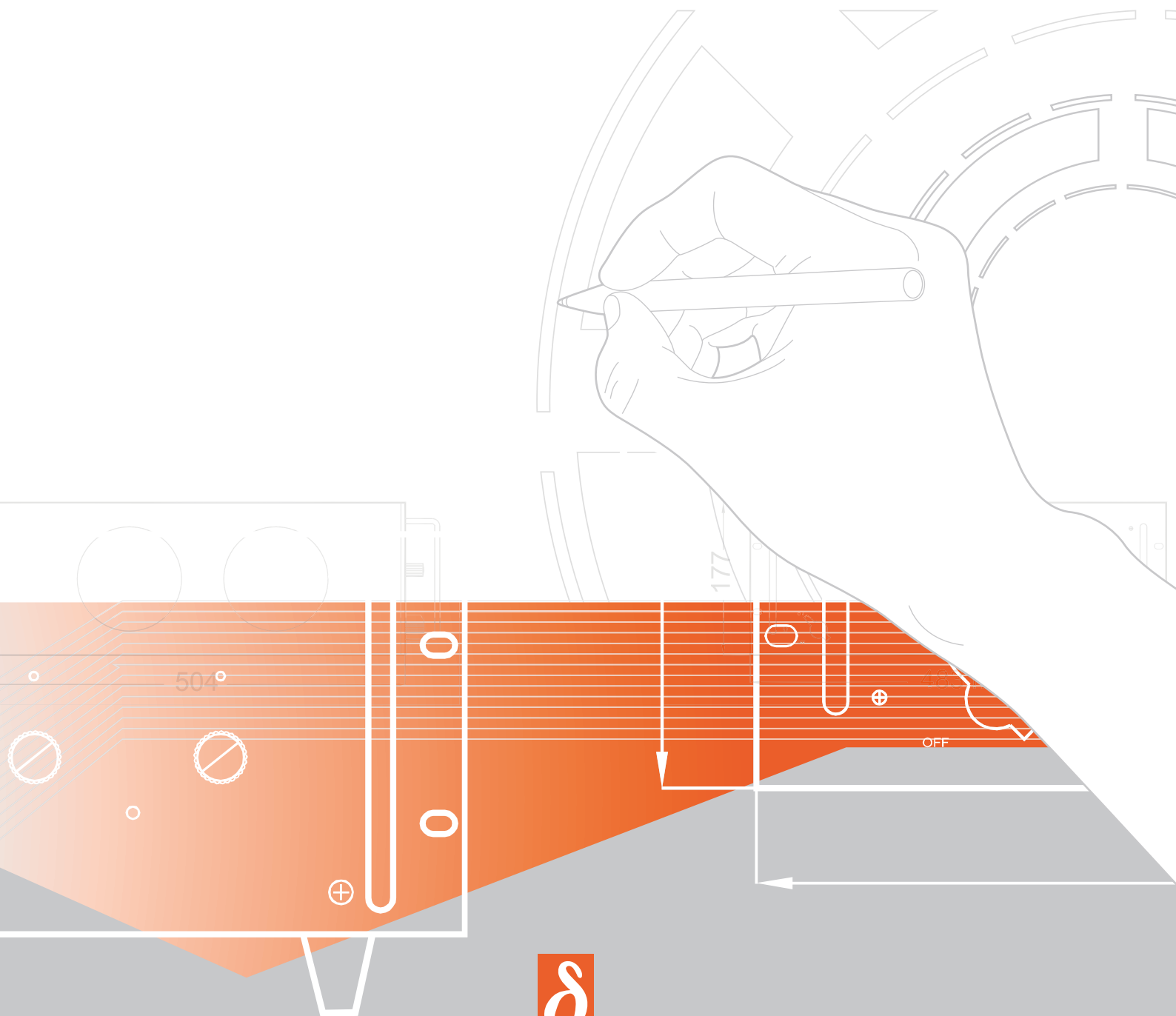


PRODUCT MANUAL.



DELTAELEKTRONIKA
DC POWER SUPPLIES

Safety Instructions

Caution

The following safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with the safety precautions or warnings in this document violates safety standards of design, manufacture and intended use of this equipment and may impair the built-in protections within. Delta Elektronika shall not be liable for user's failure to comply with these requirements.

Installation Category

The Delta Elektronika power supplies have been evaluated to installation category II. (Over voltage category II)

Grounding of Mains Input

This product is a safety Class 1 instrument. To minimize shock hazard, the instrument chassis must be connected to the AC Power Supply mains through a three or four conductor power cable for resp. a single or three phase unit, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet.

For instruments designed to be hard-wired to supply mains, the protective earth terminal must be connected to the safety electrical ground before another connection is made. Any interruption of the protective ground conductor, or disconnection of the protective earth terminal will cause a potential shock hazard that might cause personal injury.

Grounding of Power Output

If the output of a unit is specified to deliver max 60Vdc, and either the negative or positive power output is grounded, the voltage on the following connections can be considered safe:

- power outputs and sense connections
- programming/monitor/status-signals, Interlock, Master/Slave-connections, ACF/DCF-relay
- all Delta Elektronika interfaces.

Warning:

When the positive power output can exceed 60Vdc in respect to the negative output, additional external measures must be taken to ensure safety isolation of the following:

- power outputs and sense connections.

Warning:

When the negative power output of the unit can exceed 60Vdc / 42.4Vpk in respect to ground, additional external measures must be taken to ensure safety isolation of the following:

- power outputs and sense connections
- programming/monitor/status-signals, Interlock, Master/Slave-connections, ACF/DCF-relay
- interfaces with operational isolation
- non-isolated interfaces.

Caution 1: If a low voltage unit has both power outputs floating, or if the output is in series with an external high AC or DC voltage, the negative power output can exceed the safe value in respect to ground as specified in the above warning!

Caution 2: Although a high voltage unit is set to a safe voltage below 60V, for safety it must always be considered as high voltage unit! Wrong operation, a programming error or an external defect can result in an unsafe high output voltage.

Caution 3: When programming a high voltage unit directly via a PC or via a network connection, either ground the negative power output or use a safety isolated interface!

For more information and schematics regards Grounding and Safety, see the special application note "Safe operation of a power supply" on the Delta Elektronika website.

Fuses

Fuses must be changed by authorized Delta Elektronika service personnel only, for continued protection against risk of fire.

Input Ratings

Do not use an AC Supply which exceeds the input voltage and frequency rating of this instrument. The input voltage and frequency rating of the Delta Elektronika power supply series are stated in the accompanying datasheet.

Live Circuits

Operating personnel must not remove the instrument cover. No internal adjustment or component replacement is allowed by non Delta Elektronika qualified personnel. Never replace components with the power cable connected. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

Parts Substitutions & Modifications

Parts substitutions and modifications are allowed by authorized Delta Elektronika service personnel only. For repairs or modifications the unit must be returned to a Delta Elektronika service facility.

Removal of (safety) covers

Safety cover(s) are used to cover potentially hazardous voltages.

Observe the following when removing safety cover(s):

- Switch off the unit.
- Disconnect the unit from the mains supply.
- Wait for 3 minutes to allow internal capacitors to discharge.
- Unscrew the screws and remove the cover(s).
- Always place the cover(s) back before connecting the unit to the mains supply again.

Environmental Conditions

The Delta Elektronika power supplies safety approval applies to the following operating conditions:

- Indoor use
- Ambient temperature : -20 to 50 °C
- Maximum relative humidity : 95%, non condensing, up to 40 °C
: 75%, non condensing, up to 50 °C
- Altitude: up to 2000m
- Pollution degree 2



Caution risk of electrical Shock



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual



Protective ground conductor terminal



Off (supply)



On (Supply)

WEEE

(Waste Electrical & Electronic Equipment)

Correct Disposal of this Product



This marking shown on the product, its packing or its literature indicates that it should not be disposed with other wastes at the end of its working life, but should be collected separately to recycle it responsibly to promote the sustainable reuse of material resources.

DESCRIPTIONS

1) OUTPUT

The outputs of the EST150 can either be used as a constant voltage source with current limiting or as a constant current source with voltage limiting.

The change of mode occurs sharply at the crossing of the voltage and current settings. Fig. 3 - 1 shows the output ranges.

• OVERLOAD PROTECTION

The power supply is fully protected against all overload conditions, including short circuit.

2) INPUT VOLTAGE

The power supplies have a wide input voltage range.

3) INPUT CURRENT

The units have active power factor correction (PFC). The input current will therefore be almost a sine wave. This means the rms-value and the harmonic distortion of the input current will be relatively low.

4) EFFICIENCY

The efficiency is very high and constant over a wide output current range. High efficiency also means low power loss and low heat generation.

5) CV REGULATION

The CV-load regulation should be measured directly on the output terminals (see fig. 3 - 2). A few cm of cable can have a voltage drop of several mV (at high current !).

6) RIPPLE & NOISE

The output ripple is very low with almost no spikes. The ripple voltage has to be measured directly on the output terminals using a probe with very short connections (to avoid pick up of magnetic fields) (see fig. 3 - 3).

Note: to get reliable results, the background noise level should be lower than the output ripple.

7) TRACKING MODE

When the unit operates in Tracking Mode, the CV potentiometer for the output 1 sets the voltage for both output 1 and 2.

In this mode a Dual Voltage Supply with an equal negative and positive voltage can be created (see fig 3 - 4).

Both outputs can also be connected in series or parallel to create a unit with twice the output voltage or current.

Both CC potentiometers have to be set separately.

8) PULSATING LOAD

To avoid overheating of the output capacitors, the AC component of the load current should be limited (see fig. 3 - 5).

One method of decreasing the AC current through the output capacitor is by using a large external electrolytic capacitor in parallel with the load.

Care must be taken the capacitor in combination with the lead inductance will not form a series resonant circuit!

9) INSULATION

For safety reasons the insulation of the separating components (transformers) between input and output is tested at 3750 Vrms for 1 minute. This is tested before assembly.

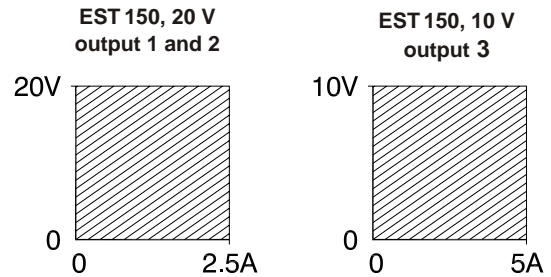


fig. 3 - 1

The two output ranges, every point in the hatched areas can be used.

The left and middle outputs operate in the 20 V / 2.5 A range. The right output operates in the 10 V / 5 A range.

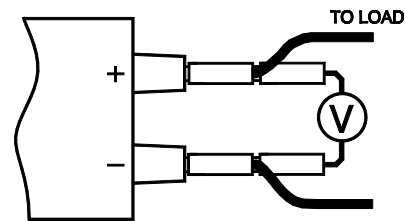


fig. 3 - 2

Measuring CV-regulation

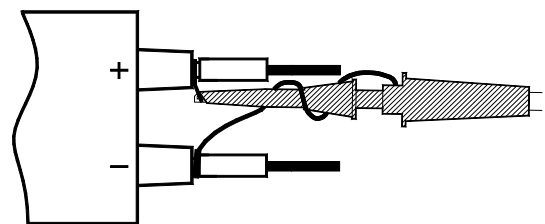


fig. 3 - 3

Measuring ripple voltage

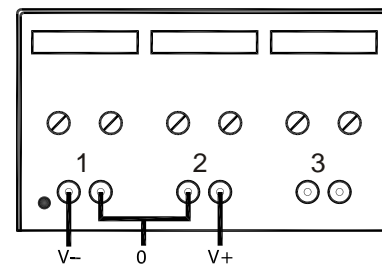


fig. 3 - 4

Dual Voltage Supply in Tracking mode

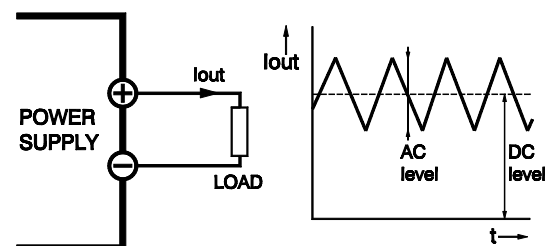


fig. 3 - 5

Pulsating load current

Warning! Afterwards the 3750 Vrms cannot be tested on the assembled unit because the insulation between the components on the input side and the case (like the bridge rectifier) is specified at 2500 Vrms. Since the insulation between output and case is low (only 600 V DC), the insulation between the primary components and case will break down when 3750 Vrms is applied between input and output ($2500 \text{ Vrms} + 600 \text{ V DC} < 3750 \text{ Vrms}$) (see also fig. 3 - 6).

Note: when testing the insulation, take care to slowly (e.g. in one second) charge and discharge the capacitors between input - case and output - case. This to prevent high peak currents, which could destroy the power supply. Make sure to discharge the capacitors completely before using the unit again.

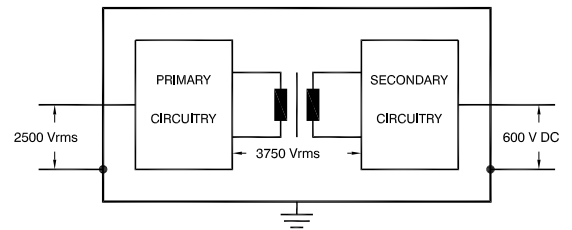


fig. 3 - 6
Insulation test voltages

10) RFI SUPPRESSION

Both the input and output have RFI filters, resulting in very low conducted RFI to the line and load. Due to the output filter the output voltage is very clean, having almost no spikes.

The combination of RFI filters and the closed metal case results in a low radiated RFI.

11) OPERATING TEMP

At full power the operating temperature range is -20 to $+50$ °C. From 50 to 60 °C the output current has to be derated linearly to 75 % at 60 °C (see fig. 3 - 7). These temperatures hold for normal use.

12) THERMAL PROTECTION

A thermal switch shuts down the output in case of insufficient cooling. After cooling down, the unit will start working again.

13) HOLD - UP TIME

The hold - up time depends on the load, output voltage and line input voltage. A smaller load or a lower output voltage results in a longer hold - up time (see fig. 3 - 8). The influence of the line input voltage is limited because of the active PFC.

14) TURN ON DELAY

The output voltage is available 0.25 sec after mains switch on.

15) INRUSH CURRENT

The inrush current is limited with a 30 Ohm NTC to about 10 A when the NTC is cold.

16) COOLING

The cooling is by natural convection, no noisy blowers are present. The unit should have sufficient free space. A distance of minimum 5 cm around the unit is recommended.

For long life the temperature of the air surrounding the unit, should be below 35 °C under normal conditions.

Under extreme conditions it should be below 50 °C.

17) SERIES OPERATION

Series operation is allowed up to 600 V total voltage. The power supplies can be connected in series without special precautions.

Note: when two or more outputs are connected in series, the maximum current is limited by the **highest** CC potmeter setting.

18) PARALLEL OPERATION

Parallel operation of the units has no limitations. The power supplies can be connected in parallel without special precautions.

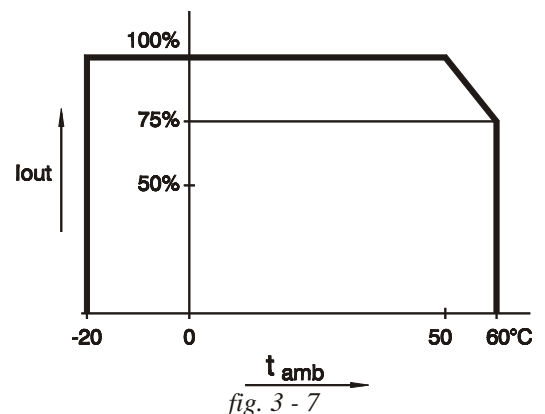


fig. 3 - 7
Operating temperature ranges

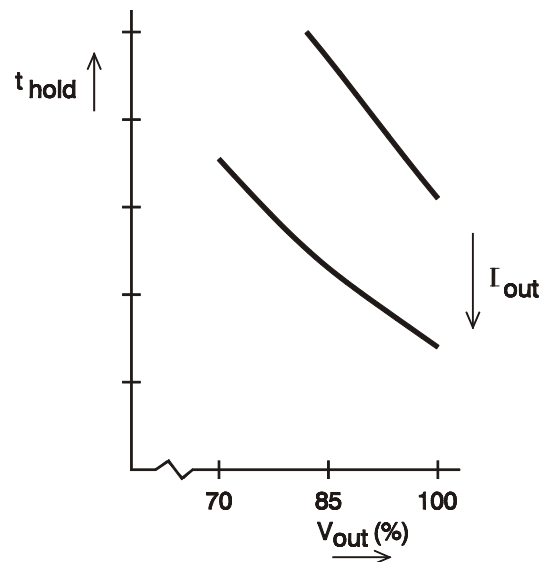


fig. 3 - 8
Hold-up time vs V_{out} with I_{out} as a parameter

OPERATING MANUAL

1) OPERATING THE UNIT FOR THE FIRST TIME

- Check there is no condensation on the unit. If there is, allow some time to dry.
- For all three outputs set the CV and CC potentiometers to minimum (fully anticlockwise).
- Switch on the unit.
- For the output 1 push the "OUTPUT ON/OFF" button to turn it on. Turn both the CV and CC potentiometer a few turns clock wise. A voltage should be present on this output. By pressing the "DISPLAY SETTINGS" button, the meters will show the setting of the CV and CC potentiometer for this output.
- Repeat above step for the other two outputs.
- Check the cooling on the backside of the unit is not obstructed.
- Now the unit is ready for operation. All three outputs are independent and floating (see fig. 4 - 1)
- Each output can be used as a Voltage Source (unit in CV-mode) or as a Current Source (unit in CC-mode).

2) TRACKING MODE

- Push the "TRACKING ON/OFF" button. Both output 1 and 2 will turn off and the LED for Tracking Mode will light.
- Turn CV potentiometer for output 1 to minimum (fully anticlockwise). This potentiometer controls both output 1 and 2 in the Tracking Mode. The CV potentiometer for output 2 is disabled in this mode.
- Turn both CC potentiometers to minimum. Both the CC potentiometers have to be set separately.
- Push the "OUTPUT ON/OFF" button for output 1 to turn both output 1 and output 2 on.
- Turn the CV potentiometer for output 1 and both CC potentiometers a few turns clock wise. An equal voltage should be present on output 1 and output 2.
- By pressing the "DISPLAY SETTINGS" button 1, the meters will show the setting of CV potentiometer 1 and CC potentiometer 1. By pressing the "DISPLAY SETTINGS" button 2, the meters will show the setting of CV potentiometer 1 and CC potentiometer 2.
- Both outputs can be used as a Dual Voltage Supply by connecting the plus of output 1 to the minus of output 2 (see fig. 4 - 2). In this configuration the outputs operate as a unit with an equal negative and positive output of $-20\text{ V} / 2.5\text{ A}$ and $+20\text{ V} / 2.5\text{ A}$.
- Both outputs can also be connected in series to operate as one unit with a range of $40\text{ V} / 2.5\text{ A}$ (see fig. 4 - 3). Note that in this configuration the current is limited by the **highest** CC potmeter setting.
- In parallel operation the outputs operate as one unit with a range of $20\text{ V} / 5.0\text{ A}$ (see fig. 4 - 4).
- The settings of output 3 are not influenced by the Tracking Mode.
- To return to the normal mode, push the "TRACKING ON/OFF" button again. Both output 1 and output 2 will turn off. After pushing both the "OUTPUT ON/OFF" buttons again, output 1 and output 2 can be set independent again.



fig. 4 - 1
Triple Mode

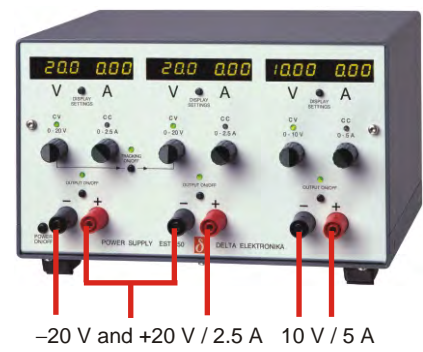


fig. 4 - 2
Dual Voltage Tracking Mode

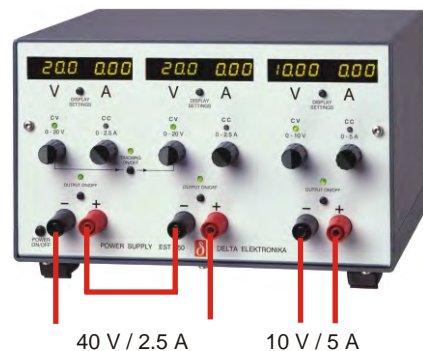


fig. 4 - 3
Series Tracking Mode



fig. 4 - 4
Parallel Tracking Mode

OPERATING AND STORAGE CONDITIONS

1) TEMPERATURE

- The operating temperature range at full load is -20 to +50 °C.
- **Note: a lower temperature extends the life of the power supply.**
- The storage temperature range is -40 to +85 °C.

2) HUMIDITY

- During normal operation humidity will not harm the power supply, provided the air is not aggressive. The heat normally produced in the power supply will keep it dry.
- **Condensation.** Avoid condensation inside the power supply, break-down could be the result. Condensation can occur during a period the power supply is switched off (or operating at no load) and the ambient temperature is increasing .
Always allow the power supply to dry before switching it on again.

3) GALVANIC INDUSTRY

- For using the power supplies in the galvanic industry it is strongly recommended to take precautions against an aggressive environment.
- An aggressive environment with acid, salt, etc. can harm the electronic components. Sometimes even the copper traces of the pc-boards dissolve.
- To avoid problems the power supplies should be mounted in a relative clean room, or mounted in a cabinet receiving clean air with over pressure. Or a cabinet with a heat exchanger.

MAINTENANCE & TROUBLE SHOOTING

1) GENERAL

- The EST power supply normally needs no maintenance or calibration. Only care must be taken that the cooling of the unit is not obstructed.

2) NO OUTPUT

- Remove load from outputs.
- Switch on unit.
- If the the output on LED is not lit, Push output ON / OFF.
- Turn all the CV and CC potentiometers a few turns clockwise.
A voltage should be present on the output.

3) NO LEDS on.

- Overheating can be the cause, cooling down will reset the thermal protection.
- Check input power.
- Check fuses inside unit.

4) NO equal voltages in Tracking Mode.

- One or both of the tracking outputs are in CC mode (CC LED on).
- Turn the CC potentiometers fully clockwise.
- Reduce the load.

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DELTA ELEKTRONIKA B.V.

EC Declaration of Conformity

We

Delta Elektronika
Vissersdijk 4
4301 ND ZIERIKZEE
The Netherlands

Declare under sole responsibility that the following Power Supply:

EST 150

Meets the intent of Directives 2014/30/EC for Electromagnetic Compatibility and Directives 2014/35/EC regarding Electrical Safety. (Low Voltage Directive)
Compliance was demonstrated to the following specification as listed in the official Journal of the European Communities:

EN 61000-6-3 Generic Emissions: (residential, light industrial)

EN 55022 Radiated and conducted, Class **B**
EN 61000-3-3 Voltage fluctuation and flicker

EN 61000-6-1 Generic Immunity: (residential, light industrial)

EN 61000-6-2 Generic Immunity: (industrial environment)

EN 61000-4-2 Electrostatic Discharge
EN 61000-4-3 Radiated electromagnetic fields
EN 61000-4-4 Electrical Fast Transients / Bursts
EN 61000-4-5 Surge on DC output
EN 61000-4-5 Surge on line input
EN 61000-4-6 RF common mode, conducted
EN 61000-4-11 Voltage variations and dips

EN 60950 Safety of IT equipment

EN 61010 Safety of electrical equipment for measurement, control and laboratory use

Managing director
Zierikzee, March 2017



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