Manual

Schulz Electronic
Professional Power Supplies

ES030-10

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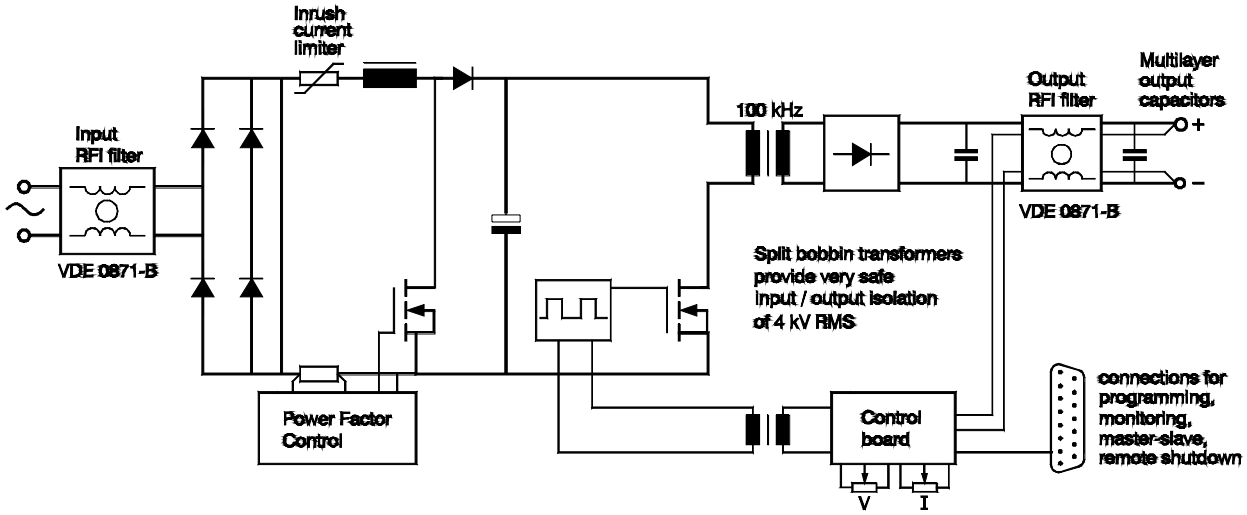
Circuit description



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 Ω 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.

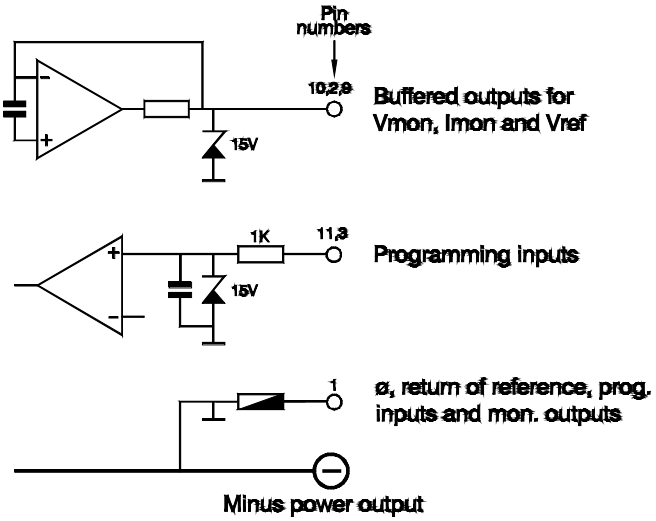
At Master / Slave series operation a voltage equal to the voltage monitor output of the master drives the voltage programming input of the slave. The result is equal voltage sharing.

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.

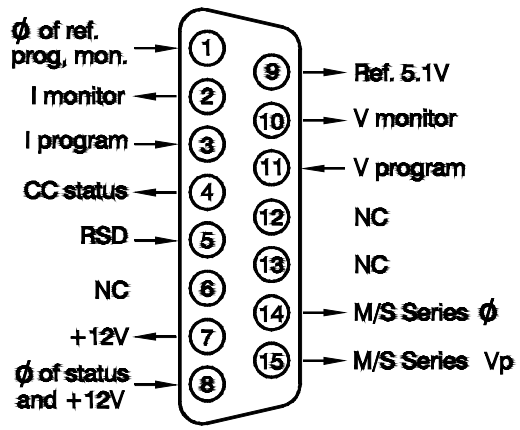


Warning:
The zero of all the programming inputs and monitor outputs are internally connected to the minus power output.

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

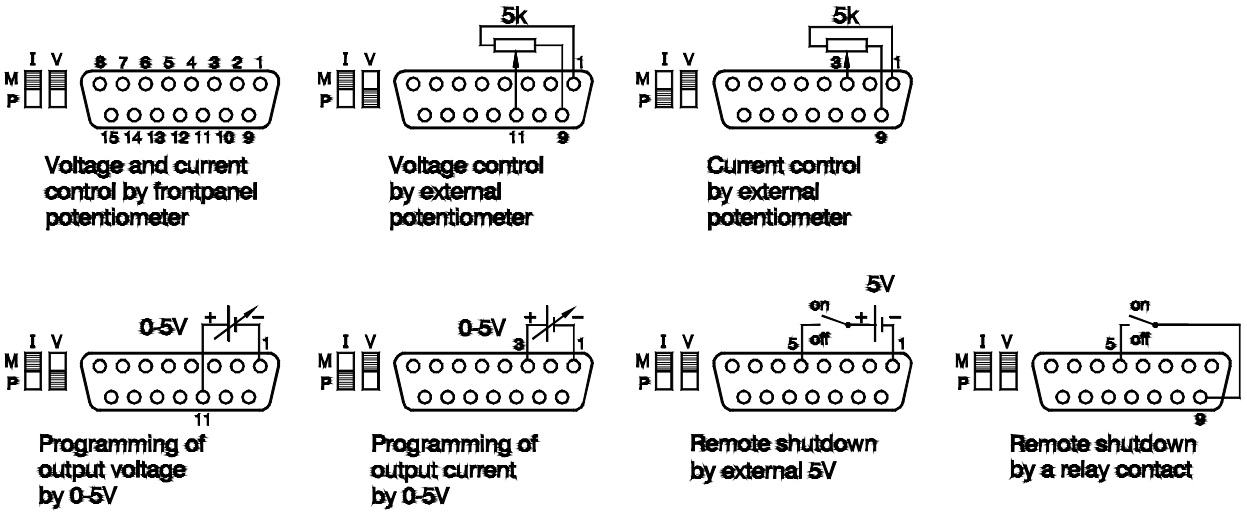
Internal connections for programming and monitoring

Connections 15-pole D-connector



Analog programming connector

pin	Description
1	Ø, 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	Ø, 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	M/S series, output for slave (Ø)
15	M/S series, output for slave (prog.)



Remote control and programming connections

Ethernet / IEEE488 / RS232 programming

The Delta Elektronika PSC-ETH and PSC 232 INT 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 EXT). With these interfaces the voltage and current can be programmed and read back by the computer.

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

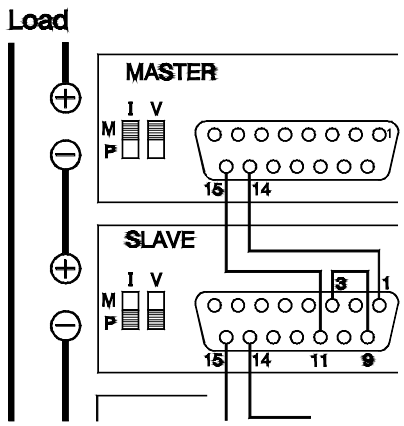
Series operation is allowed up to 600 V total voltage. Paralleling of units has no limitations. Voltage and current have to be set equal on all units with the control knobs. For easier control, Master / Slave operation is recommended.

Master / Slave operation

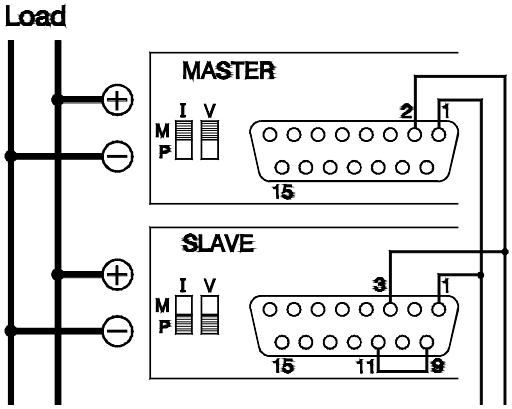
When using Master / Slave operation both current and voltage can be set with the control knobs of the master. The Slave power supplies will follow the Master resulting in equal voltage or current sharing in the series or parallel mode respectively. In case of remote programming the master is programmed 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. 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.
- To avoid hum or noise with M/S series operation it can be necessary to use shielded cable. 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.
- Note that in Master / Slave series operation the master is always the most positive unit.
- A combination of Master / Slave parallel and series is also allowed.



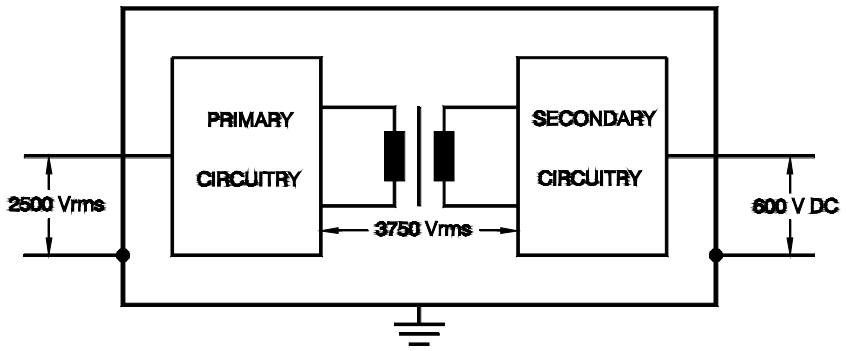
Master / Slave series operation



Master / Slave parallel operation

Insulation

For safety the insulation of the seperating 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 Vrms + 600 VDC <3750 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.