



Laboratory equipment co.,limited

## CHLORIDE ION PENETRATION METER DTL-A

# PRODUCT MANUAL



### C-TECH LABORATORY EQUIPMENT CO., LTD

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🌐 [www.testmould.com](http://www.testmould.com)

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## CONTENTS


I. Important Safety Information .....	1
II. Situation for emergency operation .....	1
III. General safety guidelines .....	2
IV. Important Notice for users .....	2
Chapter 1. DTL-A Series product overview .....	3
DTL-A Overview .....	4
Functional Units .....	5
Test channels .....	6
Chapter 2. The product installation .....	7
Chapter 3. The experimental operation guide of DTL-A .....	11
Chapter 4. Problems solving of instruments .....	20
Chapter 5. Help and Service .....	22
Appendix A: Warranty .....	23



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## I. Important safety Information

This information can help you safely use our products. Follow and retain all information included with the product of our company.

Customer safety is important for our company, the products we developed are safe and effective. This product is the mechanical and electrical integration product. Power lines, test lines and other features will cause potential safety hazards in the case of improper use, which could result in personal injury or property damage. To reduce these risks, please follow all the instructions of the product, and all the warning messages and read this instruction carefully. Carefully follow the information provided with the product and contained in this operation, to help protect you from hazards and create a safe working environment.

## II. Situation for emergency operation

The product may be damaged due to improper or negligent. The product damaged serious should be used only after our engineers' examination and repair.

Please check the equipment, if you find any situations listed below (although rarely) or any safety considerations on the product, please stop using it and disconnect the power, until you can contact our company for further guidance.

- Power lines, plugs, test line cracked, broken or damaged.
- There are smoke or strange smells emit from the host.
- Water inside the chassis of products.
- The positive and negative end of the testing line connected when testing
- Drop the product or damaged in any way.
- instrument running abnormally When operating it according to the instructions

**Note:** If the product provides by us is not produce by us, please stop using it until you non-durable durable products found these cases, please stop using the product until you contact the manufacturer and obtain further instructions or get suitable replacement.



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### III. General safety guidelines

Please always observe the following precautions to reduce the risk of personal injury and property damage.

#### Service

Please do not attempt to repair the instruments yourself unless you are at the guidance of We's Technology Center.

#### Power line

Do not place the power cord wrapped around the other items, this can stress the cord, which may cause the power cord damaged, broken or bent. So there will be a security risk. Keep the line from contacting with liquid. (It may be contact with corrosive liquid) liquid can sometimes lead to a short circuit. Liquids can also cause gradual corrosion of the power cord terminal connector, which will ultimately lead to overheating.

#### Plug and socket

The plugs of the instruments are three-wire, please choose three wire power socket.

If the power socket has damage or corrosion signs, do not use the socket.

#### Test line

When the instrument is running, the testing host will output 60V DC voltage, so there will be a 60V voltage at each test line ends. For security reasons, please do not touch the bare metal contact at both ends of the line, and do not connect the two ends together.

### IV. Important notice for users

Customers should choice accessories provided or specified by We company. We company is not responsible for the data deviation caused by accessories not specified by We company.



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## Chapter 1. DTL-A Series product overview

Concrete reinforcement corrosion is the primary factor affected the durability of concrete. According to statistics, the durability damage of reinforced concrete caused by corrosion accounted for more than 40% of all injuries, while the chloride ion erosion is a major incentive for reinforcement corrosion.

ASTM C1202 is the standard of durability of concrete - concrete to resist chloride ion penetration properties made by American Society for Testing and Materials (ASTM), which is consistent with the standard of The American association of state highway and transportation department AASHTO T277-1983, Often called electric flux method. electric flux method also meet the requirements of Test methods of long-term performance and durability of ordinary concrete(GB/T50082-2009), Corrosion prevention technical specification for concrete structure of marine harbor engineering JTJ275-2000, Apparatus to determine chloride coulomb electric flux of concrete (JG/T261-2009).

DTL-A chloride ion penetration meter is an important indicator for the durability of concrete - concrete to resist chloride ion penetration properties (density) measurements. Test indicator is the six-hour power flux (Coulomb) for the concrete specimens, quickly to evaluate the concrete resistance to the chloride ion penetration ability.

### Manufacture Standard:

Test methods of long-term performance and durability of ordinary concrete (GB/T50082-2009)

ASTM C 1202 & AASHTO T277 -05

Corrosion prevention technical specification for concrete structure of marine harbor engineering JTJ275-2000

Apparatus to determine chloride coulomb electric flus of concrete (JG/T261-2009)

Range: 0~6000 coulomb; C30-C50 Portland cement concrete

### Features:

- Embedded PC Control; Auto data storage. Reliable performance High accuracy
- LCD display and real-time display, print and analysis.



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- Test without PC suitable for work field
- Complete automatic software can report and curve the data.
- Automatic short circuit protection to avoid equipment damage
- Simultaneously test 2 groups (6pcs), 3 (9pcs), 4 (12pcs) for one time.
- Anti-corrosion copper plate electrodes fixture, convenient and durable

### DTL-A Overview



The front view of DTL-A Chloride Ion penetration meter

- |               |                                |
|---------------|--------------------------------|
| 1 – test host | 2 – LCD Screen                 |
| 3 – printer   | 4 – Voltage fine-tuning button |



The back view of DTL-A Chloride Ion penetration meter

- |                              |                           |
|------------------------------|---------------------------|
| 1 – RS232 connector          | 2 – host switch           |
| 3 – Power line connector     | 4 – Single channel switch |
| 5 – Single channel connector |                           |



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## Functional units

### Test host

- test controller is the processor of data collecting and controlling

### Fixture

- Used to fix the concrete sample, hold the test solution, applied voltage.
- Fixture is suitable for both cube concrete samples which is frequently-used in China, and cylinder samples. The installation is simple and can be finished in a few minutes if only the surface of the sample is smooth. And the leakproofness is perfect.

### Test line

- The test host output 60v voltage through testing conductor to both ends of the fixture
- Testing on concrete sample needs two testing wires, one connecting to test host, the other connect to the fixture.

### Mini-printer

- Printing data during experimental data during and after the experiment.

### Communication line

- RS232 serial port communication line used to connect the test host and computer

### Computer (which part should be self-prepared)

- Computer is the necessary hardware equipment for PC software running
- RS232 serial port communication line used to connect the test host and computer

## Test channels

According to different quantities of test channels, there are 3 types of equipment.



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- 6 channels

Can simultaneously test two groups (6 channels), there are 3 channels in each group

- 9 channels

Can simultaneously test three groups (9 channels), there are 3 channels in each group

- 12 channels

Can simultaneously test four groups (12channels), there are 3 channels in each group



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## Chapter 2 The product installation

Before testing with DTL-A series products, users should properly connect the hardware and software parts, please install the software and hardware strictly according to the given order.

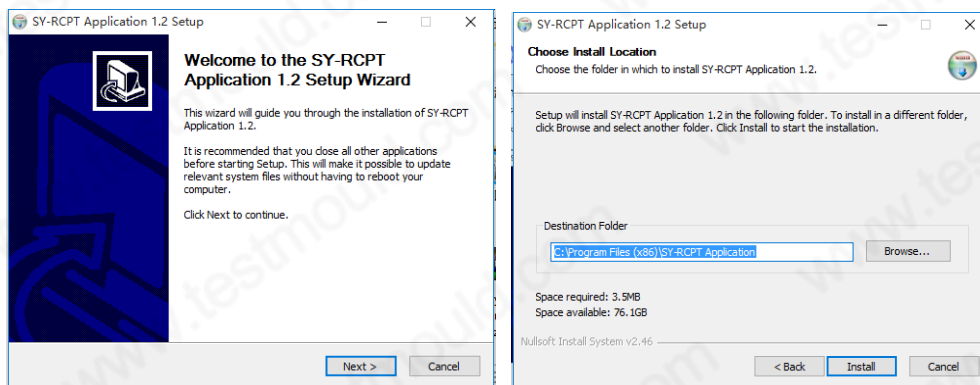
### Software installation

#### PC software installation environment

- system operating platform: Windows2000/XP
- frequency: CPU above 300MHz
- memory capacity: above 64M
- Software requirements: if users need to save the test data as Excel file or printing files, users need to install Excel2000 or above in Chinese version in the computer.

#### PC software installation

Put the installation U-disk to the computer, Double-click the installation file [Setup.exe]. According to the prompt, click on the next step until the installation is completed.

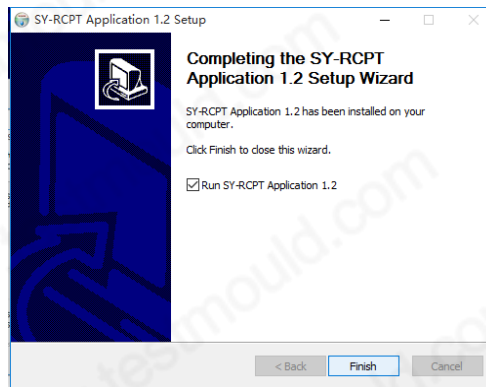


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## Fixture installation

Users can install fixtures in the following order:

1. Chose the concrete samples according to the requirements, and saturate the samples.
2. Take a fixture, confirmed that the copper gaskets and the gasket ring are in good condition. Put the four bolts through the fixture, put the gasket ring side up (put the smooth side down) on a horizontal table. As show in Figure2-1



Figure 2-1

3. Put the concrete sample horizontally on the gasket ring, make the gasket ring and the edge of the sample tangent. Then put the other half fixture with gasket ring through four bolts fastening on the test block (Figure 2-2 on the left); tighten the nuts of the four bolt(Figure 2- 2), put it upright, and the testing could begin (Figure 2-2 on the right)



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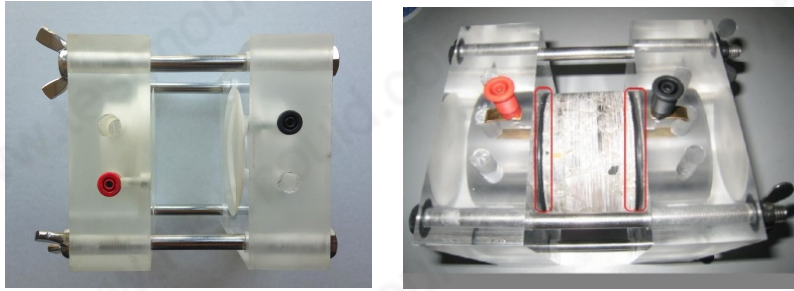


Figure 2-2

**Prompt:**

Fixture installation does not need to wax treatment, but if the user's sample is not flat, the gap between saturated concrete samples and the fixture needs of sealing wax (Figure 2-3 left the red box).

**Injecting solution to fixture**

1. Put a fixture which is installed with concrete samples vertically on a horizontal table (binding post up) figure 2-3 left.
2. Inject water from the water hole of the fixture (figure 2-3 on the right), to check if there is water leakage. If there is water leakage, please do some local sealing wax, and check it again until there is no leakage. Then pour out the water.
3. Inject 3% NaCl solution into the cathode of the fixture (black binding post), 0.3M NaOH solution into anode of the fixture (red binding post), and to ensure that the solution is filled with liquid cannot be lower than 1 cm during the test.

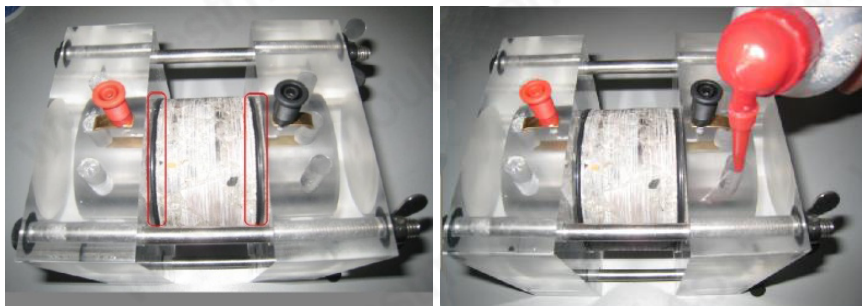


Figure 2-3

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**Prompt:**

Make sure the fixtures which are installed with concrete samples have no water leakage. Water leakage has 3 kinds of situations: 1. the installation of the fixture is not strong; 2. the concrete sample is not flat; 3. there're holes at the position of the samples that contact with the gasket ring.

- if the fixture installation is not strong, the user needs to tighten the four bolts.
- if the sample is not smooth, the user can reselect the sample or use wax sealing.
- if there're holes on concrete sample, users could do local sealing wax.

**Instrument connection**

1. Connect the test host and fixture with testing line. Connect the red connector of the test line to anode of the fixture (red binding post), black connector to cathode (black binding line), the other end is connected to the test host.

2. For the PC software, connect the RS232 serial interface with any serial interface of a computer or USB interface.

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## Chapter 3. The Experimental Operation Guide of DTL-A

Before the test, please check whether the product is correctly installed according to the instructions of ours.

### Key board introduction

1. Start: the function keys to start the equipment; if the equipment in stopped status, press this button to start working (accumulated working time and current value), the channel inverse selection, if the accumulated working time achieve, the equipment will keep the current value, the temperature value and the running time when it stopped.
2. Stop: stop the working equipment
3. Set: Set the print time interval, can be transferred from the lowest 0min to the highest 30min. When it is set, click the set key to back to the main interface.
4. “”: A single press of this key is to make the data plus 1.
5. “”: A single press of this key is to make the data minus 1.
6. Clear: remove the accumulating time and current value.

### Sample preparation

#### Sampling samples

1. Drilling concrete core sample from experimental concrete
2. If evaluating structures, core samples should be drilled from the core of the structures.
3. The samples should be maintained in the lab or at the construction site.


#### Curing samples


1. When using on-site molded concrete samples to evaluate the structure, make sure that the



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concrete sample has the same disposal with the structure, and the same vibration, curing, as well as the same temperature history.

2. The core samples or on-site samples should be maintained in a sealed plastic bag and transported to the laboratory. Samples should be protected from frozen and destruction in transportation and storage process.

### Cutting samples

1. Using concrete cutting machines, to cut down laitance and contaminants(generally cut 10 ~ 20mm), cutting a sample of 100 × 100 × 50mm (Ø100 ± 2 ) × 50mm from the top along the direction parallel to the top surface of the sample. Polishing both ends of the test sample with a grinding wheel.
2. For the surface modification of the sample, such as by rough treatment, the surface conservation agents, sealants, and any other surface treated part should be removed. If you try to use molded test samples, laitance layer must be cut off before the test samples full Water saturated

#### Prompt:

When preparing the samples, no  $\text{Ca}(\text{NO}_3)_2$ , steel fiber, graphite/carbon and any materials that can increase the conductivity should be bring into concrete test samples.

### Marking samples

Before samples are saturated salt, the sample number should be marked on both sides of samples.

### Experimental procedures

1. Water saturates the samples and install them into the fixtures
2. Make sure there is water leakage, and then Inject 3% NaCl solution into the cathode of the fixture (black binding post), 0.3M NaOH solution into anode of the fixture (red binding post)
3. Connect the test host and cathode/anode connector of the fixture with testing line;
4. Turn on the host power, set the experiment according to the following experimental instructions;
5. Clean and dry the test fixture when the experiment is finished.



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**Prompt:**

- If there is any laitance and contaminant, make sure to cut them down, because laitance and contaminant can bring deviation to the experimental data.
- We provide Intelligent concrete vacuum saturated machine, users could do the water saturated experiment according to its instructions.
- The fixture has cathode and anode, user must inject the correct solution strictly according to the marks of cathode and anode provided, to avoid of incorrect experimental data.

**Experimental operating instructions****WARNING!**

Before turning on the host to start testing, make sure that the cathode and anode output terminal of each channel is correctly connected, connecting the cathode and anode directly is forbidden. If the anode and cathode output terminal of any channel is not connected properly or the anode and cathode output terminal directly connect, the instrument will be seriously damaged after turning on.

**WARNING!**


If the current is abnormal after turning on, please make sure to turn down the Switch of this channel, otherwise the instrument maybe burned.


**Independent operation of the lower-position computer**


1. Before the experiment, to ensure that the sample, fixture, test line and power line are connected with the host, to ensure that the switch of each single channel is in off.

2. Turn on the switch of the test host, the LCD screen of the lower-position computer display as the follow figure, in normal operation state: testing the real-time current through the sample, accumulating flux, temperature, voltage and total running time. If the operation stopped, the instrument only tests the current through the sample, temperature and voltage; but not the accumulating flux and total running time.

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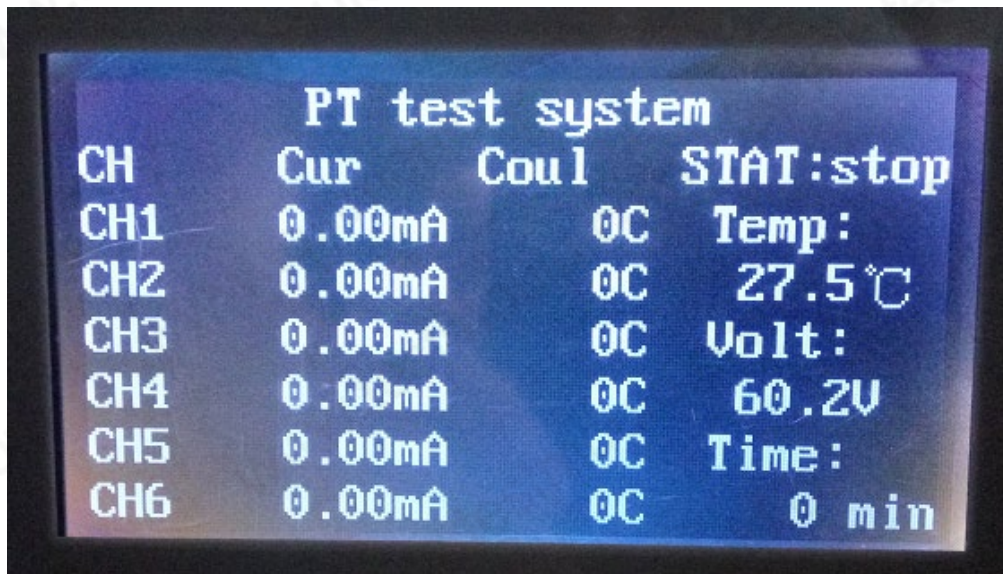


Figure 3-1

Working state: When the device is working, it will be displayed in the status bar STAT. The instrument is stopped if the display shows as in Figure 3-1.

If the deviation between total voltage and 60V is large, rotating the "Voltage fine-tuning button slowly, make sure the total voltage is  $60.0V \pm 0.2V$ .

3. Turning on the channel switch, press the " start " button, then the channel is at the status of working, the instrument began to accumulate current, working hours and electric flux. 6 hours later, the instrument will automatically stop accumulating electric flux, then record the experimental data and turn off the test host.

#### Note:

The instrument has the ability of power outages and power-down data storage". If the power is stopped when the instrument is running, when power is restored, the instrument automatically transferred to working state and obtain the last experimental data that tested before the power stopped. Here we need paying attention to the state of the switch on the back

### Upper-position computer

1. Before the experiment, to ensure that the sample, fixtures, test lines, power lines were completely connected to the test host, to ensure that each single-channel switch is turned off, then turn on the



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test host. Open the computer that installed the upper-computer software, running the software, it will show the interface as Figure 3-2.

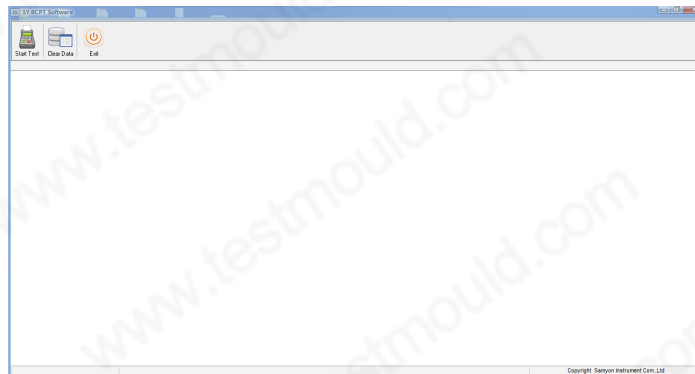



Figure 3-2

2. Then press “  ”, it will show in figure 3-3.

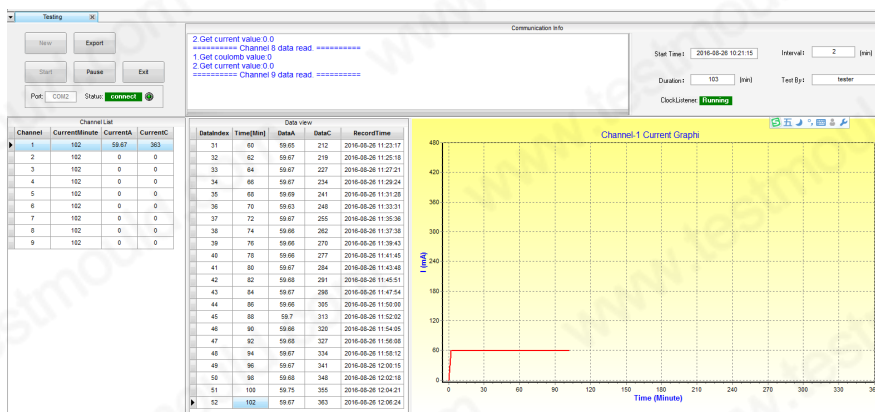
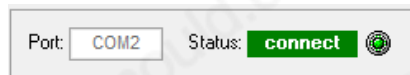



Figure 3-3


Wait a few seconds to connect the port. Then the status color from red to green.





Click tool button  , then pop up the prompt message, as shown in the figure.



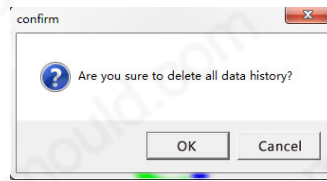
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**WARNING**

Do not clear data, when the testing window has been opened.

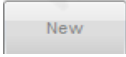

“NEW” button is used to create new test, after connect port successfully, click  button to open the test parameter setting interface pops up as shown in Figure 3-4. Users can set the data save interval during the test, and input the diameter of the sample, add the testing companies/ organizations which has been already saved in the database, input project names/sample names/testing information, and select experimenter. The data stored can be displayed in the testing interface and final test report.


Figure 3-4


3. After click “  ”, the system gets into testing status, the message is shown in prompt window as figure 3-5:



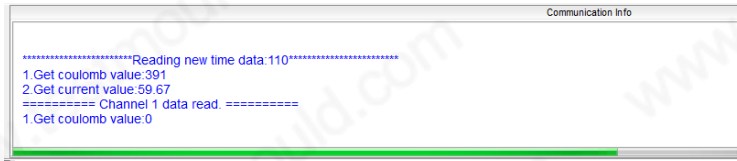
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After the data has been saved, the grid and curve graph can update instantly

Channel List				Data view				
Channel	CurrentMinute	CurrentA	CurrentC	DataIndex	Time[Min]	DataA	DataC	RecordTime
1	110	59.67	391	35	68	59.69	241	2016-08-26 11:31:28
2	110	0	0	36	70	59.63	248	2016-08-26 11:33:31
3	110	0	0	37	72	59.67	255	2016-08-26 11:35:36
4	110	0	0	38	74	59.66	262	2016-08-26 11:37:38
5	110	0	0	39	76	59.66	270	2016-08-26 11:39:43
6	110	0	0	40	78	59.66	277	2016-08-26 11:41:45
7	110	0	0	41	80	59.67	284	2016-08-26 11:43:48
8	110	0	0	42	82	59.68	291	2016-08-26 11:45:51
9	110	0	0	43	84	59.67	298	2016-08-26 11:47:54
				44	86	59.66	305	2016-08-26 11:50:00
				45	88	59.7	313	2016-08-26 11:52:02
				46	90	59.66	320	2016-08-26 11:54:05
				47	92	59.68	327	2016-08-26 11:56:08
				48	94	59.67	334	2016-08-26 11:58:12
				49	96	59.67	341	2016-08-26 12:00:15
				50	98	59.68	348	2016-08-26 12:02:18
				51	100	59.75	355	2016-08-26 12:04:21
				52	102	59.67	363	2016-08-26 12:06:24
				53	104	59.65	370	2016-08-26 12:08:29
				54	106	59.67	377	2016-08-26 12:10:32
				55	108	59.67	384	2016-08-26 12:12:33
				56	110	59.67	391	2016-08-26 12:14:36

Figure 3-5

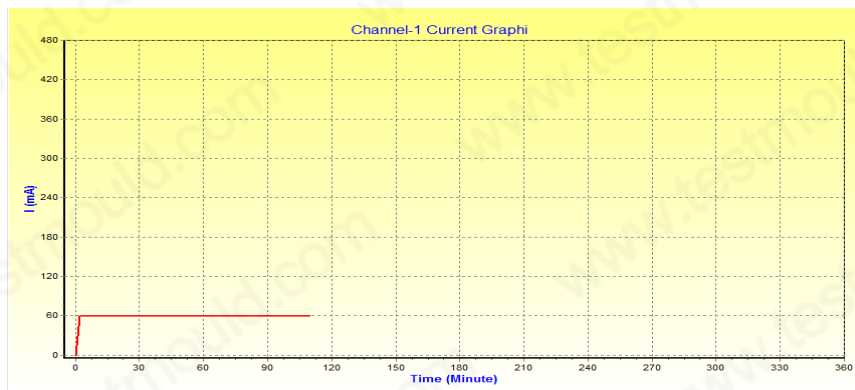


Figure 3-6

In the curve graph, you can zoom in and zoom out by dragging the mouse.

#### 4. Export data

Click [Export] button, export the data result to Excel.



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Test report of concrete coulomb		
Company Name	test company	
Project Name	project001	
Input Voltage	60	
Start Time		
Object Diameter	60	
Test By	tester	
Run Duration	0	
CH	Avg Cur (mA)	Coul

The figure is the current trends for selected channel, with time passed, the current will continue to change, the user can monitor if the current suddenly increase through the observing current change.

## 5. Exit

When finish testing, click “Exit” on the upper left corner to exit the software.

## Evaluation of concrete penetration

The total electric flux getting from test should be converted electric flux through a diameter of 95mm sample. The conversion formula is as follows:

$$Q=Q_x \times (95/x)^2$$

Q – the electric flux through a diameter of 95mm sample (C)

Q<sub>x</sub> - the electric flux through a diameter of Xmm sample (C)

X - the sample's actual diameter (mm)

Take the electric flux value of 3 samples per group, calculate the average value to be the result. When the difference value between median and one of the values is more than 15%, take the average value of the remaining two sample's electric flux as the test results of the group. When the difference value between median and the 2 values are all more than 15%, take the median of this.



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## Chloride Ion penetration based on electric flux

Electric flux (C)	Chloride Ion penetration
>4,000	High
2,000-4,000	Medium
1,000-2,000	Low
100-1,000	Very low
<100	Can be ignored

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## Chapter 4. Problem Solving of Instruments

DTL-A will apply 60V DC voltage to the sample, the instrument is likely to be damaged if the operation is improper, such as a short circuit\ burned. Please be sure to follow the company's operating guidelines during the test, to avoid short circuit of fixture and test lines during the test.

### Hardware problems

#### Problem:

The current value of software testing concrete sample is more than 360mA.

#### Solution:

- Admixtures such as Ca (NO<sub>3</sub>)<sub>2</sub> that could increase the conductivity is mixed into the concrete. When making the experimental sample, such materials can not be mixed.
- bad resistance of concrete block, immediately terminate the testing and turn off the power of the test host.
- the test lines of anode and cathode end are connected when the test host is on, which make the instrument short-circuit.
- The instrument has been breakdown by heavy current, and is already on short-circuit condition, the testing should be stopped immediately and disconnect the power supply of the test host.

These three phenomena, users need to monitoring the real-time current of equipment after the start, if the current value is above 360 mA, stop the test of this channel immediately. Looking for the problem, restart it after solving the problem.

#### Problem:

Solution leakage of the fixture.

#### Solution:



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- Check whether the sample is in the central the fixture, whether the nuts for the four screws are tight.
- Fixtures do not have solution leakage normally. But if your sample is not smooth cut, if necessary, the surface of concrete sample needed sealing wax treatment, leaving a diameter of 90mm area in the upper and lower surface. If you have enough samples, you can choose a flat surfacing sample to complete the test.

## Software problems

### Problem:

Menus are all gray and cannot be operated

### Solution:

- In different operating conditions, the menu command sets different state automatically. Please operate according to the instructions in chapter 3.

### Problem:

There is no reaction of the software, or the hardware is system halted.

### Solution:

- In the design, in order to ensure the accuracy of the test data, a large amount of system resources are used in the software to monitoring the software data, to ensure the instrument running continuously for more than 48hrs at the same time. Please don't do any other operations except the software operation when upper-position computer testing software to run the instrument. At the same time, because of the sensitivity of testing data, please don't move\strike the DTL-A instrument during the test, and save the data each time when finishing the test. If system halted happens, turn off the instrument and restart it 30s later.



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## Chapter 5. Help and Service


If you need service, technical assistance, or want to get more details about our products, please contact technical support center of our company.


- Product advice and assistant — about technical advice and assistance of our products, please call us
- product hardware repair — If the problem is confirmed to be hardware damage, please call us



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## Appendix A Warranty

It includes warranty state, period, service and technical support for DTL-A

### WE limited warranty statement

#### Notice before using

1. Please check all configurations according to the packaging list.
2. After receiving the instrument, please assemble and adjust it on time.

### Maintenance warranty range

1. The warranty begins from the shipping date when we send our instruments to the shipper.
2. We will provide the free maintenance to the DTL-A configuration hardware for one year. From the second year, we will collect the service and hardware cost according to the real state. And we are not responsible for the shipment cost from client to our factory and return back, and we can assist our client for shipments.
3. Excluding the above service, the customers can choose the upgrading service. We will make the service program according to clients' requirements.

#### Notes:

1. the instrument works unmoral, please stop it and contact our technical service center. We will give out the solution in 48h.
2. When the customers need the maintenance service, please provide the failure details and photos if possible, include the display in the screen.


### Beyond warranty range


1. We are not responsible for the damage caused by wrong operation that doesn't accord our technology guide and manual.



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2. The physical damage is caused due to the human, accident, abuse, misuse or force majeure factors (such as natural disasters, voltage instability), spare parts and chip burns, broke, such as water inside, containers leakage, rupture, and shell surface split, etc.;
3. The damage is caused due to the fault and the accident factors, or misuse beyond the product performance.
4. The damage is caused without our permission to automatic upgrade and repair
5. We will not load the warranty to the non-original spare parts from us.
6. Instrument shell, files, software disk and the other gift is not in the warranty range.
7. It has exceeded the warranty date.
8. The distributor will be in charge of all their service guarantee and additional configuration.

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**Laboratory equipment co.,limited**

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