

CONTENTS

- A.1 IMPORTANT INFORMATION**
- A.2 IMPORTANT SAFETY INSTRUCTIONS**
- A.3 SAFETY APPROVALS**

- 1. GENERAL DESCRIPTION**
- 2. INSTALLATION**
- 3. SHUTTLE REMOVAL**
- 4. SPECIFICATIONS**
- 5. APPLICATION NOTES / SETUP**
- 6. MAINTENANCE**
- 7. WARRANTY**

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A.1 IMPORTANT INFORMATION**A.1.1 WARNING**

This equipment has been manufactured to a specific requirement for the end user and should only be used after reference to all the information contained within this manual.

This equipment is class 1 and under no circumstances should the equipment be used without the earth lead correctly connected to the incoming power source.

A.2 IMPORTANT SAFETY INSTRUCTIONS

The TDK-Lambda Custom Design Range of Racks & Euro Cards are designed for use within other equipment or enclosures which restrict access to authorised, competent personnel only. For safe installation and operation of this product, carefully follow the instructions below:

A2.1

Apart from the front covers the unit covers are designed only to protect skilled personnel from hazards. They must not be used as part of the external covers of any equipment where they may be accessible to the operators. The power input should be isolated before these covers are removed. The front panel of this product may be user accessible.

A2.2

All testing of these products must be carried out by competent personnel who are conversant with the particular hazards of AC and DC line operated equipment, and with the particular dangers of servicing switch mode supplies.

These products are not customer serviceable. Repairs may only be carried out by TDK-Lambda UK Ltd. and their authorised agents.

A2.3

After disconnecting the AC or DC source, allow 5 minutes, before touching the unit, to allow capacitors within the unit to discharge.

A2.4

This product may be used on 1,2 or 3 phase supply, depending on the number of shuttles fitted. For single phase use, when 3 shuttles are fitted take note of the following warning: **WARNING: HIGH LEAKAGE CURRENT - EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY.**

A2.5

Chemicals / Solvents, cleaning agents and other liquids must not be introduced into these products. These products are rated IPXO.

A2.6 EXTERNAL HOT SURFACES

In accordance with local regulations for Health and Safety at work, manufacturers have an obligation to protect service engineers as well as users. In order to comply with this, a label must be fitted to these products which is clearly visible to service personnel accessing the overall equipment, and which legibly warns that surfaces of these products may be hot and must not be touched when the products are in operation.

A2.7 RECEIPT AND UNPACKING

On receipt, a unit should be unpacked carefully and checked for transit damage. If damage has occurred do not apply power or install the unit, but seek specialist advice. If an electrical test is carried out on the unit prior to installation, then this must be carried out by a qualified person familiar with AC & DC powered equipment and having the specialised knowledge required of hazards associated with switched mode power supplies.

A2.8 FUSING

There are internal fuses within the power supplies. The fuses should not be changed as a failure of the fuse indicates a likely failure of the shuttle and the shuttle should be returned for investigation.

A2.9 ENERGY HAZARDS

The outputs are capable of providing hazardous energy. Final equipment manufacturers must provide protection to service personnel against inadvertent contact with these outputs. The connections therefore, must not be user accessible.

A2.10 SPECIFIC LIMITATIONS

- i) Input voltage range 90-264VAC
- ii) Max output power to be drawn (specified on each Vega PSU shuttle)
- iii) Ambient temperature range. 0-50°C
- iv) These products are not authorised for use as critical components in nuclear control systems, life support systems or equipment for use in hazardous environments without the express written approval of the Managing Director of TDK-Lambda UK Ltd.

A3. SAFETY APPROVALS

Complies with the requirements of IEC/EN/UL60950-1. CE marked for the LVD as a component part of a system. CE marking when applied to any Odyssey product indicates compliance with the Low Voltage Directive (2006/95/EC) in that it complies with EN60950-1.

1. GENERAL DESCRIPTION

The Vega 2U Rack is designed to provide a re-mountable power solution in power blocks of 450 and 650 watts. These power blocks are referred to as Shuttles.

The Rack enclosure can accommodate up to 3 shuttles and each shuttle contains a Vega power supply and monitoring circuitry. A multi-pin connector on the rear of each shuttle mates with the rear of the chassis frame when the shuttle is pushed home.

The Vega power supplies incorporate protection against excessive operating temperature, excessive output current drain and overvoltage of the output. The current limit recovers automatically, the thermal cut-out and over-voltage trips are reset by cycling the mains input.

2. INSTALLATION

These power supply systems are designed as component parts of the customer's equipment, rather than as stand alone products. As such they should be mounted in an enclosure which conforms, in all respects, to the requirements of IEC/EN/UL60950-1. Access to this system should be restricted to suitably qualified service personnel who have been made aware that hazardous voltages exist within. These units are classed as Overvoltage category II, Pollution degree 2, Material Group IIIb, Class 1, indoor use.

The power supply fitted is fan cooled. It is essential that airflow to the grill on the front panel of each shuttle, and the exhaust from the rear, is not impeded.

Connection to the power input of each shuttle is via a 3 pole Wieland removable connector block, which mates to the rear of the unit. The input to each shuttle supply via the 3 pole Wieland removable connector block must include a 20A branch circuit protector in the end installation. The shuttle front panel switch must not be treated as a disconnect device and facilities should be provided to isolate the power supply system from the power source in accordance with IEC/EN/UL60950-1.

HANDBOOK

An earth connection must be maintained, at all times, to this system. If the earth connection to the power supply system is to be the main earth point associated with the incoming supply to the overall host equipment, then it should be marked with symbol No.5019 as defined in IEC 60417.

All wiring to the power supply system should conform to IEC/EN/UL60950-1.

When the outputs are earthed in the end use equipment they, and the relay outputs are SELV. If the outputs are not earthed they, and the relay outputs must be considered hazardous, as a single fault in the secondary may make them exceed the SELV limits.

NOTE: The handles mounted to the face of the shuttles are intended only for removal of the shuttles; they should not be used for carrying the complete assembly.

3. SHUTTLE REMOVAL

Prior to removal of a shuttle the switch should be set to the off position.

Release the captive screw located on the front panels and then slide out.

When replacing the shuttle, check that the shuttle is the correct voltage for the system, care should be taken to ensure that the shuttle slides in freely.

Only qualified service personnel should undertake this procedure.

4. SPECIFICATION

This specification is raised to define the requirements of the standard Vega Odyssey Rack & Shuttles.

4.1 SHUTTLES.

Specification	Limits (APPLIES PER SHUTTLE)
Input Voltage Range	90-264vac
Max Input Current	11A rms max
Frequency	45-63 Hz
Efficiency	70% minimum.
Operating Temp	0-50°C (derating 2.5%/°C above 50 to 65°C- not covered by approvals)
Operating Humidity	5% - 95% RH Non Condensing. Air pressure 78kPa too 106kPa.
Operating Altitude	-200m to 3000m.
Inrush/	<40A @ 25°C
Power Factor	PFC. Typically >0.95.
Leakage	1.5mA Max
Storage Temp	-40°C – +70°C
Storage pressure	54kpa to 106kpa. Altitude -200m to 5000m
Shock, Vibration	10-200Hz @ 1.5G sinewave, 20G for 15 minutes in 3 axes random Vibration / 3000 bumps, 10G (16ms) half sinewave
Insulation	Primary mains circuit to Earth / Secondary outputs 4.35VDC for 2-5 secs Output Secondary's to Earth 200 VDC for 2-5 secs

4.2 PHYSICAL FOR SHUTTLES AND RACK.

1. 2U by 19" by 400mm deep format.
2. On/off switch, single pole front panel each shuttle.
3. Front panels Aluminium anodised.
4. Labels containing EN60950 required information on side of shuttle, not front panel.
5. Shuttles to have silk screening for front panel legend.
6. Custom aluminium handles 1 per shuttle.
7. Each shuttle to have a LED to show output good.
8. Each shuttle to have zero volt contact for all outputs globally. I.e. outputs failing provokes relay to change state. (rated at 2 amps 30Vdc / 0.6 amps 110VDC or 125VAC
9. Main rack enclosure steel, bright zinc plated but with aluminium side facias on main rack housing.
10. Rack wired to accommodate up to 3 x Vega shuttles.
11. Blanking provided for unused shuttle positions
12. Each Vega shuttle has integral blocking diodes fitted on outputs.
13. M6 earthing Rosan fitted to LHS & RHS of rear panel on rack housing.
14. No user accessible trimmers on front panel.
15. Alarm contacts are provide at the rear for each shuttle customer can series together for a global alarm

4.3 OUTPUT PERFORMANCE PER SHUTTLE. (Standard units *8)

Specification	5/81	5/81	12/51	15/41	24/25	28/22.5	48/13	Notes
Output Voltage Range	5.0V	3.8V to 9.0V	7.6 - 15.1V	8.0V to 16.5V	24.0V to 27.3V	16.0V to 28.0V	42.0V to 55.1V	
Factory Set output Voltage	5.0V	5.0V	12.0V	15.0V	24.0V	28.0V	48.0V	*1
Line Regulation	1%							
Load Reg (10-100%)	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	*2
Overcurrent protection	105.0 - 125.0A	94.5 - 112.5A	84 - 100.0A	50.4 - 60.0A	28.35 - 33.75A	26.25 - 31.25A	15.75 - 18.75A	*3
Overvoltage Protection	120-130%	120-130%	120-130%	120-130%	120-130%	120-130%	120-130%	*7
X Module Fitted	X1	X1	X2	X2	X4	X4	X8	
Max continuous current of X module	90A	90A	64A	64A	32.3A	32.3A	20.A	
Usable continuous current at factory set output voltage	81A	81A	51A	41A	25A	22.5A	13.0A	*6
Remote Sense	Available.							
Paralleling	N+1.							*4
PARD	2%pk-pk	2%pk-pk	2%pk-pk	2%pk-pk	2%pk-pk	2%pk-pk	2%pk-pk	*5

Notes:

- *1 Set off load.
- *2 Including blocking diodes with remote sense
- *3 Constant current
- *4 Redundant or added power
- *5 Percentage of output set voltage, with 10uF and 0.1uF
- *6 The maximum power output of PSUs fitted with X modules is reduced from 450/650W by the following power: $0.55 \times (\text{total X1 current}) + 0.7 \times (\text{total X2 \& X4 current}) + 0.9 \times (\text{total X8 current}) @ 50^{\circ}\text{C}$. Example 5V output at 80A = 400 watts, X1 80A x 0.55 = 44 watts total power less than converter power of 450 /650 Watt.
For ambients up to 65°C de-rate at 2.5% per °C above 50°C for Vega converter (not covered by approvals).
- *7 Tracking Over voltage, of set output of module
- *8 For units not listed see dedicated Specification Sheet.

4.4 CONNECTIONS

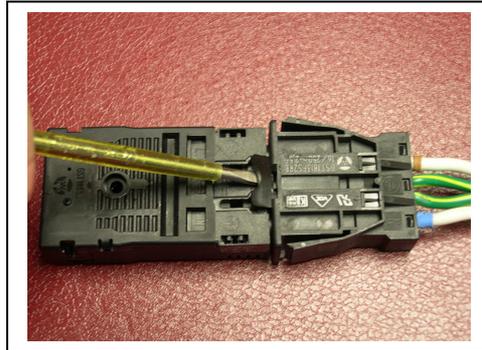
The terminations are at the rear of the rack for all DC outputs, AC inputs and signalling.

Mains Input for each Shuttle has a separate pluggable connector (Wieland 92.933.0053.1) 16A rated with 2 spring-loaded terminals per pole (see photos and explanation on page 7 for removal of connector). This allows daisy chaining of high line mains when a single phase is used. Spring loaded connections for rigid 1.5 - 2.5mm cables, 1.5mm with connector sleeves. Cable sheath strip length 45mm, insulation strip length 1.5mm: 8mm & 2.5: 9mm.

DC Outputs are via M5 screw terminals, 1 pair per shuttle output. With the parallel bus bar fitted, up to 3 pairs (assumes 3 shuttles fitted) of terminals are then available for multiple load leads.

Signals: Remote Sense, Relay contacts N/O N/C & Common, Parallel. are all terminated via a 6 way PCB terminal block cage clamp (Wago 233206).

4.4.1



Insert a flathead screwdriver down the side of the connector as shown in photo, release the locking mechanism shown in the photo showing the locking tab and pull from the back of the unit (connector removed from the back of unit for purpose of illustration) .

4.5 EMC PERFORMANCE EN61204-3

Emissions -

EN55022 class A conducted and Radiated.

Immunity.

EN61000-4-2 ESD LEVEL 4.

EN61000-4-3 RF 3V/M LEVEL 2.

EN61000-4-4 FAST TRANSIENT LEVEL 4

EN61000-4-5 SURGES LEVEL 3

EN61000-4-6 RF COMMON MODE 3V/M LEVEL 2.

EN61000-4-8 MAGNETIC FIELD 3A/M LEVEL 2.

EN61000-4-11 VOLTAGE DIPS COMPLIANT

5. APPLICATIONS NOTES / SET-UP**5.1 PARALLELING FOR POWER**

This is a technique under which the total load equals the combined power of all shuttles fitted. Should one shuttle fail there is insufficient power available in the remaining working shuttles to drive the load and the system goes in current limit.

To improve system performance see notes on Active sharing and Remote Sense.

5.2 HOT SWAP PARALLELING FOR N+ 1 TRUE REDUNDANCY (USING ACTIVE SHARING)

This is a technique under which one or two shuttles supply power to the load and the third shuttle is in a standby condition ready to take over should one of the other units fail.

To achieve active sharing which ensures that the load is evenly distributed across all working shuttles. A single wire connection is required between the Sharing pin of each output card at the rear of the rack on the Six-way cage clamp. For further details please see section on active sharing.

One disadvantage is that the diode fitted within the shuttle introduces a small voltage drop in the output lines - degrading the load regulation performance. From August 2005, products will be supplied with the remote sense connections linked to the power output terminals, forcing the power supply to compensate for this forward diode drop. To set up a system with true redundancy, these links must be removed (See also section 5.8 Remote Sense).

5.3 HOT SWAP PARALLELING FOR N+ 1 REDUNDANCY (USING ACTIVE SHARING AND REMOTE SENSE)

This technique is similar to that of True redundancy but overcomes the disadvantage of poor load regulation and uneven load distribution. However please note this is not classed as true redundancy as the remote sense lines are connected beyond the isolation diode.

To achieve active sharing, which ensures that the load is evenly distributed across all working shuttles, a single wire connection is required between the sharing pin of each output card at the rear of the rack, on the six-way cage clamp. For further details please see section on active sharing.

To reduce the effects of Voltage losses caused by the diode and wiring loom you can use the Remote Sense connections to improve load regulation. For further details please see section on remote sense.

5.4 VOLTAGE ADJUSTMENT

Voltage adjustment is possible within the confines of the rack providing you have full access to the rear panel and a very long thin insulated screwdriver. Alternately you can remove each shuttle in turn and set up on the bench, however you will need a mains power source to supply the shuttles, via the 6 way half DIN connector.

Adjustments within the rack.

Make sure that the rack system is off load. Assuming that you have 3 shuttles fitted within the rack, switch off 2 shuttles and adjust the output voltage of the remaining powered shuttle. Then adjust potentiometer to the new voltage level required (see pictures at the end of section 5). Once set, switch off this shuttle, power up the next unit, repeating the procedure until all 3 shuttles are adjusted.

Please note some shuttle configurations will have two modules connected in parallel within a shuttle. In this case turn both voltage adjustment potentiometers down (anti-clockwise) and then increase the output voltage of one of the modules until the required level is achieved. Then adjust the potentiometer on the adjacent module until the output voltage just increases slightly above the previous setting. Try and set this as close as possible, you should be able to set within 10/20mV.

Please also see notes on Alarm setup.

5.6 ALARM SET UP

The Diode Oring modules (X1, 2,4 & 8) all have an onboard voltage monitoring circuit, which in turn drives a volt free relay and an on board LED. The alarm trip point is factory set to trip at 10% below the Module / Shuttle output voltage. If you need to adjust the output voltage of the shuttle it may be necessary to change the alarm trip point. There are two methods that of calibrating the alarm trip point as follows:

5.6.1. ALARM SET-UP IN SITU.

It is possible within the confines of the rack providing you have full access to the rear panel and a very long thin insulated screwdriver. Firstly turn the output voltage down to the required trip point (see section on Voltage adjustment), and then adjust the OR module pot until the LED and relay just turns on. Reset the output voltage back to the required level.

5.6.2. TEST BENCH SET-UP.

Remove the shuttle from the rack and remove the positive link bar to the middle terminal of the OR module.

Power the shuttle from the mains and with an external voltage / bench supply, connect to the OR 0Vgnd terminal (bottom) and the OR +ve (middle) terminal. Set the external voltage to the desired level and adjust the OR module pot until the Relay and LED just turn on.

Once set disconnect the supply and replace positive link bar.

5.7 BUS BARS

Each Vega Odyssey rack is supplied with a pair of bus-bars, these are designed to parallel the output rails together when used in Parallel for Power or Redundant operations.

5.8 REMOTE SENSE

To reduce the effects of Voltage losses caused by the blocking diode and wiring loom you can use the Remote Sense connections to improve load regulation. The rack is supplied with wire links on the remote sense terminals that provide compensation for the losses in the blocking diode. These must be removed when wiring an external remote sense connection or when a true redundancy set-up is required.

Sense leads carry very little current and steps should be taken to ensure that they do not pick up noise. They should either be screened or, if this not possible, twisted together to minimise the effects of noise pick-up.

In configurations where outputs are connected in parallel for power or redundancy, a separate pair of sense wires must be run from each output module to a common point at the load.

Note that remote sense is only capable of compensating up to 0.5V per sense line. To use the remote sense the sense voltage must be allowed for within voltage range of the Vega module.

For example if the module voltage can be set between 3 and 9 volts, and you require remote sense (0.5 volts per sense line) the maximum voltage that you could set the unit to is 8 volts. Remote sense will then compensate for the losses in the diode & cable and 8 volts is maintained at the sense point.

Note when using remote sense with more than one shuttle in N+1 or Paralleled for Power, a minimum load of 5% is required to maintain correct alarm operation. Otherwise alarms can indicate a false failure when at 0% load.

5.9 ACTIVE SHARING

Active sharing helps to overcome the problems of unbalanced voltage settings. Inevitably when you connect multiple units / shuttles together there is a slight difference in the output voltage settings.

Naturally the shuttle with the highest voltage will supply most of the current.

The shared parallel connection forces each shuttle to drive approximately the same current. Which ever shuttle is driving the least current has it's voltage increased slightly to balance it. The load current is shared evenly amongst the modules and shuttles. This improves the reliability by ensuring that no one shuttle takes more stress than any others in a sharing group.

Sharing can take place from shuttle to shuttle within the same rack and between rack multiples if required.

To achieve active sharing, set shuttle output voltages as close as possible to each other and then link a single wire connection as required between the Sharing pin of each output card at the rear of the rack on the Six-way cage clamp.

5.10 ALARM CONTACTS

There is provision at the rear of each shuttle interface via the 6 way Wago Cage clamp for a volt free alarm contact. Both Normally Open and Normally Closed contacts are available too use.

To achieve a global alarm, connect each shuttle relay output (Common and Normally Open contacts) in series with its neighbouring shuttle. This will give you a summary of the Rack status.

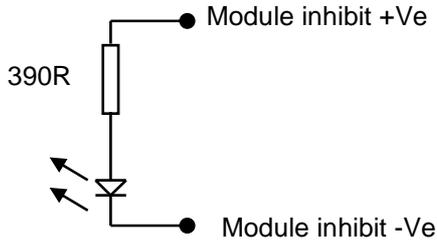
5.11 CONNECTING MULTIPLE RACKS TOGETHER:

It is good practice to run equal lengths of wire between the outputs of each rack and the load. This helps to minimise voltage drops. If this is not possible you can simply link racks together, however make sure that the lead supply to the load is capable of supplying the total load / over load current.

The mains inputs can be connected to different phases if needed or simply daisy chained between the rack and neighbouring racks. Likewise the Alarm contacts can be individually wired or series together to give a global indication.

HANDBOOK

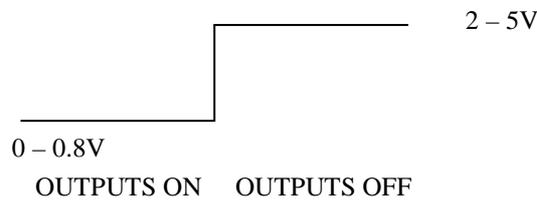
5.12 REMOTE INHIBIT CIRCUIT CONNECTION.



Internal to the module inhibit is a 390ohm 1/8W resistor and the diode of an opto-coupler.

To INHIBIT the Shuttle apply 2-5V between +ve and -ve. Do not apply >6V or damage may result, although higher voltages may be used to drive the circuit in which case additional series resistor should be used to limit the current. A current of 1-10mA will inhibit the module. Ensure 13mA is not exceeded.

When a module is inhibited, there may be up to 0.6V remaining at the outputs of the module.



5.13 ADDITIONAL SIGNALS

Pin out information

6 Way 'Wago' cage clamp connector (J5)

Pin 1 of this connector is at the bottom, as shown in the picture below.

- Pin 1 'P' Paralleling connection for single wire active sharing
- Pin 2 Normally Open contact of alarm relay
- Pin 3 'N/C' Normally closed contact of alarm relay
- Pin 4 'C' Common contact of alarm relay
- Pin 5 '-S' Negative remote sense 'N/O'
- Pin 6 '+S' Positive remote sense

6 Way Molex on OR module

- Pin 1 From J1/ Inhibit (c)
- Pin 2 From J1/ Inhibit (a)
- Pin 3 From J1/ Sense (+)
- Pin 4 Spare line
- Pin 5 From J1/ Star point
- Pin 6 From J1/ Sense (-)

Spare pin TP12 Spare line

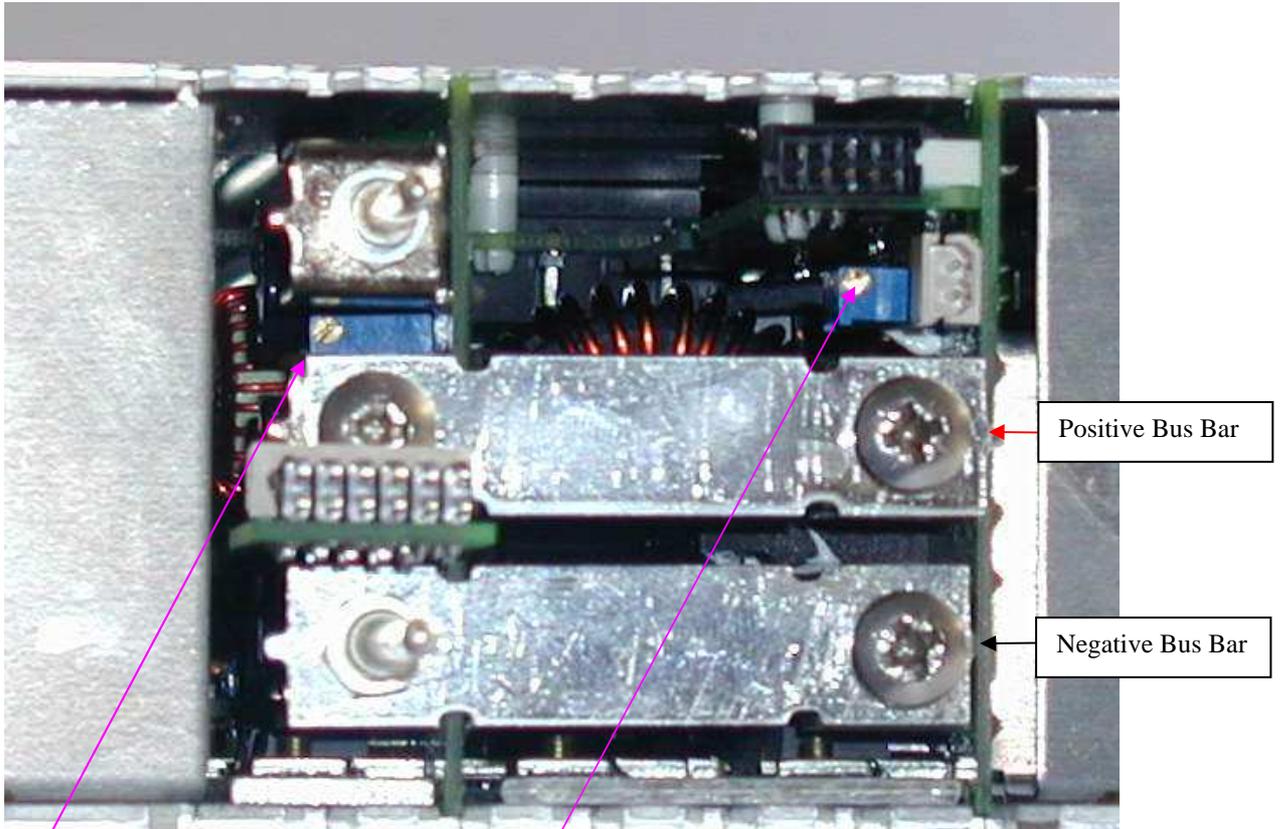
12 Way Pin Header (behind Wago cage clamp) rear of rack (J7)

- Pin 1 From J1/ Inhibit (c)
- Pin 2 From J1/ Inhibit (a)
- Pin 3 Spare line (from TP12)
- Pin 4 From J1/ Star Point (Parallel function)
- Pin 5 Spare line (from 6 way header Pin 4)
- Pin 6 From J1/ + Sense
- Pin 7 Alarm N/O
- Pin 8 Alarm N/C
- Pin 9 Alarm Com
- Pin 10 From J1/ - Sense
- Pin 11 Aux LED

J7					
2	4	6	8	10	12
1	3	5	7	9	11

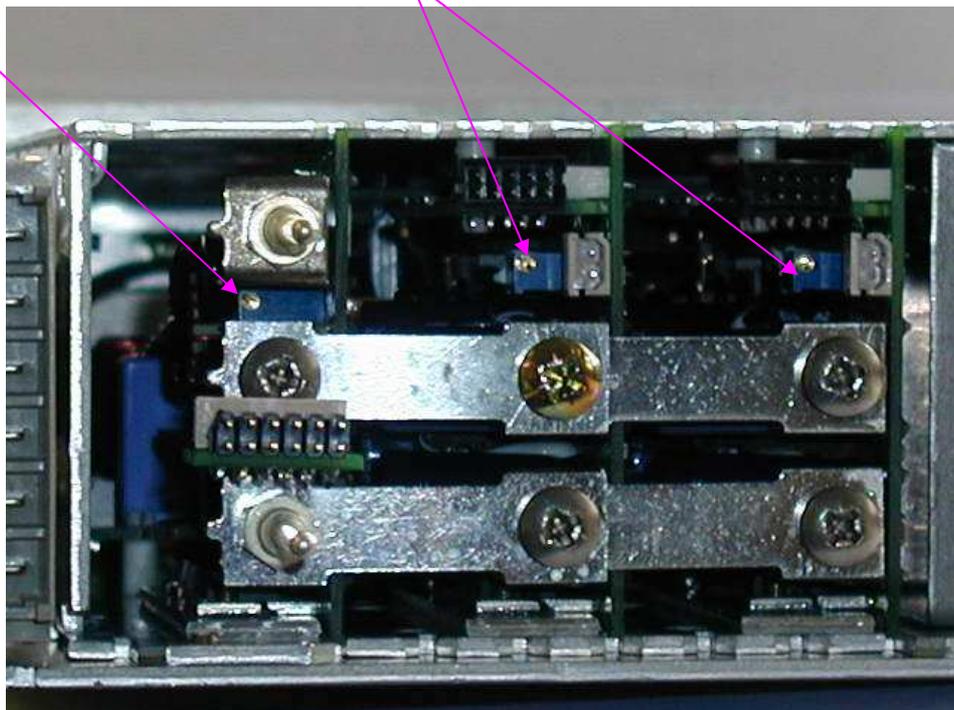
J5					
1	2	3	4	5	6
P	N/O	N/C	C	-S	+S

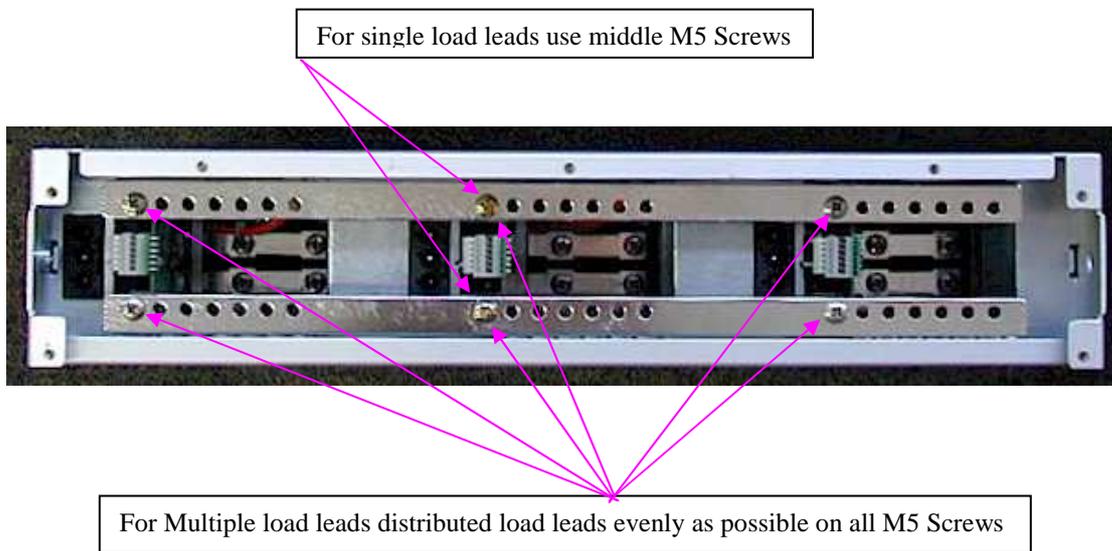
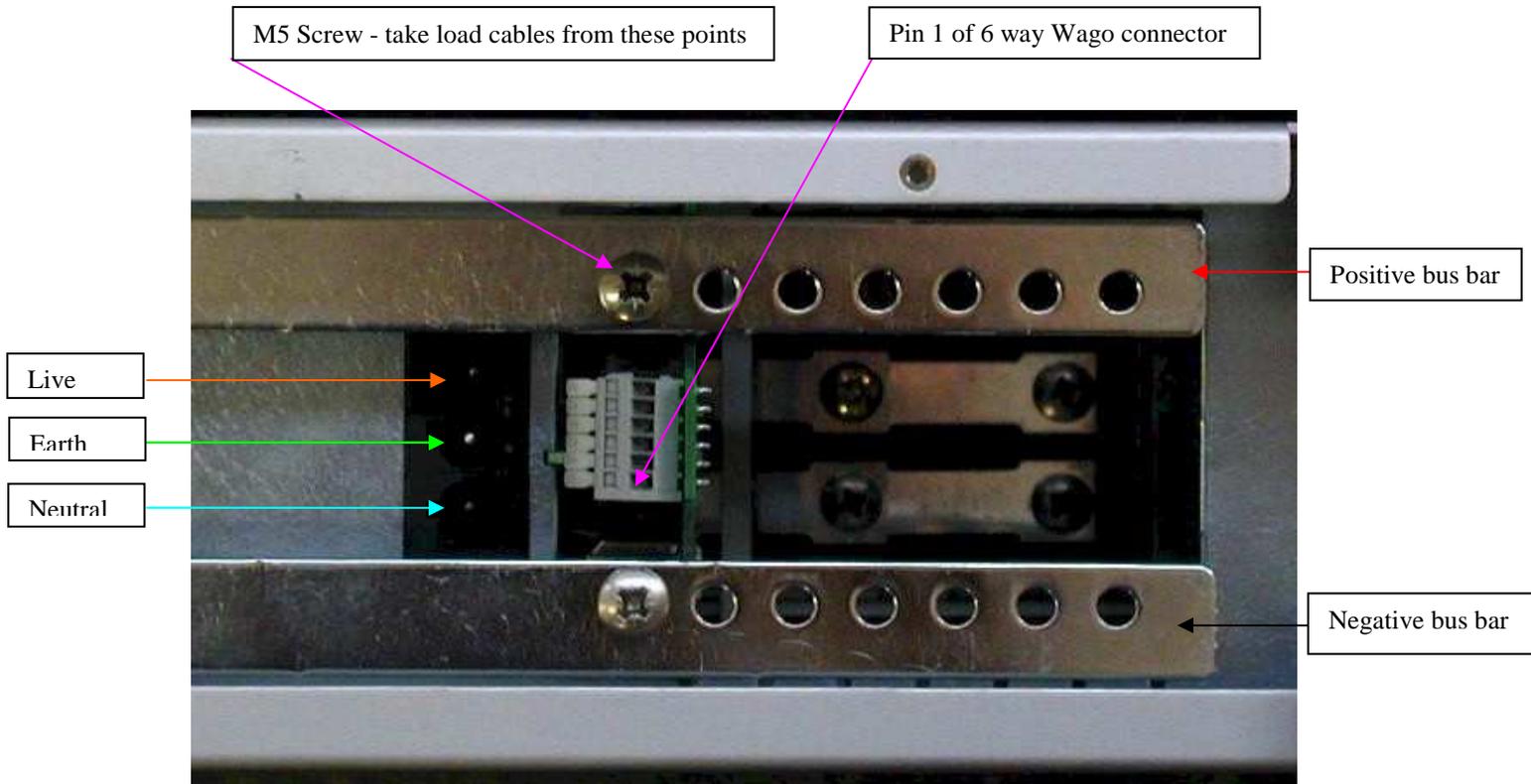
Pin 12 +12V (return for LED)

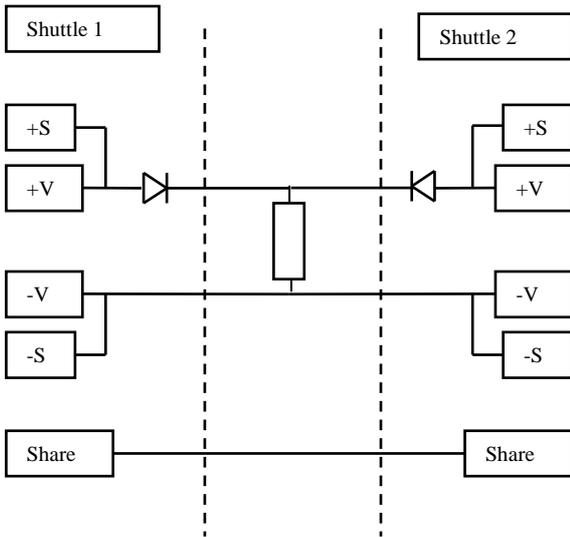


OR Alarm Adjustment Pot

Output Voltage Adjustment Pot / Pots



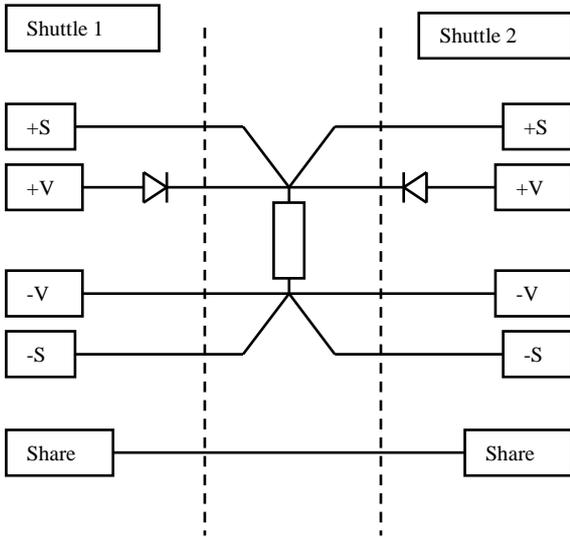




Hot Swap Paralleling for N+ 1 True Redundancy

Locally sensed is TRUE redundant function. Shuttle 1 or 2 failing cannot influence the other shuttle. The system will always remain functional.

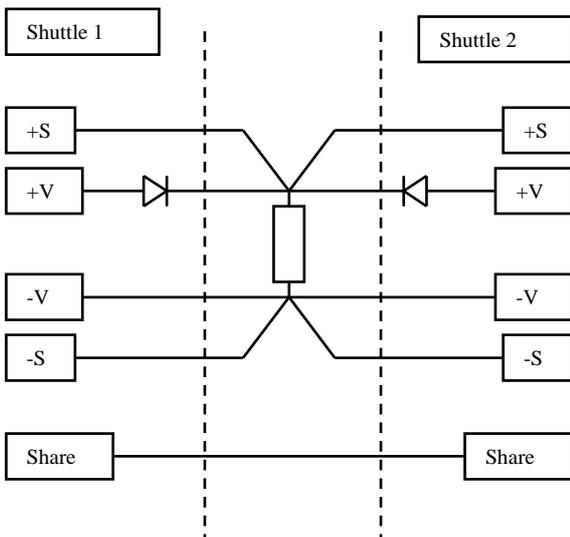
Not shown are the L,N and Earth hot swap connections which have leading earth pins



Hot Swap Paralleling for N+ 1 Redundancy (using active sharing and remote sense)

Remote sense is NOT TRUE redundant function. Shuttle 1 or 2 failing can influence shuttle 2 via the sense lines.

Not shown are the L,N and Earth hot swap connections which have leading earth pins



Paralleled for Power : Not redundant.

This shows the same circuit as the first, but the difference is that both units are needed to power the load, should either one of the shuttles fail the system would go into current limit as it is not capable of supply the load in its own right.

Not shown are the L,N and Earth hot swap connections, which have leading earth pins

6. MAINTENANCE

MAINTAINABILITY

Repair shall be by replacement of defective shuttle unit from the spares holding.

PREVENTATIVE MAINTENANCE

Spare power supply units must be tested on a regular basis (at least every year) and checked to make sure they are still performing within specification.

FAULT FINDING GUIDE

Should a failure or part failure occur to the system there are a few points to check.

- (i) Entire failure of the system could be caused by an over temperature condition resulting in a shut down of the primary converter of the power supply. To recover from this condition, the mains has to be recycled once the temperature has returned to within the specified operating range. Check that the ventilation slots have not become obstructed.
- (ii) The power supply also has an inline fuse. The user should not replace this fuse as a fault condition may exist.
- (iii) Apparent failure to one of the output modules could be caused by an overload, short circuit or overvoltage condition. If an overload/short circuit occurs, the output is reduced to a safe power level. Once the short circuit or overload is removed the output will recover automatically. Overvoltage protection is inherent in all outputs. Should a voltage transient occur internally or externally, the module would shut down to less than 2 volts. To reset this latched state, the mains needs to be cycled.
- (iv) Faulty power supplies should not be investigated by the user, but should be returned to TDK-Lambda UK for QA inspection and repair.

7. WARRANTY

The warranty covers parts used in the assembly against failure for a period of three years from the date of delivery, but excludes any misuse of the assembly or components therein.

When returning units to our customer services dept ensure that they are adequately packed for the journey. The units must also be accompanied by information as to their origin and to the nature of the defect. A Returned Materials Authorisation should be obtained before despatch.

TDK-Lambda Ltd. reserves the right to make design and component changes without notice.

Contact : TDK-Lambda Ltd,
Kingsley Avenue,
ILFRACOMBE,
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EX34 8ES.

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