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TPSD

Filtered Battery Charger / Power Supply / Battery Eliminator

Installation and Operation Manual

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Instruction Drawing Number: P25-LTPSD-1
Revision A08 Rev. Date: 06/13 ECN: 20040

Important Safety Instructions

Before using this equipment read all manuals and other documents related to this unit and other equipment connected to this unit. Always have a copy of a units manual on file nearby, in a safe place; if a replacement copy of a manual is needed it can be found at the www.lamarchemfg.com.

Electrical Safety

WARNING: Hazardous Voltages are present at the input of power systems. The output from rectifiers and from batteries may be low in voltage, but can have a very high current capacity that may cause severe or even fatal injury.

When working with any live battery or power system, follow these precautions:

- Never work alone on any live power system, someone should always be close enough to come to your aid
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Wear complete eye protection (with side shields) and clothing protection.
- Always wear gloves and use insulated hand tools.

WARNING: Lethal Voltages are present within the power system. Parts inside the unit may still be energized even when the unit has been disconnected from the AC input power. Check with a meter before proceeding. Do not touch any uninsulated parts.

- A licensed electrician should be used in the installation of any unit.
- Always disconnect the unit from the supply, batteries and loads before performing maintenance or cleaning.
- If the unit is hot-swappable, simply remove it from the shelf for any maintenance or cleaning.
- Always assume that an electrical connection is live and check the connection relative to ground.
- Be sure that neither liquids nor any wet material come in contact with any internal components.
- Do not operate this unit outside the input and output ratings listed on the unit nameplate.
- Do not use this unit for any purpose not described in the operation manual.

Mechanical Safety

- This unit or parts of the unit may get very hot during normal operation, use care when working nearby.
- Do not expose equipment to rain or snow. Always install in a clean, dry location.
- Do not operate equipment if it has received a sharp blow, been dropped, or otherwise damaged in any way.
- Do not disassemble this unit. Incorrect re-assembly may result in a risk of electric shock or fire.

Battery Safety

WARNING: Follow all of the battery manufacturer's safety recommendations when working with or around battery systems. DO NOT smoke or introduce a spark or open flame in the vicinity of a battery. Some batteries generate explosive gases during normal battery operation.

- To reduce risk of arc, connect and disconnect the battery only when the unit is off.
- If it is necessary to remove battery connections, always remove the grounded terminal from the battery first.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Always wear rubber gloves, safety glasses, and a rubber lined vest/apron when working near a battery.
- Have plenty of fresh water and soap nearby in case the battery electrolyte contacts skin, clothing, or eyes.
- If the battery electrolyte contacts skin or clothing, wash immediately with soap and water.
- If the electrolyte enters the eye, immediately flood the eye with running cold water for at least ten (10) minutes and seek medical attention immediately.
- Do not drop metal on a battery. A spark or short-circuit could occur and could cause an explosion.

Unit Location

- Allow at least 6 inches of free air on all vented surfaces for proper cooling
- Allow sufficient clearance to open the front panel for servicing.
- Do not operate this unit in a closed-in area or restrict ventilation in any way.
- Do not set any battery on top of this unit.
- Never allow battery electrolyte to drip on this unit when reading the specific gravity or filling the battery.
- Never place this unit directly above a standard flooded battery. Gases from the battery will corrode and damage equipment.
- A sealed maintenance free or valve regulated lead acid (VRLA) battery may be placed below this equipment.

Check for Damages

Prior to unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior of product for damage. If any damage is observed, contact the carrier immediately. Continue the inspection for any internal damage. In the unlikely event of internal damage, please inform the carrier and contact La Marche for advice on the risk due to any damage before installing the product. Verify that you have all the necessary parts per your order for proper assembly.

CAUTION: Failure to properly file a claim for shipping damages, or provide a copy of the claim to La Marche, may void warranty service for any physical damages reported for repair.

Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is damaged/unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage. *La Marche is not responsible for damage caused by improper packaging of returned products.*

Inspection Checklist

- Enclosure exterior and interior is not marred or dented.
- There is no visible damage components.
- All internal components are secure.
- Printed circuit boards are firmly seated.
- All hardware and connections are tight.
- All wire terminations are secure.
- All items on packing list have been included.

Handling

Equipment can be very heavy and/or top heavy. Use adequate manpower or equipment for handling. Until the equipment is securely mounted, care must be used to prevent equipment from be accidentally tipped over.

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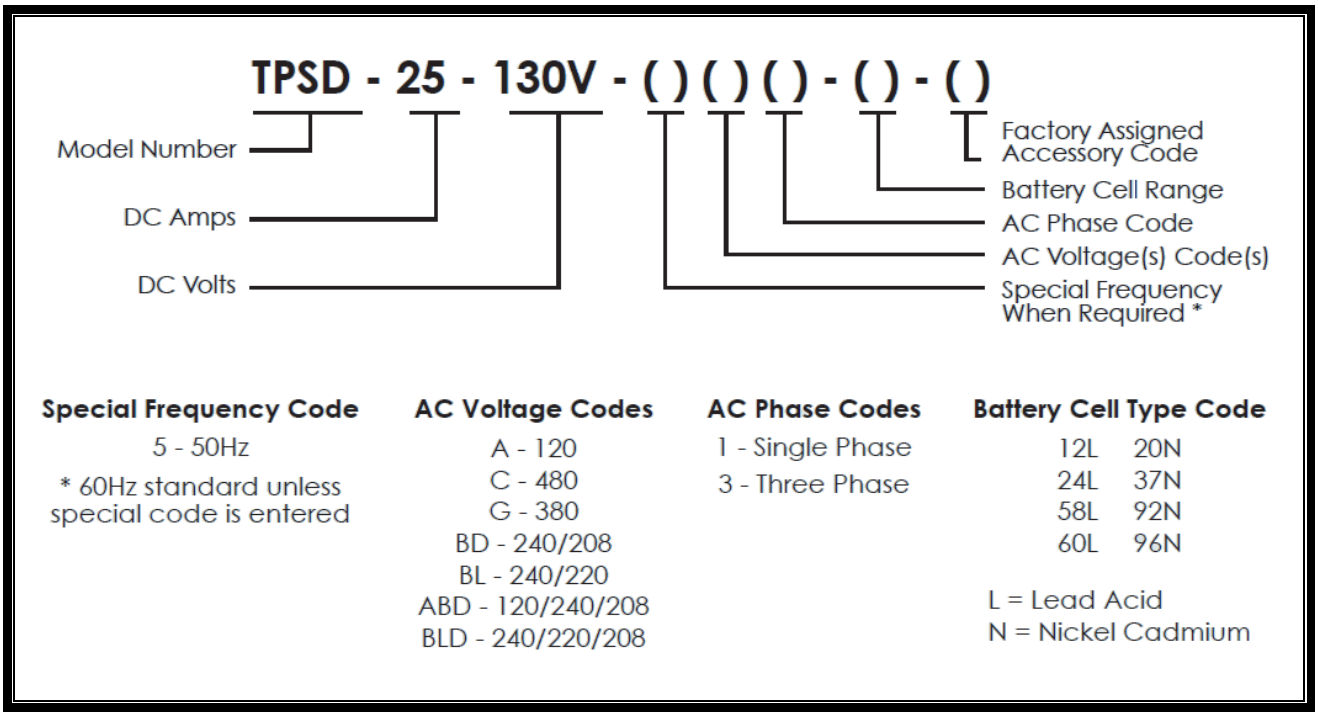
Model Scope/General Description

The La Marche model TPSD is a controlled ferroresonant float charger designed to power a load while charging the battery. The TPSD is filtered and may be used without the battery. The all solid state electronic control circuit provides excellent line-load voltage regulation, current limiting, and a power failure relay with light and Form "C" contacts. The TPSD is offered with DC output voltages of 24, 48 or 130VDC with output currents from 6 to 200 Amps. These chargers may be powered with 120, 208, 240, or 480VAC.

Understanding the Model Number

The TPSD model number is coded to describe the options that are included. Find the model number on the nomenclature nameplate of the charger. Then follow the chart to determine the configuration of your battery charger.



Optional Accessories Included in the Unit

This unit may have been outfitted with a number of optional accessories or option packages. To find out what options this unit has (if any) refer to the very first page of the manual package.

1 Equipment Handling

1.1 Storing the TPSD

If the TPSD is to be stored for more than a few days after delivery, it should be stored within its shipping container. The location chosen for storage should be within an ambient temperature of -40 to 185° F (-40 to 85° C) with a non-condensing relative humidity of 0 to 95%. Storage should not exceed 2 years due to the limited shelf life of the DC filter capacitors when they are not in service.

1.2 Moving the TPSD

After careful inspection and upon verification that the TPSD is undamaged, identify the enclosure style and weight of the TPSD unit. Refer to the tables below.

Output Voltage	Frequency	Ampere Rating								
		6 ADC	12 ADC	20 ADC	25 ADC	30 ADC	35 ADC	50 ADC	75 ADC	100 ADC
24 VDC	60 Hz	4B Case 90 lbs (40.8 kg)	4B Case 90 lbs (40.8 kg)	4 Case 100 lbs (45.4 kg)	4 Case 125 lbs (56.7 kg)	4 Case 150 lbs (68 kg)	4 Case 154 lbs (69.9 kg)	4 Case 175 lbs (79.4 kg)	4 Case 211 lbs (95.7 kg)	9 Case 225 lbs (102.1 kg)
	50 Hz			4 Case 110 lbs (49.8 kg)	4 Case 138 lbs (62.6 kg)	4 Case 165 lbs (74.8 kg)	4 Case 170 lbs (77.1 kg)	4 Case 193 lbs (87.5 kg)	4 Case 233 lbs (105.7 kg)	9 Case 248 lbs (112.5 kg)
48 VDC	60 Hz	4B Case 90 lbs (40.8 kg)	4B Case 110 lbs (49.9 kg)	4 Case 150 lbs (68 kg)	4 Case 150 lbs (68 kg)	4 Case 155 lbs (70.3 kg)	4 Case 180 lbs (81.7 kg)	4 Case 205 lbs (93 kg)	9 Case 295 lbs (133.8 kg)	9 Case 321 lbs (145.6 kg)
	50 Hz			4 Case 165 lbs (74.8 kg)	4 Case 165 lbs (74.8 kg)	4 Case 171 lbs (77.6 kg)	4 Case 198 lbs (89.8 kg)	4 Case 225 lbs (102.1 kg)	9 Case 325 lbs (147.4 kg)	9 Case 354 lbs (160.6 kg)
130 VDC	60 Hz	4 Case 140 lbs (63.5 kg)	4 Case 175 lbs (79.4 kg)	4 Case 225 lbs (102.1 kg)	4 Case 250 lbs (113.4 kg)	9 Case 319 lbs (144.7 kg)	9 Case 372 lbs (168.7 kg)	9 Case 532 lbs (241.3 kg)		
	50 Hz	4 Case 154 lbs (69.9 kg)	4 Case 193 lbs (87.5 kg)	4 Case 233 lbs (105.7 kg)	4 Case 275 lbs (124.7 kg)	9 Case 352 lbs (159.7 kg)	9 Case 410 lbs (186 kg)	9 Case 586 lbs (265.8 kg)		

Table 1 - Case Type and Weight (Single Phase, 6-100 ADC)

Output Voltage	Frequency	Ampere Rating								
		25 ADC	30 ADC	35 ADC	50 ADC	75 ADC	100 ADC	125 ADC	150 ADC	200 ADC
24 VDC	60 Hz					72 Case 400 lbs (181.4 kg)	72 Case 475 lbs (215.5 kg)		72 Case 530 lbs (240.4 kg)	72 Case 600 lbs (272.2 kg)
48 VDC	60 Hz				72 Case 400 lbs (181.4 kg)	72 Case 575 lbs (260.8 kg)	72 Case 600 lbs (272.2 kg)		72 Case 700 lbs (317.5 kg)	72 Case 755 lbs (342.5 kg)
130 VDC	60 Hz	72 Case 420 lbs (190.5 kg)	72 Case 490 lbs (222.3 kg)	72 Case 550 lbs (249.5 kg)	72 Case 600 lbs (272.2 kg)	72 Case 660 lbs (299.4 kg)	72 Case 800 lbs (362.9 kg)	44 Case 850 lbs (385.6 kg)	44 Case 900 lbs (408.2 kg)	
	50 Hz					72 Case 727 lbs (329.8 kg)	72 Case 882 lbs (400.1 kg)			

Table 2 - Case Type and Weight (Three Phase, 25-200 ADC)

The **4B & 4** enclosures do not feature lifting eyes for moving. Instead, whenever possible move these units with a forklift truck using the supplied shipping pallet. To hoist the unit into a wall-mount or rack-mount location, use a heavy-duty sling applicable to the enclosure size and unit weight. To relocate the **4B & 4** enclosures, use the aforementioned sling on a hoist or forklift truck.

2 Installation

2.1 Mounting the TPSD

When mounting the TPSD in ANY configuration, consider the size and weight of the unit. The wall, rack, and/or floor must be able to support the weight of the unit as well as an additional safety factor. Verify the method of mounting and the weight of the TPSD, using Tables 1, 2, and 3. The location chosen for the charger should be within an ambient temperature range of 32 to 122˚F (0 to 50˚C) with a non-condensing relative humidity no higher than 95%. The TPSD should be mounted in an area free of explosive materials and away from drips and splatter. The TPSD utilizes convection cooling so a clearance of at least 6in (152mm) of free air must be maintained on the top, bottom and both sides for cooling air. Maintain 36in (914mm) or more of clearance at the front of the charger in order to allow for operation and maintenance.

Case Number	Cable Entry		Mounting
	AC Input	DC Output	
4B	Right	Left	19/23" Rack, Wall/Floor (see Fig. 1a and 1b)
4	Right	Left	19/23" Rack, Wall/Floor (see Fig. 1a and 1b)
9	Top Right	Top Left	23/30" Rack, Wall/Floor (see Fig. 1a and 1b)
72	Right / Bottom	Bottom	Floor
44	Left	Right	Floor

Table 3 - Available mounting methods for each of the TPSD case sizes

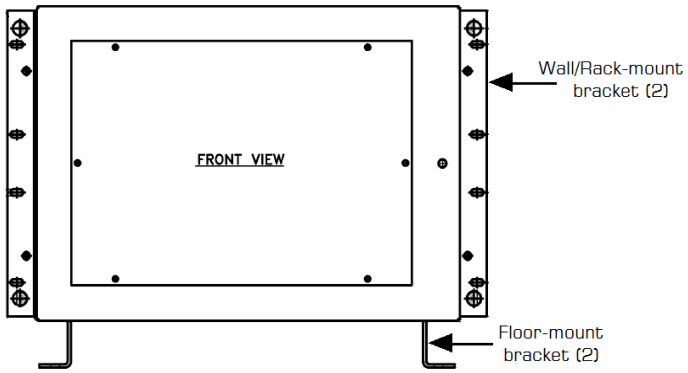


Figure 1 - Mounting configurations (4B Case front view)

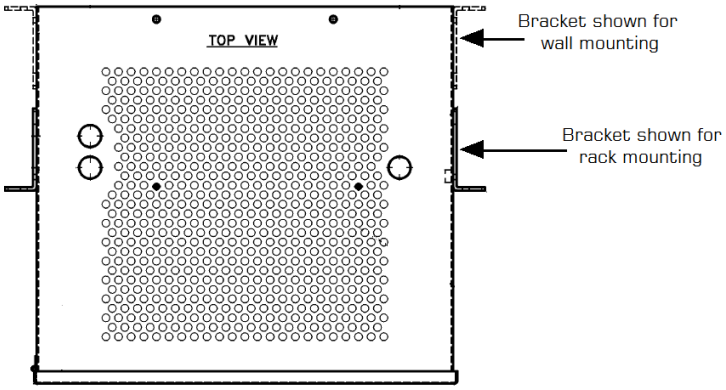


Figure 2 - Mounting configurations (4B Case top view)

2.1.1 Wall-Mounting the TPSD (4B, 4 and 9 Cases Only)

The **4B, 4 and 9** cases of the TPSD are shipped from the factory with the necessary brackets installed for wall-mounting *(The same bracket is used for rear mounting on a relay rack, 4B and 4 – 19/23" rack, 9 – 23/30" rack)* The **72 & 44** cases do not come with wall mounting equipment, it is not recommended to attempt to mount these cases on any wall.

Wall-Mount Procedure

To wall-mount the TPSD, install four 0.5 in (12.7 mm) bolts on the wall rated to support the charger weight plus a safety factor of at least two times. Place the TPSD on the bolts, add appropriate mounting hardware and tighten. Refer to the figures below for mounting dimensions and specifications.

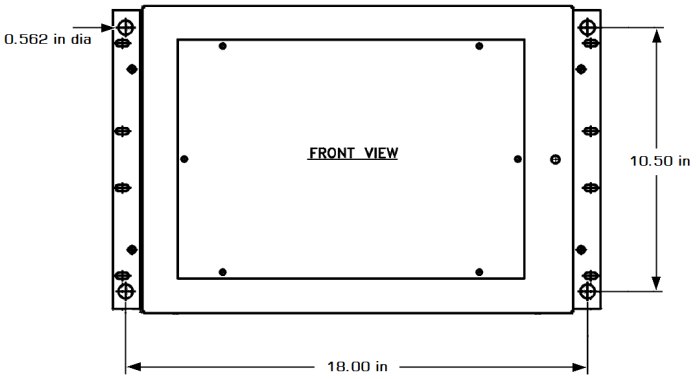


Figure 3 - 4B Case Bolt Pattern

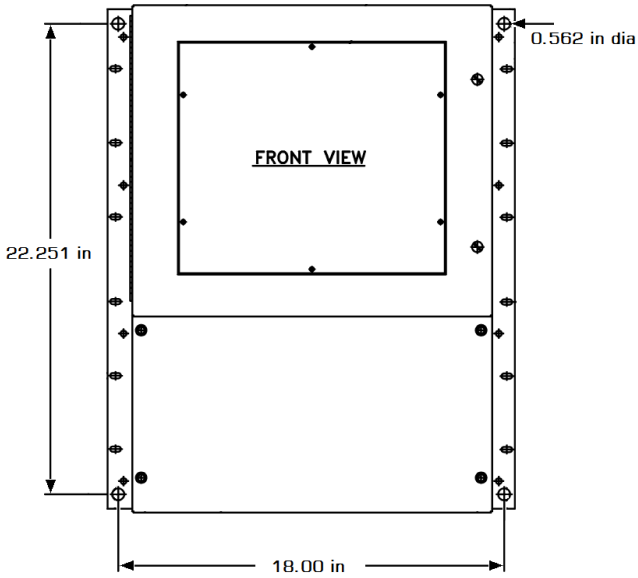


Figure 4 - 4 Case Bolt Pattern

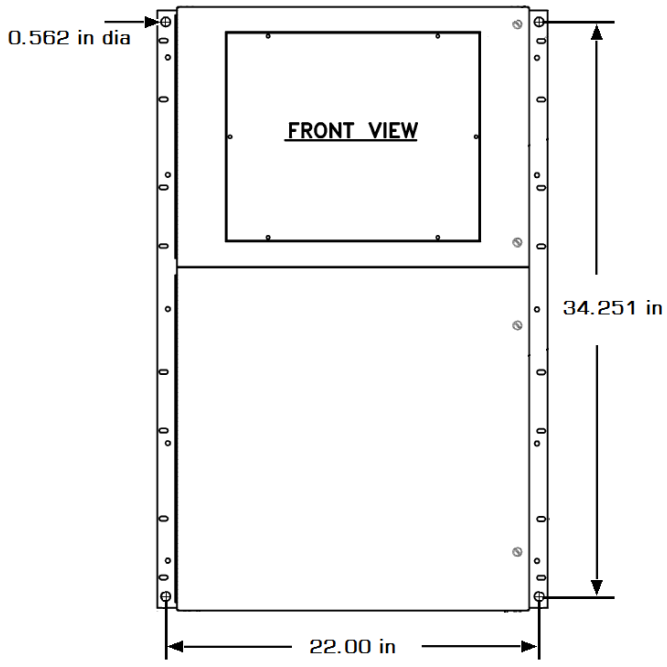


Figure 5 - 9 Case Bolt Pattern

*NOTE: All above dimensions are in inches. For further TPSD cabinet information, see the outline drawings for the **4B case (4B, 4B-23) 4 case (4, 4_23)** and **9 case (9, 9_30)** online at http://www.lamarchemfg.com/info/enclosure-drawings.html*

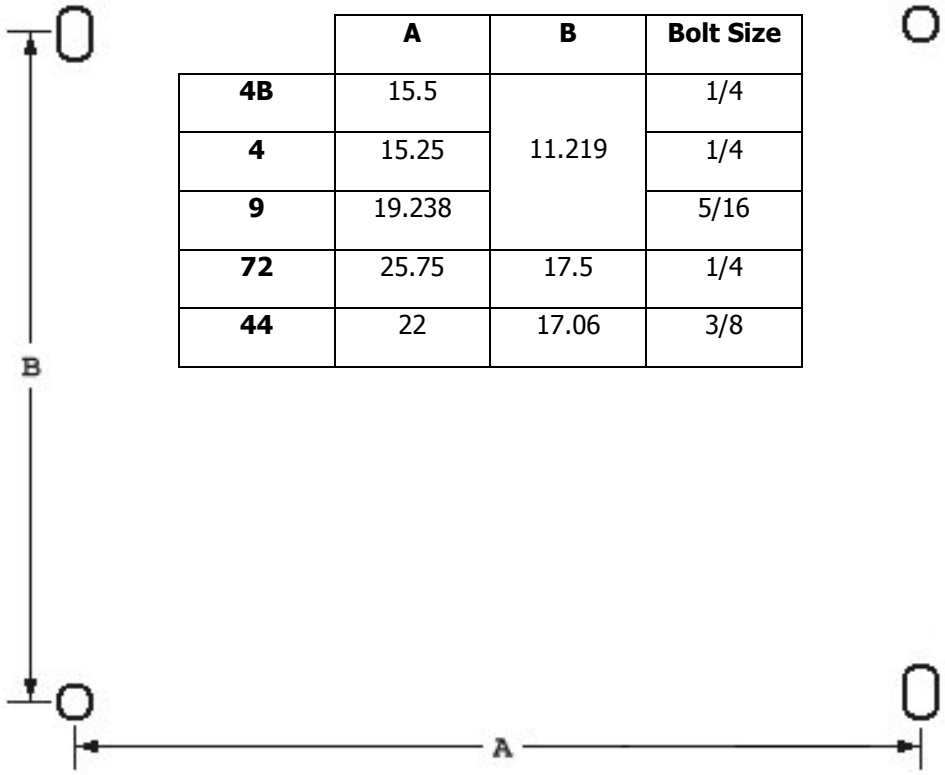
2.1.2 Floor-Mounting the TPSD (All Cases)

Floor-mounting the **72 & 44** cases is standard. If it is desired to floor mount a charger with the **4B, 4** or **9** case the floor-mount bracket is provided.

NOTE: The floor mount bracket adds an additional 2 in (51 mm) to the overall height of 4B, 4 and 9 cases. 72 and 44 cases include the height of the bracket in their overall height

Floor-Mounting Procedure

To floor-mount the TPSD, install four bolts into the floor. Place the TPSD on the bolts, add appropriate mounting hardware, and tighten securely. The figure below shows the footprint and the bolt size of each TPSD case style. (All dimensions are in inches)



	A	B	Bolt Size
4B	15.5	11.219	1/4
4	15.25		1/4
9	19.238		5/16
72	25.75	17.5	1/4
44	22	17.06	3/8

Figure 6 - TPSD Case Footprint

2.1.3 Rack-Mounting the TPSD

The TPSD can be installed in most relay racks with standard EIA hole spacing. If a relay rack is needed they are available for purchase from La Marche. The **4B, 4 and 9** cases are shipped from the factory with the necessary brackets installed for rear mounting on a relay rack *(The same bracket is used for wall mounting).* The rack mounting bracket for the **4B and 4** cases allows for mounting on either a 19" or 23" rack. The rack mounting bracket for the **9** case allows for mounting on a 23" or 30" rack.

Before installing the charger on the rack locate the conduit entrances and be sure the knockouts on the sides or bottom of the charger are accessible after the charger is rack-mounted.

The table and figure below shows rack-mounting options for TPSD.

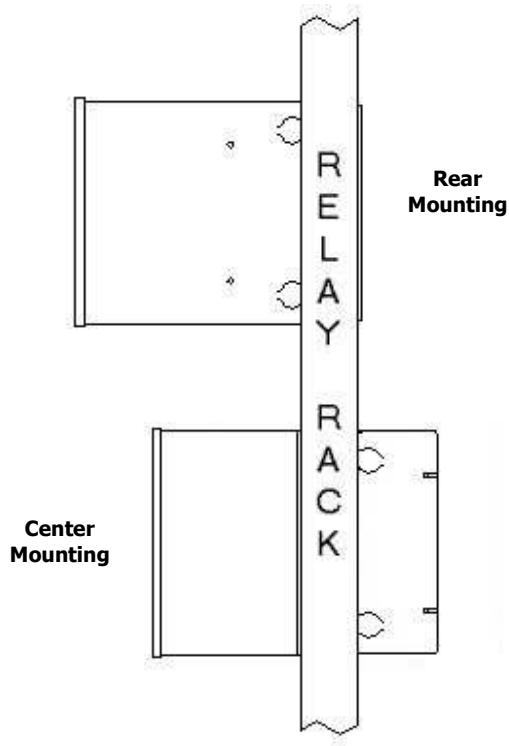


Figure 7 - Rack-Mounting Configurations (4B Case)

Rack Mounting Procedure

To rack mount the TPSD, first mount the unit onto the rack-mounting brackets using the hardware supplied. Second, install the brackets onto the rack. Provide at minimum 6in (152mm) of air space above and below to allow for cooling.

Case Number	Rear Mounting	Center Mounting
4B	Yes (19" rack only)	Yes
4	Yes (19" rack only)	Yes
9	No	Yes
72	No	No
44	No	No

Table 4 - Available Rack Mount Configurations

If you are center-mounting the charger, install the bracket on the front side of the relay rack. If you are rear-mounting the charger, install the bracket to the back side of the relay rack, as pictured in the Figure 4 above-left.

2.2 Changing Transformer Taps

*NOTE: This procedure refers **only** to TPSD battery chargers that accept three input voltages of 120, 240 and 208 VAC [Voltage code: ABD]. All other TPSD battery chargers do not include transformer taps.*

Before wiring AC power to the TPSD, check the wiring of the power transformer PT, to be sure it is connected for the correct AC input voltage. The TPSD accepts standard input voltages of 120, 208 or 240 VAC by changing the connections to the input terminals. No other changes are required.

NOTE: The TPSD is wired at the factory for 240 VAC, except on special request...

Before changing the PT taps, be sure that AC supply and DC loads to the TPSD are turned off and locked out. Verify that no voltage is present by using a voltmeter at all input and output terminals. Turning off the AC and DC circuit breakers on the TPSD *does NOT* eliminate live voltages inside the enclosure. Also de-energize any external wiring to the alarm relay contacts.

Verify that all voltages within the enclosure are de-energized and locked out. Change the connections to the input terminals as shown in the table and figure on the following page.

NOTE: A TPSD battery charger rated for 480 VAC or 600 VAC input uses a special transformer that has no taps. The 480 VAC and 600 VAC transformers cannot be used for any other input voltage.

2.2.1 Changing Transformer Taps Procedure

Before beginning any work inside the charger enclosure ensure that all incoming AC supply and DC load wires are de-energized. Verify that no voltage is present inside the case by using a voltmeter at all input and output terminals.

For 120 VAC Input Voltage:

1. For terminal strip **TS-3**, connect a jumper wire from terminal **1** to terminal **2**.
2. For terminal strip **TS-4**, connect wire marked **D** to terminal **3**.
3. For terminal strip **TS-4**, connect wire marked **E** to terminal **1**.

Note that **AC input 1** connects to terminal **L1**
Note that **AC input 2** connects to terminal **L3**

		ACin1	ACin2	TS-3 Jumper Connection	TS-4	
					D	E
INPUT VAC	120	L1	L3	1-2	3	1
	208	L1	L2	2-3	2	3
	240				1	3

Table 5 - Input Terminal Connections

For 208 VAC Input Voltage:

1. For terminal strip **TS-3**: connect a jumper wire from terminal **2** to terminal **3**.
2. For terminal strip **TS-4**: connect wire marked **D** to terminal **2**.
3. For terminal strip **TS-4**: connect wire marked **E** to terminal **3**.

Note that **AC in 1** connects to terminal **L1**
Note that **AC in 2** connects to terminal **L2**

For 240 VAC Input Voltage:

1. For terminal strip **TS-3**: connect a jumper wire from terminal **2** to terminal **3**.
2. For terminal strip **TS-4**: connect wire marked **D** to terminal **1**.
3. For terminal strip **TS-4**: connect wire marked **E** to terminal **3**.

Note that **AC in 1** connects to terminal **L1**
Note that **AC in 2** connects to terminal **L2**

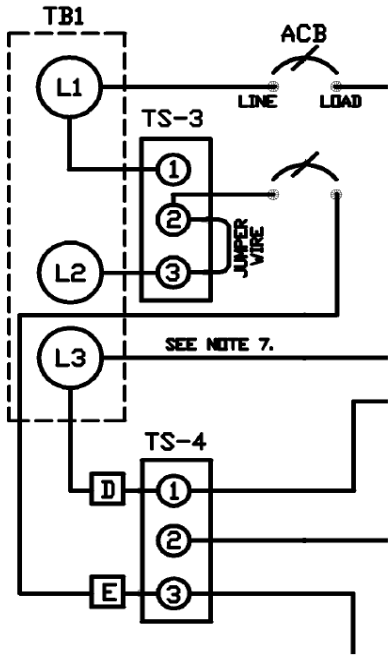


Figure 8 - Input Terminals Connection (Schematic – 240VAC input shown)

2.3 Making the AC Input Connections

Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the unit's breakers are off. Check that the source voltage and frequency matches the voltage and frequency listed on the charger nameplate. For units with transformer taps, verify that the tap has been set to the correct AC input. (See Section 2.2.1 for instructions on changing the transformer tap). Select wire size, using the table below, based on an overload current of 110-115% of the input current listed on the charger nameplate.

BREAKER\FUSE SIZE (AMPS)	WIRE SIZE REQUIREMENT FOR CUSTOMER CONNECTION	EQUIPMENT GROUNDING CONDUCTOR MINIMUM
1	#14	#14
3	#14	#14
4	#14	#14
5	#14	#14
6	#14	#14
10	#14	#14
15	#12	#12
20	#12	#12
25	#10	#12
30	#10	#10
35	#8	#10
40	#8	#10
45	#8	#10
50	#8	#10
60	#6	#10
70	#6	#8
80	#4	#8
90	#4	#8
100	#4	#8
110	#2	#6
125	#2	#6
130	#2	#6
140	#1	#6
150	#1	#6

Table 6 - Wire Size Minimum Requirements

NOTE: These are recommended sizes. All National and Local Wiring Codes must be followed

AC Connection Procedure

First connect an adequate earth ground lead (use table above for sizing) to the terminal marked "GROUND" or "GND". Run the input AC wiring to terminals marked **L1** and **L2** or **L3** on the terminal block **TB1** inside the unit (for units with transformer taps use the table on page 8 for input connections). To make these connections, strip the insulation about 0.5 inches (13 mm) and install the lugs on the incoming wires, then connect the wires to the appropriate terminals.

2.4 Making the DC Output Connections

Before making any of DC output connections make sure you have read and fully understand the DC Connection Procedure below. Select proper size for the DC wiring from the wire size table on the previous page. If the distance between the unit's DC output and the DC load exceeds 10 feet, use the Power Cable Guide below to minimize the voltage drop across the wire distance.

Power Cabling Guide

Use the following formulas and table to determine proper wire size for minimal voltage drop.

Table of Conventions

CMA = Cross section of wire in circular MIL area
A = Ultimate drain in amperes

LF = Conductor loop feet
MaxAmp = Maximum allowable amperes for given voltage drop
AVD = Allowable voltage drop
K = 11.1 for commercial (TW) copper wire (KS5482-01)
= 17.4 for aluminum (KS20189)

Calculating Wire Size Requirements

$$CMA = \frac{A \times LF \times K}{AVD}$$

Calculating Current Carrying Capacity of Wire

$$MaxAmp = \frac{CMA \times AVD}{LF \times K}$$

SIZE (AWG)	AREA CIR.MILS	SIZE (MCM)	AREA CIR.MILS
18	1620	250	250000
16	2580	300	300000
14	4110	350	350000
12	6530	400	400000
10	10380	500	500000
8	16510	600	600000
6	26240	700	700000
4	41740	750	750000
3	52620	800	800000
2	66360	900	900000
1	83690	1000	1000000
0	105600	1250	1250000
00	133100	1500	1500000
000	167800	1750	1750000
0000	211600	2000	2000000

Table 7 - Wire Size/Area Table

DC Connection Procedure

To prevent the DC circuit breaker from tripping when connecting the battery, connections should be done in the following order.

1. Turn off the unit's AC and DC circuit breakers.
2. Connect AC input line to the unit's input terminals as described in Section 2.3.
3. Connect the battery cables to the unit's DC output terminals. ***OBSERVE PROPER POLARITY***.
4. Energize the power supply by turning on the unit's AC breaker. This will charge the capacitors inside the unit and eliminate heavy arcing when the battery is connected.
5. After about 30 seconds, turn on the DC breaker

2.5 Alarm Connections

Eight alarms are included as a standard feature of the TPSD. The included alarms are Low DC Current, Low DC Voltage, High DC Voltage, High Voltage Shutdown, AC Failure, Negative Ground Detection, Positive Ground Detection and Summary. Each alarm includes two form "C" contacts enabling the customer to connect multiple remote annunciators.

Max. Operating Voltage	125 VAC 125 VDC
Max. Operating Current	2 A
Max. Switching Capacity	62.5 VA 30 W

Table 8 – Alarm Form "C" Contact Ratings

2.5.1 Alarm Connection Procedure

Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the unit's breakers are off. Verify that no voltage is present by using a voltmeter at all input and output terminals.

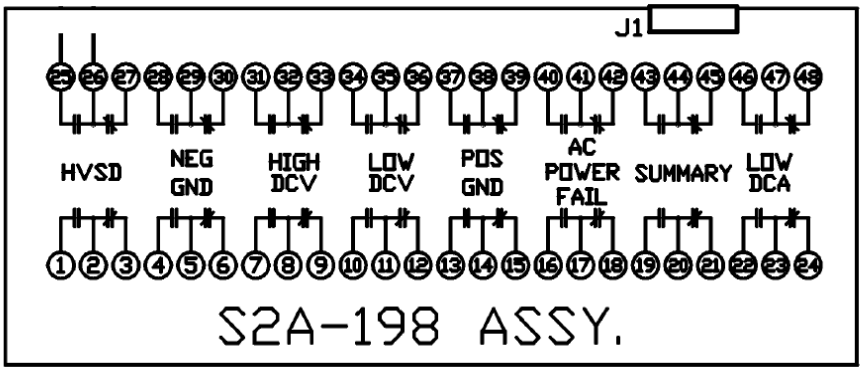


Figure 9 - Customer Alarm Connection Card

For High DCV, High DCV Shutdown, Positive Ground, and Negative Ground:

If it is desired that the annunciator be active until the alarm triggers connect the annunciator leads to the **Normally Closed** and **Common** contacts of the desired alarm (located on the Customer Alarm Connection Card *S2A-198*). If it is desired that the annunciator be activated after the alarm triggers connect the annunciator leads to the **Normally Open** and **Common** contacts of the desired alarm.

For Low DCV, AC Power Failure, Low DCA, and Summary:

If it is desired that the annunciator be active until the alarm triggers connect the annunciator leads to the **Normally Open** and **Common** contacts of the desired alarm (located on the Customer Alarm Connection Card *S2A-198*). If it is desired that the annunciator be activated after the alarm triggers connect the annunciator leads to the **Normally Closed** and **Common** contacts of the desired alarm.

Example of connecting a "Summary" alarm

Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the unit's breakers are off. Verify that no voltage is present by using a voltmeter at all input and output terminals.

EXAMPLE: A customer wants a Green Lamp to be illuminated at all times and wants a Red Lamp to illuminate and a speaker to sound when the summary alarm triggers. The customer would make the connections to the NC and C contacts on one set of the SUMMARY relay contacts between the speaker and a power supply. On the other set of SUMMARY relay contacts they would connect the NO and C contacts between the Green Lamp and power supply, and would connect the NC and C contacts between the Red Lamp and power supply.

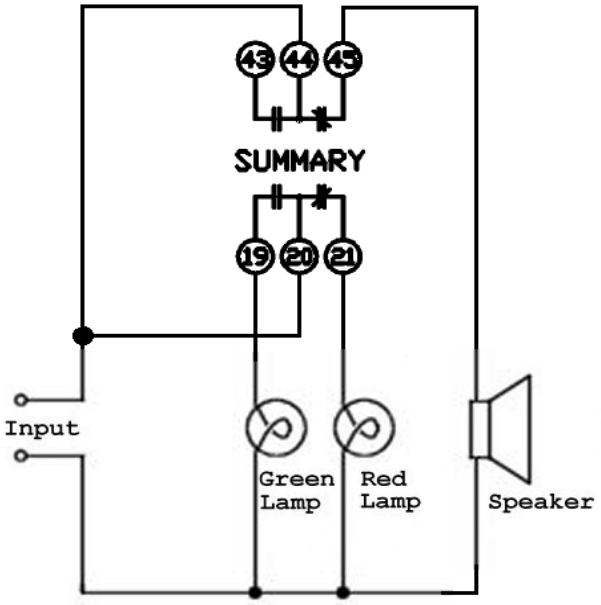


Figure 10 - Example Connections (Customer Provided Equipment)

2.6 Installing External Temperature Compensation (Option 11W/11Y)

The natural voltage of a battery changes as a function of temperature change. As the battery temperature rises, the effective voltage of the battery decreases. Without Temperature Compensation, the battery charger will always produce a set constant output voltage. As the battery temperature increases, this constant voltage will then induce a higher output current from the charger. This higher current can result in overcharging the battery, which in turn can result in damage to the batteries.

Temperature Compensation combats this overcharging by adjusting the charger's output voltage based on the temperature read by the temperature probe. In order to increase the accuracy of the temperature compensation the external probe can be used to measure the temperature of the battery.

Option 11W includes the compensation circuit and a 24 foot long temperature probe. Option 11Y includes the compensation circuit and a 100 foot long temperature probe. With either option approximately two feet of the probe is taken inside the charger enclosure.

External Probe Connection Procedure

1. Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the unit's breakers are off. Verify that no voltage is present by using a voltmeter at all input and output terminals.
2. Locate the terminal strip **TS-6** inside the charger.
3. As illustrated in Figure 8, connect wire marked **F** to terminal **1** and wire marked **G** to terminal **2**.
4. Connect the black lead of the probe to the other end of terminal **1**, and the red lead to the other end of terminal **2**.
5. Place the external probe in a desired location (it is recommended that the battery manufacturer be consulted for placement of the probe).

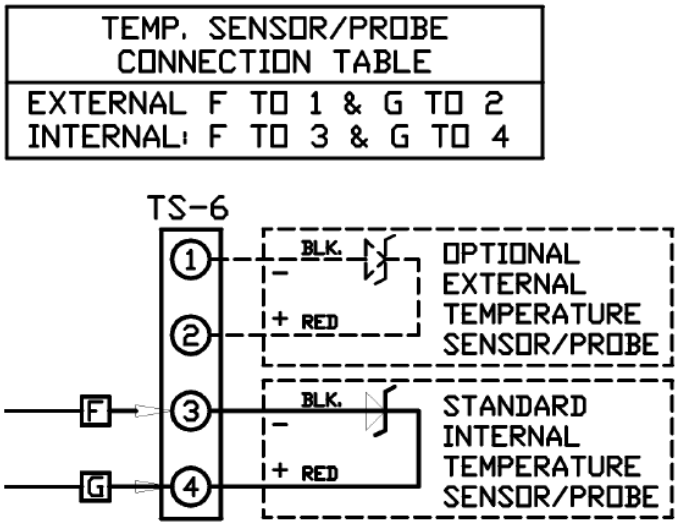


Figure 11 - Temperature Compensation Connection (External and Internal)

2.7 Enabling Load Sharing

All TPSD units include the Load Sharing feature. Load sharing allows the customer to parallel with any identical TPSD to share a DC load and therefore reduce the strain on each charger. Chargers to be paralleled *MUST* be the same output (Voltage and Current).

Load Sharing Procedure

Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the units' breakers are off. Verify that no voltage is present by using a voltmeter at all input and output terminals.

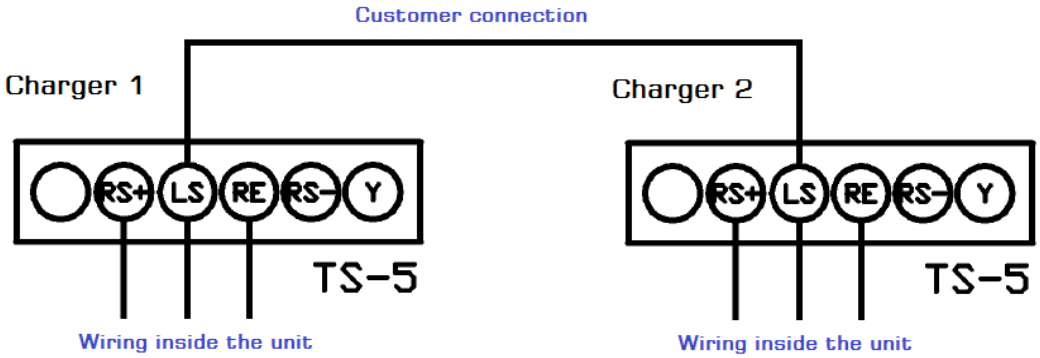


Figure 12 - Load Sharing Connection
(Schematic wiring)

1. Connect the DC Output of both units in parallel to the same DC load/battery.
2. Locate terminal strip **TS-5** inside both of the chargers.
3. As illustrated in Figure 12, connect the **LS** terminal of one charger to the **LS** terminal of the second charger.
4. Once batteries are fully charged and/or loads are stabilized, turn OFF all chargers except for one.
5. Take a voltage reading on the output of the charger.
6. Turn on the next charger, turn off the first charger.
7. Set the output voltage of the second unit to match the first by adjusting the float potentiometer.
8. After all chargers have been adjusted, turn ON all chargers
9. Follow the same procedure for setting the equalize voltage.

2.8 DNP 3 / Modbus Scada Interface (Option 21P/21Q)

The optional DNP 3/ Modbus Scada Interface Communication Card, allows the customer to remotely connect to the TPSD battery charger. The card is equipped with four methods of communication; DNP 3.0, Modbus ASCII, Modbus RTU and Modbus TCP. There are three different ports for connection to the communication card. The three port types for connection are: RS232, RS485 and TCP (Ethernet).

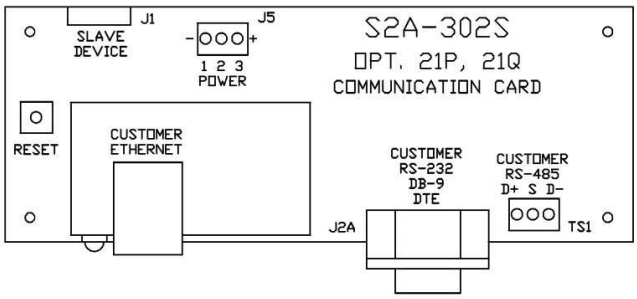


Figure 13 - DNP 3 / Modbus Communication Card

Communication Interface Connection Procedure

Before making any connections to the TPSD ensure that the AC Power is off at the main breaker box and that both of the units' breakers are off. Choose which port to use for connection. Connect the appropriate cable between the port on the communication card and the port on the computer.

For more details on connection instructions as well as operation instructions refer to the DNP 3.0 & Modbus Scada Interface instruction manual included with the TPSD. The DNP 3.0 & Modbus instruction manual is also available online at http://www.lamarchemfg.com/.

3 Operation

3.1 Starting the TPSD

All equipment is shipped from the factory fully checked and adjusted based on the customer order. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect.

Factory Settings

The factory settings of the TPSD are based on the customer order, unless otherwise specified all units are set at the factory with the following settings.

Float Voltage:	*2.17 V/C for LA and 2.25 V/C for VRLA*
	1.40 V/C for NC
Equalize Voltage:	*2.33 V/C for LA and 2.27 V/C for VRLA*
	1.55 V/C for NC
Low DC Voltage:	*1.98 V/C for LA*
Low DC Current:	*0.5 Amps*
Current Limit:	*105% or nominal output current*
High DC Voltage:	*2.45 V/C for LA and VRLA*
High Voltage Shutdown:	*2.50 V/C for LA and VRLA*
Battery End of Discharge:	*1.75 V/C for LA*
Equalize Timer Mode:	*Mode 0*
Equalize Time:	*Eight Hours*

NOTE: V/C – Volts per Cell, LA – Lead Acid, VRLA – Valve Regulated Lead Acid, NC – Nickel Cadmium

3.1.1 Checking the Installation

Before attempting to start up the TPSD check and verify that all connections are correct. Check that all terminations and contacts are tightened securely. Check that the transformer is set for the correct voltage and that the input frequency matches the nameplate or the charger. Check that the battery/load voltage matches the DC output voltage on the nameplate of the charger.

3.1.2 Starting/Stopping the TPSD

Once proper connections are established energize the power supply by turning on the unit's AC breaker (the DC breaker should be off). This will charge the capacitors inside the unit and eliminate heavy arcing when the batteries are connected. After about 30 seconds, turn on the DC breaker. When shutting down the TPSD switch off the DC breaker first and then switch off the AC breaker.

3.1.3 Start-Up Sequence

Upon powering up the TPSD a test sequence is activated. This test flashes all of the units LEDs and activates all alarms. The digital meter display will show the model and software number.

The Front Panel

Figure 14 - TPSD Front Panel

The TPSD front panel includes:

- Digital Meter Display
- Two operation mode LED indicators: FLOAT (green) and EQUALIZE (Amber)
- Incoming power LED indicator: AC (green)
- Five alarm LED indicators: LOW CURRENT, LOW VOLTAGE/DIFF, HIGH VOLTAGE/HVSD, GROUND DETECTION and SUMMARY (all red)
- Four parameter LED indicators: VOLT, AMP, TIMER MODE and EQ HRS (all red)
- HVSD RESET pushbutton switch
- EQUALIZE/SELECT toggle switch
- POS/NEG toggle switch
- Three adjustments: EQ ADJ (equalize voltage), CL ADJ (current limit) and FLT ADJ (float voltage)

After the TPSD has completed the start up sequence, "AC" and "FLOAT" green LED indicators on the front panel will be lit. The digital meter display will show the system DC output voltage. Pulling down the "EQUALIZE/SELECT" toggle switch changes the parameter on the display. The bottom four red LEDs indicate what parameter is shown:

- **VOLT**
  Shows the DC Output Voltage.
- **AMP**
  Shows the DC Output Current.
- **TIMER MODE**
  Shows what Equalize timer mode the charger is currently set to.
- **EQ HRS**
  Shows what Equalize timer hours the charger is currently set to.

3.3 Understanding the Alarms

Each alarm indication relay in the TPSD is designed as fail-safe. This means that under a complete system malfunction with all alarm relays de-energized, each alarm will indicate its correct state. Table 9 shows what state each alarm relay is in under normal running conditions of the charger, **no alarms are present.**

Alarm Relay	State of the Relay	Normally Open contacts	Normally Closed contacts
HVSD	De-energized	Open	Closed
HIGH DCV	De-energized	Open	Closed
LOW DCV	Energized	Closed	Open
NEG GND	De-energized	Open	Closed
POS GND	De-energized	Open	Closed
AC POWER FAIL	Energized	Closed	Open
SUMMARY	Energized	Closed	Open
LOW DCA	Energized	Closed	Open

Table 9 – State of each Alarm Relay (No alarms present)

The ***HVSD ALARM*** will trigger if the output DC voltage of the charger rises above the alarm threshold for longer than 20 seconds, red "HVSD" LED will turn on. This is usually due to the failure of an internal charger component, but could also be the result of maladjustments of the float/equalize potentiometers. If the high DC voltage shut down alarm activates the DC output of the charger shuts off the charger to prevent irreversible damage to the battery. See Section *3.5.1 CUSTOMER CALIBRATION* for information on viewing and adjusting the threshold value.

The ***HIGH DCV ALARM*** will trigger if the output DC voltage rises above the specified voltage threshold of the alarm for longer than 5 seconds, red "HIGH VOLTAGE" LED will flash. This is usually caused by maladjustments of the float/equalize potentiometers, or in rare cases by a failure of an internal charger component. See Section *3.5.1 CUSTOMER CALIBRATION* for information on viewing and adjusting the threshold voltage.

The ***LOW DCV ALARM*** will trigger if the DC voltage drops below the specified voltage threshold of the alarm for longer than 5 seconds, red "LOW VOLTAGE" LED will turn on. This is usually due to an AC Failure, or the charger is overloaded into deep-current limit. It could also be caused by maladjustments of the float/equalize potentiometers, or in rare cases by a failure of an internal charger component. See Section *3.5.1 CUSTOMER CALIBRATION* for information on viewing and adjusting the threshold voltage.

The ***NEG GND ALARM*** will trigger if any current between the negative terminal of the battery and earth ground is measured, red "GROUND DETECTION" LED will turn on. A negative ground alarm would signify that the negative terminal of a floating battery has become grounded. If the charger has ground detection disabled this alarm will not function.

The ***POS GND ALARM*** will trigger if any current between the positive terminal of the battery and earth ground is measured, red "GROUND DETECTION" LED will flash. A positive ground alarm would signify that the positive terminal of a floating battery has become grounded. If the charger has ground detection disabled this alarm will not function.

The ***AC POWER FAIL ALARM*** will trigger immediately when the AC power to the unit is lost, green "AC" LED will turn off. The alarm will automatically reset when AC power is restored to the unit. When AC power is lost the front panel display and indicators will remain powered by the connected batteries.

The ***SUMMARY ALARM*** will trigger if any of the below conditions occur for longer than 5 seconds. When the summary alarm triggers the red "SUMMARY" LED will turn on:

- Low DC Voltage
- High DC Voltage
- Low DC Current*
- Positive Ground*
- Negative Ground*
- AC Failure*

* - May or may not be included in the Summary Alarm (Factory Calibration)

The ***LOW DCA ALARM*** will trigger if the output DC current of the charger has dropped below the alarm threshold for longer than 5 seconds, red "LOW CURRENT" LED will turn on. This is usually caused by the load (if applicable) being disconnected or going into a sleep state as well as the battery (if applicable) reaching a full charge. This could also be the result of maladjustments of the float/equalize potentiometers. In rare cases this could be the result of certain load sharing setups in which the other charger is set up to supply more power to the load. See Section *3.5.1 CUSTOMER CALIBRATION* for information on viewing and adjusting the threshold value.

All alarms have adjustable time delay to energize; the range is 0 through 255 seconds. Table 10 shows factory setting of each alarm.

Alarm	Delay (seconds)
Low DC Voltage	5
High DC Voltage	5
High Voltage Shutdown	20
Low DC Current	4
Timer Mode	30 for Mode 4

Table 10 – Factory setting for alarm time delays

NOTE: All alarms automatically reset when the alarm condition is corrected. However the High Voltage Shutdown must be reset manually by pressing the HVSD RESET pushbutton on the front panel.

3.4 Selecting the Charging Mode

The TPSD has two different settings for DC output voltage, float mode and equalize mode. Float charging mode is used for all normal battery charging needs, in the case of the TPSD the float mode can also be used for battery elimination (directly powering the DC load from the TPSD). Equalize mode is used when it is necessary to equalize (or balance) the level of charge across all cells present in the battery.

There are two LEDs on the front panel that indicate the current mode of the charger. If the charger is in Float mode simply press the "EQUALIZE/SELECT" toggle switch to the up position to switch into Equalize mode. If the charger is in Equalize mode it will automatically switch back to Float mode after the designated equalize time, alternatively the charger can manually be switched to Float mode by pressing the "EQUALIZE/SELECT" toggle switch to the up position.

3.4.1 Equalize Timer Modes

The TPSD battery charger has five different modes of Equalize charging operation. The Equalize mode can be viewed on the charger display by pulling down the "EQALIZE/SELECT" toggle switch until "TIMER MODE" LED turns on. Equalize mode can be changed via Customer Calibration which will be discussed in detail in section 3.5. In all of the equalize modes, the charger will return to float mode if the "EQUALIZE/SELECT" toggle switch is pressed up.

Mode 0 (Displayed As "P0")

Mode 0 is a manual equalize cycle and is the default setting for the charger. When the charger is set for mode 0 the equalize cycle must be activated manually. Once activated the equalize timer will turn on and the "EQUALIZE" LED will light. The length of the timer is eight hours by default and can be changed via Customer Calibration. After the timer cycles to zero the charger will automatically return to the float mode. Equalize mode will not start again until it is manually activated by the user.

Mode 1 (Displayed As "P1")

Mode 1 is an automatic equalize cycle that activates every seven days. The length of the equalize cycle is determined by the timer setting. The length of the timer is eight hours by default and can be changed via Customer Calibration. After the timer cycles to zero the charger will automatically return to the float mode. Equalize mode will restart again after seven days.

Mode 2 (Displayed As "P2")

Mode 2 is an automatic equalize cycle that activates every 14 days. The length of the equalize cycle is determined by the timer setting. The length of the timer is eight hours by default and can be changed via Customer Calibration. After the timer cycles to zero the charger will automatically return to the float mode. Equalize mode will restart again after 14 days.

Mode 3 (Displayed As "P3")

Mode 3 is an automatic equalize cycle that activates every 30 days. The length of the equalize cycle is determined by the timer setting. The length of the timer is eight hours by default and can be changed via Customer Calibration. After the timer cycles to zero the charger will automatically return to the float mode. Equalize mode will restart again after 30 days.

Mode 4 (Displayed As "P4")

Mode 4 is an automatic equalize cycle that activates when the DC voltage drops below the low voltage setting (default set at 1.98 V/C for LA) for 30 seconds or longer. The charger will return to float mode after the battery voltage rises to approximately 8% above the low voltage set point. Equalize mode will restart again when the battery voltage drops below low voltage for 30 seconds or longer.

3.5 Adjusting Parameters

All equipment is shipped from the factory fully checked and adjusted based on the customer order. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect. If the settings have been determined to be incorrect, adjustments may be made as detailed below.

3.5.1 Customer Calibration Mode

In Customer Calibration Mode the customer can access and change various parameters used by the TPSD. To access the Customer Calibration Mode, press and hold the "EQUALIZE/SELECT" toggle switch in the up position for about 5 seconds until digital meter display shows "CAL".

Once in calibration mode the customer can raise and lower values with "EQUALIZE/SELECT" toggle switch, and advance to the next setting with the "HVSD RESET" pushbutton. After the last setting is passed the changes will automatically be saved. If a setting is accidentally passed over the customer must advance through the remaining settings and restart calibration from the beginning. The calibration settings are listed below with a brief description. Refer to the next page for detailed information.

Customer Calibration Menu (CAL)			
Sequence	**Blinking Indicator**	**Display***	**Description**
1		20NC or 24NC	Appears for Nickel Cadmium Battery chargers only
2	LOW CURRENT	0.5	Low current alarm (amps)
3	AMP	1.0	Low current alarm pull-in (amps)
4	LOW VOLTAGE	47.5	Low voltage alarm (volts)
5	HIGH VOLTAGE	58.8	High voltage alarm (volts)
6	TIMER MODE	P0	Equalize Timer Mode
7	EQ HRS	8	Equalize Time (hours)
8		HVSD	High Voltage Shutdown alarm (volts)
9		tC	Enable External Temperature Compensation
10		Addr	Modbus Address
11		bAUd	Baud Rate

Table 11 – Customer Calibration Menu
(Default settings shown for 24L charger)

** - Customer adjustment*

1. Nickel Cadmium Cells

This setting appears for Nickel Cadmium battery chargers only and may be set to 20NC or 24NC.

2. Low DC Current Alarm

This setting changes the low current threshold that causes the Low DC Current Alarm to activate. The default setting depends on the DC amps of the unit. *(EX: A unit designed for 30A has a default Low DC Current alarm setting of 0.5)*

3. Low DC Current Alarm Pull In

This setting changes the low current pull in threshold that causes the Low DC Current Alarm to clear. The default setting depends on the DC amps of the unit. *(EX: A unit designed for 30A has a default Low DC Current alarm pull in setting of 1.0)*

4. Low Voltage Alarm

This setting changes the voltage limit that causes the Low DC Voltage Alarm to activate. The default setting is 1.98 V/C (for Lead Acid batteries) based on the number of battery cells that the unit was designed for. The number and type of cells is listed on the charger's nameplate. *(EX: A unit designed for 24L has a default Low Voltage alarm setting of 47.5)*

5. High Voltage Alarm

This setting changes the voltage limit that causes the High Voltage Alarm to activate. The default setting is 2.45 V/C (for Lead Acid batteries) based on the number of battery cells that the unit was designed for. The number and type of cells is listed on the charger's nameplate. *(EX: A unit designed for 24L has a default High Voltage alarm setting of 58.8)*

6. EQ Timer Mode

This setting changes the mode of the Equalize Timer. The equalize timer mode determines when the charger will go into an equalize charging cycle. The timer modes are Mode 0 (P0), Mode 1 (P1), Mode 2 (P2), Mode 3 (P3), and Mode 4 (P4). The default setting for the equalize timer mode is Mode 0 (P0). The Equalize Timer Modes are discussed in further detail in Section 3.4.1.

7. EQ Timer Setting

This setting changes the amount of time that the charger remains in the equalize charging cycle once activated. When an equalize cycle is started the charger will remain in equalize mode until the time selected by this setting has passed. By default the Equalize timer is for 8 hours.

8. High Voltage Shutdown Alarm

This setting changes the voltage limit that causes the High Voltage Shutdown Alarm to activate. The default setting is 2.50 V/C (for Lead Acid batteries) based on the number of battery cells that the unit was designed for. The number and type of cells is listed on the charger's nameplate. *(EX: A unit designed for 24L has a default High Voltage Shutdown alarm setting of 60)*

9. Temperature Compensation

This setting enables external Temperature Compensation. *(To enable set to Yes, to disable set to No)*

10. Modbus Address

This setting changes the address of the Modbus. If the customer has purchased a Communication Card (Option 21P/21Q) this setting should be set to all in order to access further options of the communication card.

10a. Scada Protocol (Modbus Address Set To All)

This setting changes the Protocol used by the accessory communication card (Option 21P, 21Q). This setting is only available if "Modbus Address" is set to all. For more information refer to the Scada Interface with DNP 3.0 and Modbus instruction manual.

10b. Node Address (Modbus Address Set To All)

This setting changes the node address used by the accessory communication card (Option 21P, 21Q). This setting is only available if "Modbus Address" is set to all. For more information refer to the Scada Interface with DNP 3.0 and Modbus instruction manual.

10c. Scada Comm Port (Modbus Address Set To All)

This setting changes the communication port used by the accessory communication card (Option 21P, 21Q). This setting is only available if "Modbus Address" is set to all. For more information refer to the Scada Interface with DNP 3.0 and Modbus instruction manual.

11. Modbus Baud Rate

This setting changes the Modbus Baud Rate. The default baud rate is 9600. The baud rate of the TPSD should be set to match the baud rate of computer that is connected.

3.6 Setting the Float Voltage

The float voltage adjustment is set at the factory at 2.17 V/C (LA), 2.25 V/C (VRLA) or 1.4 V/C (NC). The adjustment potentiometer is located on the front panel of the unit. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect. Rotating the potentiometer clockwise raises the float voltage and counterclockwise lowers the float voltage.

The approximate adjustable range is as follows:
2.02 – 2.40 V/C (LA) (VRLA)
1.29 – 1.55 V/C (NC)

3.7 Setting the Equalize Voltage

The equalize voltage adjustment is set at the factory at 2.33 V/C (Lead), 2.27 V/C (VRLA) or 1.55 V/C (NC). The adjustment potentiometer is located on the front panel of the unit. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect. Rotating the potentiometer clockwise raises the equalize voltage and counterclockwise lowers the equalize voltage.

The approximate adjustable range is as follows:
2.15 – 2.50 V/C (LA) (VRLA)
1.40 – 1.70 V/C (NC)

4 Service

All work inside the TPSD should be performed by a qualified electrician. La Marche is not responsible for any damages caused by an unqualified technician.

Before working inside the TPSD ensure that the AC Power is off at the main breaker box and that both of the unit's breakers are off. Verify that no voltage is present by using a voltmeter at all input and output terminals.

4.1 Performing Routine Maintenance

In order for the TPSD to continue to operate properly it must undergo routine maintenance. The recommended maintenance schedule is listed below

Yearly

1. Blow out rectifier/inverter with a low-pressure air hose.
2. Make sure all connections are tight. (make sure the unit is de-energized)
3. Perform a visual check on all internal components.
4. Check front panel meters and LEDs for accuracy.
5. Check capacitors for electrolyte leakage (and replace if necessary).

Every 7 Years (If the charger is consistently run in environments with extreme temperatures)

1. Filter capacitors should be replaced.

Every 10 Years

1. Check magnetics, components and wiring for signs of excessive heat.

4.2 Troubleshooting Procedure

Troubleshooting should be performed only by trained service personnel or experienced electricians. Before setting up any complicated testing or jumping to any conclusions, give the unit a general inspection.

Check the following:

1. Check DC output cables, connections, battery type, and number of cells against the unit's rating.
2. Check unit specifications against customer order.
3. Check input connections, input voltage and breaker size.
4. Check for shipping damage, loose connections, broken wires, etc.
5. Certain failures can be caused by defective batteries and customer loads; make sure batteries and loads are free from defects.

NOTE: *If the problem is found to be located in the printed circuit boards, the board should be replaced. No attempt should be made to repair circuit boards in the field.*

When calling in for a service inquiry or for troubleshooting assistance, be sure to have all of the following information on hand:

1. Equipment model number and serial number.
2. The actual AC input voltage.
3. The DC output voltage with and without the battery.
4. Result of the check of the AC and DC breakers.
5. The actual DC output current and voltage, measured with battery and load connected to charger.

NOTE: *When ordering replacement parts, drawings, or schematics, always give model number, serial number and AC input voltage.*

4.3 Symptoms & Causes

4.3.1 AC Breaker Trips

Possible Cause:

1. Wrong AC input voltage.
2. The AC input taps on power transformer set incorrectly.
   (See section 2.2.1 Changing Transformer Taps procedure)
3. An AC to DC short or AC or DC short to ground.
   (See section 4.3.5 Ground and Short Circuit Test)
4. High DC output voltage.
   - Check battery voltage for proper number of cells.
   - Check control fuse on alarm interface card.
   - Float/Equalize voltage potentiometers not set properly.
     (See sections 3.6 Float Voltage Setting and 3.7 Equalize Voltage Setting)
   - Disconnect battery and loads from rectifier output terminals, put F/E switch in the float position, and apply AC input voltage to rectifier. If DC voltage rises above 2.5 V/C, circuit regulator assembly or "informer" option may be defective.
5. Check for shorted power diodes or diode modules (SD1).
   (See section 4.3.7 Troubleshooting and Replacing Power Silicon Diodes/Modules)
6. High Voltage shutdown improperly set.
7. Open gate or wire on triac TR-1.
   (See section 4.3.6 Troubleshooting the TRIAC)

4.3.2 Open DC Fuse or Breaker

Possible Cause:

1. Shorted power diode or diode module. *(Repair/Replace as required)*
   (See section 4.3.7 Troubleshooting and Replacing Power Silicon Diodes/Modules)
2. Shorted battery cells or defective customer equipment.
3. Shorted output cables.
4. Capacitors not pre-charged.
5. Shorted C3 capacitors.
6. Loose connections on the DC fuse.

4.3.3 Charger Operates but Output Voltage/Current Low

Possible Cause:

1. Float/Equalize voltage potentiometers not set properly.
   (See sections 3.6 Float Voltage Setting and 3.7 Equalize Voltage Setting)
2. Check power diodes or diode modules and triac.
   (See section 4.3.6 Troubleshooting the TRIAC and 4.3.7 Troubleshooting Diodes)
3. Control assembly is defective. *(S2A-205, replace as required)*
4. Defective display.
5. Unit in current limit.
6. Resonating capacitor open.
7. Defective shunt.

4.3.4 Charger Operates but Output Voltage is High.

Possible Cause:

1. Float/Equalize voltage potentiometers not set properly.
   (See sections 3.6 Float Voltage Setting and 3.7 Equalize Voltage Setting)
2. Control assembly is defective. *(S2A-205, replace as required)*
3. Open gate on triac TR-1.
   (See section 4.3.6 Troubleshooting the TRIAC)

4.3.5 Ground and Short Circuit Test.

A simple ohmmeter check can be performed to check the unit for a short to ground, primary to secondary breakdown, AC-DC short, or DC ground. Before installation of a new unit, the above checks should be made before installing. If a short of this type is suspected on a unit in service, check as follows:

1. Disconnect AC input power to the unit. Disconnect the DC battery and loads from the rectifier.
2. Set ohmmeter scale on ohms scale RX100.
3. Measure from one terminal of the input to one terminal of the output. Meter should not indicate. If the meter reads full scale deflection, this indicates an ac-dc short. During shipping, an AC wire may rub against the DC lugs, terminals, etc. And cause a short. These problems may be eliminated by being very careful in inspecting the wiring to make certain the AC wires are not touching the DC wiring.
4. Check the input terminals to ground and check the output terminals ground. If the meter indicates full scale deflection, a wire is touching a metal part of the rectifier. Look for wires that are near any metal part and inspect for possible breakdown caused by shipping. The heatsink of the diodes and the control unit are insulated from ground through the mounting legs.

4.3.6 Troubleshooting the TRIAC

The procedure for checking the triac is as follows:

1. On the ohmmeter, set the switches on "ohms", "DC", and "Rx10,000" scale.
2. Disconnect the triac to be checked. Using an ohmmeter, measure the resistance between main terminals, MT1 and MT2 in both directions. A good device will indicate open circuit in both directions, a low resistance indicates a shorted device.
3. Set ohmmeter to Rx100 scale.
4. To check for a shorted triac gate lead, measure the resistance between gate (GATE) lead and main terminal MT1. A reading of zero ohms in both directions indicates a shorted gate. A reading of infinity in both directions indicates an open gate and the triac should be replaced. A good device should have resistance in both directions, but not zero ohms.

4.3.7 Troubleshooting and Replacing Power Silicon Diodes/Modules

1. On the ohmmeter, set the switches on "ohms", "DC", and "Rx100" scale.
2. Isolate one end of the diode by disconnecting the wires attached to the nipple (or pigtail) end of the diode (only one end of the diode must be disconnected). On a diode module, both of the outside leads must be disconnected.
3. Clip one lead of the ohmmeter to the anode lead of the diode. Clip the other ohmmeter lead to the cathode.
4. Note the ohmmeter reading. Then reverse the leads to the diode. Again, note the ohmmeter reading. If the diode is good, the meter will indicate a high resistance in one direction and a low resistance with the leads reversed. If the diode is shorted, the meter will read full scale, or zero ("O") resistance with the leads in either direction. If the diode is "open", the ohmmeter needle will not indicate or it will show infinite resistance in either direction, indicating an open circuit.
5. All diodes must be checked in the event that more than one diode is defective.
6. If the diode is defective, remove the defective diode from the heatsink and replace with a new diode.

4.3.8 Checking Capacitors

1. When checking capacitors be sure all AC power is turned off and battery is disconnected from unit. Check capacitors with DC voltmeter to see that DC voltage is at near -0- volts.
2. Momentarily short circuit the capacitor leads to assure complete discharge.
3. Connect the meter test leads to the capacitor leads or terminals and observe indicated resistance.
4. A good capacitor will indicate an initial low resistance and gradually increase as the capacitor charges. The final resistance of a good capacitor is usually several hundred thousand ohms approaching a megohm.
5. Initial high resistance approaching infinity indicates an open capacitor. Initial and continued low resistance readings indicate a shorted capacitor.

When ordering replacement parts, drawings, or schematics, always give model number, serial number and AC input voltage.

Appendix A: TPSD Specifications

ELECTRICAL	
AC Input	120, 208, 240, or 480VAC Voltage range +10% / -12% Frequency Range 50Hz or 60Hz ± 5%
DC Output	6 - 200 ADC 24, 48, or 130VDC
Output Filtering	Single Phase - 30mV RMS, with or without battery Three Phase - 100mV RMS, with or without battery
Regulation	± 0.5% from no load to full load over the specified input voltage, frequency and ambient temperature range.
Load Sharing	When connected identical TPSD units are forced to share the load equally (within ± 5%).
Meters	Digital Meter Display Optional second Digital Meter Display (DC Volts Only)
PROTECTION	
Current Walk-In	The output current will gradually increase after the charger is turned on, eliminating surges and overshoot
Current Limit	50 - 115% of the rated DC output current.
AC Breaker	AC breaker is standard equipment. (2KAIC or 5KAIC depending on the model)
DC Breaker	DC breaker is standard equipment. *see DC Fuse (5KAIC, 7.5KAIC or 10KAIC depending on the model)
DC Fuse	DC fuse is standard equipment only for TPSD-100-24V and TPSD-100-48V Optional breaker is rated at 10KAIC
Emergency Restoration	The battery charger may be connected to a battery which is heavily discharged and recharge it without clearing any protective devices.
ENVIROMENTAL	
Audible Noise	Less than 65dBA at any point 5 feet from any vertical surface
Operating Temperature	32 to 122˚F (0 to 50˚C)
Storage Temperature	-40 to 185° F (-40 to 85° C)
Relative Humidity	0 to 95% (non-condensing)
Cooling	Convection cooled
Shock	The battery charger in its shipping container withstands shock developed when one edge of the container is dropped six inches while the opposite edge is resting on the ground, or it is dropped two inches without any physical damage or degradation of the electrical performance.
Vibration	The battery charger in its shipping contained, withstands vibration encountered in shipping without physical damage or degradation of the electrical performance.
Altitude	This battery charger is capable of operation at altitudes up to 10,000 feet at an ambient temperature of up to +40 degrees C.
Ventilation	The unit should be mounted so that ventilating openings are not blocked and air entering the cabinet does not exceed 50 degrees C (122 degrees F).

Appendix B: TPSD Current Draw and Feeder Breaker Sizes

	Model Number	DC Amps	Single Phase				
			60 Hz				50 Hz
			AC Current Draw (Recommended Feeder AC Supply Breaker)				
			A1 120V	ABD1 120/240/208V	BLD1 240/220/208V	C1 480V	BL1 240/220V
24 Volt Systems	TPSD-6-24V	6	2 (5)	---	---	---	---
	TPSD-12-24V	12	4 (10)	---	---	---	---
	TPSD-20-24V	20	---	6.7/3.4/3.9 (10/5/5)	---	---	3.4/3.7 (5/5)
	TPSD-25-24V	25	---	8.4/4.2/4.9 (15/10/10)	---	---	4.2/4.6 (10/10)
	TPSD-30-24V	30	---	11/5/5.8 (15/10/10)	---	---	5.0/5.5 (10/10)
	TPSD-35-24V	35	---	12/5.9/6.8 (20/10/10)	---	---	5.9/6.4 (10/10)
	TPSD-50-24V	50	---	17/8.4/9.7 (30/15/15)	---	---	8.4/9.2 (15/15)
	TPSD-75-24V	75	---	26/13/15 (40/20/20)	---	6.3 (10)	13/14 (20/20)
	TPSD-100-24V	100	---	34/17/20 (40/20/20)	---	8.4 (15)	17/19 (25/25)
48 Volt Systems	TPSD-6-48V	6	4 (10)	---	---	---	---
	TPSD-12-48V	12	8 (15)	---	---	---	---
	TPSD-20-48V	20	---	14/6.7/7.8 (20/10/10)	---	---	6.7/7.3 (10/10)
	TPSD-25-48V	25	---	17/8.4/9.7 (30/15/15)	---	---	17/19 (15/15)
	TPSD-30-48V	30	---	21/11/12 (30/15/15)	---	---	17/19 (15/15)
	TPSD-35-48V	35	---	24/12/14 (30/15/15)	---	5.9 (10)	17/19 (20/20)
	TPSD-50-48V	50	---	34/17/20 (30/15/15)	---	8.4 (15)	17/19 (25/25)
	TPSD-75-48V	75	---	51/26/30 (30/15/15)	---	13 (20)	17/19 (40/40)
	TPSD-100-48V	100	---	---	34/37/39 (50/50/50)	17 (25)	17/19 (50/50)
130 Volt Systems	TPSD-6-130V	6	---	11/5/5.8 (20/10/10)	---	---	5.0/5.5 (10/10)
	TPSD-12-130V	12	---	21/11/12 (30/15/15)	---	---	11/11 (15/15)
	TPSD-20-130V	20	---	34/17/20 (50/25/25)	---	8.4 (15)	17/19 (25/25)
	TPSD-25-130V	25	---	42/21/25 (60/30/30)	---	11 (15)	21/23 (30/30)
	TPSD-30-130V	30	---	51/26/30 (60/30/30)	---	13 (15)	26/28 (40/40)
	TPSD-35-130V	35	---	59/30/34 (80/40/40)	---	15 (20)	30/33 (45/45)
	TPSD-50-130V	50	---	---	42/46/49 (60/60/70)	21 (25)	42/46 (60/60)

	Three Phase				
	Model Number	DC Amps	60 Hz		50 Hz
			AC Current Draw (Recommended Feeder AC Supply Breaker)		
			BD3 (240/208V)	C3 (480V)	5G3 (380V)
24 Volt Systems	TPSD-75-24V	75	6.3/7.3 (10/10)	---	---
	TPSD-100-24V	100	8.5/9.8 (15/15)	---	---
	TPSD-150-24V	150	13/15 (20/20)	6.3 (15)	---
	TPSD-200-24V	200	17/20 (25/25)	8.5 (15)	---
48 Volt Systems	TPSD-50-48V	50	8.5/9.8 (15/15)	---	---
	TPSD-75-48V	75	13/15 (25/25)	6.3 (10)	---
	TPSD-100-48V	100	17/20 (30/30)	8.5 (15)	---
	TPSD-150-48V	150	26/30 (40/40)	13 (20)	---
	TPSD-200-48V	200	34/40 (60/60)	17 (25)	---
130 Volt Systems	TPSD-6-130V	25	11/13 (20/20)	---	---
	TPSD-30-130V	30	13/15 (20/20)	6.3 (10)	---
	TPSD-35-130V	35	15/18 (25/25)	7.4 (10)	---
	TPSD-50-130V	50	22/25 (35/35)	11 (20)	---
	TPSD-75-130V	75	32/37 (50/50)	16 (25)	20 (30)
	TPSD-100-130V	100	43/49 (70/70)	22 (30)	27 (35)
	TPSD-125-130V	125	53/61 (80/80)	27 (40)	---
	TPSD-150-130V	150	64/74 (100/100)	32 (45)	---

Appendix C: TPSD Heat Losses

(Based on 85% efficiency for single phase units, 90% efficiency for three phase units at 240V nominal input and rated load)

Single Phase

DCA	DCV	AC DRAW	WATTS IN	WATTS OUT	WATTS LOST	BTU/HR
6	24	2*	184	156	28	96
12	24	4*	367	312	55	188
20	24	3.4	612	520	92	314
25	24	4.2	765	650	115	392
30	24	5	918	780	138	471
35	24	5.9	1071	910	161	549
50	24	8.4	1529	1300	229	781
75	24	13	2294	1950	344	1174
100	24	17	3059	2600	459	1566
6	48	4*	367	312	55	188
12	48	8.1*	734	624	110	375
20	48	6.7	1224	1040	184	628
25	48	8.4	1529	1300	229	781
30	48	11	1835	1560	275	938
35	48	12	2141	1820	321	1095
50	48	17	3059	2600	459	1566
75	48	26	4588	3900	688	2348
100	48	34	6118	5200	918	3132
6	130	5	918	780	138	471
12	130	11	1835	1560	275	938
20	130	17	3059	2600	459	1566
25	130	21	3824	3250	574	1959
30	130	26	4588	3900	688	2348
35	130	30	5353	4550	803	2740
50	130	42	7647	6500	1147	3914

* - 120VAC Input

Three Phase

DCA	DCV	AC DRAW	WATTS IN	WATTS OUT	WATTS LOST	BTU/HR
75	24	6.3	2170	1950	220	752
100	24	8.5	2894	2600	294	1002
150	24	13	4340	3900	440	1503
200	24	17	5787	5200	587	2004
50	48	8.5	2894	2600	294	1002
75	48	13	4340	3900	440	1503
100	48	17	5787	5200	587	2004
150	48	26	8681	7800	881	3005
200	48	34	11574	10400	1174	4007
25	130	11	3617	3250	367	1252
30	130	13	4340	3900	440	1503
35	130	15	5064	4550	514	1753
50	130	22	7234	6500	734	2504
75	130	32	10851	9750	1101	3756
100	130	43	14468	13000	1468	5008
125	130	53	18085	16250	1835	6260
150	130	64	21702	19500	2202	7512

Appendix D: Field Installable Accessory Kits

La Marche offers multiple accessory kits that are available for purchase separately from the TPSD units. These accessories are installable in the field. Not all accessory kits will be installable in all enclosures.

102 – Blocking Diode
11L – Lightning Arrestor
21P – DNP3 Protocol Package
21Q – Modbus Interface Package
11W – External Temperature Package (22 Ft)
11Y – External Temperature Package (100 Ft)

The installation of each accessory varies between each of the TPSD enclosures. The installation instructions for each accessory and each enclosure is included as part of the accessory kit.

Appendix E: Manufacturer's Warranty

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory and is warranted to be free from any defect in workmanship and material that may develop within one year from date of purchase. In addition to the standard one (1) year warranty, La Marche warrants it's magnetics and power diodes on a parts replacement basis only for four (4) more years under normal use.

Any part or parts of the equipment (except fuses, DC connectors and other wear-related items) that prove defective within a one (1) year period shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. Magnetics and power diodes are warranted for five (5) years after date of purchase. During the last four (4) years of this five (5) year warranty period, the warranty covers parts replacement only, and no labor or other services are provided by La Marche, nor is La Marche obligated to reimburse the owner or any other person for work performed.

Should a piece of equipment require major component replacement or repair during the first year of the warranty period, these can be handled in one of two ways:

1. The equipment can be returned to the La Marche factory to have the inspections, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer during the first year. Transportation charges or duties shall be borne by purchaser.

2. If the purchaser elects not to return the equipment to the factory and wishes a factory service representative to make adjustments and/or repairs at the equipment location, La Marche's field service labor rates will apply. A purchase order to cover the labor and transportation cost is required prior to the deployment of the service representative.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard LaMarche units will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special units are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

The above warranty is exclusive, supersedes and is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer, nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an official of the manufacturer.

Appendix F: Manufacturer's Extended Parts Warranty

(THIS IS YOUR WARRANTY IF YOU HAVE PURCHASED THE EXTENDED PARTS WARRANTY AS SHOWN ON OUR INVOICE TO YOU OR IF YOU PURCHASE THE EXTENDED PARTS WARRANTY ANYTIME DURING THE FIRST 12 MONTHS AFTER THE DATE OF OUR INVOICE)

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory. Any part or parts of the equipment (except protective devices, DC connectors and other wear-related items) that prove defective within a one (1) year period from the date of our invoice to you shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. Labor and parts are covered during this one (1) year period.

For the next four (4) years after the expiration of the one-year warranty, on a parts replacement only basis, any part or parts of the equipment (except protective devices, DC connectors and other wear-related items) that prove defective within the additional four (4) year period shall be replaced providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation. During this four (4) year period, the warranty covers parts replacement only, no labor or other services are provided by La Marche, nor is La Marche obligated to reimburse the owner or any other person for work performed. If you return the equipment to our factory (freight prepaid), we will repair and cover parts and labor.

Should a piece of equipment require major component replacement or repair during the extended warranty period, these can be handled in one of three ways:

1. If the Purchaser elects to take the responsibility of repairing the equipment and requests replacement part(s), Purchaser or Sales Representative must contact Factory for return authorization and a purchase order must be issued. Replacement part(s) will be promptly shipped and invoiced. After the defective part(s) are returned and inspected at the Factory, if the defect(s) were due to faulty material or workmanship, credit will be issued.

2. The equipment can be returned to the La Marche factory to have the inspections, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer under the Extended Warranty. Transportation charges or duties shall be borne by Purchaser.

3. If the purchaser elects not to return the equipment to the factory and wishes a factory service representative to make adjustments and/or repairs at the equipment location, La Marche's field service labor rates will apply. A purchase order to cover the labor and transportation cost is required prior to the deployment of the service representative.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard La Marche units will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special units are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

THE ABOVE WARRANTY IS EXCLUSIVE, SUPERSEDES AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS. NO PERSON, AGENT OR DEALER IS AUTHORIZED TO GIVE ANY WARRANTIES ON BEHALF OF THE MANUFACTURER, OR TO ASSUME FOR THE MANUFACTURER ANY OTHER LIABILITY IN CONNECTION WITH ANY OF ITS PRODUCTS UNLESS MADE IN WRITING AND SIGNED BY AN OFFICIAL OF THE MANUFACTURER.

Appendix G: Document Control and Revision History

Part Number: 102755
Instruction Number: P25-LTPSD-1
Issue ECN: 15010 – 10/01

20040 – 6/13	19973 – 04/13	18985 – 04/11	17650 – 10/07
16816 – 06/05	16701 – 03/05	15349-1 – 05/02	15010 – 10/01