RAYDON Electronics

RA-530 Series

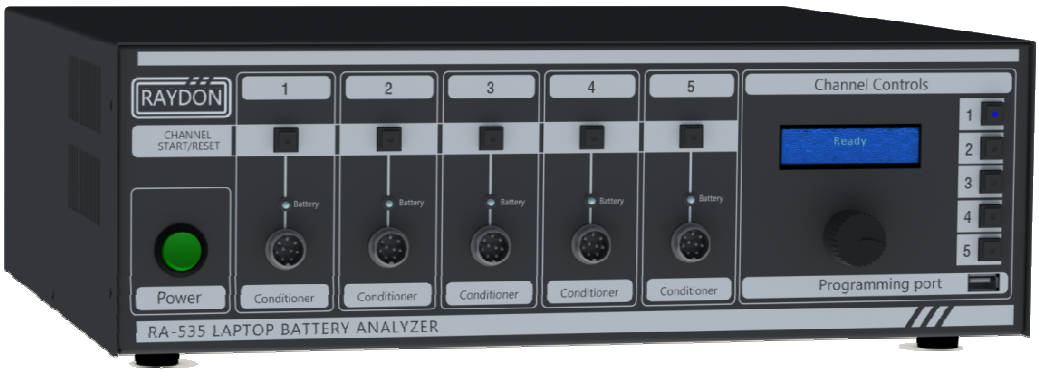
(RA-531, RA-532, RA-535)

Multi-Channel Laptop PC Battery

Charger and Re-conditioner

User Manual

V1.05



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Version Control

Version	Description	Date
V1.00	Draft, Chinese Version	18 Feb 2011
V1.01	Draft, English Version	10 Mar 2011
V1.02	Reviewed & Added Appendix for Database Download	26 Apr 2011
V1.03	Modified Battery Selection method	29 Jun 2011
V1.04	Added utilities software descriptions	14 Nov 2012
V 1.05	Added buzzer and fan controls	28 Feb 2013
V1.06	Added Search and Auto Update	20 Aug 2013

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1. Introduction

1.1. Product Description

RA-530 series (531, 532, 535) laptop battery pack analyzer is Multi-channels laptop PC battery charging and reconditioning equipment designed especially as an ideal charging station and maintenance tool for laptop PC retailers, corporate facilities, laptop repair centers and educational institutions who have a lot of batteries to maintain over the period.

Normally, users can only charge and discharge their laptop battery through the laptop. Laptop batteries also have various kind of PIN connection design that users are impossible to work on these batteries. RA-530 series (531, 532, 535) analyzer has most of the laptop battery database build-in its internal memory. It reduces the requirement of technical knowhow toward the laptop batteries.

Each RA-530 series (531, 532, 535) analyzer can store up to 1,000 set of laptop battery database and there is virtually no limitation in the battery models expansion. Latest database can be downloaded to the tester through the programming port in the front panel. This is a good protection to user's investment.

RA-530 series (531, 532, 535) analyzer contains two kinds of laptop battery testing channels:

- Charging Channel
- Reconditioning Channel

As an daily maintenance tool, the Charging channel allows the user to re-charge the stock laptop batteries over a constant period, a regular practice helps to reduce RMA over 60% as the most popular cause of laptop battery faulty is due to self discharge of prolong storage of the un-use battery.

Reconditioning channel helps to re-synchronize the laptop battery cell status with the information stored in the battery circuitry. User should perform the reconditioning of the battery in a regular base or once they find the performance of their laptop battery has drop significantly.

For standard delivery configuration, RA-530 series (531, 532, 535) analyzer provides 1, 2, 5 reconditioning channel respectively. However, flexible channel combinations and configuration can be ordered to fit different requirements. User can choose from reconditioning channel or charging channel independently to meet their needs.

Designed and produced by RAYDON Electronics who has years of experience in Laptop battery testing, The RA-530 series (531, 532, 535) analyzer provides comprehensive functions and database, and there is no matching product available in the market.

1.2. Features

- Ideal charging station and maintenance tool for laptop PC retailers, corporate facilities, laptop repair centers and educational institutions
- Stand-alone design with built-in battery database
- Completely isolated channels for separate operations at the same time
- Simple user interfaces with LCD display and dial button design, no battery knowledge is required – Just dial, select and Go!
- Multiple charging schemes, high charge or storage charge, for selected purposes
- Additional reconditioning channel for battery maintenance and improved battery performance
- Automatically activates sleeping batteries before charging or reconditioning
- Build-in simple SMBus diagnostic display allows user to determine the faulty cause and actions
- Display battery critical data when action, helps the user to monitor the testing progress
- Display individual cell voltage during testing allows user can check for cell balancing
- Each channel has its own memory to store selected Test Scheme. It allows same model of batteries to be tested under the same channel, without repeat the setting procedures.
- Build-in protection features against over-charged, under-charged, over-current and short circuit.
- Double watch-dog design (software and hardware) to ensure battery safety during charging and reconditioning.
- External Programming port allows latest database update
- Reconditioning Channel (Standard delivery):
  - Waken (combinations of small charge/discharge current to activate faulty batteries)
  - High Charge (charge battery to 93%～100%, ready to be used immediately)
  - Storage Charge (charge battery to approximately 60%, designed for safe battery storage)
  - Discharge (for over-charged battery)
  - Capacity Test (for capacity verifications)
  - Learning Cycle (for periodic maintenance)
- Charging Channel (Optional):
  - Waken Charge (apply small charge current to activate faulty batteries)
  - High Charge (charge battery to 93%～100%, ready to be used immediately)
  - Storage Charge (charge battery to approximately 60%, designed for safe battery storage)
- Provide different kinds of connectors to support most of the popular laptop battery models in the market
- Energy-saving mode enables the tester to go into sleeping mode after 3 minutes into idle stage with fan and LCD display turn off.
- User can select to turn ON or OFF the buzzer operation

1.3. Specification

SPECIFICATIONS					
			RA-535	RA-532	RA-531
					
Charge and Reconditioning	**Number of Channels**		5	2	1
	Constant Current Mode (CC)	Charge Current Range	0.01~4.99A		
		Discharge Current Range	0.01~4.99A		
		Current Resolution	5mA	5mA	10mA
		Current Accuracy	±(1%+20mA)	±(1%+20mA)	±(1.5%+30mA)
		Maximum Voltage Load	17.99V		
	Constant Voltage Mode (CV)	Voltage Output Range	0.01~17.99V	0.01~17.99V	0.01~17.99V
		Voltage Resolution	5mV	5mV	10mV
		Voltage Accuracy	±(0.5%+10mV)	±(0.5%+10mV)	±(0.8%+20mV)
		Maximum Current	4.99A		
	Capacity	Capacity Measuring Range	0~9999mAH		
		Capacity Accuracy	±(1%+20mAH)	±(1%+20mAH)	±(1.5%+30mAH)
	SMBus Support (SMR)	Numerical Parameter	Cycle Count, FCC, RSOC, Voltage, Cell Voltages		
		String Parameters	None		
		Compatibility	SMB 1.0 and 1.1		
	Timer Control	Fully Chg/Dchg max. time	4 hours		
		Condition Learning max. time	7 hours		
		Storage max time	2 hours		
		Waken max time	1 hour		
Laptop Battery Compatibility	**Battery Voltage:**		7.2 ~ 14.8 V		
	Battery Capacity:		1000 ~ 8800 mAh		
LCD Display	**Display Words:**		16 × 2		
Others	**Input :**		100 ~ 240 VAC 50 / 60 Hz		
			2 ~ 4 A	1 ~ 2 A	0.5~ 1 A
	Output :		8.4 / 12.6 / 16.8 VDC		
			5A Max.	5A Max.	4A Max.
	Max. Power Consumption :		450 W	180 W	90 W
	Working Ambiant Temperature :		0 ºC ~ 45 ºC		
	Dimensions (H x W x D) :		140 x 420 x 360 mm	110 x 290 x280mm	110 x 180 x 210 mm
	Net Weight (Approximate) :		10 Kg	5 Kg	2Kg

1.4. Testing Methodology

1.4.1. Pre-Charge

- In order to stabilize the testing battery, a pre-charge step is introduced at the start of all steps in each methodology automatically. The system will apply a small charging current (200mA) for 5 minutes.

1.4.2. Waken Charge

- Small current rate is used to charge the battery pack. It will not check for the output current since some batteries will not allow any current flow during the initial stage. The Waken Recover will be self terminated in programmed time.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Charge	CV	4V/cell	200mA	Programmed time

1.4.3. Storage Charge

- Single charge step to charge the battery pack to normal operational status.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Charge	CC	0.5 C	0.5C	Volt > 4.1V/cell

1.4.4. High Charge

- Single charge step to charge the battery pack to above 93% charged state.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Charge	CV	0.5 C	0.5C	Current < 0.02C

1.4.5. Discharge

- Single discharge step to discharge the battery pack to near empty state, user can terminate the test at any time to achieve required battery level.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Discharge	CC	0.5 C	0.5C	Volt < 3.0V/cell

1.4.6. Capacity Test

- Two steps process to fully charge and then fully discharge the battery pack with medium current rate and display the battery's capacity value at the last result display screen.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Charge	CV	4.2V/cell	0.5C	Current < 0.05C
2	Discharge	CC	0.5C	0.5C	Volt < 3.0V/cell

1.4.7. Battery Performance Recovering Cycle - Re-Learning Cycle

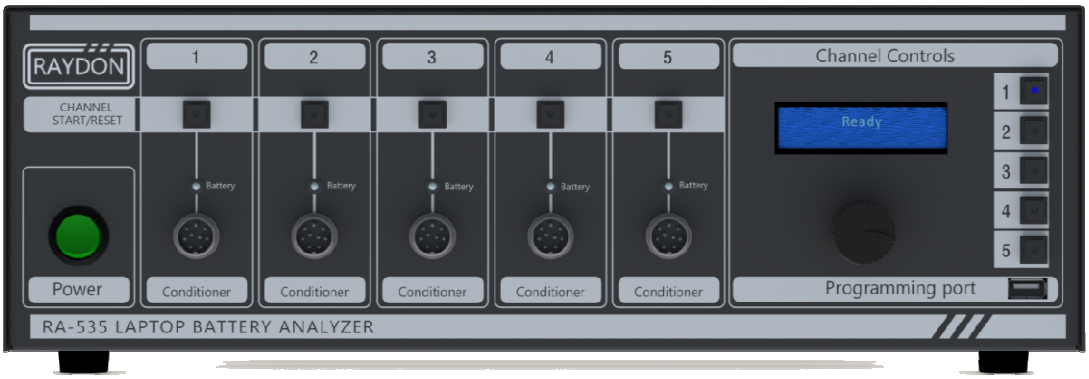
- Four steps process to re-learn the battery pack with medium current rate and update the battery's FCC value to its accurate level.
- Step description:

Step	Type	Mode	Set Value	Current Output	Terminate Conditions
1	Discharge	CC	0.5 C	0.5C	Volt < 3.0V/cell
2	Charge	CV	4.2V/cell	0.5C	Current < 0.05C
3	Discharge	CC	0.5C	0.5C	Volt < 3.0V/cell
4	Charge	CV	4.2V/cell	0.5C	Volt > 4.1V/cell

2. Hardware Introduction

2.1. Front Panel

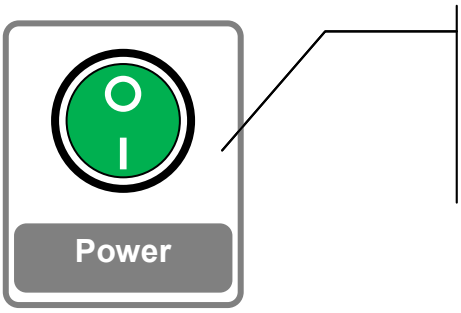
The following picture illustrates the front panel of the RA-535:



The following picture illustrates the front panel of the RA-532:

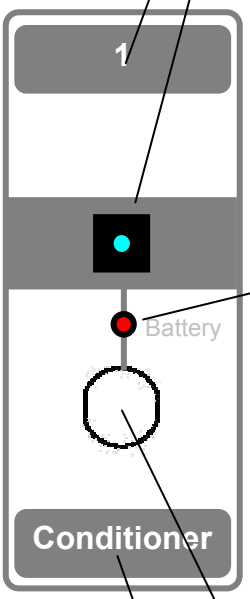
The following picture illustrates the front panel of the RA-531:

2.1.1. Power Area



ed to indicate
tester

2.1.2. Channel Operational Area



Channel Number

Channel Status LED:

1. Ready: OFF
2. Testing: ON
3. Stopped: Flash

Button Functions:

1. Press once when:
   - Ready: Start the stored procedure directly
   - Stopped: Returns to Ready State
   - Editing: N/A (When editing in the Channel Control Area)
2. Press over 3 Seconds when:
   - Testing: Stop current procedure immediately

Battery Status LED

1. Green ON: Normal battery voltage detected
2. Red ON: Any of the following errors:
   - Battery polarity error;
   - Detected sleeping Battery, Waken Charging;
   - Detected battery voltage < 1V/cell after Wakening;
   - Faulty condition during testing
3. OFF: No battery is detected

Channel Port

Only use the battery cable provided to connect the battery with the Analyzer. The cable and port are keyed. Match up the keys to ensure a proper connection.

Channel Type

Two types of Channel are available:

1. Charger
2. Conditioner

2.1.3. Channel Controls Area

Channel Selection Button (with LED)
Press respective button to select Channel for control. LED of the selected button is ON to indicate Channel is selected.
Can also be used as a cancel button during editing, press the same selected channel button, all editing will be cancelled and return to ready state.

LCD Display and Dial Button
LCD Display:

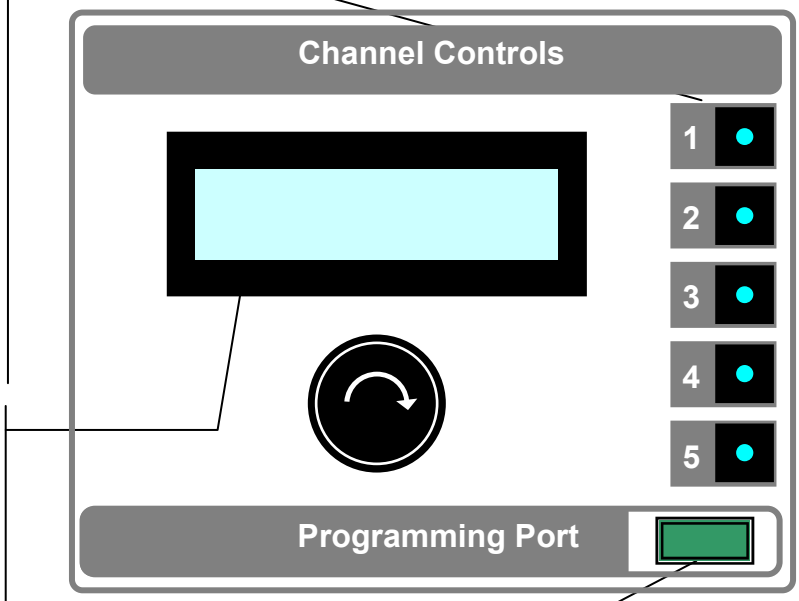
- 16 x 2 Characters
- Display selected Channel Information

Dial Button:

- Dial to change display pages
- Press to select or enter

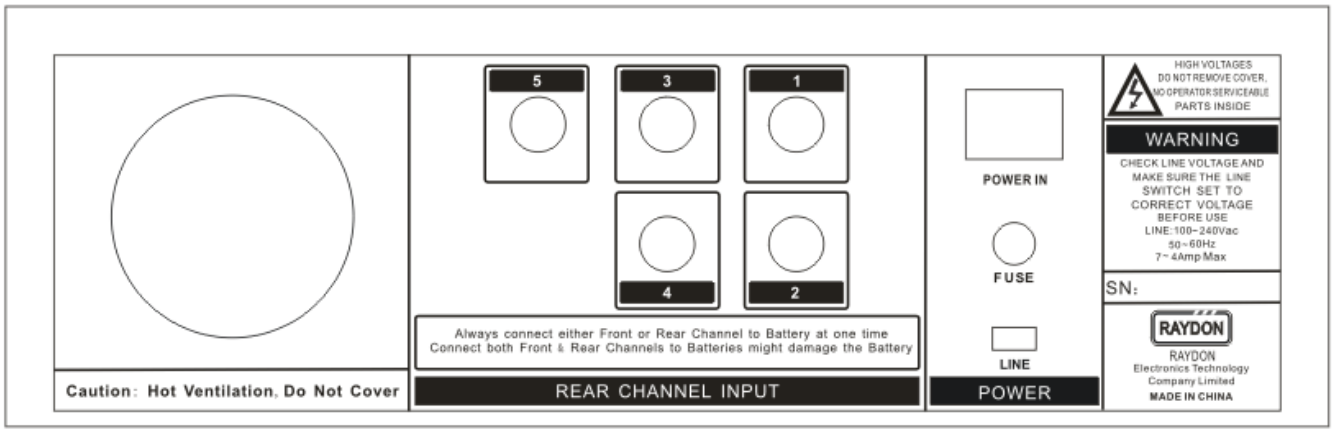
USB Programming Port
Provide connection to any Windows based computer. With provided software tools, user can:

- Extract test result information and product an instant report for future reference.
- Download/Update battery testing database from PC into tester's memory



2.2. Rear Panel

The following picture illustrates the rear panel of the RA-535



Power Section:

1 - Power Fuse

2 - Power Cable In

3 - Power Switch

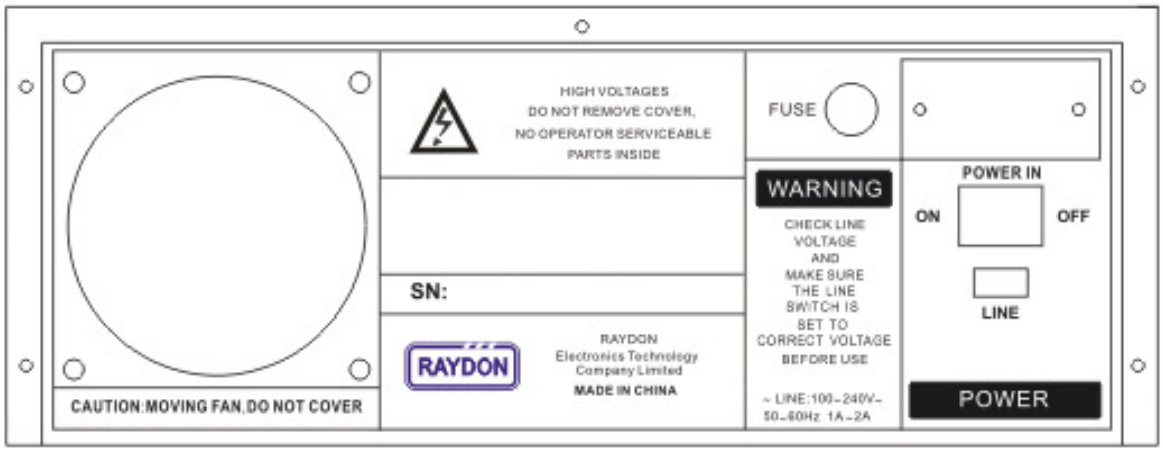
4 - Line Voltage Setting Switch

Exhaust Fan Section:

5 - Exhaust Fan Outlet

6 - Rear Panel Channel Ports (Optional, disabled in standard delivery. Please contact our sales representative)

The following picture illustrates the rear panel of the RA-532



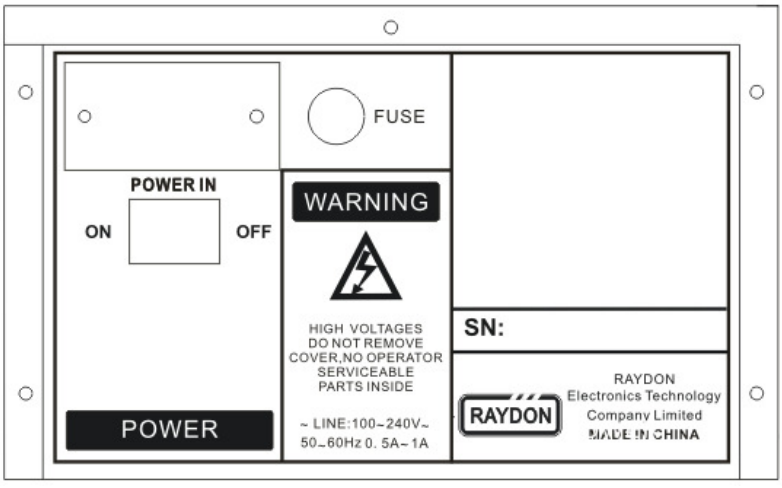
Power Section:

1 - Power Fuse
2 - Power Cable In
3 - Power Switch
4 - Line Voltage Setting Switch

Exhaust Fan Section:

5 - Exhaust Fan Outlet

The following picture illustrates the rear panel of the RA-531



Power Section:

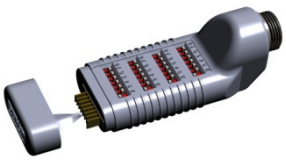
1 - Power Fuse
2 - Power Cable In
3 - Power Switch

2.3. Accessories

The following accessories are included in the standard package:

Description	QTY	Pictures
• Power Cable	1	
• Standard Testing Cables for RA-535	5	
• Standard Testing Cables for RA-532	2	
• Standard Testing Cables for RA-531	1	
• PC communications:		
■ USB A to A Communications Cable		
■ Installation CD		
• User Manual	1	
• Calibration Report	1	

The following Accessories are optional, user can order according to their needs:

Optional Accessories	Pictures
• RD series Battery Connectors	
• RM series Universal Connectors	

2.4. Hardware Installation and Start up

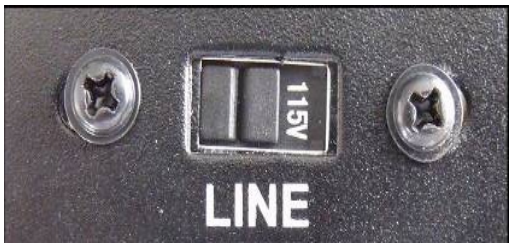
2.4.1. Power Connections

Follow the steps below to power up the RA-530 series analyzer:

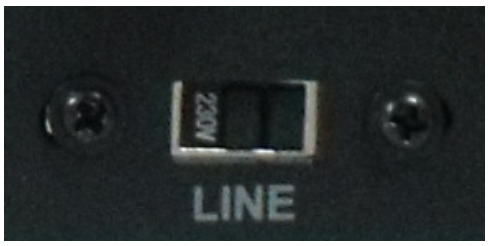
1. Before plugging in the power cable of the analyzer, be sure that the Power Switch in the front Panel is set as OFF.

2. Due to different Line Voltage supplies in different countries, Users must adjust the "Line Voltages Setting Switch" accordingly. Please make sure the line switch is set according to the Line Voltage:

Line Voltage: 100Vac to 120Vac
Please select 115V Setting



Line Voltage: 200Vac to 240Vac
Please select 230V Setting



3. Plug in the Power Cable provided in the package.

4. Double check the Line Voltage setting before turn on the Power Switch.

2.4.2. Power ON

After connected the Line Power and adjusted the “Line Voltages Setting Switch”, user may now turn on the Power Switch located at the left hand side of the front panel. Please make sure that there is no battery connected to any of the channel before turning on the power.

of the channel

When the power is ON, LED in the green Power Switch will turn on to indicate the power is ON.

At this time check the all other LEDs on the front panel should be OFF, except Channel Selection Button for Channel #1, which indicates channel 1 is selected as default. BTI-850B should go through an initialization stage, at this stage, the LCD display will show as following:

READY

When it is done, the LCD display will show the status of Channel #1 on its screen. Check Section 3.2 for further operations.

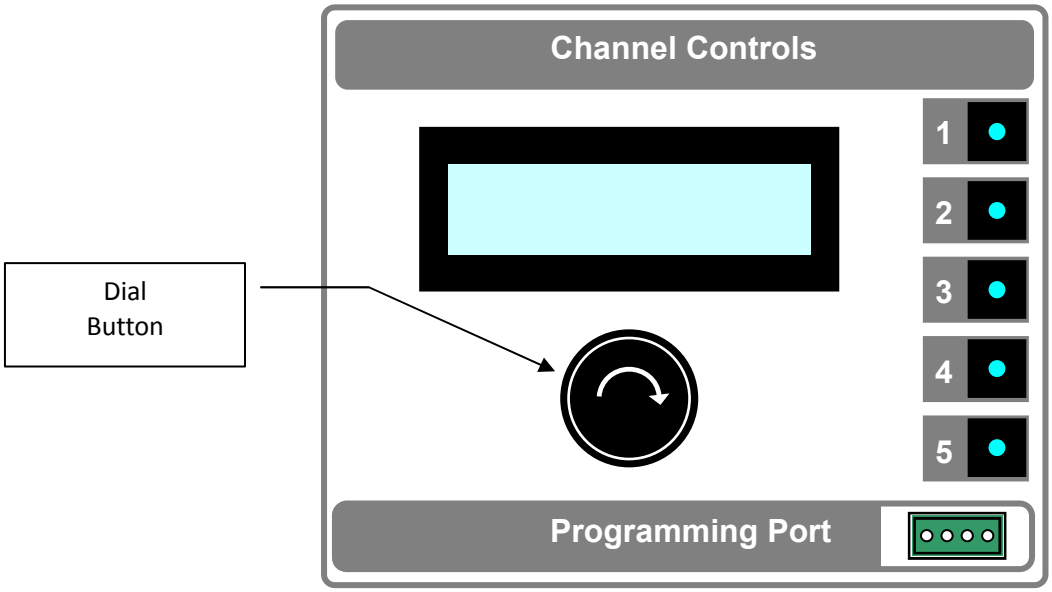
he power OFF and
·icity technical
this will happen

3. Operation Guide

3.1. Introduction to Button Controls

3.1.1. Dial Button

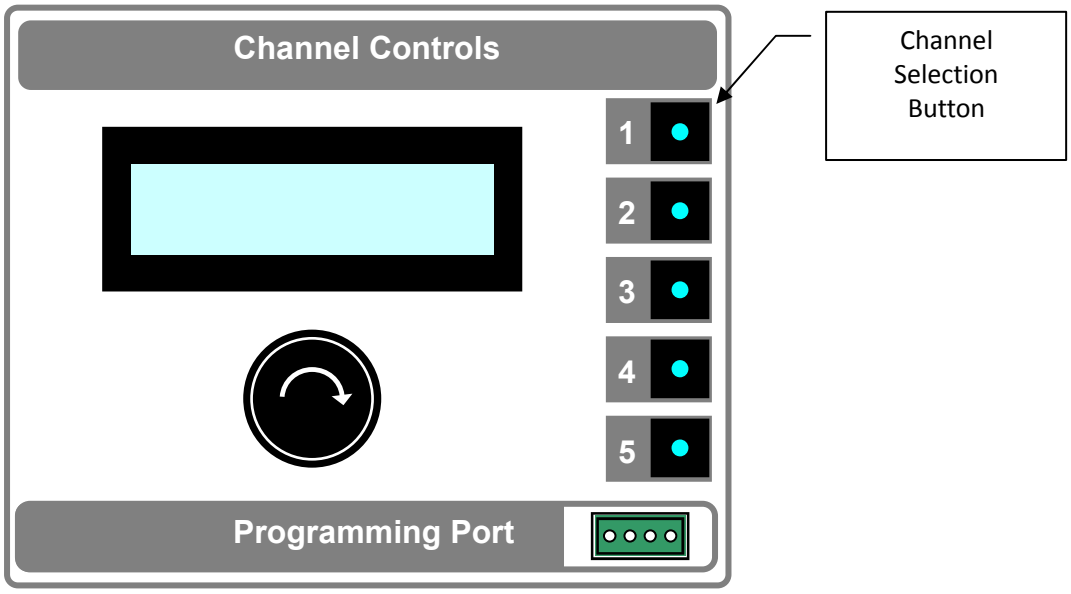
Digital Dial Button is located at the centre of the Channel Control Area. It integrates item cursor controls and entry selection in one device. User can dial up or down to display the select entries or page information on the LCD display. All operations can be simplified into three actions:



- Clockwise Rotation ↻: Menu Operation: Control cursor downward for menu entries selection
  Testing Status: Show next page information
- Anti-clockwise Rotation ↻: Menu Operation: Control cursor upward for menu entries selection
  Testing Status: Show previous page information
- Press ⇩ : Menu Operation: Select menu entry or confirm action
  Buzzer Control: Turn buzzer ON/OFF (Press for 3 Seconds)

3.1.2. Channel Selection Buttons

Channel Selection Buttons locate by the side of the LCD Display and each button has a number to indicate the according channel. A total of 5 Channel Selection Buttons are installed to represent the 5 available channels. When any of the buttons is pressed, the LCD Display will show the channel information in respected to the channel number and the Dial Button will be dedicated to the selected channel.

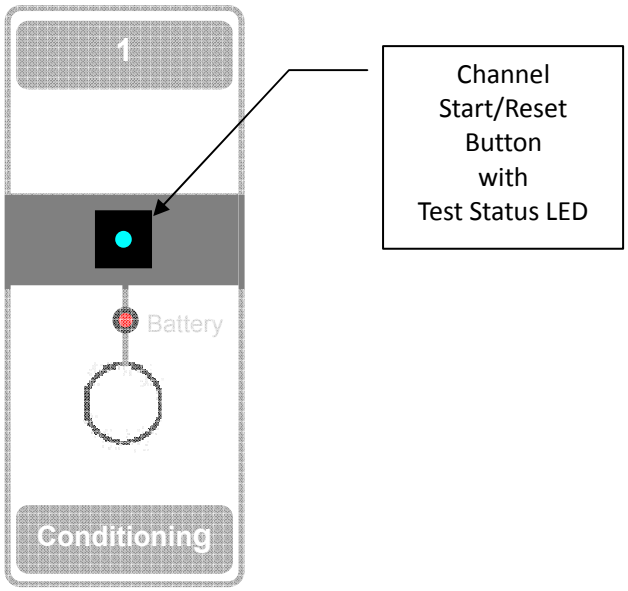


All Channel Selection Buttons have build-in LED to indicate the selected channel. User can use these buttons to switch controls among all 5 channels in the equipment.

The Channel Selection Buttons are also designed as CANCEL button to any dial button operation for that specific channel. When press the same channel button during the operation, the channel will exit from the operation and return to READY state.

3.1.3. Channel Start/Reset Button

On each channel area, there is another control button with build-in LED indication. The Channel Start/Reset Button allows user to start the recorded operation immediately without going through the menu selection again. It also allows the user to stop or reset a running channel in quick time. This button on each channel simplifies the operation when user has to perform same test scheme to a number of batteries in same type.



Test Status LED (Blue):

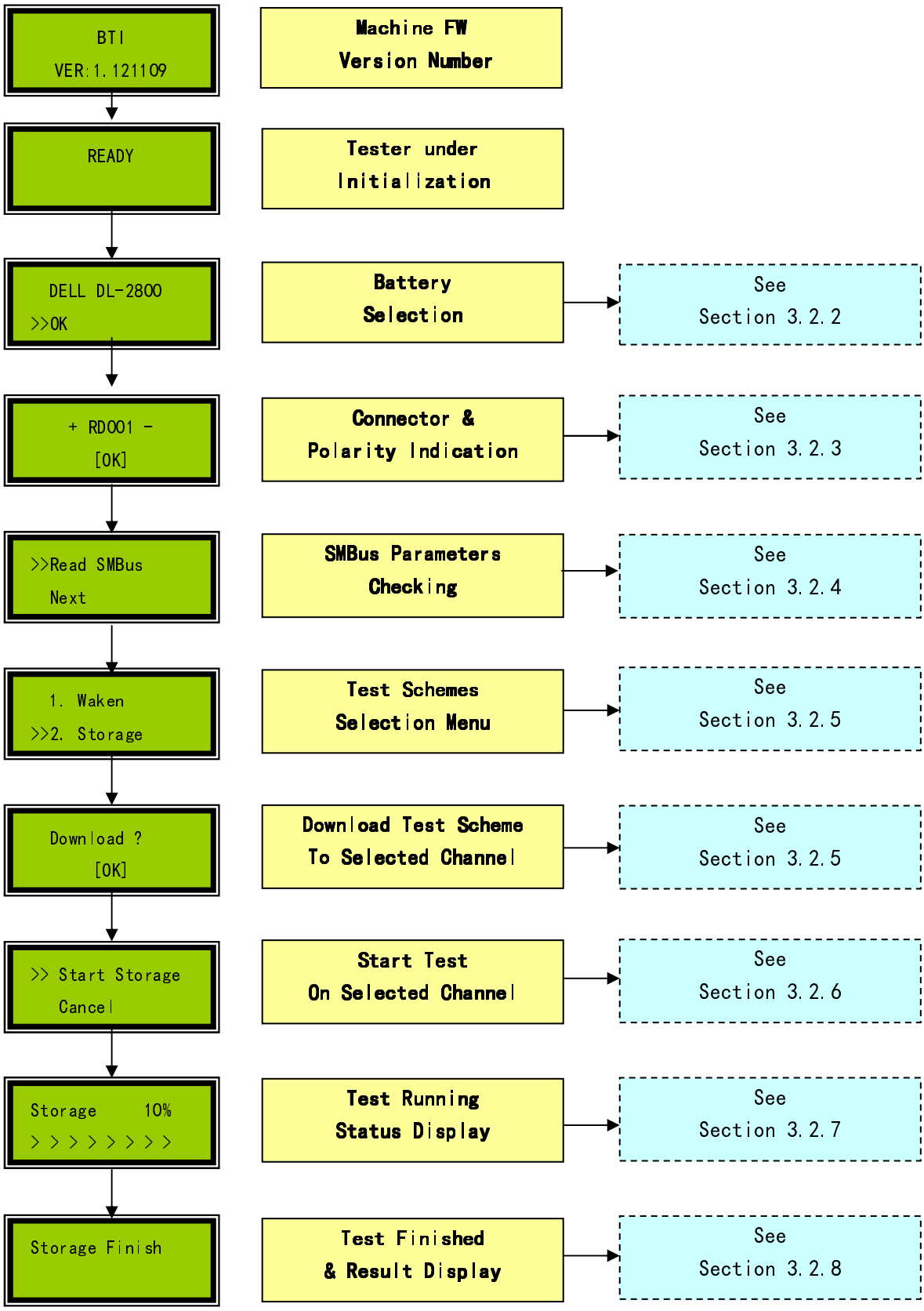
1. Ready: OFF
2. Testing: ON
3. Stopped: Flash

Button Functions:

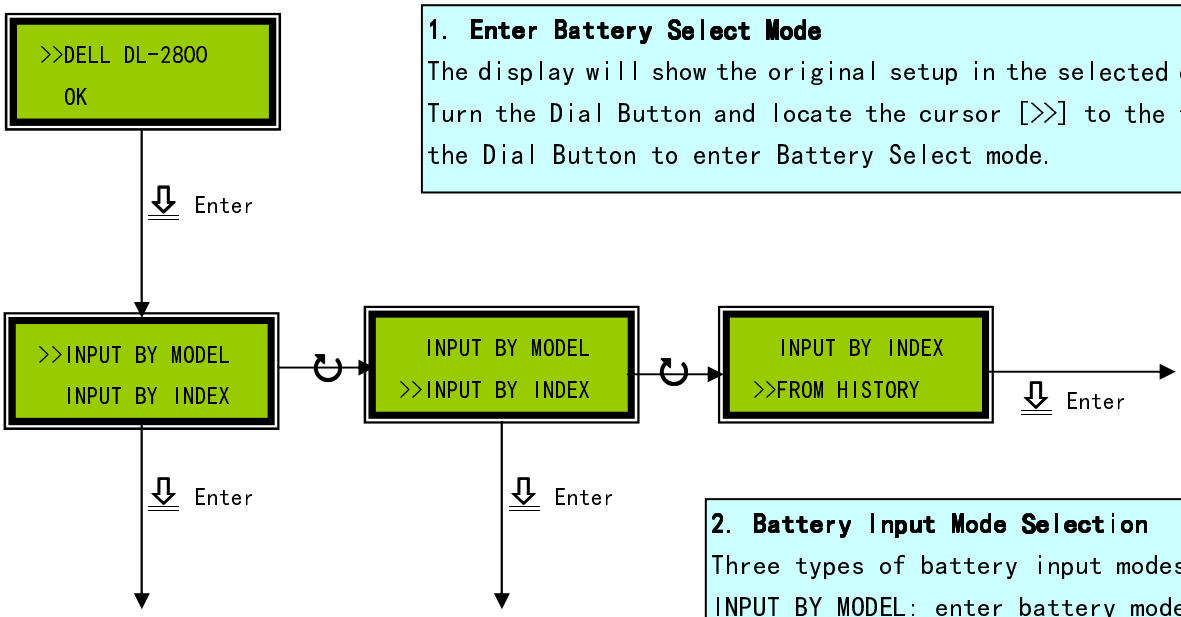
1. Press once when:
   - Ready: Start the stored procedure directly
   - Stopped: Returns to Ready State
   - Editing: N/A (When editing in the Channel Control Area)
2. Press over 3 Seconds when:
   - Testing: Stop current procedure immediately

3.2. Channel Operations

3.2.1. Overview



3.2.2. Battery Selection



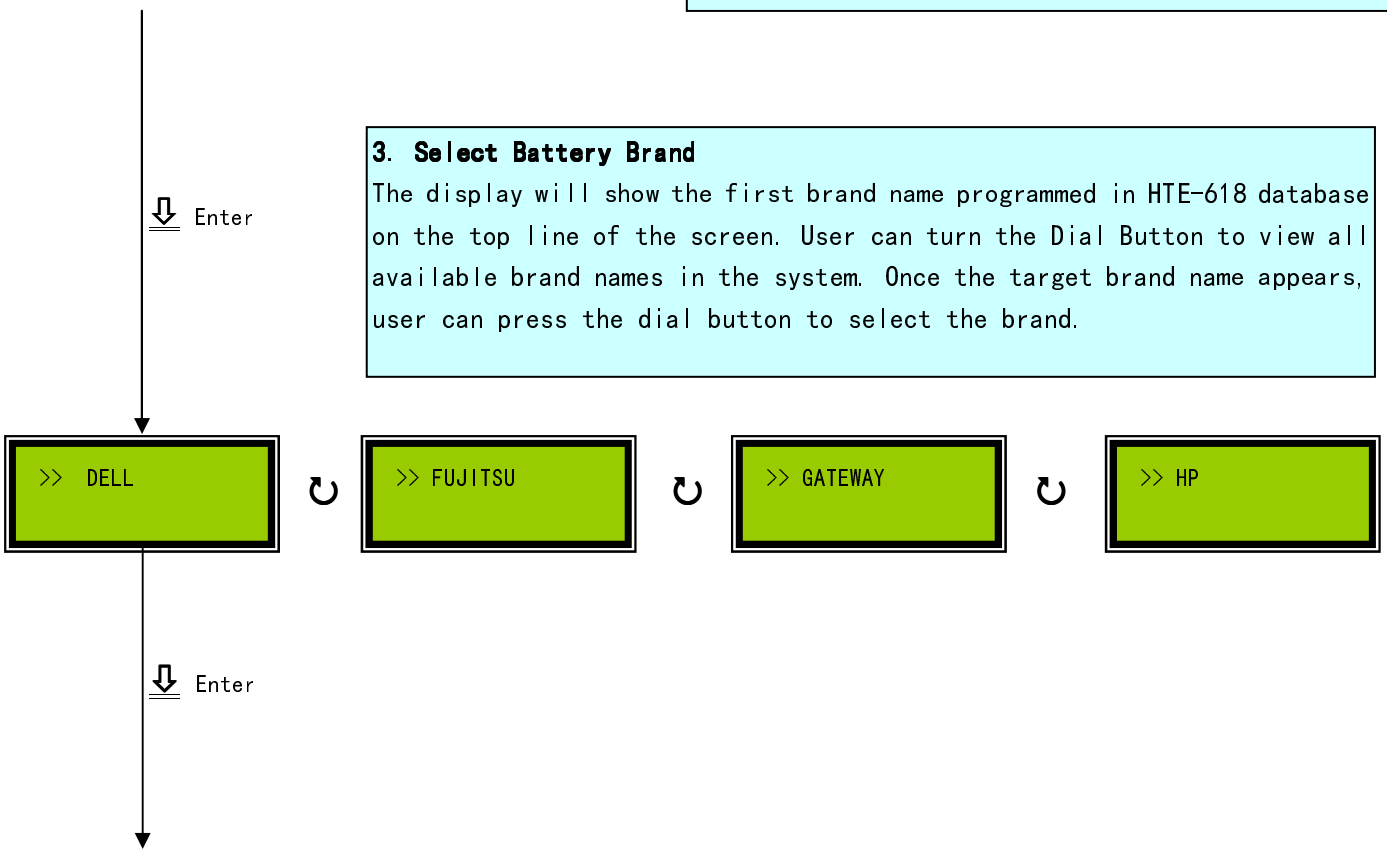
1. Enter Battery Select Mode

The display will show the original setup in the selected channel initially. Turn the Dial Button and locate the cursor [>>] to the top line and press the Dial Button to enter Battery Select mode.

2. Battery Input Mode Selection

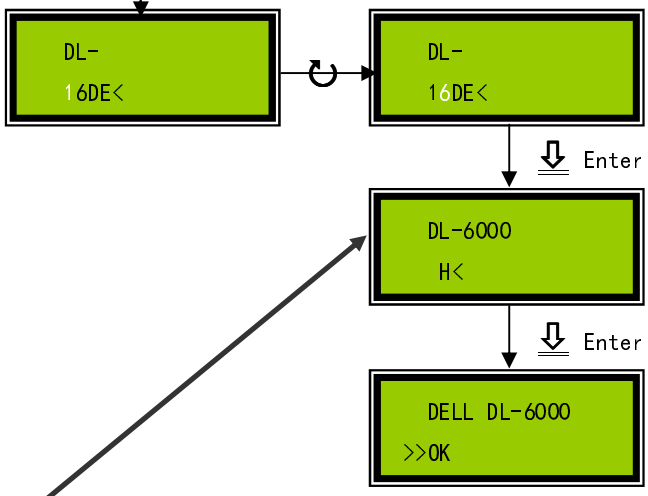
Three types of battery input modes are available:
INPUT BY MODEL: enter battery model number
INPUT BY INDEX: enter RAYDON specified ID number
FROM HISTORY: select previous 10 model records
Note: RAYDON will provide ID reference table

3.2.3. Input by Model



3. Select Battery Brand

The display will show the first brand name programmed in HTE-618 database on the top line of the screen. User can turn the Dial Button to view all available brand names in the system. Once the target brand name appears, user can press the dial button to select the brand.



3.1. Battery Model Input

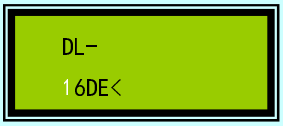
When Model Input is selected, LCD displays two lines:

- First line shows the selected characters;
- Second line shows all available characters for next character selection. When there is only one character available, the system will automatically select the character and show the next selection.

Example: If the following models are available for DELL:

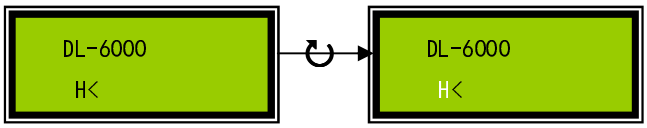
DL-1300	DL-D410
DL-1520H	DL-D420
DL-6000	DL-D820
DL-6000H	DL-D820H
DL-D400	DL-E6400H

Since the first 3 characters are【DL-】, the system will show【DL-】in the 1st line without any user input, so the display will become:



3.2. Confirm Battery Model Number

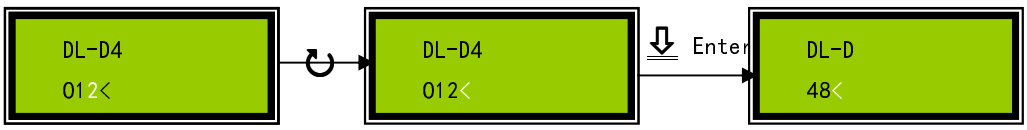
The cursor will be placed on the second line with an "OK". User press the Dial Button to confirm the selection.



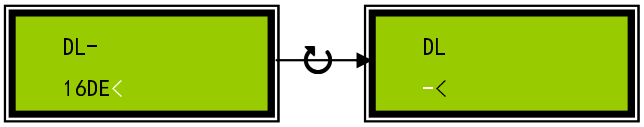
Second Line Character Display		
#1		" " for DL-6000
#2	H	"H" for DL-6000H
#3	<	Backspace

"<" Character: Backspace

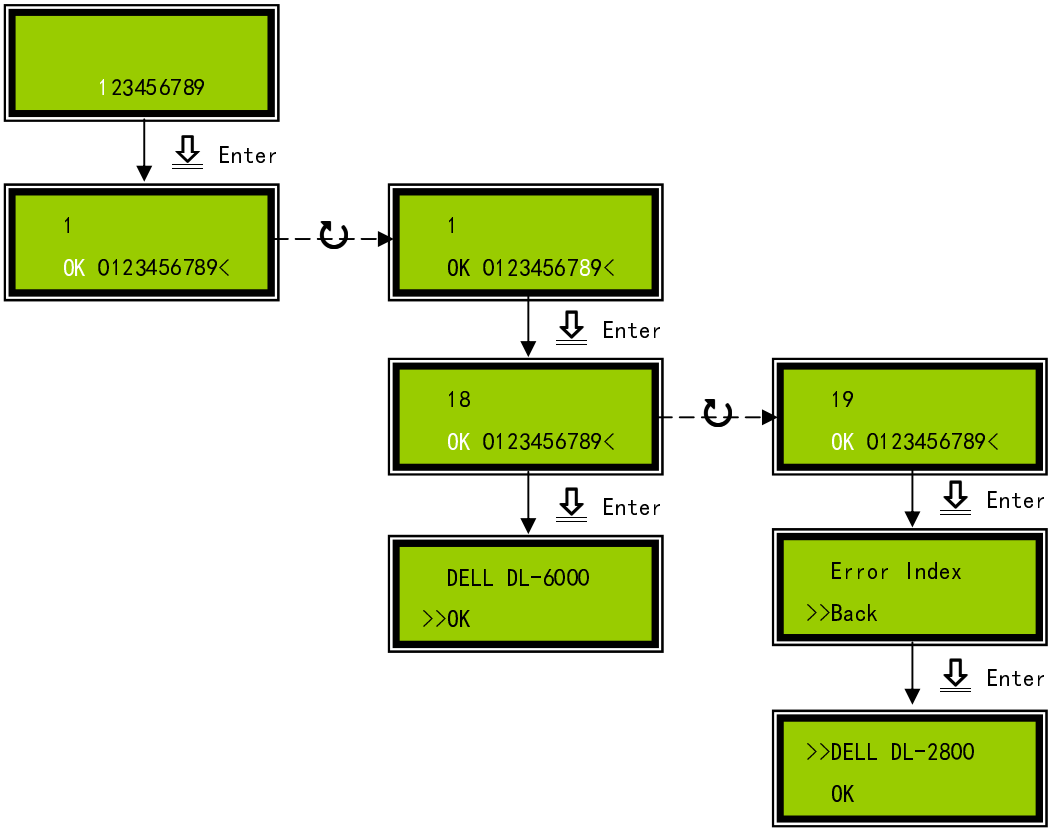
At the end of each line, there is a【<】, which is used to delete the last entered character:



When a character is deleted, system return to last character selection and cursor stay at【<】.



3.2.4. Input by Index



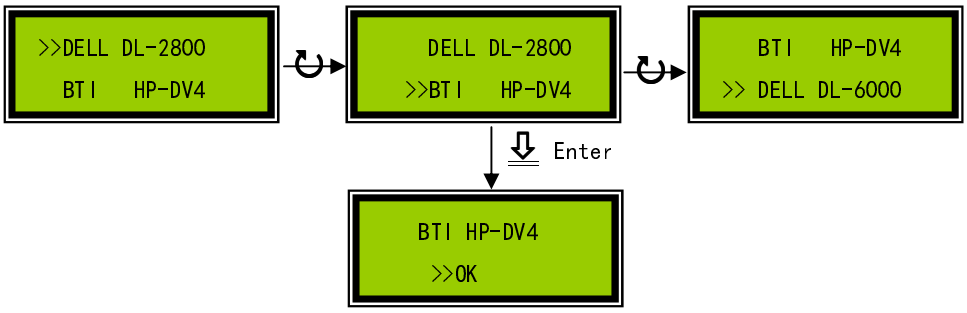
4. Battery Index Input

User can select battery model by enter the index number directly without selecting the brand and model number. User must refer to ID reference table provided by RAYDON for designated customer in the User Manual. The format of the table will appear as:

Brand	Model	Index
HP	HP-DV4	1
DELL	DL-D620X3	2
HP	HP-NC6200	3
TOSHIBA	TS-A80/85M	4
ACER	AR-AS4315	5
DELL	DL-D600	6
SONY	SY-TX	7
GATEWAY	GT-M150	8
…	…	…
DELL	DL-6000	18

Note: Backspace 【<】 is also available for user to correct their input error. When wrong index is entered, the screen will show 【Error Index】, user press dial button returning to Ready.

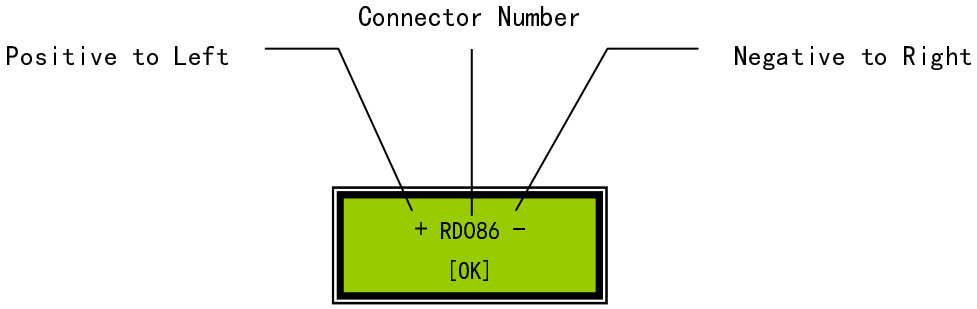
3.2.5. Select by "From History"



4. **Select battery model "From History"**
   User can select battery model from previous testing history. This allows the user to repeat their testing in the same and different channel without re-enter the models information again. The system will store most recent 10 selected models in its memory.

3.2.6. Connector & Polarity Indication

Once the battery model name is selected, the system will search for the suitable connector from its database and display the connector information on the next screen display. The connector information includes the Connector number and its polarity information.



1. Determine the Left/Right direction of the battery pack
   Always have the battery label face up and the connector PIN face the user:

2. Select Connector
   As indicated in the LCD display, select the connector accordingly, e.g. RD086.

All connectors will have labels on both sides of the surface. These labels show the Connector Number and also the design positive and negative locations of the connector.

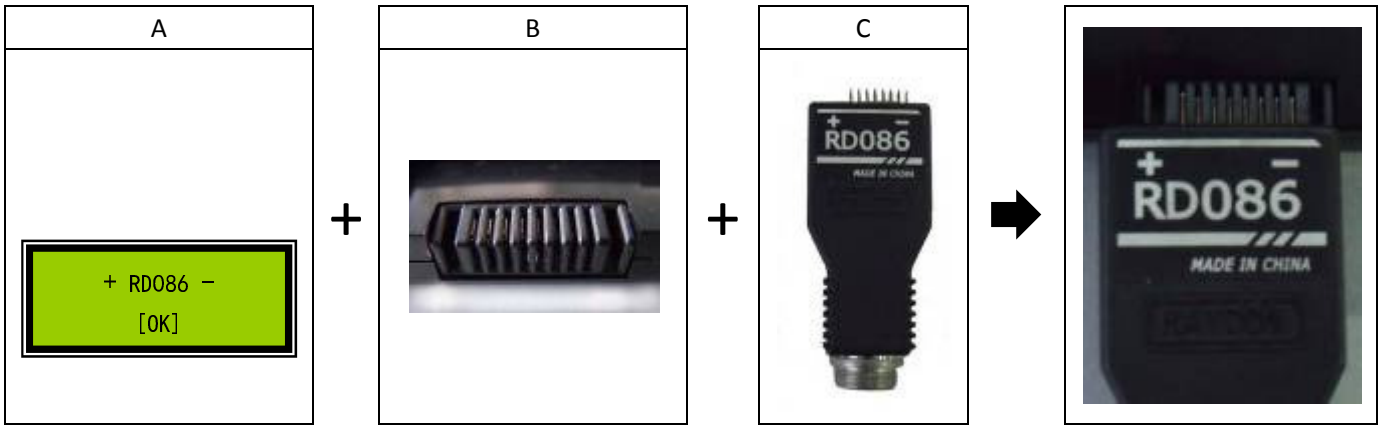
3. Plug in the connector in correct polarity

   Now user has:

   A. The information of the polarity relation between the Connector and the battery from the LCD display

   B. Turn the battery pack according to instruction above and have the connector PIN in correct direction

   C. Check the label for the positive and negative location of the connector

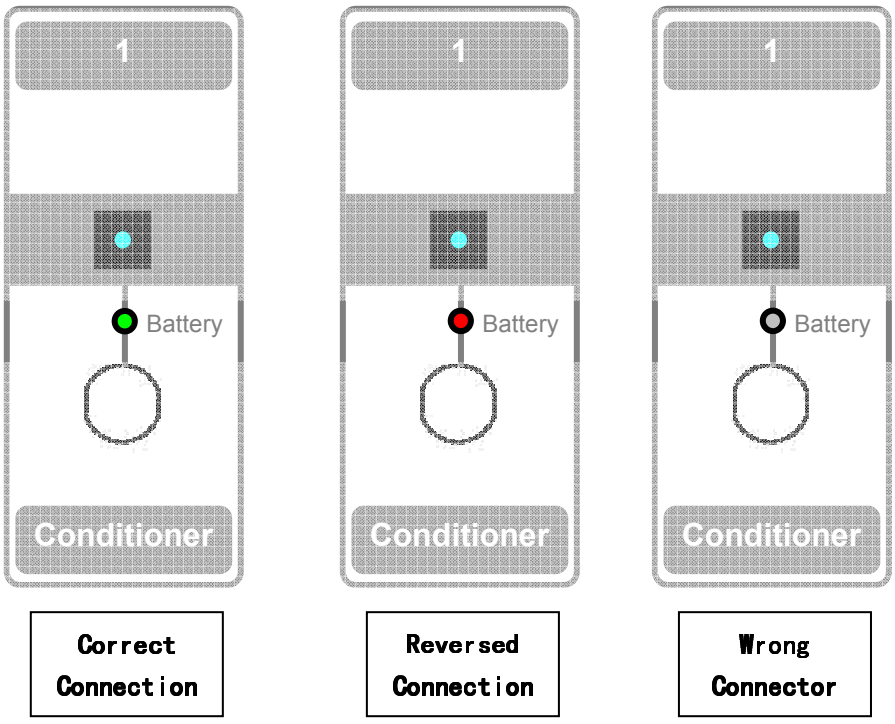


User should be able to plug in the connector and make the correct connection between the channel and the battery pack.

4. After connected the battery pack with the channel, verify the connection with the Battery Status LED:

   - Green ON: Connection correct and battery voltage detected
   - Red ON: Reverse polarity is detected, try to reverse the connector direction
   - OFF: No voltage detected, might used a wrong connector, double check the step 1 ~ 3 above. If the steps are correct, user might encounter a faulty battery. Proceed with the test as show below.

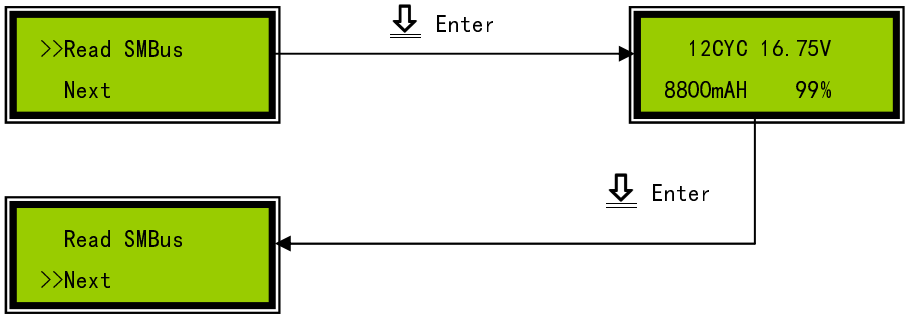
.



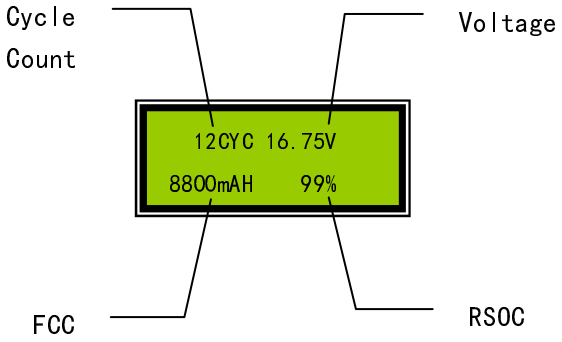
3.2.7. SMBus Parameters Checking

After connected the battery pack to the selected channel, press the Dial Button to proceed with next display screen, “Read SMBus”.

Other then the periodically maintenance to the battery, which might just require a simple re-charge in order to get the battery ready for future usage, sometimes users might encounter some faulty batteries and need to determine what action should be taken to recover the batteries. The purpose of the SMBus read function is to allow the user to check on the selected SMBus register parameters, understand the status of the battery pack and determine what action should be taken.



BTI-850B has selected four SMBus Register values for the users to review:



These SMBus Register values will indicate the status of the battery; they are (as defined by SMBus Datasheet):

- **Cycle Count:** Represent the number of cycles the battery has experienced. A cycle is defined as: An amount of discharge approximately equal to the value of Design Capacity.
- **Voltage:** Represent the battery voltage.
- **Full Charge Capacity (FCC):** Returns the predicted pack capacity when it is fully charged. FCC value is expressed in either current mAh or power 10mWh at 0.2C discharge rate.
- **Relative State of Charge (RSOC):** Returns the predicted remaining battery capacity expressed as a percentage of Full Charge Capacity (%).

SMBus read value diagnostic:

Item	Range	Reference to	Level		
			Low	Normal	High
Cycle Count (CYC)	0 ~ 500		0	1 ~ 250	> 250
Voltage (V)	0 ~ 20	Label Voltage: 7.2 / 7.4V	< 7.0V	7.0V ~ 8.2V	> 8.2V
		Label Voltage: 10.8 / 11.1V	< 10.5V	10.5V ~ 12.3V	> 12.3V
		Label Voltage: 14.4 / 14.8V	< 14V	14V ~ 16.4V	>16.4V
FCC (mAh/Wh)	0 ~ 18000	Percentage to Label Capacity	<70%	70% ~ 100%	NA
RSOC (%)	0 ~ 100		< 20%	20% ~ 80%	> 80%

The above table helps to define these SMBus Register values into 3 Levels. Once sort out the levels of these values, the following table suggests action to be taken for abnormal situations:

Item	Level		Action Suggested	Description
	Low	High		
Cycle Count (CYC)	√		Learning	Cycle count equal to zero suggested that the battery has not been properly learned during the production process. Although most of the latest SMBus Gas Gauge IC has eliminated the requirement for Learning as the initial RM and RSOC are estimated using the open-circuit voltage (OCV) characteristics of the programmed Li-ion chemistry. However, battery capacity learning is still required in order to find the accurate FCC, RM and RSOC. Therefore, learning is suggested in order to reduce problems when the battery is operated in the Laptop.
Cycle Count (CYC)		√	Learning	Learning is suggested in order to gain more working hours from the battery pack. The battery can still be operated normally, however it represents the battery should be replaced for its age and it can no longer supports the normal usage of the laptop operations.
Voltage (V)	√		Charge	The battery voltage has exceeded the safety high/low limit, it is recommended to Discharge/Charge the battery back to normal operational voltage. When the battery is too low and the Battery LED light OFF, it is suggested to use waken charge to recover the battery before any test.
		√	Discharge	

Item	Level		Action Suggested	Description
	Low	High		
FCC (mAh/Wh)	√		Learning	FCC represents the last measured capacity during a full discharge of the battery. Initially Full Charge Capacity should equal to the Design Capacity and it is modified over the course of pack usage to reflect cell aging under the particular use conditions. The FCC value has dropped to under 30% of the Design Capacity. User can try to re-learn the battery to gain more performance but it is recommended to replace the pack in order to maintain the performance of the Laptop.
RSOC (%)	√		Charge	The battery remaining capacity has exceeded the usage high/low limit. It is recommended to Discharge/Charge the battery back to normal operational capacity. When the battery is too low and the Battery LED light OFF, it is suggested to use waken charge to recover the battery before any test.
RSOC (%)		√	Discharge	
Voltage Vs RSOC (%)	**Not at the same Level**		Learning	Voltage and RSOC both represent the level of capacity in the battery pack. Voltage is the physical measurement while the RSOC is a calculated by the SMBus Gas Gauge IC. Over a long period of usage or when the battery is not properly learned, these two values might not be synchronized. The result of this might cause the reduction of working hours of the battery. Learning is suggested to re-synchronize these two parameters and improve the performance of the battery.
N/A appears in all read values field	√		Wakening	If N/A appears in all read values field, it is suggested that the user to check if the connection is correct. Otherwise user should use the wakening to recover the faulty battery.

Notices: Out of Range, all SMBus Register values will have their own physical range, if the read values are out of the defined range, the system will display N/A to the according field.

3.2.8. Test Schemes Selection Menu

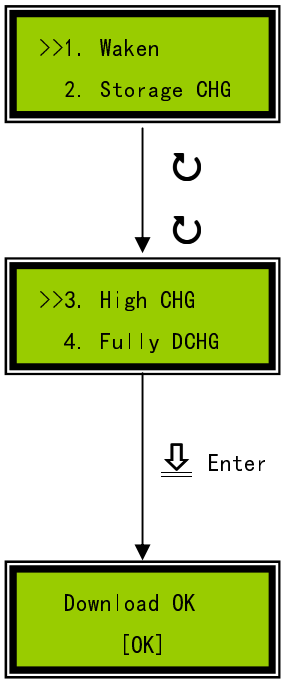
When the action scheme is decided, user can move the cursor ">>" to the "Next" entry on the SMBus Parameters Checking screen and continue with Test Scheme Selection Menu. There are two different types of channels provided by the BTI-850B. They are the Charging Channel and the Reconditioning Channel. Since the Charging Channel does not have the discharge function, the Test Schemes provided by these two types of channel will not be the same.

Entries available in Charging Channel:

1. Waken - Waken charge (see section 1.4.2 for details)
2. Storage CHG - Storage Charge (See Section 1.4.3 for details)
3. High CHG - High Charge (See Section 1.4.4 for details)
4. Cancel

Entries available in Reconditioning Channel:

1. Waken - Waken (see section 1.4.2 for details)
2. Storage CHG - Storage Charge (See Section 1.4.3 for details)
3. High CHG - High Charge (See Section 1.4.4 for details)
4. Fully DCHG - Fully Discharge (See Section 1.4.5 for details)
5. Capacity - Battery Capacity Test (See Section 1.4.6 for details)
6. Learning - Learning Cycle (See Section 1.4.7 for details)
7. Cancel



1. View Available Test Schemes

User can use the Dial Button to move the cursor ">>" up and down to view and select the available entries in different channels.

2. Select Test Scheme

Once the test scheme is located, user can press the Dial Button to select the action scheme.

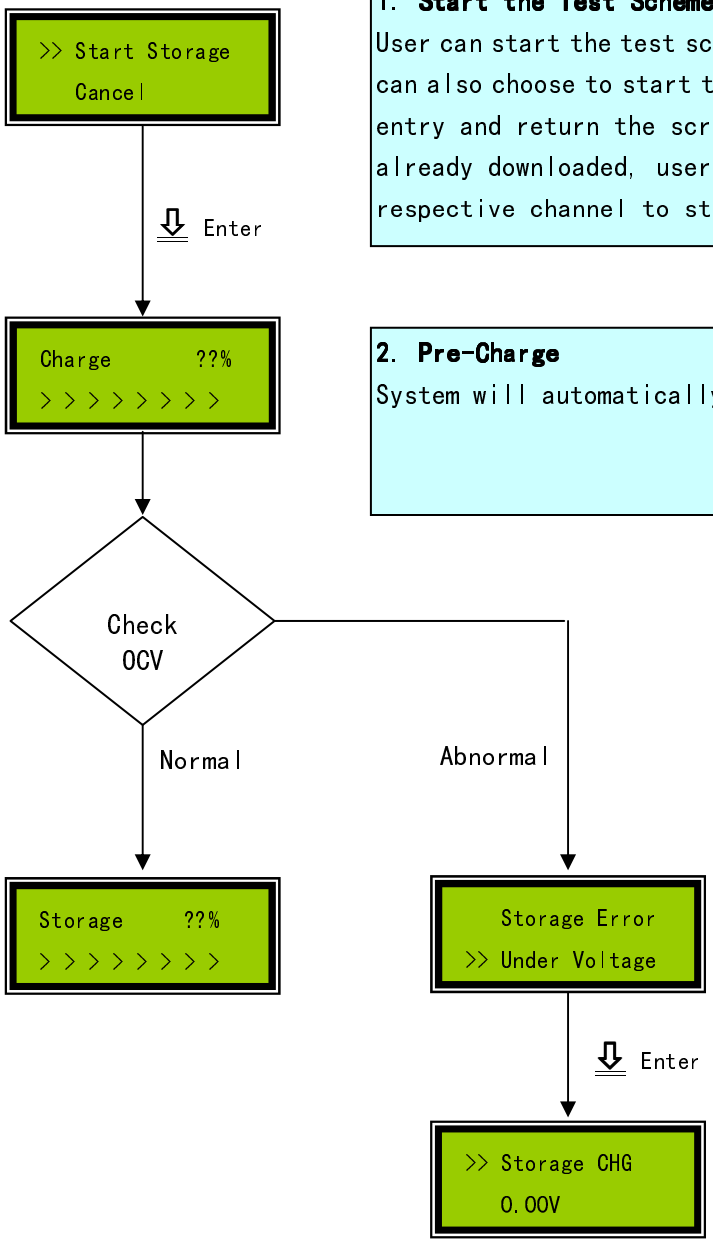
3. Download Selected Test Scheme

Each channel in RA-530 has its own memory to store Test Scheme. After the test scheme is selected for the channel, the new scheme will be required to download to the respective channel before it can be carried out.

The Test Scheme will be stored into the channel, so it allows same model of batteries to be tested under the same channel, without repeat the setting procedures. User can just press the Channel Control Button to re-start a new test when the Channel is in READY state.

3.2.9. Start Test with automatic Pre- Charge

Once the Test Scheme is downloaded to the channel, the channel is ready to start the test.



1. Start the Test Scheme now or later

User can start the test scheme immediately by pressing the Dial Button. User can also choose to start the test later by shifting the cursor to "Cancel" entry and return the screen to the main menu. Since the Test Scheme had already downloaded, user can use the Channel Control Button from the respective channel to start the test at later time.

2. Pre-Charge

System will automatically start the pre-charge to stabilize the battery.

3. Successful Pre-Charge

Pre-Charge will run for 5 minutes with small charging current to stabilize the testing battery. When the pre-charge is finished, it will resume the selected test scheme.

4. Unsuccessful Pre-Charge

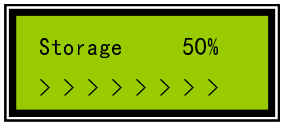
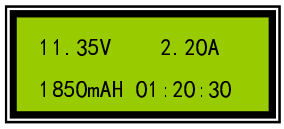
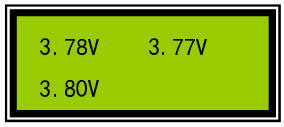
If the voltage of the battery cannot be recovered, the system will self declare an "Error".

User can press the Dial Button to see the reason of error or select to cancel the test and return back to the Main Menu.

3.2.10. Testing Status Displays

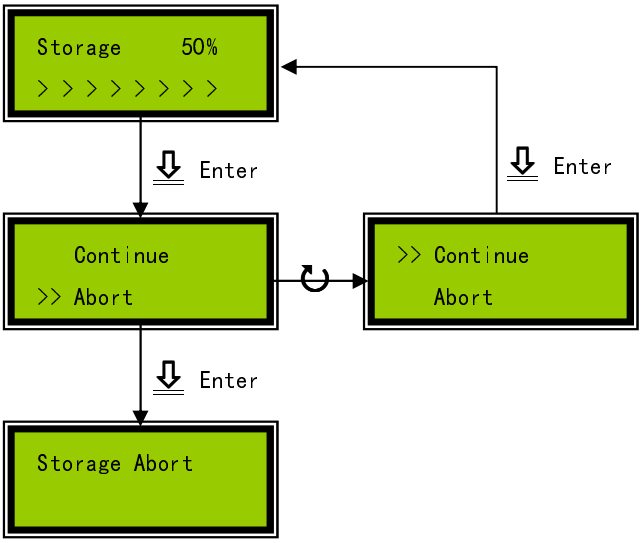
1. Checking Test Status Parameters:

When the test is running, the system provides three pages of status display for the user to view during the course. User can use the Dial Button to toggle amount these three pages and view the progress of current running test scheme. These three pages of information are:

Page	Name	Display Sample	Information Shown	Description
1	Scheme Name and Progress		• Scheme running • RSOC from SMBus • Step Action: Charging: >>>>>> Discharging: <<<<<<	Shows the current testing scheme and step taken. RSOC shows the level of charge, an indication of the charge or discharge progress.
2	Real Time Battery Step Data		• Battery Voltage (V) • Applied Current (A) • Step Capacity (mAh or Wh) • Step Time (HH:MM:SS)	Shows the real time value of the Battery voltage and applied Current. Also provides the Step capacity so far and the step running time. User should check this page to see if the step runs normally.
3	Cell Voltages		• Individual Cell Voltages (3 to 4 cells, according to the battery pack configurations)	Cell voltages for each series are a good indication for Cell Balancing. User should monitor these values constantly, especially near the end of each Discharge step, to see if large cell imbalance is occurred. Cell imbalance is known to reduce the whole pack performance. Maximum voltage difference among individual cell > 0.2V is considered as imbalance.

2. Abort a running Test:

Instead of running the whole test and check the result, user can select to abort a running test by:



1. Abort a running Test

On the Test Status display, press the Dial Button. This will trigger the channel to abort the running test.

2. Cancel Abort

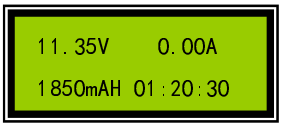
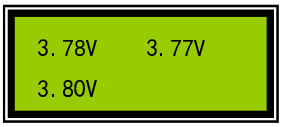
User can cancel the Abort instruction by moving the cursor to "Continue" entry and press the Dial Button, the channel will return to the Test Status display.

3. Confirm Abort

The display will ask the user to confirm if the Abort decision is true. During the period of waiting user input, the test will continue running. User press the Dial Button to confirm the Abort action.

3.2.11. Test Finish and Result Display

When the test finished in a Channel, the system will also provide three pages of result display for the user to check. User can use the Dial Button to toggle amount these three pages and view the progress of current running test scheme. These three pages of information are:

Page	Name	Display Sample	Information Shown	Description
1	Finish Display		NONE	
2	Last Step Data		• Real Time Battery Voltage (V) • Applied Current (A) = 0 • Last Step Capacity (mAh or Wh) • Last Step Time (HH:MM:SS)	Shows the real time value of the Battery voltage. Also provides the Last Step capacity and step running time. User should check this page to see if the step finished normally.
3	Cell Voltages		• Real Time Individual Cell Voltages (3 to 4 cells, according to the battery pack configurations)	Maximum voltage difference among individual cell > 0.2V is considered as imbalance.

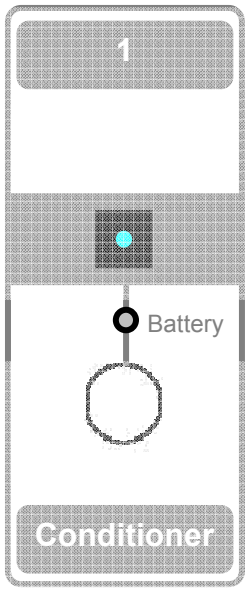
After finish all inspection, user can press the Dial Button again to allow the screen to go back to the Channel Main Menu.

4. Trouble Shooting

4.1. Battery LED OFF

After connected the battery pack and connector to a specific channel, the battery Status LED is OFF:

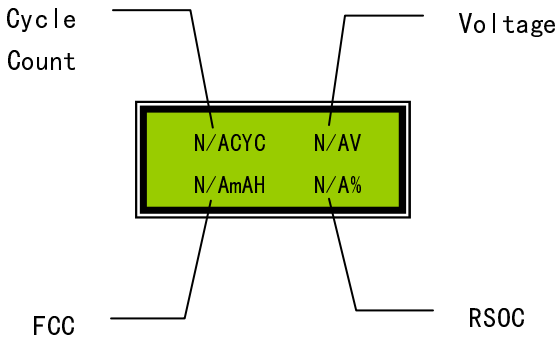
1. Check the entry of the battery model name again from the Main Menu, if error in the entry, re-enter the battery model name;
2. Check the connector number with the LCD display again, replace a correct connector is wrong;
3. Check polarity of the battery with the connector again, re-connect the connector according to the LCD display;
4. Check the contacts between the connector and the battery, some batteries have smaller contact points that some PIN in the connector might not make the full contact.
5. Battery might entered sleep mode, select waken charge scheme and start the test. The system will activate a waken charge automatically to recover the sleeping battery.
6. If waken charge failed, there is not much we can do about the battery, return the battery for RMA



4.2. SMBus Read N/A

All values are displayed as N/A when user tried to read SMBus from the SMBus checking interfaces. The N/A values represent error is encountered during the read:

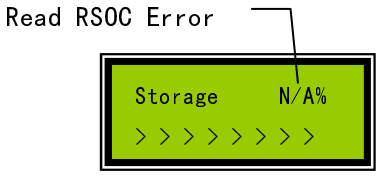
1. Check Channel Battery LED to see if Green is ON, if yes, repeat the read action again to see if the problem persists. If yes after repeat reading, select waken charge to recover the battery.
2. If the Battery LED RED is ON, it means the polarity of the connector is wrong, double check the connection direction as displayed on the LCD screen. Try to reverse the connector to see if the Green turns ON;
3. If Battery LED is OFF, repeat checking procedures stated in Section 4.1



4.3. Testing information display N/A

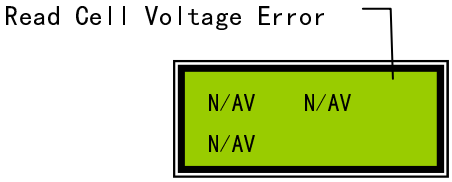
When the RSOC always show N/A when the channel is under testing:

1. Refer to Section 4.2 to correct the SMBus Read
2. If the N/A shows occasionally, ignore the RSOC reading, the test can still be carried out



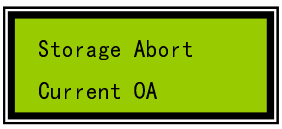
When all the read cell voltages are showing N/A:

1. Refer to Section 4.2 to correct the SMBus Read
2. Older version of the battery packs employed older version of SMBus Gas Gauge ICs. These older Gas Gauge ICs do not support cell voltages in their register data. When tried Section 4.2 and all other SMBus data can be read correct, most likely the battery does not support cell voltage. Ignore the reading and continue with the test scheme

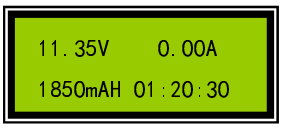


4.4. Test abort abnormally

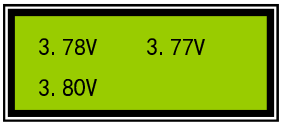
When test is forced to abort without any user interaction, check the first LCD display screen and the second line will show the reason of abort.



1. Suspects loosen connection between battery and the channel. Check the contacts between the connector and the battery, some batteries have smaller contact points that some PIN in the connector might not make the full contact.
2. Go into the Last Step Data screen by turning the Dial Button, check the battery voltage, if the voltage is 0V, the battery might have been protected. Try Charge or Discharge the battery according to the status.



3. Go into Cell Voltage screen by turning the Dial Button, check individual cell voltage to see if there is any imbalance among the cells. Over-voltage and Under-voltage protections will be triggered when one of the cell voltage exceed the protection limit.
4. Over Voltage protected during charging test: the battery pack might goes into over voltage protection when charged if it is already high charged (RSOC > 93%), Try to discharge it for 30 minutes and restart the charging test.



5. RA-530 Report & Tools Software

RA-530 Series analyzer is designed to work alone with its built-in database. However, to support the following functions so that user can work with the test result data and update the testing database, a software tool is developed and distributed with the equipment. A complete Installation CD is provided in the package.

The major functions of this software tool provide:

- Instant Report Generation
- Battery Database Downloading

The following section describes how to install the software and connect to PC. It also describes the operation of the software.

5.1. Computer Requirements

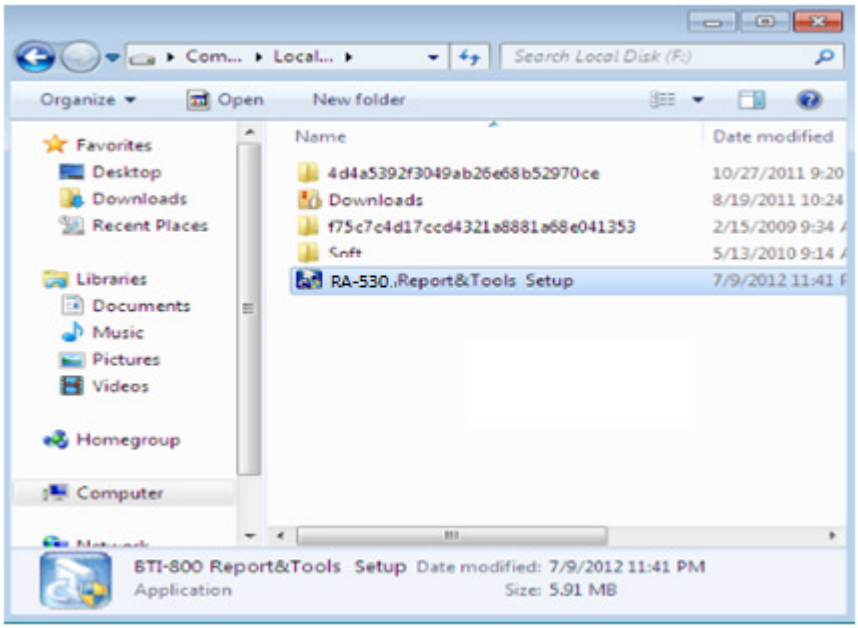
The following table states the minimum system requirements for software operation:

Computer	Requirements
Type	Desk top or Laptop, and Laptop computer is preferred for its portability.
Operating System:	Windows XP, Windows Vista, Windows 7
Free Disk Space:	10 Mb
Communication Port:	USB Port

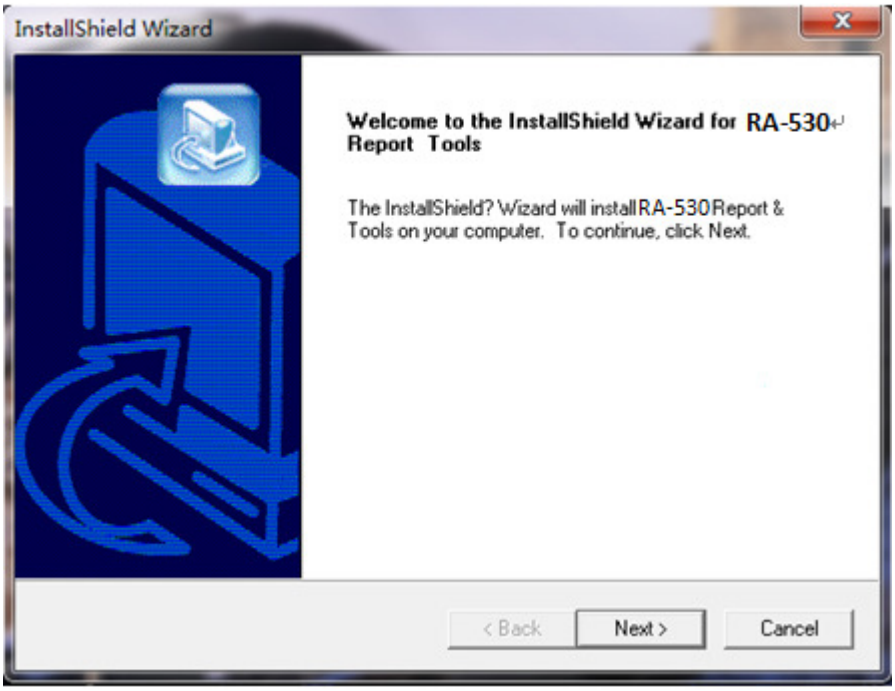
5.2. Software Installation

A complete Installation CD is provided in the package. Follow the steps below to complete the software installation:

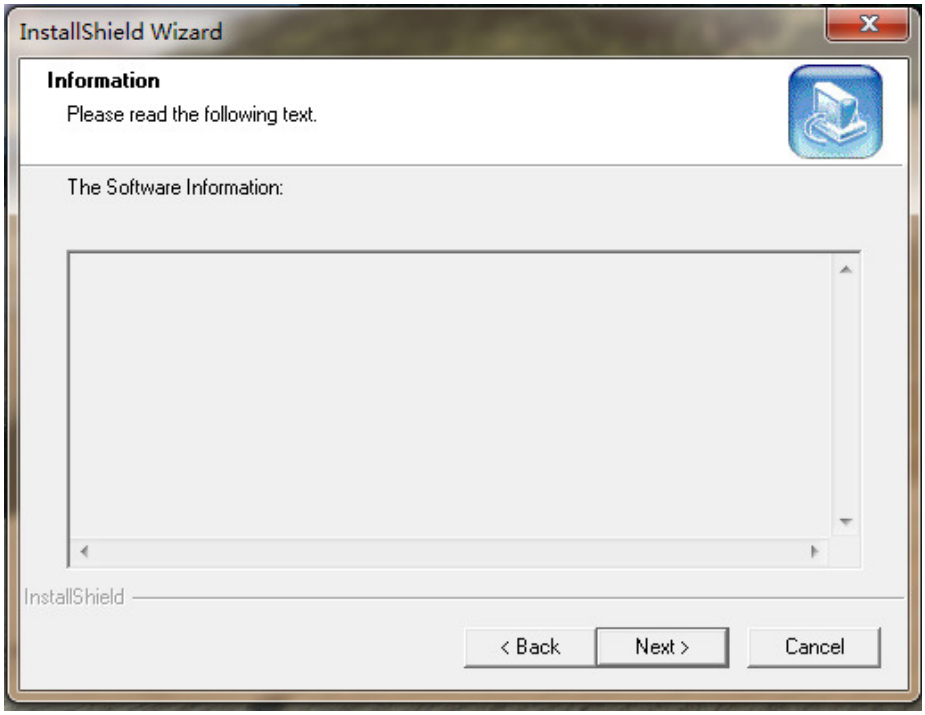
1. Insert the CD into the CD driver of the dedicated computer. Double click the installation package: “RA-530 Report & Tools Setup.exe”.



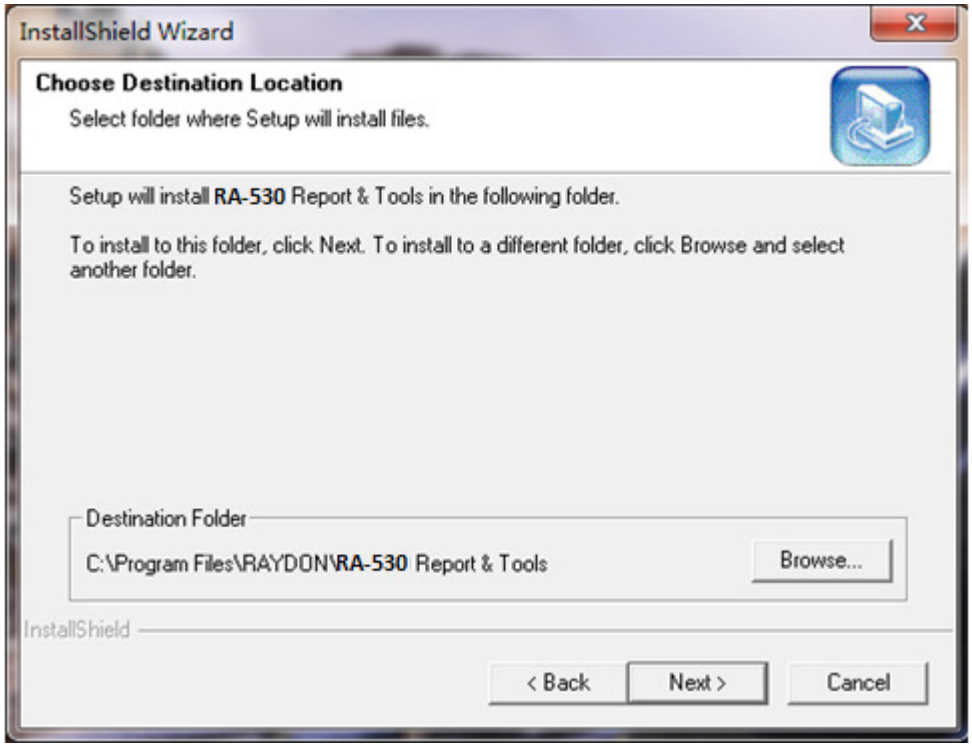
2. You will find the following Installation Windows on the screen. Press [Next>] to continue.



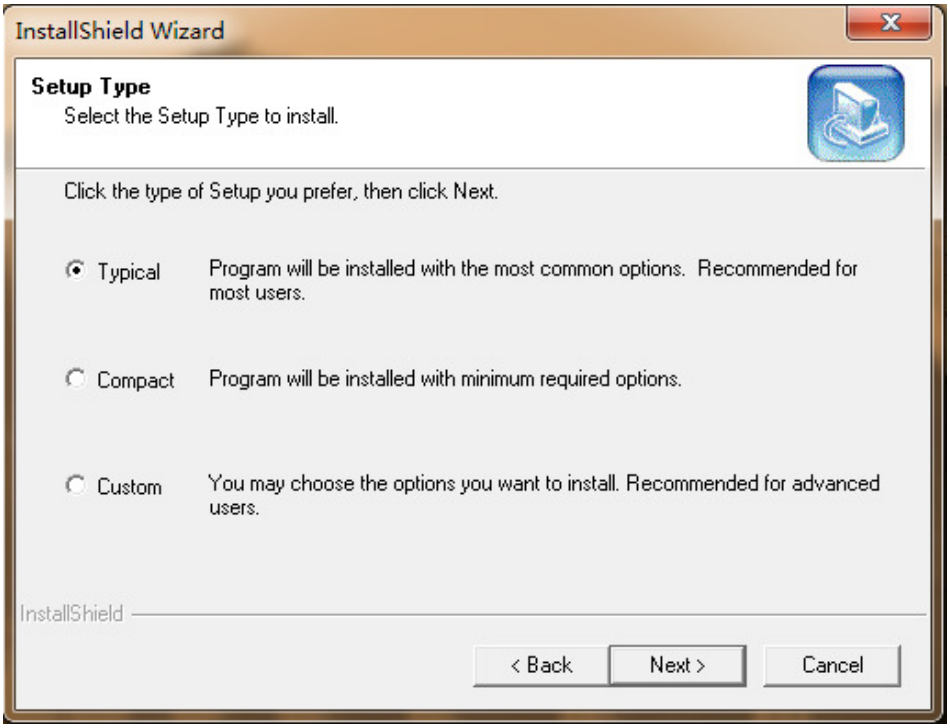
3. Agree to the License Agreement and Information Page by press the [Yes] button on both pages and continue.



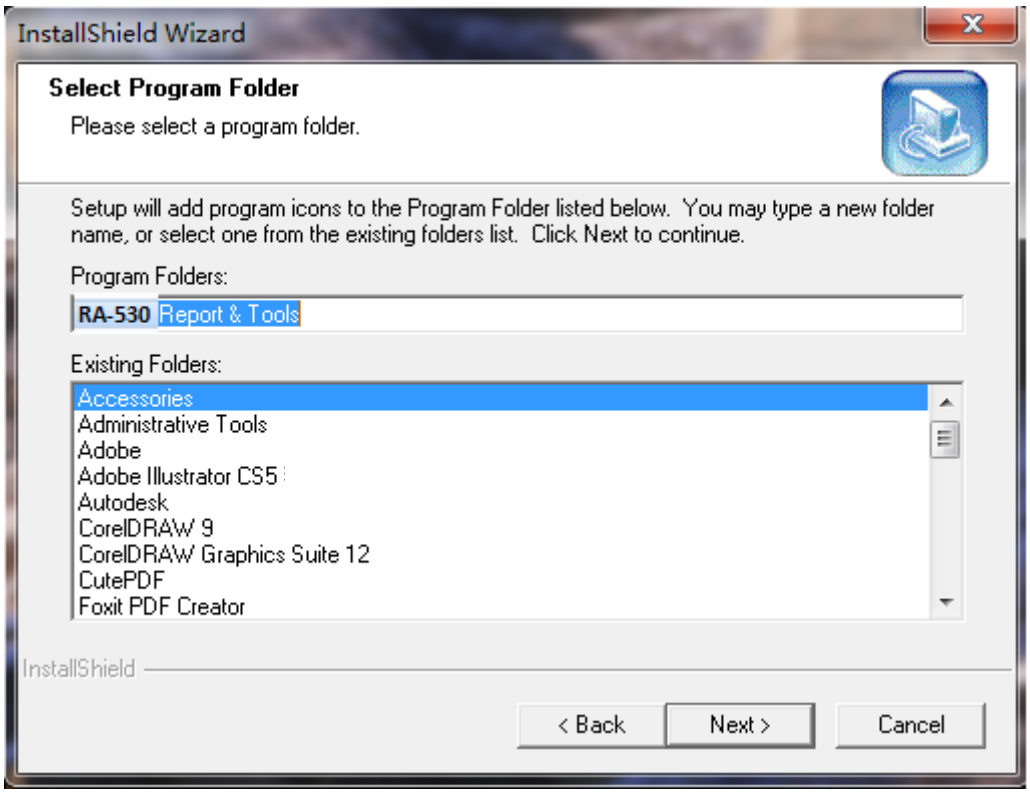
4. The following page will define the destination of the installation software. If user requires to modify the location, please select the new path by pressing [Browse], otherwise press [Next>] to install into default path and continue.



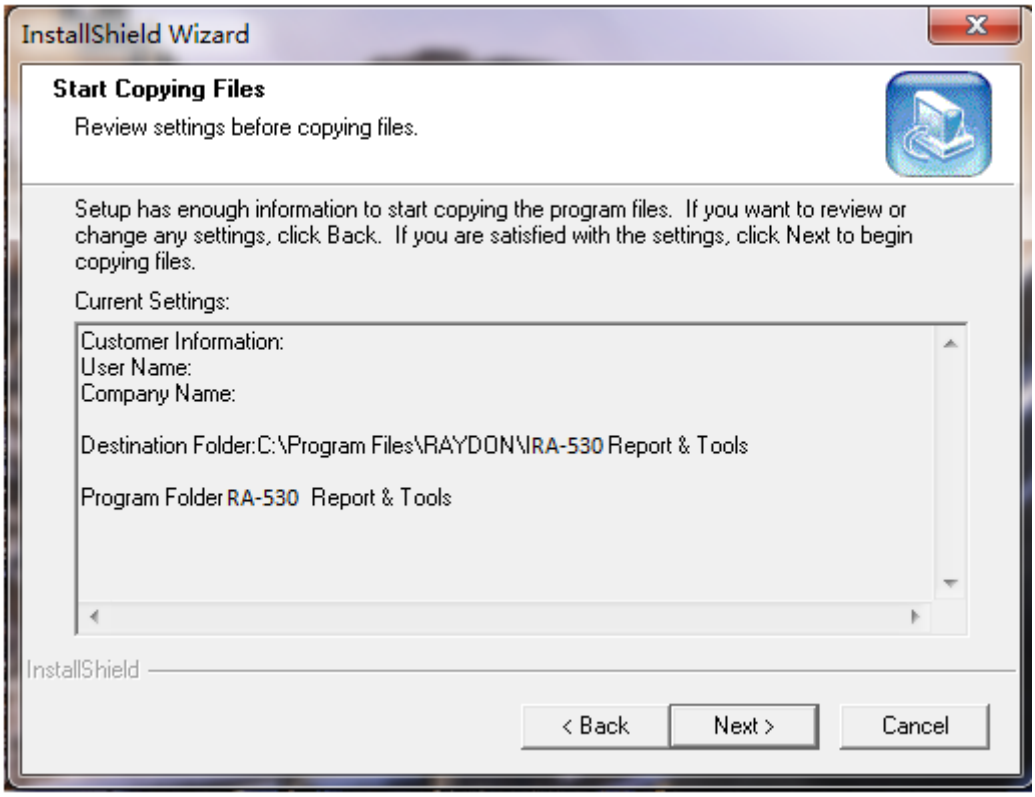
5. The next page will determine the setup type of this installation. Always choose [Typical] for first time installation. It is not recommended to select the other options. Press [Next>].



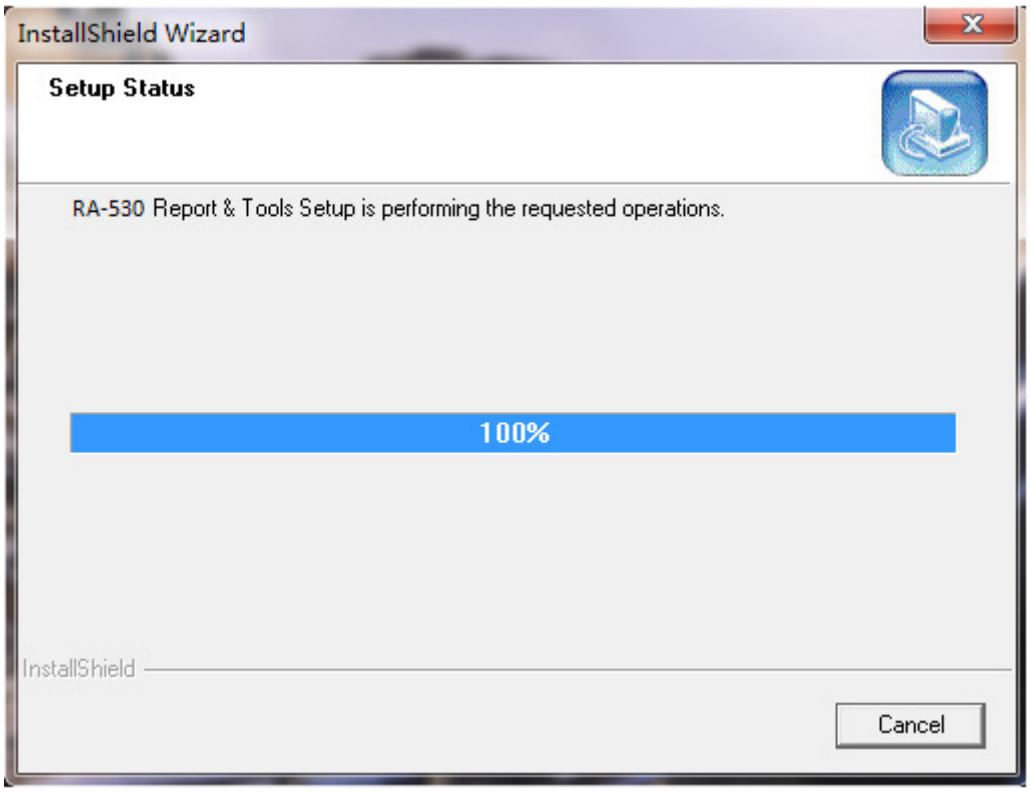
6. The system will prompt the user to enter the Program Folder which will appear in “Programs” in the Windows “Start” button. The default setting is recommended.



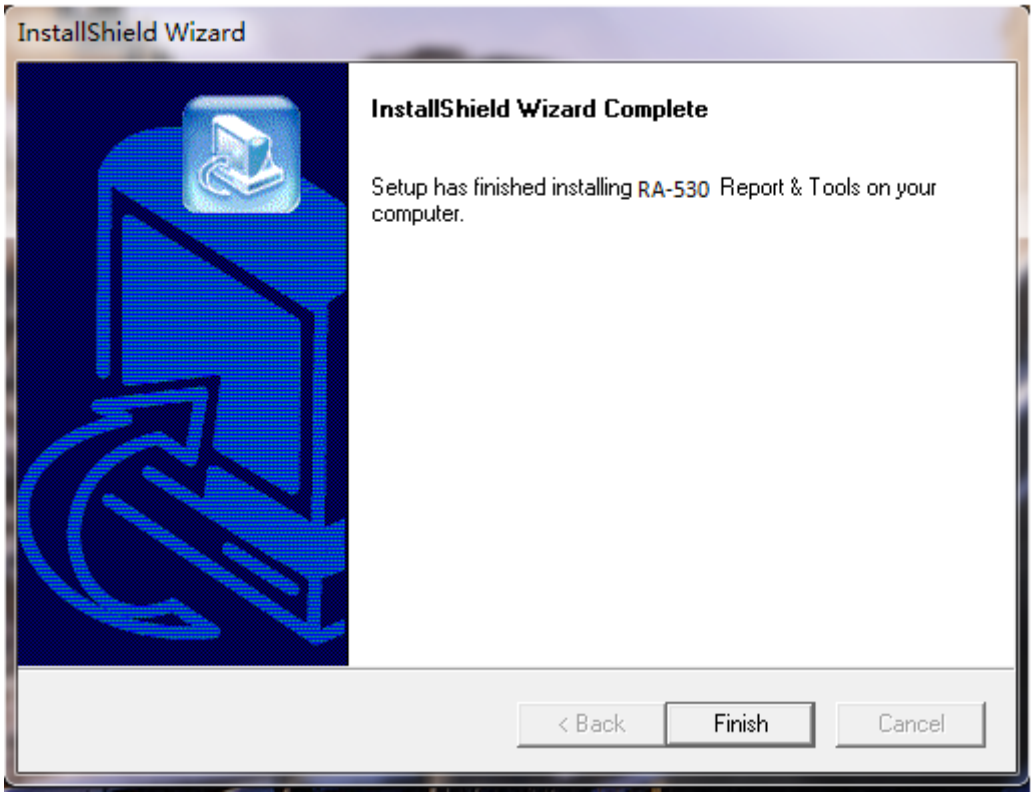
7. After pressing the [Next>] button, the system will continue with the installation:



8. The software installing:

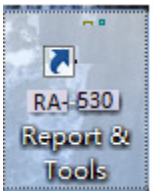


9. When the system installation is complete, the following windows will be displayed:

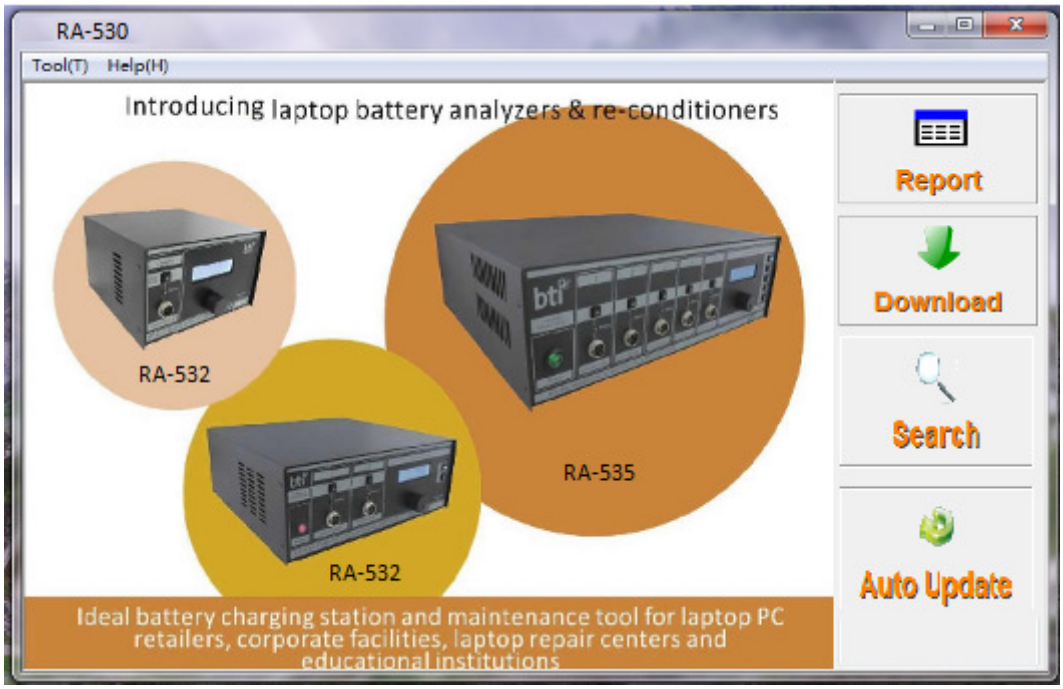


10. Please always choose to restart the computer immediately after the installation is complete. This will refresh the system register table and allows the system to be run smoothly. Press [Finish] to exit the installation program and restart the computer.

11. Once the computer is restarted, double click the “RA-530 Report & Tools” icon from the desktop to start the software:



12. The main dialogue will show on the screen. Detail operation of the software will be discussed later, and now we need to connect the computer with RA-530. Please see the connection in next section.



5.3. Connect to Computer

The USB Communications Cable is designed to connect between the RA-530 Series analyzer and computer..

1. Look for the USB Communications Cable from the delivering package:

2. The USB Programming Port is located at the bottom right hand side of the front panel.

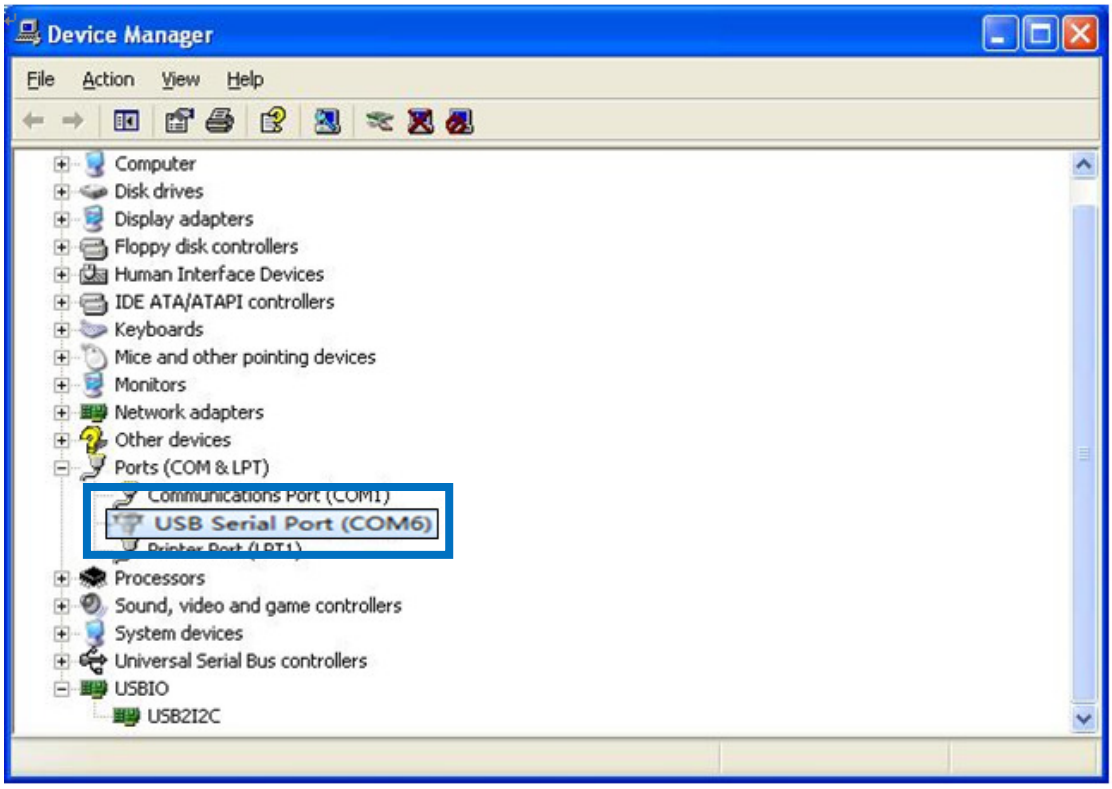
3. Plug the USB cable directly into RA-530 USB Programming Port.

4. Connect the USB cable to PC's USB port

5. Since the drivers have been installed with the software, the Windows Operating System will detect the new device and automatically assign a COM port number for the communication link. Follow the following step in the computer to check the system assigned COM port number:

- Select "My Computer" from the Windows.
- Press the right hand button of the mouse and a menu will be displayed.
- Select "Properties" from the Menu and select "Device Manager" from the "Properties" Menu.

- The “Device Manager” allows the user to check for the COM Port configuration of the newly installed device.



- Record the COM number, as in above picture, it is COM6. However this number might vary from different PC or different tester. This number will be used during the Communications Port Set Up.

!	Always check this COM port assignment again whenever a new tester is connected. MS Windows operation system might assign different COM port number to different devices.

5.4. Instant Report Generator

The RA-530 laptop battery analyzer and re-conditioner is a standalone configuration, it was designed to work by itself with all the testing controls and battery database build-in. RA-530 is able to show the test result on the LCD display in the tester's front panel but failed to record these results once the channel is reset and another test is carried out on the same channel.

Instant Report Generator function allows user to capture the latest test result from a selected testing channel and put it into a printed format for recording and documentation.

Once the connection is made between computer and RA-530, user can retrieve laptop battery information and/or testing results from the selected channel under the following conditions:

- ***Channel Selection:***

  The channel is selected on the RA-530 front panel channel control area. User can switch between different channels by pressing the Channel Selection Button of the respective channel and the LED on the button will indicate the selection. RA-530 will only return laptop battery information and/or testing results from that single selected channel. If user wants to retrieve information from multiple channels, user must perform the data retrieval on one channel at a time and change to another channel after the instant report is generated.

- ***Channel States:***

  RA-530 only allows the software to retrieve the battery information when the selected channel is at READY or FINISH state.

  When the channel is at READY state, the laptop battery information is mainly the SMBus parameters store in the battery register. User can use this information to understand and analysis the laptop battery status and make decision on their re-conditioning action base on these parameters.

  When the channel is at FINISH state, the information will include the latest SMBus parameters and also the current test results. User can use this information to generate a report for recording or documentation.

  RA-530 will refuse any data retrieval during any other operation states: SET UP and TESTING.

- ***Instant Report:***

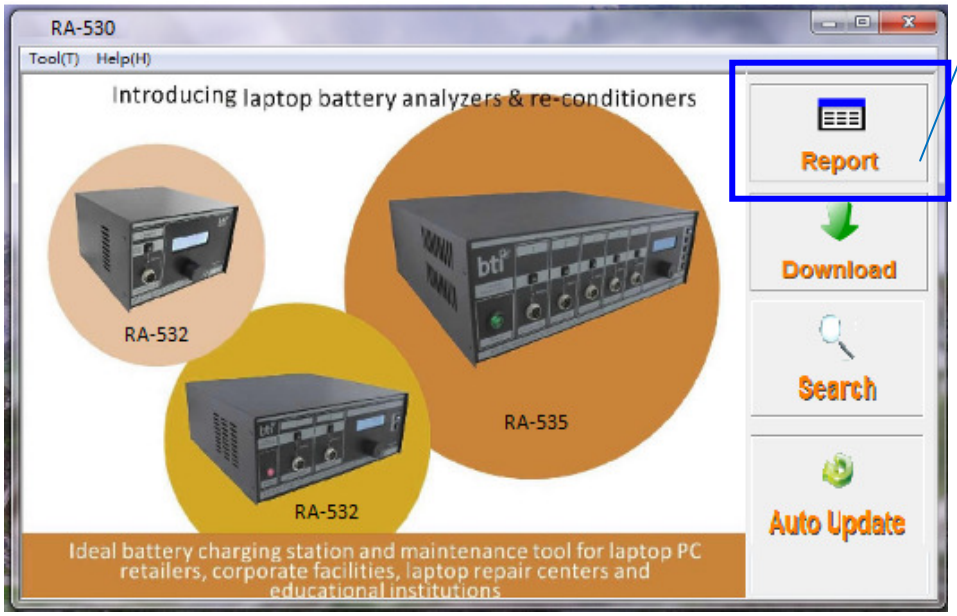
  RA-530 will not store any previous test result in its memory. All test results will be reset once the channel change from FINISH state to READY state. The information returns only reflect the current test result.

- ***Output Format:***

  The Instant Report Generation software will automatically generate a testing report; detail of the report format is shown in Section 6. It also allows the user to save the retrieved information into DOC format file for further data processing by MS WORDS.

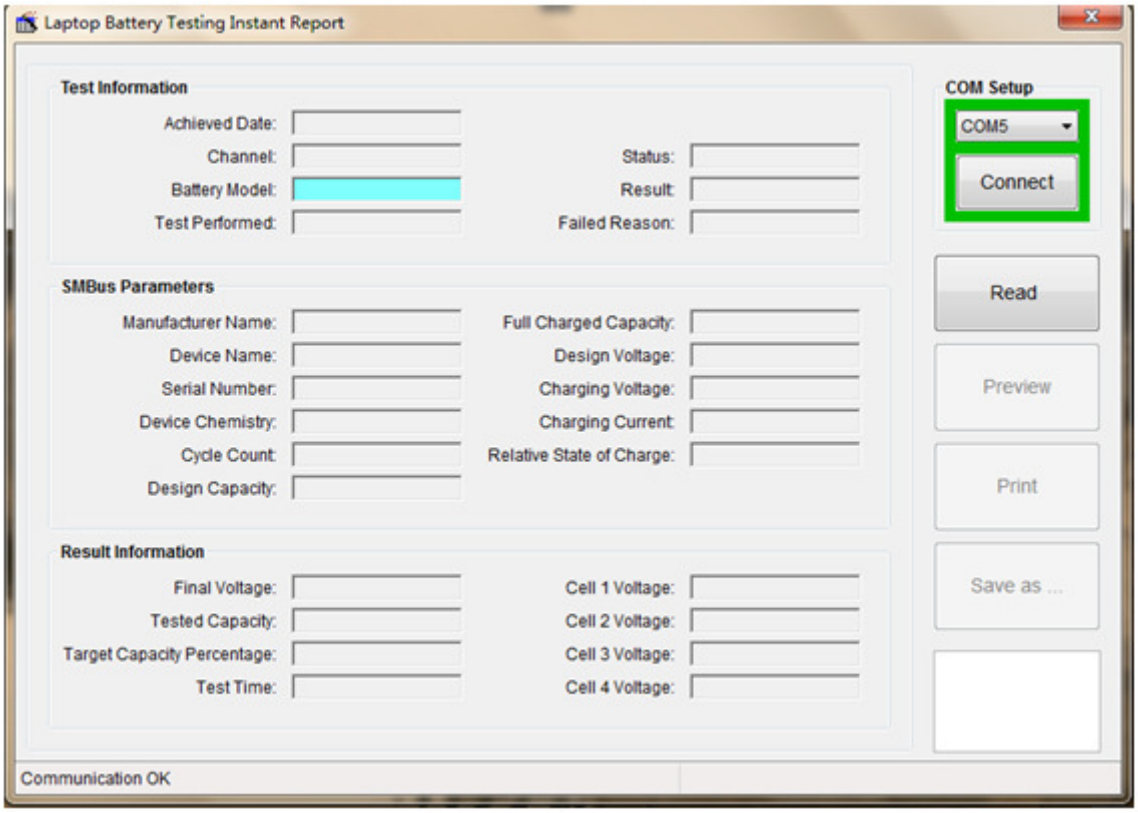
5.4.1. Enter into Instant Report Generator

To enter the Instant Report Generator Interfaces, user should select the “Report” push button at the right hand side of the main dialogue box:



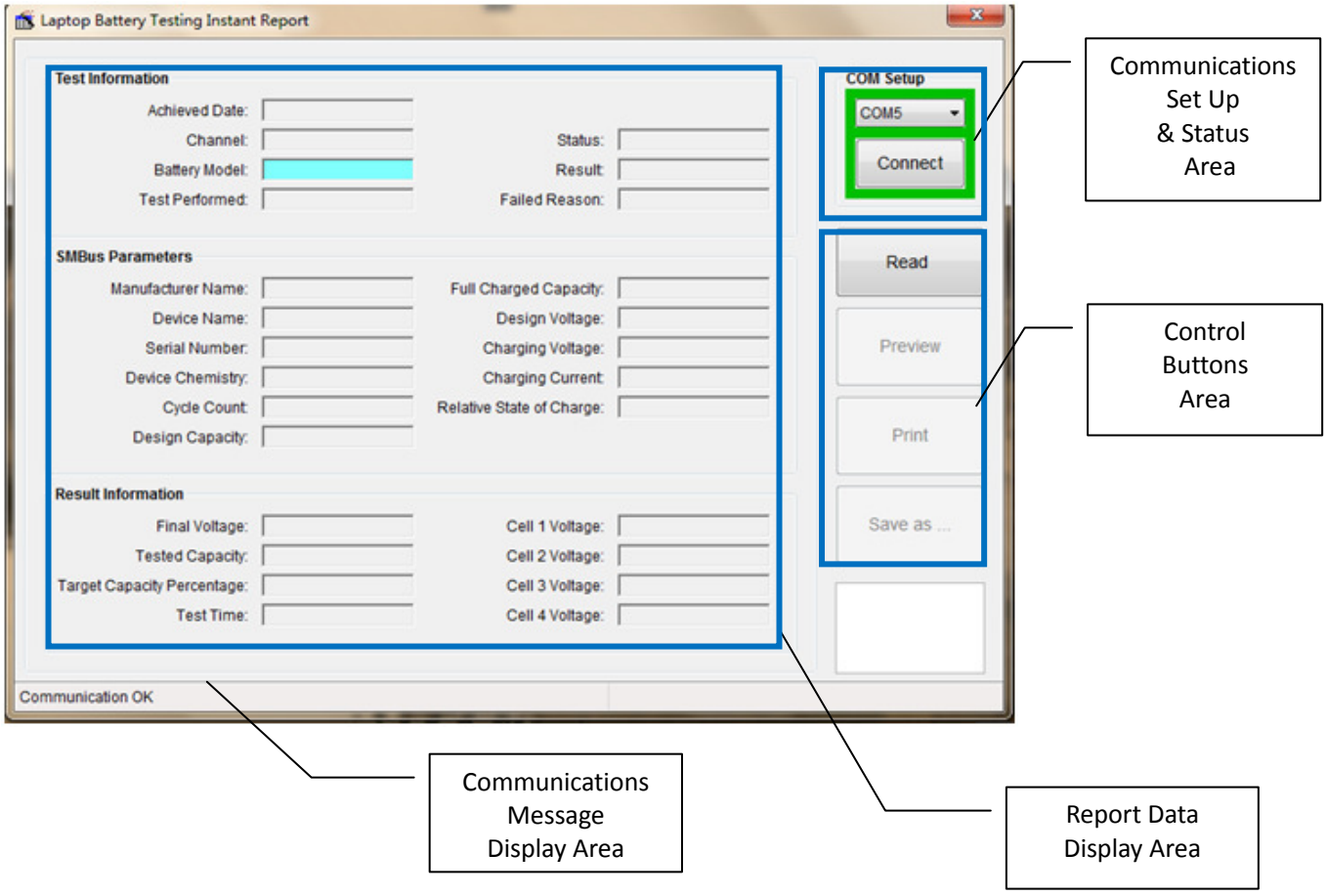
Select “Report” push button to enter the Instant Report Generator Interfaces

The Instant Report Generator dialogue box will appear:



5.4.2. Instant Report Generator Interfaces

The Instant Report Generator dialogue box is shown in the below diagram:



The dialog box consist four major areas:

- ***Communications Set Up & Status Area:***

  User should check the system assigned COM port number of the connected USB port; refer to Section 5.3 for details. When the user selects the suitable COM port number, and press the "Connect" push button, the software will try to establish the link by sending communications message to poll for any connecting analyzer.

  Once the communications between the PC and RA-530 Series analyzer is established, a Green background color indicates the normal operation of the communications exchange. If Red background color appears, they indicate error is found during the data package exchange. User should check the physical connection and also the correctness of the COM port number.

- ***Control Buttons Area:***

  There are four control buttons designed in this dialogue box:

  - Read: After user selected the channel in front panel, user presses this button to retrieve the channel information. The analyzer will respond when the selected channel is at either READY or FINISH state. The retrieved information will be shown in the Report Data Display Area. When user decided to read the data from a channel which is at neither of these two states, an error message will be displayed.

- Preview: Allow user to preview the final report.
- Print: Output the designed report directly to the linked printer. If user had installed Adobe Acrobat or any other PDF generating software, user can select to output the report into soft copy for easy circulation.
- Save As: User can save the retrieved information into a specified file in DOC format.

- ***Report Data Display Area:***

When the data is retrieved from the specific channel of analyzer, they are displayed in this area. Three type of information are grouped:

- Test Information: Provides the information of the battery pack and the test performed. When the test is finished, the overall test status will also be shown with any faulty reason.
- SMBus Parameters Provides the immediate SMBus register parameters in the battery pack which are important to the test. When user retrieve these parameter before (at READY state) or after (at FINISH state) the test to verify the changes within the battery after respective tests.
- Result Information: Provides final readings and calculated result of the test performed. If the test is aborted due to faulty state or manually control, the calculated capacity result will not be shown.

User can check the overall result parameters and decide what to do with this data by selecting the “Save As” or “Print” buttons.

- ***Communications Message Display Area:***

This area shows the communications status messages. When the error messages appear too often, user should check the communications link between computer and analyzer.

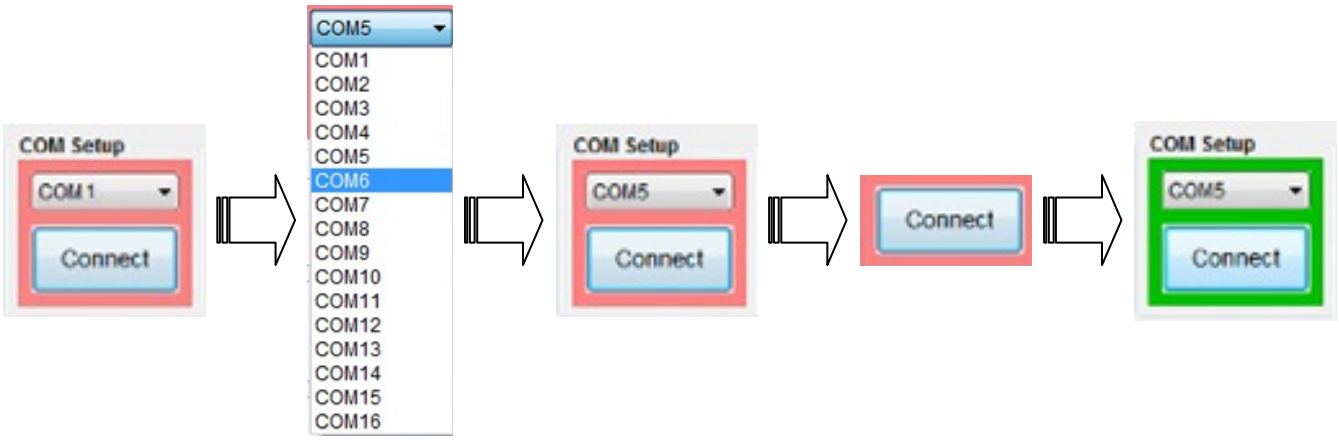
5.4.3. Steps to Generate a Report

User can generate test report from a specific channel when it is at READY or FINISHED state. The following shows the step to generate the Instant Report. Refer to Section 5.3 on the communications port set up.

1. Start the RA-530 Report & Tools software in the computer and goes into the Report Generation Interfaces.

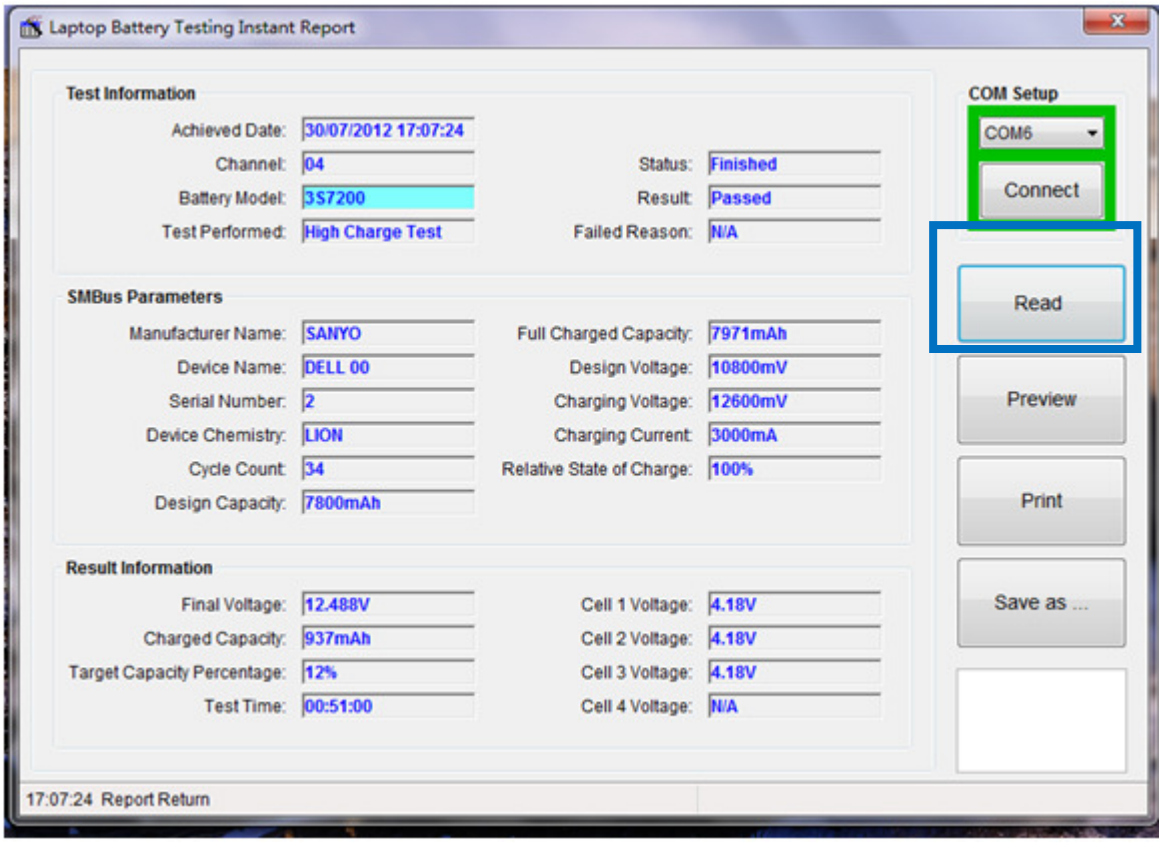
2. Connect the computer with analyzer using the provided USB cable

3. Select the correct COM port number in the communications set up area and press the “Connect” push button, the background color of the area should change from Red to Green to indicate communications between the devices is established.

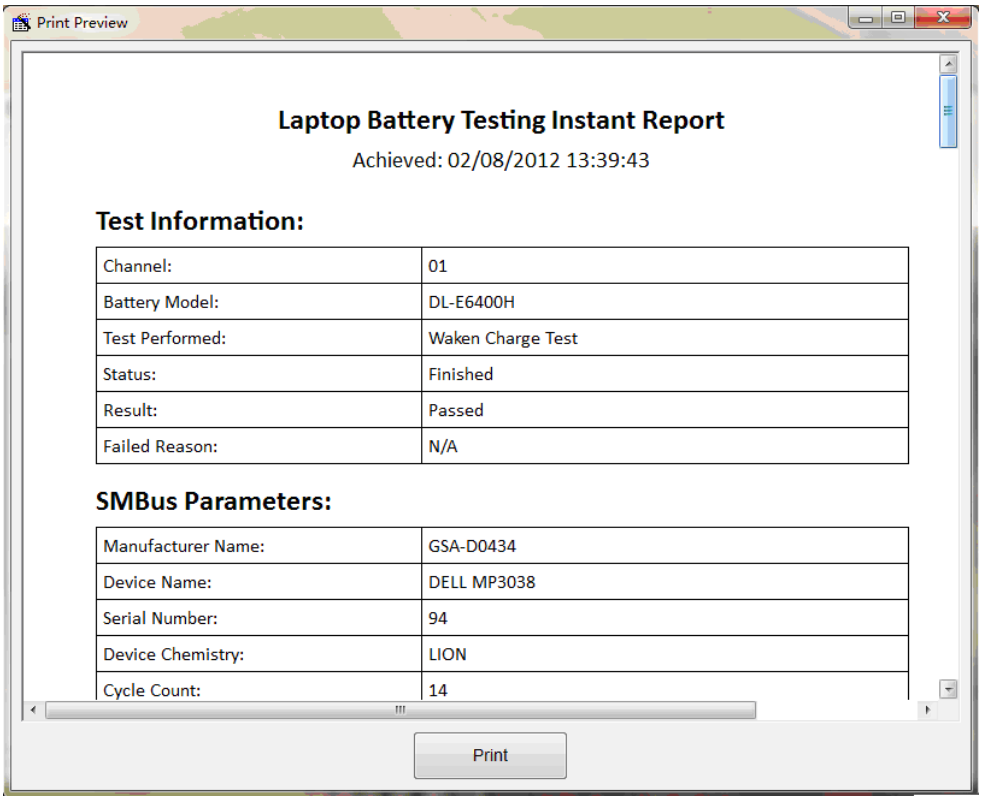


4. Select the specific channel from the front panel channel control area in analyzer.

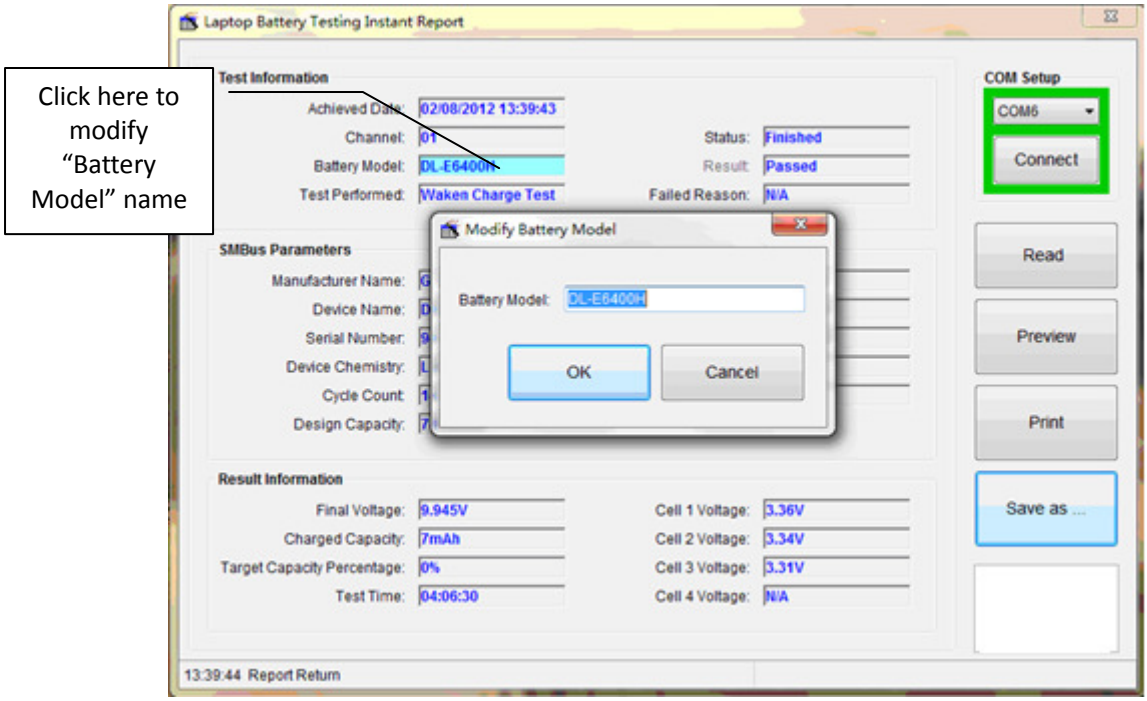
5. Press “Read” push button to retrieve test and battery data.



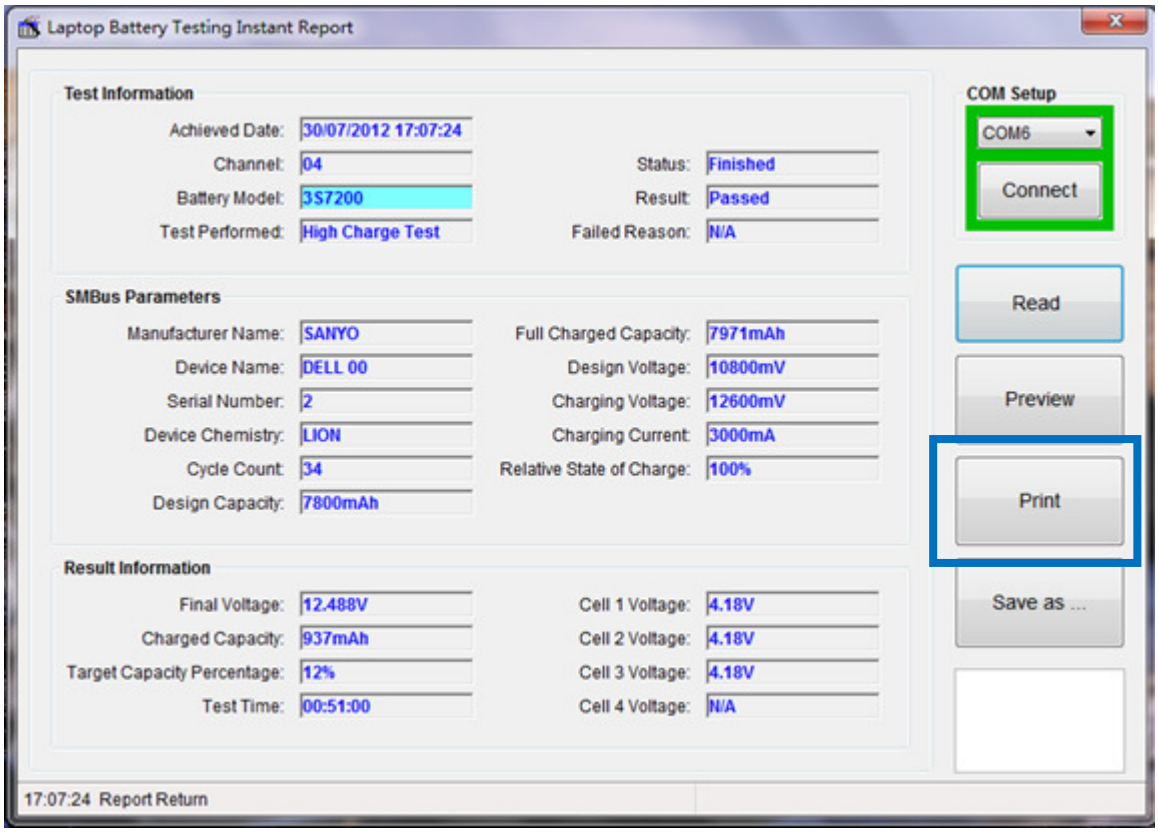
6. Press “Preview” to check the output format of the report. User can use the scroll bar to view the whole report information.



7. By clicking into the software provided entry box, user can modify the “Battery Model” name according to the actual battery model under testing.



8. Press “Print” to output the report to designed printer.



5.4.4. Report Sample

Laptop Battery Testing Instant Report

Achieved: 30/07/2012 17:09:54

Test Information:

Channel:	04
Battery Model:	3S7200
Test Performed:	High Charge Test
Status:	Finished
Result:	Passed
Failed Reason:	N/A

SMBus Parameters:

Manufacturer Name:	SANYO
Device Name:	DELL 00
Serial Number:	2
Device Chemistry:	LION
Cycle Count:	34
Design Capacity:	7800mAh
Full Charged Capacity:	7971mAh
Design Voltage:	10800mV
Charging Voltage:	12600mV
Charging Current:	3000mA
Relative State of Charge:	100%

Result Information:

Final Voltage:	12.488V
Charged Capacity:	937mAh
Target Capacity Percentage:	12%
Cell 1 Voltage:	4.18V
Cell 2 Voltage:	4.18V
Cell 3 Voltage:	4.18V
Cell 4 Voltage:	N/A
Test Time:	00:51:00

Signed: Date:

5.5. Battery Database Download

RA-530 Series analyzer is a standalone battery testing equipment with all laptop battery testing database build-in. RAYDON Electronics will update and distribute latest database from time to time in order to accommodate all latest laptop battery models for user testing. In order to update the latest database into the memory of RD-530, the Battery Database Download tool is included in the "RA-530 Report and Tools" software. User can also use this tool to verify their testing database and extract the information into files for future reference.

RAYDON will release and distribute the database using specially formatted database files with .DAT extension. User can receive these files by email or extract from RAYDON's company web site.

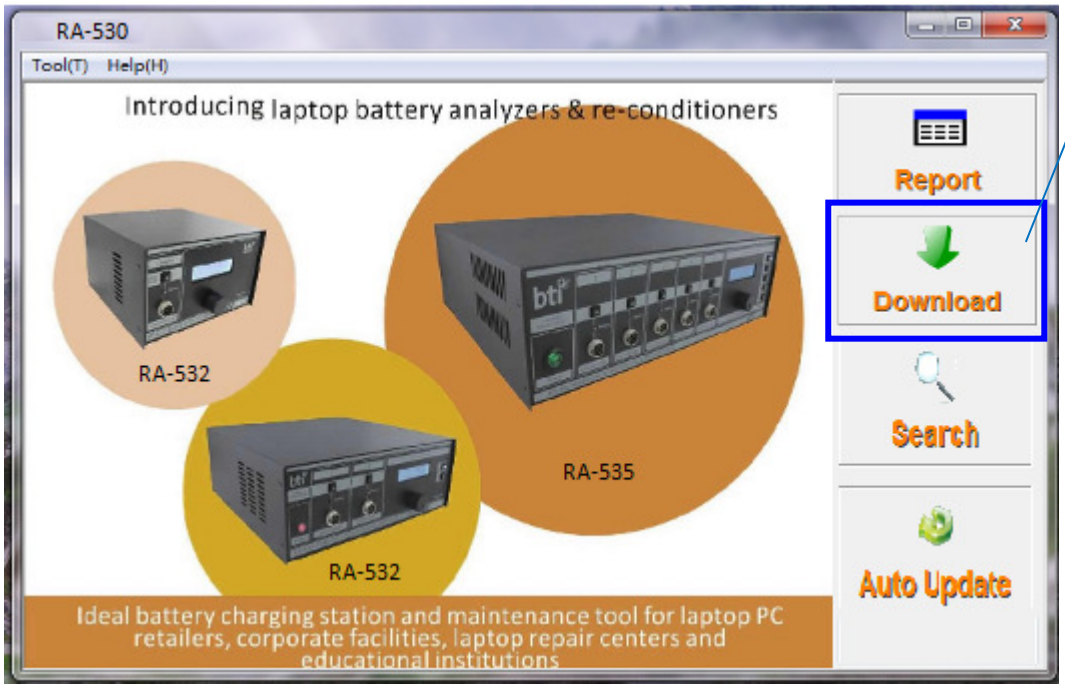
For special requirements, RAYDON can also build customer database which provides:

- Customer's battery model number build-in
- Special testing profiles for non-laptop batteries

Please contact BTI sales representatives to discuss your needs.

5.5.1. Enter into Database Download

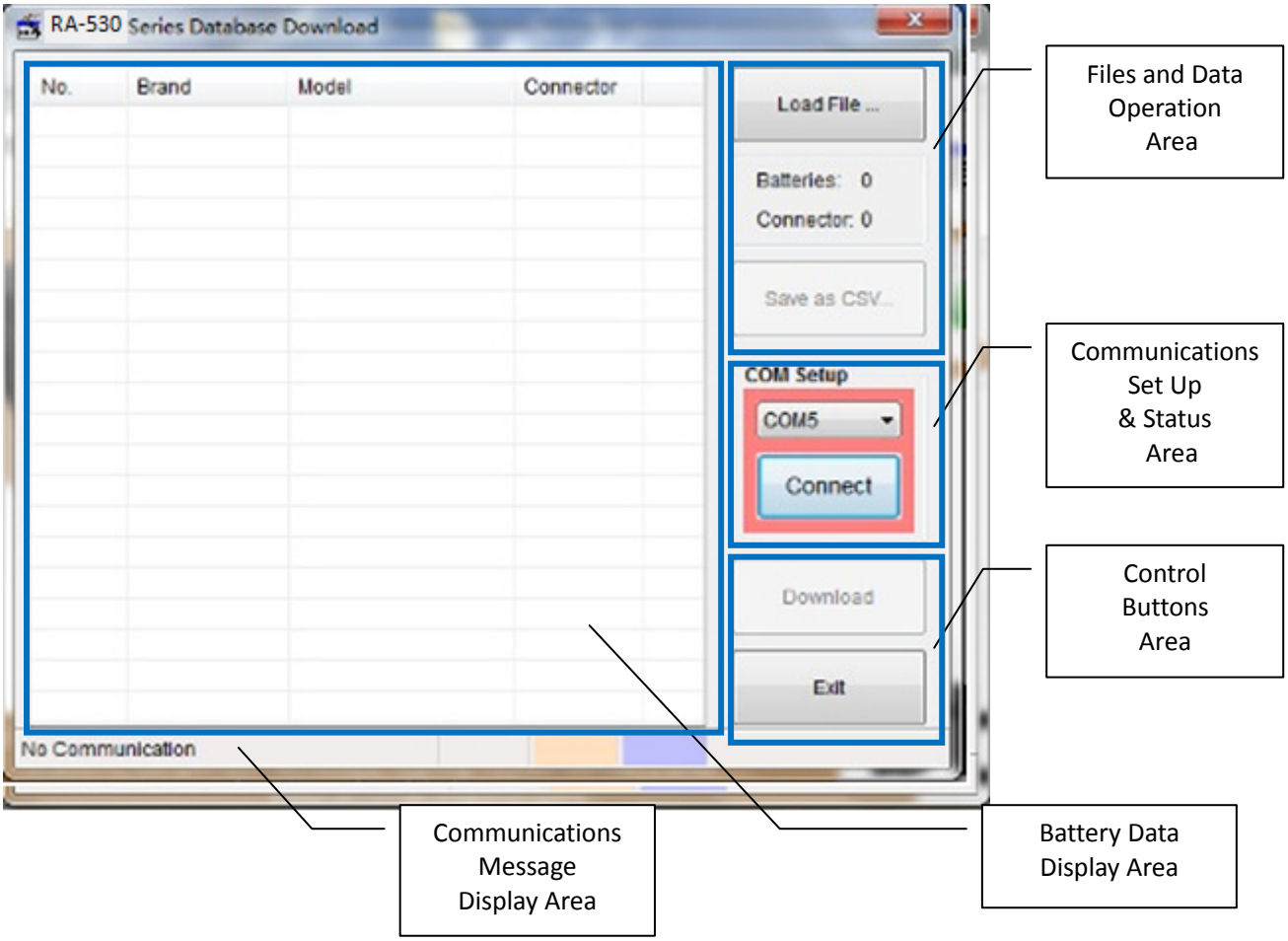
To enter the Battery Database Download Interfaces, user should select the "Download" push button at the right hand side of the main dialogue box and the Database Download dialogue box will appear.



Select "Download" push button to enter the Database Download Interfaces

5.5.2. Battery Database Download Interfaces

The Battery Database Download dialogue box is shown in the below diagram:



The dialog box consist five major areas:

- ***File and Data Operation Area:***

  This area provides push buttons for user to specify the location of the database files distributed by RAYDON. It also allows user to extract these information into MS EXCEL compatible file format. There are two control buttons designed in this area:

  - Load File …: User presses this push button to select the location and database file to be downloaded into the tester. An open file dialogue box will appear and user can browse through the storage disk for the database file. Once the file is loaded, its data will be shown on the Battery Data Display Area for verification.
  - Save as CSV: User can save the loaded battery data into CSV forma file. CSV is a comma separated text file format which is compatible to MS EXCEL application. User can save the information for verification or future reference.

- ***Communications Set Up & Status Area:***

  User should check the system assigned COM port number of the connected USB port; refer to Section 5.3 for details. When the user selects the suitable COM port number, and press the "Connect" push button, the software will try to establish the link by sending communications message to poll for any connecting analyzer.

  Once the communications between the PC and analyzer is established, a Green background color indicates the normal operation of the communications exchange. If Red background color appears, they indicate error is found during the data package exchange. User should check the physical connection and also the correctness of the COM port number.

- ***Control Buttons Area:***

  There are two control buttons designed in this area:

  - Download: After established the communications between the computer and the analyzer, user presses this button to update the loaded database into the analyzer.
  - Exit: Exit the Database Download dialogue

- ***Battery Data Display Area:***

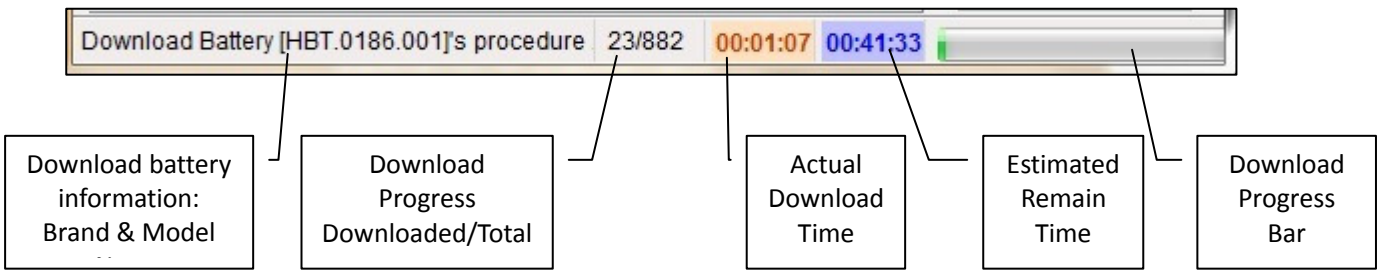
  When the battery data is imported from the specific file, they are displayed in this area. There are 4 columns information shown in this table:

  - No.: The internal index number used to identify a battery model.
  - Brand: Battery brand.
  - Model: Battery model name in respect to the brand.
  - Connector: Connector ID use during testing.

- ***Communications Message Display Area:***

  Before the download button is pressed, this area shows the communications status messages:

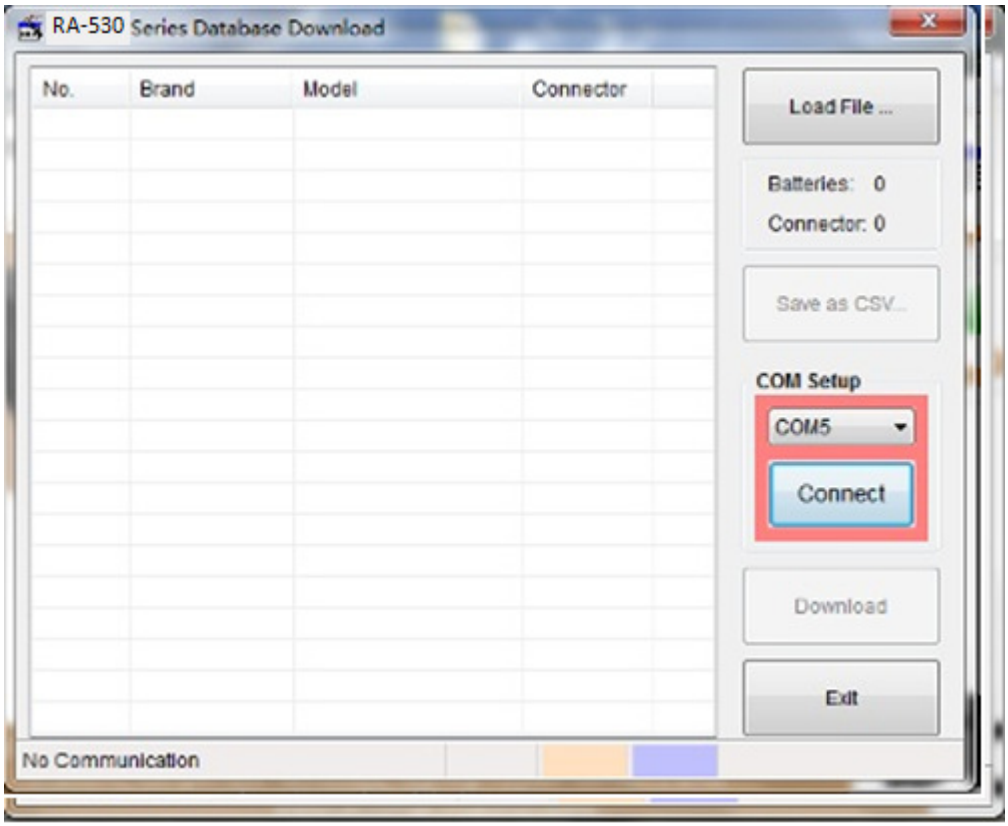
  When download is started, this area shows the download status with:



5.5.3. Steps to Download Battery Database

The following shows the step to generate the Instant Report. Refer to Section 5.3 on the communications port set up.

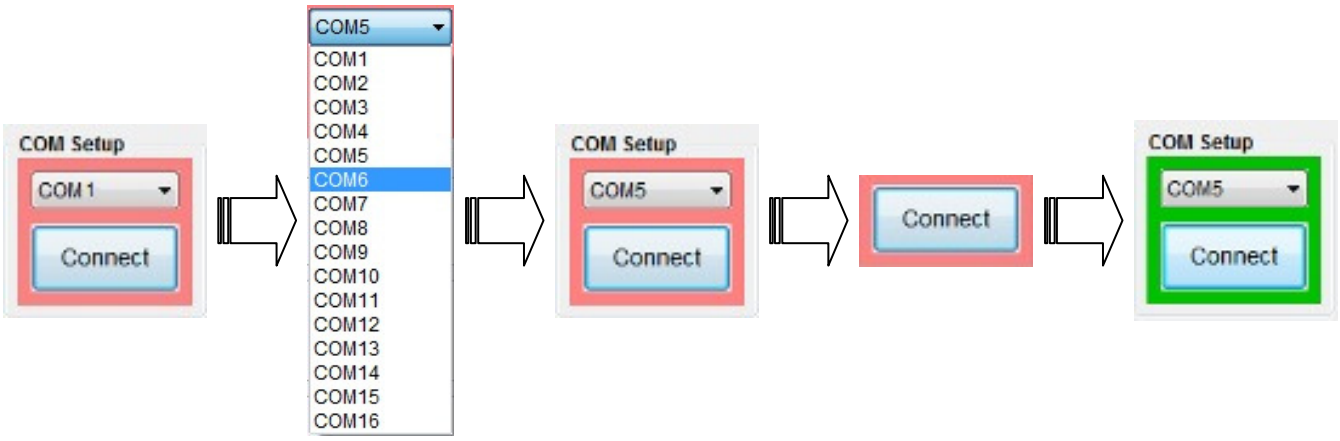
1. Start the RA-530 Report & Tools software in the computer and goes into the Battery Database Download Interfaces.



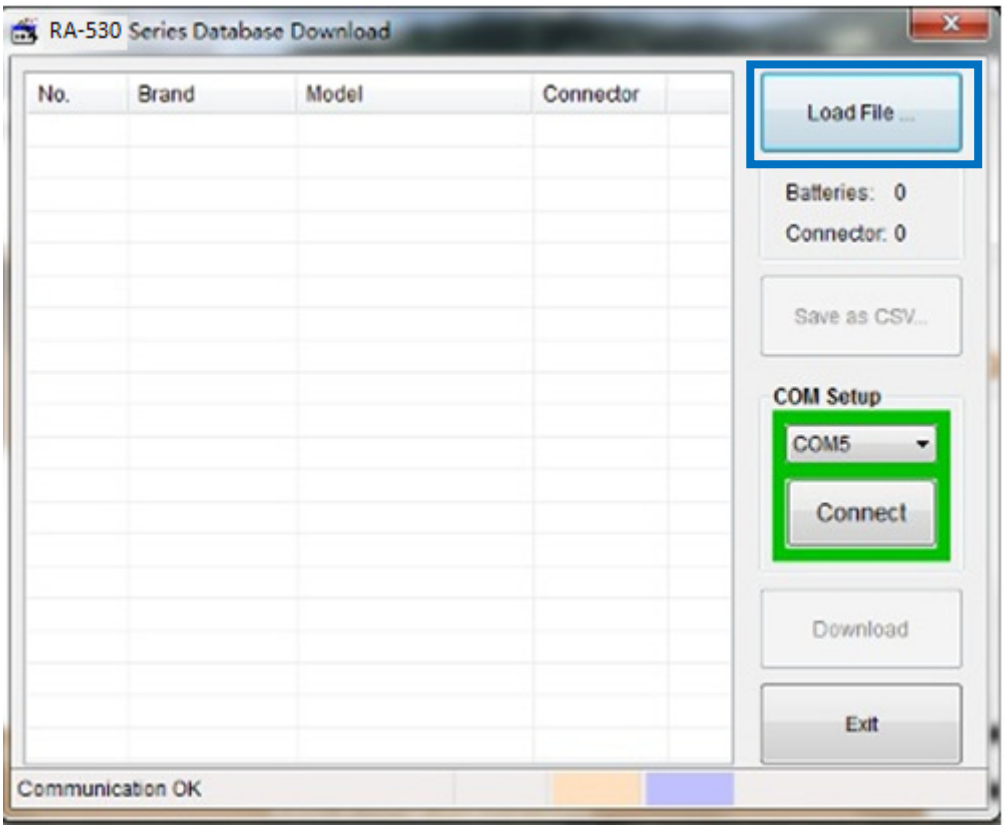
2. Connect the computer with RA-530 using the provided USB cable

3. Select the correct COM port number in the communications set up area and press the “Connect” push button, the background color of the area should change from Red to Green to indicate communications between the devices is

established.

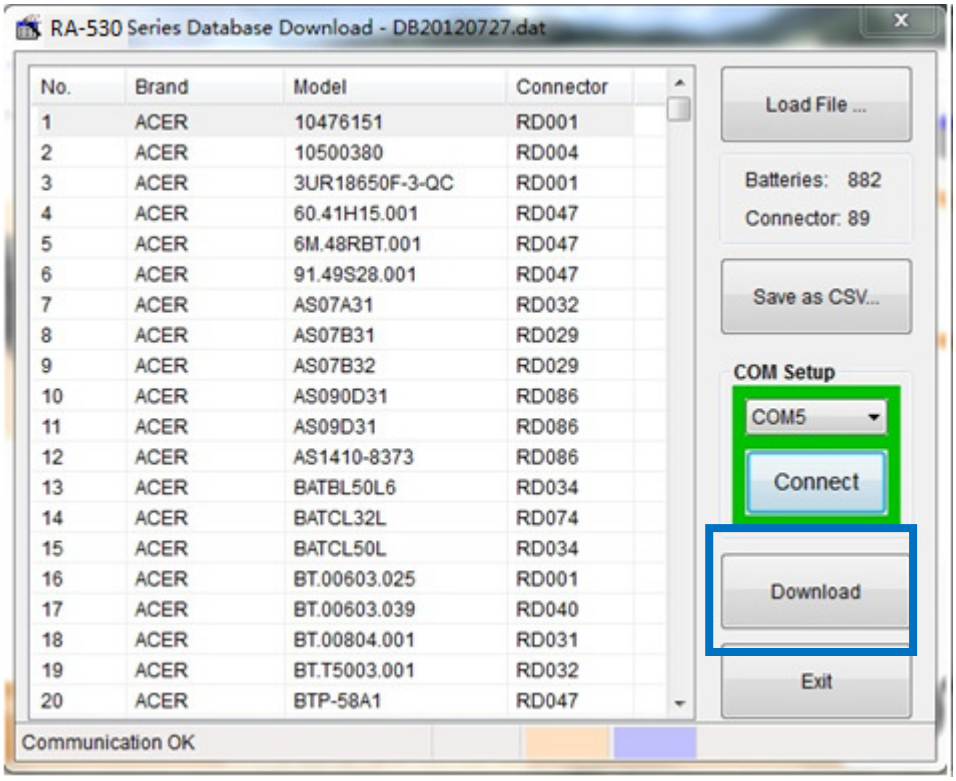


4. Press “Load File …” push button to specify battery database file location.

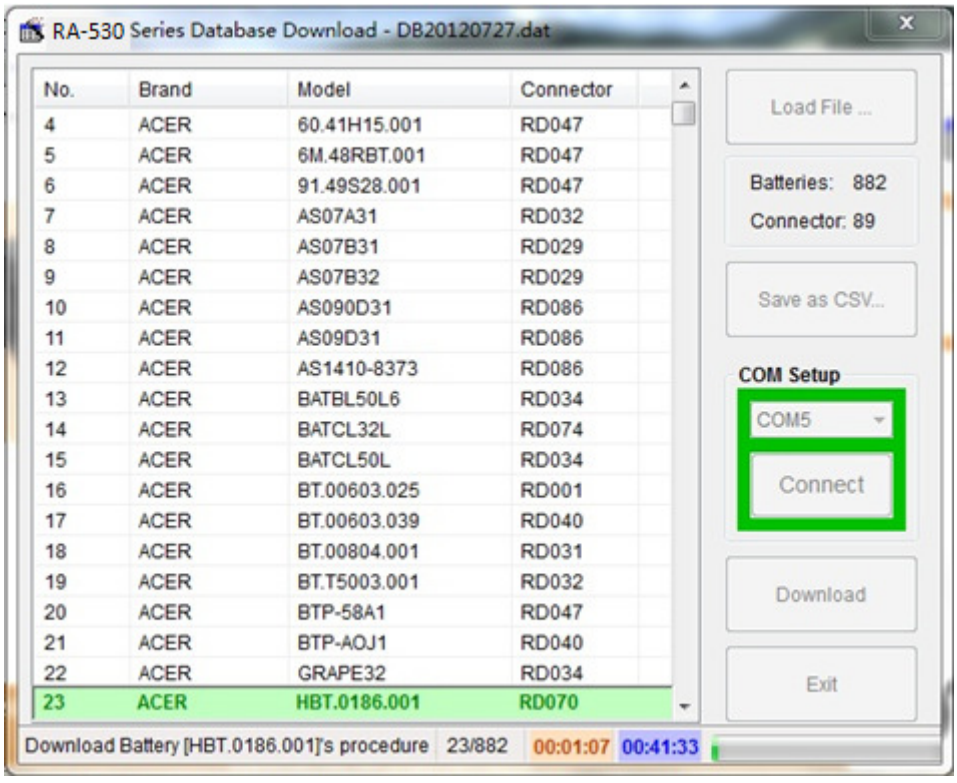


5. A “Select Database” dialogue will appear and user should browses through the storage and locates the location of the database file ready for downloading. Select the file and press “Open” to load the database file.

6. The system will read the specified database file and shows the database information on the Battery Database Display Area. Make sure the communications between computer and RA-530 is normal, press “Download” push button to start the download function



7. The system will show the download progress on the “Communications Message Display Area”:



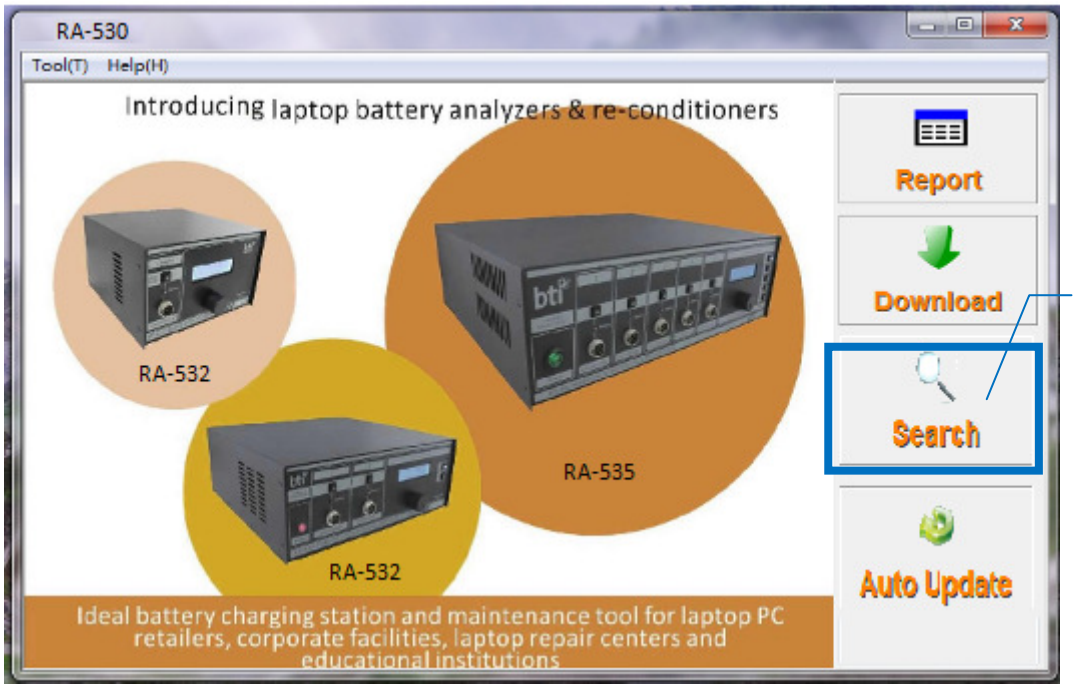
8. When the download finished, the system will show the download finish message on the screen:

5.6. Search Laptop model & Battery Model Information

RA-530 series contains over 900 different battery testing profiles in its internal memory in order to cover more than 30,000 different battery models available in the market. To assist users to search for the correct battery testing profile for a particular battery model, the Search function is introduced in the Utility Software.

5.6.1. Enter into Battery information Search

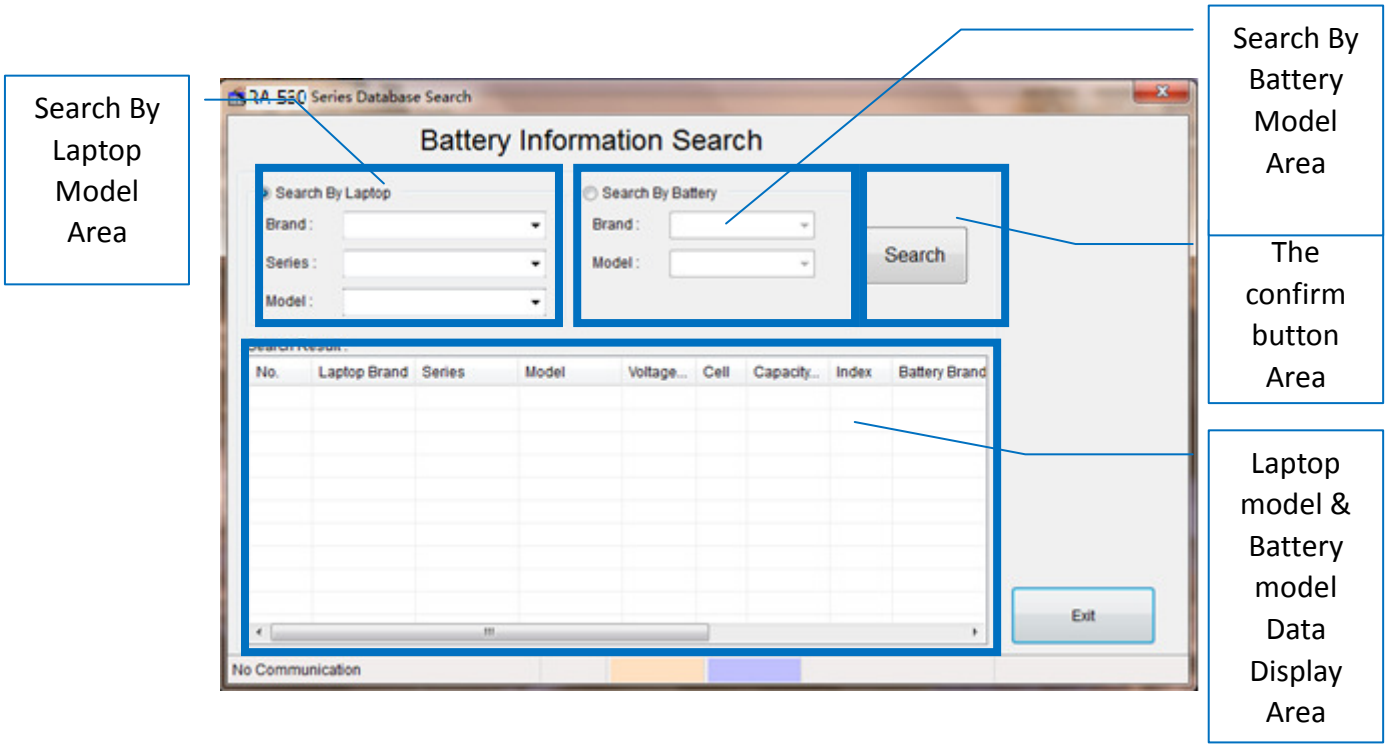
To enter the Laptop information Search Interfaces, user should select the “Search” push button at the right hand side of the main dialogue box and the Battery information Search box will appear.



Select “Search” push button to enter the Laptop Battery information serch Interfaces

5.6.2. Battery Information Search Generator Interfaces

The Laptop model Battery Information Search dialogue box is shown in the below diagram:

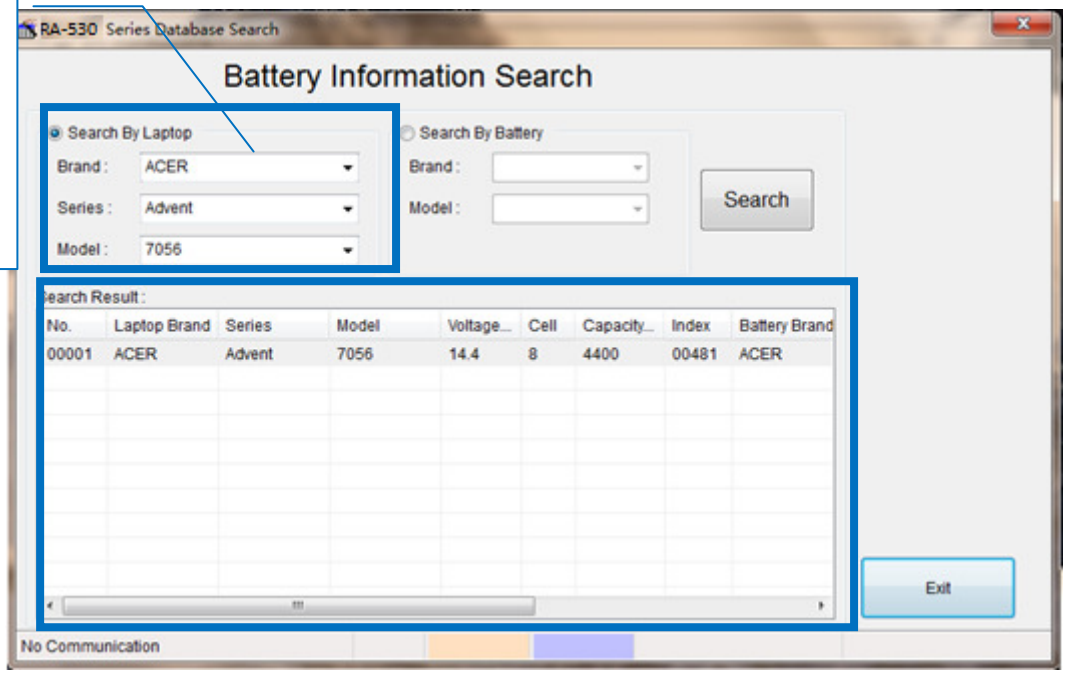


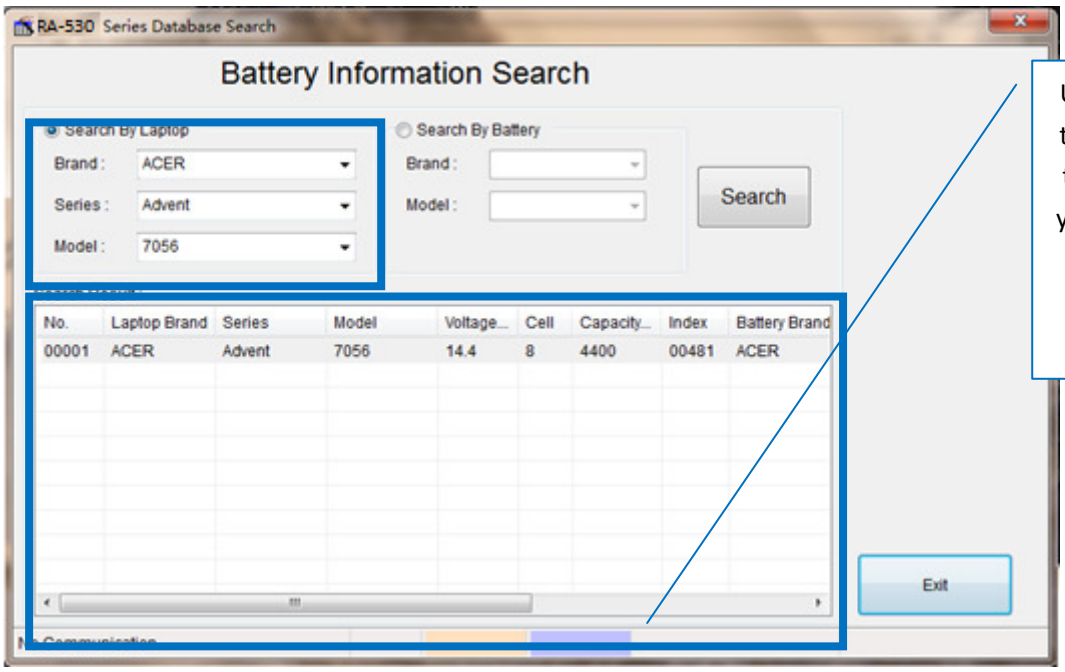
5.6.3. Select Search By Laptop Model

Search By Laptop Model;

- Select Laptop Brand drop box (For example ,Acer, Alienware, APPLE, ASUS, Averatec, Benq, Dell……)
- Select Laptop Series drop box
- Select Laptop Model drop box

Press “Search” push button after selected the Laptop model information and start the search Interfaces



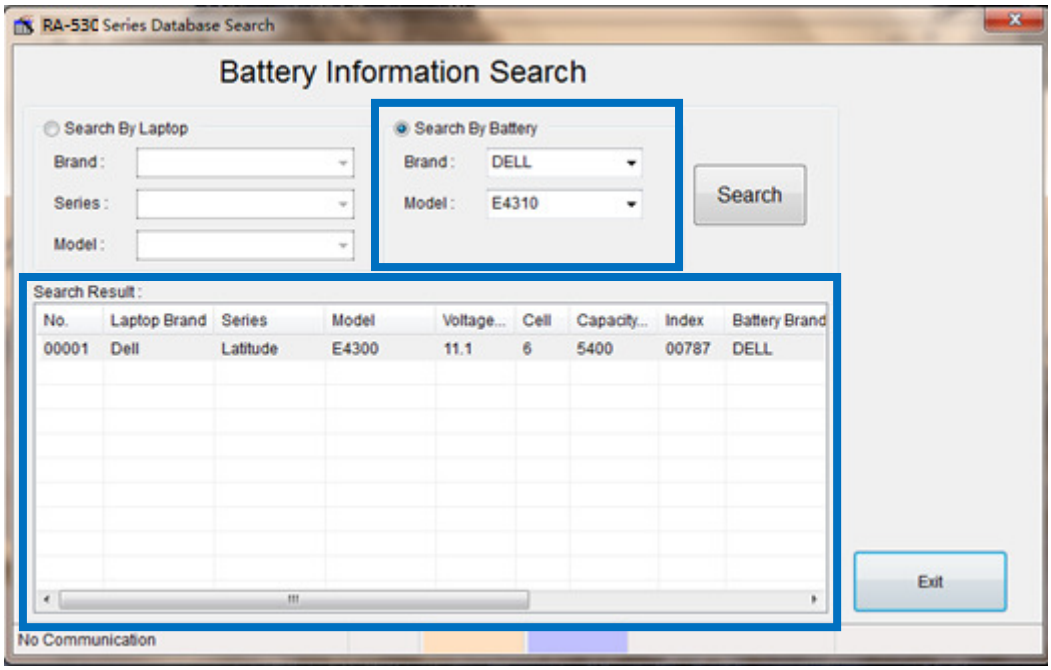


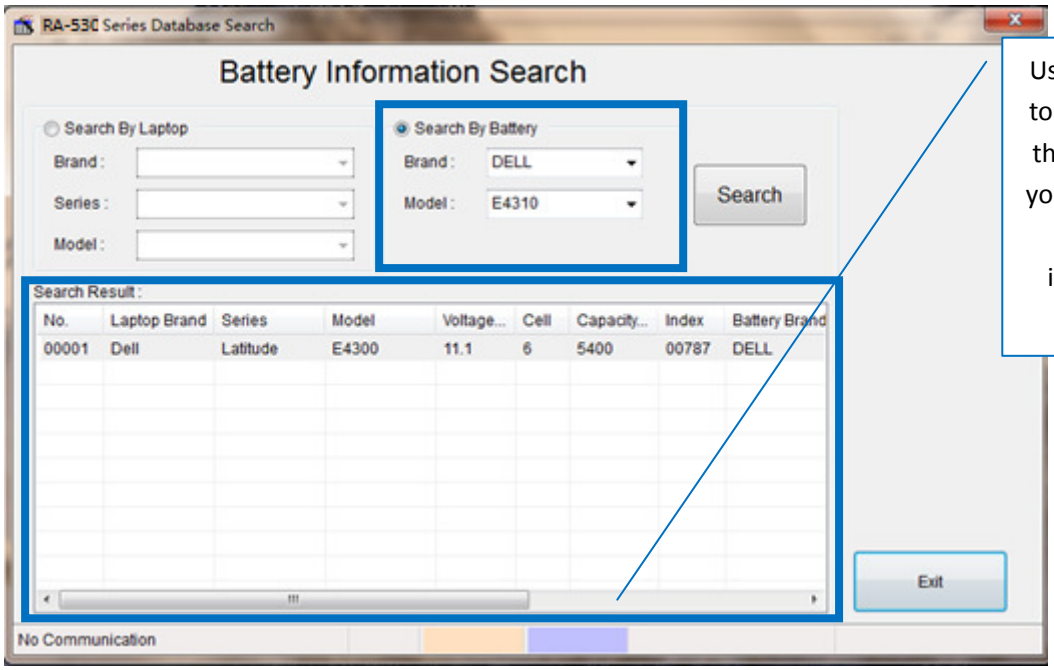
Use the mouse to move across the live bar, so you can see the required information

5.6.4. Search By Battery Model

Search By Battery Model

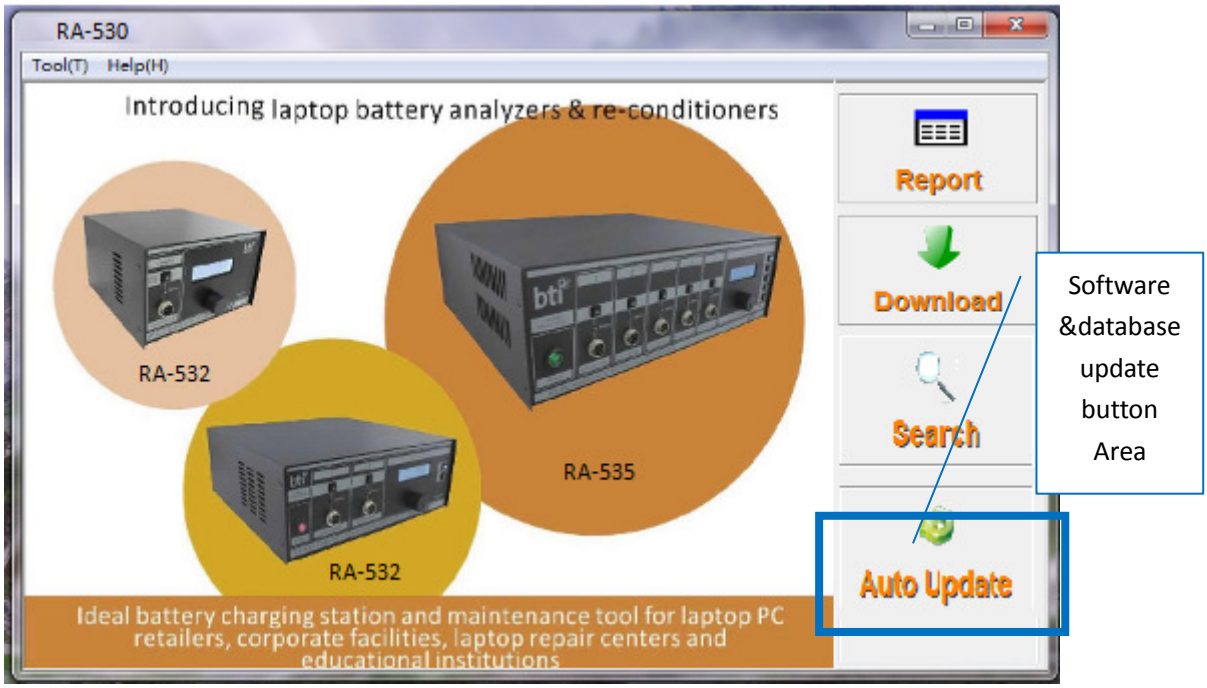
- Battery Brand drop box
- Battery Model drop box



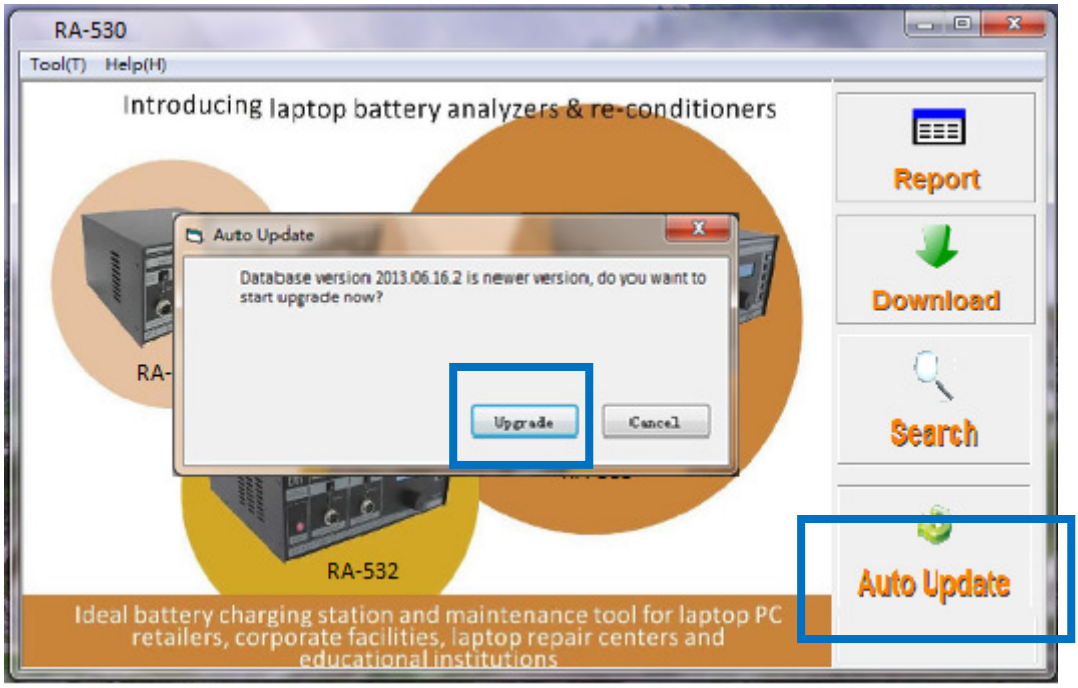


5.7. Auto Update

1. RA-530 Series Software & database Update dialogue box is shown in the below diagram:

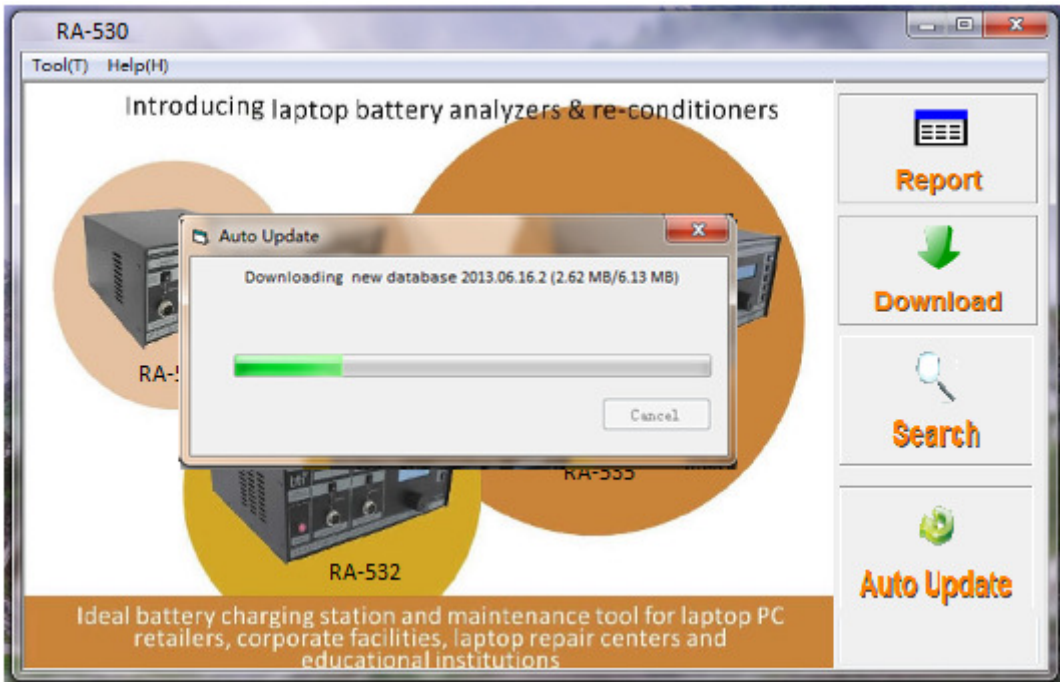


2. after pressing the 【Upgrade】button, the system will continue with the update;

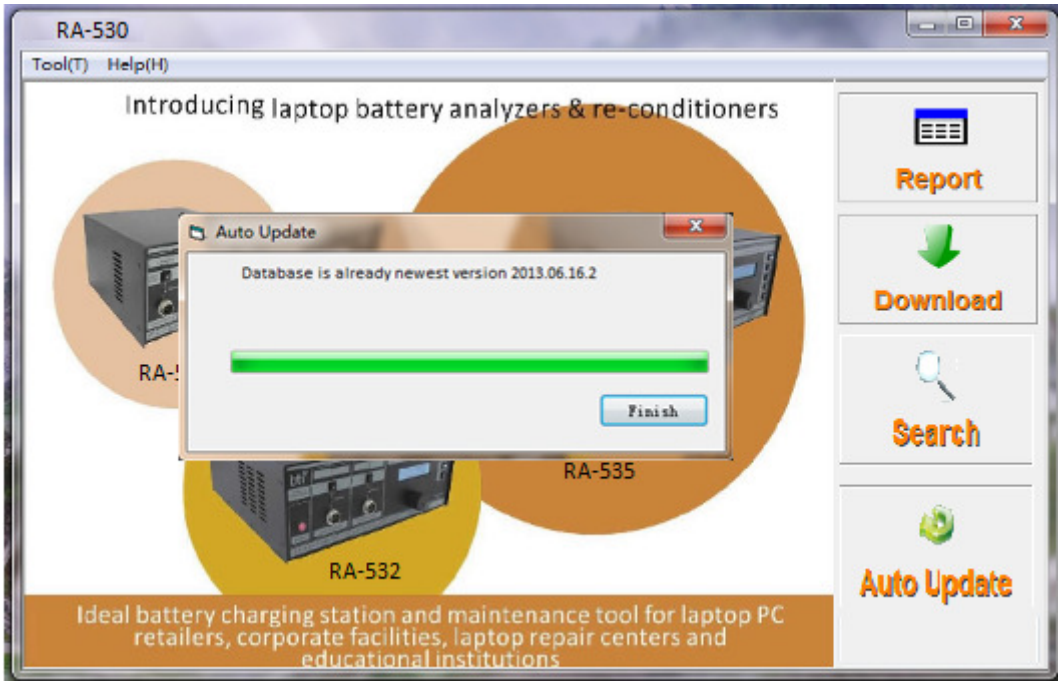


! Please make sure that the connected computer has internet access before starting the Auto-update function.

3. Update software:



4. when the update is completed ,the following windows will be displayed;



Appendix II: Battery Models List

Please check attached table for the current battery model available.

Notes: This list is subjected to change without further notices. Please check Sales Representative for the most updated listing.