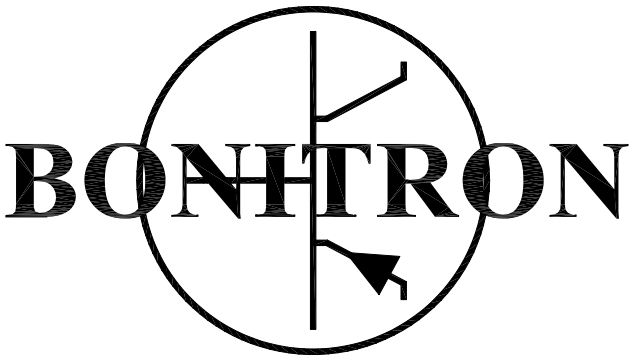


Model M3628PBT
Portable Battery Tester

Customer Reference Manual

Web: www.bonitron.com • Tel: 615-244-2825 • Email: info@bonitron.com

Bonitron, Inc.
Nashville, TN

An industry leader in providing solutions for AC drives.

ABOUT BONITRON

Bonitron designs and manufactures quality industrial electronics that improve the reliability of processes and variable frequency drives worldwide. With products in numerous industries, and an educated and experienced team of engineers, Bonitron has seen thousands of products engineered since 1962 and welcomes custom applications.

With engineering, production, and testing all in the same facility, Bonitron is able to ensure its products are of the utmost quality and ready to be applied to your application.

The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience. A clear advantage Bonitron has over many competitors is combined on-site engineering labs and manufacturing facilities, which allows the engineering team to have immediate access to testing and manufacturing. This not only saves time during prototype development, but also is essential to providing only the highest quality products.

The sales and marketing teams work closely with engineering to provide up-to-date information and provide remarkable customer support to make sure you receive the best solution for your application. Thanks to this combination of quality products and superior customer support, Bonitron has products installed in critical applications worldwide.

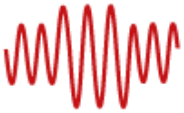
AC Drive Options

In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable frequency drives and aid in reducing drive faults. Below is a sampling of Bonitron's current product offering.

World Class Products

Undervoltage Solutions
Uninterruptible Power for Drives
(DC Bus Ride-Thru)
Voltage Regulators
Chargers and Dischargers
Energy Storage

Power Quality Solutions
12 and 18 Pulse Kits
Filtering
Noise and Transient Suppression
Power Factor Correction



Overvoltage Solutions
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

Common Bus Solutions
Single Phase Power Supplies
3-Phase Power Supplies
Common Bus Sharing Diodes
Isolation Diodes
Bus Filter Capacitance

Green/Sustainable Solutions
Voltage Boosters
(for Solar and Wind Applications)
Line Regeneration
Power Factor Correction

Portable Maintenance Solutions
Capacitor Formers
Battery Testers
Capacitor Testers
Capacitor Dischargers

This page intentionally left blank

Table of Contents

This page intentionally left blank

1. INTRODUCTION

1.1. WHO SHOULD USE

This manual is intended for use by trained personnel responsible for maintaining or testing M3528B battery strings.

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual is a user's guide for the Model M3628PBT. It will provide the user with the necessary information to successfully connect and operate the M3628PBT.

In the event of any conflict between this document and any publication and/or documentation related to any associated hardware (capacitor bank, etc.), the latter shall have precedence.

1.3. MANUAL VERSION AND CHANGE RECORD

Rev 00a of the M3628PBT manual has minor corrections.

Figure 1-1: M3628PBT

This page intentionally left blank

2. PRODUCT DESCRIPTION / FEATURES

The Bonitron M3628PBT is designed to rapidly test the condition of a Bonitron M3528B battery module.

Over time, lead-acid batteries lose storage capacity, and their internal resistance increases. The M3628PBT measures these values by applying a load to the battery module, and measuring its response to determine if the battery module needs replacement. For convenience, the M3628PBT also has a limited charging capability, to ensure that the test is run from a fully charged battery.

The M3628PBT allows the user to set the type of battery bank, either the 120V or 108V model, of the attached battery. The M3628PBT will then automatically adjust the voltage limits to the appropriate values.

2.1. RELATED PRODUCTS

M3528 ULTRACAPACITOR/ BATTERY CHARGER

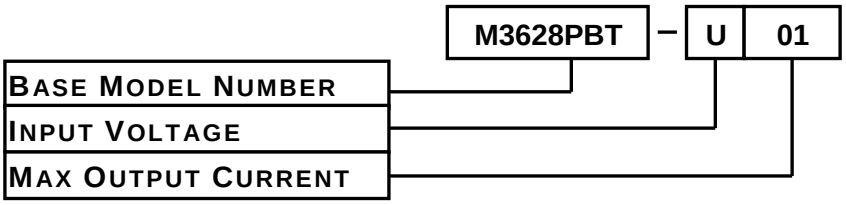
The M3528 Charger can charge strings of batteries or ultracapacitors to voltages required for industrial and commercial applications. AC or DC input is available, along with separate float and equalization charge levels. The charger is current limited, and designed for use in integrated storage and backup systems, but can also be used in bench or mobile systems.

M3534B AND M3460B MODULES

Bonitron Battery Boost Regulator Modules monitor AC line voltage and work in conjunction with batteries. If an AC line voltage sag or outage occurs, the Battery Boost Module activates and supplies the DC bus with power from separate battery modules. This allows the process to maintain normal operation without seeing a power disturbance.

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for all Portable Battery Testers is M3628PBT.

INPUT VOLTAGE RATING

The Input Voltage Rating indicates the nominal input voltage to the unit.

"U" indicates 120VAC input.

MAXIMUM OUTPUT CURRENT RATING

The Maximum Output Current rating indicates the maximum DC current the unit can supply at its maximum voltage.

2.3. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Table

PARAMETER	SPECIFICATION
Input Voltage	110-120VAC 50-60Hz 1ø
Output Voltage	103 -133VDC
Charge Current	6ADC
Discharge Current	40ADC
Controls	Four display soft keys Abort button
Display	Four line, eighty character LCD (4x20)
Unit Size (H x W x D)	18.0" x 22.0" x 10.5" (see Figure 6-1)
Weight	50 lbs.
Storage Temp	-20°C to +65°C
Humidity	Below 90 % non-condensing
Atmosphere	Free of corrosive gas and dust

2.4. GENERAL PRECAUTIONS AND SAFETY WARNINGS

ELECTROCUTION HAZARD!

- THIS UNIT PRODUCES HIGH VOLTAGES CAPABLE OF CAUSING INJURY OR DEATH!
- FOR USE BY QUALIFIED AND TRAINED PERSONNEL ONLY!
- **IMPROPER OPERATION OF THIS PRODUCT OR IGNORING THESE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH!**
- CONNECTING THE **M3628PBT**'S VOLTAGE OUTPUT TO A LOAD WITH THE POLARITY REVERSED CAN CAUSE DAMAGE TO YOUR EQUIPMENT AND POTENTIALLY CREATE A FIRE OR EXPLOSION HAZARD. ENSURE THAT THE POSITIVE AND NEGATIVE TERMINALS ON BOTH THE SOURCE AND LOAD ARE POSITIVELY IDENTIFIED AND CORRECTLY CONNECTED BEFORE OPERATION.
- NEVER OPERATE THIS PRODUCT WITH THE ENCLOSURE COVER REMOVED.

DANGER!

- NEVER ATTEMPT TO SERVICE THIS PRODUCT; IT CONTAINS NO USER-SERVICEABLE PARTS.
- CERTAIN PARTS INSIDE THIS PRODUCT MAY GET HOT DURING OPERATION.
- KEEP FACEPLATE CLEAR OF ALL WIRES AND OTHER LOOSE OBJECTS AS THEY MAY BECOME HOT ENOUGH TO MELT OR CATCH FIRE.
- BEFORE CONNECTING THIS DEVICE TO ANY OTHER PRODUCT, BE SURE TO REVIEW ALL DOCUMENTATION OF THAT PRODUCT FOR PERTINENT SAFETY PRECAUTIONS.

ANY QUESTIONS AS TO APPLICATION, INSTALLATION, OR SERVICE SAFETY SHOULD BE DIRECTED TO THE EQUIPMENT SUPPLIER.

3. INSTALLATION INSTRUCTIONS

3.1. ENVIRONMENT

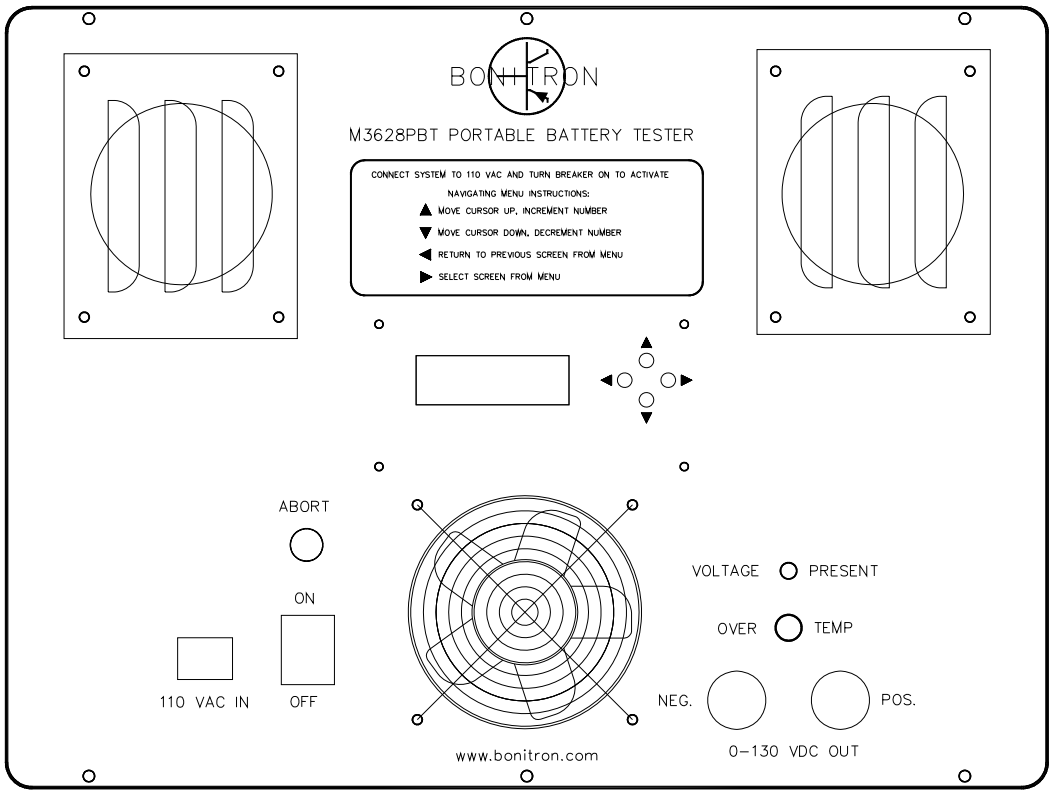
While closed, the M3628PBT is water, dust, and crush resistant. When open and in operation, the unit should be used only in dry, clean areas. Ensure that the interior of the unit casing is kept dry.

3.2. WIRING AND CUSTOMER CONNECTIONS

3.2.1. POWER WIRING

The Power Input connector accepts 50-60Hz 110VAC from the included standard C13 power cable. The DC Output connectors supply voltage to the connected battery string by a pair of high current connectors.

Figure 3-1: M3628PBT



3.2.2. SOURCE CONSIDERATIONS

Input voltage should not exceed a nominal 120VAC or damage to the unit may result. The source must be capable of supplying at least eight (8) amps to guarantee correct system operation at all output voltages.

3.2.3. LOAD CONSIDERATIONS

This unit is intended only for use with Bonitron M3528B battery strings. Use with any other battery string is not recommended.

Battery strings should be fully charged using a Bonitron M3528 charger

before testing. The M3628PBT's internal charger is intended for short-term top-off charging only, not for long-term charging of battery strings. If the connected battery string is not fully charged before testing, test results may be inaccurate.

WARNING!

The M3628PBT takes the number of 12V modules in the M3528B battery bank into account when calculating the appropriate voltage limits on its charging and testing functions. If the type of the attached battery bank is incorrectly set, test results will be incorrect, and damage to the battery bank may result!

4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M3628PBT is a digitally-controlled battery tester, capable of charging and testing M3528B battery banks. The unit is powered by 110VAC, and can provide a top-off charge to the battery bank. The charge voltage is limited based on the type of the attached battery bank, which the user must manually set for each use.

An "Abort" button manually overrides any function; if this button is pressed, charging or testing will immediately cease. The M3628PBT will not function if no battery voltage is detected on the terminals.

After the battery bank is charged, the M3628PBT can test it by applying a load to the battery and measuring its response. If the terminal voltage on the battery drops below the factory pre-set discharge voltage level (for the selected battery type), the M3628PBT indicates that the battery bank may require replacement. If at any time the terminal voltage of the battery is lower than the safe float voltage of a M3528B, the unit will also indicate that the string requires replacement.

4.2. FEATURES

4.2.1. HARDWARE

4.2.1.1. AC POWER INPUT CONNECTOR

The M3628PBT is equipped with a standard IEC C14 connector for input power. This connector mates with a standard C13 cable, commonly used with desktop computers, to provide power to the unit.

4.2.1.2. DC OUTPUT CONNECTORS

Two high-current jacks provide the connection to the M3528B battery bank for charging and testing.

4.2.1.3. DISPLAY

The digital display presents the user with information about the present status of the system, including the output voltage and current. The display also presents the user with options to control system operation, including charging and testing attached batteries.

4.2.1.4. DIRECTIONAL BUTTONS

Each of the four buttons corresponds to a direction, up, down, left or right. Right frequently moves to a screen selected on a menu, and left frequently moves back to the previous screen, while up and down move the cursor among menu items. On screens where numbers are input by the user, the left and right buttons move the cursor, while the up and down buttons change the selected digits. On some screens, certain buttons may have no function.

4.2.1.5. ABORT BUTTON

There is an Abort button on the face of the unit. This button will cause the system to immediately stop charging or testing the attached battery bank. In the event the unit is accidentally set to charge to a higher voltage than is safe for the load, this button should be pressed immediately.

4.2.1.6. VOLTAGE PRESENT INDICATOR

A red light indicates that there is an unsafe voltage on the DC output of the unit. Do not touch the output connectors or the attached equipment while this light is on, as electric shock will result.

WARNING!

Do not use this light as an indication that the output is safe to work on! Always check the output with a working voltmeter before servicing equipment, as the lamp may be malfunctioning!

ELECTROCUTION HAZARD! *This unit produces dangerous levels of voltage that can cause injury or death. Always follow safety protocols when working with high voltages!*

4.2.1.7. OVER TEMPERATURE INDICATOR

A yellow light indicates that the internal heatsink temperature has risen above 160°F. This light should not turn on during normal operation. If it does, consult the Troubleshooting guide in Section 5 of this manual.

4.2.1.8. POWER SWITCH / CIRCUIT BREAKER

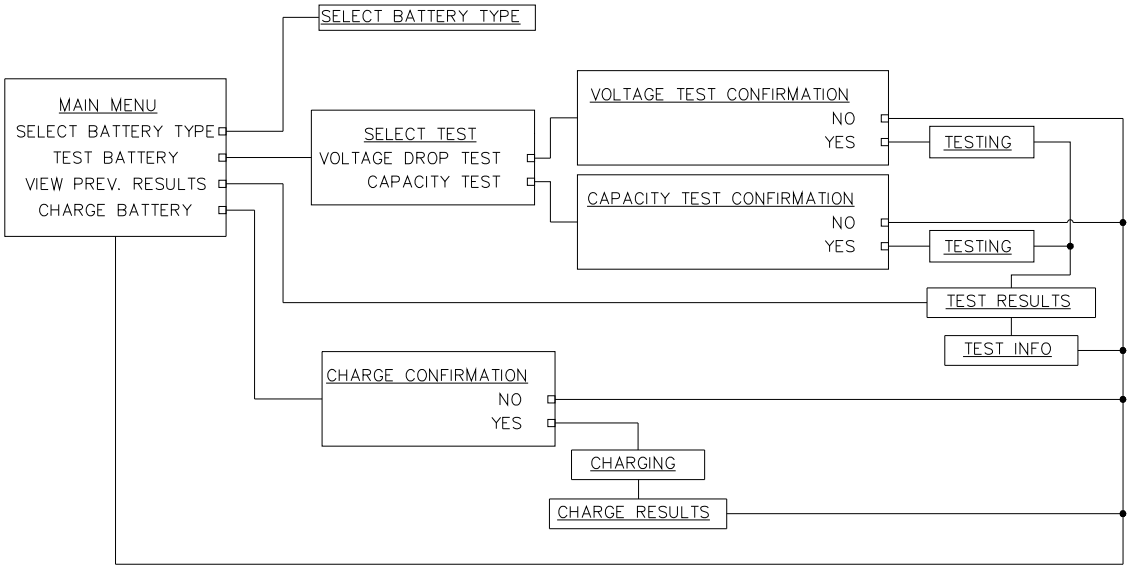
The Power Switch also acts as a circuit breaker to protect from overload conditions. If the breaker is tripped, you can reset it by simply turning the switch back on.

NOTE: The breaker should never trip during normal operation. Disconnect the battery before attempting to turn the unit back on. If the breaker continues to trip, consult the Troubleshooting guide in Section 5 of this manual.

4.3. SCREENS & MENU NAVIGATION

Many screens are menus allowing access to other screens, or lists presenting a number of options. The presently selected item on the menu is indicated by a '>' cursor. This selection indicator is moved using the *up* and *down* buttons. If a line on the menu represents another screen, that screen is accessed with the *right* button. The *left* button will return the display to the parent screen. See Figure 4-1.

Figure 4-1: M3628PBT Interface Screen Tree



4.3.1. MAIN MENU

From this menu, the Select Battery Type, Test Battery, View Previous Results, and Charge Battery screens may be accessed.

4.3.1.1. SELECT BATTERY TYPE

This screen allows the user to enter their battery bank type as either a 120V battery or 108V battery. This must be correctly set prior to running a test sequence or charge cycle.

4.3.1.2. SELECT TEST

At this screen the user chooses which test procedure they would like to run: either the Voltage Drop Test or the Capacity Test.

4.3.1.2.1. VOLTAGE TEST CONFIRMATION

At this screen the user is asked to confirm their intent to execute a Voltage Test on the attached battery bank. If they choose 'Yes', the testing procedure begins. If they choose 'No', they will be returned to the Main Menu.

4.3.1.2.1.1. TESTING

This screen indicates that the test is currently running. When complete it will automatically display the Test Results screen.

4.3.1.2.2. CAPACITY TEST CONFIRMATION

At this screen the user is asked to confirm their intent to execute a Capacity Test on the attached battery bank. If they choose 'Yes', the testing procedure begins. If they choose 'No', they will be returned to the Main Menu.

4.3.1.2.2.1. TESTING

This screen indicates that the test is currently running. It displays the terminal voltage and a timer of how long the test has been running. When the test is complete it will automatically switch to the Test Results screen.

BURN HAZARD!

During operation, unit faceplate may become very hot. Use caution. ***BURN HAZARD!*** *Never operate unit without a properly working exhaust fan. Allow 8-10 minutes cool down with the fan running before executing another Capacity Test.*

4.3.1.3. VIEW PREV RESULTS

Here the operator is able to review the results of the previous test.

4.3.1.3.1. TEST RESULTS

This screen displays whether the battery module passed the test, as well as displaying the terminal voltage drop during the test. If the module passed, the *right* button returns the user to the Main Menu. If the module did not pass, the *right* button takes the user to a second test information screen.

4.3.1.3.1.1. TEST INFO

If the test failed, this screen displays a message saying to recharge the battery and re-test.

4.3.1.4. CHARGE CONFIRMATION

At this screen the user is asked to confirm their intent to charge the attached battery bank. If they choose 'Yes', the charge cycle begins. If they choose 'No', they will be returned to the Main Menu.

4.3.1.4.1. CHARGING

This screen shows general status information during a charge procedure. It displays the terminal voltage, how long the procedure has been running, and the current state (active or resting).

4.3.1.4.1.1. CHARGING RESULT

This screen shows the results of the charging process, i.e. whether it completed successfully or what the problem was if it did not.

4.3.2. STATUS

This screen is displayed after 20 seconds of inactivity. It shows the battery bank type and the current battery terminal voltage. Press either the *left* or *right* button to return to the previous screen.

4.4. CHARGING SEQUENCE

As mentioned in Section 2, the M3628PBT does have a limited charging ability; the input voltage (nominally 120VAC) goes through a transformer and diode bridge for use by the charging circuit. The charging procedure runs a 30 second cycle: 20 seconds ON and 10 seconds OFF. During the ON phase, the battery is connected to the rectified AC from the main transformer. The OFF phase releases the battery and allows the voltage to return to its float level. After this 30 second period, if the float voltage is at or above the target threshold then it is finished charging, otherwise it will run another 30 second cycle. The target threshold and maximum terminal voltage ratings are automatically adjusted based on which type of battery bank is selected in the menu.

4.4.1. CHARGING PROCEDURE

The standard charging procedure is outlined below:

1. Connect the Portable Battery Tester's power cable to a standard 110-120 VAC wall outlet
2. Turn the unit's main breaker ON.
    a. The yellow Over Temp light should illuminate briefly during the start-up sequence. If it does not clear after 8-10 seconds, see Section 5: Troubleshooting in this manual for help.
    b. The unit's fan should also turn on and run continuously while the breaker is ON.
3. Choose "Select Battery Type" from the Main Menu and select the correct entry for your particular M3528B Battery Bank: 108V battery or 120V battery.
4. Connect the provided test cable to the battery bank first, then to your PBT.
    a. Make sure you connect the cables to the Tester in the correct orientation: red(+) goes to red(+) and black(-) goes to black(-).
5. Select "Charge Battery" at the Main Menu and confirm that the correct battery type is set to start the charge cycle.
    a. If the correct type is not indicated on the test confirmation screen, repeat Step 3.
6. While the battery is charging, the screen will show status information: current terminal voltage, elapsed time, and procedure state (RUN or REST).
7. Depending on the state of the battery initially, the charge procedure may take 2-10mins
    a. If the procedure completes successfully it will display a summary screen; press the right key to return to the Main Menu.
    b. If there was problem during the charging procedure, it will instead display a message explaining what the issue was; press the right key to return the Main Menu.

4.5. TESTING SEQUENCE

The M3628PBT offers two (2) methods for testing the status of a battery bank. The Voltage Drop Test is a quick, 4 second test; the full Capacity Test could take several minutes, but is a slightly more accurate indication of the state of a M3628 battery bank.

The Voltage Drop method evaluates the status of a battery by measuring the terminal voltage drop of the battery when a load is applied. This procedure starts by measuring the open-circuit (no load) voltage of the battery; a resistive load is then connected and the voltage drop monitored. The load is held for 4 seconds to allow time for the voltage to settle out to its final value. The pass/fail result is determined by finding the difference in the final and initial voltage readings. If the voltage drop is outside the allowable range for the designated battery bank type, then the test is considered a failure. Additionally, the M3628PBT is continuously measuring the terminal voltage during the test; if, at any time, the voltage falls below the minimum voltage rating for the battery bank, it will abort the test immediately to avoid damaging the battery.

The Capacity Test offers an estimate of the state of charge of the battery by providing a full discharge of the battery. This test measures the time to discharge to the safe, minimum float voltage; it is then up to the user to decide if this amount of time is sufficient for their specific application, or if the battery should be replaced because they require backup power for a longer period of time. The Capacity Test uses a 1 minute cycle: 30 second discharge followed by a 30 second rest. During the discharge phase, the battery is connected to the load resistor; the discharge current should be approximately 25-35A, but could be as high as 40A depending on the terminal voltage. The rest phase disconnects the load and allows the battery to return to its float voltage level. At the end of the rest period the terminal voltage is compared to the factory pre-set limits. If the battery float voltage is still above the target voltage, then it will run another discharge cycle; otherwise the test is complete and the Test Results screen is shown. As with the Voltage Drop Test, if the terminal voltage ever drops below the absolute minimum rating for the battery, the test is aborted to prevent damage.

CAUTION!

Due to the sustained currents during discharge, the unit can become quite hot. Take care not to accidentally touch the faceplate while testing. Also, the unit should sit for 10 minutes with the fan running to adequately cool down before running another Capacity Test procedure.

4.5.1. TESTING PROCEDURE

The standard testing procedure is outlined below:

1. Connect the Portable Battery Tester's power cable to a standard 110-120 VAC wall outlet.
2. Turn the unit's main breaker ON.
   a. The yellow Over Temperature light should illuminate briefly during the start-up sequence. If it does not clear after 8-10 seconds, see Section 5: Troubleshooting in this manual for help.
   b. The unit's fan should also turn on and should run continuously while the breaker is ON.

3. Choose "Select Battery Type" from the Main Menu and select the correct entry for your particular M3528B Battery Bank: 108V battery or 120V battery.
4. Connect the provided test cable to the battery bank first, then to your PBT.
    a. Make sure you connect the cables to the Tester in the correct orientation: red (+) goes to red (+) and black (-) goes to black (-).
5. Select "Test Battery" from the Main Menu.
6. Choose the testing procedure you wish to use and then confirm that the correct battery type is set to start the test.
    a. If the correct battery type is not indicated on the Test Confirmation screen, repeat step 3.
7. After the test is complete, it will automatically switch to the Results Screen.

This page intentionally left blank

5. TROUBLESHOOTING

If a problem occurs on start-up or during normal operation, refer to the problems described below. If a problem persists after following the steps below, contact the product supplier or your system integrator for assistance.

Repairs or modifications to this equipment are to be performed by Bonitron approved personnel only. Any repair or modification to this equipment by personnel not approved by Bonitron will void any warranty remaining on this unit.

Table 5-1: Troubleshooting

Display never comes on	• Ensure that the input power cable is connected firmly to the unit and to a functioning 110VAC power source. • If both connections and the power supply are good, the input circuit breaker may have tripped.
Overtemp lights comes on during operation	• Disconnect the battery from the system. Leave the AC input connected and the breaker ON to run the fan and wait for the light to clear. This may take up to half an hour.
Overtemp light stays on longer than 30 minutes and unit is cool to the touch	• Your unit is damaged and will not resume normal functioning without service. Contact Bonitron.
The circuit breaker continually trips	• Your unit is damaged and will not resume normal functioning without service. Contact Bonitron.
Red voltage present light is ON	• The voltage present light indicates that there is voltage between the output terminals of the unit. If the display indicates that no voltage is present, contact Bonitron.
Red voltage present light never turns on regardless of output voltage	• Check the output voltage with a separate voltmeter. If the voltage is above 50VDC, your unit may require service. Contact Bonitron.
There is a spark when connecting the PBT to a battery module, and the unit is constantly discharging whether on or off	• Your unit is damaged and will not resume normal functioning without service. Disconnect it from the battery module, discontinue use, and contact Bonitron.

WARNING!

Always monitor the output voltage while operating the unit. Ensure that the attached loads do not exceed their rated voltage, as catastrophic damage, injury, or death may occur.

This page intentionally left blank

6. ENGINEERING DATA

6.1. RATINGS CHART

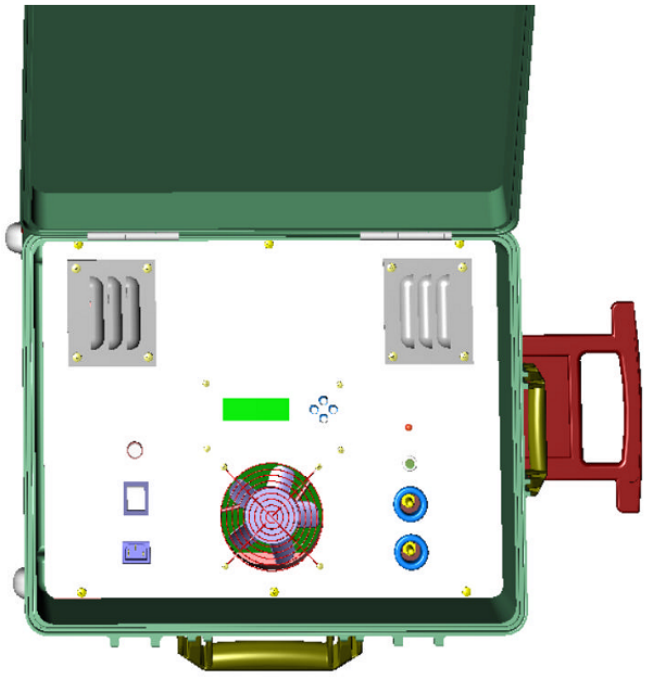
Table 6-1: Ratings Chart

Input Voltage	110-120VAC 50-60Hz 1ø
Output Voltage	103-133VDC
Max Charge Current	8ADC
Max Test Current	40ADC
Load Resistor	3.5 Ohm

6.2. DIMENSIONAL DRAWING

Figure 6-1:M3628PBT Dimensions

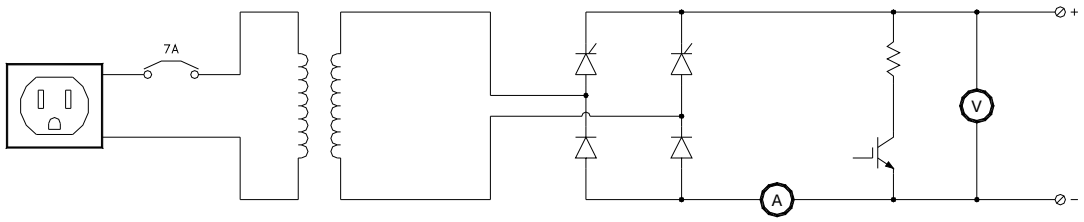
Ready for Use
18.0"H x 22.0"W x 10.5"D



Portable View

Note: Handle is not included in dimensions and retracts flush with the unit when not needed.

6.3. BLOCK DIAGRAM



This page intentionally left blank

NOTES

This page intentionally left blank

521 Fairground Court ● Nashville, Tennessee 37211
(615) 244-2825 ● FAX (615) 244-2823 ● www.bonitron.com ● info@bonitron.com