CALTECH – Pasadena, CA

Power Distribution Unit
225kVA PDU with (3) 42ckt Panel Distribution

BILL OF MATERIAL

ITEM 3 Eaton Powerware - Power Distribution Unit (PDU)

Qty (3) - 225kVA Power Distribution Unit
Each with:
(3) 42Ckt Panel Board(Branch Breakers by contractor)

Input Voltage:	480VAC, three phase, 3 wire plus ground, 60 Hertz
Output Voltage:	120/208 VAC, three phase, 4 wire plus ground, 60 Hertz

Each Module shall consist of the following:

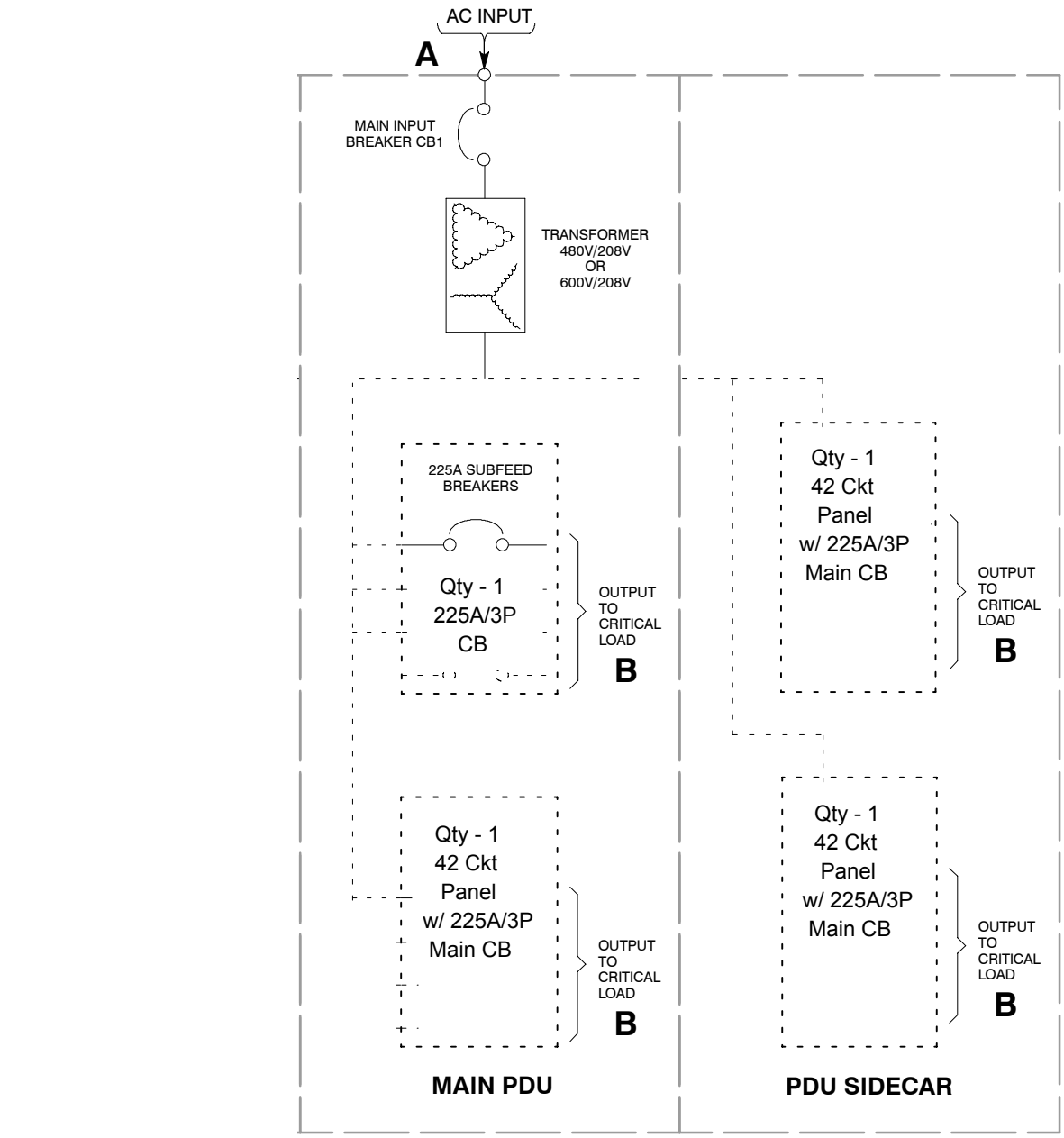
1 - Main Input Circuit Breaker (35kAIC)
1 - Input Line Arrestor
1 – Level 2 LCD Digital Display Panel with System Monitoring
1 - 225kVA - K13 Transformer : 480 to 120/208VAC, 3Ø, 4W
3 - 42-Circuit Panel Board each with 225A/3P Main CB and with Top/Bottom cable exit.
1 - SNMP/Modbus TCPIP Network Interface Card
1 - Emergency Power Off (EPO)
1 - Operation Manual
1 - Start Up and One Year Warranty (provided during normal hours-7x24)
1 - 18" Seismic Floor stand

PDU Dimensions/Weight: 55.6"Wide x 32.0"Deep x 75"High

NOTES

1. The above scope does not include offload, move or installation. Offload, move and installation is assumed to be provided by the installing electrical contractor or electrician. Equipment is shipped standard freight. It is assumed that contractor will offload and move into building.

2. Seismic anchoring is the responsibility of the contractor and not part of our scope. Anchoring attachments(angle brackets) are not included in this proposal or available by Eaton Powerware. Anchoring may require rear or side access. Seismic calculations can be added at additional cost.

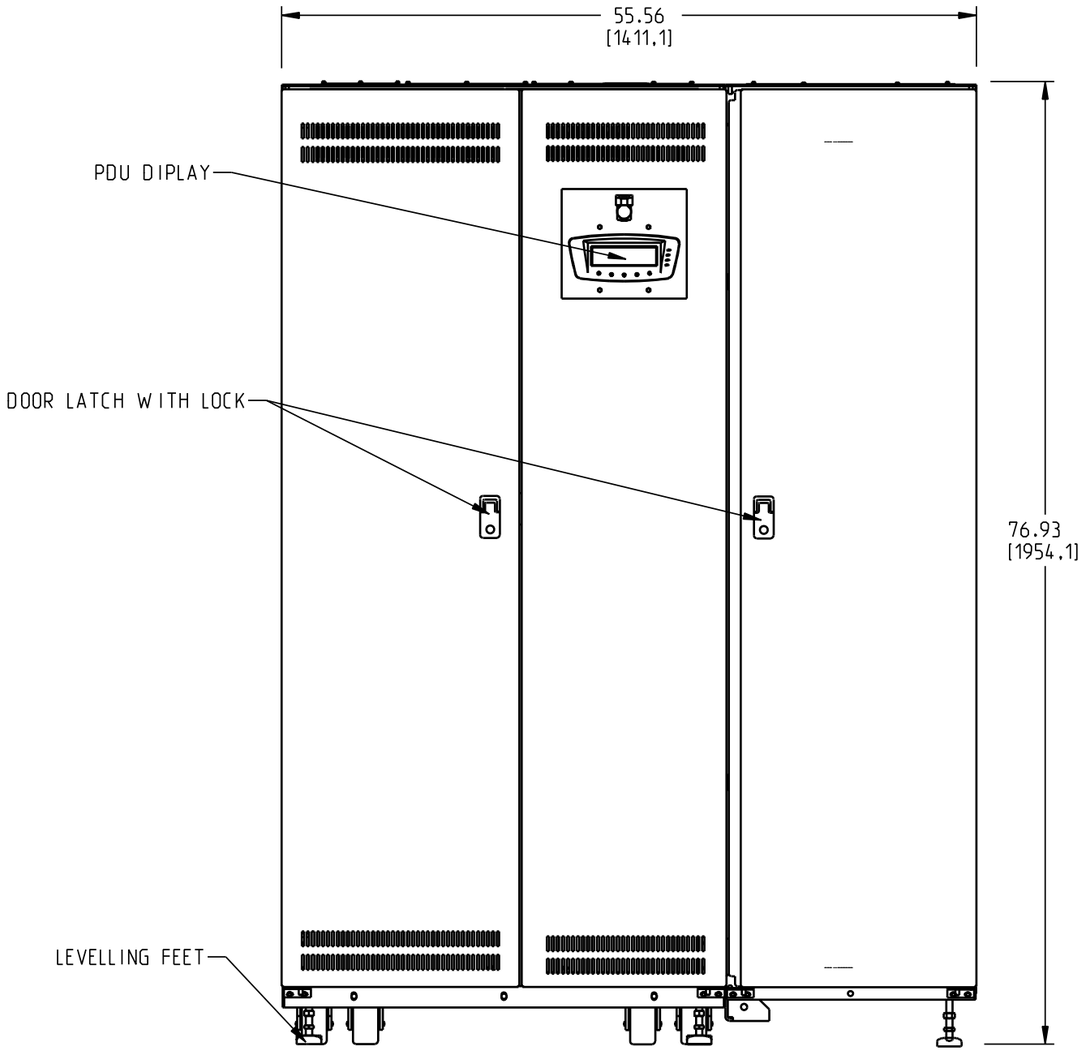


MAIN PDU AVAILABLE WITH OPTIONS FOR UP TO EIGHT 225A SUBFEED BREAKERS.
SIDECARS AVAILABLE WITH OPTIONS FOR ONE OR TWO 42-POLE 225A DISTRIBUTION PANELS.

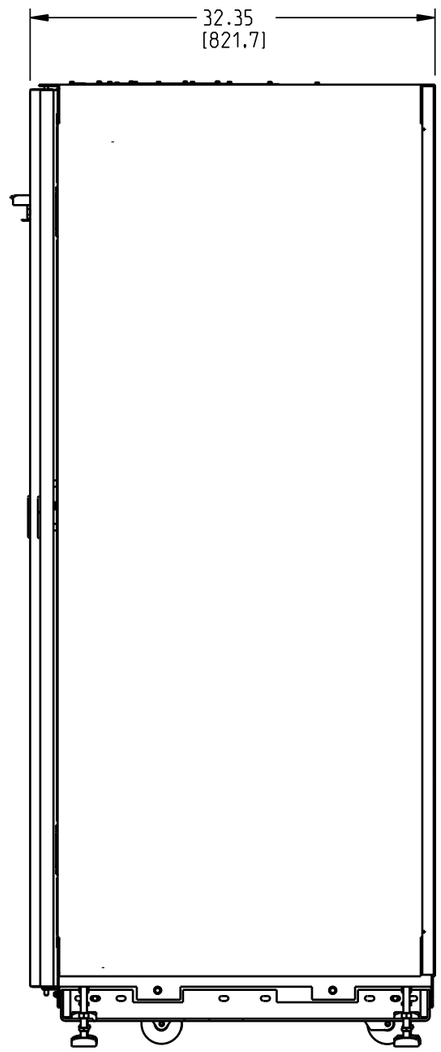
SUBFEED BREAKER OUTPUT
480V INPUT AND 208/120V OUTPUT
600V INPUT AND 208/120V OUTPUT

DESCRIPTION:	**PDU ONELINE DRAWINGS**		
DRAWING NO:	164201629–3	*SHEET:*	6 of 6
REVISION:	A	*DATE:*	041506

PDU WITH RIGHT FMSC TOP VIEW



PDU WITH RIGHT FMSC SIDE VIEW

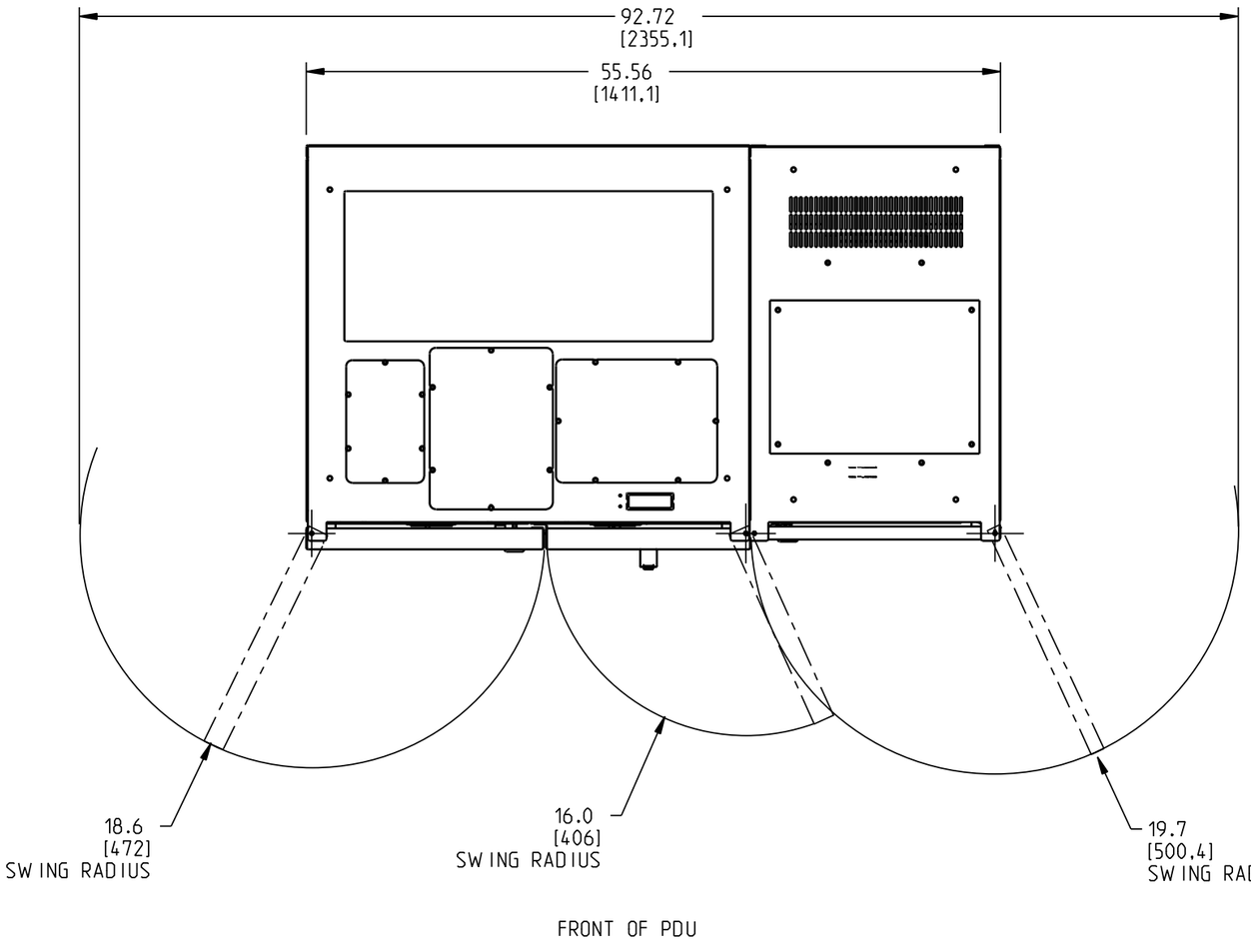


EATON | **Electrical**

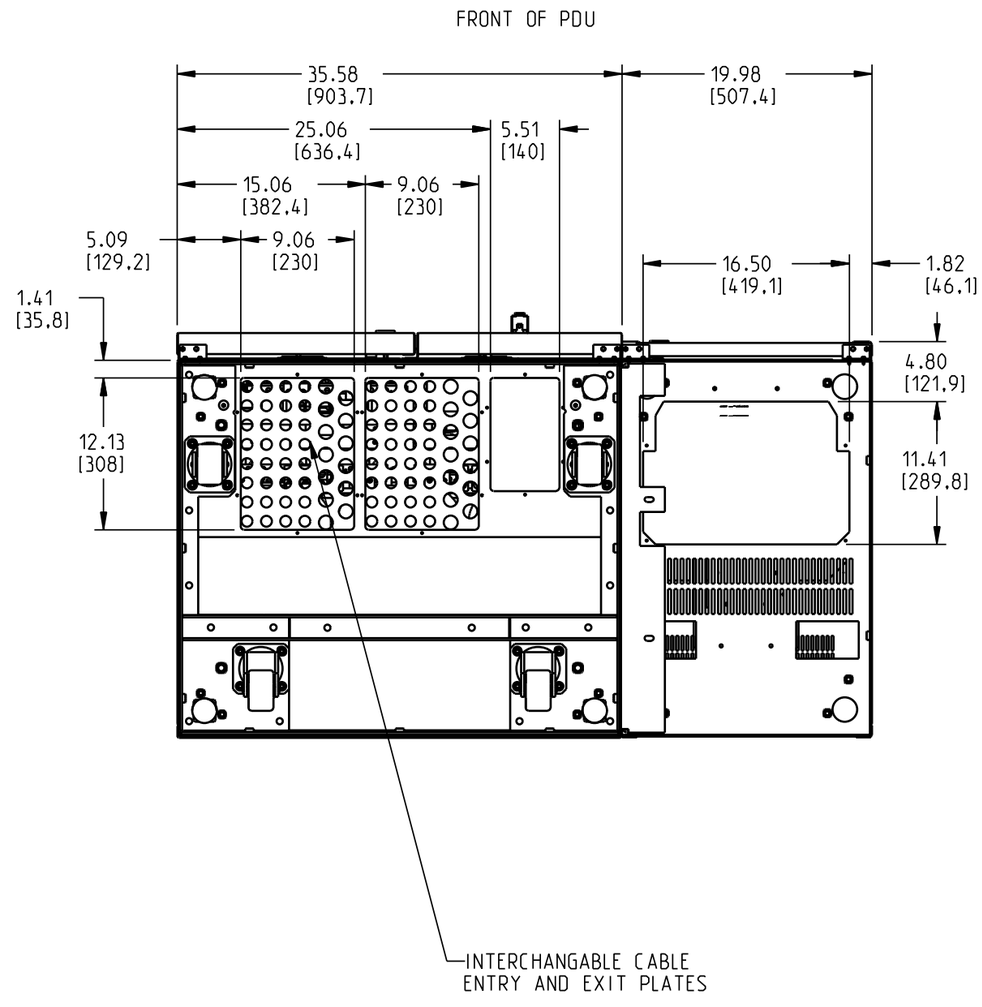
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PROJECT/GROUP: POWERWARE PDU		SCALE: 0.085
DESCRIPTION: GENERAL PDU LAYOUT RIGHT MOUNT SIDECAR		
DRAWING NO: CE71227	REVISION: 1	SHT: 5 OF 14

PDU WITH RIGHT FMSC TOP VIEW

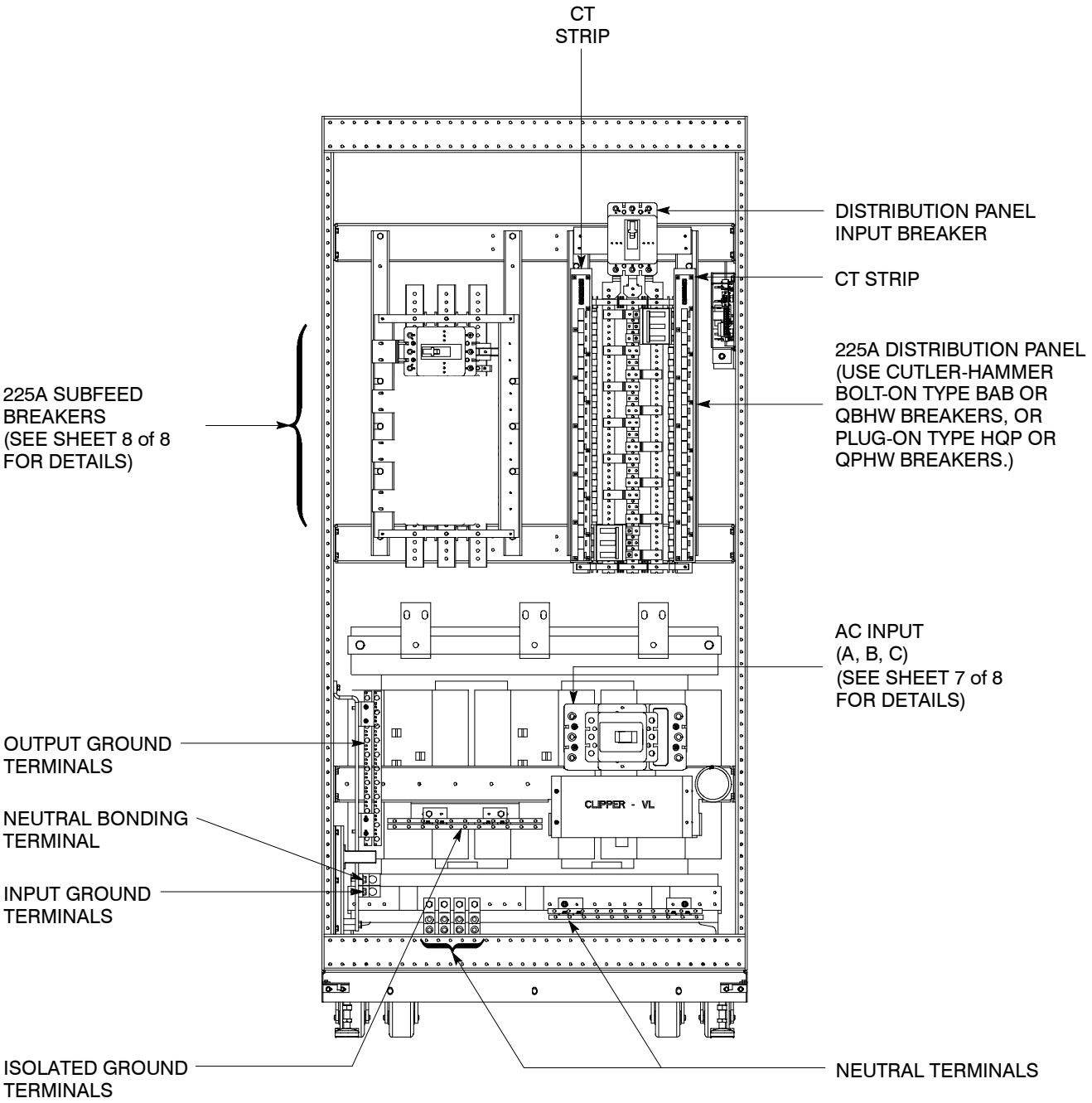


PDU WITH RIGHT FMSC BOTTOM VIEW



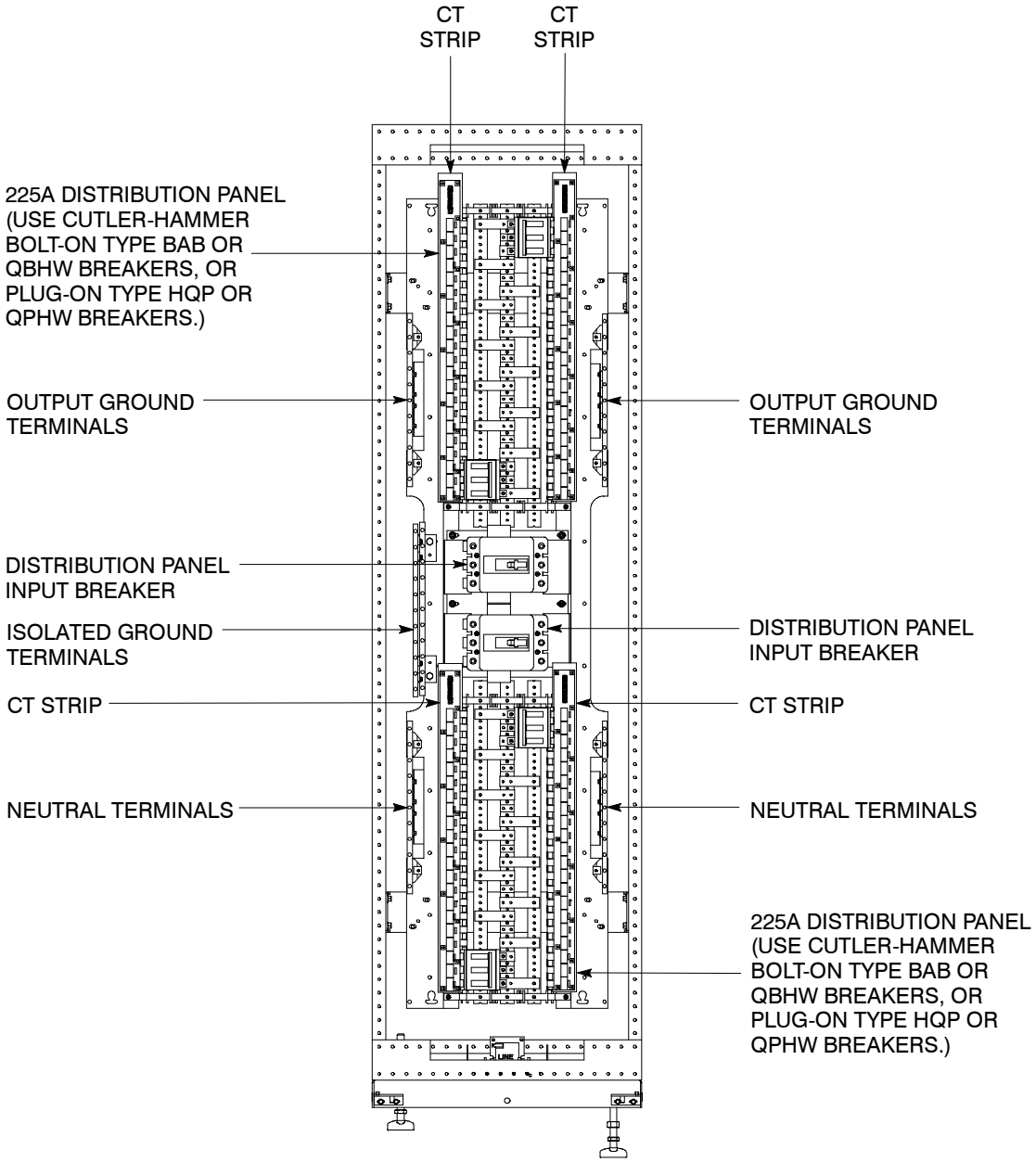
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PROJECT/GROUP: POWERWARE PDU		SCALE: 0.085
DESCRIPTION: GENERAL PDU LAYOUT RIGHT MOUNT SIDECAR		
DRAWING NO: CE71227	REVISION: 1	SHT: 6 OF 14



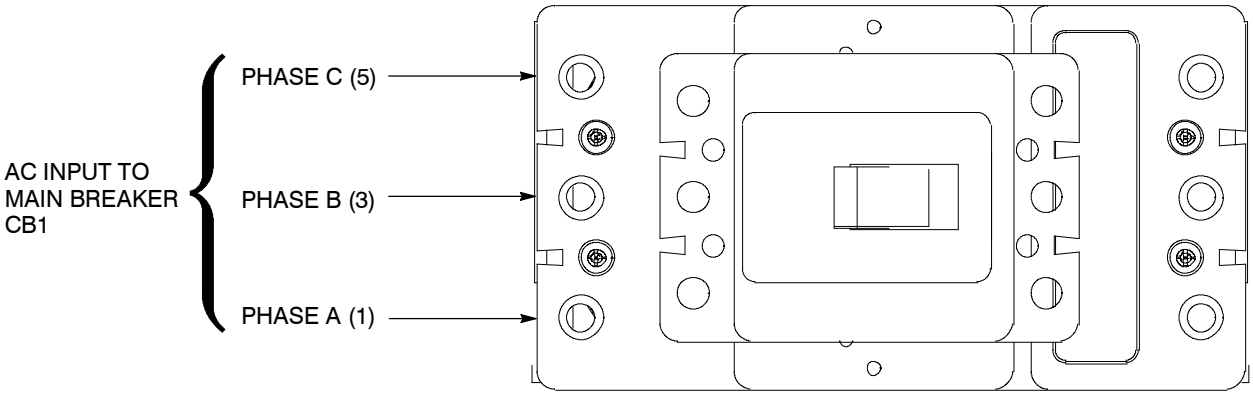
MAIN PDU WITH LEFT SUBFEED BREAKERS AND ONE OUTPUT DISTRIBUTION PANEL

DESCRIPTION:	**PDU POWER TERMINAL LOCATIONS**		
DRAWING NO:	164201629–7	*SHEET:*	2 of 8
REVISION:	B	*DATE:*	043007



LEFT OR RIGHT FRONT FACING SIDECAR
ONE OR TWO OUTPUT DISTRIBUTION PANELS

DESCRIPTION:	**PDU POWER TERMINAL LOCATIONS**		
DRAWING NO:	164201629–7	*SHEET:*	5 of 8
REVISION:	B	*DATE:*	043007



INPUT MAIN BREAKER CB1 TERMINAL DETAIL

DESCRIPTION:	**PDU POWER TERMINAL LOCATIONS**		
DRAWING NO:	164201629–7	*SHEET:*	7 of 8
REVISION:	B	*DATE:*	043007

1. The PDU equipment operating environment must meet the weight requirements shown in Table A and size requirements shown on Drawing 164201629–9.

Table A. Equipment Weight

Component	*Rating kVA*	*Weight Kgs (lbs)*		
		Shipping	*Installed*	*Point Loading*
PDU	30	474.5 (1045)	445 (980)	4 at 111.3 (245)
PDU	50	543.5 (1195)	514 (1130)	4 at 128.5 (282.5)
PDU	75	620.5 (1365)	591 (1300)	4 at 147.8 (325)
PDU	100	768.5 (1690)	739 (1625)	4 at 184.8 (406.3)
PDU	125	804.5 (1770)	775 (1705)	4 at 193.8 (193.8)
PDU	150	859.5 (1890)	830 (1825)	4 at 207.5 (456.3)
PDU	200	1052.5 (2315)	1023 (2250)	4 at 255.8 (562.5)
PDU	225	1143.5 (2515)	1114 (2450)	4 at 278.5 (612.5)
PDU with single front facing Sidecar	30	604 (1330)	570 (1255)	4 at 142.5 (313.8)
PDU with single front facing Sidecar	50	673 (1480)	639 (1405)	4 at 159.8 (351.3)
PDU with single front facing Sidecar	75	750 (1650)	716 (1575)	4 at 179 (393.8)
PDU with single front facing Sidecar	100	898 (1975)	864 (1900)	4 at 216 (475)
PDU with single front facing Sidecar	125	934 (2055)	900 (1980)	4 at 225 (495)
PDU with single front facing Sidecar	150	989 (2175)	955 (2100)	4 at 238.8 (525)
PDU with single front facing Sidecar	200	1182 (2600)	1148 (2525)	4 at 287 (631.3)
PDU with single front facing Sidecar	225	1273 (2800)	1239 (2725)	4 at 309.8 (681.3)
PDU with single side facing Sidecar	30	593 (1305)	559 (1230)	4 at 139.8 (307.5)
PDU with single side facing Sidecar	50	661 (1455)	627 (1380)	4 at 156.8 (345)
PDU with single side facing Sidecar	75	739 (1625)	705 (1550)	4 at 176.3 (387.5)
PDU with single side facing Sidecar	100	886 (1950)	852 (1875)	4 at 213 (468.8)
PDU with single side facing Sidecar	125	923 (2030)	889 (1955)	4 at 222.3 (488.8)
PDU with single side facing Sidecar	150	977 (2150)	943 (2075)	4 at 235.8 (518.8)
PDU with single side facing Sidecar	200	1170 (2575)	1136 (2500)	4 at 284 (625)
PDU with single side facing Sidecar	225	1261 (2775)	1227 (2700)	4 at 306.8 (675)

DESCRIPTION: **PHYSICAL FEATURES AND REQUIREMENTS**			
DRAWING NO: 164201629–2		*SHEET:* 1 of 2	
REVISION: B	*DATE:* 043007		

2. The PDU cabinet is palleted for shipping.
3. Do not tilt cabinets more than ±10° during handling.
4. Dimensions are in millimeters and (inches).
5. The clearances required around the PDU cabinet are shown in Table B and Drawing 164201629–9, starting on page A–41.

Table B. PDU Cabinet Clearances	
From Top of Cabinet	Minimum clearance over the PDU cabinet is 457.2 millimeters (18 inches) for ventilation
From Front of Cabinet	914.4 millimeters (36 inches) working space
From Back of Cabinet (main PDU, or main PDU with front facing left or right sidecars)	Minimum 101.6 millimeters (4 inches) for ventilation
From Back of Cabinet (main PDU with side facing left and right sidecar)	812 mm (32 inches) for door clearance and working space
From Right Side of Cabinet (main PDU, main PDU with front facing left sidecar, or main PDU with side facing left sidecar)	406.4 mm (16 inches) for door clearance and working space
From Left Side of Cabinet (main PDU, main PDU with front facing left sidecar, or main PDU with side facing left sidecar)	482.6 mm (19 inches) for door clearance and working space
From Right Side of Cabinet (main PDU with front facing right sidecar or main PDU with front facing left and right sidecars)	482.6 mm (19 inches) for door clearance and working space
From Left Side of Cabinet (main PDU with front facing right sidecar, or main PDU with front facing left and right sidecars)	482.6 mm (19 inches) for door clearance and working space
From Right Side of Cabinet (main PDU with side facing right sidecar)	812 mm (32 inches) for door clearance and working space
From Left Side of Cabinet (main PDU with side facing left sidecar)	812 mm (32 inches) for door clearance and working space
From Left and Right Side of Cabinet (main PDU with side facing left and right sidecar)	812 mm (32 inches) for door clearance and working space

DESCRIPTION: **PHYSICAL FEATURES AND REQUIREMENTS**			
DRAWING NO: 164201629–2		*SHEET:* 1 of 5	
REVISION: B		*DATE:* 043007	

6. The basic environmental requirements for operation of the PDU are:

Ambient Temperature Range: 0–40˚C (32–104˚F)

Recommended Operating Range: 20–25˚C (68–77˚F)

Maximum Relative Humidity: 95%, noncondensing

The PDU cooling requirements are shown in Table C through Table E.

Table C. PDU Cooling Requirements During Full Load Operation without Transformer

Rating		*Voltage*		*Heat Rejection*		
kVA	*K-factor*	*Input*	*Output*	*Watts*	*BTU/hr*	*Kg-cal/hr*
30	N/A	208	208	288	983	20
50	N/A	208	208	480	1639	32
75	N/A	208	208	720	2458	48
100	N/A	208	208	880	3004	59
125	N/A	208	208	1210	4130	81
150	N/A	208	208	1320	4506	88
200	N/A	208	208	1450	4949	97
225	N/A	208	208	1650	5632	110

DESCRIPTION:	**PHYSICAL FEATURES AND REQUIREMENTS**		
DRAWING NO:	164201629–2	*SHEET:*	2 of 5
REVISION:	B	*DATE:*	043007

Table D. PDU Cooling Requirements During Full Load Operation with 480V Transformer

Rating		*Voltage*		*Heat Rejection*		
kVA	*K-factor*	*Input*	*Output*	*Watts*	*BTU/hr*	*Kg–cal/hr*
30	1	480	208/120	1728	5898	115
30	13	480	208/120	1584	5407	106
30	20	480	208/120	1536	5243	102
50	1	480	208/120	2880	9830	192
50	13	480	208/120	2640	9011	176
50	20	480	208/120	2560	8738	170
75	1	480	208/120	4320	14744	287
75	13	480	208/120	3960	13516	263
75	20	480	208/120	3840	13106	255
100	1	480	208/120	5280	18021	351
100	13	480	208/120	4800	16382	319
100	20	480	208/120	4620	15768	307
125	1	480	208/120	7260	24778	482
125	13	480	208/120	6240	21297	415
125	20	480	208/120	4680	15973	311
150	1	480	208/120	7920	27031	526
150	13	480	208/120	6120	20887	407
150	20	480	208/120	5760	19659	383
200	1	480	208/120	8700	29693	578
200	13	480	208/120	7140	24369	474
225	1	480	208/120	9900	33788	657
225	13	480	208/120	8040	27440	534

DESCRIPTION: **PHYSICAL FEATURES AND REQUIREMENTS**			
DRAWING NO: 164201629–2		*SHEET:* 3 of 5	
REVISION: B		*DATE:* 043007	

Table G. INPUT/OUTPUT Ratings & External Wiring Requirements for the Powerware PDU (480V)										
		Units	***Rating 60 Hz***							
Basic Unit Rating		*kVA*	30	50	75	100	125	150	200	225
Input **Output**		*Volts* *Volts*	480 208	480 208	480 208	480 208	480 208	480 208	480 208	480 208
AC Input (3) Phases, (1) Neutral – if required, (1) Ground	**A**	Maximum AMPS	36	60	90	120	150	180	241	271
Minimum Conductor Size Number per Phase		AWG or kcmil (each)	Wiring should be sized in accordance with the PDU current rating, power cable termination sizes listed in Table J through Table L, and national and local electrical codes.							
AC Output	**–**	Maximum AMPS	84	139	209	278	347	417	556	625
AC Output from Subfeed Breaker to Critical Load (3) Phases, (1) Neutral, (1) Ground	**B**	Wire branch circuits in accordance with branch circuit breaker manufacturer's ratings, power cable termination sizes listed in Table M, and national and local electrical codes. Maximum output ratings are to be in accordance with the rating label on the PDU . The total combined load is not to exceed the maximum output rating.								
AC Output from Distribution Panel Breakers to Critical Load	**B**	Wire branch circuits in accordance with branch circuit breaker manufacturer's ratings and instructions, and national and local electrical codes (output is prewired to the panelboard). Maximum output ratings are to be in accordance with the rating label on the PDU . The total combined load is not to exceed the maximum output rating.								

NOTE: Callout letters **A** and **B** map to Drawing 164201629–3.

DESCRIPTION:	**POWER WIRING INSTALLATION NOTES**		
DRAWING NO:	164201629–5	*SHEET:*	1 of 8
REVISION:	B	*DATE:*	043007

Read and understand the following notes while planning and performing the installation:

1. Refer to national and local electrical codes for acceptable external wiring practices.
2. Material and labor for external wiring requirements are to be provided by designated personnel.
3. For external input wiring, use 90°C copper wire. See the appropriate column in Table F through Table H. Wire sizes are based on using the supplied breakers.
4. Wire ampacities are chosen from Table 310−16 of the NEC.
5. Output neutrals are rated for 200%.
6. The PDU cabinet is shipped with a debris shield covering the ventilation grill on top of the unit. Do not remove the debris shield until installation is complete. However, remove the shield before operating the PDU. Once the debris shield is removed, do not place objects on the ventilation grill.
7. Optional 225A Distribution Panels use Cutler-Hammer bolt-on type BAB or QBHW breakers for bolt-on panels, or plug-on type HQP or QPHW breakers for plug-on panels. Breakers to be provided by the customer.
8. 208V input PDU is only available up to 150 kVA. 480V and 600V input PDUs are available up to 225 kVA.
9. K20 transformers are available up to 150 kVA.
10. Refer to Section I of this manual for installation instructions.
11. If installing with a UPS, refer to the applicable UPS Installation and Operation manual for UPS cabinet wiring requirements, and conduit and terminal locations.
12. Per NEC article 300-20(a), all three-phase conductors must be run in the same conduit. Neutral and ground must be run in the same conduit as the phase conductors.
13. Conduit is to be sized to accommodate one neutral conductor the same size as the phase conductor and one ground conductor. If two neutral conductors or an oversized neutral conductor are to be installed, size the conduit to accommodate the extra wire or size. All PDU products can accommodate a double-sized neutral.

DESCRIPTION:	**POWER WIRING INSTALLATION NOTES**		
DRAWING NO:	164201629−5	*SHEET:*	3 of 8
REVISION:	B	*DATE:*	043007

14. See Table I for PDU input circuit breaker ratings.

Table I. PDU Input Circuit Breaker Ratings

Input Voltage	*kVA Rating*	*FLA*	*Main Breaker Size*	*kAIC Rating*	
				Standard	*High*
208	30	84	125A	65	100
	50	139	175A	65	100
	75	209	300A	65	100
	100	278	350A	65	100
	125	347	450A	65	100
	150	417	600A	65	100
480	30	36	60A	35	65
	50	60	80A	35	65
	75	90	125A	35	65
	100	120	150A	35	65
	125	150	200A	35	65
	150	180	225A	35	65
	200	241	300A	35	65
	225	271	350A	35	65
600	30	29	50A	18	25
	50	48	60A	18	25
	75	72	100A	18	25
	100	96	125A	18	25
	125	120	150A	18	25
	150	144	200A	18	25
	200	192	250A	25	35
	225	241	300A	25	35

DESCRIPTION:	**POWER WIRING INSTALLATION NOTES**		
DRAWING NO:	164201629–5	*SHEET:*	4 of 8
REVISION:	B	*DATE:*	043007

Table K. PDU INPUT Power Cable Terminations (480V)

Terminal Function	*Rating (kVA)*	*Main Breaker Rating*	*Terminal*	*Function*	*Size of Pressure Termination*	*Tightening Torque Nm (lb in)*	*Type Screw*
AC Input to Main Breaker CB1	30	60A	L1	Phase A	1 – #6	8 (75)	Slotted
			L2	Phase B	1 – #6	8 (75)	Slotted
			L3	Phase C	1 – #6	8 (75)	Slotted
			N	Neutral	Not Required		
	50	80A	L1	Phase A	1 – #4	8 (75)	Slotted
			L2	Phase B	1 – #4	8 (75)	Slotted
			L3	Phase C	1 – #4	8 (75)	Slotted
			N	Neutral	Not Required		
	75	125A	L1	Phase A	1 – #1	13.5 (120)	3/16″ Hex
			L2	Phase B	1 – #1	13.5 (120)	3/16″ Hex
			L3	Phase C	1 – #1	13.5 (120)	3/16″ Hex
			N	Neutral	Not Required		
	100	150A	L1	Phase A	1 – 1/0	13.5 (120)	3/16″ Hex
			L2	Phase B	1 – 1/0	13.5 (120)	3/16″ Hex
			L3	Phase C	1 – 1/0	13.5 (120)	3/16″ Hex
			N	Neutral	Not Required		
	125	200A	L1	Phase A	1 – 3/0	13.5 (120)	3/16″ Hex
			L2	Phase B	1 – 3/0	13.5 (120)	3/16″ Hex
			L3	Phase C	1 – 3/0	13.5 (120)	3/16″ Hex
			N	Neutral	Not Required		
	150	225A	L1	Phase A	1 – 3/0	13.5 (120)	3/16″ Hex
			L2	Phase B	1 – 3/0	13.5 (120)	3/16″ Hex
			L3	Phase C	1 – 3/0	13.5 (120)	3/16″ Hex
			N	Neutral	Not Required		
	200	300A	L1	Phase A	2 – 1/0	31 (275)	5/16″ Hex
			L2	Phase B	2 – 1/0	31 (275)	5/16″ Hex
			L3	Phase C	2 – 1/0	31 (275)	5/16″ Hex
			N	Neutral	Not Required		
	225	350A	L1	Phase A	2 – 2/0	31 (275)	5/16″ Hex
			L2	Phase B	2 – 2/0	31 (275)	5/16″ Hex
			L3	Phase C	2 – 2/0	31 (275)	5/16″ Hex
			N	Neutral	Not Required		
	All	All	G	Ground	1 – 1/0	31 (275)	5/16″ Hex

DESCRIPTION:	**POWER WIRING INSTALLATION NOTES**		
DRAWING NO:	164201629–5	*SHEET:*	6 of 8
REVISION:	B	*DATE:*	041506

Table M. PDU OUTPUT Power Cable Terminations

Terminal Function	*Breaker Rating*	*Terminal*	*Function*	*Size of Pressure Termination*	*Tightening Torque Nm (lb in)*	*Type Screw*
AC Output from Subfeed Breaker to Critical Load	225A ("F" Frame)	2	Phase A	1 – 4/0	31 (275)	5/16″ Hex
		4	Phase B	1 – 4/0	31 (275)	5/16″ Hex
		6	Phase C	1 – 4/0	31 (275)	5/16″ Hex
		N	Neutral	1 – 4/0	31 (275)	5/16″ Hex
		G	Ground	84 – #4–#14 or 2 x #12–#14	#4–#6: 4.0 (35) #8: 2.8 (25) #10–#14: 2.3 (20)	Slotted
AC Output from Distribution Panel Breakers to Critical Load	Wire branch circuits in accordance with branch circuit breaker manufacturers ratings and instructions and national and local electrical codes (output is prewired to the panelboard).					
	N		Neutral	84 – #4–#14 or 3 x #10–#14	#4–#6: 4.0 (35) #8: 2.8 (25) #10–#14: 2.3 (20)	Slotted
	G		Ground	84 – #4–#14 or 2 x #12–#14	#4–#6: 4.0 (35) #8: 2.8 (25) #10–#14: 2.3 (20)	Slotted

DESCRIPTION: **POWER WIRING INSTALLATION NOTES**		
DRAWING NO: 164201629–5		*SHEET:* 8 of 8
REVISION: B	*DATE:* 030107	

1. Use Class 1 wiring methods (as defined by the NEC) for interface wiring up to 30V. The wire should be rated at 24V, 1A minimum. Use twisted–pair wires for each input and common. All control wiring is customer-supplied.
2. Use Class 2 wiring methods (as defined by the NEC) for interface wiring from 30 to 600V. The wire should be rated at 600 volts, 1A minimum and 12 AWG maximum. Use twisted–pair wires for each input and common. All control wiring is customer-supplied.
3. When installing external interface wiring (for example, building alarm, relay output, and X–Slot) to the PDU interface terminals, conduit must be installed between each device and the PDU cabinet. Install the interface wiring in separate conduit from the power wiring.
4. All building alarm inputs or remote features require an isolated normally-open contact or switch (rated at 24 Vdc, 20 mA minimum) connected between the alarm input and common terminal as shown. All control wiring and relay and switch contacts are customer-supplied. Use twisted-pair wires for each alarm input and common.
5. The building alarms can be programmed to display the alarm functional name using the front panel LCD display.
6. See Table N through Table P and Chapters 3, 4, and 9 for customer interface wiring.
7. LAN and telephone drops for use with X–Slot connectivity cards must be provided by facility planners or the customer.

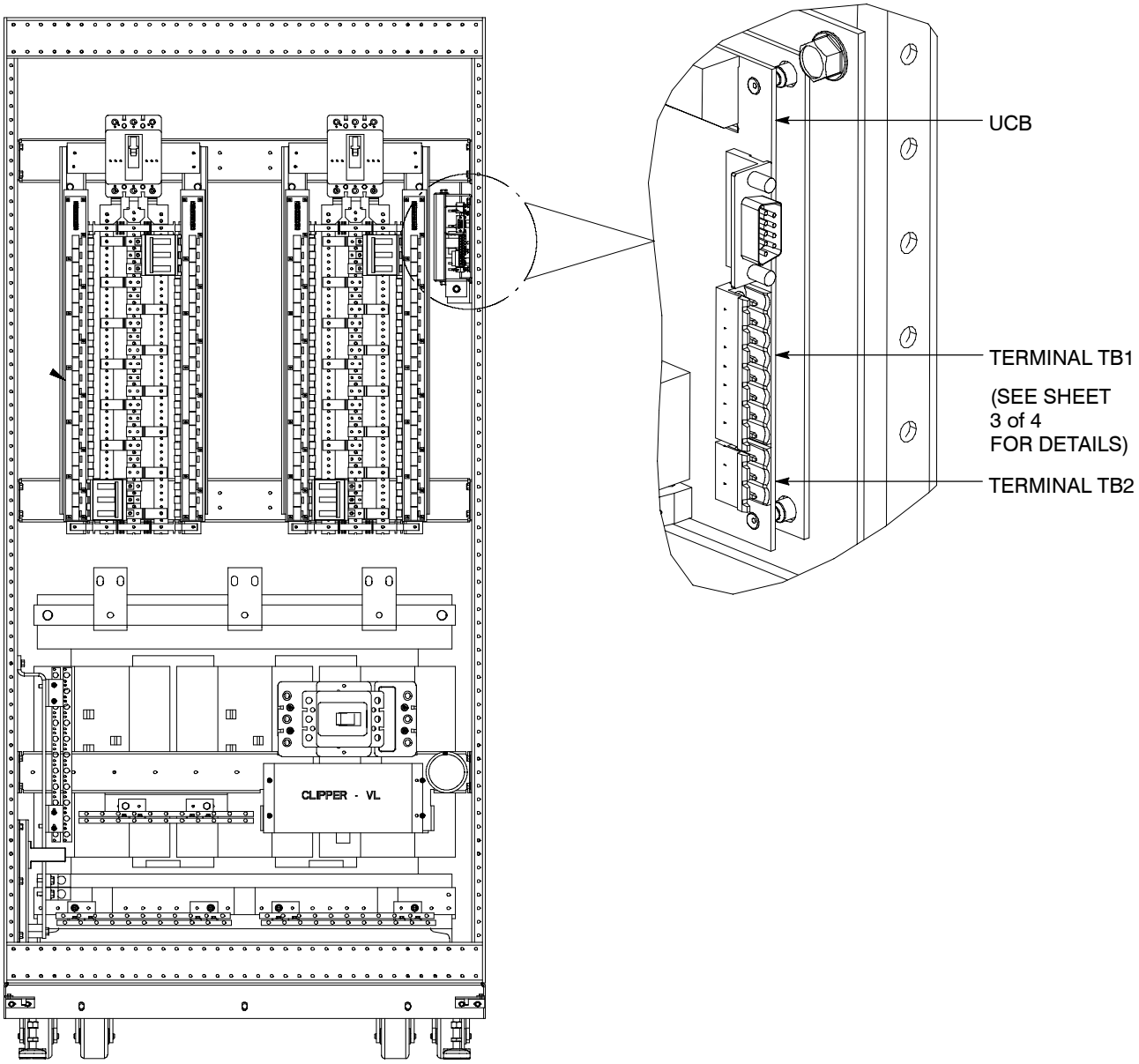
Table N. UCB TB1 and TB2 Interface Connections

Terminal TB1	*Name*	*Description*
1	Building Alarm 1	Input: Programmable PDU alarms, activated by a remote dry contact closure.
2	Building Alarm 1 Return	
3	Building Alarm 2	
4	Building Alarm 2 Return	
5	Remote EPO NO	Input: Normally-open dry contact to activate EPO of PDU from a remote switch
6	Remote EPO Return	
7	Local EPO	Input: Normally-open dry contact to activate EPO of PDU from local cabinet mounted EPO switch
8	Local EPO Return	
Terminal TB2	*Name*	*Description*
1	Alarm Relay Common	Output: General purpose normally-open and normally-closed relay contacts.
2	Alarm Relay NO	
3	Alarm Relay NC	

NOTE: “RETURN“ INDICATES CONNECTION TO ELECTRONICS CIRCUIT GROUND; “COMMON” INDICATES CONNECTION TO COMMON SIDE OF ISOLATED RELAY CONTACT.

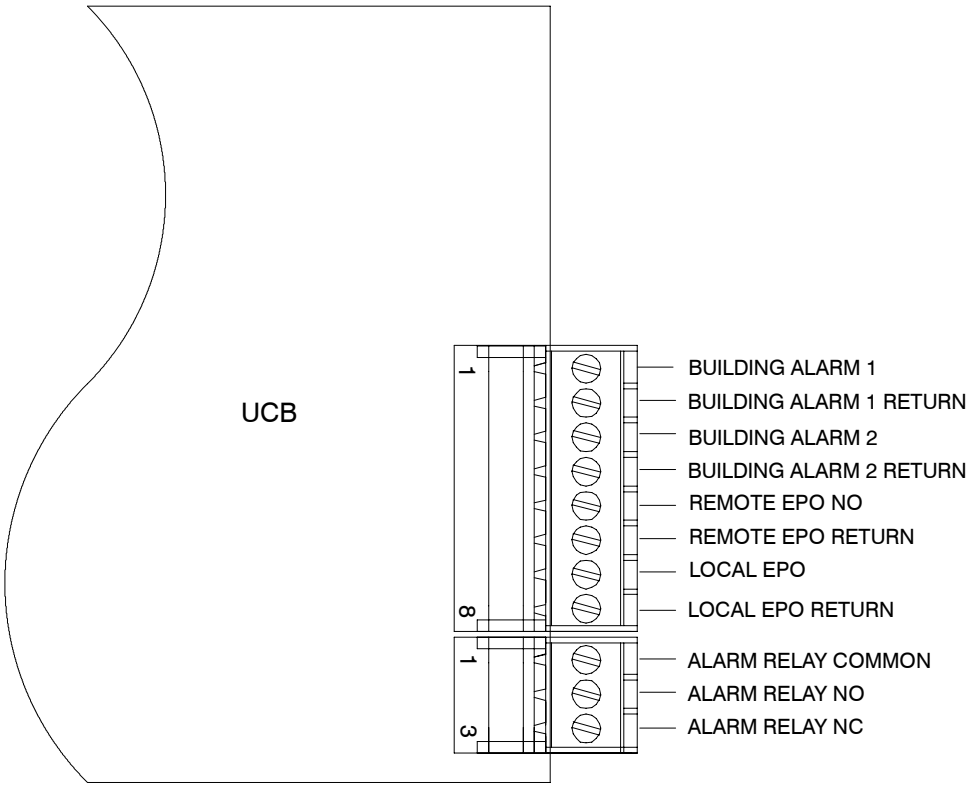
DESCRIPTION:	**INTERFACE WIRING INSTALLATION NOTES AND TERMINAL LOCATIONS**		
DRAWING NO:	164201629–8	*SHEET:*	1 of 4
REVISION:	B	*DATE:*	043007

INTERFACE TERMINAL LOCATIONS



DESCRIPTION:	**INTERFACE WIRING INSTALLATION NOTES AND TERMINAL LOCATIONS**		
DRAWING NO:	164201629–8	*SHEET:*	2 of 4
REVISION:	B	*DATE:*	043007

INTERFACE TERMINALS



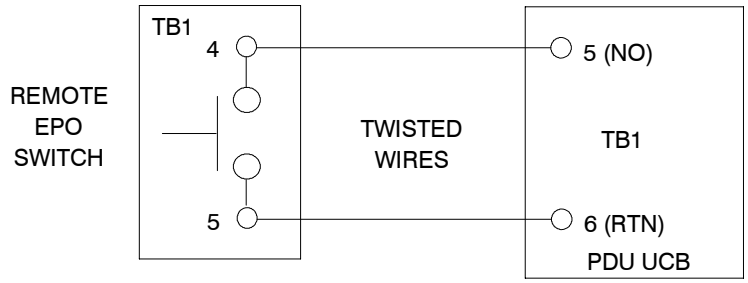
NOTE: *1. All building alarm inputs require an isolated normally-open or normally-closed contact or switch (rated at 24 Vdc, 20 mA minimum) connected between the alarm input and common terminal as shown. Building alarm inputs can be programmed for use with either normally-open or normally-closed contacts. All control wiring and relay and switch contacts are customer-supplied.*

2. The building alarms can be programmed to display the alarm functional name using the front panel LCD display.

DESCRIPTION:	**INTERFACE WIRING INSTALLATION NOTES AND TERMINAL LOCATIONS**		
DRAWING NO:	164201629–8	*SHEET:*	3 of 4
REVISION:	B	*DATE:*	043007

8. The Remote EPO feature opens PDU circuit breaker CB1 and isolates power from your critical load. Local electrical codes may also require tripping upstream protective devices.
9. Remote EPO wiring should be a minimum of 22 AWG.
10. The REPO switch is provided by the customer and must be a dedicated latching-type switch not tied into any other circuits.

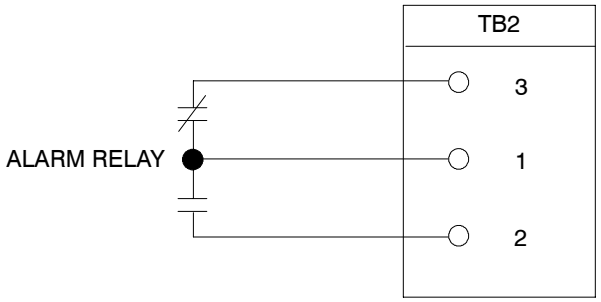
Table O. Remote EPO



Remote EPO switch rating is 24 Vdc, 1A minimum.

NOTE: *This switch must be a dedicated normally open latching-type switch not tied into any other circuits.*

Table P. Alarm Relay Contact



CONTACT RATING		
Switched Voltage: 30 Vac 28 Vdc	Maximum Current: 5A	Minimum Wire Size: 22 AWG

NOTE: *Relay is shown in de-energized state. Relay changes state when the PDU is in normal mode.*

DESCRIPTION:	**INTERFACE WIRING INSTALLATION NOTES AND TERMINAL LOCATIONS**		
DRAWING NO:	164201629–8	*SHEET:*	4 of 4
REVISION:	B	*DATE:*	043007

Chapter 8 System Events

8.1 General

When the PDU is operating, it continually monitors itself and the incoming utility power. System events on the PDU can be indicated by horns, lights, messages, or all three.

Select **Events** from the menu bar on the Main Menu screen to look at the Active System Events screen. This screen shows any currently active alarms, notices, or commands. For more information on using the Events screen, see paragraph 7.2.2, “Event Screens.”

8.2 System Event Horns

The system event horn beeps to alert an operator that an event needing attention is taking place. The Horn cycles at a half-second rate.

8.3 System Event Indicators

The status indicators on the PDU control panel work with the event horn to let the operator know when the PDU is operating in any mode other than normal. Only the ON indicator is visible during normal PDU operation. The other indicators illuminate to indicate alarms or events. When an alarm occurs, you should first check these indicators to see what type of event has taken place. For descriptions of the status indicators, see paragraph 7.3, “Reading the PDU Status Indicators.”

8.4 System Event Messages

When a system event occurs, a message appears on the LCD in the PDU status area. This message is also written to the Active Events log and may be added to the Events History log. The messages are divided into four categories: alarms, notices, status, and commands. The following tables contain the events displayed on the Events screen of the control panel. The default actions occurring for the events are listed. Some event actions are programmable. For more information contact your Eaton service representative.

ALARMS					
Message	Horn	Phone	Relay	Log*	Indication
Building Alarm 2	No	No	Yes	HA	User Action Required
Building Alarm 2 OK	No	No	Yes	HA	Condition Cleared
Check Input Switchgear	Yes	Yes	No	HA	Service Required
Check Input Switchgear OK	Off	Yes	No	HA	Condition Cleared
L1 Overload	Yes	No	No	HA	User Action Required
L1 Overload OK	Off	No	No	HA	Condition Cleared
L1 Overload (High Level)	Yes	No	No	HA	User Action Required
L1 Overload (High Level) OK	Off	No	No	HA	Condition Cleared
L1 Overload (Extreme Level)	Yes	No	No	HA	User Action Required
L1 Overload (Extreme Level) OK	Off	No	No	HA	Condition Cleared
L2 Overload	Yes	No	No	HA	User Action Required
L2 Overload OK	Off	No	No	HA	Condition Cleared
L2 Overload (High Level)	Yes	No	No	HA	User Action Required
L2 Overload (High Level) OK	Off	No	No	HA	Condition Cleared
L2 Overload (Extreme Level)	Yes	No	No	HA	User Action Required
L2 Overload (Extreme Level) OK	Off	No	No	HA	Condition Cleared
L3 Overload	Yes	No	No	HA	User Action Required
L3 Overload OK	Off	No	No	HA	Condition Cleared
L3 Overload (High Level)	Yes	No	No	HA	User Action Required
L3 Overload (High Level) OK	Off	No	No	HA	Condition Cleared
L3 Overload (Extreme Level)	Yes	No	No	HA	User Action Required
L3 Overload (Extreme Level) OK	Off	No	No	HA	Condition Cleared
Output Overload	Yes	No	No	HA	User Action Required
Output Overload OK	Off	No	No	HA	Condition Cleared
Remote Emergency Power-off	Yes	No	No	A	User Action Required
Transformer Over Temperature	Yes	No	Yes	HA	User Action Required
Transformer Over Temperature OK	Off	No	Yes	HA	Condition Cleared
TVSS AAAAAAAAAAAAAA	No	No	Yes	HA	User Action Required
TVSS AAAAAAAAAAAAAA OK	No	No	Yes	HA	Condition Cleared

*Log codes indicate where the PDU records the event: H = History log; HA = History and Active logs; and A = Active log only.

NOTICES					
Message	Horn	Phone	Relay	Log*	Indication
Check Modem	Yes	No	No	A	Information Only
Input AC Over Voltage	No	No	No	HA	Information Only
Input AC Over Voltage OK	No	No	No	HA	Condition Cleared
Input AC Under Voltage	No	No	No	HA	Information Only
Input AC Under Voltage OK	No	No	No	HA	Condition Cleared
Input Phase Rotation Error	No	No	No	No	Information Only
Input Under or Over Frequency	No	No	No	HA	Information Only
Input Under or Over Frequency OK	No	No	No	HA	Condition Cleared
Modem Call Completion Failed	No	No	No	A	Information Only
Checksum Failure	No	No	No	No	Information Only
Output AC Over Voltage	No	No	No	HA	Information Only
Output AC Over Voltage OK	No	No	No	HA	Condition Cleared
Output AC Under Voltage	No	No	No	HA	Information Only
Output AC Under Voltage OK	No	No	No	HA	Condition Cleared
Output Under or Over Frequency	No	No	No	HA	Information Only
Output Under or Over Frequency OK	No	No	No	HA	Condition Cleared
Site Wiring Fault	No	No	No	No	Information Only

*Log codes indicate where the PDU records the event: H = History log; HA = History and Active logs; and A = Active log only.

STATUS					
Message	Horn	Phone	Relay	Log*	Indication
Incoming Modem Call Started	No	No	No	A	User Status
Modem Call Completed Successfully	No	No	No	A	User Status
Modem Connection Established	No	No	No	A	User Status
Outgoing Modem Call Started	No	No	No	A	User Status

*Log codes indicate where the PDU records the event: H = History log; HA = History and Active logs; and A = Active log only.

COMMAND					
Message	Horn	Phone	Relay	Log*	Indication
Emergency Shutdown	No	No	No	No	Information Only

*Log codes indicate where the PDU records the event: H = History log; HA = History and Active logs; and A = Active log only.

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EATON POWERWARE – POWER DISTIRBUTION UNIT(PDU)

Level 2 Commumication and Monitoring :

Energy Management System (EMS)

The energy management system will provide microprocessor based monitoring and control for the PDU. Information will be displayed on a local 8 X 40 backlight LCD panel located on the front of the PDU accessible without opening the door. The LCD panel shall have 4 indicators for On, Off, Overload and Alarm. A Horn shall be integral to the system. The LCD panel shall have 5 key switches for menu navigation for monitoring, control and setup functions. The system shall be capable to monitor two (2) three phase voltage/current ports and up to 336 additional branch circuit feeds. The energy management system shall have event log capability for Alarm, Notice Status and Command events. Data shall be displayed on an LCD panel and have capability to be transmitted serially to communications devices such as WebServers, Modems and RS232 ports via Web/SNMP or Modbus TCP/IP protocols including Powerware's centralized monitoring system utilizing "X-slot" technology.

Analog and digital signals shall be processed by the controller generating metering, alarm, statistical and status information. The system shall drive 5 programmable output relays and two serial ports and also provide two discrete inputs for programmable building alarms. All currents and voltages shall be monitored using true RMS measurements. The energy management system shall come fully calibrated from the factory. This specification strictly forbids field calibration requirements.

EMS Level 2

Level 2 provides system level input and output meters, active events and history log, setup menu, mimic screen and advanced system features such as programmable building alarms, profile log and X-Slot capability.

Display

Information shall be displayed on a local 8 X 40 backlight LCD panel located on the front of the PDU accessible without opening the door. The LCD panel shall have 4 indicators for On, Off, Overload and Alarm. A Horn shall be integral to the system. The LCD panel shall have 5 push buttons for menu navigation for monitoring, configuration and control functions.

Four LEDs located on the LCD panel shall indicate the following:

GREEN: Illuminates when the output is energized

YELLOW: Illuminates if output current of any phase exceeds its 100% current level

YELLOW: Illuminates when the output is de-energized. When EPO reset is required, the LED will flash at a one second rate.

RED: Will flash any time an active Alarm is present on the active alarms

screen.

Monitored Parameters

The energy management system shall monitor and display the following parameters:

- Input Voltage (VL-L)
- Input Current (A, B & C phase)
- Input Voltage THD for all three phases
- Input Frequency
- Output Voltage (VL-L and VL-N)
- Output Current (A, B & C phase)
- Output Neutral Current
- Output Current %(A, B & C phase)
- Output Voltage Total Harmonic Distortion (THD) for all three phases
- Output Current Total Harmonic Distortion (THD) for all three phases
- Output Current Crest Factor
- System Ground Current
- Output Frequency
- Output Power Factor (Lead/Lag Indicator)
- Output kVA
- Output kW
- Output KWH
- Monthly KW HR
- Yearly KW HR
- Total KW HR
- Date
- Time

Alarms

Alarms shall be classified as Notice or Alarm. A Notice is a minor Alarm that does not activate the horn. Upon receiving an alarm, the energy management system shall activate a horn, red LED and Form-C Summary Alarm Relay. The alarm or notice event shall be displayed on the active events screen and also be available through serial communication devices. The system shall be configurable to make an outgoing service call. A soft key on the LCD panel shall be used to SILENCE the horn and reset the relay and LED alarm indicator. Alarms shall be categorized by the system as User Alarm, Shutdown is imminent, Service Required, Schedule Service or Service Alarm. Notices shall be categorized as Information Only, User Interaction Required and User Investigation.

Remote monitoring shall include notification of critical alarms, a monthly report summarizing alarms and important data relevant to PDU or system performance.

All alarm thresholds (factory set points shown in brackets) shall be adjustable by way of the service port to meet site requirements. The system shall detect and alarm the following conditions:

- Input AC Undervoltage (90% of nominal)
- Input AC Overvoltage (110% of nominal)
- Input Under / Over Frequency (+/- 3Hz of nominal)
- Input Phase Rotation Error
- Remote Emergency Power Off
- Emergency Shutdown Command
- Transformer Over-Temperature Warning (180^0C)
- Transformer Over-Temperature Shutdown (200^0C)
- Output AC Undervoltage (90% of nominal)
- Output AC Overvoltage (110% of nominal)
- Output Overload
- Overload Warning for all three phases (Level 1) - 100%
- Overload for all three phases (Level 2) - 110%
- Large Overload for all three phases (Level 3) - 125%
- Output Under / Over Frequency (+/- 0.5Hz of nominal)
- Output Phase Rotation Error
- Input Voltage THD Warning for all three phases
- Input Current THD Warning for all three phases
- Output Voltage THD Warning for all three phases

- Output Current THD Warning for all three phases
- Summary Notice
- Summary Alarm
- EEPROM Fault
- Internal Communication Fault
- Configuration Error

Profile Log

Profile Log feature provides the maximum and minimum deviations for the month. The exact time that the deviation occurred is also recorded. Data is sampled every five milliseconds. The profile data is recorded in non-volatile memory each hour. The meter shall have the ability to store and view up to twenty-four (24) monthly readings per parameter:

a. Output Voltage (All three phases independently)
b. Output Current (All three phases independently)
c. Output Frequency
d. Output Voltage THD (All three phases independently)
e. Output Current THD (All three phases independently)
f. Output Current Crest Factor for all three phases
g. Output KW
h. Output KVA
i. Output Power Factor
j. Input Voltage (All three phases independently)
k. Input Current (All three phases independently)
l. Input Frequency
m. Input Voltage THD (All three phases independently)
n. Input Power Factor
o. Input kW
p. Input kVA
q. Ground Current
r. Output Neutral Current

Programmable Building Alarms

The EMS shall be capable of providing annunciation for two customizable building alarm inputs (N/O or N/C dry contacts). The action associated with the alarms is user configurable for Alarm only or Alarm and shunt trip. The associated customized message can be up to 20 characters long and entered either via the LCD panel or RS232 service port.

Control

The PDU shall be capable of a shutdown on the following alarms:

- Phase Rotation
- Phase Loss
- Ground Fault
- Building Alarms
- Transformer Over Temperature

Communication

The EMS level 2 system must be capable of communicating via hot pluggable X-slot cards. Remote monitoring shall include notification of critical alarms, a monthly report summarizing alarms and important data relative to the PDU or system performance.

Supported cards:

- Power Xpert Gateway X-Slot Card providing SNMP, Modbus TCP, Email and Environmental Monitoring Probe functionality.

- Modbus Card (RS232/485) providing a limited set of system meters and alarms.

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TYPE-LW

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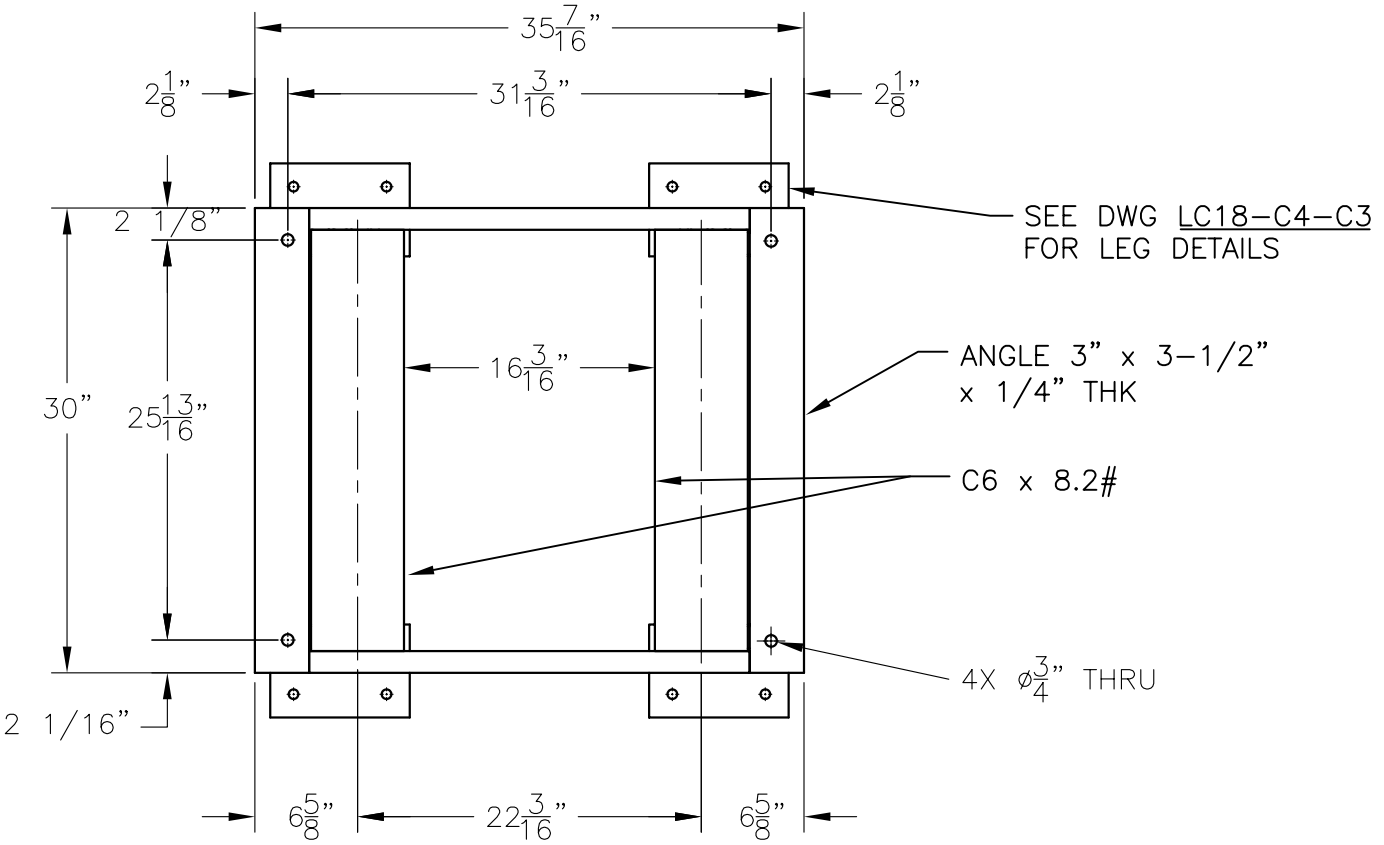
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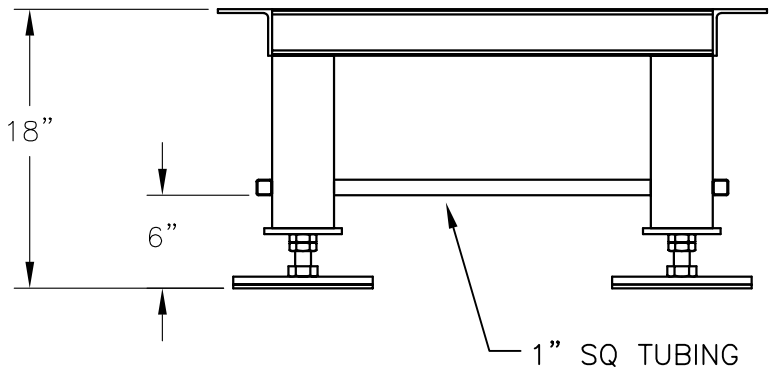
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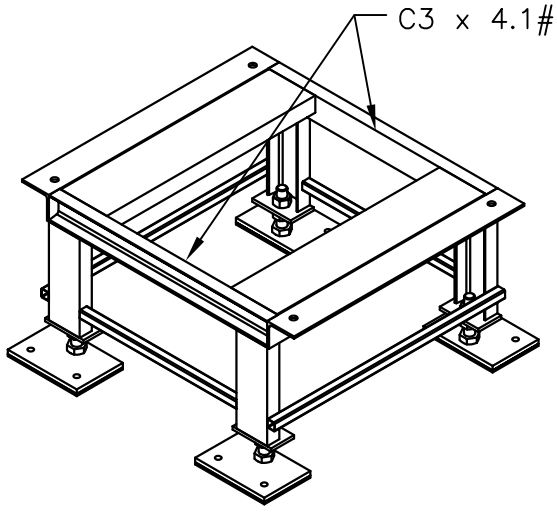
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ENG'R

TAG: PDU 225KVA







Powerware

Powerware® Power Distribution Unit (PDU)

Product Focus



The Powerware PDU provides reliable data center power distribution for both raised and non-raised floor applications. To ensure the high performance required for today's data centers, this Eaton designed and manufactured PDU provides the following in an integrated, factory-tested package:

- Isolation
- Voltage transformation
- Electrical distribution
- Equipment protection
- Computer-grade grounding

Additionally, when compared to hard-wiring methods, the Powerware PDU greatly shortens installation time and allows for easy relocation of equipment during consolidation, upgrade, or relocation of the data center. The Powerware PDU offers a broad range of options that present customized power distribution solutions for each customer's data center.

Its state-of-the-art metering system provides monitoring, alarming, and remote communications provisions to enable proactive power distribution management in the data center. Eaton's world-class service organization supports the Powerware PDU throughout the entire life-cycle of your data center, increasing reliability and providing you with peace of mind.

Customized Solution and Adaptability

At Eaton we don't just preach customization, we live it everyday. We have a great combination of experienced and responsive engineers, a skilled work force, and strategic focus to serve our customers' every need. This combination coupled with a broad product offering, which includes an extensive list of standard options, results in a highly sophisticated power distribution system that is custom-made to customer specifications and requirements.

The Powerware PDU is an exceptionally versatile solution. Its scalable design and architecture—which is accomplished through a modular construction—make expansion very simple. These multiple expansion options include:

- Front-mounted Sidecar: can be daisy-chained on either side of the PDU
- Side-facing Sidecar: allows for distribution or subfeed panels
- Subfeed Panel: presents easy installation of additional breakers in the field

The user is able to quickly configure a suitable solution for any application with a wide array of standard options such as dual input main breakers, floor stands, and TVSS.

Power Quality and Performance

The Powerware PDU is ideally suited to support today's data center computer equipment. A standard K-rated transformer, coupled with a 200%-rated neutral, supports the PDU in efficiently handling harmonic currents. Utilizing dual-transformer shielding and computer-grade grounding ensures that electrical noise such as EMI and RFI do not impact computer equipment operation. This allows the PDU to deliver high-quality power performance.

Transformer Details

- K13 Standard
- K1 & K20 Optional
- Harmonic Mitigation Available
- Standard Copper Construction
- Standard Dual

Monitoring & Connectivity

Powerware PDUs are equipped with a state-of-the-art metering system. This provides monitoring and alarming provisions that allow the user to monitor power consumption and quality, manage and plan power needs, and react quickly to any potential problems. Comprehensive connectivity options enable secure, remote power management, and real-time system

status information. The latest technology is employed by the monitoring system, which includes an 8" x 40" LCD for clarity, a soft-key driven menu for ease of use, and audio/visual Indicators that provide alarming and status updates.

Power consumption trends for up to 24 months can be viewed through a history log – a powerful aid in capacity planning. Another strong feature is the programmability of custom alarm settings, which can be done at the factory, by the user, or by our service organization.

Quality Design & Convenience

While designing the PDU, Eaton engineers gave careful consideration to style, user-friendliness, ease of installation, and serviceability. Some key features include:

- Front access only for operation and general service requirements
- Standard top and bottom cable entry/exit
- Spacious wireways to run load cables
- Swivel casters and leveling feet
- Same industrial design as other Powerware branded UPS products

Reliability

Increased reliability for the Powerware PDU is provided through system design consideration for power isolation, grounding, and distribution requirements. It is built according to the latest UL60950 standard for information technology equipment and approved by UL/CSA. The PDU utilizes Cutler-Hammer Series C circuit breakers, which employ the latest circuit breaker technology and feature the highest interrupting ratings in the industry.

Every PDU goes through extensive factory testing to ensure that each PDU meets Eaton's strict quality standards. All key PDU components are Eaton manufactured, thereby increasing consistency. Maintaining a high level of support throughout the product lifecycle ensures that system reliability is never compromised.

Superior Warranty & Service

For your peace of mind, the Powerware PDU is backed by our best-in-class service support - the largest field organization in the industry. Our service organization can provide start-up, warranty, and post-warranty support for all the Eaton power products in a data center. Some of the key features include:

- Start-up and commissioning support
- Preventive maintenance packages
- Standard 24x7 coverage with eight-hour response
- Optional two and four-hour response time
- Remote monitoring services

TECHNICAL SPECIFICATIONS

Electrical Characteristics

kVA Ratings: 30 to 300 kVA

Input ratings:

Voltage: 208V, 480V or 600V: Three-phase, three-wire plus ground
(Transformerless: three-phase, four-wire plus ground)
Frequency: 60 Hz

Output ratings:

Voltage: 208V/120V, 480V or 600V:Three-phase, four-wire plus ground
Frequency: 60 Hz

Distribution

- Cutler-Hammer 42 pole panelboards with 225A main breaker
- Cutler-Hammer Series C molded case subfeed breakers up to 225A
- Up to eight subfeed breakers
- Custom subfeed ratings available
- Factory installed branch circuit breakers

Options

- Dual main input breakers
- High kAIC input breakers
- TVSS (80 kA-200 kA)
- Lightning arrestor
- Transient suppression plate
- Floor Stands (12", 18", 24" & 36")
- Junction box
- Manual restart
- Isolated ground
- Branch circuit monitoring
- Remote power panels
- Distribution cables (WHIPS)
- Communication X-Slots™ (Two)

Physical Characteristics

- 30 to 50 kVA (K1-K20): 24"W x 24"D x 78"H
- 50 to 150 kVA (K1-K20): 36"W x 32"D x 72"H
- 200 to 225 kVA (K1-K13): 36"W x 32"D x 72"H
- 200 to 225 kVA (K20): 45"W x 37"D x 72"H
- 300 kVA (K1-K20): 45"W x 37"D x 72"H

Monitoring Features

Metered Values:

- Input voltage: L-L
- Output voltage: L-L & L-N
- Phase output current
- Neutral current
- Ground current
- kVA, KW, Hz
- Total Harmonic Distortion (THD)
- Power factor / phase
- Percent load / phase
- Load Profiling
- Min & Max V, I, Hz, KW recorded over a four hour period
- Captures highest reading on monthly basis, with trend information over last 24 months

Alarms

- Transformer over-temp. & shutdown
- Over-and under-voltage (input & output)
- High current (Three-phases, N, G)
- Phase rotation (input & output)
- Phase loss
- Building alarms (Two-programmable)
- Voltage THD
- Current THD
- Over/Under frequency
- Output overload (3-Levels)
- Modem call

Control

- Emergency power off (EPO)
- Remote EPO (Optional)
- Custom shutdowns on alarms:
  - –Phase rotation
  - –Phase loss
  - –Ground fault
  - –Site wiring fault
  - –Building alarms

Connectivity

- Modbus
- Modem

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