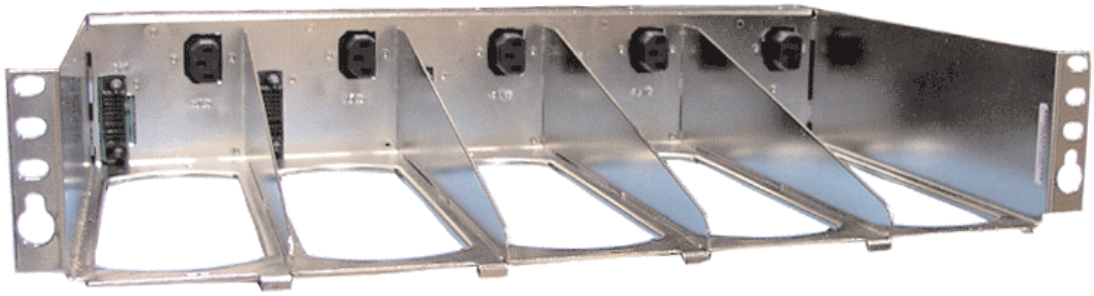
TLR5 - COMPACT DC POWER SYSTEM

Installation, Operation, and Maintenance Manual



TLR5

July 2005

Version A3

LAMBDA

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1 Safety and Recommended Practices

1.1 General practices

For use in restricted access locations only.
Suitable for mounting on concrete or other non-combustible surfaces

This product accepts an AC Voltage between 100 and 240 VAC, 47 to 63 Hz, and produces a regulated output of 10.5-14VDC, 21-28 VDC, or 42-56 VDC (depending upon deployed power modules) capable of delivering a max of 240 amps DC for 12 V power modules, max of 240 amp DC for 24 V power modules, or max 200 amps DC for 48V power modules in an ambient operating temperature range of -40°C to +75°C (depending upon deployed power modules).

HAZARDOUS VOLTAGE AND ENERGY LEVELS ARE PRESENT WHICH CAN PRODUCE SERIOUS SHOCKS AND BURNS. Only authorized, qualified, and trained personnel should attempt to work on this equipment. Removal of HI-POT seal on the power module may create a safety problem and will void product warranty. Refer to datasheets for full product specifications.

OBSERVE ALL LOCAL AND NATIONAL ELECTRICAL, ENVIRONMENTAL, AND WORKPLACE CODES.

If a line cord(s) is(are) used as the AC connection means, the plug end of the cord is considered to be the primary disconnect means, and reasonable access must be given to the plug and receptacle area. The receptacle must be fed with a breaker or fuse according to Table 5 (12 V), Table 6 (24 V), or Table 7 (48V).

For hard-wired AC connections, a readily accessible disconnect device shall be incorporated in the building installation wiring. Select a wall breaker and wire sizes according to Table 5 (12V), Table 6 (24V), or Table 7 (48V).Internal power module fuses are not field accessible. They can be replaced only by authorized factory service personnel.

CAUTION: ALL POWER MODULES EMPLOY INTERNAL DOUBLE POLE/NEUTRAL FUSING

WARNING: HIGH LEAKAGE CURRENT: EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY

Use double hole, UL listed lugs for all DC connections to prevent lug rotation and inadvertent contact with other circuits. Terminal strip connections require only single hole lugs.

Class 1, 90°C wire is recommended for all DC connections. Minimum wire sizes are shown in Table 9. In practice, loop voltage drop considerations will usually dictate larger than minimum safe wire size. Connections to multiple loads are recommended to be made through an external distribution with overcurrent protection.
The alarm contacts are rated for a maximum voltage of 60 V, SELV (Safety Extra Low Voltage) and a maximum continuous current of .5A.

Connection and mounting torque requirements are listed in Table 11 - Recommended Torque Settings

Lambda does not recommend shipping the rack with the power modules installed. Power modules should be shipped in separate boxes provided by Lambda.

1.2 FCC Compliance Statement

1.2.1 Note

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

1.2.2 Warning

Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.

1.2.3 ICES-003 Class B Notice

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

2 Product Section

2.1 Heat Dissipation

The following table displays the max and typical BTU/hr of heat dissipated for each power module. Max is calculated at 180Vac, Max Vdc and current values for power module, and typical is calculated at 240 Vac, typical Vdc and current values.

Heat Dissipation 12V Power Modules

Model	Typical BTU/hr	Max BTU/hr
TL50012	413	490
TL75012	619	718

Table 1

Heat Dissipation 24V Power Modules

Model	Typical BTU/hr	Max BTU/hr
TL50024	247	308
TL100024	493	602
TL150024	740	882

Table 2

Heat Dissipation 48V Power Modules

Model	Typical BTU/hr	Max BTU/hr
TL50048	180	281
TL100048	361	563
TL150048	541	844
TL200048	722	1100
TL250048	902	1355

Table 3

2.2 AC Requirements

2.2.1 AC input circuit breaker sizing

Table 4 shows the required input voltages for the available power modules. The power modules under wide line (WL) can be connected to a nominal input voltage between 100 V & 240V. The power modules under high line (HL) can be connected to a nominal input voltage between 200 V & 240V.

Power Module Input Voltages

Wide Line (100V - 240V)	High Line (200V - 240V)
TL50048	TL150024
TL50024	TL200048
TL50012	TL250048
TL75012	
TL100048	
TL100024	

Table 4

2.2.2 AC Input Types

This system utilizes a single, dual, or individual feed AC architecture (as shown in Figure 1, Figure 2, & Figure 3) via a rear AC terminal block.

2.2.2.1 Single Feed

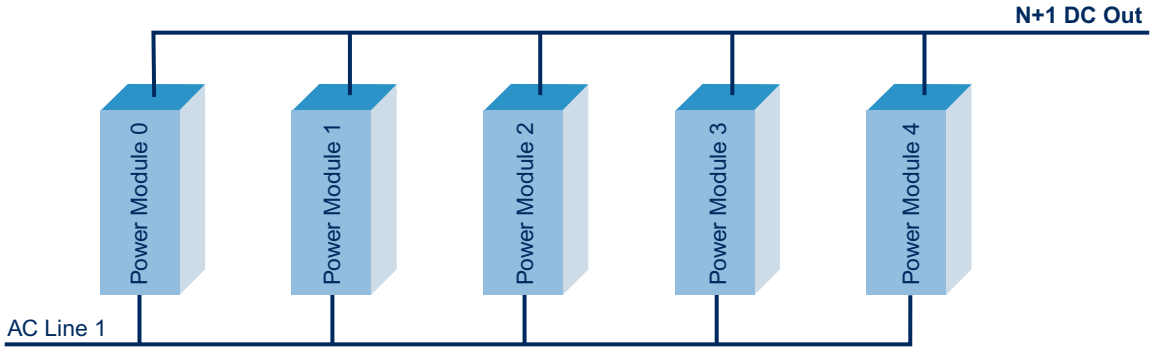

Figure 1 - Single Feed AC Wiring Architecture

A single feed architecture powers all five power modules with a single AC feed. Connect the AC source that is sized according to Table 5, Table 6, or Table 7, to the rear terminal block seen in Figure 7. The tables are separated by system voltage, i.e. 12 volt, 24 volt, or 48 volt systems.

2.2.2.2 Dual feed

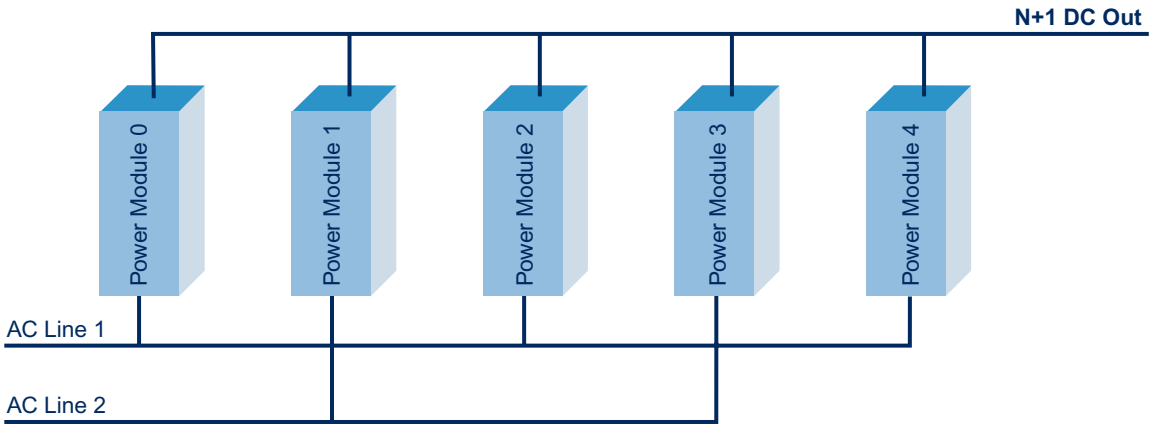

Figure 2 - Dual Feed AC Wiring Architecture

A dual feed architecture powers three power modules on AC feed 1 and two power module on AC feed 2. Connect the AC source that is sized according to Table 5, Table 6, or Table 7, to the rear terminal block seen in Figure 8. The tables are separated by system voltage, i.e. 12 volt, 24 volt, or 48 volt systems.

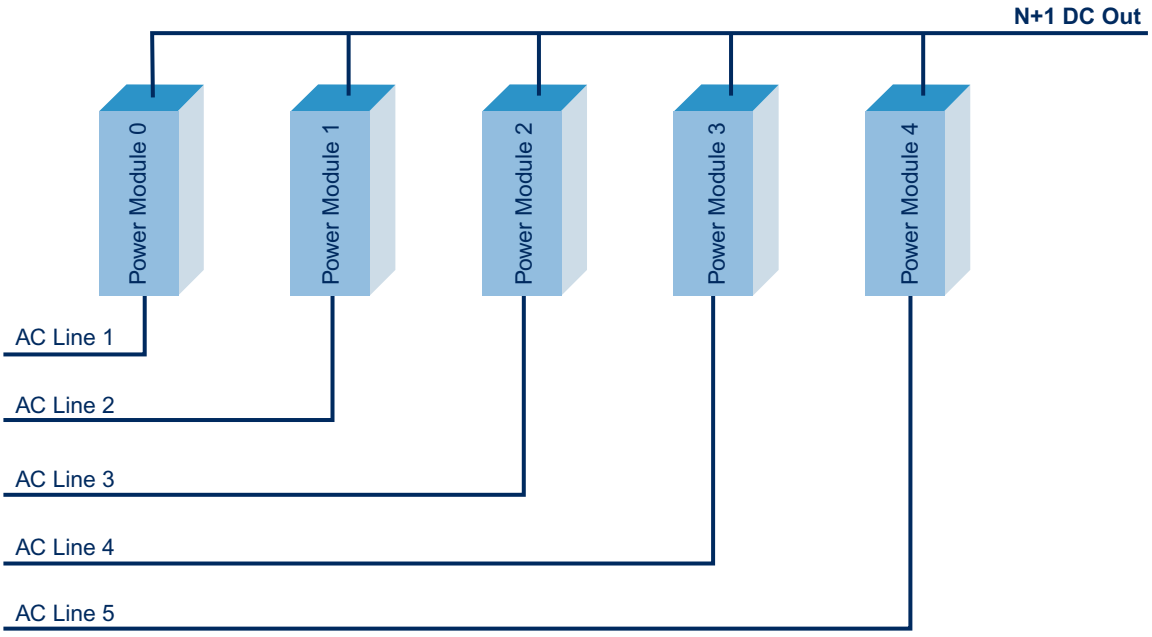

Figure 3 - Individual Feed AC Wiring Architecture

An individual feed architecture powers one power module on each AC feed. Connect the AC source that is sized according to Table 5, Table 6, or Table 7, to the rear terminal block seen in Figure 9. The tables are separated by system voltage, i.e. 12 volt, 24 volt, or 48 volt systems.

2.2.3 Sizing AC feeds

To size your AC feeds properly, use the tables below. Failure to size the AC breaker and wiring properly can result in nuisance breaker trips or even damage to the equipment.

Follow the example below for determining AC breaker and wire sizing.

The tables below use the absolute minimum input voltage at which the power modules will run at to determine AC requirements. 90 V corresponds to low line and 180 V corresponds to high line.

Recommended AC Circuit Breaker & Wire Sizes (12V system)					
Number of Power Modules on AC Feed	Minimum Input Voltage	Model Number of Power Module	Maximum *rated* AC Current (Amps)	Circuit Breaker Minimum Value to use (Amps)	90°C Minimum Wire Gauge to use at 30°C ambient (AWG)
1	90	TL50012	6	15	14
	180	TL50012	3	15	14
	90	TL75012	9	15	14
	180	TL75012	5	15	14
2	90	TL50012	13	15	14
	180	TL50012	7	15	14
	90	TL75012	18	20	12
	180	TL75012	10	15	14
3	90	TL50012	19	20	12
	180	TL50012	10	15	14
	90	TL75012	28	30	10
	180	TL75012	15	20	12
4	90	TL50012	25	30	10
	180	TL50012	14	15	14
	90	TL75012	37	50	8
	180	TL75012	20	30	10
5	90	TL50012	32	50	8
	180	TL50012	17	20	12
	90	TL75012	46	50	8
	180	TL75012	25	30	10

Table 5

Table 5

Recommended AC Circuit Breaker & Wire Sizes (24V system)

Number of Power Modules on AC Feed	Minimum Input Voltage	Model Number of Power Module	Maximum *rated* AC Current (Amps)	Circuit Breaker Minimum Value to use (Amps)	90°C Minimum Wire Gauge to use at 30°C ambient (AWG)
1	90	TL50024	7	15	14
	180	TL50024	4	15	14
	90	TL100024	14	15	14
	180	TL100024	7	15	14
	180	TL150024	11	15	14
2	90	TL50024	14	15	14
	180	TL50024	7	15	14
	90	TL100024	27	30	10
	180	TL100024	15	20	12
	180	TL150024	22	30	10
3	90	TL50024	20	30	10
	180	TL50024	11	15	15
	90	TL100024	41	50	8
	180	TL100024	22	30	10
	180	TL150024	33	50	8
4	90	TL50024	27	30	10
	180	TL50024	15	20	12
	90	TL100024	54	75	6
	180	TL100024	29	30	10
	180	TL150024	44	50	8
5	90	TL50024	34	50	8
	180	TL50024	18	20	12
	90	TL100024	68	75	6
	180	TL100024	37	50	8
	180	TL150024	55	75	6

Table 6

Recommended AC Circuit Breaker & Wire Sizes (48V system)

Number of Power Modules on AC Feed	Minimum Input Voltage	Model Number of Power Module	Maximum *rated* AC Current (Amps)	Circuit Breaker Minimum Value to use (Amps)	90°C Minimum Wire Gauge to use at 30°C ambient (AWG)
1	90	TL50048	7	15	14
	180	TL50048	4	15	14
	90	TL100048	14	15	14
	180	TL100048	7	15	14
	180	TL150048	11	15	14
	180	TL200048	15	20	12
	180	TL250048	18	20	12
2	90	TL50048	14	15	14
	180	TL50048	7	15	14
	90	TL100048	27	30	10
	180	TL100048	15	20	12
	180	TL150048	22	30	10
	180	TL200048	29	30	10
	180	TL250048	37	50	8
3	90	TL50048	20	30	10
	180	TL50048	11	15	14
	90	TL100048	41	50	8
	180	TL100048	22	30	10
	180	TL150048	33	50	8
	180	TL200048	44	50	8
	180	TL250048	55	75	6
4	90	TL50048	27	30	10
	180	TL50048	15	20	12
	90	TL100048	54	75	6
	180	TL100048	29	30	10
	180	TL150048	44	50	8
	180	TL200048	59	75	6
	180	TL250048	74	75	6
5	90	TL50048	34	50	8
	180	TL50048	18	20	12
	90	TL100048	68	75	6
	180	TL100048	37	50	8
	180	TL150048	55	75	6
	180	TL200048	74	75	6
	180	TL250048	89.8	90	4

Table 7

2.2.4 AC lugs

The table below lists part numbers for some lugs you can use to attach your AC wire to the single and dual AC terminal blocks and ground studs. Use the #8 lugs for AC terminal block connections and the ¼" hole lugs for ground connections.

Lug Part Number for AC Input

Circuit Breaker Size or Current Out	Wire Average	Burndy Lug Part #	Amp Ring Part #	Thomas & Betts part #	Desciption
15 AMPS	14 AWG		321045		SH Ring Terminal 1/4 Stud
15 AMPS	14 AWG		320565		SH Ring Terminal 8 Stud
20 AMPS	12 AWG		323763		SH Ring Terminal 1/4 Stud
20 AMPS	12 AWG		35605		SH Ring Terminal 8 Stud
30 AMPS	10 AWG		323763		SH Ring Terminal 1/4 Stud
30 AMPS	10 AWG		35605		SH Ring Terminal 8 Stud
50 AMPS	8 AWG	YA8C-TC10		54929BE	SH Lug Long Barrel 8 Stud
50 AMPS	8 AWG	YA8CL-L1-BOX		54130	SH Lug Standard Barrel 1/4 Stud

Table 8

2.3 DC output wire sizing

There are two main considerations for sizing DC wire; ampacity and voltage drop. Ampacity refers to a safe current carrying level as specified by non-profit organizations such as Underwriters Laboratories and the National Fire Prevention Association, which publishes the National Electric Code. Voltage drop is simply the amount of voltage loss in a length of wire due to ohmic resistance of the conductor. DC wire may be sized for either ampacity or voltage drop depending on branch load loop length and conductor heating. In general, ampacity considerations will drive wire selection for short loop lengths (less than 50 feet) and voltage drop will drive wire selection for long loop lengths (greater than 50 feet). The National Electric Code table 310.16 provides ampacity values for various sizes, bundles, and insulation temperature rated wire. ALWAYS FOLLOW NEC RULES AND YOUR LOCAL COMPANY PRACTICES WHEN SELECTING DC WIRING AND PROTECTION. Table 9 shows MAXIMUM recommended wire sizes.

2.3.1 DC circuit 1

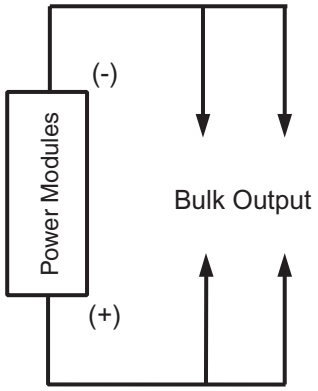

Figure 4 - DC Wiring Diagram (Circuit #1)

Each system is equipped with two double hole lug DC connection pads located behind the rear panel as shown in Figure 10. Select a wire size for each position according to the maximum load current as shown in Table 9. If the rack is to receive additional power modules at a later date, select wiring for the maximum future installation. This rack is not designed for connection to a battery system without the use of an external distribution panel. The polarity of the system is universal, therefore the polarity of the output is determined by the system grounding.

2.3.2 DC cable sizing

Size DC cable for the total capacity of the power modules installed. For example, a rack containing four TL150024 (24V, 60A) power modules has a total capacity of 240 A. Using the tables below this system will require a 4/0 AWG cable or two 2 AWG cables per output.

Minumum Recommended DC AWG for 90°C Cabling	
Total Power Module Current Rating (A)	Wire & Lug Gauge (AWG) using 90°C wire (NEC Table 310.16)
5	18*
10	16*
15	16
20	14
30	12
40	10
50	8
75	6
100	2
125	2
150	(1) 1 AWG or (2) 6 AWG
175	(1) 2/0 AWG or (2) 4 AWG
200	(1) 3/0 AWG or (2) 2 AWG
225	(1) 3/0 AWG or (2) 2 AWG
250	(1) 4/0 AWG or (2) 2 AWG
300	(2) 1 AWG

Table 9

* For wire sizes less than 15 A not covered in NEC Table 310.16 use Table 3B - Sizes of Conductors, UL60950, "Safety of Information Technology Equipment", Dec., 2000 for non-building wiring.

2.3.3

The table below lists part numbers for some lugs you can use to attach your DC wire to the "+ output" and "- output".

Lug Part Number for DC Output					
Circuit Breaker Size or Current Out	Wire Average	Burndy Lug Part #	Amp Ring Part #	Thomas & Betts part #	Desciption
10 AMPS	16 AWG		321045		SH Ring Terminal 1/4 Stud
15 AMPS	14 AWG		321045		SH Ring Terminal 1/4 Stud
20 AMPS	12 AWG		323763		SH Ring Terminal 1/4 Stud
30 AMPS	10 AWG		323763		SH Ring Terminal 1/4 Stud
30 AMPS	10 AWG	YAV102TC14		256-30695-1298PH	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
30 AMPS	10 AWG	YAV10T3-BOX		C71	SH Lug Standard Barrel 1/4 Stud
50 AMPS	8 AWG	YA8CL2TC14		542040410	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
50 AMPS	8 AWG	YA8CL-L1-BOX		54130	SH Lug Standard Barrel 1/4 Stud
75 AMPS	6 AWG	YAV6C-L2TC14-FX		54205	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
75 AMPS	6 AWG	YAV6CL-TC14-FX		54105	SH Lug Standard Barrel 1/4 Stud
100 AMPS	2 AWG	YAV2C-L2TC14-FX		54207	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
100 AMPS	2 AWG	YAV2CL-TC14-FX		54107	SH Lug Standard Barrel 1/4 Stud
125 AMPS	2 AWG	YAV2C-L2TC14-FX		54207	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
125 AMPS	2 AWG	YAV2CL-TC14-FX		54107	SH Lug Standard Barrel 1/4 Stud
150 AMPS	1 AWG	YA1CL2		54108	SH Lug Standard Barrel 1/4 Stud
150 AMPS	1 AWG	YA1CL-2TC14		54208	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
150 AMPS	1/0 AWG	YAV25-L2TC14-FX		54209	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
175 AMPS	2/0 AWG	YAV26-L2TC14-FX		54814BE	DH Lug Standard Barrel 1/4 Stud, 5/8 Center
225 AMPS	3/0 AWG	YAV27-L2TC14-FX			DH Lug Standard Barrel 1/4 Stud, 5/8 Center
250 AMPS	4/0 AWG	YAV28-L2TC14-FX		256-30695-1247	DH Lug Standard Barrel 1/4 Stud, 5/8 Center

Table 10

2.4 Torque settings

Table 11 shows the recommended torque settings for all mechanical and electrical connections according to screw or nut size. Not all screw sizes may be present on a particular rack.

Recommended Torque Settings

Screw or Nut Size	Torque (in-lbs)
4-40	6
6-32	12
8-32	22
10-32	37
12-24	50
¼ - 20	65

Table 11

3 Required Tools

Lambda power modules are designed to be installed with a minimum number of commonly available tools.

- #1 & #2 Phillips Screwdrivers
- Torque wrench
- 5/16" or 7/16" box wrenches, sockets, or nut drivers
- Wire and Cable Strippers
- Wire and Cable Crimpers

4 Site and Equipment Preparation

After removing DC Power Plant from boxes and packing material, inspect for shipping and/or other damage. Have all tools, wire, cables, hardware, etc., within easy reach. To the extent possible ensure a clean (free of debris, dust, foreign material, etc.) work environment. Ensure all AC and DC power sources are off and disconnected.

5 Power Plant Mounting and Wiring

5.1 Mechanical mounting

This equipment is intended for normal operations and is to be installed in a standard 19" telecommunications rack. It is recommended that one person lift the rack into place while another installs supplied mounting hardware. Torque mounting hardware according to Table 11. A gap of a minimum of ¾ inch above and below the system is required for proper airflow. Lambda recommends that you use at least two screws per bracket.

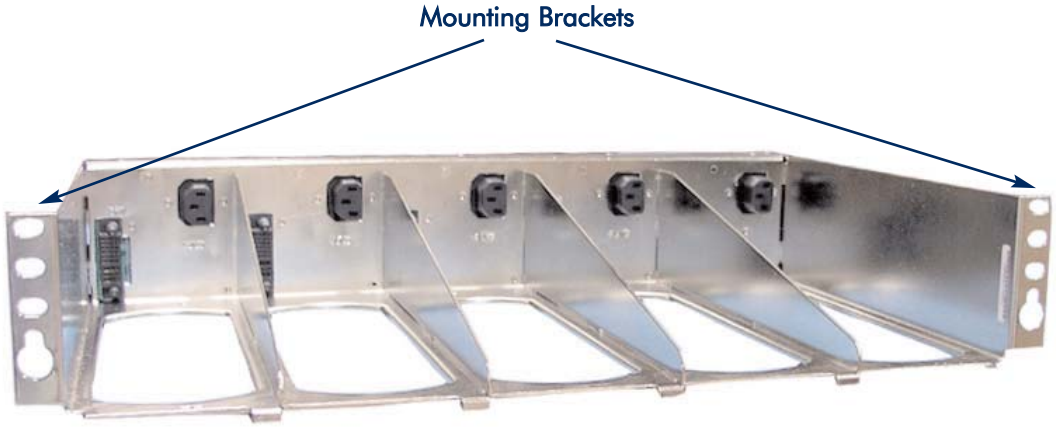

Figure 5 - Front View

5.2 AC input

Knockouts are provided to route AC cables to the proper connections on the single and dual feed shelves. Remove the cutout and place the provided cord grip in the knockout to provide protection and security to the AC cord.

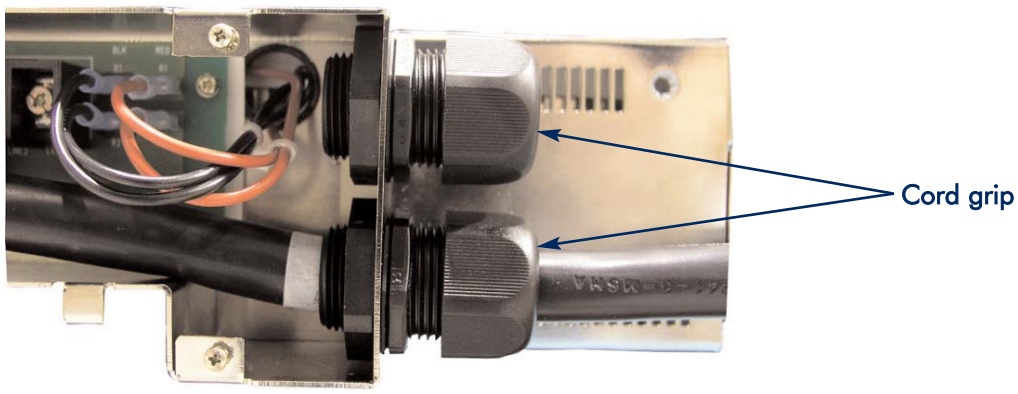

Figure 6 - AC cord grip

5.2.1 Single Feed

For 110 Vac service, connect your line/hot to Line 1, labeled on the AC terminal block shown in Figure 7. Connect your neutral to the slot labeled Line 1/N1. These connections are made with ring terminals on a #8-32 screws, and torque according to Table 11. The ground is connected the ¼" stud labeled AC "ground", and torque according to Table 11.

For 208/220 Vac service, connect your line/hot to Line 1, labeled on the AC terminal block shown in Figure 7. Connect your second line/hot to the slot labeled Line 1/N1. These connections are made with ring terminals on a #8-32 screws, and torque according to Table 11. The ground is connected the ¼" stud labeled ground, and torque according to Table 11.

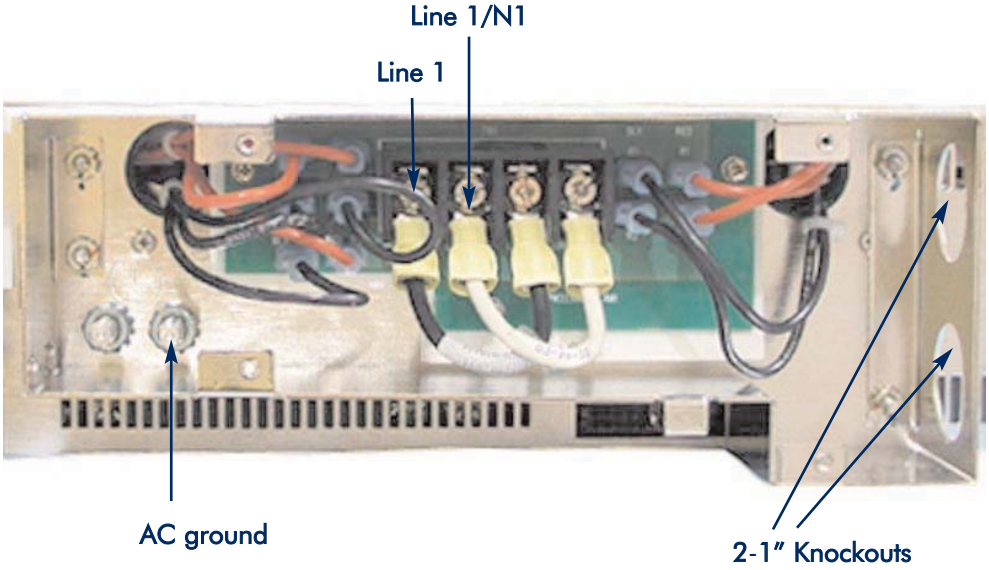

Figure 7 - Single AC feed

When ready to power up, plug in the AC cord into the proper receptacle or turn on the AC breaker.

5.2.2 Dual Feed

For 110 Vac service, connect your first line/hot to Line 1, labeled on the AC terminal block shown in Figure 8. Connect your neutral to the slot labeled Line 1/N1. For your second feed connect line/hot to the slot labeled Line 2. Connect your neutral to the slot labeled Line 2/N2. These connections are made with ring terminals on a #8-32 screws, and torque according to Table 11. Connect both grounds to the ¼" studs labeled "ground", and torque according to Table 11.

For 208/220 Vac service, connect your first line/hot to Line 1, labeled on the AC terminal block shown in Figure 8. Connect your second line/hot to the slot labeled Line 1/N1. For your second feed connect line/hot to the slot labeled Line 2. Connect your second line/hot to the slot labeled Line 2/N2. These connections are made with ring terminals on a #8-32 screws, and torque according to Table 11. Connect both grounds to the ¼" studs labeled "ground", and torque according to Table 11.

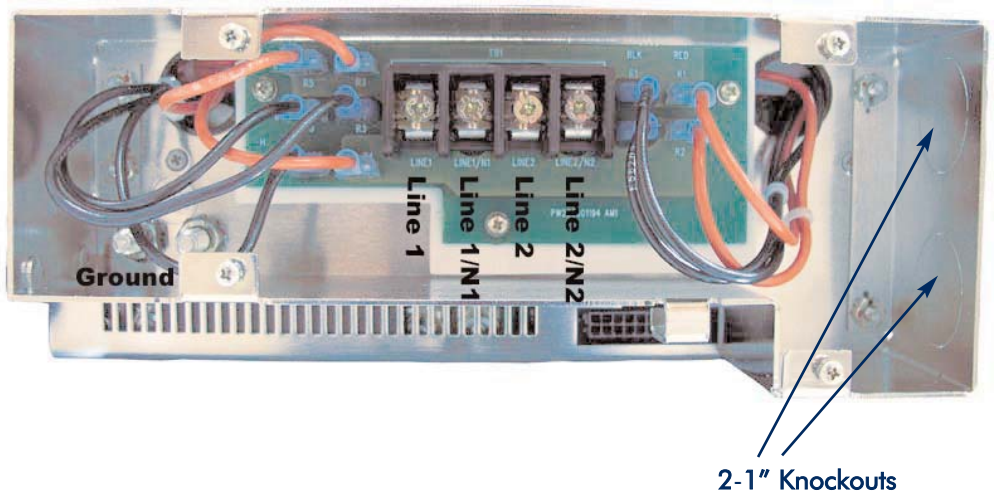

Figure 8 - Dual AC feed

When ready to power up, plug in the AC cord into the proper receptacle or turn on the AC breaker.

5.2.3 Individual Feed

The TLR5 comes with two different types of Individual AC feeds. The first type contains five IEC320/C13 plugs rated for 15 amps max a piece. The second type contains five IEC320/C19 plugs rated for 20 amps max a piece

For any AC service between 100 Vac to 240 Vac, connect each line cord into the appropriate AC receptacle on the rear on the rack as seen in Figure 9.

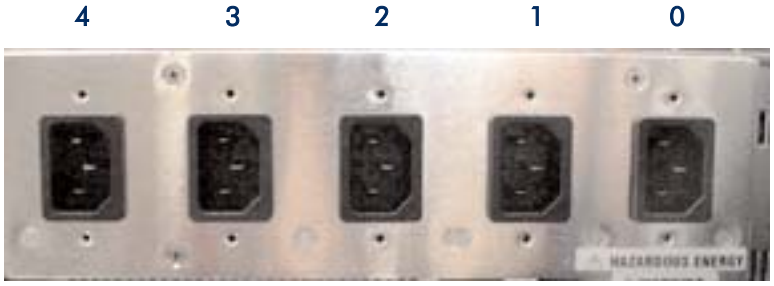

Figure 9 - Individual AC feed (IEC320/C13 shown)

When ready to power up, plug in the AC cord into the proper receptacle or turn on the AC breaker.

5.3 DC output

DC connections are accomplished via the two rear bulk output connections as shown in Figure 10. Connections are made with double hole lugs with ¼" holes and 5/8" centers. Select wire and lug sizes according to Section 2.3.

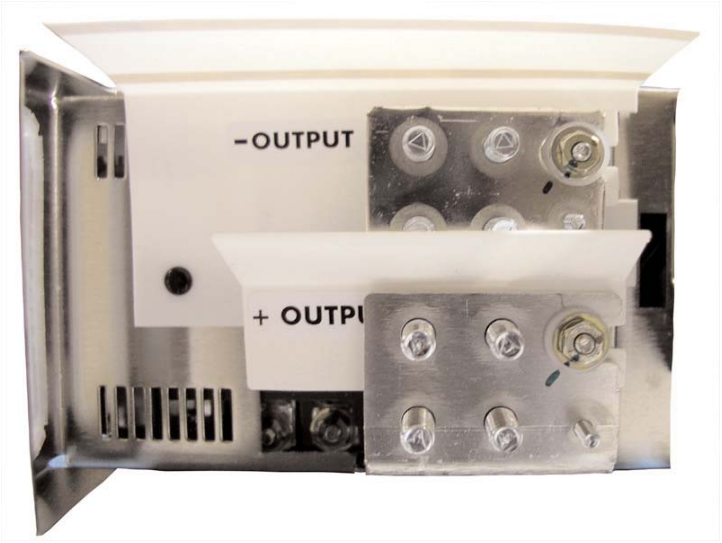

Figure 10 - DC Connections

Route DC cables out the side of the rack through the cable routing holes seen in Figure 11.

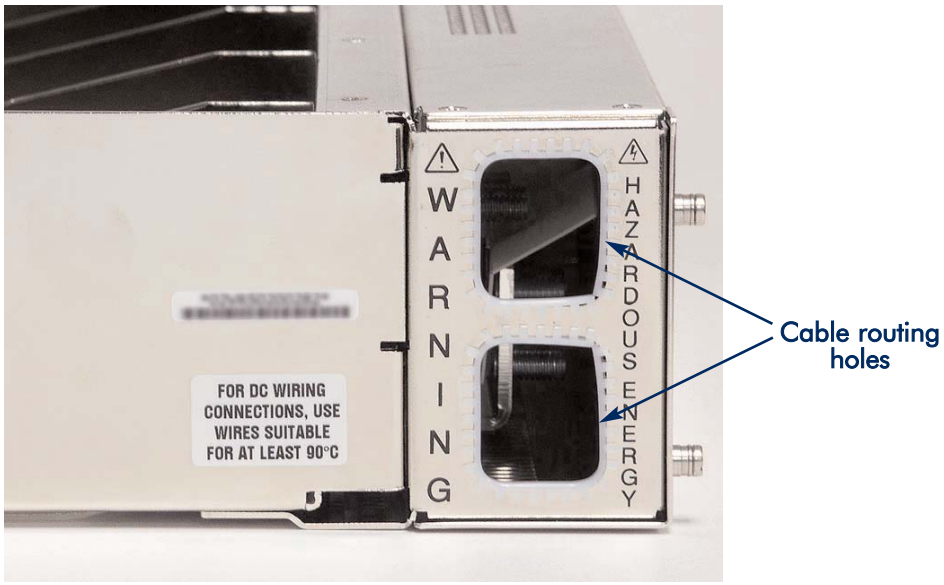

Figure 11 - Cable routing holes

5.4 Reference ground

The polarity on this rack is universal. Connect your reference ground to either the negative output or positive output depending on the desired polarity. The connection is a double ¼" studs with 5/8" centers.

5.5 Alarms and control

Access to alarms and control signals is accomplished via a rear mounted connector (p/n 43045-2019, Molex) as shown in Figure 12. Table 12 provides a pin functional description.

- The pin out of the alarm connector on the rack is a 180° difference from a standard Molex connector. See Figure 11 & Figure 12.
- AC fail, DC fail, and Thermal limit fail alarms are all open collector, opto-coupled, active high on failure/active low normally (software or factory configurable), and referenced to pin 17. The pin is able to sink 10 mA of current at 5 V and 5 mA at TTL voltages.
- Applying 5 V between pins 16 and 17 will shut all power modules down. Removing the 5V will cause the power module to power back up.

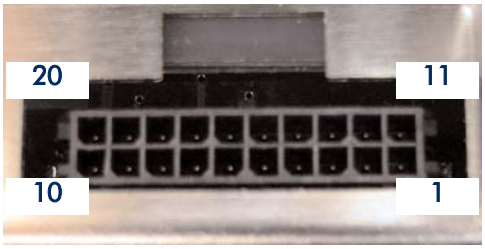

Figure 12 - Alarm and signal connector

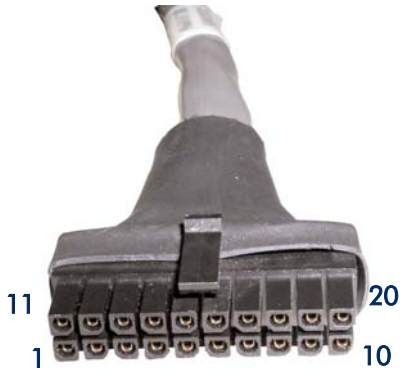

Figure 13 - Alarm cable pin out

Alarm and Signal Interconnections

J1 Pin	Wire Color	Description
20	BLK	Shelf Bias: A regulated 12V/100ma bias supply. Referenced to Pin 10.
19	RED	SCL: I²C clock line. Referenced to Pin 10.
18	RED/WHT	SDA: I²C data line. Referenced to Pin 10.
17	RED/BLK	Logic Ground: Isolated ground for opto-coupled alarms.
16	GRN/WHT	Module Disable: Opto-coupled input. Applying 5V between this pin and Pin 17 will disable all modules in the shelf.
15	LT BL	Module 0 (leftmost slot) AC Fail.
14	LT BL/WHT	Module 1 AC Fail
13	LT BL/BLK	Module 2 AC Fail
12	YLW/WHT	Module 3 AC Fail
11	YLW/BLK	Module 4 (rightmost slot) AC Fail
10	TAN/WHT	V Main Output (-). DC power ground.
9	TAN/BLK	I Shelf: Indicates average shelf current. Ratio varies with rectifier type. Call factory for details.
8	TAN	V Margin: Applying a 0-5V signal from this pin to Pin 11 will linearly change the output voltage by 0-10V.
7	GRN/BLK	Not Used
6	GRN	Module Thermal Limit Failure
5	OR/WHT	Module 0 (leftmost slot) DC Fail.
4	OR/BLK	Module 1 DC Fail
3	OR	Module 2 DC Fail
2	WHT	Module 3 DC Fail
1	YLW	Module 4 (rightmost slot) DC Fail

Table 12

6 Test and Turn-Up

6.1 Power up

Once all AC and DC connections have been secured and checked, install each power module sequentially by sliding and latching each power module into a rack position as shown in Figure 14. The power module latches must be open for installation. Attempting to install the power modules with the latches closed will result in mechanical damage to the power modules and the rack. The power modules will start in high fan speed mode and reduce their speed according to the ambient and plant conditions within 10 seconds. The AC OK and DC OK LED's will illuminate and the ALM LED will extinguish.

Figure 14 - Power module insertion

7 Troubleshooting

7.1 Problems and Solutions

The modular, plug-n-play nature of this plant makes diagnostics and repair very easy. Make sure that all power modules are properly seated and latched into their respective slots. Make sure that all power and signal connectors are properly mated. Table 13 lists problems and potential solutions.

Problems and Solutions

Problem	Solutions
DC OK LED Extinguished or Module DC fail 0-4 on alarm cable	Replace bad power module unit - unlatch, remove and replace with spare System short circuit - inspect and replace load and wiring
AC OK LED Extinguished or Module AC fail 0-4 on alarm cable	Reset commercial circuit breaker to the dedicated AC circuit that feeds system. Seek alternative power source until power is restored.
ALM LED Illuminated	Verify AC input and DC output voltages. Replace bad power module unit.
Thermal Limit Failure	Power Module has shut down because it has exceeded the maximum rated temperature. The power module will automatically restart.

Table 13

7.2 Short circuit & Current Limit

I_{Limit} can be adjusted up to +105% of the rated current of the power module. The system voltage will remain constant up to I_{Limit} at which point the system voltage will drop quickly toward 0 VDC , as in Figure 15. Once a 24V or 48V power module drops below 12 VDC for more than 5 seconds, the system will shut down. For a 12V system, once the power module drops below 4V for more than 60 seconds, the system will shut down. The system will automatically restart after 60 seconds, and will continue until the short circuit is cleared.

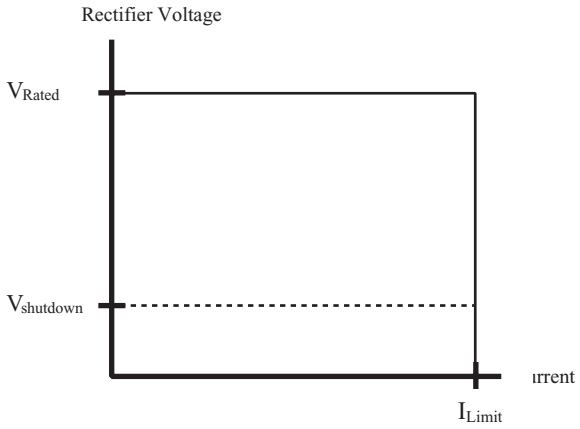

Figure 15 - Short Circuit & Current Limit

8 Installationsanleitung (German Installation)

Eingangsspannung (Voltage):	
Netzteile fuer (100V - 240V)	Netzteile fuer (200V - 240)
TL50048	TL150048
TL50024	TL150024
TL50012	TL200048
TL75012	TL250048
TL100048	
TL100024	

Table 14

Eingangsstrom (Current): 75A
Nennfrequenz (Frequency): 50/60Hz

Modellnummer (Modell No.) : TL

Abmessungen sind nur zur Referenz (Dimensions are for reference only):

- Depth: 14"/ 35.6cm
- Height: 3.45"/ 87.6cm
- Width: 17.5" (std. 19")/ 44.5cm
- Max. Umgebungstemperatur : TL200048 power module, full power: 65C/Vollast (Max Operation temperatur) TL150024, N+1 configuration: 70C

Ausgangsspannungen und -stöme 54V, max 250A (Output Voltage and Current)

- Das Gerät darf nur in Räumen mit beschränktem Zutritt aufgestellt werden. (Nur ausgebildetes Personal) Restricted Access Locations only.
- Das Gerät muß mindestens mit einer Anschlußleitung 4 x mm oder 5 x mm versehen sein. (Minimum wire sizes)
- Das Gerät hat keinen eigenen Ausschalter, es muß daher mit einem Ein- und Ausschalter im Versorgungskreis versehen sein. No mains ON/OFF switch is provided; disconnection means must be provided in the end-installation.
- Das Gerät hat kein Brandschutzgehäuse es darf daher nur auf nicht brennbaren Untergrund aufgestellt werden. (Beton, Metall usw.) Unit must be installed over non-combustible flooring
- Beim Aufstellen des Gerätes ist daraf zu achten das alle Anforderungen gemäß EN60950 eingehalten werden. Installation must comply with EN60950.