La Marche Manufacturing Company | www.lamarchemfg.com

RH-3 Series

Electronic Battery Tester

Installation and Operation Manual

Important Safety Instructions

Before using this equipment read all manuals and other supporting documents related to the Battery Tester, as well as any documentation for other equipment connected to this unit. Always have a copy of a tester's manual on file nearby, in a safe place. If a replacement copy of a manual is needed, it can be found on our website at www.lamarchemfg.com.

Electrical Safety

WARNING: Hazardous Voltages are present at the connectors of power systems. The input or output from batteries may be low in voltage, but can have a very high current capacity that may cause severe or even fatal injury.

When working with any live battery or power system, follow these precautions:

- Never work alone on any live power systems; someone should always be close enough to come to your aid.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Wear complete eye protection (with side shields) and clothing protection.
- Always wear gloves and use insulated hand tools.

WARNING: Lethal Voltages are present within the power system. Parts inside the unit may still be energized even when the unit has been disconnected from the input power. Check with a meter before proceeding. Do not touch any uninsulated parts.

- A licensed electrician should be used in the installation of any unit.
- Always disconnect the unit from the supply, batteries and loads before performing maintenance or cleaning.
- If the unit is hot-swappable, simply remove it from the shelf for any maintenance or cleaning.
- Always assume that an electrical connection is live and check the connection relative to ground.
- Be sure that neither liquids nor any wet material comes in contact with any internal components.
- Do not operate this unit outside the input and output ratings listed on the unit nameplate.
- Do not use this unit for any purpose not described in the operation manual.

Mechanical Safety

- This unit or parts of the unit may get very hot during normal operation, use care when working nearby.
- Do not expose equipment to rain or snow. Always install in a clean, dry location.
- Do not operate equipment if it has received a sharp blow, been dropped, or otherwise damaged in any way.
- Do not disassemble this unit. Incorrect re-assembly may result in a risk of electric shock or fire.

Battery Safety

WARNING: Follow all of the battery manufacturer's safety recommendations when working with or around battery systems. DO NOT smoke or introduce a spark or open flame in the vicinity of a battery. Some batteries generate explosive gases during normal battery operation.

- To reduce risk of arc, connect and disconnect the battery only when the unit is off.
- If it is necessary to remove battery connections, always remove the grounded terminal from the battery first.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Always wear rubber gloves, safety glasses, and a rubber lined vest/apron when working near a battery.
- Have plenty of fresh water and soap nearby in case the battery electrolyte contacts skin, clothing, or eyes.
- If the battery electrolyte contacts skin or clothing, wash immediately with soap and water.
- If the electrolyte enters the eye, immediately flood the eye with running cold water for at least ten (10) minutes and seek medical attention immediately.
- Do not drop metal on a battery. A spark or short-circuit could occur and could cause an explosion.

Unit Location

- Allow at least 12 inches of free air on all vented surfaces (and external heatsinks) for proper cooling.
- Do not operate this unit in a closed-in area or restrict ventilation in any way.
- Do not set any battery on top of this unit.
- Never allow battery electrolyte to drip on this unit when reading the specific gravity or filling the battery.
- Never place this unit directly above a standard flooded battery. Gases from the battery will corrode and damage equipment.
- A sealed maintenance free or valve regulated lead acid (VRLA) battery may be placed below this equipment.

Check for Damages

Prior to unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior of product for damage. If any damage is observed, contact the carrier immediately. Contact La Marche for advice on the risk due to any damage before installing the product. Verify that you have all the necessary parts per your order for proper assembly.

CAUTION: Failure to properly file a claim for shipping damages or provide a copy of the claim to La Marche may void warranty service for any physical damages reported for repair.

Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is damaged/unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

La Marche is not responsible for damage caused by improper packaging of returned products.

Inspection Checklist

- Enclosure exterior is not marred or dented.
- There are no visibly damaged components.
- All hardware and connections are tight.
- All wired terminations are secure.
- All items on packing list have been included.

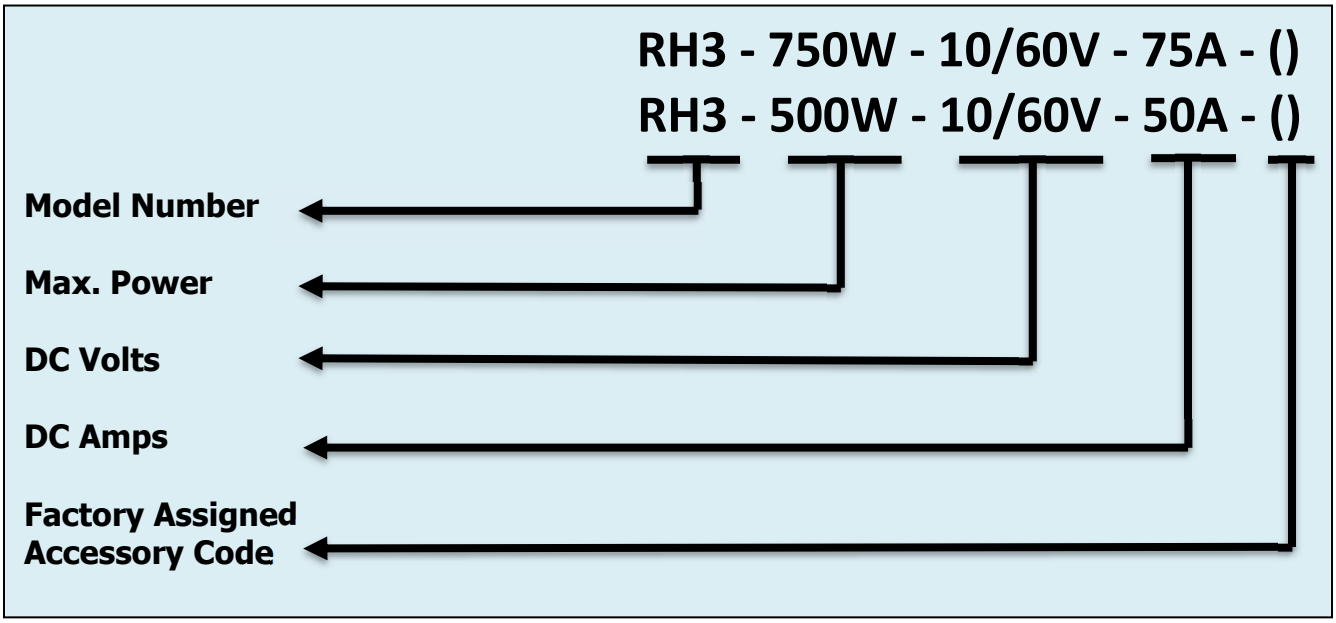
Handling

Use adequate manpower or equipment for handling. Until the equipment is securely mounted, care must be used to prevent the equipment from being accidentally tipped over.

Table of Contents

Understanding the Model Number

The RH-3 series battery tester model number is coded to describe the charger and the options that are included. Find the model number on the nomenclature nameplate of the charger. Then, follow the chart to determine the configuration of your model.



Optional Accessories Included in the Unit

This unit may have been outfitted with a number of optional accessories or option packages. To find out what options this Tester has (if any), refer to the very first page of the manual package.

Installation

The Battery Tester can be used with high capacity battery banks. Therefore, extra care must be taken while working with Battery Tester and Batteries. Incorrect use of the tester can result in damage or serious injury. Before working on the tester, the user should carefully read manual and in particular the following cautions and warnings.

- Install external fuses/breakers as the Battery Tester does not include any internal fuse. The user is responsible for appropriate external connections.
- Always confirm the polarity of the battery and charger wires while connecting to the Battery Tester. Reverse polarity connections can damage the Battery Tester and battery. Incorrect battery and charger polarity can result in *damage or serious injuries.*
- The Battery Tester dissipates a considerable amount of heat. Ensure that the airflow to and from the fans is unobstructed. Provide at least 12" (approx.) of clearance to each side of the Battery Tester.
- Always ensure all power connections are tight to avoid excessive heating from a loose connection. Loose connections may lead to damage of the Battery Tester.

The input and output connections should be made following the below block diagram:

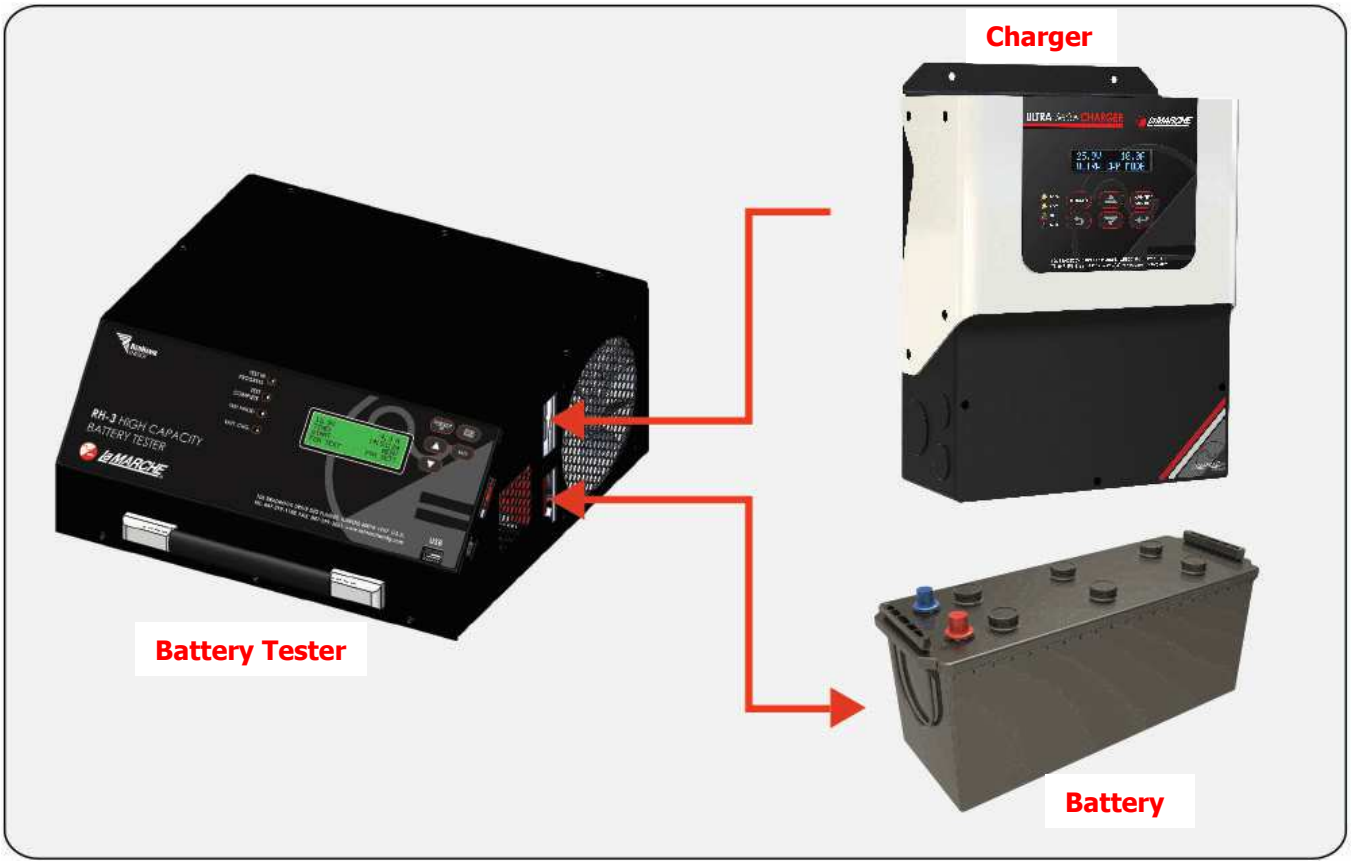
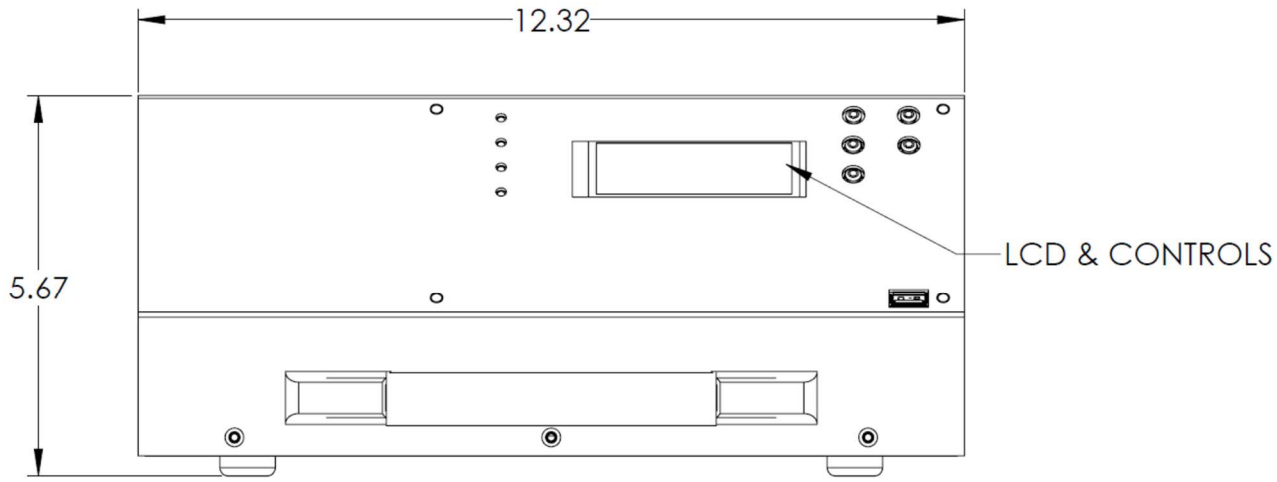
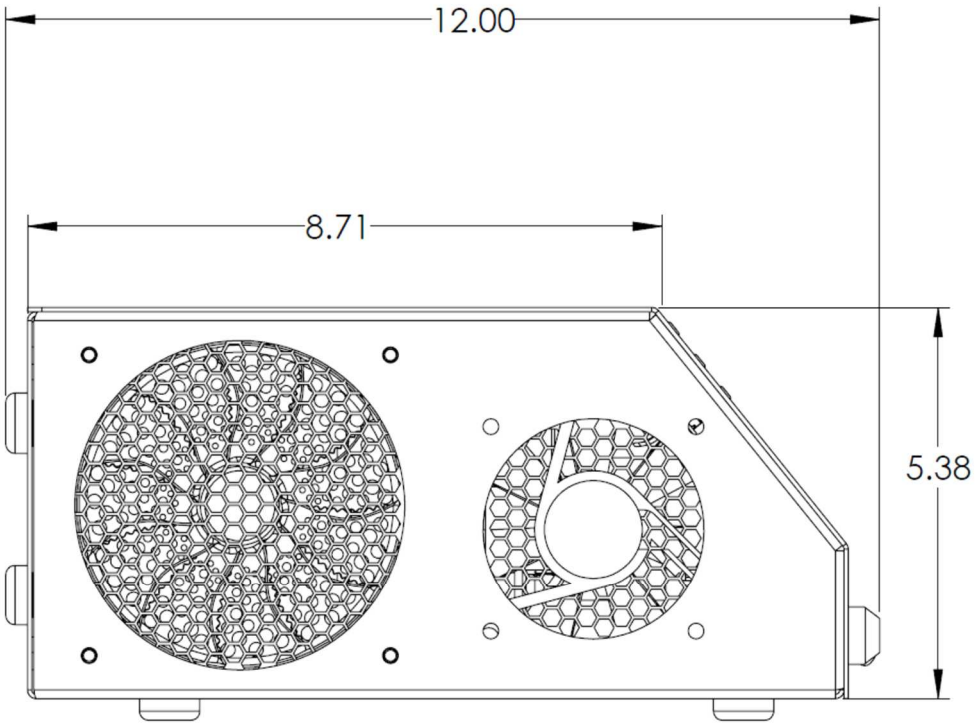


Figure 1 – RH3 Typical Setup

CAUTION: **The Tester does not contain any fusing between the battery and charger. The user is responsible for ensuring that appropriate external fusing is provided.**



FRONT VIEW



LEFT SIDE VIEW

NOTE: *All dimensions are in INCHES unless otherwise specified.*

Electrical Connections

The Electronic Battery Tester is equipped with Anderson heavy duty power connectors; one for the charger and the other for the battery. Refer to the figure below.

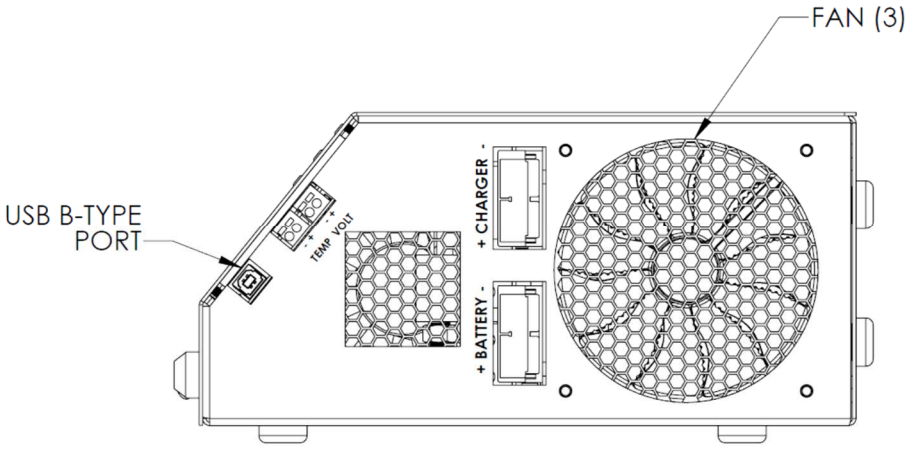


Figure 2 – Tester Connections (Right Side View)

Battery Connections

The battery connections are made between the RH3 Battery Tester and the battery under test with the help of red Anderson SB120 connector. Before connecting the battery to the tester, ensure the correct polarity of the battery wires being connected to the Battery Tester. Ensure that the battery wires used are of appropriate rating.

CAUTION: **When connecting the red Anderson connector DC cables to the battery, be certain the positive terminal of the battery is connected to the red wire of the red Anderson connector and the negative terminal of the battery is connected to the black wire of the red Anderson connector.**

Charger Connections

After confirming correct battery connection to the tester, connect external charger to the tester through Grey Anderson SB120 connector. Before connecting the external charger to the tester, ensure the correct polarity of the charger wires being connected to the tester. Use only rated charger for charging the battery through the tester as listed in the manual.

CAUTION: **When connecting the grey Anderson connector DC cables to the charger, be certain the positive terminal of the charger is connected to the red wire of the grey Anderson connector and the negative terminal of the charger is connected to the black wire of the grey Anderson connector.**

In case of longer cables needed for the connections, select proper size for the DC wiring from the wire size table below (Table 1). If the distance between the tester's terminals and the charger / battery exceed 10 feet, use the Power Cable Guide on the following page to minimize the voltage drop across the wire distance.

After making all connections, refer to *Initial Setup* section under *Operations* for Battery Tester settings and configurations.

Power Cabling Guide

Use the following formulas and table to determine proper wire size for minimal voltage drop.

Table of Conventions

CMA = Cross section of wire in circular MIL area
A = Ultimate drain in amperes
LF = Conductor loop feet
Max. Amp = Maximum allowable amperes for given voltage drop AVD = Allowable voltage drop
K = 11.1 for commercial (TW) copper wire (KS5482-01)
OR
= 7.4 for aluminum (KS20189)

Calculating Wire Size Requirements

$$CMA = \frac{A \times LF \times K}{AVD}$$

Calculating Current Carrying Capacity of Wire

$$Max.\ Amp = \frac{CMA \times AVD}{LF \times K}$$

SIZE (AWG)	AREA CIR.MILS	SIZE (AWG)	AREA CIR.MILS
18	1620	6	26240
16	2580	4	41740
14	4110	3	52620
12	6530	2	66360
10	10380	1	83690
8	16510	0	105600

Table 1 - Wire Size/Area Table

CAUTION: When connecting the DC cables to the battery, be certain the positive terminal of the charger is connected to the positive battery terminal and the negative terminal is connected to the negative battery terminal.

Operation

All equipment is shipped from the factory fully checked and adjusted to factory default settings. Before connecting the battery or charger, check with both the manufacturers for the correct voltage settings and adjust the configuration accordingly. Failure to match the battery/charger settings with the connected battery may damage or shorten the life of battery.

Initial Setup

Before starting up the Battery Tester, check and verify all connections made are secure and tightened securely. Check that the input and output voltage of battery and charger mentioned on nameplate, matches the declared manufacturer ratings for battery and charger. Before starting any test, all settings must be confirmed per battery.

Front Display and Indicators

Upon feeding power to the Battery Tester, the LCD will display current software version and all LEDs will turn on. After the complete start-up procedure, the LCD display will show the charger/battery DC voltage, DC output amperage, and the current time. The figure below shows the basic indicators and selection operation for the Battery Tester.

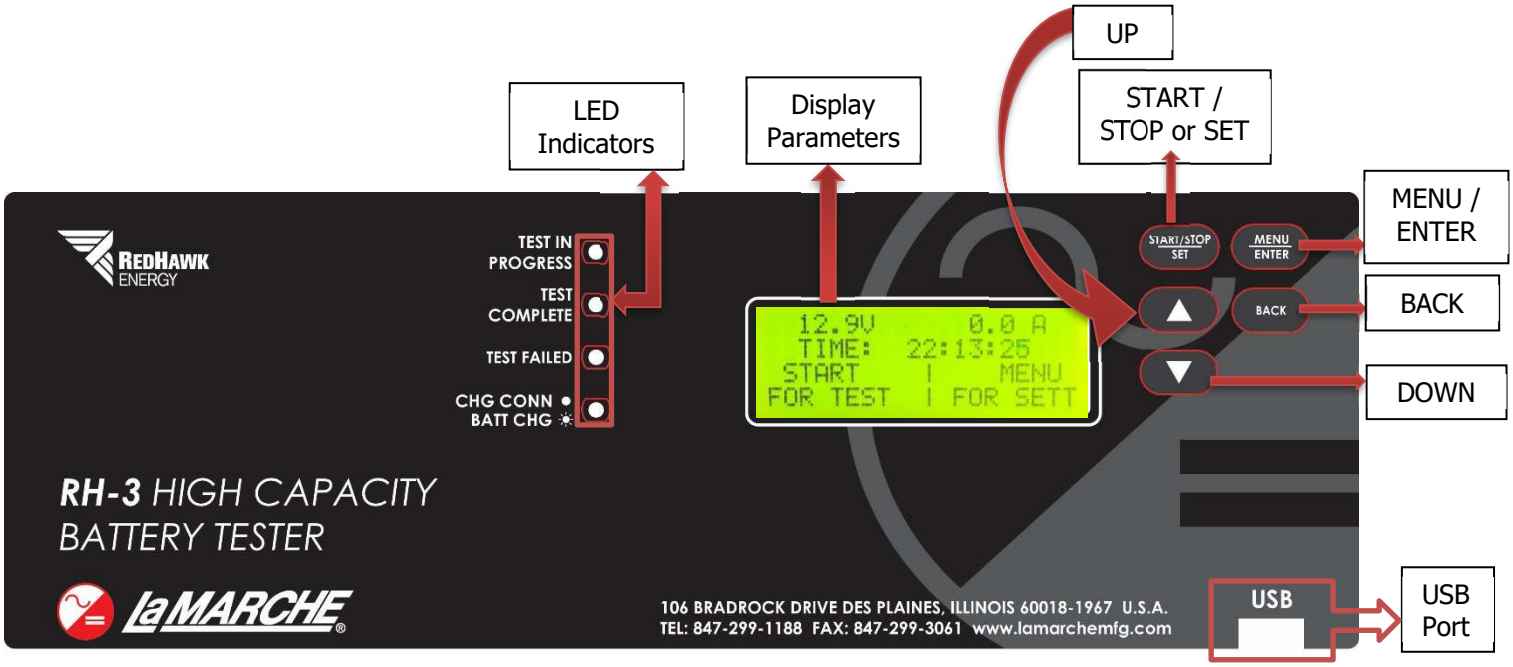


Figure 3 – Front Panel Display

Controls

Start/Stop or Set – The Start / Stop button is used to start or stop test under process. It is also used for SET, allowing the user to confirm the selection made in the Configuration Menu.

Menu / Enter – The Menu / Enter button is used to access the Configuration Menu and to select parameters that allow the user to enter into different branches of configuration.

Up / Down – The Up and Down buttons are used to review additional information regarding the test, for navigation within the Configuration Menu, and also used to increase or decrease parameter values.

Back – The Back button allows the user to navigate back to the previous menu or completely out of the Configuration Menu.

LED Indicators/Alarms

LCD Display – The LCD Display shows the Charger / Battery DC Voltage, Output DC Amperage, Battery Voltage % during test, Drawn AH, and various other parameters depending on what test is in process. Charging / Discharging modes and different alarm conditions will be displayed, should they occur

Test in Progress (Green) – This LED illuminates when the tester is discharging the battery.

Test Complete (Green) – This LED illuminates when number of cycle(s) of test is complete.

Test Failed (Red) – This LED turns on under any failure condition during test.

Chg. Conn. / Batt. Chg. (Yellow) – This LED blinks when the battery is charging & remains solid when the charger is connected and the battery is fully charged.

Test Failures

Following are the conditions for test failure:

FET Unbalanced – The electronic load in the Battery Tester consists of three high power MOSFETs. Each MOSFET has its own control circuit and the unit is set up to share the load between the three MOSFETs. If the unit detects a significant current imbalance among the 3 MOSFETs, the Battery Tester will consider this an indication of a hardware failure and will stop the test.

Over Voltage – The test will end if the battery voltage at the start of the test is greater than 60VDC.

Thermal Shutdown – "THERMAL SHUTDOWN" will display on the LCD and the unit output will shut off when the internal temperature exceeds 90°C.

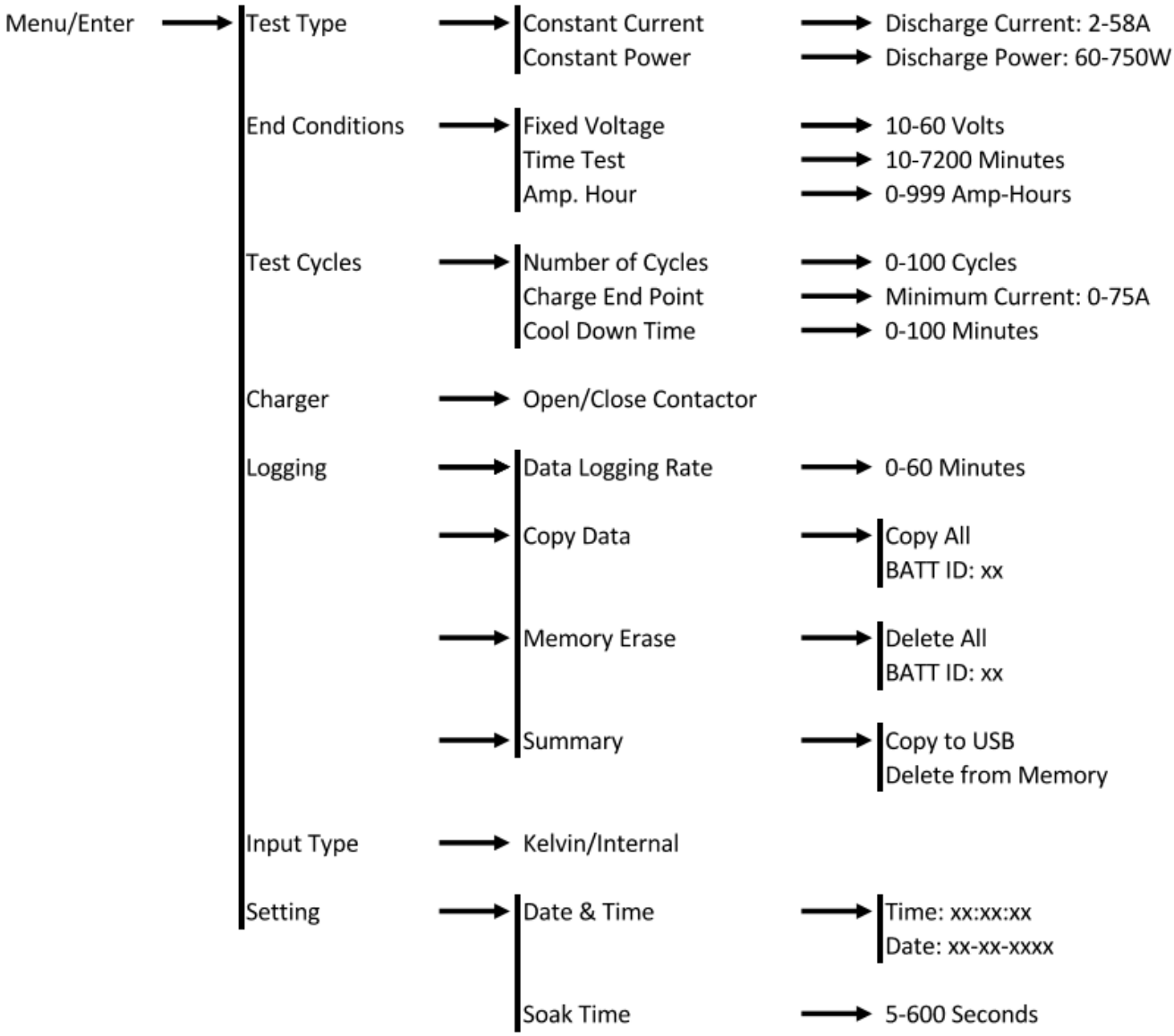
Test Failed – "TEST FAILED" will display on the LCD if the charger fails to charge the battery during the charge cycle of the test.

Insufficient Battery Capacity – "INSUFFICIENT BATTERY CAPACITY" will display on the LCD if the Battery Tester fails to remove set Amp-hours from the battery.

Configuration Mode

To enter Configuration Mode, press "MENU/ENTER" button. Once in Configuration Mode, use the Up and Down buttons to cycle through the available options and the "MENU/ENTER" button to choose the highlighted option. See the chart below for the adjustable settings in Configuration Mode. The controller settings will remain stored, even in the event of total power failure.

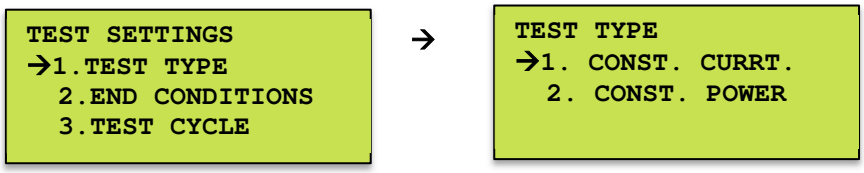
RH-3 Menu Structure



The Configuration Menu is divided into 7 submenus: "Test Type", "End Conditions", "Test Cycle", "Charger", "Logging", "Input Type", and "Setting."

Test Type

The Test Type submenu allows access to change the discharge cycle type the Battery Tester will perform, whether it is Constant Current or Constant Power. Press "MENU/ENTER" to enter the TEST SETTINGS menu and press "MENU" again which allows to select the "TEST TYPE".

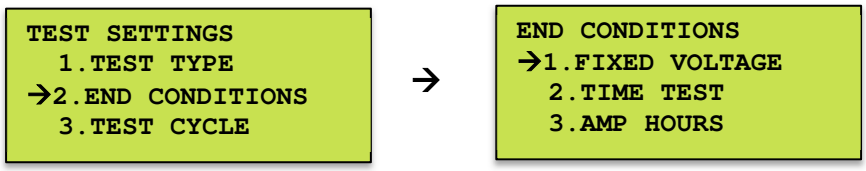


- **Constant Current –** The battery will be discharged at a specified constant current rate, dependent on the type of battery connected. Constant current ranges are shown below:
    - 12VDC Battery → 2 – 37 Amps (500W) / 2 – 50 Amps (750W)
    - 24VDC Battery → 2 – 18 Amps (500W) / 2 – 30 Amps (750W)
    - 48VDC Battery → 2 – 9 Amps (500W) / 2 – 15 Amps (750W)
- **Constant Power –** The battery will be discharged by applying amount of power ranging from **60W – 500W/750W**.

NOTE: *Consult the battery manufacturer for proper charge / discharge parameters.*

End Conditions

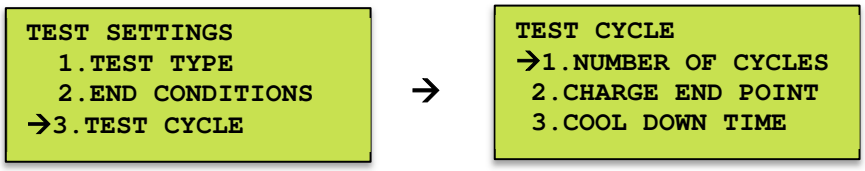
The End Conditions submenu allows user to select the condition which will end the battery test. The three available end conditions are Fixed Voltage, Time Test, or Amp Hours. Press "MENU/ENTER" to enter TEST SETTINGS menu and select "END CONDITIONS" to change or modify the test end conditions.



- **Fixed Voltage –** The test continues until the battery voltage reaches set volts, ranging from **10 – 60VDC**.
- **Time Test –** The test continues until the timer reaches set time, ranging from **10 – 7200 minutes**, or the **battery voltage** reaches the set volts value.
- **Amp Hours –** The test continues until the Amp hours drawn reaches set AH, ranging from **10 – 999 Amp Hours**, or the **battery voltage** reaches the set volts value.

Test Cycle

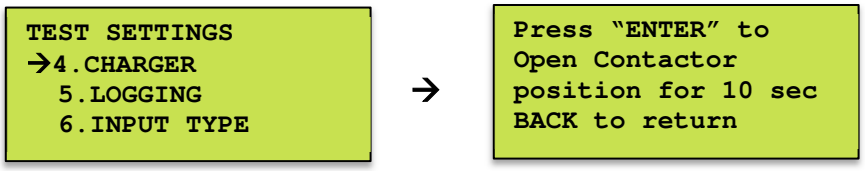
A Test Cycle consists of discharging the batteries (discharge cycle), using the selected Test Type, followed by charging the batteries (charge cycle). The Test Cycle submenu allows user to select the number of test cycles the Tester should perform, the minimum current supplied by the charger to end the charging cycle, and the cool down time in between each Test Cycle. Press "MENU/ENTER" to enter TEST SETTINGS and select "TEST CYCLE" to change or modify the Test Cycle conditions.



- **Number of Cycles –** This allows the user to set the number of Test Cycles desired which ranges from **0 – 100 cycles**.
- **Charge End Point –** This allows the user to set the minimum amount of current the charger is permitted to supply to the batteries. Once the current goes lower than the set threshold, the charge cycle will finish. The minimum current ranges from **0 – 75 Amps**.
- **Cool Down Time –** This allows the user to set the cool down time for the Battery Tester after a Test Cycle and ranges from **0 – 100 minutes**.

Charger

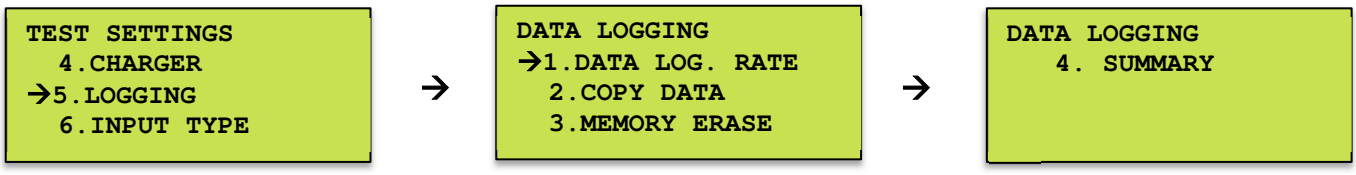
The Charger submenu allows the user to open the Tester's contactor for 10 seconds in order to safely disconnect the charger from the Tester. Press "MENU/ENTER" to enter TEST SETTINGS and select "CHARGER." The message below will be displayed and once ready to disconnect, press "MENU/ENTER" to disconnect the charger from battery.



After pressing the "MENU/ENTER" button, the display will show "Charger Contactor OPEN, Back to Close." Once assured the charger has been disconnected, press BACK to close the contactor.

Logging

The Logging submenu allows access to change the data logging rate, as well as access to copy or erase the logged data. Press "MENU/ENTER" to enter TEST SETTINGS and select "LOGGING" for data logging options.



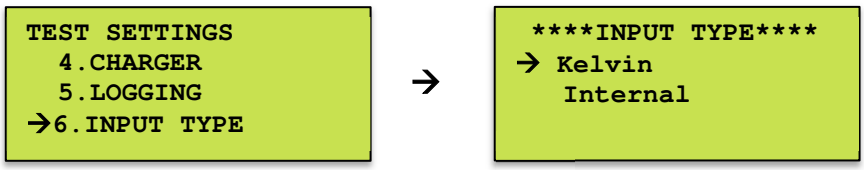
- **Data Logging Rate –** This option allows user control over the rate of data logging, ranging from 1 second to 60 minutes.
- **Copy Data –** This option stores the data logged during the test cycle(s) with referenced to set battery ID (for e.g. "Battery ID".csv). It also creates an Excel spreadsheet with different input/output parameters.
- **Memory Erase –** This option enables user to erase the particular Battery ID or entire memory of logged data from internal memory.

- **Summary –** This option enables user to copy the overall summary data of Charge/Discharge cycles for all the battery IDs into one single file as "SUMMARY.csv", which can be saved into a Flash drive. Also, this option can be used to delete the "SUMMARY" file from internal memory of the Battery Tester.

NOTE: *In order to store data to flash drive, connect flash drive to USB port to transfer the logged data.*

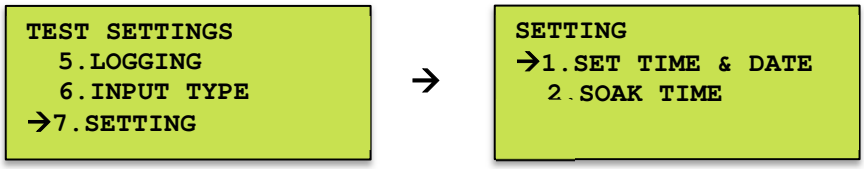
Input Type

The Input Type submenu allows access to change the input type of the Kelvin terminals provided on the side of the RH3. Press "MENU/ENTER" to enter TEST SETTINGS and select "INPUT TYPE" to modify INPUT TYPE to Kelvin or Internal.



Battery Tester Setting

The Setting submenu allows access to change the date & time, as well as the soak time. Press "MENU/ENTER" to enter TEST SETTINGS and select "SETTINGS" to modify DATE / TIME and SOAK TIME.



- **Set Time & Date** – This option allows to modify the data and time.

NOTE: *It is recommended to change or modify the Date & Time prior to any operation or test.*

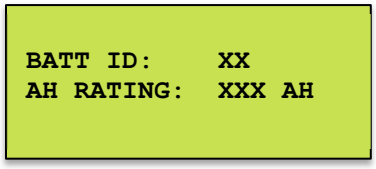
- **Soak Time** – This option allows user to modify the soak time, or ramp up time, before the start of the charge cycle of the test.

Starting the Test

Before starting the battery test, assure all the settings are set per declared ranges from the battery and charger manufacturer. If test is to be run in Time end condition or Amp Hour end condition, Fixed Voltage should be set first and then End time or Amp Hours should be set.

NOTE: *During any time of the test process, the test can be manually stopped by pressing the "START/STOP" button.*

1. To start the test, press "START / STOP" button which brings up the settings shown below. Press "MENU/ENTER" button to move to the next digit. Once these settings are set correctly, press "SET" button to confirm and move to next step.

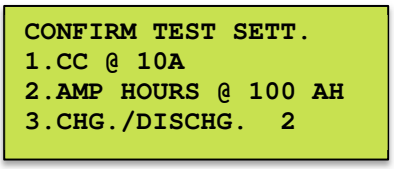


CAUTION: **If no charger is connected, the Tester will warn you of the fact as without the charger, the Tester cannot recharge the batteries after the discharge cycle***.*

- **Batt ID –** Set the "Battery ID" to identify the battery under test by setting up a two-digit serial number.
- **AH Rating –** Set the "AH Rating" to the capacity of the battery under test.

Once these settings have been confirmed to be correct, press "SET" button to confirm and move to next step.

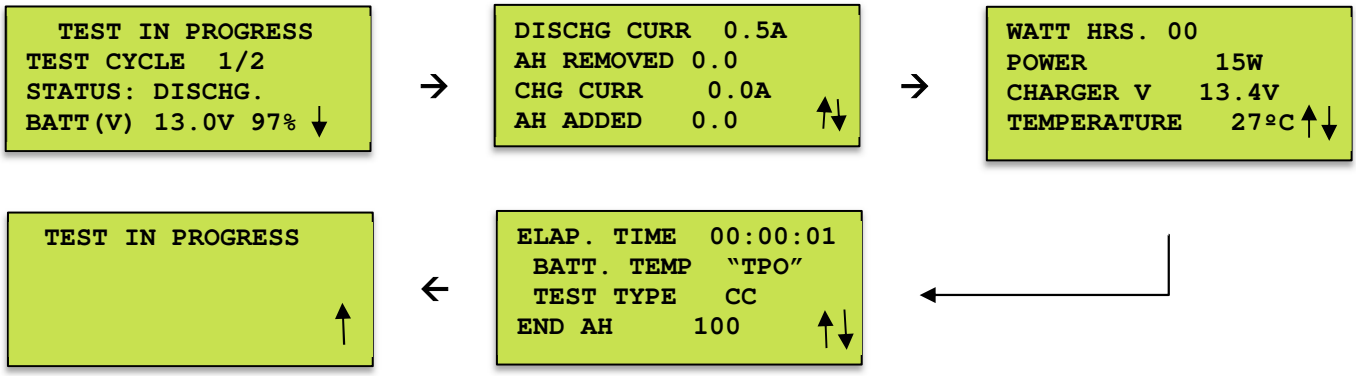
2. Confirm the test settings selected in Configuration Mode. Press "SET" button to confirm the test settings. See the below display image for an example test settings confirmation message.



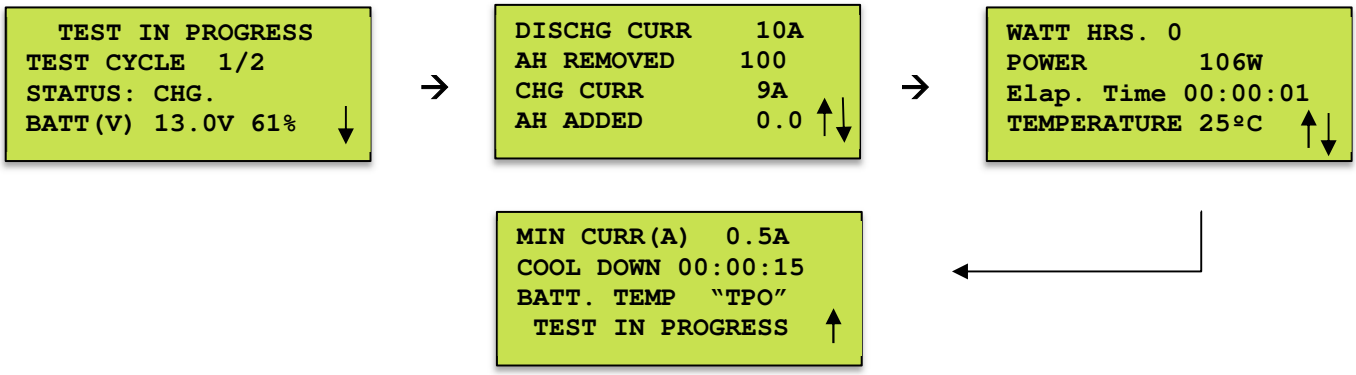
1. CC @ 10A: Constant Current Test at 10 Amps
2. AMP HOURS @ 100 AH: Amp hours set to 100 AH
3. CHG./DISCHG. 2: Number of Test Cycles set to 2

NOTE: *If settings need to be changed, press "BACK" button to go to the home screen and enter Configuration Mode.*

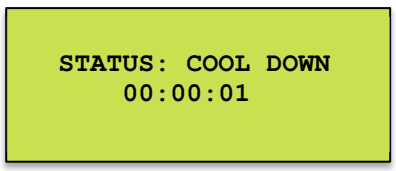
3. After all settings have been made, the Battery Tester will begin the discharge cycle. "Test in Progress" LED will start blinking until the test is in soak time for 15 seconds. Later "Test in Progress" LED will be solid ON. Test information can be seen on the display, as shown below, and can be scrolled through using the UP/DOWN buttons as desired.



4. When zero cycles are selected, the test will complete once end condition is reached during discharge. When more than zero cycles are selected and Battery Tester has reached the end condition, it will end the discharge cycle, begin the charge cycle by connecting the charger to the batteries. The "Batt Chg." LED will start blinking during the charge cycle and will become solid once the charge has been complete. Test information can be seen on the display, as shown below, and can be scrolled through using the UP/DOWN buttons as desired.



5. When one test cycle is selected and battery tester has reached charge end condition, the test gets completed. When more than one test cycles are selected and the Battery Tester has reached the charge end condition, it will end the charge cycle and will begin the cool down time. The display will show the elapsed cool down time, as shown below.



Once the cool down time has been complete, the Tester will have finished a full Test Cycle. If the number of test cycles was greater than 1, it will commence the next test cycle and will repeat this cycle until all cycles have been completed. Once test is completed, "Test Complete LED" will be ON and all the test data will be on display until BACK button is pressed.

Additional Functions

USB Port (Type A):

Allows the user to save the logged test data from battery tester by using a USB flash drive (refer to *Data Logging* section for setup instructions and Figure 2 for location).

USB Port (Type B):

Allows the user to monitor live test data. To use this function, user needs to install driver software provided in the USB flash drive with the Battery Tester (Refer to *Data Logging* section for setup instructions and Figure 2 for location).

Temperature Compensation:

This feature monitors battery temperature, when an external temperature probe is connected to "TEMP." (Remote Temperature Sensing) terminals. In case, no probe is connected, the Tester will show "TPO" (Temperature Probe Open) on the screen during test.

Voltage Sensing:

This feature allows to match the displayed voltage and actual battery voltage, as actual battery voltage may be lower due to volts drop in cables connected to batteries.

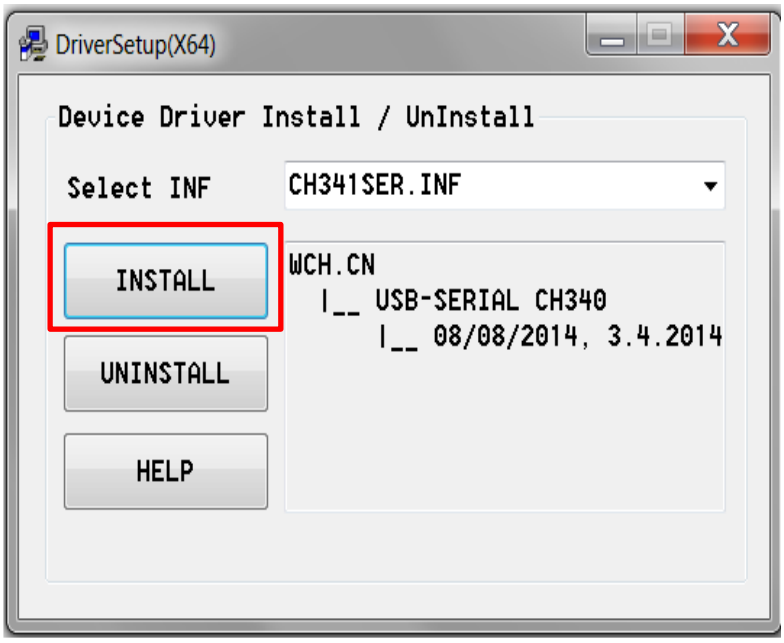
Data Logging

For USB data logging, the "Termite version 3.4" software is used, included on the USB flash drive, and is easily available online at: https://www.compuphase.com/software_termite.htm

To setup USB data logging, Follow the steps below to install the driver and the Termite software.

Driver Installation:

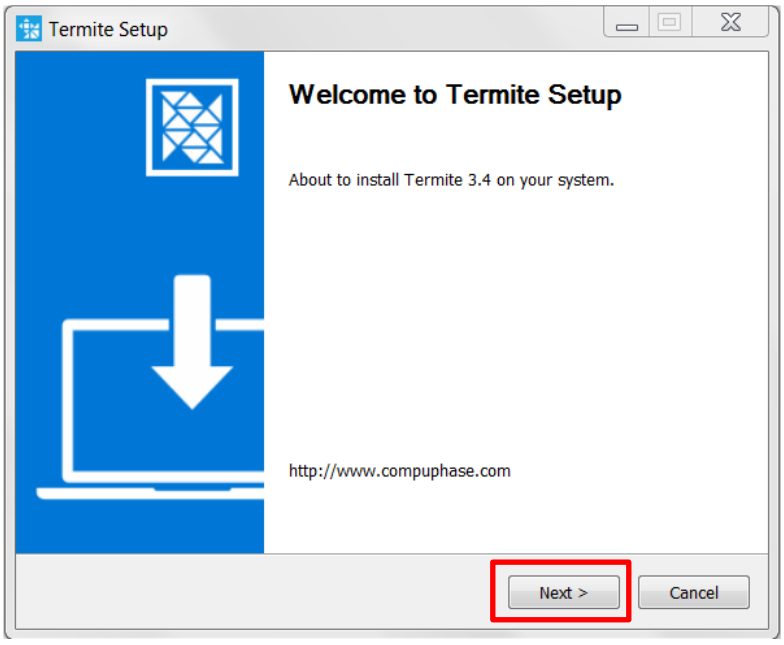
1. Install the driver "CH34x_Install_Windows_v3_4.EXE" on computer system from "Driver" folder on USB flash drive.



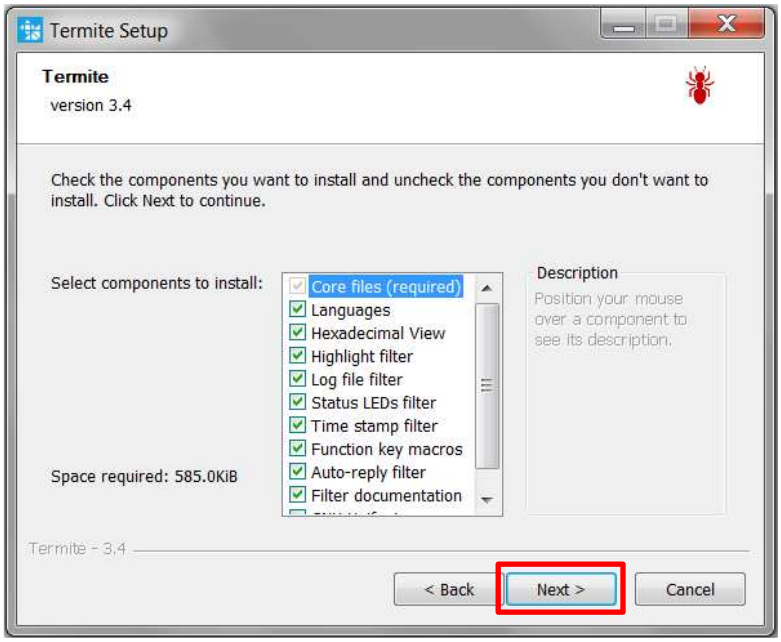
2. After installing the driver, please disconnect and reconnect the USB cable from the Battery Tester.

Termite Software Installation:

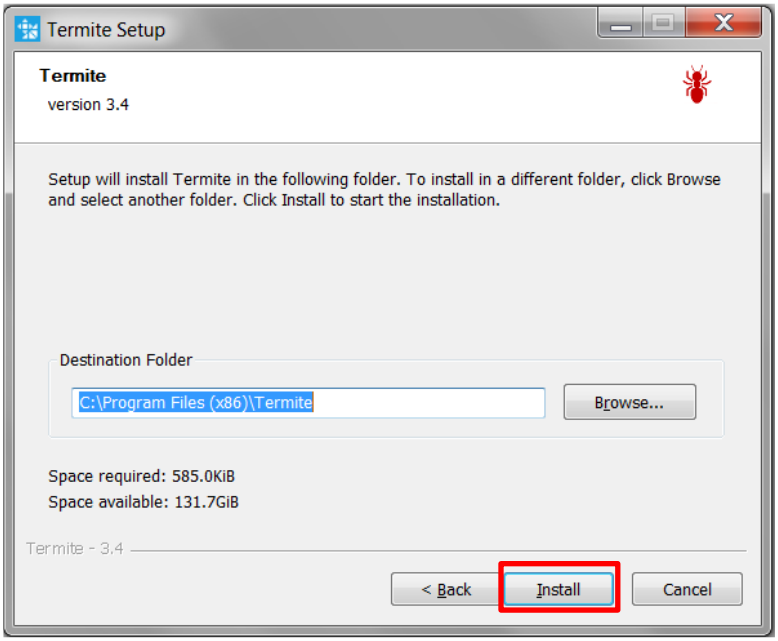
1. Run "termite-3.4.exe" file and click next per below image.



2. Ensure all components are checked and you have the required hard drive space required. Then, click on "Next" tab as shown in below image.

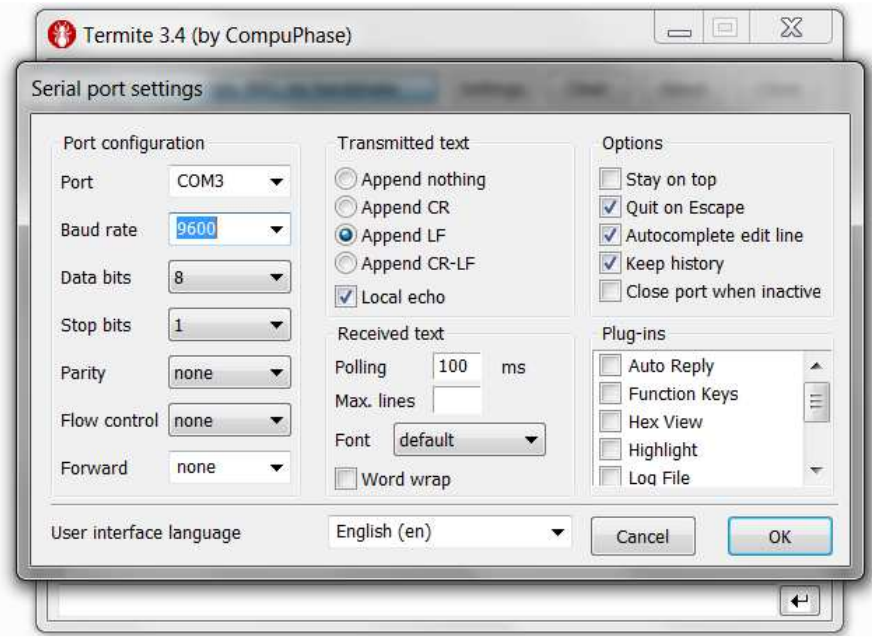


3. Click on "Install" tab to install the software as shown in below image:

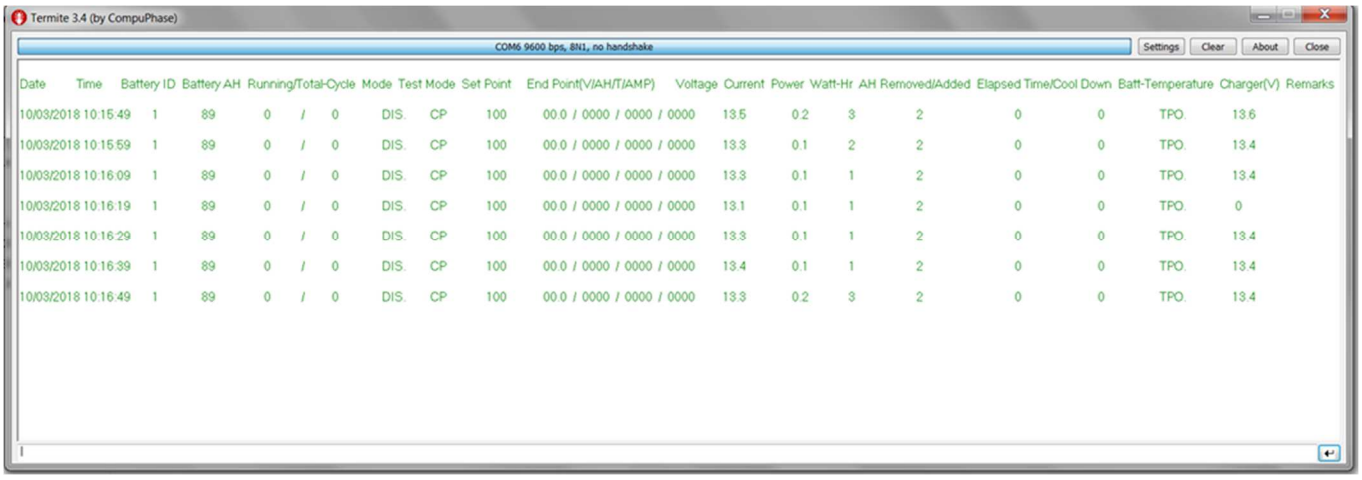


4. Click on "Finish" tab to complete installation process and run the Termite software.

5. Once the Termite software is running, go to "Settings" tab to enter the Port and Baud Rate, along with other required settings per below image.



6. After making all settings per above image, live data will appear on the Termite window per below image.



Date	Time	Battery ID	Battery AH	Running/Total-Cycle	Mode	Test Mode	Set Point	End Point(V/AH/T/AMP)	Voltage	Current	Power	Watt-Hr	AH	Removed/Added	Elapsed Time/Cool Down	Batt-Temperature	Charger(V)	Remarks
10/03/2018	10:15:49	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.5	0.2	3	2	0	0	TPO.	13.6	
10/03/2018	10:15:59	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.3	0.1	2	2	0	0	TPO.	13.4	
10/03/2018	10:16:09	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.3	0.1	1	2	0	0	TPO.	13.4	
10/03/2018	10:16:19	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.1	0.1	1	2	0	0	TPO.	0	
10/03/2018	10:16:29	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.3	0.1	1	2	0	0	TPO.	13.4	
10/03/2018	10:16:39	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.4	0.1	1	2	0	0	TPO.	13.4	
10/03/2018	10:16:49	1	89	0 / 0	DIS.	CP	100	00.0 / 0000 / 0000 / 0000	13.3	0.2	3	2	0	0	TPO.	13.4	

Service

All work inside the Battery Tester should be performed by a qualified electrician. La Marche is not responsible for any damages caused by an unqualified technician.

Before working inside the Battery Tester, ensure that the both connectors of Charger & Battery are disconnected via the Battery / Charger disconnect breaker or manually disconnecting the connectors. Verify that no voltage is present by using a voltmeter at the Battery Tester terminals.

Performing Routine Maintenance

In order for the battery tester to continue to operate properly, it must undergo routine maintenance. The recommended maintenance schedule is listed below:

Yearly

1. Blow out Battery Tester with a low-pressure air hose.
2. Make sure all connections are tight.
3. Perform a visual check on all internal components.
4. Check front panel meters and LEDs for accuracy.

Troubleshooting Procedure

Troubleshooting should be performed only by trained service personnel or experienced electricians. Before setting up any complicated testing, give the unit a general inspection.

Check the following:

1. Check DC output cables, connections, battery type, and number of cells against the unit's rating.
2. Check unit specifications against customer order.
3. Check input connections, input voltage and feeder breaker/fuse.
4. Check for shipping damage, loose connections, broken wires, etc.
5. Certain failures can be caused by defective batteries; make sure batteries are free from defects.

When calling in for a service inquiry or for troubleshooting assistance, be sure to have all of the following information on hand:

1. Equipment model number and serial number.

NOTE: *When ordering replacement parts, drawings, or schematics, always give model number and serial number.*

Troubleshooting Chart

Symptom	Possible Cause(s)
No Display and No LEDs	Loose or no connections from battery to the Battery Tester Defective Display Driver Card
Meter Reading Incorrect Voltage or Current (For batteries only)	Remote voltage sensing connection needed
Unit Running Hot	Inadequate Ventilation Ambient is Too Hot
Battery Temperature Too High	Ambient is Too Hot Shorted Battery Cell(s)
Low Output Voltage or Current	Voltage Incorrectly Set Charger is in Current Limit
High Output Voltage or Current	Voltage Incorrectly Set

Appendix A: RH-3 Battery Tester Specifications

Specifications	
Input Voltage Range	10V - 60V
Test Modes	Constant Current Constant Power
Termination Condition	End of Voltage Maximum Amp Hour Drawn Elapsed Time
Max. Discharge Current	50A | 75A
Max. Discharge Power	500W | 750W
Discharge / Charge Parameters	Voltage | Voltage % Current | Amp-Hrs Power | Watt-Hrs Temperature Elapsed Time
Data Logging	Up to 99 Battery Log Files
FAN Operation Based on Thermal Sensing	Yes
Protection	Battery Reverse Polarity Battery Over Voltage Thermal Shutdown Internal Device Failure Shutdown
Internal Memory	Up to 8GB
External Port	USB
User Interface	LCD Display and LED Indicators
Operating Temperature	0 - 40°C (32 - 104°F)

Appendix B: Manufacturer's Warranty

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory and is warranted to be free from any defect in workmanship and material that may develop within three (3) years from date of purchase.

Any part or parts of the equipment (except fuses, d.c. connectors and other wear-related items) that prove defective within a three (3) year period shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation.

Should a piece of equipment require repair during the warranty period, the equipment can be returned to the La Marche factory to have the inspection, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer during the first three years. Transportation charges or duties shall be borne by purchaser.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard La Marche units will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special units are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

The above warranty is exclusive, supersedes and is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer, nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an official of the manufacturer.

Appendix C: Document Control and Revision History

Part Number: 139602
Instruction Number: P25-LRH3-1
Issue ECN: **21950**

22445 – 1/20	22261 – 10/19		