AC Power
For *Business-Critical Continuity™*

Liebert FPC™

User Manual - 15 kVA - 300kVA, 3 Phase, 50 & 60 Hz

Liebert®

EMERSON™
Network Power

TABLE OF CONTENTS

FIGURES

TABLES

IMPORTANT SAFETY INSTRUCTIONS

NOTE

Read the entire manual before installing or operating the system.

WARNING

The shipping bands may be under tension. Use appropriate eye, face, and hand protection to safeguard against injury from band backlash.

WARNING

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

Equipment inspection and start-up should be performed only by trained personnel. Lethal voltages are present during start-up procedures. Electrical safety precautions must be followed throughout inspection and startup.

Only qualified service personnel should perform maintenance on the Liebert FPC system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

Lethal voltages exist within the equipment during operation. Observe all warnings and cautions in this manual. Failure to comply may result in serious injury or death. Obtain qualified service for this equipment as instructed.

The monitoring system contains a lithium battery for memory backup. There is a danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type. Dispose of used batteries according to the manufacturer's instructions.

NOTE

The unit should not be loosened from the shipping pallet until all handling by fork lift or pallet jack is completed.

All power and control wiring should be installed by licensed electricians and must comply with the NEC and applicable codes.

1.0 INSTALLATION INSTRUCTIONS

1.1 Unpacking and Installation

NOTE
Read the entire manual before installing and operating the system. Upon receipt of a Liebert FPC™, the installer should perform the following steps to ensure a quality installation.

1.1.1 Unpacking and Preliminary Inspection

A quality installation begins on the receiving dock.

1. Inspect the shipping crate(s) for damage or signs of mishandling before unpacking the unit(s). Check the Shock-Watch™ indicator.
2. Remove the packing and inspect the equipment for any obvious shipping damages.
3. If the FPC was shipped in an export crate, open the shipping crate carefully.
   Use care to avoid puncturing the container with sharp objects that would damage the contents.
4. Remove the packing and vapor barriers and inspect the equipment for any obvious shipping damages.

NOTE
The units should not be loosened from the shipping pallet until all handling by fork lift or pallet jack is completed. Complete internal inspection should be accomplished only after equipment positioning and prior to electrical hookup.

5. If any damage is observed, immediately file a damage claim with the shipping agency and forward a copy to:
   Liebert Corporation
   1050 Dearborn Drive
   P.O. Box 29186
   Columbus, Ohio 43229 USA

1.1.2 Handling Considerations

The Liebert FPC™ (and cables, if furnished) is bolted to a wooden pallet to allow handling by forklift equipment.

The Liebert FPC and cable reels are furnished with casters to allow the unit to be rolled into place after it has been unbolted from the pallet. The FPC should be kept on the shipping pallet until it has been moved by forklift as close as practical to its installation location.

Refer to the cabinet drawings furnished with the FPC for the unit's size and weight. Typical cabinet dimensions and weights are shown in **Figures 1** and **2**.

The route to the FPC's installation area should be planned to ensure that all passages, including doorways, elevators, ramps and hallways, are large enough to accommodate the unit and that the floors are strong enough to support the weight. Determine whether any corners or offsets would cause problems in maneuvering the unit.

Liebert recommends removing the exterior side panels, if supplied, before the unit is moved. This will prevent scratches, dents and other damage to the panels.

Figure 1 Typical cabinet and floor planning dimension data, 23" (584mm) cabinet, 15-125 kVA

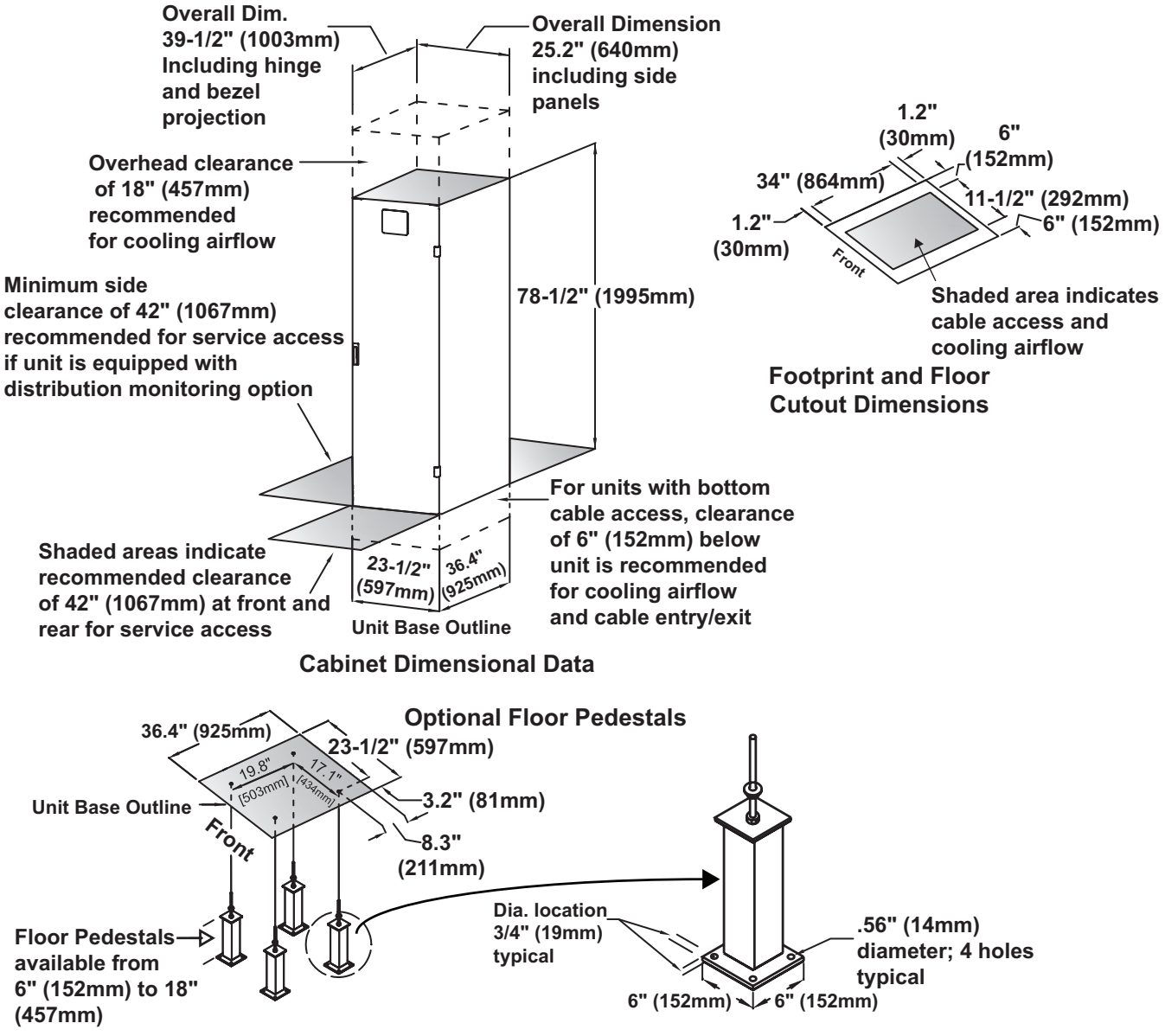


Table 1 23-inch cabinet weight

Unit kVa	Weight, lb (kg)		
	60Hz	50Hz	Without Transformer
15	1010 (458)	1060 (480)	750 (340)
30	1090 (494)	1140 (517)	750 (340)
50	1160 (526)	1235 (560)	750 (340)
75	1350 (612)	1450 (658)	800 (363)
100	1540 (699)	1665 (755)	800 (363)
125	1650 (748)	1775 (805)	800 (363)

Figure 2 Typical cabinet and floor planning dimension data, 47" (1194mm) cabinet 50-300kVA

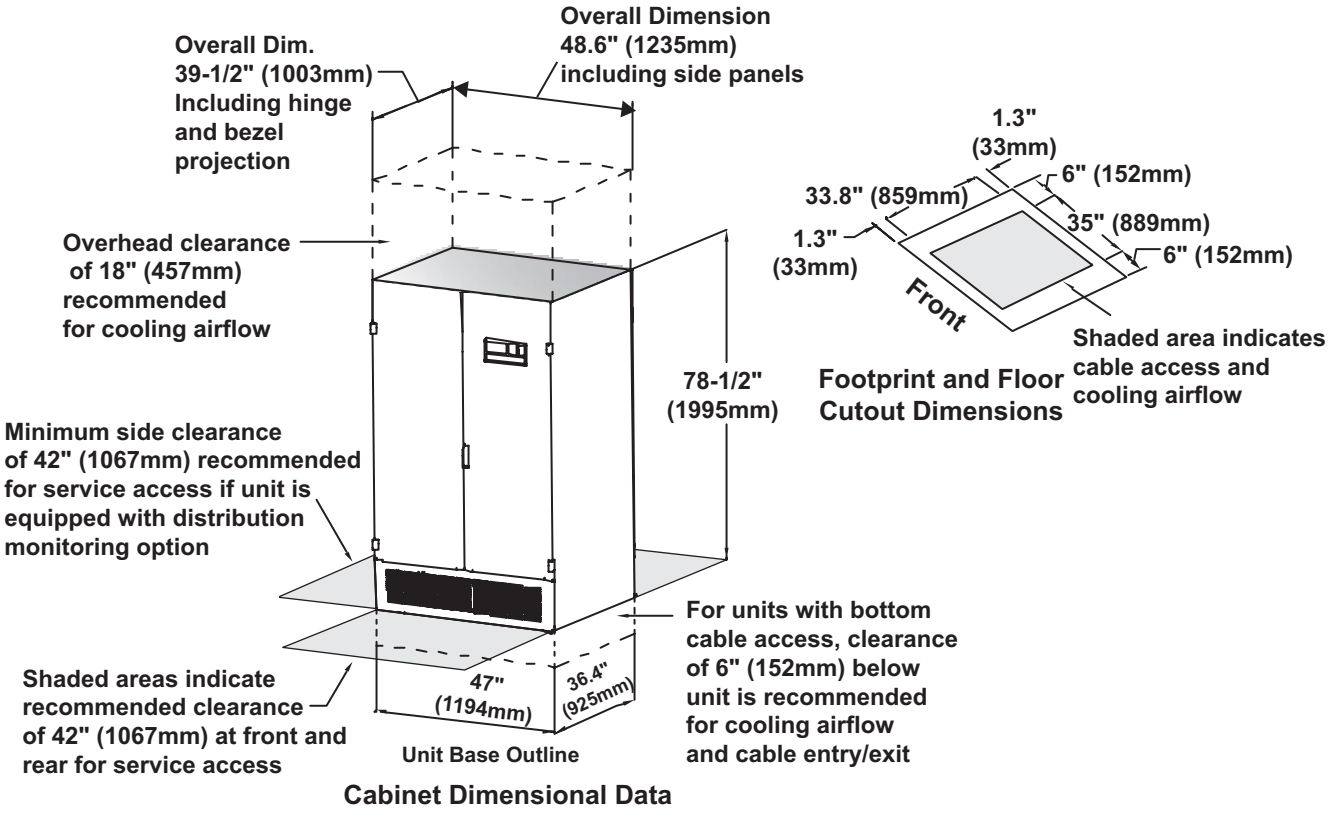


Table 2 47-inch cabinet weight

Unit kVA	Weight, lb (kg)		
	60 Hz	50 Hz	Without Transformer
50	1891 (858)	1966 (892)	1335 (606)
75	1995 (905)	2095 (950)	1335 (606)
100	2191 (994)	2316 (1051)	1335 (606)
125	2298 (1042)	2423 (1099)	1360 (617)
150	2490 (1129)	2640 (1198)	1360 (617)
200	2610 (1184)	2810 (1275)	1360 (617)
225	2800 (1270)	3000 (1361)	1390 (631)
300	2845(1290)	3045 (1381)	1390 (631)

1.1.3 Unit Preparation

The Liebert FPC may be easily removed from the shipping pallet and installed by customer personnel. A typical procedure is as follows:

1. Set the palletized assembly in a level area where there is enough room to roll the Liebert FPC and entire cable assembly off the pallet onto the floor.
2. Cut the shipping bands.

WARNING

The shipping bands may be under tension and may snap violently when cut. Use eye, face and hand protection to guard against injury when the bands are cut.

3. Remove the factory-provided ramp from its shipping position.
   One ramp is provided for every five units. Ramps are packed either in front of or on top of a set of cable reel(s).
4. Place the ramp adjacent to the pallet to provide a smooth path from pallet to floor.
5. Remove side panels from the Liebert FPC, if supplied. An Allen wrench for the side panels is furnished in the installation packet.
6. Remove the bolts and two mounting brackets holding the unit to the shipping pallet.
   Mounting brackets are located on either side of the unit.
7. If cables are on wheeled cable reel(s), remove the bolts holding the reel(s) to the pallet and remove the nailed-on shipping blocks.
8. Roll the unit off the pallet onto the floor, carefully guiding the cable reel(s) after it.
9. Roll the FPC and the cable reel(s) to the installation area. For units to be placed on a raised floor, use care when positioning unit over the floor cutout to prevent the casters from falling through the cutout.

CAUTION

Before maneuvering the unit into its final position, read and follow all advisories in **1.1.4 - Location Considerations**.

1.1.4 Location Considerations

The Liebert FPC should be placed near the load(s) it will supply, preferably within the data center.

Equipment location should employ the shortest output distribution cable runs consistent with logical equipment arrangement and allowance for expansion.

The FPC is intended for indoor installation in an area with ambient temperatures of 32°F to 104°F (0°C to 40°C) with a relative humidity of 0% to 95% (non-condensing).

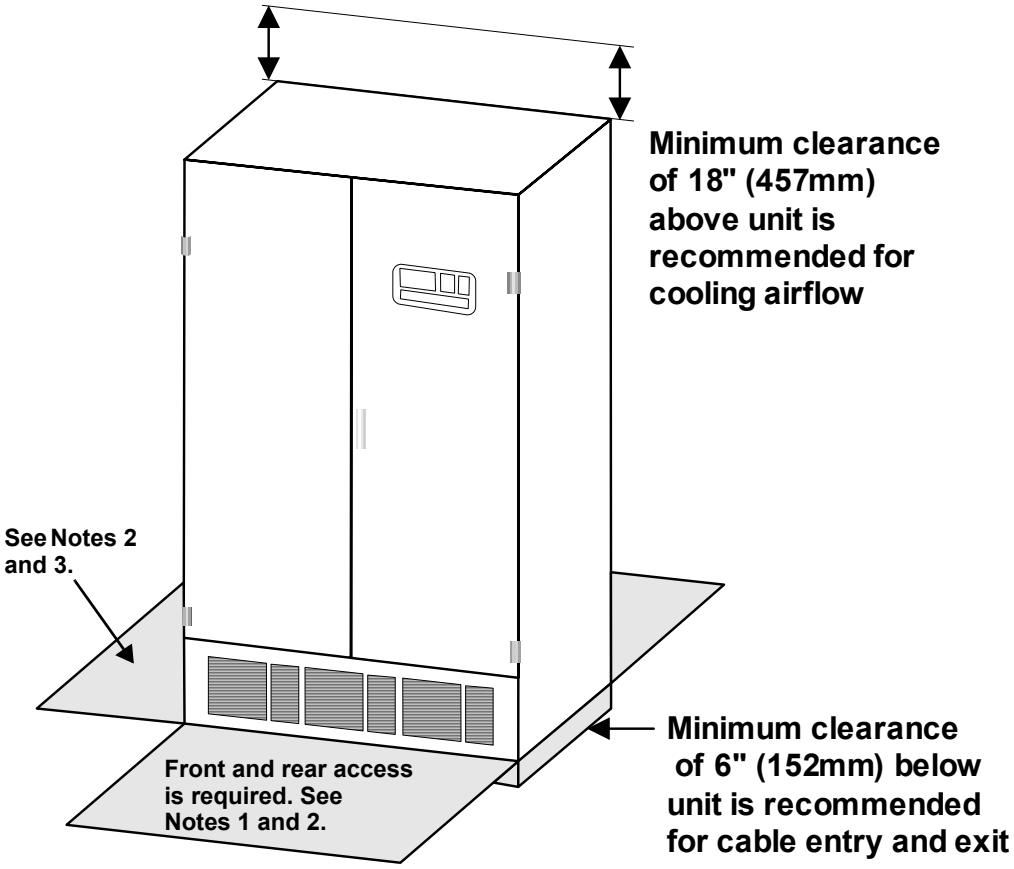
Bottom clearance is required for units with bottom entry/exit of cables. This clearance may be provided by a raised floor at least 6" (150mm) high. **Figures 1** and **2** show the typical raised-floor cutout dimensions for cables and cooling airflow.

When units are not installed on a raised floor, or if the raised floor will not support the unit, optional floor pedestals may be used. (CSA regulations require FPC arrangements employing a raised floor. Non-raised floor applications are not CSA approved.) Units with top cable exit provisions do not require bottom clearance.

Recommended minimum service clearances are shown in **Figure 3**. The National Electrical Code (NEC) requires the indicated front and rear clearances for service access. Clearance above the unit is required for cooling airflow (exhaust). Units with optional distribution monitoring also require service access clearance on the left side.

As do all electrical devices, the Liebert FPC produces heat under normal operation. (See **Table 3**.) This heat must be accounted for when calculating the environmental conditions of the room.

Figure 3 Recommended minimum service and ventilation clearances



NOTE

1. *Service access is required at the front and rear.*
2. *Service access clearance dimensions: 36" (914mm) for units up to 150V to ground. 42" (1067mm) for units over 150V to ground.*
3. *Service access is required on the left side, if unit is equipped with Liebert Distribution Monitoring Option.*

Table 3 Liebert FPC heat output

Unit kVA	Full Load Heat Output BTU/Hr (kW)
15	2,500 (0.73)
30	4,600 (1.35)
50	6,200 (1.82)
75	8,150 (2.39)
100	9,900 (2.90)
125	11,500 (3.37)
150	12,500 (3.66)
200	15,500 (4.54)
225	15,800 (4.63)
300	18,450 (5.40)

1.1.5 Floor Pedestal Installation

Floor pedestals are optional equipment that provide clearance for bottom cable entry or exit for FPC units not installed on raised flooring. The pedestals are adjustable over a limited range (approximately 3-1/2" [89mm]) to allow leveling the FPC and minor adjustments in the unit's installed height.

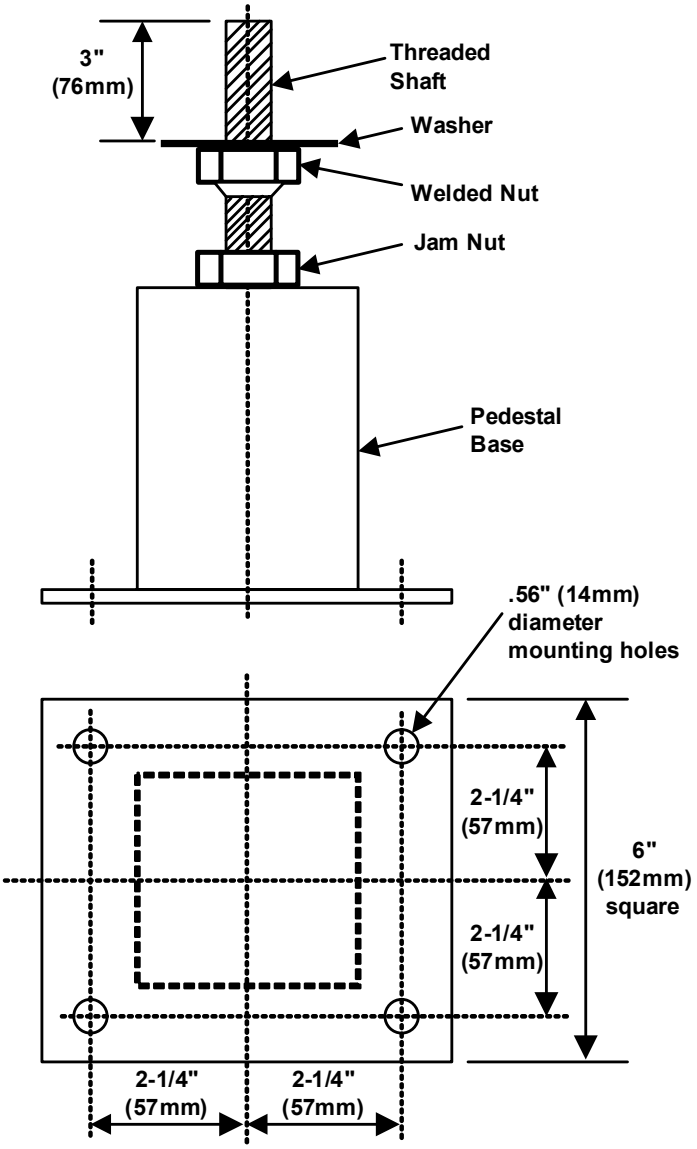
CAUTION

Floor pedestals may be reverse-assembled for shipping. Before installation, the pedestals should be reassembled as shown in **Figure 4**. When the pedestal is properly assembled, the washer on top of the welded nut provides a bearing surface for the unit's weight.

1. Insert the pedestal threaded shaft into the pedestal holes in the cabinet base as shown in **Figures 1** and **2**.
2. Adjust the pedestal height by turning the welded nut/shaft assembly into or out of the pedestal base as required.
3. Lock the height by tightening the jam nut against the pedestal base.

   The pedestal may be anchored to the floor by means of the four holes in the base. Locations of floor pedestals are shown in **Figures 1** and **2**.

Figure 4 Floor pedestal details



1.2 Additional Distribution Mounting & Wiring

For Liebert FPCs with more than four panelboards, the additional panelboards are furnished in Liebert FDC enclosures, which are shipped separately from the Liebert FPC.

1.2.1 Liebert FDC Distribution Mounting

The Liebert FDC distribution cabinet has the same base dimensions as a 23" (584mm) cabinet FPC (23-1/2" wide x 38" deep [597 x 965mm]) and may be mounted on either the left or right side of the FPC.

1. Provide a floor cutout for exit of output cables, as shown in **Figure 1**.
2. Remove the side panel, internal panel and the lower panel bracket from the FPC.
3. Remove the FDC side panel and internal panel, if supplied, and align the FDC with the FPC and bolt the units' frames together (hardware provided by others).

   If floor pedestals are used for the FPC, two additional floor pedestals are required for the outside corners of the FDC. See **Figure 1**.
4. Install the lower panel bracket on the opposite side of the FDC cabinet.
5. Make electrical connections. For details, see "Electrical Field Connections" drawings supplied with the unit.
6. Install the FPC side panel on the FDC cabinet.

1.2.2 Distribution Cabinet Electrical Connections

Five field-supplied conductors (3-phase conductors, neutral and ground) are needed to connect the FDC cabinet to the FPC cabinet in the field.

For Liebert FPCs with transformers, the distribution cabinet phase conductors are connected directly to the transformer terminals:

Phase A to X1
Phase B to X2
Phase C to X3

The FDC's neutral and ground conductors are connected to the FPC's neutral busbar and main ground busbar (see unit wiring diagram for location).

For Liebert FPCs without transformers, the distribution cabinet phase and neutral conductors are connected to the corresponding output power distribution terminal blocks inside the FPC. The distribution cabinet ground conductor is connected to the main ground busbar.

For all Liebert FPCs with current monitoring, route each distribution cabinet conductor through the appropriate current transformer (CT) in the FPC.

NOTE
Distribution cabinet conductors must pass through the current transformers in the same direction as the FPC panelboard conductors. Use the existing FPC panelboard wiring for reference.

1.3 Power and Control Wiring

Power and control wiring should be installed by licensed electricians. All power and control wiring must comply with the NEC and applicable local codes.

1.3.1 Input Power Connections

If the FPC is furnished with a main input junction box, input power connections are made as detailed in **1.3.2 - Junction Box Installation**.

If a junction box is not furnished, the input power feeder is connected to the main input circuit breaker located inside the FPC. (See **Figures 5** through **8**.)

WARNING
Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the FPC.

To minimize disturbances from other loads in the building, the 3-phase power input to the FPC should be supplied directly from the service entrance or other power source (a dedicated power feeder).

The input feeder circuit should be sized in accordance with the NEC and any local building codes to ensure the feeder's ability to safely carry the system's full load current, including losses.

Input feeder conductors should be sized for no more than 2% voltage drop. If operation at undervoltage conditions for extended periods of time is desired, the input feeders must be oversized.

Typical conductor size data is shown in **Table 4**. All connections must comply with the NEC and all other applicable codes.

For units with a transformer, the main input feeder should consist of 3-phase conductors and one (safety) ground conductor (3W + G).

For units without a transformer, the main input feeder must consist of 3-phase conductors, one neutral and one (safety) ground conductor (4W + G).

Figure 5 Electrical connection location for 23" (584mm) cabinet

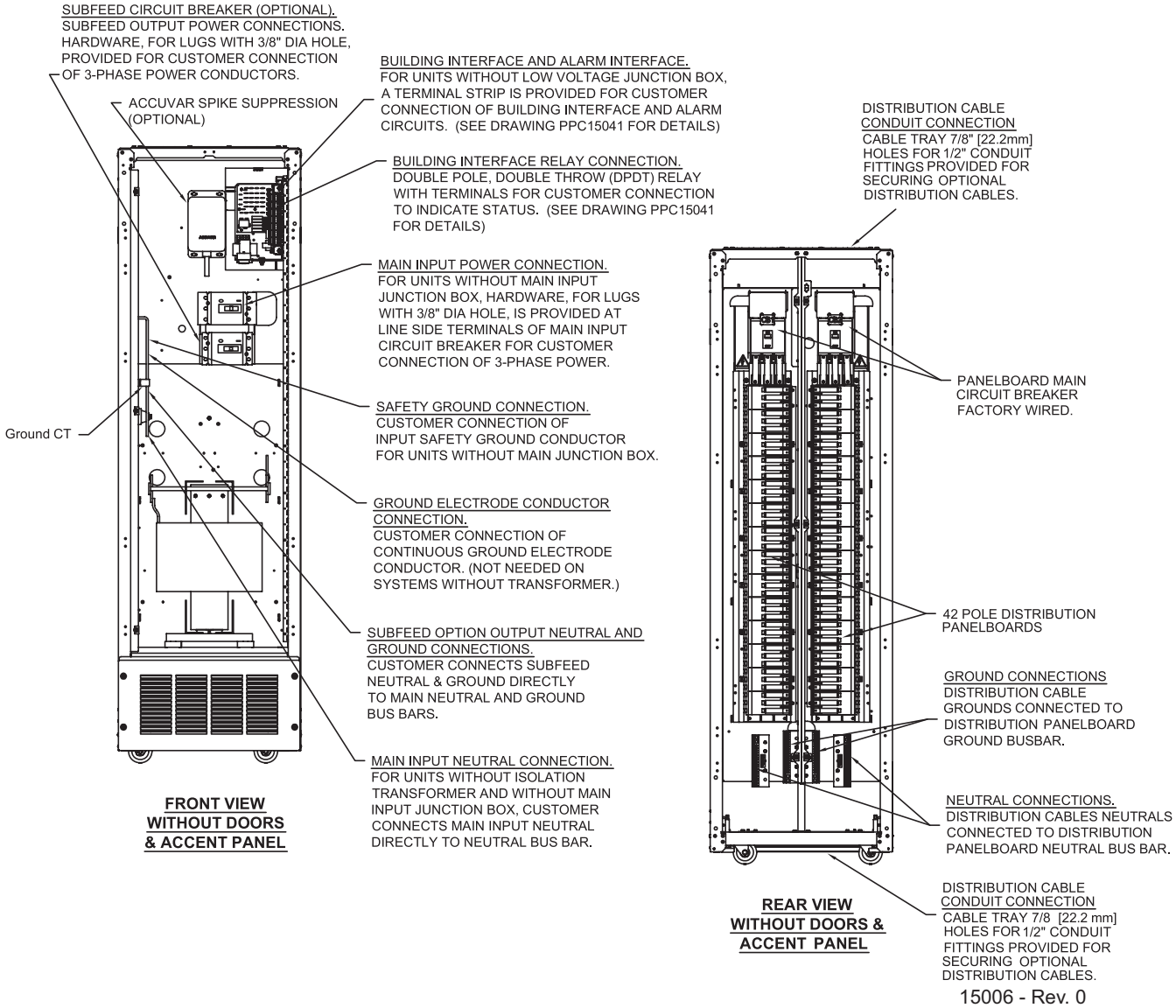


Figure 6 Electrical connection location for 47" (1194mm) cabinet—Front view

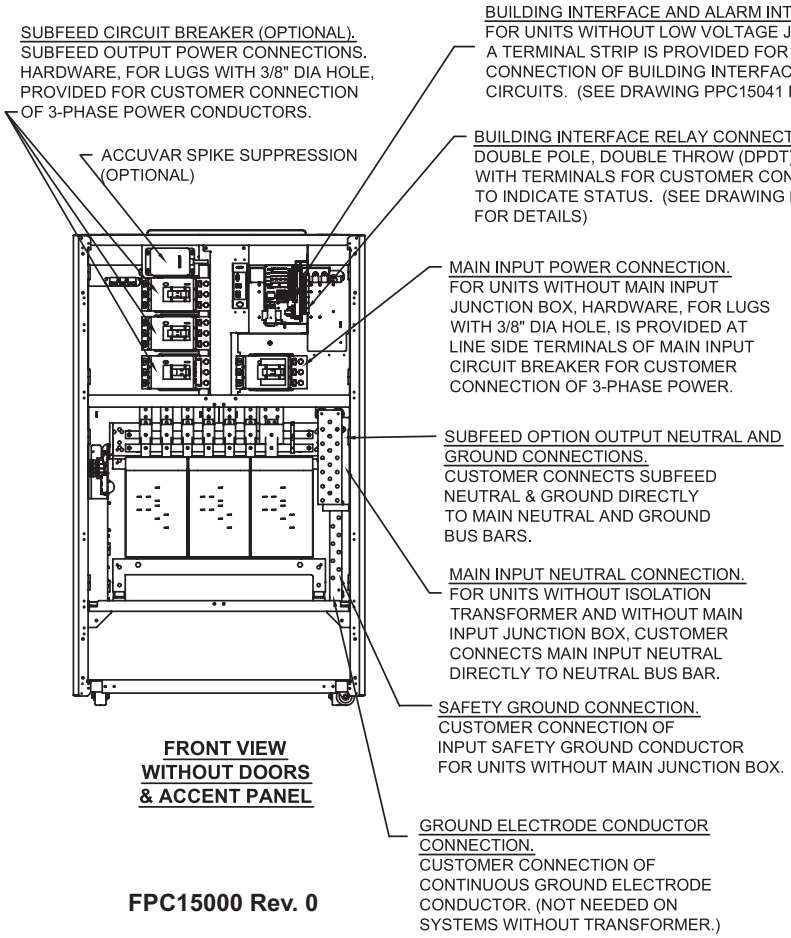


Figure 7 Electrical connection location for 47" (1194mm) cabinet—Rear view

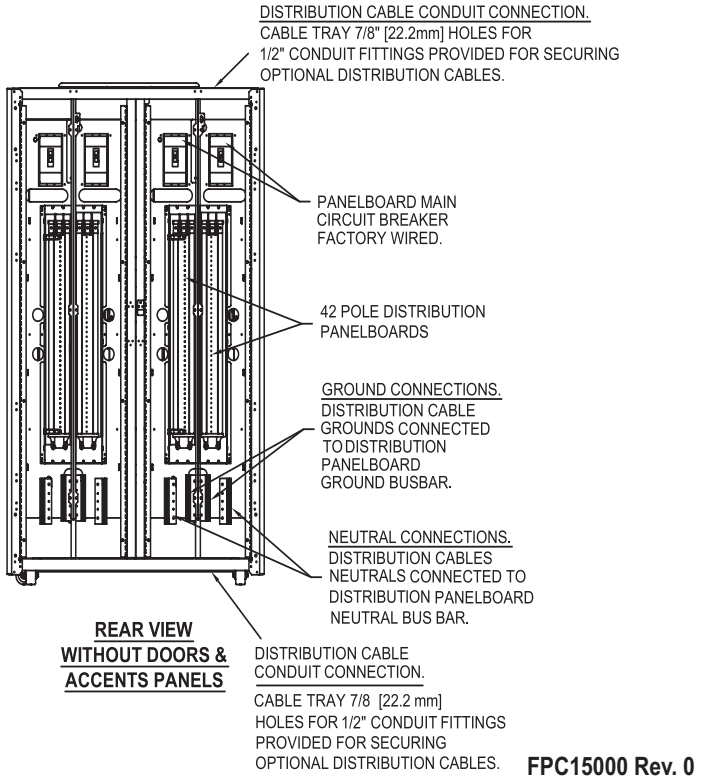


Figure 8 Electrical connection location for 47" cabinet with SqD I-Line panelboard—Front view

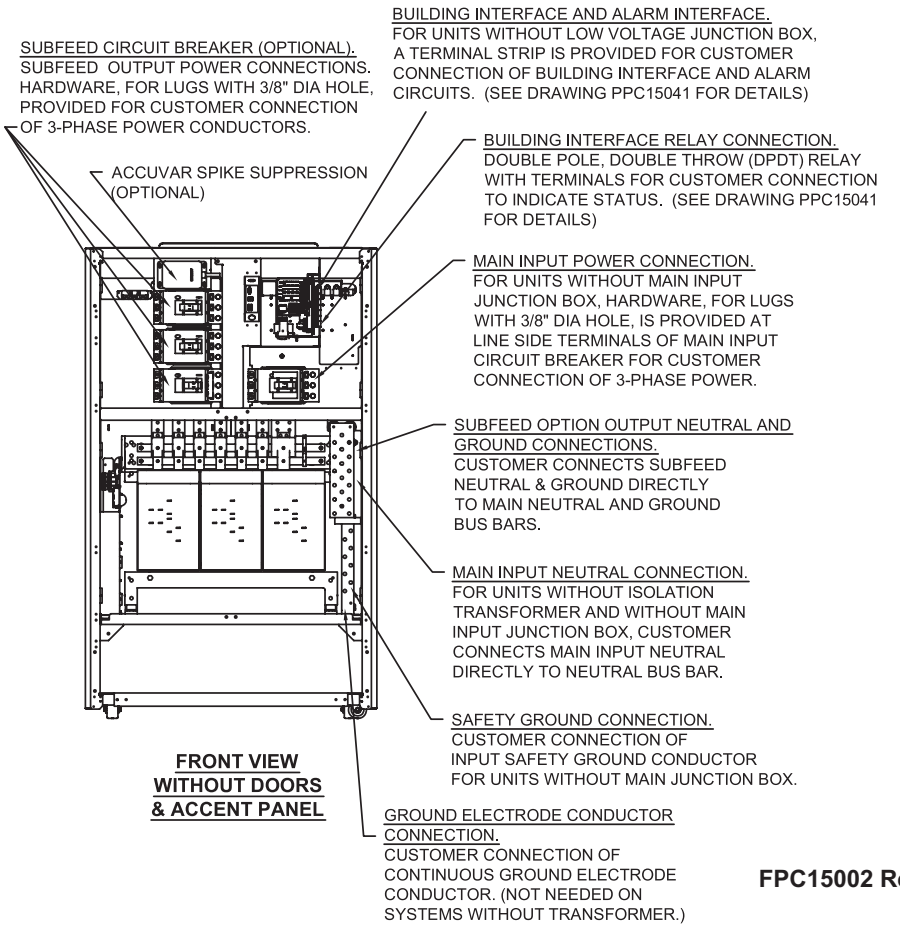


Figure 9 Electrical connection location for 47" cabinet with SqD I-Line panelboard—Rear view

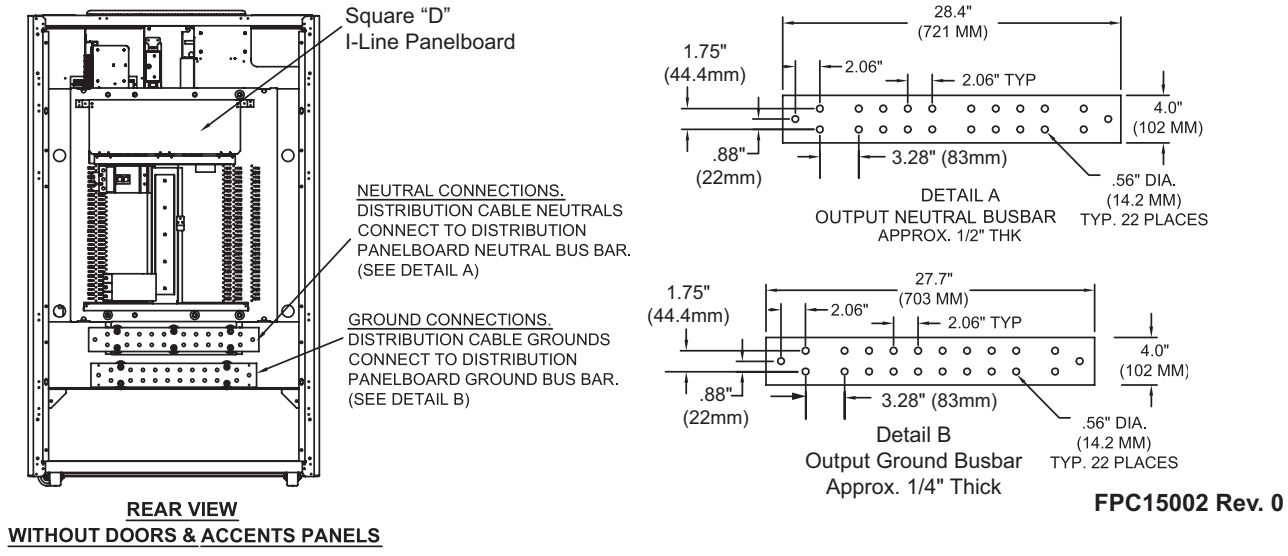


Table 4 Suggested minimum input wire size data

kVA	Input Voltage	Units with Transformers			Transformerless Units		
		Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)	Full Load Amps	MIB Trip Amps	Suggested Feeder Wire Size (AWG)
15	208	43	60	#6 AWG	42	60	#6 AWG
	240	38	50	#8 AWG	-	-	-
	380	24	30	#10 AWG	23	30	#10 AWG
	400	23	30	#10 AWG	22	30	#10 AWG
	415	22	30	#10 AWG	21	30	#10 AWG
	480	19	25	#10 AWG	-	-	-
	600	15	20	#12 AWG	-	-	-
30	208	87	110	#2 AWG	83	110	#2 AWG
	240	75	100	#2 AWG	-	-	-
	380	48	60	#6 AWG	46	60	#6 AWG
	400	45	60	#6 AWG	43	60	#6 AWG
	415	44	60	#6 AWG	42	60	#6 AWG
	480	38	50	#8 AWG	-	-	-
	600	30	40	#8 AWG	-	-	-
50	208	145	200	#3/0 AWG	139	175	#2/0 AWG
	240	125	175	#2/0 AWG	-	-	-
	380	79	100	#2 AWG	76	100	#2 AWG
	400	75	100	#2 AWG	72	90	#2 AWG
	415	72	90	#2 AWG	70	90	#2 AWG
	480	63	80	#4 AWG	-	-	-
	600	50	70	#4 AWG	-	-	-
75	208	215	300	350 kcmil	208	300	350 kcmil
	240	186	250	250 kcmil	-	-	-
	380	118	150	#1/0 AWG	114	150	#1/0 AWG
	400	112	150	#1/0 AWG	108	150	#1/0 AWG
	415	108	150	#1/0 AWG	104	150	#1/0 AWG
	480	93	125	#1 AWG	-	-	-
	600	74	100	#2 AWG	-	-	-
100	208	286	400	(2) #3/0 AWG *	278	350	(2) #2/0 AWG *
	240	248	350	(2) #2/0 AWG *	-	-	-
	380	157	200	#3/0 AWG	152	200	#3/0 AWG
	400	149	200	#3/0 AWG	144	200	#3/0 AWG
	415	143	200	#3/0 AWG	139	175	#2/0 AWG
	480	124	175	#2/0 AWG	-	-	-
	600	99	125	#1 AWG	-	-	-
125	208	358	450	(2) #4/0 AWG *	347	450	(2) #4/0 AWG *
	240	310	400	(2) #3/0 AWG *	-	-	-
	380	196	250	250 kcmil	190	250	250 kcmil
	400	186	250	250 kcmil	180	225	#4/0 AWG
	415	179	225	#4/0 AWG	174	225	#4/0 AWG
	480	155	200	#3/0 AWG	-	-	-
	600	124	175	#2/0 AWG	-	-	-

Table 4 Suggested minimum input wire size data (continued)

kVA	Input Voltage	Units with Transformers			Transformerless Units		
		Input FLA	Input OPD	Suggested Feeder Wire Size (AWG)	Full Load Amps	MIB Trip Amps	Suggested Feeder Wire Size (AWG)
150	208	427	600	(2) 350 kcmil *	416	600	(2) 350 kcmil *
	240	370	500	(2) 250 kcmil *	-	-	-
	380	234	300	350 kcmil	228	300	350 kcmil
	400	223	300	350 kcmil	217	300	350 kcmil
	415	215	300	350 kcmil	209	300	350 kcmil
	480	185	250	250 kcmil	-	-	-
	600	148	200	#3/0 AWG	-	-	-
200	380	312	400	(2) #3/0 AWG *	304	400	(2) #3/0 AWG *
	400	297	400	(2) #3/0 AWG *	289	400	(2) #3/0 AWG *
	415	286	400	(2) #3/0 AWG *	278	350	(2) #2/0 AWG *
	480	247	350	(2) #2/0 AWG *	-	-	-
	600	197	250	250 kcmil	-	-	-
225	380	352	450	(2) #4/0 AWG *	342	450	(2) #4/0 AWG *
	400	334	450	(2) #4/0 AWG *	325	450	(2) #4/0 AWG *
	415	322	450	(2) #4/0 AWG *	313	400	(2) #3/0 AWG *
	480	278	350	(2) #2/0 AWG *	-	-	-
	600	222	300	350 kcmil	-	-	-
300	380	469	600	(2) 350 kcmil *	456	600	(2) 350 kcmil *
	400	446	600	(2) 350 kcmil *	433	600	(2) 350 kcmil *
	415	430	600	(2) 350 kcmil *	417	600	(2) 350 kcmil *
	480	372	500	(2) 250 kcmil *	-	-	-
	600	297	400	(2) #3/0 AWG *	-	-	-

* Parallel feeders per NEC 300-20 and 310-4

FLA = Full Load Amps of Power Center

OPD = Overcurrent Protection Device inside FPC

Wire sizes based on NEC 2005, Table 310-16, using 75°C copper conductor

1. Main input power feeder should be a dedicated feeder direct from service entrance or other power source possible
2. Ground conductors recommended to be insulated conductors run with power conductors for increased system performance. Ground conductor minimum size per NEC Table 250-66. Input power feeder conduit may be used as the safety ground conductor. When conduit is used, adequate electrical continuity must be maintained at conduit connections to enclosures and throughout conduit run.
3. Input feeder wire size listed in this table is the minimum feeder size recommended. Larger wire size may be required because of voltage drop or supply overcurrent protection device.
4. For transformerless units with 3-phase 4W + G input feeder larger wire size may be required because of excessive neutral current (see NEC Table 310-15 note 4: For best performance, the unit should be located as close to load as practical.

Table 5 Main input circuit breaker interrupting rating

Standard interrupting rating*			
208V	**480V**	**380-415V**	**600V**
65 kA	35 kA	35 kA	18 kA

* Refer to unit specification sheet for units equipped with non-standard main input breakers.

1.3.2 Junction Box Installation

Main input (power) and low-voltage (control) junction boxes are available for the Liebert FPC to simplify customer connections.

The junction boxes, if used, can either be shipped with the system or can be advance-shipped for installation during the roughing-in stage of new construction.

Liebert supplies flexible, 10-foot-long (3m) conduit with cables for connecting the junction boxes to the unit. The junction boxes should be installed a maximum of 8 ft. (2.4m) from the feeder entrance of the unit.

Liebert recommends centering the junction boxes under a floor tile that is easily removed.

Junction box connections must be installed in compliance with the NEC and all other applicable codes.

WARNING

Verify that incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making any connections in the junction box.

Typical junction box connections are shown in **Figure 16** and described in **1.3 - Power and Control Wiring**.

Table 6 Main input junction box electrical connections (4 wire)

Junction Box Size Inches (mm)	Electrical Connections
27 x 14 x 6 (686 x 356 x 152)	400A 3 pole power block with 1/2 -13 studs on 1-3/4" (44mm) centers 750A ground busbar with two sets of 3/8 - 16 studs on 1.75” centers
35 x 22 x 6 (889 x 559 x 152)	750A phase busbars with 1/2 -13 studs on 1-3/4" (44mm) centers 750A ground busbar with two sets of 3/8 -16 studs on 1-3/4" (44mm) centers

Table 7 Main input junction box without transformer electrical connections (5 wire)

Junction Box Size Inches (mm)	Electrical Connections
27 x 14 x 6 (686 x 356 x 152)	400A 3 pole power block with 1/2 -13 studs on 1-3/4" (44mm) centers 750A neutral busbar with two sets of 1/2 -13 studs on 1-3/4" (44mm) centers 750A ground busbar with two sets of 3/8–16 studs on 1-3/4" (44mm) centers
35 x 22 x 6 (889 x 559 x 152)	750A phase busbars with 1/2 -13 studs on 1.75” centers 1500A neutral busbar with two sets of 1/2 -13 studs on 1-3/4" (44mm) centers 750A ground busbar with two sets of 3/8 - 16 studs on 1-3/4" (44mm) centers

Dimensions are given on the drawings furnished with the unit. Typical dimensions of the junction boxes are as follows:

Table 8 Low-voltage (control) junction box dimensions, typical

Width, inches (mm)	8 (203)
Length, inches (mm)	10 (254)
Height, inches (mm)	4 (102)

Table 9 Main input (power) junction box dimensions, typical

Unit kVa	Input Voltage		
	208-240V	380-415V	480-600V
15-100 kVA, L x W x H, inches (mm)	27 x 14 x 6 (686 x 356 x (152)		
125-150 kVA, L x W x H, inches (mm)	35 x 22 x 6 (889 x 559 x 152)	27 x 14 x 6 (686 x 356 x (152)	
200 kVA, L x W x H, inches (mm)	N/A	27 x 14 x 6 (686 x 356 x (152)	
225 kVA, L x W x H, inches (mm)	N/A	35 x 22 x 6 (889 x 559 x 152)	27 x 14 x 6 (686 x 356 x (152)
300 kVA, L x W x H, inches (mm)	N/A	35 x 22 x 6 (889 x 559 x 152)	

Figure 10 Low voltage control junction box connections, typical

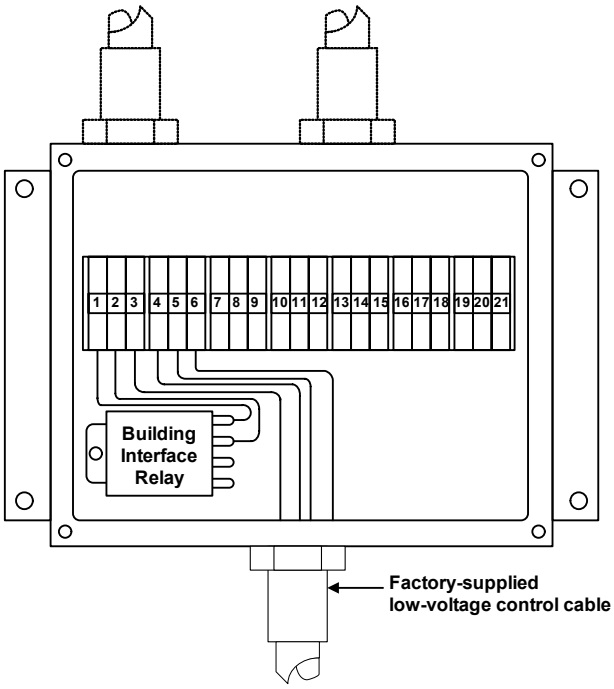
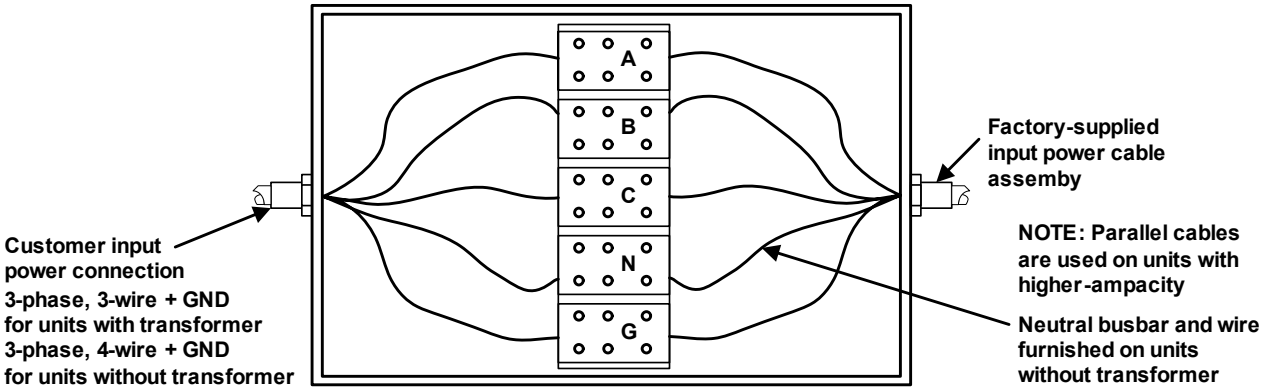


Figure 11 Main input junction box connections, typical



1.3.3 System Grounding

The performance and safety of any power conditioning system depend on proper grounding. **Figure 12** shows the typical grounding arrangements for the Liebert FPC.

Equipment Grounding

Equipment grounding is primarily for safety. Correct implementation of grounding also enhances equipment performance. All power feeders must include equipment grounding means as required by the NEC and local codes.

An insulated ground conductor is recommended to be run in each feeder conduit. Ground conductors must be at least the minimum size per NEC Table 250-66. Larger wire sizes may be used for increased system performance.

If the input power feeder conduit is used as a grounding conductor, adequate electrical continuity must be maintained at all conduit connections.

CAUTION

Using isolating bushings in a metal conduit run can be a safety hazard and is not recommended.

Signal Reference Grid

If the unit is used to supply power to a computer room or area that is equipped with a signal reference grid or a grounded raised-floor stringer system, a grounding conductor should be connected from the system ground bus to the grid or floor system. This conductor should be stranded or braided #8 AWG or larger, and as short as practical. Less than 3 ft. (1m) is recommended.

1.3.4 Grounding Electrode Conductor for FPCs With Transformer

Required by code - The Liebert FPC with transformer must be grounded according to the safety practices of NEC 250-26. A local grounding electrode conductor is recommended in addition to the equipment safety ground which is normally run with the input power conductors. (See **Figures 5** through **8**.)

As shown in **Figure 12**, the grounding electrode conductor is run from the unit to the nearest effectively grounded location (listed in order of preference):

- Building steel
- Metal water pipe
- Other made grounding electrode

The grounding electrode conductor's size is based on the secondary circuit conductors. **Table 10** shows the minimum recommended grounding electrode conductor according to the NEC (Table 250-66).

Table 10 Minimum grounding electrode conductor size (AWG)

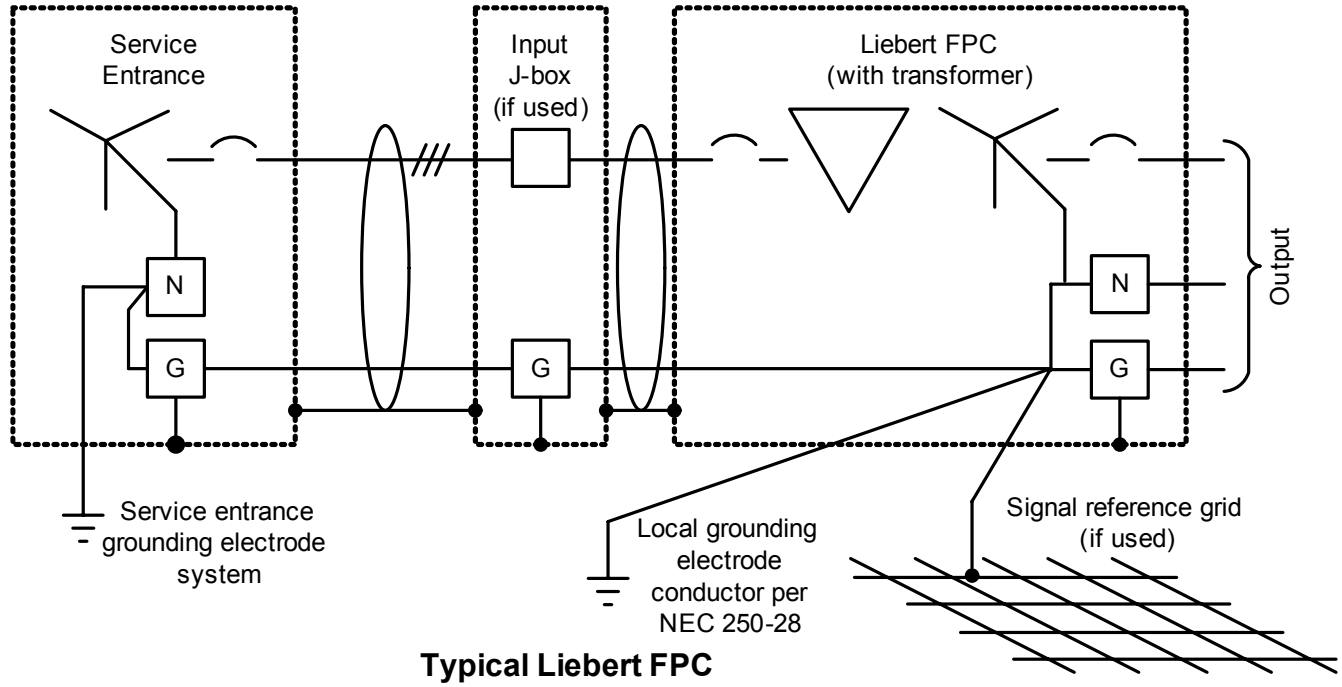
	Output Voltage		
kVA	208V	380V	415V
15	8	8	8
30	8	8	8
50	4	8	8
75	2	6	6
100	0	4	4
125	0	2	2
150	00	2	2
200	00	0	0
225	00	0	0
300	00	0	0

AWG wire size based on 75°C copper conductors

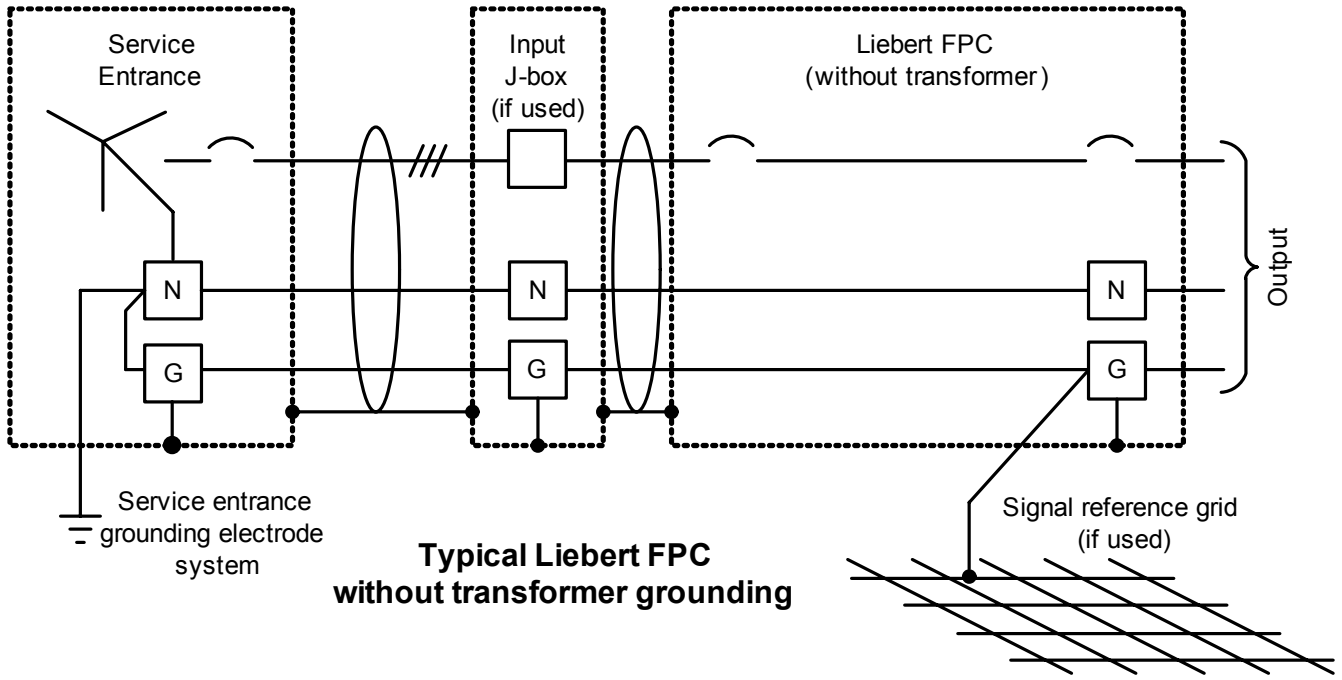
Recommended methods for running the grounding electrode conductor (arranged by preference for system performance; as acceptable by local and other applicable codes):

- Outside of conduit (where not subject to damage)
- Inside non-metallic conduit
- Inside non-ferrous conduit
- Inside ferrous conduit, bonded to the ferrous conduit at both ends, as acceptable by local and other applicable codes

Figure 12 Typical grounding arrangements



Typical Liebert FPC with transformer grounding arrangement



Typical Liebert FPC without transformer grounding

1.3.5 Output Power Connections

Output circuit breaker(s) and/or panelboards with ground and neutral provisions are provided inside the unit for connecting load(s) as required. (See **Figures 5** through **8**.)

Flexible output distribution cables for use in data processing areas under a raised floor are optional and may be factory-supplied. Cable lengths and layout should be well-planned:

- **Cable access**—Cable routes should follow aisles between equipment. This will facilitate access to cables for installation, routine inspection and alterations.
- **Cable length**—Measure the distance to the load equipment following right-angle paths, rather than diagonally or directly. Always measure to the extreme far side of the equipment with respect to the unit to ensure adequate cable length.
- **Air circulation**—Prevent restriction of airflow under the raised floor by running the flexible conduits flat on the subfloor, in parallel paths.

For best performance, the Liebert FPC should be installed as close as practical to the load.

Initial system output loading should be between 50% and 75% of rated capacity. This allows the addition of loads without immediately investing in another power conditioner. The high partial-load efficiency of the FPC permits such sizing without imposing an energy-use penalty during initial operation.

Balancing of loads is good design practice on any 3-phase system. Accordingly, each distribution panel is load-balanced at the factory, based on output branch circuit breaker sizes. All additions to the system should be arranged so as to preserve this balance.

For phase-shifted, multi-output units, to ensure proper harmonic current cancellation, the loads should be balanced across the multiple outputs as well. For example, with a dual-output unit, the loads should be balanced across the six output phases. For a quadruple output unit, the loads should be balanced across the 12 output phases.

WARNING

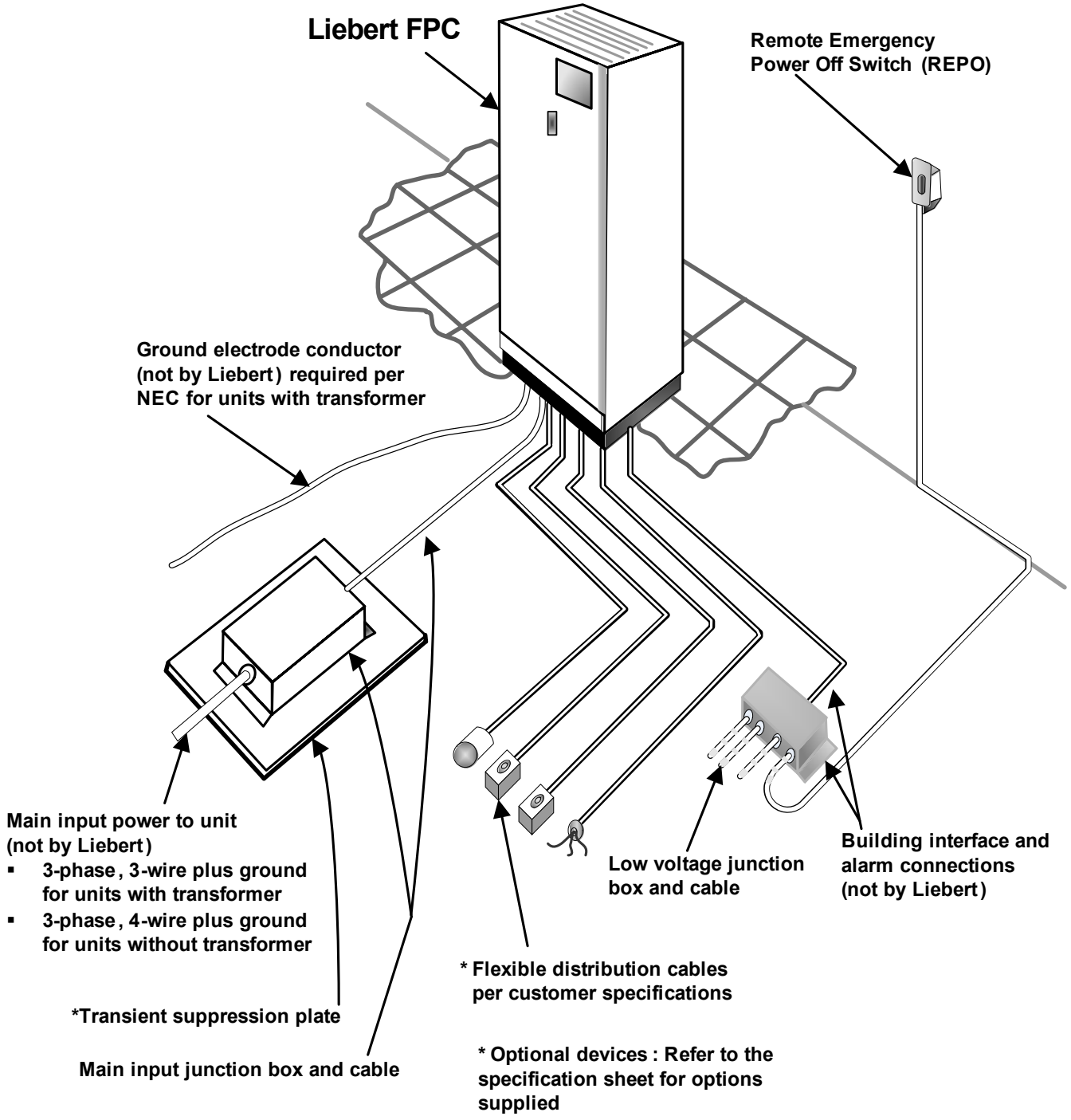
Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or output breakers or making connections, whether in the junction box or in the unit.

Verify that incoming line voltage circuits are de-energized and locked out before installing output breakers and cables.

Code Compliance—All output cables and connections must comply with the NEC and all other applicable codes.

Padlock-Off Provisions—All output cables without receptacles that are hard-wired to the load equipment must be equipped with a padlock-off accessory for the output circuit breaker. The padlock-off accessory is to be used to lock-out and tag the circuit breaker when service is performed on the hard-wired load equipment in accordance with OSHA safety rules.

Figure 13 Typical Liebert FPC equipment arrangement



1.3.6 Control Wiring Connections

NEC Article 645 requires that emergency power off (EPO) switches be located at the principal room exits. All standard Liebert power conditioning systems have provisions for external shutdown control from Remote Emergency Power Off (REPO) stations. **Figure 14** is a simplified diagram of the shutdown circuitry of the Liebert FPC.

Low-Voltage Control Circuit

Control wiring connections must comply with the NEC and all other applicable codes.

WARNING

Verify that all incoming high-voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

As shown in **Figure 14**, the control circuit operates on 24VDC. The shutdown device (represented by the REPO switch) activates a low-current, 24VDC relay that in turn operates the shunt-trip mechanism. The shunt-trip solenoid opens the Main Input Breaker, which de-energizes the power center.

Multiple-Unit Shutdown

When more than one power center is installed by the user, a typical requirement is that actuation of a single device (REPO for example) must shut down all power centers. The low-voltage control circuits of all standard Liebert FPC systems are designed to meet this requirement.

External Control Wiring Connections

External control wiring connections for remote shutdown, alarm, and/or monitoring are made to the low-voltage junction box (if used) or to the low-voltage control terminal strip located inside the unit.

Control wiring connections vary with the type of monitoring system furnished with the unit. Two typical control wiring configurations are shown in **Figures 15** and **16**.

Figure 14 Simplified shutdown circuit

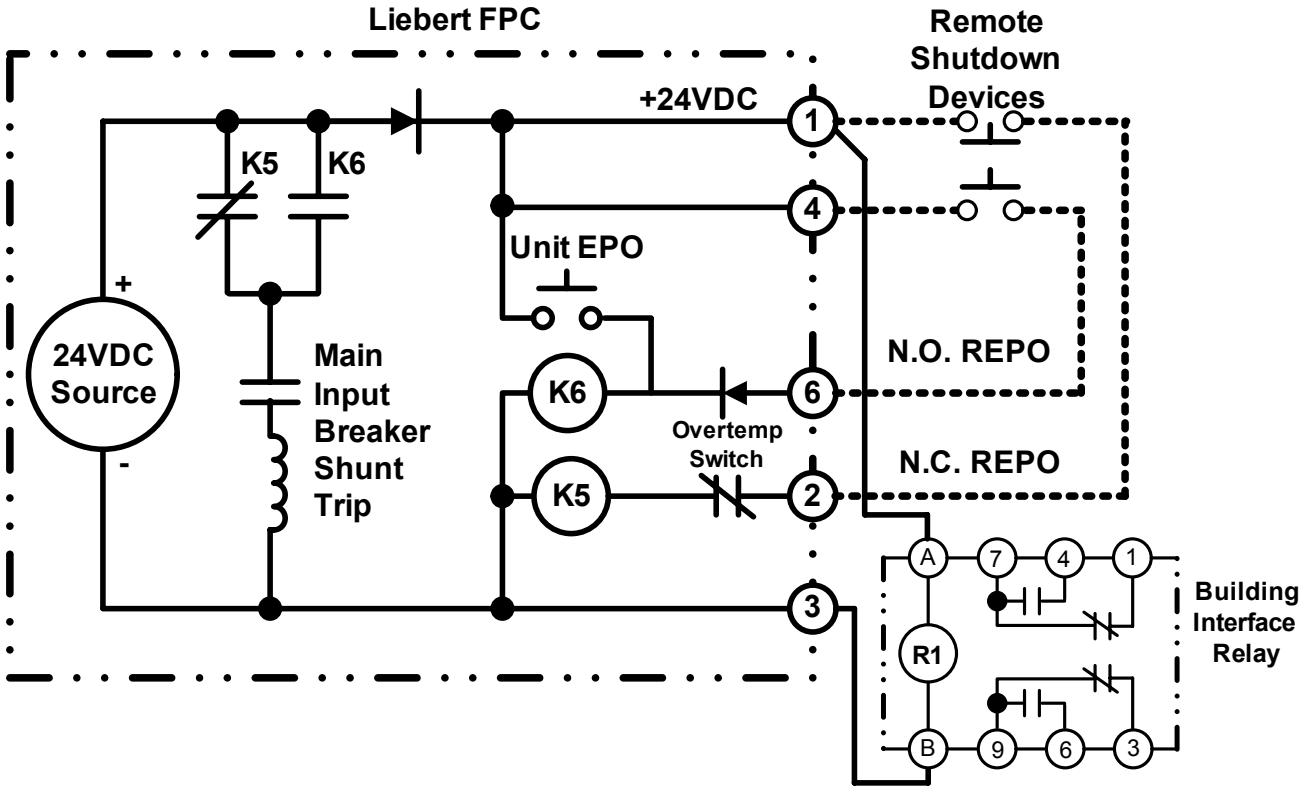
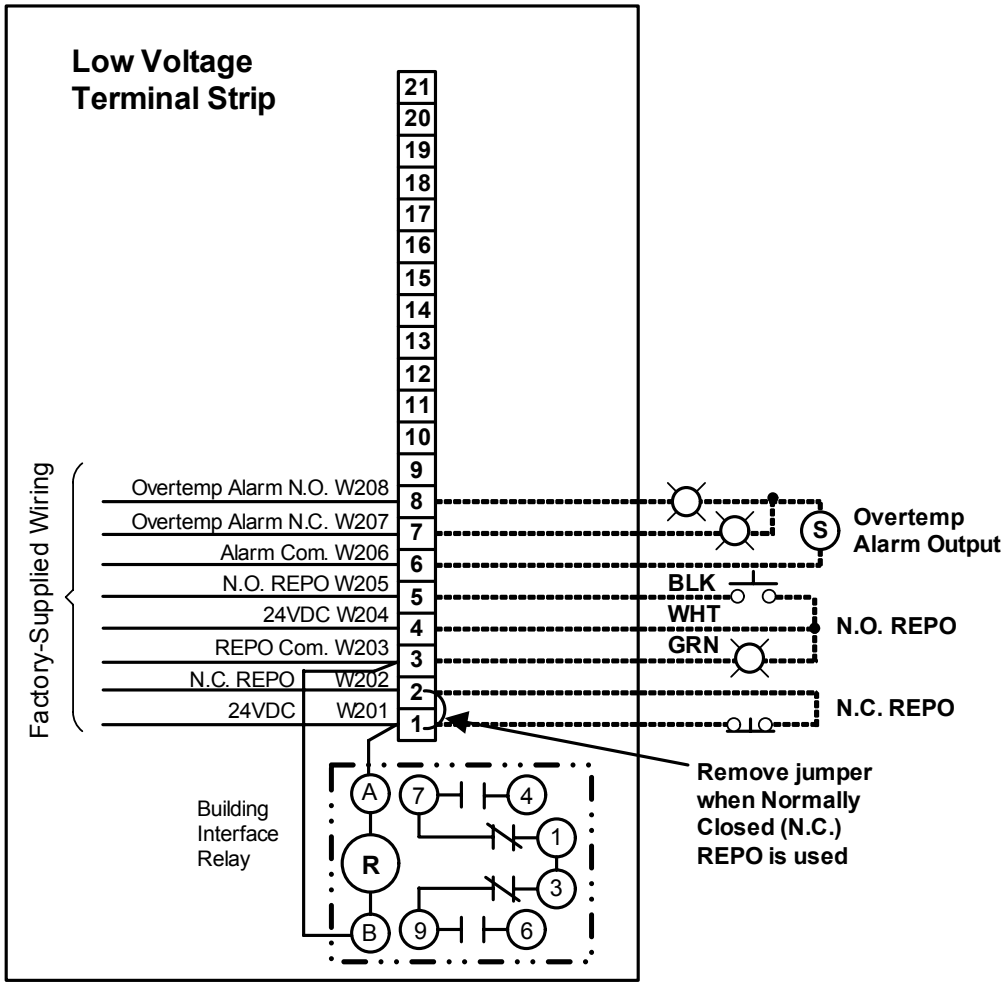


Figure 15 Typical control wiring for units without monitoring



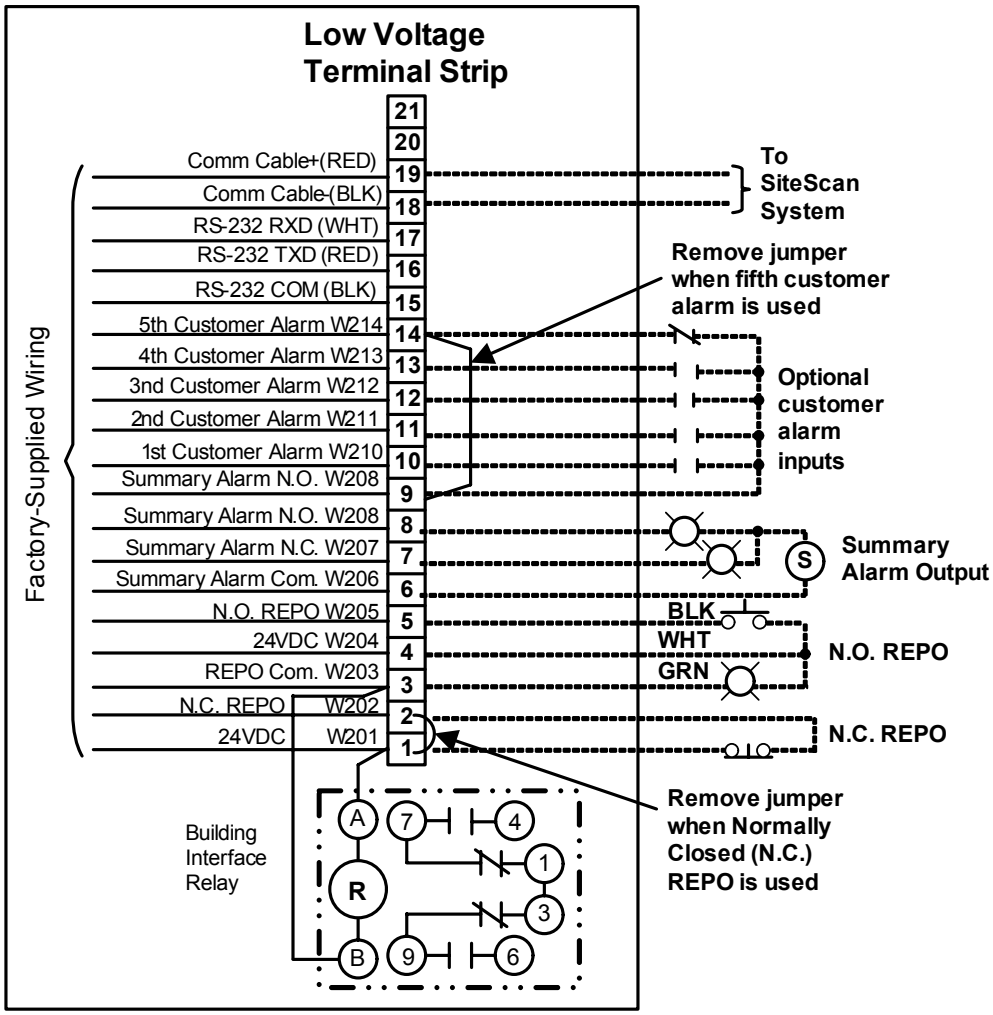
NOTES

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.

   All wiring and devices are field supplied except where noted. See installation manual for detailed installation procedures.
2. Low voltages terminal strip may be located in unit or low voltage control junction box.
3. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
4. Multiple normally open (N.O.) REPO switches may be paralleled.

   Multiple normally closed (N.C.) REPO switches may be connected in series. all lamps (if used) are connected in parallel.
5. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.

Figure 16 Typical control wiring for units with monitoring



NOTES

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.
   All wiring and devices are field-supplied except where noted.
   See installation manual for detailed installation procedures.
2. Low voltages terminal strip may be located in unit or low voltage control junction box.
3. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
4. Multiple normally open (N.O.) REPO switches may be paralleled.
   Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
5. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
6. Customer alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer alarm 5 is normally closed (indicates alarm on contact opening).
7. RS-232 communication port is connected to the low voltage terminal strip inside unit only. Connect using suitable 300V communication cable.

2.0 EQUIPMENT INSPECTION AND STARTUP

2.1 Internal Inspection

A detailed internal inspection should be performed after the unit is in place and before it is energized, to ensure trouble free startup. The same internal inspection should be carried out when performing preventive maintenance.

WARNING

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before performing the internal inspection.

Open the unit - Gain access to the internal components of the Liebert FPC unit by removing the exterior panels and internal accent panels.

Visually inspect - Be sure wiring and components are not damaged.

Check power connections - Check **all** power connections for tightness. Refer to **Tables 11** through **14** for torque requirements of all electrical connections.

Perform formal detailed inspection - Follow the procedures described in **3.0 - Inspection and Start-Up Checklist** when performing detailed inspection.

2.2 Startup

Checklists

Follow the detailed step-by-step checklist (**3.0 - Inspection and Startup Checklist**) when installing and starting up the Liebert FPC.

Initial System Startup

A qualified electrician must be employed to perform the equipment inspection and startup. Liebert system startup may be arranged by calling your local Liebert sales representative or Liebert Global Services. In the United States, call 1-800-LIEBERT.

Warranty

A copy of the appropriate checklist (furnished with the equipment) must be completed, signed, dated and returned to Liebert Corporation. Warranty coverage of the equipment is not effective unless the checklist has been received by the factory.

WARNING

Equipment inspection and startup should be performed only by trained personnel. Hazardous voltages are present during startup procedures.

Electrical safety precautions must be followed throughout inspection and startup.

Table 11 Torque specifications, general

	Electrical connections with 1 Belleville washer		Electrical connections with 2 Belleville washers	
	Torque		Torque	
	lb-in	N-m	lb-in	N-m
Bolt shaft size, in./mm				
1/4 / M6	40	4.5	80	9.0
5/16 / M8	80	9.0	180	18.0
3/8 / M10	120	13.6	240	27.1
1/2 / M12	480	54.3	—	—
Input and output breakers				
Up to 150 amp	80	9.0	160	18.0
175 - 500A	120	13.6	240	27.1

Table 12 Panelboard main circuit breaker torque specifications

	Torque	
	lb-in	N-m
Busbar-to-breaker	240	27.1

Table 13 Branch circuit breaker torque specifications

Breaker size	lb-in	N-m
Up to 30 amp	20	4.0
40 to 100 amp	20	5.1

Table 14 Terminal block compression lug torque specifications

AWG wire size or range	Torque	
	lb-in	N-m
#14 - #10	35	4.0
#8	40	4.5

3.0 INSPECTION AND STARTUP CHECKLIST

Unit Serial Number _____

Unit Model Number _____

Date _____

3.1 Inspection

WARNING

All equipment inspection procedures are to be performed with power to the unit turned off and locked out.

___ 1. Confirm that the exterior of unit is undamaged (including cables and receptacles, if furnished).

___ 2. Confirm that service and ventilation clearances are adequate. (See **Figures 1** through **3**.)

___ 3. Remove accessible exterior and internal panels.

___ 4. Inspect all wire and conductor insulation for damage.

___ 5. Check all transformer terminal connections for tightness. Retorque if necessary.

___ 6. Check all breaker connections for tightness. Retorque if necessary.

___ 7. Check all terminal block connections for tightness. Retorque if necessary.

___ 8. Check transformer mounting bolts for tightness. Retorque if necessary.

___ 9. Remove any foreign objects from the components or the interior area of the unit. Make sure air passages on transformers are clear and free of debris.

___ 10. Check that the intake and exhaust air screens are clean and free of obstructions.

___ 11. Replace internal and exterior side panels, leaving access to circuit breakers for the following start-up procedure.

3.2 Startup

WARNING

Startup procedures should be performed only by qualified personnel. Hazardous voltages are present in the equipment throughout the majority of the start-up procedure. Use proper safety equipment. proceed with caution.

When opening the main input circuit breaker wait a minimum of one minute before reclosing.

1. Make certain that all circuit breakers are in the OFF position and that power to the unit is locked out.

NOTE

***Steps 2** through **6** apply to the Main Input Junction Box. If this installation is not provided with a Main Input Junction Box, proceed to **Step 7**.*

___ 2. Remove the cover of the Main Input Junction Box. Verify proper input power connections to unit, including equipment grounding conductor.

___ 3. Turn ON the building power to the junction box. Check the phase rotation at the junction box. Phase rotation should be A, B, C, as indicated.

___ 4. Check and record the input voltages at the junction box:

Volts, Phase A to Phase B = _____

Volts, Phase B to Phase C = _____

Volts, Phase C to Phase A = _____

___ 5. Turn OFF and lock out the building power to the input junction box.

___ 6. Replace the junction box cover.

___ 7. Verify proper input power connections to unit, including equipment grounding conductor and local grounding electrode conductor.

___ 8. Turn ON the building input power to the unit.

___ 9. Check the phase rotation at the main input breaker. Phase rotation should be A, B, C, left-to-right.

___ 10. Check and record the input voltage at the main input breaker. Measured voltages should correspond to the unit's nameplate input voltage.

Volts, Phase A to Phase B = _____

Volts, Phase B to Phase C = _____

Volts, Phase C to Phase A = _____

___ 11. Turn ON the main input breaker; wait one minute. (If breaker trips OFF, check for wiring errors including control connections. Contact Liebert Global Services or the location factory representative for assistance.)

___ 12. Check the phase rotation at the line side terminals (top) of the panelboard main breaker(s) and any subfeed output circuit breaker(s). The rotation should be A, B, C, left-to-right.

___ 13. Check and record the voltages at the line-side terminals of the output circuit breaker. Measured voltages should correspond to the unit's nameplate output voltage (within +4%,-0%).

Volts, Phase A to Phase B = _____

Volts, Phase B to Phase C = _____

Volts, Phase C to Phase A = _____

Volts, Phase A to Neutral = _____

Volts, Phase B to Neutral = _____

Volts, Phase C to Neutral = _____

If output voltage is incorrect, check for wiring errors, incorrect input voltage, or improper transformer tap. Contact Liebert Global Services at 1-800-LIEBERT in the United States or your local Liebert representative for assistance.

NOTE

The Liebert FPC transformer has input voltage taps for each input phase. The taps are arranged in 2-1/2% or 5% intervals ranging from -10% to nominal to +5%. This permits the transformer to provide the proper output voltage for a range of input voltages. Should it be necessary, the tap arrangement may be changed to match the input voltage:

- *Open main input circuit breaker.*
- *Select tap arrangement to match input voltage. (Refer to transformer nameplate for tap information.)*
- *Secure each line to its proper tap.*
- *Repeat **Steps 11** to **13**.*

___ 14. Press the local EMERGENCY POWER OFF switch, if supplied, and verify system shutdown. Turn the unit back on.

___ 15. Repeat **Step 14** for each remote EMERGENCY POWER OFF switch with which the system is equipped.

CAUTION

The Remote Emergency Power Off switch may shut down more equipment or systems than just the Liebert FPC.

3.3 Monitoring System Check-Out

Basic Indicators

___ 1. Turn ON the building power to the unit, then turn the main input breaker ON.

___ 2. Check that the local EMERGENCY POWER OFF button, if supplied, is illuminated and that the ALARM PRESENT / SILENCE indicator is off.

Manual Restart Check

If the Liebert FPC is equipped with Manual Restart:

___ 1. Turn on building power to the FPC. Turn Main Input Breaker ON.

___ 2. Turn off all building power to FPC.

___ 3. Observe that Main Input Breaker automatically trips open upon power loss.

___ 4. Restore building power to the FPC and return Main Input Breaker to ON.

Power Monitor Panel

If the Liebert FPC is equipped with a Power Monitor Panel:

___ 1. Turn ON the FPC.

___ 2. Ensure that the voltage values indicated by the Monitor Panel correspond to the voltage values measured at the input and output circuit breaker (**Steps 10** and **13** in **3.2 - Startup**).

Centralized Monitor

If the Liebert FPC is connected to a Centralized Monitoring System:

___ 1. Turn ON the FPC and the Centralized Monitoring System.

___ 2. Verify proper communication to the monitor system operation.

Control Voltage

___ 1. Obtain access to the low voltage terminals in the Low-Voltage Junction Box (if used), or in the low-voltage control section inside unit.

___ 2. With the FPC ON, measure and record the DC control voltage on terminals 1 (+) and 3 (com).

___ 3. Control Voltage = _____ (Voltage should be between 16 and 23VDC).

Customer Alarms

If customer alarms are provided:

___ 1. With the FPC ON, simulate alarm operation by jumpering the appropriate low-voltage control terminals. (Refer to the control wiring installation drawing furnished with the unit.)

___ 2. Verify correct alarm annunciation by the Power Monitor Panel and/or by the Centralized Monitoring System.

3.4 Equipment Connection Check-Out of Units With Distribution Cables

CAUTION

All loads should be disconnected or turned off before proceeding with the following steps.

For units with output distribution cables, be sure that NO output receptacles are connected to load equipment plugs and that the receptacles are not in contact with foreign objects.

Pay special attention to those output cables intended for direct wiring connection; the exposed conductor ends of these cables must not be in contact with each other or with any foreign objects.

___ 1. Turn on main input power to the unit, then turn on the panelboard main output breaker(s).

___ 2. Individually turn on each branch circuit breaker and check the output voltage (also phase rotation, if a 3-phase circuit) at the receptacle or cable end.

___ 3. Turn OFF all branch circuit breakers and the panelboard main output circuit breaker(s).

___ 4. Connect the load equipment per equipment manufacturer's specifications and recommendations.

___ 5. Turn on the panelboard main output breaker(s).

___ 6. Turn on branch circuit breakers to the load equipment.

CAUTION

Observe the power-up sequence recommended by the equipment manufacturer.

___ 7. Verify that all load equipment operates properly.

___ 8. Replace all unit panels. After performing the inspection and start-up procedure described in **3.0 - Inspection and Startup Checklist** in this manual, complete the Start-Up and Inspection form furnished with the unit, sign the completed form and return it to:

Liebert Corporation
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

NOTE

Warranty is not in effect until the inspection and startup form is received by the factory.

4.0 OPERATING INSTRUCTIONS

4.1 Startup Procedures

Before the unit is placed into service after initial installation, after equipment relocation, or after equipment has been de-energized for an extended period of time, perform equipment inspection and start-up procedures as detailed in **2.0 - Equipment Inspection and Startup** and **3.0 - Inspection and Startup Checklist**.

After initial system startup, the following guidelines can be used for standard equipment operation. These guidelines should be reviewed for any special equipment modifications, special site considerations or company policies that may require changes to the standard equipment operation.

4.1.1 Emergency Shutdown—If Emergency Power Off switch is supplied

To perform an immediate system shutdown during emergency conditions, lift the clear protective cover and push the Emergency Power Off (EPO) switch on the FPC's monitoring panel.

NOTE
Depending on the particular control circuit wiring, operation of the unit EPO switch may cause other equipment to also shutdown.

If the site is equipped with a Remote Emergency Power Off (REPO) switch to perform an immediate room shutdown, actuate one of the REPO switches. NEC Article 645 requires a REPO switch at the principal exit doors.

4.1.2 Normal System Shutdown

To perform a normal system shutdown, perform an orderly load equipment shutdown according to the load equipment manufacturer's recommended shutdown sequence. The load equipment can be turned OFF at each piece of load equipment or at the FPC's output distribution (circuit breaker) panels located behind the FPC's front door. Turn OFF all unit output breakers, then turn OFF the unit's main input circuit breaker. To remove all power from the FPC, turn OFF the building power to the FPC's input breaker or junction box.

4.1.3 Normal System Turn ON

Make certain all of the FPC's circuit breakers are in the OFF position. All unit circuit breakers are located behind the front doors. Turn ON building power to the FPC. Turn ON the FPC's main input circuit breaker. If the circuit breaker has been tripped OFF (instead of being turned OFF), the circuit breaker handle must be moved to the OFF position before being turned ON. If the FPC has a voltage monitoring panel, verify proper output voltages before turning ON output circuit breakers. Turn ON the panelboard main breakers. Individually turn ON each output circuit breaker following the load equipment manufacturer's startup sequence.

4.1.4 Manual Restart

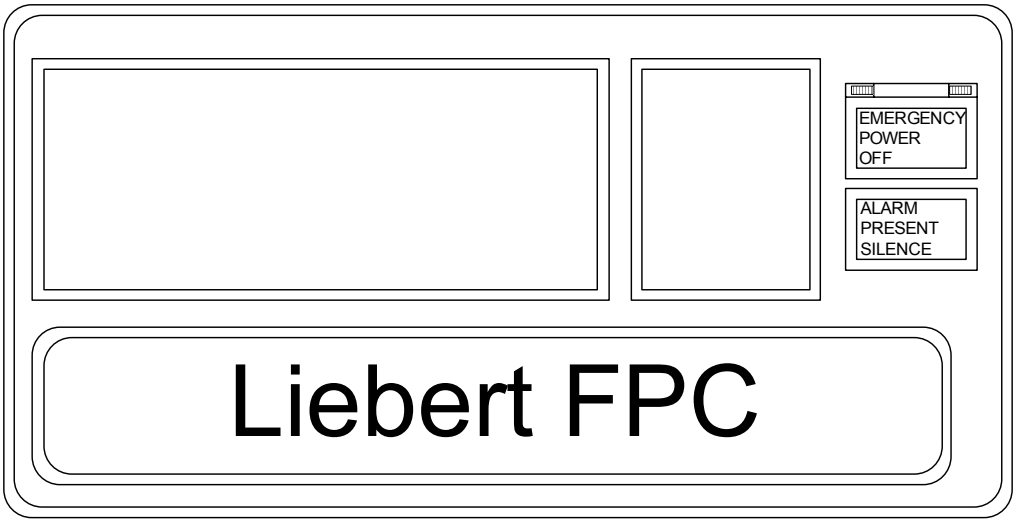
If the FPC's manual restart feature has been selected, the unit's main input circuit breaker will be tripped upon a power failure, preventing repetitive application of unstable voltage and allowing for an orderly system restart. If the main input circuit breaker is tripped upon a power failure, wait until power is restored, then follow the instructions in **4.1.3 - Normal System Turn ON**.

4.2 Basic Monitor Panel (Units Without Monitoring)

Alarm Present/Silence

Upon occurrence of a transformer overtemperature condition, the "Alarm Present/Silence" switch will become illuminated and the audible alarm will be activated. Pushing the "Alarm Present/Silence" switch will silence the audible alarm. The cause of the overtemperature condition should be investigated and corrected. Possible causes include transformer overload, excessive non-linear loading, inadequate ventilation, high or low input voltage, or monitoring malfunction. Failure to correct the overtemperature condition may result in an automatic system shutdown due to the second stage of overtemperature sensing. After correction of the alarm condition, the alarm will automatically reset.

Figure 17 Basic monitoring panel

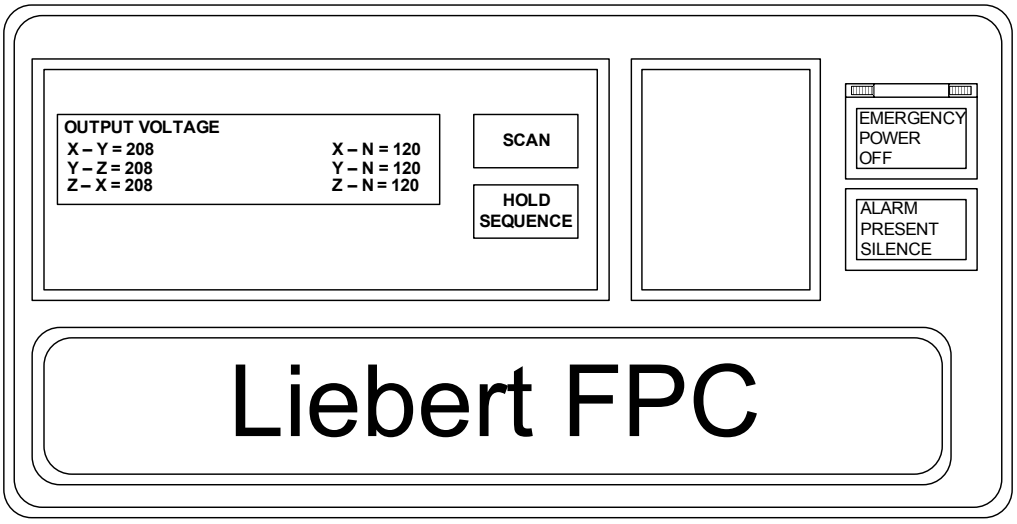


FPC16000

4.3 Power Monitor Panel

Monitored Parameters - A 4 x 20 character LCD is provided to indicate the input voltages (line-to-line), output voltages (line-to-line and line-to-neutral), output currents (each phase, neutral and ground), output voltage THD, output current THD, crest factor, K-factor, output kVA, kW, kWH, power factor, percent load and output frequency. Pressing the Scan switch will activate the "Autoscan" mode where all monitored parameters are sequentially displayed automatically. Momentarily pressing the "Hold/Sequence" switch interrupts the "Autoscan" mode. Pressing the "Hold/Sequence" switch allows manual selection of the sequentially displayed parameters.

Figure 18 Power monitor panel



FPC16001

Alarms - Upon occurrence of any of the following alarms, the alarm message appears on the LCD display, the Alarm Present/Silence switch is illuminated, and the audible alarm is activated. Pressing the "Alarm Present/Silence" switch silences the audible alarm. After the alarm condition is corrected, the alarm can be reset by pressing the "Alarm Present/Silence" switch when prompted by the LCD display or by way of any Central Monitoring System.

- **Output Overvoltage** - Indicates one or more of the output phase voltages has exceeded the preset limit (normally +6% of nominal). The high output voltage should be verified and corrective action taken. In the absence of other procedures, a normal (orderly) system shutdown should be performed to prevent load equipment damage.
- **Output Undervoltage** - Indicates one or more of the output phase voltages has exceeded the preset limit (normally -13% of nominal). The low output voltage should be verified and corrective action taken. In the absence of other procedures, a normal (orderly) system shutdown should be performed to prevent load equipment damage.
- **Output Voltage THD** - Indicates that the voltage distortion on one or more of the output phases has exceeded the preset limit (normally 10% THD). The cause of the high output voltage distortion should be investigated and corrective action (if any) taken.
- •T**ransformer Overtemp** - Indicates a unit transformer overtemperature condition. The cause of the overtemperature condition should be investigated and corrected. Possible causes include unit overload, excessive non-linear loading, inadequate ventilation, high or low input voltage, or monitoring malfunction. Failure to correct the overtemperature condition may result in an automatic system shutdown due to the second stage of overtemperature sensing.
- **Output Overcurrent** - Indicates one or more of the output phase currents has exceeded the preset limit (normally 95% of the unit's full load amp rating). The overcurrent condition should be verified and corrective action taken. In the absence of other procedures, some of the output loads should be turned off to reduce unit loading. If unbalanced phase currents exist, some of the loads should be shifted from the higher loaded phase(s) to the lower loaded phase(s).
- **Neutral Overcurrent** - Indicates that the neutral current has exceeded the preset limit (normally 95% of the unit's full load amp rating). The overcurrent condition should be verified and investigated to see if corrective action is required. In some cases, high neutral current indicates phase current unbalance which should be corrected. Where high neutral currents are the result of harmonic load currents, all affected components (including output wiring) should be verified to be suitable for the current.
- **Frequency Deviation** - Indicates that the output frequency has exceeded preset limits (normally Ø0.5 Hz). The frequency deviation should be verified and the cause investigated and corrected.
- **Phase Sequence Error** - Indicates that the output phase sequence is not A, B, C. The phase sequence should be verified and corrective action taken. Three-phase loads sensitive to phase sequence should not be operated without proper phase sequence.
- **Phase Loss** - Indicates that one or more of the phase voltages is low or missing. The low voltage condition should be verified and corrective action taken. In the absence of other procedures, a normal (orderly) shutdown should be performed to prevent equipment damage.
- **Ground Overcurrent** - Indicates the system ground current has exceeded the preset limit (normally 5 amps). The overcurrent condition should be verified and corrective action taken. Possible causes are wiring errors, ground faults, or excessive leakage current.
- **Customer Alarms (5)** - Indicates customer-designated alarms. The cause and corrective action depend on the nature of the alarm. See **1.3.6 - Control Wiring Connections** for contact closure connection information.

To Set Unit Clock - To set the clock from the unit front panel, simultaneously press the Scan and Hold membrane switches while the time and date screen is displayed on the LCD. A cursor should appear on the selected time and date field. Use the Scan switch to increment the highlighted field and the Hold switch to decrement the highlighted field. Use the Silence push button to select the next time and date field. The time can be displayed in AM/PM or 24-hour format. Simultaneously press the Scan and Hold switches to exit the clock set screen.

RS-232 ASCII Communications Port - Units with power monitoring are equipped with an isolated RS-232 ASCII Communications Port, which allows access to unit monitored parameters and alarm information. The RS-232 port connections are located on the low voltage control terminal strip inside the unit. See typical control wiring in **Figure 16**.

The ASCII interface default parameters are shown in **Table 15**.

Table 15 ASCII interface default parameters

Parameter	Default
Interface	RS-232 using EIA voltage levels
Baud rate	9600
Parity	None
Data bits	8
Stop bits	1
Terminator	<CR>
Hand shaking	Not supported
Structure	Half-duplex
Echo	OFF
Change to receive after transmit	1.28 msec
Minimum delay to transmit after receive	120 µsec
Maximum response time turn around	300 msec
Maximum response completion time	500 msec
Minimum delay between commands	500 msec
Maximum intercharacter delay	12.5 msec

The ASCII port uses a Query-Response Format.

Table 17 shows the list of available customer commands. Only one command is serviced at a time. Valid commands are terminated with a carriage return [0Dh]. Commands are accepted in upper or lower case. Responses are in upper case, terminated with a line feed [0Ah] and carriage return [0Dh].

Table 16 RS-232 ASCII port customer commands

Command	Description	Typical Response
Time? <CR> Date? <CR>	Unit: Time Unit: Date	03:40:37A<LF><CR> 05-15-97<LF><CR>
UID? <CR> kVA? <CR> V? <CR>	Unit ID Nominal kVA Nominal L-L Voltage	Unit_No._PDU_21B____<LF><CR> 0150<LF><CR> 0208<LF><CR>
SS1? <CR>	System Information (20-character fields with comma separators)	UNIT_MODEL_NUMBER___SERIAL NUMBER_____ SITE_ID_NUMBER_____TAG_NUMBER_____<LF><CR>
SA? <CR>	Number of Active Alarms (20-character alarms with time stamp)	02, OUTPUT_OVERVOLTAGE__05-15-97,01:25:30A OUTPUT_OVERCURRENT__05-15-97,01:27:46A<LF><CR>
UPMD? <CR>	Monitored Parameters (32 comma-separated data fields—see **Table 17** for descriptions of field positions)	0484,0485,0483,0210,0212,0211,0121,0122,0121,0068, 0085,0120,0131,0018,0030,0092,0033,0600,0038,0041, 0043,0549,0632,0599,0000,1528,0018,0019,0020,0045, 0047,0049,0044<LF><CR>

Table 17 Monitored parameters data definitions

Field #	Data item	Units
1	Input Voltage A-B	Volts
2	Input Voltage B-C	Volts
3	Input Voltage C-A	Volts
4	Output Voltage X-Y	Volts
5	Output Voltage Y-Z	Volts
6	Output Voltage Z-A	Volts
7	Output Voltage X-N	Volts
8	Output Voltage Y-N	Volts
9	Output Voltage Z-N	Volts
10	Output Current X	Amps
11	Output Current Y	Amps
12	Output Current Z	Amps
13	Neutral Current	Amps
14	Ground Current	0.1 Amps
15	Output Power	kW
16	Power Factor	0.01 Power Factor
17	Output Power	kVA
18	Output Frequency	0.1 Hz
19	Output Vx THD	0.1%
20	Output Vy THD	0.1%
21	Output Vz THD	0.1%
22	Output Ix THD	0.1%
23	Output Iy THD	0.1%
24	Output Iz THD	0.1%
25	Output kW-Hrs	kW-Hrs
26	Output Ix Crest Factor	0.1
27	Output Iy Crest Factor	0.1
28	Output Iz Crest Factor	0.1
29	Output Ix K-Factor	0.1
30	Output Iy K-Factor	0.1
31	Output Iz K-Factor	0.1
32	Output Loading	% of Full Load

5.0 MAINTENANCE

5.1 Repair

Even the most reliable equipment may fail. Liebert Global Services is at your service to assure fast repair of your unit and minimum downtime of your installation.

WARNING
Only qualified service personnel should perform maintenance on the Liebert FPC system.

Standard electrical troubleshooting procedures should be used to isolate problems in the unit. If there are questions, don't hesitate to contact Liebert Global Services.

Repair or replacement of standard items, such as circuit breakers, fuses, transformers, capacitors and indicator lights can either be handled by qualified electricians or referred to Liebert Global Services.

Repairs related to the monitoring system should be referred to Liebert Global Services. To contact LGS for information or repair service in the United States, call 1-800-LIEBERT.

5.2 Inspection and Cleaning

Air circulation through the cabinet may cause dust to accumulate on internal components. Cleaning should be done as necessary during electrical inspections.

Annual general system inspections, cleaning, and operation checks are recommended to ensure system performance and long service life.

WARNING
Only qualified service personnel should perform maintenance on the Liebert FPC system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

5.2.1 Inspection Schedule

- It is difficult to establish a schedule for periodic cleanings because conditions vary from site to site. Inspections after the first 24 hours, 30 days and 6 months of operation should help determine a pattern for the inspection schedule.
- Electrical connections and component mountings should be inspected after the first 24 hours, 30 days, and 6 months of operation. Inspections should be conducted annually thereafter.
- Ventilation openings and grilles should be inspected and cleaned every 6 months to one year.
- A complete inspection and operational checkout should be performed annually. This is best done by performing the inspection and start-up procedure as detailed in **3.0 - Inspection and Start-up Checklist**.
- LGS offers a complete range of preventive maintenance services. These include thorough equipment performance checks and calibration of electronics. Contact Liebert Global Services in the United States by calling 1-800-LIEBERT for details.

Ensuring The High Availability 0f Mission-Critical Data And Applications.

Emerson Network Power, the global leader in enabling business-critical continuity, ensures network resiliency and adaptability through a family of technologies—including Liebert power and cooling technologies—that protect and support business-critical systems. Liebert solutions employ an adaptive architecture that responds to changes in criticality, density and capacity. Enterprises benefit from greater IT system availability, operational flexibility and reduced capital equipment and operating costs.

Technical Support / Service
Web Site
www.liebert.com
Monitoring
800-222-5877
monitoring@emersonnetworkpower.com
Outside the US: 614-841-6755
Single-Phase UPS
800-222-5877
upstech@emersonnetworkpower.com
Outside the US: 614-841-6755
Three-Phase UPS
800-543-2378
powertech@emersonnetworkpower.com
Environmental Systems
800-543-2778
Outside the United States
614-888-0246

Locations
United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Europe
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257
Asia
7/F, Dah Sing Financial Centre
108 Gloucester Road, Wanchai
Hong Kong
852 2572220
Fax: 852 28029250

SL-20412_REV04_09-07

Emerson Network Power.

The global leader in enabling *Business-Critical Continuity*.

EmersonNetworkPower.com

- **AC Power**
- Connectivity
- DC Power
- Embedded Computing
- Embedded Power
- Monitoring
- Outside Plant
- Power Switching & Controls
- Precision Cooling
- Racks & Integrated Cabinets
- Services
- Surge Protection