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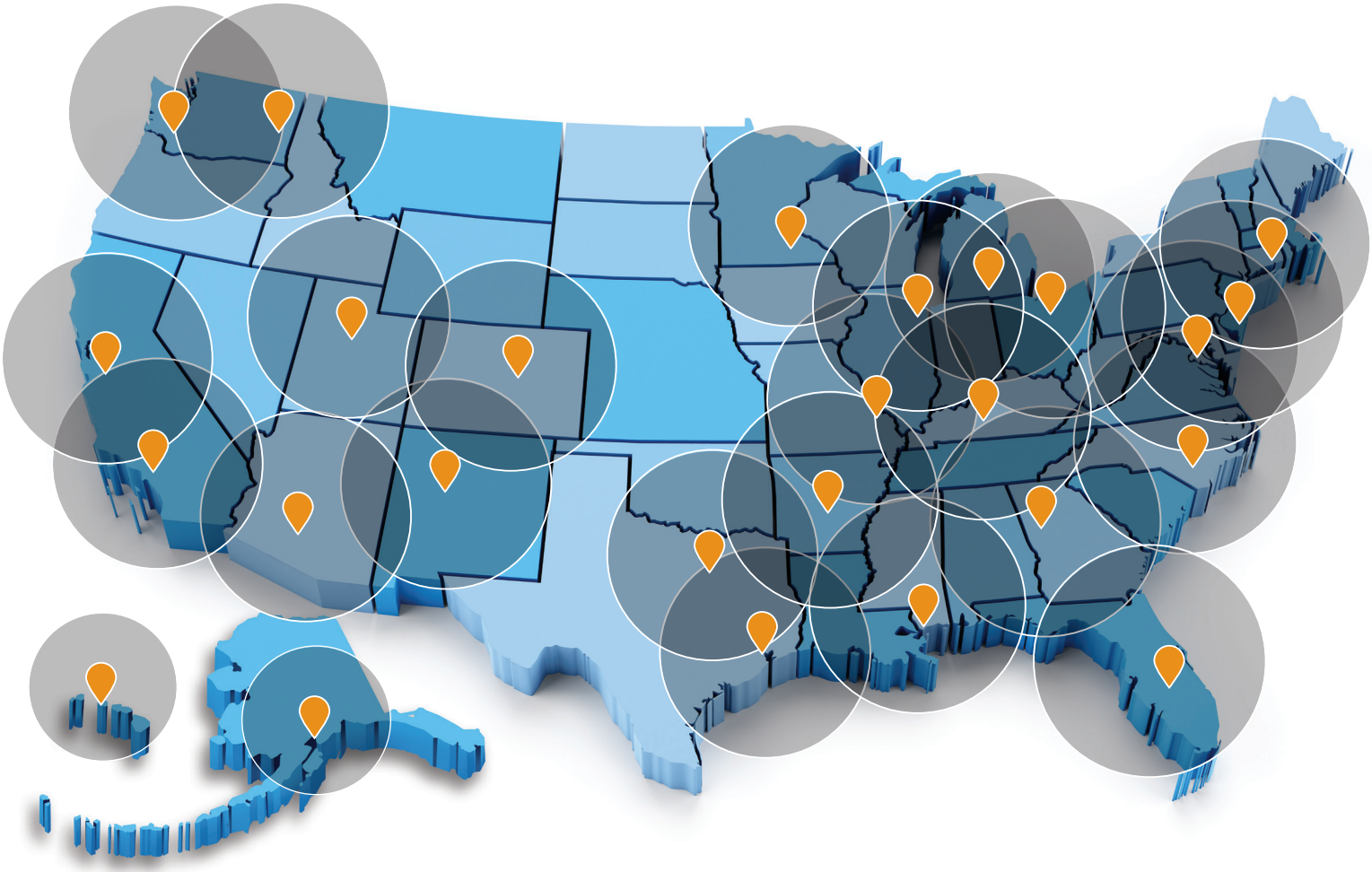

Section 1: Critical Safety Issues

1.1 Safety Admonishments

Three different levels of safety admonishments are used within this instruction manual; specifically **DANGER**, **WARNING**, and **CAUTION**.

DANGER

The statement following the **DANGER** heading alerts the equipment user of a potentially life- or health-threatening situation unless precautions are taken against it. Admonishments of this nature usually entail the hazards of electrical shock or those encountered that may result in physical injury.

WARNING

The statement following the **WARNING** heading alerts the equipment user of a condition or procedure that could result in interruption of service to the users or subscribers of the service receiving power from this product.

CAUTION

The statement following the **CAUTION** heading alerts the equipment user of a condition that could result in damage to the subject equipment or ancillary equipment if care is not exercised during certain maintenance or operating procedures.

SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

1.2 Emergency Shutdown Procedure

DANGER

Exercise extreme caution when performing the following procedure. Carry out the steps precisely in the order given to avoid the possibility of personal injury or equipment damage.

Perform the following procedure if the power supply must be shut down and disconnected on an emergency basis:

1. Open the enclosure containing the power supply.
2. Switch the BATTERY CIRCUIT breaker to the OFF (O) position.
3. Disconnect the AC power cord from its inlet connector at the side of the power supply. Power supply output is now disabled; however, continue with the following steps.

4. Remove the BATTERY connector from its location at the power supply front panel.
5. Disconnect the output cable from the OUTPUT connector at the power supply front panel, thus completely isolating the power supply from the outside plant.

1.3 General Safety Issues

The power supply documented in these instructions has been designed, tested and produced to ensure safe, trouble-free operation. Personnel using or installing this power supply should completely read and fully understand the following safety instructions. They are provided here as informational guidelines for your continued safety in usage of the product.

1.4 Safety Issues of Power Supply Installation and Use

The subject power supply has been designed and built to power broadband distribution equipment only. It is not intended for any other usage and provides output voltages suitable only for its intended application.

DANGER

This power supply operates from an AC source ranging from 100 to 260 volts and produces internal voltages in excess of 500 volts. DO NOT open any covers or panels or attempt to perform any service to the power supply without first removing and disconnecting all external AC and DC power sources. Only trained, qualified personnel should attempt service and repair work on the power supply.

Two Power Sources: All power supplies documented in this instruction manual use more than one source of power. If any reason exists to open the power supply enclosure for maintenance or adjustments, first turn off the BATTERY CIRCUIT breaker on the front panel, disconnect the AC line cord from its outlet and remove the BATTERY connector from its receptacle on the front panel. Be certain that at least 5 minutes has elapsed before opening covers after disconnecting operational power.

Install only gelled electrolyte valve regulated lead acid (VRLA) or AGM type batteries as a standby DC source for this power supply. See the following section 1.6 Battery Safety Issues for further information.

Ground Fault Protection: The power supply does not contain integral ground fault protection. Where such protection is required, the power supply input should be connected to a ground fault interrupter (GFI) outlet or to a branch circuit protected by a GFI circuit breaker of proper ratings.

1.5 Enclosure Safety Issues

The enclosure and the power supply must be installed by qualified technicians or installers only, using appropriate mounting hardware in accordance with local codes and construction practices.

The power supply must be installed within a grounded metal enclosure suitable for accommodating broadband power supplies. If installed outdoors, the cabinet must have a suitable weatherproof rating as a minimum requirement.

The outer enclosure housing the power supply must be of adequate strength to support the power supply and its associated batteries. Additionally, the enclosure must afford adequate ventilation for the power supply such that a minimum free air space of 52 mm (2 inches) remains around all sides and the top of the power supply.

Temperature of the air entering the enclosure must not exceed 50° C (122° F). Air intake and exhaust openings within the enclosure must not be less than what is required to maintain this temperature requirement. If these temperature limits are routinely exceeded or ventilation requirements cannot be attained, a suitable forced-air cooling system may be required within the enclosur

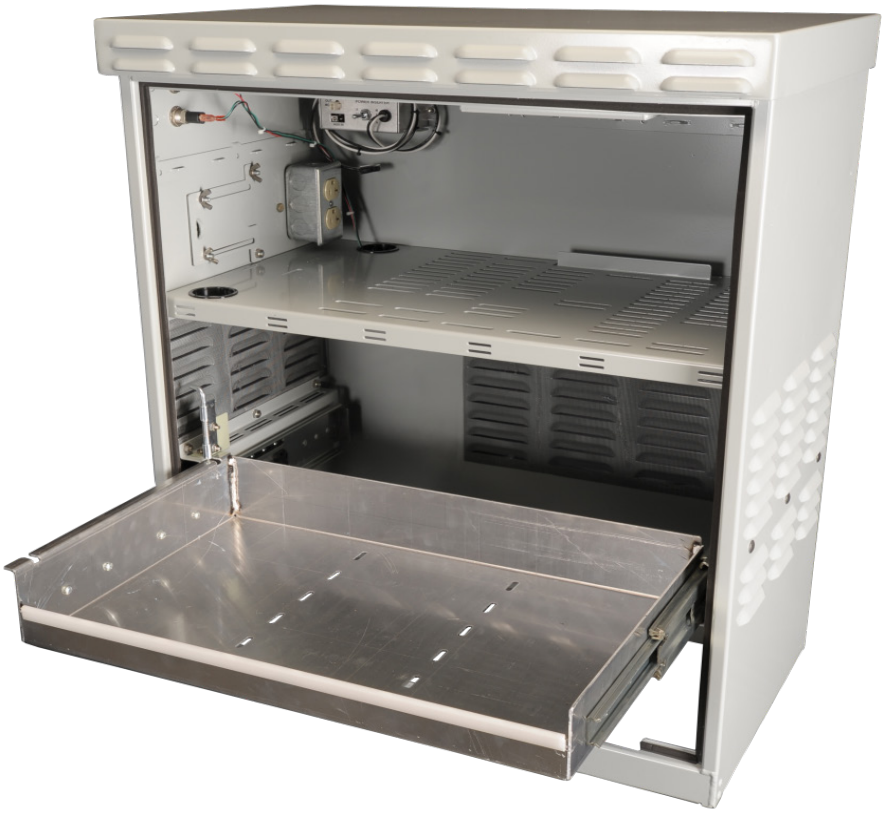

Fig. 1-1 Typical Power Supply Enclosure

1.6 Battery Safety Issues

When installing batteries for the power supply, do not mix battery types (gelled electrolyte and AGM) in the same string or within the same cabinet. DO NOT use flooded type batteries containing liquid electrolyte under any circumstances. Such batteries are hazardous to use within broadband enclosures and can degrade or destroy equipment installed in the enclosure with them. Flooded batteries also pose environmental hazards when acid containment methods cannot be employed. Use only gelled electrolyte or AGM batteries of suitable size, voltage and capacity for use in a broadband system.

Batteries can supply extremely large currents (>4000 amps) for a short period of time, sufficient to vaporize or melt metal objects. For this reason, installers must remove watches, rings and other jewelry before placing or connecting batteries in the cabinet. Insulating gloves and protective clothing should be worn during battery installation, consistent with local practices. Use only fully insulated tools designed for battery maintenance.

Batteries contain sulphuric acid in gelled or semi-liquid form. Direct contact with any spilled electrolyte from a damaged battery may result in skin irritation or chemical burns. For this reason, handle batteries carefully to avoid puncturing the case and releasing any of the electrolyte. In case of contact with the electrolyte, thoroughly wash any contaminated areas of the skin with soap and water. In case of contact with the eyes, immediately flush with copious amounts of water and seek medical attention. Minor surface spills can be neutralized with an appropriate neutralizing agent such as bicarbonate of soda (baking soda).

Always use proper lifting techniques when handling batteries. Each 12-volt battery weighs approximately 30 Kg or 66 lbs.

Personnel installing or servicing batteries must wear eye protection (goggles or full face shield) and protective clothing (apron and gloves) if necessary, according to local practices. Additionally, only fully insulated tools specifically designed for battery installation and service should be used for that purpose. Tools wrapped with vinyl or fabric-based electrical tape are NOT acceptable substitutes. (Insulated wrenches complying with IEC 60900 and ASTM F-1505 Standards
are distributed by various industrial supply organizations.)

The BATTERY CIRCUIT breaker on the front panel of the power supply must be operated to the OFF (O) position before installing, changing and connecting batteries.

Verify correct battery polarity and voltage at the DC input connector of the power supply before closing the BATTERY CIRCUIT breaker. Applying DC input of improper polarity or voltage can seriously damage or entirely destroy the power supply.

Replace any battery that is found to have a swollen or cracked case. Always recycle used batteries to reclaim lead and other materials that can pose environmental hazards if disposed of improperly.

Section 2: Installation and Setup

2.1 Preparation

Installing and wiring any model within the EB1s Series power supplies into an enclosure may be accomplished by connecting input and output wiring to the appropriate connectors of the power supply. The AC input cord of the power supply mates with standard receptacles of the region served. All other connectors on the front panels of the modules mate with industry-standard connectors widely available and used within the broadband industry. Moreover, connectors used in this power supply mate with accessory harnesses and assemblies designed and manufactured by Multilink Inc. Refer to the OPTIONS section of these instructions for further information.

In all installations, the following conditions apply and must be observed:

- A service disconnect switch containing overcurrent protection devices such as circuit breakers or fuses with appropriate AIC (amperes – interrupting capacity) rating should be placed between the AC utility source and the service entrance device for the power supply. Where used, the disconnect switch must be installed in compliance with all national, state and local codes as required.
- For outdoor installations, the AC utility conductors connected to the power supply service entrance device shall be physically protected through an appropriate restraining device and conduit, consistent with local codes and practices.
- When the power supply enclosure is located on a utility pole, suitable lifting equipment shall be employed during installation and service activities.
- Permission to mount the power supply enclosure at any site shall be made in accordance with all legal requirements and local practices of the area.

This power supply is designed for use in both existing and new enclosures of either pole or ground-mount configuration. Observe the following procedures during installation of any EB1s Series power supply.

The EB1s Series power supplies have been factory assembled, tested and prepared as a complete product ready for installation within an enclosure. The installer must verify that the correct type of AC power receptacle is installed in the enclosure for the input service and power supply selected for use at any given site. Additionally, the battery strings installed in the enclosure must match the configured EB1s battery voltage. Power supply ratings may be verified from the nameplate on the left side panel near the power cord.

2.2 Grounding

Safety ground and earth ground connections must be in place for the power supply and enclosure for both personal safety and operational considerations. During power supply and/or enclosure installation, the following grounding connections must be provided or verified.

CAUTION

Failure to provide and connect adequate safety and earth grounds at each installation site may result in improper power supply operation or permanent damage to the power supply itself. Grounding facilities and connections must conform to appropriate national codes and/or local practices.

The AC utility conductors installed in the service entrance box must contain a safety ground conductor. The power supply installer should verify that this grounding conductor is in place, having been installed along with the AC utility input.

A separate enclosure ground wire must be connected between the enclosure ground lug and an earth ground connection provided by a ground rod installed at the power supply site. In most cases, one copper or copper-clad steel ground rod of 2.5 meter (8 feet) length driven into the earth will be sufficient to provide the ground connection required. In some instances, a more elaborate grounding method (such as a ring ground) may be required; however, this may be dictated by state or local codes and depends on conductivity of the soil within the installation area.

The dead metal of the service entrance box must be bonded to the metal enclosure that houses the power supply. Additionally, the ground bar within the service entrance box should be bonded to the metal enclosures; however, this requirement may be subject to local codes and practices.

The grounding wire connected between the power supply enclosure and the earth ground rod should be no smaller in area than 13 mm^2 (6 AWG) copper. Both ends of the ground wire should be sealed with an appropriate anti-oxidation compound.

A separate bonding wire of the same size as specified in Step 4 above should be connected between the ground lug at the left side of the power supply chassis and earth ground where such connection enters the external system enclosure.

2.3 Placement in the Enclosure

This power supply has been designed primarily for use within a cabinet or enclosure offering protection from outdoor weather, entry of excessive dust, dirt or moisture, and from unauthorized contact by untrained personnel. If used in a controlled environment, the power supply may be located within an indoor equipment cabinet or may be mounted on a rack shelf.

The power supply should be mounted on a ventilated shelf that allows free air circulation, especially through the right and left side panels of the power supply cabinet. Clearance of at least 51 mm or 2 inches must be maintained around all surfaces of this power supply for unobstructed airflow. Temperature of the air entering the power supply should not exceed 65°C (149° F).

Fig. 2-1 Power Supply Front Panel

2.4 Wiring

Connect input, output, control and monitor wiring to the power supply according to the following procedure. Refer to Figs. 3-1 and 4-1 for control and connector positions.

Operate the AC line circuit breaker in the service entrance box to the OFF position. If the power supply is located at a head end or other customer premise site, ensure that the branch circuit breaker chosen to protect the AC receptacle for the power supply is operated to the OFF position.

Operate the BATTERY CIRCUIT breaker on the front panel of the power supply to the OFF (O) position.

NOTE

Power supply output wiring to the load(s) will be connected in the following steps. For safety of installation personnel and ease of wiring, two-piece terminal blocks containing the wiring contacts may be unplugged from the stationary portion in the power supply.

Apply the system loads to the OUTPUT connectors on the front panel of the power supply as follows:

If a single load only will be operated from the power supply, connect output wiring to the OUTPUT 1 terminals, line (L) and neutral (N). Wire size of 4-mm^2 area or 12 AWG is recommended. Use a wire with a temperature rating of at least 105°C.

If multiple loads will be operated from the power supply, connect the highest priority load to OUTPUT1 terminals, line (L) and neutral (N). Connect remaining loads in order of their priority to the terminals of OUTPUT2, line (L) and neutral (N). Use appropriate wire sizes based on the anticipated current draw of each load.

CAUTION

Do not load the power supply to a level greater than its total rated output. Ensure that a minimum load of greater than 1 ampere is applied. Subjecting the power supply to long-term overloads or no load conditions can result in permanent damage.

Connect the AC line cord from the power supply to the appropriate AC receptacle.

Insert the battery plug from the battery wiring harness into the mating BATTERY INPUT receptacle on the front panel of the power supply.

Insert the temperature sensor plug into the mating TEMP PROBE receptacle on the front panel of the power supply. The body of the temperature sensor probe should be placed between two of the battery cases in the enclosure.

If desired and so equipped, the cabinet tamper switch may be connected to the TAMPER SWITCH receptacle on the front panel.

If desired and so equipped, the cabinet status lights may be connected to the CABINET INDICATOR receptacle on the front panel.

If remote monitoring of the power supply is desired, connect the RF cable to the status monitor transponder or an external transponder to the SERIAL receptacle on the front panel of the power supply and connect the RF cable to external transponder.

Initial installation and wiring is now complete.

2.5 Battery Placement and Wiring

Proper installation and wiring of the batteries is critical to the long-term backup capability of any power supply system. Gelled electrolyte, valve regulated batteries are recommended for use in broadband power supply applications. All batteries should be tested and fully charged prior to installation. Interconnecting wiring must be no smaller than 8 mm^2 in area or 8 AWG. Longer run times and improved efficiency may be realized using battery wiring of 13 mm^2 in area or 6 AWG.

In light of the specialized handling and connection requirements for batteries, only trained personnel should install batteries in an enclosure. Personnel must always employ appropriate safety equipment (goggles or face shields, insulated gloves, etc.) and only use fully insulated tools for tightening hardware on the battery terminals. Additionally, proper lifting tools and techniques must always be used during battery installation to avoid personal injury or equipment damage.

2.6 Battery Installation Procedure

Place the batteries on the lower shelf of the enclosure, positive terminal facing out.

Route the terminal connector ends of the battery cable from the power supply compartment at the top of the enclosure to the battery compartment.

Wire the batteries in series, connecting negative post of one battery to positive post of the next. Battery cables and terminals are color coded to aid in correct wiring. Black terminal is negative (-); red terminal is positive (+). Use of an anti-oxidation compound, such as NO-OX-ID "A-Special"
, is recommended at each battery termination including ring lugs and threaded hardware. Use fully insulated tools only when tightening battery connections.

After completing all connections to the battery terminals, use a digital multimeter (DMM) to verify proper voltage and polarity at the battery cable connector that terminates to the power supply DC input port. For 3-battery systems, indicated voltage should be approximately 36 volts or slightly higher. In a 4-battery system, indicated voltage should be approximately 48 volts or slightly higher. When the red and black meter probes are connected to the corresponding colored terminals of the battery harness connector, the meter should indicate positive (+) voltage, assuming proper connections at the meter itself.

WARNING

If voltage and polarity indications do not correspond to those described above, determine the cause before mating the battery connector to the power supply. Incorrectly wired batteries can cause personal injury or permanent damage to equipment.

Space the batteries approximately 25-mm (1 inch) apart to provide adequate airflow.

Attach the body of the temperature sensor probe to the side of the center battery using self-adhesive tape rated for use in wide temperature ranges. Depending upon battery construction, it may be necessary to hang the sensor in close proximity to the side of the battery instead of attaching it directly.

2.7 Care and Maintenance of Batteries

Once installed and connected batteries must not be allowed to sit idle without receiving a charge. The power supply must be started, even if at minimum load, and allowed to charge the batteries. Initial charging to ensure full reserve time may require as long as seven days to accomplish. Batteries connected to an idle system without receiving a charge can be irreparably damaged, thereby requiring replacement before the system can be fully commissioned into service.

NOTE: The charging requirement becomes a special consideration when the accessory Battery Balance Manager is integrated into the cabinet installation. The Battery Balance Manager may be connected only when the power supply is fully operational and capable of charging the battery.

Startup and Operation

Section 3: Startup and Operation

3.1 Startup

The power supply is ready to be placed into operation after it has been installed in its enclosure and all input and output connections have been made. Ensure that AC input power is available to the power supply receptacle then perform the following steps in sequence.

Section 4: Maintenance and Adjustments

CAUTION

Other than the following Output Voltage Configuration procedure, there are no field serviceable items inside the power supply cabinet. The cabinet cover must not be removed except as described.

4.1 Preventive Maintenance

For optimum performance from your power supply, the following maintenance items should be performed at least every six (6) months, especially in areas where the power supply is subjected to extreme heat or cold.

- Visually inspect the enclosure for signs of damage
- Inspect the external status lamps for proper operation
- Check the LCD display and the status LEDs for any alarm indications
- Check all electrical connections
- Check the batteries for signs of swelling, split cases or other damage
- Check and record individual battery voltages
- Check and clean battery terminals; bolts or wingnuts must be tight
- Measure and record AC output voltage
- Measure and record AC output current
- Measure and record DC battery voltage
- Initiate a 15-minute battery test routine to check battery health
- Record all maintenance performed or parts replaced
- Verify the power supply is in its normal mode of operation as indicated by the LCD display. Most front panel LEDs should be illuminated green to indicate normal operation.
- Close and lock the enclosure

4.2 Analog Adjustments

Several miniature potentiometers are located on the printed wiring boards of the power supply. These potentiometers have been factory adjusted for proper voltage levels and for correct detection and measurement thresholds. Field adjustment of any potentiometer in the power supply must not be attempted; otherwise, degraded power system performance or damage to equipment or batteries may result. If any potentiometer adjustments are suspected as a cause of operational trouble or erroneous reporting, the entire power supply should be changed in the field then returned to a service center or the factory for diagnosis and repair.

Fig. 4-2 Output Voltage Select Jumper Detail

4.3 Troubleshooting

The troubleshooting guide has been designed to help you quickly locate and resolve common power supply problems. If you still cannot solve the problem, replace the power supply with a known good unit.

Condition	Check
No output to load Batteries connected AC line power present	Output connector plugged in Battery voltage within limits AC utility voltage present and within limits
Incorrect output voltage Batteries connected AC line power present	Check output voltage and current displays. Check output connector and connections to cable plant.
Batteries will not charge Batteries connected AC line power present	Battery breaker tripped Battery terminals and connectors Battery failure
Batteries not properly charged Batteries connected AC line power present	Verify connection of battery cable Verify charger mode at front panel Measure charge voltage (Bulk, Equalize, Float)

Section 5: Options

The EB1s Series power supplies support several optional features appearing in the following list. The options and accessories listed enhance the usefulness of your power supply as aids to installation and servicing and are available through Multilink as extra-cost items. Refer to the section 8.6 of this instruction manual for part numbers of the options available

5.1 Battery Cable Kits

Designed for 3, 4, 6, or 8-battery powering applications.

5.2 Output Cable

70 cm unterminated cable adapts the UPS for use in a wide variety of existing enclosures.

5.3 Battery Balance Manager

This accessory, available as an installed option, is designed to maintain identical terminal voltage of each 3 or 4-cell battery in the string within 130 millivolts (0.130 volt) as measured across the entire battery string. Balancing battery voltages will help maintain battery life to maximum attainable time and helps insure longest available reserve time. The Battery Balance Manager is available for either 36-volt or 48-volt applications and for 1 or 2 battery strings. See the connection diagrams at the end of this section.

5.4 Dual Smart Breaker

This accessory, available as an installed option, monitors the output current of both output channels and can disconnect one or both of the channels in the event of an overcurrent. After an interval it will test for the overcurrent condition and will reconnect the channel accordingly. Parameters for this option are set from a menu list.

5.5 Recommended AC Input and Battery Wiring Sizes; 900 and 1350 VA Power Supplies

AC Input Wiring: Not smaller than 4 mm^2 in area (12 AWG), 105°C temperature rating.

AC Input Circuit Breaker: 16-Amp with AIC rating of 10,000 amps

Battery Wiring: Not smaller than 10 mm^2 area (8 AWG); wiring kits of 16 mm^2 area (6 AWG) available

5.6 Available Options:	**Part Number:**
3-Battery Standard-Duty Cable Kit	874-001-23
8-Battery Heavy-Duty Cable Kit	874-031-20
Output Cable (70-cm, non-terminated)	870-009-20
Battery Balancer Module Kit (1 string, 3 or 4 batteries)	741-068-20
Battery Balancer Module Kit (2 string, 3 to 8 batteries)	741-068-21
Dual Smart Breaker Kit	741-___-__

Options subject to further development and/or change without prior notification

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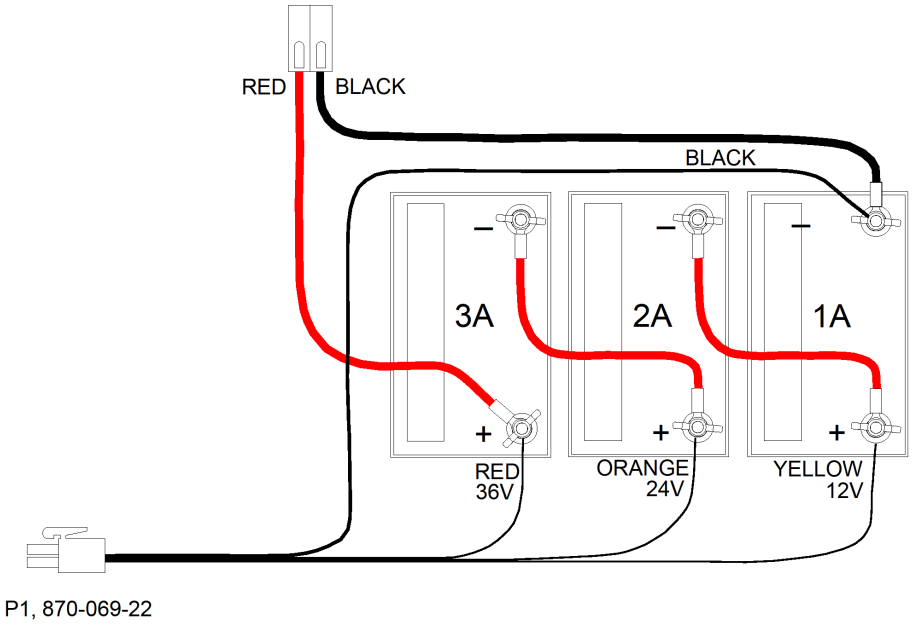
01	06/20/16	INITIAL RELEASE		RML



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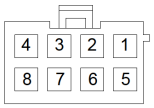

WIRING SIDE VIEW

TABLE 1	
P1 TERM NO.	WIRE COLOR
1	BK
2	Y
3	O
4	R
5	
6	
7	
8	

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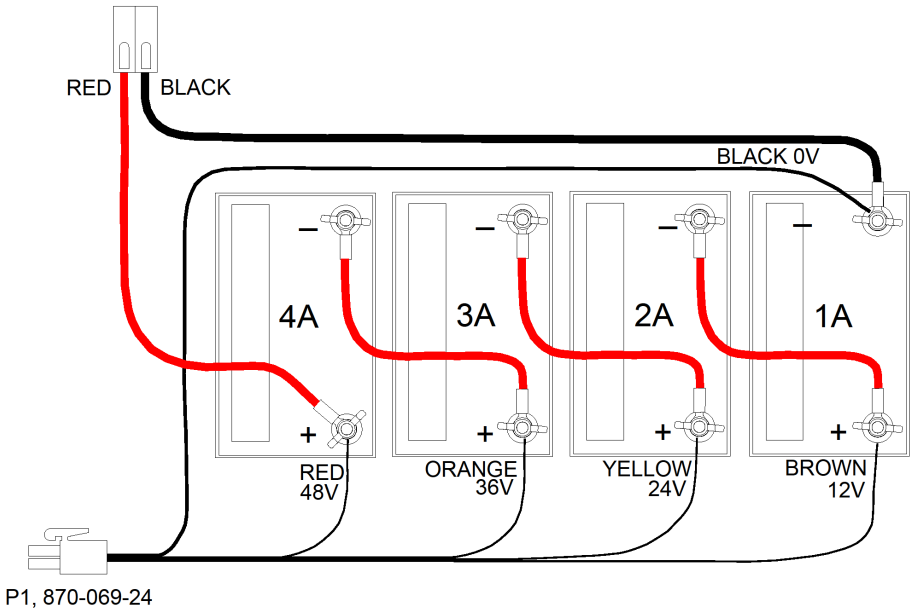
P.O. BOX 955
ELYRIA, OHIO 44035
PHONE: (440)366-6966
FAX: (440)366-6802

DESCRIPTION: WIRING DIAGRAM EB1S EMBEDDED BBM

DRAWN BY:	M. LIMPACH
DATE:	06/20/16
USED IN MODEL:	EB1S
PART NUMBER:	870-069-22
CAD FILE:	870-069-22-A0
PLOT SCALE:	
REV:	01
DRAWING NUMBER:	870-069-22-A0
PART OF ASSY:	740-068-20
SHEET:	1 OF 1

Fig. 5-1 Battery Balancer wiring, 36V, 3 batteries, 1 string

LTR.	DATE	REVISIONS	ECN	BY
01	06/20/16	INITIAL RELEASE		RML



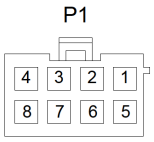


TABLE 1	
P1 TERM NO.	WIRE COLOR
1	BK
2	BR
3	Y
4	O
5	R
6	
7	
8	

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PHONE: (440)366-6966
FAX: (440)366-6802

DESCRIPTION:
WIRING DIAGRAM EB1S EMBEDDED BBM

CAD FILE: 870-069-24-A0		PLOT SCALE:	REV: 01	DRAWING NUMBER: 870-069-24-A0
PART OF ASSY: 740-068-20		SHEET: 1 OF 1		

DRAWN BY: M. LIMPACH
DATE: 06/20/16
USED IN MODEL: EB1S
PART NUMBER: 870-069-24

Fig. 5-2 Battery Balancer wiring, 48V, 4 batteries, 1 string

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Document No. EB1s Manual Eng (3)

INSTALL AND OPERATION