BATTERY BACKUP SYSTEM INSTALLATION MANUAL

EXELTECH

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Manufacturer of UL Listed Products

TÜV MANAGEMENT SERVICE ISO 9001 TL 9000

TL 9000™
The Telecom Quality Measurement System

Thank you for purchasing an Exeltech Battery Backup System. The Exeltech BBS is specifically designed to provide backup power for critical systems that must be protected from unforseen utility failures. In the event of a utility failure the Exeltech BBS will provide up to 1000 watts of true sine wave power. While utility power is present, the built in battery charger continually monitors and maintains an optimal battery state with a temperature controlled, 3 state charging algorithm. The Exeltech BBS is designed for continuous operation in extreme environmental conditions (-40C/+74C). All Exeltech products are manufactured to the highest quality standards in our state of the art manufacturing facility in Fort Worth Texas. Our products are manufactured in accordance with ISO 9000/TL 9000 QMS.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by Exeltech could void the user's authority to operate the equipment.

TABLE OF CONTENTS

GLOSSARY

Battery Backup System (BBS): A system consisting of a battery, battery charger, charge controller, power inverter, transfer switch and optional maintenance bypass switch that will provide a source of uninterruptible power to a critical system for a predetermined time.

Maintenance Bypass Switch (MBS): A multipole switch installed in a Battery Backup System that will allow continued operation of the critical system on utility power while the components of the BBS are being maintained, replaced or tested.

Algorithm: Computer software instructions that perform a precise rule or set of rules that solve a problem in a consistent and exact manor.

Distortion (D): D = PN/PT Where PN is summation of all power at frequencies other than the desired, and PN is the total power generated by the service (BBS).

Bulk Charge: Battery charge algorithm in which a constant current level is injected into a battery bank, charging it quicker than Float Charge.

Float Charge: Battery charge algorithm in which a constant voltage level is maintained, variances only due to temperature compensation.

Equalization Charge: Battery charge algorithm in which a maximum battery voltage is held constant in order to ensure all cells achieve a minimum charge level.

Absorption State: Battery charge state in between Bulk and Float that holds battery voltage above float for a specific period of time to more rapidly charge the battery.

Float Mode Only Charging: Bulk and Absorption Mode charging are not used. This mode will prolong battery life at the expense of recharge time.

EEPROM: Computer data storage that is retained even if power has been removed from the system.

Optocoupler: Electronic component that aids in isolating circuits from each other to maintain electrical isolation between different reference voltages.

Pulse Width Modulation: An output in the form of duty cycle which varies as a function of the applied measurement.

Dry Relay Contacts: Contacts that are isolated from the system allowing remote sensing of binary states Normally Open or Normally Closed.

EXELTECH BBS FEATURES

Overall system features:

- Integrated Inverter/Charger System 1000 watts true sine wave inverter w/less than 2% distortion peak efficiency greater than 89 %
- External alarm relays for remote monitoring
  - On Battery - energizes when utilizing backup power
  - Low Battery - energizes when batteries reach 40% remaining capacity
  - On Timer - energizes when a 2 hours of backup have occurred
- Low battery shutdown protection
- LED display for all parameters
  - BBS Status: Charge mode or BBS mode
  - Event Counter
  - Accumulated Event Time
  - External Alarm Relay State
  - Battery Capacity Meter
  - Battery Voltage Indicator
- Internal or external power transfer switch option
- External maintenance bypass switch
- Front panel multi-meter test points for battery voltage measurement
- Testing and Certifications
  - Manufactured in accordance with ISO 9000/TL 9000 quality systems
  - Computerized calibration and testing of each system
  - CALTRANS Compliant (July 2004)
  - Lightning/Surge rated to ANSI-C62.41 Level B2
  - FCC Compliant to Part 15 Class A
  - Totally integrated system with a 20 year MTBF
- Data collection, monitoring, parameter changes via RS-232 interface

BBS Charger Features:

- Power factor corrected, 3 state battery charger
- Temperature compensation
- Over temperature protection for batteries (50C)
- Configurable battery parameters via RS-232

BBS Transfer Switch Features:

- Microprocessor controlled operation allows multi-cycle voltage calculation while maintaining a failure detect time of less than 500 microseconds.
- Optional power conditioning maintains optimal utility voltage levels when slight variances occur
- Relay transfer time less than 10 ms, optional relay less than 5 ms.

GENERAL DESCRIPTION

The system overall operation will maintain battery charge state, provide a trip counter, provide backup battery time, and remaining capacity, and dry relay contacts that can be used for external event triggering.

MODES OF OPERATION:

BBS Mode

This is the mode of operation that occurs when utility has failed, or is below the minimum set point.

Several events are initiated when the system goes into BBS mode:

1) A 2 hour counter is initialized
2) The event counter is incremented
3) The relay contact ON BATT is energized
4) The display changes state to show the relay menu option, indicating the ON BATT relay has energized
5) Total Time on battery will accumulate until proper utility has been restored
6) Battery voltage is monitored for the LOW BATT relay, LOW BATT is energized when the batteries diminish to 40% useful capacity.

BBS Mode exceeding 2 hours will energize the ON TIMER relay and update the Relay State menu option to indicate both ON BATT and ON TIMER relays are energized. BBS Mode that continues and allows the batteries to drop below the 40% useful capacity will result in the LOW BATT relay to energize. Depending on the system load, a low battery shut off point will engage when batteries are depleted.

CHG Mode

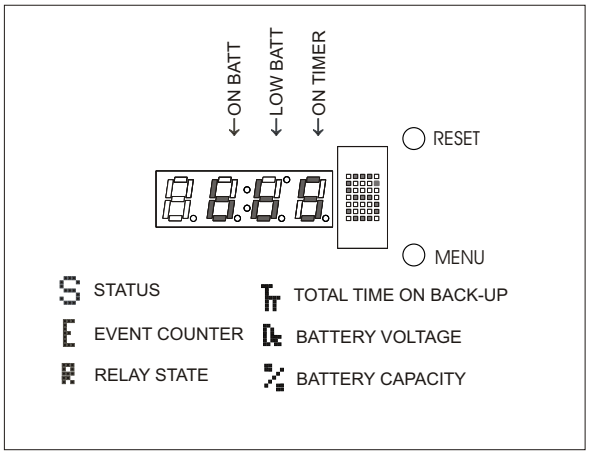
This mode of operation performs the utility monitoring and battery charging functions of the charger and transfer switch. If an external battery temperature sensor is not used, temperature compensation is not possible. Battery charging will continue regardless of temperature. Using the provided temperature sensor will ensure continuous safe operation of the BBS, prevent overcharging, and over temperature charging.

Battery Charging

The Exeltech BBS utilizes a sophisticated 3 state battery-charging algorithm in order to maintain optimal battery state. If battery voltage falls below a predetermined level, the charger will start a “Bulk” charge operation, maintaining a constant current charge state until the maximum battery voltage is achieved. Once maximum temperature compensated voltage is achieved, “Absorption” state will transition from the constant current to a constant voltage state. When preprogramed triggers are reached the charger will connect to a long term temperature compensate Float Voltage state where it will maintain battery charge without overcharging. The system is also capable of “Float Mode Only” charging, for those who feel that 3 state charging is not warranted for their situation; the feature is software selectable.

SYSTEMS INTERFACE

Display Interface:
The display interface consists of a 4 character, 7 segment LED, a 5x7 pixel LED, and 2 interface buttons. (See diagram)



The graphic LED indicates which menu option is currently displayed; follow the chart on the faceplate to determine the meaning of the graphic symbol. There are 6 different display screens providing information to determine the system state.

Status (S): This will display either BBS (bbS) or CHG (chb) depending in the current state of the system.

Event Counter (E): This is a count of utility failure occurrences that have been detected since the counter has been reset. The information is stored in EEPROM and maintained while the system power is disconnected. To reset the counter simply press and hold the reset button until the graphic display blinks once.

Relay State (R): This is a screen showing the current state of the dry relay contacts located on the back of the unit. There are 3 indicators above the character display to determine the value of each relay. These indicators can show one of two responses, a 0 indicates non energized, 1 indicates a relay is energized.

Total Time On Backup: This is an hour: minute counter of the total time that has elapsed in the current set of batteries, or, since the reset button has reset the value. This reading is also stored in EEPROM and remains valid as the power is cycled off or on.

Battery Voltage: This is an indicator of battery voltage. For accurate battery voltage measurements, voltage test points are provided in the faceplate. The battery voltage indicator is accurate to approximately 1%.

Battery Capacity: This is an indicator of approximate battery capacity remaining. Battery capacity is continuously calculated and monitored to ensure an accurate reading. In order to correctly calculate capacity, a learn mode is initiated by pressing the reset button until the graphic display blinks. Learn mode is used when batteries are changed. The system is shipped with learn mode active.

PC SERIAL INTERFACE

The PC serial interface is used to adjust all battery parameters and modes of operation. This is an isolated interface, and power derived form the PC's serial port will drive an opto-coupler. A DB9 cable containing 9 signal wires must be used. Currently only a Win32 operating system is supported for serial interface.

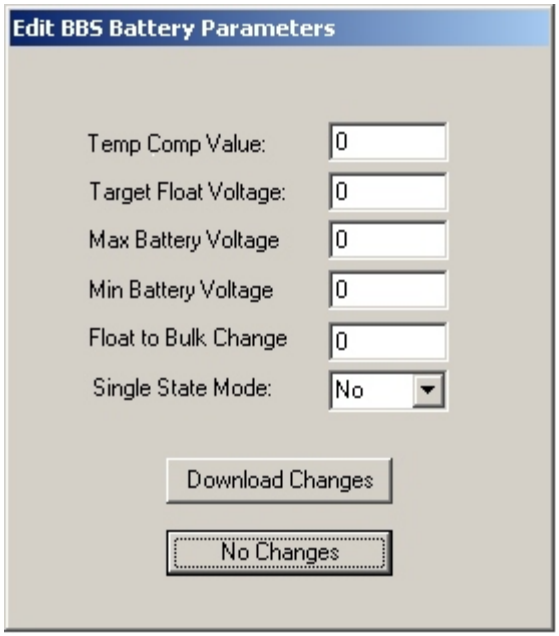
PC Interface software for the Exeltech Battery Backup System

The Exeltech BBS allows system data logging and battery parameter updates from a PC serial port interface. In order to use this, you must have a Win32 PC (Windows NT, 2000, or XP) with a serial port DB9 connector. Locate the DB9 on the back of the BBS and use a standard serial port cable equipped with ALL nine wires. The serial communication is an isolated interface, and power must be derived from the PC Serial port over additional communication lines. Once the cable is connected, turn on the BBS unit.

The interface software is a simple application allowing data logging and parameter changes, there is no setup program, there are no system, hidden, or registry files added. Simply copy the executable and .ini file to a local directory, the .ini file maintains serial port configuration. On startup the interface software attempts to contact a BBS through the PC serial port, without a BBS in place, it will sit and wait for one.

EDIT BATTERY PARAMETERS

Only perform this action when battery parameters change due to purchase of a different battery type, with different voltage requirements. ENTERING WRONG INFORMATION MAY DAMAGE YOUR BATTERY.



On power up, current parameters will show in the edit boxes, simply change the values to the desired levels and hit Download Changes to update the BBS, hitting No Changes safely backs out of this menu option.

LOG BBS DATA

This menu Item allows the capture of BBS information for data analysis.

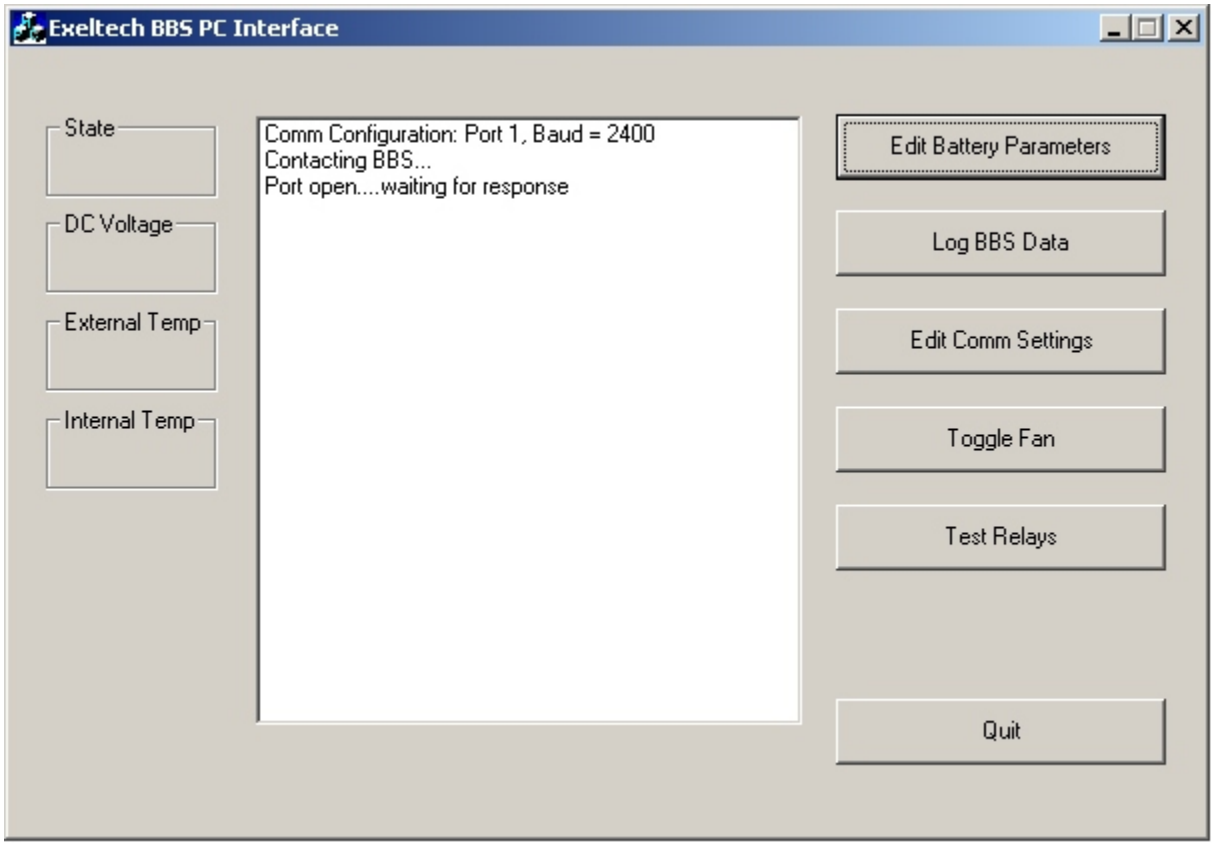
Provide a name for the file, .csv is added to the name. Default interval is 30 seconds, but up to 1 hour intervals are possible. The log file will be located in the folder where the application is stored.

EDIT COMM SETTINGS

The default comm. port is 1, if needed 2-4 are an option. Baud Rate is set at 2400. Do not change this value.

TOGGLE FAN / TEST RELAYS

These are two menu options used to force the BBS into different states.
Toggle Fan will turn the fans on and off. Toggle Relays energizes all three relays for testing purposes.



INSTALLATION INSTRUCTIONS FOR BATTERY SYSTEM, BBS AND MAINTENANCE BYPASS SWITCH

Caution: Installation and maintenance of this equipment must be done only by qualified personnel.

Note: This is the generic version of the installation instructions. For installation in an Eagle brand cabinet, contact the factory for specific instructions.

Battery Installation: The battery system is typically composed of four or eight batteries connected to provide 48 volts. They may be mounted in the controller cabinet, in an external cabinet, or in an in-ground vault. The wiring kit for the in-ground vault has 20ft. 8 gauge leads and the kit for the cabinet installation has 10ft leads. Regardless of the location of the batteries, consider maintenance access. Keep the in-ground vault as close as practical to the inverter. Locate the batteries in as cool a location as possible, and be sure the tops of the batteries will stay dry.

Battery Wiring: The batteries are wired according to the diagram in Fig. 2, page 20. Pay strict attention to polarity. Leave the connector nearest to the BBS unit unplugged until all the other connections are made. The battery temperature sensor is installed under the head of a bolt in any negative terminal. Don't bolt the sensor between the wire terminal and the battery terminal, but just under the head.

Mounting the BBS Unit: Make all wiring connections before fastening the unit in place unless the back is accessible. The main BBS unit can be either rack mounted or shelf mounted. Mounting ears are available which can be used for rack mounting or the shelf brackets can be used to fasten the unit to a shelf. Locate the unit so the display will be easily readable.

Wiring the BBS Unit: Make wiring connections as shown in Fig. 3, page 21. Complete all relay and accessory wiring before operating the BBS.

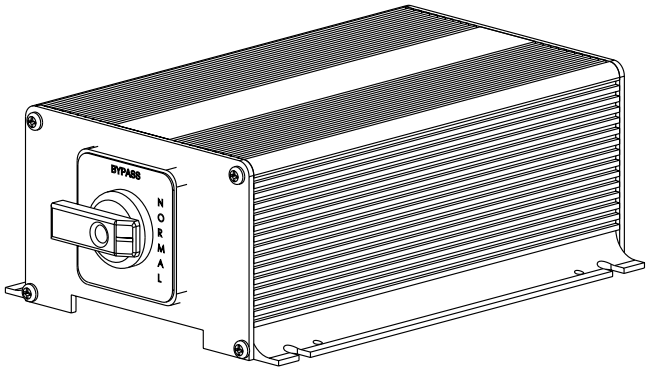
Installation Kit for BBS

Quantity	Part Number	Description
1	See page 16-17	BBS unit
1	See page 9	Maintenance Bypass Switch
4	960-12070-000	12V Battery
1	809-BP001-000	Battery Cable assembly 3m length
3	809-BP003-000	Dry Relay contact assembly
2	809-BP004-000	Battery Temperature sensor
1	809-BP002-000	25' extension battery assembly

Installation tools:
Screwdrivers: 1/18” flat blade screwdriver, phillips, #2 and #10 torx bit.

Wrenches: 10mm wrench for battery lugs, 1/2" wrench for DC connections to BBS and Line Filter connection.

Additional: Wire cutter, Wire stripper (10 AWG), Crimper (10 AWG), Multi-meter, Cable ties, Electrical tape, wire nuts (large)



Maintenance Bypass Switch (MBS) Installation: This optional component is provided in order to enable continued operation of the load while the Battery Backup System is installed or maintained. The switch is supplied in a readily mountable case with leads provided. If included, install the MBS first, as that will minimize the downtime required in the cabinet.

Prior to installation, ensure all utility power has been disconnected.

Mounting: Mount the switch close to the utility power inlet to the enclosure, and oriented so that it is easily accessible to maintenance personnel.

Grounding: There is a provision for a ground connection on the rear of the MBS; run a #14 minimum green wire from there to the system ground point.

Wiring: The MBS installs between the line connection in the cabinet and the line connections to the inverter and the load. The leads are color coded; follow the wiring shown in figure Fig.4, page 22. Run all leads together with existing harness or in a protected raceway according to local codes. Only the hot sides of the wiring are switched, the neutrals are connected together.

If it is desired to restore power to the cabinet as soon as possible, this can be done by placing the MBS in “Bypass”. The rest of the system can then be installed while the cabinet is powered. Caution: Beware of voltage feedback through an unconnected neutral. If in doubt, leave enclosure unpowered until all connections are complete.

STARTUP PROCEDURES

When all wiring is complete and thoroughly checked, turn on the BBS by flipping the system breaker to the ON position. If a lockout is engaged, the reason for lockout must be addressed prior to applying system power.

When the system power is turned on, 4 dashes appear on the display until system startup is complete. The default startup menu is the STATUS screen. If the BBS starts up without the utility present, it will immediately switch to BBS mode, however the default start state is CHG mode.

Inverter Testing/Dry run operation (Optional)

The BBS unit is tested and burned in at the factory, so this procedure is optional. However, it may be desired to check the BBS unit by itself, or to experiment with the menu options. In this case, accomplish the following:

*Place the Maintenance Bypass Switch (MBS) in “BYPASS”.
*Connect a dummy 120 volt load to the Inverter output of the BBS, such as up to 1KW of light bulbs.
*The BBS can now be started up by turning on the front panel breaker. The light bulb load will be supplied by the inverter. Note: The Charger is not operational so running time is limited by battery capacity.
*When the dry run is completed, shut down the BBS with the front panel breaker switch, disconnect the dummy load and restart the inverter. Then place the MBS in “NORMAL”.

Overall system test (Required): The following steps will check operation. This should be performed at initial start up, or any time it is desired to check system function.

*Place the MBS switch in “NORMAL”
*Turn on power. The system should operate normally.
*Place the MBS switch in “INVERTER”, the system should continue to operate normally.
*The front panel display should show “Chg” (charge).
*Turn off power to the enclosure. The BBS should now power the system, and this will display as “BBS”.
*Turn on power to enclosure. After a 30 second delay the front panel display should show “Chg”.

The preceding steps check the operation of the inverter, transfer switch, and maintenance bypass portions of the system. For the charger portion, it is somewhat more difficult to verify operation. A DC ammeter can be placed in series with the battery bank. When the batteries are partially discharged, a current of about 2 amperes should flow into the battery bank. It may take several hours of battery operation to discharge the batteries to the level required to detect this charging activity. In float mode (when the batteries are fully charged), the current may be just a few milliamperes.

The charger voltage only has meaning when it is connected to a battery bank. Do not attempt to operate the BBS when it is not connected to a battery.

ADJUSTMENTS

The Exeltech BBS has no adjustments, where possible, the system should be able to self adjust. Battery parameters, charge algorithm, and single state charging are all adjustable from the PC interface. Battery Capacity is a measured parameter and a new learn mode is initiated by pressing and holding the RESET button until the capacity graphic symbol “%” blinks once.

THEORY OF OPERATION

System Overview

The Exeltech BBS is comprised of several discrete components integrated together. The main system contains a digitally controlled battery charger and true sine wave power inverter. A built in transfer switch also mounts within the system cage; however, an external option is also available. External to the main system are the maintenance bypass switch, temperature sensor and batteries.

The Exeltech BBS operates as an offline UPS. Offline power systems monitor the state of the utility voltage and quickly transfer to inverter power. A power transfer switch continuously monitors line voltage, when the average utility voltage drops below a predetermined level, or falls out altogether, a transfer to inverter power takes place. Traditional offline UPS systems offer key advantages: simpler design, greater efficiency and cooler operation over the long term allowing mechanical components, such as fans, to achieve substantially longer life.

BBS Inverter

The heart of the Exeltech BBS is the built in true sine wave power inverter. Operating at efficiencies greater than 87%, the use of hi-speed switching/pulse-width modulation, allows the Exeltech BBS to be one of the industries lightest power inverters. The proven technology behind the Exeltech Power Inverter will provide hassle-free operation for any critical load.

BBS Charger

To ensure batteries maintain the optimal readiness in an unexpected utility failure, the Exeltech BBS incorporates a processor controlled battery charging system. An external temperature sensor sends back information that is used to adjust the charger output, based in the battery temperature. The charger has built in protection. By using the temperature sensor, batteries above 50°C are not charged.

Transfer Switch

The Exeltech BBS Transfer Switch converts the utility sine wave into a digital signal for voltage level determination. Noise filtering techniques ensure that accurate voltage reading will prevail over any single cycle voltage sag, reducing the number of false triggers. A second digital input maintains a fast detect algorithm capable of reacting to a loss of signal within 500 microseconds (actual transfer time is determined by the mechanical switch latency).

Maintenance Bypass Switch
An external maintenance bypass switch allows a single switch to remove the BBS from the circuit for anything requiring attention such as battery replacement, relay configuration, or other installation requirements.

MAINTENANCE:

Preventive Maintenance
The Exeltech BBS unit has been designed so that there is no need for any periodic maintenance. There are no user serviceable components inside the system case.

Batteries supplied with the BBS are maintenance free batteries. Occasional inspection and cleaning of battery terminal should be preformed on a schedule that suits the installation.

TROUBLE ANALYSIS

Troubleshooting the BBS system is best performed outside of the system that is requiring backup. Use the Maintenance Bypass Switch, or equivalent device, and remove the BBS from the power path. A system restart with the power breaker should be preformed before troubleshooting and removing the BBS from any system.

INVERTER TROUBLESHOOTING

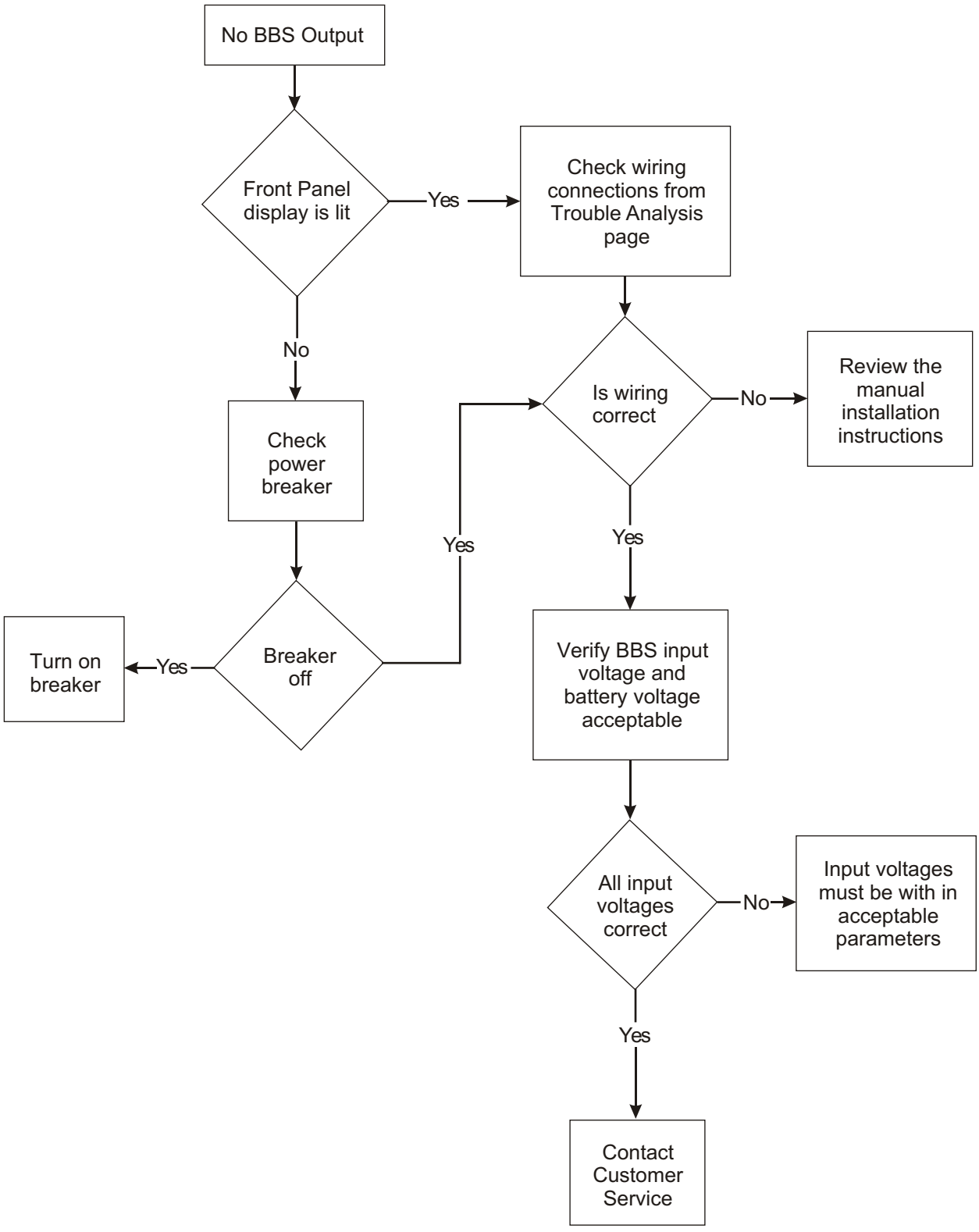
With the BBS turned off and line in removed from the input, inspect all line in and line out connections and ensure proper grounding of all lines to the chassis ground bar. Check battery connections at the back of the BBS, use a voltmeter to ensure proper battery connections and voltage levels to BBS terminals. With the line in disconnected, engage the power on breaker and the BBS transfer switch will immediately jump to BBS mode, an audible switch will occur, and the built in power inverter will begin supplying power to the line out connector. To test, simply connect a small load; a single light bulb will suffice for this test.

CHARGER TROUBLESHOOTING

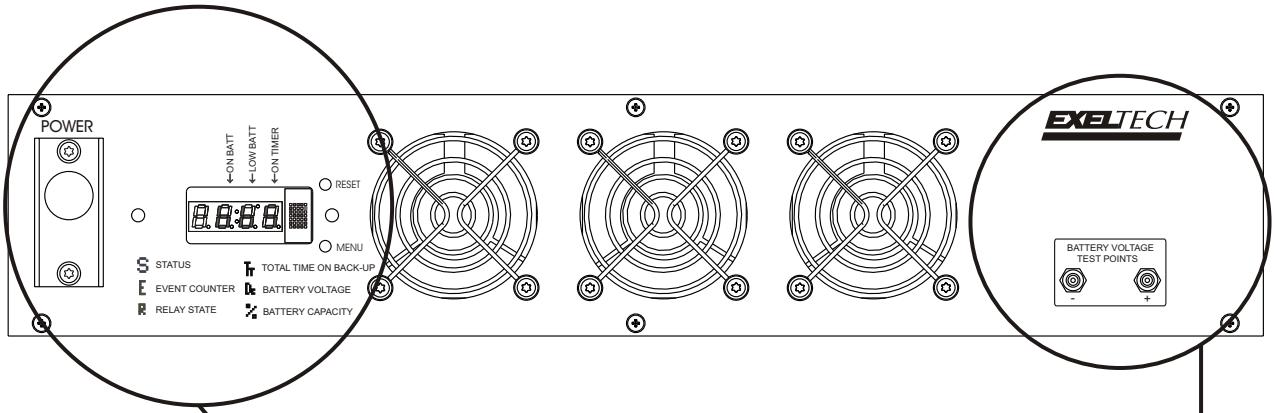
Verifying charger performance is typically a two step process: Is the system generating an acceptable voltage, and is the system providing current to charge batteries. To check the BBS voltage output, disconnect the batteries and test the open circuit voltage using the battery voltage test points located on the faceplate. Once it has been verified that the BBS is providing a sufficient voltage, testing the current requires a Direct Current, DC ammeter clamp.

Connect the system line in, line out, and batteries, in a standard, normal configuration, place the DC ammeter around one of the positive wires near the battery terminal. Be sure to correctly orient the DC ammeter clamp so that current flow into the battery is measured. Once set up, turn on the BBS and remove the utility in, placing the system in BBS mode for a short period of time. While in BBS mode the DC ammeter should be reading a negative value, current is flowing from the battery. If this is not the case, turn the DC ammeter in the opposite direction. Once sufficient time has elapsed, and the batteries have slightly discharged, apply utility to the system and note the positive current flow into the battery.

TROUBLESHOOTING SEQUENCE CHART



FRONT VIEW


POWER
ON BATT
LOW BATT
ON TIMER
RESET
MENU
STATUS
EVENT COUNTER
RELAY STATE
TOTAL TIME ON BACK-UP
BATTERY VOLTAGE
BATTERY CAPACITY
EXELTECH
BATTERY VOLTAGE TEST POINTS
-
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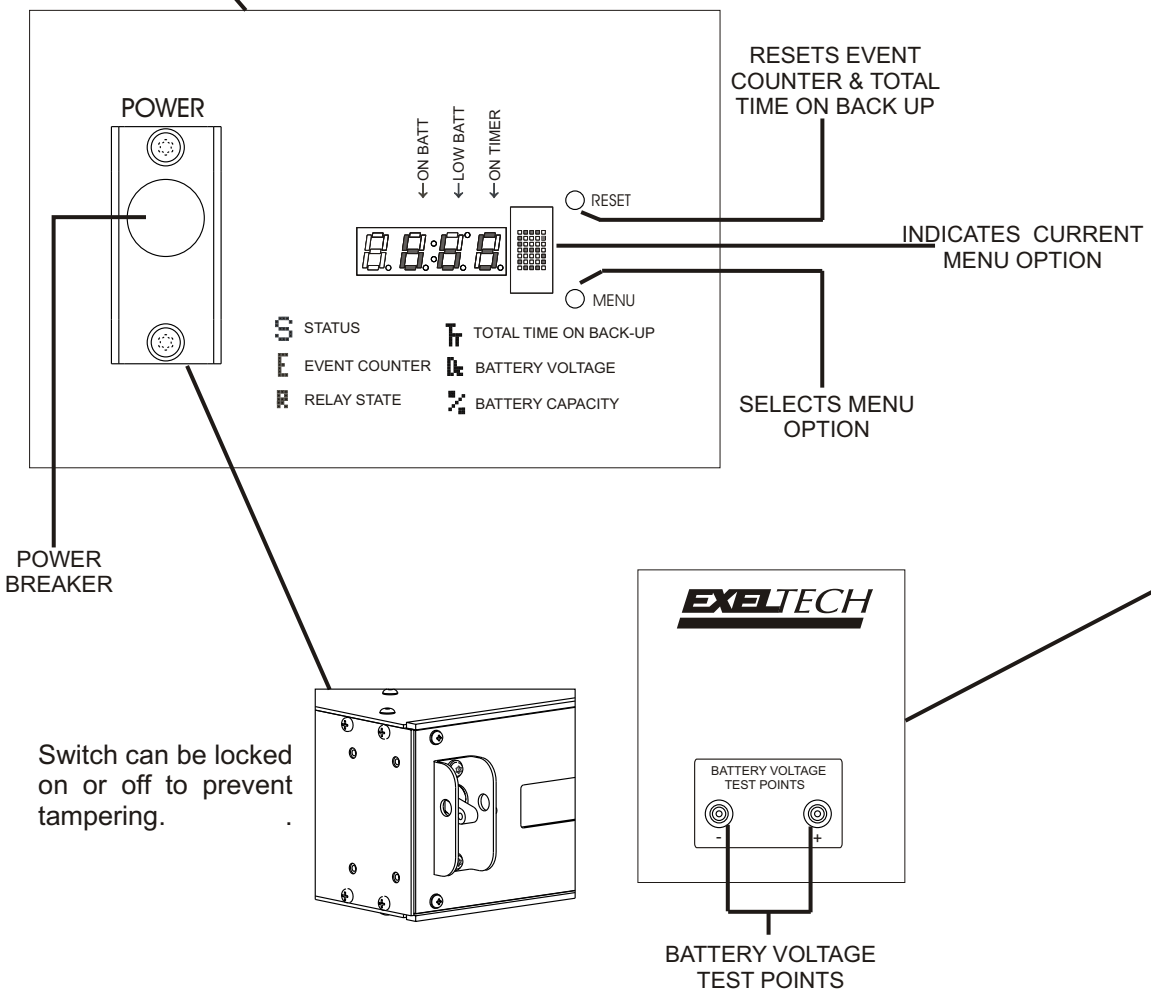
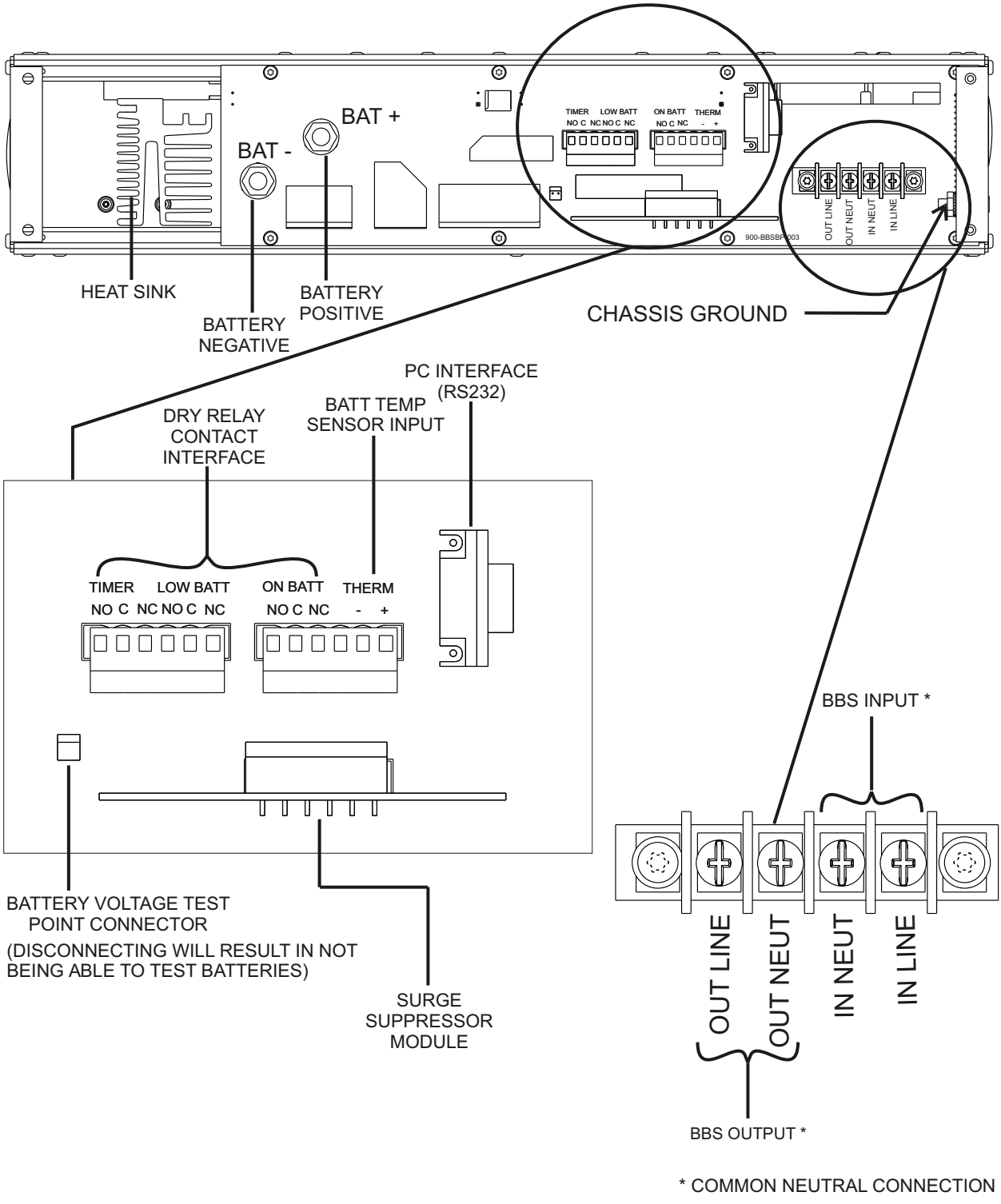
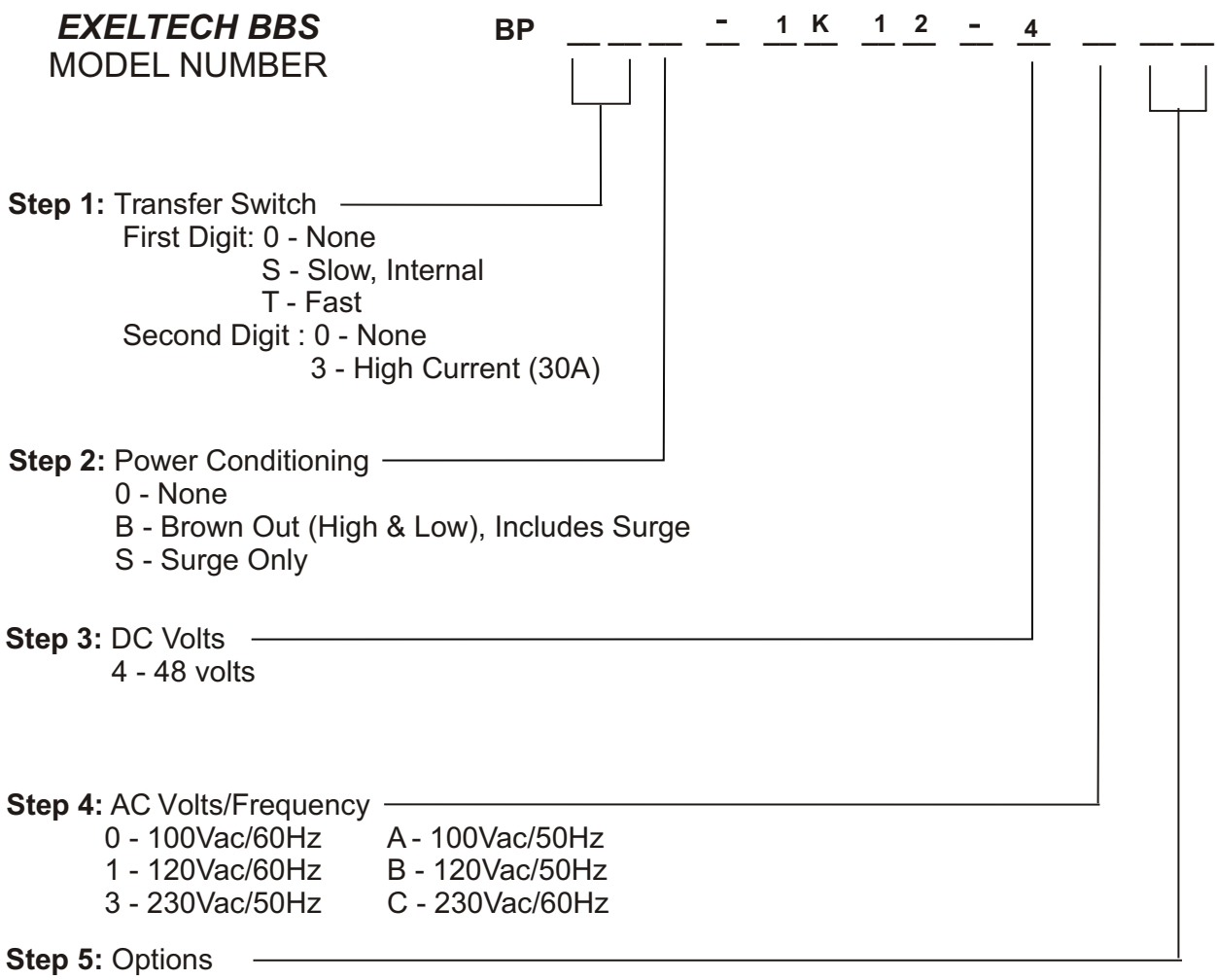

POWER
ON BATT
LOW BATT
ON TIMER
RESET
MENU
STATUS
EVENT COUNTER
RELAY STATE
TOTAL TIME ON BACK-UP
BATTERY VOLTAGE
BATTERY CAPACITY
RESETS EVENT COUNTER & TOTAL TIME ON BACK UP
INDICATES CURRENT MENU OPTION
SELECTS MENU OPTION
POWER BREAKER
Switch can be locked on or off to prevent tampering.
EXELTECH
BATTERY VOLTAGE TEST POINTS
-
+
BATTERY VOLTAGE TEST POINTS

BACK VIEW


BAT +
BAT -
TIMER LOW BATT ON BATT THERM
NO C NC NO C NC NO C NC - +
OUT LINE
OUT NEUT
IN NEUT
IN LINE
HEAT SINK
BATTERY NEGATIVE
BATTERY POSITIVE
CHASSIS GROUND
PC INTERFACE (RS232)
DRY RELAY CONTACT INTERFACE
BATT TEMP SENSOR INPUT
BBS INPUT *
BATTERY VOLTAGE TEST POINT CONNECTOR
(DISCONNECTING WILL RESULT IN NOT BEING ABLE TO TEST BATTERIES)
SURGE SUPPRESSOR MODULE
BBS OUTPUT *
* COMMON NEUTRAL CONNECTION

BBS SERIES SYSTEM PART NUMBER



MAINTENANCE BYPASS SWITCH NUMBERING SYSTEM

EXELTECH MBS
MODEL NUMBER

MB – ___ – ___ – ___

Step 1: Maintenance Bypass

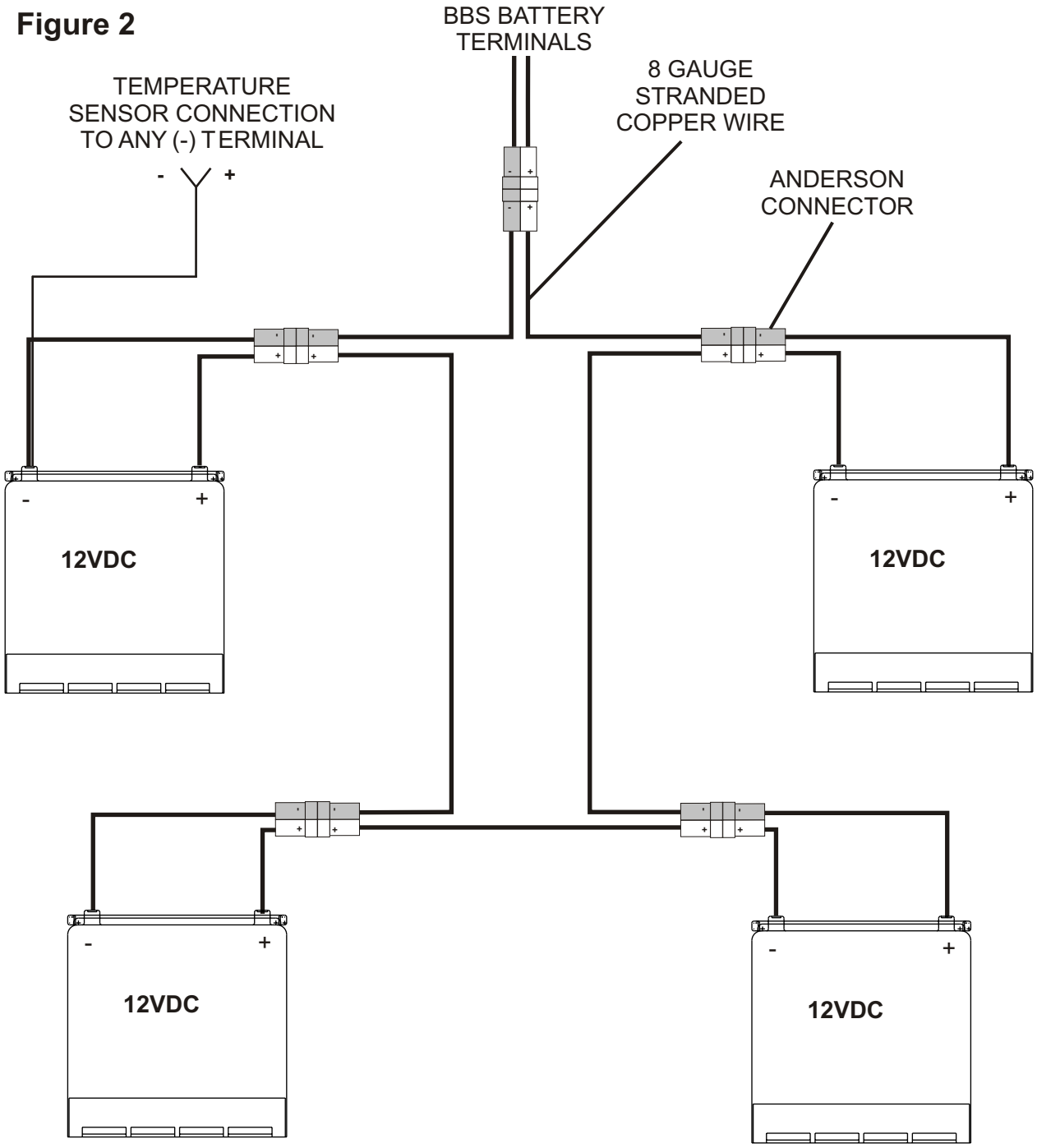
Step 2: Bypass Switch
1 - 15amp
3 - 30amp

Step 3: Cover Closure
0 - No case, angle bracket only
1 - mounted in 19” faceplate (no case)
2 - mounted in 23” faceplate (no case)
X - mounted in XP250 style case

Step 4: Options
01 - Mounted in XP250 style case w/o leads

BATTERY WIRING DIAGRAM

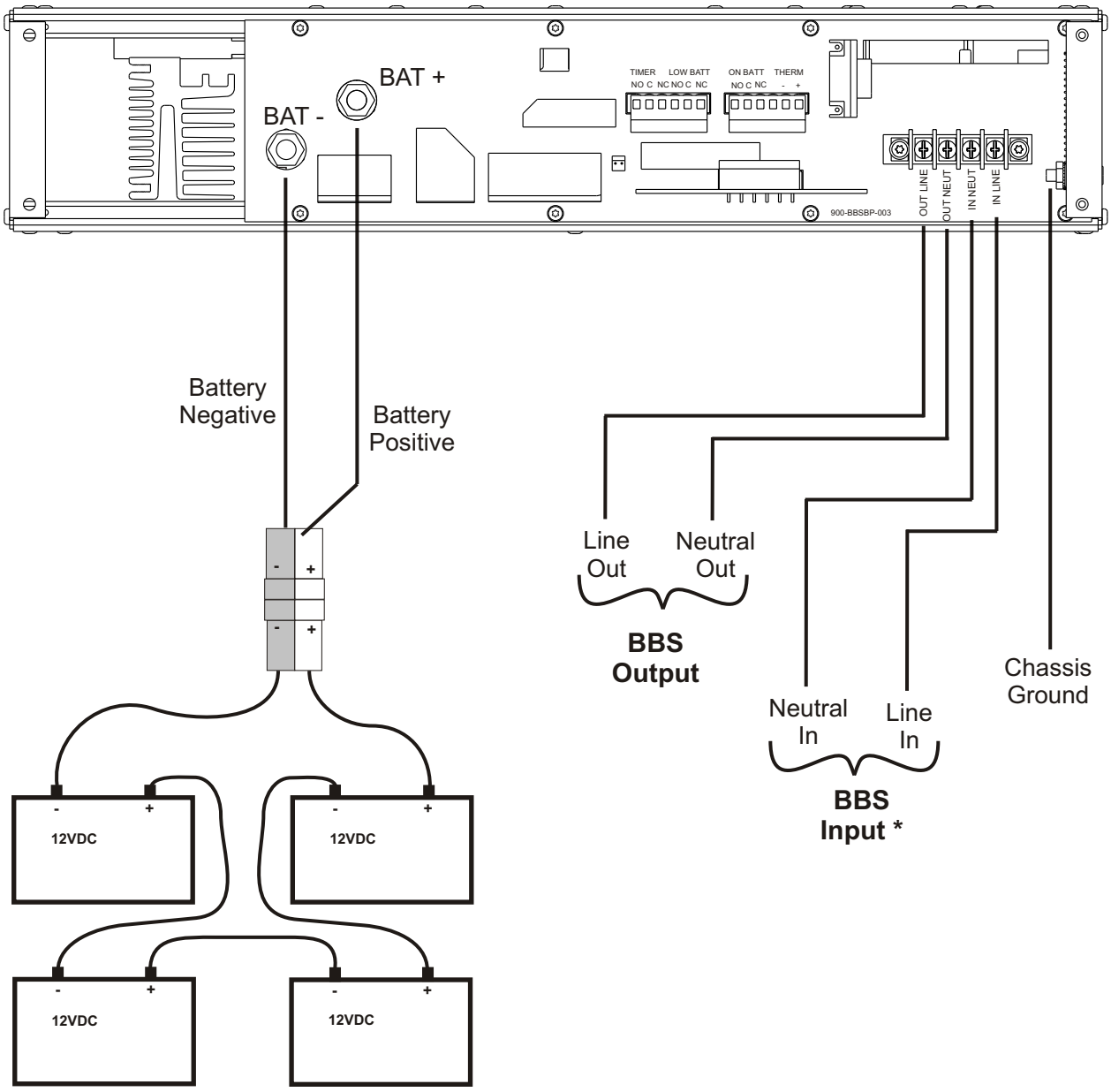
Figure 2



This diagram represents the typical 48 volt configuration. Note that in order to utilize temperature compensated charging, the supplied battery temperature sensor must be connected to a negative battery terminal. All standard Exeltech wiring harnesses of this configuration are 8 ga. stranded copper, with Anderson type interconnects. Cable extensions are available to allow any custom arrangement or configuration.

ELECTRICAL INTERCONNECT

Figure 3

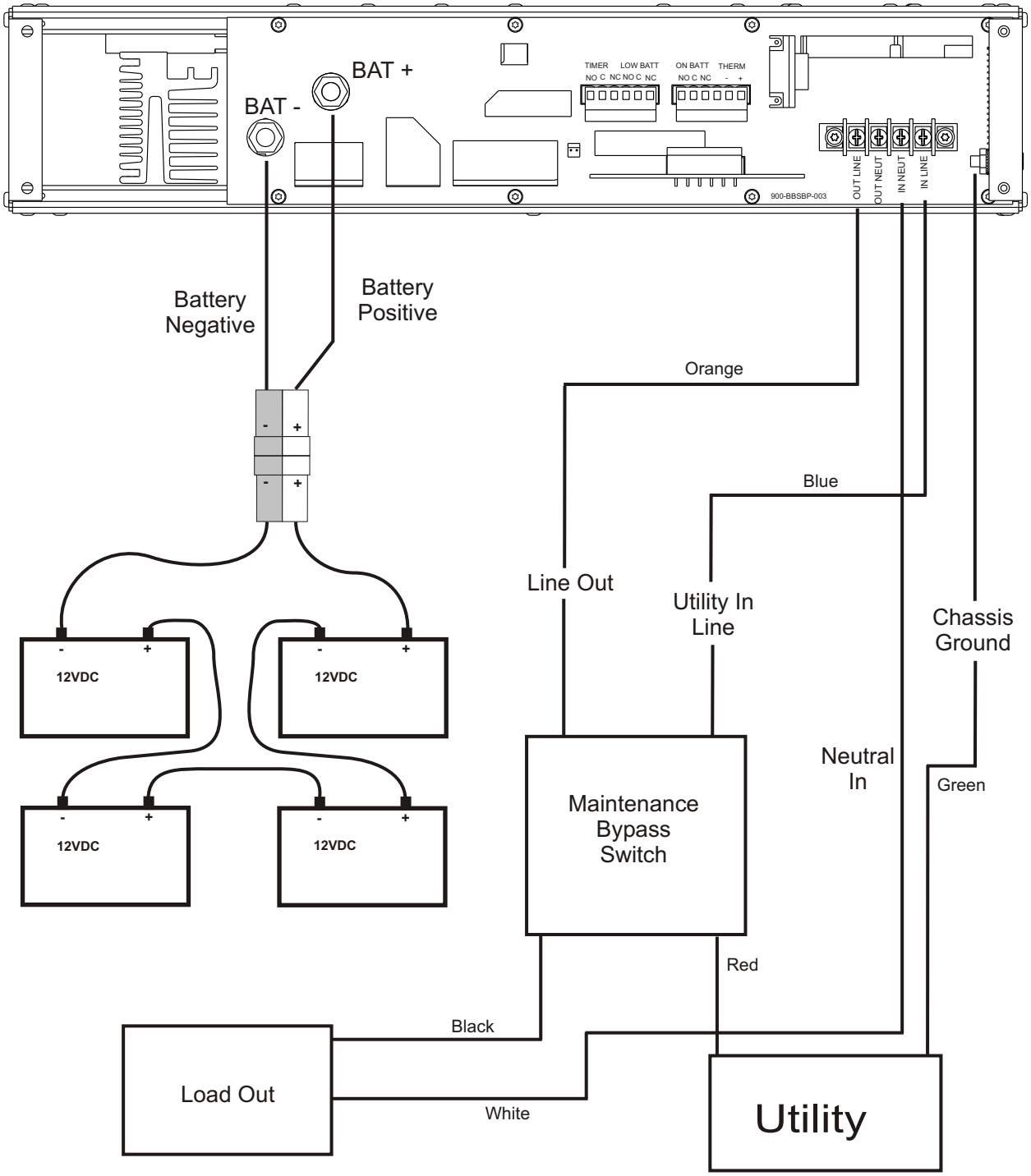


* Input current should never exceed12 AMPS, approximately 1400 watts.

NOTE: For BBS systems with out MBS. See Fig.4, page 22 for wiring with a MBS.

MAINTENANCE BYPASS INTERCONNECT

Figure 4



General Battery Information

Deep-cycle batteries are an excellent choice for battery backup power systems. By design, they may be discharged up to 80% of their rated capacity (20% remaining useful capacity). The sealed, lead-acid, deep-cycle batteries should be used with your Exeltech BBS are designed to be maintenance-free. With proper care and use, they will provide long-term, reliable backup power.

All lead-acid batteries suffer reduced life if not properly charged and maintained. The Exeltech BBS has a microprocessor-based, three-state charger that continually monitors the charge cycle, and also compensates for temperature variation, both of which aid in attaining the longest possible battery life. Discharged batteries are recharged in a "bulk charge" mode that provides the maximum charge current available, in the shortest time possible, and in a manner consistent with the maximum ratings of the batteries. When the batteries attain a nearly full charge condition (approximately 90%), the charger automatically reduces the output current to an "absorption" level that will complete the final 10% of the charging process. Once a 100% state of charge is reached, the charger will automatically change to a "float" mode that provides a constant, very small current to ensure the batteries are always charged.

Battery Capacity

The storage capacity of a battery (the amount of electrical energy it can hold) is usually expressed in amp-hours ("a-h"). For example, if one amp is drawn from the battery for 100 hours, then 100 amp-hours will have been used.

The battery for an Exeltech BBS should have sufficient amp-hour capacity to supply the needed power during the longest expected period of power failure without exceeding 80% of the battery capacity. For improved battery life, a lead-acid battery should be sized at least 20% larger than this amount. This will reduce the depth of discharge experienced by the battery, thus enhancing its service life. The batteries provided with your Exeltech BBS meet the specifications provided to us.

Environment

The battery environment can have a dramatic effect on overall battery life. For instance, battery reliability and capacity are greatly affected by temperature. Cold temperatures reduce the available reserve energy. At 40°F a lead-acid battery will have 75% of its rated capacity compared to 77°F. At 0°F, the capacity drops to 50%.

High temperatures significantly shorten battery life. Raising the temperature from 77°F to a sustained 95°F will decrease battery life expectancy by up to 50%, with an even more rapid decrease at yet higher temperatures. Thus a battery designed for a ten-year life at 77°F may provide only one to three years of service at elevated temperatures before requiring replacement.

Ideally, the Exeltech BBS batteries should be stored and used in a 70-77°F environment.

Maintenance

Sealed, deep-cycle, lead-acid batteries are maintenance free insofar as they never need water or an equalization charge. They cannot freeze or spill, so they may be mounted in any position. Battery tops (where the terminals are located) should be kept clean and dry. Wipe away any accumulated dirt or debris from between the terminals. All battery connections should be clean, with no visible evidence of leakage or corrosion. Corrosion may be an indication of pending trouble and should be properly reported. Observe the proper torque specification when performing an installation and during any annual (or more frequent) checkups.

Periodically check battery voltage. With the charger connected and operating in the float mode, you should measure 13.5V ±0.2VDC across each battery. Significant deviations from this value indicate a problem with one or more of the batteries in the string.

If any battery in the BBS system fails during normal operation, all batteries in that group should be replaced as a group. Do not mix old and new batteries in a system.

Safety

Always follow all prescribed safety procedures when working around the Exeltech BBS and/or batteries.

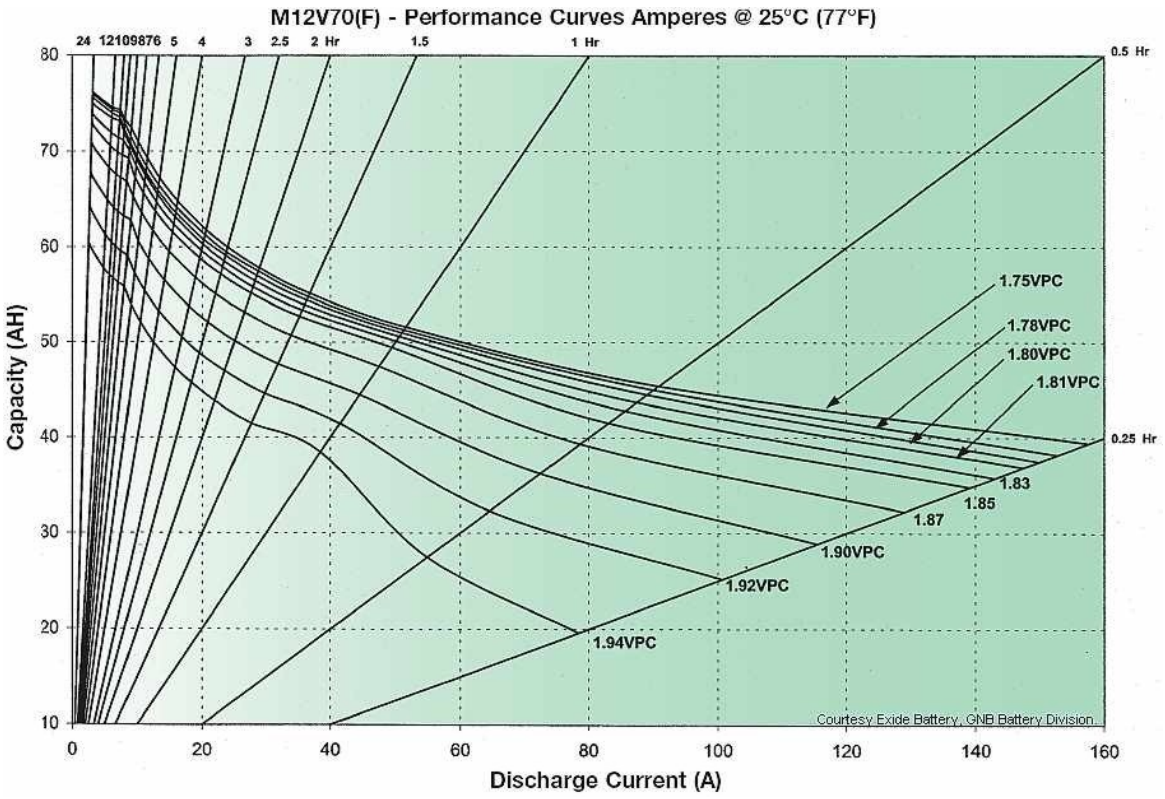
Lethal voltages exist in the AC wiring that enters and exits the BBS. Batteries also pose a risk, particularly in the event of a short occurring between the battery terminals. Always use fully insulated tools to avoid shorting the battery terminals.

Other Information

The batteries commonly provided with the Exeltech BBS are rated to provide 72 amp-hours at an 8-hour discharge rate. The Exeltech BBS is designed to provide up to 1,000 watts of continuous power at 74°C, significantly exceeding many states' requirements. The Exeltech BBS is very conservatively rated and designed, and will automatically protect itself in the event of over-temperature or overload conditions. However, exceeding the BBS environmental specifications may lead to erratic operation, damage and decreased component and/or battery life. Please ensure all environmental specifications are observed for the BBS and batteries.

A set of typical battery voltage curves based on varying rates of discharge is provided below. Exeltech specifies its BBS operation down to 1.75 volts per cell ("VPC"). This is the topmost curve in this graph.

This graph is provided for informational purposes only. Different battery capacity, operational/environmental temperatures, or other variables will affect your results.



The Exeltech BBS is designed to operate down to the battery voltage of 1.75 volts per cell (”VPC”). With a 48 volts system, and based on approximately 500 watts load, a fully-charged 72 a-h battery will have attained 1.75 VPC (42 volts for the battery) after eight hours and the inverter will automatically turn off to avoid damaging the battery and/or significantly decreasing battery life.

Made in the USA

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