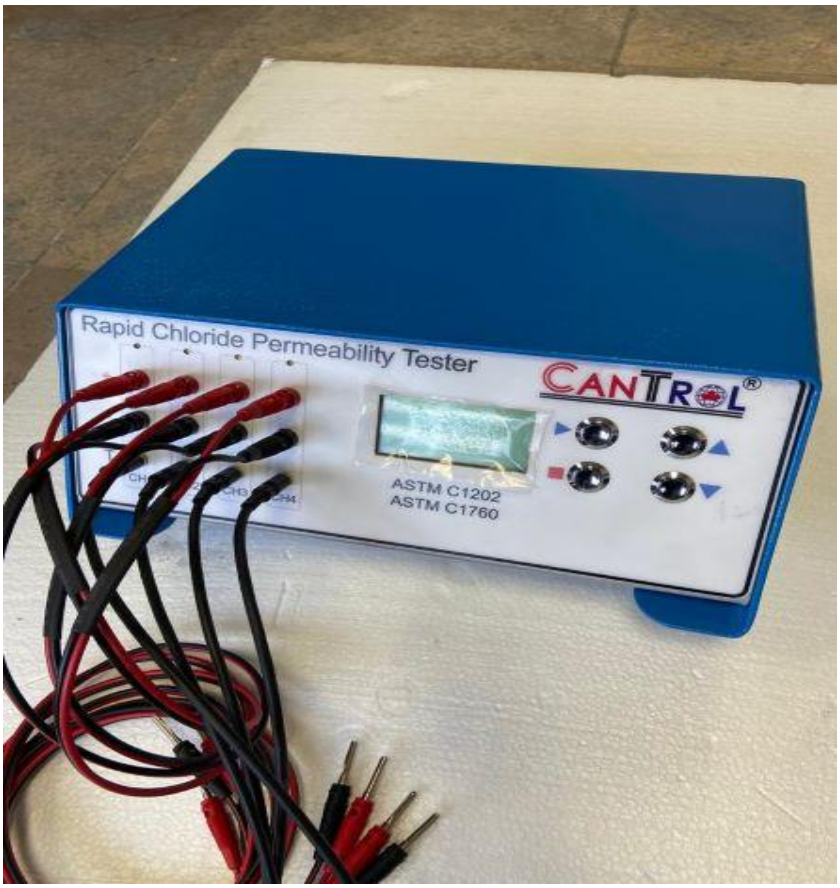
Instruction Manual

Rapid Chloride Permeability Test (RCPT)

according to standard (ASTM C1202)

Model #: 5110151



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Introduction

The Rapid Chloride Permeability Test (RCPT) is designed to assess the resistance of concrete to the penetration of chloride ions. It provides an indication of the concrete's permeability, which is crucial for predicting the durability and service life of concrete structures, especially those exposed to de-icing salts or marine environments. The test measures the total electrical charge (in Coulombs) that passes through a saturated concrete specimen when a 60V DC potential is applied across it for 6 hours. This charge is used to classify the concrete's chloride ion penetrability.

It should be mentioned that the equipment of this test is used in the electrical conductivity of hardened concrete testing (ASTM C1760).

Specifications

Number of channels	4
Independent channels	Yes
Sampling rate (minutes)	from 5
Voltage (VDC)	60
Current measurement (mA)	0 - 500
Temperature measurement (°C)	0-100
PC connection	User-friendly PC software with full device control
Short circuit protection	Yes
Operating voltage	100-240V 50/60Hz 1ph
Dimensions of device	330x260x130 mm
Dimensions of each cell	180x150x150 mm
Weight of device	5.5 kg
Weight of each cell	3.5 kg
Power supply	110V,60Hz. / 220V,50Hz.

Safety Precautions

- **Electrical Hazard:** The device operates at 60V DC. Ensure hands are dry and avoid touching connections while the power is on. Ensure proper grounding.
- **Chemical Hazard:** The test uses Sodium Hydroxide (NaOH) solution (typically 0.3 N), which is corrosive, and Sodium Chloride (NaCl)

solution (typically 3.0%). Wear appropriate Personal Protective Equipment (PPE), including chemical-resistant gloves (nitrile or neoprene), safety goggles or a face shield, and a lab coat.

- **Ventilation:** Perform the test in a well-ventilated area, ideally under a fume hood, especially when handling NaOH.
- **Handling Specimens:** Handle concrete specimens with care to avoid damage.
- **Disposal:** Dispose of chemical solutions according to local environmental regulations. Neutralize NaOH solution before disposal if required.

Equipment Required

- RCPT Test Apparatus
- Test Cells and Gaskets
- Concrete Specimen (Typically a 100 mm diameter x 50 mm thick disc, prepared according to ASTM C1202)
- Vacuum Saturation Equipment (Vacuum desiccator, vacuum pump, distilled/deionized water container)
- Solutions:
    - 0.3 N Sodium Hydroxide (NaOH) solution (13 g NaOH per liter of distilled water)
    - 3.0% Sodium Chloride (NaCl) solution (30 g NaCl per liter of distilled water)
- Beakers and Graduated Cylinders
- Personal Protective Equipment (Gloves, Goggles, Lab Coat)

Sample and device preparation

1- Preparation of concrete sample:

• The sample can be made in the laboratory by molding with 100 mm diameter and 200 mm height, as shown in the figure below, or obtained by using coring. According to ASTM C1202 test, the test specimen shall be 100 mm in diameter and 50 mm(± 3 mm) in high. Ensuring cut faces are parallel.

Figure 1: Mold for concrete sample production.

2- Sample preparation:

• Place the samples in the vacuum desiccator.

• Desiccator must remain in the same position permanently.

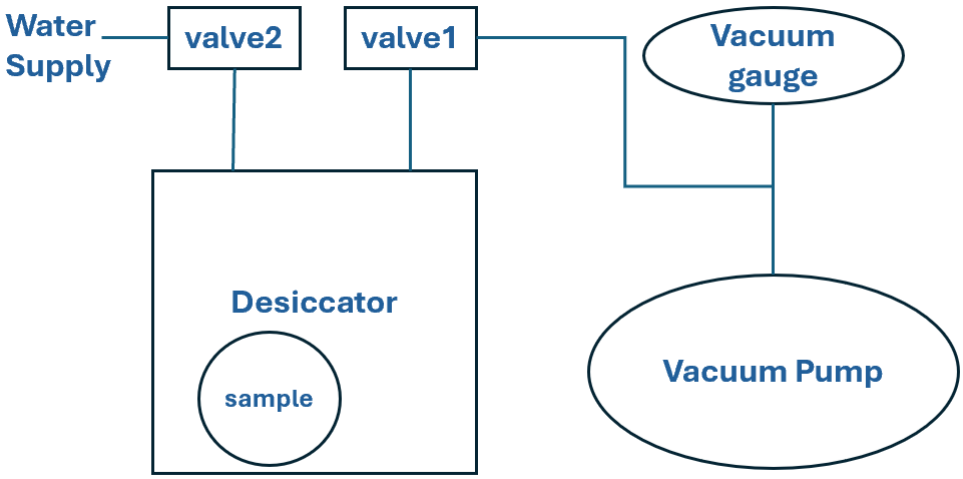


Figure 2: Vacuum pump and desiccator device.

• Clean the edge of the desiccator lid and lubricate with silicone oil.

• Check all valves are closed. Now put the lid on the desiccators.

• Connect the hose from the vacuum pump to valve 1 on the lid. To create a vacuum, open valve 1 and turn on the pump.

• Keep the vacuum pump on to less than 50 mm Hg (13.3 kPa) [absolute pressure] for about three hours, then close the valve and turn off the vacuum pump.

Connect another hose to valve 2 on the lid and place the end of the hose in the container with distilled water. Now open the valve 2 and let the water flow into the desiccators. Water should completely cover the samples. No air should be allowed to enter the desiccators.

• Open valve 1 and close valve 2 and turn on the pump for another hour.

• Turn off the vacuum pump and disconnect the hoses from both valves, the valves must be closed while removing the hoses. Now slowly open the valve to allow air to enter the desiccators.

• Keep the sample in the desiccator for another 18 hours. Then remove the desiccator lid and take out the sample.

• Remove specimen from water, clean excess surface water.

3- Choosing the rubber gasket for RCPT cell:

The table below shows the proposed type of gasket according to the sample diameter. Select the type of gasket according to the sample diameter

Table 2: Sample diameter and required gasket dimensions

Sample diameter	gasket dimensions
104 mm - 99 mm	97 × 117 × 10 mm

Figure 3: Rubber gasket

4- Installing gasket:

• Clean gasket and spacer.

Lightly lubricate the bottom surfaces of the gasket with silicone oil.

• Press one of the gaskets on the sample from one side. Place the spacer in the center of the sample and press another gasket at the end of the sample.

Now place a cell on the table. Insert the installed gasket into the grooves of the cell. Place the other part of the cell to complete the arrangement.

• Make sure both connections (red and black) are in the same direction.

• Insert the four bolts with washers into the cell holes in each corner. Tighten the opposite screws with a wrench. The screws should not be too tight, which may damage the cell.

• To check for cell leaks, put it on paper and fill the cells with water with by a funnel. Then check the water level or leaks on the paper.

Before starting the test, drain the water from the cell and fill with the solutions (3.0% Nacl and 0.3 N NaoH). Ensure the liquid level covers the specimen face.

• Appropriate assembly is shown in Figure 4 below.

Figure 4: Assembled RCPT cell

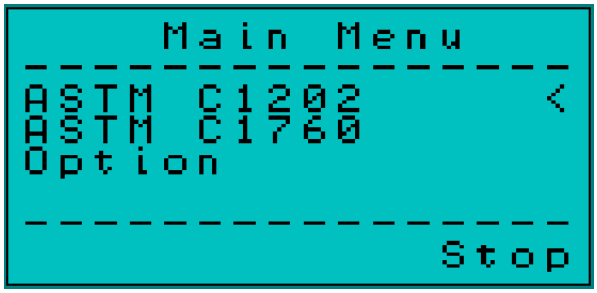
5- Connecting the cells to the RCPT device:

Cell number 1 should be connected to channel number 1, cell number 2 to channel number 2, and so on.

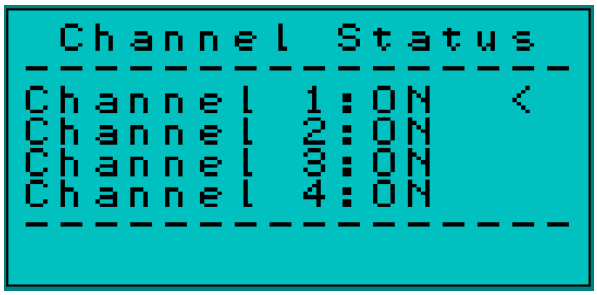
Figure 5: RCPT device

Before the test:

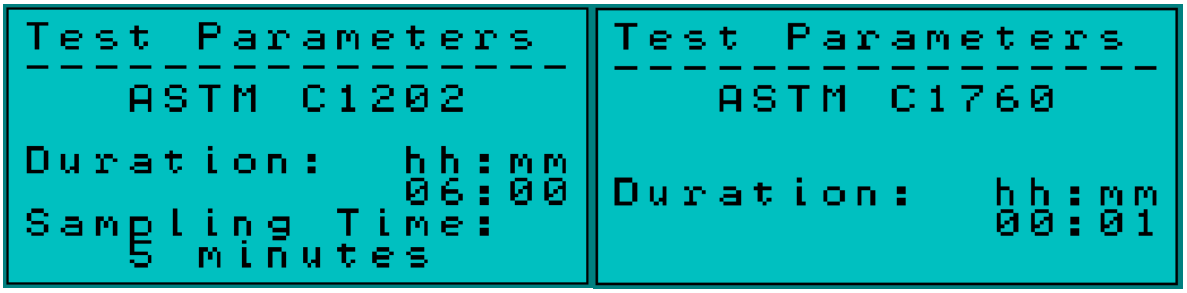
First, set the power supply status to 220 or 110 volts. After turning on the device, the screen shows the names of the 2 standards and option as shown below.



Select the desired standard with the up and down button ▲▼ and by pushing the start button ►, the next screen will show the status of 4 channels as shown below.

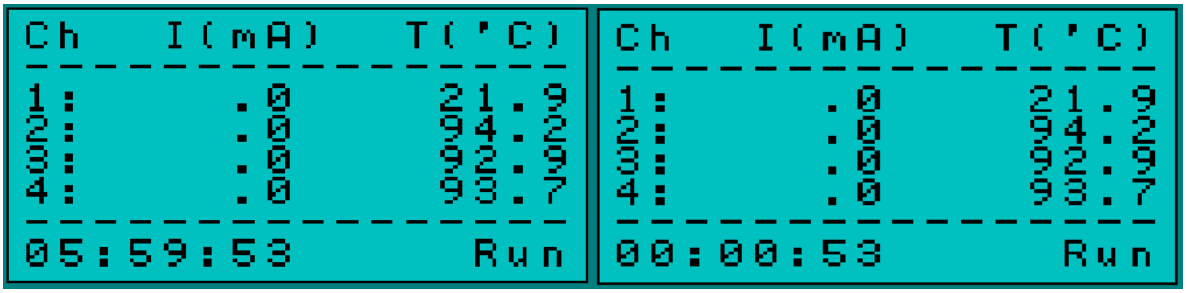


Push the stop button ■ to change the status of the channels, and by pushing the start button ►, the test information will be displayed as shown below. The default time is 6 hours for ASTM C1202 and 1 minute for ASTM C1760.



During the test

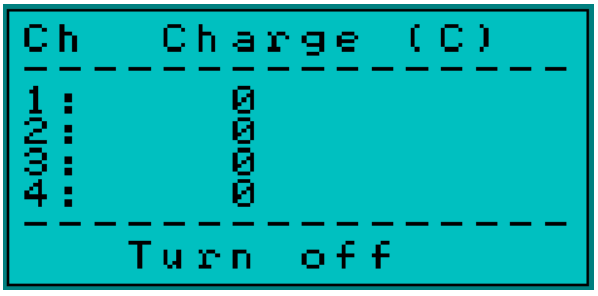
Use the Start button ► to start the test. The test results will then be displayed as shown below.



Each channel shows status, current, temperature in degrees Celsius, remaining time, and coulomb. Coulombs are stored after the selected sampling time and then updated in the desired interval. The test will continue until the selected time is reached, by pushing the stop button ■, the current exceeds 600 mA or the temperature exceeds the maximum temperature of 90 ° C.

After the test

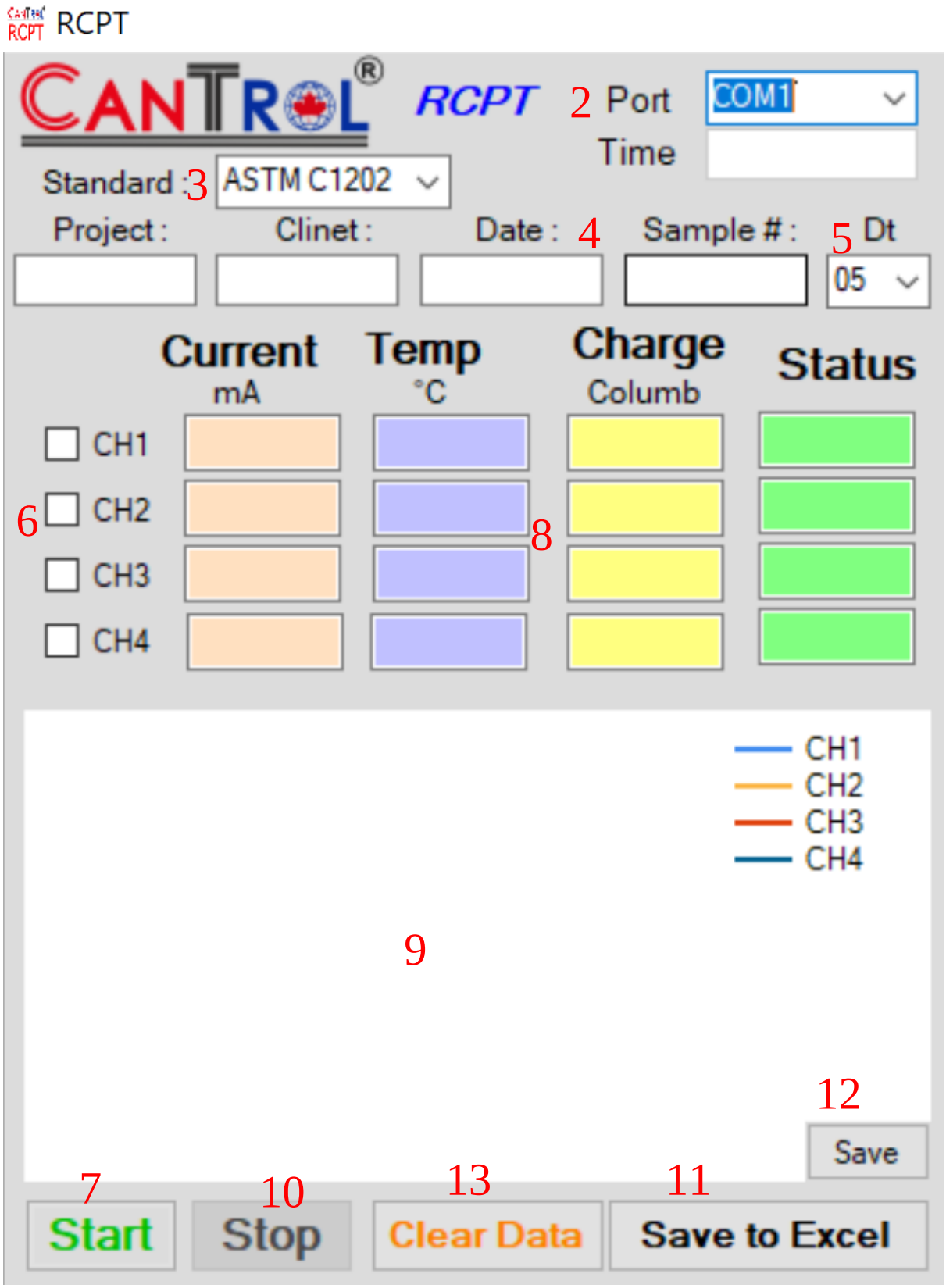
The stop button ■ is used to stop the test. When a channel is stopped, the test results will be displayed as shown below.



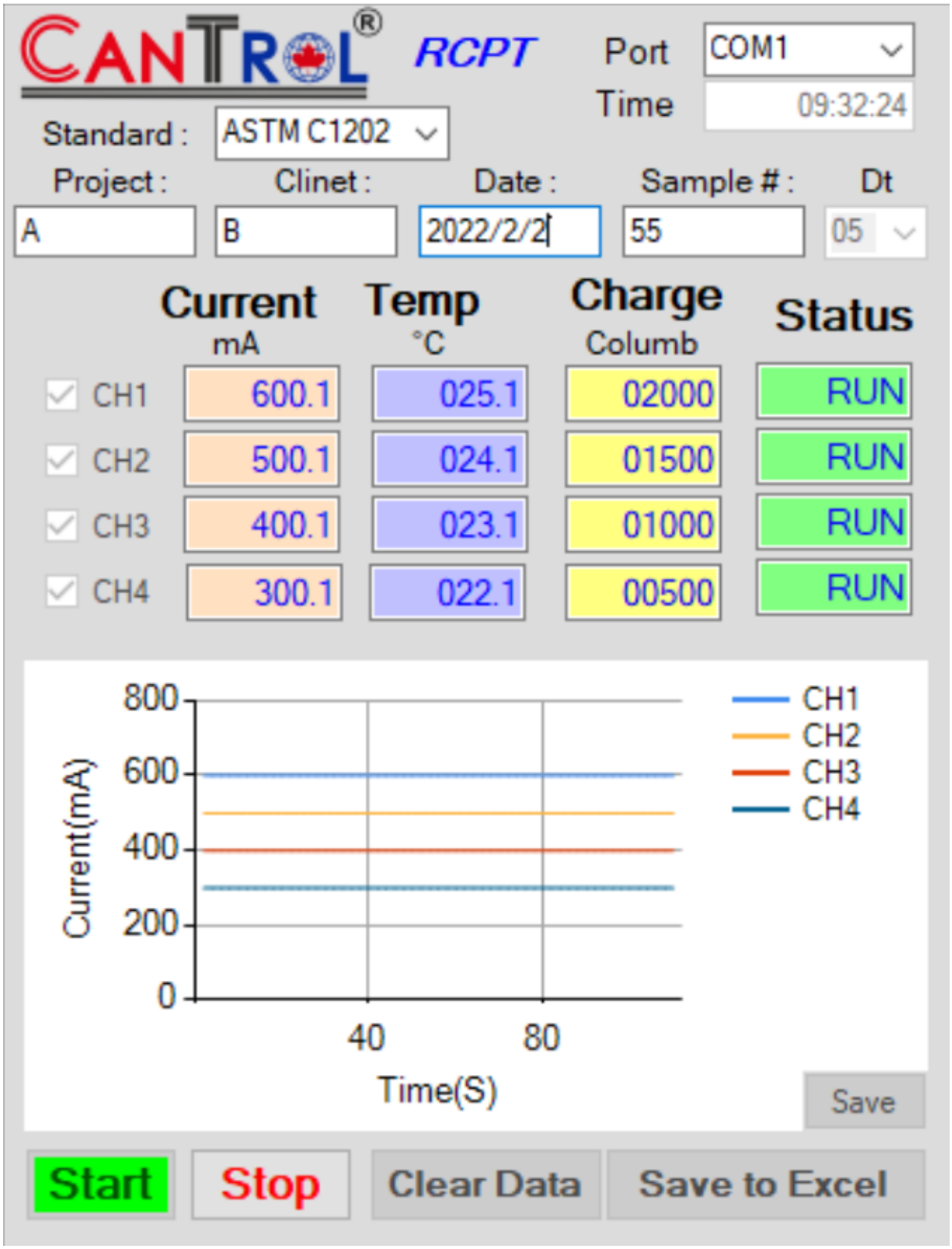
Disconnect the cables from the test cell. Carefully disassemble the test cell, remove the specimen, and dispose of the solutions safely.

Test by Software

1. Use a USB A-USB B cable (printer cable). Connect USB B to back of the device and USB A to PC. Install the software.
2. Select port
3. Select standard type (ASTM C1760, ASTM C1202)
4. Fill sample specifications
5. Select sampling time (5, 10, 15, 20, 25 & 30 min)
6. Select channels
7. Start the test
8. See result in table
9. See result in graph
10. Stop the test
11. Save all data in MS Excel format
12. Save graph in picture formats
13. Clear memory for new test


RCPT
CANTROL
RCPT
2
Port
COM1
Time
Standard :
3
ASTM C1202
Project :
Clinet :
Date :
4
Sample # :
5
Dt
05
Current
mA
Temp
°C
Charge
Columb
Status
CH1
6
CH2
CH3
CH4
8
CH1
CH2
CH3
CH4
9
12
Save
7
Start
10
Stop
13
Clear Data
11
Save to Excel

RUN


CANTROL
RCPT
Port
COM1
Time
09:32:24
Standard :
ASTM C1202
Project :
Clinet :
Date :
Sample # :
Dt
A
B
2022/2/2
55
05
Current
mA
Temp
°C
Charge
Columb
Status
CH1
600.1
025.1
02000
RUN
CH2
500.1
024.1
01500
RUN
CH3
400.1
023.1
01000
RUN
CH4
300.1
022.1
00500
RUN
800
600
400
200
0
Current(mA)
40
80
Time(S)
CH1
CH2
CH3
CH4
Save
Start
Stop
Clear Data
Save to Excel

Interpretation of Results (Based on ASTM C1202)

The calculated total charge passed is used to classify the chloride ion penetrability:

Total Charge Passed (Coulombs)	Chloride Ion Penetrability
> 4000	High
2000 - 4000	Moderate
1000 - 2000	Low
100 - 1000	Very Low
< 100	Negligible

Troubleshooting

- *No current* (DC)*:* Check cable connections, solutions, sample saturation.
- *Leaks:* Check gasket, bolt and screw. Leaks invalidate the test.
- *Unstable readings:* May indicate poor connections, internal specimen cracking.
- *Excessive temperature rise:* May indicate very high conductivity concrete. Stop the test if temperature exceeds limits.
- *Power supply error* (error60v): turn the device off for 2 minutes and then turn it on.

Maintenance and periodically Inspection

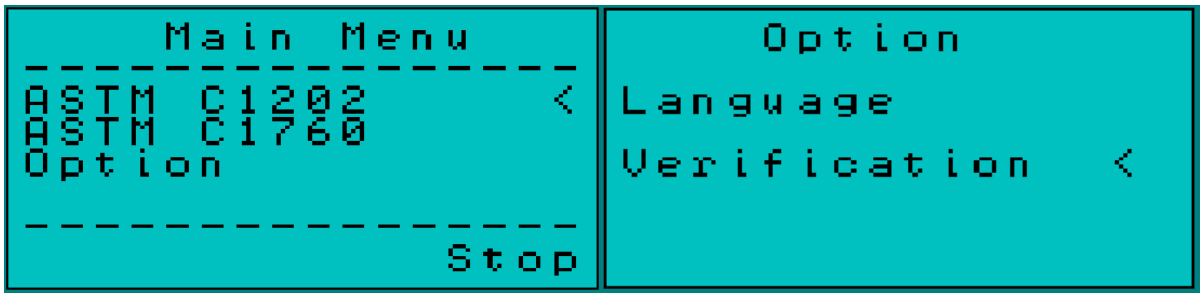
- **Cleaning:** Thoroughly rinse the test cells, gaskets, and electrodes with clean water after each test. Do not use solvents that might damage the acrylic cells or gaskets.
- **Gaskets:** Inspect gaskets regularly for damage or compression set. Replace if they appear worn or if leaks occur.
- **Connections:** Keep electrical connections clean and free of corrosion.
- **Verification:** Periodically verify the accuracy of the current measurement.

Verification

This method will correct small differences between the measured current and the calibration kit current.

1 .First select the Option menu.

2 .Then select the Verification menu.



3 .According to the instructions on the screen, disconnect all channel connections and press the start button.

4 .Connect the calibration kit and adjust the calibration kit current using the Up and Down buttons. (198±1 mA)

5 .Press the Stop button to save the settings and repeat this for all four channels.

Disclaimer

This manual provides general guidance. Users must be properly trained in concrete testing procedures and adhere strictly to the relevant standards (e.g., ASTM C1202). The accuracy of the results depends heavily on correct specimen preparation, test setup, and procedure execution.