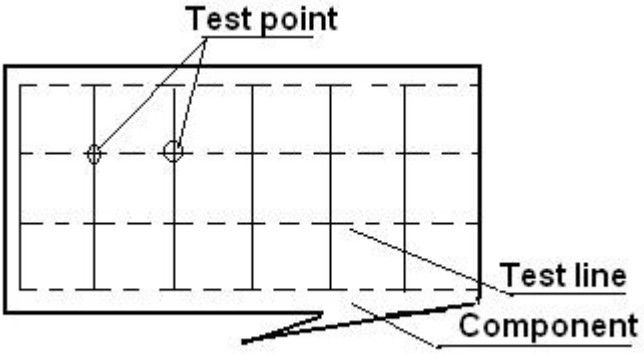

Diagram 2-7 Arrangement of Test Area and Test Point

B. Moinsten the tested structure with a little amount of mixed liquid of domestic detergent and pure water. This can strengthen the infiltration of wetting agent and reduce the time required by moistening the structure.

C. Instrument Connection

For potential test, chisel some concrete to expose the steel and remove the corrosion layer. Clamp the metal electrode to the steel. A black signal wire is used to connect the metal electrode and the black socket of the corrosion meter. At the same time, a red signal wire is used to connect the potential electrode and the red socket of the corrosion meter.

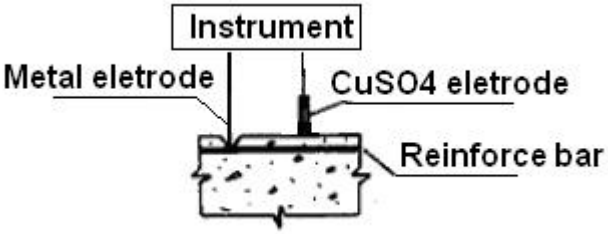

Diagram 2-8 Potential Test of the Steel Corrosion Meter

From left to right: metal electrode, test main engine, cupric sulfate electrode, steel.

For gradient test, there is no need to chisel the concrete. Connect the two potential electrodes with joint lever with dot pitch of 20 cm. The arrangement of the test area and test point is shown in Diagram 2-7.And the test is shown in Diagram 2-9.

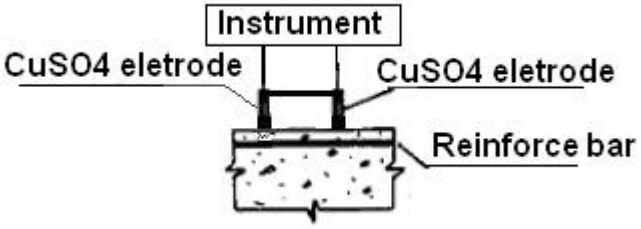

Diagram 2-9 Gradient Test of the Steel Corrosion Meter

From left to right: cupric sulfate electrode, test main engine, cupric sulfate electrode, steel.

2.2.3 Corrosion Test

Once the preparation is over, test will start. The Current Test Point Paramete Area is as follows:

1).X: location in X direction of the current test point

2).Y: location in Y direction of the current test point

1) Electric voltage of the current test point

2) Direction: current test direction

The test procedure is as follows:

1. Press OK button, and enter Test Interface. X stands for the horizontal direction, while Y stands for vertical direction. The icon " ✚ "stands for the location of the current test point.

2. Put the potential electrode in the test point in the test area, and the measured potential will be displayed in the Current Test Point Parameter Area. When the potential remains constant, press the SAVE button and complete the test of the point.

3. The direction buttons change the test direction. The new direction is displayed in the Current Test Point Parameter Area.

4. When all the test points in the test area are completed, move on to next test area. Press the ESC button, and set the parameter again.

2.3 Data Check

Data Check Interface is shown in Diagram 2-10. On the left is the Completed Area, while on the right is the Test Area Information. Press the ↑、↓ buttons, and select different test areas. The arrow points to the current selected component. In

Test Area Information, information such as test date, ambient temperature, test mode, measuring space and test point numbers is displayed. Press the ESC button and return to Function Interface.

Test Area	Test Area Information
>0000 0001	Date: May 23rd, 2009 Ambient Temperature: +24℃
	Test Mode: Potential Measuring Space: X20 Y20 Test Point Numbers: 00006

Diagram 2-10 Data Check Interface

Press the OK button and enter the current selected test area for data brouse. The Brousing Interface is the same as the Test Interface 2-3. Press the ↑、↓ buttons to change the test point in Y direction. Press the ←、→ buttons to change the test point in X direction. If there is data in this test point, the current potential is displayed. Press the ESC button and return to 2-10 interface and select the broused test areas again.

2.4 Data Transmission

The USB Transmission Interface is shown in Diagram 2-11. Press the OK button and transmit the data; Press the ESC button and return to Function Interface. In the process of transmission, "In transmitting" is displayed, as is shown in Diagram 2-12;When the transmission is over, "Transmission is

over" is displayed, as is shown in Diagram 2-13.Then press any button to return to Function Interface.

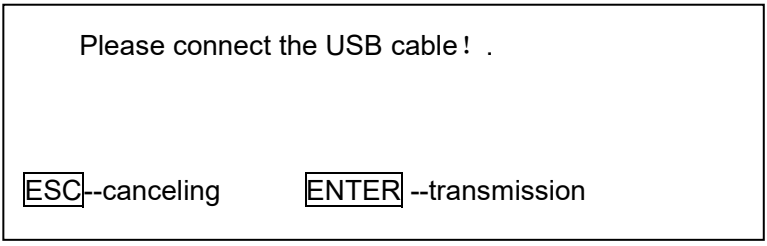

Diagram 2-11 USB Transmission Interface

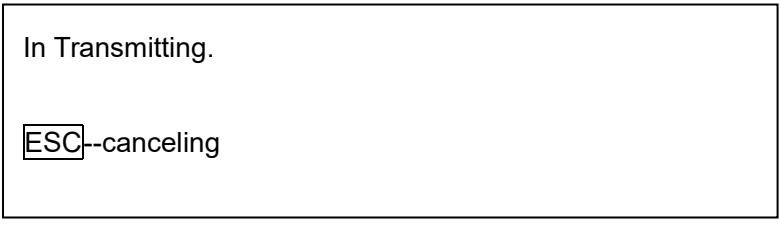

Diagram 2-12 Data Transmission Interface

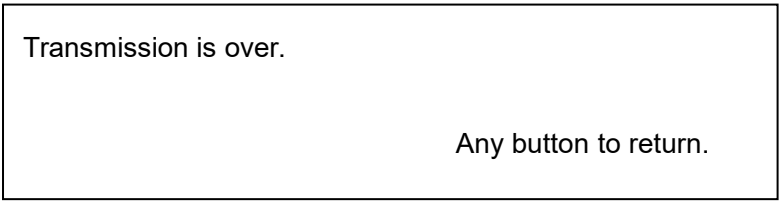

Diagram 2-13 Transmission Over Interface

2.5 Data Deletion

The Data Deletion Interface is shown in Diagram 2-14. Press the OK button and delete all the data. When it is over, "Deletion is over." is displayed. Press the ESC button to cancel the deletion and return to the Function Interface.

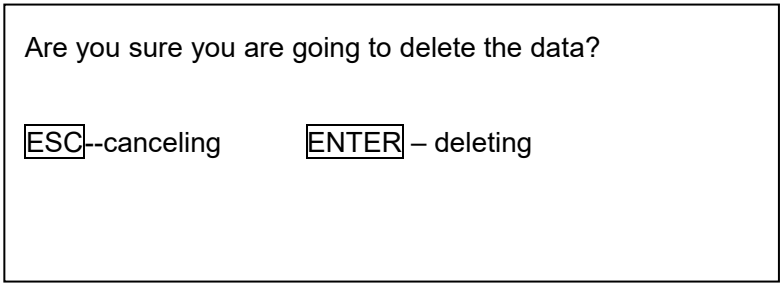

Diagram 2-14 Data Deletion Interface

Note: All the data can`t be restored after being deleted. Please use this function with caution.

2.6 Date Setting

The Date Setting Interface is shown in Diagram 2-15.

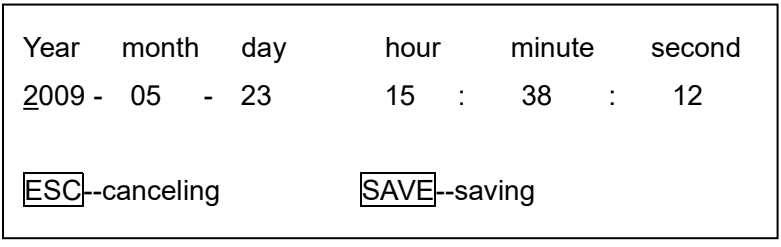

Diagram 2-15 Date Setting Interface

Press the ←、→ buttons and move the cursor; Press the ↑、↓ buttons to revise the number. After the revison, press the ESC button to return without saving; press the SAVE button to save the setting and return.

2.7 Power off

Press the ⏻ button to switch off the instrument.