Warranty

All Polyamp DC/DC converters are warranted against defective material and workmanship. This warranty is valid for 24 months from the date of delivery. We will repair or replace products which prove to be defective during the warranty period. The warranty is valid only if the converter is used within specification.

Manual

This manual is as complete and actual as possible at the time of printing. However, the information may have been updated since then. Polyamp AB reserves the right to make changes in this manual without notice.

The exclamation point within an equilateral triangle is intended to alert the user to presence of important operating and maintenance instructions in the literature accompanying

The lightning flash with arrowhead, within an equilateral triangle, is intended to alert the user to presence of uninsulated ”dangerous voltage” within the products enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons

Caution!

To prevent the risk of electric shock, do not open enclosure. No serviceable parts inside. Refer servicing to qualified service personnel only

CONTENTS

1 Before installation

The converter type name consists of model name PSE100, PSE150 ,PSE200 or PSE250 followed by input code and output voltage. Two examples:

"Type: PSE100B24" has input code "B" and nominal output voltage 24Vd.c.

"Type: PSE200 110/48" has input code "110" and nominal output voltage 48Vd.c.

Input, output and case are galvanically separated from each other. You can thus choose how you want the system connected.

The input is protected against reverse polarity by a parallel diode at the input on all models. With option K1 a series diode is used as reverse voltage protection.

The input shall be fused with an approved fuse with a slow blow characteristic and high breaking capacity. See *Table 1*.

Input voltage code	Slow blow fuse PSE100
A	16 A
B	8 A
C	3.15 A
D	1.6 A

Input voltage code	Slow blow fuse PSE150	Slow blow fuse PSE200	Slow blow fuse PSE250
24	10 A	15 A	20 A
48	5 A	8 A	10 A
110	3 A	4 A	6 A
220	1.5 A	2 A	3 A

Table 1. Recommended input fuses.

There are two reasons we do not include the fuse.

1. DC-networks should be fused at the distribution point to protect the cable.
2. Different applications require different types of fuses.

If the converter is mounted in an electric vehicle, an external series diode on the input is recommended. Please contact your Polyamp dealer.

If the converter supplies a DC-motor, we recommend an external parallel diode at the motor poles to protect against reverse voltages.

A switching device able to switch off both polarity input cables has to be mounted externally. The switching device shall be marked accordingly and easy accessible.

In case the fuse is activated at start-up the fuse need to bee dimensioned for longer time delay or order inrush current limit, see option, *see page 10*

2 Installation

The converter is designed to be mounted in a 3U 19" sub rack unit. Otherwise a location only accessible for service, which meets the demand of EN60950 regarding fire enclosure, voltage hazard protection and mechanical strength shall be used.
With option N, wall mounting set you can mount the converter in any direction on a wall or with optional mounting clips on DIN rail TS35. The converter is convection cooled and in order to get sufficient cooling there shall be a free air around the converter. If this is not possible, we recommend the use of an external fan.

On 5 V single output voltage the case temperature might increases +20°C above ambient temperature.
An optional extra cooler can be provided on 5V versions to lower temperature or increase the operating temperature range.

Note that the expected life of the converter is dependant on converter temperature. For every 10°C that the temperature is lowered the expected life is approximately doubled. It is therefore crucial to cater for good ventilation and if possible to reduce ambient temperature.

To meet the EMC specifications in the enclosed "declaration of conformity" use twisted-pairs for connecting input, output and alarm. Shielded cables are not necessary.

Installation in a 19" sub rack :

1. Check the pin-out, see figure 1. Be aware that if the sense option "S" is provided the sense must be connected to the sensing point and cannot be left open.
2. Connect the protective earth. This provide safety against electrical shock and is required to achieve EMC performance according to the declaration of conformity.
3. Plug in the unit. Go to point 4 below.

Installation with wall mounting panel option N:

1. Connect protective earth. This provide safety against electrical shock and is required to achieve EMC performance according to the declaration of conformity.
2. Connect the output. Be aware that if the sense option ”S” is provided the sense must be connected to the sensing point and cannot be left open. Bundle the output cables together, separate from input.
3. The converter output is short-circuit proof by a constant current limit which works unlimited in time. Therefore there is no need to fuse the load (unless you use multiple loads, see below). The current limit is fixed to 105% of nominal output current.
   - If the converter is to be connected in parallel at the output, please consult on page 5.
   - If you use multiple loads, please consult *Multiple loads at the output* on page 8.
   - If you intend to use alarm options, please consult *Under* voltage Alarm on page 7.
4. Connect the input cables. Bundle input cables together separated from the output cables.
5. Start the converter by inserting your input slow blow fuse to your DC voltage supply. Sparks may occur when the input capacitors are charging.

Beware of hazardous voltages!

- The output voltage can be adjusted +10% to -5% of nominal output voltage with the potentiometer marked V.ADJ on the front panel. Clockwise turn increases the output voltage. The potentiometer has 15 turns. If you have connected units in parallel on the output, the procedure of adjusting the output voltage is described in *Adjusting output voltage when units are paralleled on the* output on page 6.

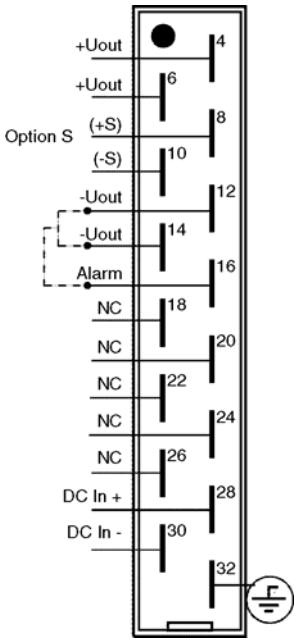

Figure 1 Pin-out DIN41612 H15 connector.

3 Parallel connection

If a redundant power supply system is requested, two or more converters can be connected in parallel. To achieve redundancy the number of converters must be dimensioned to carry the whole load even if one converter is faulty. The option C series diode on the output must be provided. Connect your load to the + output after the series diode (cathode). Do not forget to fuse the inputs separately to achieve redundancy.

Another reason for connecting two or more converters in parallel is to get more power. The option C must be provided and use the output with series diode.

3.1 Series diode on the output, option C

The series diode protects the converter output from external voltage sources. A series diode is necessary if the output is connected in parallel with another power supply or if you require redundant operation. If a converter breaks down with an internal short-circuit on the output and other converters are connected in parallel on the output, the broken unit will short-circuit the others if the series diode is not used. This might cause excessive heat or even fire in the faulty unit.

If the series diode is used, we recommend to use the alarm function option B alarm circuit. The alarm relay will switch to ”ALARM” on the faulty unit if one power supply breaks down in a redundant power supply system. Otherwise there will be no alarm indication from a faulty power supply unless all units are in current limit.

3.2 Connecting converters in parallel on the output

The expected life of the converter is dependant on converter temperature. It is therefore important for paralleled unit to share the load as equal as possible to reduce the converter temperature. To achieve good current sharing the converters must have separate cables to the load. The cables should be dimensioned to have a voltage drop, U_d, between the converter and the load at maximum current capacity, see Figure 2 and Figure 3.

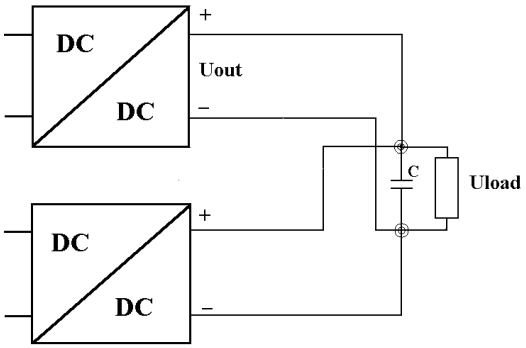

Figure 2 Voltage drop $U_d = U_{out} - U_{load}$

- When the series diode is used, which we recommend, the voltage drop should be approximately 1.0% of nominal output voltage (to also compensate for the negative temperature coefficient of the diode).
- When the series diode is **not** used**, this is not recommended,** the voltage drop should be approximately 0.5% of nominal output voltage.

Note that the voltage drop affects the load regulation (the voltage at the load), see Figure 3

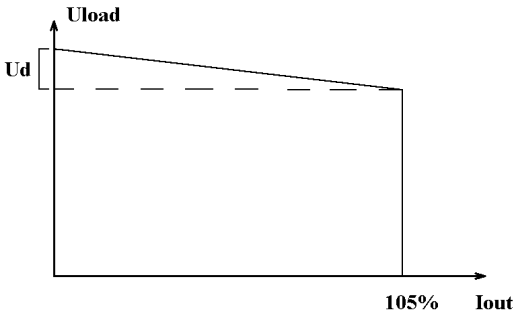

Figure 3 Load regulation with voltage drop U_d between output and load

3.3 Adjusting output voltage when units are paralleled on the output

1. Connect and start all converters according to *Installation* on page 4. We recommend using the series diode and separate cables as mentioned above in *3.2 Connecting converters in parallel on the output.*
2. Measure the voltage at the load. Connect voltmeters as showed in *Figure* 4. If you have only access to one voltmeter you must move it around to make the adjustments. This will take time but is of course possible.

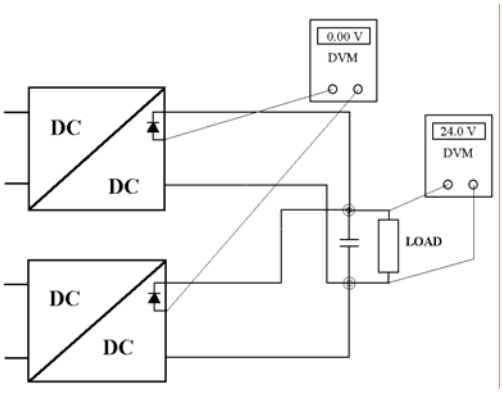

Figure 4 Adjusting output voltage measure at +Test or pin 8 on the H15 connector.

To **increase** the output voltage.

i. Increase the output voltage by turning the potentiometer marked ”V.ADJ” clockwise on the unit with the lowest output voltage until you reach the desired voltage at the load or until the output voltage does not increase anymore (as the unit is in current limit). To find the unit with the lowest output voltage you can measure the voltage difference before the series diode, as in *Figure* 4.

ii. Repeat from i. until you reach the desired output voltage at the load.

4. To **decrease** the output voltage.

i. Decrease the output voltage by turning the potentiometer marked ”V.ADJ” counter clockwise on the unit with the highest output voltage until you reach the desired voltage at the load or until the output voltage does not decrease anymore (as the other units supply all current). To find the unit with the highest output voltage, measure the voltage difference before the series diode, as in *Figure* 4.

ii. Repeat from i. until you reach the desired output voltage at the load.

To achieve good current sharing, adjust all converters so that the voltage difference before the series diode is 0.00V between all units that are connected in parallel and so that the voltage at the load is still the desired.

4 Output voltage sense, option S.

The remote voltage sense is used to improve the regulation at the load. The voltage regulation is moved to a point outside the converter where the sense is connected. Longer sense leads than 3 m is not recommended. The voltage difference between the load and the converter should not be larger than the output voltage range.
Use twisted sense wires, see figure 5.

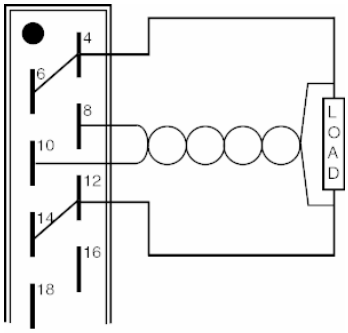

Figure 5 Remote sense connection.

5 Under voltage Alarm (UL Alarm)

On DC-inputs a built in logic alarm changes to alarm state if the converter output voltage drops below -10% of nominal output. The alarm circuit also controls the DC OK LED.

A standard unit is equipped with a logic signal. DCOK or POWER GOOD signal use logic 1. The drive voltage is 6 to 10 V, 5 mA = logic 1.
See also figure 6.

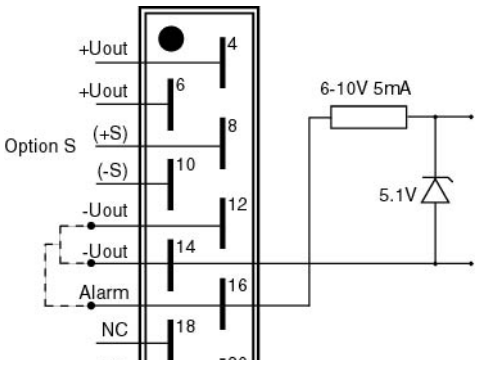

Figure 6 UL Alarm with 5V logic signal.

6 Under voltage alarm relay option B

The logic alarm output is replaced with a relay with selectable alarm logic NO or NC.
Alarm = No input or low output <-10% of nominal output, see figure 7.
The relay is rated 30V 0.5A (a.c. & d.c.).

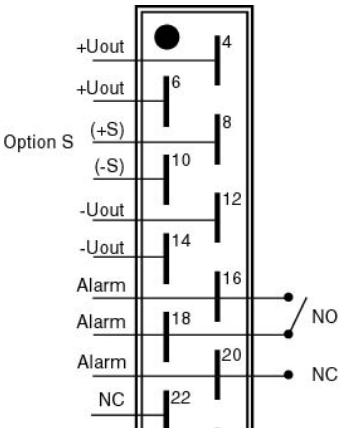

Figure 7 UL alarm with internal relay. option B. Relay symbol shows Alarm state.

7 Output over voltage protection, OVP, option A

The PSE family has an electronic overvoltage limiter as a standard feature. This optional overvoltage protection is more accurate and factory adjustable. When the overvoltage protection is activated, a SCR thyristor short circuits the output. The circuit protects the converter from high external voltages as well as regulation failures of the unit. The OVP trigger voltage is set to 115% to 120% of the nominal voltage. When the OVP is triggered it is reset by switching the input voltage off and on. OVP is standard on all 5 V master outputs and will trigger at max. 6.2 V.

8 Multiple loads at the output

If you are using several loads, we recommend fusing them separately with fast acting fuses. Some considerations regarding short-circuits should be taken. See below.

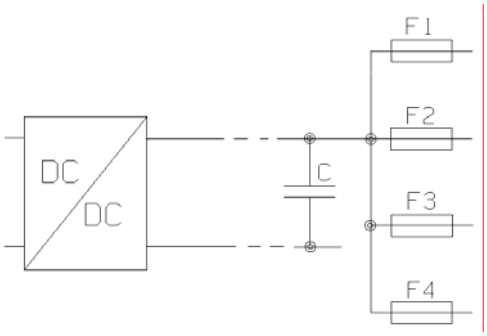

Figure 8. Connecting multiple loads.

8.1 Short-circuits

1. If there is a short-circuit in one branch and the total current in all branches **does not** exceed 105% of the nominal current of the converter (see label on front panel), the output voltage will not be affected. The time for the fuse to blow can be calculated from the data sheet of the fuse if you know the short-circuit current trough the fuse.
2. If there is a short-circuit in one branch and the total current in all branches **does** exceed 105% of the nominal current of the converter, the output voltage will drop until the fuse is blown. Depending on the impedance of the short-circuit (whether it is abrupt or merely an overload) and the resistance of the load cables, the effects of a short-circuit will vary.

   Long cables reduce short-circuit currents, resulting in longer delay until the fuse is blown and hence an increased voltage dip. Light overload does not necessarily result in a blown fuse.

   To reduce the voltage drop at short-circuit and if any branch has more than approximately 30% of the total output current of the converter, a large external capacitor is recommended. Such a capacitor will supply the peak current needed to blow the fuse, see *Figure 8.* To calculate the capacitor needed, use the following formula:

   $C = 1.2 \times (I_S \times \Delta t) / \Delta U$

   1.2 = Safety margin.

   I_S = Short-circuit current through the fuse.

   Δt = Time before the fuse blows (see data sheet on the fuse).

   ΔU = Acceptable voltage dip before the fuse blows.

   Example:

   You have a 1A fuse with fast characteristic and the short-circuit current is 10A. The data sheet gives you that Δt = 10ms. The output voltage is 24V, and you can accept 10% voltage drop => ΔU=24 x 0.1= 2.4V.

   The capacitance you need:

   $C = 1.2 \times (I_S \times \Delta t) / \Delta U = 1.2 \times 10 \times 0.01 / 2.4 =$ 50,000µF

   Choose a capacitance with a rated voltage of at least 115% of nominal output voltage of the converter.

   Repeat this calculation for all branches and choose the highest capacitance value.
3. It is sometimes difficult to estimate the short-circuit current when the nature of a fault is unknown. In this case a voltage dip might appear under some short-circuit conditions even with a large capacitor present. If a voltage dip is critical in one branch it is recommended to use a separate DC/DC converter supplying this branch.

9 Isolation voltage test

Each converter has been isolation tested in factory before delivery.

Warning!

An isolation test shall only be performed by personnel aware of the dangers and hazards of the

The isolation voltage is 2 kVd.c. between input and output, input and case on models with input code A, B, 24, 48. On models with input code C,110, D the insulation voltage is 2.5kVa.c between input and output, input and case (Option E1). The output to case isolation is 2kVd.c. on all models. Option E1 and E2 can increase this isolation.
If your isolation test equipment cannot supply the AC current, you can perform a DC isolation test with 4000Vd.c (2500V x √2 x 1.1 ≈ 4000Vd.c where 1.1 = safety factor).

9.1 DC isolation test output to case

1. Disconnect all cables from the converter.
2. Connect the input terminals of the converter to case.
3. Connect the output terminals together.
4. Connect your isolation tester between output and case. *See istor* between put and case.
5. *Figure 9* Raise the voltage of the isolation tester from 0 to 2000Vd.c. (With option E2 0 to 4000 Vd.c.) Check that the leakage current does not exceed 5µA. The voltage should not be applied for more than a few seconds or the Y-capacitors might be damaged.
   See *figure 10* to include the alarm relay option. The relay outputs are insulated from output/input/case.
6. Turn off the isolation tester and discharge the test voltage with a 10 MΩ resistor between output and case.

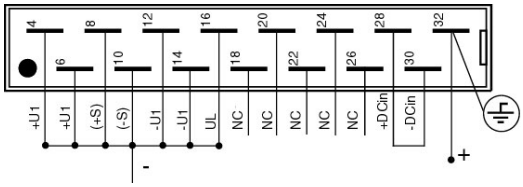

Figure 9 Output to case isolation voltage test.

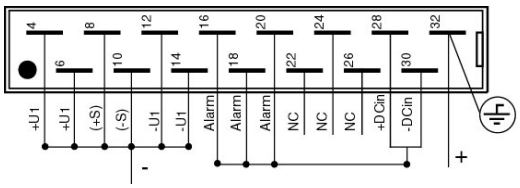

Figure 10 Output to case with relay alarm isolation voltage test.

9.2 AC isolation test output to case, option E2

Beware of the rather high capacitive earth currents (about 100mA) that will occur during this test.

1. Disconnect all cables from the converter.
2. Connect the input terminals of the converter to case.
3. Connect the output terminals together.
4. Connect your isolation tester between output and case. *See istor* between put and case.
5. *Figure 9* Raise the voltage of the isolation tester from 0 to 2500Va.c. The voltage should not be applied for more than one (1) minute or the Y-capacitors might be damaged See *figure 10* to include the alarm relay option. The relay outputs are insulated from output/input/case.
6. Turn off the isolation tester and discharge the test voltage with a 10 MΩ resistor between output and case.

9.3 DC isolation test input to output and input to case

1. Disconnect all cables from the converter.
2. Connect the output terminals of the converter to case.
3. Connect the input terminals together.
4. Connect your isolation tester between input and case. See *Figure 11*. Raise the voltage of the isolation tester from 0 to 2000Vd.c. (With option E1 or C, 110, D input codes 0 to 4000 Vd.c.). Check that the leakage current does not exceed 5µA. The voltage should not be applied for more than a few seconds or the Y-capacitors might be damaged.
   See *figure 12* to include the alarm relay option. The relay outputs are insulated from output/input/case.
5. Turn off the isolation tester and discharge the test voltage with a 10 MΩ resistor between input and case.

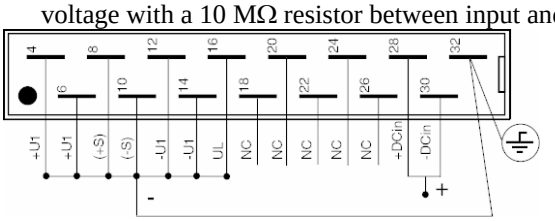

Figure 11 Input to output and input to case isolation voltage test.

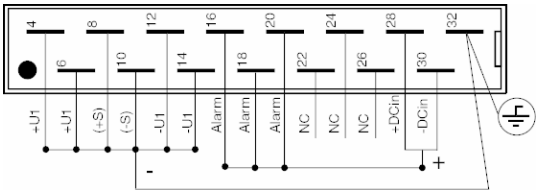

Figure 12 Input to output and input to case with relay isolation voltage test.

9.4 AC isolation test input to output and input to case (Option E1)

Beware of the rather high capacitive earth currents (about 100mA) that will occur during this test.

1. Disconnect all cables from the converter.
2. Connect the output terminals of the converter to case. *See.Figure 11*
3. Connect the input terminals together.
4. Connect your isolation tester between input and case. *See Figure 12*. Raise the voltage of the isolation tester from 0 to 2500Va.c. The voltage should not be applied for more than one (1) minute or the Y-capacitors might be damaged. See *figure 12* to include the alarm relay option. The relay outputs are insulated from output/input/case.
5. Turn off the isolation tester and discharge the test voltage with a 10 MΩ resistor between input and case.

Option H, inrush current limit

The input capacitors are charged through an NTC resistor to reduce the input current during start up. This feature is only available on the PSC models with input codes B, C, and 110. On input code D this option is standard.

The input voltage range is changed when this option is included, see *Table 2*. This is because if the load changes from 0 to 100% abruptly, the input current also changes abruptly. This will cause a voltage drop across the NTC resistor (until it heats up). If the input voltage is only slightly higher than the start voltage of the converter this voltage drop will cause the converter to stop. The converter will then start and stop several times until the NTC resistor is heated up. We have therefore increased the lowest input voltage on units with a NTC resistor so this behaviour not arises.

PSE (normal input voltage range)	
Input voltage code	**Input voltage range**
B	20-72Vd.c.
C	50-150Vd.c.
D	90-270Vd.c.

PSE with option H	
Input voltage code	**Input voltage range**
B	30-72Vd.c.
C	75-150Vd.c.
D	115-270Vd.c.

Table 2. Input voltage range with and without option H

The unit starts if the voltage is within the normal input voltage range, but depending on the load (if the NTC is heated up) a load change might cause the converter to stop and start as described before.

All models have a ”slow start” feature. To reduce input current during start up, the output capacitors are charged ”slowly” (approximately 0.1s).

10 Higher isolation voltage than standard, Option E1 & E2

E1 is 2 to 2.5 kVa.c. 1 minute between input and output, input and case.

E2 is 2 to 2.5 kVa.c. 1 minute between output and case.

11 Trouble shooting

11.1 There is no output voltage

1. Check that the input fuse is not broken.
2. Check that the input voltage polarity is correct.
3. Check that the input voltage is within the specified limits.
4. The converter may be in current limit due to excessive output current or an external short-circuit on the output.
   - Disconnect the input by removing the fuse.
   - Disconnect the load.
   - Connect input fuse again and measure the output voltage.

   If the converter now starts the load was too heavy or there was a short-circuit.
   - If there is an external short-circuit, remove it.
   - If the load is too large decrease the load or consult your Polyamp dealer.
5. The unit is broken. Contact your Polyamp dealer.

11.2 The input fuse blows when the input is connected

1. Check that the input voltage polarity is correct.
2. Check that the input fuse is of time delay type and with correct current rating. See *Table 1*.
3. The unit is broken. Contact your Polyamp dealer.

11.3 The converter starts and stops repeatedly

All models have an over/under voltage protection which shuts down the converter if the input voltage is not within specified limits.

1. The cables to the converter input may be under-sized, causing too high voltage drop in the supply cables.
2. Your supply does not have enough current capacity so the input voltage to the converter drops below specified limit.

11.4 Fault report

We do not recommend you to repair a faulty unit.

Please describe the conditions when the fault occurred and please return a faulty converter to:

Your local distributor or:

SWITCH CRAFT S.A.
Bel Air 63
CH-2300 La Chaux-de-Fonds
Switzerland

Tel: +41 32 9678800 Fax: +41 32 9678809
e-mail: terranova@switchcraft.ch

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