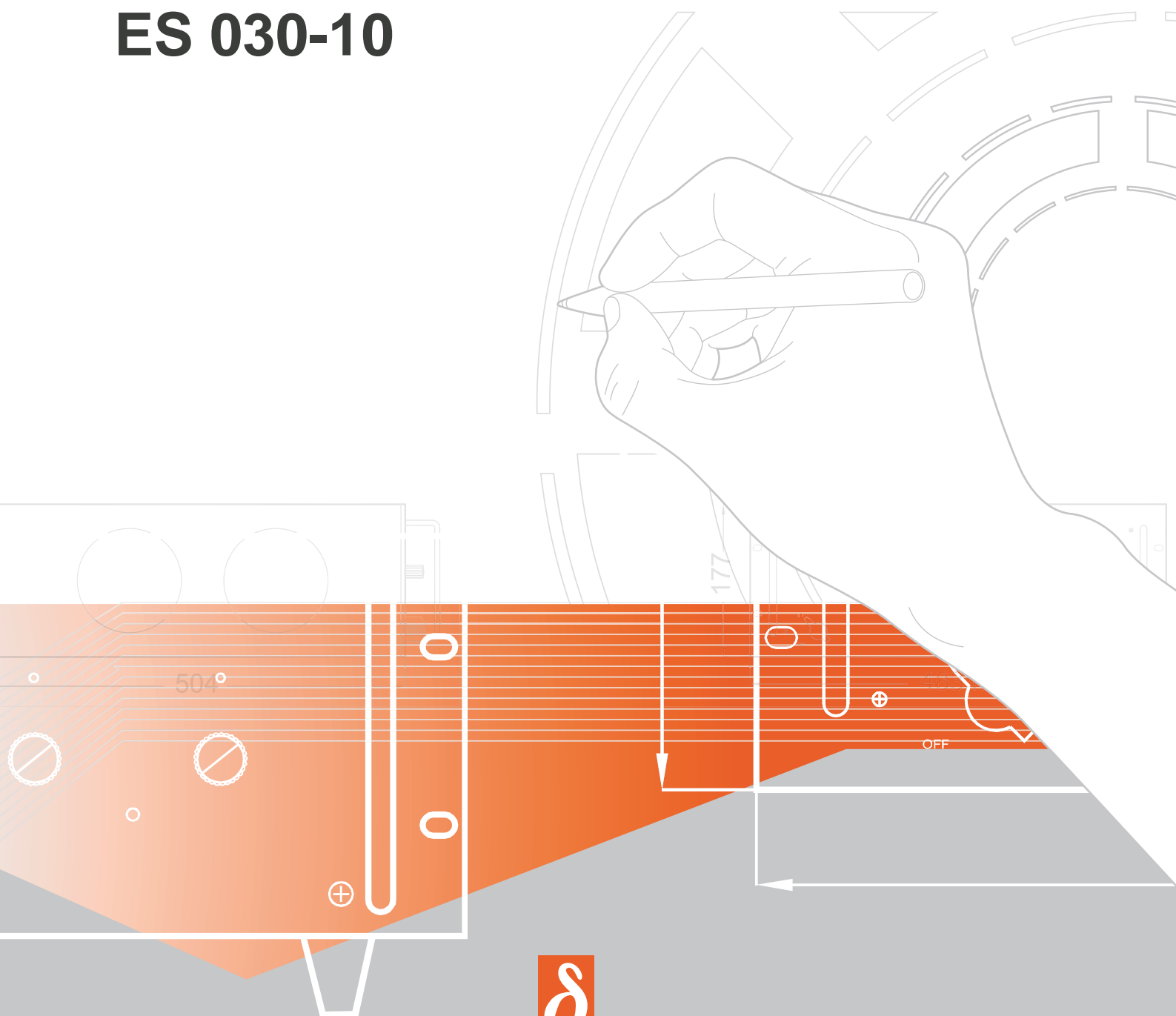


# PRODUCT MANUAL.

**ES 030-10**



**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)

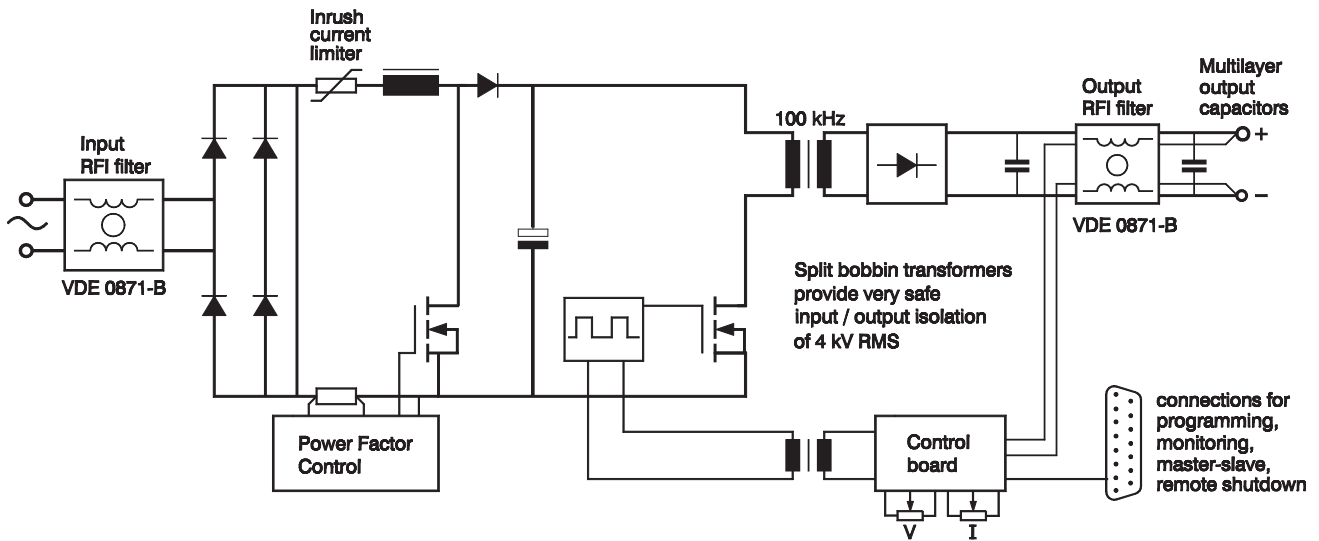
### Correct Disposal of this Product

Applicable in the European Union.



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.

## Circuit description



*Simplified functional diagram*

The input voltage is rectified by a bridge rectifier. A boost-type converter converts this voltage to about 370 V. The power factor control circuit forces the line input current to be sine-wave.

With an NTC resistor of 16  $\Omega$  cold resistance the inrush current is limited. After switch on, the resistance of the NTC decreases rapidly and causes only a small loss during operation.

The pulse width regulated switcher is a 100 kHz forward converter. Much attention has been paid to the safety of input-output isolation. At the vital separation points split bobbin transformers are used.

At the output multilayer capacitors are used instead of electrolytic capacitors. This makes it possible to program the output voltage fast (0 - 30 V in 1.5 ms) without limitation of the repetition frequency.

The programming inputs and monitor outputs of voltage and current are 0 - 5 V for 0 to full scale.

At Master / Slave parallel operation the current monitor output of the master drives the current programming input of the slave. The result is equal current sharing.

At Master / Slave series operation a voltage equal to the voltage monitor output of the master drives the voltage programming input of the slave. The result is equal voltage sharing.

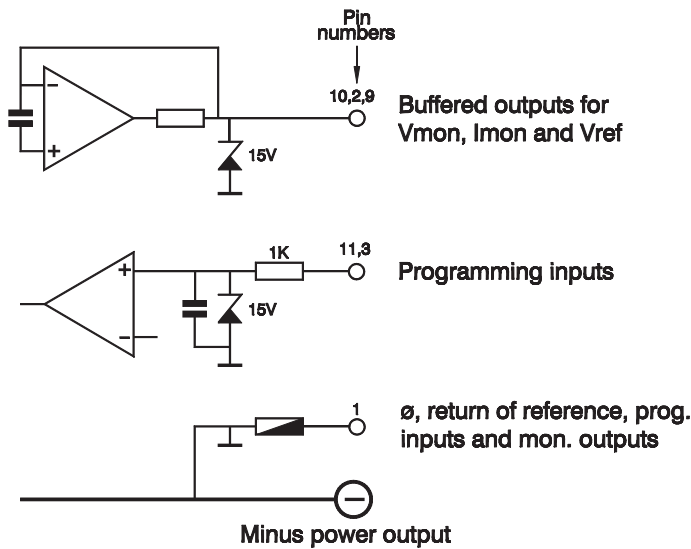
RFI filters at input and output prevent radio frequencies, generated by the switcher, to be conducted to the line or to the load. It also prevents interference from outside to enter into the power supply circuits.

Radiated RFI is also very low because of the closed metal case.

### Programming inputs, Monitor outputs

The output voltage and current of the ES030-10 can be programmed with an external voltage. A programming voltage 0-5 V results in zero to full scale at the output of the power supply.

With a switch at the rear side of the power supply manual control (knob at the front panel) or remote programming can be chosen. The monitor outputs of voltage and current are 0-5 V and proportional to the output voltage and current. The programming connector is a 15 pole D-connector which is pin compatible with other Delta Elektronika power supplies and with the external IEEE488 interface.



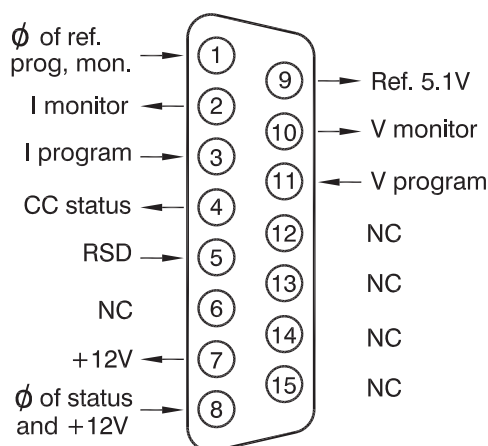
**Warning:**

The zero of all the programming inputs and monitor outputs are internally connected to the minus power output.

The internal fuse between the minus of the power output and the return of the programming input is a self recovering PTC fuse.

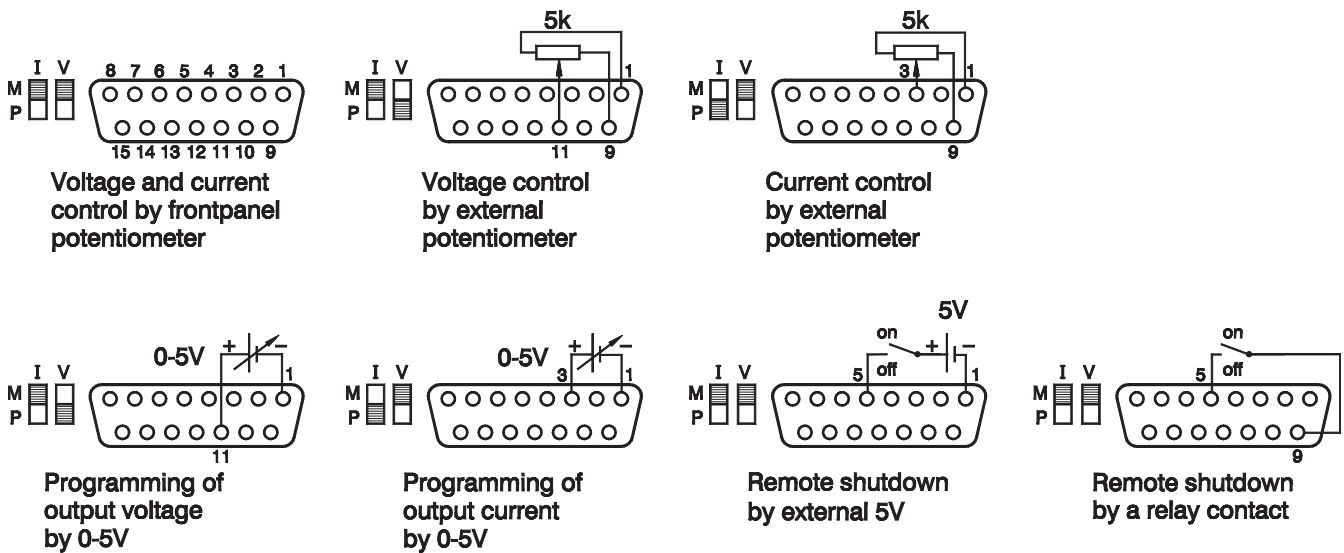
Internal connections for programming and monitoring

### Connections 15-pole D-connector



pin	Description
1	$\emptyset$ , return of reference, programming inputs and monitor outputs
2	Current monitor output (0 - 5 V)
3	Current programming input (0 - 5 V)
4	CC status output, logic 1 = CC mode
5	Remote shutdown
6	Not Connected
7	+12 V output (ri = 500 Ohms)
8	$\emptyset$ , return of status output and +12 V
9	Reference voltage 5.16 V
10	Voltage monitor (0 - 5 V)
11	Voltage programming input (0 - 5 V)
12	Not Connected
13	Not Connected
14	Not Connected
15	Not Connected

Analog programming connector



*Remote control, programming connections and the position of the manual/program switches*

### **Ethernet / IEEE488 / RS232 programming**

The Delta Elektronika PSC-ETH and PSC-232 controllers can be built inside the power supply. The 15 pole D-connector on the power supply is pin compatible with the external IEEE488 interface (PSC-488 module). With these interfaces the voltage and current can be programmed and read back by the computer. On the rear side of the unit change the position of the switches from Manual to Programming and use the programming input of the interface to control the output of the power supply.

### **Over Voltage Limit**

The ES030-10 has an Over Voltage Limit which is factory set at 34 V but can be internally adjusted between 6 and 34 V with trimmer R402. The OVL can be set a few volts above the desired maximum output voltage. In case the voltage potmeter at the front panel or the programming voltage is accidentally set too high, the output voltage is limited to the set OVL voltage.

### **Parallel and Series operation**

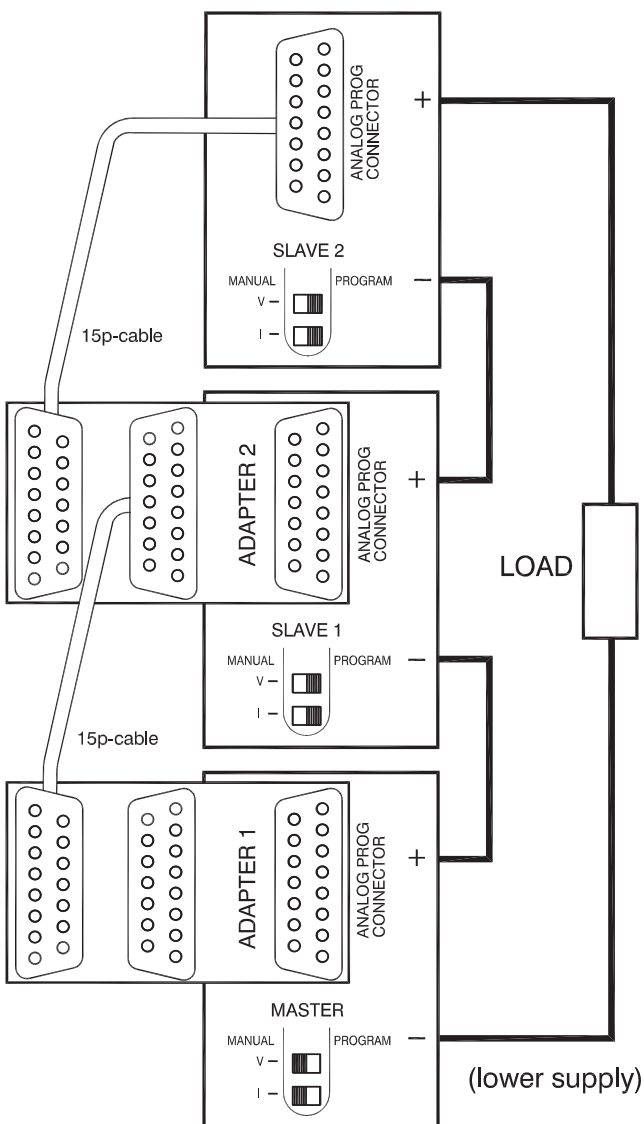
Series operation is allowed up to 600 V total voltage. Paralleling of units has no limitations. Voltage and current have to be set equal on all units with the control knobs. For easier control, Master / Slave operation is recommended.

### **Master / Slave operation**

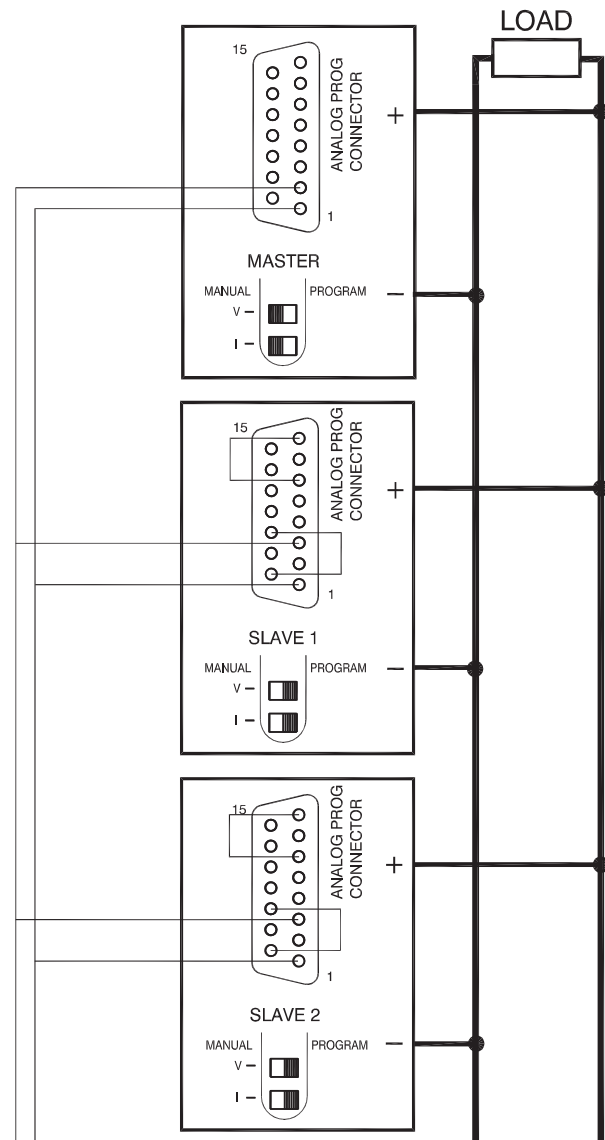
When using Master / Slave operation both current and voltage can be set with the control knobs of the master. The slave power supplies will follow the master resulting in equal voltage or current sharing in the series or parallel mode respectively. In case of remote programming the master is programmed and the slave(s) will follow. By using the Master / Slave *series* feature, a *Dual Tracking* power supply can be made with one unit as master and one as slave.

### Setting up Master / Slave operation:

- Connect the output terminals and test the system in normal parallel or series operation. Ensure that all (output) power connections are reliable. An interruption of one of the power leads can cause a PTC fuse inside the unit to trip.
- The voltage drop across the power leads between the units should be kept  $< 10$  mV.
- Switch off all units. For Master / Slave series operation, use a Master / Slave Series Adapter for each slave. Plug in the programming connectors with the connections according to one of the figures below. Put both programming switches on the slave power supplies in the "PROG" position and switch the units on again.
- The total output voltage and current can now be controlled by the knobs on the master.
- Always use shielded cables for the programming connectors and the M/S Series Adapters. The shielding should be connected to pin 1 of the programming connector, **only at one end**.
- The maximum number of slaves in series operation is limited by the maximum total voltage of 600 V.
- A combination of Master / Slave parallel and series is also allowed. For each series slave, a Master / Slave Series Adapter must be used.



*Master / Slave series operation*



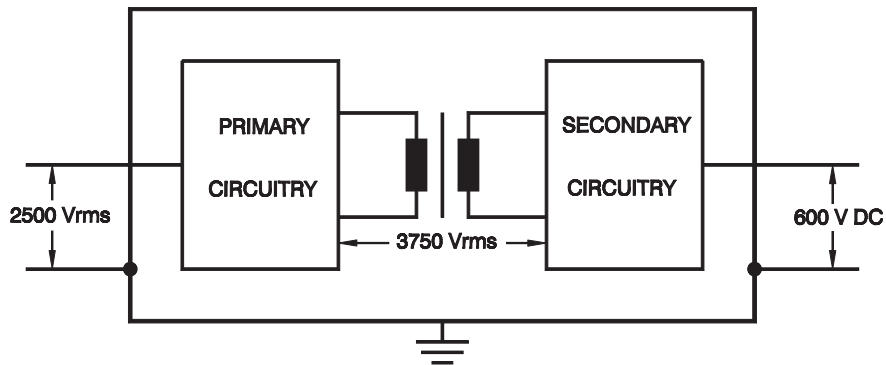
*Master / Slave parallel operation*



## Insulation

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

**Warning!** The 3750 Vrms cannot be tested afterwards on the assembled unit because the insulation between the components on the input side to the case (like the bridge rectifier) is specified at 2500 Vrms. Since the insulation output - case is low (only 600 VDC) the insulation of the primary components to case will break down when 3750 Vrms is applied between input and output ( $2500 \text{ Vrms} + 600 \text{ VDC} < 3750 \text{ Vrms}$ ) (see also the figure below).



## Calibration

### General

The power supplies are factory calibrated and normally need no further calibration.

### Meter calibration

The full scale indication of the voltmeter can be calibrated with trimpotmeter R480.  
The full scale indication of the Current meter can be calibrated with R490.



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**DELTA ELEKTRONIKA B.V.**

## EC Declaration of Conformity

We

Delta Elektronika  
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The Netherlands

Declare under sole responsibility that the following Power Supplies:

### **ES 030-10**

Meet the intent of Directives 2004/108/EC for Electromagnetic Compatibility and Directives 2006/95/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 61000-3-2 Power Harmonics  
EN 61000-3-3 Voltage fluctuation and flicker

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

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**

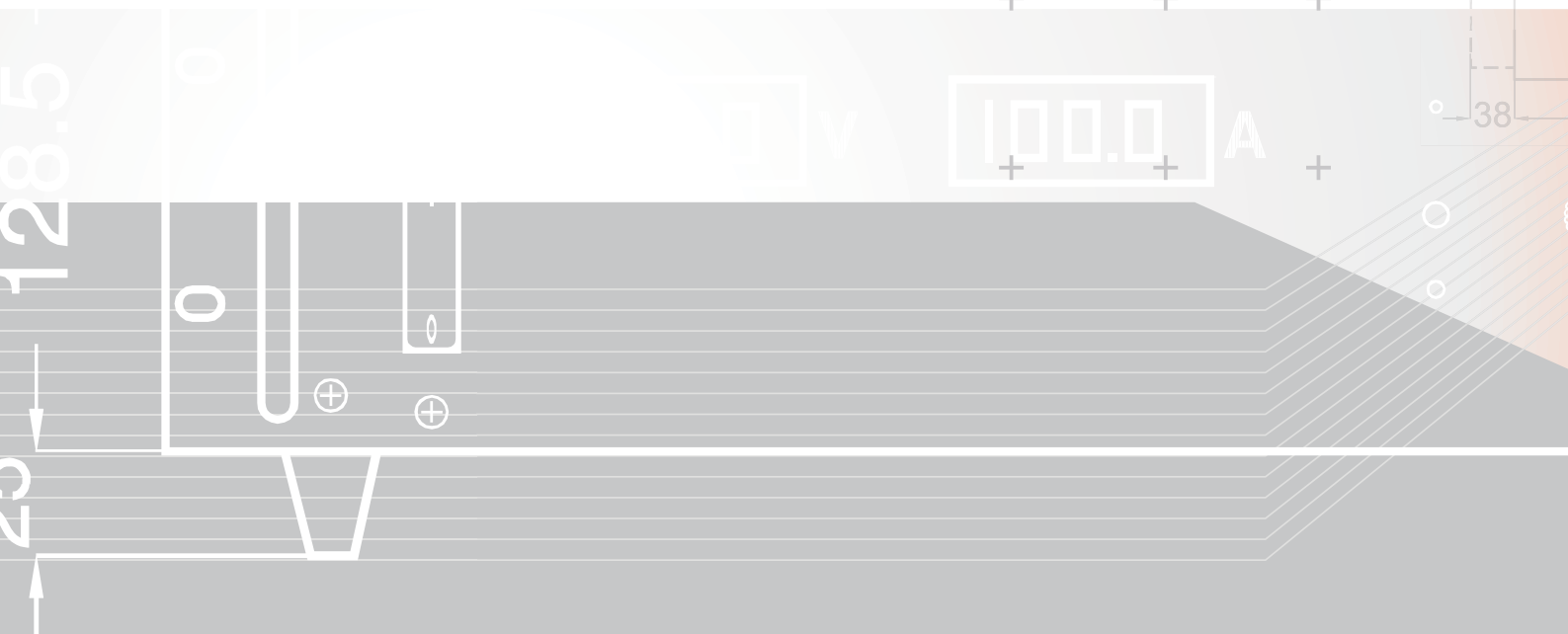
Managing director



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