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Lucent Technologies Lineage® 2000 Battery Distribution Fuse Bay (BDFB) J85568C-1

Notice:
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Table of Contents

1 Introduction

2 Ordering Information

3 Product Description

4 Installation

5 Product Warranty

List of Figures

List of Tables

1 Introduction

General

This product manual describes the J85568C-1 Battery Distribution Fuse Bay (BDFB). The J85568C series BDFB is shown in Figure 1-1. It serves as a secondary fuse distribution center for dc power delivered from a central office battery plant to the using equipment. It provides space efficient branch loading for distributing +/- 24, 48 or 130 volt dc power or combinations of these voltages from different battery plants. In many applications, telecommunication equipment requires power redundancy from the battery plant. A BDFB provides this redundancy through the use of multiple load buses. The J85568C-1 is a cabinetized distribution system that supports these applications by providing up to six distinct load buses.

Each load bus has a rated current carrying capacity of 600 amperes and may be configured to include one or multiple fuse panels. Each fuse panel provides 20 mounting positions that may be equipped with either WP-92461 cartridge fuses that range from 3 to 70 amperes and/or GMT fuse modules containing three fuses ranging from 1/2 to 5 amperes. Additional features include: digital meters; remote monitoring capability for alarms; multiple cabinet heights, and optional 2-hole ground bus arrangements mounted either in the cabinet or external to the cabinet on a cable rack. These options and many more provide greater flexibility for customers with different distribution requirements.

The topics covered in this manual include a general product description, basic features and options, ordering guides, and engineering and installation information. The main emphasis will be to familiarize the user with alarm options and cabling issues such as, connector and hardware types available for input

load-bus feeds, output load leads and ground return leads. Suggested cable routing strategies for cable entry are also discussed.

Documentation

This document (Lucent Technologies 157-005-100) is part of a set of documentation developed to assist engineering and installation personnel. Additional product information includes the following:

- ED-83127-30 Fuse Panel Drawing
- T-83150-30 Wiring Drawing
- SD-83150-01 Schematic Drawing

This documentation is provided with each BDFB in Documentation Service Kit, Comcode 846991032.

Additional Information

Additional copies of this manual or any other Lucent Technologies document may be obtained by calling Lucent Technologies Customer Service at 1-800-THE-1PWR (1-800-843-1797). Specify the code number for manuals or the drawing numbers for drawings.

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On a post-sale basis, **during the Product Warranty period,** our Technical Support telephone number 1-800-CAL RTAC (1-800-225-7822) provides coverage during normal business hours. Product Specialists are available to answer your technical questions and assist in troubleshooting problems. For out-of-hours EMERGENCIES, the 800 number will put you in touch with a Regional Technical Assistance Center Engineer via our 24 hour a day, 7 day per week Help Desk.

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Central and South America

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Europe, Middle East, and Africa

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Asia Pacific Region

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

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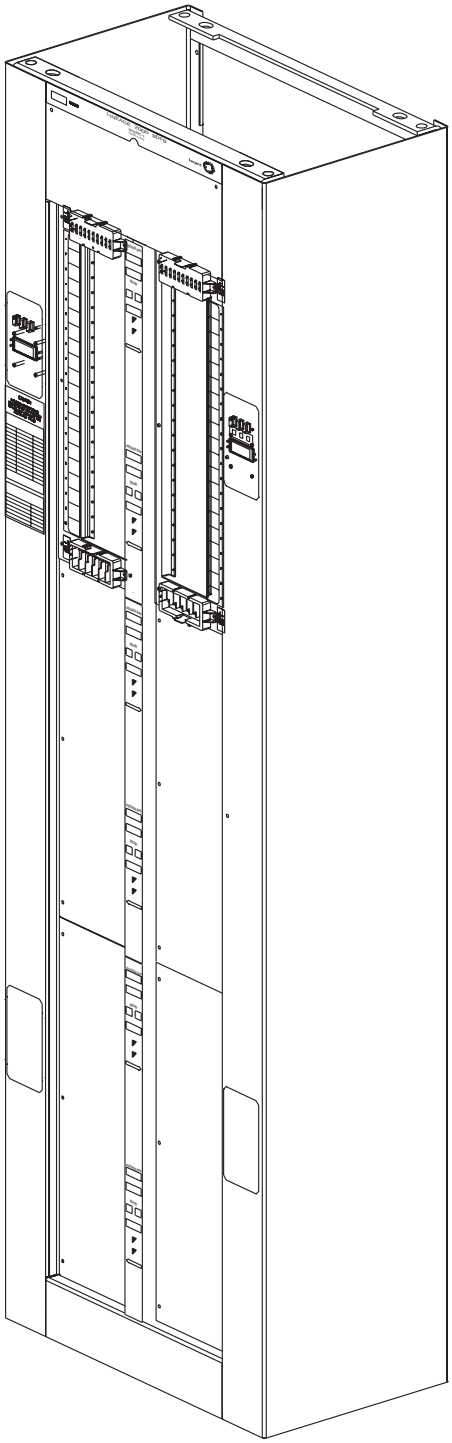


Figure 1-1: J85568C-1 Battery Distribution Fuse Bay (BDFB)

2 Ordering Information

The following tables are provided to describe the list structure of the J85568C-1 BDFB. Table 2-A provides a summary of the J85568C-1 List structure and Table 2-B a summary of ED-83127-30 Group options. A detailed description of each of the options on the BDFB is presented in Section 3.

Table 2-A: J85568C-1 BDFB Ordering Information

Description	List
Provides a 7 foot cabinet with space for six fuse panels and from one to six load buses	1
Provides a 9 foot cabinet with space for eight fuse panels and from one to six load buses	2
Same as List 2 with 2-1/2 foot extension cabinet for 11-1/2 foot office environments	3
Equipment required for terminating battery input cabling. Provides a bus bar connection from a fuse panel in position 1 to the top or bottom of cabinet	11
Same as List 11, except for panel position 2	12
Same as List 11, except for panel position 3	13
Same as List 11, except for panel position 4	14
Same as List 11,, except for panel position 5	15
Same as List 11, except for panel position 6	16

Table 2-A: J85568C-1 BDFB Ordering Information

Description	List
Optional equipment for a discharge return bus mounted to a fuse panel (maximum of one per fuse panel)	20
Equipment always required in addition to List 20 for terminating battery return cabling to panel position 1. Provides a bus bar connection from a fuse panel in position 1 to the top or bottom of cabinet	21
Same as List 21, except for panel position 2	22
Same as List 21, except for panel position 3	23
Same as List 21, except for panel position 4	24
Same as List 21, except for panel position 5	25
Same as List 21, except for panel position 6	26
Bus bar link for connecting two fuse panel battery buses together	A
Bus bar link for connecting two List 20 discharge return buses together	B
One blank panel required for each unequipped fuse panel position	D
One 300 ampere shunt for monitoring current on a load bus	E
One 600 ampere shunt for monitoring current on a load bus	F
One digital meter and switch for monitoring up to three 300 ampere shunts (maximum of two meters)	G
One digital meter and switch for monitoring up to three 600 ampere shunts (maximum of two meters)	H
Equipment required to arrange a cabinet for bottom load feed	BF
Optional material required in addition to List 1 to provide a 4-1/2 foot cabinet extension for 11-1/2 foot office environments	J
Optional material required in addition to List 1 to provide a 2 foot cabinet extension for 9 foot office environments	K

Table 2-A: J85568C-1 BDFB Ordering Information

Description	List
Optional material to provide a 2400 ampere discharge return bus arranged for mounting on a 15 or 20 inch ladder type cable rack	K1
Optional material required in addition to List K1 to provide an additional 2400 ampere discharge return bus bar for a stacked bus arrangement	K2
Optional material required with Lists 1, 2 or 3 to provide a 1200 ampere ground bus (ED83019-50) arranged for mounting a 15 or 20 inch ladder type cable rack	K3

3 Product Description

General Description

The Battery Distribution Fuse Bay (BDFB), Model J85568C-1, is available in five cabinet arrangements. These include:

7 foot cabinet: 26 inches wide by 15 inches deep
7 foot cabinet with 2 foot extension cabinet
7 foot cabinet with 4-1/2 foot extension cabinet
9 foot cabinet: 26 inches wide by 18 inches deep
9 foot cabinet with 2-1/2 foot extension cabinet

The 7 foot cabinet has six fuse panel positions and the 9 foot cabinet has eight fuse panel positions. Fuse panels and associated alarm circuit modules are ordered per ED-83127-30. Alarms include both remote signaling and visual indication of fuse failure and panel power loss.

Each cabinet type may be configured with one to six separate load buses. All input battery and battery return feeds are terminated at the top center (or bottom center) of the cabinet. Each load feed is then bused down (or up) the center of the cabinet to the fuse panel(s). This eliminates the congestion associated with routing input power and return feeds to each fuse panel in the cabinet and provides a common termination point. Each load bus must have a load monitoring shunt. Digital meters may also be ordered to allow the user to monitor individual load bus current.

Load leads from each fuse are routed along cable troughs on either side of the cabinet. Discharge return leads from the load equipment can be handled in one of two ways. A discharge return bus bar arrangement mounted either on the fuse panels in the cabinet or external to the cabinet on a cable rack. Both configurations comply with Bellcore 2-Hole grounding requirements.

Features

The following is a list of the many features provided with this product:

- Distributes +/- 24, 48 or 130 volt dc power
- 7, 9 or 11-1/2 foot cabinet arrangements
- One to six load buses
- Optional digital meters
- Cable entry from the top or bottom of cabinet
- 120 cartridge fuse positions in 7 foot cabinet
- 160 cartridge fuse positions in 9 foot cabinet
- Accomodates fuse sizes 1/2 to 70 amperes.
- 300 or 600 ampere monitoring shunts
- Frame alarm indicator lamp
- Panel fuse alarm and power loss indicator lamps
- Individual fuse alarm indicator
- Alarm circuit modules for remote monitoring
- Optional internal or external ground bus arrangements

Specifications

List 1 Cabinet: Six fuse panel positions

Height	84 inches (2134mm)
Width	26 inches (660mm)
Depth	15 inches (381mm)
Weight	approx. 375 pounds (6 panels)

List 2 Cabinet: Eight fuse panel positions

Height	108 inches (2743mm)
Width	26 inches (660mm)
Depth	18 inches (457mm)
Weight	approx. 450 pounds (8 panels)

List 3 Cabinet: Eight fuse panel positions

Height	108 inches (2743mm) 30 inches (762mm) extension cabinet
Width	26 inches (660mm)
Depth	18 inches (457mm)
Weight	approx. 525 pounds (8 panels)

J85568C-1 Cabinet

Cabinet Types and Features

Two cabinet types and three cabinet extension options are available with this BDFB:

List 1 7 foot Cabinet
List 2 9 foot Cabinet
List 3 9 foot Cabinet with 2-1/2 foot Extension Cabinet
List J 4-1/2 foot Extension Cabinet for 7 foot Cabinet
List K 2 foot extension cabinet for 7 foot cabinet

The List 1 cabinet contains six fuse panel positions and the List 2 and List 3 cabinets have eight fuse positions. Each of these panel positions must be equipped with either a fuse panel or a List D blank panel. Figures 3-1 through 3-6 show some of the possible cabinet configurations.

List 3 is comprised of a 9 foot cabinet, a 2-1/2 foot extension cabinet and interconnection hardware. The extension cabinet mounts on top of the 9 foot cabinet as shown in Figure 3-5. It is constructed in the same manner as the other cabinets and offers a clean aesthetically pleasing solution for 11-1/2 foot central office applications. Interframe ground cabling and mounting hardware is also furnished to provide a continuous frame ground to the top of the cabinet.

List J provides a 4-1/2 foot extension cabinet for the List 1 cabinet to offer another option for the 11-1/2 foot office environment. List K provides a 2 foot extension cabinet for the List 1 cabinet to offer another option for the 9 foot environment. The extensions, shown in Figure 3-6, may be disassembled if future wire center modernization requires a 7 foot office environment. Intercabinet ground cable and mounting hardware is furnished to provide a continuous frame ground to the top of the cabinet.

The frame ground connection is located on top of each cabinet. Connection is made using a 1/4 inch double hole terminal lug on .625 inch centers. For ground wire connection greater than 2 gauge, order Comcode 846337798 bus bar adapter to allow for 3/8 inch double hole terminal lugs on 1.00 inch centers.

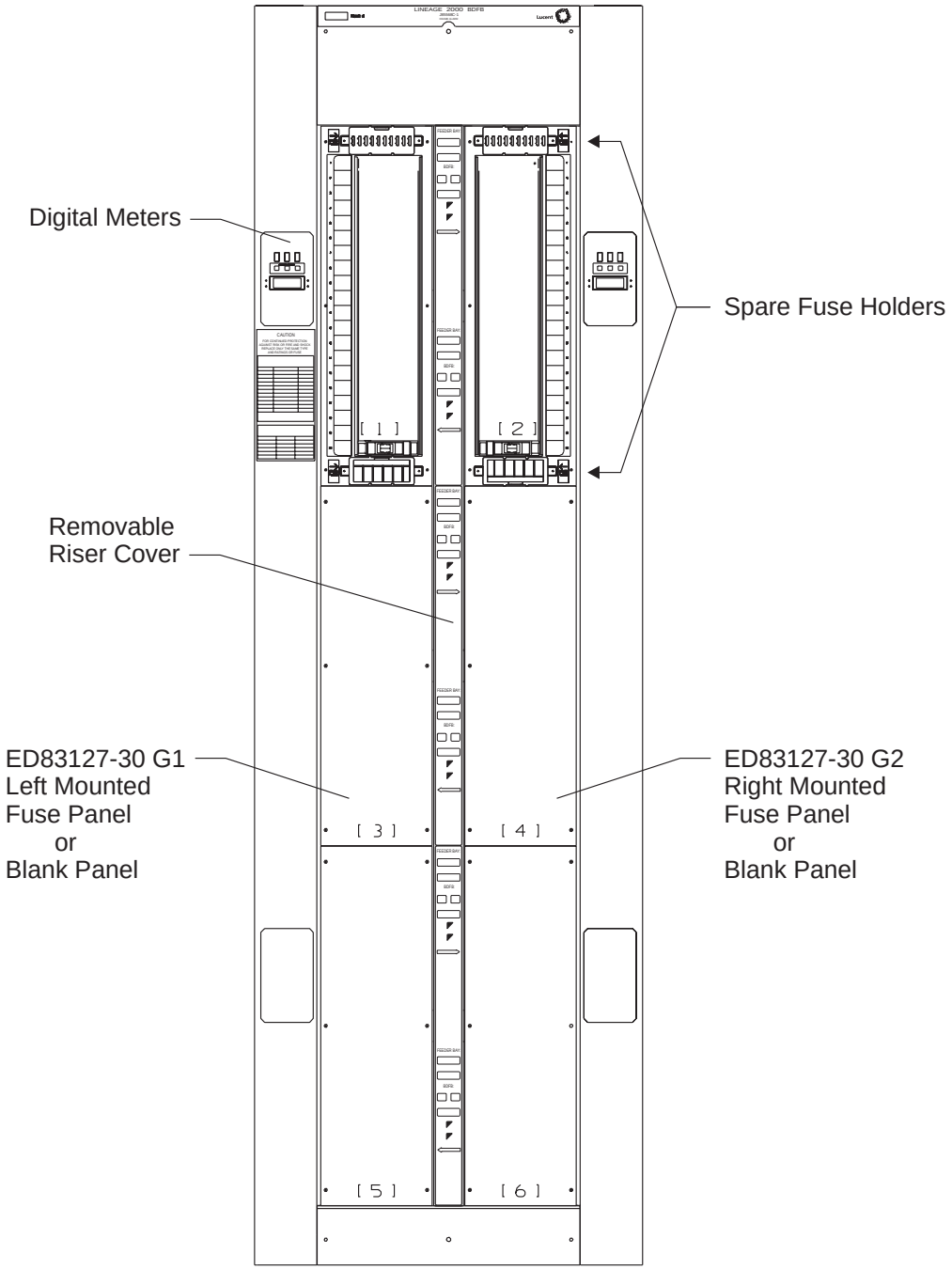


Figure 3-1: 7-foot cabinet (List 1)

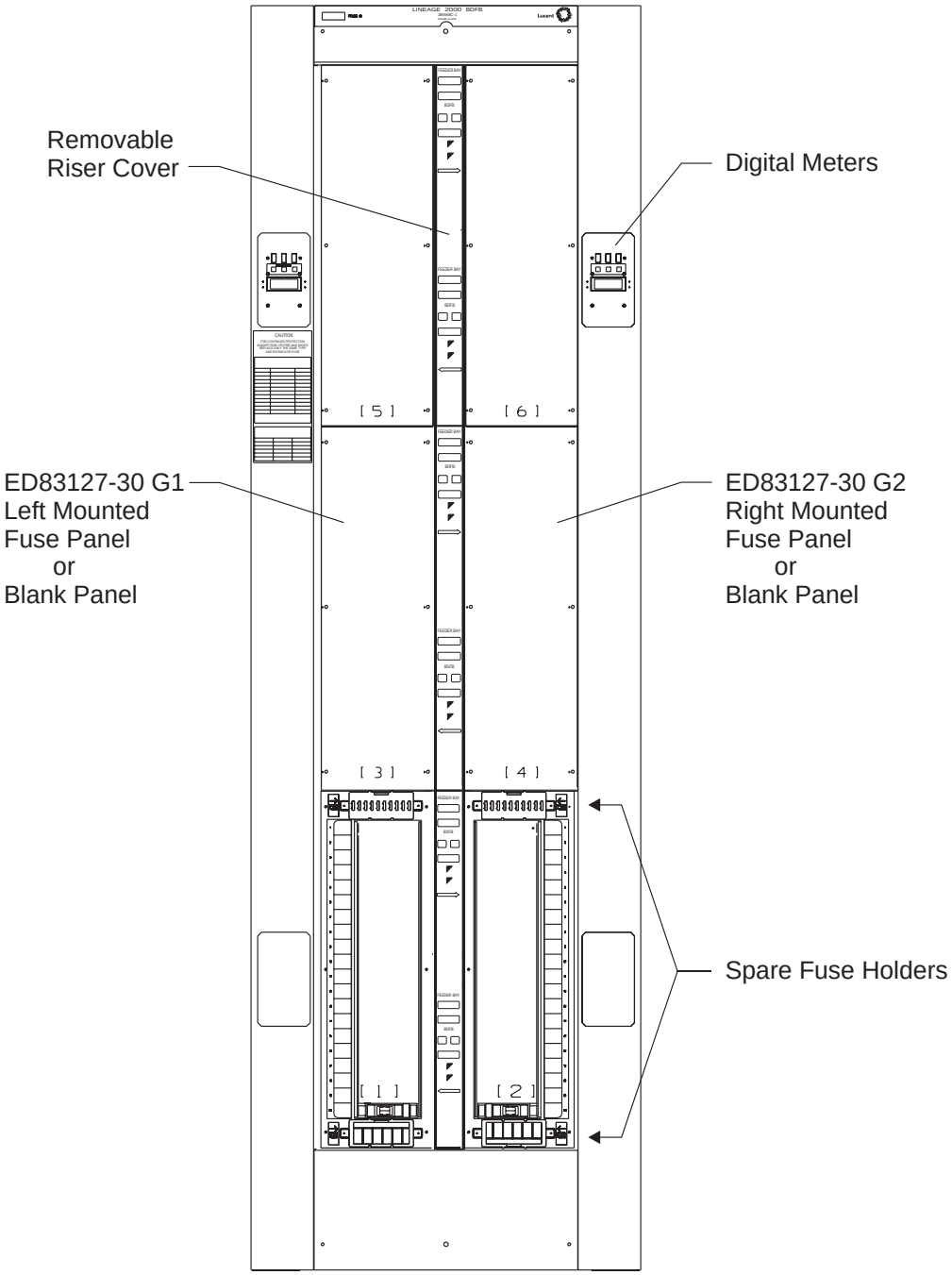


Figure 3-2: 7-foot cabinet (List 1, BF)

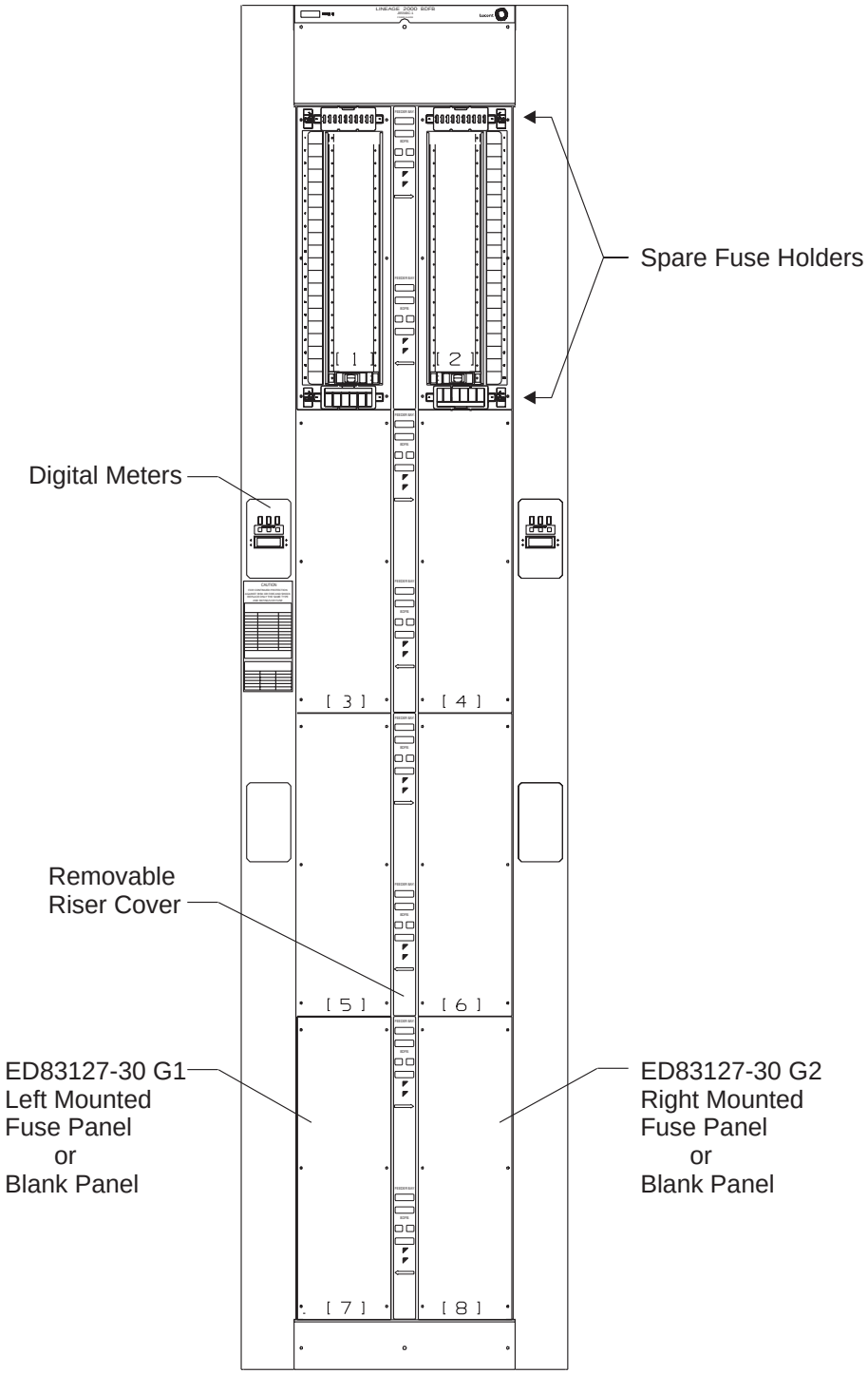


Figure 3-3: 9-foot cabinet (List 2)

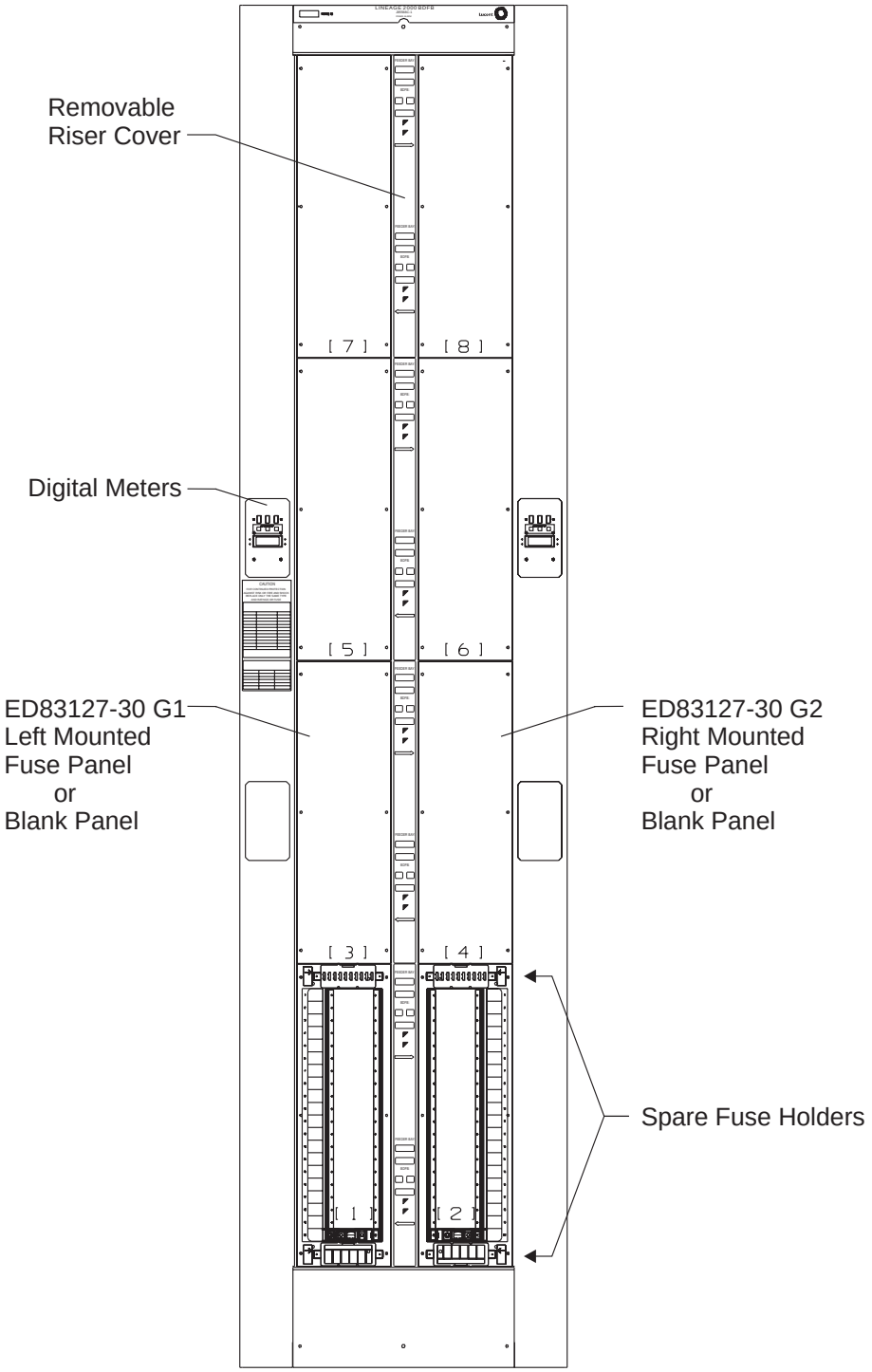


Figure 3-4: 9-foot cabinet (List 2, BF)

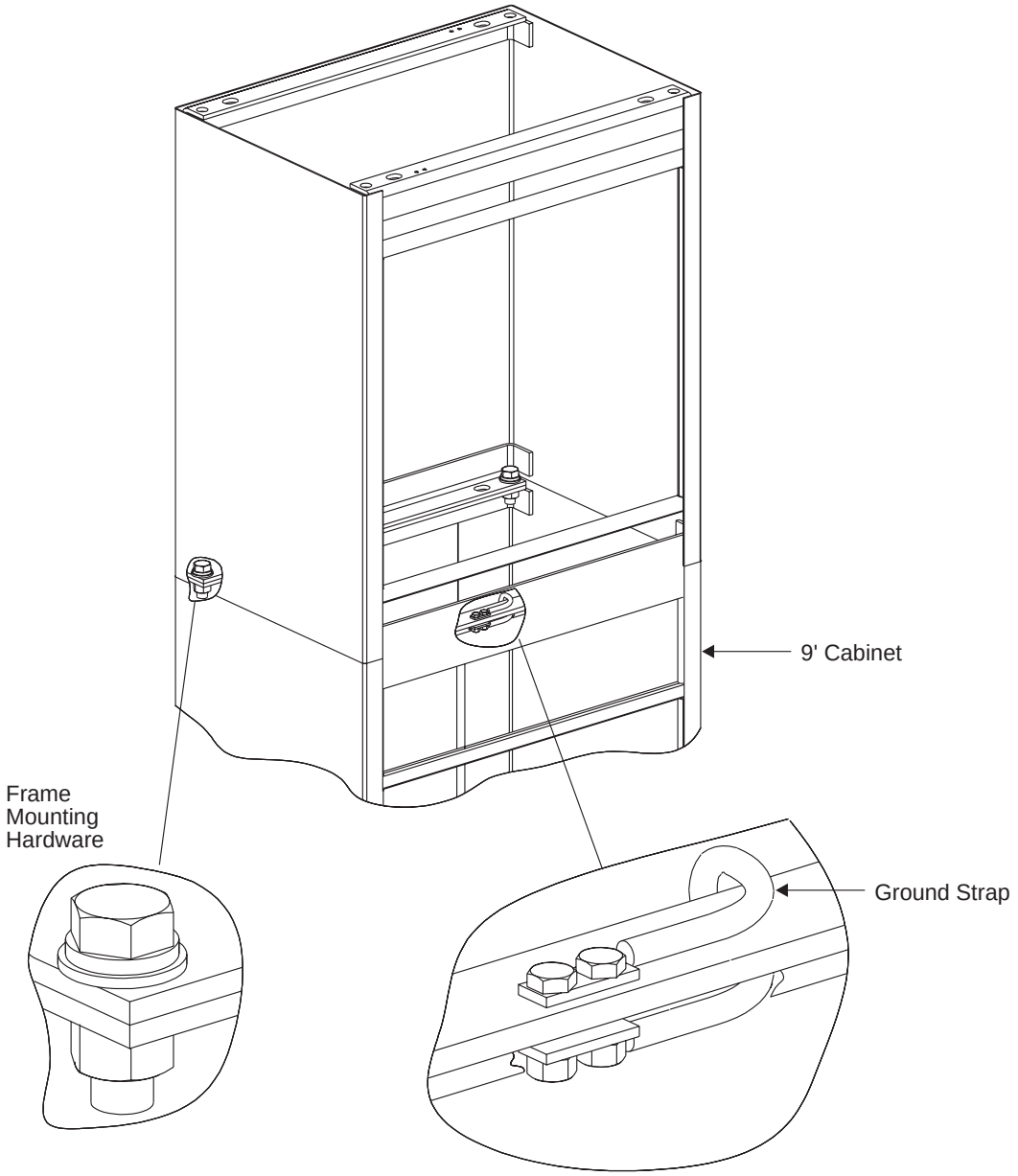


Figure 3-5: 2-1/2-foot extension cabinet

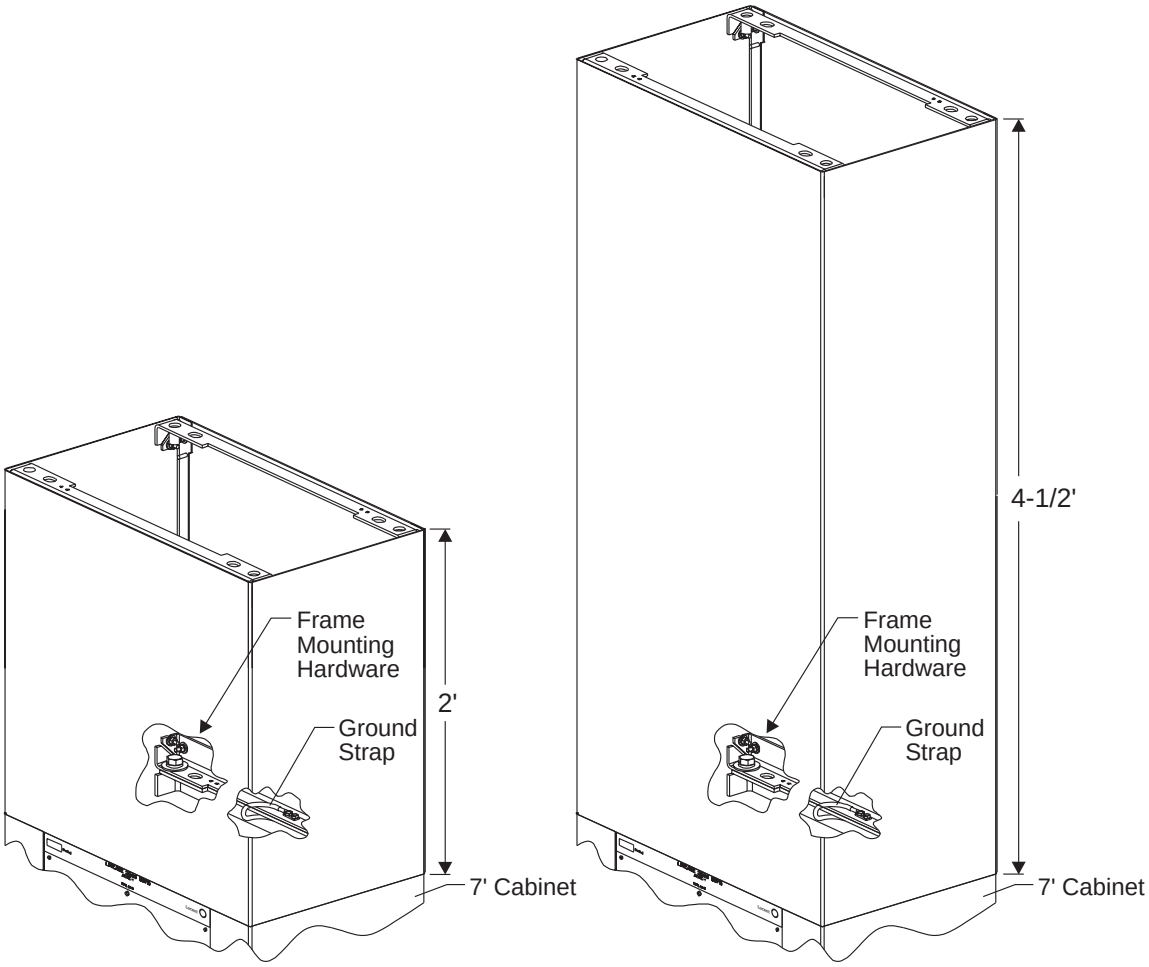


Figure 3-6: 2 foot or 4-1/2 foot extension cabinet

Cabinets may be configured for either top or bottom cable entry. For bottom feed applications, a List BF should be ordered in addition to the main list. In either case, the same cabinet is used, but the cabinet is rotated 180 degrees and the digital meters and spare fuse holders swap positions.

When ordering fuse panels for the BDFB it is important to remember the numbering schemes associated with top and bottom feed applications. Refer again to Figures 3-1 through 3-4 for fuse panel position numbers for each application. This information is necessary to communicate where fuse panel with different configurations should be located on factory orders. Panel numbering is also stamped on the front of each cabinet at the factory as an installation reference.

NOTICE:

Equip fuse panels starting at panel position 1 to eliminate possible cable congestion when installing additional fuse panels in the field

Load Bus Arrangements

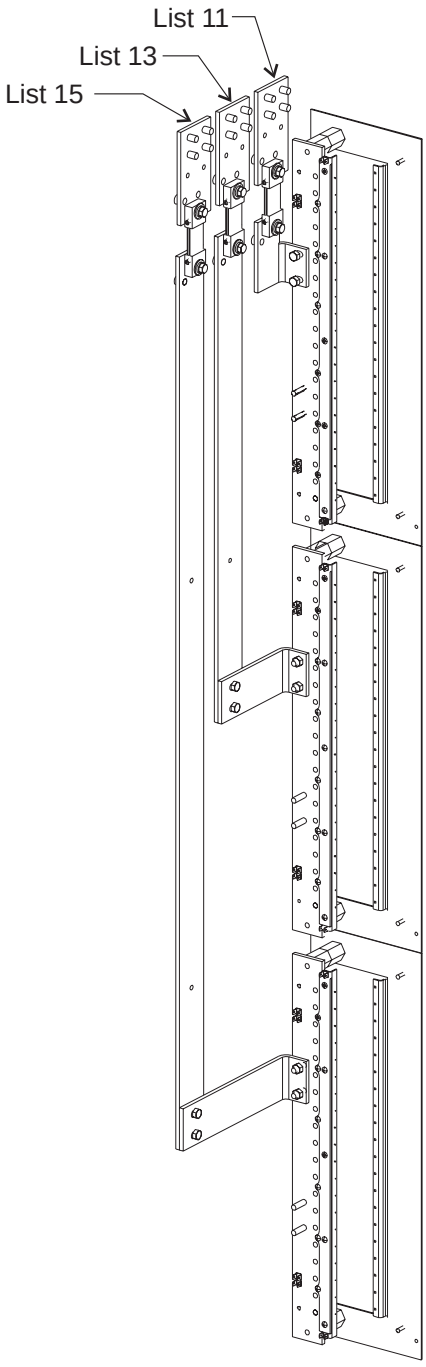
The bus bars used in the BDFB are sized to provide a 600 ampere current carrying capacity for each load bus. A load bus is defined as one or more fuse panels protected by a single circuit breaker or fuse at the battery plant. Cable from the battery plant is terminated at the top of the cabinet for top load feed or the bottom of the cabinet for bottom feed. Cables are terminated to each load bus on two sets of 3/8 inch studs with 1.00 inch centers. Table 3-A lists recommended terminal lugs for different cable sizes. Note that the largest cable that can be terminated is 350 KCMIL. Lists 11 thru 16 provide bus bar assemblies that connect the input cabling to each fuse panel. Figure 3-7 shows this busing arrangement on one side of the BDFB. Battery is bused across a load monitoring shunt to each fuse panel.

If fewer load buses are required, it is possible to connect fuse panel battery buses together using a List A bus bar link. This feature is shown on Figure 3-8. This may be desirable for two or four load BDFB applications where more than twenty fuse positions are required for a single load. Only fuse panels mounted above or below one another may be connected, i.e. fuse panels mounted on the left side of the cabinet cannot be joined to fuse panels mounted on the right side of the cabinet. For example, if positions one, three and five are linked together as shown in Figure 3-8, one List 11 would be ordered for busing to panel position 1 and two List A's for linking panels 5 to 3 and 3 to 1. Remember that the 600 ampere capacity per load bus applies even if multiple fuse panels are connected together.

The 9 foot cabinet has two additional fuse panel positions. Since a maximum of six separate load buses are possible, fuse panel positions 7 and 8 can only be used as growth panels for loads associated with fuse panels 5 and 6, i.e. positions 7 and 8 must be linked using the List A bus bars to fuse panels 5 and 6 respectively. This is important for planning engineers to remember for six-load BDFB applications where there is a potential for one or two of the load buses to require more than twenty fuse positions. These loads should be located in panel positions 5 and 6.

NOTICE:

All bus bars used in this product are copper with a solder plate finish. Bus bars do not require buffing or the application of NO-OX before connection to terminal lugs or other bus bars.



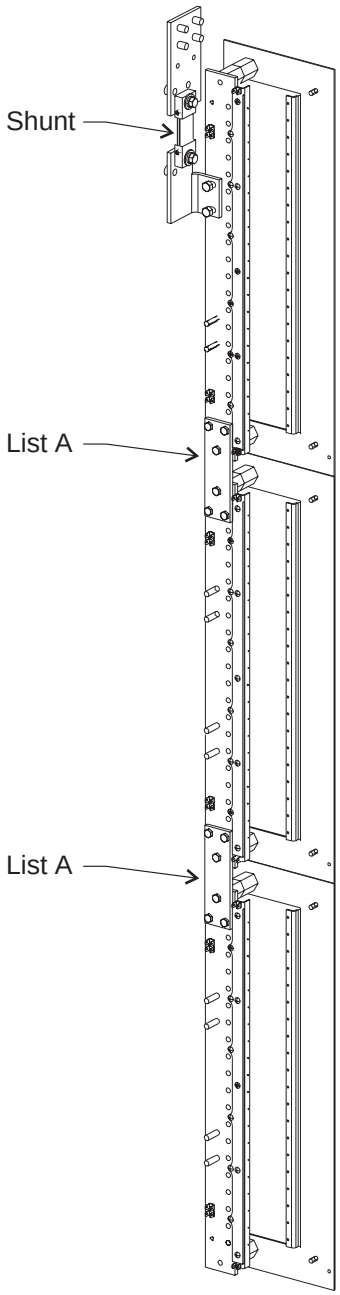


Figure 3-7: (Left) Busing scheme to fuse panels
Figure 3-8: (Right) Connecting multiple battery buses

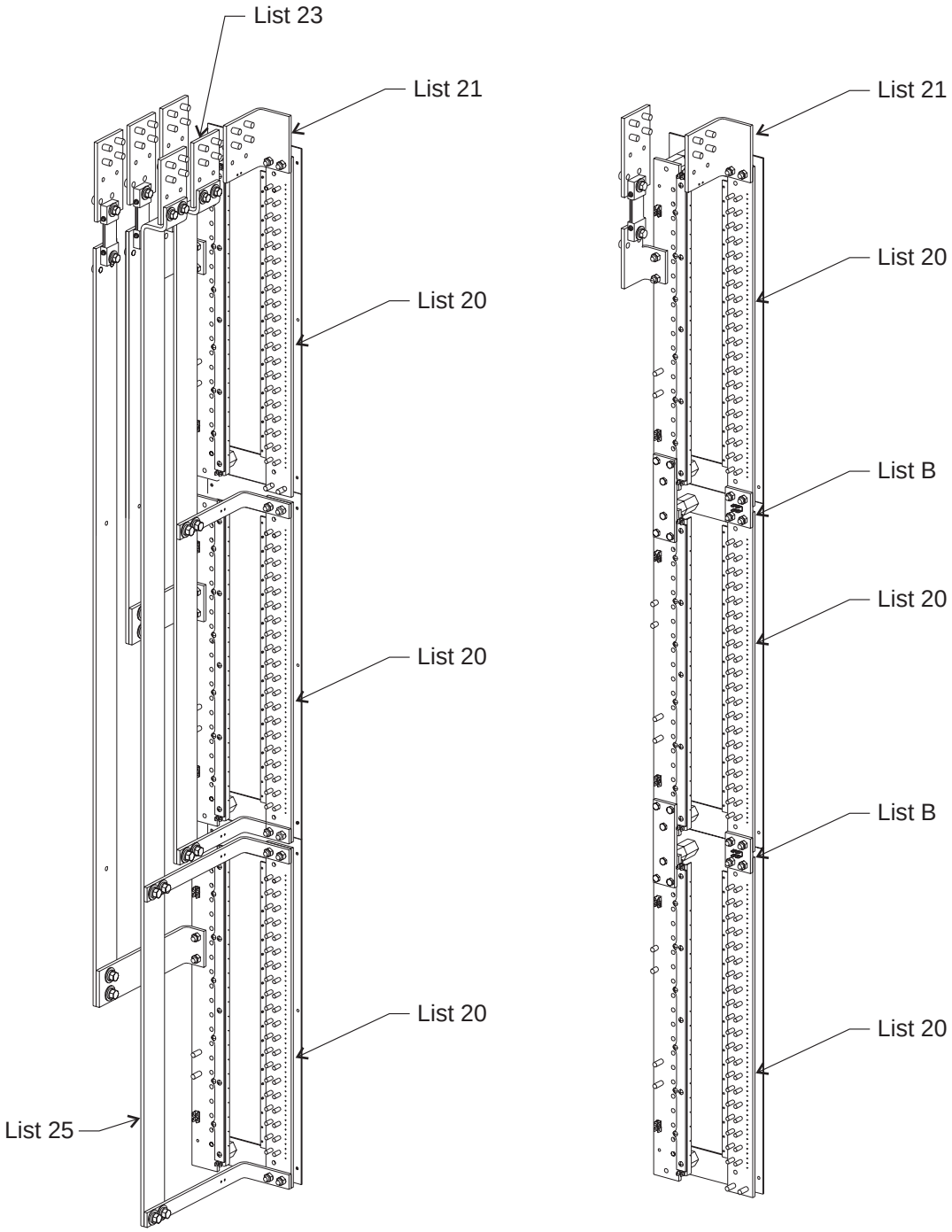


Figure 3-9: (Left) Busing scheme to internal discharge returns
Figure 3-10: (Right) Connecting multiple internal discharge returns

Discharge Return Bus Options

Two optional discharge return bus options are available for terminating fuse return leads: (1) Bus bar returns located in the BDFB or (2) A return bus located outside the BDFB on a cable rack.

The first option involves a bus bar arrangement similar to the battery bus connection scheme discussed in the previous section. Discharge return cable from the battery plant is terminated at the top (or bottom) of the cabinet adjacent to the battery input cabling. Lists 21-26 provide bus bar assemblies to connect the battery plant discharge return cabling to List 20 bus bars mounted on each fuse panel adjacent to the fuse blocks. This option is shown in Figure 3-9 for one side of the BDFB. It offers the advantage of paired leads directly from the fuse and eliminates the need for identification tags on each return lead. The discharge return bus is designed for terminating 1/4 inch double hole terminal lugs. See Table 3-B. All terminal lug mounting hardware is furnished.

When the internal discharge return option is selected, a List 20 bus bar should be ordered for every fuse panel. However, there is seldom a need to run individual discharge return leads back to the battery plant. A more common practice is to connect multiple discharge return buses together as shown in Figure 3-10 with only one set of leads cabled back to the battery plant. When multiple discharge return buses are connected together, a List B bus bar link should be ordered. Only units mounted above or below each other may be connected, i.e., panels mounted on the left side of the cabinet cannot be connected to panels mounted on the right side of the cabinet. For example, if positions 1, 3 and 5 are linked together as shown in Figure 3-9, order three List 20 discharge return bus bars, one List 21 for panel position 1 and two List B bus bar links.

The drawback to this cabling scheme is that you are limited to 600 amperes capacity due to the size of the bus bars. A second concern is the potential cable congestion resulting from twice the number of leads in the BDFB. For these reasons, the internal discharge return option is recommended only for applications with smaller ultimate capacities. For most applications, the external return bus option is recommended.

The external discharge return bus bar options are shown in Figure 3-11. The external bus is mounted on a standard 15 or 20 inch ladder type cable rack. Lists K1 and K2 are rated for 2400 amperes of current. List K1 provides the first bus bar and the

cable rack mounting hardware. List K2 provides a bus bar, the connecting bus bar and insulating standoffs for stacking additional tiers as required. List K3 provides the ED83019-50 G1 bus bar assembly, which has a 1200 ampere current rating. Figure 3-12 shows the arbitrary numbering assignment and hole pattern for the discharge return bus bar for List K3. Recommended terminal lugs for terminating to the external discharge return bus bar are listed in Table 3-C. The engineer must furnish all mounting hardware per Table 3-D.

Table 3-A: Recommended Double Hole Terminal Lugs For Terminating Input Battery And Return Cables (350 KCMIL Maximum)

KS-24194 L3	KS-24194 L2	WP-91412 List	Comcode	Bolt Size	Centers	Die	Die Code
2/0	1/0	57	405348236	0.375	1.00	Black	45
-	2/0	77	406021725	0.375	1.00	Orange	50
4/0	-	59	405348251	0.375	1.00	Purple	54
-	4/0	27	405347923	0.375	1.00	Yellow	62
350	-	61	405348277	0.375	1.00	Red	71
-	350	183	407890748	0.375	1.00	None	80

Table 3-B: Recommended Double Hole Terminal Lugs For Terminating To List 20 Discharge Return Bus

KS-5482 Wire	KS-20921 Wire	WP-91412 List	Comcode	Bolt Size	Centers	Die	Die Code
8	8	75	406021626	0.250	0.62	Red	21
6	6	3	405347519	0.250	0.62	Blue	24
4	4	5	405347576	0.250	0.62	Grey	29
2	-	54	405348202	0.250	0.62	Brown	33
-	2	8	405347683	0.250	0.62	Green	37

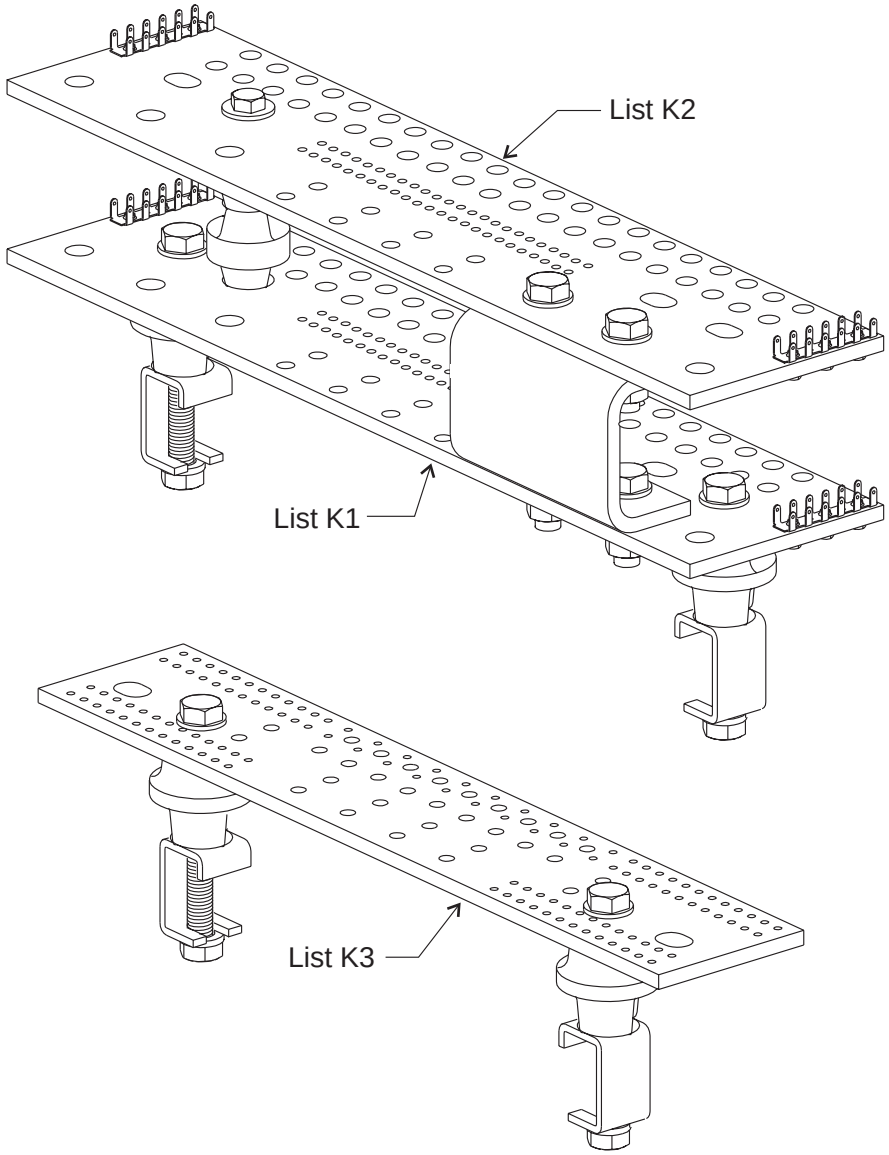
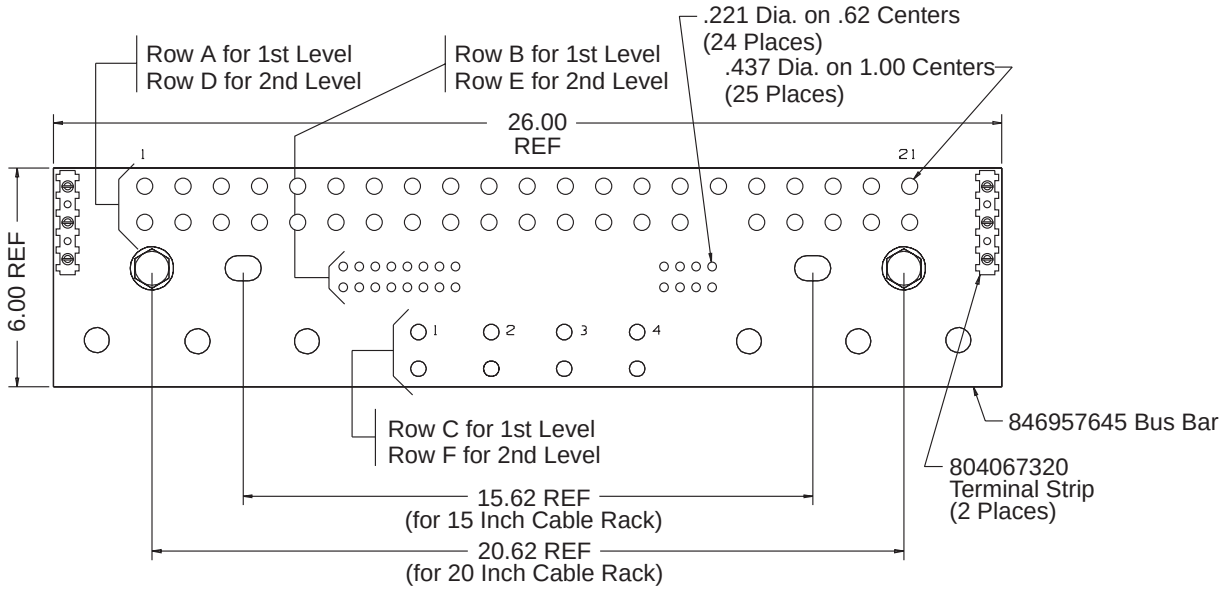
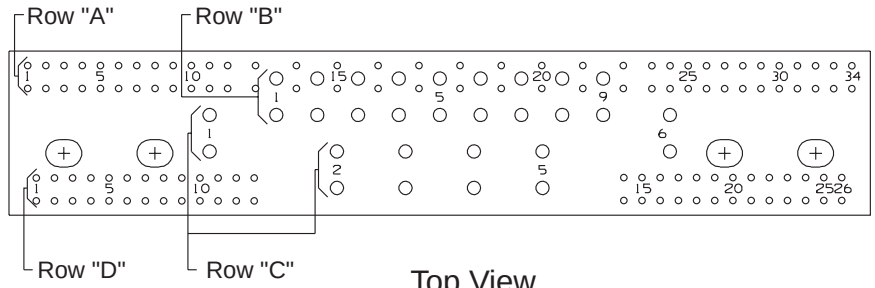


Figure 3-11: External discharge return bus options on cable rack



Top View
List K1 and K2



Top View
List K3

Figure 3-12: Bus bar hole pattern and numbering schemes

Table 3-C: Recommended Double Hole Terminal Lugs For Terminating To External Discharge Return Bus

Rows B and E (Lists K1 and K2) Rows A and D (List K3)							
KS-5482 Wire	**KS-20921 Wire**	**WP-91412 List**	**Comcode**	**Bolt Size**	**Centers**	**Die**	**Die Code**
14-10	14-10	73	405356171	10	0.62	R5473	-
8	8	52	405348178	10	0.62	Red	21
6	6	108	406332841	10	0.62	Blue	24
Rows A, C, D and F (Lists K1 and K2) Rows B and C (List K3)							
KS-5482 Wire	**KS-20921 Wire**	**WP-91412 List**	**Comcode**	**Bolt Size**	**Centers**	**Die**	**Die Code**
6	6	111	406332841	0.375	1.00	Blue	24
4	4	116	406332940	0.375	1.00	Grey	29
2	-	121	406338665	0.375	1.00	Brown	33
1/0	-	56	405348228	0.375	1.00	Pink	42
2/0	1/0	57	405348236	0.375	1.00	Black	45
-	2/0	77	406021725	0.375	1.00	Orange	50
4/0	-	59	405348251	0.375	1.00	Purple	54
-	4/0	27	405479923	0.375	1.00	Yellow	62
Rows C and F Only (Lists K1 and K2) Row C (List K3)							
KS-5482 Wire	**KS-20921 Wire**	**WP-91412 List**	**Comcode**	**Bolt Size**	**Centers**	**Die**	**Die Code**
350	-	61	405348277	0.375	1.00	Red	71
-	350	86	406021915	0.375	1.00	-	80
500	-	63	405348293	0.375	1.00	Brown	87
-	500	165	406434241	0.375	1.00	Pink	99
750	-	135	406335141	0.375	1.00	Black	106
-	750	170	406434290	0.375	1.00	Yellow	115

Table 3-D: Recommended Mounting Hardware For Securing Double Hole Terminal Lugs To External Discharge Return Bus

Bolt Size	Comcode	Quantity	Description
0.190	840059885	2	Screw, PHM
	802841510	2	Washer, Plain
	802235127	2	Lockwasher
	800812935	2	Nut, Hex
0.375	801273129	2	Screw, HH Cap
	814251898	4	Washer, Plain
	801829607	2	Lockwasher
	841064777	2	Nut, Hex

Digital Meters and Monitoring Shunts

As discussed in the previous sections, there are six possible load buses in the BDFB, three per side. Each bus must be equipped with either a 300 ampere shunt per List E or a 600 ampere shunt per List F. Shunts are provided to determine actual current use and the remaining capacity of each load bus. They can either be monitored externally by other office equipment or in the BDFB with digital meters.

Digital meters are available for monitoring either 300 ampere or 600 ampere shunts per List G or List H respectively. All shunts connected to a meter must be the same size. Shunts are wired to the meters through three-position switches, enabling the user to select among the three possible load buses.

There are two meter positions in the BDFB. Shunts for odd-numbered panel positions are monitored by the left-mounted meter and shunts for even-numbered panel positions are monitored by the right-mounted meter. The meters are powered from the first equipped panel position on each side of the cabinet. They operate from a 24-, 48-, or 130-volt source. See Figure 3-13. The negative lead (battery or return) is inserted in meter terminal 2. The positive lead is inserted in meter terminal 1 if the panel is 48V, terminal 3 for 24V, or terminal 4 for 130V. For example, a -48-volt fuse panel in panel position 1 would power the left meter. A 22-gauge wire is run from the fuse panel battery bus to meter terminal 2. Another is run from the discharge return bus to meter terminal 1.

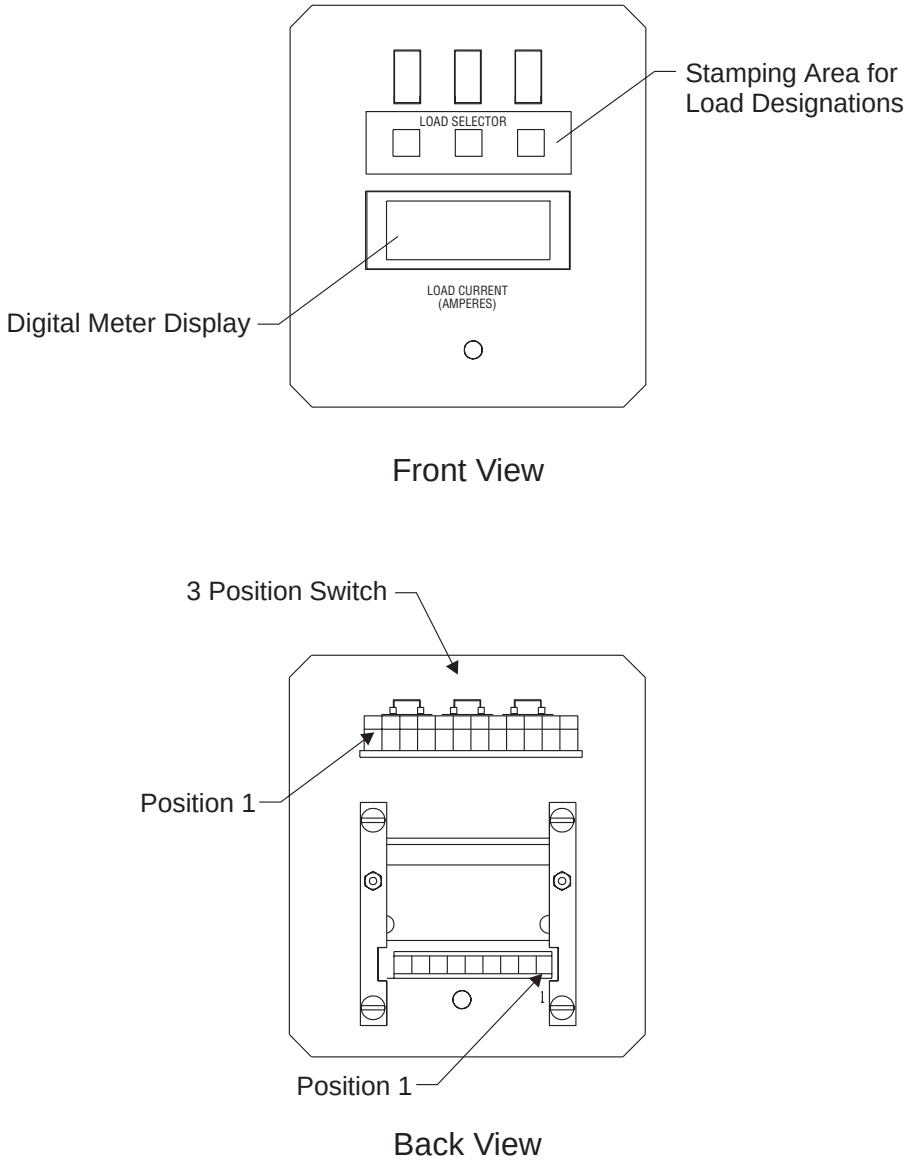


Figure 3-13: Digital meters (front and back views)

ED-83127-30 Fuse Panel

Two types of fuse panels are available. Group 1 provides panels for mounting on the left side of the cabinet and Group 2 provides panels for mounting on the right side of the cabinet. Each of these fuse panels has twenty mounting positions that must be equipped with either a fuse block (Group A or B) or a blank filler (Group C). Figure 3-14 shows the different fuse panel options. These fuse panels also come with spare fuse holders.

Group A provides one 3-70 ampere cartridge type fuse holder, comcode 406686980. This fuse block is UL listed and provides a more compact design than previous fuse holders. The fuse block was developed by USD (Underwriters Switching Devices) to accomodate the WP-92461 series of fuses. These fuses offer a big advantage over other fuse types in that they are UL recognized to UL standard 198L "DC Industrial Fuses" and have a 170 Vdc, 100,000 ampere interrupt rating. Table 3-E shows the sizes and comcodes of fuses available. Table 3-F lists the recommended terminal lugs for terminating different load lead cable sizes to the fuse block. Notice that the largest cable size allowable is 2/0 standard wire or 1/0 flex wire.

Group B provides one GMT fuse module containing three fuse positions. Each fuse position may be equipped with a GMT fuse ranging from 1/2 to 5 amperes. Table 3-G lists the sizes and comcodes available. Table 3-H lists recommended terminal lugs. The GMT fuse module offers the customer the option of using the BDFB for small miscellaneous loads in the office that might otherwise require a separate fuse panel.

Group C is a blank filler bracket used to cover open mounting positions when fewer than twenty fuses are required. They may also be removed at a later time and the positions populated with fuse blocks.

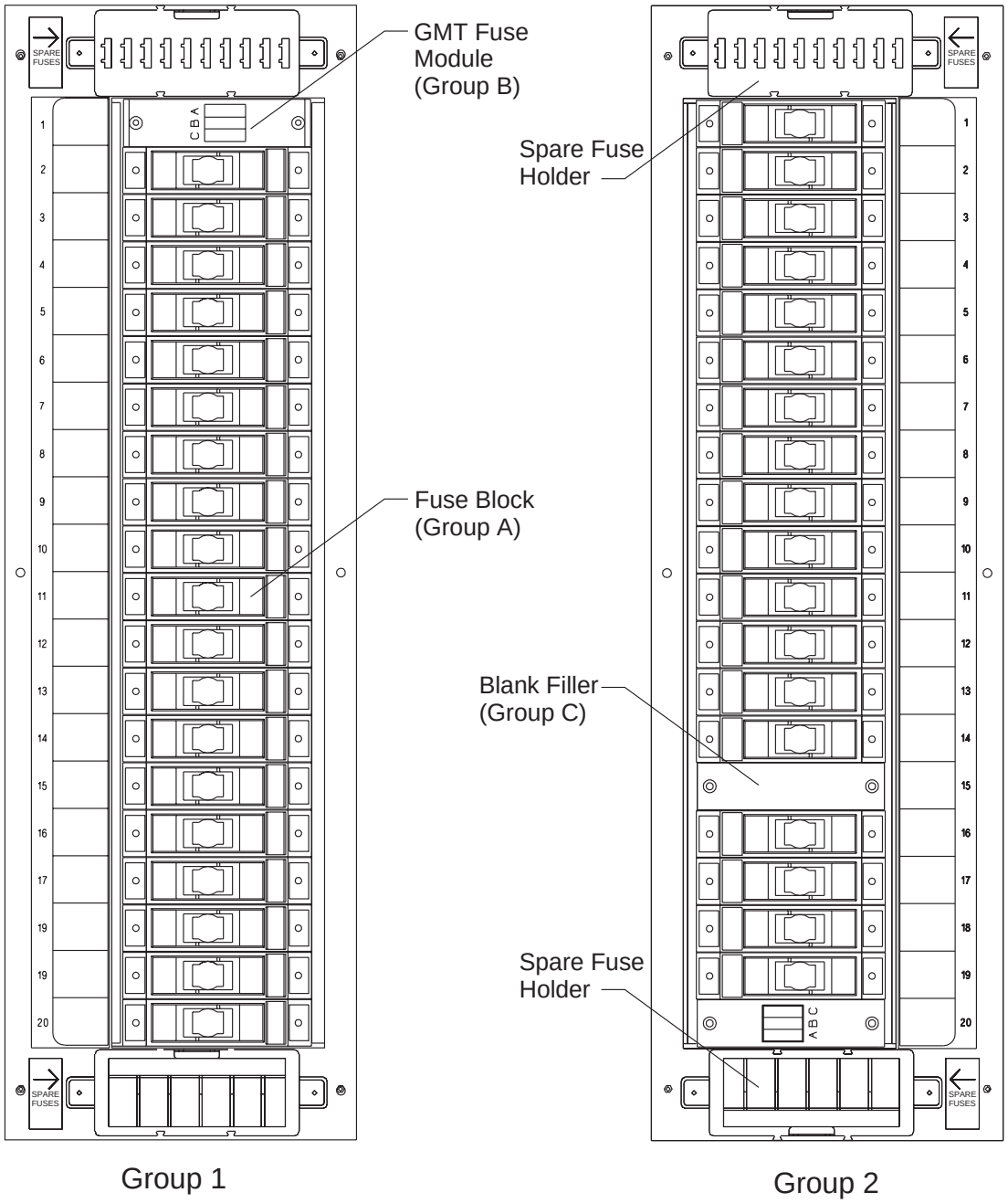


Figure 3-14: ED83127-30 fuse panels

Table 3-E: WP-92461 Cartridge Fuse Ordering Information

Comcode	WP-92461 List	Amp Rating
406700567	100	3
406700583	101	5
406700591	102	6
406700609	103	10
406700617	104	15
406700625	105	20
406700633	106	25
406700641	107	30
406700658	108	40
406700674	109	50
406700682	110	60
406700690	111	70
402328926	.18 amp GMT alarm fuse	

Table 3-F: Recommended Single Hole Terminal Lugs For Terminating To ED-83127-30 Group "A" Fuse Block

KS-5482 Wire	KS-20921 Wire	WP-91412 List	Comcode	Bolt Size	Die	Die Code
14-10	14-10	94	406338152	0.250	R5473	-
8	8	74	405356189	0.250	Red	21
6	6	2	405347436	0.250	Blue	24
4	4	4	405347543	0.250	Grey	29
2	-	53	405348186	0.250	Brown	33
-	2	7	405347659	0.250	Green	37
1/0	-	125	406338707	0.250	Pink	42
2/0	1/0	(T&B)	406896373	0.250	Black	45

Table 3-G: GMT Fuse Ordering Information

Comcode	Amp Rating
401231501	1/2
401841473	1
400994604	1-1/3
401231527	3
401231535	5

Table 3-H: Recommended T&B Lugs For Terminating GMT Load Leads And Returns

Wire Size	T&B Lug	Comcode	Bolt Size
18-22	RA333	997588891	6
14-16	RB854	403950975	6
10-12	RC333	401437033	6

Alarm Circuit Module

The alarm circuit module, apparatus code A-CP/BEP1, provides a means for indicating a power loss and a fuse alarm for each fuse panel. Indications of these alarms are by means of an LED and by contact closures.

General Description

The BEP1 pack will accept nominal input voltages of 24 and 48 volts. Operation in 130 volt BDFB frames is achieved by addition of a dropping resistor mounted on the ED-83127-30 fuse panel to drop the nominal 130 volt level to the nominal 48 volt level.

The BEP1 alarm module is provided with ED-83127-30 Groups E, F and G. These groups describe the nominal voltage at which the fuse panel will operate (24, 48, or 130 volts). Figure 3-15 shows the layout of the alarm circuit module and Figure 3-16 shows the input (P102) and output (P101) connector pin descriptions. The alarm module provides two Form C contacts for power loss and three Form C contacts for fuse failure. The alarm output connector references of audible, visual and remote given with each alarm module are arbitrary and are provided as a suggested standard for remote monitoring equipment. However, installation personnel may select any set of Form C contacts.

When power loss to a panel occurs, a closure exists between pins 1 and 2 and pins 3 and 4 on the output connector (P101), while an open condition exists between pins 1 and 9 and pins 3 and 10.

When a fuse operates on a panel, a closure exists between pins 8 and 15, pins 11 and 12, and pins 13 and 14 of connector P101, while an open condition exists between pins 7 and 8, pins 6 and 12, and pins 5 and 13.

Detailed Circuit Description

The BEP1 consists of two circuits. One monitoring for panel power loss and the other monitoring for fuse failures. The monitoring circuits are described as follows.

Power Input

DC power (24, 48, or 130 Vdc through external resistor) is provided to P102 pins 11 or 6. Nominal input voltage to bridge CR101 is 24 Vdc. Bridge CR101 is provided to allow the BEP1 to operate from either positive or negative voltages. Output voltage of nominal 22 Vdc from CR101 is applied to relay K101 and LED DS101. Relay K101 is held normally operated and DS101 (green) is illuminated. Fuse alarm power is provided through P102 pins 7 or 8. Bridge CR102 allows operation from either voltage polarity. CR102 output of 22 Vdc nominal is applied to relay K102 and LED DS102 (red). Fuse alarm power is normally present only when a fuse blows and thus K102 is normally released and DS102 is extinguished. The return path for the power monitor and fuse alarm monitor is through P102-12 & 14.

Power Loss Alarm

Loss of bus voltage will cause relay K101 to release and LED DS101 (green) to extinguish. Two Form C contacts on K101 are available through P101 to monitor for power loss.

Fuse Alarm

A cleared fuse will apply power through P102 to operate relay K102 and illuminate LED DS102 (red). Three Form C contacts on K102 are provided through P101 for external alarms.

Frame Alarm

In addition to the individual panel alarm indicators, there is also a frame alarm lamp at the top of the bay. This frame alarm lights when power is lost to a fuse panel or there is a fuse alarm. Power for lighting the frame lamp is brought from the battery plant on an auxiliary battery supply (ABS) lead. Figure 3-17 shows the frame alarm and ABS termination points at the top of the cabinet. When ABS is from a positive ground battery plant, it is brought into the BDFB on terminal E3. This signal is daisy chained through all the circuit modules. A fuse failure or power loss on a circuit module sends the ABS signal back up to the frame lamp socket. The ABS return lead back to the battery plant is also connected to the frame alarm lamp via terminal E4 to complete the circuit.

In some installations, the use of a ABS lead from the battery plant may not be available or desirable. An alternative alarming method substitutes power from a load bus for ABS. A 22-gauge wire may be run from the battery bus of fuse panel number 1 to terminal E3. The return lead from the frame lamp via terminal 4 would go to the discharge return bus located on the cable rack. The obvious consequence of this option is if power is lost to fuse panel number 1, the frame alarm will not light.

Fuse Alarm

Monitoring Multiple Alarm Modules for Negative Plants

In most BDFB applications, customers require remote monitoring of a frame fuse alarm only and not individual load buses. Therefore, fuse alarms on multiple packs may be connected so that the remote fuse alarm signal on one pack can be operated from the other packs. This daisy chain is factory wired so that frame fuse alarm may be monitored from the position 1 alarm module. A fuse alarm on any pack will cause current flow through opto-isolator U101 causing it to turn on and apply voltage to P102 pins 4 and 5. Pins 4 or 5 are alternately connected from pack to pack providing a common fuse alarm output signal. The position 1 alarm module monitors the other packs by connecting its P102 pin 1 fuse alarm input to P102 pin 4 of the position 2 alarm module. See Figure 3-18. Thus voltage from any pack with an active fuse alarm will cause K102 of the position 1 pack to be operated via P102 pin 1, causing an alarm on its P101 contacts. This feature is intended to provide a local visual indication of a fuse alarm (DS102 of the pack with the fuse alarm) and remote monitoring of the Form C contacts of a

single alarm module. All packs will alarm independently by simply disconnecting pin 1.

Power Loss Alarm

Remote monitoring of power loss is furnished for individual fuse panels. However, power loss alarms will probably not be remotely monitored in most applications because loss of power in a BDFB usually results in a number of other simultaneous alarms from the battery plant and load equipment. If power loss alarm for the entire cabinet is desired, the installer must connect the alarm module output pins P101 - 1, 2, 3, 4, 9, 10 as shown in Figure 3-19. The connections can be made with 26 gauge solid wire soldered or wire-wrapped to the 405095043 output connectors. These connectors are furnished with each alarm module.

Monitoring Multiple Alarm Modules for Positive Plants

Opto-isolator U101 is current-direction sensitive. Therefore remote monitoring of frame alarms for positive plants is wired differently than for negative plants. For positive plants, fuse alarms on multiple packs should be daisy-chained together via P101. This allows the remote fuse alarm signal on any pack to be monitored from the position 1 alarm module. Three Form C contacts are provided. They must be connected to alarm module output pins on connector P101 5, 6, 7, 8, 11, 12, 13, 14 and 15 (see Figure 3-20). The connections can be made with 26-gauge solid wire and wire-tapped to the 405095043 output connector provided with each alarm module.

Reference Data

Input Voltage: 24V (21 to 30 Vdc), 48V (42 to 60 Vdc)

Current Drain: 12 milliamps normal operation, 22 milliamps with fuse alarm.

Functional Designations:

R101	Dropping resistor 48V to 24V, power monitor
R102	LED current limit resistor, power monitor
R103	Dropping Resistor 48V to 24V, fuse alarm
R104	LED current limit resistor, fuse alarm
U101	Opto-isolator, remote fuse alarm
K101	Relay, 24V, power monitor
K102	Relay, 24V, fuse alarm
CR101	Diode bridge, power monitor

CR102	Diode bridge, fuse alarm
CR103	Voltage blocking diode
DS101	Green power LED
DS102	Red fuse alarm LED

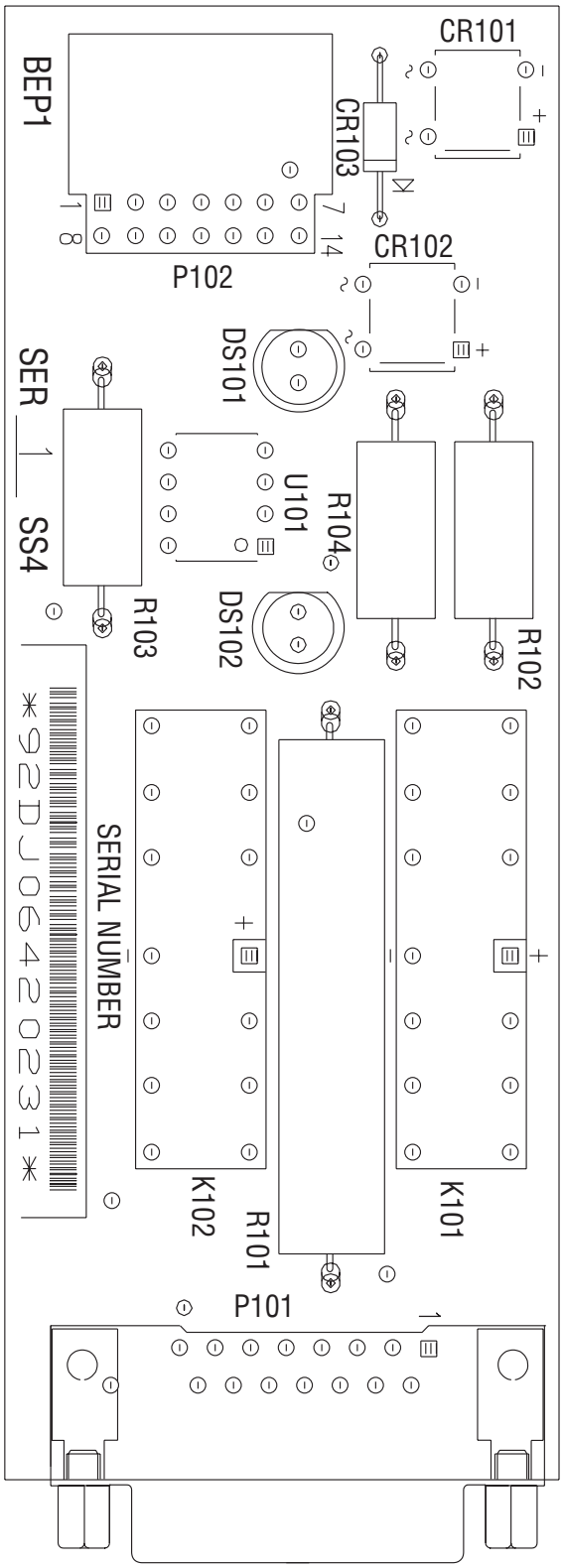


Figure 3-15: A-CP/BEP1 board layout

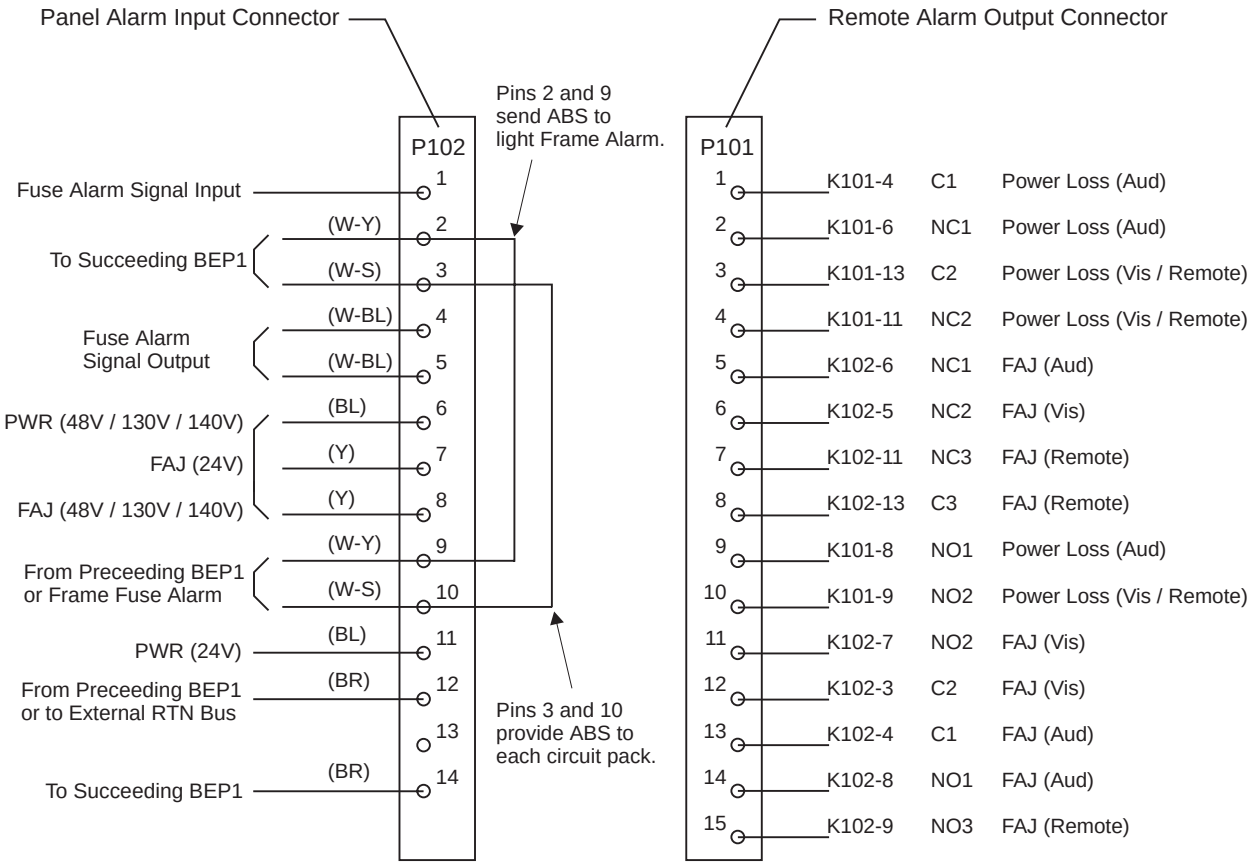


Figure 3-16 : A-CP/BEP1 input/output connections (alarm module with no power is in "normal" state)

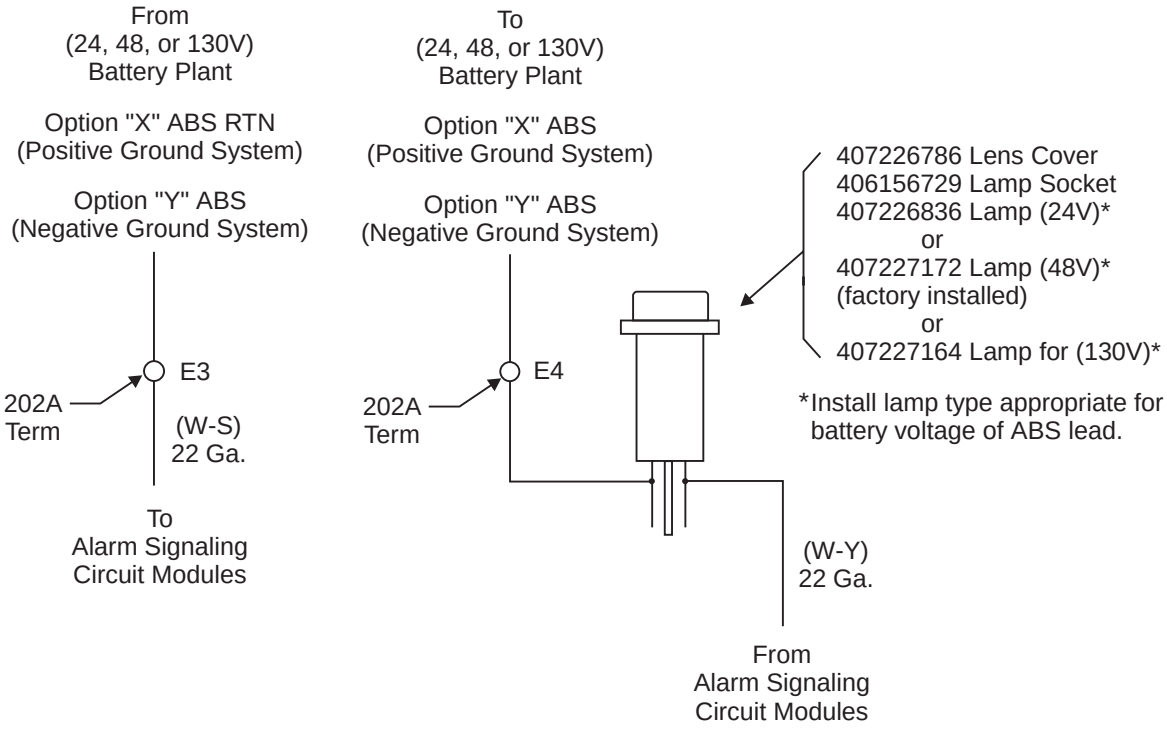


Figure 3-17: Frame alarm

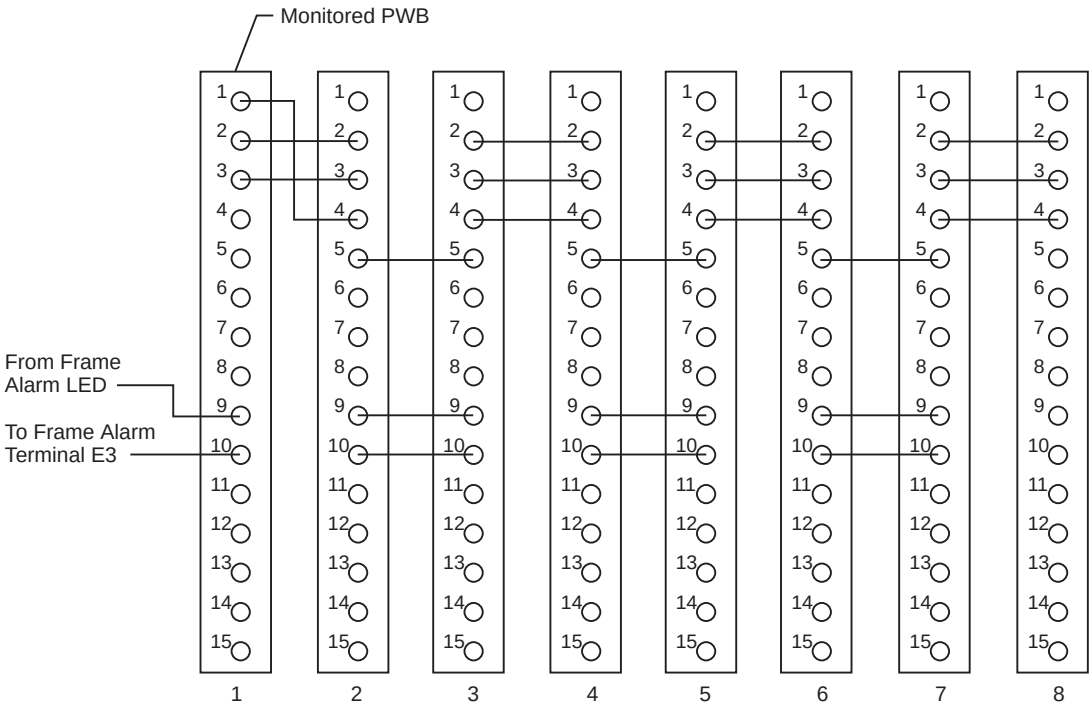


Figure 3-18: P102 factory alarm wiring

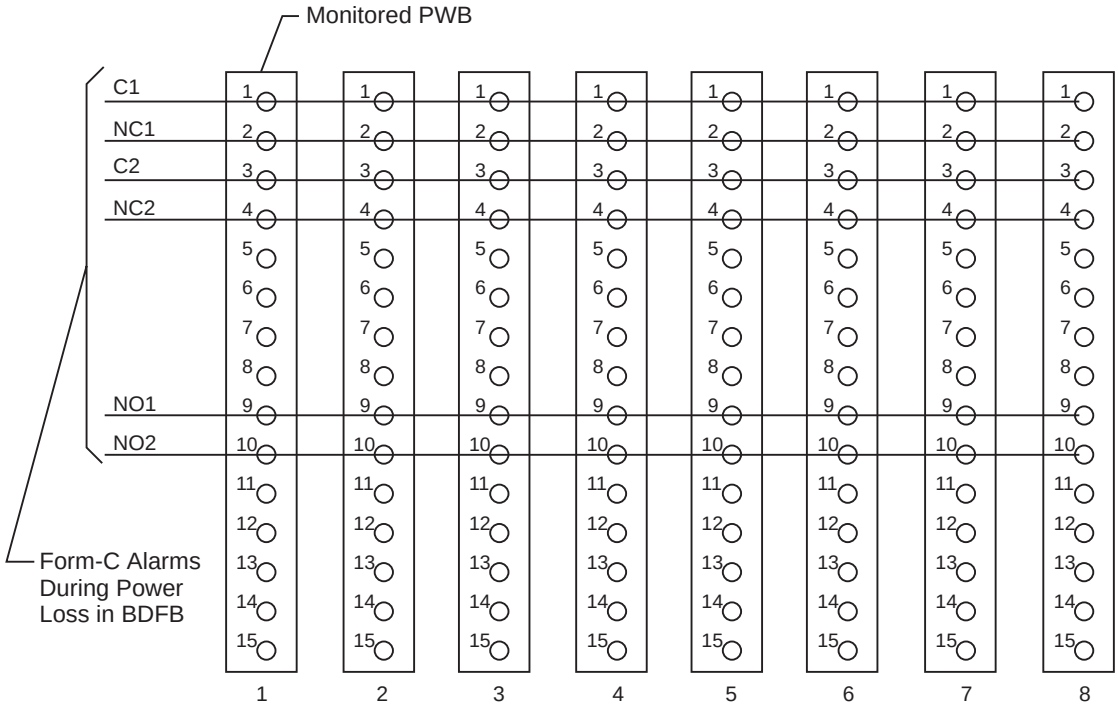


Figure 3-19: P101 frame power loss alarm wiring

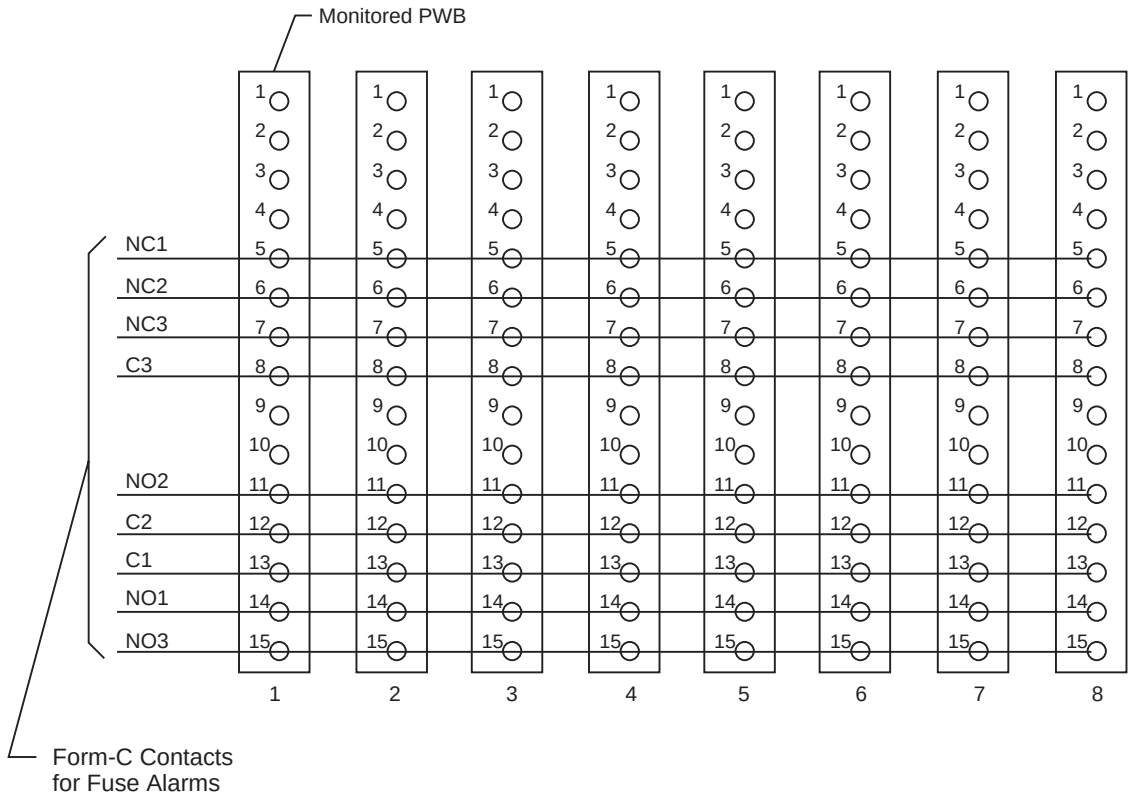


Figure 3-20: Fuse alarm wiring for positive plant P101

4 Installation

Installation Material Provided

- Frame ground mounting hardware (1/4 inch)
- Battery and battery return lead mounting hardware (3/8 inch)
- Load lead mounting hardware (1/4 inch)
- Load lead return mounting hardware to internal discharge return bus (1/4 inch)

Installation Material Required But Not Provided

- Input and output cable and terminal lugs
- Material handling equipment to unload BDFB at site, remove from shipping container and set in final position
- Lifting eye bolts, (4) 5/8-11 threaded holes provided
- Floor mounting hardware
- Drill to bore hole for floor anchors
- Cable rack and associated hardware
- Common electrician's hand tools, including jeweler's screwdriver, electrical tape, wire cutters and strippers, 6 AWG to 350 KCMIL
- Proper crimping tools and dies for connectors. The connectors specified in this section are WP-91412 and may be installed with compression tools made by Thomas & Betts using color-coded dies
- Common mechanic's hand tools, including flat blade screwdriver, socket and torque wrenches for 1/4 inch and 3/8 inch blts, crowbar for uncrating and a small soldering iron
- All WP-92461 and GMT type load fuses
- Alarm fuses for cartridge type fuse holders, 18/100 amp GMT alarm fuse, comcode 402328926
- Mounting hardware for connecting load return leads to external discharge return bus
- Central office and frame ground lugs

- 22-gauge wiring to connect external ground leads to digital meters and alarm circuit modules

Cabinet Anchoring

The BDFB has two floor footprints. The seven-foot cabinet is 26 inches wide by 15 inches deep. The nine-foot cabinet is 26 inches wide by 18 inches deep. See Figure 4-1. Cabinets are equipped with four .75x1.00 inch slots to accommodate various sizes and types of anchor bolts. Table 4-A provides a summary of the anchor bolt options.

Various regions of the country have their own requirements for anchoring power equipment. For earthquake Zone 4, 12 millimeter drop-in anchors are required. Other anchor sizes and types can be ordered as required per H569-407 Anchor Bolt Kit Drawing. Figure 4-2 shows the typical floor mounting detail. The cabinet has passed Zone 2 and 3 earthquake testing with H569-407 Group 10 anchor bolts.

Table 4-A: H569-407 Anchor Bolt Ordering Information

Group	Description
1	(4) 1/2 inch self-drill anchors with threaded rod
2	(4) 1/2 inch drop-in anchors with threaded rod
3	(4) 12 millimeter heavy duty anchors with threaded rod and hold-down plates
4	(4) 12 millimeter heavy duty anchors with torque cap bolt and hold-down plates
10	(4) 3/8 inch self-drill anchors with threaded rod
11	(4) 3/8 inch drop-in anchors with threaded rod

Installing Extension Cabinet for 9 Foot or 11-1/2 Foot Environment

When the BDFB is used in an 11-1/2 foot environment, order either the J85568C-1 List 3 or List 1, J. List 3 includes a 9 foot cabinet, a 2-1/2 foot extension cabinet and interconnection hardware. List 1, J includes a 7 foot cabinet, a 4-1/2 foot extension cabinet and interconnection hardware. When the BDFB is used in a 9 foot environment, order J85568C-1 List 1, K. List 1, K includes a 7 foot cabinet, a 2 foot extension cabinet and interconnection hardware. The extensions mount on top of the cabinet as shown in Figure 3-5 or Figure 3-6. The following mounting hardware is furnished to connect the cabinets together:

(4) 804220838 screw, HH .625-11x1-1/2
(4) 840058044 lock washer .625
(4) 814251930 washer .625

Interframe ground cable and mounting hardware is also furnished to provide a continuous frame ground to the top of the cabinet. Hardware includes:

(1) 846524130 ground strap
(2) 801462987 screw, HH .250-20x1
(4) 801098963 washer .250
(2) 803690668 lock washer .250
(2) 841064751 hex nut .250-20

Cable Routing Strategy

Lucent Technologies strongly recommends that fuse panels be equipped starting at panel position 1 to eliminate possible cable congestion when adding load leads or installing additional fuse panels.

Load leads are routed along cable troughs on either side of the cabinet. Location of the cable rack with respect to the BDFB is critical to avoid cable routing problems. If possible locate the cable rack along the front of the BDFB as shown in Figure 4-3. Run the load leads in three distinct quadrants down the sides of the cabinets. Run load leads to the top panel toward the front of the cabinet. Run load leads to the bottom panel toward the back of the cabinet. This routing scheme will simplify future cabling in the BDFB.

Frame Ground

The frame ground connection is located at the top of the cabinet.

Connection is made using a 1/4 inch double hole terminal lug on .625 inch centers. For ground wire connections greater than 2 gauge, order comcode 846337798 bus bar adapter to allow for 3/8 inch double hole terminal lugs on 1.00 inch centers. Table 4-B provides a list of compatible terminal lugs. Mounting hardware is furnished with each cabinet.

Table 4-B: Recommended Double Hole Terminal Lugs For Frame Ground

KS-5482 Wire	KS-20921 Wire	WP-91412 List	COMCODE	Bolt Size	Centers	Die	Die Code
8	8	75	406021626	0.250	0.62	Red	21
6	6	3	405347519	0.250	0.62	Blue	24
4	4	5	405347576	0.250	0.62	Grey	29
2	-	54	405348202	0.250	0.62	Brown	33
-	2	8	405347683	0.250	0.62	Green	37

Central Office Ground

Lucent Technologies recommends that central office ground (C.O. ground) be run from the battery plant discharge return bus to building ground. BDFBs equipped with local discharge return buses do not require their own C.O. grounds. However, the standard practices of some telephone companies require that ALL local discharge return buses be terminated directly to C.O. ground. Therefore, both return bus options in the BDFB are equipped with C.O. ground termination points for use as required by installation.

List K1 external discharge return bus option has row A, position 21 reserved for terminating C.O. ground. List K3 has row B, position 9 reserved for terminating C.O. ground. See Figure 3-12.

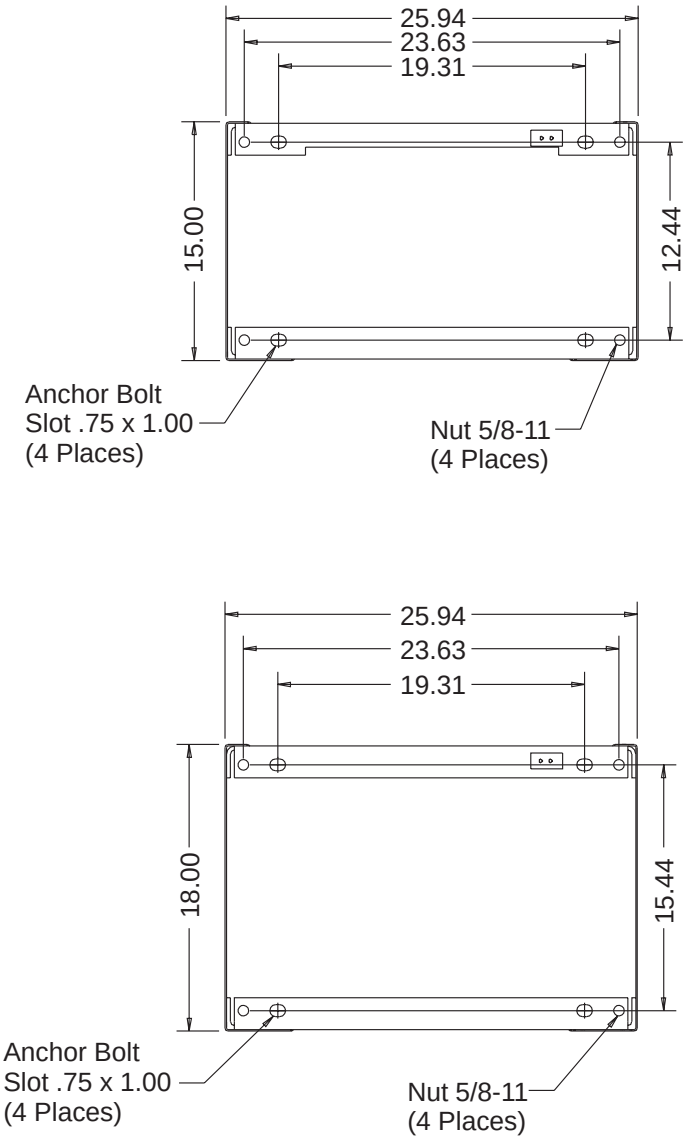


Figure 4-1: BDFB Floor Footprints (Top, 7-foot Cabinet, Bottom, 9-foot Cabinet)

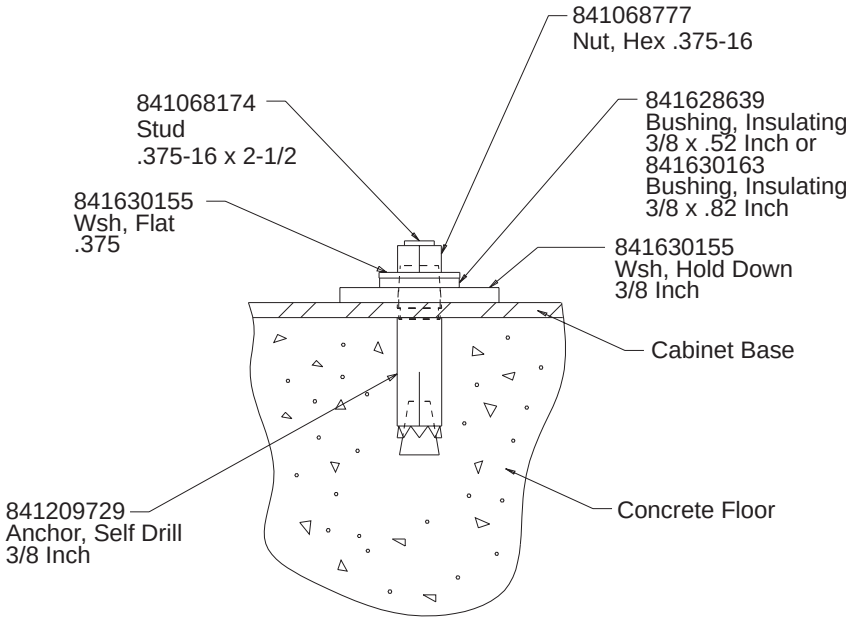


Figure 4-2: H569-407 Group 10 Floor Mounting Detail

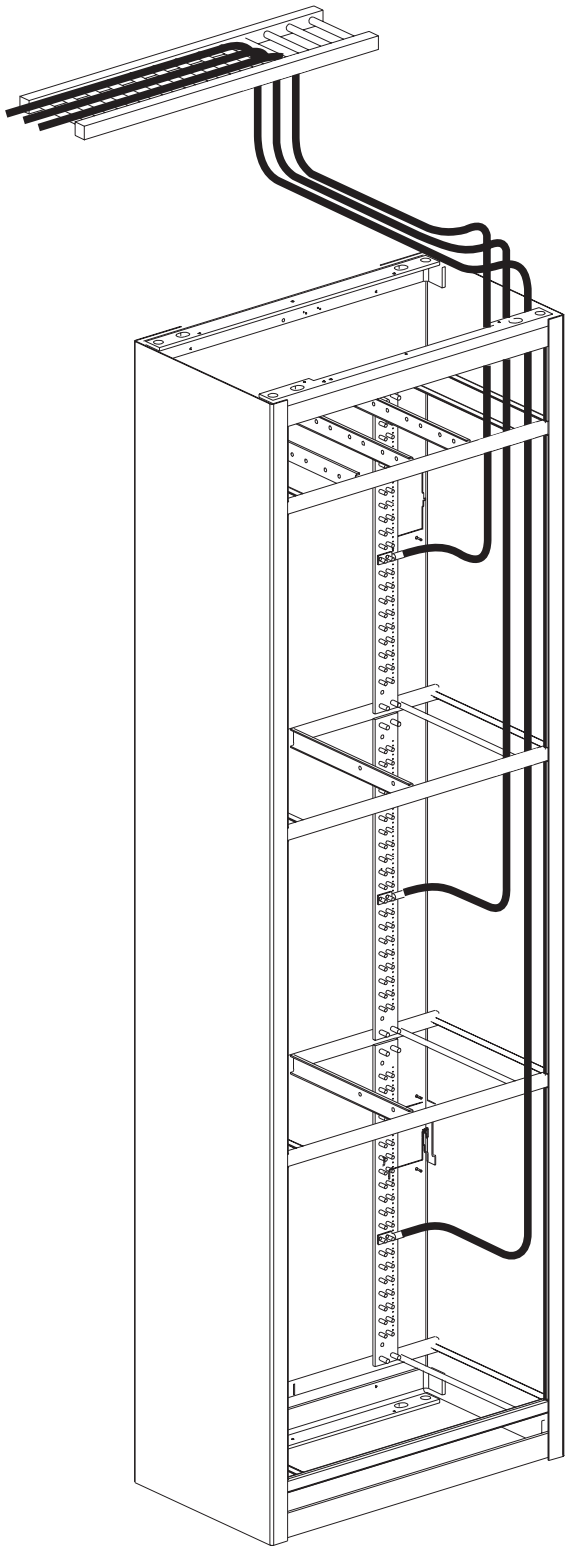


Figure 4-3: Cable Rack Location

Discharge return buses located in the BDFB are also equipped with a C.O. ground termination point. Lists 21-26 provide bus bar assemblies for busing battery to each fuse panel. Discharge return cabling from the battery plant is terminated to these assemblies at the top (or bottom) of the cabinet. C.O. ground termination is made adjacent to the battery return cabling as shown in Figure 4-4.

All C.O. ground connections accommodate 3/8 inch double hole terminal lugs on 1.00 inch centers. Wire size is determined by engineering based on local office requirements. Table 4-C lists some recommended terminal lugs

Table 4-C: Recommended Double Hole Terminal Lugs For Central Office Grounds

KS-5482 Wire	KS-20921 Wire	WP-91412 List	COMCODE	Bolt Size	Centers	Die	Die Code
6	6	111	406332841	0.375	1.00	Blue	24
4	4	116	406332940	0.375	1.00	Grey	29
2	-	121	406338665	0.375	1.00	Brown	33
1/0	-	56	405348228	0.375	1.00	Pink	42
2/0	1/0	57	405348236	0.375	1.00	Black	45
-	2/0	77	406021725	0.375	1.00	Orange	50
4/0	-	59	405348251	0.375	1.00	Purple	54
-	4/0	27	405347923	0.375	1.00	Yellow	62
350	-	61	405348277	0.375	1.00	Red	71
-	350	86	406021915	0.375	1.00	-	80
500	-	63	405348293	0.375	1.00	Brown	87
-	500	165	406434241	0.375	1.00	Pink	99
750	-	135	406335141	0.375	1.00	Black	106
-	750	170	406434290	0.375	1.00	Yellow	115

Digital Meters

The BDFB has two meter positions, left mounted and right mounted. Load monitoring shunts are wired to the meters through three position switches enabling the user to select between the three possible load buses on each side of the cabinet. Switch positions are wired from left to right beginning with the lowest numbered panel position. Panel position 1 is monitored from the left meter and its left switch position. Panel position 2 is monitored from the right meter and its left switch position. Refer again to Figure 3-13.

A stamping area is provided under each switch position for the installer to stamp load bus designations. The recommeded stamping sequence begins with load bus A for panel position 1 and proceeds through load bus F for panel position 6. When multiple panels are connected together to form a common load bus, stamp the common load bus designation on each switch position.

The meters are powered from the first equipped panel position on each side of the cabinet. They operate from a 24-, 48- or 130-volt source. The negative lead (battery or return) is inserted in meter terminal 2. The positive lead is inserted in meter terminal 1 if the panel is 48V, terminal 3 for 24V, or terminal 4 for 130V. For example, a -48-volt fuse panel in panel position 1 would power the left meter. A 22-gauge wire is run from the fuse panel battery bus to meter terminal 2. Another is run from the discharge return bus to meter terminal 1. If the return bus is mounted in the cable rack, the installer must connect this lead. Figure 4-5 shows meter wiring options for a positive or negative ground plant.

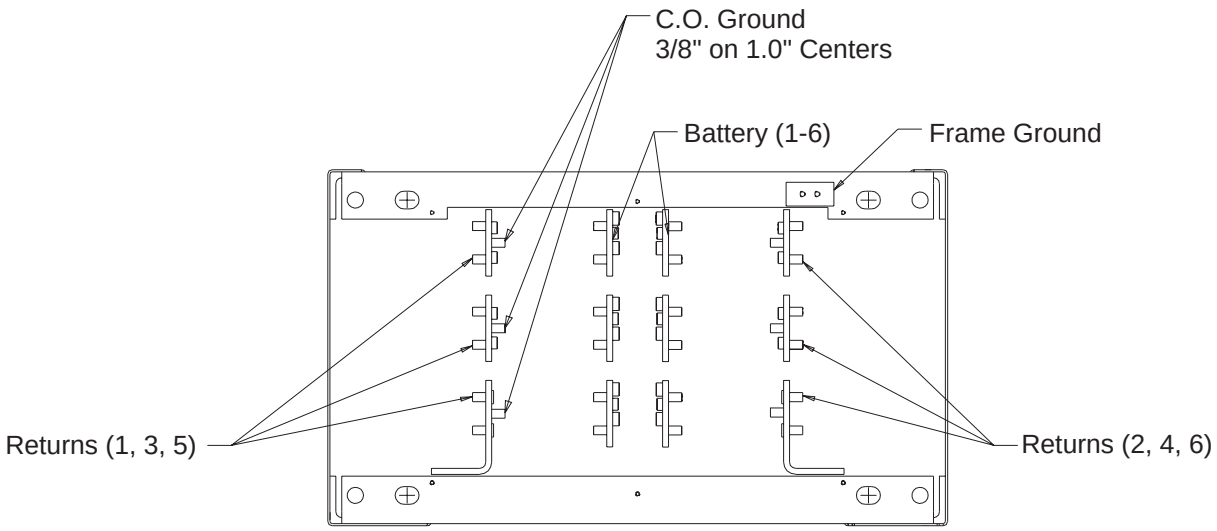


Figure 4-4: Central Office Ground Terminations

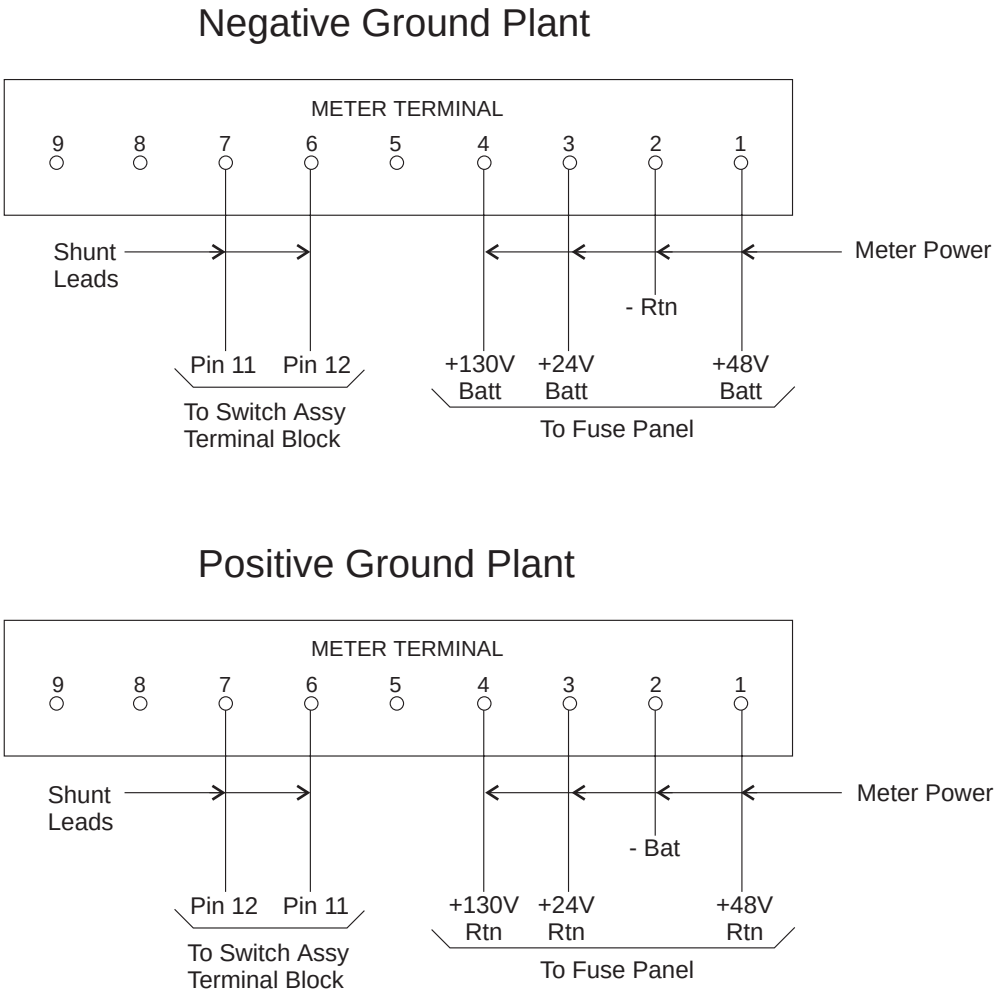


Figure 4-5: Meter Wiring Options

Alarm Circuit Modules

Accessing Alarm Modules

The alarm circuit modules, apparatus code A-CP/BEP1, provides a means for indicating a power loss and fuse alarm for each fuse panel. The alarm modules are located down the center of the cabinet. They are accessed by first removing the top cover and then lifting the alarm cover up and pulling out. Refer to Figure 4-6. The cover has labeling information with arrows that associate each alarm module with a fuse panel. The labels also

contain installer stamping areas for load designations, and the size and location of the circuit breaker feeding each load bus. See Figure 4-7.

Alarm Outputs

Each alarm module provides two form-C contacts for power loss and three form-C contacts for fuse failure. The alarm output connector references of audible, visual and remote given with each alarm module are arbitrary and are provided as a suggested standard for remote monitoring equipment. However, installation personnel may select any set of form-C contacts. Figure 3-16 shows the output (P101) connector pin descriptions. The output connector is a standard 15 pin D-subminiature female connector. A mating connector, comcode 405095043, is provided with each alarm module for wire-wrapping alarm leads. Figure 4-8 shows the connector pin numbering.

When power loss to a panel occurs, a closure exists between pins 1 and 2 and pins 3 and 4 on the output connector (P101), while an open condition exists between pins 1 and 9 and pins 3 and 10.

When a fuse operates on a panel, a closure exists between pins 8 and 15, pins 11 and 12, and pins 13 and 14 of connector P101, while an open condition exists between pins 7 and 8, pins 6 and 12, and pins 5 and 13.

Monitoring Multiple Alarm Modules for Negative Plants

Fuse Alarm

In most BDFB applications, customers require remote monitoring of a frame fuse alarm only and not individual load buses. Therefore, fuse alarms on multiple packs may be connected so that the remote fuse alarm signal on one pack can be operated from the other packs. This daisy chain is factory wired so that frame fuse alarm may be monitored from the position 1 alarm module. A fuse alarm on a pack will apply voltage to P102 pins 4 and 5. Pins 4 or 5 are connected from pack to pack as shown in Figure 3-18, providing a common fuse alarm output signal. The position 1 alarm module monitors the other packs by connecting P102 pin 1, which is the fuse alarm input, to P102 pin 4 of the position 2 alarm module. Thus voltage from any pack with a fuse alarm will cause the monitoring pack to alarm on its P101 contacts. All packs will alarm independently by simply disconnecting P102 pin 1 from the position 1 pack.

Power Loss Alarm

Remote monitoring of power loss is furnished for individual fuse panels. However, power loss alarms will probably not be remotely monitored in most applications because loss of power in a BDFB usually results in a number of other simultaneous alarms from the battery plant and load equipment. If power loss alarm for the entire cabinet is desired, the installer must connect the alarm module output pins P101 - 1, 2, 3, 4, 9, 10 as shown in Figure 3-19. The connections can be made with 26 gauge solid wire soldered or wire-wrapped to the 405095043 output connectors furnished with each alarm module.

Monitoring Multiple Alarm Modules for Positive Plants

Opto-isolator U101 is current-direction sensitive. Therefore remote monitoring of frame alarms for positive plants is wired differently than for negative plants. For positive plants, fuse alarms on multiple packs should be daisy-chained together via P101. This allows the remote fuse alarm signal on any pack to be monitored from the position 1 alarm module. Three Form C contacts are provided. They must be connected to alarm module output pins on connector P101 5, 6, 7, 8, 11, 12, 13, 14 and 15 (see Figure 3-20). The connections can be made with 26-gauge solid wire and wire-tapped to the 405095043 output connector provided with each alarm module.

Frame Alarm Lamp

A frame alarm lamp is located at the top of each cabinet. This frame alarm lights when power to a fuse panel is lost or there is a fuse alarm. Power for lighting the frame lamp is from an auxiliary battery supply (ABS) lead which is a 22-gauge wire run from the battery plant. Refer to Figure 3-17 for frame alarm and ABS termination points. The ABS lead is soldered to terminal E3 and the ABS return lead is soldered to terminal E4 for a negative plant (positive ground). Reverse these leads for a positive plant (negative ground).

Each cabinet has a 48-volt lamp for use with the ABS lead. If another voltage is used, change the lamp (24-volt comcode 407226836 or 130-volt comcode 407227164) to agree with the ABS voltage.

If no ABS lead from the battery plant is available, an installer may choose an alternative alarming method, substituting power from a load bus for ABS. For a negative plant (positive ground), run a 22 gauge wire from the battery bus of fuse panel number 1

to terminal E3. Connect the return lead from the external discharge return bus located on the cable rack to solder terminal E4. For a positive plant (negative ground, reverse these two leads. The obvious consequence of this option is that if power is lost to fuse panel number 1, the frame alarm will not light.

Alarm Verification

Perform the following verification procedures with the load buses powered from the battery plant, but with no load equipment in service.

Simulate a fuse failure alarm on each panel using a blown GMT fuse. Insert the GMT fuse in one of the GMT indicating fuse positions on each fuse panel. Verify that the red LED on the associated BEP1 circuit pack lights as well as the frame alarm lamp at the top of the cabinet. If remote alarms are connected, verify that office alarms are generated as specified by the job records.

Simulate a panel power loss alarm on each fuse panel by turning off or disconnecting the circuit breaker or fuse feeding each load bus. Verify that the green LED on the associated BEP1 circuit pack is extinguished and that the frame alarm lamp at the top of the cabinet lights. If remote alarms are connected, verify that office alarms are generated as specified by the job records.

If alarms are not indicated as described, re-check alarm wiring on T-83150-30, Figures 6 and H2. If alarms still do not function, it may be necessary to replace the BEP1 circuit module, comcode 106849506.

Recommended Torque Settings

Table 4-D lists the recommended torque settings for the input and output connections on the BDFB.

Table 4-D: Recommended Torque Settings For BDFB Connections

Connection	**Screw or Nut Size**	**Torque Tool Setting** inch/pounds
GMT fuse module	#6	10
Cartridge type fuse block Frame ground Internal return bus	1/4	75
Input battery and returns External return bus Anchor bolts	3/8	260

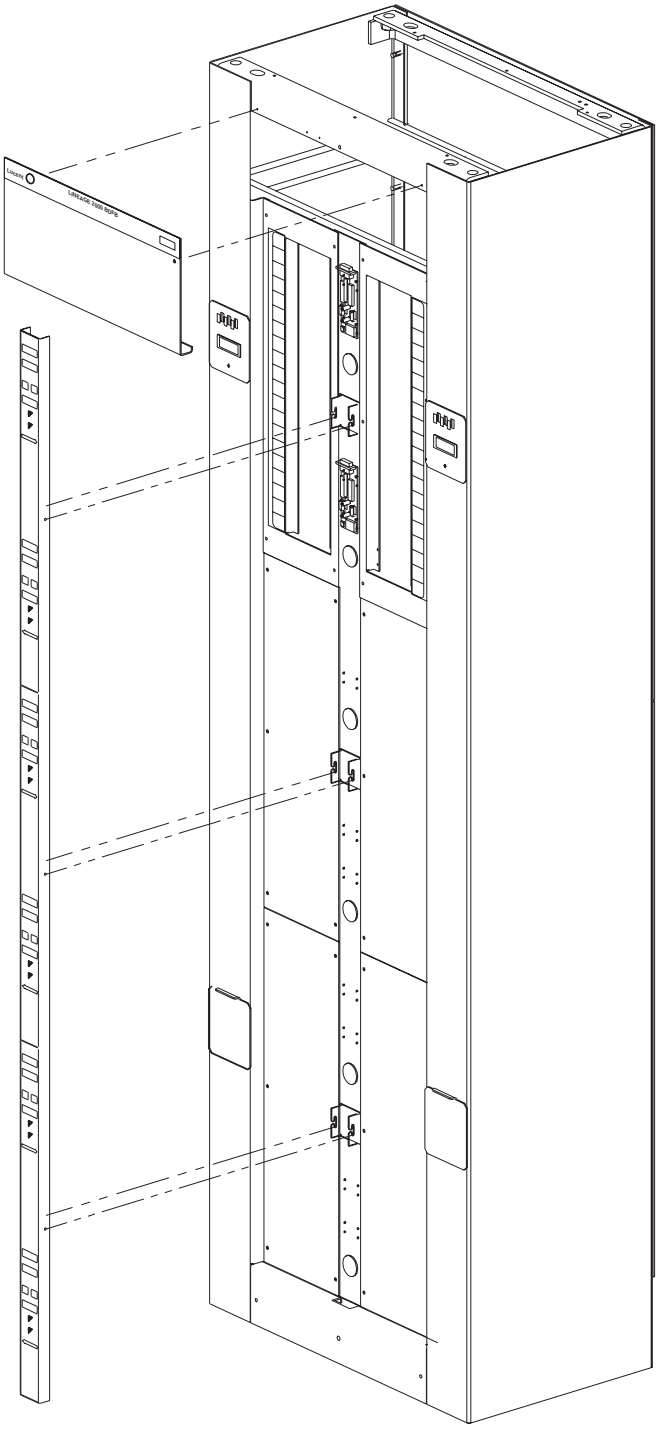


Figure 4-6 Accessing Alarm Modules

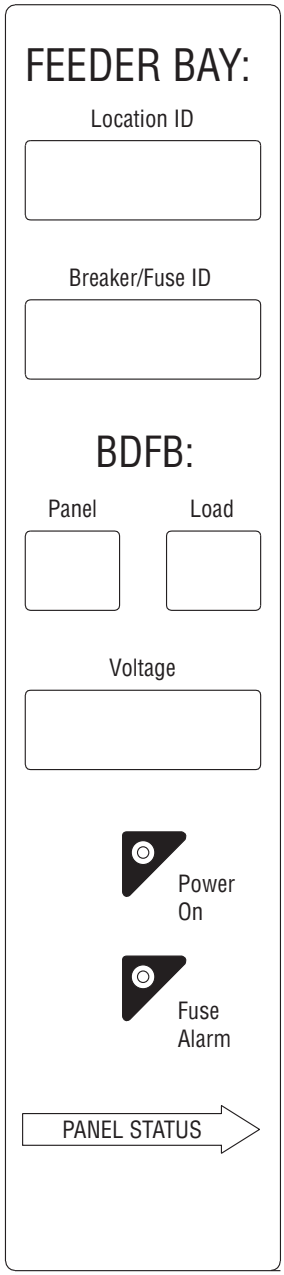


Figure 4-7: Load Designation Labels

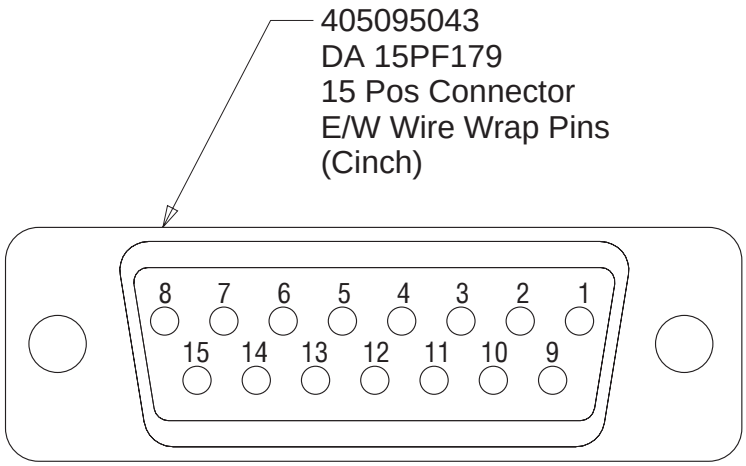


Figure 4-8: Alarm Output Connector

5 Product Warranty

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;
2. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product;
3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its Vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the Vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the Vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

Warranty Period

Product Type	New Product	Repaired Product or Part*
Central Office Power Equipment**	24 Months	6 Months

* The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer.

** The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

   With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense

associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repair or replacing Product to the destination designated by Customer within the Territory.

E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.