

Author: Jacob Peters	Hapeman Electronics 761 N. Cottage Road Mercer, PA 16137	Mobile Battery Tester Model HE3000 User Manual
Approved By: Bryan Hapeman		
For:		Date: 05/05/2021

Single Battery Tester for Locomotives

PN: HE3000

User Manual

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Purpose:

The purpose of this document is to explain the process required to safely use and maintain the Hapeman Electronics Single-Battery Tester for locomotive batteries.

Disclaimer: Hapeman Electronics is not responsible for injuries or damages resulting from the improper or untrained use of this device. Please abide by all safety recommendations, rules, and regulations regarding this product while it is in operation.

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WARNING:

Hazardous power present.

- 110VAC at 5A (when plugged in) and 24V 7Ah batteries supply the cabinet
- 36VDC input from the connected battery

Any battery connected to the tester adds 36VDC at potentially lethal currents. If possible, disconnect battery before opening the door to the battery tester. Otherwise, power from connected battery will be exposed within the battery tester EVEN WHEN THE MAIN POWER IS OFF.

Do not operate when any of the sides of the resistive load are removed. It becomes hot during use and may cause potentially serious burns upon touch.

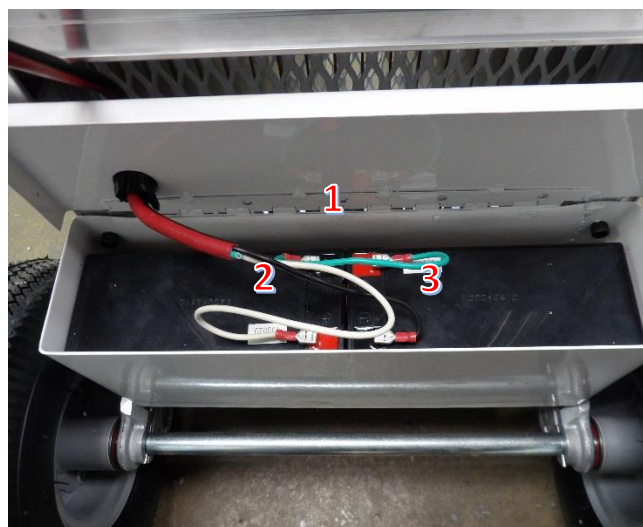
Unpacking and Battery Installation:

WARNING: These batteries are charged from the manufacturer and care must be taken not to short the terminals during this process. This could result in arcing which may damage the unit or injure the operator / technician.

When the battery tester is unpacked, there should be two additional items with the unit. One is a box containing the on-board batteries that power the unit and the other is a set of safety covers for the battery test leads. Once the unit is removed from the packaging and standing upright, install the on-board batteries in the box on the back of the unit so that the tabs are facing each other in the center of the box.

Once the batteries are in the box connect the wiring to the batteries as described below.

1. Install the short between the left battery negative and right battery positive.
2. Install the white lead on the left battery positive.
3. Install the black lead on the right battery negative.

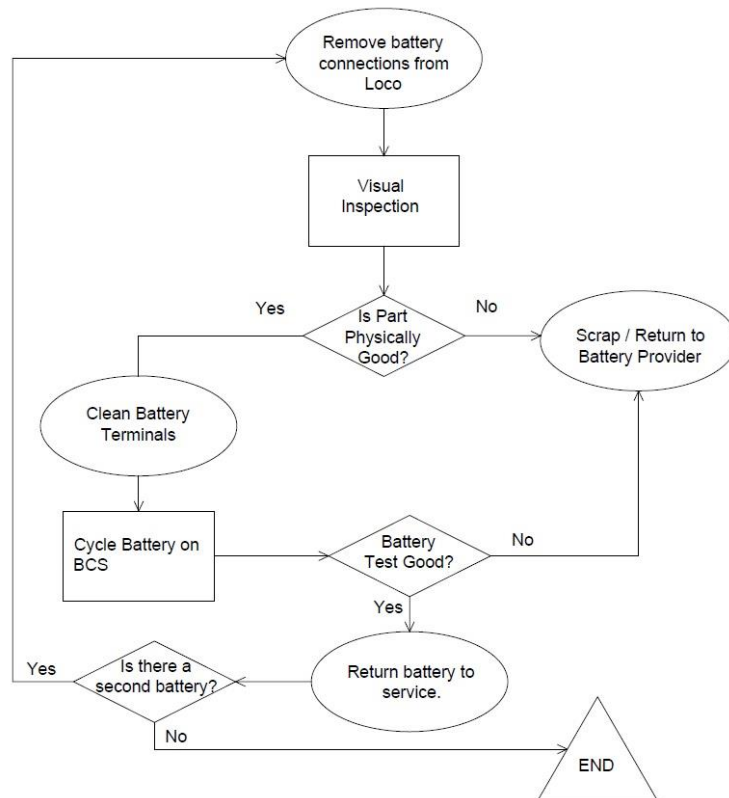


On-board batteries installed

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Process Overview:

The Hapeman Electronics single-battery tester is a great option for testing battery health while servicing locomotives batteries that are being returned to service after storage. To get the best possible performance and safety out of the tester, the proper battery handling process must be followed. The recommended process is outlined below.



Battery Processing Flow Chart

1. Remove the battery connections to the locomotive. If a battery not in a locomotive is to be tested omit this step.
2. Inspect the battery for any obvious defects. If a battery looks like it has been damaged in anyway DO NOT test. Examples of damage include bent/broken connections, damaged fill caps, smashed / cracked casing, etc. Physically damaged batteries should be scrapped or returned to the manufacturer for service.
3. If the battery is physically good then make sure that the battery connection tabs are clean of corrosion and/or other grime.
4. Perform load testing on the battery.
5. If the battery tests good, then service and charge the battery for continued use by the locomotive. If the battery tests bad, then remove the battery for processing on the Hapeman Electronics Battery Conditioning System or return to the manufacturer for refurbishment.

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6. If servicing a locomotive and a second battery is to be tested, perform steps 2 through 5 on battery 2.

Powering the Tester:

The HE3000 can intended to be a mobile unit that can be used anywhere in the shop with relative ease. To achieve this, the unit is operated by a set of (2) 12VDC batteries. With a full charge, the battery tester can be operated without the need for facility power for upwards of 5 to 7 hours. If the internal batteries are dead, the unit can be operated via a standard 110VAC outlet with the supplied IEC style power cord. Leave the unit plugged-in while not in use to charge the internal batteries. A green LED next to the power cord connection indicates if the unit is operating on 110VAC. While on battery power, an indicator on the screen displays battery life remaining.

Basic Operation:

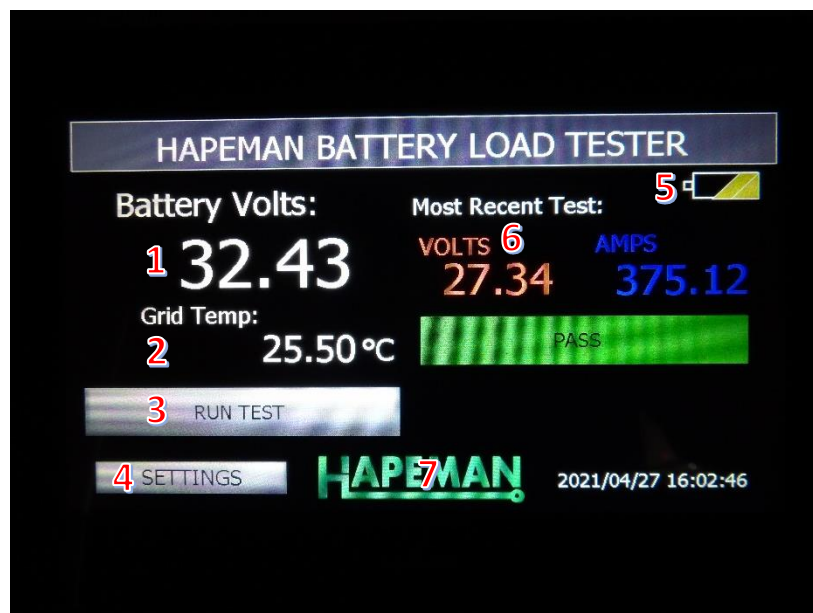
1. Wheel the battery tester up to the battery being tested. It is recommended that the unit be turned so that it can be operated while facing the battery.
2. If the battery is still in the locomotive, remove the locomotive cables from the battery.
3. Unwrap the battery cables and pull them to either side of the battery.
4. Slide the supplied battery covers over each cable and bolt them to the battery. Do NOT use quick connect fittings such as alligator clips to attach the cables to the battery. Poor connections resulting from such clips could result in poor test results or potentially hazardous safety conditions.
5. Remove all personnel from the area surrounding the battery.
6. Turn on the battery tester by flipping up the power switch on the front of the unit. If the batteries in the tester are dead be sure to plug it in using the supplied 110VAC power cable.
7. Once the unit is powered up, the live battery reading should be displayed as well as a live grid temperature and the result from the last load test performed with the unit.
8. To start the test, either press the "Run Test" button on the touch screen or press the physical "Start" button to the right of the E-Stop button. *Note: if the touch screen is used a simple page of instructions will be displayed before pressing "Start" to run the test. If the physical button is used the tester will begin testing immediately without displaying the instructions.*
9. The test will run in three stages which are displayed at the top of the test screen.
 - a. Setting: The unit is preparing to run the test, also serves a buffer for the operator between pressing the start button and loading the battery.
 - b. Testing: The contactor is closed, and the test is battery is being loaded. Current will start flowing and be displayed on the screen.
 - c. Cooldown: A period after the test that the tester must remain idle to allow the load resistor to cool before running another test. A "Reduced Cooldown" may be displayed if the system is testing the first battery of a pair. This is the same as a regular cooldown simply shorter to allow the testing of a pair of batteries before the much longer standard cooldown. Reduced cooldowns can be disabled by maintenance personnel and so this may not ever be displayed.

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10. After the testing phase, the tester will hold the battery voltage and current recorded at the end of the test for Pass/Fail determination which will be displayed on the screen.
11. After the cooldown period, the tester will automatically return to the home screen.
 - a. The operator can manually return to the home screen at any point during the test, however, the system will indicate that a test is running and prevent certain operation. This blocks the possibility of the operator accidentally starting another test while the first is still active.
12. Once the test cycle is complete, it is safe to remove the tester leads from the battery.

Home Screen Navigation:

When the unit is first powered up the LCD screen will turn on and the user will be presented with the home screen. Below is a definition of each item on the screen.

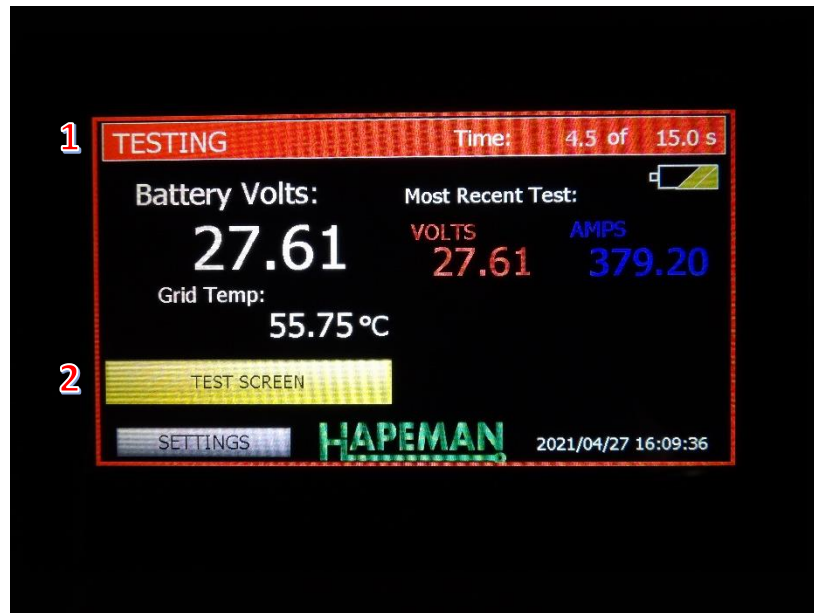


Main Screen Legend

1. Live Battery volts – Shows a live voltage reading of the connected locomotive battery.
2. Live Grid Temperature – Shows a live reading of the grid resistor on the tester used to load the battery.
3. Run Test Button – Soft key that can be used to start running a load test.
 - a. NOTE – This button will be inaccessible during a test. It will be replaced with a yellow “TEST SCREEN” button.
4. Settings Button – Soft key that navigates to the settings menu for the tester.
5. Tester Battery Indicator – Shows the battery life remaining on the batteries powering the tester.
6. Most Recent Test Results – Displays the result data from the most recent battery test.
7. Hapeman Logo / Contact Info – Hapeman logo is also a soft button that will navigate to a screen containing contact information.

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If the unit is currently in a test cycle and the operator returns to the home screen it will look slightly different. Below is a representation of how the screen changes when the unit is currently testing.



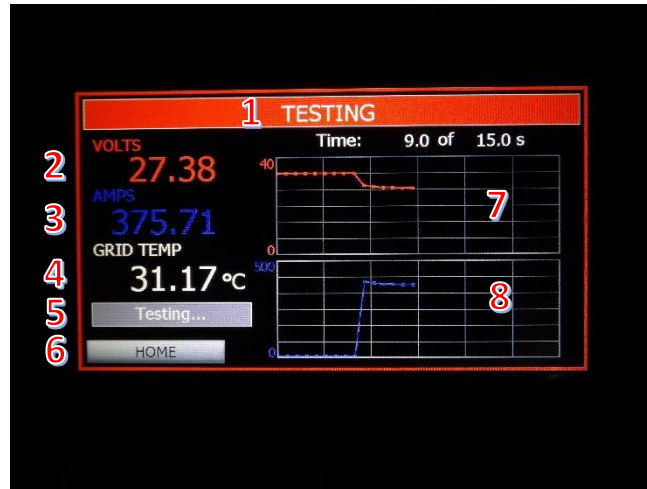
Main Screen During Test

1. Test Status – When the unit is in a test cycle, the main screen will replace the title bar on the home screen with the current test status and the countdown for that status. It will also circle the whole screen in a red line to catch the operators attention and inform them that it is currently testing.
2. Test Screen Button – The “RUN TEST” button is replaced with this button to, not only prevent the operator from starting another test, but to allow them to return to the test screen if they so desire.

Test Screen:

When the a battery test is started, the screen will automatically switch to the test screen. This screen shows live info about the battery while the test is in process.

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Battery 1 Analysis Screen.

1. Test status – shows the current step of the test. A description of the status is listed below.
 - a. Setting – Tester is setting up for the test and providing a buffer period for the operator to be ready for loading.
 - b. Testing – The contactor is closed and the load is being applied to the battery.
 - c. Cooldown – The unit is in a forced idle period to cool down the grid resistor.
 - d. Reduced Cooldown – The unit is in a cooldown period that is shorter than the standard cooldown so that an operator may test two batteries close together. This is generally useful for when the two batteries on a locomotive are being tested at the locomotive.
2. Battery Volts (HOLD) – The voltage of the battery that remains live until the end of the testing period where it holds the value at the end of the test.
3. Battery Current (HOLD) – The current coming out of the battery that remains live until the end of the testing period where it holds the value at the end of the test.
4. Grid Temperature – Live reading of the temperature in the grid resistor area of the tester.
5. Test Result – Shows the pass / fail result of the test after the “Testing” phase. Displays “Testing...” before the test is completed.
6. Home Button – Allows a return to the home page before the completion of the test cycle.
7. Voltage Graph – Shows a live graphical representation of the voltage reading during the setting, testing, and early cooldown stages.
8. Current Graph – Shows a live graphical representation of the current reading during the setting, testing, and early cooldown stages.

Settings Screen:

The setting screen allows for the user to change various settings for the tester. Some of these settings require the use of a username and password to access.

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Operator Level Settings

Pressing the settings button on the home screen navigates to the basic settings menu for the tester. This menu displays the settings that are accessible and editable by the operator. More advanced settings are available with a maintenance level login.



Basic Settings Screen

1. Date and Time – Allows the operator to set the date and time of the unit. Simply enter the date using the MM/DD/YYYY format and the time using the HH:MM:SS, 24-hour format. Press the “SET” button to apply. The live date and time shown below the “SET” button should update to what was set by the operator.
2. 24V Battery Information – Shows the live voltage and current readings from the on-board 24V control batteries. Also displays the battery life remaining in percent.
3. Live Battery Amps – This is a live load test current reading that is mainly used for service and calibration.
4. RESET DEFAULTS Button – This button allows the maintenance team to reset the system defaults in the event of a calibration issue or unit failure. Button will not work unless a maintenance level user is logged in to the system.
5. Firmware Version – Displays the current firmware version loaded on the tester.

Logging In to Maintenance Access

Sometimes maintenance level access is required to reset calibration defaults, perform certain adjustments, or troubleshoot issues. Use the steps below to log in as maintenance personnel.

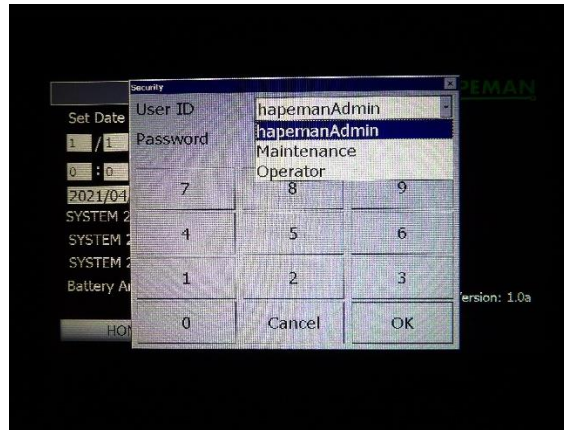
1. Press the “SETTINGS” button on the home screen to access the basic settings menu.
2. Press the Hapeman logo on the upper right-hand side of the screen to bring up the login prompt.

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Press the Hapeman Logo to Log In

- From the dropdown menu, select “Maintenance.”



Login Dialog with Dropdown

- Enter the password “1793” and press “OK.”
- Once logged in, the “ADMIN SETTINGS” button will pop up on the basic settings menu.



ADMIN SETTINGS Button Appears on Log In

To log out, or return to the operator user level, simply perform steps 1 through 3 from above but instead of selecting “Maintenance,” select “Operator.” No password is needed, simply press “OK” and acknowledge the prompt that the user will be changed.

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NOTE: The “hapemanAdmin” user level is not to be accessed by operators or maintenance personnel. This is a special “super-user” login that is intended for strict use by Hapeman personnel when troubleshooting the unit.

Resetting Defaults

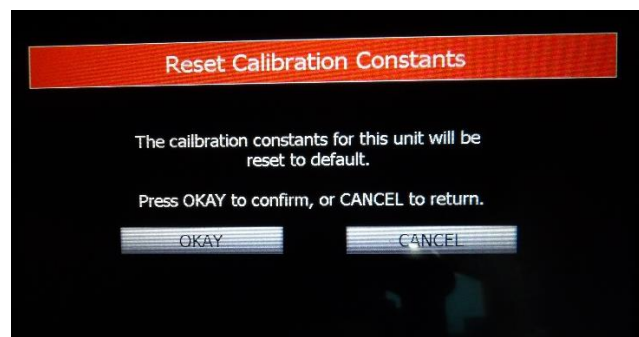
There may be an instance where the system may need to be reset to default. This could be a loss of calibration constants due to a system error or because some other maintenance settings were changed that need to be reset. Below is the procedure used for resetting the system defaults.

NOTE: Resetting the defaults changes most maintenance settings in the system. If any setting was adjusted from the maintenance settings menu that needs to be saved, it will have to be re-entered after resetting to defaults.

1. From the home screen, press the “SETTINGS” menu.
2. Log in with maintenance access as shown in the section “Logging In to Maintenance Access” section on page 10.
3. Press the “RESET DEFAULTS” button on the settings screen. This will bring up a new screen asking for confirmation.



RESET DEFAULTS Button on Settings Screen



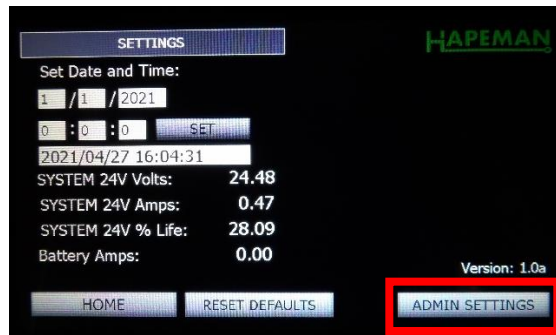
Confirmation Screen

4. Press “OKAY” to reset defaults.
5. Log out of the maintenance user and back in the operator user to remove access to maintenance settings.

Maintenance Settings

Most of the settings for the system are locked behind the maintenance login. This is because these settings fundamentally change how the unit works and should only be modified by trained personnel. These settings can be accessed by pressing the “ADMIN SETTINGS” button from within the settings menu. Remember, this button only appears AFTER logging in as maintenance personnel.

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ADMIN SETTINGS Button After Login

This menu contains several settings across two pages. Below is a basic description of each setting. If more information is needed, please contact Hapeman Electronics for assistance.

Volts Slope / Offset – The calibration slope and offset for scaling the voltage of the battery being tested.

Amps Slope / Offset - The calibration slope and offset for scaling the load current of the battery being tested.

Grid TC °C Slope / Offset - The calibration slope and offset for scaling the grid temperature when the system is set to display in Celsius.

Grid TC °F Slope / Offset - The calibration slope and offset for scaling the grid temperature when the system is set to display in Fahrenheit.

Fuse Check Max Amps / Min Volts: Thresholds for fuse error. If the current is below max amps and the voltage is above min volts during a load test, then the fuse is likely blown, and an error is tripped.

Show Pass / Fail – This will enable or disable the pass / fail indication when a test is finished.

ON – Show pass / fail.

OFF – Do not show pass / fail.

Use Fahrenheit – Turning this on will convert the grid temperatures to Fahrenheit. By default they are in Celsius.

Use Short Cooldown – When enabled, starting with the first test, every other cooldown will be reduced to allow the testing of two batteries back to back without having to wait the full cooldown time. If disabled, every cooldown cycle will require the full cooldown time.

Updating the Firmware Using a USB Jump Drive:

It is possible to update the firmware on the tester by using the USB port on the side of the screen inside of the unit. It is recommended that the firmware be updated with each new release to ensure the unit is taking advantage of the newest improvements by Hapeman.

The current firmware version can be checked in the settings menu. No maintenance login is required.

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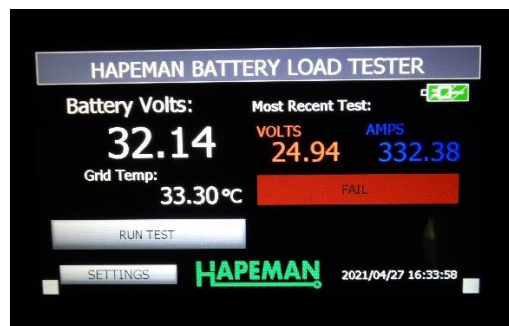
To load new firmware on the unit, use the following procedure.

1. Place a USB flash drive into the PC containing the new firmware obtained by Hapeman.
2. The firmware file, as it is received from Hapeman, will be a zip file. Inside this zip file is a folder called "XpanelProject" that must be copied to the root of the USB flash drive. If this flash drive already contains an XpanelProject folder from a previous firmware delete before copying the new folder.
NOTE: no matter what version of firmware is downloaded, the folder in the zip file will always be called "XpanelProject."
3. Once the folder is copied to the flash drive remove it from the PC.
4. Power off the battery tester and open the front access by releasing the two latches on the top of the unit.
5. Push the flash drive into the USB port on the left side of the screen, inside of the access.



USB Port on the Screen

6. Close the access on the unit and power it back up.
7. Once the home screen is displayed press the lower left, lower right, and upper right corners to display small white squares.



Lower Left and Lower Right Corners Pressed

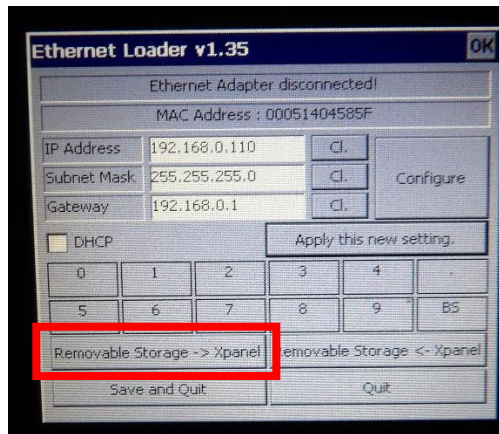
8. Once all three are pressed, a menu will appear. Press "EXIT." This will close the current firmware and expose the Windows backend with an open dialog box.

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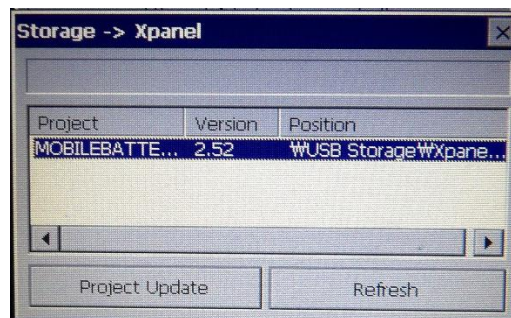
Exit Menu Once All 3 Corners are Pressed

9. Press the button labeled “Removable Storage -> Xpanel.” This will read the flash drive for firmware files and load them into a new dialog box labeled “Storage -> Xpanel.”



Button to Load New Firmware

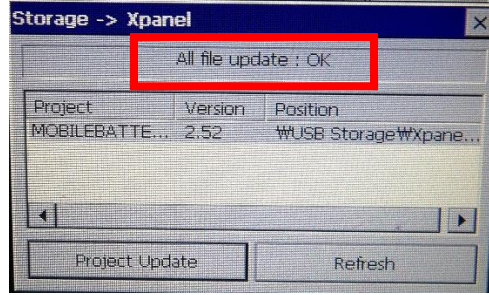
10. There will likely only be one project in this list but if there is not, select “MOBILEBATTERYTESTER.” This may be abbreviated.



New Firmware Selected

11. Press “Project Update” to load the new firmware.
12. A new once the firmware is done loading the dialog will display “ALL FILE UPDATE: OK.”

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Firmware Finished Loading

13. Power off the unit and remove the flash drive from inside of the unit.
14. Power the unit back on. The new firmware will load automatically. Check the firmware version in the settings menu to confirm that it has been loaded.

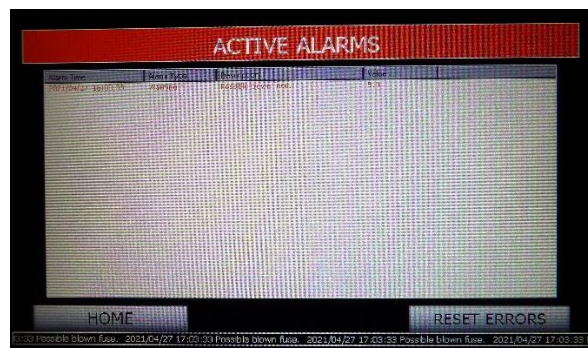
Critical Errors and Handling:

There are certain safety critical errors that will halt all operation of the tester. Operation is halted because these errors could damage the tester or even potentially harm the operator. For the purposes of this tester, the terms “Error” and “Alarm” are used interchangeably.

There are essentially five error states that the tester can be in. They are as follows:

1. The E-Stop button has been pressed.
2. The load contactor failed to close or the contactor feedback is incorrect.
3. The load contactor failed to open or the contactor feedback is incorrect.
4. The grid resistor is too hot.
5. The load test fuse is possibly blown.

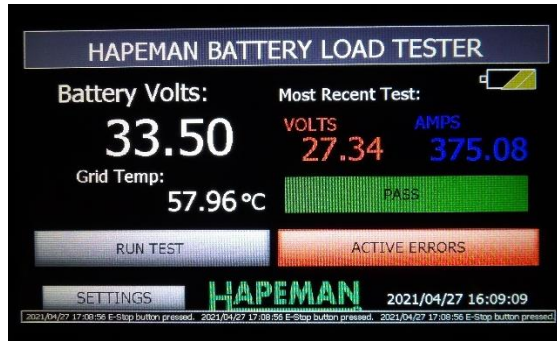
Each one of these errors will result in an error screen that lists the error history since the unit was powered up. The error at the top of the list is the most recent. On power cycle all errors are cleared from this list.



Active Errors / Alarms Page

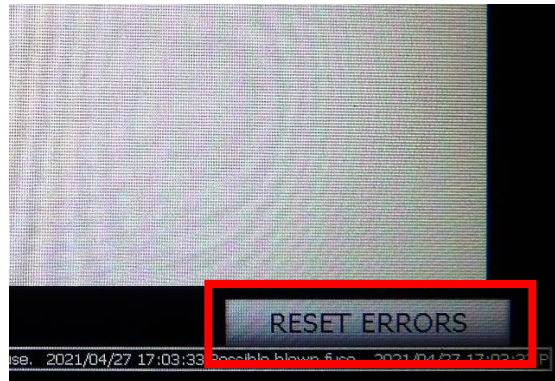
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The operator may return to the home screen from the error screen by pressing the “HOME” button, however the test will not run when in an error state. If there are active errors, a red button labeled “ACTIVE ERRORS” will be shown on the home screen. Use this button to return to the error screen.



Active Error Button on the Home Screen

If the error condition has been fixed then the error(s) in the system need to be reset before testing can resume. Do this by pressing the “RESET ERRORS” button on the error screen.



Missing Calibration Constants

There is one more error state that can happen which is not indicative of a critical safety issue but is important to the operation of the tester. This is when, for any reason, one or more of the calibration constants loses their value. This is important because if the calibration constants are lost the system will not be able to properly interpret battery voltage, current, or grid temperature. This is so important to the operation of the tester that, if constants are lost, the system will inform the operator and force a reset to default parameters.

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Calibration Constants Lost / Reset Message

Preventative Maintenance:

While the system is mostly maintenance free, there are some items that need to be checked / maintained from time to time. All of these items should be something that the operator pays attention to regularly while running the test and should be maintained immediately if a problem is detected.

Maintenance Task	Frequency
Inspect the lugs on the test cables for cleanliness and damage / hole wear. Replace lugs if necessary.	Daily
Check dolly tire pressure. Fill tires if necessary.	Weekly
Inspect safety covers for battery leads. Replace if necessary.	Monthly
Check E-Stop and flasher operation. Replace / repair if necessary.	Monthly

Troubleshooting:

Below is a list of potential issues and ways to troubleshoot those issues. For issues not resolved by this list, please contact Hapeman Electronics for technical support.

Symptom	Potential Issue / Fix
Voltage / current / temperature inaccurate	Check the calibration constants. Constants may have been entered incorrectly. If original constants are unknown, reset the system defaults.
Contactors open / close error	Check the contactor and its aux contact. It may be fused closed or stuck open with a bad coil. Possibly the aux contact is bad. Check the normally closed contact on the E-Stop button.
Fuse error	Check the main load test fuse to see if it is blown. Check the grid resistor and load current shunt for open circuit.
Unit will not power if not plugged in	Check internal 24V batteries and their connections.
The internal 24V batteries will not charge / charge indicator does not appear when plugged in	Check the fuse on the AC line at the terminal block before the charger. Check the fuse built into the charger. Check that the power switch on the charger is on.

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Parts List:

Description	Part Number	QTY Per Unit
HMI / System Controller	HE3001	1
24V Charger	HE3002	1
Load Contactor	HE3003	1
Load Shunt	HE3004	1
24V Shunt	HE3005	1
Load Test Fuse	HE3006	1
Control Relays	HE3007	2
Grid Resistor	HE3008	1
E-Stop Button	HE3009	1